CHAPTER 3

Existing Conditions and Environmental Consequences

This chapter describes the likely effects of the project alternatives on the community, cultural resources, and environment. The CRC project team studied current conditions in the project area, and analyzed the impacts of the project alternatives and components.

Each of the sections in this chapter summarizes key findings for one or more elements of the environment. Following a brief discussion of existing conditions and methodology, when appropriate, each section summarizes impacts for the No-Build Alternative, the four build alternatives, and the various components and options. As described in Chapter 2, the alternatives consist of combinations of components; these are outlined in Exhibit 3.1.

CHAPTER CONTENTS

Exhibit 3.1
Summary of Components in Project Alternatives

Components	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Multimodal River Crossing and Highway	Existing	Replacement[a]	Replacement[a]	Supplemental	Supplemental
HCT Mode[b]	None	Bus Rapid Transit	Light Rail	Bus Rapid Transit	Light Rail
HCT Terminus	N/A	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS	(A) Kiggins Bowl, (B) Lincoln, (C) Clark College MOS, or (D) Mill Plain MOS
TDM/TSM	Current Programs	Expanded TDM/TSM programs			
I-5 Bridge Toll	None	Standard rate	Standard rate[c]	Higher rate	Higher rate
Transit Operations	Existing	Efficient	Efficient	Increased	Increased

[a] The Replacement crossing has two designs, a three-bridge design and a Stacked Transit/Highway Bridge (STHB) design; these are described in Section 2.3.1.

[b] HCT Mode also dictates the location of a maintenance base expansion. BRT would entail expanding a bus maintenance facility in eastern Vancouver. LRT would entail expanding the Ruby Junction maintenance base in Gresham. See Section 2.3.2.

[c] Alternative 3 was also evaluated no toll in order to quantify the traffic affects of tolling the I-5 crossing. This is discussed more in Section 2.3.5.

Following a description of existing conditions and summary of impacts at the alternative level, each section provides more detail on the long-term impacts of the components. The discussion of long-term impacts is followed by a discussion of short-term impacts that would occur during construction. Finally, each section concludes with a discussion of potential mitigation measures.

These findings are based on detailed technical reports included as electronic appendices to this DEIS and cited throughout the chapter. All projections and forecasts are for the design year of 2030, unless otherwise stated.

3.1 Transportation

This section describes how the CRC project could affect travel patterns and mobility for cars, trucks, transit vehicles, pedestrians, and bicyclists. Existing conditions for these transportation modes, as well as future conditions in 2030 under the No-Build Alternative, are compared to the effects of the four build alternatives. This comparison illustrates the benefits, as well as potential impacts, to transportation performance from this project. All data in this section comes from the CRC Traffic Technical Report and CRC Transit Technical Report, unless otherwise noted.

TERMS & DEFINITIONS

Transportation Terms

Average – The average traffic condition is the vehicle flow on a weekday during the average month for a given time period, usually Tuesday, Wednesday, or Thursday.

Congestion – For highways, congestion occurs when average speed is below 30 miles per hour.

Demand – The total number of users attempting to access the transportation system, including those caught in congestion.

Peak – This is a more technical description of "rush hour" when travel patterns generate the most traffic, especially in a particular direction. The a.m. peak is from 6-10 a.m. The p.m. peak is from 3-7 p.m.

Queuing – Occurs when traffic lanes cannot accommodate all the vehicles trying to use them, or if the line at an intersection extends into an upstream intersection.

Throughput – The amount of users being served at any time by the transportation system.

3.1.1 Existing Transportation Facilities

The CRC project evaluates potential improvements to I-5 from SR 500/39th Street in Vancouver to near Interstate Avenue/Victory Boulevard in Portland, and the addition of a high-capacity transit system within this same area. Chapter 2 of this DEIS provides descriptions and maps of the highway and transit improvements evaluated by this project.

The following I-5 interchanges are included in the CRC area (Exhibit 3.1-1):

- SR 500/39th Street
- Fourth Plain Boulevard
- Mill Plain Boulevard
- SR 14/City Center
- Hayden Island
- Marine Drive

Exhibit 3.1-1
CRC Project Area

DIMENSIONS ARE APPROXIMATE.

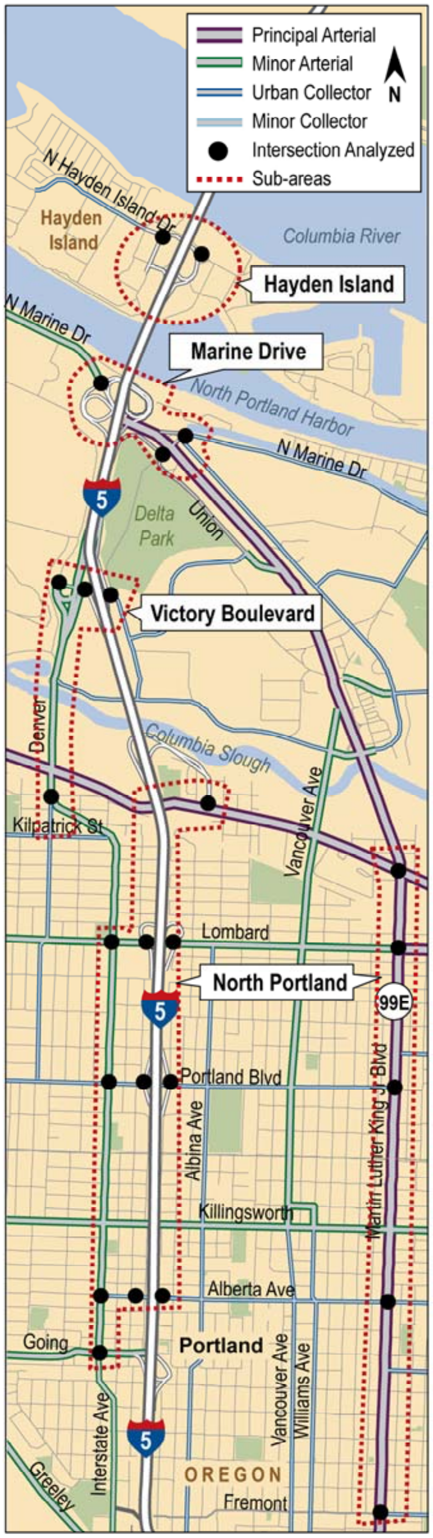
To build a better understanding of regional traffic conditions, the CRC project team analyzed the I-5 corridor well beyond the project area—from Ridgefield in Clark County to the Marquam Bridge in downtown Portland. This 23-mile segment generally consists of three through-lanes in each direction and includes 23 interchanges. Regional highway analysis also included the I-205 corridor over the Columbia River.

Transit service within the project area is provided by two agencies: TriMet in Oregon and C-TRAN in Clark County, Washington. Existing bi-state transit service includes local fixed-route bus service between Vancouver and the park and ride lot at Delta Park in Portland (with light rail service continuing on to downtown Portland) and commuter-oriented routes from Clark County park and ride lots and transit centers to central Portland or to other light rail stations in Portland.

Local Street System

Local traffic impacts are measured by performance standards for intersection levels-of-service, delay, and queuing. WSDOT, ODOT, the City of Vancouver, and the City of Portland have all defined standards for intersections, which were used to analyze the performance results of the CRC project alternatives. Detailed descriptions of these standards can be found in the Traffic Technical Report.

Exhibit 3.1-2
Portland Interchange Areas

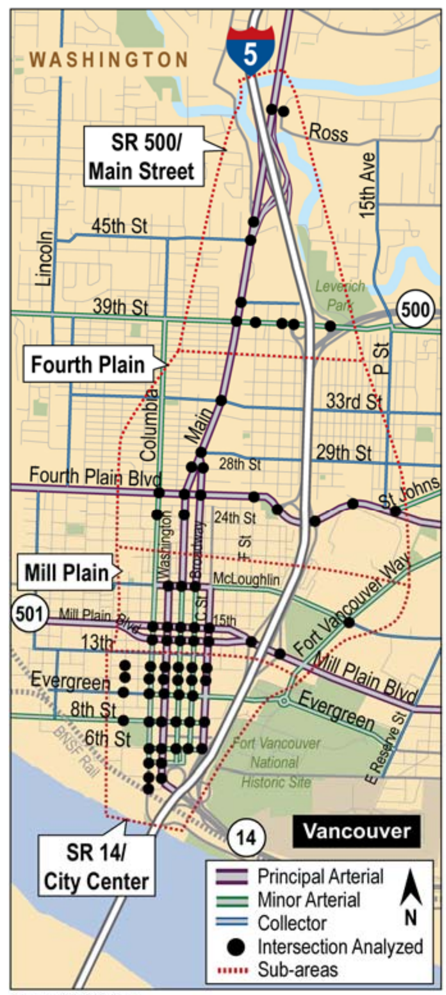


NOT TO SCALE

The local street network within the project area was divided into subareas to more closely examine changes in local street operations resulting from the various CRC alternatives (see Exhibits 3.1-2 and 3.1-3). The local street system in Vancouver was divided into four subareas that include 73 key intersections.

- **SR 500/Main Street Interchange Area:** Ten intersections, located primarily along 39th Street, including the ramp terminal at I-5, and the area bordered by P Street to the east, 35th Street to the south, Main Street to the west, and Ross Street to the north.
- **Fourth Plain Boulevard Interchange Area:** Fourteen intersections, located primarily along Main Street and along Fourth Plain Boulevard, including the I-5 ramp terminal, and the area bordered by Q Street to the east, 20th Street to the south, Columbia Street to the west, and 35th Street to the north.
- **Mill Plain Boulevard Interchange Area:** Sixteen intersections located primarily along Mill Plain Boulevard, 15th Street, McLoughlin Boulevard, and the I-5 ramp terminal at Mill Plain Boulevard, and the area bordered by Fort Vancouver Way to the east, 13th Street to the south, Columbia Street to the west, and 20th Street to the north.

Exhibit 3.1-3
Vancouver Interchange Areas



NOT TO SCALE

- **SR 14/City Center Interchange Area:** Thirty-three local street intersections covering most of the downtown core, bordered by I-5 to the east, the Columbia River to the south, Esther Street to the west, and 13th Street to the north.

The Portland local street system was divided into four subareas that include 25 key intersections:

- **Hayden Island Interchange Area:** The two existing I-5 ramp terminals on Hayden Island.
- **Marine Drive Interchange Area:** The I-5 ramp terminal along Marine Drive, and two other key intersections along Marine Drive and Martin Luther King Jr. Boulevard near the I-5 ramp terminal.
- **Victory Boulevard Interchange Area**: Three intersections along Victory Boulevard that access the I-5 ramp terminals, and the Interstate Avenue/Argyle Street intersection.

- **North Portland Area:** Sixteen key intersections along Interstate Avenue between Going and Lombard Streets, I-5 ramp terminals at Alberta Street, Portland Boulevard (renamed to Rosa Parks Way), Lombard Street, and Columbia Boulevard interchanges, and along Martin Luther King Jr. Boulevard from Fremont Street to Columbia Boulevard.

Existing Transit Operations

TRANSIT MARKETS

As shown in Exhibit 3.1-4, two key transit market areas have been defined for bi-state travel across the Columbia River:

- **Urban Market:** Local and intermediate-distance trips between downtown Vancouver and downtown Portland, with destinations in these two areas and in North Portland, Delta Park, Rivergate, Hayden Island and inner urban areas in and around downtown Vancouver.
- **Suburban Commuter Market:** Long-distance trips from Salmon Creek, East Clark County and outer Clark County to destinations in the inner urban market and downtown Portland.

Exhibit 3.1-5 illustrates the existing transit centers and park and ride locations for TriMet and C-TRAN, while Exhibits 3.1-6 and 3.1-7 summarize the operating characteristics and facilities of these two transit agencies.

Exhibit 3.1-4
Transit Travel Markets

DIMENSIONS ARE APPROXIMATE.

C-TRAN

As of November 2007, C-TRAN operates 10 local bus routes in downtown Vancouver. Three of these local bus routes, route 4 – Fourth Plain, route 37 – Mill Plain, and route 71 – Highway 99, have the highest percentage of bi-state riders and the highest local ridership. In 2004, C-TRAN extended Route 4 to Hayden Island and the light rail station at Delta Park. While crossing the Columbia River, Route 4 operates in general purpose lanes on I-5.

Within the CRC area, C-TRAN also operates three "limited" bus routes: route 44 – Fourth Plain Limited, route 114 – Camas/Washougal Limited, and route 173 – Battle Ground Limited. The 44 is a limited stop version of the local bus route 4, with a peak period headway of 30 minutes. The 44 crosses the Columbia River on I-5 in general purpose lanes and allows a transfer to light rail at Delta Park, but does not stop on Hayden Island. The 114 and 173 also connect to light rail at Delta Park. These routes both have peak headways of 120 minutes. All three of these limited routes make fewer stops and have increased stop spacing than local routes.

Exhibit 3.1-5
Existing Transit Center and Park and Ride Locations

DIMENSIONS ARE APPROXIMATE.

The C-TRAN network includes five express bus routes in the I-5 corridor; route 105 – I-5 Express, route 134 – Salmon Creek Express, route 157 – Lloyd District Express, route 190 – Marquam Hill Express, and route 199 – 99th Street Express. These routes travel in general purpose lanes along I-5, but during the afternoon/evening peaks they use the northbound high-occupancy vehicle (HOV) lane on I-5 from Going Street to Marine Drive. Express buses operate on weekdays only and, except for route 105, only during peak periods.

In addition to service in the I-5 corridor C-TRAN provides express bus service over the Columbia River in the I-205 corridor. Routes include the 65 – Parkrose Limited, 164 – Fisher's Landing Express, and 177 – Evergreen Express. During the morning peak the 164 and 177 use I-205 but return in the afternoon/evening using the I-5 HOV lane. These buses do not pick up or drop off passengers in the I-5 corridor. Further information related to C-TRAN existing service is included in the Transit Technical Report.

Exhibit 3.1-6
Summary of 2005 Transit System Operating Characteristics

Transit Characteristic		TriMet	C-TRAN
Vehicles	Fixed Route Buses	660	111
	Light rail cars	105	N/A
Annual Revenue Hours	Fixed Route Bus	1,873,568	231,191
	Light rail	415,713	N/A
Maintenance Facilities	Buses	3	1
	Light rail	2	N/A

Source: 2005 National Transit Database.

Exhibit 3.1-7
Existing Transit Facility Summary

	Transit Centers	Parking Spaces Available
Clark County I-5	Salmon Creek	493
	99th Street	600
	BPA	175
	Vancouver Mall	N/A
	K-Mart	100
	Total	**1368**
Clark County I-205	Fishers Landing	566
	Evergreen	271
	Total	**837**
Portland I-5	Expo Center	300
	Delta Park	304
	Lombard	N/A
	Rose Quarter	N/A
	Total	**604**

Source: CRC Transit Technical Report 2008.

TRIMET

In the CRC area in north Portland, TriMet operates three local bus routes: Line 6 – Martin Luther King Jr. Boulevard, Line 8 – Northeast 15th Avenue, and Line 16 – Front Avenue/St. Johns. Line 6 runs to Hayden Island. It is one of TriMet's frequent service lines, with 15-minute headways all day on weekdays and weekends. Line 8 provides service to Middlefield east of I-5 and facilitates a transfer to Line 16, which travels along Marine Drive, stopping at the Expo Center light rail station and the Rivergate area of Portland. Line 8 is also one of TriMet's frequent service lines. Line 16 operates at 30-minute headways in the weekday peaks.

TriMet also operates the MAX Yellow Line (light rail), which runs through north Portland and includes 10 stations between the Rose Quarter and its terminus at the Expo Center. It runs at approximately 10-minute headways during the peaks and 15-minute headways off-peak.

3.1.2 Existing Transportation Performance

Existing I-5 and I-205 Performance

This section summarizes existing traffic performance for the I-5 and I-205 study areas. This data was collected in 2005.

EXISTING: DAILY TRAFFIC LEVELS

Average daily traffic volumes represent the average 24-hour weekday traffic on a roadway segment. The I-5 bridges currently carry 135,000 vehicles each day. The I-205 bridges, located six and a half miles to the east, carry 146,000 vehicles each day.

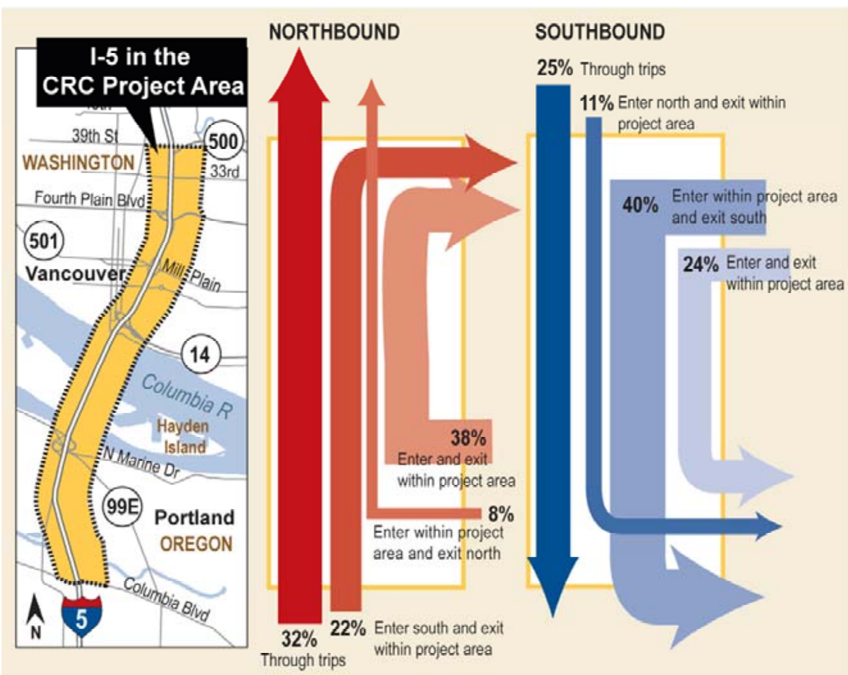
Approximately 11,000 trucks cross the I-5 bridges on the average weekday, accounting for eight percent of all traffic. On the I-205 crossing five percent of all traffic is from trucks, with an average of 7,750 trucks per day. Although the I-5 crossing carries less total traffic than the I-205 crossing, it carries about 42 percent more trucks.

EXISTING: I-5 TRAFFIC PATTERNS IN THE CRC PROJECT AREA

The average length of a vehicle trip using the I-5 crossing is about 20 miles during the morning and afternoon/evening peaks. However, most vehicle trips using the crossing are only on I-5 for a short portion of their trip.

Exhibit 3.1-8 illustrates that a majority of vehicles on I-5 during peak travel periods enter and/or exit the freeway within the project area. During the weekday morning peak traffic period (between 6 a.m. and 10 a.m.), only 25 percent of southbound traffic across the bridge travels through the entire project area; the other 75 percent enters and/or exits I-5 within the project area. During the afternoon/evening peak, only 32 percent of northbound traffic across the bridge consists of through-travel; the other 68 percent enters and/or exits I-5 within the project area.

Exhibit 3.1-8
Vehicle Trips on I-5 in the CRC Project Area



Source: CRC Traffic Technical Report 2008.

EXISTING: PEAK TRAFFIC DEMAND

Peak traffic demand is high within the project area due to the limited number of Columbia River crossings between Vancouver and Portland, and due to I-5's connections with key east-west highways and arterial roadways immediately north and south of the Columbia River (such as SR 14). High traffic demand combined with short spacing between on- and off-ramps results in congestion and safety issues.

Current traffic volumes within the CRC area are typically at their highest on weekdays during the four-hour morning peak (6 a.m. to 10 a.m.) and

Traffic Demand vs. Traffic Throughput

The terms "traffic demand" and "traffic throughput," both used throughout this chapter, have different meanings. Traffic demand refers to the total number of motorists attempting to access the transportation system, including those caught in congestion. Traffic throughput is the total number of motorists actually able to travel through the transportation facility. When traffic demand exceeds traffic throughput, congestion occurs and some motorists are forced to take an alternate route or experience delay.

the four-hour afternoon/evening peak (3 p.m. to 7 p.m.), as indicated in Exhibit 3.1-9. During the morning peak, southbound traffic demand is greatest, whereas northbound traffic demand is greatest during the afternoon/evening peak.

Exhibit 3.1-9
2005 Vehicle Demand on I-5

Location	Demand
A.M. Peak[a] Demand	
Pioneer St	9,810
SR 14	20,200
Going St	23,295
P.M. Peak[b] Demand	
Pioneer St	9,495
SR 14	14,990
Going St	19,425

Source: CRC Traffic Technical Report.
[a] a.m. peak refers to 6 a.m. to 10 a.m.
[b] p.m. peak refers to 3 p.m. to 7 p.m.

Southbound traffic demand during the four-hour morning peak reaches 20,200 vehicles at the I-5 crossing. This demand exceeds the capacity of I-5, resulting in substantial traffic congestion, as discussed later in this chapter. Southbound traffic demand along the 23-mile I-5 study corridor ranges from a low of about 10,000 vehicles near Pioneer Street in Ridgefield to a high of over 23,000 vehicles north of the I-405 split in Portland.

Northbound traffic demand is substantially higher during the four-hour afternoon/evening peak than during the morning peak period. Traffic demand at the I-5 crossing reaches 21,400 vehicles, exceeding the I-5 crossing's capacity and resulting in substantial congestion, as discussed later in this section. Northbound traffic demand along the I-5 corridor ranges from a low of about 7,000 vehicles near 139th Street to a high of almost 24,000 vehicles near Fourth Plain Boulevard.

About 42 percent of daily truck movement across the I-5 bridges occurs from 9 a.m. to 3 p.m. when conditions are generally less congested and are more reliable for truck movement. The highest truck volumes occur between noon and 1 p.m. when trucks account for about 10 percent of traffic demand. The I-5 ramps with the highest truck volumes in the CRC area are the Marine Drive and Mill Plain Boulevard interchanges.

EXISTING: TRAFFIC CONGESTION AND TRAVEL TIMES

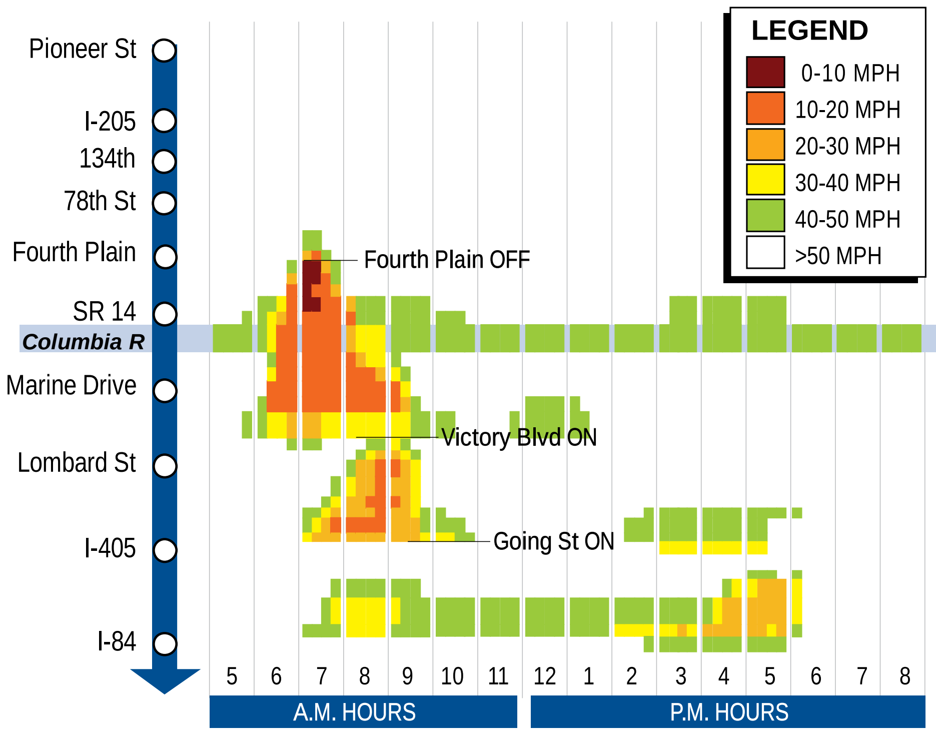
Illustrative profiles of traffic congestion show travel speeds at different locations and times in the CRC area over the 16-hour period from 5 a.m. to 9 p.m. Exhibit 3.1-10 shows southbound traffic, and Exhibit 3.1-11 shows northbound traffic. These profiles help assess early morning, midday, and afternoon/evening effects along the 23-mile study corridor.

In the morning, congestion and queuing occur at the I-5 southbound bridge, the Delta Park southbound lane drop, north of the I-405 split, and the Rose Quarter/I-84 off-ramp. The I-5 crossing is congested because of its limited capacity and the downstream Delta Park bottleneck where I-5 transitions from three lanes to two lanes. This section of the highway will be widened to three lanes, with construction planned to begin in 2008. Congestion occurs north of the I-405 split due to high traffic demand on three lanes that eventually feed both I-5 and I-405.

Midday congestion and queuing occurs along southbound I-5 at the Delta Park lane drop and Rose Quarter/I-84 off-ramp section. This queuing occurs independently of peak period congestion and lasts multiple hours throughout the day. During the afternoon/evening, southbound congestion and queuing occur north of the I-405 split and near the Rose Quarter/I-84 off-ramp.

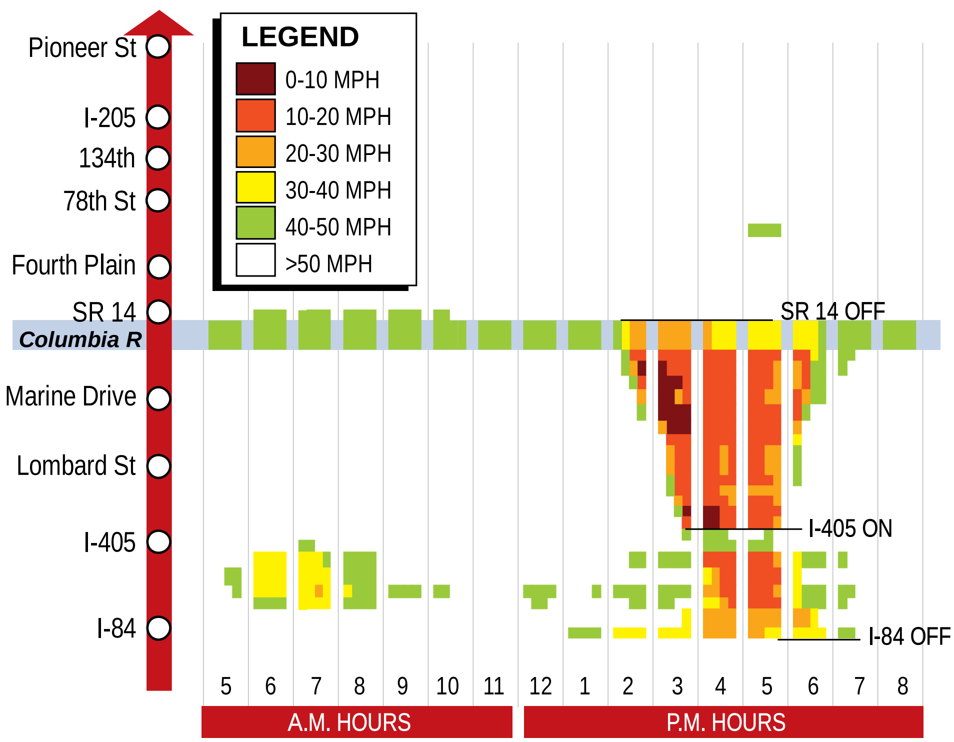
The average morning 2-hour peak southbound travel time between 179th Street and I-84 (16.6 miles) is 31 minutes. The afternoon/evening 2-hour peak northbound travel time between I-84 and 179th Street is 38 minutes.

Exhibit 3.1-10
Speed Profiles: 5 a.m. to 9 p.m.
Existing 2005 Conditions, Southbound



Source: CRC Traffic Technical Report 2008.

Exhibit 3.1-11
Speed Profiles: 5 a.m. to 9 p.m.
Existing 2005 Conditions, Northbound



Source: CRC Traffic Technical Report 2008.

Northbound I-5 also experiences multiple hours of congestion. During the morning, queuing occurs between the I-84 on-ramp and the I-405 off-ramp. As shown in Exhibit 3.1-11, afternoon/evening congestion and vehicular queuing occurs between the Broadway Avenue on-ramp and the I-405 off-ramp, and at the crossing. The bridge bottleneck is more restrictive and extends longer than the Broadway/I-405 bottleneck.

EXISTING: PEAK TRAFFIC AND PERSON THROUGHPUT

Capacity constraints along I-5 limit the vehicular and person demand that can be served along the corridor in the peak travel directions.

Currently, the I-5 bridges are usually congested for two hours in the morning and four hours in the afternoon/evening. I-5 and local streets experience congestion at the same time. This congestion is expected to get worse. More information about future congestion can be found in the No-Build Alternative discussion, later in this chapter.

During the morning peak, southbound vehicle throughput reaches 19,100 vehicles at the I-5 crossing. However, actual southbound vehicle demand is about five percent greater, as the bottleneck at the bridge limits the number of vehicles that can cross during the peak. For the westbound SR 14 to southbound I-5 movement, vehicle demand exceeds the amount of traffic that is served by about 600 vehicles, resulting in congestion and delay on the SR 14 ramp. Some traffic volumes divert to alternative connections (such as downtown Vancouver streets).

Northbound vehicle throughput on I-5 during the afternoon/evening peak reaches 20,500 vehicles at the I-5 crossing. This represents only 96 percent of the actual peak demand (21,400 vehicles).

About 21,400 persons in vehicles and 1,500 persons in buses cross the I-5 bridge southbound during the morning four-hour peak. During the afternoon/evening four-hour peak, about 24,600 persons in vehicles and 1,200 persons in buses travel northbound over the bridge.

Existing Local Street Performance

This section summarizes existing local street performance for peak hours of travel.

The cities of Portland and Vancouver, WSDOT, and ODOT establish and monitor I-5 ramp and local street performance standards. Established standards include wait time at intersections and standards for queuing. Additional information on performance standards is provided in the Traffic Technical Report.

Local street congestion is most intense near the I-5 ramps and is influenced by the travel direction and length of time that I-5 is congested each day. When I-5 is congested, major arterials that provide east/west connectivity are also congested.

EXISTING: VANCOUVER LOCAL STREETS

Despite localized vehicle queuing affecting up to 18 local intersections, 71 of the existing 73 study intersections in Vancouver meet performance standards during the morning and 72 intersections meet performance standards during the afternoon/evening peak.

During the morning peak, most traffic travels toward downtown Vancouver from areas to the north and east, and travels away from downtown during the afternoon/evening peak period. Main Street, the only north-south arterial roadway in the Vancouver subareas, carries higher southbound volumes in the morning (78 percent of total morning traffic volumes) and higher northbound volumes in the afternoon/evening (65 percent of total afternoon/evening traffic volumes).

Freight movements are heaviest within the I-5/Mill Plain Boulevard interchange area and the I-5/Fourth Plain Boulevard interchange area, both serving the Port of Vancouver. I-5 divides the Vancouver local street system, with community connections limited to Columbia Way, Evergreen Boulevard, Mill Plain Boulevard, McLoughlin Boulevard, Fourth Plain Boulevard, 29th Street, 33rd Street, and 39th Street.

More than 97 percent of Vancouver's study intersections meet performance standards today.

In the morning, southbound I-5 is congested, and some commuters seek to bypass congestion on I-5 and SR 14 by circulating through downtown Vancouver to enter southbound I-5 at Washington Street. This adds traffic and congestion on local streets through downtown Vancouver.

EXISTING: PORTLAND LOCAL STREETS

Despite localized vehicular queuing at 16 intersections, all 25 intersections studied in Portland meet performance standards established by the City of Portland and ODOT during both the morning and afternoon/evening peaks. Most traffic on these local streets travels toward downtown Portland during the morning peak and away from it during the afternoon/evening. Correspondingly, north-south arterials carry higher southbound volumes in the morning and higher northbound volumes in the afternoon/evening. In North Portland, regional east/west travel is strongly toward I-5 and toward downtown Portland in the morning and away from these areas in the afternoon/evening.

All of Portland's study intersections meet performance standards today.

Freight movements are heaviest within the I-5/Marine Drive interchange area serving the Port of Portland and Columbia Corridor. Freight movements are also heavy within the I-5/Columbia Boulevard interchange area serving the Columbia Corridor, and the I-5/Going Street interchange serving the Swan Island industrial area.

The Portland local street system is divided by I-5, with community connections across I-5 mostly limited to interchanges, with some local street over-crossings. When I-5 is congested, commuters often travel on roadways parallel to I-5. Many of these motorists then enter I-5 via on-ramps from Victory Boulevard or Marine Drive.

Along Interstate Avenue, the MAX light rail line receives priority over vehicles at traffic signals. This means that light rail trains generally get green lights when they arrive at signalized intersections, which can add to intermittent traffic delays and backups to cross traffic when trains cross at these intersections.

Existing Conditions for Pedestrians and Bicyclists

Pedestrians and bicyclists often experience difficult conditions when crossing the Columbia River on the I-5 bridges. Sidewalks on the bridges are only about four feet wide and are separated from highway traffic by low barriers. The mixing of pedestrians and bicycles in this narrow facility can cause safety problems. Pedestrians and bicyclists are exposed to high noise levels, exhaust, and debris. The grades on the bridge create high downhill speeds for bicyclists and difficult uphill climbs for some pedestrians and bicyclists.

The designated pedestrian and bicycle route between downtown Vancouver, Hayden Island and Marine Drive area is circuitous and requires users to navigate local street intersections (see Exhibit 3.1-12). On the south side of the Columbia River, connections to the large Portland bikeway network exist via Marine Drive to the west and east, Martin Luther King Jr. Boulevard to the southeast, and Expo Road to the south. Directional or way-finding signing can be confusing or non-existent in some places. Furthermore, the paths connecting the crossing to the larger bikeway network are narrow and place bicyclists close to high speed traffic, which includes a high percentage of heavy vehicles.

Despite constraints, many pedestrians and bicyclists use the existing facilities to cross the Columbia River.

Although there are constraints for pedestrian and bicycle travel across the Columbia River and North Portland Harbor, a substantial number of pedestrians and bicyclists use the existing crossing facilities. Year 2007 (September) 14-hour weekday counts (from 6 a.m. until 8 p.m.) showed about 60 pedestrians and 300 bicyclists using the crossing. About twice as many bicyclists use the western bridge’s sidewalk, primarily because it connects more directly with bicycle routes to the north and south. About 60 percent of the pedestrians crossing the Columbia River use the western sidewalk.

A multi-use pathway is located on the east side of the I-5 crossing of North Portland Harbor. The 14-hour counts showed about 30 pedestrians and 350 bicyclists using the pathway. For comparative purposes, pedestrian and bicycle counts were also conducted on the I-205 crossing. The 14-hour counts showed about 10 pedestrians and 190 bicyclists using the I-205 crossing’s multi-use pathway, which meets current standards.

Pedestrian and bicycle planning documents and maps from local jurisdictions were reviewed to develop an understanding of the existing facilities in the CRC area. The maps were aggregated to show all pedestrian and bicycle existing and planned facilities in the CRC area (Exhibit 3.1-12, below).

The Portland Transportation System Plan includes several proposed connections for pedestrians and bicycles, and these connections would improve accessibility and safety for users. Notable among the proposed improvements is the Bridgeton Trail along the Columbia River. This trail would improve the connection to the Marine Drive area from the east and provide users with an off-street multi-use pathway option that could eliminate travel on Marine Drive. Another proposed improvement that would improve the connection from the south is a multi-use pathway along the Columbia Slough and along Whitaker Road.

Numerous connections to regional pedestrian and bikeway facilities exist throughout Vancouver. The waterfront multi-use trail on the north bank of the Columbia River provides vehicle-separated access to the Confluence Land Bridge, Vancouver National Historic Reserve, and points farther east. The existing multi-use trail along Columbia Street enables access through downtown Vancouver and the northwest along 15th Street towards Vancouver Lake. There are a number of east-west streets with bike lanes that cross I-5 and provide access to the Burnt Bridge Creek Greenway Trail and to the larger system of regional trails in Clark County.

Exhibit 3.1-12
2007 and Proposed Pedestrian and Bicycle Facilities

DIMENSIONS ARE APPROXIMATE.

Source: Data from published maps and plans from the cities of Portland and Vancouver, WSDOT, ODOT, Clark County, and Metro.

The City of Vancouver has several major streets, such as Columbia Way, that have been identified as future bikeways and bike lanes. These improvements would increase north-south access throughout the city and provide straight line connections to many neighborhoods and parks in Vancouver.

Existing Traffic Safety and Security

The project's Purpose and Need statement includes provisions to improve river crossing safety and reduce vulnerability to incidents, to improve substandard bicycle and pedestrian facilities, to improve marine navigation, and to reduce the seismic vulnerability of the existing bridges. All of these needs are safety-related, and improved safety is one of the cornerstones of this project.

CRC project staff undertook a comprehensive examination of safety-related conditions. They examined traffic safety using methodologies such as ODOT's Safety Priority Index System (SPIS) and data from WSDOT's High Accident Location and High Accident Corridor records. Project staff compiled a detailed crash analysis using a five-year data set that included all collisions in the CRC area. The data were analyzed by crash type and severity, location, time of day, truck involvement, and the effects of non-standard highway geometrics, bridge lifts, and traffic stops.

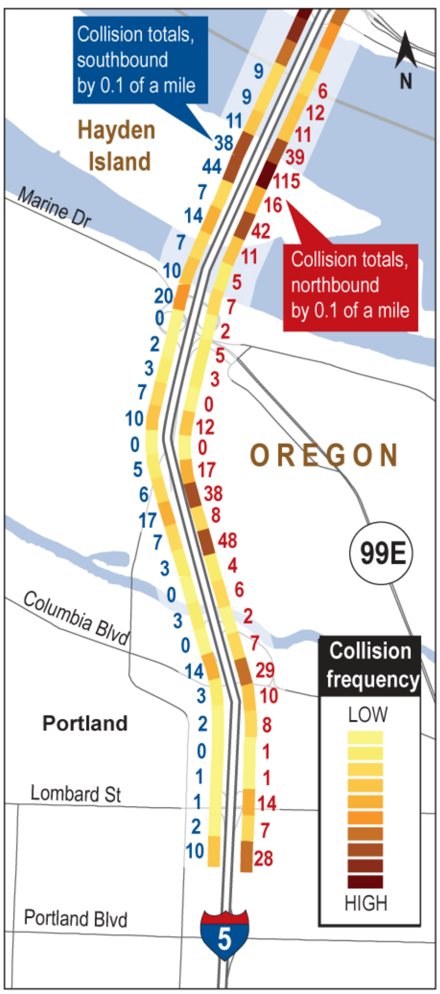
I-5's collision rate in the CRC project area is double that of similar facilities in Oregon.

EXISTING: NUMBER OF VEHICULAR COLLISIONS AND COLLISION RATES

Between January 1, 2002, and December 31, 2006, 2051 collisions were reported on mainline I-5 and its ramps within the CRC area. An average of one reported collision occurred per day. The Washington segment of the CRC area had a crash rate of 1.02 collisions per million vehicle-miles traveled (MVMT). In Oregon, the crash rate was 1.08 collisions per MVMT. This is nearly twice the average rate (0.55 MVMT) experienced on similar urban interstate facilities in Oregon.

Collision rates are measured in million vehicle-miles traveled (mvmt).

Exhibit 3.1-13
Oregon Collisions

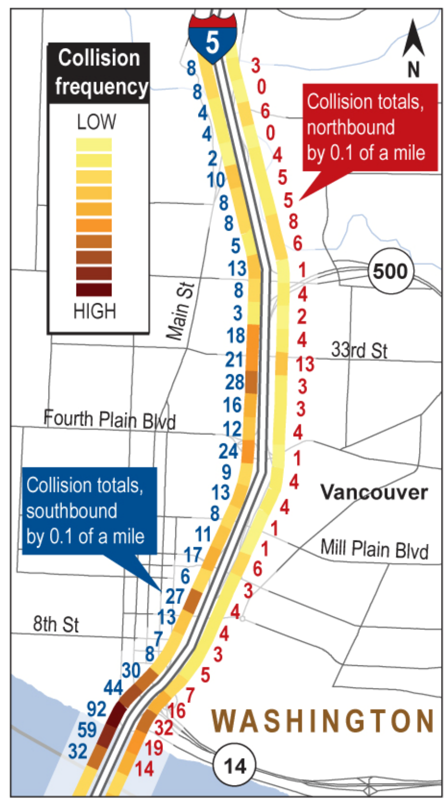


NOT TO SCALE

EXISTING: VEHICULAR COLLISIONS BY TYPE AND SEVERITY

The number, type, and severity of collisions reported in the CRC area between 2002 and 2006 were compiled and plotted by direction (northbound and southbound) in 0.1-mile increments. Four collision types were reported: rear-end, side-swipe, fixed object, and other. Three severity types were reported: property damage only, injury, and fatality. Exhibits 3.1-13 and 3.1-14 show the number of collisions reported within the CRC area in Oregon and Washington, respectively.

Exhibit 3.1-14
Washington Collisions



NOT TO SCALE

Southbound collisions in Washington happened at almost three times the reported northbound rate. Fifty-seven percent were rear-ends, and 15 percent were side-swipes. This reflects recurrent southbound traffic congestion at and near the approaches to the bridge.

In Oregon, northbound collisions occurred at about twice the reported southbound rate, reflecting high northbound congestion levels at and near the bridge approach. Seventy-seven percent of these collisions were rear-ends, and 13 percent were side-swipes.

About 61 percent of the total collisions had property damage only. Injury crashes accounted for almost all remaining collisions, and were more prevalent in the peak direction of travel.

Three fatalities occurred during the five-year study period between 2002 and 2006, representing 0.1 percent of all collisions. The three fatalities involved either a pedestrian or a bicyclist being struck by a vehicle or truck. Two of the three crashes occurred on southbound I-5 near the crossing, one near the Hayden Island southbound on-ramp and one near the southbound SR 14 on-ramp. The third fatality occurred along northbound I-5, near the Victory Boulevard off-ramp.

EXISTING: RELATIONSHIP OF VEHICULAR COLLISIONS TO HIGHWAY GEOMETRICS

While the current highway and bridge design generally met design standards applicable at the time of their construction, vehicles have changed and standards have evolved over the years, reflecting continued research in areas such as vehicle operating characteristics, driver expectations, traffic volumes, and physical highway elements.

Non-standard geometric features exist throughout the CRC area, including short ramp merges/acceleration lanes, short ramp diverges/deceleration lanes, short weaving areas, vertical curves (crest and sag curves) limiting sight distance, and narrow shoulders. In the CRC area, there are multiple non-standard features, with the greatest concentration located on the bridge and along its approaches.

The presence of non-standard design features is strongly correlated with the frequency and type of collisions. For example, non-standard acceleration and deceleration lanes at several on- and off-ramps contribute to a high number of rear-end and side-swipe collisions along northbound I-5, particularly at Hayden Island Drive, the downtown Vancouver/City Center off-ramp, and at SR 14. Along southbound I-5, these lanes contribute to a high number of rear-end and side-swipe collisions at Fourth Plain Boulevard, SR 14, Hayden Island Drive, and Victory Boulevard.

Non-standard weaving areas contribute to a high number of rear-end and side-swipe collisions, primarily southbound between SR 500 and Fourth Plain Boulevard, between Mill Plain Boulevard and SR 14, between Hayden Island Drive and Marine Drive, and between Marine Drive and Victory Boulevard.

Non-standard geometric features are highly correlated with the type and frequency of crashes in the CRC area.

EXISTING: VEHICULAR COLLISIONS DURING BRIDGE LIFTS AND TRAFFIC STOPS

The I-5 bridges are equipped with lift spans. Lifting the spans or stopping traffic for maintenance is allowed on weekdays between 9 a.m. and 2:30 p.m., overnight between 6 p.m. and 6:30 a.m., and any time on weekends. Weekday collisions that occurred within a one-hour window of bridge lifts/traffic stops were analyzed for vehicles approaching the bridge.

Northbound collisions are three times more likely when a bridge lift or traffic stop occurs than when it does not. Southbound collisions are four times more likely. Collisions occurring during bridge lifts or traffic stops generally result in a higher rate of rear-end collisions and greater injury frequency than collisions that occur during peaks, when stops and lifts are not allowed.

Collisions are up to four times more likely to occur during bridge lifts and traffic stops associated with the bridge, and increase substantially during congestion.

EXISTING: VEHICULAR COLLISIONS BY TIME OF DAY

The number of reported collisions is generally proportional to prevailing traffic volumes, except during late night periods when fixed-object and alcohol-related collisions increase. During periods when traffic volumes approach near-congestion or operate at congested levels, collisions increase substantially. Rear-end collisions are the most prevalent in the CRC area, and the higher proportion during congestion could be from existing non-standard design features or vehicular queuing during peak conditions.

EXISTING: VEHICULAR COLLISIONS INVOLVING TRUCKS

Trucks are involved in 12 percent of collisions in the CRC area.

Collisions involving trucks account for about 12 percent of all collisions reported on I-5 from Lombard Street to Main Street/Hwy 99; this is approximately equal to or higher than the proportion of truck volume to all traffic.

In Oregon, 95 collisions involving trucks were reported. Forty-six percent of these collisions occurred southbound and 54 percent occurred northbound. In Washington, 160 collisions involved trucks. Seventy-two percent occurred southbound and 28 percent occurred northbound.

The rate of side-swipe collisions involving trucks is higher than any other type (39 percent). This is attributed to truck drivers attempting to change lanes in congested traffic and short acceleration/deceleration lanes and weaving sections in the CRC area.

Locations with high numbers of truck-related collisions are the Columbia Boulevard ramps, Victory Boulevard ramps, Hayden Island, and the northbound exit to Marine Drive. The SR 14 westbound to I-5 southbound on-ramp with its short turning radius, steep super-elevation, uphill grade and short merging distance contributes to the higher number of truck-related collisions at the bridge approach.

EXISTING: IDENTIFICATION OF SAFETY IMPROVEMENT LOCATIONS ON STATE HIGHWAYS

The Safety Priority Index System (SPIS) is the primary method for identifying locations of frequent crashes on state highways within Oregon. The SPIS score is based on three years of crash data and considers crash frequency, crash rate, and crash severity. ODOT bases its SPIS on 0.10 mile segments, to account for variances in how crash locations are reported. To become an SPIS site, a location must meet one of the following criteria:

- Three or more crashes have occurred at the same location over the previous three years.
- One or more fatal crashes have occurred at the same location over the previous three years.

Each year, a list of the highest scoring 10 percent of SPIS sites is generated, and the top five percent of sites are investigated by the five Regional Traffic Manager's offices. These sites are evaluated and investigated for safety problems. If a correctable problem is identified, a benefit/cost analysis is performed and appropriate projects are initiated.

A search of the ODOT 2004 to 2006 SPIS database revealed five locations (two overlap) within the Oregon section of the CRC area that ranked among the 10 percent highest scored sites in the state. These locations are summarized in Exhibit 3.1-15. Two of these locations are in the top five percent in the state and the other three are in the top 10 percent. ODOT does not include the interchange ramps or intersections in the calculations of SPIS rates for the highway.

Exhibit 3.1-15
ODOT SPIS Locations 2004-2006

Location	Mileposts	Number of Crashes	2007 SPIS Index	SPIS Rank
Hayden Island interchange	307.81 to 308.17	78	77.12	top 5%
North Portland Harbor Bridge	307.66 to 307.84	22	66.01	top 5%
Victory Boulevard interchange	306.63 to 306.75	33	48.67	top 10%
Victory Boulevard interchange	306.59 to 306.69	33	48.67	top 10%
I-5 Bridge Bridgehead	308.14 to 308.24	15	46.05	top 10%

Source: CRC Traffic Technical Report 2008.

The Washington State Department of Transportation (WSDOT) uses two major programs to identify and correct potentially unsafe locations. These are the High Accident Location (HAL) and the High Accident Corridor (HAC) programs.

A HAL location is a location less than one mile long which has experienced a higher than average rate of severe accidents during the previous two years. The severity of an accident, the severity per million vehicles, the roadway access category, and the accumulated severity rate per million vehicle miles are all taken into account to determine HAL locations.

A HAC is a section of state highway one or more miles long, which has a higher than average number of severe accidents over a continuous period of time. For the five-year analysis period, the following statewide benchmark averages are calculated for each of the six roadway access categories:

- Total severity points per mile
- Total accidents per mile
- Severity points per accident per mile

Information provided by WSDOT revealed that within the CRC area, the following five locations met the HAL criteria:

- Westbound SR 14 off-ramp to southbound I-5 on-ramp
- Southbound I-5 off-ramp to eastbound SR 14 on-ramp
- Southbound I-5 off-ramp to Mill Plain Boulevard
- Southbound I-5 off-ramp to Fourth Plain Boulevard
- 39th Street between the southbound and northbound ramp terminals

All of these locations are ramp-related, which supports the conclusion drawn from the crash analysis that there are safety issues with the ramps. There were no HAC locations identified within the CRC area.

Existing Transit Performance

Metrics highlighted in this chapter focus on those that offer the greatest distinction among the CRC alternatives and options. These include mobility, reliability, accessibility, congestion reduction, and efficiency. The Transit Technical Report describes these and other metrics in more detail.

EXISTING: TRANSIT RIDERSHIP AND MODE SPLIT

Nineteen transit vehicles per hour currently provide service over the I-5 bridges during the afternoon/evening peak period.

About 3,300 weekday daily transit passenger trips across the Columbia River used the I-5 corridor in 2006.[1] This includes approximately 1,400 trips on the four C-TRAN express bus routes and 1,900 local bus trips.

During the afternoon/evening peak, 67 percent of the persons crossing the river on I-5 northbound are in single-occupant vehicles (SOVs), 27 percent are in high-occupancy vehicles (HOVs), and six percent use transit. Six percent of the travelers between the Clark County Urban Market and Oregon use transit daily. Three percent of travelers between the Clark County Suburban Commuter Market and Oregon use transit, and one percent of travelers from Oregon to Clark County use transit.

EXISTING: TRANSIT TRAVEL TIME BETWEEN MARKETS

Exhibit 3.1-16 shows existing transit travel times between representative locations in the CRC transit markets. Transit travel times include those for the northbound and southbound peak times. Traveling from Expo Center to downtown Portland on the MAX line takes approximately 30 minutes.

Exhibit 3.1-16
Existing Average Weekday Transit Travel Times in the I-5 Corridor and CRC Area

Route	Travel Times (in minutes)
Two-Hour Morning Southbound Peak	
Salmon Creek to Pioneer Square (via C-TRAN Route 134)	36
Vancouver Mall to Lombard Transit Center (via LRT & Route 4L)	31
Two-Hour Afternoon/Evening Northbound Peak	
Pioneer Square to Salmon Creek (via C-TRAN Route 134)	44
Lombard Transit Center to Vancouver Mall (via LRT & Route 4L)	48

Source: 2005 CRC VISSIM analysis of I-5 and EMME/2.

EXISTING: OPERATION AND MAINTENANCE COSTS

Exhibit 3.1-17 summarizes the existing annual transit costs for the study area. To provide the existing bi-state transit service, the transit system requires a total of 2,383 weekday platform hours (with 28,668 vehicle miles traveled). This service results in an associated annual cost to operate of nearly $66 million.

[1] The CRC On-Board Survey (November 2006).

Exhibit 3.1-17
Transit System Operation and Maintenance Costs

	Costs in 2007 Dollars
C-TRAN Local Bus	$21,177,000
C-TRAN I-5 Express Bus	$4,150,000
TriMet North Portland Local Bus	$33,111, 000
Light Rail (Yellow Line)	$6,799,000
C-TRAN Limited Stop Bus	$699,000
Total	**$65,936,000**

Source: C-TRAN, 2007 and TriMet, 2007.

3.1.3 Long-Term Effects from Project Alternatives

This section discusses the transportation performance effects of the five project alternatives.

Alternative 1: No-Build

This section explains how existing transportation conditions would change by 2030 if none of the improvements evaluated by this project occur.

NO-BUILD: I-5 AND I-205 TRAFFIC LEVELS

By 2030, average weekday traffic across the I-5 bridges is forecast to reach 184,000 vehicles per day, an increase of 37 percent over current conditions. Daily traffic levels on the I-205 crossing would rise to 210,000 vehicles each day, an increase of 44 percent over current volumes.

Truck volumes on I-5 are projected to increase at a higher rate than general purpose traffic. Truck traffic across the I-5 bridges is estimated to increase by 77 percent over current truck volumes.

By the year 2030 in the CRC area, the I-5 morning peak and afternoon/evening peak travel demand is expected to increase substantially and would continue to be well in excess of the crossing's available capacity, resulting in substantially increased congestion and delay. The highest growth in traffic demand is projected to occur in northern Clark County (double by 2030) and the lowest growth in North Portland (less than five percent).

NO-BUILD: TRAFFIC CONGESTION AND TRAVEL TIMES

Illustrative profiles of traffic congestion based on travel speeds were developed for the No-Build Alternative, as shown in Exhibits 3.1-18 and 3.1-19.

Southbound Peak. During the morning peak, for vehicle trips from 179th Street to I-84, southbound I-5 travel times would increase over the current 31 minute travel time by 15 minutes (50 percent) due to the increase in forecast congestion levels along I-5. Exhibit 3.1-18 illustrates estimated southbound conditions along the 23-mile I-5 corridor. Southbound congestion and vehicular queuing on the crossing is expected to increase from two hours per day currently to over seven hours under the 2030 No-Build Alternative. One of these hours of

Traffic across the I-5 bridges in 2030 is forecast at 184,000 vehicles per day, an increase of 37 percent over current conditions.

Truck traffic is expected to grow twice as fast as general purpose traffic over the next 20 years.

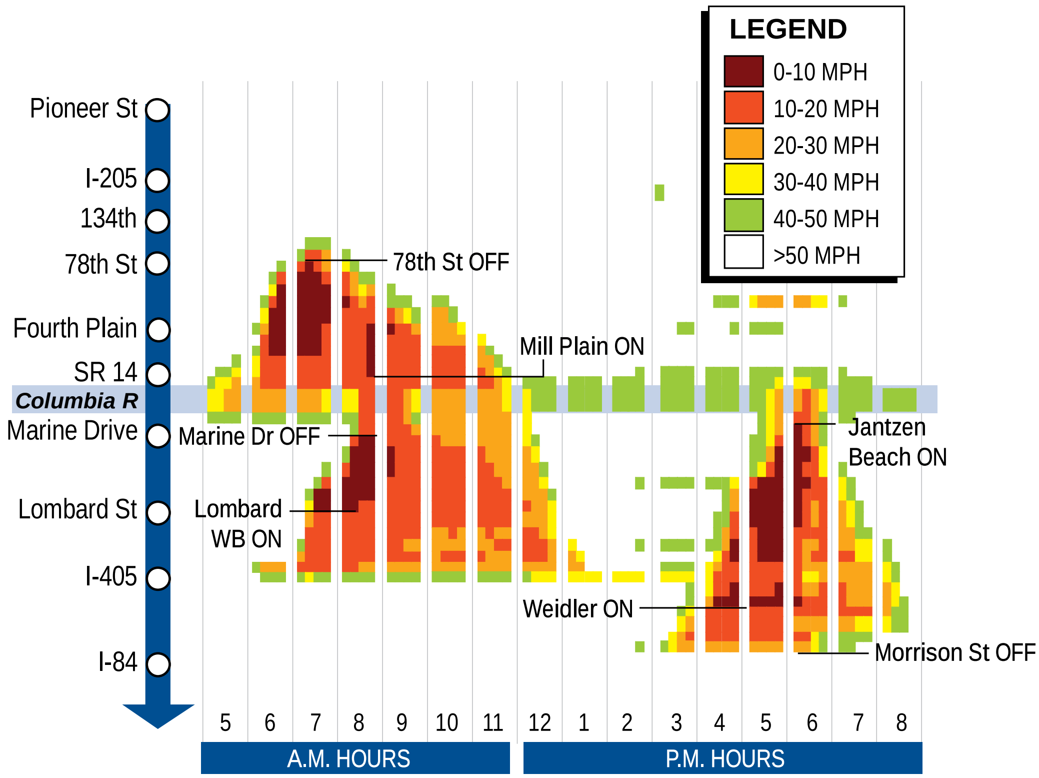
Daily congestion on the I-5 bridges is expected to rise from 6 hours today to 15 in year 2030.

Forecast Traffic Data

All forecast future traffic data was derived by the CRC project team using well established traffic modeling techniques. A key element in forecasting future travel demand and travel patterns is anticipated growth within the region. This project used regional growth assumptions from local governments that predict the magnitude and location of housing and job growth within the region. More information on these techniques, as well as more detailed traffic data, is contained in the CRC Traffic Technical Report.

southbound congestion would develop during the afternoon/evening peak.

Exhibit 3.1-18
I-5 Traffic Speeds: 5 a.m. to 9 p.m.
2030 No-Build, Southbound



Source: CRC Traffic Technical Report 2008.

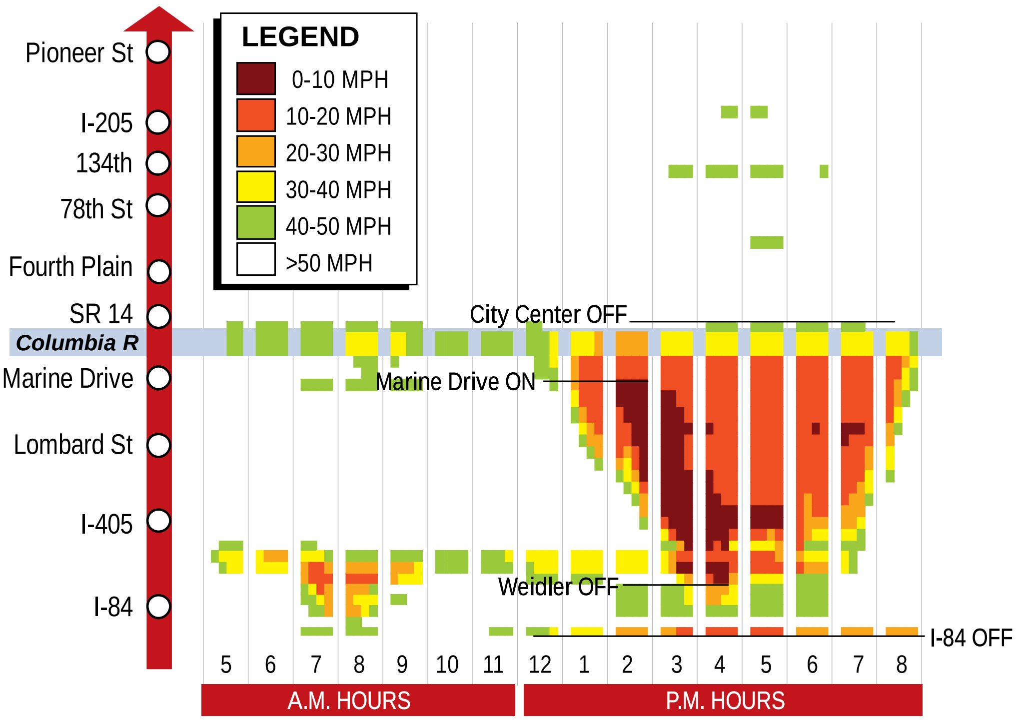
The Delta Park project (not part of CRC) will eliminate the Delta Park bottleneck. However, congestion and vehicular queuing would still result through this portion of highway due to the capacity constraint north of the I-405 split. Southbound congestion and vehicular queuing here would increase from 2.5 hours to 11.5 hours under No-Build conditions, with over four of these hours occurring during the afternoon/evening.

Congestion at the southbound bottleneck near the I-5 lane drop in the Rose Quarter would increase from 2.75 hours to 3.5 hours under 2030 No-Build conditions, despite the planned I-84 off-ramp/Broadway-Weidler Street on-ramp improvements.

Northbound Peak. During the afternoon/evening peak, for a vehicle trip from I-84 to 179th Street, northbound I-5 travel times would increase from the current 38-minute travel time by 6 minutes (16 percent) due to increased congestion in the two existing bottleneck locations (Interstate Bridge and the I-405/Rose Quarter section). Exhibit 3.1-19 illustrates estimated northbound conditions along the 23-mile I-5 corridor. Northbound congestion and vehicular queuing on the crossing would increase from four hours to almost eight hours in the year 2030 under the No-Build Alternative, as increased traffic attempts to utilize the existing limited capacity across the bridge.

Northbound congestion near the I-405/Rose Quarter weaving area would increase from approximately 3.25 hours today to nearly seven hours under 2030 No-Build conditions. More than half of the increased congestion (2.5 hours) would occur during the morning peak.

Exhibit 3.1-19
I-5 Traffic Speeds: 5 a.m. to 9 p.m.
2030 No-Build, Northbound



Source: CRC Traffic Technical Report 2008.

Northbound congestion in the highway weaving area on the Marquam Bridge upstream from the off-ramp to I-84 would increase from five to approximately seven hours.

NO-BUILD: PEAK TRAFFIC AND PERSON THROUGHPUT

The previously identified constraints along I-5 limit the amount of traffic that could travel along the corridor during the morning and afternoon/evening peaks.

Under the No-Build Alternative, during the morning four-hour peak, southbound vehicle throughput across the bridge would increase over the current 19,100 vehicle throughput by 2,900 vehicles (16 percent). While the Delta Park lane drop bottleneck would be eliminated by widening I-5 southbound from Victory Boulevard to Columbia Boulevard, traffic congestion at the bridge combined with congestion at the southern bottleneck located just north of the I-405 split would limit the throughput across the bridge to 87 percent of its vehicular demand.

Under 2030 No-Build conditions traffic back-ups would occur at three southbound I-5 on-ramps, which would not be able to serve their traffic demand—SR 500/39th Street, Mill Plain Boulevard, and SR 14/City Center. These back-ups would add to congestion on local streets around these interchanges.

During the afternoon/evening peak, northbound vehicle throughput would be similar to existing conditions, with about 20,300 vehicles crossing the northbound bridge. Congestion at the crossing would limit the service volume to 72 percent of northbound vehicular demand.

Under 2030 No-Build conditions traffic back-ups would occur at five northbound I-5 on-ramps (Interstate Avenue/Victory Boulevard, Marine Drive, Hayden Island, Mill Plain Boulevard, and Fourth Plain Boulevard). Although all these ramps currently meet demand, these future back-ups would add congestion on local streets around these interchanges.

For the No-Build Alternative, about 24,600 persons in southbound vehicles would cross during the morning peak, with up to 1,900 persons using transit during this period. About 24,400 persons in northbound vehicles would cross during the afternoon/evening four-hour peak, with up to 2,050 persons using transit during this period.

NO-BUILD: LOCAL STREET PERFORMANCE

No-Build: Vancouver Local Streets

Regional travel patterns in 2030 are expected to continue existing commute patterns, with morning traffic traveling toward downtown Vancouver and afternoon/evening traffic traveling toward outlying residential areas in Clark County.

Population and employment growth would spur increased regional travel demand. The City of Vancouver has identified relatively few local street projects within the traffic study subareas that would increase vehicular capacity.

Similar to today, local street congestion would be most intense near the I-5 on- and off-ramps. During congested periods on I-5 (15 hours daily by 2030), nearby local streets would also experience congestion.

Under No-Build conditions, only 46 of 73 intersections (63 percent) in Vancouver would meet performance standards in 2030.

By 2030, the No-Build Alternative would result in the following specific effects on local streets in the Vancouver subareas:

- The increased duration of southbound I-5 congestion in the morning would be expected to increase the use of Main Street as a parallel alternate route for commuters destined to downtown Vancouver, as well as those bypassing I-5 congestion north of SR 14 and then entering the highway again at City Center.
- Even with planned widening of Fourth Plain Boulevard to a five-lane roadway between I-5 and the western railroad bridge, 11 of 14 subarea intersections would not operate at acceptable performance standards during the afternoon/evening peak hour.
- While truck-hauled freight trips are forecast to grow at a higher rate than non-truck trips, it would become increasingly difficult for freight trips to occur at times when the transportation system is not congested. This result is not aligned with the region’s planned increase in Port of Vancouver activity and associated truck-hauled freight movement.
- The Mill Plain Boulevard interchange would be congested for freight and commuter travel for several hours each day, including the

The term “operating acceptably” is defined by the performance standards set by the local jurisdiction and/or State DOT. For specific information on the performance standards used for this project, see the Traffic Technical Report.

mid-day period between peak commute hours commonly targeted by regional freight movers.

- Local street intersection operations would degrade system-wide and would affect all four Vancouver subareas. During the congested afternoon/evening peak, while all 73 local street intersections analyzed operate acceptably today, only 46 of these intersections would meet performance standards under 2030 No-Build conditions.

No-Build: Portland Local Streets

In 2030, the Portland local street system would be configured essentially as it is today. Two exceptions involve minor local street changes along Denver Avenue associated with I-5 widening through Delta Park and signalization of the I-5 southbound and northbound ramp terminals on Alberta Street.

Under No-Build conditions, seven of 25 study intersections in North Portland would fail to meet operating standards in 2030.

Similar to current conditions, local street congestion would be most intense near the I-5 ramps and would remain influenced by the travel direction(s) and length of time that I-5 is congested each day. In short, when I-5 is congested (up to 15 hours daily), the nearby local street system is expected to be congested.

By 2030, the No-Build Alternative would result in the following specific effects on local streets in the Portland subareas:

- Travel to and from Hayden Island, provided exclusively by the I-5 interchange, would be constrained for several hours each day limiting the number of vehicles able to pass through this interchange.
- The Marine Drive interchange would be congested for several hours each day, including the mid-day period between peak commute hours commonly targeted by regional freight movers.
- While truck-hauled freight trips are forecast to grow at a higher rate than non-truck trips, it would become increasingly difficult for freight trips to occur at times when I-5 is not congested. This result is not aligned with the region’s planned increase in port activity and associated truck-hauled freight movement.
- Local street intersection operations would degrade system-wide and would affect all four Portland subareas. During the most congested afternoon/evening peak periods, where all 25 local street intersections operate acceptably under current conditions, only 18 would operate acceptably in 2030.

NO-BUILD: PEDESTRIANS AND BICYCLISTS

Although pedestrian and bicycle use by 2030 has not been modeled, such trips across the Columbia River are expected to substantially increase as traffic congestion worsens and only limited transit service improvements are provided.

Without addressing non-standard design and safety features, collisions in the I-5 bridge area are expected to increase 80 percent between today and 2030.

Under the No-Build Alternative, an increased number of pedestrians and bicyclists would face the same or more difficult conditions when crossing the Columbia River. Along the narrow sidewalks, increased collisions could arise between pedestrians and bicyclists. In addition, increased conflicts would result when pedestrians and bicyclists interact with motor vehicles, such as when accessing the crossing in Vancouver, on Hayden Island, or in the Marine Drive interchange area.

NO-BUILD: TRAFFIC SAFETY AND SECURITY

Under No-Build conditions, the number of collisions is predicted to increase substantially by 2030—approximately 80 percent over existing conditions[2]. With existing non-standard features remaining on I-5 and its ramps, traffic levels would increase, the duration of congestion would lengthen, and bridge lifts/traffic stops would continue at their current rate or increase in the future.

NO-BUILD: TRANSIT RIDERSHIP AND MODE SPLIT

With the No-Build Alternative, Clark County and Portland would be connected by 24 buses crossing the Columbia River in the corridor during the peak hour in the peak direction. This compares with 19 buses currently providing service in the peak hour. These buses would provide local and express service. No high-capacity transit service would be provided into Clark County under this alternative. Platform hours of service would increase over existing conditions by approximately 10 percent, from 2,383 hours to 2,632 hour per weekday.

Between 2006 and 2030, total transit trips over the I-5 crossing are expected to increase by nearly 170 percent on an average weekday.

With the No-Build Alternative total passenger trips on transit over the I-5 crossing would be about 8,800 daily and 2,508,000 annually. This is an increase of nearly 170 percent over existing ridership of 3,300 daily and 928,000 annual passenger trips.

The transit share of trips between the Clark County Urban transit market and Oregon would double from 2006 to 2030 with the No-Build Alternative.

With the No-Build Alternative, the transit mode split would be 1 percent of the afternoon/evening peak direction trips (up from 6 percent today) within the I-5 corridor. Mode split for single-occupancy vehicles (SOVs) would drop to 54 percent (from 67 percent today). Trips via high-occupancy vehicles would increase to 33 percent (from 29 percent today).

Daily transit mode split between the Clark County Urban and Suburban transit markets and markets in Oregon would both be 12 percent. This doubles the current mode split between the Clark County Urban Market and Oregon, and quadruples the current mode split between the Clark County Suburban Market and Oregon. The daily transit mode split from markets in Oregon to Clark County would be 3 percent, (three times the existing mode split of 1 percent). The increase in transit mode split for the No-Build Alternative is attributable to the much slower travel times anticipated for drivers by the year 2030 due to increased congestion.

NO-BUILD: TRANSIT TRAVEL TIMES

With the No-Build Alternative, during peak travel periods the speed of transit vehicles would average 10 mph throughout the corridor and 7.5 mph within downtown Vancouver, lower than the current 8.3 mph average travel speed in downtown Vancouver.

During the afternoon/evening peak periods, average northbound travel times between major transit travel markets would increase over existing conditions (Exhibit 3.1-20). Trips between Pioneer Courthouse Square and the Salmon Creek Park and Ride are expected to increase by

[2] Source: Traffic Technical Report.

approximately four minutes over existing conditions (from 44 minutes). Trips between the Lombard transit center and the Vancouver Mall would increase by nine minutes (from 48 minutes).

During the morning peak hours, southbound travel times would increase by nearly 19 minutes over the current 37 minutes for trips between the Salmon Creek Park and Ride and Pioneer Courthouse Square. Average travel times between Lombard Transit Center and the Vancouver Mall would remain roughly the same.

Exhibit 3.1-20

No-Build Average Weekday Transit Travel Times in the I-5 Corridor and CRC Area

Transit Characteristic	Location	Travel Times (in minutes)
Two-Hour a.m. Peak/Peak Direction	Salmon Creek to Pioneer Square (via C-TRAN Route 134)	56
	Vancouver Mall to Lombard Transit Center (via LRT & Route 4L)	31
Two-Hour p.m. Peak/Peak Direction	Pioneer Square to Salmon Creek (via C-TRAN Route 134)	48
	Lombard Transit Center to Vancouver Mall (via LRT & Route 4L)	57

Source: 2005 CRC VISSIM analysis of I-5 and EMME/2.

NO-BUILD: TRANSIT OPERATIONS AND MAINTENANCE COSTS

With the No-Build Alternative, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of about $70 million. This compares with a current annual operating cost of nearly $66 million. This relatively minor increase in operating costs is based on the assumption that worsening congestion from No-Build conditions would result in increased ridership.

Alternative 2: Replacement Crossing with Bus Rapid Transit

This section explains how existing transportation conditions would change if Alternative 2, a replacement crossing with bus rapid transit, were selected and constructed. Exhibit 3.1-21 summarizes predicted year 2030 transportation performance under Alternative 2.

Exhibit 3.1-21
Alternative 2: Replacement Crossing with Bus Rapid Transit

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Metric	**Kiggins Bowl Terminus (A)** [e]	**Lincoln Terminus (B)**	**Clark College MOS (C)** [d]	**Mill Plain MOS (D)** [d]
People over the I-5 Crossing during peak periods[a]				
In cars	34,400 (NB)	34,400 (NB)	34,400 (NB)	34,400 (NB)
On transit	6,100 (NB)	6,100 (NB)	6,100 (NB)	6,100 (NB)
Vehicles over the I-5 crossing each weekday	178,000	178,000	179,500	179,500
Hours of congestion per day	3.5-5.5 hours	3.5-5.5 hours	3.5-5.5 hours	3.5-5.5 hours
Pedestrian and bicycle connections	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.
Transit mode split in p.m. peak[b]	20%	19%	17%	21%
Transit travel time from Mill Plain station to Expo Center	8 min	8 min	8 min	8 min
Annual transit operations and maintenance costs ($ million)[c]	$74.9	$75.1	$74.9	$74.9
Traffic safety and security	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.
Transit safety and security	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	Additional buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.

[a] Total number of people in cars and on transit vehicles using the I-5 crossing traveling north (NB) during the afternoon/evening peak period.

[b] Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

[c] Total annual cost to run C-TRAN local and express routes, TriMet N Portland local buses, MAX LRT Yellow Line, and HCT service.

[d] Taking into account exclusive guideway length, park-and-ride structure, operating characteristics, etc., these figures were extrapolated from data produced from modeling Alternative 3 using ratio differences between alignments

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

ALTERNATIVE 2: I-5 AND I-205 TRAFFIC LEVELS

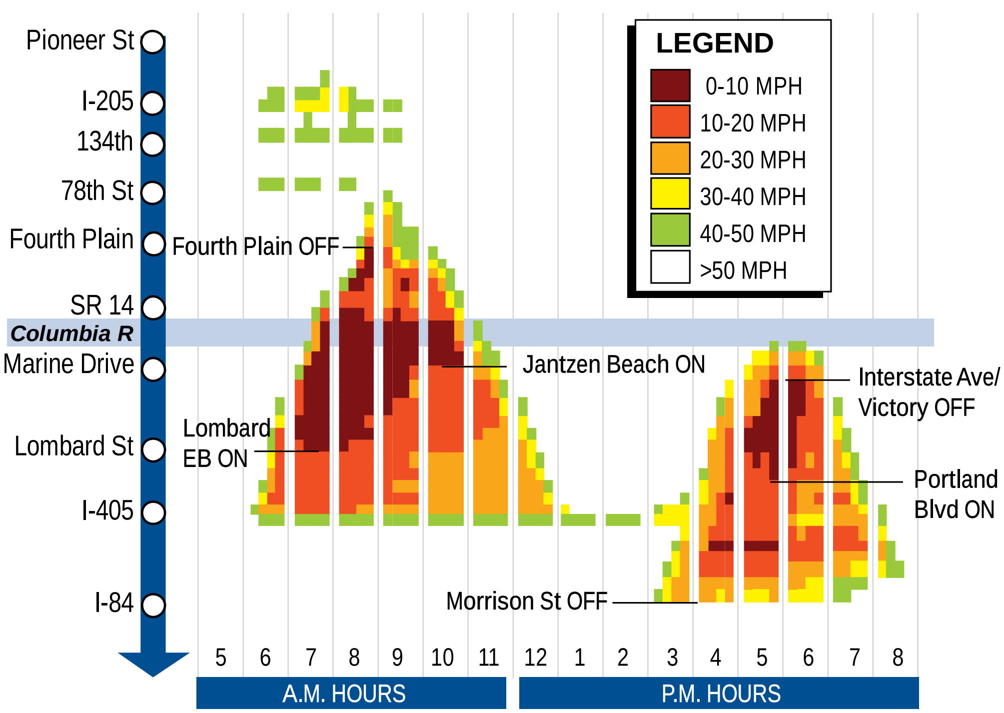
With Alternative 2, the 2030 average weekday traffic across the I-5 crossing is expected to be 178,000 vehicles. This is lower than the 184,000 daily vehicle trips predicted under the No-Build Alternative because of the introduction of high-capacity transit and a toll at the I-5 crossing.

Daily traffic volume on I-205 would increase slightly from 210,000 vehicles per day with the No-Build Alternative to 213,000 vehicles with Alternative 2, potentially adding to congestion on I-205.

ALTERNATIVE 2: TRAFFIC CONGESTION AND TRAVEL TIMES

Exhibit 3.1-22 portrays estimated year 2030 southbound conditions for Alternatives 2 and 3. As shown, Alternative 2 would reduce the duration of southbound congestion in the vicinity of the I-5 crossing to 3.5 hours from 7.25 hours for the No-Build Alternative. Southbound traffic queues would no longer extend beyond Fourth Plain Boulevard for multiple hours each day. The traffic congestion remaining at the bridge would result from the existing downstream bottleneck on I-5 north of the I-405 split. Alternative 2 would not exacerbate or worsen this existing bottleneck, although the CRC improvements would enable an increase in vehicle throughput of about 6 percent along I-5 just north of I-405.

Exhibit 3.1-22
Speed Profiles: 5 a.m. to 9 p.m.
2030 Replacement Bridge Alternatives 2 and 3, Southbound



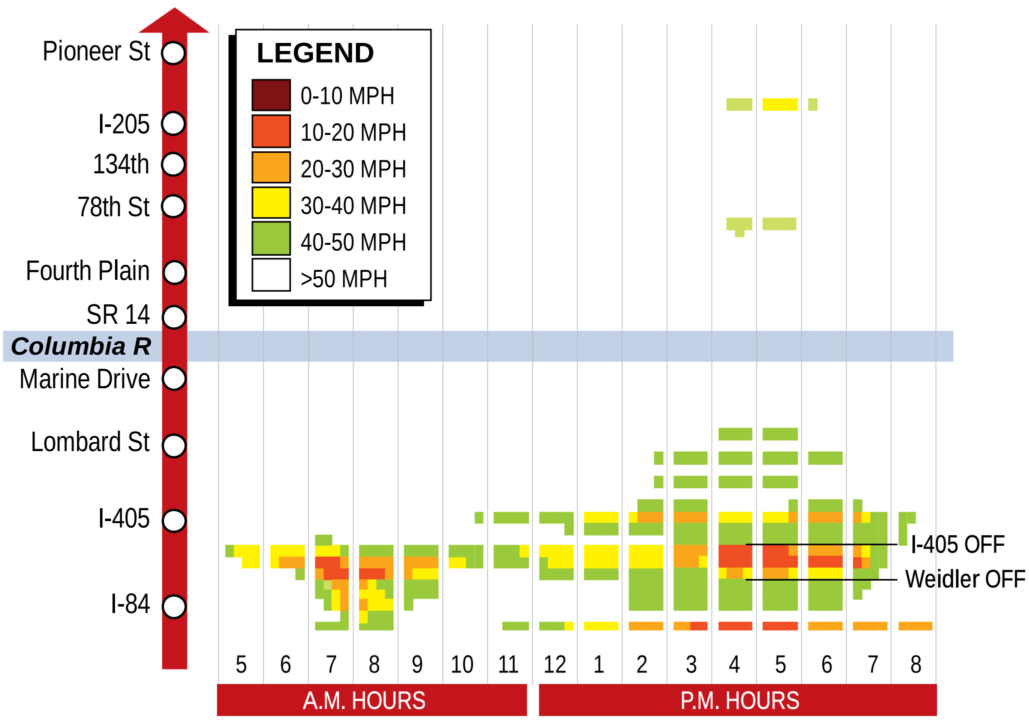
Source: CRC Traffic Technical Report 2008.

Exhibit 3.1-23 shows estimated year 2030 northbound conditions for Alternatives 2 and 3. This alternative would eliminate the northbound I-5 crossing bottleneck. Northbound traffic queues would no longer extend to I-405 for multiple hours each day. Alternative 2 would likely reduce the duration of congestion at the I-5 crossing from 7.75 hours under the

No-Build Alternative to no delay (with a margin of error of 2 hours). This is an estimate, as the model output shows no delay at the I-5 crossing.

Vehicle travel time estimates were developed for peak travel directions. Compared to the No-Build Alternative, Alternative 2 would decrease travel time for southbound trips along I-5 from 179th Street to I-84 during the morning peak by 5 minutes over the 46 minute travel time for the 2030 No-Build Alternative (12 percent). Vehicles traveling northbound along I-5 from I-84 to 179th Street during the afternoon/evening peak would experience a travel time decrease of 18 minutes over the 44 minute travel time for the 2030 No-Build Alternative (40 percent).

Exhibit 3.1-23
Speed Profiles: 5 a.m. to 9 p.m.
2030 Replacement Bridge Alternatives 2 and 3, Northbound



Source: CRC Traffic Technical Report 2008.

ALTERNATIVE 2: PEAK TRAFFIC AND PERSON THROUGHPUT

During the four-hour morning peak, southbound vehicle throughput across the I-5 bridge with Alternative 2 is forecast to increase by 2,000 vehicles, an increase of 9 percent, compared to 2030 No-Build conditions of 22,100 vehicles. While the southbound bridge bottleneck would be eliminated with either crossing, recurrent traffic congestion from the downstream bottleneck located just north of the I-405 split would limit the traffic volume served across the I-5 bridge to about 95 percent of demand.

Under No-Build conditions, three southbound ramps in the CRC area would have vehicle back-ups during the four-hour morning peak, while with Alternative 2, all southbound on-ramp traffic demand would be served; this would be due primarily to reduced congestion.

During the four-hour afternoon/evening peak, northbound vehicle throughput across the I-5 bridge with Alternative 2 would increase by 8,100 vehicles (40 percent) compared to 2030 No-Build conditions of 21,000 vehicles. Alternative 2 would remove the northbound bottleneck at the I-5 crossing, resulting in higher vehicle throughput for northbound I-5. The number of northbound on-ramps in the CRC area unable to serve their traffic demand during the afternoon/evening peak would decrease from five under No-Build conditions to two (Mill Plain Boulevard and Fourth Plain Boulevard) with Alternative 2.

With Alternative 2, in the year 2030 about 27,400 persons in southbound vehicles would use the I-5 crossing during the morning peak, an increase of 11 percent over No-Build conditions. With the provision of high-capacity transit, up to 7,550 persons using transit are forecast to cross during this period. In the northbound direction, about 34,400 persons would use the I-5 crossing during the afternoon/evening four-hour peak, an increase of 30 percent over No-Build conditions. With the provision of high-capacity transit, up to 7,250 persons using transit are forecast to cross during this period.

ALTERNATIVE 2: LOCAL STREET PERFORMANCE

Alternative 2: Vancouver Local Streets

Local street intersection operations would improve system-wide relative to the No-Build Alternative. For example, during the afternoon/evening peak under No-Build conditions, 46 of the 76 local study intersections in Vancouver would operate acceptably. Alternative 2 would improve local street operations, resulting in 67 of 76 intersections operating acceptably.

Alternative 2 would reduce the duration of southbound congestion during the morning peak, which would also reduce congestion on most Vancouver local streets.

Traffic volumes along key east-west local streets between 39th Street and Mill Plain Boulevard would increase by 5 to 15 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Kaufman and P Streets would decrease by up to 30 percent.

Traffic traveling to or from downtown Vancouver on SR 14 would be able to use two access points—one along Columbia Street at Fourth Street and the other along Washington Street. The two access points would support better dispersion of traffic without overloading downtown intersections.

Alternative 2: Portland Local Streets

Portland's local street operations would improve system-wide relative to No-Build conditions. For example, during the afternoon/evening peak under No-Build conditions, 18 of 25 local street intersections would operate acceptably. Alternative 2 would add 12 new study intersections (primarily in the Hayden Island and Marine Drive interchange areas) and would result in a total of 35 of 37 intersections operating acceptably.

The increased capacity provided on I-5 under Alternative 2 would draw traffic from nearby parallel roadways back to I-5. Traffic volumes along key east-west local streets between Columbia Boulevard and Going Street would decrease by 5 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Greeley Avenue and Martin Luther King Jr. Boulevard would decline by up to 15 percent.

The duration of congestion periods along northbound I-5 during the afternoon/evening peak at the river crossing would decrease from eight hours under No-Build conditions to less than two hours with Alternative 2. This would also reduce congestion on north-south local streets.

ALTERNATIVE 2: PEDESTRIANS AND BICYCLES

Alternative 2 would substantially improve pedestrian and bicycle connectivity within the CRC area by providing a continuous grade-separated multi-use pathway from downtown Vancouver to the Marine Drive area, without requiring pedestrian and bicycle users to navigate Hayden Island at-grade.

Alternative 2 includes a multi-use pathway west of and adjacent to the transit guideway. The pathway would be continuous and above-grade from approximately Sixth Street in Vancouver to just north of Marine Drive, then pass under Marine Drive and connect to the Expo Center. The pathway would be a minimum of 16 feet wide between its barriers and could separate pedestrian and bicycle traffic through pavement markings.

Alternative 2 would provide access to Vancouver via a ramp to a roadway in the downtown area. A second potential connection in Vancouver, closer to the Columbia River, would provide access (with an elevator) to waterfront attractions and the multi-use path along the shore. On Hayden Island, the pathway would be accessible via an elevator and stairs located at the high-capacity transit station. In addition, potential stairs at the north and south ends of the island could be provided. Note that Hayden Island access points are being studied as a part of the City of Portland’s separate Hayden Island planning efforts.

At the Marine Drive interchange, the multi-use path would have access to the Expo Center transit station and to the 40 Mile Loop trail pathway running along North Portland Harbor. Additional connections to Delta Park and bicycle routes along Union Court and Martin Luther King Jr. Boulevard would be maintained or improved with off-street facilities, ramps and stairs. Bicyclists and pedestrians would be able to cross North Portland Harbor on a new pathway along the high-capacity transit guideway on the west side of I-5. The connections proposed by the CRC project would be coordinated with ongoing planning efforts in Vancouver, Hayden Island and near Marine Drive.

ALTERNATIVE 2: TRAFFIC SAFETY AND SECURITY

The replacement river crossing with BRT alternative would address most of the existing non-standard features and remove the lift spans, resulting in substantially improved vehicle and freight safety.

ALTERNATIVE 2: TRANSIT RIDERSHIP AND MODE SPLIT

This alternative would include 40 standard 40-foot buses operating on local and express routes over the Columbia River each hour during the peak period in the peak direction. Fourteen 60-foot, dual-door BRT buses would also operate over the river during the peak hour, in the peak direction. Platform hours of service would increase over No-Build conditions by approximately 7 percent, from 2,632 to 2,819 hours per weekday.

Alternative 2 would generate 16,800 daily passenger trips on transit over the I-5 crossing and 4,828,000 trips annually. This is an increase of nearly 90 percent over the No-Build Alternative.

Nineteen percent of travelers over the I-5 crossing during the afternoon/evening northbound peak would use transit. The daily transit mode split for travel between the Clark County Inner Urban and Oregon markets would be 15 percent, for travel between Clark County Suburban and Oregon markets it would be 13 percent, and for travel between Oregon and Clark County markets it would be 6 percent.

ALTERNATIVE 2: TRANSIT TRAVEL TIMES

Buses using the transit guideway would travel through the CRC area at an average speed of 14.5 mph. Buses could travel from the Kiggins Bowl or Lincoln terminus to the Expo Center station during the afternoon/evening peak in 13 minutes. Transit users traveling between the Lincoln Park and Ride and downtown Portland (Pioneer Courthouse MAX station) could make this trip in 43 minutes.

ALTERNATIVE 2: TRANSIT OPERATIONS AND MAINTENANCE COSTS

With Alternative 2, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of about $75 million. This compares with a current annual operating cost of nearly $66 million and $70 million for the No-Build Alternative.

ALTERNATIVE 2: TRANSIT SAFETY AND SECURITY

BRT would cross several intersections at grade, where the higher number of transit vehicles associated with this mode would interact with automobile and truck traffic, bicycles, and pedestrians, potentially increasing the risk of collision. The Kiggins Bowl terminus would include fewer at-grade intersections than the Lincoln terminus, potentially improving the risk of collisions involving transit.

Transit security on vehicles and at stations and park and ride lots will also be addressed during the planning, design, construction and operational phases of the project. Station security may be more challenging with the Kiggins Bowl terminus. Stations at Clark College, Rose Village, and Kiggins Bowl would be in the highway right-of-way, an environment that provides less non-transit activity and visibility and may decrease security.

Alternative 3: Replacement Crossing with Light Rail

This section explains how existing transportation conditions would change if Alternative 3, a replacement crossing with light rail, were selected and constructed. Exhibit 3.1-24 summarizes predicted year 2030 transportation performance under Alternative 3.

Exhibit 3.1-24
Alternative 3: Replacement Crossing with Light Rail

Alternative 3: Replacement Crossing with Light Rail				
Metric	**Kiggins Bowl Terminus (A)** [e]	**Lincoln Terminus (B)**	**Clark College MOS (C)** [d]	**Mill Plain MOS (D)** [d]
People over the I-5 Crossing during peak periods[a]				
In cars	34,400 (NB)	34,400 (NB)	34,400 (NB)	34,400 (NB)
On transit	7,250 (NB)	7,250 (NB)	7,250 (NB)	7,250 (NB)
Vehicles over the I-5 crossing each weekday	178,000	178,000	179,500	179,500
Hours of congestion per day	3.5-5.5 hours	3.5-5.5 hours	3.5-5.5 hours	3.5-5.5 hours
Pedestrian and bicycle connections	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.	Provide continuous grade-separated multi-use path between Marine Drive and downtown Vancouver.
Transit mode split in p.m. peak[b]	22%	21%	19%	23%
Transit travel time from Mill Plain station to Expo Center	7 min	7 min	7 min	7 min
Annual transit operations and maintenance costs ($million)[c]	$74.0	$73.3	$72.7	$72.6
Traffic safety and security	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.	Reduced congestion and improved safety design would reduce collisions.
Transit safety and security	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.

a Total number of people in cars and on transit vehicles using the I-5 crossing traveling north during the afternoon/evening peak period.

b Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

c Total annual cost to run C-TRAN local and express routes, TriMet N Portland local buses, MAX LRT Yellow Line, and HCT service.

d Taking into account exclusive guideway length, park-and-ride structure, operating characteristics, etc., these figures were extrapolated from data produced from modeling Alternative 3 using ratio differences between alignments

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

Alternative 3 would have highway, local street, and bicycle and pedestrian traffic physical improvements similar to those described in detail for Alternative 2.

ALTERNATIVE 3: TRAFFIC SAFETY AND SECURITY

Alternative 3 would improve I-5 vehicle safety in the same manner as Alternative 2. Likewise, the trade-offs from transit termini would be the same as those described above for Alternative 2.

ALTERNATIVE 3: TRANSIT RIDERSHIP AND MODE SPLIT

This alternative would include 17 standard 40-foot buses operating on local and express routes over the Columbia River each hour during the peak period in the peak direction. Eight two-car light rail trains would also operate over the river during each peak hour in the peak direction.

Alternative 3 would generate 20,800 daily passenger trips on transit over the I-5 crossing and 6,673,000 trips annually. This is an increase of over 130 percent over the No-Build Alternative.

Twenty-one percent of travelers over the I-5 crossing during the afternoon/evening northbound peak would use transit. The daily transit mode split for travel between Clark County Inner Urban and Oregon markets would be 20 percent, for travel between Clark County Suburban and Oregon markets it would be 15 percent, and for travel between Oregon and Clark County markets it would be 8 percent.

ALTERNATIVE 3: TRANSIT TRAVEL TIMES

Light rail could travel through the transit guideway at an average speed of 17.3 mph. Light rail trains could travel from the Kiggins Bowl or Lincoln terminus to the Expo Center station during the afternoon/evening peak in 12 minutes. Transit users traveling between the Lincoln Park and Ride and downtown Portland (Pioneer Square MAX station) could make this trip in 40 minutes, because light rail could make this trip without a transfer at the Expo Center station.

ALTERNATIVE 3: TRANSIT OPERATIONS AND MAINTENANCE COSTS

With Alternative 3, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of about $73 million. This compares with a current annual operating cost of nearly $66 million and $70 million for the No-Build Alternative.

ALTERNATIVE 3: TRANSIT SAFETY AND SECURITY

Light rail would cross several intersections at grade. Train frequency would generally be fairly low compared to the BRT frequency in Alternative 2, thus potentially reducing the risk of collision with other vehicles. However, because trains have substantial mass, collisions could potentially be severe.

Light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. Light rail vehicles using this maintenance facility would not be carrying passengers. The proposed expansion is unlikely to have an adverse effect on safety or security.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

This section explains how existing transportation conditions would change if Alternative 4, a supplemental crossing with bus rapid transit, were selected and constructed. Exhibit 3.1-25 summarizes predicted year 2030 transportation performance under Alternative 4.

Exhibit 3.1-25
Alternative 4: Supplemental Crossing with Bus Rapid Transit

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Metric	**Kiggins Bowl Terminus (A)** [e]	**Lincoln Terminus (B)**	**Clark College MOS (C)** [d]	**Mill Plain MOS (D)** [d]
People over the I-5 Crossing during peak periods[a]				
In cars	25,700 (NB)	25,700 (NB)	25,700 (NB)	25,700 (NB)
On transit	5,900 (NB)	5,900 (NB)	5,900 (NB)	5,900 (NB)
Vehicles over the I-5 crossing each weekday	165,000	165,000	166,500	166,500
Hours of congestion per day	10.75 hours	10.75 hours	10.75 hours	10.75 hours
Pedestrian and bicycle connections	Improvements over the river but has at-grade crossings on Hayden Island.	Improvements over the river but has at-grade crossings on Hayden Island.	Improvements over the river but has at-grade crossings on Hayden Island.	Improvements over the river but has at-grade crossings on Hayden Island.
Transit mode split in p.m. peak[b]	33%	32%	30%	34%
Transit travel time from Mill Plain station to Expo Center	14 min	14 min	14 min	14 min
Annual transit operations and maintenance costs ($million)[c]	$114.1	$114.4	$114.2	$114.1
Traffic safety and security	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.
Transit safety and security	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.	High frequency of buses could increase collisions but dedicated guideway may improve separation of modes. Potential security issues would need to be addressed at less visible stations.

[a] Total number of people in cars and on transit vehicles using the I-5 crossing traveling north during the afternoon/evening peak period.

[b] Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

[c] Total annual cost to run C-TRAN local and express routes, TriMet N Portland local buses, MAX LRT Yellow Line, and HCT service.

[d] Taking into account exclusive guideway length, park-and-ride structure, operating characteristics, etc., these figures were extrapolated from data produced from modeling Alternative 3 using ratio differences between alignments

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

ALTERNATIVE 4: I-5 AND I-205 TRAFFIC LEVELS

Alternative 4 would result in 11 hours of congestion at the I-5 river crossing. By 2030, about 165,000 (166,500 with either MOS) vehicles would use the I-5 river crossing each day, and 219,000 vehicles would use the I-205 crossing. The supplemental crossing with bus rapid transit (BRT) would address some of the existing non-standard features, but would retain the lift spans, resulting in fewer safety improvements. Alternative 4 would increase vehicle delay and queuing at some local street intersections due to a reduction in lane capacity along the guideway. BRT vehicles and local bus service would be allowed to enter and exit the guideway, causing additional delay to local street traffic. Reduced connectivity to the SR 14 interchange would also increase delays for vehicles in the vicinity of lower downtown Vancouver.

With Alternative 4, the 2030 average weekday traffic across the I-5 crossing is expected to be 165,000 vehicles. This is lower than the 184,000 daily vehicle trips predicted under the No-Build Alternative because of the introduction of high-capacity transit and a toll at the I-5 crossing.

However, more traffic would shift to I-205 under this alternative. The daily volume on I-205 would increase from 210,000 vehicles per day under year 2030 No-Build conditions to 219,000 vehicles with Alternative 4, adding to congestion problems on I-205.

ALTERNATIVE 4: TRAFFIC CONGESTION AND TRAVEL TIMES

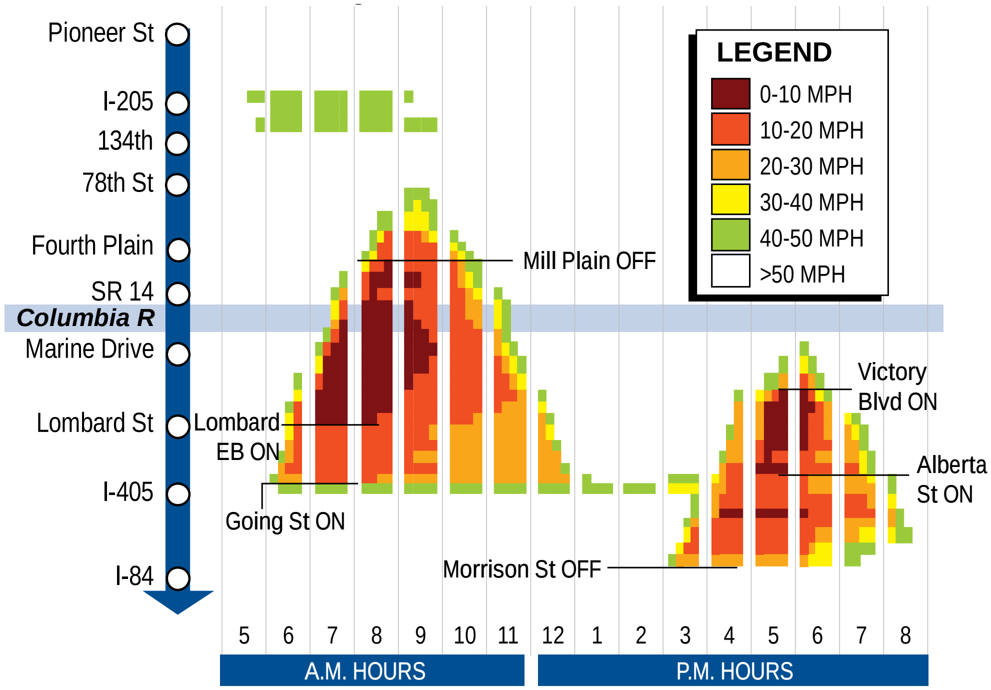
Exhibit 3.1-26 portrays estimated year 2030 southbound conditions for Alternatives 4 and 5. As shown, Alternative 4 would reduce the duration of southbound congestion in the vicinity of the I-5 crossing from 7.25 hours to 3.75 hours. Downstream congestion arising along I-5 just north of the I-405 split would continue.

Alternative 4 would decrease travel time for southbound trips during the morning peak by five minutes (12 percent) for trips along I-5 from 179th Street to I-84, compared to the 46-minute travel time for the 2030 No-Build Alternative.

Exhibit 3.1-27 shows estimated year 2030 northbound conditions for Alternatives 4 and 5. As shown, northbound traffic would experience congested conditions on I-5 approaching the crossing. Since Alternative 4 would use both existing bridges for northbound I-5 traffic, travel lanes on I-5 must physically separate or diverge in advance of the two structures, then reconnect where the crossing touches down. This arrangement would require all northbound traffic accessing I-5 from Marine Drive and Hayden Island to use the existing eastern bridge. All northbound traffic on I-5 traveling from south of Marine Drive and destined for SR 14, City Center, Mill Plain Boulevard, or Fourth Plain Boulevard would have to use the eastern bridge.

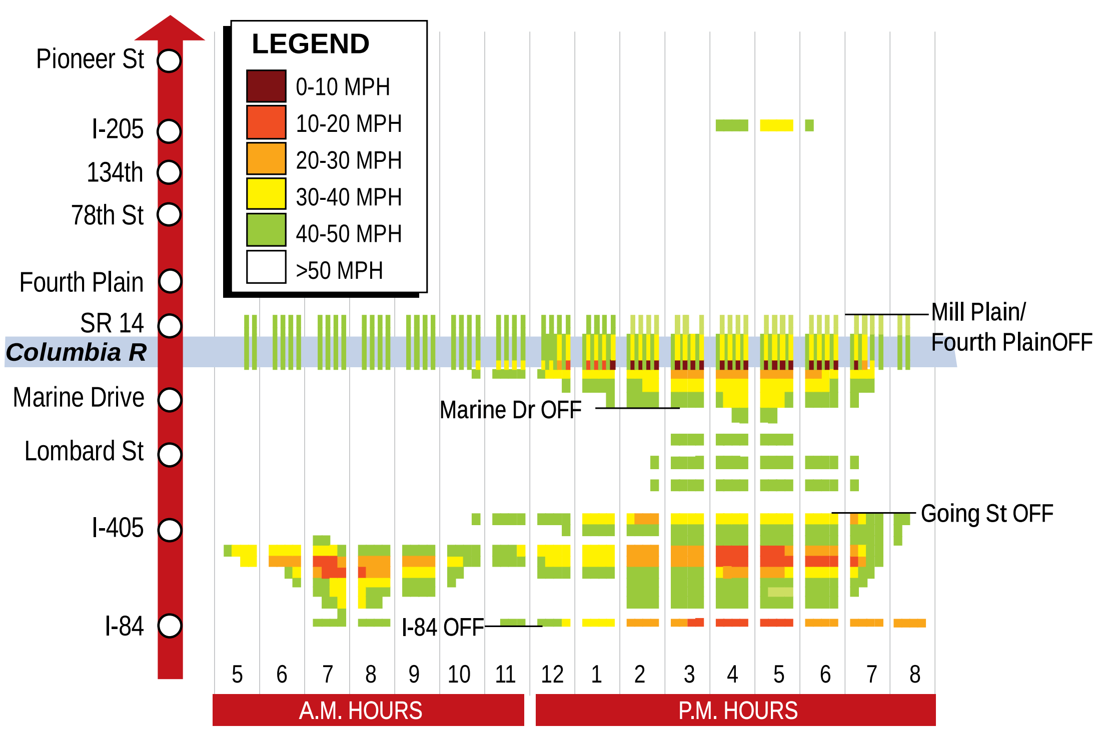
Due to substantial traffic maneuvers in advance of the I-5 “diverge” point, as well as the high traffic demand for the eastern bridge and the extensive weaving that would result within the eastern travel lanes, vehicular back-ups would result on the eastern bridge and on I-5 downstream of the divergence. Traffic congestion would result in these locations for about seven hours each weekday afternoon/evening.

Exhibit 3.1-26
Speed Profiles: 5 a.m. to 9 p.m.
2030 Supplemental Bridge Alternatives 4 and 5, Southbound



Source: CRC Traffic Technical Report 2008.

Exhibit 3.1-27
Speed Profiles: 5 a.m. to 9 p.m.
2030 Supplemental Bridge Alternatives 4 and 5, Northbound



Source: CRC Traffic Technical Report 2008.

As a side effect of the northbound congestion associated with Alternative 4, only 45 to 55 percent of the traffic demand attempting to access northbound I-5 from the Marine Drive and Hayden Island on-ramps during the afternoon/evening peak would be served. The highway's traffic congestion would limit the number of vehicles that could enter the highway from these locations, resulting in ramp back-ups and local street congestion, as further described below.

Northbound travel times would improve for motorists using the through lanes (western bridge) by about 17 minutes, or 39 percent, compared to 2030 No-Build conditions. However, northbound vehicles using the eastern bridge (those entering the highway from Marine Drive or Hayden Island, and those exiting the highway to SR 14, City Center, Mill Plain Boulevard, and Fourth Plain Boulevard) would experience substantial delays during the seven hours of congestion expected to occur with a supplemental river crossing. Northbound travel times would improve for motorists using the eastern bridge by about 15 minutes, or 34 percent, compared to 2030 No-Build conditions. About half of the afternoon/evening travel demand from Marine Drive and Hayden Island would not be able to access the highway and would experience high delays on the highway ramps and along the local street system. Transit buses would benefit from reduced travel times and greater reliability.

ALTERNATIVE 4: PEAK TRAFFIC AND PERSON THROUGHPUT

During the four-hour morning peak, southbound vehicle throughput across the I-5 bridge with Alternative 4 is forecast to increase by 1,200 vehicles (5 percent) over 2030 No-Build conditions of 22,100 vehicles. While the southbound bridge bottleneck would be eliminated, recurrent traffic congestion from the downstream bottleneck located just north of the I-405 split would limit the traffic volume served across the southbound bridge to about 95 percent of demand.

While under No-Build conditions three southbound ramps in the CRC area would have vehicle back-ups during the four-hour morning peak, all southbound on-ramp traffic demand would be served under Alternative 4, primarily due to reduced congestion.

During the afternoon/evening peak, northbound vehicle throughput across the I-5 bridges would increase by 1,100 vehicles (6 percent) over 2030 No-Build conditions of 21,000 vehicles, as the result of the slightly higher capacity of the new four-lane northbound system. However, the separation between travel lanes in advance of, across and downstream of, the two existing bridges, combined with the short on-ramp spacing between Marine Drive and Hayden Island, would result in traffic congestion lasting throughout the day.

Because of the northbound traffic congestion that would result across the existing eastern bridge, at the highway "diverge" point, and downstream of the diverge, only 45 percent of Hayden Island's on-ramp demand would be served during the afternoon/evening peak. Only 55 percent of Marine Drive's on-ramp demand would be able to access northbound I-5. This would result in back-ups along the ramps and on the adjacent local street systems.

For Alternative 4, about 26,400 persons in southbound vehicles would cross during the morning peak, an increase of 7 percent over No-Build conditions. Up to 8,450 persons would use transit during this period. Due to the level of congestion that would be experienced at the I-5 river crossing with Alternative 4, about 25,700 persons in northbound vehicles would cross during the afternoon/evening four-hour peak, an increase of 5 percent compared to No-Build conditions. However, up to 7,350 persons using transit would cross during this period.

ALTERNATIVE 4: LOCAL STREET PERFORMANCE

Alternative 4: Vancouver Local Streets

Since Alternative 4 would reduce the duration of southbound congestion during the morning peak, the duration of congestion on most local Vancouver streets would also decline.

Increased capacity provided on I-5 would draw some traffic from nearby roadways back to I-5. Traffic volumes along key east-west local streets between 39th Street and Mill Plain Boulevard would increase by 5 to 15 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Kaufman and P Streets would decrease by up to 30 percent.

For Alternative 4, only the Columbia Street intersection connection would be feasible for inbound SR 14 traffic to access downtown Vancouver. An additional 800 vehicle trips per hour would access Columbia Street during the morning peak, resulting in local street congestion and intersection failures in lower Vancouver.

For Alternative 4, only the Columbia Street intersection would be feasible for outbound SR 14 traffic from downtown Vancouver. An additional 800 vehicles per hour would try to use Columbia Street during the afternoon/evening peak, resulting in local street congestion and intersection failures in lower Vancouver. About 10 additional intersections in lower downtown Vancouver would experience level-of-service or vehicle queuing deficiencies.

This alternative would increase the frequency of bus service compared to Alternative 2. Increasing the frequency of buses would moderately increase delays for local traffic on cross streets of the transit guideway.

Alternative 4: Portland Local Streets

The increased capacity provided on I-5 under Alternative 4 would draw traffic from nearby parallel roadways back to I-5. Traffic volumes along key east-west local streets between Columbia Boulevard and Going Street would decrease by 5 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Greeley Avenue and Martin Luther King Jr. Boulevard would decline by up to 15 percent.

For Alternative 4, northbound traffic congestion near the crossing would decrease from eight hours under No-Build conditions to seven hours. Because of northbound traffic backups with Alternative 4, congestion would occur at I-5 interchange ramps (at Marine Drive and Hayden Island) and on local streets in the vicinity of these interchanges.

Alternative 4 would improve local street intersection operations in the north Portland and Victory subareas, but would degrade intersection operations in the Marine Drive and Hayden Island areas. Alternative 4 would add 12 new study intersections, but during the afternoon/evening peak only 29 of 37 would operate acceptably, compared to 18 of 25 intersections operating acceptably under No-Build conditions.

ALTERNATIVE 4: PEDESTRIANS AND BICYCLISTS

Alternative 4 would substantially improve pedestrian and bicycle connectivity within the CRC area, although it would continue to require users traveling across Hayden Island to navigate at-grade streets and intersections. Alternative 4 was evaluated with a widened sidewalk on the existing eastern bridge in order to accommodate both pedestrians and bicyclists in a safe manner. Ramps would connect this widened pathway with Columbia Way in Vancouver and with Tomahawk Island Drive on Hayden Island. An above-grade multi-use pathway on the western bridge would connect Tomahawk Island Drive and Marine Drive. Pedestrians and bicyclists using both pathways would need to travel along Tomahawk Island Drive, under I-5, and through at-grade intersections.

Today, pedestrians and bicyclists cross North Portland Harbor on a multi-use pathway on the east side of the harbor bridge. The proposed crossing for Alternative 4 would remove access at this location and require users to access the new pathway along the high-capacity transit alignment. Once on Hayden Island, the new pathway would require additional time for users to access the proposed pathway on the east side of the east bridge over the Columbia River. Connections to the crossing would require that pedestrians and bicyclists leave the grade-separated pathway and drop down to Hayden Island, then travel on sidewalks before they could access the southern end of the new cantilevered pathway on the existing northbound I-5 bridge. A potential mitigation measure to alleviate some of this circuitous routing would be to construct a pedestrian pathway on the east side of the harbor bridge.

ALTERNATIVE 4: TRAFFIC SAFETY AND SECURITY

The supplemental river crossing with BRT alternative would address some of the existing non-standard features and add new mainline merge and diverge areas, but would retain the existing bridges for northbound Interstate traffic, resulting in fewer safety improvements.

ALTERNATIVE 4: TRANSIT RIDERSHIP AND MODE SPLIT

Since Alternative 4 includes Increased transit operations, it would provide very frequent bus service, with 43 standard 40-foot buses operating on local and express routes over the Columbia River each hour during the peak period in the peak direction. Twenty-four 60-foot dual door rapid transit buses would cross the river during each peak hour in the peak direction.

Alternative 4 would generate 19,800 daily passenger trips using transit over the I-5 crossing and 5,701,000 such trips annually. This is an increase of 125 percent over the No-Build Alternative.

Thirty-three percent of travelers over the I-5 crossing during the afternoon/evening northbound peak would use transit. The daily transit mode split for travel between Clark County Inner Urban and Oregon markets would be 18 percent, for travel between Clark County Suburban and Oregon markets it would be 15 percent, and for travel between Oregon and Clark County markets it would be 8 percent.

ALTERNATIVE 4: TRANSIT TRAVEL TIMES

Buses using the transit guideway would travel through the CRC area at an average speed of 13.1 mph. Buses could travel from the Kiggins Bowl or Lincoln terminus to the Expo Center station during the afternoon/ evening peak in 19 minutes. Transit users traveling between the Lincoln Park and Ride and downtown Portland (Pioneer Square MAX station) could make this trip in 48 minutes.

ALTERNATIVE 4: TRANSIT OPERATIONS AND MAINTENANCE COSTS

With Alternative 4, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of $114 million. Increased transit operations packaged with this alternative would require substantially more operating and maintenance costs than the No-Build Alternative, which would cost $70 million.

ALTERNATIVE 4: TRANSIT SAFETY AND SECURITY

BRT would cross several intersections at grade, and the very high number of transit vehicles associated with the Increased transit operations provided by this alternative, would interact with automobile and truck traffic, bicycles, and pedestrians, potentially increasing the risk of collision. The Kiggins Bowl terminus would include fewer at-grade intersections than the Lincoln terminus, potentially improving the risk of collisions involving transit. Transit security on vehicles and at stations and park and ride lots is also addressed during the planning, design, construction and operational phases of the project. Station security may be more challenging with the Kiggins Bowl terminus. Stations at Clark College, Rose Village, and Kiggins Bowl would be in the highway right-of-way, an environment that provides less non-transit activity and visibility and may decrease security.

Alternative 5: Replacement Crossing with Light Rail

This section explains how existing transportation conditions would change if Alternative 5, a supplemental crossing with light rail, were selected and constructed. Exhibit 3.1-28 summarizes predicted year 2030 transportation performance under Alternative 5.

Exhibit 3.1-28
Alternative 5: Supplemental Crossing with Light Rail

Alternative 5: Supplemental Crossing with Light Rail				
Metric	**Kiggins Bowl Terminus (A)** [e]	**Lincoln Terminus (B)**	**Clark College MOS (C)** [d]	**Mill Plain MOS (D)** [d]
People over the I-5 Crossing during peak periods[a]				
In cars	25,700 (NB)	25,700 (NB)	25,700 (NB)	25,700 (NB)
On transit	7,350 (NB)	7,350 (NB)	7,350 (NB)	7,350 (NB)
Vehicles over the I-5 crossing each weekday	165,000	165,000	166,500	166,500
Hours of congestion per day	10.75 hours	10.75 hours	10.75 hours	10.75 hours
Pedestrian and bicycle connections	Improvements but has at-grade crossings on Hayden Island.	Improvements but has at-grade crossings on Hayden Island.	Improvements but has at-grade crossings on Hayden Island.	Improvements but has at-grade crossings on Hayden Island.
Transit mode split in p.m. peak[b]	37%	36%	34%	38%
Transit travel time from Mill Plain station to Expo Center	8 min	8 min	8 min	8 min
Annual transit operations and maintenance costs ($ million)[c]	$106.5	$105.5	$104.7	$104.5
Traffic safety and security	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.	Improvement to highway design for safety, but some compromises on the existing I-5 bridges.
Transit safety and security	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.	New mode (light rail) could increase collisions but dedicated guideway would improve separation of modes. Potential security issues would need to be addressed at less visible stations.

a Total number of people in cars and on transit vehicles using the I-5 crossing traveling north during the afternoon/evening peak period.

b Percentage of people traveling over the I-5 crossing on transit vehicles in the afternoon peak period, in the northbound direction.

c Total annual cost to run C-TRAN local and express routes, TriMet N Portland local buses, MAX LRT Yellow Line, and HCT service.

d Taking into account exclusive guideway length, park-and-ride structure, operating characteristics, etc., these figures were extrapolated from data produced from modeling Alternative 3 using ratio differences between alignments

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

Alternative 5 would have highway, local street, and bicycle and pedestrian traffic improvements similar to those described for Alternative 4.

ALTERNATIVE 5: TRAFFIC SAFETY AND SECURITY

Alternative 5 would improve I-5 vehicle safety and aviation and navigation safety and efficiency in the same manner as Alternative 4.

Likewise, the trade-offs from transit termini would be the same as those described above.

ALTERNATIVE 5: TRANSIT RIDERSHIP AND MODE SPLIT

Since Alternative 5 includes Increased transit operations, it would include more buses and trains operating within the CRC area. This alternative would include 20 standard 40-foot buses operating on local and express routes over the Columbia River each hour during the peak period in the peak direction. Ten two-car light rail trains would also operate over the river during each peak hour in the peak direction.

Alternative 5 would generate 23,100 daily passenger trips using transit over the I-5 crossing and 7,411,000 such trips annually. This is an increase of more than 160 percent over the No-Build Alternative.

Thirty-seven percent of travelers over the I-5 crossing during the afternoon/evening northbound peak would use transit. The daily transit mode split for travel between Clark County Inner Urban and Oregon markets would be 22 percent, for travel between Clark County Suburban and Oregon markets it would be 16 percent, and for travel between Oregon and Clark County markets it would be 10 percent.

ALTERNATIVE 5: TRANSIT TRAVEL TIMES

Light rail trains could travel through the transit guideway at an average speed of 17.3 mph. Light rail trains could travel from the Kiggins Bowl or Lincoln terminus to the Expo Center station during the afternoon/evening peak in 12 minutes. Transit users traveling between the Lincoln Park and Ride and downtown Portland (Pioneer Square MAX station) could make this trip in 40 minutes.

ALTERNATIVE 5: TRANSIT OPERATIONS AND MAINTENANCE COSTS

With Alternative 5, bi-state transit service (based on existing level of weekday and annual platform hours and vehicle miles traveled) would have an associated annual operating cost of $106 million. The Increased transit operations packaged with this alternative would require substantially more operating and maintenance costs than the No-Build Alternative, which would cost $70 million.

ALTERNATIVE 5: TRANSIT SAFETY AND SECURITY

Light rail would cross several intersections at grade. Train frequency would generally be fairly low compared to the BRT frequency in Alternative 4, and thus potentially reducing the risk of collision with other vehicles. However, because trains have substantial mass, collisions could potentially be severe.

Light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. Light rail vehicles using this maintenance facility would not be carrying passengers. The proposed expansion is unlikely to have an adverse effect on safety or security.

3.1.4 Long-term Effects from Project Components

This section describes the transportation effects of the project components that are part of the CRC alternatives. Each component that affects transportation performance is discussed below in terms of the same performance metrics used for alternatives in the previous section.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The river crossing type influences all metrics for traffic performance and for bicycle and pedestrian connections. For transit, the river crossing only has a substantial influence on transit operating and maintenance costs.

MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: I-5 AND I-205 TRAFFIC LEVELS

The performance results described in this section assume that tolling would be included in the CRC project and that it would be collected at the I-5 crossing using an electronic toll collection system, as described in Chapter 2.

As shown in Exhibit 3.1-29, with the replacement crossing, the 2030 average weekday traffic across the I-5 crossing is expected to be 178,000 vehicles. For the supplemental crossing, the average daily traffic is estimated to be 165,000 vehicles. Both these volumes are lower than the 184,000 daily vehicle trips expected under No-Build conditions, because providing high-capacity transit and charging tolls would reduce vehicle trips.

The supplemental crossing would carry less traffic than the replacement crossing because it has less capacity. However, more traffic would shift to I-205 with the supplemental crossing. The daily volumes on I-205 would increase from 210,000 vehicles per day under No-Build conditions to 219,000 vehicles with the supplemental crossing and 213,000 vehicles with the replacement option, adding to congestion problems on I-205.

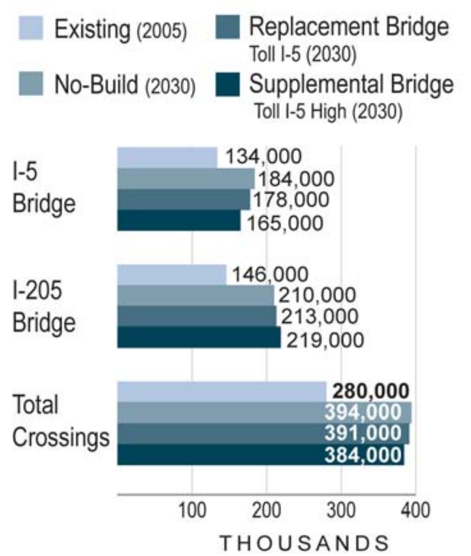
MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: TRAFFIC CONGESTION AND TRAVEL TIMES

Illustrated profiles of traffic congestion based on travel speeds were developed for the replacement and supplemental crossings. Exhibits 3.1-22 and 3.1-26 (earlier in this section) portray estimated year 2030 southbound conditions for the replacement and supplemental crossings, respectively.

As shown in Exhibit 3.1-30, the replacement bridge would reduce the duration of southbound congestion in the vicinity of the I-5 crossing from 7.25 hours to 3.5 hours. Southbound traffic queues would no longer extend beyond Fourth Plain Boulevard for multiple hours each day. The traffic congestion remaining at the crossing would result from the existing downstream bottleneck on I-5 north of the I-405 split. The replacement crossing would not exacerbate or worsen this existing bottleneck, although the associated improvements would enable an increase in vehicle throughput of about 6 percent along I-5 just north of I-405.

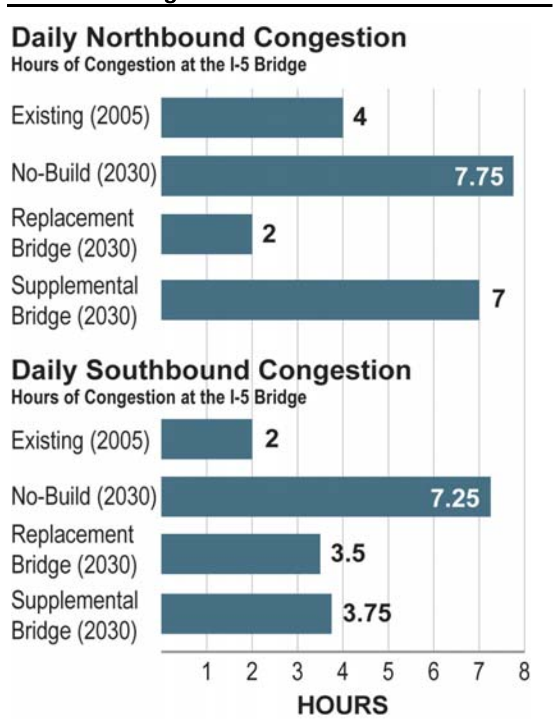
Southbound traffic conditions would be similar to those for the supplemental crossing, as shown in Exhibit 3.1-30. The supplemental crossing would reduce the duration of southbound

Exhibit 3.1-29
Columbia River Crossing Vehicle Trip Comparison



Source: CRC Traffic Technical Report 2008.

Exhibit 3.1-30
Hours of Congestion



Source: CRC Traffic Technical Report 2008.

congestion in the vicinity of the I-5 crossing from 7.25 hours to 3.75 hours. Downstream congestion arising along I-5 just north of the I-405 split would continue.

Exhibits 3.1-23 and 3.1-27 (earlier in this section) show estimated year 2030 northbound conditions for the replacement and supplemental crossings. The replacement crossing would eliminate the northbound I-5 crossing bottleneck. Northbound traffic queues would no longer extend to I-405 for multiple hours each day. The replacement crossing would reduce the duration of congestion at the I-5 crossing from 7.75 hours to less than 2 hours each day.

As shown in Exhibit 3.1-27, northbound traffic would experience congested traffic conditions on I-5 approaching the supplemental crossing. Since the supplemental crossing uses both existing bridges for northbound I-5 traffic, travel lanes on I-5 must physically separate or diverge in advance of the two structures and then reconnect where the crossing touches down. This arrangement would require all northbound traffic accessing I-5 from Marine Drive and Hayden Island to use the existing eastern bridge. In addition, all northbound traffic on I-5 traveling from south of Marine Drive to SR 14, City Center, Mill Plain Boulevard, or Fourth Plain Boulevard would have to use the eastern bridge.

Due to substantial traffic maneuvers as traffic approaches the I-5 “diverge” point, as well as the high traffic demand for the eastern bridge and the extensive weaving that would result in the eastern travel lanes, vehicular back-ups would result on the eastern bridge and on I-5 downstream of the divergence. These locations would be congested about seven hours each weekday afternoon/evening.

Reconfiguration of the existing bridges under the supplemental crossing alternatives, requiring a split in northbound I-5, would result in seven hours of daily congestion, one hour less than No-Build conditions.

As a side effect of the northbound congestion associated with the supplemental crossing, only 45 to 55 percent of the traffic demand attempting to access northbound I-5 from the Marine Drive and Hayden Island on-ramps during the afternoon/evening peak would be served. The highway’s traffic congestion would limit the number of vehicles that could enter the highway from these locations, resulting in ramp back-ups and local street congestion, as further described below.

Vehicle travel time estimates were developed for peak travel directions. Compared to the No-Build Alternative, the replacement and supplemental crossings would decrease travel time for southbound trips during the morning peak by five minutes, or 12 percent, for trips along I-5 from 179th Street to I-84.

Under the replacement crossing, vehicles traveling northbound along I-5 from I-84 to 179th Street during the afternoon/evening peak would experience a travel time decrease of 18 minutes, or 40 percent, compared to No-Build conditions.

For the supplemental crossing, northbound travel times would improve for motorists using the through lanes (i.e., the western northbound bridge) by about 15 minutes, or 34 percent, compared to No-Build conditions. However, due to the seven hours of congestion expected to occur on the eastern northbound bridge, northbound vehicles using the eastern bridge (those entering the highway at Marine Drive or Hayden Island, and those exiting the highway at SR 14, City Center, Mill Plain

Boulevard, or Fourth Plain Boulevard) would experience substantial delays. Northbound travel times would improve for motorists using the eastern bridge by about 15 minutes, or 34 percent, compared to 2030 No-Build conditions. About half of the afternoon/evening travel demand from Marine Drive and Hayden Island would not be able to access the highway and would experience high delays on the highway ramps and along the local street system.

MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: MANAGED LANES

Managed lanes on I-5 in the CRC area would not offer sufficient operational benefit.

Managed lanes are a fairly common feature on major highways in large metropolitan areas. In contrast with general purpose lanes open to all users, managed lanes are for preferential or exclusive use and are most often reserved for high-occupancy vehicles (HOVs). On some highways, managed lanes can be used by motorcyclists and certain hybrid vehicles. Some areas of the country are experimenting with truck-only managed lanes.

Managed lanes are intended to save time for bus riders, carpoolers, and motorcyclists by enabling them to bypass areas of traffic congestion. Managed lanes increase highway efficiency by moving more people in fewer vehicles than full, general purpose lanes. These lanes allow more reliable highway travel times and help carpools and buses stick to their schedules. Managed lanes reduce single-occupant vehicle trips, overall highway demand, and the burden on the environment from greenhouse gas emissions. Managed lanes are a crucial component of sustainable transportation alternatives to solo driving.

On I-5 a managed lane exists northbound between Going Street and Marine Drive. The 3.2-mile lane is reserved for high-occupancy vehicle (HOV) use between 3 p.m. and 6 p.m. on weekdays. During this three-hour period, only vehicles with two or more people, buses, and motorcyclists are allowed to use the lane.

The No-Build, replacement, and supplemental crossing alternatives all assume that this HOV lane, the majority of which is located south of the project area, would remain in place through the year 2030.

Including managed lanes on I-5 within the CRC area would not offer operational benefits for most users, including carpools or trucks. This is due to a number of factors.

- Because of the substantial amount of traffic entering from on-ramps or exiting to off-ramps within the project area, many users would not be inclined to navigate to and from a managed lane located to the inside of the highway.
- A managed lane for southbound users would transition into a general purpose lane just south of the CRC area, but traffic is expected to back up in that general purpose lane throughout most of the morning peak period, which would cause congestion and back-ups within the managed lane.
- A managed lane for northbound users would not offer enough time savings to be effective. For example, under the replacement crossing all of the general purpose lanes are forecast to operate at nearly free-flow conditions, with less than two hours congestion.

For the above reasons, it is likely that only a small portion of all HOV-eligible users would use an inside managed lane along I-5 within the CRC area. If managed lanes were positioned to be the outside lanes on the highway instead of the inside lanes, the substantial volumes of traffic entering from on-ramps and/or exiting to off-ramps within the CRC area would create congestion and conflicts with managed lane users.

While managed lanes would not offer operational benefits for most users in the project area, the replacement crossing could be flexible enough to allow future managed lanes within the project area to connect with a potential system-wide network of managed lanes north and south of the CRC area (e.g., between 179th Street and I-405).

MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: PEAK TRAFFIC AND PERSON THROUGHPUT

The replacement crossing would provide greater throughput than the supplemental crossing.

During the four-hour morning peak, southbound vehicle throughput on the I-5 crossing under the replacement and supplemental crossings is forecast to increase by 2,000 vehicles (9 percent) and 1,200 vehicles (5 percent) respectively, compared to No-Build conditions. While the southbound bridge bottleneck would be eliminated with either crossing, recurrent traffic congestion from the downstream bottleneck located just north of the I-405 split would limit the traffic volume served across the I-5 bridge to about 95 percent of demand for either crossing.

During the four-hour afternoon/evening peak, northbound vehicle throughput across the replacement crossing would increase by 8,100 vehicles (40 percent) compared to No-Build conditions. The replacement crossing would remove the northbound bottleneck at the I-5 bridge, resulting in higher vehicle throughput for northbound I-5. With a supplemental crossing during the afternoon/evening peak, northbound vehicle throughput across the I-5 bridge would increase by 1,100 vehicles (6 percent) compared to No-Build conditions, as the result of the slightly higher capacity of the new four-lane northbound system. However, the separation of northbound travel lanes using the two existing bridges, combined with the short on-ramp spacing between Marine Drive and Hayden Island, would result in traffic congestion lasting throughout the day. This congestion would result in substantial delays and queuing around the Hayden Island and Marine Drive interchanges.

MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: LOCAL STREET PERFORMANCE

The river crossing choice principally influences local street traffic around the SR 14/City Center, Hayden Island, and Marine Drive interchanges.

Multimodal River Crossing and Highway Improvements: Vancouver Local Streets

Since both river crossing types would reduce the duration of southbound congestion during the morning peak, the duration of congestion on most local Vancouver streets would also decline.

The increased capacity provided on I-5 by either crossing would draw similar traffic levels from nearby roadways back to I-5. Traffic volumes along key east-west local streets between 39th Street and Mill Plain

Boulevard would increase by 5 to 15 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Kaufman and P Streets would decrease by up to 30 percent.

With a replacement crossing, inbound SR 14 traffic to downtown Vancouver would be able to use two access points—one along Columbia Street at Fourth Street and the other along Washington Street. The two access points would support better dispersion of traffic without overloading downtown intersections. For the supplemental crossing, only the Columbia Street intersection connection would be feasible. An additional 800 vehicle trips per hour would access Columbia Street during the morning peak, resulting in local street congestion and intersection failures in lower Vancouver.

The replacement crossing would enable outbound SR 14 traffic from downtown Vancouver to use two access points—one along Columbia Street at Fourth Street and the other along Main Street at Fifth Street. For the supplemental crossing, only the Columbia Street intersection would be feasible. An additional 800 vehicles per hour would try to use Columbia Street during the afternoon/evening peak, resulting in local street congestion and intersection failures in lower Vancouver.

With a replacement crossing, local street intersection operations would improve system-wide relative to the No-Build Alternative. For example, during the afternoon/evening peak under No-Build conditions, 46 of the 76 local study intersections would operate acceptably in Vancouver. The replacement bridge would improve local street operations, resulting in 67 of 76 intersections operating acceptably.

A supplemental crossing would result in local street performance similar to that with a replacement crossing, with the exception of the local street congestion and intersection failures in lower downtown Vancouver as a result of limited SR 14 connections. With a supplemental crossing, about 10 additional intersections in lower downtown Vancouver would experience level-of-service or vehicle queuing deficiencies, compared to the replacement crossing.

Multimodal River Crossing and Highway Improvements: Portland Local Streets

There are three options being considered for the Marine Drive interchange, as discussed and illustrated in Chapter 2. Because Marine Drive is heavily used by trucks, the effect of the design of this interchange is critical to truck traffic.

Maintaining the existing Marine Drive interchange location would allow trucks to continue to operate at 45 mph with good sight and stopping distances.

The southern realignment option would realign Marine Drive south of the Expo Center, reducing sight and stopping distances and requiring trucks to slow to below the existing 45 mph speed. However, this realignment would move the Marine Drive interchange farther south and increase the distance to the Hayden Island interchange, allowing more space for vehicles to merge onto and off of the freeway. This extra distance is particularly important for trucks.

The diagonal realignment option would slightly decrease sight and stopping distances, but much less so than a southern realignment. This diagonal realignment would not improve (increase) distances between the Marine Drive and Hayden Island interchanges, as would the southern realignment.

The increased capacity provided on I-5 under all build alternatives would draw similar traffic levels from nearby parallel roadways back to I-5. Traffic volumes along key east-west local streets between Columbia Boulevard and Going Street would decrease by 5 percent relative to No-Build conditions, while traffic volumes on key north-south local streets between Greeley Avenue and Martin Luther King Jr. Boulevard would decline by up to 15 percent.

The duration of congestion along northbound I-5 at the river crossing during the afternoon/evening peak would decrease from eight hours under No-Build conditions to two hours with a replacement crossing. This would also reduce north-south congestion on local streets.

For the supplemental crossing, northbound traffic congestion near the bridge would decrease from eight hours under No-Build conditions to seven hours, as discussed earlier. Because of northbound traffic back-ups under the supplemental crossing, about 50 percent of the traffic demand to northbound I-5 from Hayden Island and Marine Drive and Hayden Island would go unserved, resulting in congested ramp terminals and local streets in the vicinity of these interchanges.

With a replacement river crossing, 35 of 37 study intersections would operate acceptably in Portland during the afternoon/evening peak period.

The replacement crossing would include auxiliary lanes directly connecting Hayden Island and Marine Drive, but the supplemental crossing would not. With a supplemental crossing, all vehicle trips between Hayden Island and Marine Drive would need to travel on I-5 to either Vancouver or Victory Boulevard and turn around. This would add traffic to I-5 and local intersections, further affecting traffic operations.

Portland’s local street operations would improve system-wide under the replacement crossing relative to No-Build conditions. For example, during the afternoon/evening peak under No-Build conditions 18 of 25 local street intersections would operate acceptably. The replacement bridge would add 12 new study intersections (primarily in the Hayden Island and Marine Drive interchange areas) and would result in a total of 35 of 37 intersections operating acceptably.

With a supplemental river crossing, 29 of 37 study intersections would operate acceptably in Portland during the afternoon/evening peak period.

The supplemental crossing would improve local street intersection operations in the North Portland and Victory subareas, but would degrade intersection operations in the Marine Drive and Hayden Island areas. During the afternoon/evening peak, 18 of 25 local street intersections would operate acceptably under No-Build conditions. The supplemental crossing would add 12 new study intersections, but only 29 of 37 would operate acceptably.

MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: PEDESTRIANS AND BICYCLISTS

The replacement crossing was evaluated with a multi-use pathway west of and adjacent to the transit guideway. As discussed in Chapter 2, pathways could be located on both sides of the river crossing. The pathway would be continuous and above-grade from approximately Sixth

Street in Vancouver to just north of Marine Drive. It would pass under Marine Drive and connect to the Expo Center. The pathway would be a minimum of 16 feet wide between its barriers and could separate pedestrian and bicycle traffic through pavement markings.

The replacement crossing would provide access to Vancouver via a ramp to a roadway in the downtown area. A second potential connection in Vancouver, closer to the Columbia River, would provide access to waterfront attractions and the multi-use path along the shore with an elevator. On Hayden Island, the pathway would be accessible via an elevator and stairs located at the high-capacity transit station. In addition, potential stairs at the north and south ends of the island could be provided. Note that Hayden Island access points are being studied as a part of the City of Portland’s separate Hayden Island planning efforts.

At the Marine Drive interchange, the multi-use path would have access to the Expo Center transit station and to the 40-Mile Loop trail running along North Portland Harbor. Additional connections to Delta Park and bicycle routes along Union Court and Martin Luther King Jr. Boulevard would be maintained or improved with off-street facilities, ramps and stairs. The connections proposed by the CRC project would be coordinated with ongoing planning efforts that affect Vancouver, Hayden Island and the Marine Drive area.

Today, pedestrians and bicyclists cross North Portland Harbor on a multi-use pathway on the east side of the harbor bridge. The proposed crossing for the replacement bridge would remove access at this location and require users to travel out of direction to access the new pathway along the high-capacity transit alignment. A potential mitigation measure to alleviate this circuitous routing would be to construct a pedestrian pathway on the east side of the harbor bridge. In addition, a longer-range measure to install a pedestrian sidewalk on the east side of the eastern span of the replacement crossing could be considered.

The supplemental crossing was evaluated with a widened sidewalk on the existing eastern bridge in order to accommodate both pedestrians and bicyclists in a safe manner. Ramps would connect this widened pathway with Columbia Way in Vancouver and with Tomahawk Island Drive on Hayden Island. An above-grade multi-use pathway on the western bridge would connect Tomahawk Island Drive and Marine Drive. Pedestrians and bicyclists using both pathways would need to travel along Tomahawk Island Drive, under I-5, and through at-grade intersections.

Today, pedestrians and bicyclists cross North Portland Harbor on a multi-use pathway on the east side of the harbor bridge. The supplemental river crossing would remove access at this location and require users to travel out of direction to access the new pathway along the high-capacity transit guideway. Once on Hayden Island, the new pathway would require additional time for users to access the proposed pathway on the east side of the east bridge over the Columbia River. Connections to the bridge would require that pedestrians and bicyclists leave the high-capacity transit guideway pathway and drop down to Hayden Island, then travel on sidewalks before they could access the southern end of the new, cantilevered pathway on the existing northbound I-5 bridge. As with the replacement crossing, a potential mitigation measure to alleviate some of the circuitous routing would be to construct a pedestrian pathway on the east side of the harbor bridge. A longer-range measure to help avoid these issues would be a new cantilevered pathway on the west side of the existing southbound bridge.

The stacked transit/highway bridge design for the replacement crossing would accommodate transit beneath the highway deck of the new western bridge and place the multi-use pathway under the northbound bridge. As with the supplemental crossing, ramps to the east of I-5 would connect the pathway to Columbia Way in Vancouver and Tomahawk Island Drive on Hayden Island. An above-grade multi-use pathway would be provided west of I-5, alongside the high-capacity transit guideway between Tomahawk Island Drive and Marine Drive. Pedestrians and bicyclists using both pathways would need to travel along Tomahawk Island Drive, under I-5, and through at-grade intersections.

Alternatively, the stacked transit/highway bridge design could locate the pathway under the traffic deck of the southbound bridge. This would enable a more direct pathway similar to that proposed under the replacement crossing standard design. Further evaluation would be required to determine if this option is feasible due to potential bridge loading issues with highway and transit loads combined on one structure. Suspending the pathway under an edge of a bridge would shorten connections, as the pathway's elevation would be lower than the roadway deck.

For all build alternatives, connections consisting of ramps, stairs, or elevators would connect with existing and planned sidewalks and pathways in Vancouver, Hayden Island, and near Marine Drive. The connections would be coordinated with ongoing planning in those areas and would be ADA compliant.

MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: TRAFFIC SAFETY AND SECURITY

The replacement crossing would substantially improve traffic safety within the CRC area, eliminating the lift span and most of the non-standard design features for the I-5 mainline and ramps. In contrast, the supplemental crossing would result in substantial northbound congestion at the bridgehead, increasing the likelihood of collisions compared to the replacement crossing.

The replacement crossing would substantially improve traffic safety compared to the supplemental crossing.

The supplemental crossing would not provide the same level of safety benefits as the replacement crossing. It would address some of the existing non-standard geometric and safety design elements by including highway and interchange enhancements affecting southbound I-5. However, it would not eliminate bridge lifts for northbound traffic or non-standard ramp features such as short merging and diverging areas for northbound traffic.

The supplemental crossing would create a northbound mainline "diverge" point near Marine Drive, which is an atypical design and would result in traffic turbulence and weaving for both passenger vehicles and trucks at and in advance of the divergence.

MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: TRANSIT OPERATIONS AND MAINTENANCE COSTS

The average annual operating cost of the replacement crossing would be $50,000, whereas a supplemental crossing would require, on average, about $750,000 each year to operate and maintain the structures. These costs are for all bridges included in each crossing, so they would be spread between both highway and transit elements of the project. The substantially lower cost to operate the replacement crossing would reduce the overall cost of operating the transit element of this project and improve the transit cost-effectiveness.

A replacement crossing could further reduce transit costs. After the DEIS is issued, a bridge type study will evaluate multiple bridge types, including a Stacked Transit/Highway Bridge (STHB) design. The STHB design has the potential to reduce cost because it would allow high-capacity transit to operate on a shared bridge with highway traffic. This would eliminate the need for a third bridge to carry transit, bicyclists and pedestrians, potentially reducing construction costs and improving the overall cost effectiveness for the transit element of this project.

MULTIMODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS: TRANSIT SAFETY AND SECURITY

Transit would be placed on a new bridge with either crossing and so would be unaffected by bridge lifts retained by the supplemental crossing. Thus, there is no difference in transit safety or security between crossing alternatives. For transit, one configuration is not inherently safer than the other.

With the shared transit/highway bridge design for the replacement crossing, transit would be placed the lower level of the bridge inside the structural elements supporting the traffic deck. There is a potential that if an event should damage one level (such as an explosion that potentially affected the structural integrity of the bridge), the other level would sustain damage more easily than if the traffic and transit crossings were placed on separate structures.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

The selection of BRT or light rail does not have a substantial effect on I-5 crossing traffic performance or bicycle and pedestrian connections. Transit mode does have important effects on local traffic and, of course, on transit performance.

All numbers and discussion in the Transit Mode section are for Efficient transit operations. Increased transit operations would change the value of some data in this section, but the relationship between BRT and light rail would generally be similar. The Efficient and Increased transit operating options are compared later in a separate section.

TRANSIT MODE: LOCAL STREET PERFORMANCE

Transit Mode: Vancouver Local Streets

In Vancouver, local street performance would degrade on streets where light rail trains receive traffic signal pre-emption. Signal pre-emption would increase delays for motor vehicles crossing the light rail guideway. BRT would not have traffic signal pre-emption (with three to five times more buses using the transit guideway than light rail trains, traffic signal pre-emption for buses would result in substantial traffic congestion on Vancouver’s local streets). However, due to the added buses, bus “bunching” would likely occur, resulting in some congestion on streets in downtown Vancouver.

Transit Mode: Portland Local Streets

Neither mode would cause local street traffic impacts in Portland north of the Expo Center station, because the guideway would be elevated. South of the Expo Center station, either transit mode would increase the number of peak trains operating along the existing MAX Yellow Line from 10 trains per hour to 16 trains per hour with Efficient operations. Increased transit operations would increase the number to 20 trains per hour.

The traffic effects of an increased number of trains would be limited to local streets along the Interstate Avenue corridor. Because trains receive traffic signal priority at signalized intersections, pre-empting vehicular traffic traveling on cross-streets, an increase in the number of trains would increase vehicle delays. Additional impacts would result under Increased transit operations. In the Rose Quarter/Steel Bridge area in Portland, adding light rail vehicles may require modifications to signals, street geometry, or traffic and pedestrian movements to optimize transit and traffic performance.

TRANSIT MODE: TRANSIT RIDERSHIP AND MODE SPLIT

As noted in Exhibit 3.1-31, BRT would result in a higher number of transit vehicles operating in the transit guideway through the project area than would light rail. BRT would also have slightly more weekday and annual platform hours than light rail.

Exhibit 3.1-31
Transit Vehicles and Platform Hours of Service

Transit Characteristic	No-Build	BRT	Light Rail
Standard 40-foot Buses	24	43	17
Articulated 60-foot Buses	0	24	0
LRT Two-Car Trains	0	0	10
Total Transit Vehicles	**24**	**54**	**25**
Weekday Platform Hours	2,600	2,800	2,700
Annual Platform Hours	799,000	851,000	823,000

Source: CRC Transit Technical Report 2008.

Light rail would attract 30 to 40 percent more annual riders over the Columbia River than BRT.

As illustrated in Exhibit 3.1-32, all of the build alternatives would at least double transit ridership crossing the Columbia River, compared to the No-Build Alternative. Light rail would attract approximately 30 to 40 percent more annual riders across the Columbia River than BRT. Integration with the existing MAX system is an important benefit of light rail, and would help attract additional transit riders. This integration allows riders to travel between Vancouver and Portland without a transfer. To get to destinations in central or north Portland, BRT riders would have to transfer to the Yellow Line or a TriMet local bus line at the Expo Center station.

Exhibit 3.1-32
Comparison of Transit Ridership

	No-Build	BRT	LRT
Daily Express and Local Bus	8,827	11,330	2,182
Daily High-Capacity Transit	N/A	5,443	18,606
Total Daily Passenger Trips	**8,827**	**16,773**	**20,788**
Annual Express and Local Bus	2,508,134	3,227,309	552,000
Annual High-Capacity Transit	N/A	1,600,837	6,121,000
Total Annual Passenger Trips	**2,508,134**	**4,828,146**	**6,673,420**

Source: 2007 travel demand forecasting outputs.

As illustrated in Exhibit 3.1-33, BRT would have nearly 50 percent higher transit mode split than the No-Build Alternative. In the afternoon/evening peak, 19 percent of the trips over the I-5 crossing would be by transit, 53 percent by SOVs, and 28 percent by HOVs. Light rail would further increase transit mode split to 21 percent of afternoon/evening peak hour trips over the I-5 crossing. The slightly higher transit mode split for light rail directly corresponds to the greater ridership attracted by light rail, as discussed earlier.

Exhibit 3.1-33
Comparison of Transit Mode Split over the I-5 Columbia River Crossing

	No-Build	BRT	LRT
P.M. peak direction SOV [a]	54%	53%	50%
P.M. peak direction HOV[a]	33%	28%	29%
P.M. peak direction transit	13%	19%	21%

Source: 2007 travel demand forecasting outputs.
[a] SOV – Single-Occupancy Vehicle, HOV – High-Occupancy vehicle.

Transit mode share at the crossing would be 50 percent higher with BRT and 60 percent higher with light rail compared to the No-Build Alternative.

Similar to the mode split over the river, both BRT and light rail would increase the transit mode split for commutes between target markets compared to the No-Build Alternative, and light rail would provide a greater increase than BRT (Exhibit 3.1-34).

Exhibit 3.1-34
Daily Transit Mode Split by Transit Market (Home Based Work Trips)

	No-Build	BRT	LRT
Clark County Inner Urban Transit Market to Markets in Oregon	12%	15%	20%
Clark County Suburban Commuter Market to Markets in Oregon	12%	13%	15%
Markets in Oregon to Clark County	3%	6%	8%

Source: CRC Transit Technical Report 2008.

TRANSIT MODE: TRANSIT TRAVEL TIMES

Exhibit 3.1-35 below shows that both BRT and light rail would increase the average transit vehicle speed through the CRC area, compared to No-Build. BRT would be slightly slower than light rail in the exclusive guideway because it would not have signal priority, there would be more variation in operator performance, dwell times at transit stations would be slightly longer, and acceleration would be slower. Signal priority in downtown Vancouver would not be possible for BRT because the high service frequencies would disrupt cross-traffic flow. As a result, BRT would be approximately one minute slower than light rail through the CRC area.

Exhibit 3.1-35
Transit Travel Speeds and Vehicle Hours of Delay

	No-Build	BRT	LRT
P.M. Peak Transit Vehicle Travel Speed in Miles Per Hour (MPH)			
Through CRC area	10 mph	14.5 mph	17.3 mph
Downtown Vancouver	7.5 mph	9.6 mph	12.9 mph

Source: CRC Transit Technical Report 2008.

In most instances, light rail would provide better travel times than BRT (Exhibit 3.1-36). BRT buses would travel with general traffic outside the CRC area, and thus would be subject to congestion-induced delays before they enter the exclusive guideway in the CRC area. Such delays could cause buses to miss schedules and increase travel times. As modeled, LRT frequencies have no identified impact on LRT travel times or on operations through the Rose Quarter/Steel Bridge area. Additional analysis may show some impacts which could be mitigated with modifications to signals, street geometry, traffic and pedestrian movements, or improvements to the trackway on or near the bridge, to optimize transit system performance.

Exhibit 3.1-36
Comparison of Average Weekday Transit Travel Times (Minutes)

	No-Build	BRT	LRT
Northern Terminus to Expo Center	N/A	13	12
Northern Terminus to Pioneer Square	N/A	43	40
Northern Terminus to Lombard Transit Center	N/A	23	18
Downtown Vancouver (7th St. and Washington St.) to Pioneer Square	N/A	35	32
Pioneer Square to Salmon Creek (via C-TRAN Route 134)	48	32	32
Lombard Transit Center to Vancouver Mall (via Route 4L)	57	40	39
Hayden Island to 99th Street Transit Center (via 71L)	40	24	32
Salmon Creek to Pioneer Square (via C-TRAN Route 134)	56	51	51
Vancouver Mall to Lombard Transit Center (via Route 4L)	31	37	34
99th Street Transit Center to Hayden Island (via 71L)	41	24	19

Source: CRC Transit Technical Report 2008.

TRANSIT MODE: TRANSIT OPERATIONS AND MAINTENANCE COSTS

As illustrated in Exhibit 3.1-37, BRT would be less expensive to construct but more expensive to operate than light rail. Although the BRT system would require the purchase of more transit vehicles than light rail, the additional expense of constructing the light rail guideway would ultimately require 22 percent more capital cost. However, the lower number of vehicles required for light rail would mean that annual operating and maintenance costs for light rail would be $1.8 million less than BRT. Light rail is more cost-effective because it attracts more riders, can carry more riders with fewer vehicles, and is therefore cheaper per passenger.

Exhibit 3.1-37
Transit Mode Costs[a]

	No-Build	BRT	LRT
Operation and Maintenance Cost	$70 Million	$75 Million	$73 Million
Capital Cost (Millions)[b]	$0	$600 - $750	$780 - $940
Cost-Effectiveness[c]	N/A	$15.09	$11.55

Source: CRC Transit Technical Report 2008.

[a] These costs are for the Lincoln terminus. The Kiggins Bowl terminus would have different costs, but the relationship between BRT and light rail would be the same.

[b] The capital cost range is based on a risk assessment, and includes contingency.

[c] Incremental capital and operational cost per incremental passenger over the No-Build Alternative.

TRANSIT MODE: TRANSIT SAFETY AND SECURITY

The introduction of fixed guideway transit service to Hayden Island and Clark County would introduce a new travel mode into an already busy transportation system. All build alternatives would cross several intersections at grade, where transit vehicles would interact with automobile and truck traffic, bicycles, and pedestrians, potentially increasing the risk of collisions. Intersection crossings would be controlled by traffic signals to direct safe transit, pedestrian, bicycle, and auto movements. Signage would increase the awareness of the new guideway by clearly delineating the guideway and adjacent streets and by warning pedestrians when trains would be approaching.

Many similar intersections exist today on TriMet’s light rail system. Transit would operate at the speed limits designated for vehicles on adjacent streets in the at-grade sections of the guideway. Designated pedestrian crossing areas would provide safe crossing opportunities. Light rail vehicles would have a high-intensity light that would remain on at all times, and operators would sound the train horn if they saw vehicles or pedestrians in the guideway.

Despite these safety precautions, crashes could still occur. For example, although left turns across the guideway would not be allowed away from signalized intersections, they may be attempted illegally by some drivers. Because of similarities in construction and operation of the guideway, BRT would likely have crash rates at its at-grade street crossings similar to those for light rail.

Light rail on the stacked transit/highway bridge would control safety access better than BRT.

According to recent data collected by the Federal Transit Administration (FTA) on safety incidents (such as collisions) that occurred with light rail, 34 percent were at at-grade intersections. However, with safety measures such as signal controls to clearly delineate right-of-way at intersections, and the implementation of adequate active and passive signage, collisions can be minimized. Collisions on TriMet’s light rail system have decreased over the years with the addition of positive traffic control and signage. Also, rates have dropped as travelers have become more aware of the system and its potential conflicts with vehicles and pedestrians. This is true even as the number of system miles has increased. Other transit systems have experienced similar decreases as they have matured. For example, recent studies of at-grade crossings on the Blue Line in Los Angeles and the St. Louis light rail system indicate that these locations have collision rates substantially lower than typical rates at high-volume signalized intersections that carry only general purpose motor vehicle traffic.

Interactions with other vehicles increase as the number of transit vehicles using an at-grade crossing or intersection increases. Therefore, safety equates to alternatives with fewer vehicles, or with more vehicles in a designated guideway separated from other traffic. For this reason, both light rail and BRT options have the potential to improve safety over the No-Build Alternative. The light rail mode would have fewer total transit vehicles, but a greater number of fixed route buses in mixed traffic on downtown city streets. With BRT, there would be a lower number of fixed route buses in mixed traffic on downtown Vancouver streets (because they would operate in the guideway), but BRT options would have the highest total number of vehicles.

Expanded transit maintenance bases associated with either mode are not expected to differ in safety and security concerns. Both C-TRAN and TriMet have reduced their use of hazardous materials required for vehicle maintenance, lowering the risk of exposure or environmental contamination at the maintenance bases from historic levels.

If light rail is chosen for the transit mode, overhead wires should not be installed above roadway lighting fixtures, in order to reduce the potential hazard to aircraft from hard-to-see structures above the roadway.

In addition to considerations for building safety into the design and operation of high-capacity transit systems, transit security on vehicles and at stations and park and ride lots would also be addressed during the planning, design, construction and operational phases of the project.

TriMet is currently developing a plan for enhancing safety and security. This plan would be updated annually and would address system-wide security goals, reductions in crime and the perception of crime, improved awareness and involvement in security issues by agency employees and the public, incorporating better approaches to security into design and construction practices, and enhancing emergency preparedness. TriMet has budgeted resources to address safety and security, and works closely with local agency partners and the Department of Homeland Security. In construction of the Clackamas County Green Line, TriMet has integrated crime prevention into environmental design, including good lighting, clear sight lines, clearly defined public travel routes, reduced station clutter and closed caption television. Similar measures would be undertaken for the selected high-capacity transit mode.

Light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. Light rail vehicles using this maintenance facility would not be carrying passengers. Thus, the proposed expansion is unlikely to have an adverse effect on safety or security.

Transit Terminus Options (with all Alternatives)

KIGGINS BOWL TERMINUS AND LINCOLN TERMINUS

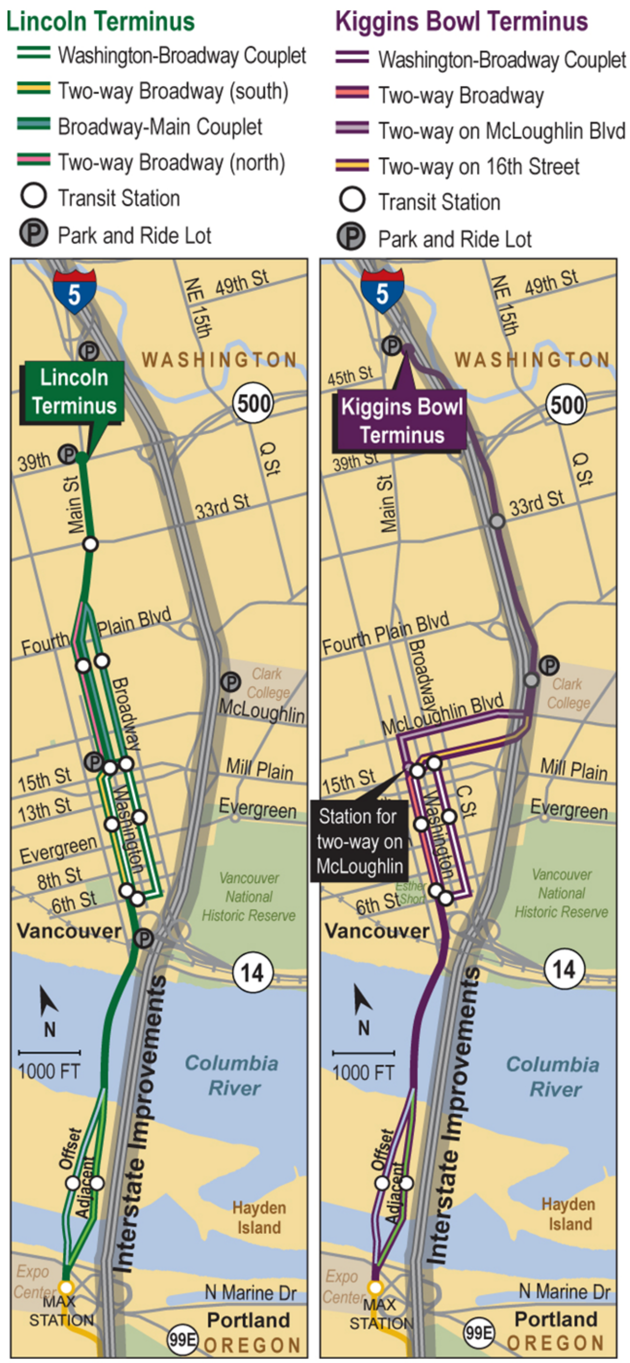
Both transit terminus options would result in similar traffic performance for the I-5 crossing (see Exhibit 3.1-38).

<u>Kiggins Bowl and Lincoln: Local Street Performance</u>

However, the four terminus options would have different effects on local streets in Vancouver. The Kiggins Bowl and Lincoln terminus options would each operate high-capacity transit from the MAX Yellow Line Station at Expo Center to a terminus north of downtown Vancouver.

The Lincoln terminus would operate on local streets throughout Vancouver. The Kiggins Bowl terminus north of Mill Plain Boulevard would operate in a separated guideway running adjacent to I-5. The Lincoln terminus would have more impact on local streets and would require the elimination of a greater number of parking spaces. Both options would include park and ride facilities that are discussed in greater detail in the Transit section of this DEIS.

Exhibit 3.1-38
Transit Terminus and Alignment Options



DIMENSIONS ARE APPROXIMATE.

A reduction in travel lanes on Main Street, associated with the Lincoln terminus, would adversely impact local street operations.

The Kiggins Bowl terminus would include two park and ride facilities. The Kiggins Bowl Park and Ride would generate about 925 morning and 850 afternoon/evening peak hour vehicle trips. The Clark College Park and Ride would generate about 725 morning and 715 afternoon/evening peak hour vehicle trips. As part of the Kiggins Bowl terminus, Main

Street would be widened north of 45th Street to accommodate the traffic levels expected to access the Kiggins Bowl Park and Ride during peak hours. The overall increase in traffic levels generated by the Kiggins Bowl Park and Ride would result in increased traffic congestion and vehicular queuing at nearby intersections.

A key impact to local street performance with the Lincoln terminus is that transit, which would run within the street right-of-way, would require the elimination of two vehicular travel lanes (one per direction) along Main Street between 29th Street and the Lincoln Park and Ride. As Main Street is the only principal north-south arterial in northern Vancouver west of I-5, reductions in vehicular travel lanes on Main Street would adversely affect local street travel. The lower number of travel lanes would reduce capacity and likely increase congestion and delay in northern Vancouver.

The Lincoln terminus would include three park and ride facilities. The Kiggins Bowl Park and Ride would generate about 85 morning and 75 afternoon/evening peak hour vehicle trips. The Lincoln Park and Ride structure would generate about 1,200 morning and 1,200 afternoon/evening peak hour vehicle trips. The Clark College Park and Ride surface lot would generate about 225 morning and 230 afternoon/evening peak hour vehicle trips.

To accommodate the additional traffic generated by the Lincoln Park and Ride during peak hours, Main Street would be widened north of 39th Street. The overall increase in traffic levels generated by the proposed park and ride facilities would result in increased congestion and queuing at nearby intersections, including those along 39th Street, Main Street between 39th Street and Mill Plain Boulevard, and Broadway Street between Main Street and Mill Plain Boulevard.

Kiggins Bowl and Lincoln: Transit Performance

Kiggins Bowl and Lincoln terminus options have very similar transit performance characteristics, despite their different routes and guideway characteristics in northern Vancouver. Key measures of transit performance such as ridership and travel times are very similar for both terminus options. Overall, the primary difference in transit performance between these terminus options is cost. (Differences for other elements of the environment, such as land use, are discussed in other sections of this chapter.)

As illustrated in Exhibit 3.1-39, the Lincoln terminus would be less expensive to construct than the Kiggins Bowl terminus, as it would not require a new tunnel underneath I-5 to connect to the Clark College Park and Ride, or an elevated structure to cross back over I-5 to connect to the Kiggins Bowl Park and Ride. The Lincoln terminus would also be 25 percent less expensive to maintain and operate because the Kiggins Bowl terminus would have a longer and more complex transit guideway.

Exhibit 3.1-39
Transit Terminus Characteristics and Performance

Characteristic		Kiggins Bowl terminus	Lincoln terminus	Clark College MOS	Mill Plain MOS
Daily Passenger Trips on Transit over alignment		21,100	20,800	18,200	19,100
Annual Passenger Trips on Transit over alignment		6,780,000	6,670,000	5,820,000	6,110,000
Peak/Peak Direction Mode Split over I-5 river crossing	SOV	50 percent	50 percent	52 percent	50 percent
	HOV	29 percent	29 percent	29 percent	27 percent
	Transit	21 percent	21 percent	19 percent	23 percent
Transit Accessibility	Clark County households within ½ mile of HCT station	5 percent	5 percent	4 percent	3 percent
	Clark County employment within ½ mile of HCT station	11 percent	11 percent	10 percent	9 percent
Estimated Capital Cost		**$1,068.8M**	**$879.3M**	**$674.9M**	**$615.8M**
Annual Operating Cost (Increment over the No-Build)		**$4,240,000**	**$3,510,000**	**$2,950,000**	**$2,830,000**
Annualized Cost per Transit Guideway River Crossing		**$13.67**	**$11.55**	**$10.38**	**$8.91**

Source: CRC Transit Technical Report 2008.

Note: Data presented in this table is for light rail. The relationship between alignments and MOS options would be the same for BRT.

Kiggins Bowl and Lincoln: Transit Safety and Security

Safety factors for the transit terminus options are dictated by the environment they traverse. Fully grade-separated sections are inherently safer since there is no interaction with other vehicles, bicycles, or pedestrians at intersections. However, stations located in secluded areas or away from busy environments could increase passenger security concerns.

The CRC project will work with emergency service providers to allow transit guideways adjacent to traffic lanes to be used for emergency passage around congestion, where feasible.

Because the Kiggins Bowl terminus would have fewer at-grade crossings than the Lincoln terminus, there would be fewer interactions between high-capacity transit and automobile traffic, bicycles, or pedestrians. This would reduce the potential safety issues due to traffic conflicts.

The Kiggins Bowl terminus would be fully grade-separated from Clark College to Kiggins Bowl. While this is safer in terms of interaction between traffic and transit, the station environment is less conducive to security. The Clark College station would be placed in a retained cut 30 to 38 feet below the surface with very little visibility from McLoughlin Boulevard and no visibility from any other street or from I-5. The Rose Village station would be placed at highway level, which is below the neighborhood level. This location can only be viewed by motorists traveling on I-5 at highway speed or by pedestrians crossing the 33rd Street bridge on the north side. At its terminus, the elevated guideway would cross over I-5, entering the Kiggins Bowl station at the fifth floor of a six-story parking structure. Visibility of this station is only possible from the adjacent bus transfer area. The lack of visibility of these stations creates an environment that could make security problematic.

The three stations in northern Vancouver for the Lincoln terminus (25th Street, 33rd Street, and Lincoln stations) would all be built at neighborhood grade near commercial buildings and residences, creating a high visibility environment. The guideway, however, would be adjacent to travel lanes, and transit vehicles would interact with traffic and pedestrians at each intersection.

CLARK COLLEGE MINIMUM OPERABLE SEGMENT

Both the Clark College and Mill Plain MOS (minimum operable segment) terminus options would result in similar highway performance for I-5 within the CRC area (see Exhibit 3.1-40). Highway vehicle travel demand would be consistent for both short terminus options and full-length alignments.

For safety and security, there is little difference between the Clark College and Mill Plain MOS terminus options. The routes differ only in the extension past the Mill Plain transit center to Clark College. The Clark College MOS would be at-grade between the Mill Plain transit center and the proposed terminus at the Clark College Park and Ride. This would increase the potential for collisions involving transit compared to the Mill Plain MOS, although it would be less than the Lincoln terminus. The Clark College Park and Ride would have limited visibility from surrounding areas, potentially increasing security risks.

Clark College Minimum Operable Segment: Local Street Performance

The Clark College MOS would include two park and ride facilities with about 1,300 parking spaces. Parking facilities would include a surface lot at Kiggins Bowl and a parking structure at Clark College. The Kiggins Bowl lot would connect to the high-capacity transit station via shuttle bus. The Kiggins Bowl Park and Ride would generate about 85 morning and 75 afternoon/evening peak hour vehicle trips. The Clark College Park and Ride would generate about 725 morning and 715 afternoon/evening peak hour vehicle trips.

Impacts from the Clark College MOS terminus would be similar to those from the Kiggins Bowl terminus. However, the roadway improvements proposed on Main Street north of 45th Street under the Kiggins Bowl terminus would not be necessary with the Clark College MOS, as the Kiggins Bowl Park and Ride facility would only be a surface lot, rather than a six-level parking structure.

The Clark College MOS would not require the elimination of two vehicular travel lanes (one in each direction) along Main Street between 29th Street and the Lincoln Park and Ride lot. Maintaining the four vehicular travel lanes on Main Street would improve local street operations in northern Vancouver compared to the Lincoln terminus.

TERMS & DEFINITIONS

Traffic Term

Minimum Operable Segments (MOS) are shorter, fully evaluated, less expensive options compared to the full-length alignments.

Exhibit 3.1-40

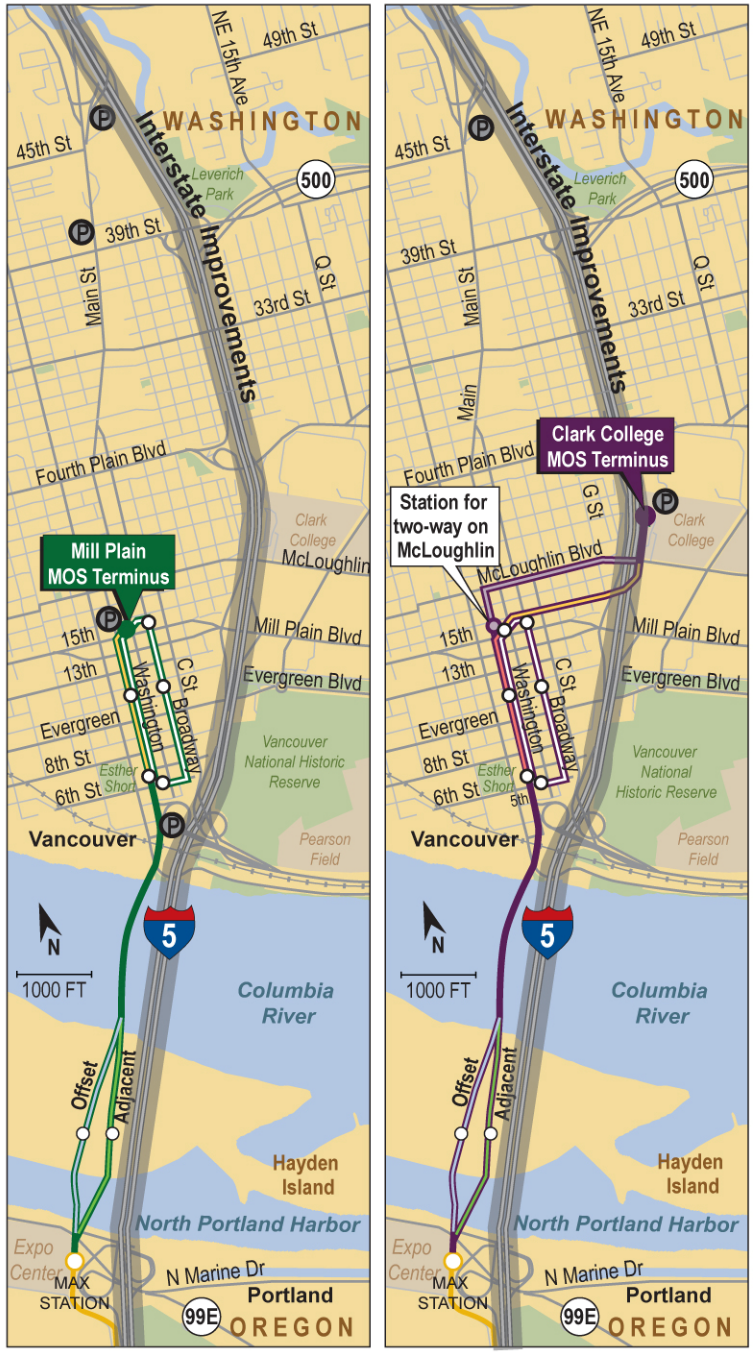
Minimum Operable Segments (MOS)

Mill Plain MOS Alignment Options

- Washington-Broadway Couplet
- Two-way Broadway
- Transit Station
- Park and Ride Lot

Clark College MOS Alignment Options

- Washington-Broadway Couplet
- Two-way Broadway
- Two-way on McLoughlin Blvd
- Two-way on 16th Street
- Transit Station
- Park and Ride Lot



DIMENSIONS ARE APPROXIMATE.

Clark College Minimum Operable Segment: Parking and Access Impacts

The Clark College MOS would have the same parking and access impacts between Fifth and G Streets as the Kiggins Bowl terminus (see Exhibit 3.1-41). However, these impacts vary, based on the packaging of the four alignment options discussed below. Routing high-capacity transit along the Broadway-Washington couplet in downtown Vancouver would require removing fewer on-street parking spaces; however, this option would entail greater loss of access to surface lots that serve downtown businesses. Additionally, the Clark College MOS would provide half as much new parking at park and ride lots. Adjustments in lane configurations could reduce or mitigate these impacts, but would be unlikely to change the relationship between alignment options.

Exhibit 3.1-41
Clark College MOS Parking and Access Impacts

	2-way Washington to 2-way 16th	2-way Washington to 2-way McLoughlin	Downtown Couplet to 2-way 16th	Downtown Couplet to 2-way McLoughlin
Parking				
Total	205	237	310	342
Parking Lost	151	197	123	169
Percent	74%	83%	40%	49%
Access Points				
Total	46	51	61	66
Points Lost	11	0	31	20
Percent	24%	0%	51%	30%
Loading Zones				
Total	5	5	2	2
Loading Zones Lost	0	0	1	1

Source: CRC Land Use Technical Report 2008.

Clark College Minimum Operable Segment: Transit Ridership and Mode Split

The Clark College MOS would attract about 13 percent fewer daily transit trips than the full length I-5 alignment.

The shortened guideway with the Clark College minimum operable segment (MOS) terminus option, and the fewer number of high-capacity transit stations, would reduce the percent of Clark County households and employment within one-half mile of a high-capacity transit station. Four percent of Clark County households (compared to 5 percent with the Kiggins Bowl terminus) and 10 percent of employment (compared to 11 percent with the Kiggins Bowl terminus) would be within one-half mile of a station.

With this configuration, the number of daily and annual passenger trips on transit over the Columbia River within the I-5 corridor would be approximately 13 percent less than with the Kiggins Bowl terminus—18,200 trips compared to 21,100. The reduction in trips on transit could be attributed to the diminished accessibility of the high-capacity transit line to northern Vancouver and Clark County which would result from shortening the length of the guideway and reducing the number of park and ride spaces. With the Clark College MOS there would be 1,100 spaces at the Clark College Park and Ride lot and 150 spaces at a satellite surface lot at Kiggins Bowl, for a total of 1,250 spaces, about half that of the Kiggins Bowl terminus.

The Clark College MOS terminus would have a peak period/peak direction transportation mode split comparable to the Kiggins Bowl terminus. Peak period/peak direction traffic over the Columbia River would be made up of 52 percent SOV, 29 percent HOV, and 19 percent transit. With the full length of the Kiggins Bowl terminus, the mode split would be 50 percent SOV, 29 percent HOV, and 21 percent transit.

Clark College Minimum Operable Segment: Transit Operations and Maintenance Costs

Because the transit guideway of the Clark College MOS would be about 1.5 miles shorter than the Kiggins Bowl terminus, the transit capital cost would be approximately 36 percent less. For light rail, the reduction in capital costs is because fewer light rail vehicles would need to be purchased.

Although the transit capital cost would be less, the annual operating costs would be similar to the Kiggins Bowl terminus. For light rail, because the length of the MOS would be one-third less than the Kiggins Bowl terminus, the cost to operate light rail to the Clark College Park and Ride terminus would be correspondingly less. However, the cost to operate the rest of the transit network (such as the limited stop buses and C-TRAN's local buses) would be similar to the cost for the Kiggins Bowl terminus. Therefore, the total cost to operate light rail on the Clark College MOS would only be marginally less than the Kiggins Bowl terminus.

Conversely, BRT operating costs would actually be slightly higher with the Clark College MOS than with the Kiggins Bowl terminus. The BRT lines would have the same routes and headways as the Kiggins Bowl terminus, but the bus routes would extend outside of the exclusive guideway for a greater portion of their travel, slightly increasing the amount of congestion the BRT lines would be subject to. This would increase the total number of platform hours required for BRT compared to the Kiggins Bowl terminus, and increase BRT operating costs with the Clark College MOS more than $1 million each year.

The Clark College MOS would be more cost efficient than the Kiggins Bowl terminus despite attracting fewer transit trips and having negligible, or somewhat higher, operating and maintenance costs. Because the capital cost to construct the Clark College MOS is lower, the total annualized cost per transit rider over the river crossing for the Clark College MOS would be $10.38, whereas for the Kiggins Bowl terminus it would be $13.67.

MILL PLAIN MINIMUM OPERABLE SEGMENT

Mill Plain Minimum Operable Segment: Local Street Performance

The Mill Plain MOS would increase vehicle trips to and from downtown Vancouver by approximately 750 vehicles per hour, increasing delays and queuing on local streets.

The Mill Plain MOS terminus option would include eight park and ride facilities with approximately 2,700 parking spaces. Satellite parking lots would be located north and east of downtown and would have access to high-capacity transit stations via shuttle buses. The Kiggins Bowl Park and Ride surface lot would generate about 85 morning and 75 afternoon/evening peak hour vehicle trips. The Lincoln Park and Ride would generate about 600 morning and 590 afternoon/evening peak hour vehicle trips. The Clark College Park and Ride surface lot would generate about 250 morning and 230 afternoon/evening peak hour vehicle trips.

The Mill Plain MOS would not require the elimination of two vehicular travel lanes (one in each direction) along Main Street between 29th Street and the Lincoln Park and Ride. Maintaining four vehicular travel lanes on Main Street would improve local street operations in northern Vancouver compared to the Lincoln terminus.

In addition to the three satellite lots, five park and ride sites (two structures and three surface facilities) would be located along the transit guideway in downtown Vancouver. The Mill Plain Park and Ride structure would be located between 16th and 17th Streets and Broadway and Main Streets. This park and ride would generate about 255 morning and 230 afternoon/evening peak hour vehicle trips. The second park and ride structure would be located between Fourth and Fifth Streets and Washington and Columbia Streets. It would generate 305 morning and 275 afternoon/evening peak hour vehicle trips. In addition, three adjacent surface lots would be located near the SR 14 interchange (bounded by Fifth Street on the north, the railroad tracks on the south, I-5 on the east, and Columbia Street on the west), generating 255 morning and 235 afternoon/evening peak hour vehicle trips.

The total number of vehicle trips within downtown Vancouver would increase with this alignment. The park and ride facilities in downtown Vancouver would generate an additional 805 morning and 740 afternoon/evening peak hour vehicle trips. As a result, the traffic impacts to downtown streets would be exacerbated more than with the other three terminus options, resulting in further increased vehicle delays and queuing on local streets. Limited access points to each of the park and ride lots (one per location) would reduce the arrival and departure capacities and would likely cause increased congestion on local streets near the lots.

Exhibit 3.1-42

Mill Plain MOS Parking and Access Impacts

	Washington-Broadway Couplet	2-way Washington
Parking		
Total	281	150
Parking Lost	109	119
Percent	39%	79%
Access Points		
Total	44	27
Points Lost	26	4
Percent	59%	15%
Loading Zones		
Total	4	5
Zones Lost	1	0

Source: Land Use Technical Report 2008.

Mill Plain Minimum Operable Segment: Parking and Access Impacts

The Mill Plain MOS would have varying impacts to on-street parking and access in downtown Vancouver, depending on the alignment option (see Exhibit 3.1-44). The two-way Washington alignment option would impact more parking than the couplet. Approximately 79 percent of on-street parking would be lost with the two-way Washington option; with the couplet only 39 percent on each street would be lost. With regard to access, the Washington-Broadway couplet would lose 59 percent of its access points, as opposed to the 15 percent loss expected with the two-way Washington option. One loading zone in this area would be lost with the Washington-Broadway couplet alignment option.

The Mill Plain MOS would end the guideway near 17th Street and, based on the alignment options, could provide additional park and ride spaces. The two-way Washington Street option would terminate at a mid-block station (Mill Plain Station) between 15th and 16th Streets (two additional blocks northeast of this station would be used for turn-around). This option would provide 564 new park and ride spaces in a parking structure on 17th Street. The Washington-Broadway couplet would not provide new parking, but instead would use this block to turn from Broadway Street to the Mill Plain Station. Adjustments in lane configurations could reduce or mitigate these impacts but are unlikely to change the relationship between alignment options.

Mill Plain Minimum Operable Segment: Transit Ridership and Mode Split

The Mill Plain MOS would attract about 9 percent fewer daily transit trips than the Vancouver alignment.

The shortened guideway and the lower number of high-capacity transit stations provided by the Mill Plain MOS terminus options would reduce the percentage of Clark County households and employment within one-half mile of a high-capacity transit station. For this terminus, 3 percent of Clark County households (compared to 5 percent for the Kiggins Bowl or Lincoln terminus) and 9 percent of employment (compared to 11 percent for the Kiggins Bowl or Lincoln terminus) would be within one-half mile of a high-capacity transit station.

Daily and annual passenger trips on transit over the Columbia River within the I-5 corridor would be approximately 9 percent less than the Lincoln terminus—19,100 trips compared to 20,800. The reduction in trips on transit could be attributed to the diminished accessibility of the high-capacity transit line to northern Vancouver and Clark County from shortening the length of the guideway and reducing the number of park and ride spaces. With the Lincoln terminus, there would be 1,800 park and ride spaces directly on the guideway alignment. With the Mill Plain MOS, there would be 1,100 spaces at two joint-use parking structures in downtown Vancouver, plus two additional satellite lots, for a total of 2,758 spaces.

The Mill Plain MOS would likely have a peak period/peak direction mode split comparable to that for the Lincoln terminus. With the Mill Plain MOS the peak period/peak direction mode split would be 50 percent SOV, 27 percent HOV and 23 percent transit. With the Lincoln terminus, the mode split would be 50 percent SOV, 29 percent HOV, and 21 percent transit.

Mill Plain Minimum Operable Segment: Transit Operations and Maintenance Costs

Because of the shorter transit guideway, capital costs to construct the Mill Plain MOS would be approximately 42 percent and 30 percent less than for the Kiggins Bowl or Lincoln terminus, respectively. Annual operating costs would not be reduced as much for the Mill Plain MOS, as the cost to operate the rest of the transit network (such as the limited stop buses and C-TRAN local buses) would be similar to the other terminus options.

With the Mill Plain MOS, the new BRT lines would follow the same route and have the same headways as the other terminus options, but would extend outside the exclusive guideway and would travel in mixed traffic for a greater distance. This would slightly increase the amount of congestion the BRT lines could be subjected to, which would increase the total number of platform hours required. For this reason, the BRT operating costs with the Mill Plain MOS would be $5.1 million, nearly the same as the cost to operate as BRT with the Lincoln terminus ($5.3 million).

The Mill Plain MOS would be more cost-effective than either the Kiggins Bowl or Lincoln terminus, despite attracting fewer transit trips and having negligible, or somewhat higher, operating and maintenance costs. Because the capital cost to construct the Mill Plain MOS would be lower, the total annualized cost per transit rider over the river crossing for the Mill Plain MOS would be $8.91, compared to $13.67 for the Kiggins Bowl terminus and $11.55 for the Lincoln terminus.

Transit Alignment Options (with all Alternatives)

Following is an evaluation of how each of the alignment options would affect local streets, and any parking or access impacts resulting from these different alignments.

OFFSET OR ADJACENT

The transit alignment options in Oregon—either offset from or adjacent to I-5 on Hayden Island—would not substantially affect transit performance metrics such as ridership, travel times, or operating and maintenance costs (see Exhibit 3.1-43). These alignment options would have a minor (less than 1 percent) effect on transit capital costs.

Exhibit 3.1-43
Delta Park to South Downtown Alignment Options

DIMENSIONS ARE APPROXIMATE.

Offset or Adjacent: Local Street Performance

The transit alignment options between Delta Park and South Downtown Vancouver would be grade-separated and would not impact local street operations.

Offset or Adjacent: Parking and Access Impacts

On Hayden Island there would be no impact to on-street parking. Both the offset and adjacent options would run west of I-5, connecting the existing Expo Center light rail station with downtown Vancouver. Both options assume one station on Hayden Island. Approximately 15 off-street spaces would be lost with either high-capacity transit option, based on the likely placement of support pillars for the aboveground transit guideway. With either the offset or adjacent alignment option, existing parking that serves businesses near southbound I-5 would be lost due to the shift and widening of I-5. There is likely to be minimal loss of access to other businesses with either option.

Offset or Adjacent: Safety and Security

Both alignment options are grade-separated and so would have similar safety concerns. Station placement for the offset alignment option may be better integrated with the urban environment. This station setting would be visible from all sides, unlike the adjacent option station which is next to the I-5. The lack of visibility creates an environment that makes security problematic.

TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

The two transit alignment options in downtown Vancouver (two-way travel on Washington Street or a couplet on Washington and Broadway) would not affect transit performance metrics such as ridership, travel times, or operating and maintenance costs. However, the couplet on Washington and Broadway would cost approximately 35 percent more to construct than the two-way Washington alignment. However, this difference is only for the construction costs of the transit guideway in downtown Vancouver, not for the total transit costs of this project, so it would not have as dramatic an impact on overall construction costs. All transit construction costs discussed elsewhere in this section assume a two-way Washington alignment option.

Two-Way Washington or Washington-Broadway Couplet: Local Street Performance

From south downtown Vancouver to Mill Plain, transit would run either two-way on Washington Street or via a Washington Street and Broadway Street one-way couplet system. The two-way Washington Street configuration would accommodate two-way high-capacity transit operations and two-way (one travel lane in each direction) vehicular operations along Washington Street.

Due to reduced traffic lane capacity, downtown streets generally south of Mill Plain Boulevard, east of Columbia Street, and west of C Street would experience moderately increased vehicle delays and queuing impacts in comparison to No-Build conditions. With light rail service, signal pre-emption for transit would cause additional delay and queuing.

The Washington-Broadway one-way couplet would accommodate southbound transit and two southbound vehicular travel lanes along Washington Street, and northbound high-capacity transit and two northbound vehicular travel lanes along Broadway Street.

Due to reduced traffic lane capacity, downtown streets generally south of Mill Plain Boulevard, east of Columbia Street and west of C Street would experience increased congestion compared to No-Build conditions. With light rail service, signal pre-emption for transit would cause additional congestion for traffic traveling on streets that cross the transit guideway.

Two-Way Washington or Washington-Broadway Couplet: Parking and Access Impacts

The two-way Washington Street option would remove all on-street parking (97 spaces) and five loading zones along Washington Street between Fifth Street and Mill Plain Boulevard. The existing 18 access points would remain, but drivers would be prohibited from making left turns across the high-capacity transit guideway, except at signalized intersections. This option would not require the removal of disabled parking. However, the removal of all on-street parking along Washington Street would impact the ease of auto accessibility to these properties. Potential mitigation could be required to improve auto access for the disabled.

The Washington-Broadway couplet option would remove 69 on-street parking spaces and one loading zone along Washington and Broadway Streets between Sixth Street and Mill Plain Boulevard. This option would also remove 20 (61 percent of the total) access points along these streets.

Two-Way Washington or Washington-Broadway Couplet: Safety and Security

Intersections are the point of interface between traffic, transit and pedestrian modes and so are the focus of much of the concern for safety. A couplet has generally twice as many intersections to go through as a two-way option and so is less safe from that standpoint. However, two-way transit operation on one street requires pedestrians and drivers to be more aware of transit. With two-way transit in the middle of the street on Washington, there would be no allowed left turns. It would be difficult to adequately sign for this, so there is some concern that drivers might make unsafe, uncontrolled left turns across transit lanes.

16TH STREET OR MCLOUGHLIN

The transit alignment options for the Kiggins Bowl terminus or Clark College MOS in northern Vancouver would not substantially affect the transit performance metrics reported in this section (see Exhibit 3.1-45).

16th Street or McLoughlin: Local Street Performance

The Kiggins Bowl and Clark College MOS terminus options would turn east at the Mill Plain Transit Center and cross I-5. The high-capacity transit route could be aligned east along either McLoughlin Boulevard or 16th Street to the Clark College Park and Ride.

The McLoughlin Boulevard option would maintain two-way traffic, while the 16th Street option would require converting the street to one-way westbound traffic. Converting 16th Street would result in some minor re-routing of local traffic in the vicinity of 16th Street to account for limited movements along 16th Street. Running high-capacity transit along either street would generally degrade intersection operations and cause increased vehicle queuing in the subarea between 15th Street and 19th Street, and Main Street and I-5.

16th Street or McLoughlin: Parking and Access Impacts

As shown in Exhibit 3.1-44, the 16th Street option would remove 54 (50 percent) on-street parking spaces along 16th Street between Mill Plain Boulevard and G Street; two of these are disabled parking spaces, and none of them are loading zones. It would also eliminate 11 (39 percent) access points in this segment.

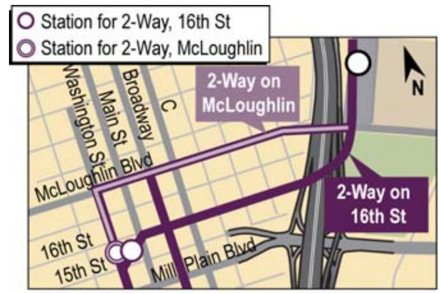
The McLoughlin Boulevard option would remove 100 (about 71 percent) on-street parking spaces along McLoughlin Boulevard between Mill Plain Boulevard and G Street; none of these are disabled parking spaces or loading zones. None of the mid-block driveways would be lost, but drivers would be prohibited from making left turns across the guideway, except at signalized intersections.

These options also assume the construction of an angled high-capacity transit station north of 15th Street (bound by 15th Street, 16th Street, Washington Street, and Main Street). Currently, this block is undeveloped and used by area employees for long-term off-street parking. These options would remove existing off-street parking without providing alternate facilities at this location.

16th Street or McLoughlin: Safety and Security

These alignment options apply to the Kiggins Bowl and Clark College MOS terminus options. There may be some safety difference between locating transit on the side of the street, as planned for 16th Street, and locating transit in the middle of the street, as planned for McLoughlin Boulevard. However, the difference would be small. Both options would include a transit crossing under I-5. Tunnel portals in a neighborhood can provide an unsafe environment for children or other pedestrians who might enter the tunnel.

Exhibit 3.1-44
Alignment Options in North Vancouver for the Kiggins Bowl Terminus



NOT TO SCALE

	16TH ST	McLOUGHLIN
PARKING		
Total	108	140
Parking Lost	54	100
Percent	50%	71%
ACCESS POINTS		
Total	28	33
Points Lost	11	0
Percent	39%	0%
LOADING ZONES		
Total	0	0
Zones Lost	0	0

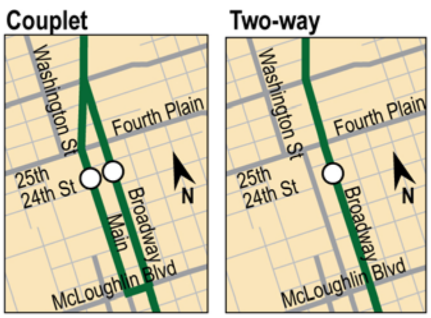
TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET

Transit alignment options north of downtown for the Lincoln terminus—two-way on Broadway between 16th and 29th Streets, or a couplet on Main and Broadway between 16th and 29th Streets—would not substantially affect the transit performance metrics reported in this section (see Exhibit 3.1-45).

Two-Way Broadway or Broadway-Main Couplet: Local Street Performance

The Lincoln terminus would run either two-way along Broadway Street between McLoughlin Street and 29th Street and along Main Street north of 29th Street to the northern terminus at the Lincoln Park and Ride, or as a one-way couplet along Broadway and Main Streets to 29th Street, and two-way on Main Street from 29th Street to the northern terminus at the Lincoln Park and Ride.

Exhibit 3.1-45
Parking and Access Impacts from Alignment Options in North Vancouver for the Lincoln Terminus



NOT TO SCALE

	COUPLET	2-WAY
PARKING		
Total	256	163
Parking Lost	206	83
Percent	80%	51%
ACCESS POINTS		
Total	83	60
Points Lost	38	19
Percent	46%	32%
LOADING ZONES		
Total	0	0
Zones Lost	0	0

Two-Way Broadway or Broadway-Main Couplet: Parking and Access Impacts

As shown in Exhibit 3.1-45, the two-way Broadway option would remove 83 (about 50 percent) on-street parking spaces along Broadway between Mill Plain Boulevard and 29th Street; none of these are disabled parking spaces or loading zones. North of 29th Street there is no on-street parking, so all impacts would be to access. This option, from Mill Plain Boulevard to 40th Street, would remove 13 (22 percent) access points.

The Broadway-Main Street couplet option would remove 206 (about 80 percent) on-street parking spaces along Broadway Street between Mill Plain Boulevard and 29th Street, but no loading zones. This option, from Mill Plain Boulevard to 40th Street, would remove 38 (46 percent) access points along these streets.

In north Vancouver, the City of Vancouver has found on-street parking to be underutilized. A recent study conducted in the north Vancouver area (bound by 15th Street, 28th Street, Columbia Street and D Street) found that on-street parking had a 44.5 percent utilization during the weekday peak hour at 11 a.m. This parking space utilization was even lower during the weekend peak hour at 1 p.m., with 28.7 percent of the spaces occupied.[3]

All options assume the construction of an angled high-capacity transit station north of 15th Street (bound by 15th Street, 16th Street, Washington Street and Main Street). Currently, this block is undeveloped and used by area employees for long-term off-street parking. This alignment would remove the existing off-street parking without providing alternate facilities at this location.

Two-Way Broadway or Broadway-Main Couplet: Safety and Security

These alignment options apply to the Lincoln terminus. The safety concerns are the same here as for the two-way Washington or Washington-Broadway couplet, discussed above.

[3] City of Vancouver, 2007.

Transit Operations

The two transit operation scenarios under evaluation—“Efficient” or “Increased”—differ in the frequency that rapid transit buses or light rail trains would operate, as described in Chapter 2. Increased transit operations would shorten the headways between transit vehicles and could lead to greater impacts on local traffic conditions than those caused by Efficient operations.

TRANSIT OPERATIONS: LOCAL STREET PERFORMANCE

Vancouver Local Streets

Increasing the frequency of light rail trains would moderately increase delays for vehicles crossing the transit guideway caused by signal pre-emption. Increasing bus frequency could cause greater bus queuing, resulting in more congestion on streets in downtown Vancouver. Increased transit frequency would congest upper Main Street. Additionally, streets south of Mill Plain Boulevard would likely to experience congestion from Increased transit operations.

Portland Local Streets

Neither transit mode would cause local street traffic impacts in Portland north of the Expo Center station, as the guideway would be elevated. South of the Expo Center station, either transit mode would increase the number of peak trains operating along the existing MAX Yellow Line from 10 trains per hour to 16 trains per hour with Efficient operations, whereas Increased transit operations would increase the frequency to 20 trains per hour.

The traffic effects of an increased number of trains would be limited to local streets along the Interstate Avenue corridor. Because trains receive traffic signal priority at signalized intersections, pre-empting vehicular traffic on cross-streets, an increased number of trains would increase vehicle delays. Additional impacts would result under Increased transit operations. In the Rose Quarter/Steel Bridge area in Portland, adding light rail service may require modifications to signals, street geometry, or traffic and pedestrian movements to optimize transit and traffic performance.

TRANSIT OPERATIONS: TRANSIT RIDERSHIP AND MODE SPLIT

Efficient operations would entail 2,700 to 2,800 weekday platform hours of transit service (including both revenue and non-revenue service) versus 3,900 to 4,400 weekday platform hours with Increased operations. Similarly, Efficient operations would entail 823,000 to 850,000 annual platform hours of transit service, versus 1,185,000 to 1,320,000 annual platform hours of transit service with Increased operations. The higher values represent service with BRT; the lower values represent light rail.

Adding transit capacity (Increased operations) would attract more transit ridership and correspondingly increase transit mode split. As shown in Exhibit 3.1-46, this difference would be more dramatic during peak periods when congestion makes transit more attractive, because the exclusive transit guideway would allow high-capacity transit to avoid congestion on I-5.

Exhibit 3.1-46
Ridership and Mode Split for Efficient and Increased Transit Operations

	Efficient Operations		Increased Operations	
	BRT	**LRT**	**BRT**	**LRT**
Transit riders over the I-5 crossing				
PM peak period	4,900	6,100	5,600	6,700
Daily	16,800	20,800	19,800	23,100
Transit mode split over the I-5 crossing				
PM peak period	19%	21%	33%	37%
Daily	13%	15%	15%	16%

Source: CRC Transit Technical Report 2008.

TRANSIT OPERATIONS: TRANSIT TRAVEL TIMES

Increased transit operations would slow buses but would not affect light rail travel speeds. BRT would require more vehicles than light rail to provide the same capacity. With Increased operations, the additional vehicles would cause congestion in the transit guideway during peak periods, slowing buses using the guideway (Exhibit 3.1-47). In contrast, light rail could use fewer vehicles in either operating scenario, and would not experience congestion or reduction in travel speed.

Exhibit 3.1-47
Travel Speeds and Times [a] for Efficient and Increased Transit Operations

	Efficient Operations		Increased Operations	
	BRT	**LRT**	**BRT**	**LRT**
Average travel speed through CRC area	14.5 mph	17.3 mph	13.1 mph	17.3 mph
Average travel speed through downtown Vancouver	9.6 mph	12.9 mph	7.5 mph	12.9 mph
Travel time from Expo Center to Northern Terminus [b]	13 min.	12 min.	19 min.	12 min.

Source: CRC Transit Technical Report 2008.

[a] These speeds and times are during the afternoon/evening peak period in the peak direction (northbound).

[b] The data in this table assumes a Lincoln terminus, so the northern terminus is the Lincoln station. Travel times would be similar for the Kiggins Bowl terminus.

TRANSIT OPERATIONS: TRANSIT OPERATIONS AND MAINTENANCE COSTS

Capital costs would be slightly higher for Increased transit operations in order to purchase additional new vehicles (Exhibit 3.1-48). However, Increased transit would cost substantially more for annual operating and maintenance costs. This substantial increase in annual operating and maintenance costs would reduce the cost-effectiveness of the transit system, even though Increased transit operations would attract higher ridership. Ultimately, Increased transit operations would have a larger effect on annual operating and maintenance costs than on ridership, producing a higher cost per transit passenger.

Exhibit 3.1-48
Cost Comparison of Efficient and Increased Transit Operations

	Efficient Operations		Increased Operations	
	BRT	LRT	BRT	LRT
Annual operating and maintenance costs	$75 Million	$73 Million	$114 Million	$106 Million
Cost per incremental new passenger[a]	$15.09	$11.55	$23.67	$16.58

Source: CRC Transit Technical Report 2008.

[a] Incremental capital and operational cost per incremental passenger over the No-Build Alternative.

TRANSIT OPERATIONS: SAFETY AND SECURITY

The Increased transit operations scenario would place many more buses on the street, which would result in more interaction with pedestrians and other traffic. Efficient operations would have fewer transit vehicles than Increased operations, potentially reducing the likelihood of collisions involving transit vehicles.

Bridge Toll

This section compares how daily traffic levels would vary at the I-5 and I-205 crossings if no toll were collected, if only the I-5 crossing were tolled, or if both the I-5 and I-205 crossings were tolled using the same toll rate structure (see Exhibit 3.1-49). Tolls on the I-5 crossing are included in all build alternatives. Other scenarios were included to analyze how tolling would affect demand on the roadway.

Exhibit 3.1-49
Average Daily Traffic per Tolling Scenario (Replacement Crossing)

Tolling Scenario	I-5 Crossing	I-205 Crossing	Total
No Toll	210,000	200,000	410,000
Toll I-5 Only	178,000	213,000	391,000
Toll I-5 and I-205	196,000	170,000	366,000

Source: CRC Traffic Technical Report 2008.

Note: Comparative data for the supplemental river crossing show similar trends.

BRIDGE TOLL: I-5 AND I-205 TRAFFIC LEVELS

The adjacent table summarizes 2030 average daily traffic volumes for the I-5 and I-205 crossings under non-tolling and two tolling scenarios (the No-Build Alternative would not be tolled). The comparative analysis was conducted for the replacement crossing (Alternatives 2 and 3); however, with these tolling scenarios similar trends would result for the supplemental crossing (Alternatives 4 and 5). Sensitivity tests conducted on supplemental bridge alternatives showed trends similar to the replacement bridge for No Toll, Toll I-5 only, and Toll I-5 and I-205 scenarios.

Highway performance results assume that tolls would be administered at the I-5 crossing. Under this scenario, the replacement crossing would result in 178,000 daily vehicle trips across the I-5 bridges and 213,000 vehicle trips across the I-205 bridges.

If no toll were collected in 2030, the I-5 crossing's daily traffic levels would increase by 32,000 vehicles (18 percent). The I-205 crossing's daily traffic would decrease by 13,000 vehicles (6 percent). Without tolling, an additional 19,000 (5 percent) cross-river vehicle trips would be made in 2030.

Without tolling, I-5's traffic performance would substantially degrade compared to the modeled project alternatives. Peak travel demand would be higher, as would the duration of congestion experienced at critical highway bottlenecks. I-5 travel speeds would be lower and travel times higher than under an I-5 only tolled scenario. In addition, traffic conditions along I-205 would not improve substantially, as traffic demand would continue to exceed the I-205 crossing's capacity.

If both I-5 and I-205 crossings were tolled, daily cross-river vehicle trips would decrease by 6 percent compared to the scenario with only I-5 tolled. Daily traffic levels would increase by 18,000 vehicles (10 percent) at the I-5 crossing, but would decrease by 33,000 vehicles (20 percent) at the I-205 crossing.

Compared to No-Build conditions in 2030, without the provision of tolling, I-5's daily traffic would increase by 32,000 vehicles or 18 percent. I-205's daily traffic would decrease by 13,000 vehicles, or 6 percent.

With both crossings tolled, the I-5 crossing's traffic performance would degrade compared to a condition where only the I-5 crossing was tolled, resulting in increased traffic congestion. However, the I-205 crossing would experience substantially lower traffic demand, resulting in improved operations along this corridor.

BRIDGE TOLL: LOCAL STREET PERFORMANCE

Without a toll on the I-5 crossing, or with a toll on both the I-5 and I-205 crossings, traffic volumes to and from I-5 would be higher and local streets in the vicinity of I-5 interchanges would generally perform with decreased levels-of-service compared to the scenario with only the I-5 crossing tolled. Local streets in the vicinity of I-205 interchanges would benefit with improved service levels with both the I-5 and I-205 crossings tolled.

BRIDGE TOLL: TRAFFIC SAFETY AND SECURITY

Traffic models that analyze tolling (discussed in the Traffic section of this DEIS) indicate that tolling the I-5 crossing would reduce traffic demand and congestion over non-tolled levels, which is likely to reduce the collision rate on the highway and increase traffic safety. Local traffic tends to increase when the highway is congested as drivers seek alternate routes, so lowering congestion on the highway is likely to lower local street congestion as well, reducing the likelihood of collisions on local streets.

If both the I-5 and I-205 crossings were tolled, it would increase demand and congestion on I-5, although not to as great an extent as a no-toll projection. This would increase congestion and the likelihood of collisions on I-5, although it would reduce this risk on I-205 compared to tolling only the I-5 crossing.

BRIDGE TOLL: TRANSIT RIDERSHIP AND MODE SPLIT

Introducing a toll on the I-5 crossing (or, as ridership models show, on the I-205 crossing as well) would generally increase the attractiveness of transit. The No-Build Alternative is the only alternative that would not be tolled. Tolling would not affect most measures of transit performance, such as travel times or cost, but could increase ridership as some commuters might decide to take transit instead of driving to avoid paying the toll (Exhibit 3.1-50). A higher toll ($0.50 more during peak travel periods) would further increase transit ridership, though only modestly. Tolling both I-5 and I-205 (at the standard rate) would increase transit ridership even more than a standard or higher rate toll on just the I-5 crossing.

Increases in transit ridership caused by tolling would produce a greater increase in transit mode split. In general, tolling would increase transit ridership over the river, decrease auto usage over the river, and thus increase transit mode split.

Exhibit 3.1-50
Daily Transit Trips across the I-5 River Crossing[a]

	No Toll	I-5 Standard Toll	I-5 Higher Toll	I-5 and I-205 Standard Toll
Daily transit trips across the I-5 river crossing	19,300	20,800	21,400	21,700
Transit mode split across the I-5 river crossing	19%	21%	22%	23%

Source: CRC Transit Technical Report 2008.

[a] These data are for light rail, but the relationship would be the same for BRT.

Transportation Demand and System Management Measures

TRANSPORTATION DEMAND AND SYSTEM MANAGEMENT MEASURES: I-5 AND I-205 TRAFFIC LEVELS

This project includes substantial transportation demand management measures—chiefly, adding high-capacity transit through Vancouver and introducing a toll on the I-5 crossing. The effects of high-capacity transit and tolling are discussed in detail earlier in this chapter. There are also several other transportation demand and system management measures, such as commute trip reduction policies, which are part of all of the build alternatives; these are described in Chapter 2. These additional measures would increase the efficiency of the other improvements included in the build alternatives.

TRANSPORTATION DEMAND AND SYSTEM MANAGEMENT MEASURES: TRAFFIC SAFETY AND SECURITY

Transportation demand management (TDM) and transportation system management (TSM) measures will not have an impact on safety and security. However, TDM programs often include public education campaigns aimed at encouraging alternative modes of travel. Components of these campaigns (newsletters, promotions, web pages, etc.) can be used to address safety and security issues as well.

Temporary Effects

River crossing and highway construction impacts to transportation will come from a variety of sources—detours, construction activity, lane and ramp closures, narrow lanes and shoulders, construction traffic, commuter behavioral changes, dust, and others. As more definitive plans are developed, impacts will be further defined. All discussion of construction staging is conceptual at this phase of project development.

With the provision of high-capacity transit and tolling, the build alternatives would reduce vehicle traffic volumes across the I-5 bridge by up to 10 percent compared to No-Build conditions.

The main construction issue is having only one feasible alternative route for north-south travel across the river (I-205), which is also congested at peak hours. Pedestrian and bicycle traffic is always a safety concern in a construction zone, with rerouting and out of direction travel possibly required.

The detour alignments necessary during construction are generally not up to highway standards, and would contribute to increased congestion during construction. The constraints of this narrow urban corridor do not permit high-speed detour connections. As such, sharper curves, narrower lanes, and adverse pavement slopes would be common. These conditions would require lowering the speed limit.

TEMPORARY EFFECTS: REGIONAL TRAFFIC

I-5 is one of only two highway crossings of the Columbia River in the Portland-Vancouver area. The I-205 crossing is about 6.5 miles upstream. The closest crossing downstream is some 40 miles away at Longview-Rainier. The closest upstream crossing outside this area is over 40 miles away at Cascade Locks, and is a tolled crossing.

The I-5 and I-205 crossings are approaching or at capacity during peak hours, leaving little opportunity for diversion of traffic if construction leads to an increase in congestion on I-5. Construction impacts would extend the hours of existing congestion and likely create failure at other times of day. The project would strive to accommodate peak hour traffic by keeping three lanes open for all weekday, daytime hours. Lane closures on I-5 would likely be restricted to night-time hours.

The interchanges near the river have interrelated movements that make it imperative to construct the crossing and new interchanges simultaneously. Interchanges north of SR 14 can be built independently; however, if they are not built at the same time because of funding or other issues, overall construction would be extended by several years.

During evening and weekend closures, motorists would have to use I-205 to avoid congestion in the I-5 corridor. It is estimated that half the peak weekend I-5 trips would need to divert to I-205 to keep an acceptable level of service on I-5. Advanced warning systems and real-time motorist information signing would be used to redirect motorists.

Staging area and casting yard activities would need to be managed to keep movement to and from the construction sites to a minimum during peak hours. The main effect of movement between these sites would be on local road networks, for deliveries not using the highway system.

TEMPORARY EFFECTS: LOCAL TRAFFIC

Local systems would experience direct and indirect effects—backups from ramps due to highway congestion, closures of highway over-crossings while new structures are constructed, loss of access to or from the highway at some interchanges, use of local systems for material delivery and haul routes, and partial closure of city blocks during transit construction. Motorists would need to change routes or travel modes to avoid some of these impacts.

Marine Drive Interchange

Two construction features could create problems at Marine Drive, under all build alternatives. Constructing an overpass to carry Marine Drive across the highway would be a priority. After the main pier of this crossing is constructed, the short distance between the North Portland Harbor bridge and the new pier would require the most adverse alignment of the mainline detours. A speed reduction to 40 miles per hour or lower might be necessary, which could result in expanding congestion hours and further lowering the level of service during other high volume periods. These conditions could last from 1.5 to 2 years.

Regional traffic uses this interchange to reach the state highways leading east and west. Peak hours are already gridlocked north-south, and this would increase congestion. The total number of lanes would remain the same. Backups would still occur from highway-related merging conditions northbound. Backups do not currently halt east-west travel through the interchange area. The current slow-downs would continue, and could possibly worsen during construction. Staging areas are possible here, most likely to the west. Material deliveries should for the most part be scheduled outside peak hours.

Columbia River Bridges

Retrofitting the existing bridges for the supplemental crossing (Alternatives 4 and 5) would create additional congestion. Substructure work can likely be performed with traffic on the structures. Superstructure work would require traffic to switch to the other structure. Motorists would generally adapt, however the on and off connections at each end would change between stages and would be more difficult to navigate than under current conditions, especially for the I-5 northbound to SR 14 eastbound movement. This ramp's curve is already very substandard and would be made much more so when the traffic has to come from over 80 feet further away. Backups occur now and would be further aggravated during construction, leading to additional congestion on the bridge.

Hayden Island Interchange

During construction of the replacement crossing, staging the construction of the North Portland Harbor structure would be the main issue at the Hayden Island interchange. Traffic lanes would be restricted to 11 feet with 1-foot shoulders during several construction stages, and traffic entering I-5 southbound from Hayden Island would lose an existing auxiliary lane that now exits at Marine Drive. This would likely expand the hours of southbound congestion and lower the level of service during other heavily traveled times of day. With the supplemental crossing, Hayden Island may experience more backups from the highway with the elimination of both auxiliary lanes between Marine Drive and the island.

For the supplemental crossing, Hayden Island construction would have the most adverse effects to traffic. The construction of the North Portland Harbor bridge would eliminate both auxiliary lanes, versus just the southbound in the replacement. This configuration could last up to three years and would reduce capacity. The only remedy for congestion in this area is reducing vehicle travel demand at peak hours through transit, rideshare and other measures; no temporary roadway configurations could remedy congestion here.

Congestion would extend the peak hours and affect other high volume hours at the crossing. I-5 northbound traffic would split into two 2-lane movements just north of Marine Drive. This is an unexpected movement and would require additional signing to safely direct motorists. Traffic in the two left lanes would not be able to exit at Hayden Island or SR 14. Traffic entering I-5 northbound would merge into through traffic. At times this movement would be an add lane, and other than speed differential, should not have an adverse effect on traffic. However, in a latter phase all traffic would use the existing southbound bridge and this movement would have to merge into the fast lane. The geometry to move northbound traffic from a temporary detour on the southbound bridge to the existing southbound lanes/bridge may require a reduction in speed to 40 miles per hour or less, adding to congestion.

The on and off movements to Hayden Island are already substandard, so detours needed during construction would probably have minimal effect. Short term closures are not anticipated if traffic can switch over in the evening with the help of flaggers and signing.

The main effect on local traffic would be additional backups from traffic trying to access the highway. These afternoon/evening peak problems occur daily now, and would likely increase, causing congestion for local trips. Detours should accommodate the current lanes but the lack of an auxiliary highway lane southbound, along with revised and shortened merges in both directions, would add to current backups and affect the local traffic movement. Construction staging areas could be located on the island, and haul routes would have to use the local system.

Remediation efforts for the southbound auxiliary lane closure are likely limited to information and outreach. Physical limitations prohibit additional lanes. A moveable barrier system to create an additional lane in the peak directional period could be considered, although this would sacrifice a lane in the opposing direction. Alternating lane assignments would be difficult, and could make congestion worse if motorist confusion or unnecessary weaving should develop.

SR 14 Interchange

SR 14 is one of the few areas where traffic movements would be eliminated for an extended period of time. For the replacement crossing, Washington Street to SR 14 eastbound, I-5 northbound to C Street, and SR 14 westbound to C Street movements would all be closed for a majority of the construction timeline, which could last three to four years. Traffic to or from SR 14 and downtown have a small number of alternate routes: Mill Plain interchange to access the highway, then SR 14; Columbia Way and the Columbia House interchange on SR 14; or Mill Plain or Evergreen Boulevard to Grand Boulevard, then south to SR 14.

For the supplemental crossing, construction would require closing the same three ramps into and out of Vancouver, but the durations would be much less. The Washington Street to SR 14 eastbound closure could be as short as 2.5 years. The I-5 northbound to C Street and SR 14 westbound to C Street could be closed for as little as 9 months.

Detour geometry for the highway would be less severe for the supplemental crossing, and the I-5 northbound weave between SR 14 and Mill Plain would be less affected. The I-5 southbound weave between Mill Plain and SR 14, however, would become shorter and more difficult, as the touchdown for the supplemental bridge would be several hundred feet farther north than the replacement bridge and would restrict the room needed to design adequate geometry for this temporary weave. It would have a few staging iterations and possibly add to motorists' confusion.

The effect to I-5 traffic would be mainly to northbound traffic. Traffic normally leaving I-5 to enter downtown Vancouver at SR 14 would have to merge with traffic westbound from SR 14 and exit at the Mill Plain interchange. This movement would combine with the already heavy weaving movement used by traffic exiting at Mill Plain and traffic coming from SR 14 to proceed north on I-5. Local traffic would soon adjust to the options for east-west travel. At SR 14 some access closures would be shorter for the supplemental crossing, so effects to downtown Vancouver and east-west detour routes would not last as long.

While the I-5 southbound to SR 14 eastbound movement would not close during peak hours, the current weave between this and the Mill Plain to I-5 southbound movement would be relocated during various stages, and the weaving distance could be shorter than currently exists. This weave area is already a major source of conflict with mainline traffic, and would extend congestion and lower the level of service at other heavy traffic volume hours.

Construction staging activities in Vancouver would generate construction traffic for material delivery and removal. Construction activities could occur at any time of the day or night. To the west, a staging area in lower downtown could access the construction site via city streets. Other sites would use Mill Plain Boulevard and city streets to gain access to SR 14 construction areas on the west side. Problems most likely would occur at construction access points from city streets, especially if the areas cannot accommodate more than one vehicle at a time or if the size of the load requires special maneuvering. Flaggers would facilitate local traffic movement where such conflicts occur.

Crossing I-5 from west to east may result in larger local traffic issues. Evergreen Boulevard would close for 9 to 12 months while the new crossing is constructed. Construction on Evergreen should be completed before closing the SR 14 over-crossing into Vancouver. When SR 14 closes, Evergreen and Columbia Way would become the relief routes. Columbia Way may not be able to handle some oversized loads, which would need to use Evergreen or move up to Mill Plain. Few streets on the east side of the highway would be impacted.

Remediation would consist of extensive public information and outreach to encourage motorists and employers to reduce commute trips, especially during peak hours. Real-time information needs to be readily available through message boards and broadcast media. Incident response would be enhanced. Signed detours to I-205 would be required during I-5 closures.

Mill Plain, Fourth Plain and SR 500/39th Street Interchanges

During highway construction of all build alternatives, the northbound Mill Plain highway off-ramp could have intersection failure during peak hours, which could result in traffic backing up into the weaving section from SR 14. Construction traffic hauling materials on Mill Plain, Fourth Plain, and SR 500/39th Street would add to local congestion during peak hours.

For the most part through-flow would not be adversely affected at these interchanges. Detour alignments may require speed reductions, and some areas would require construction under traffic, but would not have traffic impacts above what is normal in a construction zone. SR 500 would be narrowed to one southbound lane before it crosses I-5, whereas it currently has two lanes. However, it effectively becomes one-lane as it enters I-5, and the exit at Fourth Plain from SR 500 would be eliminated, so the overall effects to congestion should be manageable.

The replacement of highway crossings at Mill Plain and construction on McLoughlin would not close the movements to east-west traffic. Fourth Plain and 39th Street would have temporary structures in place before the old ones are dismantled. Fourth Plain's temporary crossing would likely be three lanes, versus the current five, which could lead to congestion at peak times.

The 29th and 33rd Street over-crossings would close during construction of their replacement structures. However, they would not be closed at the same time, to shorten the detour. These are relatively low volume and low speed roadways, and the detours should not pose a problem to motorists.

TEMPORARY EFFECTS: FREIGHT

Truck traffic would be influenced by construction, with effects comparable to regional and local traffic. Trucks generally avoid peak hour traffic, when possible. With peak hours extended by construction detours and other factors, the choice of travel times would become slimmer. The nearest alternate route is also affected by peak hour traffic. Other options create a longer trip (with some of the trip subject to Oregon's weight-mile fee), and the trucks must still pass through the Portland Metro area. The Bridge of the Gods, a toll bridge located 43 miles upstream in Cascade Locks, cannot accommodate over-height or over-weight loads. The Longview-Rainier Bridge 40 miles downstream has weight restrictions and requires flagging for loads over 12 feet wide. Therefore, trucks would probably be more highly represented in peak hours and would add to the congestion with their lower performance. Trucks are not prone to making discretionary trips, so there is little mitigation available. Some loads may shift to rail, but more than likely no in appreciable amounts.

TEMPORARY EFFECTS: PEDESTRIANS AND BICYCLISTS

Effects to pedestrians and cyclists would be similar to those described for vehicles. One main difference, however, would be the need to maintain access to businesses and residences through the construction area. This could be accomplished with temporary walkways and short bridges over and through the construction zone, with appropriate safety fencing and signing.

Construction of the river crossings would require closing the sidewalk on the southbound bridge, and all bicycle and pedestrian traffic would move to the northbound bridge, which is slightly narrower and slightly less convenient for accessing downtown Vancouver. This configuration would remain until the new high-capacity transit bridge is constructed and bicycles and pedestrians can move to it.

On Hayden Island, once construction of the North Portland Harbor Bridge begins, it would be necessary to eliminate the current bike path. The transit crossing of the harbor to accommodate non-motorized travel would ideally be finished before this closure. Construction of the interchange and crossing could be delayed approximately 13 months and not delay the overall completion of the interchange, which would allow for this sequencing. If this is not feasible then a shuttle or construction of a temporary structure may be possible, but could present access issues.

The Marine Drive interchange has paths that connect to the crossing on the east side of I-5. These paths would be eliminated once construction of the new interchange begins. As with Hayden Island, the construction start could be delayed to allow the transit crossing to be constructed first. If not, then a temporary path would have to be designed and constructed. East/west travel through these two interchanges would be maintained on separated or adjoining temporary paths associated with the detours.

The recently opened Confluence Land Bridge pedestrian overcrossing of SR 14 gives a northbound alternate route close to the east side of I-5. Traffic going to lower Vancouver would have to circle around and use Columbia Way. East-west movements at Mill Plain, Fourth Plain, and 39th Street would be maintained. Fourth Plain and 39th Street would be on temporary structures, along with the local traffic; 29th Street and 33rd Street would be closed at different times, and bicycle and pedestrian traffic normally using the structure would detour.

Constructing a wider path on the existing northbound bridge for bicycle and pedestrian traffic (as part of the supplemental crossing) would require some additional staging for this traffic. The southbound bridge would be closed to bicycle and pedestrian traffic during construction of the new river crossing. The widened path would most likely be constructed while the northbound bridge is undergoing seismic upgrades. Bicycle and pedestrian traffic would then move back to the southbound bridge, with temporary connections to access current paths or connections outside the right-of-way. Scenarios similar to those described in the replacement option apply to the remaining interchanges. The North Portland Harbor crossing presents the biggest challenge and is similar in effects to the replacement crossing.

TEMPORARY EFFECTS: CONSTRUCTION SAFETY

Safety in a construction zone decreases when traffic patterns change, lane and shoulder widths narrow, merging and weaving distances shorten, or turns become sharper. Increased congestion and substandard geometry leads to more collisions. Scenarios that close more interchanges, reduce the number or width of lanes, or present longer construction times would pose higher safety risks. Temporary connections would be designed to the highest standards possible within the constraints of the physical environment. An effective awareness campaign would be the key to safety.

Several stages of construction for the supplemental crossing would require unusual merge or diverge movements and would place traffic entering the highway into the left lane. These measures would likely decrease safety compared to the construction effects of the replacement crossing. However, the SR 14 interchange closures would likely not last as long with the supplemental crossing, decreasing detours and increasing safety near that interchange compared to the replacement crossing.

Construction areas that eliminate sidewalks, shoulders, or multi-use paths can increase the danger to pedestrians and cyclists who may utilize traffic lanes rather than make out-of-direction travel around construction areas.

Effects to bicycle and pedestrian traffic would be similar to that for motor vehicles. Access to businesses and residences through the construction areas would be accomplished with temporary walkways and short bridges with appropriate safety fencing and signing.

TEMPORARY EFFECTS: TRANSIT MODE

The choice of light rail or BRT would have similar effects on local traffic; construction of either mode would have minimal effects on regional highway traffic. Construction of either a bus or light rail guideway would have a substantial impact on local streets in Vancouver around the transit guideway. In general, both modes would require reconstructing the roadbed. Besides closing sections of streets to traffic, associated utility impacts would add to the duration and conflicts. Traffic could be totally excluded from blocks during active construction, resulting in detours to adjacent streets. Cross-traffic would also be precluded in some areas and restricted in others to one lane each direction or one lane total. Transit construction impacts in Oregon should be minimal.

TEMPORARY EFFECTS: TRANSIT TERMINUS AND ALIGNMENT OPTIONS

The largest temporary effect of construction of the transit guideway would be at the Kiggins Bowl terminus, which will require shifting the I-5 roadway approximately 25 feet west. This shift would require constructing new piers for I-5 overpasses, and could entail additional detours. For the Kiggins Bowl terminus, the transit guideway would cross I-5 north of SR 500, potentially narrowing some highway lanes or creating rolling traffic stops to erect girders. These effects are typical for construction activities in the corridor, but could cause some additional congestion.

Construction of the Lincoln terminus on Main Street north of 29th Street may have the most impacts. Downtown Vancouver has adjacent blocks that can accommodate detour traffic. However, Main Street is the primary north-south arterial for northern Vancouver west of I-5, so construction activity on Main Street may be more disruptive for north-south travelers. Construction north of 29th Street would take all but two lanes of traffic, and would require establishing some alternate routes with out of direction travel, especially north of 39th Street. High-capacity transit construction would disturb parking along Main and Broadway Streets for the duration of construction. Parking might be reestablished on sections of these streets during some phases of construction.

TEMPORARY EFFECTS: TRANSIT PERFORMANCE

During construction, expanded hours of peak congestion and lower traffic levels-of-service during heavy demand periods on I-5 would be the norm. Express buses would experience similar effects to those experienced by regional and local traffic. Bus priority or special purpose lanes would not be available in the narrow construction corridor. Routes would be adjusted to reflect the potential longer travel times outside normal peak hours.

Bus service through downtown Vancouver and Delta Park would be affected by interchange closures at SR 14. One bus line that uses SR 14 into the city would have to use Columbia Way. Schedule adjustments would be required for these routes.

High-capacity transit construction may have the greatest impact on current service. Construction of the Lincoln terminus may disrupt some primary bus routes in northern Vancouver. Disruption of these routes would affect transit service, and routes or times may have to be adjusted.

Potential Mitigation Measures

POTENTIAL MITIGATION MEASURES: MULTI-MODAL RIVER CROSSING AND HIGHWAY IMPROVEMENTS

Exhibit 3.1-51 summarizes the local street impacts that would result under the build alternatives and show potential measures to mitigate impacts to less-than-substantial levels.

Many of the impacts that would occur with Alternatives 4 and 5 could not be mitigated without changing the supplemental crossing's fundamental design. Many of the traffic impacts from the supplemental crossing occur at on- and off-ramps as traffic is funneled into the two right-hand lanes that are separated from the interior northbound lanes. Essentially, the only mitigation possible for these traffic impacts would be to add an additional auxiliary lane on the outside northbound bridge; however, this is not reasonable because it would remove the safety shoulders on this bridge that are necessary to improve safety conditions and to address this project's Purpose and Need.

Bus routes would need to be rerouted during construction. To minimize disruptions to passengers, substantial rerouting could be minimized.

To help citizens and business owners become aware of how to navigate within the construction area, public meetings could be held, booths could be set up at public events, public notices could be posted, and information could be distributed by local newspapers and during local television new casts. In addition, the project sponsors could assist business owners in making the public aware that they are open during construction through additional signage and way-finding descriptions to available public parking.

Exhibit 3.1-51
Potential Impacts and Mitigation Measures for River Crossing and Highway Effects on Local Street Performance

Subarea and Crossing	Potential Impact	Potential Mitigation Measure
Marine Drive Area		
Replacement river crossing	Union Court/Vancouver Way (PM LOS, AM Queuing)	Signalize intersection and optimize for critical turning movements
	Circuitous pedestrian and bicycle route	Add pedestrian only sidewalk on east side of N Portland Harbor Bridge and add sidewalk to east side of northbound bridge
Supplemental river crossing	Union Court/Vancouver Way (PM LOS, AM/PM Queuing)	Extend northbound right turn storage lane 50 feet, signalize intersection and optimize for critical turning movements
	Vancouver Way/MLK on- and off-ramps (PM Queuing)	No reasonable mitigation recommended
	Circuitous pedestrian and bicycle route	Add pedestrian only sidewalk on east side of N Portland Harbor Bridge and cantilevered pathway on west side of current southbound bridge
Stacked Transit/Highway Bridge	Circuitous pedestrian and bicycle route	Add suspended pathway on west side of current southbound bridge and/or sidewalk to fix below roadway deck for east side of northbound bridge

Source: CRC Traffic Technical Report 2008.

POTENTIAL MITIGATION MEASURES: TRANSIT MODE

Exhibit 3.1-52 summarizes local street impacts that would result for transit options and provides potential measures to mitigate impacts to non-substantial levels.

Exhibit 3.1-52
Potential Impacts and Mitigation Measures for Transit Mode Effects on Local Street Performance

Potential Impact	Potential Mitigation Measure
Increased vehicle delays at some intersections with LRT service due to pre-emptive traffic signals for transit	• Optimize traffic signal coordination. • Minimize or eliminate transit pre-emption at key downtown traffic signals with the heaviest cross-traffic demand.

POTENTIAL MITIGATION MEASURES: TRANSIT TERMINUS AND ALIGNMENT OPTIONS

Exhibit 3.1-53 provides potential measures for impacts from the transit terminus and alignment options.

Exhibit 3.1-53
Potential Vancouver Local Street Intersection Impacts and Mitigation Measures for Long-Term Impacts from Minimum Operable Segments

Potential Mitigation Measures
City of Vancouver, C-TRAN and WSDOT could monitor traffic operations and pursue mitigating measures such as:
■ Monitor traffic volumes and signalize intersections as warranted.
■ Extend/add turn lanes at key intersections.
■ Prohibit on-street parking during peak periods (e.g., 8th Street, 15th Street, Mill Plain Boulevard).
■ Monitor northbound left-turns on Main Street at 15th Street and on Columbia Street at 15th Street and prohibit when appropriate to provide southbound left and left/thru lanes to Mill Plain Boulevard.
■ Monitor and adjust Interstate ramp meter rates at Mill Plain Boulevard on-ramps.
■ Convert two-way streets to one-way couplets.
■ Reduce number of parking spaces at park and ride stations.
■ Provide multiple driveways to/from park and ride stations.
■ Increase shuttle bus service to park and ride station to decrease automobile traffic generation.
■ Current underutilized off-street facilities may be able to mitigate the loss of on-street parking.
■ Provide drop-off facilities for disabled patrons.
■ Reduce number of parking spaces at park and ride stations.
■ Reconfigure Fourth Plain Blvd. over-crossing to provide two through lanes in the westbound direction.
■ Grade separate HCT crossing at 39th Street and Main Street.
■ Designate Columbia Street as an arterial roadway.

Source: CRC Transit Technical Report 2008.

POTENTIAL MITIGATION MEASURES: TRANSIT SAFETY AND SECURITY

Safety mitigation measures are generally proposed for transit projects after an alignment is chosen, since mitigation is very site-specific, but often include improvements for pedestrian crossing by adding signalized intersections or other types protected crossings. Intersections and access points to transit are analyzed individually to enhance safety. Pedestrian and traffic crossings will be limited to controlled areas and will be discouraged in other places.

Intersections with transit crossings will be controlled by traffic signals to direct safe pedestrian, bicycle and auto movements. Signage should increase the awareness of the new guideway by clearly delineating the guideway and adjacent streets and by warning pedestrians when trains are approaching. One possible measure could be inclusion of audible warnings and textured ramps to alert hearing and visually impaired persons to crossings.

During construction, additional public involvement and education programs should provide information to residents, travelers, shoppers, cyclists, and others. The project could assist a transportation management association with public education for downtown Vancouver.

Local transit agency employees and the public should be involved in a public campaign to address security issues, incorporating security into design and construction practices, and enhancing emergency preparedness. Crime prevention should be integrated into station environmental design by including good lighting, clear sight lines, clearly defined public travel routes, reduced station clutter, and security cameras. For the Stacked Transit/Highway Bridge design, TriMet's experience with safety and security management of the Westside MAX tunnel offers guidance for effective measures to limit access to the inside of the bridge structure.

3.2 Aviation and Navigation

When proposing changes to the river crossing, project staff considered the beneficial or adverse effects of the project on aviation and navigation. Two goals of the CRC project are to minimize hazards to Columbia River navigation and to minimize hazards to air navigation from Pearson Field. However, these goals conflict, as recommended clear heights for river navigation intrude on recommended clear airspace for Pearson Field. Some obstruction of both river and air traffic is inevitable, but the project has worked to balance these two interests fairly.

The information presented in this section is based on analyses found in the Aviation and River Navigation Technical Reports.

3.2.1 Existing River Navigation and Aviation Conditions

Existing River Navigation Safety

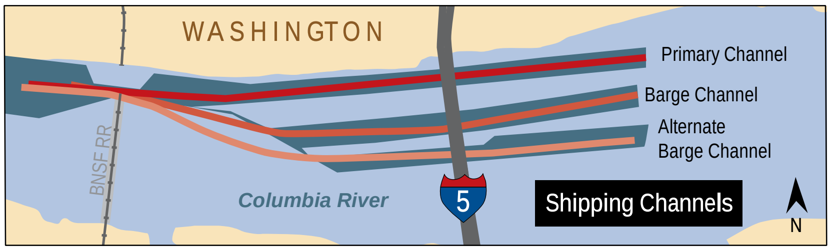
The I-5 bridges cross both the main channel of the Columbia River and a channel on the south side of Hayden Island known as North Portland Harbor. Because both channels are designated Federal Navigable Waterways, the U.S. Coast Guard must approve construction or alteration of bridges across either of them. Currently, navigation is limited for both waterways by the I-5 crossing and by a BNSF railroad bridge located about one mile downstream to the west of the I-5 crossing (Exhibit 3.2-1).

Exhibit 3.2-1
I-5 and BNSF Railroad Bridges

Near the CRC area, North Portland Harbor supports marinas of floating homes and primarily non-commercial boats, as shown on the south side of Hayden Island in Exhibit 3.2-1. West of the I-5 crossing, large ocean-going cargo ships use North Portland Harbor to reach Port of Portland Terminal 6 (not shown). This channel has a navigation width of 215 feet and a clearance height under the existing bridges of 35 to 40 feet, which limits the use of the channel to primarily recreational boats and smaller boats and barges.

In the main Columbia River channel, large vessels must pass the railroad bridge at its opening span near the Washington shore, (shown open in Exhibits 3.2-1 and 3.2-2). The lift spans of the I-5 crossing are also located in the primary channel near the Washington shore. During hours of lift-span operation, vessels can pass the two bridges without steering a complex, weaving maneuver, course.

Exhibit 3.2-2
I-5 and BNSF Railroad Bridge Shipping Routes

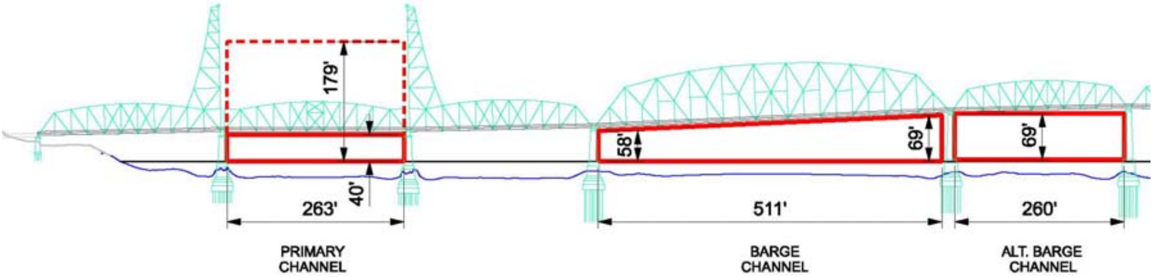


NOT TO SCALE

However, during restricted hours (weekdays, between 6:30 and 9:00 a.m. and between 2:30 and 6:00 p.m.), many medium-sized vessels use one of the alternate channels under the I-5 crossing rather than wait several hours for the lift-spans to open. This result's in more complex navigation for vessels, which must make relatively sharp turns in a short stretch of river and use channels that may have lower height clearance, narrower width, or shallower depths than the primary channel. This represents a potential safety hazard for marine traffic.

Exhibit 3.2-3 illustrates the navigation constraints posed by the existing I-5 crossing. The primary channel lies between piers set 263 feet apart, and has a vertical clearance of 40 feet when the lift spans are down. When fully raised, the vertical clearance is 179 feet. The barge channel lies under the wide spans of the bridge, and has a horizontal clearance of 511 feet and a vertical clearance ranging from 58 to 69 feet. The alternate barge channel occupies the span directly to the south of the wide span, and has a horizontal clearance of 260 feet and a vertical clearance of 69 feet.

Exhibit 3.2-3
Existing I-5 Columbia River Crossing Navigation Clearances



Source: CRC Navigation Technical Report 2008. Drawing not to scale.

With the exception of some specialized vessels that use the river infrequently, commercial, cruise and recreational vessels require vertical clearances of less than 90 feet from the surface of the water to the bottom of the bridge deck. The project team, in consultation with the Coast Guard, established a vertical minimum of 95 feet clearance, so that new structures could be built without a lift-span. Higher vertical clearances would have violated restricted airspace for flight navigation.

Exhibit 3.2-4
Summary of Vertical Clearance Requirements and Frequency of Use

Vessel Type	Clearance Requirement	Approximate Annual Frequency
Tugs and Tows	49 feet to 58 feet	> 500 trips
Sailboats/Recreation	76 feet to 88 feet	24 trips
Marine Contractors	100 feet to 110 feet	Infrequent
Marine Industrial	65 feet	6 trips
Cruise/Passenger	50 feet to 60 feet	25 trips

Source: Parsons Brinckerhoff Inc., 2004.

The Coast Guard, which approves construction or alteration of the bridges, has stated that navigation conditions cannot become worse than existing conditions, if the CRC project designs are to receive permitting. They have requested at least a 300-foot navigation clearance between bridge piers, which would require bridge spans of between 400 and 500 feet. For Alternatives 4 and 5, because of seismic retrofits required to the piers of the existing bridges, the primary channel would have an available clearance of only 200 feet. The Coast Guard, as the permitting agency, has stated that piers for all adjacent new structures must align with the piers on the existing I-5 bridges. This would most directly apply to the Supplemental crossing (Alternatives 4 and 5).

Existing Aviation Safety

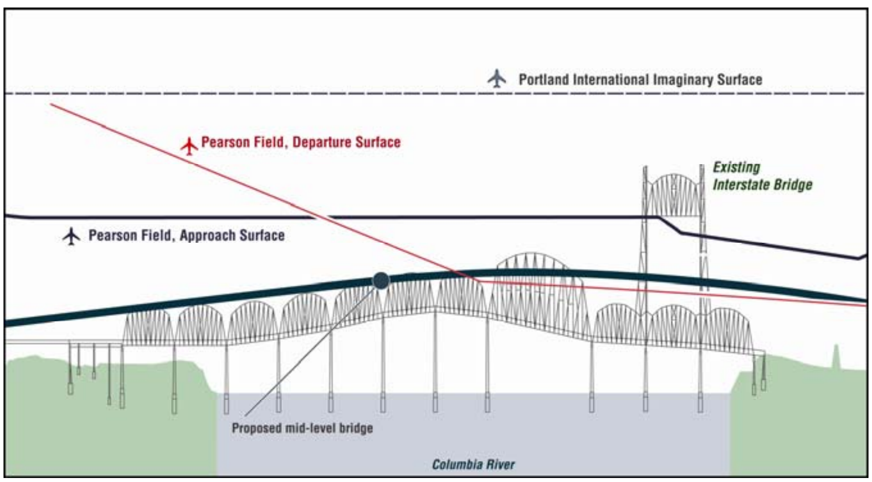
Two airports are located near the CRC area. Portland International Airport is located about three miles southeast of the project on the Oregon side of the Columbia River. It is the major regional airport and serves large commercial passenger and freight service, private craft, and Air National Guard fleets. Planned expansions include both potential runway extensions and the addition of a new runway.

Pearson Field is located directly east of the project on the Washington side of the Columbia River. It serves primarily small piston engine aircraft weighing 10,000 pounds or less. Because it is surrounded by developed urban uses and the Vancouver National Historic Reserve, there are no plans to expand facilities or operations at this airfield in the future.

The lift towers of the existing bridge currently intrude into the recommended clear airspace for Pearson Field and are an aviation hazard. To avoid the towers, aircraft must use a departure gradient of 650 feet elevation per nautical mile (ft/NM). If the lift towers were removed, then electrical transmission towers on Hayden Island would be the tallest structures in the airport flight path. These require a gradient of only 269 ft/NM, making it much safer for aircraft to arrive and depart without steep changes in altitude.

An important goal of the CRC project is to minimize effects of the crossing to both Columbia River navigation and air navigation from Pearson Field. However, the area between allowable airspace clearances overlaps with necessary navigational heights. The Federal Aviation Administration uses a 20:1 horizontal to vertical clearance ratio to identify obstructions (obstacle clearance surface) to aviation for the runway classification of Pearson Field. The existing lift span towers penetrate 98 feet into this airspace. Exhibit 3.2-5 shows the design constraints posed by both Portland International imaginary surface and Pearson Field approach and departure clearance surfaces.

Exhibit 3.2-5
Pearson Field and Portland International Airport Aviation Constraints



Source: CRC Aviation Technical Report 2008. Drawing not to scale.

In order design a bridge with minimal negative height, portions of both the maritime and aviation envelopes were used for the proposed bridge and roadway design.

3.2.2 Long-term Effects from Full Alternatives

This section summarizes the safety-related impacts on navigation and aviation associated with the project alternatives.

Alternative 1: No-Build

In the No-Build Alternative, the current lift span towers would continue to represent an aviation hazard for Pearson Field. The lift span restrictions would continue to cause delays to river traffic, while the continuing need to navigate around the lift-span and the relatively narrow width between existing bridge piers would continue to represent potential hazards to navigation. In addition, without the seismic upgrades included in the build alternatives, a major earthquake could collapse or seriously damage the bridge, creating an adverse impact to navigation.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.2-6
Summary of Safety Performance for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
River Navigation Safety and Security	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.
Aviation Safety and Security	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.

Source: Traffic, Transit, River Navigation and Aviation Technical Reports.
Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 2 would improve both aviation and navigation safety and efficiency. Likely bridge designs would not include lift towers. The bridge would be located slightly farther from the airfield, and so would intrude less into Pearson Field airspace.

The crossing would require fewer piers, creating less of an obstacle to river navigation than either the existing crossing or the supplemental crossing. Taller ships would not be restricted by the hours of lift-span operation, and would not have to navigate a difficult path around the lift-span channel. A replacement crossing would be slightly closer to the downstream railroad bridge, which could potentially make navigation past the two bridges more difficult. However, the new primary channel under the I-5 crossing would have a better alignment with the channel through the railroad bridge than currently exists, which should improve navigation even with the two crossings slightly closer together.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.2-7
Summary of Safety Performance for Alternative 3

Alternative 3: Replacement Crossing with Light Rail				
Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
River Navigation Safety and Security	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.	Improved by eliminating S-curve maneuver and reduction of piers.
Aviation Safety and Security	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.	Less intrusion to Pearson Field airspace.

Source: Traffic, Transit, River Navigation and Aviation Technical Reports.
Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 3 would have aviation and river navigation improvements similar to those described for Alternative 2.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.2-8
Summary of Safety Performance for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
River Navigation Safety and Security	Adverse. S-curve maneuver more difficult. More piers and narrower channels.	Adverse. S-curve maneuver more difficult. More piers and narrower channels.	Adverse. S-curve maneuver more difficult. More piers and narrower channels.	Adverse. S-curve maneuver more difficult. More piers and narrower channels.
Aviation Safety and Security	Existing lift-span would remain a hazard to aviation at Pearson Field.	Existing lift-span would remain a hazard to aviation at Pearson Field.	Existing lift-span would remain a hazard to aviation at Pearson Field.	Existing lift-span would remain a hazard to aviation at Pearson Field.

Source: Traffic, Transit, River Navigation and Aviation Technical Reports.

Alternative 4 would have adverse effects to aviation and navigation. The supplemental crossing would retain the existing lift span towers and would remain a hazard to aviation at Pearson Field. The height difference between the deck of the existing and supplemental structures would further restrict an area already congested for aviation.

Lift-span restrictions of the existing crossing would continue to cause delays to river traffic. The continuing need to navigate around the lift-span and the relatively narrow width between existing bridge piers would continue to represent a potential hazard to navigation. This width would decrease by 40 to 60 feet because of the seismic reinforcement planned for the existing bridge piers.

In addition, the supplemental crossing would require placing a new structure between the existing I-5 crossing and the downstream railroad bridge. This would increase the potential hazard to navigation, particularly if vessels should attempt to navigate around the I-5 lift-span, by providing less distance to navigate between the BNSF and I-5 crossings. The existing piers would be retained and new piers added for the new bridge, increasing the number of obstacles to navigation in the river.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.2-9
Summary of Safety Performance for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail				
Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
River Navigation Safety and Security	Adverse. S-curve maneuver more difficult. More piers & narrower channels.	Adverse. S-curve maneuver more difficult. More piers & narrower channels.	Adverse. S-curve maneuver more difficult. More piers & narrower channels.	Adverse. S-curve maneuver more difficult. More piers & narrower channels.
Aviation Safety and Security	Lift-span remains a hazard to aviation at Pearson Field.	Lift-span remains a hazard to aviation at Pearson Field.	Lift-span remains a hazard to aviation at Pearson Field.	Lift-span remains a hazard to aviation at Pearson Field.

Source: Traffic, Transit, River Navigation and Aviation Technical Reports.

Alternative 5 would have aviation and river navigation improvements similar to those described for Alternative 4.

3.2.3 Long-term Effects from Project Components

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

RIVER CROSSING AND HIGHWAY IMPROVEMENTS: NAVIGATION AND AVIATION

The replacement crossing would improve both aviation and navigation safety and efficiency over existing conditions and the supplemental alternatives. Likely designs would not include lift towers and so would intrude less into Pearson Field airspace. The supplemental crossing would retain the existing lift span towers and would remain a hazard to aviation at Pearson Field. The height difference between the deck of the existing and supplemental structures would further encroach on restricted airspace for aviation.

With either crossing, ramps connecting SR 14 and I-5 would intrude into Pearson Field airspace, in part because they must pass over a BNSF railroad berm between the bridge and surface grade. This would require a flight gradient of 275 ft/NM, which is a substantial improvement over current conditions but which would still represent the controlling gradient for the airfield.

A replacement crossing would be slightly closer to the downstream railroad bridge, which could potentially make navigation past the two bridges more difficult. However, the new primary shipping channel under the I-5 crossing would have a better alignment with the channel through the railroad bridge than currently exists, which should improve navigation even with the two crossings slightly closer together.

The replacement crossing would require fewer piers, therefore fewer obstacles to river navigation than either the existing bridge or the supplemental crossing. Taller ships would not be restricted by the hours of lift-span operation, and would not have to navigate a difficult path around the lift-span. For the supplemental crossing, lift-span restrictions of the existing bridges would continue to cause delays to river traffic. The continuing need to navigate around the lift-span and the relatively narrow width between existing bridge piers would continue to represent a potential hazard to navigation. This width may decrease by 40 to 60 feet because of the seismic reinforcement planned for the existing bridge piers.

In addition the supplemental crossing would require placing a new structure between the existing I-5 crossing and the downstream railroad bridge. This would increase the potential navigation hazard, particularly if vessels should attempt to navigate around the I-5 lift-span, by providing less distance to between the crossings. The existing piers would be retained and new piers added for the new bridge, increasing the number of obstacles to navigation in the river.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

The choice of transit mode would not substantially influence how this project affects aviation or river navigation.

Transit Terminus Options (with all Alternatives)

The choice of transit terminus option would not substantially influence how this project affects aviation or river navigation.

Transit Alignment Options (with all Alternatives)

The choice of transit alignment option would not substantially influence how this project affects aviation or river navigation.

Transit Operations

Transit operations would not substantially influence how this project affects aviation or river navigation.

I-5 Bridge Toll

Tolling would not substantially influence how this project affects aviation or river navigation.

Transportation Demand and System Management

Transportation demand and system management would not substantially influence how this project affects aviation or river navigation.

3.2.4 Temporary Effects

Temporary Effects: River Navigation

The actual construction methods selected would determine the type and extent of temporary effects on navigation. The North Portland Harbor structure is expected to match or exceed the height of the existing structure. Construction methods would be chosen to eliminate the need for extensive construction supports in the navigation channel. However, there may be some temporary restrictions due to blockages from barges and cranes used to construct piers and lift bridge segments into place. Most vessels that currently use the navigation channel would likely be able to continue to use the channel throughout most of the construction period.

During construction of a replacement crossing, bridge piers in the Columbia River are not likely to line up with the existing bridge piers. While the new crossing is under construction and the existing crossing is still operational, this would result in more obstacles in the river and more difficulty in navigation during construction.

During construction of a supplemental crossing, vertical clearance may be reduced from 95 feet to approximately 70 feet. This would result from the seismic retrofits planned for the existing lift-span towers, which would periodically prohibit their operation.

Construction staging would be planned to minimize adverse effects to river navigation. In-water work would likely occupy only part of the river at one time, maintaining a minimum channel for navigation. Closures or restrictions on river traffic would be communicated in advance, enabling river users to accommodate their schedules without undue interruption. Additional tugs may be needed to assist vessels through areas of reduced clearances, especially during times of high water. The Coast Guard would review construction plans to determine potential effects.

Temporary Effects: Aviation

Tall cranes used during construction may be a hazard to aviation. Equipment used to either remove or retrofit the existing lift-span towers would likely be the tallest construction equipment and therefore the most likely to present a hazard to aviation. Cranes used to remove or retrofit the existing lift towers would need to be taller than the existing structures, and would temporarily affect Pearson Field airspace more than under existing conditions. Construction activities are not anticipated to affect Portland International Airport. The FAA would review construction plans to determine potential effects.

Construction dust or emissions from construction equipment could pose a short-term hazard to aviation by reducing visibility. Dust could result when wind disturbs uncovered fill or open excavations. Trucks and equipment traveling on unimproved construction roads could also stir up dust, impairing visibility.

Temporary stormwater ponds that fall within the limits of the hazardous wildlife exclusion zone, especially near the SR 14 interchange, may provide a place for birds to land and congregate, increasing the potential for aircraft bird strikes.

3.2.5 Potential Mitigation Measures

Potential Mitigation Measures: Navigation and Aviation

The FAA would require obstruction marking and lighting to make the river crossing structures and any construction equipment visible to aircraft. Proposed roadway or accent lighting on the bridge and surrounding interchanges should be designed to limit light or glare that could affect air navigation.

The FAA has established a 5,000-foot zone around runways where features attractive to birds, such as open water ponds, should not be created. For Pearson Field, this zone extends across the CRC area. Stormwater ponds constructed by the project in this area may require features to discourage birds from utilizing the ponds. To improve safety at Pearson Field, structures in this zone should be designed to minimize locations for birds to roost or nest.

Because it would not include a lift-span, a replacement crossing would reduce the maximum available vertical clearance under the bridge from 179 feet to approximately 102 feet. The CRC project team collected information on vessels traveling this river section to assess the vertical and horizontal clearance needs of river users.[4] Results were discussed and verified with vessel operators and the Coast Guard. Exhibit 3.2-4 summarizes the vertical clearances needed by river users and the frequency of their use.

As shown, specialized marine contractors, which utilize this portion of the river at less than annual frequency, could not pass under the fixed-span bridge without partial disassembly of their loads. This limitation would be offset by substantially improved navigational safety and the elimination of river traffic delays caused by restrictions on the lift-span.

A supplemental crossing would increase the difficulty in navigating around the lift-span and could prompt a repeal of the current lift-span restrictions in order to improve navigation safety. The Coast Guard may require the bridges to have navigational aids such as vertical clearance gauges and lighting.

During construction, additional public involvement and education programs should be used to provide information to tug operators, pilots, and the general public. Additional tugs may be needed to aid in temporary navigational challenges. Construction materials and activities should be managed so as to minimize dust, glare, and smoke.

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[4] Parsons Brinckerhoff Inc., 2004.

3.3 Property Acquisitions and Displacements

All build alternatives would need to acquire property to allow for the new river crossing and highway improvements, transit guideway and stations, bicycle and pedestrian improvements, improved local intersections, maintenance facilities, and park and rides. In many areas, the project would require only a narrow strip of property next to the existing road for highway or transit construction, allowing businesses and homes to remain. In some cases, entire parcels would be affected, displacing the existing residents, businesses, or other uses.

This section describes potential property acquisitions (the amount of new land each alternative or option would require) and potential displacements (the number of residences, businesses, or other uses that would need to relocate). Appendix D includes a list of all the properties that could potentially be affected by the river crossing, highway, and transit components of this project. The location of potential staging sites will be identified and potential environmental impacts analyzed in the Final EIS (FEIS). This section also discusses possible steps to potentially mitigate for these acquisitions and help relocate displaced residents and businesses, which would be done in compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended).

The information presented in this section is based on the analysis done in the Acquisitions Technical Report, included as an electronic appendix to this DEIS.

3.3.1 Existing Conditions

Vacancy Rates

Vacancy and rental rates of residential, commercial and industrial properties are an indication of the potential for finding viable sites for relocating displaced residents and businesses. Higher vacancy rates generally indicate greater potential for relocating a displaced use to a location that is desirable to the property owner or tenants. The average length of time that single family homes are on the market prior to sale and median single family home sale price also indicate the potential for finding viable sites for relocating residents of single family homes.

In November 2007, the Portland-Vancouver metropolitan area had an 8.3 month supply of homes for sale and a median home sale price of $285,000. Median annual home prices, but not supply of homes, are also available for smaller geographic areas for 2007, up to and including the month of November 2007. For the seven subareas relevant to the CRC project, median annual sale prices and approximate locations are summarized in Exhibit 3.3-1.

Exhibit 3.3-1
Median Home Prices

Subarea	Median Annual Sale Price	Northern Boundary	Western Boundary	Southern Boundary	Eastern Boundary
Downtown Vancouver	$215,500	39th Street	Vancouver Lake	Columbia River	I-5
Lincoln – SW Hazel Dell	$230,000	78th Street	Vancouver Lake	39th Street	I-5
SW Heights	$284,300	Mill Plain Blvd.	I-5	Columbia River	Andresen Blvd.
NW Heights	$170,000	SR 500	I-5	Mill Plain Blvd.	Andresen Blvd.
E Hazel Dell/ Minnehaha	$235,000	78th Street	I-5	SR 500	Andresen Blvd.
North Portland	$235,500	Columbia River	Willamette River	Willamette River	Williams Ave.
NE Portland[a]	$283,000	Columbia River	Williams Ave.	East Burnside	182nd Ave.

Source: Regional Multiple Listing Services 2007.

[a] The "NE Portland" subarea includes Hayden Island east of I-5 and the Bridgeton Neighborhood on the south shore of the North Portland Harbor and east of I-5.

In February of 2008, industry reports showed that West Vancouver, which includes the Vancouver portion of the project area, has a higher vacancy rate, but higher costs per square foot for multi-family residential units than the North Portland/St Johns area.[5] These rates are listed in the Exhibit 3.3-2.

Exhibit 3.3-2
Multi-family Vacancy and Rental Rates

Subarea	Vacancy Rates	Monthly Rental Rate per sq ft	Monthly Rental Rate for 1-Bedroom Apt[a]	Northern Boundary	Western Boundary	Southern Boundary	Eastern Boundary
West Vancouver[b]	4.65%	$0.88	$572.00	159th Street	Columbia River	Columbia River	117th Avenue
N Portland/ St. Johns[c]	2.61%	$0.81	$526.50	Columbia River	Willamette River	I-84	Williams Ave

Source: Metro Multifamily Housing Association 2007.

[a] Typical apartment defined as 650 square feet.

[b] Corresponds to zip codes 98660-98666, 98685, 98656, and 98668.

[c] Corresponds to zip codes 97203, 97217, 97227, and 97283.

All build alternatives would require the displacement of floating homes in the North Portland Harbor. Most marinas currently operate at capacity, and there are therefore very few floating home slips available in the

[5] Metro Multifamily Housing Association, 2007.

metropolitan area. As there is no known planned growth in the number or size of marinas, there are limited opportunities to relocate floating homes in the region. Additionally, displaced floating homes may not have the structural integrity to be moved or may not meet with architectural design standards at other marinas.

All build alternatives will likely require commercial and industrial property. Office space is more available than either retail or industrial space in the CRC project area, as illustrated in Exhibit 3.3-3.

Exhibit 3.3-3
Office, Retail and Industrial Vacancy Rates[a]

Subarea	Vacancy Rates	Monthly rental rate for Class A office space per sq foot	Monthly rental rate for Class B office space per sq foot	Northern Boundary	Western Boundary	Southern Boundary	Eastern Boundary
Office Space							
Portland-Vancouver	11.5%	$25.01	$19.51	Both Metropolitan areas			
Vancouver Central Business District/West Vancouver[a].	11.5%	$24.32	$18.08	Burnt Bridge Creek Greenway	Columbia River	Columbia River	I-5
Retail Space[b]							
Hayden Island	5.74%	N/A	N/A	Columbia River	Oregon Slough	North Portland Harbor	Oregon Slough
West Vancouver	8.83%	N/A	N/A	159th Street	Columbia River	Columbia River	117th Avenue
Industrial Space[c]							
Portland-Vancouver	5.7%	N/A	N/A	Both Metropolitan areas			
Columbia Corridor[c]	6.9%	N/A	N/A	South shore of the Columbia River from its confluence with Sandy River to the Willamette River			
Rivergate	7.4%	N/A	N/A	At confluence of Willamette and Columbia Rivers			

[a] All vacancy rates based on the fourth quarter of 2007.
[b] Grubb & Ellis Company, 2007.
[c] CB Richard Ellis, 2007.
[d] Grubb & Ellis Company, 2007.

Industry research reports that new industrial development will slow in 2008, though vacancy rates are still expected to increase modestly east of the Willamette River in Oregon.[6]

[6] Grubb & Ellis Company, 2007.

3.3.2 Long-term Effects from Project Alternatives

The build alternatives, as described in the Description of Alternatives (Chapter 2), comprise different combinations of river crossing, high-capacity transit mode, and transit terminus and alignment options. Despite these different combinations of components, there is relatively little difference in the total acquisitions and displacements among the build alternatives. The following tables and associated discussions summarize the acquisitions (in acres), residential displacements (including floating homes), and business displacements that could occur as a result of the project alternatives.

Alternative 1: No-Build

The No-Build Alternative would not require any direct property acquisitions in the project area. Both the C-TRAN bus maintenance facility and TriMet Ruby Junction light rail maintenance facility may be expanded with the No-Build alternative, though the exact size of the expansions is not known.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.3-4 summarizes the potential property acquisitions, and residential and business displacements, that could occur as a result of Alternative 2.

Exhibit 3.3-4
Acquisition Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit[a]				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Total area of Acquisitions (acres)	41-43	43-45	36-38	38-40
Residential Displacements	29-36	29-36	21-28	21-28
Business Displacements[b]	43-52	58-68	41-50	44-46

Source: CRC Acquisitions Technical Report and Economics Technical Report.

a Includes all acquisitions and displacements that would occur as a result of the river crossing and highway improvements, and transit alignments.

b Does not double-count the businesses displaced by both the highway and transit components on Hayden Island.

Note: The impacts with the STHB option for the river crossing would be the same as shown in the table above for the replacement crossing.

Alternative 2 would require 36 to 45 acres of property for the river crossing, highway improvements, and transit terminus and alignment options. Alternative 2, as paired with the Lincoln terminus option requires more acreage because it travels along dense, predominately commercial streets with little right-of-way, while the Kiggins Bowl terminus can take advantage of existing right of way along I-5. Although shorter in length, the Mill Plain MOS would require two to four more acres in property acquisitions than the Clark College MOS, because it is associated with additional park and rides in downtown Vancouver.

Alternative 2 would require 21 to 36 residential displacements predominately in the floating home community in North Portland Harbor and along I-5 north of Fourth Plain Boulevard. Alternative 2, when paired with either the Kiggins Bowl or Lincoln terminus options would both result in the same number of residential displacements, although in northern Vancouver these would not be the same residences. Alternative 2, when paired with either MOS, results in the same 21 to 28 residential displacements in the floating home community and along I-5 in Vancouver.

Alternative 2 would require 41 to 68 business displacements predominately on Hayden Island, and for alternative 2B, along Main Street north of Fourth Plain. The Lincoln transit terminus travels along dense commercial streets, while the Kiggins Bowl transit terminus travels through largely residential areas and can take advantage of existing right of way. As both MOSs, have a shorter transit component, they avoid some of the business acquisitions, resulting in fewer displacements as compared to the full-length terminus options.

Alternative 2 would displace the ODOT permit center on Hayden Island, and possibly the WSDOT maintenance facility at 39th and Main when paired with the Lincoln (B) and Mill Plain MOS (D) terminus options.[7]

Alternative 2 would require the expansion of the existing C-TRAN bus maintenance facility. This expansion would acquire five parcels zoned for light industrial use and would displace one business and two residences directly south of the existing facility.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.3-5 summarizes the potential property acquisitions, and residential and business displacements, that could occur as a result of Alternative 3.

Exhibit 3.3-5
Acquisition Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail[a]				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Total area of Acquisitions (acres)	41-43	43-45	36-39	38-39
Residential Displacements	29-36	29-36	21-28	21-28
Business Displacements[b]	43-52	58-68	41-50	44-46

Source: CRC Acquisitions Technical Report and Economics Technical Report.

a Includes all acquisitions and displacements that would occur as a result of the river crossing and highway improvements, and transit alignments.

b Does not double-count the businesses displaced by both the highway and transit components on Hayden Island.

Note: The impacts with the STHB option for the river crossing would be the same as shown in the table above for the replacement crossing.

Alternative 3 would result in the same number of residential and business displacements as Alternative 2.

7 See discussion of this impact in Transit Alignments section.

The light rail transit mode associated with Alternative 3 requires slightly less area around Expo Center than bus rapid transit, but potentially more near the proposed Mill Plain Transit Center, making the difference very minor. Due to rounding this difference is not evident in for Alternative 3, when comparing the Lincoln and Kiggins Bowl terminus options, which have the same range of acreage required as in Alternative 2. A difference is evident in the MOS options. Alternative three, when paired with the Clark College MOS and Mill Plain MOS would result in 36 to 39 acres and 38 to 39 acres of property acquisitions, respectively.

Alternative 3 would displace the ODOT permit center on Hayden Island, and possibly the WSDOT maintenance facility at 39th and Main when paired with the Lincoln and Mill Plain MOS terminus options.

Alternative 3 would require the expansion of the existing TriMet Ruby Junction light rail maintenance facility. This expansion would fully acquire 14 parcels zoned for heavy industrial use, and displace up to seven potentially inhabited residences and up to seven businesses, including a mix of service and light industrial uses.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.3-6 summarizes the potential property acquisitions and residential and business displacements that could occur as a result of Alternative 4.

Exhibit 3.3-6
Acquisition Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit[a]				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Total area of Acquisitions (acres)	36-37	39-40	32-33	34-35
Residential Displacements	26-27	32-33	24-25	24-25
Business Displacements[b]	40-48	56-64	34-43	37-39

Source: CRC Acquisitions Technical Report and Economics Technical Report.

a Includes all acquisitions and displacements that would occur as a result of the river crossing and highway improvements, and transit alignments.

b Does not double-count the businesses displaced by both the highway and transit components on Hayden Island.

Alternative 4 would acquire a total of 32 to 40 acres of property for the river crossing, highway improvements, and transit terminus and alignment options. The Lincoln terminus requires more acreage because it travels along dense, predominately commercial streets with little right-of-way, while the Kiggins Bowl terminus can take advantage of existing right of way along I-5. Although shorter in length, the Mill Plain MOS would require two to three more acres in property acquisitions than the Clark College MOS, because it is associated with additional park and rides in downtown Vancouver.

Alternative 4 would require 24 to 33 residential displacements predominately in the floating home community in North Portland Harbor and along I-5 north of Fourth Plain Boulevard. The narrower highway associated with the supplemental river crossing reduces the need to the Kiggins Bowl terminus to shift the highway west, which would result in residential displacements, while the Lincoln terminus is still associated with the residential displacements at the Lincoln Park and Ride. When paired with the two MOSs, Alternative 2 results in the same 21 to 28 residential displacements in the floating home community and along I-5 in Vancouver.

Alternative 4 would require 34 to 64 business displacements predominately on Hayden Island, and for the Lincoln terminus option, along Main Street north of Fourth Plain. The Lincoln transit terminus travels along dense commercial streets, while the Kiggins Bowl transit terminus travels through largely residential areas and can take advantage of existing right of way. The Clark College MOS and Mill Plain MOS have shorter transit components, and would avoid some of the business acquisitions.

Alternative 4 would displace the ODOT permit center on Hayden Island and possibly the WSDOT maintenance facility at 39th and Main with Alternatives 4B and 4D.

Alternative 4 would require the expansion of the existing C-TRAN bus maintenance facility as described for Alternative 2.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.3-7 summarizes the potential property acquisitions and residential and business displacements, that could occur as a result of Alternative 5

Exhibit 3.3-7
Acquisition Summary for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail[a]				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Total area of Acquisitions (acres)	35-37	38-40	32-34	34
Residential Displacements	26-27	32-33	24-25	24-25
Business Displacements[b]	40-48	56-64	34-43	37-39

Source: CRC Acquisitions Technical Report and Economics Technical Report.

a Includes all acquisitions and displacements that would occur as a result of the river crossing and highway improvements, and transit alignments.

b Does not double-count the businesses displaced by both the highway and transit components on Hayden Island.

Alternative 5 would result in the same number of residential and business displacements as Alternative 4. Alternative 5 would require the acquisition of between 32 and 40 acres.

Alternative 5 would displace the ODOT permit center on Hayden Island and possibly the WSDOT maintenance facility at 39th and Main with the Lincoln terminus option and Mill Plain MOS.

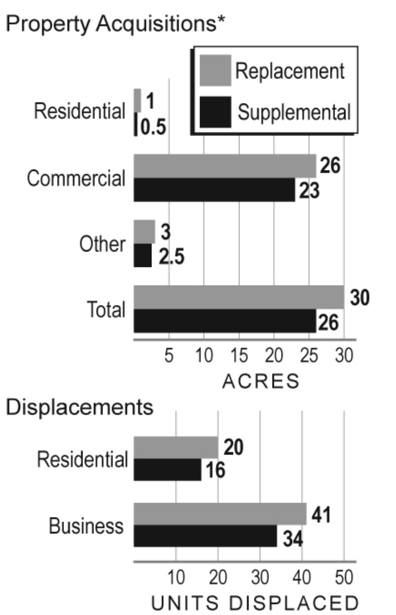
Alternative 5 would require the expansion of the existing TriMet Ruby Junction light rail maintenance facility, as described for Alternative 3.

Acquisition of DOT Land

Both river crossings, and associated highway improvements would need to expand into existing DOT right-of-way adjacent to I-5. The river crossings would also require the acquisition of the ODOT permit center on Hayden Island and possibly the WSDOT maintenance facility on 39th in Vancouver. As this land is already owned by the DOTs, its acquisition is not counted in the total acreage requirements, although the displacement of these public owned facilities are included and disclosed in this document.

Exhibit 3.3-8
River Crossing and Highway Improvements

Total acquisitions and displacements



*Assumes Kiggins Bowl Terminus in North Vancouver.

Source: CRC Acquisitions Technical Report and Economics Technical Report.

3.3.3 Long-term Effects from Project Components

This section describes the impacts of the project components and various options that are part of the project alternatives. Operational components (I-5 bridge tolling, transit operations, and transportation system and demand management options) do not influence acquisitions and are therefore not discussed below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The multimodal river crossings and associated highway improvements would require between 26 and 30 acres of new right-of-way, and would displace residences, businesses, and publicly-owned facilities mostly on Hayden Island. This section discusses the acquisition impacts resulting from the river crossing and highway improvements in more detail. Transit related acquisitions are discussed in the Transit Terminus and Alignment Options sections below.

The replacement river crossing would acquire about 30 acres of new right-of-way, not including land already owned by the state Departments of Transportation (DOTs, see sidebar), and would displace up to 20 residences (including 13 floating homes) and up to 41 businesses. Up to eight additional displacements could occur as a result of pairing the replacement river crossing with the Kiggins Bowl terminus option. The Kiggins Bowl terminus option requires the shifting of the highway west to accommodate transit on the east side of I-5. These impacts are attributed to transit and discussed in the Transit Terminus Options section. The supplemental river crossing would acquire about 26 acres of new acquisitions, and would displace up to 16 residences (including 15 floating homes) and up to 34 businesses for highway construction. Exhibit 3.3-8 compares the acquisitions caused by the two river crossings, and Exhibits 3.3-9 and 3.3-10 show the approximate locations of these property acquisitions. Exhibits 3.3-11 and 3.3-12 highlight the entire parcel where these property acquisitions result in the displacement of a residence, business, or public service. These impacts are discussed by geographical area in the following paragraphs.

The stacked transit/highway bridge (STHB) option for the replacement river crossing does not result in new and unique acquisitions from those described for the replacement river crossing, and is therefore not addressed in this section.

Most, if not all, of the acquisitions required for bicycle and pedestrian facilities are disclosed as a part of the river crossing. The project may acquire a portion of a block on Fifth and Washington in Vancouver or possibly additional area immediately adjacent to the transit crossing on Hayden Island for pathways, stairs, or elevators to transport users up to and down from the elevated pathway. Every effort will be made to employ land already acquired for the purpose of the river crossing. These features of the bicycle and pedestrian facilities have yet to be fully designed, and will be largely influenced by the recommendations of the Bicycle and Pedestrian advisory committee.

OREGON

Near the Marine Drive interchange both river crossings would require approximately three acres of new right-of-way, which would displace up to five businesses. On Hayden Island, highway and interchange realignments would require 20 acres for the replacement crossing, and displace up to 29 businesses. The supplemental crossing would acquire 21 acres and displace up to 24 businesses in this area. These businesses include a mix of retail/service, professional office, and lodging, as well as one publicly-owned facility; the ODOT permit center. The only grocery store on Hayden Island, Safeway, would be displaced by the supplemental river crossing. The replacement river crossing could likely avoid this displacement. For specific uses see Appendix D.

The Southern and Diagonal Marine Drive interchange options could require additional acquisitions. The Southern realignment of Marine Drive could require the acquisition of two buildings that are used by a warehouse distributing business on the corner of Marine Drive and Force Avenue. The Diagonal realignment of Marine Drive would divide the Expo Center Complex by removing about 3 acres of land on the north side of the complex. The northern building of the Expo Center would be removed to provide right-of-way for Marine Drive. See Chapter 2, Description of Alternatives for more detailed design information regarding these two interchange options.

Both river crossings would displace floating homes in North Portland Harbor. The replacement crossing would result in 13 floating home displacements, while the supplemental would displace 15. These displacements are included in Exhibit 3.3-8.

WASHINGTON

In Washington, the highway improvements would require fewer property acquisitions and displacements compared to impacts in Oregon. The replacement crossing would require 7.9 to 8.3 acres of right-of-way in Washington, displacing up to seven residences, seven businesses, and possibly a portion of one publicly-owned facility, the FHWA Western Federal Lands building in the Vancouver National Historic Reserve.[8] The supplemental crossing would require 3.9 acres of right-of-way in Washington, displacing up to one residence and five businesses. The supplemental crossing would avoid impacting the Western Federal Lands building.

The impacted businesses include a mix of retail/service and professional office businesses. Most of the acquisitions and displacements in Washington would be due to the high-capacity transit alignments and park and rides, discussed on the following pages.

Appendix D includes a list of all the properties that could potentially be affected by any of the river crossing or highway improvements.

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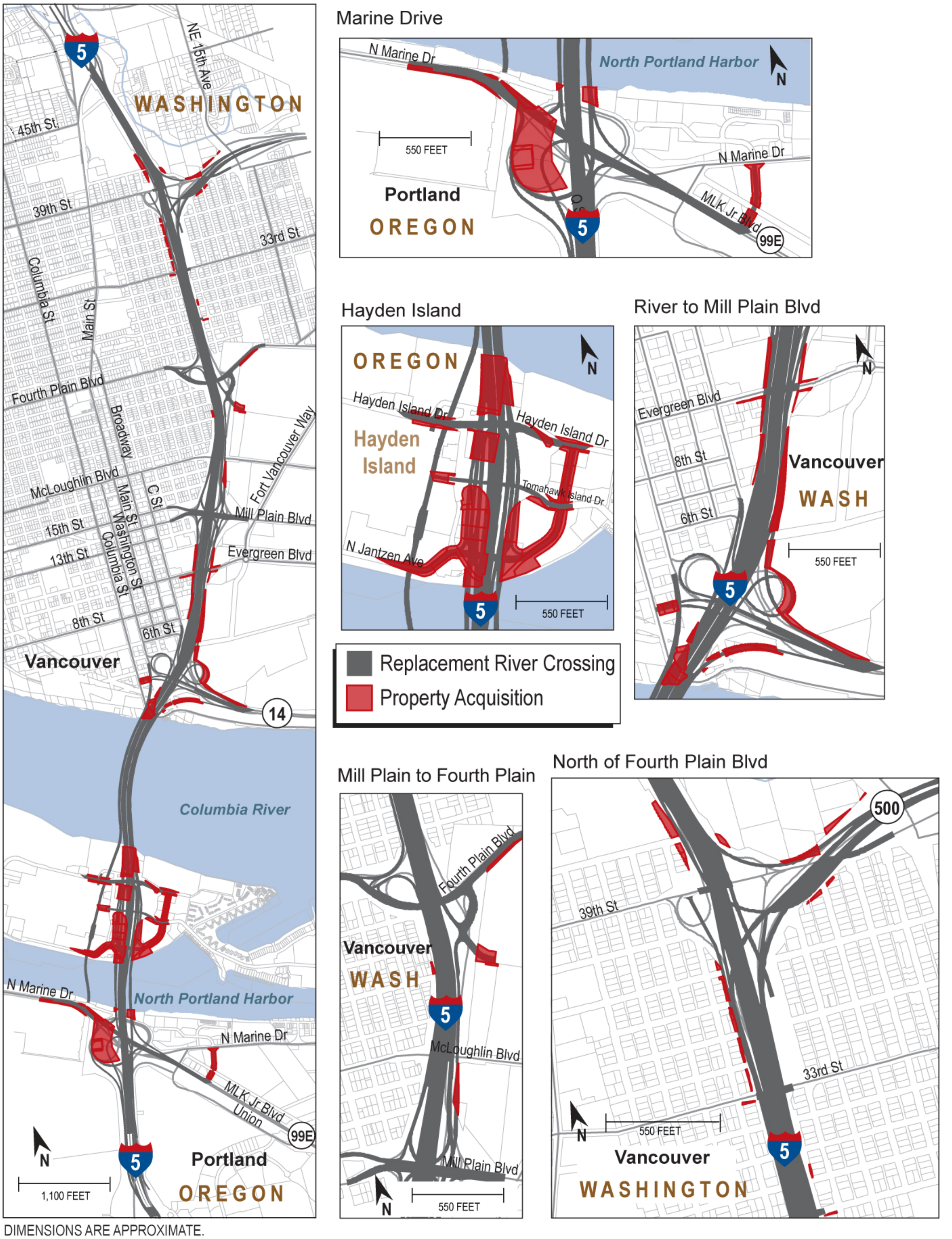
[8] The impacted portion of the FHWA Western Federal Lands building is an annex that could potentially be removed without displacing the entire building. Design refinements of the replacement crossing may avoid this impact, though access through that area (from Anderson Road) would still be eliminated.

Exhibit 3.3-9

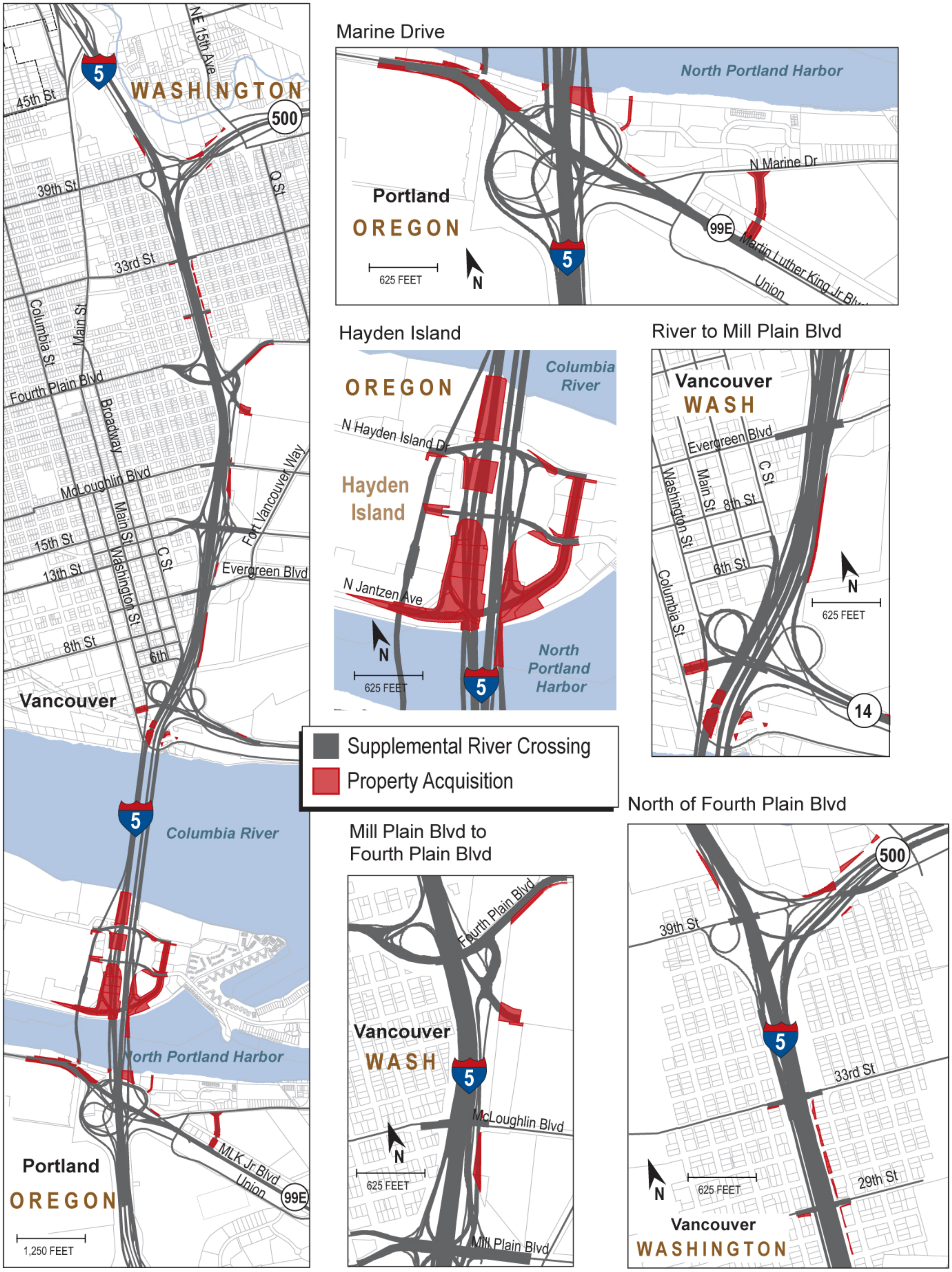
Replacement River Crossing and Highway Improvements Acquisitions



DIMENSIONS ARE APPROXIMATE.

Exhibit 3.3-10

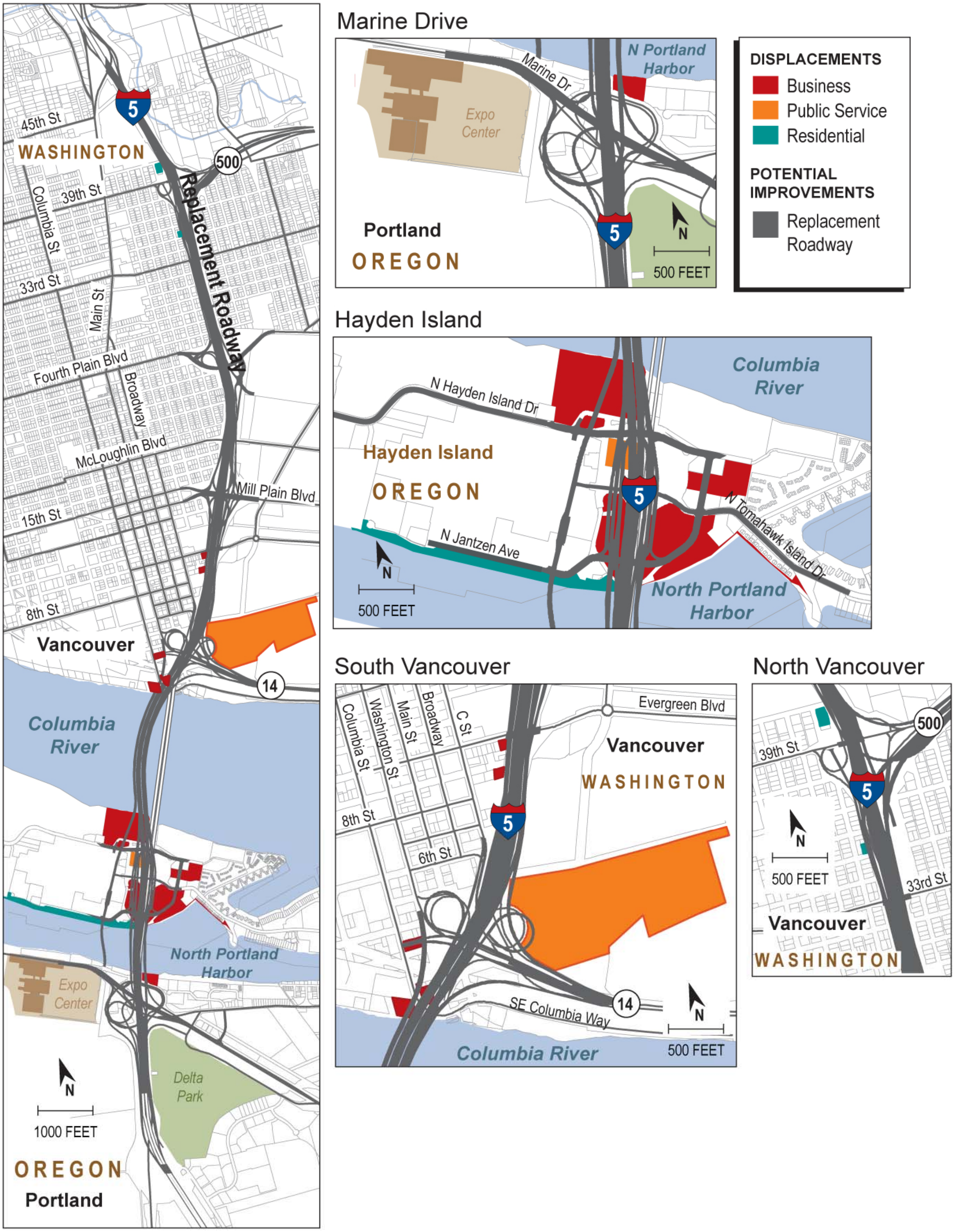
Supplemental River Crossing and Highway Improvements Acquisitions



DIMENSIONS ARE APPROXIMATE.

Exhibit 3.3-11

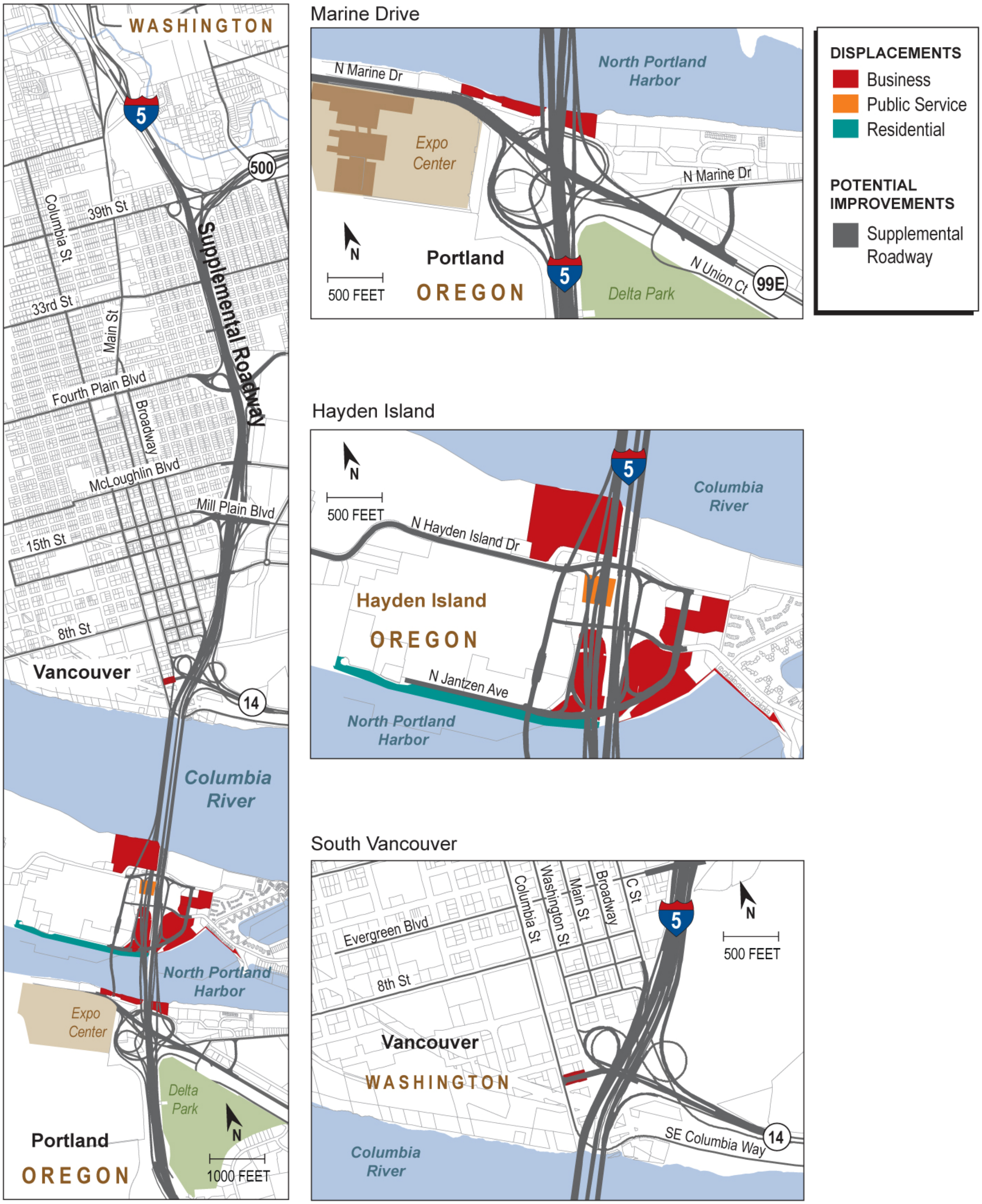
Displacements* Caused by Replacement Roadway



DIMENSIONS ARE APPROXIMATE.

*Entire parcels where displacements occur are highlighted.

Exhibit 3.3-12
Displacements* Caused by Supplemental Roadway



DIMENSIONS ARE APPROXIMATE.
*Entire parcels where displacements occur are highlighted.

Acquisition of TriMet land

All transit terminus options and both modes would require the acquisition of land already owned by TriMet at the Expo Center. These 0.4 to 1.1 acres of land are disclosed here, but not counted in total acreage requirements in this Draft EIS.

Acquisition of DOT Land

All transit terminus options would require portions of the parcel that houses the ODOT permit center, and the Lincoln terminus option and Mill Plain MOS would fully acquire the 3 acres WSDOT parking lot north of Kiggins Bowl. These acreage requirements are disclosed here, but not included in any acquisition totals, as the land is already owned by the Departments of Transportation.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

There are slight differences in property acquisitions from bus rapid transit versus light rail. At the Expo Center transit station, bus rapid transit would require 1.1 acres, as compared to 0.4 acre for light rail of TriMet owned property (see sidebar). Buses would require a turnaround area and passenger facility so riders could transfer between buses and light rail. Light rail would not require this additional transfer and turnaround area as fewer buses would be transferring passengers to this station.

Additionally, light rail would require greater acquisitions near the Mill Plain transit center than bus rapid transit, as it would cut diagonally through one, possibly two blocks. Bus rapid transit can largely stay within the existing right-of-way, and would avoid some of these impacts. With the Washington/Broadway couplet to two-way Broadway, light rail may result in the displacement of the US Bank Building at 16th and Main Streets. Bus rapid transit would avoid this impact, but would displace the Wells Fargo Bank building at McLoughlin Blvd and Main Street with all transit alignments, with the exception of the 16th Street transit alignment option.

Bus rapid transit would require expanding the C-TRAN bus maintenance facility in east Vancouver at 65th Avenue. This expansion would acquire five parcels and would displace one business and two residences on NE 18th Street directly south of the existing facility.

Likewise, light rail would require expansion of the existing TriMet Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. This expansion would fully acquire 14 parcels, and displacing up to seven potentially inhabited residences, and one vacant residence used for storage. The expansion would also displace up to seven businesses, including a mix of service and light industrial uses, and one potentially vacant factory. One partial acquisition would be acquired from a parcel for the construction of a cul-de-sac, but would not displace the use. Please see the TriMet Ruby Junction Maintenance Facility Technical Addendum for more information.

Either maintenance base expansion would also support other planned transit service improvements in the region. According to TriMet's maintenance facility expansion plans, the CRC project would account for approximately half of the Ruby Junction expansion. Though the entire footprint is necessary to develop the track connections for even a smaller expansion and to make the required changes in the roadway.

Transit Terminus Options (with all Alternatives)

The Kiggins Bowl (A), Lincoln (B), Clark College MOS (C), and Mill Plain MOS (D) terminus options could have the same alignment options from the Expo Center to the Mill Plain transit center in Vancouver. At this point, the Mill Plain MOS would terminate, while terminus option B would continue north through Uptown Vancouver and onto upper Main Street, and terminus options A and C would travel east across I-5. The Clark College MOS (C) would terminate immediately after crossing I-5 near Clark College, while the Kiggins Bowl terminus (A) would travel north along the eastern side of the highway. For more information regarding the details of the terminus options, please see Chapter 2, Description of Alternatives. Exhibit 3.3-13 compares the right-of-way requirements for all four terminus options. In order to graphically display this comparison, the same alignment options were assumed for each transit terminus.

The Lincoln terminus (B) would acquire approximately 2 to 3 more total acres than the Kiggins Bowl terminus (A), and would displace more residences and businesses. While terminus option B would require widening a relatively narrow street in a dense commercial area, terminus option A could take advantage of existing right-of-way near the interstate in a low-density residential area. Seven of the residential displacements associated with terminus option B are the result of the Lincoln Park and Ride, while the residential displacements associated with terminus option A all occur along the alignment. These acquisitions are graphically displayed on Exhibits 3.3-16 and 3.3-17. Exhibit 3.3-18 shows the locations of these impacts when they result in the displacement of a residence, business, or public service.

Compared to the full-length terminus options, both of the MOS options (C and D) would require 3 to 9 fewer acres of property acquisitions, as well as fewer residential and business displacements. The Mill Plain MOS (D) would still require property acquisitions and displacements associated with the Lincoln, Kiggins, and Clark College Park and Rides, as well as park and ride space near SR 14 and the Mill Plain transit center. The Clark College MOS (C), would still require acquisitions along 16th Street or McLoughlin Boulevard, as well as those for the Kiggins and Clark College Park and Rides. Due to the greater number of park and rides associated with the Mill Plain MOS (D), it would require two to three more acres than the slightly longer Clark College (C) terminus option.

PERMANENT AIRSPACE OR SUBSURFACE EASEMENTS

In addition to the acquisition of specific properties, the transit terminus options may require airspace or aerial guideway easements from properties being passed over, and subsurface or tunnel easements from properties being passed under. Permanent airspace rights from WSDOT may be required for the flyover associated with Kiggins Bowl terminus option. An aerial guideway easement would include the area immediately surrounding and beneath the elevated structure, while a tunnel easement would include the area immediately over and surrounding the tunnel. Depending on the depth of potential guideway tunnels, allowable land uses above the tunnel will vary.

Transit Alignment Options (with all Alternatives)

The transit-related acquisitions and displacements discussed on the following pages are graphically displayed in Exhibits 3.3-16, 3.3-17, and 3.3-18.

OFFSET OR ADJACENT

Starting from the Expo Center in Portland and continuing north to where the transit bridge touches down in Vancouver, the transit guideway could be placed either adjacent to the roadway or offset from it toward the

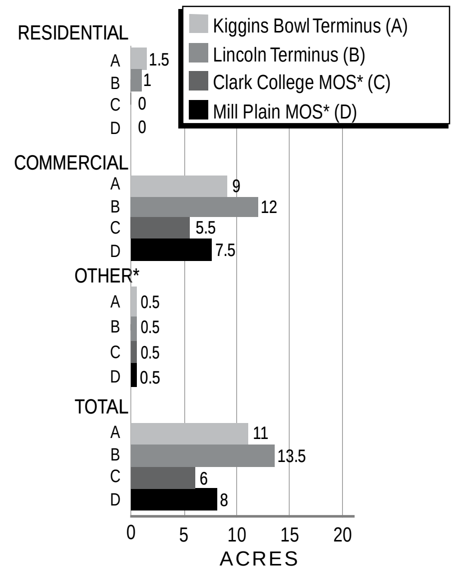
Exhibit 3.3-13
High-Capacity Transit Acquisitions and Displacements

Values are based on light rail transit with the following alignments:

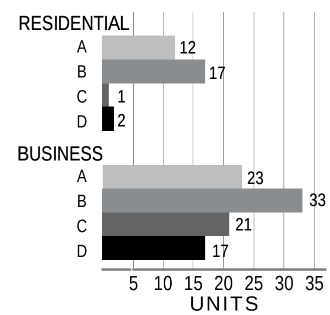
- Adjacent for Delta Park to South Vancouver,
- Two-way on Washington to the Mill Plain District, and
- Two-way on either McLoughlin or Broadway.

The Lincoln Terminus values assume a supplemental roadway. The Kiggins Bowl Terminus values assume a replacement roadway.

Property Acquisitions (Acres)



Displacements (Units)



MOS=Minimum Operable Segment

Source: CRC Acquisitions Technical Report and Economics Technical Report.

Note: Includes industrial and open space.

west. Exhibit 3.3-14 summarizes the acquisition impacts associated with the offset and adjacent alignment options.

Exhibit 3.3-14
Offset versus Adjacent: Summary of Transit Related Acquisitions

River crossing	Replacement		Supplemental	
Transit alignment option	**Offset**	**Adjacent**	**Offset**	**Adjacent**
Acres of Acquisition	3.7 to 4.2	2.5 to 3.0	2.9 to 3.7	2.2 to 3.0
Residential Displacements[a]	8	1	8	9
Business Displacements	4 to 5	13 to 14	4 to 5	4 to 5

Source: CRC Acquisitions Technical Report and Economics Technical Report.

[a] Includes displacement of floating homes.

Note: ranges reflect differences between BRT and LRT.

Most of the transit-related acquisitions from the offset or adjacent alignment options would occur on Hayden Island. South of Hayden Island, both of these alignment options would require less than 1 acre and could displace up to one single-family home around the Marine Drive interchange. North of Hayden Island, where transit touches down in Vancouver, approximately 0.2 to 0.5 acre and one business could be displaced.

Most, if not all of the businesses, displaced by the offset or adjacent transit alignments as shown in Exhibit 3.3-14, would also be displaced by the river crossings, as shown in Exhibit 3.3-15.

Exhibit 3.3-15
Business Displacements on Hayden Island from both the River Crossing and Transit Alignment Options

River crossing	Replacement		Supplemental	
Transit alignment option	**Offset**	**Adjacent**	**Offset**	**Adjacent**
Businesses displaced by transit	4	13	4	4
Those businesses also displaced by roadway	4	12	4	3
Displacements unique to transit	0	1	0	1

Source: CRC Acquisitions Technical Report and Economics Technical Report.

In addition to business displacements, floating homes in North Portland Harbor would also be displaced. The adjacent alignment would displace no additional floating homes when paired with the replacement crossing, but would add eight displacements when paired with the supplemental crossing. The offset alignment would displace seven floating homes when paired with either river crossing.

TWO-WAY WASHINGTON OR BROADWAY-WASHINGTON COUPLET

Neither the two-way Washington nor the Washington-Broadway couplet alignment option would require property in addition to the existing right-of-way through most of downtown Vancouver. North of Mill Plain Boulevard, three to seven parcels used for parking could be acquired where the guideway transitions to new streets. Additionally, one business may potentially be displaced in this area, depending on transit mode and guideway transition.

16TH STREET OR MCLOUGHLIN

These two alignment options apply to the Kiggins Bowl (A) and Clark College MOS (C) terminus options. The 16th Street alignment would result in the partial acquisition of the parcel on which the Clark County Historical Museum is located on 16th, but would not displace the use. The McLoughlin alignment could require partial acquisitions from approximately 33 parcels along McLoughlin, resulting in the displacement of two commercial buildings. Most of these acquisitions would be relatively minor; a narrow strip of property would be required from front yards to accommodate the widening of McLoughlin Boulevard.

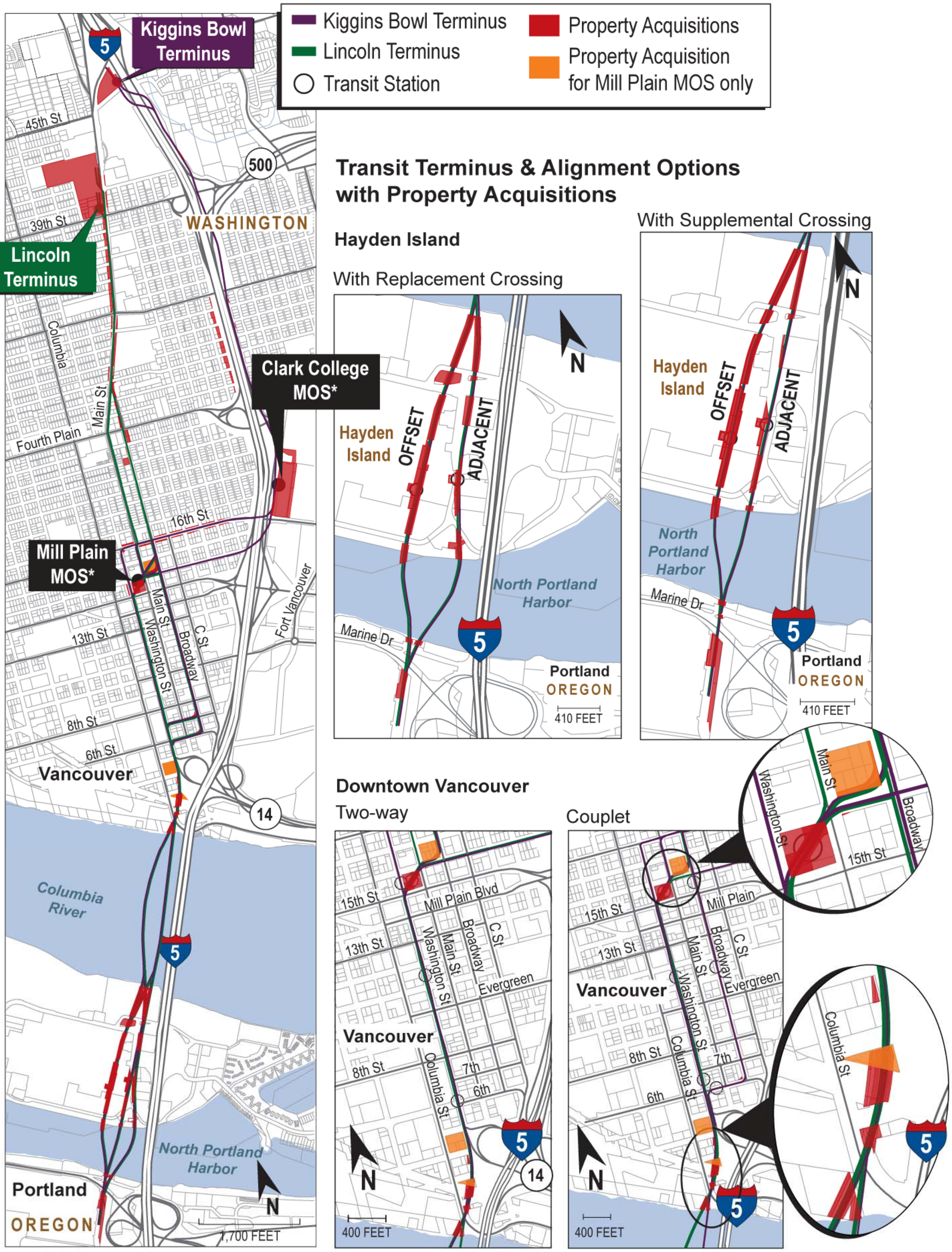
TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET

These two alignment options apply only to the Lincoln terminus option (B). The two-way Broadway alignment could result in the partial acquisition of four parcels that contain businesses between McLoughlin Boulevard and 29th, resulting in one displacement. This alignment option would require the full acquisition of two parcels on Broadway that contain businesses. The Broadway-Main couplet could result in partial acquisitions to approximately four parcels along Broadway Street that contain businesses, but would not result in any displacements. There would be no property acquisitions on Main Street associated with this alignment option.

Additionally, both of these alignment options could result in access impacts to businesses, although none has been identified as severe enough to require the full acquisition of the property. Those properties that have an access to parking or a driveway from Broadway or Main that could be eliminated or limited by alignment options have alternate access from alleys or side streets. For more detail regarding parking and access impacts see Section 3.1, Transportation.

Exhibit 3.3-16

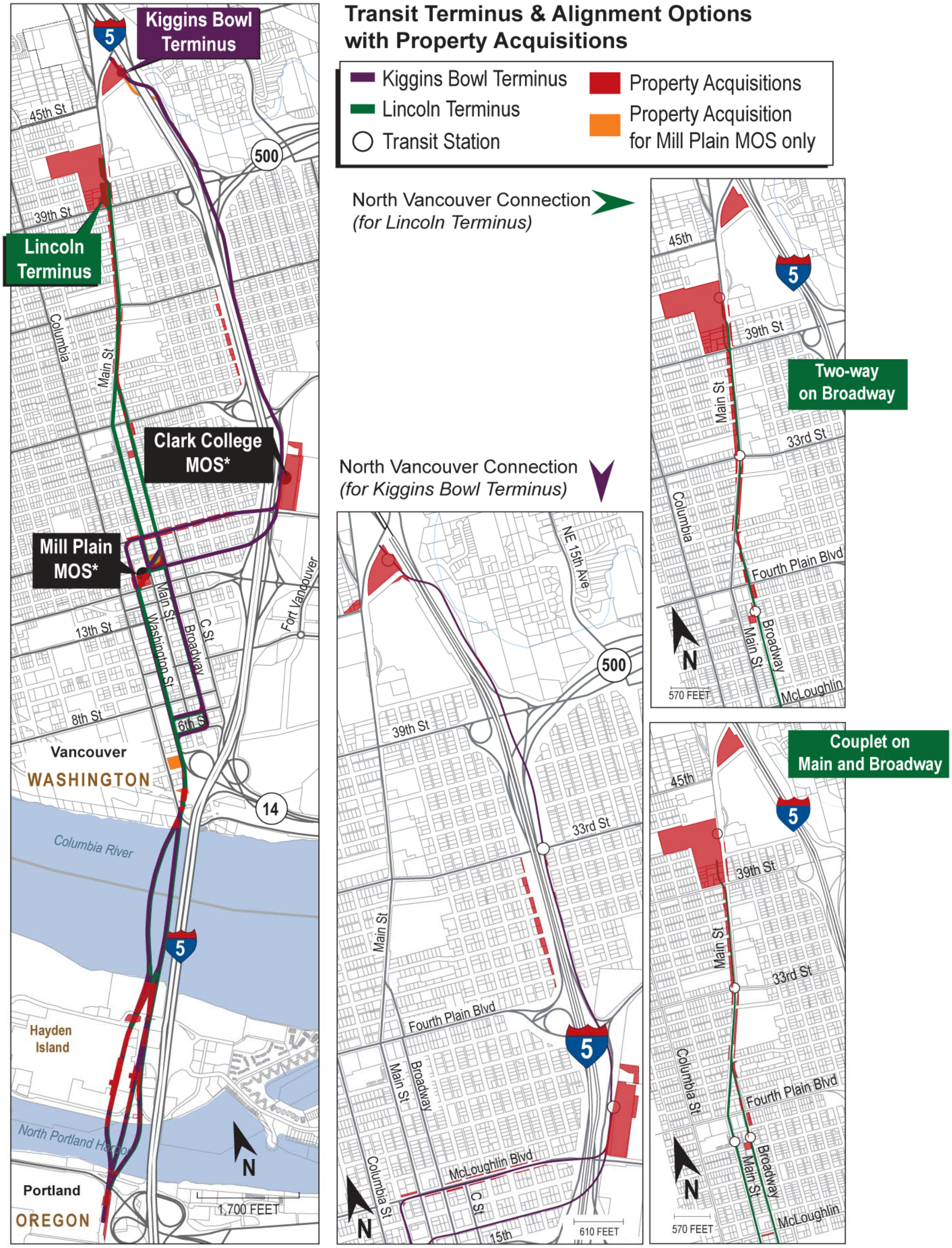
TRANSIT ACQUISITIONS: Expo Center to Downtown Vancouver



DIMENSIONS ARE APPROXIMATE.
*MOS=Minimum Operable Segment

Exhibit 3.3-17

TRANSIT ACQUISITIONS: North Vancouver Connections



DIMENSIONS ARE APPROXIMATE.

* Minimum Operable Segment

Exhibit 3.3-18

Displacements* Caused by Transit Terminus Options

DIMENSIONS ARE APPROXIMATE.
*Entire parcels where displacements occur are highlighted.

3.3.4 Temporary Effects

Temporary Property Easements

Construction easements would be required for the temporary staging of equipment and materials during construction. These easements are separate from the acquisitions and displacements reported elsewhere in this section because they are temporary uses. Property used during construction could be returned to its owner once construction is complete, or alternatively, if the site is accessible to transit, the land might instead be purchased at a fair market value and then developed with transit-oriented uses, such as retail, residential, or mixed use.

Staging or construction activity can often be accommodated in existing right-of-way, but an estimated 1.5 to 3 acres of temporary easements could be required near the proposed transportation improvements. Additional land may be permanently acquired for staging for transit construction and then later developed as described above. Preference would be given to locations that are vacant or could be obtained or leased from willing owners.

Along the transit alignment, it may be necessary to seek temporary construction easements or small permanent easements on adjacent properties to allow construction workers to enter the first several feet of a property while rebuilding the sidewalk in front of the property or to place specific elements such as an overhead catenary pole behind the sidewalk.

It is too early in the design process to know whether a large casting yard and staging site will be needed for the construction of the river crossing. However, if the pre-casting construction technique is used, desirable site characteristics are likely to include:

- A large (at least 15 acres) open site suitable for heavy machinery and casting of bridge segments,
- Waterfront property with access for barges to convey material to the construction zone, and
- Roadway or rail access for landside transportation of materials by truck or train.

The acquisition of a large casting yard and staging site could result in additional displacements, which would be appropriately mitigated at described in the Potential Mitigation discussion below.

Activities occurring on any of the potential casting and staging sites would be in accordance with federal, state, and local environmental regulation and land use code. Depending on the construction requirements of the project, the project may need to obtain variances for some or all of these local codes.

AIRSPACE RIGHTS AND SUBSURFACE EASEMENTS

As the construction plan is developed, the project will need to identify all locations where temporary airspace rights or easements or subsurface easements would be required. A temporary easement conveys certain property rights, but not ownership, to a parcel of real estate for a defined period of time. The temporary easement provides its holder with specified rights to use the easement area. Temporary airspace easements may be acquired for construction over locally-owed roads, the interstate, or the railroad, while subsurface easements may be required for utility relocation.

The project may need to obtain a temporary airspace easement from the Burlington Northern Santa Fe Railway (BNSF) for the construction of the project over the mainline. BNSF has requirements for access to and construction over its property. Project staff would need to work with BNSF to determine specific construction and safety requirements and access permits needed as the construction plan is developed. Additionally, an agreement between BNSF and the project may be developed before the FEIS that will identify any terms and conditions for construction.

Project staff would work with the cities of Portland and Vancouver land use, transportation, and development staff to determine specific permitting and easement requirements. These requirements are typically determined during the development review process in each city. Memoranda of understanding may be used by city, county, or state project participants to determine how issues related to easements, access, etc. would be handled.

3.3.5 Potential Mitigation Measures

During the design process to date, the CRC project has minimized the amount of new property required for the proposed improvements. Once a locally preferred alternative is chosen, the project would further refine designs and solicit public input in order to further avoid or minimize property acquisitions, where possible.

Most aspects of mitigation for property acquisition are addressed by federal and state statutes, which require that property be purchased at fair market value and that all residential displacements be provided with replacement housing or relocation assistance and business displacements be provided relocation assistance. Federal and state statutes, such as the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended) (see sidebar), determine the standards and procedures for providing such replacement housing and business relocation assistance. A Real Estate Management Plan, or a similar document, will be developed to provide consistent policy, direction, and guidance for management of real estate activities that need to occur as a result of any of the build alternatives.

Providing Relocation Assistance

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended) provides important protections and assistance for people affected by federally funded projects. It was enacted by Congress to ensure that people whose real property is acquired, or who have to move as a result of projects receiving federal funds, are treated fairly and equitably and receive assistance in moving from the property they occupy. The CRC project and all project partners will follow the requirements of this Act.

Residential relocation benefit packages are based on the characteristics of individual households and usually include replacement housing for owners and renters, moving costs, and assistance in locating replacement housing. Relocation benefits for businesses can include moving costs, site search expenses, and business reestablishment expenses. As with residential displacements, relocation packages are determined on an individual basis based on ownership or tenant status. In general, an attempt would be made to minimize relocation impacts to residences, businesses, and public facilities. Eligibility and terms of relocation assistance would be determined during future project planning.

The relocation of displaced residents, businesses, and public services could be encouraged to occur within the same neighborhood when possible. This could mitigate the impact to the residents and avoid the loss of resources to their communities.

The displacement of floating home s in the North Portland Harbor could be mitigated through relocation of displaced homes and residents in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended). Ideally, relocations would be near their original location, although this may not be possible. These relocations could potentially occur in the following ways:

- Purchase or build a marina and build new slips, although this would likely be difficult because of the potential impacts to ESA-protected fish species from a new facility or additional slips.
- Work with a marina/moorage to add slips, although this could run into the same difficulties as above.
- Purchase low-value floating homes and replace them with newer homes that are comparable to ones displaced.
- Purchase and remodel floating homes to bring them up to standards for relocating displaced home owners.
- Find comparable “upland” housing, which would often provide displaced floating home owners with a relocation option that results in additional property value.
- Begin search for relocation opportunities early, so as to maximize the possibility of finding suitable relocation options. This would require early permission to purchase property, and the allocation of funds to do so.

All of these relocation ideas are preliminary. ODOT is currently investigating new ways to perform the relocation of displaced floating homes, with the first step being the identification of new marina locations.

The US General Services Administration may be involved in any property acquisition related to the acquisition of federally-owned property, such as the property owned by FHWA Western Federal Lands. Additionally, the acquisition of property owned by the US Army, such as that near the SR-14 interchange, would require consultation with the Defense Base Closure and Realignment Commission (BRAC).

The displacement of publicly owned facilities, such as the ODOT permit center, FHWA Western Federal Lands building, or WSDOT maintenance facility could be mitigated by functionally replacing the property acquired with another facility that would provide equivalent utility.

This project would pay the fair market-value equivalent of rent for easements needed for the temporary use of land during construction. The project would strive to maintain reasonable access to all uses during construction, although temporary access impacts will likely be inevitable.

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3.4 Land Use and Economic Activity

This section evaluates the CRC project's potential effects on the region's ability to meet land use planning goals and to influence existing and future economic activity. The evaluation includes a detailed assessment of changes to land uses as well as consistency of these changes with adopted policies and regulations. Information in this section is based on data in the CRC Land Use Technical Report and Economics Technical Report.

Jurisdictions in the Portland-Vancouver metropolitan region traditionally integrate transportation and land use planning to encourage economic and community development around designated urban centers and transportation corridors. I-5 is the region's primary north-south traffic corridor, and there is substantial adjacent development, including the downtowns of both Portland and Vancouver. The CRC project segment of I-5 is expected to accommodate travel resulting from the region's anticipated growth and economic development. Any acceptable project alternative must directly accommodate trips arising from additional residents and jobs near this project, and must indirectly improve the ability of trucks that rely on I-5 to more efficiently deliver freight to and from the area's ports and industrial centers.

3.4.1 Existing Conditions

Transportation and land use plans have helped define how this region has grown. Oregon's Statewide Planning Goals and Washington's Growth Management Act agree on general principles of compact urban form, preservation of rural areas, use of urban growth boundaries, and multimodal transportation systems. Regional plans help local and regional governments to tailor these goals for the Portland-Vancouver area. Local plans provide further refinement of these goals and help governments to establish policies, such as zoning and other development regulations, to implement them.

The Portland-Vancouver region is located at the confluence of two navigable rivers, the Columbia and the Willamette, and is served by the Burlington Northern Santa Fe (BNSF) and Union Pacific transcontinental rail lines, Portland International Airport, and marine terminals at the ports of Portland and Vancouver. The region's economic competitiveness largely depends on its role as a gateway and distribution center for domestic and international markets. Freight moving through the two ports is expected to double from approximately 300 million tons in 2000 to almost than 600 million tons in 2035.[9] Access to port facilities is crucial because many of this region's industries depend on the movement of freight.

Existing Land Uses

The area in north Portland between Columbia Boulevard and the Columbia River consists mostly of commercial uses along with a few industrial uses. There are also parks and open space near the existing I-5 corridor. Some regionally important properties in this area include

[9] Metro, 2006.

Portland International Raceway, Portland Meadows, the Exposition (Expo) Center, and large wetlands. Currently the TriMet MAX light rail line ends at the Expo Center just south of the Columbia River and north of the Columbia Slough.

Exhibit 3.4-1
Existing Land Use on Hayden Island

Hayden Island, shown in Exhibit 3.4-1, has two distinct land use types. Much of the developed part of the island west of I-5 is devoted to the Jantzen Beach commercial district. East of I-5 and along the waterfront west of I-5 are residential uses that include condominiums, manufactured homes, and floating homes. Several restaurants, two gas stations, and the Red Lion Hotel surround the I-5 interchange. There is a large vacant parcel at the former Thunderbird Motel, immediately west of I-5.

Downtown Vancouver includes a central business district, residential areas, and the large Central Park neighborhood, which includes the Vancouver National Historic Reserve, a nationally important park. Land uses in the area are typical of an urban core, with retail, offices, industrial, governmental, and residential uses. The downtown Vancouver area serves as the governmental and cultural center of Clark County. Community facilities include a train station, the Vancouver National Historic Reserve, and various government offices. The I-5 corridor separates the west side—including the downtown area, commercial, residential, and office centers—from the eastside, which includes the Historic Reserve, Fort Vancouver, a large Veterans Administration complex, the Clark County Center for Community Health, and Clark College. This separation can be seen in Exhibit 3.4-2.

Exhibit 3.4-2
Existing Land Use in Vancouver (facing south)

The Uptown commercial district (between Mill Plain and Fourth Plain Boulevards on Main Street) is a small-scale commercial and residential area between downtown and the lower-density neighborhoods to the north. Primary uses are residential, with major transportation corridors such as Fourth Plain Boulevard and Main Street supporting vibrant commercial districts. South of Fourth Plain Boulevard, there are older neighborhoods with many vintage homes and a tight street grid. The east side of I-5 includes public facilities and institutions, multi-family housing, and some commercial uses. Further to the east and south of Fourth Plain Boulevard there is a traditional street grid with historic neighborhoods and small lots, single-family homes, and duplexes. North of Fourth Plain Boulevard in the Rose Village neighborhood there is a traditional street grid with small lots, single-family homes, and duplexes. North of SR 500, development becomes progressively more suburban, with larger lots, off-street parking lots, and few structures over one story in height.

Adopted Plans

State, regional, and local plans provide guidance on economic development, transportation systems, and urban form. These plans and their implementing regulations provide both general policy and specific standards for community and transportation planning and for transportation projects. The list below shows many of the laws, regulations, and plans that were reviewed for this analysis:

FEDERAL

- U.S. Department of Transportation, Federal Transit Administration (FTA). 2004. “New Starts Guidelines and Standards for Assessment of Transit Supportive Land Use.” Washington, D.C.
- Uniform Relocation Assistance and Real Property Acquisition Act. 42 USC 4601 et. seq., 49 CFR 24.
- Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. EO 12898; 59 CFR 7629, 62 CFR 18377, 60 CFR 33896.

STATE – WASHINGTON

- Revised Code of Washington (RCW). Growth Management Act (GMA), Chapter 36.70A.
- RCW. 1971. “Shoreline Management Act (SMA) of 1971.” RCW 90.58, Olympia, Washington.
- Washington State Transportation Commission, Washington State Department of Transportation. 2002. Washington Transportation Plan (WTP), 2005-2022. Olympia, Washington.
- Washington Administrative Code (WAC). 1998. State Environmental Policy Act (SEPA) WAC 197-11. Olympia, Washington.

STATE – OREGON

- Oregon Revised Statutes (ORS). 1973. ORS 660-15-0000 (1-15), Salem, Oregon.
- The Oregon Department of Transportation (ODOT), Transportation Development Division, Planning Section. 1999. Oregon Highway Plan (OHP). Salem, Oregon.

- Land Conservation and Development Commission (LCDC). Transportation Planning Rule (TPR). OAR Chapter 660, Division 12. As amended 2005.

LOCAL – WASHINGTON

- Southwest Washington Regional Transportation Council (RTC). 2003. Metropolitan Transportation Plan for Clark County. Vancouver, Washington.
- Clark County, Long Range Planning Division of the Community Development Department. 2004. Comprehensive Growth Management Plan. Vancouver, Washington.
- Clark County, Long Range Planning Division of the Community Development Department. 2004. Highway 99, Focused Public Investment Area Action Plan. Vancouver, Washington.
- City of Vancouver, Community Development Department. 2004. City of Vancouver Comprehensive Plan. Vancouver, Washington.
- City of Vancouver, Economic Development Department. 2004. Vancouver City Center Vision (VCCV) Plan. Vancouver, Washington.
- City of Vancouver, Transportation Services. 2004. City of Vancouver Transportation Plan. Vancouver, Washington.
- The Columbia Renaissance Trail Plan, as represented in The Clark County Trails and Bikeway System Plan. 1992.
- City of Vancouver, Community Planning. 2007. The Central Park Plan. Vancouver, Washington.
- City of Vancouver. Vancouver Municipal Code.

LOCAL – OREGON

- Metro. 1995. 2040 Growth Concept. Portland, Oregon.
- Metro. 2005. Regional Framework Plan. Portland, Oregon.
- Metro. 2004. Regional Transportation Plan (RTP). Portland, Oregon.
- Metro. 2005. Nature in Neighborhoods. Ordinance No. 05-1077C. Portland, Oregon.
- City of Portland, Bureau of Planning. 2004. Comprehensive Plan Goals and Policies. Portland, Oregon.
- City of Portland, Bureau of Planning. 2000. Central City Plan. Portland, Oregon.
- Albina Community Plan.
- Kenton Downtown Plan.
- Interstate Corridor Urban Renewal Area Plan.
- Natural Resource Management Plans (NRMPs) for the Portland International Raceway, East Columbia, Columbia Corridor, and Peninsula.
- City of Portland Code (CPC), Title 33 Planning and Zoning.

Site-specific master plans were reviewed for the Bonneville Power Administration, Vancouver Campus; Clark College; Columbia Gateway Subarea; Vancouver National Historic Reserve; and other locations.

Applicable Policies and Regulations

In 1973, the Oregon Legislature passed legislation requiring all cities and counties to adopt and implement comprehensive land use plans that comply with 19 Statewide Planning Goals. These goals range from the protection of natural resources to promotion of economic development to land use and transportation planning.

The State of Washington adopted the Growth Management Act in 1990. This act requires most local jurisdictions to define and implement a land use policy framework that emphasizes reducing inappropriate conversion of rural land to urban development. This law also requires designation of urban growth areas around cities and identification of areas for future urban expansion to help preserve rural land.

The Southwest Washington Regional Transportation Council (RTC) is the metropolitan planning organization for southwest Washington, and has regional authority over transportation only. Clark County determines population and employment growth forecasts, and sets urban growth areas.

Plan Consistency

The CRC project has been designed to address and support adopted land use and transportation plans. A few key plans are summarized here in the DEIS. The CRC Land Use Technical Report provides a comprehensive discussion of adopted local and regional plans that are relevant to the CRC alternatives.

LOCAL PLANNING

In Oregon, Metro is an elected regional government that serves as a Metropolitan Planning Organization with jurisdiction over both transportation and land use. The Metro 2040 Growth Concept outlines a vision for regional growth and development in the Portland metropolitan region. Policies in the 2040 Growth Concept encourage efficient use of land and protection of farmland and natural resources by focusing growth along transportation corridors and in urban centers.

Comprehensive plan designations in Portland are similar to existing land uses. North Portland neighborhoods adjacent to I-5 are a mix of residential zones, with higher densities and a few commercial areas along arterial roads. Most land between Columbia Boulevard and north Portland Harbor is either industrial or open space.

The City of Portland is currently developing a plan for Hayden Island that may include comprehensive plan and zoning designations, and a street plan. The planning process will influence specific elements of the CRC project, such as transit station design.

LOCAL PLANNING

The Vancouver comprehensive plan designations are similar to existing land uses. The waterfront immediately west of I-5 is designated City Center to accommodate planned development here. This designation extends north to 15th Street.

Commercial zoning along Broadway and Main Streets extends north past Fourth Plain Boulevard. East and west of these streets are primarily low-density residential land uses. East of I-5 is designated public facility and open space in recognition of the Vancouver National Historic Reserve, Pearson Airfield, and Clark College. North of Fourth Plain Boulevard to

SR 500, the east side of I-5 has low-density residential development, with duplexes and commercial uses along arterial corridors.

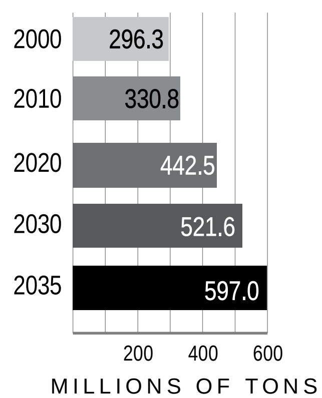
The Vancouver City Center Vision includes a list of goals and guiding principles for downtown Vancouver. Land use goals include focusing waterfront redevelopment on residential uses, with public access, recreation, cultural, hospitality, entertainment, and limited commercial uses. Specific goals include:

- Strengthen the primary street connections to the waterfront.
- Support a secondary connection to the waterfront.
- Connect downtown with the Vancouver National Historic Reserve via a Seventh Street pedestrian bridge.
- Ensure that expansion of I-5 and CRC improvements improve access to the city center and minimize potentially negative effects.
- Reduce the disruption between downtown and the waterfront created by the physical barrier of the BNSF railroad berm.
- Provide improved access into the southern and western areas of the city center.

Vancouver has adopted the Downtown Vancouver Transportation System Plan, which addresses transportation conditions and plans between Fourth Plain Boulevard and the Columbia River. This plan states: “The extension of MAX service into Vancouver is a key ingredient to the region’s growth management strategy and the overall I-5 corridor plan. Light rail in Vancouver would directly benefit the downtown area by improving access to downtown Vancouver, particularly during the peak commuter hours.”

Exhibit 3.4-3

Ports of Portland/Vancouver projected commodity growth (millions of tons)



Source: Metro, 2006.

Economic Conditions

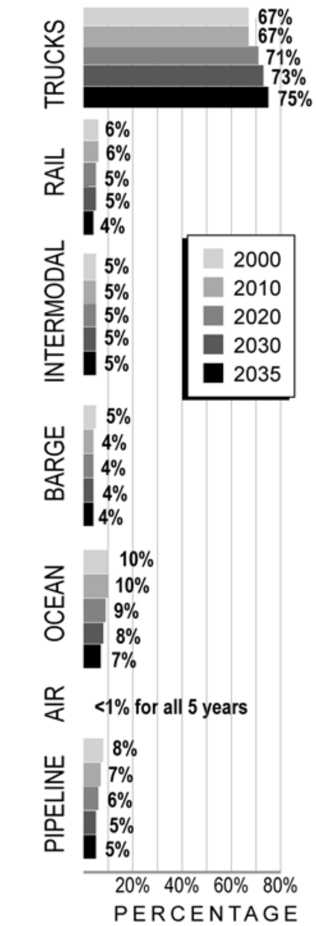
The ports of Portland and Vancouver are critical to the economic growth and prosperity of this region. For these ports to remain competitive with other West Coast ports, efficient and cost-effective multimodal transportation systems must be available. Reducing freight travel times by investing in transportation infrastructure improvements that increase access and decrease congestion will help maintain the region’s competitiveness. The total annual tonnage moving through these two ports is expected to double between 2000 to 2035 (see Exhibit 3.4-3). Furthermore, trucks are predicted to play an increasingly large role in transporting freight. Increased demand for truck-hauled freight will create a corresponding growth in demand on the Interstate system, as shown in Exhibit 3.4-4.

The Portland-Vancouver region is more susceptible to long-term economic losses from congestion than other areas because its economy is relatively dependent on manufacturing, transportation/port distribution, and services that serve broader regional, national and global markets. Transportation-related firms bring new money into the region by selling their products and services nationally and internationally. These firms could locate elsewhere, but choose the Portland-Vancouver region for its attractiveness and competitiveness for their operations. An inadequate transportation system could negatively impact this region's economic competitiveness.

Both the City of Portland and the City of Vancouver rely heavily on tax revenues to fund general services. Property taxes are the largest single source of revenue for both cities, accounting for 36 percent of Portland's annual tax revenue and 31 percent of Vancouver's. Total tax revenue accounts for 40 percent of Portland's overall revenue and 78 percent of Vancouver's. This dramatic difference in percentage is largely because Vancouver receives sales tax revenues, while Oregon does not have a sales tax. The Economics Technical Report provides a detailed breakdown of revenue sources for each city.

Exhibit 3.4-4

Ports of Portland-Vancouver commodity flow forecast by mode



Source: Metro, 2006.

3.4.2 Long-Term Effects from Project Alternatives

The CRC project team analyzed land use and economic effects in five broad categories:

- Direct land use effects from property acquisitions
- Direct economic effects from displacing businesses, parking, or access points to these businesses, and the resulting loss of employment and revenue generation, and loss of tax revenue to local jurisdictions
- Regional economic impacts resulting from changes in transportation performance and access to businesses and freight movement
- Consistency with land use plans and implementing regulations
- Potential for induced growth and development that could arise from two separate elements of this project—induced development pressure at the urban periphery (sprawl) resulting from added highway capacity, and growth from economic investment around high-capacity transit stations (transit-oriented development).

The impacts of each alternative are summarized in Exhibits 3.4-5 through 3.4-8 and in the following discussions. This is followed by a discussion of the impacts from the individual components and options that make up the alternatives.

Alternative 1: No-Build

The No-Build Alternative would not have direct impacts to land use or commercial property, but would increase existing transportation problems that inhibit economic growth. This alternative would impact regional freight movement because it would allow transportation on I-5 to deteriorate well beyond current conditions. For example, daily congestion at the I-5 river crossing would grow from 6 hours per day to 15 hours per day by 2030. This congestion would greatly reduce travel time reliability and spread into the middle of the day when trucks most often travel. Furthermore, this congestion could hinder access to businesses for employees and even retail trips in some areas. These transportation effects of the No-Build Alternative would indirectly limit economic development, urban development in downtown Vancouver and the planned development on Hayden Island

Alternative 2: Replacement Crossing with Bus Rapid Transit

Replacing the existing bridges with a safer, larger capacity river crossing and adding bus rapid transit (BRT) would provide substantial benefits for the local and regional economy and assist jurisdictions in reaching land use goals. However, these improvements would also require property acquisitions that could have localized effects on the economy and, to a lesser extent, land use goals.

Exhibit 3.4-5

Land Use and Economic Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Direct Land Use Impacts (related to acquisitions)	Minor	Moderate	Minor	Minor
Direct Commercial Impacts (related to acquisitions)	Moderate	High	Moderate	Moderate
Regional Economy	Highly beneficial	Highly beneficial	Highly beneficial	Highly beneficial
Plan Consistency	Moderate consistency	Moderate consistency	Moderate consistency	Moderate consistency
Increased TOD Potential	Low	Moderate	Low	Low

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

This alternative would require property acquisition for additional right-of-way, but this would have little effect on the broader scale of local or regional land use planning. Business displacements would have a moderate to high impact on Hayden Island and potentially on North Main Street in Vancouver. However, there is likely to be only a minor effect on local or regional economic conditions, such as property tax revenue generation for the Cities of Portland and Vancouver.

A replacement river crossing would result in improved economic development conditions for businesses in Portland and Vancouver by reducing congestion (to about 5 hours per day, versus 15 hours with the No-Build Alternative) and improving access and safety. This would support economic growth by improving travel times and travel reliability for freight, commuters, and other vehicles traveling between Portland and Vancouver.

Adding high-capacity bus rapid transit through Vancouver would help concentrate growth along the transit corridor and advance local and regional land use goals. This growth would in turn stimulate economic investment around transit stations.

Alternative 3: Replacement Crossing with Light Rail

This alternative would long-term effects similar to those under Alternative 2, except that light rail (LRT) could attract more redevelopment around transit stations. This could result in greater advancement of local and regional land use goals to concentrate growth along transit corridors, and potentially greater economic investment around station areas.

Exhibit 3.4-6
Land Use and Economic Effects Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Direct Land Use Impacts (related to acquisitions)	Minor	Moderate	Minor	Minor
Direct Commercial Impacts (related to acquisitions)	Moderate	High	Moderate	Moderate
Regional Economy	Highly beneficial	Highly beneficial	Highly beneficial	Highly beneficial
Plan Consistency	High consistency	High consistency	High consistency	High consistency
Increased TOD Potential	Moderate	High	Moderate	Moderate

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

This alternative would provide benefits similar to those provided under Alternative 2 by introducing bus rapid transit through Vancouver; however, it would provide less overall highway improvement and congestion relief.

A supplemental crossing would offer better I-5 traffic performance than the No-Build Alternative, but less improvement than the replacement river crossing (nearly 11 hours of congestion by 2030, versus 5 hours for a replacement crossing). This congestion relief would benefit businesses, employers, and industrial centers that rely on the I-5 corridor.

Exhibit 3.4-7
Land Use and Economic Effects Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Direct Land Use Impacts (related to acquisitions)	Minor	Moderate	Minor	Minor
Direct Commercial Impacts (related to acquisitions)	Moderate	High	Moderate	Moderate
Regional Economy	Moderately beneficial	Moderately beneficial	Moderately beneficial	Moderately beneficial
Plan Consistency	Low consistency	Low consistency	Low consistency	Low consistency
Increased TOD Potential	Low	Moderate	Low	Low

A supplemental crossing would require displacement of fewer businesses than a replacement crossing, as described in Section 3.3 of this DEIS, Property Acquisitions. This would result in slightly lower loss of property tax revenue for the Cities of Portland and Vancouver.

With Alternative 4 there is less emphasis on highway improvements and more emphasis on transit improvements. However, this alternative would result in minimal increase in transit ridership over Alternatives 2 or 3, as discussed in Section 3.1, Transportation. This alternative would also have BRT-related land use benefits through Vancouver similar to those described above for Alternative 2.

Alternative 5: Supplemental Crossing with Light Rail

This alternative would have long-term effects similar to those under Alternative 4, except that light rail could attract more redevelopment around stations. This could result in greater advancement of local and regional land use goals for concentrating growth around transit, and potentially greater economic investment in these station areas.

Exhibit 3.4-8
Land Use and Economic Effects Summary for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Direct Land Use Impacts (related to acquisitions)	Minor	Moderate	Minor	Minor
Direct Commercial Impacts (related to acquisitions)	Moderate	High	Moderate	Moderate
Regional Economy	Moderately beneficial	Moderately beneficial	Moderately beneficial	Moderately beneficial
Plan Consistency	Moderate consistency	Moderate consistency	Moderate consistency	Moderate consistency
Increased TOD Potential	Moderate	High	Moderate	Moderate

3.4.3 Long-Term Effects from Project Components

This section describes the effects of the project components that make up the alternatives described above. Some components, such as transit operations, the stacked transit/highway bridge design, and TDM/TSM measures, would have few impacts on land use or economics effects, and are therefore not discussed in this section.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

DIRECT EFFECTS ON LAND USE AND COMMERCIAL PROPERTY

Both the supplemental and replacement river crossings would require property acquisition for additional right-of-way. The supplemental crossing would require acquisition of less property because it has a narrower footprint. The replacement crossing would incur a slightly greater loss of property tax revenue for the Cities of Portland and Vancouver. Exhibit 3.4-9 summarizes the business impacts of the replacement and supplemental crossings.

Exhibit 3.4-9
Potential River Crossing and Highway Business Impacts

	Replacement Crossing	Supplemental Crossing
Businesses displaced or relocated	Up to 41	Up to 34
Employees in businesses displaced or relocated	Up to 565	Up to 481
Annual sales of displaced/relocated businesses	Up to $112 million	Up to $68 million
Direct property tax impact[a]	$240,000	$215,000
Parking spaces removed	40-80 spaces	40-80 spaces

Source: CRC Economics Technical Report.

[a] Annual loss in tax revenues (based in 2006 dollars) from displaced business.

Hayden Island is the only area where property acquisitions could potentially result in a change in planned land uses. A privately initiated redevelopment plan for the Jantzen Beach shopping center envisions a “Main Street” feel and a greater mix of uses. Changes in the highway alignment and addition of a transit guideway could potentially alter development trends on the island. The City of Portland is currently in the process of drafting a plan for how Hayden Island should develop in the future; this planning process recognizes the CRC project as an integral part of future development on Hayden Island.

TRANSPORTATION EFFECTS ON THE ECONOMY

Both replacement and supplemental river crossings would result in improvements to economic development conditions for businesses in Portland and Vancouver by reducing congestion and improving access, safety, and travel time reliability. These improvements would support economic growth by increasing the efficiency of truck-hauled freight in the region and improving access for commuters and other travelers traveling between Portland and Vancouver.

A replacement crossing would offer superior traffic performance on I-5 compared to a supplemental river crossing and No-Build Alternative, as summarized in Exhibit 3.4-10 and described in detail in Section 3.1, Transportation. This congestion relief would substantially benefit businesses, employers, and industrial centers that rely on the I-5 corridor.

Exhibit 3.4-10
Highway Transportation Performance

	Existing	No-Build	Replacement	Supplemental
Peak-period person trips	49,000	55,000	75,000	66,000
Duration of congestion	6 hours	15 hours	3.5–5.5 hours	11 hours

Source: CRC Traffic Technical Report.

The following discussions highlight the long-term economic effects of the transportation improvements included in the replacement and supplemental river crossings on key areas of concern.

Downtown Portland and downtown Vancouver: The replacement crossing offers modest travel time improvements and greatly improved travel reliability between downtown areas, due to the elimination of bridge lifts and the reduced potential for traffic accidents that cause unexpected congestion. Improved access to these central business districts would reinforce the economic growth and development that is already occurring in both districts. Under the replacement crossing, vehicles traveling northbound along I-5 from I-84 to 179th Street during the afternoon/evening peak would experience a travel time decrease of 18 minutes, or 40 percent, compared to No-Build conditions. Under the supplemental crossing, northbound travel times would improve for motorists using the through lanes (western bridge) by about 15 minutes, or 34 percent, compared to No-Build conditions. However, due to the seven hours of congestion expected to occur due to over-capacity conditions on the eastern bridge, northbound vehicles using the eastern bridge (those entering the highway from Marine Drive or Hayden Island, and those exiting the highway to SR 14, City Center, Mill Plain Boulevard, and Fourth Plain Boulevard) would experience substantial delays.

How would highway capacity affect job distribution?

Modeling conducted in 2002 as part of the I-5 Strategic Plan evaluated I-5 capacity improvements similar to those proposed by CRC. That analysis projected that, compared to No-Build, increased I-5 crossing capacity would shift about one percent of the region's employment to the I-5 corridor by the year 2020.

Regional economy: The I-5 corridor is the backbone of a network of roads that provide access to the greater Vancouver and Portland region. The Oregon Commodity Flow Forecast[10] projects an 81 percent increase in tonnage moving to, from, and through the state by 2030. Trade capacity studies further concluded that while all modes are important, the roadway system links all of the others and links land uses critical to business. Roadway congestion increases the cost of doing business for those activities that are transportation-dependent.

Five industries in the Portland-Vancouver region are particularly sensitive to road congestion: lumber/wood/paper, distribution/wholesale trade, transportation equipment/steel, farm and food products, and high-tech. These industries account for approximately 70 percent of the commodity tonnage crossing the I-5 and I-205 bridges and for 31 percent of Oregon and Washington's gross regional output in 2000. These industries would benefit greatly from the improvements offered by the build alternatives. Both crossing alternatives would reduce future southbound congestion to less than four hours each day. The replacement crossing would reduce northbound congestion to less than two hours per day. Reconfiguration of the existing bridges under the supplemental crossing, requiring a split in northbound I-5, would result in seven hours of daily congestion, one hour less than under No-Build conditions.

Ports: Maintaining and enhancing the efficiency of the highway system would allow the ports of Portland and Vancouver to stay competitive with other West Coast ports. This is especially true because of anticipated growth in the movement of truck-hauled freight to and from marine and aviation ports. The replacement crossing would require fewer piers, creating less of an obstacle to river navigation than either the existing or the supplemental crossing. Taller ships would not be restricted by the hours of lift-span operation, and would not have to navigate a difficult path around the lift-span. A replacement crossing

[10] Global Insight et al., 2006.

would be slightly closer to the downstream railroad bridge, which could potentially make navigation past the two bridges more difficult. However, the new primary channel under the replacement crossing would be better aligned with the channel through the railroad bridge than currently. This should improve navigation, even with the two bridges slightly closer together.

The supplemental crossing would result in more adverse effects to navigation than either the No-Build Alternative or the replacement crossing. Lift-span restrictions from the existing bridges would continue to cause delays to river traffic. The continuing need to navigate around the lift span, and the relatively narrow width between existing bridge piers, would continue to represent a potential hazard to navigation. Moreover, this width could potentially be decreased even more because of the seismic reinforcement planned for the existing bridge piers. In addition to the effects from retaining the existing structures, a supplemental crossing would require a new structure between the existing I-5 bridges and the downstream railroad bridge. By providing a shorter distance to navigate between the two bridges, this has the potential to increase the hazard to navigation, particularly when vessels have to navigate around the I-5 lift-span.

The river crossing component also affects river navigation and the movement of marine-hauled freight. Nearly 10 million tons of freight in over 9,500 shipments passed under the I-5 crossing in 2005.[11] River navigation between the I-5 crossing and the BNSF railroad bridge would be improved by a replacement crossing, but worsened by a supplemental crossing, as discussed in Section 3.2 of this DEIS.

Regional competitiveness: Transportation infrastructure is one of many factors that affect the relative attractiveness of doing business in this region. The build alternatives would improve transportation and increase the competitiveness of the region. The amount of this improvement depends on the extent to which this region adopts policies to capitalize on the benefits of this project.

Trucking industry: Congestion at the I-5 crossing is predicted to increase the cost of delay to trucks by 140 percent, from $14 million in 2000 to $34 million in 2020.[12] By reducing congestion, the build alternatives would benefit the trucking industry by reducing labor and fuel costs, improving safety, and reducing scheduling uncertainty.

PLAN CONSISTENCY

The CRC project would generally support Oregon's Statewide Planning Goals and Washington's Growth Management Act policies pertaining to transportation and infrastructure improvements. The project would be integrated with a variety of planned transportation facilities. Both the replacement and supplemental river crossings would be consistent with goals for providing infrastructure to urban areas. Improving infrastructure in the urban core would also support regional plans adopted by the Southwest Washington RTC, Clark County, and Metro.

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[11] U.S. Army Cops of Engineers, 2005.

[12] Cambridge Systematics et al., 2003.

Overall, the CRC project would comply with the direction of the Vancouver Comprehensive Plan to provide City Center infrastructure and a range of transportation facilities that would accommodate transit, bicycles, and pedestrians. The project would meet the Comprehensive Plan goals for improved access to I-5 and for improved connections to the Vancouver National Historic Reserve and waterfront areas.

Both Oregon and Washington highway plans state objectives for mobility, congestion relief, and freight movement. Both river crossings would support these objectives, although the replacement crossing would be more supportive as it would result in greater congestion improvements.

The higher clearance of the replacement crossing would open more space along the waterfront for the park that currently passes under the relatively low clearance of the existing I-5 crossing (Exhibit 3.4-11). A replacement crossing would also allow Vancouver to extend Main Street to Columbia Way, which supports the City's vision of providing greater connectivity to the waterfront. A supplemental crossing would not allow this, and the lack of this connectivity could hinder planned development in lower downtown Vancouver. This connectivity under the replacement option would also be beneficial for the waterfront Renaissance project, which is required to integrate with the downtown. The City of Vancouver considers the Main Street connection to be critical to achieving Vancouver City Center Vision goals.

Exhibit 3.4-11
Existing Low Clearance at Waterfront Park

The supplemental crossing would result in closure of the intersection of Sixth and Washington Streets. This closure could negatively affect the economic vitality of several businesses by reducing east-west circulation in lower downtown Vancouver.

The supplemental river crossing could make it more difficult for the City of Vancouver to provide a planned physical connection, such as a pedestrian pathway, between downtown and the Vancouver National Historic Reserve. The supplemental crossing calls for increasing the height of the southbound portion of I-5 through downtown Vancouver, thus requiring any physical connection to be elevated approximately 15 feet higher than under existing conditions or with a replacement river crossing. This additional height would increase the cost, complexity, and size of a connection between downtown Vancouver and the Vancouver National Historic Reserve.

INDUCED GROWTH

Highway improvements could induce development by improving travel times and making areas at the urban periphery more attractive to developers. Additional highway capacity could increase pressure on local jurisdictions to allow higher intensity land uses outside urban centers, encouraging employment and residential development to locate further from the urban core. This induced growth is typically not desirable, as it often conflicts with local and regional planning goals and can lead to deterioration of existing economic and cultural centers such as downtown areas.

How is potentially induced growth managed?

State and local plans and regulations manage growth in the Portland/Vancouver area. Local decision making regarding growth rates, zoning, and development intensities are developed to direct growth, even that which may be partially "induced" as a project specific effect.

There is concern that increased capacity and decreased travel times on I-5 could result in housing and commercial development pressure to expand urban growth boundaries in Clark County. Some indirect effects on job and population distribution are likely with the CRC project, but these are likely quite small. A comprehensive literature review and comparative analysis of case studies indicate that adding highway capacity within a well-planned urban area with a full range of infrastructure and urban services is unlikely to have substantial indirect effects on land use patterns. Previous modeling of I-5 highway and high-capacity transit improvements similar to those included in the CRC build alternatives suggests that induced effects on jobs and housing distribution would not be substantial and would generally be consistent with local and regional land use plans.[13]

While adding highway capacity at the river crossing would reduce congestion and increase potential throughput, other aspects of the project—such as tolling the crossing and adding a new high-capacity transit connection between urban centers—would reduce auto trips. Overall, the CRC improvements are expected to support local and regional goals for providing efficient transportation, encouraging alternative transportation, supporting urban centers, and concentrating growth in the urban core. Jurisdictions would be able to continue to effectively manage growth through adopted plans and implementing regulations. Prior to completion of the Final EIS, the project team will review access and land use controls near proposed interchanges to ensure that the transportation investments would be adequately protected from unintended or unplanned development.

MARINE DRIVE INTERCHANGE DESIGNS

In addition to the standard design assessed with the full alternatives, there are two interchange options for Marine Drive, called the Southern and the Diagonal Marine Drive Realignments. Both realignments would directly impact buildings to the north and west of the Expo Center, and could indirectly impact freight movement through traffic changes.

Realigning Marine Drive south of the Expo Center would require acquisition of two existing buildings, located at the SW corner of Marine Drive and Force Avenue. Exhibit 3.4-12 shows the property tax, gross sales, and number of employees impacts that would result from these potential acquisitions.

Realigning Marine Drive south of the Expo Center would also greatly reduce sight and stopping distances, requiring trucks to slow to below the existing 45 mph speed limit. However, this southern realignment of Marine Drive would push the interchange farther south, increasing the spacing between the Hayden Island interchange and allowing space for vehicles to merge onto and leave the highway. This extra distance is particularly important for trucks. The southern realignment would also displace parking for the Expo Center.

The diagonal realignment of Marine Drive would divide the Expo Center Complex by removing about 3 acres of land on the north side of the complex. The northern building of the Expo Center would be removed to provide right-of-way for Marine Drive. The diagonal realignment of Marine Drive would slightly decrease sight and spotting distances, but

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[13] Regional Land Use Assessment Committee, 2001.

much less so than the southern realignment. The diagonal realignment would also require displacement of parking for the Expo Center.

Exhibit 3.4-12
Potential Acquisitions Associated with Marine Drive Interchange Designs

	Southern Design	Diagonal Design
Businesses displaced or relocated	1	1
Employees in businesses displaced or relocated	Up to 5	Up to 80
Annual sales of displaced/relocated businesses	Up to 2.4 million	Up to $12.4 million
Direct property tax impact[a]	$322,000	0[b]

Source: CRC Economics Technical Report.

[a] Annual loss in tax revenues (in 2006 dollars) from displaced business.

[b] This design impacts the corner of an Expo Center building. It would not require a full displacement. While there is no property tax paid by the Expo Center, The City of Portland Assessor's data shows a market value of nearly $50 million, and $769,000 in annual taxes on its sales.

TRANSIT MODE (BRT WITH ALTERNATIVES 2 AND 4; LRT WITH ALTERNATIVES 3 AND 5)

Direct Effects on Land Use and Commercial Property

The direct impacts of the proposed transit systems are discussed more fully in following sections. The difference in long-term impacts between these transit modes is their required maintenance facilities.

Choosing the light rail transit option would require an expansion of the existing Ruby Junction light rail maintenance facility expansion, including full acquisition of 14 parcels in the vicinity of NW Eleven Mile Lane in Gresham. These parcels are zoned for heavy industrial, but currently support residential, commercial, and light industrial uses. In many cases there seem to be multiple uses occurring on a single lot. Expansion of the Ruby Junction facility would be more consistent with Heavy Industrial zoning than with the current mix of single-family residence (SFR), small service business, and industrial uses. This expansion would displace six businesses that, together, employ an estimated 60 people and have estimated annual sales of approximately $17.4 million (see Exhibit 3.4-13).

In contrast, choosing bus rapid transit would require expansion of only one maintenance facility, the AOM facility at 18th Street and 65th Avenue in Vancouver. The area now includes a business, and two residences. One business would be displaced; this business has 5 employees and just over $1 million in annual sales.

Exhibit 3.4-13
Maintenance Base Business Displacements

	No. Businesses Impacted	No. Employees Impacted	Affected Sales (Millions)
Maintenance Base Option			
LRT Maintenance Base Option (Expansion of Ruby Junction Facility)	6	60	$17.4
BRT Maintenance Base Option (Expansion of AOM Facility)	1	5	$1.2

Source: InfoUSA, 2007, CRC Right-of-Way Acquisitions Dataset.

TRANSIT EFFECTS ON THE ECONOMY

Bus rapid transit or light rail would improve transit accessibility and travel time reliability, and would potentially broaden the pool of labor available to firms within the region. The following would be economically improved by either transit mode.

Downtown Portland and downtown Vancouver: Both high-capacity transit modes would offer improved access between these two downtown areas. Light rail would be especially beneficial because it would allow for no-transfer transit trips between downtown Vancouver and downtown Portland; bus rapid transit would require a transfer at the Expo Center station. Improved access to these downtown areas would reinforce the economic growth and development that is already occurring in both.

Regional economy: Transportation system improvements could reduce household out of pocket costs for personal travel, thereby increasing disposable personal income. The result would be an increase in living standards and consumer spending, which could then support additional retail and consumer business activity. High capacity transit could also increase the employment and incomes of local residents by increasing their access to outside business locations.

Regional competitiveness: Transportation infrastructure is one of many factors that affect the relative attractiveness of doing business in this region. The amount of improvement to regional competitiveness depends on the extent to which this region adopts policies to capitalize on the benefits of this project, including access management, congestion pricing, and others. Currently, this region has many policies and existing infrastructure in place to encourage transit usage. Adding bus rapid transit or light rail to the CRC project area would capitalize on this.

Local Businesses: High Capacity Transit service and its accompanying transit stations have the potential to significantly benefit nearby businesses. The increase in access for both customers and employees is a direct benefit. Factors related thereto are discussed in the following sections on induced growth and transit oriented development. The improved access, especially near transit stations, will bring many more potential customers within walking distance of commercial nodes serving to offset losses in customer parking. This will provide a benefit to existing businesses as well as increase opportunities for new business.

Furthermore, the investments in transit stations, which often include public art, high quality design, and new landscaping, will represent an investment in a specific area. These public investments typically lead to higher levels of private investment and subsequently increased vitality in commercial nodes.

PLAN CONSISTENCY

Either transit mode would generally support Oregon Statewide Planning Goals and Washington Growth Management Act policies pertaining to transportation and infrastructure improvements. Both modes would be consistent with goals for providing infrastructure to urban areas and for directing high-density growth to urbanized locations. Improving infrastructure in the urban core and extending high-capacity transit would also support regional plans adopted by the Southwest Washington RTC, Clark County, and Metro.

Adding bus rapid transit or light rail through Vancouver would comply with the direction of the Vancouver Comprehensive Plan to provide city center infrastructure and a range of transportation facilities that would accommodate transit, bicycles, and pedestrians. Comprehensive Plan goals include the introduction of high-capacity transit to Vancouver.

The Portland Comprehensive Plan, the Vancouver City Center Vision, and Vancouver Downtown Transportation System Plan call for expanding the existing light rail system to serve Hayden Island and Vancouver, making bus rapid transit potentially inconsistent with these plans.

INDUCED GROWTH

More information on the methodology for assessing transit-oriented development potential is provided in the CRC Land Use Technical Report.

Transit, particularly high-capacity transit, can be a catalyst for development around transit stations. Often referred to as transit-oriented development (TOD), this is generally pedestrian-oriented and higher-density development that further supports the nearby transit service. This type of development is sought after by jurisdictions because it reduces demand for additional roadway capacity and advances local and regional planning goals by focusing development along transportation corridors.

The likelihood and magnitude of economic investment in transit-oriented development depends on many factors beyond the existence of transit stations. These factors include the characteristics of the transit infrastructure, local land use and development policies, and the strength of residential and commercial markets. The long-term nature of the analysis of this project (through 2030) makes assessing market conditions problematic. Local development policies are generally highly supportive of transit-oriented development. Therefore, the primary variable of this project that could influence potential for transit-oriented development is the high-capacity transit mode. The choice of transit terminus would influence TOD potential, as described in the Transit Terminus Options discussion below.

Academic research, case studies, and public outreach suggest that both light rail and bus rapid transit can attract economic investment, but that light rail can attract more investment than bus rapid transit. Rail lines have greater visibility and appeal than buses,[14] and studies have correlated this with a rider preference for trains.[15] These factors, in addition to the perception that rail infrastructure is a more permanent and fixed public investment,[16] indicate that developers are more likely to invest around light rail stations than around bus rapid transit stations.

The following points are important to understanding the indirect land use and economic impacts of transit:

- Economic development and land use intensification opportunities arise from investment in high-capacity transit. There has been documented development at both light rail and bus rapid transit stations.[17]
- There is limited documentation about the expected level of economic development around stations, or whether one mode of transit will consistently induce more economic development than the other. Local zoning, market forces, developer incentives, choice of origin and destination points, and public preferences will all greatly affect the levels of economic development at transit stations.[18]
- TOD potential is directly correlated with ridership.

Transit Terminus Options (with all Alternatives)

DIRECT EFFECTS ON LAND USE AND COMMERCIAL PROPERTY

The transit terminus options would require property acquisition for additional right-of-way to accommodate the exclusive transit guideway. However, these property acquisitions would generally have little effect on land use. The Kiggins Bowl terminus (A) would require less property acquisition and fewer business displacements than the Lincoln terminus (B), as illustrated in Exhibit 3.4-14. The Kiggins Bowl terminus would displace some commercial properties along 16th Street or McLoughlin Boulevard. The Lincoln terminus would displace some of the businesses along Broadway and Main Streets. The Lincoln terminus would also remove more on-street parking, although the Kiggins Bowl terminus with the McLoughlin alignment option would remove all on-street parking from McLoughlin Boulevard.

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[14] Dittmar and Ohland, 2004.

[15] Kenworthy, 2000.

[16] WMATA, 2005.

[17] APTA 2007, Cura 2003, Levinson et al. 2003, Light Rail Now 2006, MaryPIRG Foundation 2003, Weinstein 1999.

[18] Cervero 2004, 1993, ECONorthwest et al. 1998, Seskin 1996, Thomas 2004.

Exhibit 3.4-14
Potential Business Impacts from Transit in Northern Vancouver[a]

	Lincoln terminus (B)	Kiggins Bowl terminus(A)
Businesses Displaced or Relocated	17 to 26	2 to 9
Employees in Businesses Displaced or Relocated	50 - 129	10 to 45
Annual Sales of Businesses Displaced or Relocated (millions)	$7 to $15	$<1 to $3
Direct Property Tax Impact (thousands)	$5 to $7	$1 to $2
Parking Spaces Removed	85 to 131	43 to 82

Source: CRC Economics Technical Report.

a North of Mill Plain Boulevard.

Two alignment options on Hayden Island have been analyzed. The adjacent option would locate the transit guideway immediately next to the west side of I-5. The offset option would separate the guideway approximately 450 to 650 feet west of I-5. Exhibit 3.4-15 summarizes impacts from property acquisitions that would result from each of the alignment options. Few business displacements were uniquely associated with the transit alignments in this area—most would already be affected by the highway improvements.

Exhibit 3.4-15
Potential Business Impacts from Transit in Oregon

	Adjacent Replacement (Alts 2 or 3)	Adjacent Supplemental (Alts 4 or 5)	Offset Replacement (Alts 2 or 3)	Offset Supplemental (Alts 4 or 5)
Businesses Displaced or Relocated	17	7	5	5
Employees in Businesses Displaced or Relocated	215	165	25	50
Annual Sales of Businesses Displaced or Relocated (millions)	$ 15	$ 17	$ 3	$ 7
Direct Property Tax Impact (thousands)	$ 15	$ 65	$ 140	$ 130-135
Parking Spaces Removed	15	15	15	15

Source: CRC Economics Technical Report.

There are two alignment options for downtown Vancouver—a two-way guideway on Washington Street and a couplet on Washington and Broadway Streets. Near Mill Plain, transit vehicles would transition from the core of downtown to their uptown Vancouver or highway alignments. There are four options north of 15th Street—a two-way Broadway alignment or a Broadway-Main couplet (both for the Lincoln terminus), and a 16th Street or McLoughlin Boulevard alignment (for the Kiggins Bowl and Clark College MOS terminus options). Each of these options would result in slightly different impacts, as summarized in the Exhibit 3.4-16.

Exhibit 3.4-16
Potential Business Impacts from Transit in Downtown Vancouver

	Two-Way Washington				Washington-Broadway Couplet			
	Two-way Broadway	**Broadway-Main Couplet**	**16th Street**	**McLoughlin Blvd**	**Two-way Broadway**	**Broadway-Main Couplet**	**16th Street**	**McLoughlin Blvd**
Businesses Displaced or Relocated	1	0	0	1	1	0	0	1
Employee in Businesses Displaced or Relocated	5	0	0	5	30	0	0	30
Annual Sales of Businesses Displaced or Relocated (millions)	<$1	$0	$0	< $1	< $1	0	0	<$1
Direct Property Tax Impact (thousands)	0. 8 -1	0. 9	1	0.1-0.6	0.33	0.2	0	0.33
Parking Spaces Removed	97	97	151	197	69	69	123	169

Source: CRC Economics and Acquisition Technical Reports.

There would be no business displacements between Sixth and 15th Streets in the core of downtown Vancouver. The two-way Washington alignments would impact both on-street and off-street parking. Under either transit mode option, parking along Washington Street would not be allowed on either side of the street. This would result in a loss of all of the 106 on-street parking spaces along Washington Street between Sixth and 15th Streets.

Under all options, one block between 15th Street and 16th Street and Washington and Main would be acquired, where the future Mill Plain transit station would bisect the block. Currently this area is used as a paid surface parking lot with capacity for about 150 (unstriped) parking stalls. According to the operator of the lot, about 90 percent of spaces are rented monthly. Many monthly pass holders work in the downtown area.

The two-way Broadway and the Broadway-Main alignment options would impact the parking lot of a bank near Broadway and McLoughlin Boulevard. Both options are expected to remove approximately 10 parking spaces. The two-way Broadway and the McLoughlin Boulevard connections would also require the acquisition of an area bank, as described above. For light rail, the Broadway-Main connection would impact the parking lot of this bank, removing approximately 30 parking stalls, and would eliminate a small number of parking stalls (approximately five) of an auto parts store.

Exhibit 3.4-17 below shows the direct economic impacts associated with the McLoughlin Boulevard and 16th Street alignment options for the Kiggins Bowl terminus. The 16th Street alignment would result in fewer business displacements and parking impacts.

Exhibit 3.4-17
Potential Business Impacts from Alignment Options in Northern Vancouver for Kiggins Bowl and Clark College MOS Terminus[a]

	McLoughlin Blvd Alignment Option		16th Street Alignment Option
	with Two-way Washington	with Washington-Broadway Couplet	
Businesses Displaced or Relocated	9	8	2
Employee in Businesses Displaced or Relocated	45	31	10
Annual Sales of Businesses Displaced or Relocated (millions)	$3	$3	< $1
Direct Property Tax Impact (thousands)	$2 - $ 8 (Replacement - Supplemental	$2	$1
Parking Spaces Removed	82	82	43

Source: CRC Economics Technical Report.
[a] North of Mill Plain Boulevard.

Exhibit 3.4-18 below shows the direct economic impacts associated with the Lincoln terminus. All the options for this terminus result in comparable impacts to businesses. The Broadway-Main alignment has the greatest impact to parking spaces. The two-way Broadway alignment when combined with the two-way Washington alignment has the highest number of business displacements.

Exhibit 3.4-18
Potential Business Impacts from Lincoln Terminus Alignment Options in Northern Vancouver[a]

	Two-Way Broadway Alignment Option		Broadway-Main Couplet Alignment Option
	With Two-Way Washington	With Washington-Broadway Couplet	
Businesses Displaced or Relocated	32	26	25
Employee in Businesses Displaced or Relocated	285	215	209
Annual Sales of Businesses Displaced or Relocated (millions)	$ 15	$8	$ 7
Direct Property Tax Impact (thousands)	$ 5	$ 5	$ 7
Parking Spaces Removed	83	83	206

Source: CRC Economics Technical Report.
[a] North of Mill Plain Boulevard.

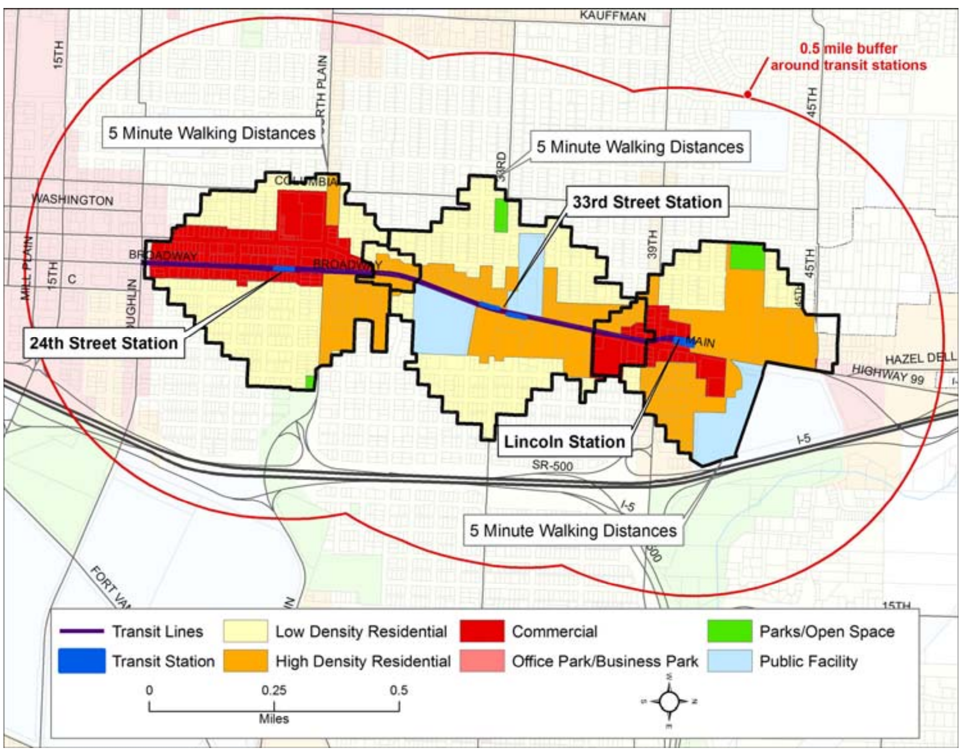
INDUCED GROWTH

North of Mill Plain Boulevard the Lincoln terminus is surrounded by land uses and zoning more conducive to transit-oriented development, especially south of Fourth Plain Boulevard. The Kiggins Bowl terminus

(A) is bounded by the highway to the west and surrounded by a neighborhood of single-family homes. The adjacent highway creates a barrier at the western edge of the Kiggins Bowl terminus, restricting pedestrian access to transit stations. In additions, low-density residential zoning, such as that near the Kiggins Bowl terminus, is not conducive to higher-density TOD. In contrast, the Lincoln terminus is generally surrounded by medium- and high-density residential and commercial zoning that could allow for redevelopment around transit stations. A half-mile radius around transit stations (Exhibits 3.4-19 and 3.4-20) is generally considered to be the area in which transit is likely to influence development and redevelopment. These maps also indicate the land uses within a 5-minute walking distance of transit stations in northern Vancouver.

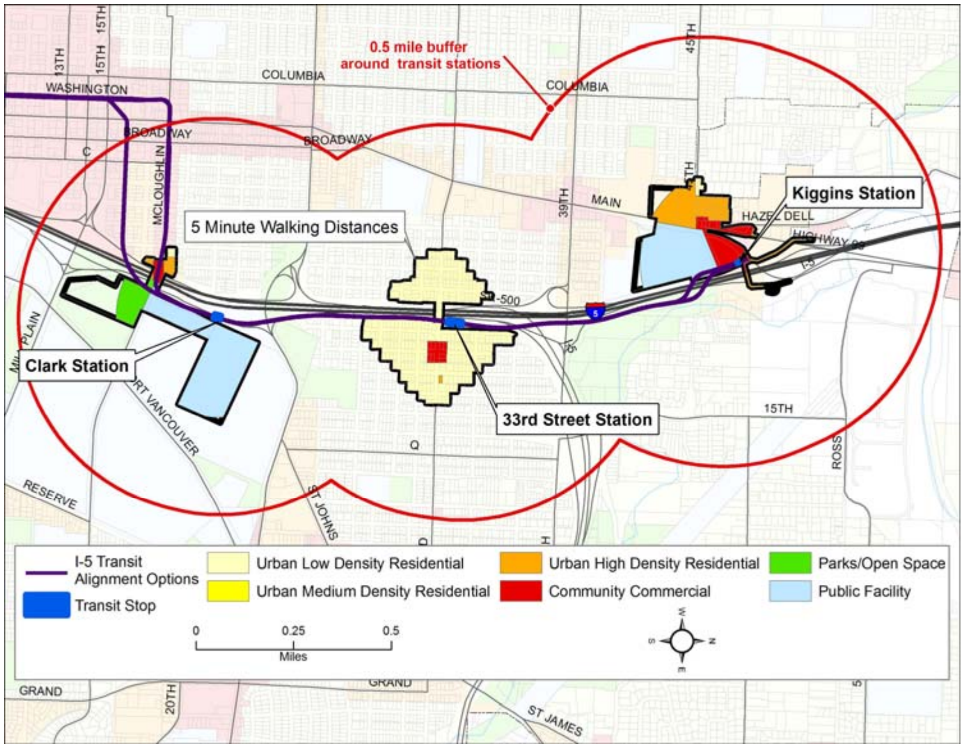
The potential for transit-oriented development can be estimated by analyzing existing land uses and the zoning around each transit station. The ratings shown in Exhibit 3.4-21 indicate the extent to which the high-capacity transit system is likely to attract transit oriented development around each station.

Exhibit 3.4-19
Zoning Around Lincoln Terminus (B) Stations in Northern Vancouver



Source: CRC Transit Technical Report.

Exhibit 3.4-20
Zoning Around Kiggins Bowl Terminus (A) Stations in Northern Vancouver



Source: CRC Transit Technical Report.

Exhibit 3.4-21
Transit-Oriented Development Potential for Transit Stations

Station	TOD Potential Rating
Hayden Island Station	Moderate to High
7th Street Station	Moderate
12th Street Station	Moderate to High
Mill Plain Station	High
Lincoln terminus (B)	
24th Street Station	Moderate
33rd Street Station	Low
Lincoln Park and Ride	Low to Moderate
Kiggins Bowl terminus (A)	
Clark College Station	Low
33rd Street Station	Low
Kiggins Bowl Park and Ride	Low

Source: CRC Land Use Technical Report.

The Clark College and Mill Plain minimum operable segment (MOS) terminus options would avoid some property acquisitions and business displacements in northern Vancouver. However the potential benefits of transit oriented development would go unrealized in these areas.

Transit Alignment Options (with all Alternatives)

OFFSET OR ADJACENT

There is little difference between these alignment options in terms of their impacts on land use and economics, and both would require displacement of some floating homes and businesses on Hayden Island. These impacts are summarized in Section 3.3, Property Acquisitions and Displacements.

TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

Neither transit alignment option in downtown Vancouver would displace any businesses, but both would reduce on-street parking. The two-way Washington Street alignment would require removal of all on-street parking spaces along Washington Street between Sixth and 15th Streets. The Washington-Broadway couplet would require removal of 34 percent of existing parking spaces on these streets. These parking losses could result in economic impacts to some businesses in this area, although parking would be available on side streets and parallel streets. A plan for replacing these lost parking spaces may be required if this parking is heavily utilized. There are parking-related mitigations proposed in this DEIS. See Section 3.1 for a discussion of transit-related parking impacts.

TWO-WAY MAIN OR MAIN-BROADWAY

There is no substantial difference between these two alignment options in terms of their impacts on land use or economics. The impacts of these alignments are summarized in the range of impacts presented for the Lincoln terminus.

16TH STREET OR MCLOUGHLIN BOULEVARD

There is no substantial difference between these alignment options in terms of their impacts on land use or economics. The impacts of these alignment options are summarized in the range of impacts presented for the Kiggins Bowl terminus.

Tolling Scenarios

Tolling the I-5 crossing would generally benefit the regional economy by reducing congestion and improving travel time reliability, but some retail business could be adversely impacted. Some travelers may choose to avoid the toll and do business elsewhere; retail oriented trips would likely be most affected. Analysis of both the standard and higher rate tolling scenarios reveals similar vehicle throughput on I-205 (see Chapter 4 of this DEIS for more detail on tolling). This indicates that little traffic would divert to I-205 as a result of tolling, but instead drivers may avoid making trips or switch to another mode such as transit or carpool. Under a no toll scenario, the river crossing would be heavily congested, thereby diverting more trips to I-205 to avoid the congestion. This diversion would fail to provide many of the projects benefits to freight mobility.

For many travelers, the value of time saved from reduced congestion would be greater than the out-of-pocket cost of the toll, which would translate into greater efficiency and increased business productivity.[19]

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[19] Clower and Weinstein, 2005.

Increased business productivity can make locations more attractive for development and improve opportunities for trade.

The proposed toll scenarios would employ a variable toll structure, charging different rates during peak and non-peak times. This would help regulate traffic flows and increase traffic reliability throughout the day. Freight-dependent businesses and businesses that rely on just-in-time deliveries are especially likely to benefit from the improved travel predictability.

3.4.4 Temporary Effects

Construction activity for any of the build alternatives could temporarily disrupt land uses on Hayden Island, but would not likely have a major effect elsewhere in the project area. I-5 provides the only way on and off Hayden Island, and the existing businesses on the island are predominantly auto-oriented, big-box retail. Construction could temporarily reduce the attraction of the shopping center. Attracting new tenants, and possibly new residents, could be temporarily impeded by construction activities. Other parts of the project area are not as reliant on I-5 for access, and are thus less likely to experience any substantial effects on local land uses from temporary disruption.

Construction activities associated with all of the transit and highway improvements have the potential to cause economic impacts by temporarily blocking visibility and access to businesses, causing traffic delays, and rerouting traffic to detours. Access restrictions or other difficulties could divert customers and clients and hamper deliveries. However, most traffic movements would remain open throughout the construction stages.

Traffic congestion is already common within the I-5 corridor during peak travel periods. Adjacent construction activities and temporary detours would extend periods of congestion, negatively impacting businesses and other land uses. Movement of freight, goods, and services would also be negatively affected. If construction activities make travel times more difficult to determine, many freight shippers and businesses that rely on just-in-time delivery would be negatively affected. Through effective communication strategies and advanced signing, motorists would be warned about delays. As a result, some might avoid the project area entirely, which could negatively affect patronage of local businesses.

The potential sites for a bridge assembly/casting yard are unknown at this time. Regardless of the location, it is unlikely to have an impact on land use, but it could temporarily displace other economic activities from the site.

Construction of any of the build alternatives would bring increased employment and spending to the project area during construction. Funds from local or regional sources could be spent by residents and businesses on other economic activities within the region. Federal or state funds that are new to a region can have a measurable economic effect on employment and income gains resulting from project construction. Funds from the federal government and the states of Oregon and Washington will likely be sought for the project. If secured, such funding would provide added local and regional income and job benefits.

3.4.5 Potential Mitigation Measures

Most negative economic impacts result from business displacements, losses in parking, or changes in access to businesses. For those businesses displaced by the project, project sponsoring agencies would provide a relocation assistance program. Property acquisitions affecting other uses could also be mitigated by relocation assistance, as described in Section 3.3, Property Acquisitions and Displacements.

Permanent closure of the intersection of Sixth and Washington Streets (with Alternatives 4 and 5) could be mitigated by working with the Vancouver Convention Center and downtown businesses to develop a circulation plan. Mitigation for a supplemental crossing could include finding alternative ways to connect waterfront development with downtown Vancouver. There are planned connections through the Union Pacific railroad berm at Esther Street and elsewhere. Aiding the completion of these projects could help to mitigate impacts of the supplemental crossing, which would preclude the Main Street connection to the waterfront.

The City of Portland’s Light Rail transit zoning overlay could aid in the development transitions on Hayden Island. This overlay is not in place now. Similarly, The City of Vancouver could develop transit-oriented development goals and implementing regulations. Vancouver’s Design Review Committee could be extended to help guide implementation.

An Interchange Area Management Plan is currently being developed in coordination with the City of Portland Office of Transportation and Bureau of Planning, the Portland Development Commission, ODOT, and business owners on Hayden Island. This effort is linked to the Hayden Island Master Plan, and will address how the design of the Hayden Island interchange will accommodate a local circulation system, access spacing, and land use policies to help manage traffic demand on the interchange. An Interchange Justification Report, in Washington, will serve similar purposes and is also underway. The report includes an analysis of alternatives, access connections, and design, and consistency with transportation and land use plans.

Several measures could reduce the potential for unwanted, induced growth that could result from increased highway capacity. Additional coordination between regional governments could reduce the potential for increased highway capacity to induce changes in future growth patterns. In Washington, public input is required before making the decision to move an urban growth boundary. Input is taken from the cities in Clark County and from regional entities such as Metro and WSDOT. Formalizing the process by which these regionally substantial decisions are made through a broad intergovernmental agreement could allow for more direct participation in the decision on how much land is opened for development in Clark County. Such an agreement could help to protect new highway capacity and balance growth on a regional level.

Loss of on-street parking and access from the project alternatives may need to be mitigated using a variety of techniques. In south-downtown Vancouver there would be a large loss of on-street parking on street(s) where the guideway is proposed. In south-downtown Vancouver currently underutilized off-street facilities might be able to mitigate the loss of on-street parking. At present most off-street parking facilities are privately owned. With future redevelopment of private facilities, some could be converted into public/private shared facilities if necessary. In northern Vancouver, parking losses from the proposed guideway would largely occur in areas where parking is underutilized. In these areas, it is likely that parking demand could be absorbed by the existing on-street facilities in the surrounding area.

The following mitigation measures would be pursued for temporary (construction) effects of the build alternatives.

Construction of any of the build alternatives would be carefully planned to minimize road closures and to avoid completely closing access to businesses. Signs to identify the location of these access points and the businesses served would be provided during detours or closures. Detours would be carefully routed to reduce travel times and signed to reduce confusion.

Programs to help businesses affected during construction could include business planning assistance, low-interest loans, marketing and retail consulting, business-oriented workshops, and promotions to generate patronage in construction areas. The City of Vancouver is planning to establish a Growth and Transportation Efficiency Center, which would be charged to improve transportation efficiency and could develop and administer a construction communication and mitigation plan.

Efforts would be made to ensure that at least one of the three river navigation channels would remain open during construction.

Coordination with the Port of Portland and businesses in the Rivergate and Portland International Airport industrial areas would identify ways to minimize delays during construction for commercial freight vehicles. Signs would be posted to encourage commercial freight vehicles not serving destinations in the Portland-Vancouver I-5 corridor to shift from I-5 onto I-205 during construction.

3.5 Neighborhoods and Environmental Justice

Transportation infrastructure influences neighborhoods and communities. Highways and transit lines connect people with their homes and daily destinations, while local streets and paths provide circulation for motorists, bicyclists, and pedestrians within their neighborhoods. Modifying or building new transportation infrastructure can improve these connections, but can also change the character of communities. For example, a new road or transit station may improve nearby residents' commutes or attract investment in a community, but could also displace an important neighborhood resource. Likewise, highway improvements may reduce congestion and improve air quality, but could increase noise for residents adjacent to the highway.

Careful consideration of new transportation infrastructure can ensure that it benefits surrounding communities and minimizes unintended negative impacts. Consideration of Environmental Justice (EJ) populations, which include low-income and minority populations, is particularly important to ensure these communities are not disproportionately impacted by adverse effects on human health or the environment.

This section evaluates the CRC projects' potential benefits and impacts to neighborhoods and populations, including EJ populations. The information in this section is based on the CRC Neighborhoods and Populations Technical Report and the Environmental Justice Technical Report.

TERMS & DEFINITIONS

Minority and Low-Income Populations

Minority populations are individuals listed in the census as considering themselves to be either nonwhite or Hispanic or Latino, regardless of race. Low-income populations are defined as households with incomes below the federal poverty level.

3.5.1 Existing Conditions

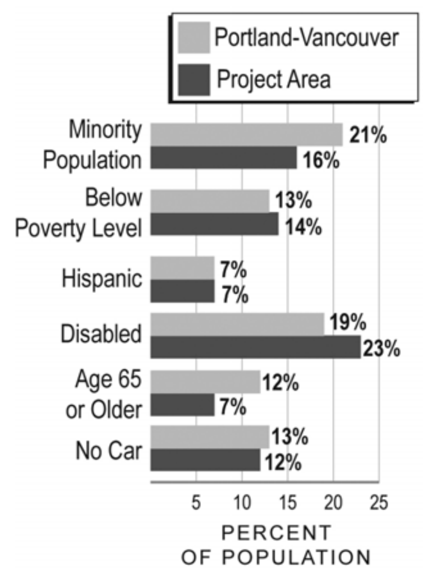
The project area extends north-south from SR 500 to Columbia Boulevard, and about one mile, east and west, on each side of the I-5. There are 16 neighborhoods within or near the project area. Each neighborhood has a unique character formed by the residents, community resources, businesses, and landmarks exclusive to its community. Exhibit 3.5-1 compares the demographics of the CRC project area with those of the Portland-Vancouver region.

Overall, the CRC project area has a higher percentage of people with disabilities than the Portland-Vancouver metropolitan area. The Washington State School for the Blind and School for the Deaf are both near the project area. The disabled population rate varies widely between neighborhoods. Esther Short reports a 45 percent disability rate, likely due to the senior housing located in the area. All other neighborhood disability rates fall between 16 and 30 percent. Exhibit 3.5-2 shows the neighborhood boundaries in the CRC project area.

Demographic Data

Data used in this analysis are from the 2000 U.S. Census. Since conditions may have changed since that census was completed, the CRC team also used more recent supplemental data, public meetings, and outreach efforts to communities potentially affected by this project. This helped the team gain a better understanding of the character of each neighborhood and which concerns are most important to these communities. Fully updated information from the U.S. Census will not be available until 2011-2012.

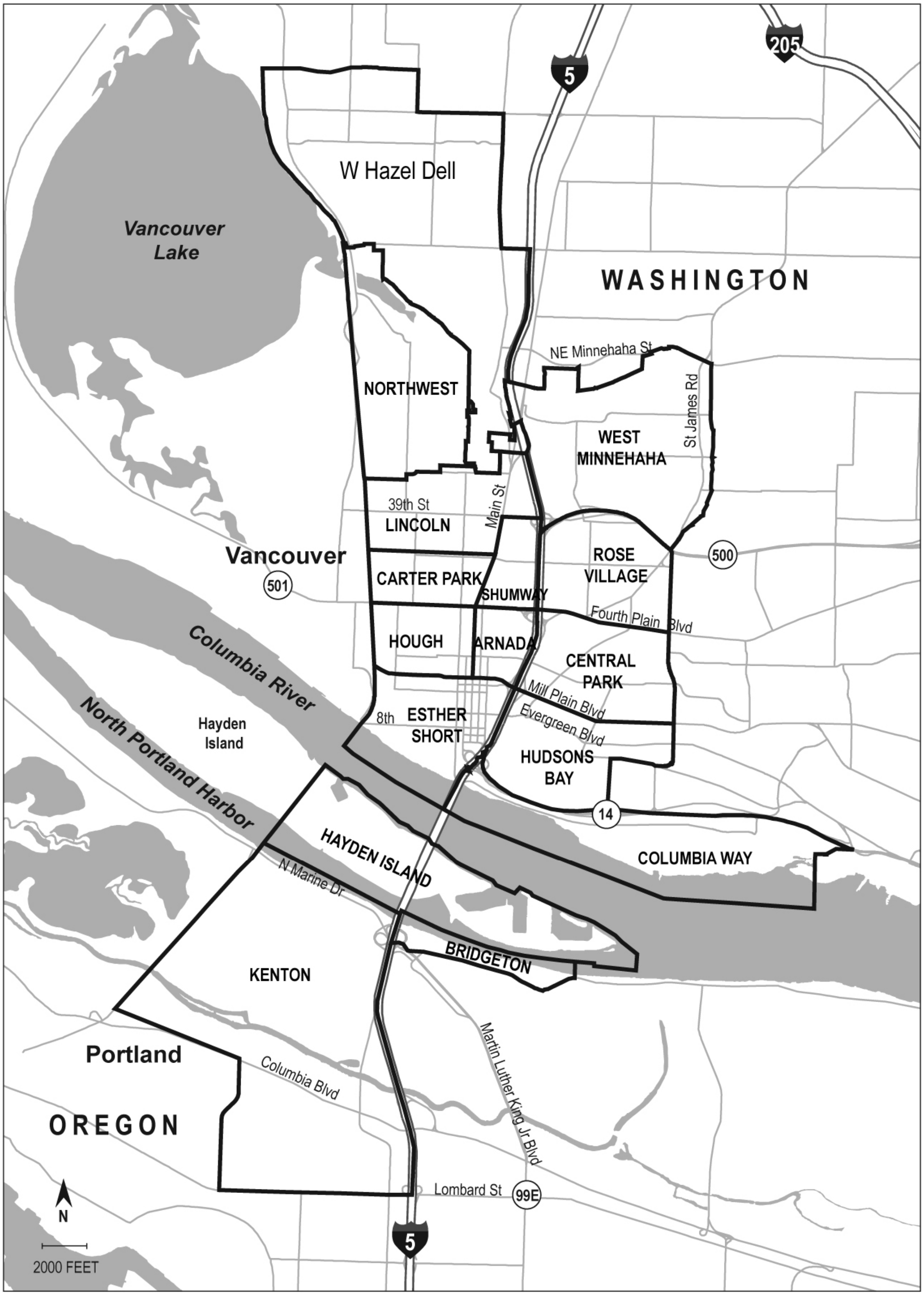
Exhibit 3.5-1
Census Demographics
CRC Project and Portland-Vancouver Areas



Source: U.S. Census 2000.

Exhibit 3.5-2

Neighborhoods in the CRC Project Area



DIMENSIONS ARE APPROXIMATE.

Exhibit 3.5-3 summarizes demographic characteristics by neighborhood and shows the diversity between them. The Columbia Way neighborhood has by far the largest rate of people over 65, with 21 percent. In all other neighborhoods, the rate of people over age 65 is between 4 and 10 percent, which is lower than the Portland-Vancouver area average.

While the project area has a lower rate of minority populations than the metropolitan region, the Kenton neighborhood has 36 percent minorities. Neighborhoods such as Arnada, with two percent minority residents, lower the average within the project area and illustrate the importance of understanding the diversity among the neighborhoods.

Poverty rates range from a low of 6 percent in the West Hazel Dell neighborhood to a high of 35 percent in the Esther Short neighborhood. Other central Vancouver neighborhoods such as Rose Village, Central Park, and Hough also show higher than average poverty rates of between 20 and 25 percent.

The neighborhoods vary widely in their reliance on auto transportation. Thirty-four percent of households in the Esther Short neighborhood report not owning a car. The Hough and Central Park neighborhoods also show relatively low rates of car ownership; twenty-five percent of residents in these neighborhoods do not own a car. The rate of households without a car varies between 3 and 18 percent in all other neighborhoods.

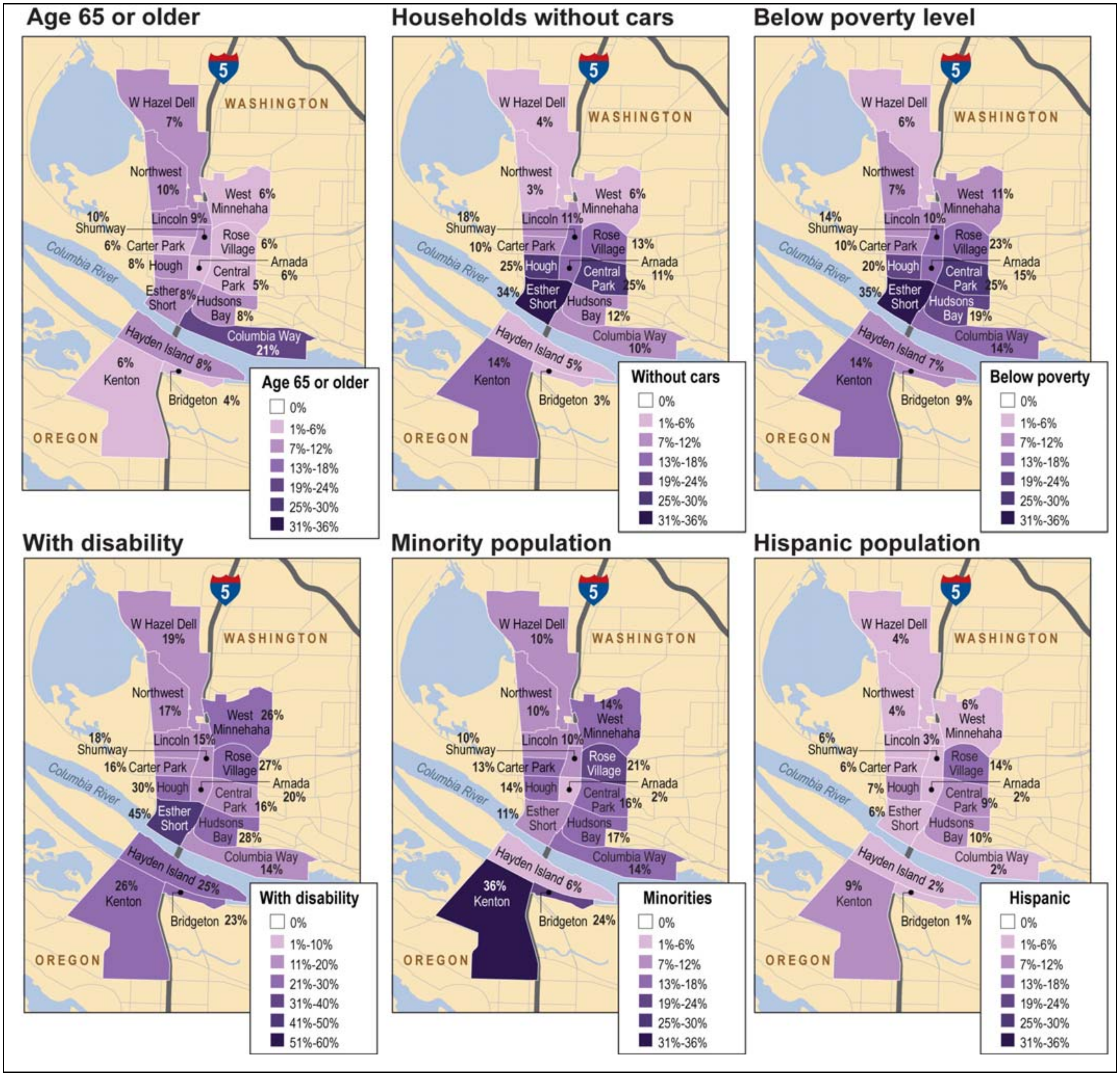
Neighborhood Plans

Neighborhoods often define themselves and strengthen their identities through the development of neighborhood plans. These plans are adopted by the City-supported (Portland and Vancouver) neighborhood associations. Every neighborhood in the study area has an adopted plan, except for Hayden Island, which is currently undergoing a planning process with the City of Portland. While some plan goals may be unique to a certain neighborhood, other goals are common to many communities. Following are goals from neighborhood plans in the project area that are relevant to the potential benefits and impacts from the CRC project:

- Minimize the adverse impacts of increased density; support density adjacent to transit
- Preserve existing housing stock; preserve historic character
- Reduce transportation-related noises and odor; mitigate I-5 noise
- Reduce speeding within the neighborhood
- Enhance and maintain on-street parking
- Maintain adequate bus service; support development of light rail
- Improve bicycle and pedestrian facilities and connections
- Protect the Columbia River from contaminants.

Neighborhood associations formally adopt neighborhood plans. The cities do not formally adopt these plans, but they are reviewed and accepted by City Councils. Neighborhood plans do not have the force of the Comprehensive or Subarea Plans.

Exhibit 3.5-3
Neighborhood Demographics near the CRC Project



Source: CRC Neighborhoods and Populations Technical Report.

Effects Guidelines

The CRC project team used the following questions to help identify potential effects:

- Does this project displace residents or community resources?
- Does this project separate neighborhood residents from their community resources or commercial service?

- Does this project increase traffic through a neighborhood, or decrease access to transit, bicycle, or pedestrian opportunities?
- Does this project severely impact community cohesion?
- Is this project consistent with adopted neighborhood plan goals?

Impacts to EJ populations are assessed based on Executive Order 12898 and subsequent U.S. Department of Transportation and FHWA regulations that identify disproportionately high and adverse effects as that:

- Are predominantly borne by minority populations or low-income households; or
- Would be experienced by these populations in a way that is appreciably more severe or greater in magnitude than would be experienced by non-minority or non-low-income populations.

For this analysis, "predominantly borne by minority populations or low-income households" means that more minority or low-income people are impacted than non-minority or non-low-income people. Environmental justice impacts from transportation projects may include displacement of households and businesses, disruptions in community cohesion, restricted commercial access, noise impacts, air quality impacts, or other adverse impacts affecting low-income and minority populations.

The CRC Environmental Justice Technical Report describes the Executive Order on Environmental Justice (EO 12898) and guidelines for assessing impacts to low-income and minority populations in detail. Important guidelines for avoiding disproportionately high and adverse effects to EJ populations include:

- Avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority and low-income populations.
- Ensure full and fair participation by all potentially affected communities in the decision-making process.
- Prevent the denial of, reduction in, or substantial delay in the receipt of benefits by minority and low-income populations.

Community Resources

An inventory of community resources within each neighborhood was collected by the project team (Exhibits 3.5-4 and 3.5-5). The project team met with members of the community who identified the resources that were important to them on a map. Project staff identified neighborhood resources within and near the study area that fit the following commonly accepted neighborhood resource categories: parks, schools, locally and nationally recognized historic structures, and emergency services.

Project staff created two draft maps based on these resources, one for Oregon and one for Washington. On September 14, 2006, the Community and Environmental Justice Group reviewed the two draft neighborhood resource maps and identified additional resources. Thereafter, these maps were further reviewed and modified at neighborhood meetings and open houses.

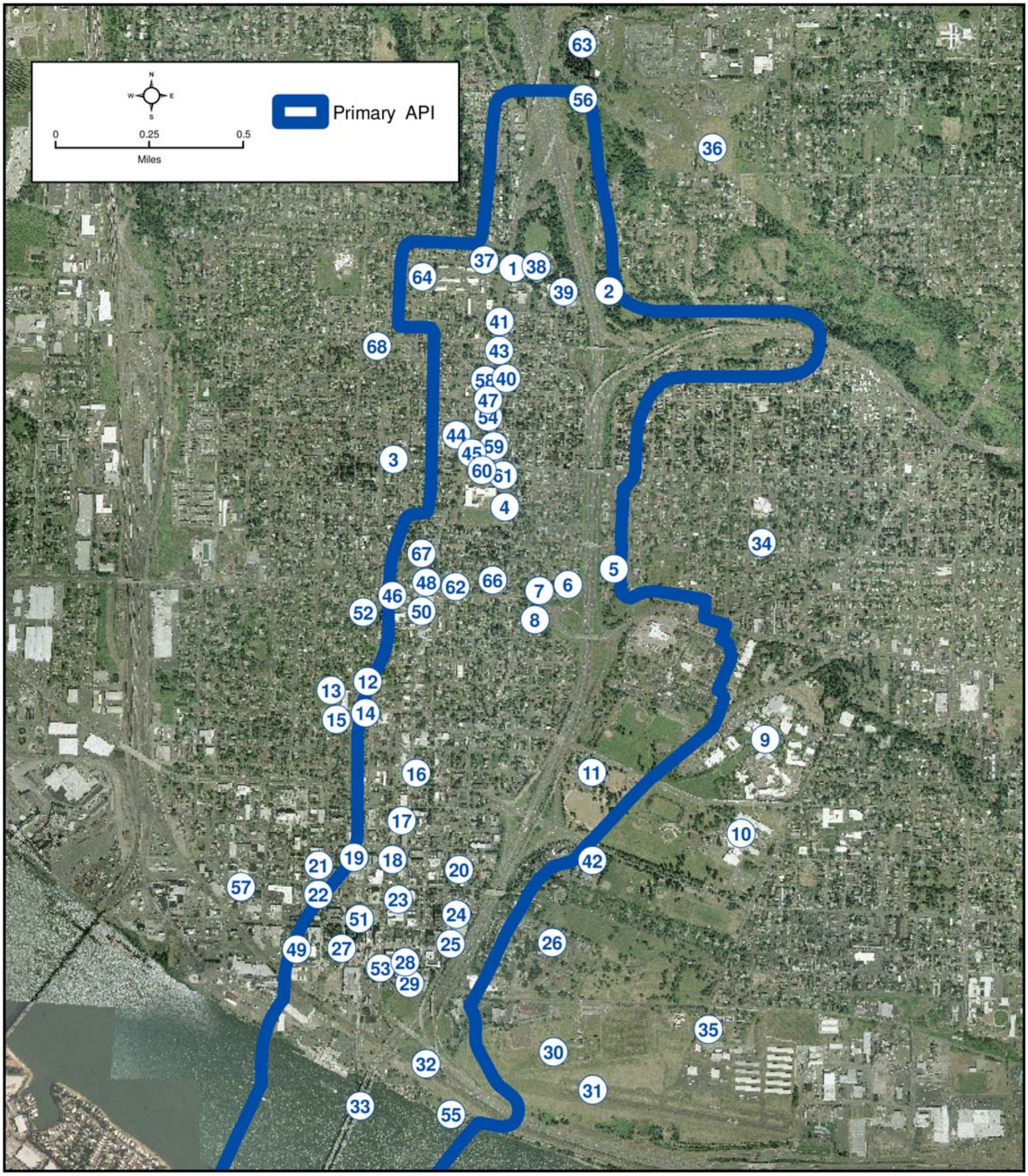
TERMS & DEFINITIONS

Community Resources and Cohesion

Community resources typically include educational, religious, health care, cultural, and recreational facilities.

Community cohesion measures how well residents can connect with one another within their community. These connections can occur at gathering places such as schools, community centers, parks, or transit stations. High home ownership rates and active neighborhood associations also contribute to cohesion.

Exhibit 3.5-4 (page 1 of 2)
Community Resources in Washington



Resource 65 is outside the map boundaries.

Exhibit 3.5-4 (page 2 of 2)

1	**Covington House** 4201 Main Street *historical*	**24**	**Future Library** *educational*	**47**	**YWCA** 3609 Main Street *community center*
2	**Leverich Park** 39th and M Street *park*	**25**	**Regal Cinema** 801 C Street *recreational*	**48**	**Uptown Village** Main Street *shopping*
3	**Carter Park** 33rd Street *park*	**26**	**National Historic Reserve** East Reserve Street to I-5 *historical*	**49**	**Farmers Market** 555 W. 8th Street *shopping*
4	**Shumway Park** 3014 F Street *park*	**27**	**Slocum House/Ester Short Park** 605 Esther Street *historical/park*	**50**	**Starbucks** 2420 Main Street *community/recreation*
5	**Leach Park** 28th and K Street *park*	**28**	**Heritage Building** 601 Main Street *historical*	**51**	**Starbucks** 304 W. 8th Street *community/recreation*
6	**2613 "H" Street House** 2613 H Street *historical*	**29**	**Evergreen Hotel** 500 Main Street *historical*	**52**	**Columbia House** 33415 NW Lancaster Road *community/recreation*
7	**Swan House** 714 E. 26th Street *historical*	**30**	**Fort Vancouver** 612 E. Reserve Street *historical*	**53**	**Smith Tower** 515 Washington Street *senior/low-income*
8	**Arnada Park** W. 25th and G Street *park*	**31**	**Pearson Field** 1115 E. 5th Street *historical*	**54**	**Pythian Home** 3409 Main Street *senior/low-income*
9	**Clark College** 1800 E. McLoughlin Boulevard *Educational*	**32**	**Old Apple Tree Park** East of I-5 *historical/park*	**55**	**Waterfront Park** 115 Columbia Way *senior/low-income*
10	**Hudson's Bay High School** 1206 E. Reserve Street *educational*	**33**	**I-5 Bridges** *historical*	**56**	**Discovery & Ellen Davis Trails** Highway 99 and I-5 *park*
11	**Marshall and Luepke Centers** 1009 E. McLoughlin Boulevard *community center*	**34**	**Washington Elementary School** 2908 S Street *educational*	**57**	**Vancouver Fire Department, #82** 900 W. Evergreen Boulevard *public service*
12	**Hough Elementary School** 1900 Daniels Street *educational*	**35**	**VA Medical Center** 1601 E. 4th Plain Boulevard *healthcare*	**58**	**Vancouver Fire Department, #86** 400 E. 37th Street *public service*
13	**Steffan House** 2000 Columbia Street *Historical*	**36**	**Dog Park** Between 15th and 18th *park*	**59**	**Vancouver Health and Rehabilitation Center** 400 E. 33rd Street *public service*
14	**Charles Zimmerman House** 1812 Columbia Street *historical*	**37**	**First Presbyterian Church** 4300 Main Street *religious institution*	**60**	**First United Methodist Church of Vancouver** 401 E. 33rd Street *religious institution*
15	**Hough Aquatic Center** 1801 Esther Street *recreational*	**38**	**Kiggins Bowl** 800 E. 40th Street *recreational*	**61**	**Evergreen Habitat for Humanity** 521 E. 33rd Street *public service*
16	**Carnegie Library** 1511 Main Street *educational*	**39**	**Discovery Middle School** 801 E. 40th Street *educational*	**62**	**First Church of Christ Scientist** 204 E. 4th Plain Boulevard *religious institution*
17	**Hidden, Lowell M. House** 100 W. 11th Street *historical*	**40**	**Safeway** 3707 Main Street *shopping*	**63**	**Bonneville Power, Ross Complex** 5411 NE Highway 99 *public services*
18	**Vancouver Telephone Exchange** 112 W. 11th Street *historical*	**41**	**Community Wellness Center** 317 E. 39th Street *healthcare*	**64**	**City of Vancouver Water Tower** 42nd and NW Washington *historical*
19	**Chumasero-Smith House** 310 W. 11th Street *historical*	**42**	**Fort Vancouver Regional Library** 1007 E. Mill Plain *educational*	**68**	**WSDOT Service Center** 11018 NE 51st Circle *public service*
20	**House of Providence (Academy)** 400 E Evergreen *historical*	**43**	**Home Ownership Center** 3801-A Main Street *public service*	**66**	**Saint Luke's Episcopal Church** 426 E. 4th Plain Boulevard *religious institution*
21	**Langsdorf House** 1010 Esther Street *historical*	**44**	**SW Washington Medical Center** 3400 Main Street *healthcare*	**67**	**First Baptist Church** 108 W. 27th Street **religious institution**
22	**Lloyd DuBois House** 902 Esther Street *historical*	**45**	**Arts & Academics School of Vancouver** 3101 Main Street *educational*	**68**	**Trinity Lutheran Church** 309 W. 39th Street *religious institution*
23	**Elks Building** 916 Main Street *historical*	**46**	**Vancouver Housing Authority** 2500 Main Street *public service*		

Exhibit 3.5-5
Community Resources in Oregon

1 **Private Community Center**
N. Arbor Avenue and Alder Street
recreational

2 **Former Hayden Is. Yacht Club**
120050 N. Jantzen Drive
community center

3 **Safeway**
11919 N. Jantzen Drive
shopping

4 **Lotus Isle Park**
N. Tomahawk and Island Drive
park

5 **Oregon Slough & Industrial Marinas**
natural resource/housing

6 **Expo Center**
2060 N. Marine Drive
recreational

7 **Vanport Wetlands**
natural resource

8 **Dog Run**
park

9 **Delta Park**
N. Martin Luther King Boulevard and Denver Avenue
park

10 **Portland International Raceway**
1940 N. Victory Boulevard
recreational

11 **Portland Meadows**
1001 N. Schmeer Road
recreational

12 **Columbia Slough**
recreational

13 **Columbia Cemetery**
1151 N. Columbia Boulevard
historical

14 **Paul Bunyan**
N. Denver Avenue and Interstate Avenue
historical

15 **Christmas Lights House (NRHP)**
1441 N. McClellan Street
historical

16 **Kenton Commerical Historic Destrict**
Denver Avenue
historical/shopping

17 **Kenton Community Policing Office**
8134 N. Denver Avenue
public service

18 **Jantzen Beach**
shopping

19 **Portland Fire and Rescue, Station #17**
848 North Tomahawk Drive
public service

20 **Historic Kenton Firehouse**
8105 N Brandon Avenue
community center

21 **Kenton Park**
8417 N Brwndon Avenue
park

22 **Wells Fargo Bank**
8324 N Denver Avenue
financial services

23 **Wells Fargo Bank**
12240 N Jantzen Drive
financial services

Coordination

Two key principles of Environmental Justice, as defined by the U.S. Environmental Protection Agency (EPA), are the fair treatment and meaningful involvement of all people. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of negative environmental consequences. Meaningful involvement means that: (1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment or health; (2) the public's contribution can influence the regulatory agency's decision; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) the decision-makers seek out and facilitate the involvement of those potentially affected.

To achieve the goal of meaningful public involvement in the project development process, in August of 2006, the CRC project team formed the Community and Environmental Justice Group (CEJG). The fifteen members of the CEJG come from neighborhoods in the project area and included environmental justice populations, two liaisons from the CRC Task Force, and five at-large members. Together, they represent the diverse interests and perspectives of Vancouver and Portland neighborhoods potentially affected by the project.

The CEJG provides assistance to CRC project staff in identifying community concerns in the project development process; presenting recommendations at key milestones; raising relevant issues of interest (or potential impact) such as air quality, noise, highway interchange alignments and design features to help inform the project’s efforts to avoid, minimize, and/or mitigate potential community impacts.

The CRC project team also designated a CRC Tribal Liaison, with the statewide tribal liaisons for both WSDOT and ODOT assisting in tribal coordination efforts, when necessary. All communication with tribes was coordinated through the CRC Tribal Liaison to ensure that information is managed internally and integrated into the government-to-government dialogue with the tribes.

The general approach to government-to-government consultation for the CRC project was as follows.

CRC staff met with interested tribes early in the environmental review process in order to review broad issues and establish the following:

- An understanding of those aspects of the CRC project that were likely to interest the tribes
- Preliminary information about the potential for the project to affect tribal land, historical or cultural resources, fishing and other aquatic resources, or any other issues of tribal concern
- An initial agreement regarding the process for the government-to-government consultations

CRC staff also engaged in both formal and technical consultation with tribal staff. At the request of the tribes, project staff formally met with cultural and natural resource committees, and involved technical staff in working group meetings concerning applicable issues (for example identification of fish and wildlife habitat).

- At the request of interested tribes, the project team met with the Tribal Council and appropriate committees at major project milestones.
- Technical staff were invited to working group meetings that the tribes may have an interest or expertise in.
- The consultation process integrated both formal and informal contact with the Tribal Council and tribal staff, respectively.

CRC staff sought to resolve issues in parallel with project planning and permitting activities, and kept interested tribes fully informed throughout the project planning, permitting, and development process. In acknowledgement that CRC must afford the interested tribes with more than the opportunity to participate as members of the general public in the planning and permitting process, CRC took the following actions to ensure effective government-to-government consultation:

- Sought tribal input regarding alternatives and opportunities to avoid, reduce, or otherwise mitigate the effects of the CRC project on tribal interests.
- Sought tribal comment throughout the project's environmental review, permitting and regulatory review processes.

The CRC team used information collected from other sources to supplement the data-gathering efforts for the neighborhoods and environmental justice analyses. These additional sources included the 2004 American Community Survey, Section 8 Housing Assistance data, and public school free and subsidized lunch program data. The team contacted local social service agencies to identify recent development projects that serve low-income and/or minority populations.

Information collected through field visits and public outreach events with community and stakeholder groups further supplemented and refined the above data, including attendance at meetings and events such as AsiaFest, Good in the Hood, Alberta Coop Farmers Market, Vietnamese New Year celebration, Say Hey! Partners in Diversity, Juneteenth Festival, and a Slavic Coalition meeting.

Prior to issuance of the CRC project Notice of Intent (NOI) to prepare an EIS, the project team identified limited English proficiency populations using geographic information systems (GIS) and the 2000 US Census data. The data used for limited English proficiency were derived from responses to the Census question of "language spoken at home". The smallest geographic unit for which "language spoken at home" data are available is the census block group. Because of data limitations and the importance of identifying those populations with the greatest likelihood of experiencing direct impact, "language spoken at home" data were collected for all census block groups entirely or partially in the project study area. The data showed that those speaking Spanish, Russian, German, and Vietnamese at home represented at least one percent of the population in the study block groups. Because German speakers tended to also have high levels of English language fluency, Spanish, Russian, and Vietnamese were chosen as the focus languages.

Project information has been routinely translated into those languages, including project newsletters, some project documents, and portions of the project Web site. Russian, Spanish, and Vietnamese interpreters have been made available at numerous public open houses. Russian and Spanish are the two most common languages (except for English) spoken at home in Portland, Vancouver and Clark County. Vietnamese is the third most spoken language in Portland and Vancouver, but not in Clark County.

Press releases advertising the open houses in the fall of 2005 and April 2006 were translated into Spanish, Russian and Vietnamese and distributed to the following newspapers. Advertisements for the open houses were purchased in these same newspapers:

- The Asian Reporter
- El Hispanic News
- Portland Observer
- The Skanner

As the project moves toward a final design and completion of a Final Environmental Impact Statement, coordination will continue and will include specific, potentially affected groups. Such groups will include local schools, the Washington State Schools for the Blind and the Deaf, specific employers (such as the Hayden Island Safeway), administrators, and persons served by the Wellness Project, among others.

3.5.2 Long-Term Effects from Project Alternatives

This section summarizes long-term effects from the project alternatives. Many of the effects that are relevant to neighborhoods and EJ populations, including residential displacements, noise impacts, and air quality, are discussed in detail in their respective sections in this chapter. Exhibits 3.5-6 through 3.5-9, below, summarize the neighborhood and environmental justice impacts for the project alternatives and terminus options.

Alternative 1: No-Build

The No-Build Alternative would not require displacement of residents, community resources, or jobs. Long-term indirect impacts for neighborhoods would include increased travel times for residents traveling within the I-5 corridor. The No-Build Alternative would not bring high-capacity transit to Hayden Island or Vancouver. Low-income populations use transit at a higher rate than other populations, and would be unable to benefit from high-capacity transit in the project area. There would be no toll, so potential adverse impacts on EJ populations from the expense of tolls would be avoided, as well as the potential benefits of decreased congestion and improved reliability and mobility.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.5-6 summarizes the neighborhood and environmental justice impacts for Alternative 2 and its terminus options.

Exhibit 3.5-6
Neighborhood & Environmental Justice Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Residential displacements	29-36 units Minimal except on Hayden Island.	29-36 units Minimal except on Hayden Island and in Lincoln neighborhood.	21-28 units Minimal except on Hayden Island.	21-28 units Minimal except on Hayden Island.
Business displacements	43-52 Minimal except on Hayden Island.	58-68 Minimal except on Hayden Island and in Lincoln neighborhood.	41-50 Minimal except on Hayden Island.	44-46 Minimal except on Hayden Island.
Separation from community resources	Potential displacement of Safeway on Hayden Island.	Potential displacement of Safeway on Hayden Island. Displacement of Wellness Project in Lincoln.	Potential displacement of Safeway on Hayden Island.	Potential displacement of Safeway on Hayden Island.
Increased local traffic or decreased access to transit, bike, or pedestrian facilities	Improvements on Hayden Island and downtown Vancouver.	Improvements on Hayden Island, north of 4th Plain, and downtown Vancouver Increased congestion in uptown Vancouver.	Improvements on Hayden Island and downtown Vancouver.	Improvements on Hayden Island and downtown Vancouver.
Impacts to community cohesion	Offset HCT alignment on Hayden Island could separate floating home community.	Offset HCT alignment on Hayden Island could separate floating home community.	Offset HCT alignment on Hayden Island could separate floating home community.	Offset HCT alignment on Hayden Island could separate floating home community.
Consistency with neighborhood plans	Generally consistent, though some plans call for light rail.	Generally consistent, though some plans call for light rail.	Generally consistent, though some plans call for light rail.	Generally consistent, though some plans call for light rail.
Noise impacts	Moderate impacts, though reduced impacts after mitigation.	Higher impacts, though reduced after mitigation.	Moderate impacts, though reduced impacts after mitigation.	Moderate impacts, though reduced impacts after mitigation.
Air quality	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.
Potentially disproportionate, adverse impacts specific to low-income or minority populations	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation. Displaced Wellness Project would need mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.

Source: CRC Neighborhoods and Environmental Justice Technical Reports.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

The replacement crossing with bus rapid transit (BRT) would require displacement of between 13 and 20 floating homes on Hayden Island, depending upon the transit alignment option on Hayden Island (offset or adjacent to I-5). Environmental justice populations may be employed in businesses on Hayden Island that could be displaced by this alternative.

The Lincoln terminus would require displacement of the Wellness Project in the Lincoln neighborhood. To access the Lincoln Park and Ride, the project would have to acquire the northwest and southwest corners of the intersection move of Main Street south of 39th Street, including the Wellness Project). The Wellness Project is important to low-income populations, as it provides free mental health services. The CRC project would need to provide relocation assistance for the Wellness Project if it is displaced.

Neighborhood residents, including EJ populations would benefit from decreased traffic congestion with the replacement crossing. In particular, the replacement crossing would provide substantially improved access between Hayden Island and Marine Drive, with three separated auxiliary lanes in each direction between these two interchanges. These auxiliary lanes make short-distance trips between north Portland and Hayden Island much easier during peak periods because cars can make these trips without merging into mainline freeway traffic. Bus rapid transit would increase access to transit and improve the existing level of transit service, but this mode is not as consistent with some neighborhood plans that call specifically for light rail.

Air quality would generally improve. Emissions from I-5 traffic are projected to decrease between 30 and 90 percent by 2030 for all alternatives.

Noise levels would increase in some areas, but anticipated mitigation measures (sound walls and residential sound insulation) would reduce the number of impacted residents below existing conditions. Noise impacts would still result for all build alternatives. Some residences would experience noise impacts that could be mitigated to within HUD standards via residential sound insulation; depending on transit alignment option chosen, these could include floating homes in North Portland Harbor, residences along Broadway, McLoughlin, or 16th (all in the Arnada neighborhood), or in the Rose Village neighborhood.

Where would acquisitions occur with the different alternatives?

The Acquisitions section of this chapter includes maps showing where property would likely be acquired. More detailed maps and discussions of property acquisitions are included in the CRC Acquisitions Technical Report.

In a few locations, new and improved noise walls would not be able to completely mitigate all traffic-related noise impacts. These impacts would occur when noise walls could not be built high enough to block noise to upper floors of apartment buildings (e.g., in the Esther Short neighborhood) or at the openings in noise walls at the 29th street and 33rd Street overpasses (in the Rose Village and Shumway neighborhoods).

None of the homes near the noise wall openings in Shumway or Rose Village have been identified as low-income, although noise impacts in Rose Village, which does have a higher proportion of low-income and minority households, might be more likely to impact these communities. Unmitigated noise impacts in the Esther Short Neighborhood are the most likely to impact low-income individuals, as this neighborhood has the highest proportion of low-income households in the project area. The noise impacts in Esther Short would be limited to two apartment buildings, the Fort Apartments and the Normandy Apartments.

The three-story Normandy Apartments are located at 316 East Seventh Street in Vancouver, directly west of I-5. There are approximately 35 studio and one-bedroom apartments that rent for approximately $500 to

$650 per month. Twelve households on the upper floors of the Normandy Apartments currently experience noise levels that exceed FHWA's traffic noise impacts criteria. While noise levels in this area would decrease slightly under the build scenarios compared to the No-Build Alternative, the same 12 households would continue to be impacted. Under current FHWA policy, which does not employ residential sound insulation as a mitigation measure, a noise wall could not be built high enough to block these impacts.

The Fort Apartments are located at 500 E 13th Street in Vancouver directly west of I-5. There are 49 newly remodeled studio, one-bedroom, and two-bedroom units in the Fort Apartments; rent ranges from $450 to $500 per month. As with the Normandy Apartments, 12 households on the upper floors of the Fort Apartments currently experience noise levels that exceed FHWA's traffic noise impacts criteria. Noise levels at these units would increase slightly under both the build and No-Build alternatives, but the same 12 units remain impacted.

Bus rapid transit is louder than light rail, so Alternative 2 would create louder outdoor noise levels, even with mitigation.

Tolling could impact EJ populations in general and low-income populations in particular. Impacts of tolling on EJ populations are discussed under Tolling Scenarios, below. Potential mitigation measures are discussed in Section 3.5.5.

Alternative 3: Replacement Crossing with Light Rail

The only difference between this alternative and Alternative 2 is the transit mode. Environmental Justice impacts for Alternative 3 are summarized in Exhibit 3.5-7.

Exhibit 3.5-7
Neighborhood and Environmental Justice Effects Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Residential displacements	29-36 units Minimal except on Hayden Island.	29-36 units Minimal except on Hayden Island and in Lincoln neighborhood.	21-28 units Minimal except on Hayden Island.	21-28 units Minimal except on Hayden Island.
Business displacements	43-52 Minimal except on Hayden Island.	58-68 Minimal except on Hayden Island and in Lincoln neighborhood.	41-50 Minimal except on Hayden Island.	44-46 Minimal except on Hayden Island.
Separation from community resources	Potential displacement of Safeway on Hayden Island.	Potential displacement of Safeway on Hayden Island. Displacement of Wellness Project in Lincoln.	Potential displacement of Safeway on Hayden Island.	Potential displacement of Safeway on Hayden Island.
Increased local traffic or decreased access to transit, bike, or pedestrian facilities	Improvements on Hayden Island and downtown Vancouver.	Improvements on Hayden Island, north of 4th Plain & downtown Vancouver. More congestion in uptown Vancouver.	Improvements on Hayden Island and downtown Vancouver.	Improvements on Hayden Island and downtown Vancouver.
Impacts to community cohesion	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment could separate floating home community.
Consistency with neighborhood plans	Highly consistent.	Highly consistent.	Highly consistent.	Highly consistent.
Noise impacts	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.
Air quality	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.
Potentially disproportionate, adverse impacts specific to low-income or minority populations	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation. Displaced Wellness Project would need to be mitigated.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.

Source: CRC Neighborhoods and Environmental Justice Technical Reports.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

This alternative would have effects similar to those for Alterative 2, with the following exceptions. Light rail would be more consistent with some neighborhood plans that call specifically for light rail.

However, light rail would require expanding the existing TriMet maintenance facility in Gresham, displacing up to seven homes. Census data for the area surrounding the site indicate that 40 percent of residents are minority and 35 percent have incomes below the poverty line. Specific house-by-house analysis is needed to determine the proportion of EJ residents on these parcels impacted.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Alternative 4 would have similar effects to those for Alternative 2 described above, with differences noted below in Exhibit 3.5-8.

Exhibit 3.5-8
Neighborhood and Environmental Justice Effects Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Residential displacements	26-27 Minimal except on Hayden Island.	32-33 Minimal except on Hayden Island and Lincoln.	24-25 Minimal except on Hayden Island.	24-25 Minimal except on Hayden Island.
Business displacements	40-48 Minimal except on Hayden Island.	56-64 Minimal except on Hayden Island and in Lincoln neighborhood.	34-43 Minimal except on Hayden Island.	37-39 Minimal except on Hayden Island.
Separation from community resources	Displacement of Safeway on Hayden Island.	Displacement of Safeway on Hayden Island. Displacement of Wellness Project in Lincoln.	Displacement of Safeway on Hayden Island.	Displacement of Safeway on Hayden Island.
Increased local traffic or decreased access to transit, bike, or pedestrian facilities	More congestion on Hayden Island and downtown Vancouver.	More congestion on Hayden Island, downtown Vancouver, and uptown Vancouver.	More congestion on Hayden Island and downtown Vancouver.	More congestion on Hayden Island and downtown Vancouver.
Impacts to community cohesion	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on could separate floating home community.	Offset alignment could separate floating home community.
Consistency with neighborhood plans	Generally consistent, but some plans call for light rail.	Generally consistent, but some plans call for light rail.	Generally consistent, but some plans call for light rail.	Generally consistent, but some plans call for light rail.
Noise impacts	High impacts, but reduced after mitigation.	Very high impacts, but reduced after mitigation.	High impacts, but reduced after mitigation.	High impacts, but reduced after mitigation.
Air quality	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.
Potentially disproportionate, adverse impacts specific to low-income or minority populations	Tolls require higher share of income for low-income populations and could impact these populations without mitigation.	Tolls require higher share of income for low-income populations and could impact these populations without mitigation. Displaced Wellness Project would need to be mitigated.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.	Tolls require higher share of income for low-income populations and could impact low-income populations without mitigation.

Source: CRC Neighborhoods and Environmental Justice Technical Reports.

Alternative 4 would require displacement of up to 23 floating homes on Hayden Island. Alternative 4 would require acquisition of fewer commercial buildings on Hayden Island. While this could result in fewer impacts to low-wage retail and service industry employees, the supplemental crossing's displacement of the only grocery store on the island could have a profound effect, as it likely employs and serves those that live on the island.

The Smith Tower, which accepts Section 8 Housing Choice Vouchers, is the only identified low-income housing that might experience noise impacts resulting from Alternative 4. The Smith Tower is an elderly-care facility with one-bedroom units, located at 515 Washington Street in the Esther Short neighborhood. Smith Tower would experience noise impacts as a result of bus rapid transit when paired with a supplemental river crossing. With this crossing, the transit guideway would descend into Vancouver from a higher elevation. Due to the grade threshold for transit vehicles, the transit bridge would not touch down until after Sixth on Washington, putting the ramp near the higher units of the Smith Tower Apartments. A noise impact would only occur with bus rapid transit, but could be completely mitigated through residential sound insulation.

The higher toll packaged with Alternatives 4 and 5 could have an impact on EJ populations if mitigation is not included (mitigation is discussed in Section 3.5.5).

The supplemental river crossing would lead to worse congestion and mobility than the replacement crossing, especially around the Marine Drive, Hayden Island, and SR 14 interchanges.

Alternative 5: Supplemental Crossing with Light Rail

The only difference between this alternative and Alternative 4 is the transit mode. Environmental justice impacts for Alternative 5 are summarized in Exhibit 3.5-9, below.

Exhibit 3.5-9

Neighborhood and Environmental Justice Effects Summary for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Residential displacements	Minimal except on Hayden Island.	Minimal except on Hayden Island and Lincoln.	Minimal except on Hayden Island.	Minimal except on Hayden Island.
Business displacements	26-27 Minimal except on Hayden Island.	32-33 Minimal except on Hayden Island and in Lincoln neighborhood.	24-25 Minimal except on Hayden Island.	24-25 Minimal except on Hayden Island.
Separation from community resources	Displacement of Safeway on Hayden Island.	Displacement of Safeway on Hayden Island. Displacement of Wellness Project in Lincoln.	Displacement of Safeway on Hayden Island.	Displacement of Safeway on Hayden Island.
Increased local traffic or decreased access to transit, bike, or pedestrian facilities	More congestion on Hayden Island and downtown Vancouver.	More congestion on Hayden Island, downtown Vancouver, and uptown Vancouver.	More congestion on Hayden Island and downtown Vancouver.	More congestion on Hayden Island and downtown Vancouver.
Impacts to community cohesion	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.	Offset alignment on Hayden Island could separate floating home community.
Consistency with neighborhood plans	Highly consistent.	Highly consistent.	Highly consistent.	Highly consistent.
Noise impacts	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.	Few impacts, reduced after mitigation.
Air quality	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.	Emissions 30 to 90% lower than existing. No violations.
Potentially disproportionate, adverse impacts specific to low-income or minority populations	Tolls would require higher share of income for low-income populations and could impact these populations without mitigation.	Tolls would require higher share of income for low-income populations and could impact these populations without mitigation. Displaced Wellness Project would need to be mitigated.	Tolls would require higher share of income for low-income populations and could impact these populations without mitigation.	Tolls would require higher share of income for low-income populations and could impact these populations without mitigation.

Source: CRC Neighborhoods and Environmental Justice Technical Reports.

This alternative would have effects similar to Alterative 4, with two exceptions.

First, light rail would require expanding the existing TriMet maintenance facility in Gresham, resulting in displacement of up to seven homes. Census data for this area indicates that 40 percent of residents are minority and 35 percent have incomes below the poverty line. Specific house-by-house analysis is needed to determine the proportion of EJ residents on these parcels impacted.

Second, light rail would be more consistent with some neighborhood plans that call specifically for light rail.

3.5.3 Long-Term Effects from Project Components

This section describes the effects or impacts of the components and various options that make up the project alternatives. Transportation demand and system management options would not result in a substantial effect on neighborhoods or EJ, and are therefore not discussed in detail below. Likewise, the stacked transit/highway bridge (STHB) design for the replacement river crossing is not discussed, as it has little potential to affect neighborhoods or EJ populations.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The replacement crossing would substantially improve connections from Hayden Island to Marine Drive and to SR 14, downtown Vancouver, Mill Plain and Fourth Plain. It would have two or three auxiliary lanes, allowing traffic to travel between these destinations without merging with mainline highway traffic. This is especially beneficial between Hayden Island and Marine Drive, where these lanes are physically separated from the mainline highway, and would act similar to an arterial connection between the island and the mainland. These improved connections would provide improved access to community resources for neighborhood residents.

The supplemental crossing would only provide some of these transportation improvements for neighborhoods. Increased I-5 capacity over the No-Build Alternative would reduce congestion and improve travel time reliability on I-5. However, compared to the replacement crossing, the supplemental crossing design between the Marine Drive and Mill Plain interchanges would lead to increased congestion on local streets in the Kenton, Hayden Island, Esther Short, Columbia Way, and Hudson’s Bay neighborhoods.

The replacement and supplemental crossings would both require property acquisitions, some of which would displace residents and businesses. Because the highway improvements of the supplemental crossing would have a narrower footprint, this crossing would require fewer displacements and less overall property acquisition. Exhibits 3.5-10 and 3.5-11 summarize the demographics and location, respectively, of each neighborhood where acquisitions could occur. The percentages of EJ populations (minority and low-income) are given for each neighborhood as an indication of the potential for these displacements and property acquisitions to affect EJ populations.

Exhibit 3.5-10
Potential Displacements from Highway Acquisitions by Neighborhood

			Residences Displaced		Total Acres (All property types)[a]	
	Percent Minority	Percent Low-Income	Replacement	Supplemental	Replacement	Supplemental
Vancouver Neighborhoods						
Arnada	2%	15%	0	0	0.1	0
Central Park	16%	10%	0	0	3.6	1.7
Columbia Way	14%	14%	0	0	0.2	0.1
Esther Short	11%	35%	1	0	2.3	1.2
Hudson's Bay	17%	19%	0	0	0.6	0.1
Lincoln	10%	10%	3	0	0.5	0.1
Rose Village	21%	23%	1	1	0.1	0.3
Shumway	11%	14%	1	0	0.4	0.1
West Minnehaha	14%	11%	0	0	0.4	0.3
Portland Neighborhoods						
Bridgeton	24%	9%	0	0	0.5	1
Hayden Island	7%	7%	13	15	18.6	19.9
Kenton	37%	14%	1	0	1.4	1.2
Total	**16%**	**14%**	**20**	**16**	**28.7**	**26**

Source: CRC Neighborhoods and Populations Technical Report.

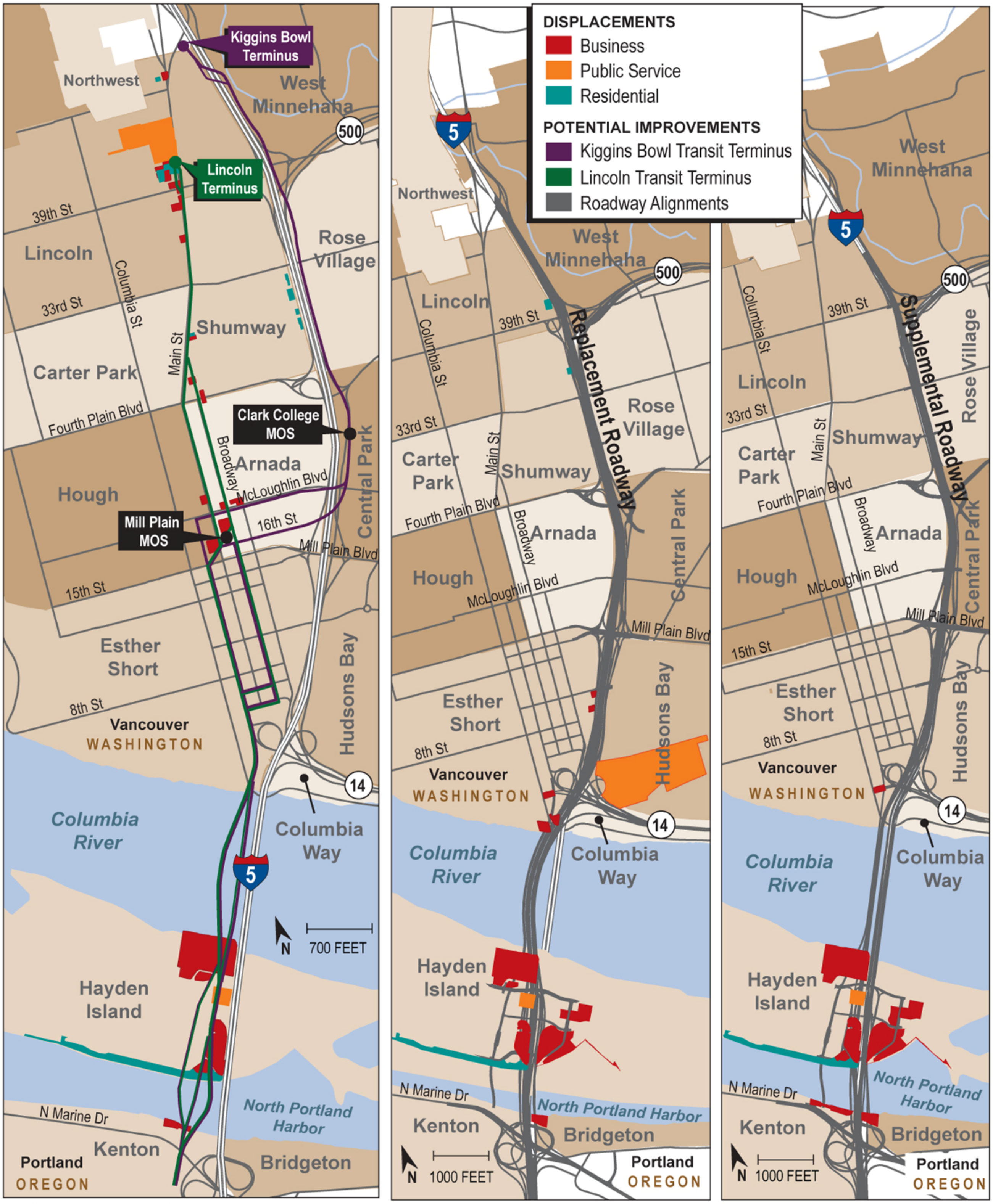
[a] Does not include land already owned by the state Departments of Transportation.

Acquisition of residential property would have some direct impacts or require displacements in Portland neighborhoods. The Kenton and Bridgeton neighborhoods have the highest percentage of minority populations (37 percent and 24 percent, respectively) and low-income populations (14 percent and 9 percent, respectively). However, in these neighborhoods, the replacement crossing would require only one residential displacement, and the supplemental crossing would require no displacements. Hayden Island would require the most displacements (13 floating home displacements for the replacement crossing, 15 floating home displacements for the supplemental crossing) and has among the lowest concentration impacts on low-income and minority populations. Given the low number of overall displacements and distribution of displacements in neighborhoods with low concentrations of EJ populations, it does not appear likely that these effects would be disproportionately borne by EJ populations. For the FEIS, additional evaluations of potential EJ impacts will include assessments of individual households and businesses.

Exhibit 3.5-11

Displacements* with Neighborhood Boundaries

Displacements Caused by Transit Terminus Options | **Displacements Caused by Replacement Roadway** | **Displacements Caused by Supplemental Roadway**



DIMENSIONS ARE APPROXIMATE.

*Entire parcels where displacements occur are highlighted.

The supplemental and replacement crossings could have impacts on businesses. Both river crossings could require displacement of the Safeway on Hayden Island, the only grocery store on the island, although the replacement crossing could be designed to avoid it. The supplemental crossing would require substantial exceptions to highway design standards to avoid the Safeway. Unless mitigated, displacing Safeway would be an adverse impact to the neighborhood, as it would require residents to make much longer trips to shop for groceries. Low-income populations may be employed at the Safeway store as well as other businesses at locations on Hayden Island that could be displaced by either river crossing. The Southern and Diagonal Marine Drive interchange options could require acquisitions of a portion of the Vanport wetlands or the Portland Expo Center, which have been identified as community resources (see Exhibit 3.4-5).

How would the project address noise?

The Noise and Vibration section of this chapter describes where noise could potentially increase, where it would likely become quieter, and what could be done to reduce its effects. The CRC highway improvements, combined with new sound walls, would result in fewer noise impacts than today.

Traffic-related noise impacts resulting from the highway improvements would not generally differ between the replacement and supplemental crossings. Most of the noise impacts that exceed FHWA or state standards could be mitigated by the placement of new sound walls or the replacement of old sound walls. In a few locations, new sound walls or extended walls would not be able to completely mitigate all traffic-related noise impacts. This would occur when noise walls could not be built high enough to block impacts to upper floors of apartment buildings (e.g., in the Esther Short neighborhood), or at the openings in noise walls at overpasses (in Rose Village and Shumway neighborhoods). Overall, mitigating highway noise for either river crossing would reduce noise to similar or lower levels than current conditions. The Noise and Vibration section of this chapter has more information on potential noise impacts.

The Washington State Schools for the Blind and the Deaf are near the project area. The School for the Blind is at 2214 E 13th Street near Mill Plain Boulevard and E Reserve Street. The School for the Deaf is at 611 Grand Boulevard, at Grand and Evergreen. The School for the Blind provides mobility classes, including instruction on crossing streets, business area travel skills, and bus travel. The project team will work with the City and County to ensure that the project does not result in unnecessary adverse impacts to sidewalks and other facilities used for mobility training.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

All neighborhoods in the project area would benefit from the introduction of bus rapid transit or light rail. With context sensitive, security-minded design, the transit stations could become community resources that are integrated with the neighborhoods, that attract investment, and that serve as common meeting places for neighborhood residents. The primary differences between these modes are noise (bus rapid transit is louder than light rail) and consistency with local plans (some neighborhood plans call specifically for light rail). Light rail also provides better transit mobility and thus provides more benefits to neighborhood residents and EJ populations that are more reliant on transit than other segments of the population.

Light rail would require expanding the existing TriMet maintenance facility in Gresham and displacing up to seven homes, some of which may contain businesses as well. Census data for this area indicate that 40 percent of residents are minority and 35 percent have incomes below the poverty line. Specific house-by-house analysis is needed to determine the proportion of EJ residents on these parcels that would be impacted by each transit mode.

Transit noise impacts would be more prevalent and severe with bus rapid transit than with light rail. Additionally, quieter residential areas along McLoughlin Boulevard, 16th Street and Broadway Street would experience a more dramatic noise impact from the introduction of transit than areas with higher existing noise levels such as in downtown Vancouver. Exhibit 3.5-12 summarizes the potential transit-related noise impacts by neighborhood. The table lists the number of buildings/units where potential noise impacts would occur.

Exhibit 3.5-12
Potential Transit-Related Noise Impacts by Neighborhood

Neighborhood	Percent Minority	Percent Low-Income		Total Noise Impacts[a]	Severe Noise Impacts	Noise Impacts After Mitigation	Total Noise Impacts[a]	Severe Noise Impacts	Noise Impacts After Mitigation
				Offset Alignment			**Adjacent Alignment**		
Hayden Island	7%	7%	BRT	42	21	0	35	7	0
			LRT	21	0	0	7	0	0
				Lincoln terminus (B)			**Kiggins Bowl terminus (A)**		
Arnada	2%	15%	BRT	40-47	1-30	0	31-49	17-31	0
			LRT	0-30	0	0	10-19	0	0
Carter Park	16%	10%	BRT	7-11	0-8	0	0	0	0
			LRT	0	0	0	0	0	0
Esther Short	11%	35%	BRT	0-20	0	0	0-20	0	0
			LRT	0	0	0	0	0	0
Rose Village	21%	23%	BRT	0	0	0	15	12	0
			LRT	0	0	0	0	0	0
Shumway	11%	14%	BRT	3-7	0	0	0	0	0
			LRT	0	0	0	0	0	0

Source: CRC Noise and Vibration Technical Report.

[a] Includes “moderate” and “severe” impacts, as defined in Section 3.11 Noise and Vibration.

A residential sound insulation program[20] could mitigate transit noise in the interior of affected residences, including floating homes on Hayden Island and residences along Broadway or 16th Streets in the Arnada neighborhood and in the Rose Village neighborhood. While only one residential structure affected by transit noise has been identified as low-income housing (the Smith Tower in the Esther Short neighborhood), other units may also be residences for low-income or minority individuals. For additional information for specific neighborhoods with EJ populations, see the Environmental Justice Technical Report.

[20] Residential Sound Insulation is an FTA-allowed measure (for transit impacts), not traditionally funded by the FHWA (for highway impacts).

Neighborhood plans for the Esther Short and Hough neighborhoods call for light rail. All of the project alternatives would have high-capacity transit running through the Esther Short and Hough neighborhoods, and access to transit would improve over current conditions. However, alternatives with light rail would more closely fulfill these neighborhood goals.

Residents of Hayden Island would benefit greatly from new transit service. The transit guideway and station would provide greatly improved transit service to and from the island and an alternative to highway travel between the island and downtown Portland and Vancouver. Both transit modes would provide access to downtown Vancouver without a transfer, and light rail would allow access to downtown Portland without a transfer.

Bus rapid transit would have longer travel times than light rail and would be less reliable, thus providing less benefit than light rail to low-income persons, who rely more heavily on public transit. Bus rapid transit would also require a C-Tran maintenance facility in eastern Vancouver, near the intersection of 18th Street and 65th Avenue, displacing up to two homes. Census data for this area indicate that 17 percent of residents are minority and 7 percent have incomes below the poverty line.

Transit Terminus Options (with all Alternatives)

The Lincoln and Kiggins Bowl terminus options would require some residential displacements in northern Vancouver neighborhoods, as summarized in Exhibit 3.5-13 (Hayden Island displacements are discussed below under Transit Alignment Options). The Arnada, Carter Park, Central Park, Hough and West Minnehaha neighborhoods would not have displacements. The Lincoln neighborhood would have seven displacements with the Lincoln terminus and two displacements with the Kiggins Bowl terminus. Shumway would have one displacement with the Lincoln terminus and one to eight displacements with the Kiggins Bowl terminus (the wider footprint of the replacement crossing highway improvements would cause eight displacements when paired with the Kiggins Bowl terminus, while the supplemental would only require one displacement). Rose Village would have one displacement with the Kiggins Bowl terminus.

Exhibit 3.5-13
Potential Displacements in North Vancouver[a] from Terminus options

			Residences Displaced		Total Acres[b] (All property types)	
	Percent Minority	Percent Low-Income	Lincoln Terminus (B)	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Kiggins Bowl Terminus (A)
Arnada	2%	15%	0	0	0.3	<0.1–0.3
Carter Park	13%	10%	0	0	0.1	0
Central Park	16%	25%	0	0	6.1	6.1
Hough	14%	20%	0	0	0	0.1
Lincoln	10%	10%	7	2	5.6–6.0	3.3–3.4
Rose Village	21%	23%	0	1	0	<0.1–0.2
Shumway	11%	14%	1	1–8	0.6–0.7	0.1–1.1
West Minnehaha	14%	11%	0	0	0	<0.1
Total	**13%**	**17%**	**8**	**4–11**	**12.7–13.2**	**9.6–11.2**

Source: CRC Neighborhoods and Populations Technical Report and Acquisitions Technical Report.
[a] North of 16th Street.
[b] Range depends on roadway alignment pairing.

Transit stations along the Lincoln terminus could have a greater effect on the surrounding community, where conducive zoning and existing land uses are more likely to accommodate new pedestrian- and transit-oriented development. Such development encourages greater interaction among residents and could enhance cohesion in the community.

The Lincoln terminus would displace the Wellness Project. While it is a non-profit rather than a public (governmental) facility, the Project does primarily serve a low-income population that may not have easy access to other medical care. If the Lincoln terminus is selected, plans would need to be made to relocate the facility within the same general area, or in a new location that offers substantially the same or better accessibility to the Center's clientele, as the current location. If the new Wellness Project location is served by high-capacity transit, persons traveling there could benefit from the project. If the Wellness Project is not successfully relocated, this could have a high adverse effect on low-income populations.

The Lincoln Park and Ride with the Lincoln terminus would result in displacement of seven homes immediately south of the existing WSDOT maintenance facility. This would have a local effect on neighborhood cohesion, but would not likely have a substantial impact on the broader Lincoln neighborhood. The park and ride would primarily serve travelers outside of the Lincoln neighborhood, and would attract traffic and increase congestion, particularly on Main Street where automobile capacity would be reduced. Traffic coming into the park and ride from other points could increase noise and congestion on neighborhood streets. The introduction of the Lincoln Park and Ride could disrupt neighborhood cohesion if the facility is not properly designed to fit with the existing community character.

The Kiggins Bowl terminus would have fewer direct impacts on neighborhoods than the Lincoln terminus, but would provide less benefit to Vancouver communities. Stations along the Kiggins Bowl terminus are less likely to attract economic investment and redevelopment, and are unlikely to encourage as great a level of interaction among residents or enhance cohesion in the community. The Kiggins Bowl Park and Ride is associated with full acquisition of three parcels and partial acquisition of five parcels. The Kiggins Bowl Park and Ride would result in building impacts to two retail buildings which currently house a computer services business and a furniture resale store.

In most areas, new sound walls would make noise levels on properties adjacent to I-5 quieter than today. Traffic coming into the park and ride at Kiggins Bowl from locations outside the project area could increase local congestion on neighborhood streets. In general, displacements, increased noise, and congestion impacts would conflict with neighborhood plan goals, but could be offset by advancing other goals, such as improved access to transit.

In addition to the full length transit alignments, there are two shorter-length alignments referred to as minimum operable segments (MOS): the Mill Plain MOS and the Clark College MOS. Both MOS options, particularly Mill Plain, would avoid most direct impacts to neighborhoods in north Vancouver. However, these shorter-length options would not provide the potential benefits, such as improved transit access, to these neighborhoods.

The Mill Plain MOS (D) terminus option would require displacement of the U.S. Bank Building between 16th and 17th Streets, to make space for a park and ride with potential ground floor retail. Impacting this business would displace (or relocate) approximately 30 employees. This business is a potential community resource, but its displacement would likely be offset by the introduction of high-capacity transit and redevelopment around this new station area.

Residential displacements and noise impacts associated with the Lincoln and Kiggins Bowl terminus options in northern Vancouver would largely be avoided by these MOS options. The Clark College MOS (C) would still incur the noise impacts associated with the Kiggins Bowl terminus along 16th Street or McLoughlin Boulevard.

Neither MOS would provide the improved high-capacity transit access in northern Vancouver afforded by the Lincoln or Kiggins Bowl terminus options. The Clark College MOS would provide better access to the Rose Village and Central Park neighborhoods than the Mill Plain MOS. The Mill Plain MOS would not provide direct, high-capacity transit service to Clark College or to the Marshall Community Center, both of which would be served by the Clark College MOS.

Transit Alignment Options (with all Alternatives)

The specific neighborhood and EJ impacts from the alignment options for the Lincoln and Kiggins Bowl terminus options are discussed below.

OFFSET OR ADJACENT

At the south end of the project, the offset alignment would require displacement of more floating homes on Hayden Island than the adjacent alignment, and would separate one group of floating homes from the rest of the floating home community. In the case of the adjacent alignment option, these floating home displacements will be influenced by the river crossing that it is paired with. The adjacent alignment option would displace no additional floating homes when paired with the replacement crossing, but would add eight displacements when paired with the supplemental crossing. The offset alignment option would displace seven floating homes when paired with either river crossing.

The offset alignment would also increase the number of potential noise impacts, although these could all likely be mitigated.

The offset transit alignment option could affect the cohesion of the floating home community by separating some floating homes from the larger community and placing them between the highway and the new transit guideway. The floating home community does not have a relatively high concentration of low-income or minority residents.[21]

TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

There are no known substantial impacts to neighborhoods or EJ populations as a result of these alignment options in downtown Vancouver.

16TH STREET OR MCLOUGHLIN

These two alignment options are for the Kiggins Bowl and Clark College MOS terminus options. The McLoughlin option would use McLoughlin Boulevard. McLoughlin Boulevard may serve as a pedestrian route for students of the Washington State School for the Blind and the School for the Deaf, both located in the project area. The School for the Blind provides mobility classes with instruction on crossing streets, business area travel skills, and bus travel. Further coordination will be required to ensure that the project does not result in unnecessary adverse impacts to McLoughlin or other east-west connections across I-5 that are used by these schools.

Transit on 16th Street would increase traffic congestion and noise in an otherwise quiet residential and commercial area.

TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET

These alignment options are for the Lincoln terminus. There are no known substantial impacts to the neighborhoods or EJ populations resulting from these two alignment options in northern Vancouver. Impacts north of these options resulting from the Lincoln terminus are discussed above under Transit Terminus Options.

Transit Operations

Increased transit operations would cause additional noise impacts because transit rapid transit vehicles would operate more frequently. Bus rapid transit is inherently louder than light rail and must operate more

[21] CRC Demographic Survey of JBMI, 2007.

frequently in general because buses have less capacity than trains. Exhibit 3.5-14 summarizes these noise impacts.

Exhibit 3.5-14
Noise Impacts by Transit Alignment Option, Mode, and Transit Operations[a]

	Light Rail		Bus Rapid Transit	
	Efficient	**Increased**	**Efficient**	**Increased**
Hayden Island Adjacent	7	7	35	35
Hayden Island Offset	21	21	42	42
Washington 2-Way	0	0	0	3
Broadway/Washington Couplet	0	0	0	3
Kiggins, McLoughlin option	16	19	22	34
Kiggins, 16th Street	10	10	16	17
Kiggins north of Clark College	0	0	15	15
Lincoln, Broadway 2-way	24	30	39	39
Lincoln, Broadway/Main Couplet	0	0	39	39
Lincoln north of 29th Street	0	0	1	8

Source: CRC Noise and Vibration Technical Report.

a Includes number of properties affected by both "moderate" and "severe" impacts.

Tolling Scenarios

Tolling could impact low-income populations, and the higher toll packaged with supplemental crossing Alternatives 4 and 5 would have a correspondingly higher impact on low-income populations. While these tolls would be paid by all motorists using the river crossing, they would represent a proportionally greater expense for low-income individuals. However, tolling the I-5 crossing also would reduce congestion and improve travel time reliability. (See Section 3.1 Transportation for information on tolling effects on transportation improvement.)

Electronic toll collection systems that use transponders would present difficulties for some low-income users, but would also provide opportunities for mitigation, as discussed below. Transponder users must normally link the transponder to a bank account or a credit card. Some low-income populations may not be able to purchase a transponder[22] due to large set-up fees or lack of a credit card and bank account. This would potentially be a disproportionate impact on those low-income populations affected. In addition, new tolls could present difficulties if used in areas where some individuals lack the English language skills to quickly learn the new tolling system.

The adverse impact of tolling on low-income populations could be mitigated by measures such as financial assistance programs, outreach and education, and increasing accessibility to transponders for low-income persons. It is particularly important to provide low-income and minority communities with information on how to obtain transponders, and with possible financial assistance. These programs do not currently exist, but are listed under, and described further as, potential mitigation measures, below.

[22] Parknay, 2004.

Not tolling the crossing might avoid some of the disproportionate adverse impact on low-income persons using the bridge. However, without a toll, the demand for the crossing capacity would increase, and reduce the transportation benefits of this project. Including a toll would reduce congestion, improve travel times, and could even result in a slight improvement in air quality by reducing emissions.

3.5.4 Temporary Effects

Neighborhoods in the project area would experience temporary effects from construction of the CRC project. These effects would generally increase with proximity to the physical improvements, and could include:

- Noise and vibration from construction
- Dust and fumes from construction
- Traffic delays, detours, and traffic spillover into neighborhoods
- Property easements for temporary construction staging areas

Neighborhoods that are the site of major bridge construction activity, such as Hayden Island and the Esther Short neighborhood, could experience some of these effects for several years. Roadway and transit construction effects in other areas could cause traffic disruption and noise for several months.

Construction impacts important to EJ populations include increased congestion, reduced mobility, reduced transit service, and increased noise. Temporary congestion during construction may have an impact on the EJ populations in the project area and the organizations that serve them. Environmental justice populations rely more on transit, which could be affected by construction-related congestion.

The potential sites for a bridge assembly/casting yard are unknown at this time, but it is unlikely that this would be in a residential area. However, truck traffic could increase noise and air emissions along access and haul routes to and from the site.

3.5.5 Potential Mitigation Measures

Several options are available to potentially mitigate the adverse long-term effects of the project identified for neighborhoods and EJ populations.

Potential Mitigation for Displacements

Most aspects of mitigation for property acquisition are addressed by federal and state regulations, which require that property be purchased at fair market value and that all residential displacements be provided with replacement housing and relocation assistance. Federal regulations and state statutes, such as the Uniform Relocation Act, determine the standards and procedures for providing such replacement housing, based on the characteristics of individual households. Relocation benefit packages usually include replacement housing for owners and renters, moving costs, and assistance in locating replacement housing.

Relocation benefits for businesses can include moving costs, site search expenses and business reestablishment expenses. As with residential displacements, relocation packages are determined on an individual basis based on ownership or tenant status. In general, an attempt would be made to minimize relocation impacts to residences, businesses, and public facilities. Eligibility and terms of relocation assistance will be determined during future project planning.

Displacement of residents and community resources could be mitigated by exploring relocation options within their neighborhoods to reduce impacts to residents and avoid the loss of these resources to their communities. This is especially important for neighborhood resources such as the Wellness Project, which serves low-income clients.

Impacts to the floating home community on Hayden Island could be mitigated by relocating displaced homes and/or residents. Ideally, relocations would be near their original location, although this may not be possible. Very few floating home slips in the metropolitan area are vacant, and there is no planned increase in the number of marinas. If there were sufficient spaces available, there would be additional difficulties. The displaced floating homes may not physically fit in the available slips or meet architectural design standards at other marinas. Relocation assistance programs for floating home residents should include provisions for addressing inconsistencies with new slip sizes and standards.

Potential Mitigation for Loss of Community Resources and Neighborhood Cohesion

The offset transit alignment option has the potential to divide the floating home community. To minimize any loss of community cohesion, mitigation measures could include providing physical connections (new walkways) between the newly separated piers of floating homes.

Relocation of the Safeway grocery store on Hayden Island would be considered to avoid removing the residents’ only grocery store. The project team has also identified highway alignment refinements for the replacement crossing that could avoid displacing the Safeway store. Relocation of the Wellness Project would be considered to avoid removing this community resource.

Potential community disruption from the introduction of the Lincoln Park and Ride could be mitigated by low-impact development techniques. These could include using Leadership in Energy and Environmental Design (LEED) methods or landscaping. Designs could include public amenities that would benefit the Lincoln neighborhood.

Potential Mitigation for Noise Impacts

Transit noise impacts at residences could be mitigated using residential sound insulation. Residential sound insulation is an FTA-allowed measure for transit impacts, but is not traditionally funded by the FHWA for highway impacts.

Traffic-related noise impacts may be mitigated depending on whether or not the decibel level exceeds FHWA and state standards for mitigation. New sound walls or replacing old sound walls may be recommended near residences and other noise-sensitive locations.

Potential Mitigation for Tolling

Several potential strategies could mitigate impacts of tolling on low-income populations. Since toll facilities are uncommon for most Washington-Oregon residents, educational program materials will be made available that explain how tolling works. All such communications of this sort need to be made available in selected non-English languages, as appropriate.

This project could provide assistance to programs to increase their levels of service and encourage more people to take transit or bike. C-TRAN offers programs that assist low-income populations and the disabled to obtain a reduced fare. TriMet offers similar programs that may assist low-income, senior, and disabled populations. Other programs include:

- The Community Cycling Center is a nonprofit organization dedicated to reaching children, restoring communities, and recycling bicycles. The center offers classes in safety, bike repair, commuting, and riding, and helps low-income youth and adults obtain bicycles.
- The Create a Commuter project provides bicycles to low-income individuals for work trips.
- The Job Access and Reverse Commute program includes late-night and weekend service, Guaranteed Ride Home Programs, vanpools or shuttle services to improve access to employment or training sites, car-share or other projects to improve access to autos, and access to child care and training.

A variety of methods could potentially improve low-income drivers' access to transponders used by the electronic tolling system. Two examples of existing programs in other areas of the country include:

MDX SunPass Direct: The Miami-Dade Expressway Authority (MDX) has created the SunPass Direct program to issue a limited number of free SunPass transponders to low-income Miami-Dade County residents. In addition to ease of use, the SunPass transponder saves about 20 percent of the toll each time it is used. Personal Accounts can be established on-line, by phone, mail, fax, or in person. Information and forms are available in English and Spanish

Illinois Tollway, I-PASS Assist: The Illinois Tollway has launched the I-PASS Assist program, using income-eligibility criteria to qualify people who could purchase an I-PASS at a reduced rate ($20 versus the typical $50).

For this project, potential mitigation for possible impacts of tolling on EJ populations includes:

- Providing information about transponders in multiple languages
- Locating venues for acquiring transponders near lower income and minority communities
- Enabling people without credit cards or checking accounts to obtain transponders
- Sharing information with and through other public service providers
- Subsidizing transponders to low-income drivers

Potential Mitigation for Temporary Effects

Measures for minimizing and/or mitigating temporary effects on neighborhoods and EJ populations could include:

- Providing effective detours that minimize out-of-direction travel and delays for travelers
- Maintaining transit service where possible throughout construction
- Using best management practices to reduce noise, dust, and fumes during construction
- Using existing or newly acquired right-of-way for construction staging to minimize additional temporary property acquisitions
- Communicating information about construction activities and impacts throughout neighborhoods, with focused outreach to ensure compliance with federal guidance regarding limited-English-proficiency populations.

3.6 Public Services and Utilities

Public services such as schools, emergency response, government offices, and hospitals are vital to the health of a community and can be affected by large construction projects and changes to the transportation network. Similarly, utilities such as private or public providers of electricity, water, sewer, natural gas, telephone, data, fiber optic, and other communications, can be affected by construction activities. This section identifies public services and utilities in the project area and evaluates the potential long-term and construction-related effects to them as a result of any of the build alternatives. The information presented in this section is based on the Public Services Technical Report and Utilities Technical Report.

In this analysis utilities include private or public providers of electricity, water, sewer, natural gas, telephone, data, fiber optic, and other communications. The information presented in this section is based on the Utilities Technical Report.

What is a public service?

For the purpose of this analysis, public services are defined as fire and medical services, law enforcement, school transportation, cemeteries, postal services, and municipal solid waste service. Potential impacts to other community resources such as libraries, non-profit medical clinics, community centers or meeting spaces, etc. are analyzed in Section 3.5, Neighborhoods and Environmental Justice. Potential impacts to parks, trails, and other recreational resources are analyzed in Section 3.7, Parks and Recreation.

3.6.1 Existing Conditions

Several fire stations, police stations, medical centers, schools, and other public services are located within the project area, as shown on Exhibit 3.6-1. Emergency mobile service providers include two fire stations, one police station, and one medical center. These service providers depend on the local and highway transportation network to respond to emergencies, and thought they are given signal priority, are negatively affected by traffic congestion.

Exhibit 3.6-1
Public Service Locations

Source: CRC Public Services Technical Report.

Emergency mobile service providers designate critical access routes they rely on to provide rapid emergency response. I-5 is an important north-south access route through the area, and the only access route to and from Hayden Island. In Vancouver, other critical north-south access routes include NW Hazel Dell Avenue and SR 99. In Portland, critical north-south access routes include N Interstate, Vancouver, and Williams Avenues and NE Martin Luther King Jr. Boulevard.

Five Vancouver School District schools, two Washington State schools, and one college are located in the project area. These schools are stationary, but their students rely on safe and efficient transportation facilities to reach them.

Utilities in the project area are described in Exhibit 3.6-2.

Exhibit 3.6-2
Utilities with Infrastructure in the CRC Project Area

Utility Owner	Type of Utility	Notes
AT&T	Communications	Local network services only.
Chevron	Fuel pipeline	Serves Portland International Airport. It will not be affected by the project.
Clark Public Utilities	Power	Serves the area north of the Columbia River.
Comcast	Communications	
Integra Telecom	Communications	Fiber-optic network formerly owned by Electric Lightwave.
NW Natural	Natural gas	Natural gas service provider for the area.
ODOT	Communications	
Pacific Power & Light	Power	Generally serves the area east of I-5 and south of Oregon Slough.
Portland, City of	Water, sewer and communications	
Portland General Electric	Power	Generally serves Hayden Island and the area west of I-5 and south of Oregon Slough.
Qwest	Communications	General telephone service provider for the area.
Sawtooth Technologies	Communications	Owns a fiber-optic line between the BPA Ross Complex and Vancouver VA Medical Center.
Time Warner Telecom	Communications	Fiber-optic network.
TriMet	Power & communications	Data provided showed changes made to existing utilities when the Interstate MAX Project light rail line was extended to the Expo Center.
Vancouver, City of	Water, sewer and communications	
WSDOT	Communications	

Source: Utilities Technical Report.

Several important utility lines travel across the Columbia River to provide services to Hayden Island and to connect the services between two states. These include a major water main, a natural gas feed line, and telephone, television, data, and fiber optic trunk lines carried on the I-5 crossing of North Portland Harbor. Additionally, trunk communication lines (telephone. TV, data, and fiber optics) are carried on the Columbia River Crossing and an underwater power cable immediately west of the crossing supplies Hayden Island.

Other important utility lines or structures that could be affected by the project include the main electrical switching station for Hayden Island which adjoins I-5, a natural gas supply line under Main Street in Vancouver, and water mains that cross I-5 at McLoughlin Boulevard, Mill Plain Boulevard, Fifth Street, 16th Street, and 40th Street. Additionally, there is a gas main along the entire length of Main Street, as well as a water main and communications tower on the WSDOT Maintenance Facility at 39th and Main.

While there are a significant number of utilities that could be affected by the project (for example, overhead and underground lines and pipes located on Hayden Island and in Vancouver), the discussion focuses on major infrastructure considered to be important to utility operations.

In general, transportation agencies and utility owners prefer that utilities not be located parallel to and under high-use corridors, such as a freeway or transit guideway, because they are difficult and expensive to maintain, repair and replace in such locations.

3.6.2 Long-term Effects from Project Alternatives

Project alternatives vary in their physical impact on public service facilities (i.e., buildings) and the amount of congestion that the project alternatives create, which can impact mobile public services (i.e., fire, ambulance, school bus). The following tables and associated discussion summarize these impacts.

Alternative 1: No-Build

As Section 3.1, Transportation describes, traffic congestion will increase substantially in the I-5 corridor over the next 20 years, as the number of vehicles increases and the bridge capacity does not. This could have substantial negative effects for emergency service providers, especially for police and ambulance response on Hayden Island, which does not have alternative access routes when the highway is congested.

Traffic analysis predicts that five intersections along Mill Plain Boulevard in Vancouver would fail to meet traffic standards. Mill Plain Boulevard serves as an important east-west connector across I-5, and delays could present an obstacle to emergency response.

The existing bridges do not comply with modern seismic standards and are vulnerable to damage or collapse in a severe earthquake. This would have serious effects to public services and utilities on Hayden Island, as medical and police emergency services have no alternate routes, and water, natural gas, and communications lines carried on the bridge could be damaged and fail. Additionally, existing utilities along I-5 and potential transit alignments would continue to age and require maintenance repairs or replacement.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.6-3 summarizes the potential impacts to the provision of public services and utilities that could occur as a result of Alternative 2.

Exhibit 3.6-3
Public Service and Utilities Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Potential effect of traffic congestion on mobile public services (on Interstate)	Substantially improved compared to No-Build	Substantially improved compared to No-Build	Substantially improved compared to No-Build	Substantially improved compared to No-Build
Potential effect of traffic congestion on mobile public services (in Vancouver)	Moderate	Moderate-High	Moderate	Moderate-High
Potential displacement of stationary public services	ODOT Permit Center, Clark Public Utilities offices, and FHWA Western Federal Lands Building.	ODOT Permit Center, Clark Public Utilities offices, FHWA Western Federal Lands Building, and the WSDOT maintenance facility.[a]	ODOT Permit Center, Clark Public Utilities offices, and FHWA Western Federal Lands Building.	ODOT Permit Center, Clark Public Utilities offices, FHWA Western Federal Lands Building, and WSDOT maintenance facility.
Potential need to relocate utilities as a result of transit component	Low-Moderate	Moderate- High	Low-Moderate	Moderate

Source: CRC Public Services Technical Report and Utilities Technical Report.

[a] See discussion of this impact in Transit Terminus options section.

Note: The STHB design does not result in different effects for the metrics listed in the above table, and is therefore not included.

Alternative 2 would have increased highway capacity, improved interchange movements and weaving distances, and standardized highway features, which would result in better travel times and the shortest duration of congestion both on and off the highway. This would substantially improve the ability of emergency services to access emergencies on I-5 and travel between Vancouver and Hayden Island.

Traffic congestion in downtown Vancouver could affect the ability of emergency vehicles to travel to and from an emergency, and is influenced by many different factors, including the river crossing choice, length of transit terminus option and associated park and rides. As compared to No-Build, the replacement river crossing would result in fewer trips using local streets to navigate around congestion on I-5, thereby resulting in less congestion in downtown.

The full-length Kiggins Bowl and Lincoln terminus options would affect local traffic more as they are longer in length, as would those options that travel predominately on local streets. The Lincoln terminus, therefore, could have a greater effect on local traffic than the Kiggins Bowl terminus. The Clark College MOS would likely result in similar traffic effects as the Kiggins Bowl terminus option, while the Mill Plain MOS, although shortest in length, is associated with multiple park and rides in downtown Vancouver, which could increase in local traffic.

The additional of a separate transit crossing across the Columbia River could improve emergency service access across the river. Additionally, emergency services could access the at-grade transit guideway on local streets to access emergencies in the City of Vancouver.

The replacement crossing when paired with any of the transit terminus options would require the displacement of the ODOT permitting center on Hayden Island, the Clark Public Utilities offices adjacent to the highway in Vancouver, and possibly a portion of the FHWA Western Federal Lands building on the Vancouver National Historic Reserve (VNHR). In addition, the Lincoln terminus option and Mill Plain MOS would displace the WSDOT maintenance facility at 39th and Main Street.

Alternative 2 would require the relocation of utilities currently carried on the river crossing, but would be less likely than light rail alternatives to require local street utility relocation. The Lincoln terminus option and Mill Plain MOS would have a higher potential to require the relocation of major utilities as a result of transit, because there are major utilities at the site of the proposed Lincoln Park and Ride and along Main Street north of Fourth Plain Boulevard.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.6-4 summarizes the potential impacts to the provision of public services and utilities that could occur as a result of Alternative 3.

Exhibit 3.6-4
Public Service and Utilities Effects Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Potential effect of traffic congestion on mobile public services (on Interstate)	Substantially improved compared to No-Build	Substantially improved compared to No-Build	Substantially improved compared to No-Build	Substantially improved compared to No-Build
Potential effect of traffic congestion on mobile public services (in Vancouver)	Moderate	Moderate-High	Moderate	Moderate-High
Potential displacement of stationary public services	ODOT Permit Center, Clark Public Utilities offices, and FHWA Western Federal Lands Building.	ODOT Permit Center, Clark Public Utilities offices, FHWA Western Federal Lands Building, and the WSDOT maintenance facility.[a]	ODOT Permit Center, Clark Public Utilities offices, and FHWA Western Federal Lands Building.	ODOT Permit Center, Clark Public Utilities offices, FHWA Western Federal Lands Building, and WSDOT maintenance facility.
Potential need to relocate utilities as a result of transit component	Moderate	High	Moderate	Moderate-High

Source: CRC Public Services Technical Report and Utilities Technical Report.

[a] See discussion of this impact in Transit Terminus options section.

Note: The STHB design does not result in different effects for the metrics listed in the above table, and is therefore not included.

Effects to public services for Alternative 3 would be the same as those for Alternative 2. This alterative would also require the relocation of utilities that currently reside on the river crossing, and would be more likely than alternatives that involve bus rapid transit to require the relocation of underground utilities located along the potential alignments.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.6-5 summarizes the potential impacts to the provision of public services and utilities that could occur as a result of Alternative 4.

Exhibit 3.6-5
Public Service and Utilities Effects Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Potential effect of traffic congestion on mobile public services (on Interstate)	Improved compared to No-Build	Improved compared to No-Build	Improved compared to No-Build	Improved compared to No-Build
Potential effect of traffic congestion on mobile public services (in Vancouver)	Moderate-High	High	Moderate-High	High
Potential displacement of stationary public services	ODOT Permit Center and Clark Public Utilities offices.	ODOT Permit Center, Clark Public Utilities offices, and the WSDOT maintenance facility.	ODOT Permit Center and Clark Public Utilities offices.	ODOT Permit Center, Clark Public Utilities offices, and the WSDOT maintenance facility.
Potential need to relocate utilities as a result of transit component	Low-Moderate	Moderate- High	Low-Moderate	Moderate

Source: CRC Public Services Technical Report and Utilities Technical Report.

Alternative 4 would not substantially increase highway capacity, would be unable to substantially improve some interchange movements and weaving distances, and would keep some substandard highway features. These limited highway improvements would be slightly offset by a highway toll and increased transit use to cross the river, resulting in some congestion relief on I-5. This could improve the ability of emergency services to access emergencies on I-5 and travel between Vancouver and Hayden Island.

Traffic congestion in downtown Vancouver could affect the ability of emergency vehicles to travel to and from an emergency, and is influenced by many different factors including the river crossing choice, length of transit terminus options, and associated park and rides.

The supplemental river crossing could result in greater transit use and somewhat fewer trips using local streets to navigate around congestion on I-5, thereby resulting in some congestion relief. The Lincoln terminus could have a greater effect on local traffic than the Kiggins Bowl terminus. The Clark College MOS could likely result in similar traffic effects as the Kiggins Bowl terminus option, while the Mill Plain MOS, although shortest in length, could have multiple park and rides in downtown Vancouver and could likely result in increases in local traffic.

The addition of transit crossing and at-grade local street guideway could improve emergency vehicle access as described with Alternative 2.

All of the alternatives would displace the ODOT permitting center on Hayden Island and the Clark Public Utilities office adjacent to the highway in Vancouver. Alternatives 4B and 4D would also displace the WSDOT maintenance facility at 39th and Main Street.

The potential for utility relocation with Alternative 4 would be the same as described in Alternative 2.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.6-6 summarizes the potential impacts to the provision of public services and utilities that could occur as a result of Alternative 5.

Exhibit 3.6-6
Public Service and Utilities Effects Summary for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Potential effect of traffic congestion on mobile public services (on Interstate)	Improved compared to No-Build	Improved compared to No-Build	Improved compared to No-Build	Improved compared to No-Build
Potential effect of traffic congestion on mobile public services (in Vancouver)	Moderate-High	High	Moderate-High	High
Potential displacement of stationary public services	ODOT Permit Center and Clark Public Utilities offices.	ODOT Permit Center, Clark Public Utilities offices, and WSDOT maintenance facility.	ODOT Permit Center and Clark Public Utilities offices.	ODOT Permit Center, Clark Public Utilities offices, and WSDOT maintenance facility.
Potential need to relocate utilities as a result of transit component	Moderate	High	Moderate	Moderate-High

Source: CRC Public Services Technical Report and Utilities Technical Report.

Effects to public services for Alternative 5 (A, B, C, and D) would be the same as those for Alternative 4. This alterative would also require the relocation of utilities that currently reside on the river crossing, and would be more likely than alternatives that involve bus rapid transit to require the relocation of utilities located in the local street network.

3.6.3 Long-term Effects from Project Components

This section describes the effects of the specific project components and various options. The tolling scenarios and transportation demand and system management options would not have a meaningful effect on public services and utilities and are therefore not discussed below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The replacement crossing would provide greater capacity and more highway improvements, therefore resulting in less congestion on the highway than the supplemental crossing. Less congestion on the highway could discourage drivers from exiting onto local streets to navigate around highway traffic. Decreasing congestion on I-5 would improve the ability for mobile services providers to respond to emergencies throughout the project area.

Either river crossing could result in the loss of a few parking spaces in the Discovery Middle School parking lot, but would not affect the operation of this facility after construction of the project. The Clark Public Utilities office adjoining I-5 in Vancouver and the ODOT Permit Center on Hayden Island would need to relocate for either the replacement or supplemental crossing.

The replacement crossing could impact a portion of the FHWA Western Federal Lands building on the Vancouver National Historic Reserve. The impacted portion of the FHWA Western Federal Lands building would be an annex that could potentially be removed without the displacement of the entire building. Design refinements of the replacement crossing may avoid this impact, although access through that area from Anderson Road would still be eliminated.

The supplemental crossings' constraints on the transit bridge design may result in the closure of the intersection of Sixth Street and Washington Street, which could affect the mobility of emergency services on this critical east-west connection through south downtown Vancouver.

Both river crossings are expected to require the relocation of utilities on the existing river crossing. The new river crossings, including the transit bridge, could potentially carry the displaced utilities.

Interchange construction could require relocating utilities if they involve tunnel construction. No long-term change to utility service levels for existing uses is expected from either river crossing or associated highway improvements.

The Southern Realignment Marine Drive interchange design option as described in chapter 2 could slow down large emergency response vehicles on the segment of Marine Drive west of I-5, which could increase emergency response times. Neither the Standard nor Diagonal Marine Drive interchange options would result in this impact.

The stacked transit/highway bridge design for the replacement river crossing would operate high-capacity transit beneath the traffic deck and within the structure of the bridge for approximately 2,600 feet. Fire and life safety access to transit passengers and egress of passengers in case of an emergency will be evaluated in the FEIS, as the bridge type and design are refined. Please see the CRC Stacked Transit/Highway Bridge Technical Memorandum for more information.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

As bus rapid transit (BRT) vehicles have lower capacity than light rail vehicles, more would be needed to operate the shorter headways that would be required to provide the same capacity, resulting in congestion and potentially posing as additional obstacles for emergency response.

In general, utility impacts associated with bus rapid transit could be less for light rail, because light rail often requires less excavation. This does not apply to station locations, as they are designed to have the same footprint for both BRT and light rail. Additionally, buses can be temporarily re-routed onto adjacent streets when access to underground utilities is required. Agencies and utility providers would jointly determine whether utilities under the transit guideway need to be relocated. Key considerations would be the 1) permanency of the guideway, 2) the need for uninterrupted transit service, 3) the cost and responsibility for relocation, and 4) land use policies and service standards. The Transit Terminus and Alignments Options discussion below and the Utilities Technical Report provide more information regarding utility relocation.

The operation of light rail would require the construction of power substations along the alignment. The existing MAX light rail line uses a 750-volt DC system to deliver power to the cars from the overhead electrical lines (catenary wires). Other elements of the light rail system—such as lighting, signals, and switches—use either AC or DC electricity for power. As described in Chapter 2, light rail would require power substations to provide power to the catenary system used to propel light rail vehicles. Substations are placed based on voltage load but are generally located about every mile along the alignment but especially near steep grades such as bridges. Three would be located within MOS option alignments; one on Hayden Island, one in downtown Vancouver near the bridge and another near, or in, the Mill Plain District. A fourth sub-station would be placed nearer a full-length terminus for full-length options. Signal and Communications buildings would also need to be placed near, or on, every station. Siting for both sub-station and Signal and Communications buildings would occur during Preliminary Engineering.

The expansion of either the C-TRAN bus maintenance facility in east Vancouver or the TriMet Ruby Junction light rail maintenance facility in Gresham is not expected to affect the provision of any public service. No impacts to major utilities have been identified for the two maintenance base expansions. Additionally, as construction would involve only development of existing maintenance facilities or contiguous property, utility impacts would be limited to infrastructure serving those bases and located on the property being developed.

Transit Terminus Options (with all Alternatives)

The Lincoln terminus (B) would reduce automobile capacity on northern Vancouver streets and could increase congestion in this area, potentially increasing emergency response times. The Kiggins Bowl terminus (A) would avoid these traffic impacts in northern Vancouver and could improve public access to Clark College, as would the Clark College

MOS (C). Both the Clark College (C) and Mill Plain (D) minimum operable segments would not extend transit north of about McLoughlin Boulevard and would therefore have less impact on traffic in that area. The park and ride facilities associated with the Mill Plain MOS (D) in and near the I-5/SR 14 interchange could potentially result in greater congestion and travel delay, and thus impacts on the provision of mobile public services, in downtown Vancouver, compared to the Clark College MOS (C) or full-length alignments (A or B).

With any terminus option, emergency vehicles could access the transit guideway to navigate around local traffic when responding to emergencies.

Currently, the design of the Lincoln terminus (B) and the Mill Plain MOS (D) would acquire the WSDOT maintenance facility at 39th and Main Street for the Lincoln Park and Ride. WSDOT has had plans in place for many years to move this facility to another location. Independent of the CRC project, WSDOT has obtained funding to study two potential relocation sites for their facility, which they plan to complete by the end of 2008.[23] If either site is deemed viable, WSDOT will move forward with the acquisitions and begin relocation as soon as possible. Relocation of this facility will likely occur before construction. If the Lincoln terminus (B) or the Mill Plain MOS (D) is selected, with the Lincoln Park and Ride, as the preferred alternative, and construction of the park and ride has to begin before the relocation of the facility, this would be considered a displacement.

The Lincoln terminus (B) would travel directly in front of the Vancouver Academy of Arts and Academics and the SW Washington Medical Center. This would require minor strip acquisitions from both properties, but would improve transit access to these resources. This terminus option may also result in temporary impacts during construction to public services located on Main Street, such as the Academy of Arts and Academics, SW Washington Medical Center, Fire Station #86, and the WSDOT maintenance facility. See the Temporary Effects section for more information. The Kiggins Bowl terminus option, and Clark College and Mill Plain MOSs would avoid these effects.

A water main on the southern edge of the WSDOT maintenance facility, and a communications tower in the southwest corner would also be affected by the Lincoln terminus (B) or Mill Plain MOS (D) and associated Lincoln Park and Ride. Additionally, a gas feed line on Main Street north of 29th and communications trunk line north of 39th could be affected by the Lincoln terminus (B). The Kiggins Bowl terminus would avoid these impacts. Specific impacts to utilities as a result of the transit alignment options from Hayden Island through northern Vancouver are discussed below.

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[23] Canter, Personal Communication, 2008.

Transit Alignment Options (with all Alternatives)

OFFSET OR ADJACENT

The adjacent transit alignment option on Hayden Island could likely acquire additional portions of the ODOT permitting center parcel, potentially making its relocation on the same parcel more challenging. The offset transit alignment would avoid this parcel.

The only impacts to utilities would be the result of pier location, as the transit guideway is elevated, and would likely be limited to the main electrical feed to and switches for the Jantzen Beach mall.

TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

There is not expected to be a meaningful effect to the provisions of public services from the two-way Washington transit or Washington-Broadway couplet alignment options.

Communication trunk lines belonging to two services are located along Washington Street south of Eighth Street could be effected by either alignment option. Additionally, a water main on 16th between Main and Broadway and a communications trunk line on Sixth between Washington and Main could be impacted if the alignments travel on these streets.

16TH STREET OR MCLOUGHLIN

These two transit alignment options apply to the Kiggins Bowl terminus (A) and the Clark College MOS (C). Travel delay or congestion as a result of transit on McLoughlin Boulevard could result in greater impacts to mobile public services than on 16th, as McLoughlin is one of the few east-west connections across the highway in Vancouver.

In addition to potential traffic impacts, water mains cross the highway along both 16th and McLoughlin, and may have to be relocated because height requirements for the McLoughlin Boulevard underpass or 16th Street tunnel may require substantial excavation.

TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET

These two transit alignment options apply to the Lincoln terminus (B). There is not expected to be a meaningful effect to the provisions of public services or utilities from the two-way Broadway or Broadway-Main couplet transit alignment options. Impacts to public services and utilities common to both alignment options along Main Street north of Fourth Plain Boulevard are addressed in the Transit Terminus Options discussion above.

Transit Operations

The higher transit frequencies associated with Increased transit operations (part of Alternatives 4 and 5) could result in additional traffic impacts in Vancouver over those expected with Efficient operations (part of Alternatives 2 and 3). Increased congestion as a result of these higher frequencies could impact the provision of mobile public services, such as emergency vehicles.

Tolling Scenarios

The I-5 bridge toll is not expected to affect the provision of public services or utilities.

Transportation Demand and System Management

Transportation demand and system management program levels are not expected to affect the provision of public services or utilities.

3.6.4 Temporary Effects

Construction of the river crossing, highway interchanges, and transit alignments in Vancouver could cause temporary delays for emergency services such as police, fire, or ambulances. For emergency services that use I-5 to access downtown Vancouver or Hayden Island, these effects would be most strongly felt at and around the SR 14 and Hayden Island interchanges. While certain movements through the SR 14 interchange could be closed completely for two to three years, the Hayden Island interchange would largely remain open (with possible detours) throughout construction. In addition to the SR 14 interchange construction, emergency vehicles in downtown Vancouver would likely have to navigate transit guideway construction on local streets.

If construction of the project causes congestion on I-5, critical access routes must be available in order for emergency service providers to serve their communities. The full transit terminus options could take approximately 2.5 to 3.5 years to build, and would likely be constructed at the same time as the river crossing and interchanges. More information regarding construction related closures and traffic delays can be found in Section 3.1, Transportation.

Construction near the Discovery Middle School (Kiggins Bowl terminus) or the Academy of Arts and Academics and SW Washington Memorial Center (Lincoln terminus) in Vancouver could cause temporary increases in noise, vibration, or traffic delays.

The Lincoln terminus would involve construction near Fire Station 86 at 37th and Main Street, though no property would be acquired from the parcel. The Vancouver Fire Department has plans to relocate this station and is currently looking at possible locations, although the plans have not finalized as of the preparation of this DEIS.[24] Construction in this area will require carefully planned staging to maintain access for the fire station if it remains at this location during the construction time frame.

For the replacement river crossing, or during seismic retrofitting of the existing bridges (part of the supplemental crossing), utility lines on the existing crossing and underwater cables that could be damaged by construction would need to be re-routed.

The potential sites for a bridge assembly/casting yard are unknown at this time. A remote bridge assembly/casting yard could require the temporary extension of utilities to the site if they are not already adequately serving the site.

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[24] Deputy Chief Tom Miletich, August 2007, Personal Communication.

3.6.5 Potential Mitigation Measures

During the planning and design process, the CRC team has attempted to avoid and minimize effects to public services and utilities by modifying alignments where possible and considering access and travel times during construction and operation of the project. This process of minimizing impact will continue as designs are refined.

The project team will continue to work with the local service providers to alleviate concerns about transit projects near schools and other sensitive uses. The transit guideway can be designed in a way that separates it from local traffic, but allows emergency vehicles to cross into the guideway to access emergencies and navigate around local traffic. The project team has contacted the City of Vancouver Fire and Police departments, the Clark County Fire Marshall, the City of Portland Police Bureau and Fire and Rescue, emergency services staff at local hospitals, as well as local schools. Future coordination will focus on identifying potential mitigation measures that would assure safety during construction and operation of the project. See the Public Services Technical Report for more information regarding this coordination.

The displacement of publicly owned facilities, such as the ODOT permit Center, FHWA Western Federal Land building, or WSDOT maintenance facility could be mitigated by functionally replacing the property acquired with another facility that would provide equivalent utility.

If the stacked transit/highway bridge design moves forward, the design team would address the unique fire, life, safety and security concerns associated with operating transit within the structure of the bridge though the type of the structure will be identified in the FEIS. This would include a Safety and Security Management Plan developed in accordance with federal requirements and in close coordination with the transit agencies, the cities of Vancouver and Portland, Clark and Multnomah counties, the ports of Vancouver and Portland, and all associated police and fire departments, during the preliminary and final design, construction and operation of the project. The plan would provide reliable emergency access, develop alternate plans or routes to avoid delays in response times, and institute other features as necessary so that safety and emergency services are not compromised.

The project team would work closely with utility service providers to reduce the number and extent of service outages during construction or relocation activities, and to provide advance notice when such outages might occur. Any utility relocation would occur in accordance with state and federal policy. Detailed Composite Utility Plans that show existing utilities, and propose temporary and permanent utility relocations could be developed after the selection of a locally preferred alternative.

It would be beneficial to the project to develop agreement(s) with affected utility owners for utilities to be relocated, were feasible, prior to the start of the project. It is possible that some of the unavoidable utility relocations may provide the opportunity for substandard infrastructure to be brought up to standard.

3.7 Parks and Recreation

Existing and planned parks and recreation facilities are important resources, highly valued by local governments and community members. Park and recreation facilities of local, regional, and national significance are located within the project area. This section discloses potential effects by project alternatives to all park and recreation resources currently open to the public or those that will be in the foreseeable future. These include school facilities, public docks, interpretative or community centers, or trails, in addition to traditional open spaces. Additionally, this analysis looks at potential impacts to recreational events and activities. Some, but not all of the park and recreation resources in the project area are protected by federal regulation. The evaluation of use of park and recreation resources in accordance with Section 4(f) of the Department of Transportation Act (49 USC 303) can be found in the Draft Section 4(f) Evaluation (Chapter 5) of this DEIS. An analysis of potential impacts to park and recreation resources protected under Section 6(f) of the federal Land and Water Conservation Fund Act is included later in this section.

The information presented in this section is based on the Parks and Recreation Technical Report which is included as an electronic Appendix to this document.

3.7.1 Existing Conditions

Exhibit 3.7-1 shows the location of all park and recreational facilities in the CRC project area. Exhibit 3.7-2 summarizes these park facilities and their amenities.

Exhibit 3.7-1

Parks in the CRC Project Area

DIMENSIONS ARE APPROXIMATE.

Exhibit 3.7-2 (page 1 of 2)
Parks and Recreation Facilities in or Near the Project Area

	Type	Location	Agency with Jurisdiction	Amenities
East Delta Park	Regional park	Adjoins I-5 to the east in Oregon.	City of Portland	Sports complex: 5 softball fields, 8 soccer fields; 6 volleyball courts, playground, picnic tables, restrooms, parking, support buildings, nature trails, and dog off-leash area.
Marine Drive multi-use path	Multi-use trail	Adjoins I-5 to the west in Oregon, connects to trails on existing bridges.	City of Portland	Paved multi-use non motorized trail. Access to Columbia River; Smith and Bybee Lakes natural area, & Kelley Point Park to the west.
Proposed Bridgeton Trail	Proposed multi-use trail	Would adjoin I-5 to the east in Oregon	City of Portland	Paved multi-use non motorized trail. Would connect Bridgeton neighborhood with the Marine Drive multi-use path west of I-5.
Lotus Isle Park	Neighborhood park	East of I-5 on Hayden Island, Oregon.	City of Portland	Paved paths, picnic tables, playground
Lower Columbia River Water Trail	Recreational and commercial waterway.	Passes under I-5 bridges in Washington.	Lower Columbia River Estuary Partnership	Boat ramps, marinas, fueling stations, dock-side restaurants, scenic views, fishing, boating recreation (within 5 miles of the bridge).
Waterfront Park	Regional park	Adjoins I-5 to the east in Washington.	National Park Service (NPS).	Scenic views, public access, start of Waterfront Renaissance Trail; Boat of Discovery artwork, Cptn George Vancouver Monument, Illchee statue, viewing plaza.
Waterfront Renaissance Trail	Multi-use trail	Crosses under I-5 in WA, connects to trails on existing bridges.	City of Vancouver/ NPS.	Paved multi-use non motorized trail along waterfront. Connects to VNHR & Old Apple Tree Park via confluence land bridge.
Vancouver Landing	City amphitheater and public dock	Approx. 1,000 feet west of I-5 in WA.	City of Vancouver	Public moorage facility/dock, amphitheater.
Old Apple Tree Park	Community park	Adjoins I-5 to the east in Washington.	City of Vancouver	Oldest apple tree in the Pacific NW, benches, and paved plaza
Vancouver National Historic Reserve (VNHR)	Includes a National Historic Site, Historic District	Adjoins I-5 to the east in Washington.	NPS, City of Vancouver, WA. State, and US Army; supported by VNHR Trust.	Historic interpretive sites and replica structures, confluence land bridge, large annual events, trails, picnic tables and shelter, recreation fields.

Exhibit 3.7 2 (page 2 of 2)

	Type	Location	Agency with Jurisdiction	Amenities
Esther Short Park	Community park	1 block from proposed transit station in Washington.	City of Vancouver	Event pavilion, play equipment, benches, paved walkways, landscaping, paved square, interactive water feature.
Clark College Recreational Fields	College facilities open to the public	Adjoins proposed park and ride facility in WA.	Clark College	Sports fields, benches, landscaping
Leach Park	Community park	50 feet east of I-5 in WA.	City of Vancouver	Playground, benches
Marshall Community Park/Center	Community center, park, and pool.	Adjoins I-5 to the east in Washington.	City of Vancouver	Playground, community gardens, trail, picnic tables, ball fields, horseshoes, public pool, fitness center, basketball, gym, commercial kitchen, meeting rooms.
Waterworks Park	Community park	Less than 1 mile east of I-5	City of Vancouver	Walking trails, play equipment, picnic shelters, restrooms, skatepark, community amphitheater.
Arnada Park	Neighborhood park	Adjoins I-5/ Fourth Plain interchange to the southwest.	City of Vancouver	Gazebo, picnic shelter, play equipment, lighting, sports court, benches, paved walkway.
Shumway Park	Neighborhood park	1 block east of transit design option on Main St.	City of Vancouver	Play equipment, benches, picnic tables, and a walkway.
Leverich Park	Regional park	Adjoins I-5 to the east and SR 500 to the south in Washington.	City of Vancouver	Ball fields, picnic tables and shelter, paved walkway, restroom, BBQ stands, horseshoes, access to Burnt Bridge Creek Greenway.
Burnt Bridge Creek Greenway and Trail	Natural area, multi-use trail	Trail crosses I-5 north of SR 500 via a pedestrian overpass.	City of Vancouver	8-mile long interconnected trails providing access to creek, natural areas, and developed parks.
Kiggins Bowl	Sports venue	Adjoins proposed of park and ride facility in Washington.	Vancouver School District	Natural area, sports fields, Trail connection to Burnt Bridge Creek Greenway.

Source: CRC Parks and Recreation Technical Report.

Important recreational events within the project area include the Fort Vancouver fireworks display at the Fort Vancouver National Historic Site, the Wine and Jazz Festival at Esther Short Park, Hot July Nights at Esther Short Park, and Hoops on the River at the Vancouver Landing.

Additionally, recreational activities, such as fishing, occur in the Columbia River throughout the year. For impacts to recreational fishing, please see Section 3.14, Ecosystems.

The Columbia Slough has been defined as a scenic waterway by the City of Portland, which could be considered a recreational resource. Information regarding impacts to this visual resource can be found in Section 3.9, Visual and Aesthetic Qualities.

Potential 6(f) Resources

Section 6(f) of the federal Land and Water Conservation Fund Act prohibits the conversion of property, primarily park and recreation facilities, acquired or developed with grant funds provided through the act, unless replacement land of at least equivalent property and recreational value is identified, approved, and acquired. State-funded and implemented programs that are very similar to the federal LWCF program include the Oregon Local Government Grant Program, Oregon County Opportunity Grant Program, and Washington Salmon Recovery Funding Board.

Currently, of all the park or recreation facilities potentially affected, the only facilities known to have received funding from the Land and Water Conservation Fund (LWCF) are a portion of the trail within the Burnt Bridge Creek Greenway near SR 500 (grant in 2007)[25], Waterworks Park (grant received in 1984)[26], and Vancouver Landing.[27] See Exhibit 3.7-3 for locations of these resources. See Exhibit 3.7-2 for information about each resource.

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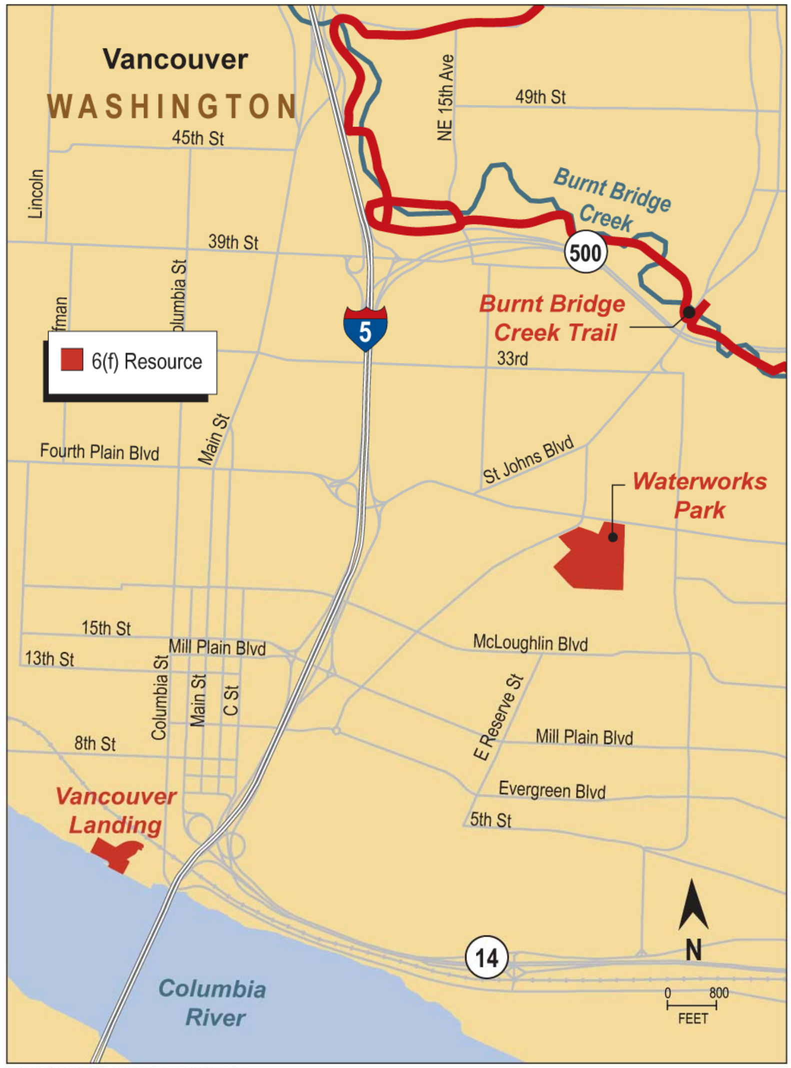
[25] Washington State Recreation and Conservation Office Lands and Water Conservation Fund (LWCF), Grant Project Locations, 2008.

[26] Washington State Recreation and Conservation Office Lands and Water Conservation Fund (LWCF), Grant Project Locations, 2008.

[27] City of Vancouver, Personal Communication, 2008.

Exhibit 3.7-3
Known and Potential 6(f) Resources



DIMENSIONS ARE APPROXIMATE.

The project alternatives would not directly affect the Burnt Bridge Creek Trail, although they may require the realignment of a local connection to the trail. The project alternatives would not directly impact Waterworks Park or Vancouver Landing.

A final Section 6(f) evaluation will be provided in the Final EIS, following the development of more refined designs and staging information and further consultation with parks and recreation officials. Though not currently expected, if any of the build alternatives were to require the acquisition of land protected by Section 6(f) or other land protected by similar state program grants, the FHWA and/or FTA would coordinate with the agencies owning the resources, state LWCF managing agencies, and if appropriate, the National Park Service to develop formal conversion documentation. Additionally, the FHWA and/or the FTA would be required to acquire replacement lands of equal value, location, and usefulness.

3.7.2 Long-term Effects from Project Alternatives

The build alternatives, as described in the Description of Alternatives (Chapter 2), comprise different combinations of river crossing, high-capacity transit mode, and transit terminus options and alignment options. The following tables and associated discussions summarize the acquisition of park and recreation resources, including trails that could occur as a result of the project alternatives, as well as the potential improvements in transit access to these parks.

Alternative 1: No-Build

If the CRC project does not go forward there would be no CRC-related impacts to park or recreation resources. The pedestrian and bicycle connection on the existing bridges, which connects multi-use trails in Vancouver and Portland, would remain poor. Large events such as the Fort Vancouver fireworks display, Wine and Jazz Festival, Hot July Nights, and Hoops on the River would continue to have limited traffic and transit access, particularly from Portland.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.7-4 summarizes the potential effects to park and recreation resources that could occur as a result of Alternative 2.

Exhibit 3.7-4
Parks and Recreation Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus(B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Acres of park and recreation resources potentially acquired[a]	5.26 to 6.47	4.90 to 6.11	4.90 to 6.11	4.90 to 6.11
Acres of the VNHR potentially acquired[b]	1.73 to 2.70	1.73 to 2.70	1.73 to 2.70	1.73 to 2.70
Linear feet of trails potentially realigned	230	230	230	230
Transit access to park and recreation resources	Improved access to many large regional parks	Improved access to small community parks	Improved access to some large regional parks	Limited direct access improvements

Source: CRC Parks and Recreation Technical Report.

a For a breakdown of acquisition impacts by park and recreation resource see Section 3.8.3.

b Included in the totals in the above row.

Note: The impacts with the STHB design for the river crossing would be the slightly different for multi-use trail connections, as the text below describes.

The Kiggins Bowl terminus paired with the replacement river crossing (Alternative 2A), would acquire 5.26 to 6.47 acres of park and recreation resources, including 1.73 to 2.70 acres of the Vancouver National Historic Reserve (VNHR). Acquisition impacts for Alternative 2 would be slightly less with the Lincoln, Clark College, and Mill Plain terminus options, as compared to the Kiggins Bowl terminus option, because they avoid the transit related impacts to Leverich Park (0.01 acre) and the additional impacts to Kiggins Bowl sports venue (0.35 acre). Effects to the VNHR are not influenced by the transit terminus options.

Alternative 2 would require the relocation of 50 feet of a local connection to the Burnt Bridge Creek Greenway trail near Kiggins Bowl, and would travel over approximately 180 feet of the Waterfront Renaissance Trail, requiring the realignment of any portion of this section of trail.

Alternative 2 would improve transit access to parks to different degrees depending on the transit terminus option. The Kiggins Bowl terminus option would provide direct bus rapid transit access to large regional parks such as the Clark College Recreational fields, Marshall Community Center and Park, Kiggins Bowl, and Leverich Park, while the Lincoln terminus option could provide improved transit access to smaller community and neighborhoods parks on the west side of I-5 south of 39th Street. Like the Kiggins Bowl terminus option, the Clark College MOS would provide direct bus rapid transit access to Clark College Recreational fields and Marshall Community Center and Park, but would not provide access to the large parks further north. As the Mill Plain MOS does not extend as far east and/or north as the other alternatives it would only improve transit access for those resources in south downtown Vancouver, such as Waterfront Park, Waterfront Renaissance Trail, Vancouver Landing, and Esther Short Park.

Alternative 2 would have greater highway capacity than Alternatives 4 and 5, and therefore less traffic congestion. It could improve access to and from major recreation events at the Vancouver National Historic Reserve, Esther Short Park, and the Vancouver waterfront areas. Additionally, Alternative 2 would result in improved bicycle and pedestrian connections over the Columbia River and North Portland Harbor, as users would no longer have to navigate local streets on Hayden Island to move between the two crossings.

The stacked transit/highway bridge design for a replacement crossing would cause slightly different effects in the Vancouver shoreline area. The multi-use trail over the river would likely be located on the east rather than west side of the bridge, though adequate trail connections for users heading both east and west along the shoreline would be provided. Users connecting to trails in Portland would have to use local streets to cross under the highway on Hayden Island and reconnect with the trail on the separated transit guideway there.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.7-5 summarizes the potential effects to park and recreation resources that could occur as a result of Alternative 3.

Exhibit 3.7-5
Parks and Recreation Effects Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Acres of park and recreation resources potentially acquired[a]	4.91 to 6.12	4.90 to 6.11	4.90 to 6.11	4.90 to 6.11
Acres of the VNHR potentially acquired[b]	1.73 to 2.70	1.73 to 2.70	1.73 to 2.70	1.73 to 2.70
Linear feet of trails potentially realigned	230	230	230	230
Transit access to park and recreation resources	Improved access to many large regional parks	Improved access to small community parks	Improved access to some large regional parks	Limited direct access improvements

Source: CRC Parks and Recreation Technical Report.

a For a breakdown of acquisition impacts by park and recreation resource see Section 3.8.3.

b Included in the totals in the above row.

Note: The impacts with the STHB design for the river crossing would be the slightly different for multi-use trail connections, as the text below describes.

Alternative 3 would result in the same effects as Alternative 2 for park and recreation resources, except for the total acres of park and recreation resources required for Alternative 3 when paired with the Kiggins Bowl terminus option. As Alternative 3 uses light rail instead of bus rapid transit, it avoids a 0.35 acre acquisition of forested area from the parcel on which the Kiggins Bowl sports venue is located.

This alternative would improve transit access to park and recreation resources in the same way as described for Alternative 2. Alternative 3 could also include the STHB design, resulting in the same changes to trail configuration as mentioned under Alterative 2.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.7-6 summarizes the potential effects to park and recreation resources that could occur as a result of Alternative 4.

Exhibit 3.7-6
Parks and Recreation Effects Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Acres of park and recreation resources potentially acquired[a]	3.66	3.30	3.30	3.30
Acres of the VNHR potentially acquired[b]	0.28	0.28	0.28	0.28
Linear feet of trails potentially realigned	143	143	143	143
Transit access to park and recreation resources	Improved access to many large regional parks	Improved access to small community parks	Improved access to some large regional parks	Limited direct access improvements

Source: CRC Parks and Recreation Technical Report.

[a] For a breakdown of acquisition impacts by park and recreation resource see Section 3.8.3.

[b] Included in the totals in the above row.

The Kiggins Bowl terminus, when paired with the replacement river crossing, would acquire 3.66 acres of park and recreation resources, including 0.28 acre of the Vancouver National Historic Reserve (VNHR). Acquisition impacts for Alternative 4 would be slightly less for the Lincoln, Clark College, and Mill Plain terminus options, as compared to the Kiggins Bowl terminus option, because they avoid the transit related impacts to Leverich Park (0.01 acres) and the additional impacts to Kiggins Bowl sports venue (0.35 acres).

Alternative 4 would require the relocation of 50 feet of a local connection to the Burnt Bridge Creek Greenway trail near Kiggins Bowl, and would travel over approximately 93 feet of the Waterfront Renaissance Trail, requiring the realignment of any portion of this section of trail.

This alternative would improve transit access to park and recreation resources in the same way as described for Alternative 2.

Alternative 4 would not provide substantial congestion relief and would therefore not result in a considerable improvement to access to and from important recreational events in Vancouver. This option would also potentially increase the number of bridge piers in the waters, making marine navigation more difficult, and possibly impeding recreational use of the Columbia River Water Trail and North Portland Harbor. Last, this alternative would not provide a grade-separated bicycle and pedestrian pathway across Hayden Island.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.7-7 summarizes the potential effects to park and recreation resources that could occur as a result of Alternative 5.

Exhibit 3.7-7
Parks and Recreation Effects Summary for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Acres of park and recreation resources potentially acquired[a]	3.31	3.30	3.30	3.30
Acres of the VNHR potentially acquired[b]	0.28	0.28	0.28	0.28
Linear feet of trails potentially realigned	143	143	143	143
Transit access to park and recreation resources	Improved access to many large regional parks	Improved access to small community parks	Improved access to some large regional parks	Limited direct access improvements

Source: CRC Parks and Recreation Technical Report.

[a] For a breakdown of acquisition impacts by park and recreation resource see Section 3.8.3.

[b] Included in the totals in the above row.

Alternative 5 would result in the same effects as Alternative 4 for park and recreation resources, except for the total acres of park and recreation resources required for the Kiggins Bowl terminus option As Alternative 5 uses light rail instead of bus rapid transit it avoids a 0.35 acre acquisition of forested area from the parcel on which the Kiggins Bowl sports venue is located.

This alternative would improve transit access to park and recreation resources in the same way as described for Alternative 4.

3.7.3 Long-term Effects from Project Components

This section describes the effects of the project components and various options. Operational components (tolling scenarios, transit operations and TDM/TSM) would not affect parks and recreation facilities and are therefore not discussed in detail below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The highway widening associated with either river crossing could require a strip of land used for three horseshoe courts that adjoins parking and fields at Marshall Community Park (totaling 1.2 acres). In Leverich Park, highway construction could require between 0.24 acre (supplemental) and 0.33 acre (replacement) adjoining the highway. This contains landscaping, berms, and part of the park main entrance road. The guideway would be elevated in this section.

Either river crossing could interfere with the proposed route of the Bridgeton multi-use trail, which would connect the East and West Marine Drive trails. However, the replacement crossing and Marine Drive interchange improvements would improve pedestrian and bicycle conditions compared to the No-Build Alternative, and a connection to the planned Bridgeton trail could be incorporated into the design. The land where the Bridgeton trail is proposed is not publicly owned.

With the supplemental river crossing recreational use of the Lower Columbia River Water Trail could suffer due to the increased number of piers in the water and potential increased river navigation hazard.

The replacement crossing could acquire up to 0.27 acre of Old Apple Tree Park, although the tree itself would not be displaced. Shading from the bridge ramps may increase. The supplemental river crossing and associated interchange improvements would not impact the park, nor displace the tree or increase shading.

The replacement crossing would travel over approximately 180 feet of the Waterfront Renaissance Trail. Any portion of this may need to be realigned as a result of pier placement. With the replacement crossing bicycles and pedestrians would access the crossing from the west side and travel uninterrupted across the Columbia River and North Portland Harbor. With the supplemental crossing, up to 93 feet of the trail could potentially need to be relocated. Users would access the river crossing pathway from the east side of the bridge, and would be forced to navigate local streets on Hayden Island to complete the crossing, as is currently the case.

Exhibit 3.7-8
Existing Low Clearance at Waterfront Park

The bridge landing with the replacement river crossing may shade up to 0.23 acre of Waterfront Park viewing area, which includes a portion of the Waterfront Renaissance Trail. Currently, the existing bridges shade a similar-sized portion of the park and trail. The existing bridge landing would be removed, potentially providing better park access from downtown Vancouver and more space in a currently constricted area of the park. The bridge deck's increased height clearance over the shoreline (as seen in Exhibit 3.7-8) could also improve park conditions compared to the No-Build Alternative. The supplemental river crossing would shade approximately 0.17 acre of the park, in addition to the area shaded by the existing bridges, and would not improve existing low clearance over the park. Current designs indicate that the art pieces located at this site, the Capitan George Vancouver Monument and the Boat of Discovery, would not be displaced by either crossing.

Depending on the design of the SR 14 interchange, between 1.76 (for left-loop design) and 2.70 acres (for dual loop design) of Vancouver National Historic Reserve, (which includes the Fort Vancouver National Historic Site) could be acquired for the replacement crossing. The supplemental crossing would require approximately 0.31 acre of the Vancouver National Historic Reserve, including the Fort Vancouver National Historic Site. No built recreational facilities would be impacted in this area, but it could detract from the nearby replica of the Hudson's Bay Company Village. Park plans also include future recreational uses of the FHWA Western Federal Lands Mule Barn and possibly the City of Vancouver Police Administration site, neither of which would likely be affected by the strip acquisitions required for both crossings along the western edge of these two parcels.[28] The Description of Alternatives (Chapter 2) and Draft Section 4(f) Evaluation (Chapter 5) describe the

[28] National Park Service, 2003.

potential SR 14 interchange designs and impacts to the Vancouver National Historic Reserve, as well as future plans for the Vancouver National Historic Reserve, in more detail.

The planned Seventh Street pedestrian connection, as indicated in City of Vancouver and NPS plans, across I-5 would be more difficult with the supplemental river crossing than with the replacement crossing, as the supplemental bridge would be higher than existing grade in this area. The replacement crossing would match the existing grade in this area. The replacement river crossing would also allow for another use (through an airspace lease) of the property for Fifth Street to cross under I-5. This would provide a new connection between downtown Vancouver and Vancouver National Historic Reserve.

The stacked transit/highway bridge design for a replacement crossing would cause slightly different effects in the Vancouver shoreline area. The multi-use trail over the river would likely be located on the east rather than west side of the bridge, though adequate trail connections for users heading both east and west along the shoreline would be provided. Users connecting to trails in Portland would have to use local streets to cross under the highway on Hayden Island and reconnect with the trail on the separated transit guideway there.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

The only impact to park and recreation resources that differentiates the two transit modes is a bus rapid transit related impact to the parcel on which the Kiggins Bowl sports field is located. In order for the transit guideway for bus rapid transit to access the proposed Kiggins Park and Ride from the Kiggins Bowl terminus (A), it must transition over I-5 further south than light rail, and would therefore travel over approximately 0.35 acre of this forested area before terminating at the park and ride. As piers would be placed in a forested portion of this parcel, this impact would not be expected to interfere with the functional use of the Kiggins Bowl playing field.

The expansion of either the C-TRAN maintenance facility in East Vancouver or the TriMet Ruby Junction facility in Gresham would not be expected to affect any park or recreation resources. The planned Gresham/Fairview Trail through this area would run along the east side of the existing TriMet Ruby Junction facility, and therefore would not be impacted by the expansion, which would occur to the west.

Transit Terminus Options (with all Alternatives)

The Kiggins Bowl (A), Lincoln (B), Clark College (C), and Mill Plain (D) terminus options could all acquire up to 1.24 acres of the Clark College recreational fields for the construction of the Clark College Park and Ride. This acquisition would require mostly passive recreational space, but could displace a batting cage. Building a transit station at this location, as would occur with the Kiggins Bowl terminus (A) and Clark College minimum operable segment (C), would improve access to the recreational facilities at Clark College and Marshall Community Center and Park.

The Kiggins Park and Ride, located directly north of the Kiggins Bowl sports venue, would be included with all transit terminus options. Its construction would require the realignment of 50 feet of trail that connects Main Street to the Burnt Bridge Creek Greenway Trail and would acquire 0.14 acre of landscaping and a road/trail to the Kiggins Bowl sports fields. An additional 0.35 acre of forested area of this parcel may also be acquired by the Kiggins Bowl terminus (A), if bus rapid transit is the preferred mode. Transit access to the Kiggins Bowl sports fields would likely improve more with the Kiggins Bowl terminus (A), which ends in this location, as compared to the Lincoln terminus (B) which ends two to three blocks south of the sports venue, or either MOS (C and D).

The Kiggins Bowl terminus (A) would cross over approximately 0.01 acre (370 square feet) of Leverich Park, which is east of I-5 along the Burnt Bridge Creek Greenway. These impacts are in addition to those caused by the highway improvements. The transit guideway would transition over I-5 at this location, and would cross over landscaping and berms. The Lincoln (B), Clark College (C) and Mill Plain (D) terminus options would avoid transit-related impacts to Leverich Park

Transit Alignment Options (with all Alternatives)

None of the transit alignment option would result in impacts to park and recreation resources.

Transit Operations

Transit operations options are not expected to result in impacts to park and recreation resources.

Tolling Scenarios

I-5 bridge tolling is not expected to result in impacts to park and recreation resources.

Transportation Demand and System Management

Transportation demand and system management options are not expected to result in impacts to park and recreation resources.

Where are the regional multi-use trails?

Section 3.1, Transportation contains a map showing the routes and connections of the region's non-motorized multi-use trails.

3.7.4 Temporary Effects

Temporary effects from construction are likely to be similar for any of the build alternatives and include issues relating to access, noise, dust, or travel delays. The location and duration of these effects would differ depending on the alternative chosen as discussed below.

Between 0.13 acre for the supplemental river crossing and 0.54 acre for the replacement river crossing, of the Vancouver National Historic Reserve could be temporarily acquired as construction easements. These would likely be required to construct a retaining wall and/or sound walls along SR 14 or I-5.

For some people, construction of a project on the scale of the Columbia River Crossing would be interesting, and facilities with views of the bridge, such as Vancouver Waterfront Park, the Confluence Land Bridge (part of the VNHR), or the Columbia River would be appealing vantage points to watch construction. Others will find the noise and sight of construction activities detract from their recreation experience.

At times, construction of the bridge could require channel closure of the Columbia River or North Portland Harbor. Although efforts would be made to ensure at least one shipping channel is passable, in-water construction could detract from enjoyment and increase the hazard to recreational boating near the bridges and enjoyment of the Lower Columbia River Water Trail may be affected.

Interchange construction near Marine Drive could make access to East Delta Park, the West Marine Drive Multi-use Trail, and the planned Bridgeton Trail more difficult. Construction at the bridge footing in Vancouver and the SR 14 interchange could affect access to Waterfront Park, the Renaissance Trail, Old Apple Tree Park, the confluence land bridge, and associated recreation facilities. Transit construction in downtown Vancouver could temporarily reduce access to Esther Short Park and Vancouver Landing. Construction at the SR 500 to I-5 northbound ramp may temporarily affect access to Leverich Park from 39th Street.

Exhibit 3.7-9
Heritage Apple Tree with SR 14 Ramp in Background

Construction activities such as demolition, movement of heavy equipment, regrading, etc. have the potential to affect the health of the Heritage Apple Tree (see Exhibit 3.7-9), located in Old Apple Tree Park, which would be very close to these activities. Extreme care to avoid damaging this tree during construction would be necessary. The supplemental alternatives would not require demolition of the existing ramps here, and could pose less of a construction hazard to the heritage tree. Vancouver urban forestry experts would be consulted to ensure that all appropriate measures are taken to preserve the health of the Heritage Apple Tree and other trees in the park.

Delays associated with transit, bridge, and highway construction could affect the attendance at large events such as the Fort Vancouver Independence Day Fireworks display, the Wine and Jazz Festival, Hot July Nights, Hoops on the River, as well as the docking of the Portland Spirit.

A discussion of potential temporary impacts to recreational fishing in the Columbia River is discussed in Section 3.14, Ecosystems.

Construction could close or limit bicycle or pedestrian access along the transit alignments and on the river crossing, which could affect recreation in Vancouver and Portland, and the connection between multi-use trails in both cities.

The potential sites for a bridge assembly/casting yard are unknown at this time. The bridge assembly/casting yard could potentially impact unknown public parks or recreation facilities. However, avoiding public parks and recreation facilities will be a priority for siting this temporary facility.

3.7.5 Potential Mitigation Measures

Construction closures could be timed to minimize effects to large events such as the Fort Vancouver fireworks, Wine and Jazz Festival, Hot July Nights, Hoops on the River, and the docking on the Portland Spirit. Certain construction staging, described in Section 3.1, Transportation, could retain pedestrian and bike connectivity during construction.

The construction plan for the SR 14 interchange could include specific protection measures to reduce the potential of harm to the Heritage Apple Tree, located in Old Apple Tree Park. These could include debris or dust shielding, barriers to prevent construction equipment from accidentally damaging the tree, or scheduling work during the fall and winter when the tree is dormant. The project team would consult with the Vancouver Urban Forester, National Park Service cultural landscape specialists, and an urban forestry specialist to determine the best methods of protecting the tree.

At Leverich Park and Kiggins Bowl, the project could provide re-routed access to the Burnt Bridge Creek Greenway, and create or retain a forested landscape buffer between the park and ride and the greenway. The project staff would consult Vancouver Parks and Recreation Department staff on design and implementation.

Best management practices, including those already developed in WSDOT and ODOT construction manuals, could also be developed to protect the art installations in Waterfront Park—Captain George Vancouver Monument and the Boat of Discovery—from construction related impacts such as dust, vibration, or accidental damage from construction equipment.

Other potential measures for reducing impacts to the parks and recreation facilities are discussed in the Draft Section 4(f) Evaluation of this DEIS.

3.8 Historic and Archaeological Resources

The CRC project team has collected information on cultural resources in the project area, and has analyzed the CRC alternatives' potential adverse effects to these resources. Cultural resources include the historic built environment, historic features, and potential archaeological features. The project area contains several hundred cultural resources (including the northbound I-5 bridge), a substantial number of historic buildings in downtown Vancouver, the Vancouver National Historic Reserve, and numerous archaeological sites.

3.8.1 Cultural Resources Regulations

Cultural resources consist of a broad range of tangible and intangible aspects of human existence that have, or had, value for maintaining lifeways. Cultural resources may include, but are not limited to, buildings or materials that are used in living as well as beliefs or customs attached to physical places or landscapes. Because of their importance, various cultural resources are protected by federal, state and/or local laws. The National Historic Preservation Act (NHPA) of 1966 (as amended) establishes a program for the preservation of historic and cultural resources throughout the United States. In particular, Section 106 provides the foundation for ensuring that federal agencies such as the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) take into account the effects of their undertakings on any district, site, building, structure, or object that is included on or eligible for inclusion on the National Register of Historic Places (NRHP). This law focuses on tangible historic resources—things and places. For this project, historic resources have been broadly categorized as "historic built environment" (typically above-ground buildings, structures, objects, and districts), "archaeological" (typically below-ground remnants of human activity), and traditional cultural properties.

TERMS & DEFINITIONS

Traditional Cultural Properties

The National Park Service's *Guidelines for Identifying and Documenting Traditional Cultural Properties* defines a traditional cultural property as a site that is "eligible for inclusion on the National Register [of Historic Places] because of its association with cultural practices or beliefs or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." These properties could include, but are not limited to, ceremonial sites, traditional homes of a particular cultural group, or locations of historic economic, artistic, or other cultural practices.

Source: Parker and King, 1998.

Section 106 Compliance

Section 106 applies whenever there is a federal nexus to a project, that is, whenever the project requires a federal permit, uses federal dollars, or takes place (in whole or in part) on federal lands. Title 36, Part 800 of the Code of Federal Regulations (36 CFR 800) instructs federal agencies how to implement the requirements of section 106. Primary themes in these regulations are early and frequent consultation, systematic investigations, and achieving historic preservation objectives through careful consideration of avoidance, minimization, and mitigation of unavoidable adverse effects.

These regulations also stipulate or outline the procedures by which federal agencies are to conduct their accounting. The procedures are organized in a stepped fashion, generally starting with initiating the section 106 process (36 CFR 800.3), then identifying historic properties (36 CFR 800.4), assessing adverse effects (36 CFR 800.5), and resolution of adverse effects (36 CFR 800.6). While the steps afford practitioners a level of certainty and consistency for many situations, the regulations also allow flexibility in choosing both how to carry out the steps technically and how to organize them, considering the opportunities and constraints afforded by the proposed project and the context underlying the historic resources environment.

The following discussion describes how the CRC project is complying, and will continue to comply, with the procedural steps of 36 CFR 800 regarding the historic built environment and archaeological resources.

36 CFR 800.3 – INITIATION OF THE SECTION 106 PROCESS

The CRC project is an Undertaking (36 CFR 800.16(y)), because the project build alternatives would involve the type of activities that have the potential to cause effects to historic properties. Specifically, the build alternatives would directly involve the northbound I-5 Columbia River Bridge, which is a National Register-listed historic property, as well as other National Register-listed or -eligible historic resources.

Section 106 requires that "consulting parties" be included in decisions regarding eligibility for listing on the National Register and as findings of effect (see sidebar). The section 106 consulting parties identified by FHWA and FTA for the CRC project include:

TERMS & DEFINITIONS

Consulting Party

Section 106 requires that "consulting parties" be involved in all findings of effect and determinations of eligibility during the section 106 process. These consulting parties include the State Historic Preservation Offices (SHPOs), federally and non-federally recognized tribes, local government, and the public.

- Chinook Tribe
- City of Portland
- City of Vancouver
- Confederated Tribes and Bands of the Yakama Nation, Washington
- Confederated Tribes of the Grand Ronde Community of Oregon
- Confederated Tribes of the Siletz Reservation, Oregon
- Confederated Tribes of the Umatilla Reservation, Oregon
- Confederated Tribes of the Warm Springs Reservation of Oregon
- Cowlitz Indian Tribe, Washington
- National Park Service (NPS)
- Nez Perce Tribe of Idaho
- Oregon State Historic Preservation Office (SHPO)
- Spokane Tribe of the Spokane Reservation, Washington
- Vancouver National Historic Reserve Trust
- Washington Department of Archaeology and Historic Preservation (DAHP)

Information about the project's consideration of historic properties, excluding sensitive archaeological resources, was discussed publicly through the project's public involvement program. These discussions occurred in the project's conceptual alternative development and evaluation phases.

36 CFR 800.4 THROUGH 36 CFR 800.6 – IDENTIFICATION OF HISTORIC PROPERTIES, ASSESSMENT OF ADVERSE EFFECTS, AND RESOLUTION OF ADVERSE EFFECTS

Determine Scope of Identification Efforts

The CRC project team coordinated with the Oregon SHPO, Washington DAHP, the nine consulting tribes, and other section 106 consulting parties listed above to determine the project's Cultural Area of Potential

Effect (APE). On May 29, 2007, the CRC project team solicited formal input and asked for formal concurrence from Section 106 consulting parties regarding the APE. Comments received were limited, and no revisions to the APE were needed.

The APE was defined as the area that could potentially experience direct or indirect impacts from the range of alternatives that are being advanced for consideration in the DEIS (Exhibit 3.8-1). Because assessment techniques vary by resource type, the CRC project has created three areas of concern within the APE. These areas of concern reflect different boundaries for the historic-period built environment and archaeological resources.

The CRC team held several meetings with the nine consulting tribes, DAHP and SHPO, and others to seek information regarding historic properties. The consulting parties were afforded review opportunities of the technical report and research design, and appropriate modifications were made to these based on comments received. Please refer to the Tribal Consultation section or Appendix A at the end of this document for a more detailed discussion of tribal consultation.

Exhibit 3.8-1
Cultural Resources
Area of Potential Effect (APE)

DIMENSIONS ARE APPROXIMATE.

ARCHAEOLOGY

Determine Scope of Identification Efforts

The archaeological area of concern within the APE (Exhibit 3.8-2) was developed by making a good faith effort to review and analyze background technical reports and maps regarding the location of formally recorded archaeological sites, and by conducting initial consultations with the section 106 consulting parties, especially tribes, to identify known or potential resource areas and concerns.

The project team hosted a History Seminar on March 20, 2007, with representatives from all nine tribes, the CRC project team, USDOT leadership, state DOT leadership, the National Park Service, and other academics and historians. The purpose of this seminar was to provide the project team, including engineers, transportation planners, and document production staff with the same level of historical context for this project area as the project moves forward in design.

The archaeological area of concern within the APE included all areas within which ground-disturbing impacts might occur, plus a 50 foot buffer of additional land to accommodate potential staging areas. This area of concern includes landforms that date back to the Pleistocene (12,000 years BP). These are landforms that are deeply buried in some parts of the APE.

Background Research

Background research included a thorough review of existing information on geology, geomorphology, prehistory, ethnography, ethnohistory, history, and archaeology (historic-period and pre-contact) within the APE. This background research is documented in more detail in the Archaeology Technical Report.

Previously recorded archaeological sites were mapped and data about these sites were analyzed. A pedestrian reconnaissance survey was conducted of the existing rights-of-way within the archaeological area of concern in order to characterize ground surface and natural- and human-modified topography. This information was used to develop a probability map that illustrates the likelihood of finding archaeological resources throughout the APE. Consulting parties reviewed the Archaeology Research Design and the Inadvertent Discovery Plan. The Draft Research Design was developed based on guidance in *Archaeology and Historic Preservation: Secretary of Interior's Standards and Guidelines*. The Draft Inadvertent Discovery Plan, developed in consultation with affected tribes, outlines the specific procedures that will be followed to prepare for and manage unanticipated discoveries of cultural resources or human remains; this document will be updated for construction activities. These documents were prepared and reviewed by multiple professional archaeologists and other specialists meeting the Secretary of Interior's professional standards. The APE and each report are designed to be living documents and tools that will be supplemented and modified as needed to reflect new information as it is obtained from ongoing cultural resource investigations.

Information about geotechnical boring samples gathered during previous studies (between 1954 and 2006; see the CRC Archaeology Technical Report for more detail on previous studies) within the Columbia River and North Portland Harbor were analyzed in order to better characterize the subsurface geomorphology and the probable presence or absence of archaeologically sensitive materials.

The CRC project is developing service contracts with interested tribes to participate in monitoring ground-disturbing activities during the project. Further coordination with tribes and their participation in monitoring ground-disturbing activities is expected to help inform further design refinements for any alternative. Potential impacts to traditional cultural properties or sacred sites are not expected to differ substantially between alternatives.

The CRC project collected information in accordance with steps outlined in 36 CFR 800. Background research, including the archaeology probability map and information about known archaeological sites, provided information that helped to disclose potential archaeological impacts for the various alternatives during this phase. For this phase, the background research and pedestrian survey provided sufficient scientific and analytical substance to provide a basis for evaluating the comparative merits of the alternatives, which will inform the selection of a Locally Preferred Alternative (LPA).

The CRC project benefits from the fact that much of the project's APE, especially areas within or adjacent to it, has been archaeologically investigated as part of other projects. These past studies provide a wealth of information regarding appropriate archaeological methods for the area and archaeological resources in the area. For example,

- The Vancouver National Historic Reserve (VNHR) has been extensively investigated by the NPS.
- Previous highway construction projects along I-5 and SR 14 have required archaeological investigations.
- Several archaeological investigations have occurred in downtown Vancouver very near the CRC project.

- Archaeological investigations have occurred at the Delta Park interchange in Oregon.

Exhibit 3.8-2
Archaeological Area of Concern

DIMENSIONS ARE APPROXIMATE.

Exhibit 3.8-3
Historic Built Environment Area of Concern

This extensive archaeological work allows for a material and substantive understanding of the archaeological context of the area, as well as identifying recorded historic (archaeological) properties, and determining the likelihood of encountering them within the archaeological area of concern. This information, in addition to the initial archaeological research and identification performed by the CRC project team, will assist local decision-makers to make an informed and reasoned decision regarding a locally preferred alternative. Each alternative has been analyzed to a comparable level of detail. If archaeological resources are found during future testing, attempts will be made to avoid these resources through further design refinement.

Next Steps

The project will continue to follow the steps identified in 36 CFR 800. Depending on circumstances, the following steps may be sequential or concurrent; estimated times to complete are shown in parentheses.

- Non-invasive Ground Penetrating Radar (GPR) to identify subsurface soil anomalies that could indicate the location of potential archaeological features (approximately four months).
- Collect geo-core samples at geotechnical drilling locations to investigate the potential for presence of archaeological resources (approximately four months).
- Monitor geotechnical drilling to identify presence or absence of archaeological resources in the samples (approximately eight months, possibly more).
- Conduct ethnographic/oral histories to assist in identifying historic and archaeological resources important to Native Americans, including, but not limited to, traditional cultural properties (approximately five months).
- Perform pedestrian surveys followed by initial discovery probing (hand excavation) to locate archaeological deposits that may be obscured (approximately seven months).
- Perform subsurface archaeological testing to evaluate the historic significance of archaeological sites identified during previous archaeological investigation steps.
- Assess project effects to National Register-eligible archaeological sites.
- Prepare a Memorandum of Agreement (MOA) for resolution of adverse effects, including those to archaeological sites. The MOA will contain a programmatic element that stipulates and guides how archaeological work will be conducted after the Record of Decision (ROD). The MOA is scheduled to be completed by the Final EIS.

HISTORIC BUILT ENVIRONMENT

Determine Scope of Identification Efforts

The historic built environment area of concern within the APE is divided into two subareas: where direct impacts could be expected to occur; or where indirect impacts, could be expected to occur (Exhibit 3.8.3). Indirect impacts could potentially occur in the area identified as being at risk for direct impacts. As currently defined, the direct impact subarea of the APE extends one block on either side of the project highway and transit alternatives. It starts north of the I-5/Main Street interchange in Washington, and runs to the I-5/Columbia Boulevard interchange in Oregon. North of the river, the APE expands west into downtown Vancouver, and east near Clark College to include potential high-capacity transit alignments and park and ride locations. Within this area, potential effects to the historic built environment could include demolition or displacement of historic properties, noise or visual effects to historic properties due to increased traffic levels, or introduction of new features that compromise the integrity of the property.

The indirect impact subarea of the APE represents the area where indirect impacts, such as development changes, could occur from the proposed alternatives. The study team relied primarily on data from other CRC project technical reports to evaluate indirect project impacts. The indirect impact subarea consists of an area defined by a 0.25-mile radius around each of the potential transit stop sites. Traffic projections, land use, and neighborhood analyses were used to determine the geographic extent of potential indirect impacts.

Background Research

The CRC project team coordinated with ODOT, WSDOT, Oregon SHPO and Washington DAHP to determine survey requirements. The historic resources team surveyed the direct impact subarea by mapping, photographing, and describing each resource constructed prior to 1967 listed in state SHPO databases or on Section 106 forms. Resources were inventoried using the 1967 construction date to take into consideration resources that would become 50 years old within the time allotted for the project to be constructed. The project team compared the information gathered regarding historic resources with project maps and potential right-of-way acquisitions to determine what resources could be affected.

The project team collected data for this evaluation in phases. During the first phase, the team reviewed existing historic resources surveys and information from Washington DAHP, City of Vancouver, Clark County, Oregon SHPO, City of Portland, National Park Service, local museums, and published research. Additionally, historic maps were reviewed to help establish an understanding of the historic context underlying the historical development of the project area. This information formed the basis for developing the APE and refining methods for the historic property identification step of the project.

Phased Identification and Evaluation (36 CFR 800.4(b)(2))

The project team concentrated historic resource inventories within the direct impact subarea based on an agreement with DAHP. After completing the field investigations to identify historic properties and evaluating them for National Register eligibility, the project team, in coordination with WSDOT and ODOT, provided DAHP and SHPO with copies of cultural resource forms and database reports for their concurrence regarding the NRHP eligibility of discovered resources. The NPS and the Native American tribes, as consulting parties, were also offered the opportunity to review the Historic Built Environment Technical Report, which included background information and recommendations.

A Section 106 Determination of Eligibility Form for Oregon's only NRHP-eligible property (Pier 99) was verbally concurred with by the Oregon SHPO staff in November 2007, and it is anticipated that the formal, signed concurrence will be completed by or before May 2008.

DAHP's National Register Coordinator and the section 106 review staff are currently reviewing the 870 DAHP historic inventory forms submitted for the Washington Historic Resources Database. DAHP has verbally concurred on the determination of eligibility for all resources potentially affected by the project alternatives, as well as all resources preliminarily determined to be eligible for the NRHP, and is now reviewing forms submitted for unaffected non-eligible resources. The comments from DAHP staff are being incorporated into a final database submittal, which is anticipated to be completed Spring 2008.

Preliminary Section 106 Findings of Effect have been prepared for the affected NRHP properties and it is anticipated that they will be reviewed by Oregon SHPO and Washington DAHP and concurrence completed by May 2008. A Memorandum of Agreement to mitigate for project effects to the historic built environment will be prepared in consultation with ODOT, WSDOT, FHWA, FTA, Oregon SHPO and Washington DAHP by the Record of Decision.

TRIBAL CONSULTATION

Introduction

The Columbia River Crossing project team has conducted extensive consultation with interested tribes since December 2005. The project's Environmental Manager led the consultation effort until January 2007, when a Tribal Liaison was dedicated to the project. This report summarizes the following:

- Who we are consulting with and why
- Summary of consultation activities to date
- Current/upcoming consultation efforts
- Key tribal concerns
- Tribal meeting record
- Upcoming tribal meetings

Who are we consulting with and why?

To determine which tribes to consult with, the CRC project team met with WSDOT and ODOT Tribal Liaisons. They also submitted a formal letter to the Oregon Commission on Indian Services requesting their input, as required by Oregon law. Eight federally recognized tribes and one non-federally recognized tribe were identified through those efforts.

The National Park Service has a list of approximately 35 tribes and tribal organizations that have ancestors buried within Fort Vancouver. The CRC project team sent a letter to each of these tribes to determine if they were interested in consulting on this project. The Spokane Tribe was the only one to respond with a request to be a consulting party. As such, the remaining 34 tribes contacted are not being consulted with on this project. However, if human remains are found on National Park Service property, then the NPS will be the lead for complying with the

Archaeological Resources Protection Act (ARPA) and the Native American Graves Protection and Repatriation Act (NAGPRA). In addition, if human remains are found on property belonging to the US Army Reserve or FHWA, each federal agency will be responsible for complying with ARPA and NAGPRA on their respective properties. If the remains are determined to be post-contact Native Americans, the park service will notify all 35 tribes and tribal organizations of the find.

The following is a list of the nine tribes we are actively consulting with on this project. The Chinook Tribe, which is non-federally recognized, is being consulted as an "additional consulting party" under Section 106 of the National Historic Preservation Act (NHPA). The other, federally recognized tribes consulting on the project have not objected to the participation of the Chinook, and Chinook representatives have participated in intertribal meetings and are included in this report. Each tribe received a formal letter initiating consultation in December 2005.

Federally Recognized Tribes

- Confederated Tribes and Bands of the Yakama Nation, Washington*
- Confederated Tribes of the Grand Ronde Community of Oregon
- Confederated Tribes of the Siletz Reservation, Oregon
- Confederated Tribes of the Umatilla Reservation, Oregon*
- Confederated Tribes of the Warm Springs Reservation of Oregon*
- Cowlitz Indian Tribe, Washington
- Nez Perce Tribe of Idaho*
- Spokane Tribe of the Spokane Reservation, Washington

[*] *Tribes with court adjudicated treaty fishing rights on the Columbia River, upstream of the project area.*

Non Federally Recognized Tribes

- Chinook Tribe

The project team is consulting with both the natural and cultural resource offices of each affected tribe, and the team meets periodically with tribal councils and committees, when requested.

Consultation Activities to Date

The CRC project team has provided the following opportunities for the tribes to consult on the CRC project.

- Initiated consultation with the tribes in December 2005.
- Conducted face-to-face meetings with each tribe (see meeting record below).
- Sent invitations to be participating agencies under SAFETEA-LU to all the tribes in March 2006. The Grand Ronde and Cowlitz Tribes accepted.
- Held several meetings to solicit input on methods for analyzing impacts to resources in the DEIS, which the Cowlitz and Grand Ronde both attended.
- Provided the following products for tribal review:

  - Purpose and Need statement
  - Methods and data reports
  - Range of alternatives
  - Area of Potential Effects for section 106
  - Tribal consultation plan
  - Overwater geotechnical boring plan
  - Inadvertent Discovery Plan
  - Jurisdictional Wetlands and Waters technical report
  - Geology and Soils technical report
  - Water Quality technical report
  - Geology and Soils technical report
  - Hazardous Materials technical report
  - Ecosystems technical report
  - Acquisitions and Relations technical report
  - Historic Resources technical report
  - Archaeological technical report
  - Draft research design for archaeological discovery field investigations
- Hosted a History Seminar on March 20, 2007, to educate the project team about the important history of the project area. Each tribe sent a speaker to tell their history and experiences in the area. There were also four non-tribal historians who gave presentations on the non-tribal and environmental history of the project area.
- Coordinated with the Grand Ronde tribes (as requested) to participate in the pedestrian archeology survey in July 2007 and to observe cultural resources monitoring for geotechnical borings in February 2008.
- Consulted with 17 tribes and agencies (including FHWA, FTA, NPS, Oregon and Washington SHPOs, WSDOT and ODOT archaeologists) on an Inadvertent Discovery Plan (IDP) for any ground-disturbing activity on the project. Held two intertribal/ interagency meeting to review the plan. Consulted on four drafts of the plan before it was “finalized” in October 2007. The plan is being applied to ground-disturbing activities such as testing. This is a living document that the project team, in coordination with the consulting parties, will amend in the future as needed. It will likely be revised before construction.
- Held multi-tribal/agency meetings to discuss preliminary findings for the natural and cultural resource discipline reports.
- Held pre-DEIS meetings with individual tribes between November and January.

- Hosted an intertribal meeting with presentations by the NPS and CRC project team. The purpose of the meeting was to look at detailed archaeological information in relation to the detailed CRC design maps.

Current/Upcoming Consultation Activities

The following lists known upcoming consultation opportunities. The project intends to consult with the tribes at all project milestones.

- Consult on the DEIS.
- Host a Tribe and Agency Leadership Meeting, modeled after one hosted by the Alaskan Way Viaduct and Seawall Replacement project. The meeting will include the leaders of involved tribes, FHWA, FTA, WSDOT, ODOT, City of Portland, City of Vancouver, National Parks Service, Washington and Oregon Governor's Offices, and others. This meeting occurred on April 1, 2008.
- Develop contracts with tribes to conduct oral history studies for the project area. (Six tribes have expressed an interest. Four tribes have submitted scopes of work. Three tribes have declined).
- Develop service contracts with interested tribes to conduct cultural resource monitoring during ground-disturbing activities on the project.
- Consult on the on-land geotechnical borings plan and associated cultural resources monitoring plan.
- Consult on the biological assessment for the Endangered Species Act.

Key Tribal Concerns and Positions Expressed to Project Team

The following is a general list of concerns expressed by multiple tribes throughout the consultation process.

- Tribes are concerned about the high probability of disturbing human remains throughout project testing and construction.
- Tribes are concerned about the high probability of disturbing cultural resources and sacred sites throughout project testing and construction.
- Tribes are concerned about potential impacts to fish and other marine life throughout project construction. Substantial impacts to aquatic life could affect treaty fishing rights upstream.
- Tribes want cultural resource monitoring conducted for ground-disturbing work.
- During consultation on the range of alternatives, many tribes stated a preference for the downstream replacement bridge alignment over the upstream replacement bridge alignment because of the upstream alignment's higher probability to disturb human remains and/or cultural resources. The upstream replacement bridge alignment has since been dropped from further consideration.

- During the pre-DEIS meetings, tribes were asked if they were willing to enter into agreements to address disinterment and reburial of remains if found in parts of the project that would be impossible to avoid/design around. The tribes were not willing to enter into advanced decision making agreements because the context of the find will greatly affect the tribes' support or opposition to disinterment (such as how many burials, how old, where they are located, etc.). The tribes are willing to talk about general principles. These are included in the Inadvertent Discovery Plan mentioned in the background research section of Archaeology on the previous pages.

Tribal Meeting Record

Unless otherwise noted, the meetings listed in Exhibit 3.8-4 took place at the tribal offices.

Exhibit 3.8-4 (page 1 of 2)
Tribal Meeting Record to Date

Date	Tribe	Purpose
11/9/05	Cowlitz Tribe	To introduce the project to the tribe and hear initial concerns about cultural and natural resources in the project area.
12/9/05	Grand Ronde Tribe	To introduce the project to the tribe and hear initial concerns about cultural and natural resources in the project area.
2/21/06	Umatilla Cultural Resources Sub-Committee	To present initial baseline cultural resource information to the sub-committee and introduce the project.
3/3/06	Grand Ronde Tribal Council	To discuss the project and Tribal Council involvement.
3/7/06	Nez Perce Natural Resource Sub-Committee	To present initial baseline natural resource information to the sub-committee and introduce the project.
3/14/06	Umatilla Natural Resources Sub-Committee	To present initial baseline natural resource information to the sub-committee and introduce the project.
5/17/06	Spokane Tribe	To present initial baseline cultural resource information and introduce the project.
9/28/06	Intertribal Meeting (Yakama, Grand Ronde, Cowlitz and Siletz staff attended) (Portland)	To discuss preliminary screening findings for natural and cultural resources.
11/3/06	Intertribal Meeting (Yakama, Grand Ronde, Spokane, Nez Perce, Cowlitz and Siletz staff attended) (Portland)	The tribes wanted a chance to discuss how they will coordinate amongst themselves.
12/05/06	Nez Perce Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
1/4/07	Grand Ronde Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
1/8/07	Cowlitz Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
1/24/07	Umatilla Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
1/25/07	Warm Springs Tribe	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
2/5/07	Yakama Nation	Project update; recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.

Exhibit 3.8-4 (page 2 of 2)

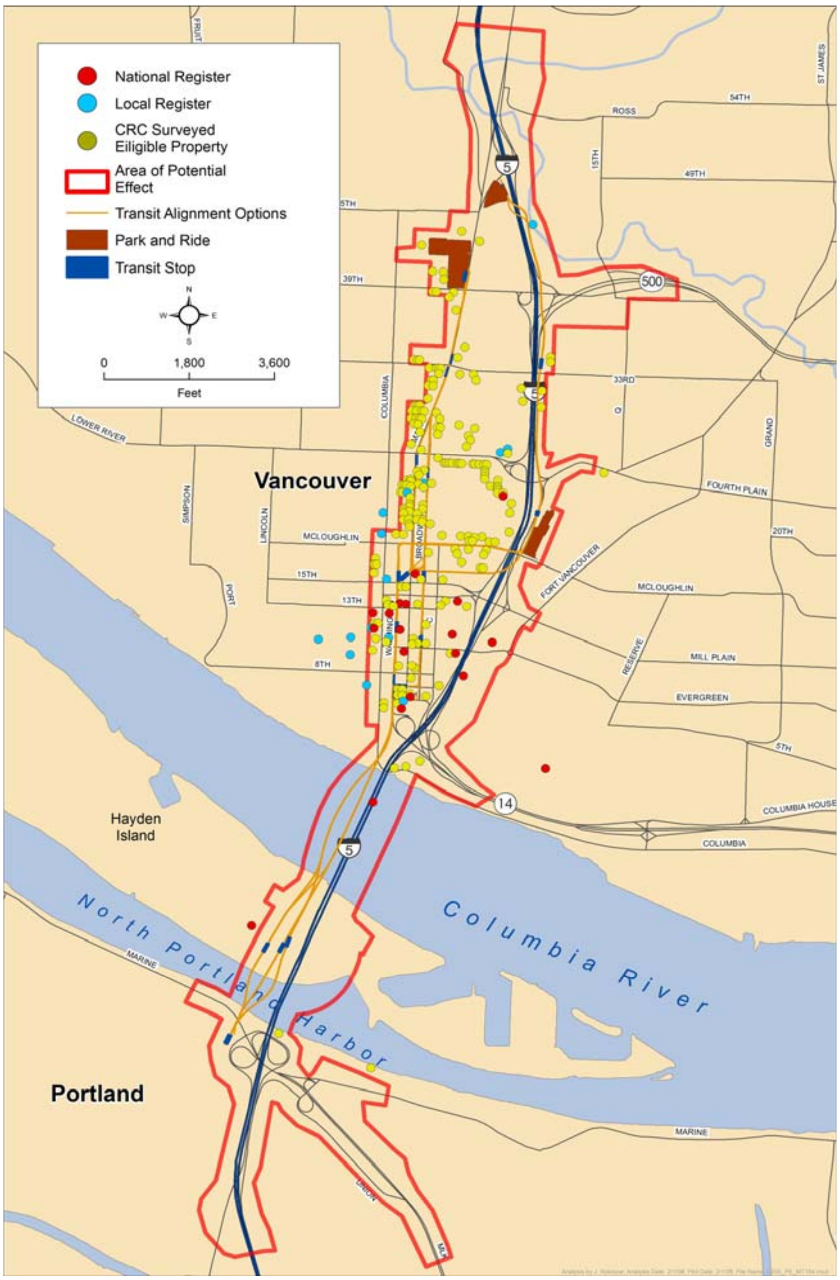
Date	Tribe	Purpose
2/27/07	Intertribal/Interagency cultural resources meeting (Portland)	The purpose of the meeting was to discuss: ▪ Inadvertent discovery plan ▪ Scope of work for archaeology survey ▪ Introduce the cultural resources consultant and archaeological consultant to the tribes
3/1/07	Siletz Tribe	Project update; Recommendations for the range of alternatives to be studied for the project; an inadvertent discovery plan; discuss the preliminary cultural resources findings from the screening analysis conducted.
3/20/07	Intertribal/Interagency Seminar (Chinook, Cowlitz, Grand Ronde, Nez Perce, Siletz, Spokane, Umatilla, Warm Springs, Yakama attended) (Vancouver)	History Seminar. Give the project team and its partners an opportunity to learn about the important and diverse history of the project area.
3/22/07	Columbia River Intertribal Fish Commission	Project introduction; consultation approach.
6/5/07	Intertribal Meeting (Cowlitz, Umatilla cultural resources staff attended). (Vancouver)	Discuss human remains examination protocols with tribes.
7/24/07	Intertribal/Interagency Meeting (Grand Ronde tribe attended). (Portland)	Interagency meeting to discuss the natural resources discipline reports.
8/6/07	Intertribal/Interagency Meeting (Umatilla Tribe called in. Difficulty with phone system prevented Grand Ronde from participating). (Portland)	Interagency meeting to discuss the cultural resources discipline reports.
9/10/07	Intertribal/Interagency Meeting (Cowlitz Tribe attended). (Vancouver)	Interagency meeting to discuss the cultural resources discipline reports.
9/27/07	Intertribal/Interagency Meeting (Cowlitz and Grand Ronde staff attended). (Vancouver)	Interagency meeting to discuss the natural resources technical reports.
10/15/07	Grand Ronde Tribe	Discuss the possibility of contracting with Grand Ronde to conduct an oral history study.
11/19/07	Cowlitz Tribe	Provide a project update, discuss the DEIS, technical report findings.
11/20/07	Grand Ronde Tribe	Provide a project update, discuss the DEIS, technical report findings.
12/4/07	Umatilla Tribe, Cultural Resources Sub-committee	Provide a project update, discuss the DEIS, technical report findings.
12/5/07	Warm Springs Tribe	Provide a project update, discuss the DEIS, technical report findings.
12/17/07	Spokane Tribe	Provide a project update, discuss the DEIS, technical report findings.
12/18/07	Nez Perce Tribe	Provide a project update, discuss the DEIS, technical report findings.
1/8/08	Chinook Tribe, Cultural Resource Committee	Project introduction; Discuss the DEIS, technical report findings.
1/22/08	Affiliated Tribes of Northwest Indians Conference. Culture and Elder's Committee	Project introduction, discuss tribal consultation approach and the DEIS.
3/13/08	CRC/NPS Intertribal Cultural Resources meeting (Cowlitz, Grand Ronde, Spokane, Warm Springs and Yakama attended) (Vancouver)	Review detailed archaeological information in relation to the detailed CRC design maps.

3.8.2 Existing Conditions

Historic Buildings, Sites, and Resources

Of the approximately 870 resources constructed prior to 1967 surveyed by the CRC project team, approximately 218 were preliminarily identified as NRHP-listed or are considered eligible for listing. Nationally and locally registered historic properties, as well as the eligible historic resources within the APE are mapped in Exhibit 3.8-5. This exhibit provides a general picture of the distribution of historic resources throughout the project area. More detailed maps can be found in the Historic Built Environment Technical Report. Appendix E at the end of this document contains a list of all of these resources.

Exhibit 3.8-5
Registered and Eligible Historic Resources Within the APE



Source: CRC Historic Built Environment Technical Report.

Very few previously inventoried historic resources are located within the APE in Oregon. Only four resources have been previously identified as a Portland Historic Landmarks or NRHP-listed or eligible. They include:

- The NRHP-listed Carrousel located at Jantzen Beach.
- Waddles restaurant (now Hooters), which is no longer considered a Portland Landmark because of recent alterations.
- The Columbia Slough and Levee System, which was determined eligible on July 22, 2005, for the Multnomah County Drainage District No. 1 by the Oregon SHPO as contributing elements of the Columbia Slough Drainage Districts Historic District (CSDDHD). The CSDDHD is a group of four geographically contiguous Columbia Slough drainage districts that are located on the Columbia River floodplain between the Willamette River and the Sandy River, occupying approximately 10,000 acres.
- The 1917 I-5 bridge (northbound structure), which crosses the Columbia River between Portland, Oregon and Vancouver, Washington. At the time of its construction, it was considered a major engineering feat and was one of the largest bridges in the world. It was listed on the NRHP in 1982. It is now part of two bridges located side by side and joined by a common foundation; this foundation was added in 1958, when the northbound structure was added. (Exhibit 3.8-6).
- The 1960 Pier 99 commercial building (originally called the Totem Pole Marina) has not been previously identified as NRHP-eligible. The CRC project team, in consultation with the OR SHP has determined that it is NRHP-eligible for two reasons: (1) it is a good example of a Mid-Century Modern Commercial building designed and constructed in the “Googie” style, and (2) it was designed by Oregon architect, John Storrs, whose innovate designs were a important contribution to the Northwest Regional style of architecture.

Exhibit 3.8-6
The 1917 Bridge and Ferry

DAHP, Clark County, and City of Vancouver records contain historic site record forms for previously inventoried historic resources in the direct impact area of the Historic Built Environment area of concern of the APE. All of these sites were occupied during the historic period (more than 50 years ago) or were related to activity taking place during the historic period, and some of these sites have historical archaeological components. One, the Fort Vancouver Historic Site, has been combined with other major elements of the VNHR to form the Fort Vancouver National Register District. Seventeen other properties are listed on the NRHP, including the 1917 I-5 bridge and various historic resources in the Vancouver-Fort Vancouver area. All of the properties on the Washington State Historic Register are also on the NRHP, and about a dozen additional properties are listed on the Clark County Historic Register. A list of all known historic resources is included in the Historic Built Environment Technical Report.

In addition to previously recorded sites, the project area includes approximately 850 historic resources built before 1967 that were not previously inventoried or entered into the DAHP database. Project staff evaluated the buildings using NRHP criteria and determined that there are approximately 218 historic properties in the direct impact subarea of the Historic Built Environment area of concern that are eligible for listing on the NRHP. Areas of concentration are located in the downtown Vancouver commercial core and Uptown Village, and include the area containing residential buildings adjacent to the project in the Esther Short, Arnada, Hough, Carter Park, Rose Village, and Shumway neighborhoods. All surveyed historic resources (both eligible and not eligible) are being entered into the DAHP Historic Property Inventory database.

The Vancouver National Historic Reserve (VNHR), located east of downtown Vancouver on the east site of I-5, is cooperatively managed by the National Park Service (NPS), City of Vancouver, U.S. Army, and Vancouver National Historic Reserve Trust. This resource encompasses 366 acres, and contains the following cultural and historic resources:

- VNHR Historic District (Exhibit 3.8-7) was designated in 2007 for the NRHP, and included 252 acres the westernmost portion of the VNHR that contains both contributing and non-contributing resources.

Exhibit 3.8-7
VNHR Historic District

- Fort Vancouver National Historic Site, including the reconstructed fort (see Exhibit 3.8-8 for the bastion), adjacent Fort Vancouver Village (“Kanaka” Village), and the Parade Ground
- Officers Row and the Vancouver Barracks, including the Barracks Post Hospital
- Pearson Air Field (the oldest operating airfield in the United States) and Pearson Air Museum (home of the second oldest wooden hangar in the United States)
- Columbia River Waterfront
- The Water Resources Education Center

Exhibit 3.8-8
Fort Vancouver Bastion

The Vancouver National Historic Reserve is a complex cultural landscape. Use and occupation of the land now within the Reserve by Native Americans, the Hudson’s Bay Company, the U.S. Army, and the NPS has influenced and reflected the history of the Pacific Northwest region. Over one million visitors come to the Reserve each year to explore this physical link to the past.

Archaeological Sites and Resources

Previous archaeological research has demonstrated the presence of Native American settlements along the Columbia River spanning at least the last 3,500 years. This includes research completed by specialists outside the CRC project, but within or adjacent to the APE. There has been extensive discovery, testing and recovery conducted in the APE, including area in the Vancouver National Historic Reserve and on the west side of I-5 in Vancouver. The breadth of available data from these past activities exceeds the level of such data typically available during this phase in the NEPA process, and has helped inform the identification and screening of alternatives as well as the conceptual design of the current range of alternatives. These studies have also helped establish a context and framework for how the project archaeological specialists, through consultation, have and will continue to conduct archaeological research, including field methodologies, and what might be encountered in different locations.

REGIONAL HISTORY

The CRC project area is located within the Lower Columbia River Valley, which has long been recognized as a pivotal area in Pacific Northwest prehistory. As used here, the term Lower Columbia refers to that portion of the valley extending downstream from The Dalles to the Pacific Ocean. As a near-sea-level connection between the interior Columbia Plateau and the coastal lowlands of western Oregon and Washington, the Lower Columbia served as a route of transmission for populations, cultural traits, and trade throughout prehistory.

Pre-Contact Development

At the time of Euor-American contact, the shores of the Lower Columbia River were occupied by Chinookan peoples. A review of linguistic and ethnographic information indicates that the CRC project area falls along the boundary between groups that spoke different dialects of the Upper Chinookan language. The groups downstream, notably in the concentration of villages on Sauvie Island and the adjacent mainland on both sides of the Columbia, spoke the Multnomah dialect. The groups upstream on the Columbia around the Cascades and at The Dalles, as well as those at Willamette Falls on the Willamette River, spoke the Kiksht dialect.

On the south (Oregon) shore of the Columbia River, the closest identified village upstream from the CRC project area is *Neerchokioo* just below the last island in the Government Island chain. The closest identified village downstream from the CRC project area is *Waksin* at the mouth of the Willamette River.

The primary ethnographic sources seem to indicate the existence of a long gap in the distribution of villages on the north (Washington) shore of the Columbia River in the CRC project area vicinity (e.g., Hajda 1984:85; Silverstein 1990:534). The closest identified village upstream from the CRC project area is *Washuhwal* at present-day Washougal. The closest identified village downstream from the CRC project area is *Wakanasisi* nearly opposite the mouth of the Willamette River below Vancouver.

No pre-contact archaeological sites have been identified on the south shore of the Columbia River within the CRC project APE. No pre-contact Indian villages were noted by the Lewis and Clark expedition in the CRC project area, nor has any present day research identified any.

Historic Period Development

In 1825, dramatic changes occurred for the Indians residing near the confluence of the Willamette and Columbia rivers. Executives administering the Hudson’s Bay Company concluded that they needed a site better suited to their economic objectives than Fort George (formerly Fort Astoria) at the mouth of the river. Under the leadership of Dr. John McLoughlin, Chief Factor, the company initiated construction of Fort Vancouver.

The fort soon became a commercial depot at the crossroads of the Pacific Northwest and the site of disparate enterprises. The setting on the north bank of the Columbia—in the midst of a Native American population—underwent rapid transformation (Rich 1959:606- 655).

Construction and operation of Fort Vancouver inaugurated a little more than twenty years of trade opportunities for the Indians of southwestern Washington and northwestern Oregon. The company constructed and operated an “Indian Trade Shop” inside the fort’s stockade. This facility received furs from visiting Indians and exchanged a variety of material goods: beads, clothing, blankets, tools, foods, and other items. The building, as identified in 1845, measured 80 by 32 feet, confirmation that trade relations with regional tribes were an important part of the company’s enterprise (Hussey 1957:189-190).

Several tribes engaged in the trade at Fort Vancouver. The local Upper Chinookans, Cowlitz, and Kalapuyans of the Willamette Valley were important customers. The Klikitats, outfitted with horses and eager to travel via a trail through the Western Cascades into the Lewis River watershed, were another important trade partner. A number of Klikitats by the 1830s settled in the vicinity of Fort Vancouver, an event documented in Catholic sacramental registers and in enrollment of Klikitat children in the post school.

The Fort Vancouver Village (“Kanaka” Village) was one of the largest settlements in the West during its time. Housing the workers and their families, and the fur brigades when they returned from their expeditions, the population of the Village exceeded 600 people. The Village was culturally, home to area natives, Cree people, people with a French Canadian and Iroquois background, native Hawaiians, Scots, etc.

During the late 1840s and early 1850s, there was a shift away from the fur trade, toward a more diversified mercantile exchange. The numbers of Hawaiian employees increased, leading to the Village being known as "Kanaka Town," or "Kanaka Village," referring to the Hawaiian word for "person." During the last few years, NPS and WSDOT archaeologists conducted survey level archeological work to identify the location of the houses located in the Fort Vancouver Village (“Kanaka” Village).

Historical and Pre-Historic Archaeology

In the Pacific Northwest, **historical archaeology** dates from after the beginning of Euro-American settlement of the area.

Pre-historic or Pre-contact archaeology dates from before this time, and generally concerns sites associated with Native American peoples, culture, and settlements, and encompass both Native American and Euro-American settlements.

ARCHAEOLOGICAL EVIDENCE

As described above, evidence of pre-contact Native American occupation is present in the CRC project vicinity on the north shore of the Columbia River in Washington. To date, no archaeological investigations have uncovered evidence of pre-contact Native American occupation on the south shore of the Columbia River in Oregon within the APE.

A study of the geology and geomorphology of the Oregon south shore helped to identify ancient and modern landforms on which archaeological resources may be preserved, many of which are deeply buried. The temporal focus of this study was on the last 12,000 years. This date coincides with the estimated age of the last of the Missoula Floods, which were responsible for creating much of the modern landscape in the Lower Columbia Valley. Archaeological evidence greater than 12,000 years old is unlikely to be encountered in the CRC project area. Advance testing of the landforms identified as having the potential for supporting archaeological remains will help ensure that important archaeological resources will not be inadvertently damaged or destroyed during CRC project construction. This will occur in the upcoming discovery phase.

The CRC APE on the Oregon shore includes the I-5 corridor from the Columbia River south approximately to Victory Boulevard. From the Columbia River shoreline, the APE crosses Hayden Island, North Portland Harbor, and extends southward for approximately 0.75-mile on the south shore flood plain.

Hayden Island is separated from Vancouver by the main channel of the Columbia River and from Portland by North Portland Harbor. Both channels have been subject to extensive dredging and channel modifications to improve navigability. Hayden Island is named for the Hayden family, which settled there in 1851 and established a short-lived farm on the north shore. Over the years this island has been referred to as “Image Canoe Island,” “Menzies Island,” “Vancouver Island,” “Shaw’s Island,” and “Hayden’s Island.” Much if not all of Hayden Island was inundated every year or two by spring floods. The eastern (upstream) end of Hayden Island, in which the CRC APE is situated, appears on historic maps as a shoal, suggesting it formed in the relatively recent past.

Today, this eastern portion of Hayden Island is highly developed, with hotels, shopping centers, residential communities, and other commercial activities. Likewise, most of the south shore flood plain adjacent to the I-5 corridor has been substantially altered from its natural state by agricultural, industrial, and urban developments. While upland, riparian, and wetland natural areas still exist on the south shore flood plain, recent developments have substantially reduced the visibility of any archaeological resources in the CRC APE on the Oregon shore.

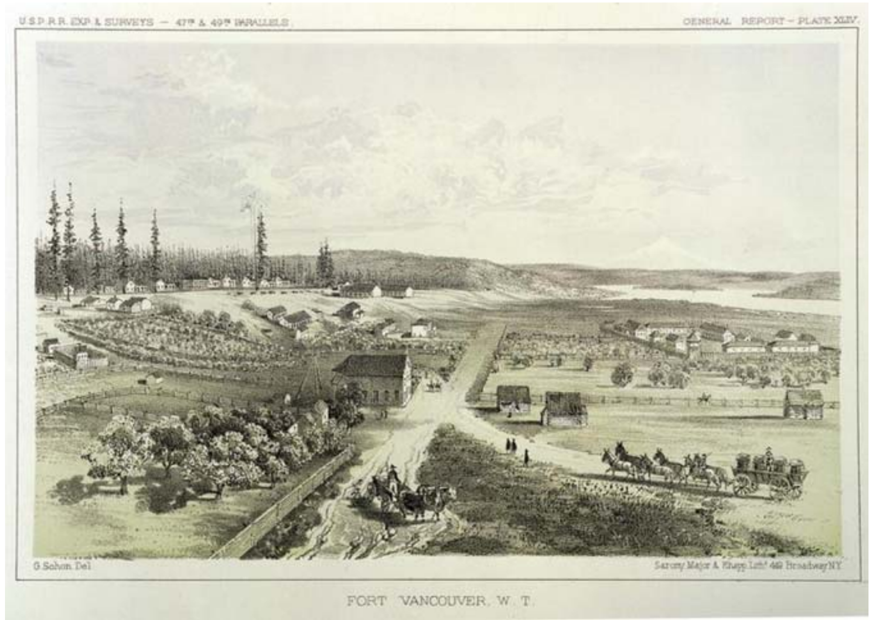
No evidence of pre-contact Native American occupation has been found in the Oregon portion of the APE via archaeological investigations, although pre-contact archaeological sites have been found in similar locations in other places along the Columbia. The closest recorded site is a small charcoal and fire-cracked rock feature about one-half mile west of I-5. Seasonal flooding on the Oregon shore in the CRC project area made permanent settlements unlikely. To date, Native American burials have not been encountered during any excavations on the south shore floodplain. Nonetheless, during the course of the CRC project, representatives of Tribal consulting parties have expressed general concern about possible Native American burials on Columbia River islands, such as Hayden Island.

The CRC APE in Washington encompasses the I-5 corridor as it extends from the Columbia River northward through the intensively developed city of Vancouver, with the Vancouver National Historic Reserve (VNHR) to the east, and the business district and adjacent residential neighborhoods on the west and north. Just north of the Columbia River, the BNSF railroad extends east-west across the APE, and the intersection of SR 14 and I-5 is immediately north of the Columbia River on the northeast side of the APE. In contrast to the Oregon shore, the environmental setting in the CRC APE on the Washington shore of the Columbia River has been relatively stable over the last 12,000 years.

Research was conducted at the Washington DAHP to identify previously recorded archaeological sites in the CRC APE. Review of the DAHP records resulted in identification of 11 archaeological sites, including one landscape feature (with an underlying archaeological component) within the CRC APE.

These include sites associated with the early history of Fort Vancouver, first constructed in 1829 (see Exhibit 3.8-9). An extensive multicultural settlement known as the Fort Vancouver Village ("Kanaka" Village) was located along the southwest side of the Fort near the present day SR 14 interchange. In 1849, the U.S. Army established Vancouver Barracks here. Related archaeological deposits could be located in the present day Mill Plain interchange. This post expanded over the years and was one of the most important military installations in the Pacific Northwest during the late nineteenth and early twentieth centuries.

Exhibit 3.8-9
Early Rendering of Fort Vancouver Settlement



Source: Thomas and Hibbs, 1984.

Beginning in the 1850s, the City of Vancouver started developing west of the Fort. The earliest settlement and development occurred in the area immediately west of modern-day I-5. Recent historical archaeological investigations in the oldest portions of the city have potential to shed light on the early development of Vancouver. See the CRC Archaeology Technical Report for more information regarding these investigations.

In Washington, evidence of precontact cemeteries has not been identified, although during the 1958 construction of I-5 potential burial sites of unknown age were reportedly observed, but not documented in technical reports.[29]

3.9.3 Long-Term Effects from Project Alternatives

The following tables and associated discussion outline the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of any project alternative. A project alternative contains three physical components: 1) a river crossing and associated highway improvements, 2) a high-capacity transit mode, and 3) a transit terminus.

Alternative 1: No-Build

The No-Build Alternative would not result in direct effects to any NRHP-listed or eligible historic resources, although the substantial traffic congestion along the I-5 corridor expected with No-Build could affect overall community livability, and in turn, the viability of maintaining each community's historic fabric.

[29] Thomas and Friedenburg, 1998.

The No-Build Alternative would not have any effects to historic or pre-historic archaeological resources.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.8-10 summarizes the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of Alternative 2, as paired with any of the possible transit terminus options.

Exhibit 3.8-10
Historic and Archaeological Resources Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Number of NRHP-listed or eligible historic resources potentially impacted	10 to 14	13	9 to 13	8
Total area acquired from NRHP-listed or eligible historic resources (acres)	3.12 to 4.15	3.21 to 4.21	2.64 to 3.68	2.64 to 3.64
Number of preliminary adverse direct impacts to NRHP-listed or eligible historic resources	6 to 8	8	5 to 7	5
Number of NRHP-listed or eligible historic resources that could experience noise impacts before mitigation	7 to 12	12 to 13	7 to 12	5
Number of NRHP-listed or eligible historic resources with one or more access(es) eliminated	0 to 5	1 to 8	0 to 5	0 to 4
Potential to impact archaeological historic properties	High	High	High	High

Source: CRC Historic Built Environment Technical Report and Archaeology Technical Report.
Note: The impacts with the STHB option for the river crossing would be the same as shown above.

Alternative 2 could potentially affect between 8 and 14 resources listed or eligible for the NRHP, depending on the transit terminus and alignment options chosen. Of these impacts, 5 to 8 are expected to be adverse. Washington DAHP and Oregon SHPO are in the process of reviewing these preliminary findings of effect. Between 2.64 and 4.21 acres listed or eligible properties could be impacted.

Alternative 2A or 2C would result in the same number of potential impacts to historic resources as a result of noise (seven to 12 resources impacted) and access (zero to five resources impacted). Alternative 2B would result in the highest number of noise (12 to 13) and access (one to eight) impacts, while Alternative 2D would have the fewest noise and access impacts.

The left-loop SR 14 interchange option with Alternative 2 would have an adverse effect to the integrity of the aesthetic setting of some historic properties in downtown Vancouver. Because of its greater size, mass, and height, the left loop option would have a more intrusive effect to the resource's aesthetic integrity of setting than would the dual loop option. The specific interchange designs are a design detail that will be decided before the FEIS is published and after the later phases of the archaeological investigation are completed for this area.

Alternative 2 could potentially affect historic as well as potential precontact archaeological resources in Washington. All terminus options have a high potential to impact historical archaeological sites associated with downtown Vancouver as well as precontact archaeological resources adjacent to the shoreline.

Under Alternative 2A, there would be a high potential to impact 0.36 mile of high probability areas for precontact resources along the Burnt Bridge Creek drainage and 1.68 miles of medium to low probability north of downtown Vancouver. Under Alternative 2B, there would be an additional 1.24 miles of bus rapid transit line which could potentially impact archaeological resources north of downtown Vancouver. Alternative 2C, could potentially impact an additional 0.6 mile of bus rapid transit lines in medium to low probability areas north of downtown Vancouver. Alternative 2D potential impacts extend only to downtown Vancouver.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.8-11 summarizes the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of Alternative 3, as paired with any of the possible transit terminus options.

Exhibit 3.8-11
Historic and Archaeological Resources Effects Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Number of NRHP-listed or eligible historic resources potentially impacted	10 to 14	13	9 to 13	8
Total area acquired from NRHP-listed or eligible historic resources (acres)	2.77 to 3.80	3.21 to 4.21	2.64 to 3.68	2.64 to 3.64
Number of preliminary adverse direct impacts to NRHP-listed or eligible historic resources	6 to 8	8	5 to 7	5
Number of NRHP-listed or eligible historic resources that could experience noise impacts before mitigation	11	10	11	5
Number of NRHP-listed or eligible historic resources with one or more access(es) eliminated	0 to 6	1 to 9	0 to 6	0 to 5
Potential to impact archaeological historic properties	High	High	High	High

Source: CRC Historic Built Environment Technical Report and Archaeology Technical Report.
Note: The impacts with the STHB option for the river crossing would be the same as shown above.

The number of NRHP-listed or eligible historic resources potential impacted and potentially adversely impacted by Alternative 3 is the same as those potentially impacted by Alternative 2. Between 2.64 and 3.80 acres listed or eligible properties could be impacted with Alternative 3.

Alternative 3A and 3C would result in the same number of potential impacts to historic resources as a result of noise (11 resources impacted) and access (zero to six resources impacted). Alternative 3B would result in slightly fewer noise impacts (11) and slightly more access impacts (one to nine), while Alternative 3D would have the fewest noise and access impacts.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.8-12 summarizes the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of Alternative 4, as paired with any of the possible transit terminus options.

Exhibit 3.8-12
Historic and Archaeological Resources Effects Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Number of NRHP-listed or eligible historic resources potentially impacted	9 to 13	12	8 to 12	7
Total area acquired from NRHP-listed or eligible historic resources (acres)	1.46 to 1.49	1.55	0.98 to 1.02	0.98
Number of preliminary adverse direct impacts to NRHP-listed or eligible historic resources	6 to 8	8	5 to 7	6
Number of NRHP-listed or eligible historic resources that could experience noise impacts before mitigation	8 to 13	13 to 14	8 to 13	6
Number of NRHP-listed or eligible historic resources with one or more access(es) eliminated	1 to 6	2 to 9	1 to 6	1 to 5
Potential to impact archaeological historic properties	High	High	High	High

Source: CRC Historic Built Environment Technical Report and Archaeology Technical Report.

Alternative 4 could potentially affect between seven and 13 NRHP-listed or eligible resources, depending on the transit alignment and chosen. Between 0.98 and 1.55 acres of listed or eligible properties could be impacted. Of these impacts, between five and eight are expected to be adverse, though Washington DAHP and Oregon SHPO are in the process of reviewing these preliminary findings of effect.

Alternative 4A and 4C would result in the same number of potential impacts to historic resources as a result of noise (eight to 13 resources impacted) and access (one to six resources impacted). Alternative 4B would result in some more noise impacts (13 to 14) and slightly more access impacts (two to nine), while Alternative 4D would have the fewest noise and access impacts.

Potential impacts to historic and potential precontact archaeological resources would be the same as Alternatives 2 and 3, because the terminus and alignment options are the same.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.8-13 summarizes the potential effects to NRHP-listed or eligible historic resources and historic or precontact archaeological resources that could occur as a result of Alternative 5, as paired with any of the possible transit terminus options.

Exhibit 3.8-13
Historic and Archaeological Resources Effects Summary for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Number of NRHP-listed or eligible historic resources potentially impacted	9 to 13	12	8 to 12	7
Total area acquired from NRHP-listed or eligible historic resources (acres)	1.11 to 1.14	1.55	0.98 to 1.02	0.98
Number of preliminary adverse direct impacts to NRHP-listed or eligible historic resources	6 to 8	8	5 to 7	6
Number of NRHP-listed or eligible historic resources that could experience noise impacts before mitigation	11	10	11	5
Number of NRHP-listed or eligible historic resources with one or more access(es) eliminated	1 to 7	2 to 10	1 to 7	1 to 6
Potential to impact archaeological historic properties	High	High	High	High

Source: CRC Historic Built Environment Technical Report and Archaeology Technical Report.

The number of NRHP-listed or eligible historic resources potentially impacted or potentially adversely impacted by Alternative 5 is the same as those potentially impacted by Alternative 4. Between 0.98 and 1.55 acres listed or eligible properties could be impacted with Alternative 5.

Alternative 5A and 5C would result in the same number of potential impacts to historic resources as a result of noise (11 resources impacted) and access (one to seven resources impacted). Alternative 5B would result in slightly fewer noise impacts (10) and slightly more access impacts (two to 10), while Alternative 5D would have the fewest noise and access impacts.

3.8.3 Long-term Effects from Project Components

This section describes the effects of the project components and various. The operational components (tolling scenarios, transit operations, and transportation demand and system management measures) would not affect cultural resources and are therefore not discussed in detail below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

Historic Buildings, Sites, and Resources

Exhibit 3.8-14 summarizes potential effects of the river crossing and highway improvements to NRHP-listed or eligible historic resources. Maps illustrating these impacts can be found in Chapter 5, Draft Section 4(f) Evaluation.

Exhibit 3.8-14
Direct Impacts to NRHP-Listed and Eligible by River Crossing and Highway Improvements

Location	Description	Date	NRHP	River Crossing Option	Potential Impact	Preliminary Finding of Effect[a]
Marine Drive	Pier 99	1960	eligible	replacement or supplemental	Demolition/ Relocation (20593 sq ft)	Adverse
Interstate 5	Northbound I-5 bridge	1917	listed	replacement or supplemental	Demolition or major seismic retrofits and compromised setting	Adverse
North Portland Harbor	Oregon Slough Levee	1916-60	eligible	replacement or supplemental	No known impact from pier placement	No Adverse
Vancouver National Historic Reserve	Historic District	2007	listed	replacement or supplemental	Impacts to the following contributing resources: Old Apple Tree Park, Pearson Field, Barracks Hospital, and Officers Row (75359 to 117612 sq ft)	Adverse
411 E Evergreen	Kiggins House	1907	listed	replacement only	Demolition/ Relocation if not moved by other project prior to CRC (2424 sq ft)	Adverse
400 E Evergreen	Providence Academy	1873	listed	replacement only	Partial acquisition without displacement (11923 sq ft)	Adverse

Location	Description	Date	NRHP	River Crossing Option	Potential Impact	Preliminary Finding of Effect[a]
3000 K St	Residence	c. 1915	eligible	replacement	Partial without displacement (505 sq ft)	No Adverse
				supplemental	Demolition/ Relocation of garage (1481 sq ft)	Adverse
3110 K St	Residence	c. 1910	eligible	supplemental	Partial acquisition w/o displacement; setting compromised (847 sq ft)	Adverse

Source: CRC Historic Built Environment Technical Report.

a Preliminary findings of effect are being reviewed by the Washington DAHP and Oregon SHPO.

The existing NRHP-listed northbound I-5 bridge would be completely removed as a result of the replacement crossing. The supplemental crossing would likely also affect the bridge's historic integrity, as seismic retrofits would enlarge the bridge piers substantially and alter the trusses and lift towers. Adding the supplemental bridge adjacent to the historic structure would visually intrude upon it. This crossing would have less harm than removing the historic bridge.

Both the supplemental and replacement river crossings would result in the displacement of Pier 99 near the Marine Drive interchange.

The parcel on which the Providence Academy is located would be affected by the widening of I-5 and the Evergreen Boulevard overpass, but this would not displace any of the buildings on the campus.

Exhibit 3.8-15
Oldest Apple Tree in the Pacific Northwest

The VNHR Historic District has been preliminarily determined to be adversely affected by both river crossings. Impacts to any of the contributing resources within the District are therefore part of that preliminary determination of adverse effect. Effects to the historic built environment within the District include the construction vibration and visual setting of the Barracks Hospital (both river crossings), small acquisitions from the most western parking lot of Officer's Row (replacement river crossing), minor acquisitions or potential shading of the Old Apple Tree Park (replacement river crossing), and minor obstructions to Pearson Field's airspace (supplemental river crossing).

The impact to the Barracks Hospital would likely be considered an adverse impact because without mitigation the vibration impacts during construction may damage the unreinforced masonry structure. Additionally, the proximity of the proposed freeway would negatively impact the visual setting by removing existing and planned buffer areas. The acquisition impacts to Officers Row and the Old Apple Tree Park (Exhibit 3.8-15), and potential obstructions of Pearson Field's airspace, would be very minor and would not change the characteristics for which these resources are considered contributing to the VNHR Historic District,, but these resources are included in the District and are therefore included in the adverse effect to the District.

Noise levels at the VNHR Historic District could decrease with highway sound walls potentially constructed with the highway improvements. This would likely result in a benefit to the two non-commissioned officers duplexes closest to I-5 south of the Barracks Post Hospital, as well as the Hospital itself. Noise levels at these contributing residential units currently exceed impact criteria, and would worsen with the No-Build Alternative. In addition to these benefits, these sound walls could potentially alter the historic setting of the buildings adjacent to the wall.

With both the supplemental and replacement river crossings, noise levels at the Normandy apartments (318 E Seventh Street) and the Fort Apartments (500 E 13th Street) would increase. Sound walls are proposed as a mitigation measure, but would be unable to mitigate the noise impacts on the upper floors of these buildings. The construction of new sound walls would not physically impact either structure.

The replacement crossing could displace the Kiggins House located on the west side of Interstate 5. However, the separately planned Riverwest development project, expected to begin construction in 2008, would require the removal of the Kiggins House before CRC is constructed. That relocation, occurring independent of the CRC project, is anticipated to occur in May 2008.

The highway improvements associated with the supplemental crossing could result in the demolition or relocation of the garage associated with a NRHP-eligible private residence at 3000 K Street, while replacement crossing would result in only a partial acquisition and would not impact the buildings on the property. The supplemental crossing could require a partial acquisition without the displacement of the NRHP-eligible private residence at 3110 K Street.

Archaeological Sites and Resources

The proposed roadway footprint for the replacement crossing would move further into the Vancouver National Historic Reserve than the current highway, with potential to affect archaeological sites there. Because it would require less new land, the supplemental crossing would be less likely to affect archaeological resources in this area.
Exhibit 3.8-16 illustrates the VNHR and associated Historic Site.

The replacement crossing could have effects on archaeological resources associated with the Vancouver National Historic Reserve including the Fort Vancouver National Historic Site, Heritage Apple Tree, Fort Vancouver Village (“Kanaka” Village) and associated pond, Vancouver Barracks, Quartermaster East, and Benoit site. Ongoing and planned archaeological investigations (as summarized in Section 3.9.1) of the footprint of the proposed river crossings will help to determine the likelihood of project construction encountering these historic archaeological resources. Additionally, further design refinement will work to minimize the possibility of affecting these resources. The supplemental crossing would avoid potential effects to the HBC Pond, Quartermaster East, and Benoit sites. The supplemental crossing effects to the Vancouver National Historic Reserve and Vancouver Barracks north of Sixth Street would be less than under the replacement crossing.

Exhibit 3.8-16

Vancouver National Historic Reserve (VNHR)

DIMENSIONS ARE APPROXIMATE.

Both crossings are likely to affect undiscovered archaeological sites in Vancouver, particularly those that might lie below previously disturbed soils associated with the existing I-5/SR 14 interchange area.

The potential sites for a bridge assembly/casting yard for either crossing are unknown at this time. See Chapter 2, Description of Alternatives, for more information regarding the characteristics of this potential site. However, because the yard would be located adjacent to the water, there is a potential for encountering archaeological resources. Any potential sites would be evaluated for the presence of historic structures, and investigated for potential historic and prehistoric archaeological resources. This will be done in coordination with the Section 106 consulting parties, and will follow the protocols outlined in the CRC Archaeological Research Design Report.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Light rail could potentially reestablish the early 20th century context of the historic buildings downtown, when streetcars served the area.

Bus rapid transit (BRT) would not reestablish this context and could result in a slightly greater number of potentially adverse noise impacts to NRHP-listed or eligible historic resources along the transit alignments, especially on quieter streets such as 16th, McLoughlin, or Broadway. As illustrated in Exhibit 3.8-17, bus rapid transit could potentially result in noise impacts to between two and seven NRHP-eligible historic resources, while light rail would result in zero to six impacts.

Some of these resources could be eligible for residential sound insulation through FTA, although outside noise levels could remain high, especially with BRT. Potential alterations caused by the sound insulation to the NRHP-listed or eligible historic resources would need go to the Secretary of the Interior Standards for Rehabilitation. See the Noise and Vibration section of this chapter for more information on potential noise impacts as a result of transit.

Exhibit 3.8-17
Potential Noise Impacts to Historic Resources from Transit

Mode Responsible for Impact	Transit Alignment Option	Address	Preliminary Finding of Effect[a]
Light rail or BRT	2-way Broadway	2000 Broadway St	Adverse
		2008 Broadway St	Adverse
		2214 Broadway St	Adverse
		2218 Broadway St	Adverse
		2414 Broadway St	Adverse
	McLoughlin	401 E McLoughlin	Adverse
		405 E McLoughlin	Adverse
		501 E McLoughlin	Adverse
		611 E McLoughlin	Adverse
		502 E McLoughlin	Adverse
		510 E McLoughlin	Adverse
BRT only	2-way Broadway	2221 Broadway St	Adverse
		2217 Broadway	Adverse
		111 W 29th St	Adverse
	Broadway-Main Couplet	2000 Broadway St	Adverse
		2008 Broadway St	Adverse
		2214 Broadway St	Adverse
		2218 Broadway St	Adverse
		2414 Broadway St	Adverse
		2221 Broadway St	Adverse
		111 W 29th St	Adverse
	16th Street	1605 F St	Adverse
		604 E 16th St	Adverse
	McLoughlin	700 E McLoughlin	Adverse
BRT (only with Supplemental River Crossing)	2-way Washington or Washington-Broadway Couplet	515 Washington St	Adverse

Source: CRC Noise and Vibration Technical Report.

[a] Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Bus rapid transit could result in a more substantial impact (an additional 0.35 acre) to Kiggins Bowl Park as compared to light rail.

The expansion of either the C-TRAN maintenance facility in East Vancouver or the TriMet Ruby Junction facility in Gresham is not expected to affect any properties that are NRHP-eligible or listed. There is no known evidence of prehistoric activity or occupation at either location. However, expansion of either maintenance facility site could potentially encounter pre-contact or historic archaeological resources.

Transit Terminus Options (with all Alternatives)

Historic Buildings, Sites, and Resources

The Kiggins Bowl (A) and the Lincoln (B) terminus options would result in a similar level of impacts to historic resources. As Exhibit 3.8-18 shows, the Lincoln terminus would require acquisitions from four NRHP-eligible properties, two of which could result in adverse effects, as they would require the demolition or relocation of the resource. The Kiggins Bowl terminus could result in acquisition impacts to between two and five NRHP-eligible properties, depending on the transit alignment option chosen. This total also includes a potentially adverse impact to a NRHP-eligible resource at 903 E 31st Street. Exhibit 3.8-18 summarizes potential impacts to NRHP-listed or eligible historic resources as a result of the transit alignments. Maps illustrating these impacts can be found in Chapter 5, Draft Section 4(f) Evaluation.

In addition to the full length terminus options, there are two shorter-length terminus options referred to as minimum operable segments (MOS). The Clark College MOS (C) would avoid the adverse effect to the NRHP-eligible private residence at 903 E 31st Street, as well as a portion of the acquisition impact to Kiggins Bowl Park, but would result in the same acquisition related impacts to between one (16th Street) and five (McLoughlin) NRHP-listed or eligible historic resources.

There would be no transit-related acquisition impacts to NRHP-listed or eligible historic properties by the Mill Plain MOS (D). This MOS may result in potential visual impacts associated with the transit alignment and stations through downtown Vancouver.

Exhibit 3.8-18
Direct Impacts to NRHP-Listed and Eligible Resources by Transit Terminus Option

Location	Description	Date	NRHP	Terminus Option	Potential Impact	Preliminary Finding of Effect[a]
1511 Main	Carnegie Library	1909	listed	A and C (16th Street option)	Access impact; Partial acquisition without displacement (50 sq ft)	No Adverse
401 E McLoughlin	Residence/ office	c.1916	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (378 sq ft)	Adverse
501 E McLoughlin	Residence	c. 1927	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (55 sq ft)	No Adverse
611 E McLoughlin	Residence	c. 1910	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (149 sq ft)	Adverse
502 E McLoughlin	Residence	c. 1900	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (586 sq ft)	No Adverse
510 E McLoughlin	Residence	c. 1910	eligible	A and C (McLoughlin option)	Partial acquisition without displacement (366 sq ft)	No Adverse
903 E 31st St	Residence	c. 1910	eligible	A	Demolition/Relocation (5461 sq ft)	Adverse
Kiggins Bowl Park	Sports Venue	Dedicated 1933	eligible	A, B, C, and D	Partial acquisition (6099 sq ft); additional 15246 sq ft for Kiggins Bowl terminus option with BRT)	No Adverse
2901 Main	Residence/ Office	c. 1915	eligible	B	Demolition/Relocation (454 sq ft)	Adverse
401 33rd St	First United Methodist	1948	eligible	B	Partial acquisition without displacement (3325 sq ft)	No Adverse
3200 Main	Office	c. 1956	eligible	B	Partial acquisition without displacement (660 sq ft)	No Adverse
3212 Main	Office	c. 1960	eligible	B	Partial acquisition without displacement (1892 sq ft)	Adverse
300 E 37th St	Office	c. 1950	eligible	B	Demolition/Relocation (18500 sq ft)	Adverse

Source: CRC Historic Built Environment Technical Report.
[a] Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

All transit terminus options and associated transit stations, if not designed properly, could result in visual impacts that could adversely affect the setting of historic resources. See the CRC Historic Built Environment Technical Report for more information regarding potential visual impacts.

Noise impacts could occur along these alignments which could also adversely affect the setting of historic resources along these alignments. Noise impacts are summarized in the Transit Mode discussion.

Parking and access impacts would likely occur along any of the transit alignments, especially in downtown and uptown Vancouver. These impacts could result in adverse effects to historic resources that occur along the transit alignments. These potential impacts are summarized in the Transit Alignment Options discussion, Section 3.2, and the CRC Historic Built Environment Technical Report.

Archaeological Sites and Resources

In Oregon, the proposed transit alignments extend within or close by the existing I-5 corridor across the Columbia River south shore floodplain and Hayden Island. Review of records on file at the Oregon SHPO indicates that no prehistoric archaeological sites have been recorded within the vicinity of the proposed transit alignments. An archaeological survey within the I-5 corridor found no evidence of prehistoric or historical archaeological sites. The project area in Oregon has been subject to substantial alteration, primarily from deposition of fill material, but the geological history suggests there is some potential for the discovery of prehistoric archaeological sites. Due to the fact that little development occurred along the I-5 corridor and vicinity until relatively recently, there appears to be little potential for encountering significant historical archaeological sites within the project area on the Oregon shore.

All areas where transit alignments are proposed in Vancouver have been occupied for more than 50 years. Therefore, there is some potential for historical archaeological remains to be found in these areas. Construction activities within city streets, where the proposed transit alignments are located, generally have not been monitored by archaeologists. Consequently, the extent to which prehistoric and historical artifacts may be found during construction excavations in the streets has not been established. Based on recent investigations by archaeologists at historic buildings sites in Vancouver, however, potential exists for encountering historical archaeological remains during construction along the proposed transit alignments.

On the north shore of the Columbia River, the proposed transit alignments begin west of the I-5 corridor, and extend across a gradually ascending flood plain that appears to have offered little inducement for settlement by prehistoric Native Americans. Review of records on file at the Washington DAHP indicates that no prehistoric archaeological sites have been recorded within or in the close vicinity of the proposed transit alignments. An archaeological survey along the proposed transit alignments found no evidence of prehistoric activity or occupation. Based on current information, there appears to be little potential for encountering prehistoric sites within the transit alignments directly on the Washington shore.

In contrast, as the proposed transit alignments extend northward from the Columbia River through the oldest portion of the City of Vancouver, the potential to encounter historical archaeological resources increases. From initial settlement in the late 1840s and 1850s, the city’s business district and adjacent residential areas rapidly developed northward from the river bank into the interior.

The proposed transit alignments extend through established commercial and residential areas. An archaeological reconnaissance undertaken along the alignments confirmed the existence of paved streets and sidewalks which effectively cover any evidence of historic (and earlier prehistoric) activity or occupation. A review of archaeological site records at DAHP indicates that four historical archaeological sites have been recently recorded in the oldest portion of Vancouver, specifically where historic buildings were formerly present within a few blocks of the Columbia River on Main, Broadway, and Columbia.

The proposed transit alignments extend along some of the same streets (e.g., Washington, Broadway) where the earlier railway systems were constructed. Although the rails from the earlier systems were reportedly removed (Freece 1985:43), it is possible that some remains of these historic railway systems may be encountered during construction along the proposed transit alignments. Additionally, the first modern street pavement in Vancouver consisted of Belgian blocks, rectangular stone blocks having several square feet of top surface laid lengthwise to the street (Freece 1985:88). Intact segments of Belgian blocks underlying modern pavement may be considered historically significant and require recording as an historical archaeological resource.

Historically, the edges of city streets were often ill-defined, and foundations or other architectural and/or archaeological features associated with the front portions of former buildings may extend into the current roadways. Depending on the precise location of the transit alignments in relation to the modern streets (i.e., whether in the center or on one side or the other of the roadway), construction may encounter archaeological remains associated with historic buildings.

Before the inception of city-sponsored waste disposal, it was not uncommon for trash to be disposed of simply by being discarded into the street (creating what are known as “sheet middens”), or buried in trash pits adjacent to structures. Consequently, historical artifacts (e.g., fragmentary glass containers, broken domestic ceramics, nails and other hardware, and butchered animal remains) from these discard activities may be found below the pavement of current roadways as well as in utilities trenches (e.g., storm water, sewer, electric lines) encountered during construction excavations for the proposed transit alignments.

In general, there could be fewer overall effects to archaeological resources caused by the two MOS options than the two full length terminus options, as they have smaller construction footprints, and therefore might involve less ground disturbance. However, unlike the other terminus options, the Mill Plain MOS would include new parking facilities in the south downtown area where historic archaeological resources may be located. However, the locations of these proposed park and ride facilities have already experienced a great amount of ground disturbance associated with the construction of the I-5/SR 14 interchange. Therefore, the possibility of finding intact artifacts in this area may be diminished.

There is also a high potential for encountering pre-contact archaeological sites along the Burnt Bridge Creek drainage, which could occur with the

Kiggins Bowl terminus option, but would be avoided by all other terminus options.

Transit Alignment Options (with all Alternatives)

OFFSET OR ADJACENT

Neither the offset nor the adjacent transit alignment option across Hayden Island would result in impacts to NRHP-eligible or listed historic resources. Preliminary research has not identified any archaeological sites this portion of the project area.

TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

Neither the two-way Washington nor the Washington-Broadway transit alignment option through downtown Vancouver would result in acquisition related impacts to NRHP-eligible or listed historic resources. Transit guideways and stations could introduce new visual elements to downtown and potentially eliminate parking and access. See Exhibits 3.8-19 and 3.8-20 for potential access impacts to historic resources from the Washington-Broadway couplet as a result alignment would be center running; and would therefore not result in any access impacts to historic resources. There may be some challenges getting to an historic property if a vehicle is traveling on the other side of the transit line. The driver would have to remain on Washington until the opportunity to make a left-hand turn. These impacts could result in an effect to the setting of these resources if not designed appropriately, or if alternate access and parking is not provided.

Exhibit 3.8-19
Potential Access Impacts with Washington-Broadway Couplet and LRT

Address/Description	Access(es) Lost	Alternative Access	Preliminary Finding of Effect[a]
801 Main St	1, to side parking lot (from Broadway)	Yes, from 8th or 9th	No Adverse
102 E Evergreen (Old Columbian Building)	1, to back parking (from Broadway)	Yes, from 11th	No Adverse
Hidden Brick Factory	1, to back parking (from Washington)	Yes, from Mill Plain Blvd	No Adverse
108 W 13th St (a Hidden House)	1, to back parking (from Washington)	Yes, from Mill Plain Blvd	No Adverse
110 W 13th (a Hidden House)	1, to back parking (from Washington)	Yes, from Mill Plain Blvd	No Adverse

Source: Historic Built Environment Technical Report.

a Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Exhibit 3.8-20
Potential Access Impacts with Washington-Broadway Couplet and BRT

Address/Description	Access(es) Lost	Alternative Access	Preliminary Finding of Effect
601 Broadway (Econo Lodge)	1, main entrance (from Broadway)	Yes, from 7th	No Adverse
1111 Broadway (Olson Engineering)	1, to back parking (from Broadway)	Yes, from 12th	No Adverse
1308 Washington (sm. house)	1, to a small parking lot (from Washington)	Yes, from 13th and Mill Plain	No Adverse
1300 Washington (Luepke Florist)	1, to a small parking lot (from Washington)	Yes, from 13th and Mill Plain	No Adverse

Source: Historic Built Environment Technical Report.

[a] Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Construction in this area has potential to result in an effect to historic archaeological features and deposits associated with early residences and businesses in the oldest portion of Vancouver.

16TH STREET OR MCLOUGHLIN

These alignment options apply to the Kiggins Bowl and Clark College MOS terminus options. The 16th Street alignment would result in an acquisition-related impact to the NRHP-listed Carnegie Library, now the Clark County Historical Museum. This impact has been preliminarily determined as not having an adverse effect on the property, but it would potentially block the ADA and delivery access to the museum, which could be considered an adverse effect.

The McLoughlin alignment would result in five partial acquisitions of NRHP-eligible historic properties. None of these acquisitions would result in the displacement of eligible historic buildings. Two of these acquisition impacts are estimated to be adverse, although Washington DAHP concurrence with these findings is pending.

Transit guideways and stations along 16th or McLoughlin could introduce a new visual element that could result in an effect to the setting of these resources if not designed appropriately. Parking and access could also be potentially eliminated, resulting in an adverse effect if alternate parking and access is not provided to impacted historic resources. See Exhibit 3.8-21 for the potential access impact to historic resources as a result of the 16th Street alignment. There are no access related impacts for the McLoughlin Boulevard alignment.

Exhibit 3.8-21
Potential Access Impact with 16th Street Alignment

Address/Description	Access Lost	Alternative Access	Preliminary Finding of Effect[a]
Carnegie Library 1511 Main	1, ADA and Delivery access (from 16th)	No	Adverse

Source: Historic Built Environment Technical Report.
[a] Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

No archaeological sites have been identified along these alignment options, but construction in this area may result in an effect to historic or archaeological features and deposits that may be in these areas.

TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET

These alignment options apply to the Lincoln terminus. Any acquisition-related impacts to NRHP-eligible resources would occur north of these options on Main Street. These options would only result in indirect effects. The Broadway-Main couplet could result in more access and parking related impacts to eligible and listed historic resources than the two-way Broadway alignment option (Exhibits 3.8-22 and 3.8-23).

Exhibit 3.8-22
Potential Access Impacts with Broadway-Main Couplet Alignment

Address/Description	Access Lost	Alternative Access	Preliminary Finding of Effect[a]
1920 Broadway St	1, to parking front (from Broadway)	Yes, from back alley	No Adverse
2407 Main St	1, to parking (from Main)	Yes, from back alley	No Adverse
2425 Main (Car repair)	1, to parking (from Main)	Yes, from 25th	No Adverse
2607 Main Street (Historic Safeway)	2, to parking from Main and Broadway	Yes, from Fourth Plain Blvd	No Adverse

Source: Historic Built Environment Technical Report.
[a] Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Exhibit 3.8-23
Potential Access Impacts with Two-way Broadway Alignment

Address/Description	Access Lost	Alternative Access	Preliminary Finding of Effect[a]
1920 Broadway St	1, to parking front (from Broadway)	Yes, from back alley	No Adverse

Source: Historic Built Environment Technical Report.
[a] Potential findings of effect are will be reviewed by the Washington DAHP and Oregon SHPO once the review of eligibility is complete.

Transit guideways and stations could introduce a new visual element to downtown that could result in an effect to the setting of these resources if not designed appropriately.

No archaeological sites have been identified along these alignments, but construction in this area may result in an effect to historic or archaeological features and deposits in these areas.

Transit Operations

Differences in transit operations are not expected to result effects to NRHP-eligible or listed historic resources, or archaeological artifacts, or deposits.

Tolling Scenarios

Different tolling scenarios are not expected to result in an effect to NRHP-eligible or listed historic resources, or archaeological artifacts, or deposits.

Transportation Demand and System Management

Transportation demand and system management measures are not expected to result in any effect to NRHP-eligible or listed historic resources, or archaeological artifacts, or deposits.

3.8.4 Temporary Effects

Substantial construction-related temporary impacts to historic and archaeological resources are not likely. Removal of historic and archaeological resources would be long-term effects and are discussed in the preceding text. One exception is a temporary easement (561 sq ft) for the Normandy Apartments (318 E Seventh) for the replacement crossing only and a possible additional exception is the Vancouver Barracks Post Hospital building, which would be monitored for vibration impacts during I-5 construction in this area. It is not expected that any other historic structures that remain in place near the highway (for example, the Providence Academy) would experience vibration impacts during construction.

During the construction of the transit guideway through Vancouver the economic viability of the businesses in the downtown historic buildings could diminish as a result of access and parking issues.

3.8.5 Potential Mitigation Measures

Historic Buildings, Sites, and Resources

The CRC team has attempted to avoid and minimize impacts to historic resources throughout the project development process, and will continue to do so as designs are refined. For unavoidable adverse effects to historic properties, where there is no prudent and feasible alternative, mitigation plans would be developed in consultation with Oregon SHPO, Washington DAHP, and other Consulting Parties, which include the nine participating tribal governments, the National Park Service, and FTA and FHWA. Mitigation measures could include:

- Moving rather than dismantling historic buildings.
- Providing assistant to restoration efforts, such as seismic stabilization of the Barracks Post Hospital.
- Preparing interpretive panels and placing them in locations available to the public to describe historic resources in the area.
- Supporting oral history efforts.
- Supporting, in cooperation with the NPS, historic museums and curatorial facilities.
- Where possible, returning historic properties affected by construction to their original condition.
- When possible, any residential sound insulation used to mitigate transit related noise impacts, or sound walls used to mitigate highway noise impacts, to historic resources should be done in a manner sensitive to the historic character of the building.
- Minimizing adverse effects to planned landscaping buffers in the Vancouver National Historic Reserve.
- Providing improved connections between downtown Vancouver and the Vancouver National Historic Reserve, including the construction of an expanded overpass/cover-connector between Evergreen Boulevard adn5th Street.
- Mitigating construction noise during special cultural events related to history appreciation at historic sites.
- Minimizing visual impacts to historic resources (i.e., sound walls near the Vancouver National Historic Reserve, transit stations near resources along Broadway or Main Streets) through site-specific, culturally and historically appropriate design or visual buffers.
- Minimizing parking and access impacts to businesses in historic buildings with signs to direct traffic and pedestrians to the businesses and services, and providing alternative access and parking during construction.
- Supporting the development of a facility within the Fort Vancouver National Historic Site for curating, testing, and interpreting artifacts and cultural resources information.
- Supporting the development of interpretive and educational exhibits and materials.

- Providing landscaping, sound walls, and/or other features that are capable of reducing noise and visual impacts, but would also be consistent with the cultural landscape.

Archaeological Sites and Resources

Advance testing of landforms identified as having the potential for supporting archaeological remains and monitoring during project construction would help ensure that important archaeological resources would not be inadvertently damaged or destroyed during CRC project construction. Based on local geology, construction of bridge piers will require testing for archaeological sites potentially buried in the deep sediments that have accumulated along the south shore of the Columbia River. Archaeological sites are likely to be shallower in Washington except in areas covered by dredge spoils (along the riverfront) or construction fill (I-5/SR 14 interchange).

The disposition of any artifacts or samples recovered during archaeological investigations or during construction will be determined in consultation with agencies, property owners, and appropriate tribes, with consideration given to feedback from other interested parties. It is anticipated that the bulk of the artifacts recovered north of the Columbia River could be curated at the Fort Vancouver National Historic Site. Long-term curation of recovered materials is an essential element of archaeological investigations and is required as part of federal and state permitting processes. The disposition of any artifacts or samples would also occur in accordance with the process outlined in the CRC Archaeology Research Design Report.

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3.9 Visual and Aesthetic Qualities

Highways and major transit facilities can be highly visible public resources that can noticeably affect the visual character of the surrounding landscapes and the perception of visual resources. Such changes are of keen interest to local residents and jurisdictions.

This section describes and evaluates existing visual resources and their context in order to reasonably determine potential impacts from the project alternatives. Understanding these effects contributes to the creation of well-designed transportation facilities that fit appropriately with their settings and benefit their communities. This assessment examines the possible positive and negative effects from the alternatives upon views and visual resources. This section is based on the CRC Visual Quality and Aesthetics Technical Report.

3.9.1 Existing Conditions

The existing I-5 crossing, shown in Exhibit 3.9-1, consists of two matched, steel through-truss bridges, each of which has a lift tower near the Vancouver side that supports large counterweights used to raise and lower a lift span so that tall river vessels can pass. The lift trusses and towers rise above the roadway and are highly visible, even from distant viewpoints along the river, as illustrated in Exhibit 3.9-2 on the following page.

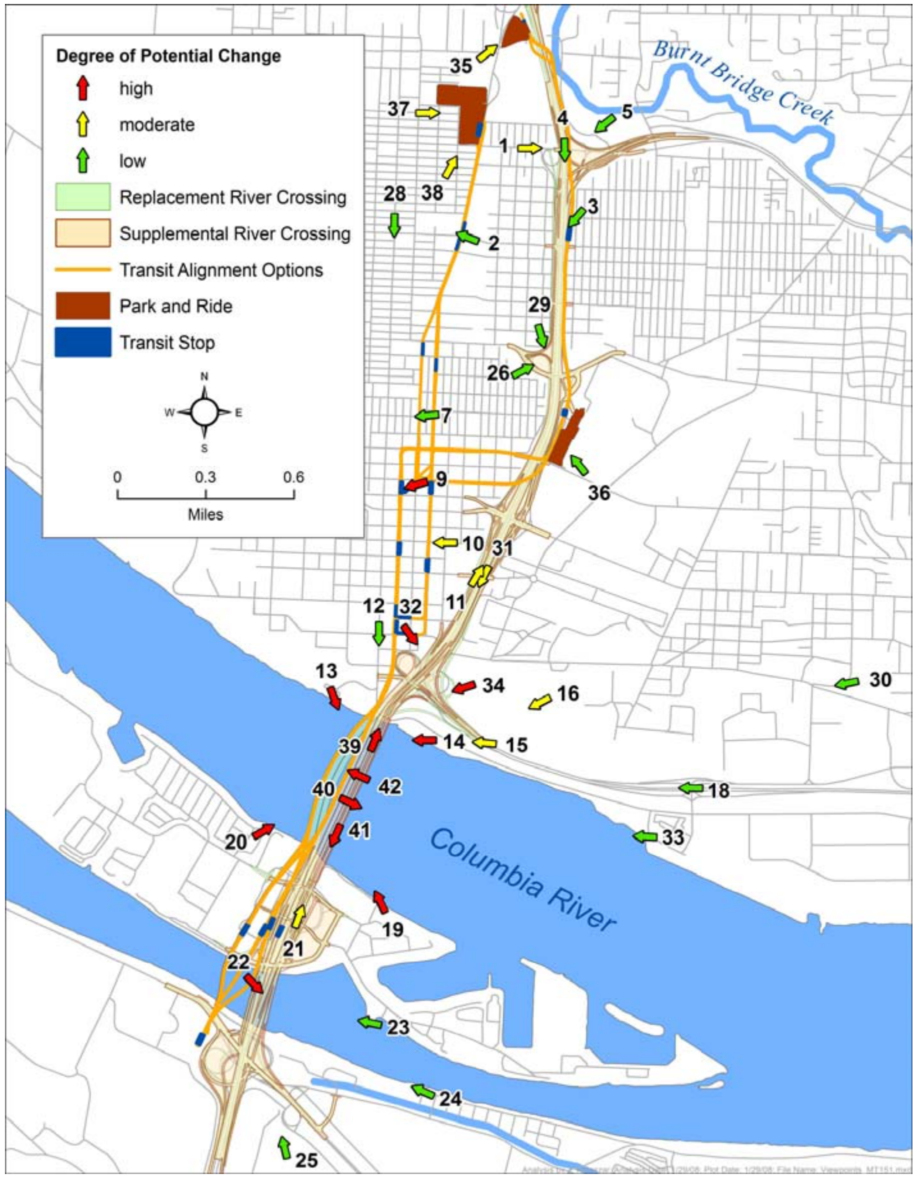
Exhibit 3.9-1
I-5 Bridges over the Columbia River

Exhibit 3.9-2 illustrates the view points from which potential changes to the visual context from project alternatives were analyzed. Evaluators employed descriptive and numeric analytical tools to assess visual quality and character of these view points, and assess the before and after conditions of selected views, using accepted, predefined numeric significance thresholds. The arrows on Exhibit 3.9-2 indicate the direction of the selected view, and the level of potential change expected from the project alternatives.

Degree of Potential Change

Based on methods developed by the Federal Highway Administration, visual field assessments were developed from the viewpoints shown here. The arrows indicate likelihood for high, moderate, or low potential for changes to the visual environment. The viewpoints showing potentially high degrees of change were then used for further analysis and the development of visual simulations

Exhibit 3.9-2
View Points



Source: CRC Visual and Aesthetics Technical Report.

In order to describe the existing visual environment and understand the level of visual changes that could occur with the project, the project team has defined five distinct "landscape units" in the CRC project area (see Exhibit 3.9-3). The five landscape units are the Columbia Slough in North Portland, the Columbia River, Downtown Vancouver, Greater Central Park, and Burnt Bridge Creek.

Exhibit 3.9-3
Landscape Units

Not to scale.

Columbia Slough Landscape Unit

The Columbia Slough landscape unit lies between Marine Drive on the north and N Columbia Boulevard/NE Lombard Street on the south.

The visual character of this unit is defined by level open fields and industrial sites, and the interstate highway. The area is a mix of older industrial parcels, parks and recreation sites, the slough system, and small residential neighborhoods. The Scenic Views, Sites, and Drives Inventory[30] identifies the Columbia Slough waterway as a scenic drive, acknowledging that it is actually several unconnected segments of slough and several secondary sloughs. The highway is elevated through this section, as is the bridge of the Tri-Met Yellow MAX Line. The I-5 bridges and towers are an iconic landmark from certain viewpoints because of their historic nature and having long been part of the view. Buildings or trees block most views of the roadway from the east. Views from the highway include tree canopies and roof tops, the open areas of Delta Park and Vanport Wetlands, and the Expo Center.

Viewers in this area are a mix of motorists on I-5 and surface roads, and park and trail users, as seen in Exhibit 3.9-4. Of these, passengers in vehicles and people in the area for recreation are likely to be sensitive to aesthetic details and the quality of scenic or landscape views. This sensitivity is a combination of having time to observe views and expecting to see park-like, pleasant landscapes because they are there to enjoy recreation activities.

Exhibit 3.9-4
I-5 from Delta Park

Columbia River Landscape Unit

The Columbia River landscape unit lies between Marine Drive and the BNSF tracks on the north shore of the river. This unit includes North Portland Harbor, Hayden Island, and the main river channel. The overall visual character is defined by the Columbia River, the I-5 bridges, and near-continuous development along the shorelines. The river channel is broad and flanked by short, steep banks and short, flat beaches.

This area is a mix of small to medium-scale residential and marina structures, large footprint, one or two story retail box buildings surrounded by paved parking, low-rise hotels and restaurants, and heavy and light industries. As shown in Exhibit 3.9-5, the I-5 crossing is the dominant structure in this area. It can be seen from most points along the river and many viewpoints having some elevation. The industrial character of the towers and complexity of the trusses contrasts with the character of the river channel and the hills and mountain on the horizon. However, the bridges and towers are an iconic landmark from many

Exhibit 3.9-5
Bridges from Waterfront Park

[30] City of Portland, 1988.

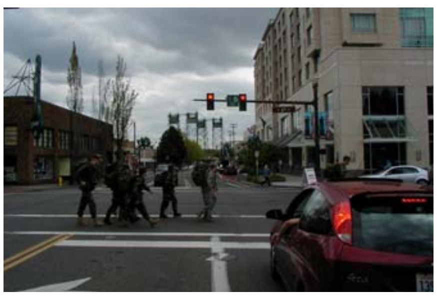
viewpoints because of their historic nature and having long been part of the view.

The I-5 roadway is elevated through this area. Views from the roadway include scenic views of the river and distant Mount Hood. From the bridge, views are obstructed by the superstructure, but pedestrians still have panoramic views of the river. Views that include the bridge are obstructed or decreased in quality, with a larger effect for closer viewers.

Viewers in this area comprise travelers on the I-5 bridges and side streets, boaters on the river, park and trail users, people in trains crossing the river and airplanes from Pearson Airfield and the Portland International Airport. Of these groups, recreationists, air passengers, pedestrians, and vehicle passengers are likely to have high sensitivity to the views and visual character of the area because they have time to observe the environs. They are also likely to have higher expectations for a visually pleasing experience, particularly if walking across the bridge, boating, or using one of the waterfront trails or parks.

Vancouver Downtown Landscape Unit

Exhibit 3.9-6
Bridge Towers from Columbia and 6th Streets in Downtown Vancouver



The Vancouver landscape unit includes Vancouver's downtown core of commercial and office buildings west of I-5, as well as the surrounding residential neighborhoods north toward Mill Plain Boulevard. This is an urban landscape with a mix of historic and contemporary buildings and both small and large-scale developments.

The overall visual character of this landscape unit is defined by Vancouver's urban form. Development is continuous and moderately dense and consists of single and multi-family homes, mixed use buildings and a pedestrian-friendly urban commercial and business core. There are many historic or vintage buildings and homes that contribute to a distinctive residential urban character.

The I-5 bridges are visible from several north-south streets, numerous transit stops, parks, and various locations throughout Vancouver; however, the bridges do not dominate most views (see Exhibit 3.9-6). Buildings, street signs, street trees, and the miscellaneous furnishings typical of an urban core are in the fore and middle grounds of those views. These elements obstruct views of the bridges. The exceptions are views from the conference center and hotels along the Vancouver shoreline. The highway is recessed into the grade through this section, and views of it from the surrounding area are limited by landform, buildings, and trees. Views outward from the roadway are limited by berms, sound walls, and retaining walls.

Viewers in this landscape unit are travelers on I-5 and local streets including commuters, shoppers, visitors, and tourists, residents living adjacent to I-5, and people engaged in recreation activities. Residents and visitors to the commercial and business areas may be sensitive to view quality because they are likely to expect an attractive, familiar urban or neighborhood environment.

Greater Central Park Landscape Unit

This landscape unit lies east of I-5 between the BNSF railroad berm and Fourth Plain Boulevard. It includes the Vancouver National Historic Reserve (VNHR), Clark College, Pearson Air Field, various public buildings, parks, and residential neighborhoods. The Fort Vancouver area is a national tourist attraction and includes several facilities intended to recreate historic conditions. These would be especially sensitive to visual impacts from the CRC project. A new pedestrian overpass (the Confluence Land Bridge) connecting the Fort to the waterfront is a public facility and offers panoramic views of the river and bridges.

Exhibit 3.9-7
Bridges from Fort Vancouver

The overall visual character of this landscape unit is park-like campus and open fields. Development is primarily recreation and education-oriented with the previous military/commercial activities having evolved into historic landscapes used for recreation activities. The I-5 bridges are visible from Pearson Airfield, the Fort's plain (see Exhibit 3.9-7), and is also partially visible over the Stockade fence and from the upper floor of the bastion, a look-out tower that is part of the Stockade. Except for a few locations on hillsides, there are few unobstructed views of visual resources such as the Tualatin Hills, Mount Hood, or the Columbia River.

The I-5 bridges and SR 14 ramps are barriers to views between south Vancouver and the south Fort area. The highway is primarily recessed into the grade in this section, and views of it from the surrounding area are limited. The view of the surroundings from the roadway is blocked by berms, sound walls, and retaining walls. Existing transit as well as bicyclists and pedestrians utilize the at grade, street-system.

Viewers in this landscape unit are tourists, travelers and commuters on I-5 and its cross streets, residents living adjacent to I-5, visitors to schools and hospitals, users of Pearson Airfield, and certain residents with homes on southwest-facing hills. Tourists and residents are likely to be sensitive to views and visual quality because they expect to see scenic or familiar, pleasant landscapes and have the time to enjoy the views.

Burnt Bridge Creek Landscape Unit

The Burnt Bridge Creek landscape unit is a riparian greenbelt surrounded by wooded hills. This landscape unit lies between the SR 500 interchange and the north limit of the project area. Visual quality is defined by the low-density, single-family residential development interspersed through the rural landscape. A Bonneville Power Administration substation and office complex adjoins I-5 on the east side. West of I-5 is the open space of the creek floodplain. The hilly, wooded terrain screens the I-5 roadway from the surrounding area. Views from the roadway are limited by trees growing along the roadway.

Viewers in this area are travelers on I-5 and residents passing through the corridor on their way to or from home. A small numbers of residents with views of the highway facilities and may be sensitive to the quality of the views. Viewers could also be sensitive to increased transit vehicle use on the roadway, and the introduction of transit supportive infrastructure.

3.9.2 Long-term Effects from Project Alternatives

The visual impacts from the project alternatives are outlined in Exhibits 3.9-8 through 3.9-11 and summarized in the text that follows.

Alternative 1: No-Build

The No-Build Alternative would not result in changes to the visual quality or character of landscapes within the project area.

Alternative 2: Replacement Crossing with Bus Rapid Transit

A replacement river crossing would replace the existing bridges with uniformly-styled, modern bridges that would not have the prominent structures above the bridge deck, nor the tall lift towers. The new bridges would still be visible from many areas that currently can see the lift towers of the existing crossings, because the bridge decks of the new crossing would be substantially higher than the decks of the existing bridges. In general, the new crossings would likely improve views of the river from nearby areas by providing a reduced overall visual prominence. Furthermore, the views from the new structures, for transit riders, drivers, and others, would likely improve because there would not be the intricate structure over the bridge decks, like that of the existing bridges. Pedestrians and cyclists may have fewer options with build alternatives as both sides of the existing bridges currently have bike and pedestrian pathways. The replacement bridges provide the pathway only on the west side of the bridges.

Exhibit 3.9-8
Visual Effects Summary for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College Terminus (C)**	**Mill Plain Terminus (D)**
Columbia Slough Landscape Unit	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.
Columbia River Landscape Unit[a]	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.
	STHB may reduce visual presence with less width and fewer structures, but would have less symmetry.			
Vancouver Downtown Landscape Unit	Replace views of bridge towers with new bridges. Could remove street trees on McLoughlin.	Replace views of bridge towers with new bridges. Could remove street trees on Main.	Replace views of bridge towers with new bridges. Could remove street trees on McLoughlin.	Replace views of bridge towers with new bridges.
Greater Central Park Landscape Unit	Could improve views from VNHR.	Could improve views from VNHR.	Could improve views from VNHR.	Could improve views from VNHR.
Burnt Bridge Creek Landscape Unit	SR 500 interchange tunnel could reduce prominence of highway. Could remove vegetation around highway.	SR 500 interchange tunnel could reduce prominence of highway.	None	None

Source: CRC Visual and Aesthetics technical Report.

[a] In cases where values differ between these designs, the STHB values are lined in the inset box.

Views in the immediate vicinity of new transit stations could change because the stations will be introduce new fixtures and designs and because the transit vehicles must stop for short durations, adding a new dynamic quality to blocks with stations. The transit guideway and stations would be designed to integrate with the surrounding built environment, and generally would not substantially change the visual quality or character of these surroundings. The transit vehicles would not impact most views because they would not be permanent parts of any view other than at or near maintenance facilities. In a few areas vegetation would need to be removed to accommodate the new right-of-way required by the guideway. These areas include the road widening along Main Street north of 29th Street for the Lincoln terminus (B) option, and McLoughlin Boulevard for the Kiggins Bowl terminus (A) and the Clark College MOS (C). The Kiggins Bowl terminus (A) would also remove vegetation adjoining to the highway between Mill Plain and Fourth Plain Boulevards because of the additional right-of-way required for the transit guideway.

Alternative 3: Replacement Crossing with Light Rail

The effects of Alternative 3 would be the same as Alternative 2 because there is little substantial visual or aesthetic difference between bus rapid transit and light rail. With LRT the overhead wire system would add to visual complexity. However, in urban environments it is typically a low visual impact. The transit vehicles would not impact most views because they would not be permanent parts of any view other than at or near maintenance facilities.

Exhibit 3.9-9
Visual Effects Summary for Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College Terminus (C)**	**Mill Plain Terminus (D)**
Columbia Slough Landscape Unit	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.
Columbia River Landscape Unit[a]	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.	Visual change from higher bridges, removal of bridge towers.
	STHB may reduce visual presence with less width and fewer structures, but would have less symmetry.			
Vancouver Downtown Landscape Unit	Replace views of bridge towers with new bridges. Could remove street trees on McLoughlin.	Replace views of bridge towers with new bridges. Could remove street trees on Main.	Replace views of bridge towers with new bridges. Could remove street trees on McLoughlin.	Replace views of bridge towers with new bridges.
Greater Central Park Landscape Unit	Could improve views from VNHR.	Could improve views from VNHR.	Could improve views from VNHR.	Could improve views from VNHR.
Burnt Bridge Creek Landscape Unit	SR 500 interchange tunnel could reduce prominence of highway. Could remove vegetation around highway.	SR 500 interchange tunnel could reduce prominence of highway.	None	None

Source: CRC Visual and Aesthetics Technical Report.

[a] In cases where values differ between these designs, the STHB values are lined in the inset box.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Because of its differing bridge types, a supplemental river crossing would potentially cause adverse impacts to the visual quality and character for certain views in the Columbia River, Vancouver Downtown, and Greater Central Park landscape units. Retaining the existing bridges and adding a new modern-styled bridge would introduce an incoherent view. Effects from the transit guideway would be the same as Alternative 2. Pedestrians and cyclists may have fewer options with build alternatives as both sides of the existing bridges currently have bike and pedestrian pathways. The replacement bridges provide the pathway only on the west side of the bridges. Views in the immediate vicinity of new transit stations would change because the stations will be introduce new fixtures and designs and because the transit vehicles must stop for short durations, adding a new dynamic quality to blocks with stations. With The transit vehicles would not impact most views because they would not be permanent parts of any view other than at or near maintenance facilities.

Exhibit 3.9-10
Visual Effects Summary for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College Terminus (C)**	**Mill Plain Terminus (D)**
Columbia Slough Landscape Unit	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.
Columbia River Landscape Unit	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.
Vancouver Downtown Landscape Unit	Different style bridges could degrade views. Could remove street trees on McLoughlin.	Different style bridges could degrade views. Could remove street trees on Main.	Different style bridges could degrade views. Could remove street trees on McLoughlin.	Different style bridges could degrade views.
Greater Central Park Landscape Unit	Would degrade views from VNHR.	Would degrade views from VNHR.	Would degrade views from VNHR.	Would degrade views from VNHR.
Burnt Bridge Creek Landscape Unit	SR 500 interchange tunnel could reduce highway prominence. Could remove vegetation around highway.	SR 500 interchange tunnel could reduce highway prominence.	None.	None.

Source: CRC Visual and Aesthetics Technical Report.

Alternative 5: Supplemental Crossing with Light Rail

The effects of Alternative 5 would be the same as Alternative 4 because there is no substantial visual or aesthetic difference between bus rapid transit and light rail. With LRT the overhead wire system would add to visual complexity. However, in urban environments it is typically a low visual impact. The transit vehicles would not impact most views because they would not be permanent parts of any view other than at or near maintenance facilities.

Exhibit 3.9-11
Visual Effects Summary for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College Terminus (C)**	**Mill Plain Terminus (D)**
Columbia Slough Landscape Unit	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.	Visual effects would be minor.
Columbia River Landscape Unit	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.	Visual impact from wider, less uniform bridges.
Vancouver Downtown Landscape Unit	Different style bridges could degrade views. Could remove street trees on McLoughlin.	Different style bridges could degrade views. Could remove street trees on Main.	Different style bridges could degrade views. Could remove street trees on McLoughlin.	Different style bridges could degrade views.
Greater Central Park Landscape Unit	Would degrade views from VNHR.	Would degrade views from VNHR.	Would degrade views from VNHR.	Would degrade views from VNHR.
Burnt Bridge Creek Landscape Unit	SR 500 interchange tunnel could reduce highway prominence. Could remove vegetation around highway.	SR 500 interchange tunnel could reduce highway prominence.	None.	None.

Source: CRC Visual and Aesthetics Technical Report.

3.9.3 Long-term Effects from Project Components

This section describes the effects or impacts of the components and various options that comprise the project alternatives. High-capacity transit mode, tolling scenarios, transportation demand and system management measures, and transit operations would not affect visual and aesthetic qualities, and are therefore not discussed in detail below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5) Improvements

COLUMBIA SLOUGH LANDSCAPE UNIT

Visual effects from either river crossing would be minor in this area for any of the build alternatives. The Marine Drive interchange ramp would be slightly taller, but the overall impact is likely to be low. The Marine

Drive Interchange Designs could change the visual character of the Expo Center parking area and the adjacent light rail station.

COLUMBIA RIVER LANDSCAPE UNIT

The replacement and supplemental river crossings would both create high level visual changes near the Columbia River, but differ in their visual impacts.

The replacement crossing would have high-level visual impacts in the Columbia River landscape unit from widening and reconfiguring the I-5 bridges over North Portland Harbor, adding a new transit bridge and elevated guideway, and building a new main channel crossing. A simulation of the river crossing can be seen in Exhibit 3.9-12. These impacts could be positive if the new structures are attractive and sensitive to the surrounding uses and landscapes. Effects from either transit option would be largely the same in this unit and would be an additive impact because the guideway would be part of the new bridge. Visual character and quality near the new crossing would undergo high level changes due to the removal of docks, floating homes, and other structures.

Exhibit 3.9-12
Visual Simulation of Replacement Crossing

Removing the truss structures and lift towers of the existing I-5 bridges would dramatically open up views from I-5. From both northbound and southbound directions on I-5, views of the Portland and Vancouver skylines would be visible, as would distant shorelines, rolling hills, and mountain profiles. Views for travelers on the crossing could be better for the replacement than for the supplemental crossing, because the latter would retain the view-blocking through-truss structure on the existing bridges. Reducing the number of supporting piers in the river, as is planned for the replacement crossing, would open views of the river from the shore and water.

The stacked transit/highway bridge design, as illustrated in Exhibit 3.9-13, would locate high-capacity transit under the highway deck. This design would cause different visual impacts and benefits than the standard replacement crossing. This design would require two, rather than three bridges, which would reduce the prominence of the river crossing from all views. However, the bridges would be of different sizes in order to accommodate transit in one of the structures. This would reduce their symmetry, unless other design elements mitigated for such.

Exhibit 3.9-13
Visual Simulation of Stacked Transit/Highway Bridge Design

The footprint of the supplemental crossing would be similar to the replacement crossing, but the overall visual presence would be greater (Exhibit 3.9-14). The supplemental structure will not mimic the design of the existing bridge and it will have a higher deck and no lift span. The piers of the existing crossing will be reinforced for seismic safety, and this could add substantially to their bulk. This could also result in discordant visual styles for the combined crossing.

Exhibit 3.9-14
Visual Simulation of Supplemental Crossing

The supplemental crossing would also add visual complexity to the I-5 corridor on Hayden Island. The supplemental structure would be closer than the current roadway to a residential neighborhood west of I-5, and could affect visual quality there.

The view from the roadway would be similar to existing conditions for northbound motorists because they would use the existing bridges. Views for transit passengers and southbound motorists on the new supplemental structure are likely to improve over existing conditions if the design does not include a structures elevated over the deck.

Views for pedestrian and cyclists would greatly change as the existing circuitous circulation system would be replaced with a simpler one, at a higher elevation.

VANCOUVER DOWNTOWN LANDSCAPE UNIT

Either river crossing could replace existing highway vegetation and buffer area with a widened highway and sound walls near the SR 14 interchange, which would lessen the visual quality of the roadway for travelers.

The replacement crossing would remove the current bridge lift towers, but the new bridge deck would be higher than the existing deck and would still be visible from many locations in downtown Vancouver. The higher and wider decks of the replacement bridges are likely to degrade the quality of views that include the crossing when compared to existing conditions. For the supplemental crossing, the lift towers would remain visible and the higher roadway of the new bridge would add to the prominence of the crossing from these locations. The differing styles of the existing and supplemental bridges are likely to degrade the quality of views that include the crossing when compared to either existing conditions or the replacement crossing.

GREATER CENTRAL PARK LANDSCAPE UNIT

With the exception of Fort Vancouver, visual impacts would be low in this landscape for both river crossings, because visibility of the bridges and highway would not increase. With a replacement crossing, views of the bridges from Fort Vancouver could improve in quality, depending on the final design of the crossing. However, having the structure in view from the historic reserve would remain a visual impact. The supplemental crossing is likely to increase the prominence of the crossing from the Fort and degrade the quality of views that include it.

This impact would be compounded by changes to the SR 14 and Mill Plain interchanges that would bring I-5 closer to the historic Post Hospital and encroach on the HBC Village area. As illustrated in Exhibit 3.9-15, existing vegetation will likely visually block the SR 14 interchange (double-loop) from the HBC Village. With the single-loop design, this could be more visually prominent and incompatible in scale and use with the historic Village site.

Exhibit 3.9-15
Visual Simulation from HBC (Fort) Village

BURNT BRIDGE CREEK LANDSCAPE UNIT

The I-5/SR 500 interchange could replace existing ramps with a tunnel. This could be a visual improvement for the view of the interchange from the surrounding area, since it would have more open space. This would have an adverse visual impact on highway users, for the length of the tunnel. Highway widening through SR 500 could slightly degrade visual quality from nearby homes and for travelers on the roadway, as landscaped buffers would likely be lost.

Transit Terminus Options (with all Alternatives)

This section compares the Kiggins Bowl (A), Lincoln (B), Clark College MOS (C), and Mill Plain MOS (D) terminus options within each of the five landscape units. It also evaluates the impacts from the different alignment options. All of the terminus options have the same set of alignment options through the Columbia Slough and Columbia River landscape units.

COLUMBIA SLOUGH LANDSCAPE UNIT

Visual effects from high-capacity transit would be minor in this area. Expanding the Expo Center transit station would not change its existing character. However, the Southern or Diagonal Marine Drive Interchange designs would.

COLUMBIA RIVER LANDSCAPE UNIT

The new elevated transit guideway from the Expo Center to Hayden Island would increase the width of the bridge, or add a new, separate bridge, across North Portland Harbor. This would have a negative impact on views from floating homes and boats in the channel, and would block more of the distant views from nearby vantage points. Transit users would have improved views to the west, since more of the scenic surrounding area would be visible than from the current roadway. Views in the immediate vicinity of the new Hayden Island transit station could change because the station will be on an elevated structure.

VANCOUVER DOWNTOWN LANDSCAPE UNIT

The transit guideway through downtown Vancouver would be at street level and designed to fit in with the existing built environment. Views in the immediate vicinity of new transit stations could change because the stations will be introduce new fixtures and designs and because the transit vehicles must stop for short durations, adding a new dynamic quality to blocks with stations. With LRT the overhead wire system would add to visual complexity. However, in urban environments it is typically a low visual impact. The transit vehicles would not impact most views because they would not be permanent parts of any view.

North of 29th Street, the Lincoln terminus (B) could change the visual character of Main Street by widening the street from 80 to 100 feet to accommodate the transit guideway. This could result in the loss of mature street trees. For the Mill Plain MOS (D) a five-story parking structure (with ground-floor commercial use) would be inconsistent with the scale of buildings in the surrounding area, as most structures in the immediate area are one story. The parking structures around the SR 14 interchange would generally be in keeping with the scale of surrounding structures.

GREATER CENTRAL PARK LANDSCAPE UNIT

The Kiggins Bowl (A) and Clark College MOS (C) terminus options could require widening McLoughlin Boulevard from 80 to 100 feet. This could result in the loss of mature street trees and decrease the visual quality of the street. The 16th Street alignment option would not require street widening and would not degrade visual quality on 16th Street.

The Clark College Park and Ride, as either a three-level structure (with A and C) or a surface lot (with B and D), would be visually compatible with the existing large-footprint, mid-rise buildings and parking lots of the Clark College campus and the Veterans Administration campus to the north.

With LRT the overhead wire system would add to visual complexity. However, in urban environments it is typically a low visual impact.

BURNT BRIDGE CREEK LANDSCAPE UNIT

The Kiggins Bowl terminus (A) would cause visual impacts by adding a transit guideway in the I-5 right-of-way and shifting the highway slightly west to accommodate it. This could result in the removal of vegetation from the highway right-of-way and could make the highway corridor more noticeable from surrounding areas.

The Lincoln terminus (B) station at the Lincoln Park and Ride would be reasonably consistent with the portion of the site used as a WSDOT maintenance facility (building complex surrounded by asphalt parking), although it would also displace some single-family homes and a small business. This park and ride would be clearly visible from nearby residential units, but could be landscaped to screen it.

TRANSIT MAINTENANCE FACILITY EXPANSIONS

Expansion of high capacity transit systems will require expansions in regional maintenance facilities. The light rail maintenance facility expansion would require full acquisition of 14 parcels in the vicinity of NW Eleven Mile Lane in Gresham. These parcels support residential, commercial, and light industrial uses. In many cases there seems to be multiple uses occurring on a single lot. The maintenance facility expansion would be largely consistent with the building types and scales in the immediate area. The BRT maintenance facility would be located at 18th Street and 65th Avenue in Vancouver. The area now includes a business, and two residences, dispersed across a somewhat vacant property. The surrounding area is includes single story commercial and warehouse facilities, including a C-Tran facility. A BRT maintenance facility would be largely consistent with the existing conditions.

Transit Alignment Options (with all Alternatives)

OFFSET OR ADJACENT

On Hayden Island, building the transit guideway adjacent to the highway would increase the width and bulk of the visual barrier that the elevated roadway creates. The elevated transit station would increase the visibility of the guideway over the highway, although this could benefit transit users trying to find the station.

Offsetting the transit guideway between 450 and 650 feet west of the elevated highway on Hayden Island could have slightly greater negative visual effect than the adjacent alignment option. The elevated highway barrier would still be present, and the offset guideway would create a second, though much smaller barrier to the west.

TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

There would be no substantial difference in visual effects between the two-way Washington and Washington-Broadway couplet alignments.

16TH STREET OR MCLOUGHLIN

The 16th Street alignment option would not require street widening and would not degrade visual quality on 16th Street. In contrast, the McLoughlin alignment option would widen McLoughlin Boulevard from 80 to 100 feet, and potentially remove mature street trees and decrease the visual quality of this street.

TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET

There would be no substantial difference in the visual effects between the two-way Broadway and Broadway-Main couplet alignment options.

Tolling Scenarios

Introducing an electronic-based tolling system on the crossing could add overhead signs and electronic equipment that would be visible for motorists and other users of the bridges. These signs and equipment could result in low to moderate change in the views for users of the bridges.

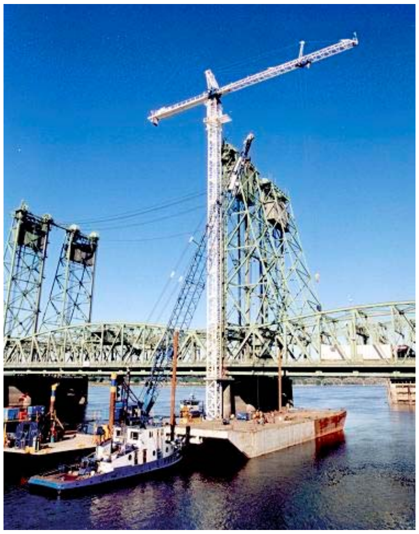
3.9.4 Temporary Effects

During construction the quality of views to and from the project area would be temporarily altered. Construction-related signage and heavy equipment would be visible at and near construction sites. Vegetation would be removed from some areas to accommodate construction of the bridge, new ramps, and the transit guideway. This would degrade or partially obstruct views or vistas. Short-term changes to the visual character of areas adjacent to the alignment could result from:

- Clearing and grading activities resulting in exposed soils and immature replacement plantings.
- Erosion control devices such as silt fences, plastic ground covers, or straw bales.
- Dust, exhaust, and airborne debris in areas of active construction.
- Stockpile areas of construction equipment, gravel or earth, or construction debris.

Construction outside of daylight hours would require bright temporary lighting. This could expose nearby residents and travelers to higher levels of glare from unshielded light sources or increased ambient nighttime light levels. Temporary lighting on the crossing structure could also add glare effects to river navigation and would be noticeable from wide areas of the surrounding landscape.

Exhibit 3.9-16
Barge and Crane Performing Bridge Work



Both the replacement and supplemental river crossing would station barges and large cranes in the Columbia River near the bridge, possibly similar to that which is illustrated in Exhibit 3.9-16. They would be highly noticeable from the roadway and surrounding landscape and would detract from the scenic quality of the area. Construction duration is expected to be shorter for the replacement river crossing.

Depending on the location of the bridge assembly/casting yard, it could result in temporary visual impacts. Any potential sites would be evaluated for the visual impacts and potential mitigation will be considered. This will be most important if the site is visible from public parks or other visually sensitive uses.

3.9.5 Potential Mitigation Measures

High-quality design and construction of the proposed highway and transit facilities will be important mitigation tools for visual quality and aesthetics. The following techniques could be employed for any of the alternatives to improve the visual effects of the CRC project:

- Planting vegetation, street trees, and landscaping in and around the project where appropriate,
- Giving special consideration to the design of alternatives that could result in visual impacts from public parks, open spaces, and historic or cultural resources,
- Shielding station and roadway lighting to reduce impacts from glare.
- Minimizing structural bulk where appropriate, and
- Designing the facilities to complement or blend with the surrounding landscapes and communities.

The CRC project team will coordinate with the local communities and responsible agencies to create visual design guidelines for the project. Both the replacement and supplemental crossing structures will provide opportunities to enhance community access to the scenic landscape of the Columbia River. The replacement river crossing also provides the opportunity to design a uniform crossing that does not detract from the landscapes surrounding it.

3.10 Air Quality

Air pollutants can affect human and environmental health. Many natural and human activities can affect air quality. Transportation system improvements, such as the CRC project, can have both beneficial and adverse effects on air quality. Two types of air emissions are evaluated in the CRC air quality analysis:

- Criteria pollutants – federal regulations have established limits for these pollutants in order to protect public health.
- Mobile source air toxics – these have potential public health concerns but have no established standards for transportation projects.

This section is based on the CRC Air Quality Technical Report and discusses how CRC alternatives would affect criteria pollutants and mobile source air toxins. In addition, carbon dioxide emissions are a concern, not for air quality, but because of their potential to contribute to global climate change. This is a potential cumulative impact and is discussed in the Cumulative Impacts section at the end of this chapter.

3.10.1 Existing Conditions

Air Quality Pollutants and Standards

This section describes the pollutants that were studied, why they are relevant to the CRC project, and how they were analyzed.

CRITERIA POLLUTANTS

The U.S. Environmental Protection Agency (EPA) has developed National Ambient Air Quality Standards (NAAQS, or federal standards) for six pollutants, known as "criteria pollutants." These include carbon monoxide (CO), lead, ozone, nitrogen dioxide, sulfur dioxide, and particulate matter (PM). Washington and Oregon also have State Ambient Air Quality Standards for these pollutants. Carbon monoxide is the only pollutant of concern for potential violations related to transportation projects in the Portland-Vancouver metropolitan area.

Greenhouse Gases

For a discussion of greenhouse gas emissions and global climate change, please see Section 3.19.8.

The CRC air quality study followed well-developed analysis methods to evaluate air quality impacts from criteria pollutants. The evaluation estimated criteria pollutant emissions for the region (Clark, Multnomah, Washington, and Clackamas counties) and for project subareas (four segments of I-5 affected by the CRC alternatives). It also performed CO hotspot analysis, estimating concentrations of CO at the most congested intersections.

The I-5 CRC project is located within the Portland CO Maintenance Area and the Vancouver CO Maintenance Area, as shown on Exhibit 3.10-1. Because of that, the Oregon Department of Environmental Quality (DEQ) and the Southwest Clean Air Agency (SWCAA) have State Implementation Plans with regulatory procedures to maintain compliance with the NAAQS. Complying with the Portland CO maintenance plan requires verifying that planned transportation projects will not cause or contribute to a violation of the federal standards for CO. This verification process is referred to as demonstrating conformity. Demonstrating conformity consists of two different analyses:

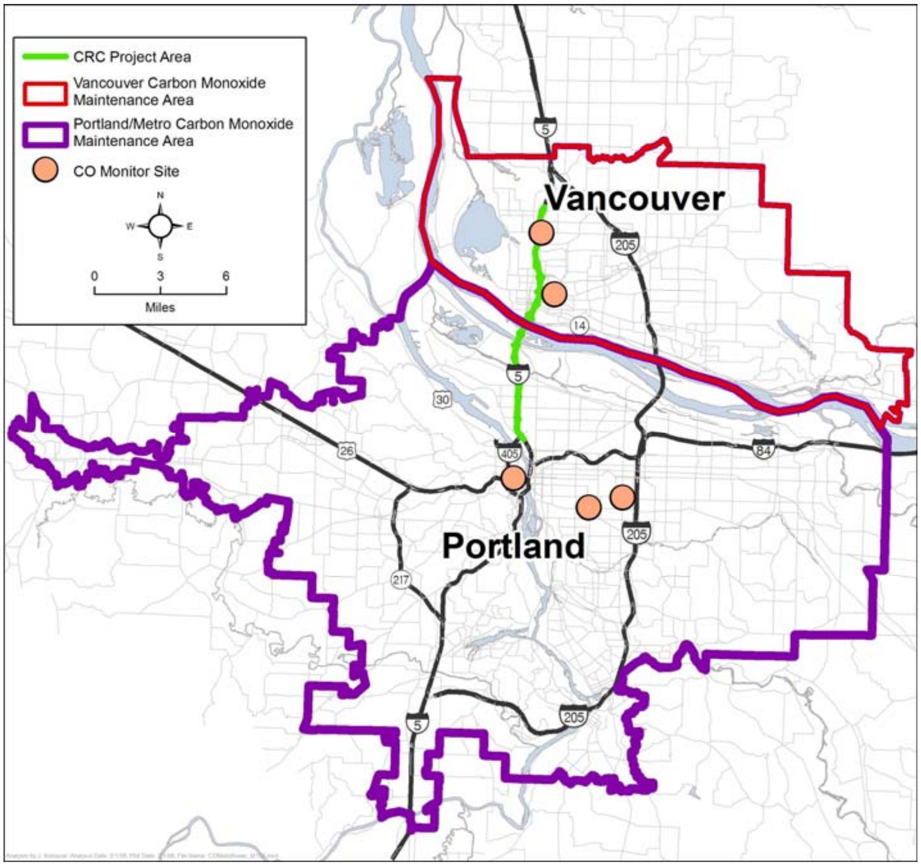
- A regional analysis – the project must be included in a conforming regional transportation plan and transportation improvement plan.
- A local analysis - the project must analyze the most congested intersections and demonstrate that CO levels, including the project, will be below the CO standards.

Metro prepared a conformity determination for the 2035 Regional Transportation Plan, and this was circulated for public and technical review and comment. After the 30 day comment period, and receiving no comments, the Metro Council approved Resolution 08-3911 and forwarded the air quality conformity determination to the USDOT (Federal Highway Administration and Federal Transit Administration.)

The USDOT (after consultation with EPA), reviewed the regional analysis and approved the air quality conformity determination on February 29, 2008. Metro included a placeholder assumption for the CRC project in the regional conformity determination they conducted. Their modeling of RTP conformity assumed a replacement bridge with LRT and tolling, with 10,000 vehicles per hour each direction, $2 tolls, and an LRT terminus at the Lincoln Park and Ride. The project was assumed to be completed by 2017. In order to conclude that the CRC project conforms, the design and scope of the CRC preferred alternative would need to match the assumptions in Metro's RTP conformity determination. In addition, nothing could be expended before 2011 or it would need to be included in the Transportation Improvement Plan as well.

This DEIS also includes the analysis of CO levels at congested intersections in Portland and Vancouver and demonstrates compliance with Federal and State CO standards. The year of opening analysis will need to be completed before the local hot spots analysis meets the conformity requirements, and if the locally preferred alternative isn’t well represented by the hot spot analysis that was completed for the DEIS, then an updated analysis would need to be completed. No regional conformity analysis is required for the Vancouver area.

Exhibit 3.10-1
Portland and Vancouver Carbon Monoxide Maintenance Areas



Source: SWCAA and DEQ.

MOBILE SOURCE AIR TOXICS

Nationally and locally, concerns have grown about several other pollutants that have a potential impact on public health but, unlike the criteria pollutants, do not have regulatory standards. These pollutants—designated as priority mobile source air toxics (MSATs) by FHWA based on EPA's rulemaking—include benzene, 1,3 butadiene, formaldehyde, acetaldehyde, acrolein, and diesel particulates. Analyzing mobile source impacts is a challenge because there is no analysis requirement and no standardized method. The CRC project team, together with federal and state regulatory and transportation agencies, agreed upon an approach for estimating these emissions from I-5 both at the regional and sub-area level.

Evaluating environmental and health impacts on a proposed highway project involves emissions modeling (to estimate the amount of pollutant discharged), dispersion modeling (to estimate the resulting concentrations of the pollutant), exposure modeling (to estimate human exposure to the estimated concentrations of the pollutant), and a final determination of health impacts based on the estimated exposure. Each step is encumbered by technical shortcomings or uncertain science that prevents a complete determination of the MSAT health impacts. The Air Quality Technical Report includes a full discussion of these limitations.

Car Emissions Keep Getting Cleaner

Starting in the early 1970s, EPA regulations controlled air pollutant emissions from motor vehicles. Recent regulations, including those for fuel formulations, help control emissions from heavy-duty diesel on-road and off-road vehicles. New gasoline reformulation rules should substantially reduce benzene emissions. These standards are expected to continue reducing pollutants in vehicle emissions over the next 25 to 30 years.

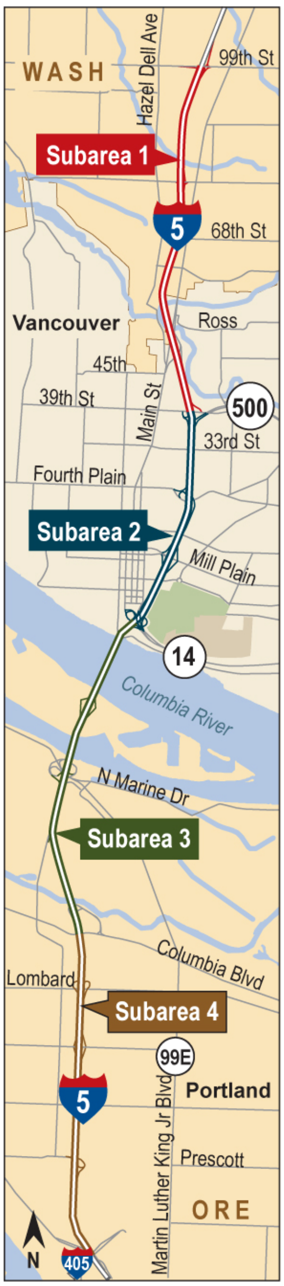
Note that the mobile source analyses for CRC and other transportation projects have forecast large declines in emissions over time. Reduced emissions have already occurred and are projected to continue due to on-going advances in cleaner fuels and emission control technologies.

Existing Pollutant Levels

CRITERIA POLLUTANTS

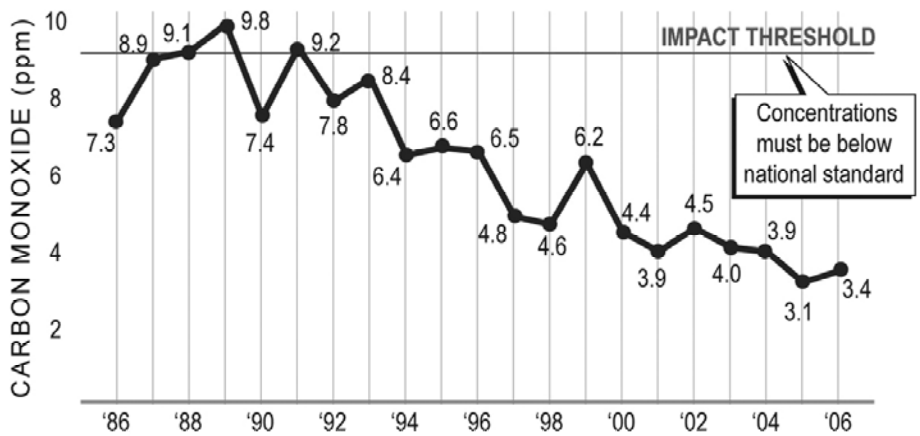
This section describes Portland-Vancouver pollutant trends for the last 30 plus years in order to provide context for the CRC-related impacts. Monitoring stations within the Portland-Vancouver area measure concentrations of some of the criteria pollutants discussed above. The highway contributions to pollutant concentrations in the project area are developed through understanding vehicle emissions from existing and future vehicles, as well as existing and forecast future traffic volumes and speeds. The long-term effects section discusses this further.

Exhibit 3.10-2
Subareas for Air Quality



NOT TO SCALE

Exhibit 3.10-3
Carbon Monoxide Trends Since 1986 (8-hour averages)



Source: CRC Air Quality Technical Report.

During the 1970s, CO concentrations in the Portland-Vancouver area exceeded the NAAQS (referred to as federal standards) one out of every three days, and ozone levels were often as high as 50 percent over the federal standard. CO trends are illustrated in Exhibit 3.10-2. Programs and regulations were put into effect to control air pollutant emissions, and substantial improvements were made. There have been no violations of any of the federal standards in nearly ten years. Still, because of previous violations of standards, the region is a designated air quality maintenance area. This recognizes that the region is currently in compliance with the federal standards, but requires the region to develop and implement a maintenance plan to prevent backsliding.

MOBILE SOURCE AIR TOXICS

The Portland Air Toxics Assessment is a computer modeling project designed to estimate and assess the risk from 12 air toxics in the Portland-Vancouver area, including the six MSATs. It is based on a 1999 air emissions inventory. Its purpose is to provide more refined estimates of the most important local air toxics. Such estimates enable air quality regulators to better characterize the risks from air toxics, understand local patterns of air toxics exposure, identify locations with elevated risk, and develop emission reduction strategies.

The results identified diesel exhaust, motor vehicles, and burning as important sources of air toxics in Portland. In general, the assessment shows widespread risks from benzene, formaldehyde, and diesel exhaust throughout the Portland-Vancouver region. Higher risks for benzene and formaldehyde appeared to align to some degree with major highway corridors.

3.10.2 Long-term Effects from Project Alternatives

To provide information for analyzing the trade-offs in air quality effects of the project alternatives, the project team estimated emissions for the four-county region, and for the following four segments or sub-areas of I-5 (see Exhibit 3.10-3), including on and off ramps:

- NE 99th Street to East 39th Street (Subarea 1)
- East 39th Street to State Route 14 (Subarea 2)
- State Route 14 to Columbia Boulevard (Subarea 3)
- Columbia Boulevard to the I-405 junction (Subarea 4)

The results of the emissions analysis showed that future (no-build or build) emissions of all pollutants would be substantially lower than existing emissions for the region and the subareas. Compared to existing conditions, future regional emissions for all the alternatives are expected to decline by about 30 percent for CO, 70 percent for NOx, 50 percent for volatile organic compounds (VOCs), and 90 percent for particulate matter (PM). Mobile source emissions would be about 50 percent lower for benzene, 1,3-butadiene, formaldehyde, and acrolein, and about 90 percent lower for diesel particulates. These reductions in emissions are largely due to expected improvements in vehicle emissions by 2030. Differences in the 2030 emissions among the project alternatives, including the No-Build Alternative, are extremely low—varying by one percent or less. In the context of the very large reductions (30 to 90 percent) relative to existing conditions, and given the potential error in available modeling methods, the one percent difference is unsubstantial.

To summarize, criteria pollutant and mobile source emissions for the region are expected to be substantially lower in the future than under existing conditions. On a regional basis, future differences between alternatives are small enough not to be meaningful within the accuracy of the estimation methods. All the build alternatives (with highway toll) either reduce emissions relative to No-Build, or have some tradeoffs between CO and NOx emissions relative to VOC and MSAT emissions. Without a toll, the build alternatives would increase sub-area emissions relative to the No-Build Alternative, but are still substantially lower than existing conditions. No violations of federal standards are expected.

Alternative 1: No-Build

Exhibit 3.10-4
Existing and Future (2030)

Regional MSAT Emissions (Pounds Per Summer Day)	Existing	2030 No Build
Benzene	3,661	1,610
1,3-Butadiene	412	198
Formaldehyde	1,017	544
Acetaldehyde	440	382
Acrolein	50	25
Diesel PM	2,144	114

Source: CRC Air Quality Technical Report.

Under the No-Build Alternative, emissions would be substantially lower than they are today. This is largely due to projected improvements in emissions for vehicles in the future.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.10-5
Summary of Air Quality Performance for Alternative 2

Regional MSAT Emissions (Pounds Per Summer Day)	Kiggins Bowl Terminus(A) [a]	Lincoln Terminus (B)	Clark College MOS (C) [a]	Mill Plain MOS (D) [a]
Benzene	1,613	1,613	1,613	1,613
1,3-Butadiene	198	198	198	198
Formaldehyde	544	544	544	544
Acetaldehyde	382	382	382	382
Acrolein	25	25	25	25
Diesel PM	115	115	115	115

Source: CRC Air Quality Technical Report.

[a] The values for these terminus options are estimated to be the same as the Lincoln terminus. Traffic modeling of the terminus options indicates minimal differences in traffic volumes, patterns, or speeds, and thus these terminus options are estimated to have the same regional MSAT emissions.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 2 has very similar (less than one percent difference) regional mobile source air toxics emissions as the No-Build Alternative. There would be no expected differences between the four terminus options.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.10-6
Summary of Air Quality Performance for Alternative 3

Regional MSAT Emissions (Pounds Per Summer Day)	Kiggins Bowl Terminus(A)[b]	Lincoln Terminus (B)	Clark College MOS (C)[b]	Mill Plain MOS (D)[b]
Benzene	1,614 (1,620)	1,614 (1,620)	1,614 (1,620)	1,614 (1,620)
1,3-Butadiene	198 (199)	198 (199)	198 (199)	198 (199)
Formaldehyde	544 (546)	544 (546)	544 (546)	544 (546)
Acetaldehyde	383 (384)	383 (384)	383 (384)	383 (384)
Acrolein	25	25	25	25
Diesel PM	115	115	115	115

Source: CRC Air Quality Technical Report.

a The values in parentheses indicate estimated emissions if no toll were included with this alternative.

b The values for these terminus options are estimated to be the same as the Lincoln terminus. Traffic modeling of the terminus options indicates minimal differences in traffic volumes, patterns, or speeds, and thus these terminus options are estimated to have the same regional MSAT emissions.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 3 has very similar (less than one percent difference) regional mobile source air toxics emissions as the No-Build Alternative. There are no expected differences between the four terminus options. Removing the toll on the I-5 crossing slightly increases the emissions of some criteria pollutants, but these would still be substantially lower than existing conditions.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.10-7
Summary of Air Quality Performance for Alternative 4

Regional MSAT Emissions (Pounds Per Summer Day)	Kiggins Bowl terminus(A)[e]	Lincoln terminus (B)	Clark College MOS (C)[e]	Mill Plain MOS (D)[e]
Benzene	1,613	1,613	1,613	1,613
1,3-Butadiene	198	198	198	198
Formaldehyde	544	544	544	544
Acetaldehyde	382	382	382	382
Acrolein	25	25	25	25
Diesel PM	115	115	115	115

Source: CRC Air Quality Technical Report.

a The values for these terminus options are estimated to be the same as the Lincoln terminus. Traffic modeling of the terminus options indicates minimal differences in traffic volumes, patterns, or speeds, and thus these terminus options are estimated to have the same regional MSAT emissions.

Alternative 4 has very similar (less than one percent difference) regional mobile source air toxics emissions as the No-Build Alternative. There are no expected differences between the four terminus options.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.10-8
Summary of Air Quality Performance for Alternative 5

Regional MSAT Emissions (Pounds Per Summer Day)	Kiggins Bowl terminus (A) [e]	Lincoln terminus (B)	Clark College MOS (C) [e]	Mill Plain MOS (D) [e]
Benzene	1,613	1,613	1,613	1,613
1,3-Butadiene	198	198	198	198
Formaldehyde	544	544	544	544
Acetaldehyde	382	382	382	382
Acrolein	25	25	25	25
Diesel PM	115	115	115	115

Source: CRC Air Quality Technical Report.

a The values for these terminus options are estimated to be the same as the Lincoln terminus. Traffic modeling of the terminus options indicates minimal differences in traffic volumes, patterns, or speeds, and thus these terminus options are estimated to have the same regional MSAT emissions.

Alternative 5 has very similar (less than one percent difference) regional mobile source air toxics emissions as the No-Build Alternative. There are no expected differences between the four terminus options.

Subarea Emissions for Criteria Pollutants and MSATs

The subareas show some variation in emissions between alternatives, although that variation is far less than the reductions that all alternatives show compared to existing conditions.

For build alternatives that include a toll (all build alternatives are packaged with a toll, but Alternative 3 was also modeled without a toll to determine the effect that tolling has on traffic volumes and patterns), emissions of VOC and MSATs are reduced relative to the No-Build in all the subareas. Emissions of CO and NOx are also reduced in all subareas except Subarea 2. The No-Build Alternative and the tolled build alternatives have the following differences:

In Subareas 3 and 4 (located between SR 14 in Vancouver and the I-405 junction in Portland) there are reductions up to 35 percent in emissions for the build alternatives relative to the No-Build Alternative. The project would have the greatest potential benefit for emissions in these areas.

Differences between alternatives are more moderate in Subarea 1 (one to four percent decrease relative to No-Build) and may not be meaningful within the accuracy of the emission estimates.

Emissions for Alternatives 2 and 3 show increases in CO and NOx in Subarea 2 relative to the No-Build. Other pollutants either show a reduction or no increase. No impact is anticipated because estimated CO concentrations are not expected to exceed the federal standards, and NOx emissions are more of a concern for regional ozone formation than for local effects. Consequently, the benefits of reduced VOC and MSAT emissions in relation to increased CO and NOx emissions is probably still an overall benefit for this subarea.

Intersection-level Carbon Monoxide Concentrations

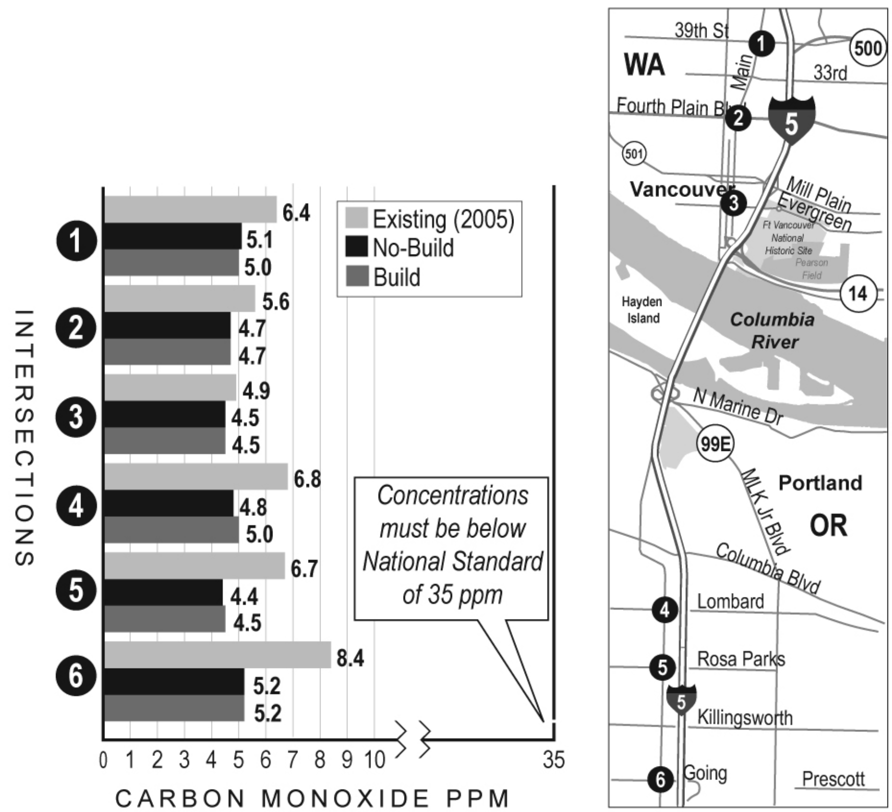
In addition to evaluating emissions at the regional and subarea level, the project team analyzed CO concentrations at the intersections that would be most affected by project alternatives. This intersection analysis is also referred to as hotspot analysis, and is part of demonstrating conformity with federal standards. The project team performed a quantitative analysis for the worst congestion conditions at three intersections in Vancouver and three intersections in Portland, as shown on Exhibit 3.10-9. The intersections were selected to represent locations where CO emissions would likely be the highest. The analysis is based on the local traffic impacts of Alternative 3 (replacement crossing and light rail) with a Lincoln terminus. The other alternatives would have similar concentrations, all well below the federal standard.

The project team followed the required methods and formulas to estimate CO concentrations based on traffic forecasts, and compared these estimated concentrations to the regulatory standards, which are:

- the maximum one-hour CO concentration cannot exceed 35 parts per million (ppm)
- the maximum eight-hour CO concentration cannot exceed 9 ppm.

The highest modeled one-hour concentration at any of the intersections was 5.2 parts per million (ppm), or about 38 percent lower than existing conditions and 85 percent below the standard. The highest modeled eight-hour concentration at any of the intersections was 4.7 ppm, or about 34 percent lower than existing conditions and 48 percent below the standard. No violations of the national standards were forecast for existing conditions, or the No-Build or build alternatives. No CO hotspot violations are anticipated.

Exhibit 3.10-9
Air Quality Findings for Specific Intersections



Source: CRC Air Quality Technical Report. Map not to scale.

Intersection 1: East 39th Street at Main Street
Intersection 2: Fourth Plain Blvd. at Main Street
Intersection 3: Mill Plain Blvd. at Main Street
Intersection 4: Lombard Street at Interstate Avenue
Intersection 5: Rosa Parks Blvd. at Interstate Avenue
Intersection 6: Going Street at Interstate Avenue

3.10.3 Long-term Effects from Project Components

This section describes the effects or impacts of the components that comprise the project alternatives.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

As described in the full alternatives section above, the difference in emissions between the replacement and supplemental river crossing and highway improvement options would be unsubstantial, and both would be a substantial improvement over existing and No-Build conditions.

The stacked transit/highway bridge design for the replacement crossing could have a detrimental local effect on air quality for high-capacity transit users, compared to the standard replacement design or supplemental bridge. If the bridge uses enclosed girder type construction, then ventilation systems would likely be required for transit operating inside the girders, in order to meet ventilation and safety standards. Open girder or truss design could eliminate the need for ventilation systems.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Selecting bus rapid transit would result in more exhaust-emitting transit vehicles (analysis assumes diesel powered buses), whereas light rail is electric and has no street-level exhaust emissions. However, as a result of federal regulations requiring new buses (model year 2007 and later) to meet stringent exhaust emission standards that lower PM and NOx emissions by 90 and 95 percent, respectively, even the BRT emissions would likely be minimized. C-TRAN, for example, is currently using and purchasing hybrid buses that would reduce emissions relative to existing diesel buses.

Maintenance of light rail or bus rapid transit vehicles would occur at existing facilities, either the TriMet Ruby Junction maintenance base in Gresham for light rail, or the C-TRAN maintenance base in east Vancouver for bus rapid transit. Stationary sources such as maintenance facilities are subject to the permitting regulations of either DEQ or SWCAA, and no impacts are expected as a result of expanded maintenance base operations.

Transit Terminus and Alignment Options (with all Alternatives)

Transit terminus and alignment options would affect different intersections in the project area at varying levels. However, based on the analysis of the most affected intersections, CO concentrations with any of the alternatives would be well below the CO standards. The terminus and alignment options would not substantially affect other criteria pollutants.

Tolling Scenarios

Alternative 3 was modeled without a toll, which revealed increased emissions in the subareas relative to the No-Build. The increase for the no toll scenario relative to the No-Build Alternative is most observable in the CO, NOx, and VOC emissions. For these pollutants the difference ranges from two to 10 percent in Subareas 1, 3, and 4, and 15 to 23 percent in Subarea 2. The range in modeled results is due to variation in forecasted traffic volumes and speeds in the different subareas. Even with the no toll alternative, 2030 emissions would be substantially lower than existing levels.

3.10.4 Temporary Effects

Construction for any CRC build alternative would be extensive and would involve activities that could temporarily affect air quality, such as demolishing existing structures and pavement, operating a wide variety of heavy construction equipment, on-road construction activities, and potential activities at concrete plants or staging sites where construction materials are temporarily stored or prepared. Traffic congestion will occur on some roadways during construction, and potentially along detour or construction haul routes. Construction impacts would be lowest with the No-Build Alternative and much higher for the build alternatives. Construction would cause short-term increases in air pollutant emissions and odors.

The primary direct impacts of construction will be the generation of dust from demolition, site clearing, excavating, and grading activities, direct exhaust emissions from construction equipment, and increased congestions on the mainline highway and local streets in the project area. Traffic congestion increases idling times and reduces travel speeds, resulting in increased vehicle emission levels. Demolition may involve structures containing lead or asbestos.

Construction of concrete structures or asphalt paving will have associated pollutant-emitting sources, such as mixing operations. Stationary sources, such as concrete mix and asphalt plants, are generally required to obtain an air permit from either Oregon DEQ or the Southwest Clean Air Agency (SWCAA), and to comply with regulations for controlling dust and other pollutant emissions. Burning of debris from land clearing is prohibited in the project area. Demolition of a structure containing asbestos is regulated by DEQ (in Portland) and SWCAA (in Vancouver).

3.10.5 Potential Mitigation Measures

Potential Mitigation of Long-term Effects

Long-term air quality impacts for criteria pollutants and mobile source air toxins would not be expected to occur as a result of the project. No mitigation is proposed. Elements of the CRC options that help reduce operational emissions include:

- High-capacity public transit.
- Electric-powered light rail and bio-diesel and electric-diesel hybrid buses.
- Highway capacity and safety improvements that reduce congestion and idling.
- TSM/TDM measures that reduce auto trips.
- Highway tolling that encourages the reduction of auto trips and the increase of transit mode share.

Potential Mitigation of Temporary Effects

Construction mitigation would include measures to control dust and exhaust emissions from demolition and construction activities and minimize the effects of traffic congestion. Because of the magnitude of the I-5 CRC project, the contractor would be required to develop a pollution control plan that includes documentation of operational measures that will be used to reduce emissions. Section 290 of the ODOT standard specifications and Section 1-07.5(4) of the WSDOT standard specifications outline requirements for environmental protection, including air pollution control measures. These control measures could be included in the project specifications.

Strategies to minimize the occurrence and effects of construction-related congestion will be developed throughout the design phase. This includes refining alternatives, further analyzing traffic impacts, and developing detailed construction traffic mitigation plans. Some of the strategies for reducing construction-related air quality impacts may include:

- Providing alternatives to single-occupant vehicle (SOV) trips.

- Providing incentives to reduce automobile trips and encourage mode shifts to non-SOV types.
- Managing traffic and lane closures to avoid congestion and delay.
- Providing traveler information at key junctions to encourage traffic diversion from the I-5 project area and crossing routes.
- Promoting continuous information campaigns to alert motorists of delay times within the corridor and of upcoming traffic pattern changes and detours.
- Incorporating transit priority measures where feasible.
- Working with employers whose employees must commute through the area to promote alternative work schedules.
- Instituting contractor incentives or requirements to shorten construction durations and encourage the use of lower-emitting construction equipment.

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3.11 Noise and Vibration

The CRC noise and vibration analysis followed the guidance of state and federal transportation agencies in order to identify the CRC alternatives' potential noise and vibration impacts and mitigation. The guidelines and standards for analyzing and mitigating highway noise are established by the Federal Highway Administration (FHWA) and state DOTs. They are different than those for transit noise, which are established by the Federal Transit Administration (FTA). These differences, and the results of the analysis, are summarized below. This information draws from the information included in the CRC Noise and Vibration Technical Report.

3.11.1 Existing Conditions

How are sound levels measured?

Two important aspects of sound that determine its potential impacts are loudness and frequency. The unit used to measure the loudness of noise is a decibel (dB). An adjusted dB scale, referred to as the A-weighted decibel scale, accounts for humans' ability to hear only a limited range of frequencies. Decibels in the A-weighted scale are designated as dBA. This report uses the dBA unit of measurement.

Noise levels at a given location tend to vary with time. To account for the variance in loudness over time, a common noise measurement is the equivalent sound pressure level (Leq). It is measured in dBA, for a specific time period (for example, 1 minute). This report uses Leq to describe traffic and transit noise at schools, libraries, and other sensitive institutions. This analysis also gave more weight to noise that occurs at night (10:00 p.m. to 7 a.m.), consistent with federal regulations. Calculations that use this method produce the Day-Night Equivalent Sound Level, which is abbreviated as Ldn.

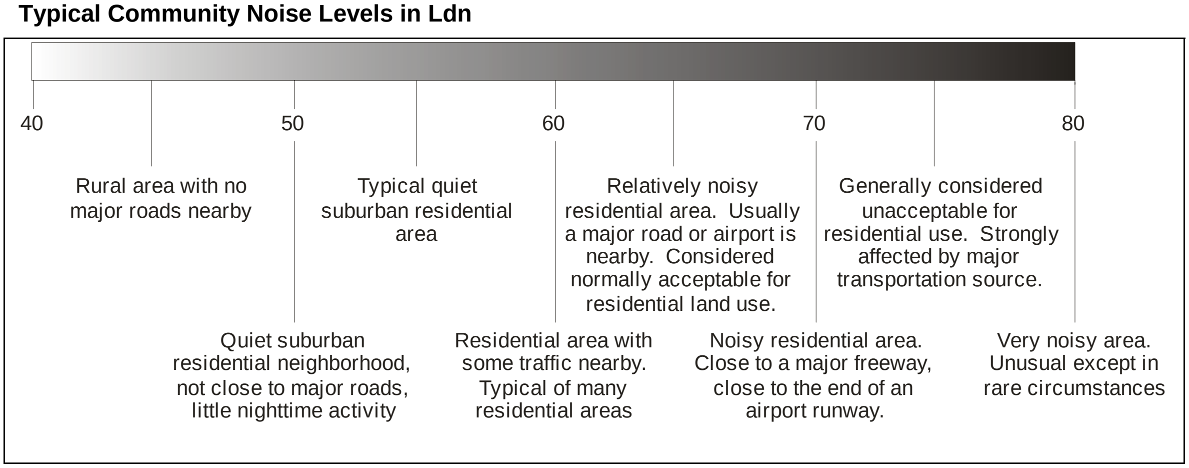
How do decibels relate to loudness?

The human ear generally cannot detect very slight up or down changes in noise levels. The smallest change in noise level that a human ear can perceive is about 3 dBA, while increases of 5 dBA or more are clearly noticeable. For most people, a 10 dBA increase in noise levels is judged as a doubling of sound level.

What are typical noise levels?

Most urban and suburban neighborhoods have Ldn levels in the range of 50 to 70 dBA. Exhibit 3.11-1 shows typical community noise levels.

Exhibit 3.11-1
Typical Community Noise Levels in Ldn



Source: FTA, 1995.

Exhibit 3.11-2 indicates the noise levels for various noise sources and the typical human response to the noise level.

Exhibit 3.11-2
Typical Sound Levels

Sound Level (dBA)	Noise Source of Activity	Relative Loudness (Human judgement of different sound levels)	Subjective Impression
140	Jet aircraft takeoff from carrier (50 feet)	64 times as loud	Threshold of pain
130	50-horsepower siren	32 times as loud	
120	Loud rock concert near stage Jet takeoff (200 feet)	16 times as loud	Uncomfortably loud
110	Float plan takeoff (100 feet)	8 times as loud	
100	Jet takeoff (2,000 feet)	4 times as loud	Very loud
90	Heavy truck or motorcycle (25 feet)	2 times as loud	
80	Garbage disposal (2 feet)	Reference loudness	Moderately loud
70	Typical at-grade light rail vehicle	1/2 as loud	
60	Moderately busy department store	1/4 as loud	
50	Typical television show (10 feet) Typical quiet office environment	1/8 as loud	
40	Bedroom or quiet living room	1/16 as loud	Quiet
30	Quiet library, soft whisper (15 feet)	1/32 as loud	Very quiet
20	High-quality recording studio	1/84 as loud	Just audible
10	Acoustic Test Chamber	1/128 as loud	
0			Threshold of hearing

Noise Criteria and Analysis Methods

This section outlines how the CRC project analyzed noise impacts.

WHAT ARE THE HIGHWAY TRAFFIC NOISE CRITERIA?

Exhibit 3.11-3 outlines FHWA traffic noise abatement criteria. ODOT is responsible for implementing the FHWA regulations in Oregon. Under ODOT policy, a traffic noise impact occurs if predicted noise levels are within two A-weighted decibels (dBA) of the FHWA criteria. These criteria apply to the peak noise impact hour. WSDOT administers the FHWA regulations in Washington. Under WSDOT policy, a traffic noise impact occurs if predicted noise levels are within 1 dBA of the FHWA criteria. Both agencies consider an increase of 10 dBA or more substantial.

Exhibit 3.11-3
FHWA Traffic Noise Abatement Criteria

	Land Use Category	Hourly Leq[a] (dBA)
Type A:	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose	57 (exterior)
Type B:	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, (exterior) motels, hotels, schools, churches, libraries and hospitals	67 (exterior)
Type C:	Developed lands, properties or activities not included in the above categories	72 (exterior)
Type D:	Undeveloped land	—
Type E:	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums	52 (interior)

Source: FHWA, 1982.
[a] Leq = equivalent sound pressure level.

Other state regulations set allowable noise levels for individual vehicles, and for different land uses. They do not apply to highway or transit noise, but could apply to associated stationary noise sources such as park and ride lots and maintenance facilities.

WHAT ARE THE TRANSIT NOISE CRITERIA?

The criteria for transit impacts are taken from the FTA Transit Noise and Vibration Impact Assessment, Final Report May, 2006. The FTA noise criteria apply to noise generated by the bus rapid transit and light rail transit elements of the project. Under these criteria, the amount that the transit project is allowed to change the overall noise environment is reduced with increasing levels of existing noise. The FTA noise impact criteria identify 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. This includes residences, hospitals, and hotels where nighttime sensitivity is assumed to be of utmost importance.

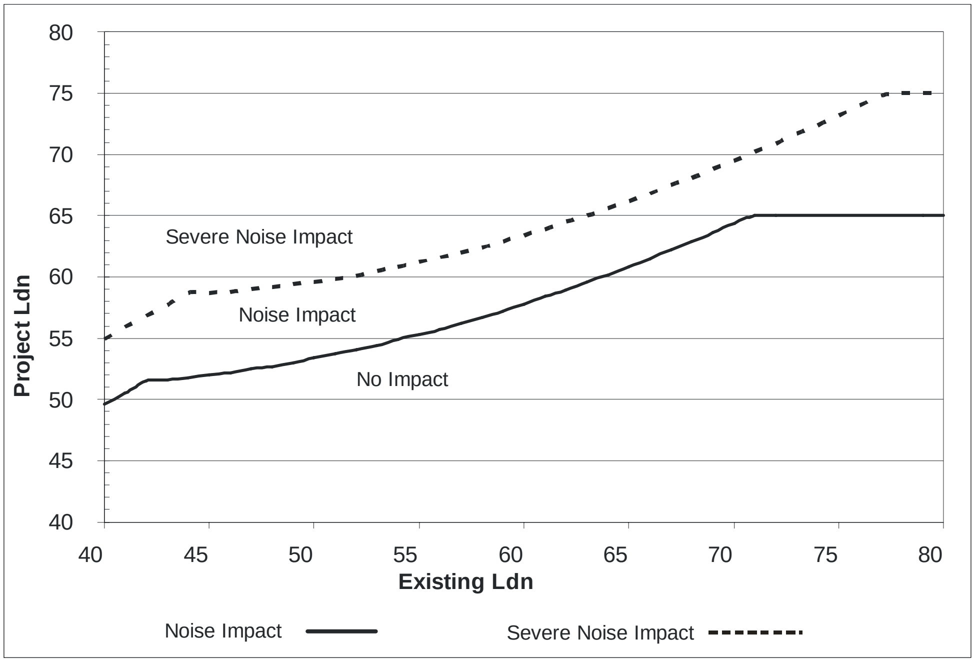
Category 3: Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, office buildings, and other commercial and industrial land uses.

There are two levels of impact included in the FTA transit noise criteria, as shown in Exhibit 3.11-4. These two levels are:

- **Severe Impact:** Severe noise impacts are considered significant as this term is used in the National Environmental Policy Act (NEPA) and implementing regulations. Noise mitigation will normally be specified for severe impact areas unless there is no practical method of mitigating the noise.

- **Impact:** In this range, often called a moderate impact, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These other factors can include the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-indoor sound insulation, and the cost effectiveness of mitigating noise to more acceptable levels.

Exhibit 3.11-4
FTA Transit Noise Impact Criteria



Source: FTA, 2006.

HOW WERE FUTURE TRANSIT NOISE IMPACTS ESTIMATED?

The transit noise analysis for the project alternatives follows the FTA's Detailed Noise Analysis methodology. This methodology provides a comprehensive assessment of project noise impacts commensurate with the level of design detail available. For bus transit/highway projects, the FTA guidance recommends following the FHWA methodology, which was followed for this analysis. Bus transit centers and other bus transit/highway transit stationary sources were analyzed following the FTA's Detailed Assessment methodology.

WHAT ARE THE CITY NOISE STANDARDS?

The City of Portland regulates construction noise, and virtually all major construction projects require a noise variance if they perform nighttime construction. Multnomah County, Clackamas County, and the City of Portland do not have vibration regulations.

The City of Vancouver has incorporated most state noise and vibration regulations into the Vancouver Municipal Code. It prohibits off-site vibration impacts that are discernible without instruments at the property line, and construction activity between 8 p.m. and 7 a.m. The regulations do not apply to public streets and sidewalks, rail maintenance yards, or essential public facilities such as the interstate highway system or intercity passenger rail. This code may apply to transit stations and to park and ride lots.

Understanding Vibration

HOW ARE VIBRATION LEVELS MEASURED?

Vibration consists of oscillatory waves that propagate from the source through the ground to adjacent buildings, and is typically called ground-borne vibration. Two types of vibration were analyzed for the CRC alternatives—vibration from the operation of proposed light rail options, and vibration that would occur during project construction.

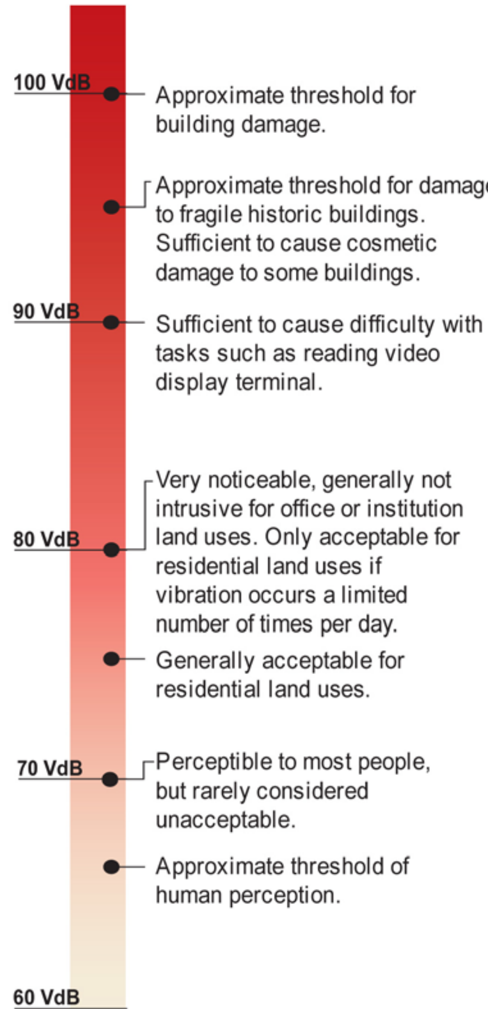
Vibration velocity is usually given in terms of either inches per second or decibels. This report uses the abbreviation VdB for vibration decibels to minimize confusion with sound decibels.

WHAT ARE SOME TYPICAL VIBRATION LEVELS?

Exhibit 3.11-5 gives a general idea of human and building response to different levels of vibration in VdB. Existing background building vibration is usually in the range of 40 to 50 VdB, which is well below the range of human perception.

Exhibit 3.11-5

Human and Building Response to Ground-borne Vibration Levels



SOURCE: FTA, April 1995

Vibration Criteria and Analysis Methods

WHAT ARE THE VIBRATION CRITERIA?

The FTA has developed impact criteria for acceptable levels of ground-borne noise and vibration that would apply to the bus rapid transit and light rail transit components of the project. These were followed for the analysis of CRC alternatives.

HOW ARE FUTURE VIBRATION IMPACTS ESTIMATED?

An important factor in projecting levels of vibration related to transit operations is the rate at which the vibration is reduced as it moves away from the source. The relationship between a vibration source, and the level of ground vibration at a specific distance from the source, is known as the transfer mobility. To properly determine the transfer mobility, vibration propagation measurements were conducted at four locations in the CRC corridor near the proposed transit alignments. The transit vibration analysis follows the FTA's General Vibration Assessment methodology. This methodology provides a comprehensive assessment of project vibration and ground-borne noise impacts.

Existing Noise Levels in the CRC Project Area

Existing noise levels were measured at 68 locations from North Portland Harbor and Hayden Island to SR 500 in Vancouver. Each of these locations has one or more noise receptors at sensitive land uses such as residences, hotels, motels, or parks (see sidebar). Noise levels in the project corridor ranged from 53 to 75 dBA Leq, with 24-hour Ldn noise levels ranging from 57 to 75 dBA.

What is a noise receptor?

Sensitive noise receptors are, in general, those areas of human residence or frequent use where increases in noise could potentially adversely affect the occupancy, use, or enjoyment of the location. For certain locations, such as an apartment building or hotel, there may be multiple receptors for the multiple residential units that they contain.

Currently, estimated noise levels meet or exceed the traffic noise criteria at 234 noise-sensitive receptors along I-5 and proposed transit alignments in the CRC project area. This includes single and multi-family residences along with several hotels and the residential equivalents for the parks, schools and cemetery. Of the existing impacts identified in the CRC project area, 92 are located on the Portland side, and 142 are located in Vancouver. Overall, noise levels in the project study area are dominated by traffic on I-5.

3.11.2 Long-term Effects of the Project Alternatives

The number of highway noise impacts would be the same for all of the build alternatives. Transit noise impacts would vary substantially by transit mode, transit operations, transit terminus option, and transit alignment options. The following tables and associated discussion summarize the potential noise and vibration impacts associated with the project alternatives.

Alternative 1: No-Build

Noise levels in the project area would continue to increase as traffic volumes increase. Overall, noise levels are projected to increase the most along I-5 and Main Street north of Mill Plain, where levels are projected to increase by 2 to 4 dBA with No-Build. Noise level on Hayden Island and in the downtown Vancouver core would increase by 1 dBA. Noise along most of McLoughlin and 16th Street would increase by 1 dBA except for locations close to I-5, where noise may increase by up to 4 dBA Leq. Under No-Build, the number of impacted noise receivers would increase to 268, as compared to the 234 noise receivers that are currently impacted.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.11-6 summarizes the range of potential highway and transit noise impacts, and transit vibration impacts that could occur as a result of Alternative 2.

Exhibit 3.11-6
Number of Receivers Impacted by Traffic and Transit Noise or Transit Vibration for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Number of Highway Noise Impacts	334	334	334	334
Number of Moderate Transit Noise Impacts	42-53	58-68	39-50	28
Number of Severe Transit Noise Impacts	19-31	7-17	12-14	7-14
Transit Vibration Impacts	0	0	0	0

Source: CRC Noise and Vibration Technical Report.

Note: The number of noise impacts with the STHB option for the river crossing would be the same as shown in the table above.

Exhibits 3.11-15, 3.11-16, and 3.11-17 at the end of this discussion illustrate locations of the projected traffic noise impacts resulting from the build alternatives, as well as the locations of potential sound walls. Exhibits 3.11-19, 3.11-20, and 3.11-21 show the location of potential transit noise impacts as a result of the four terminus options and transit mode.

Alternative 2 would result in 334 highway noise impacts. Alternative 2 would result in between 28 and 68 moderate transit noise impacts, and between seven and 31 severe noise impacts. These ranges for transit noise impacts are dependent on the transit terminus option and transit alignment options chosen. See Exhibit 3.11-7 for a detailed breakdown of transit noise impacts by alignment option. The replacement crossing when paired with the Kiggins Bowl terminus would result in 400 to 413 highway and transit noise impacts prior to mitigation. The Lincoln terminus option would result in 409 to 416 highway and transit noise impacts, while the Clark College MOS and Mill Plain MOS terminus options would result in 385 to 398 and 369 to 423 transit and highway noise impacts, respectively.

Exhibit 3.11-7
Alternative 2 Noise Levels and Impacts by Transit Alignment Option (BRT with Efficient Transit Operations)

			Existing		BRT L_{dn}		Impacts		
Terminus Options	**Alignment**	**Area**	**Min**	**Max**	**Min**	**Max**	**Mod**	**Sev**	**Total**
A, B, C, or D	Adjacent	Hayden Island Floating Homes	61	69	60	68	28	7	35
A, B, C, or D	Offset	Hayden Island Floating Homes	60	68	60	68	28	14	42
A, B, C, or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	71	71	64	64	0	0	0
A or C	McLoughlin Blvd	D St to I-5	62	65	61	65	22	0	22
A or C	16th Street	C St to I-5	61	70	63	66	11	5	16
A	Kiggins Terminus	I-5 North of 33rd	70	70	68	72	3	12	15
B	Two-way Broadway	Broadway; 19th to 29th	64	66	61	68	29	10	39
B	Broadway-Main couplet	Broadway; 19th to 29th	64	66	62	65	39	0	39
B	Lincoln Terminus	Main Street; North of 29th	70	70	64	64	1	0	1

Source: CRC Noise and Vibration Technical Report.

Alternative 2, as it includes BRT, would not result in any transit-related vibration impacts due to the operation of transit.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.11-8 summarizes the range of potential highway and transit noise impacts, and transit vibration impacts that could occur as a result of Alternative 3.

Exhibit 3.11-8
Number of Receivers Impacted by Traffic and Transit Noise or Transit Vibration for Alternative 3

Alternative 3: Replacement Crossing with Light Rail				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Number of Highway Noise Impacts	334	334	334	334
Number of Moderate Transit Noise Impacts	17-37	7-45	17-37	7-21
Number of Severe Transit Noise Impacts	0	0	0	0
Transit Vibration Impacts	40-47	32	5-12	0

Source: CRC Noise and Vibration Technical Report.

Note: The number of impacts with the STHB option for the river crossing would be the same as shown in the table above.

Alternative 3 would result in the same number of highway noise impacts as Alternative 2. Alternative 3 would result in between seven and 45 moderate transit noise impacts, and no severe noise impacts. The range for moderate transit noise impacts is dependent on the transit terminus option and transit alignment options chosen. See Exhibit 3.11-9 for a detailed breakdown of transit noise impacts by alignment option. The replacement crossing when paired with the Kiggins Bowl terminus would result in 351 to 371 highway and transit noise impacts prior to mitigation. The Lincoln terminus option would result in 341 to 379 highway and transit noise impacts, while the Clark College MOS and Mill Plain MOS would result in 351 to 371 and 341 to 355 transit and highway noise impacts respectively.

Exhibit 3.11-9
Alternative 3 Noise Levels and Impacts by Transit Alignment Option (Light Rail with Efficient Transit Operations)

Terminus Option	Alignment Option	Area	Existing		Train L_{dn}		Impacts		
			Min	Max	Min	Max	Mod	Sev	Total
A, B, C, or D	Adjacent	Hayden Island Floating Homes	61	69	55	63	7	0	7
A, B, C, or D	Offset	Hayden Island Floating Homes	60	68	55	64	21	0	21
A, B, C or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	71	71	56	58	0	0	0
A or C	McLoughlin Blvd	D St to I-5	62	65	56	61	16	0	16
A or C	16th Street	C St to I-5	61	70	59	62	10	0	10
A	Kiggins Bowl Terminus	Along I-5; North of 33rd	70	70	57	61	0	0	0
B	Two-way Broadway	Broadway, 19th to 29th	64	66	55	63	24	0	24
B	Broadway-Main couplet	Broadway, 19th to 29th	64	66	55	57	0	0	0
B	Lincoln Terminus	Main Street; North of 29th	70	70	60	60	0	0	0

Source: CRC Noise and Vibration Technical Report.

The Kiggins Bowl terminus (3A), with light rail on the McLoughlin alignment option, would result in vibration impacts at 12 residential locations along McLoughlin Boulevard. With the 16th Street alignment option, there are five predicted vibration impacts. The Clark College MOS (3C) would also result in these vibration impacts depending on which transit alignment option is chosen. An additional 35 vibration impacts are predicted along the Kiggins Bowl terminus (3A) where the trackway would be below the grade of the adjacent neighborhood from 26th to 33rd Streets. With the Lincoln terminus option (3B), up to 24 vibration impacts are predicted along Broadway, and eight are predicted along Main Street. No vibration impact would be expected at the Southwest Washington Medical Center on Main and 33rd Streets, but vibration levels would exceed the residential criteria at the Fire Department on Main and 37th Street. The Mill Plain MOS (3D) is not expected to result in any vibration impacts.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.11-10 summarizes the range of potential highway and transit noise impacts, and transit vibration impacts that could occur as a result of Alternative 4.

Exhibit 3.11-10
Number of Receivers impacted by Traffic and Transit Noise or Transit Vibration for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Number of Highway Noise Impacts	329	329	329	329
Number of Moderate Transit Noise Impacts	37-49	41-70	34-46	24-31
Number of Severe Transit Noise Impacts	26-52	15-51	14-40	7-21
Transit Vibration Impacts	0	0	0	0

Source: CRC Noise and Vibration Technical Report.

Alternative 4 would result in 329 highway noise impacts. Alternative 4 would result in between 24 and 70 moderate transit noise impacts, and between seven and 52 severe noise impacts. These ranges for transit noise impacts are dependent on the transit terminus option and transit alignment options chosen. See Exhibit 3.11-11 for a detailed breakdown of transit noise impacts by alignment option. The supplemental crossing when paired with the Kiggins Bowl terminus would result in 399 to 423 highway and transit noise impacts prior to mitigation. The Lincoln terminus would result in 414 to 421 highway and transit noise impacts, while the Clark College MOS and Mill Plain MOS would result in 384 to 408 and 367 to 374 transit and highway noise impacts respectively.

Exhibit 3.11-11
Alternative 4 Noise Levels and Impacts by Transit Alignment Option (BRT with Increased Transit Operations)

			Existing		BRT L_{dn}		Impacts		
Terminus Option	**Alignment Option**	**Area**	**Min**	**Max**	**Min**	**Max**	**Mod**	**Sev**	**Total impacts**
A, B, C or D	Adjacent	Hayden Island Floating Homes	61	69	62	69	28	7	35
A, B, C or D	Offset	Hayden Island Floating Homes	60	68	61	70	21	21	42
A, B, C or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	71	71	65	66	3	0	3
A or C	McLoughlin Blvd	D St to I-5	62	65	62	67	15	19	34
A or C	16th Street	C St to I-5	61	70	64	68	10	7	17
A	Kiggins Terminus	Along I-5; North of 33rd	70	70	0	0	3	12	15
B	Two-way Broadway	Broadway; 19th to 29th	64	66	63	69	9	30	39
B	Broadway-Main Couplet	Broadway; 19th to 29th	64	66	64	66	31	8	39
B	Lincoln Terminus	Main Street; North of 29th	70	70	65	66	8	0	8

Source: CRC Noise and Vibration Technical Report.

Alternative 4, as it includes BRT, would not result in any transit-related vibration impacts due to the operation of transit.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.11-12 summarizes the range of potential highway and transit noise impacts, and transit vibration impacts that could occur as a result of Alternative 5.

Exhibit 3.11-12
Number of Receivers Impacted by Traffic and Transit Noise or Transit Vibration for Alternative 5

Alternative 5: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Number of Highway Noise Impacts	329	329	329	329
Number of Moderate Transit Noise Impacts	17-31	7-51	17-31	7-21
Number of Severe Transit Noise Impacts	0	0	0	0
Transit Vibration Impacts	40-47	32	5-12	0

Source: CRC Noise and Vibration Technical Report.

Alternative 5 would result in the same number of highway noise impacts as Alternatives 4. Alternative 5 would result in between seven and 51 moderate transit noise impacts, and no severe noise impacts. The range for moderate transit noise impacts is dependent on the transit terminus option and transit alignment options chosen. See Exhibit 3.11-13 for a detailed breakdown of transit noise impacts by alignment option. The supplemental crossing when paired with the Kiggins Bowl terminus would result in 346 to 360 highway and transit noise impacts prior to mitigation. The Lincoln terminus option would result in 336 to 380 highway and transit noise impacts, while the Clark College MOS and Mill Plain MOS would result in 346 to 360 and 336 to 350 transit and highway noise impacts, respectively.

Exhibit 3.11-13

Alternative 5 Noise Levels and Impacts by Transit Alignment Option (Light Rail with Increased Transit Operations)

			Existing		Train L_{dn}		Impacts		
Terminus Options	**Alignment Options**	**Area**	**Min**	**Max**	**Min**	**Max**	**Mod**	**Sev**	**Total**
A, B, C, or D	Adjacent	Hayden Island Floating Homes	61	69	56	63	7	0	7
A, B, C, or D	Offset	Hayden Island Floating Homes	60	68	55	64	21	0	21
A, B, C, or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	71	71	0	0	0	0	0
A or C	McLoughlin Blvd	D St to I-5	62	65	57	62	19	0	19
A or C	16th Street	C St to I-5	61	70	59	63	10	0	10
A	Kiggins Terminus	Along I-5; North of 33rd	70	70	57	61	0	0	0
B	Two–way Broadway	Broadway; 19th to 29th	64	66	55	64	30	0	30
B	Broadway-Main Couplet	Broadway; 19th to 29th	64	66	55	58	0	0	0
B	Lincoln Terminus	Main Street; north of 29th	70	70	60	61	0	0	0

Source: CRC Noise and Vibration Technical Report.

The Kiggins Bowl terminus (5A), with light rail on the McLoughlin alignment option, would result in vibration impacts at 12 residential locations along McLoughlin Boulevard. With the 16th Street alignment option, there are five predicted vibration impacts. The Clark College MOS (5C) would also result in these vibration impacts depending on which transit alignment option is chosen. An additional 35 vibration impacts are predicted along the Kiggins Bowl terminus (5A) where the trackway would be below the grade of the adjacent neighborhood, from 26th to 33rd Streets. With the Lincoln terminus option (5B), up to 24 vibration impacts are predicted along Broadway, and eight are predicted along Main Street. No vibration impact is expected at the Southwest Washington Medical Center on Main and 33rd Streets, but vibration levels would exceed the residential criteria at the Fire Department on Main and 37th Street. The Mill Plain MOS (5D) is not expected to result in any vibration impacts.

3.11.3 Long-term Effects from Project Components

This section describes the noise and vibration impacts of the components and options that comprise the project alternatives. This same information is presented above by alternative. Components such as tolling and transportation demand management options do not influence long-term noise and vibration effects, and so are not discussed below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

Overall noise impacts from the replacement and the supplemental river crossing and highway improvements are very similar, with minor differences in subareas of the project. Traffic noise impacts are illustrated by Alternative in Exhibit 3.11-14.

Exhibit 3.11-14
Summary of I-5 Traffic Noise Impacts before Mitigation (dBA)

Subarea	Existing	No-Build	Replacement crossing (Alternatives 2 and 3)	Supplemental crossing (Alternatives 4 and 5)
Portland				
noise levels (dBA)	47–73	48–74	51–75	51–74
receptors exceeding noise criteria	92	92	92	87[a]
Downtown Vancouver				
noise levels	61–74	63–75	64–74	64–74
receptors exceeding noise criteria	62	62	62	62
Fort Vancouver				
noise levels (dBA)	61–73	62–74	60–76	62–76
receptors exceeding noise criteria	12	18	26	26
Mill Plain to N Vancouver east of I-5				
noise levels	55–74	57–76	58–76	58–76
receptors exceeding noise criteria	16	16	37	37
Mill Plain to N Vancouver west of I-5				
noise levels (dBA)	56–73	57–74	58–78	58–78
receptors exceeding noise criteria	52	80	117	117
Total				
Receptors exceeding noise criteria	234	268	334	329

Source: CRC Noise and Vibration Technical Report.

[a] The number of traffic noise impacts as a result of the supplemental river crossing are five less than with the replacement river crossing because five potentially impacted floating homes are displaced by the supplemental crossing.

PORTLAND SUBAREA TRAFFIC NOISE

Without the CRC highway improvements, in the year 2030 I-5 traffic noise levels in north Portland would exceed traffic noise criteria at the same 92 locations as under existing conditions. Noise levels would increase about 1 dBA (an increase typically not discernable by a person with average hearing) over existing levels at approximately 50 floating homes that currently exceed the impact criteria with existing levels of 67 to 74 dBA Leq. Noise impacts with No-Build would also occur at the Red Lion Hotel on the River (on the north shore of Hayden Island), and include all rooms facing I-5 with noise levels ranging from 68 to 72 dBA Leq.

The build alternatives would lower traffic noise levels at some receivers by up to 2 dBA and raise noise levels at other receivers by up to 5 dBA, but would not increase the number of receivers exceeding the noise impact criteria. In the case of the supplemental river crossing, the number of noise impacts is less because the river crossing displaces five of the potentially effected floating homes. Exhibit 3.11-15 illustrates traffic noise impacts in north Portland and on Hayden Island. The difference in noise levels between the replacement crossing (Alternatives 2 and 3) and supplemental crossing (Alternatives 4 and 5) is less than 2 dBA—imperceptible to a person with average hearing. In some cases, as at the floating homes in North Portland Harbor, some of these noise impacts may over lap or be in addition to transit noise impacts as a result of the offset or adjacent transit alignments across the Harbor.

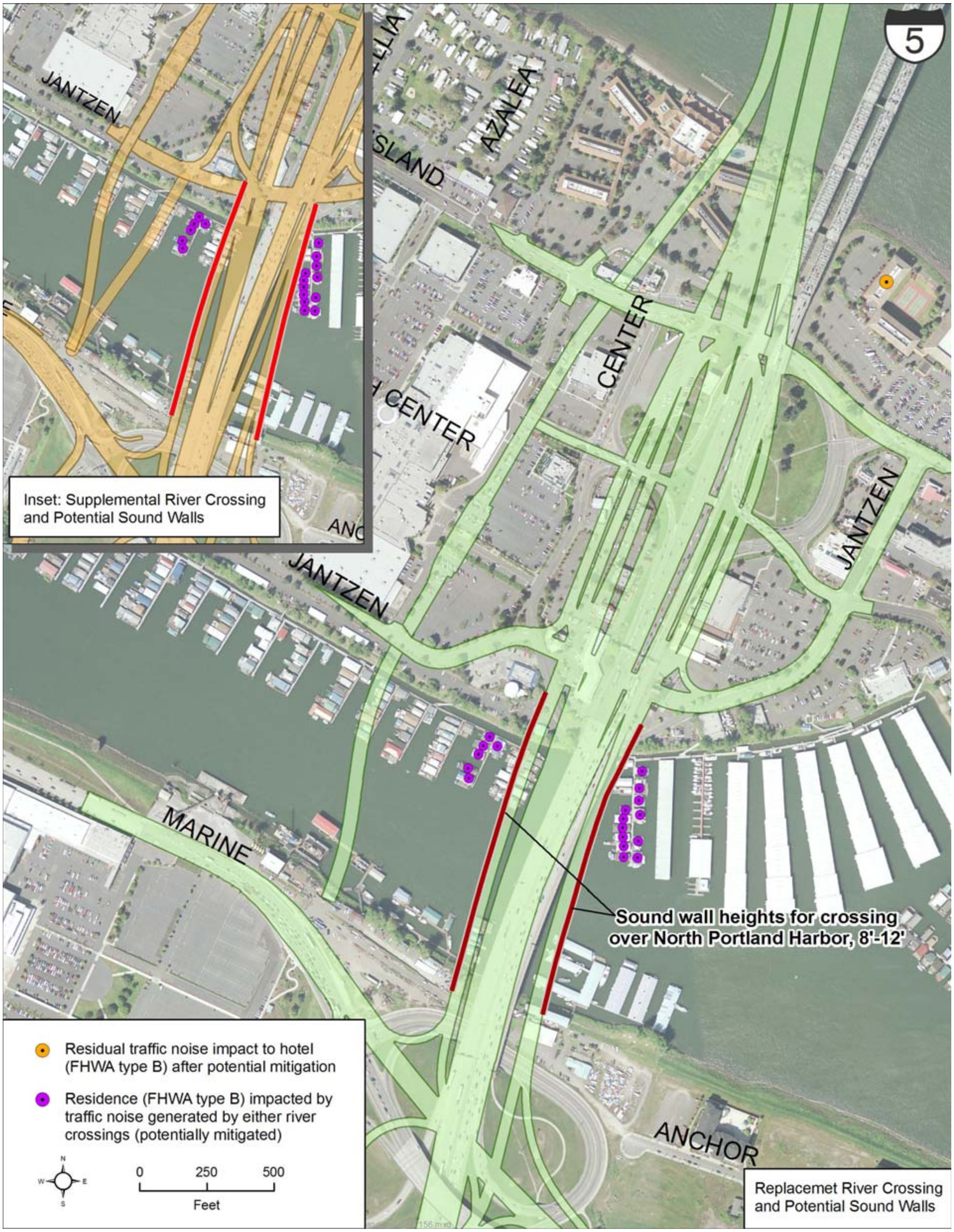
DOWNTOWN VANCOUVER SUBAREA TRAFFIC NOISE

Without the CRC highway improvements, I-5 traffic noise would exceed the WSDOT traffic noise criteria at the same 62 noise-sensitive land uses as under existing conditions. Noise levels would increase by 0 to 2 dBA under the No-Build Alternative when compared to the current noise level estimates.

All the build alternatives would lower traffic noise levels at some receivers by up to 6 dBA and raise noise levels at other receivers by up to 5 dBA, but would not change the number of receivers exceeding the noise criteria. The differences in noise levels between the replacement and supplemental bridge and highway options is less than 1 to 2 dBA—imperceptible to a person with average hearing.

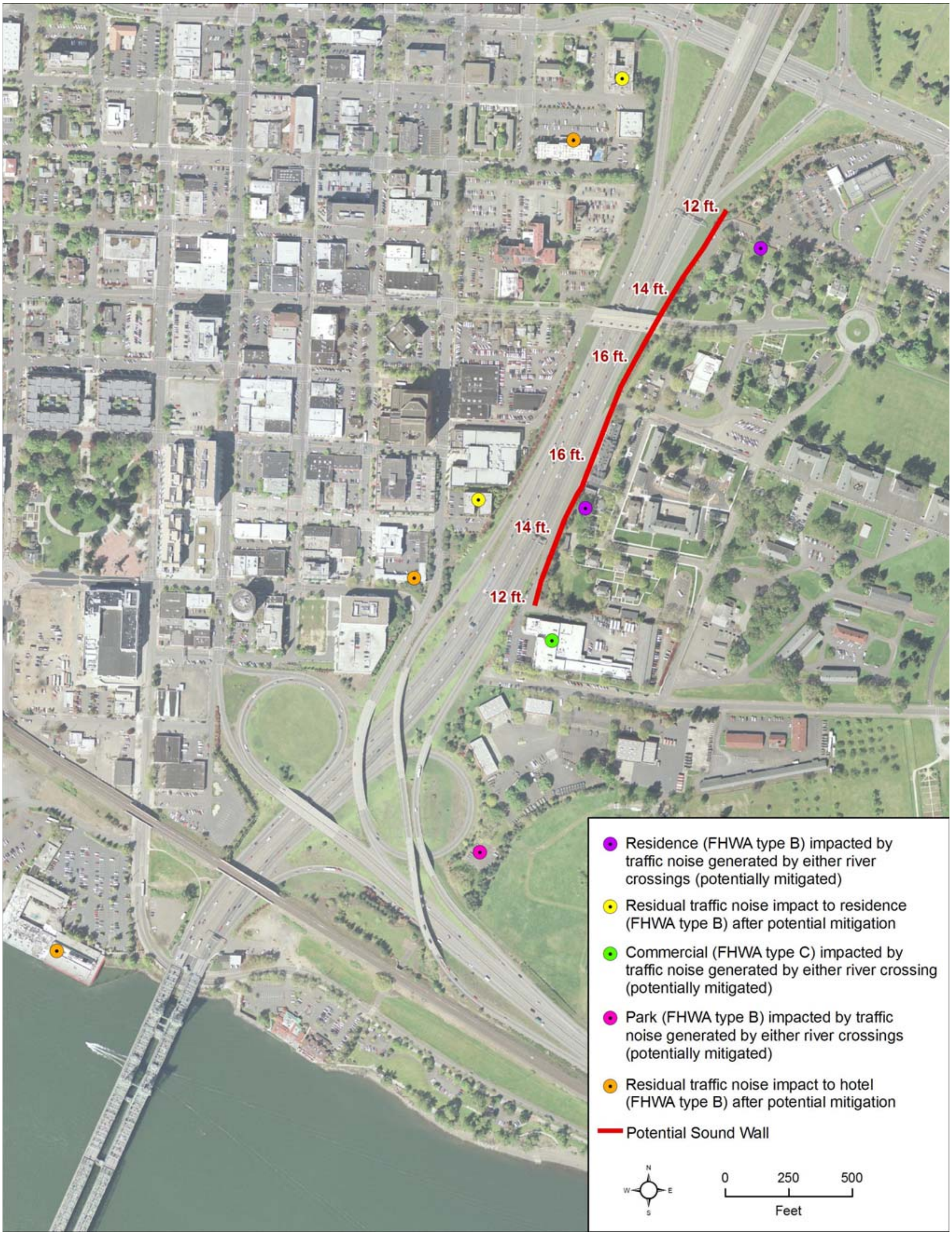
Traffic noise modeling shows that future traffic noise levels in downtown Vancouver would be the same at all receivers except the Red Lion Hotel Vancouver at the Quay, which is adjacent to the I-5 bridge. Exhibit 3.11-16 illustrates traffic noise impacts in south Vancouver. The shift in I-5 alignment and elevation between the replacement and supplemental alternatives would create a 3 dBA difference in future traffic noise levels at this location. However, the noise sensitive land use here would be impacted by I-5 traffic noise under the No-build or build alternatives, so there would be no change in the number of traffic noise impacts.

Exhibit 3.11-15
Traffic Related Noise Impacts and Potential Mitigation in North Portland and Hayden Island



Source: CRC Noise and Vibration Technical Report.

Exhibit 3.11-16
Traffic Noise Impacts and Potential Mitigation in Downtown Vancouver and near Fort Vancouver



Source: CRC Noise and Vibration Technical Report.

FORT VANCOUVER SUBAREA TRAFFIC NOISE

By 2030, the increase in traffic on I-5 would raise traffic noise by about 1 dBA, and exceed the WSDOT traffic noise criteria at 18 noise-sensitive land uses, six more than under existing conditions. Noise levels on the Fort under the No-Build Alternative are projected to range from 62 to 74 dBA Leq with the highest levels at unshielded areas along I-5 and SR 14. The new noise impacts would be at residential receivers, one commercial use near Officers Row, and potentially one location in the park.

Compared to the No-Build Alternative, the build alternatives would increase traffic noise levels at some receivers by up to 5 dBA and reduce noise levels at other receivers by up to 3 dBA. Modeled results show that the build alternatives would impact 26 receivers, eight more than with the No-Build Alternative. Exhibit 3.11-16 illustrates traffic noise impacts in the Fort Vancouver sub-area.

EAST OF I-5/MILL PLAIN TO NORTH VANCOUVER SUBAREA TRAFFIC NOISE

By 2030, noise levels at the modeling locations in this area will range from 57 to 76 dBA Leq, an increase of 1 to 2 dBA over existing noise levels. The 16 locations that would meet or exceed WSDOT traffic noise criteria with the No-Build Alternative are already impacted under existing conditions. Noise levels do not exceed the criteria at the hospital, school or church, but do exceed the criteria at the VA Cemetery for areas within the cemetery near I-5.

All the build alternatives would raise traffic noise levels at some receivers by 0 to 5 dBA, and would increase the number of receivers exceeding the noise criteria by 21, to a total of 37 receivers. Exhibit 3.11-17 illustrates traffic noise impacts east of I-5 and north of Mill Plain Boulevard.

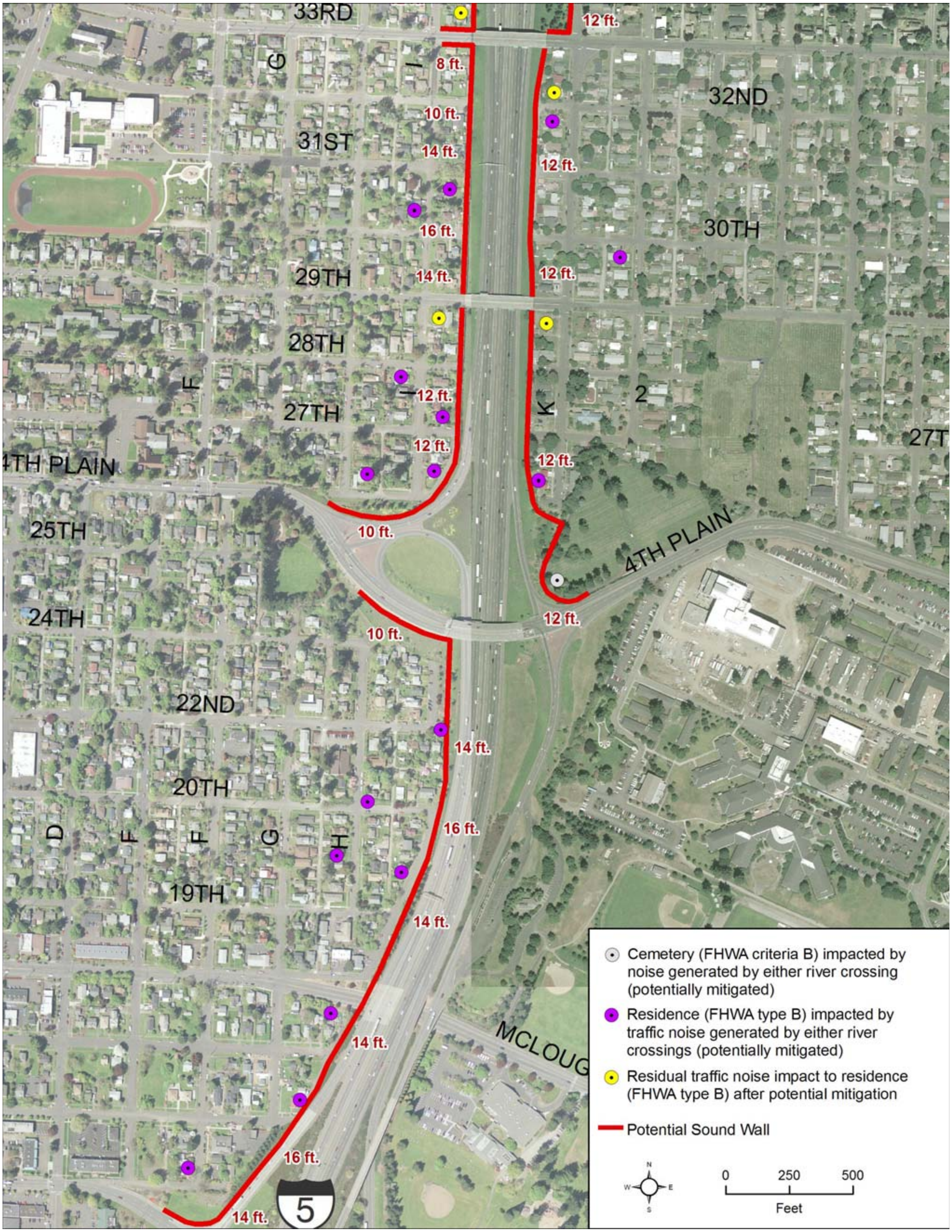
WEST OF I-5/MILL PLAIN TO NORTH VANCOUVER SUBAREA TRAFFIC NOISE

Traffic noise levels west of I-5 and north of Mill Plain are projected to range from 57 to 74 dBA Leq, a 1 to 4 dBA increase over existing conditions. Under the No-Build Alternative, 80 noise sensitive land-uses would exceed the noise impact criteria, compared to 52 noise impacts under existing conditions. The Discovery School parking area would continue to have noise levels that exceed the criteria. The eastern edge of the football field north of the school would be newly impacted under the No-Build Alternative.

The build alternatives would raise traffic noise levels by 0 to 3 dBA at some receivers, and reduce traffic noise by up to 6 dBA at others. Both options would increase the number of receivers exceeding the noise criteria by 62 compared to No-Build, to a total of 117 receivers. There is little difference between the build alternatives. Exhibit 3.11-17 illustrates traffic noise impacts west of I-5 and north of Mill Plain Boulevard. When paired with the Kiggins Bowl terminus option, the highway improvements associated with the replacement river crossing would be required to shift 25 feet West through this area. This shift would not result in any new noise impacts.

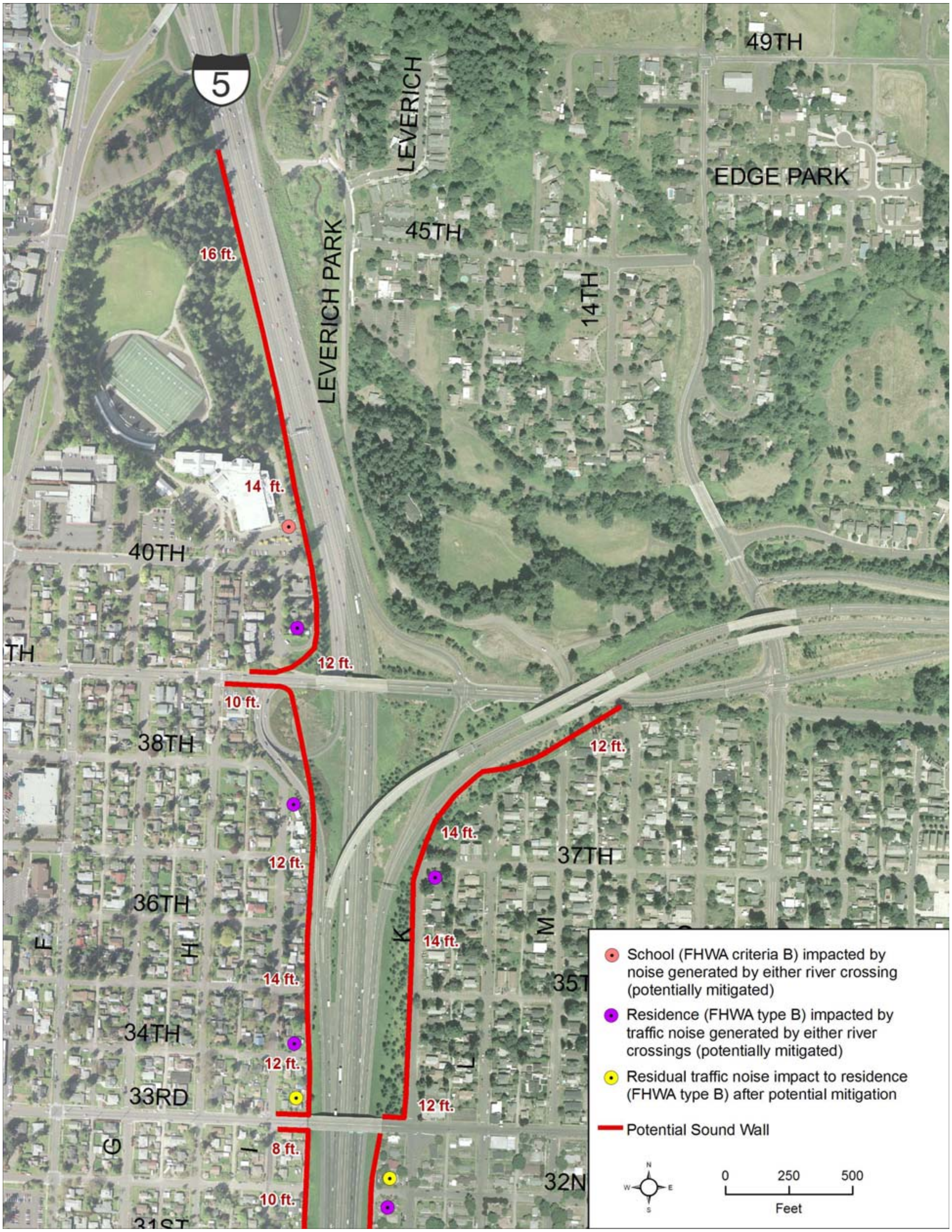
Exhibit 3.11-17 (page 1 of 2)

Traffic Noise Impacts and Potential Mitigation in Northern Vancouver



Source: CRC Noise and Vibration Technical Report.

Exhibit 3.11-17 (page 2 of 2)
Traffic Noise Impacts and Potential Mitigation in Northern Vancouver



Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Transit noise impacts vary substantially by transit mode because a typical diesel bus is considerably louder than an electric light rail vehicle. Bus rapid transit would result in between 24 and 70 moderate noise impacts and between seven and 52 severe noise impacts. Light rail would result in between seven and 51 moderate noise impacts and no severe noise impacts. The range of impacts for each mode is based on the range of potential transit terminus and alignments options, as discussed in the following section.

Vibration impacts would occur only with light rail, as buses rarely produce vibration levels high enough to surpass the criteria. Train systems like light rail create ground-borne vibration by the interaction of steel wheels rolling on the steel rails. Vibration and radiated noise can be intrusive and annoying to building occupants. Light rail would result in 32 to 47 vibration impacts, depending on the transit terminus and alignment options selected, as discussed in the following section.

Expansion of either the C-TRAN bus maintenance facility in eastern Vancouver or the TriMet light rail maintenance facility in Gresham would not result in any additional noise or vibration impacts

Transit Terminus Options (with all Alternatives)

The Kiggins Bowl terminus option (A) would have 17 to 53 moderate noise impacts and 0 to 52 severe noise impacts. The Lincoln terminus option (B) would have seven to 70 moderate noise impacts and 0 to 51 severe noise impacts. The range reflects the variation in transit mode, design alignment options and transit operating assumptions.

The Clark College minimum operable segment (MOS) (C) would have 17 to 50 moderate noise impacts and 0 to 40 severe noise impacts. This terminus option would avoid transit noise impacts north of Clark College along the Kiggins Bowl terminus option (A) and north of Mill Plain along Main and Broadway. However, local street traffic near Clark College could increase, as drivers travel to the terminus park and ride.

The Mill Plain MOS (D) would have seven to 31 moderate noise impacts and 0 to 21 severe noise impacts. This terminus option would avoid the transit noise impacts associated with the Kiggins Bowl (A), and Lincoln (B) terminus options. Added local traffic traveling to the Mill Plain MOS park and ride and the park and rides near the SR 14/I-5 interchange, as described in Section 3.1, Transportation could increase localized traffic noise levels compared to the full length transit terminus options.

There would be no vibration impacts in Portland or downtown Vancouver. Vibration impacts with the Kiggins Bowl terminus would range from 40 to 47 receivers. With the Lincoln terminus, vibration impacts would range from 8 to 24 receivers. The Clark College MOS (C) would result in vibration impacts to 5 to 12 receivers, while the Mill Plain MOS would not impact any receivers. All of these vibration impacts can be mitigated. Exhibit 3.11-18 indicates vibration impacts by transit alignment option.

Exhibit 3.11-18
Light Rail Vibration Impact Summary before Mitigation

Terminus Option	Alignment option	Area	Impact Criteria (VdB)	Predicted Level (VdB)	Vibration Impacts
A, B, C, or D	Offset or Adjacent	Portland	72	<62	0
A, B, C, or D	Two-way Washington or Washington-Broadway Couplet	Downtown Vancouver	72	69 to 71	0
A or C	McLoughlin Blvd	D St to I-5	72	72 to 73	12
A or C	16th Street	C St to I-5	72	78	5
A	Kiggins Terminus	Along I-5, 26th to 33rd	72	74 to 76	35
B	2-way Broadway or Broadway-Main Couplet	Broadway; 19th to 29th	72	72 to 73	24
B	Lincoln Terminus	Main Street; north of 29th Street	72	72 to 73	8

Source: CRC Noise and Vibration Technical Report.

Transit Alignment Options (with all Alternatives)

ADJACENT OR OFFSET

On Hayden Island for light rail, the adjacent alignment option would have seven predicted noise impacts to floating homes, and the offset option would have 21. Bus rapid transit noise would affect seven more homes with the adjacent than the offset alignment. The adjacent option would have seven impacts considered severe under the FTA criteria, and the offset option would have 14. These impacts are in addition to, or overlap with, traffic noise impacts as illustrated in Exhibit 3.11-15. Additionally, some of the floating homes that would otherwise be impacted by noise are displaced by the transit guideway itself. See section 3.3, Acquisitions and Displacements for more information. These impacts are illustrated in Exhibit 3.11-19, although all could be mitigated. These are significant impacts under NEPA guidelines, and the FTA recommends avoiding severe impacts whenever possible. There would be no light rail vibration impacts in this segment.

TWO-WAY WASHINGTON OR WASHINGTON-BROADWAY COUPLET

Between zero and three moderate noise impacts are predicted for either alignment option in the downtown Vancouver segment. Bus rapid transit with Increased operations would result in three impacts, with all other transit modes and operation levels not resulting in impacts downtown. There would be no vibration impacts in this segment. These impacts are illustrated in Exhibit 3.11-20. All could be mitigated.

16TH STREET OR MCLOUGHLIN

With the Kiggins Bowl terminus option (A) or the Clark College MOS (C), the McLoughlin alignment option would have more noise impacts than the 16th Street alignment option. Tables in the Alternatives section above list the number of transit noise impacts associated with each alignment option, including how it would vary by transit mode and frequency of transit service. These impacts are illustrated in Exhibit 3.11-21. All could be mitigated.

Exhibit 3.11-19

Transit Noise Impacts and Potential Mitigation in North Portland and Hayden Island

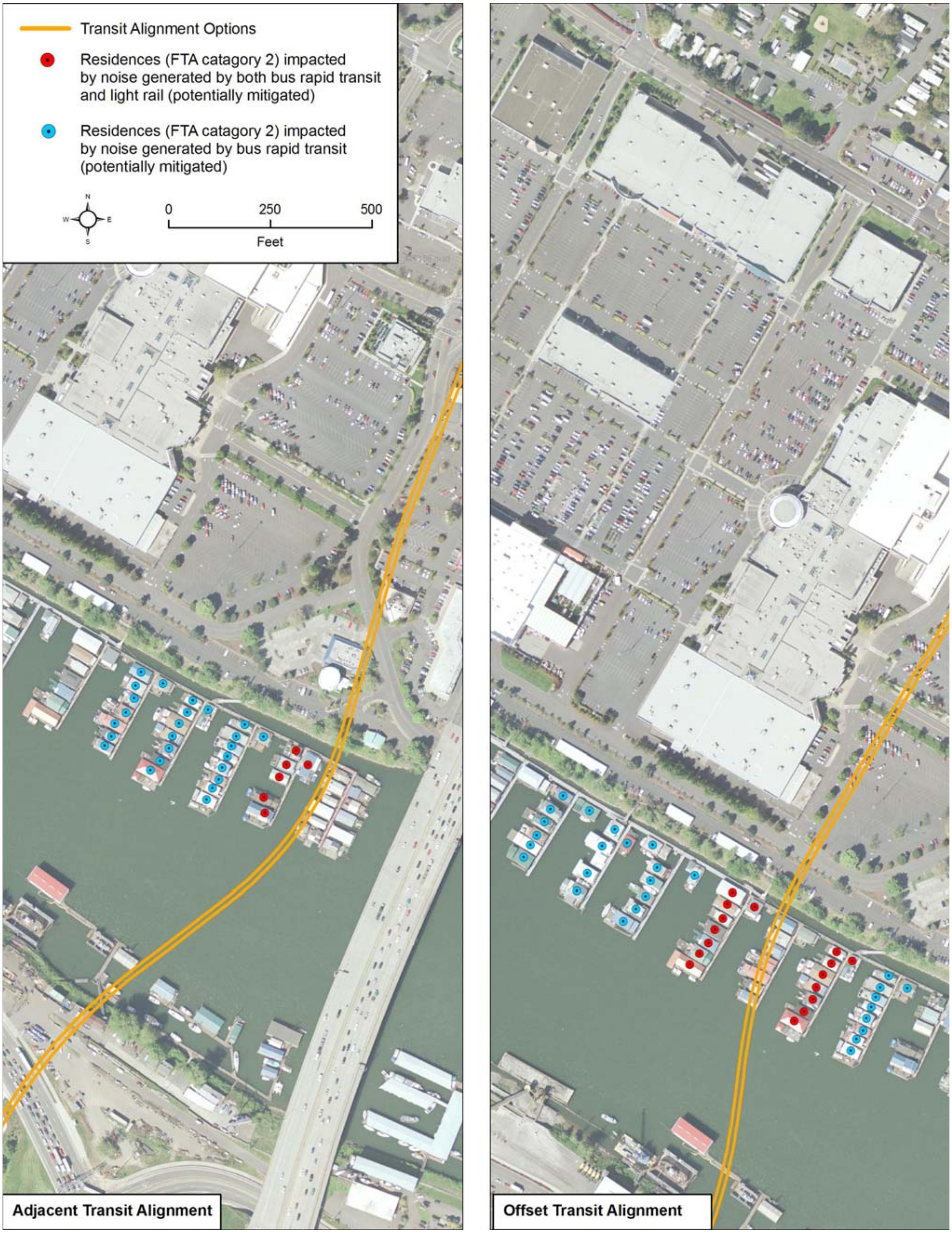


Exhibit 3.11-20
Transit Noise Impacts and Potential Mitigation in Downtown Vancouver

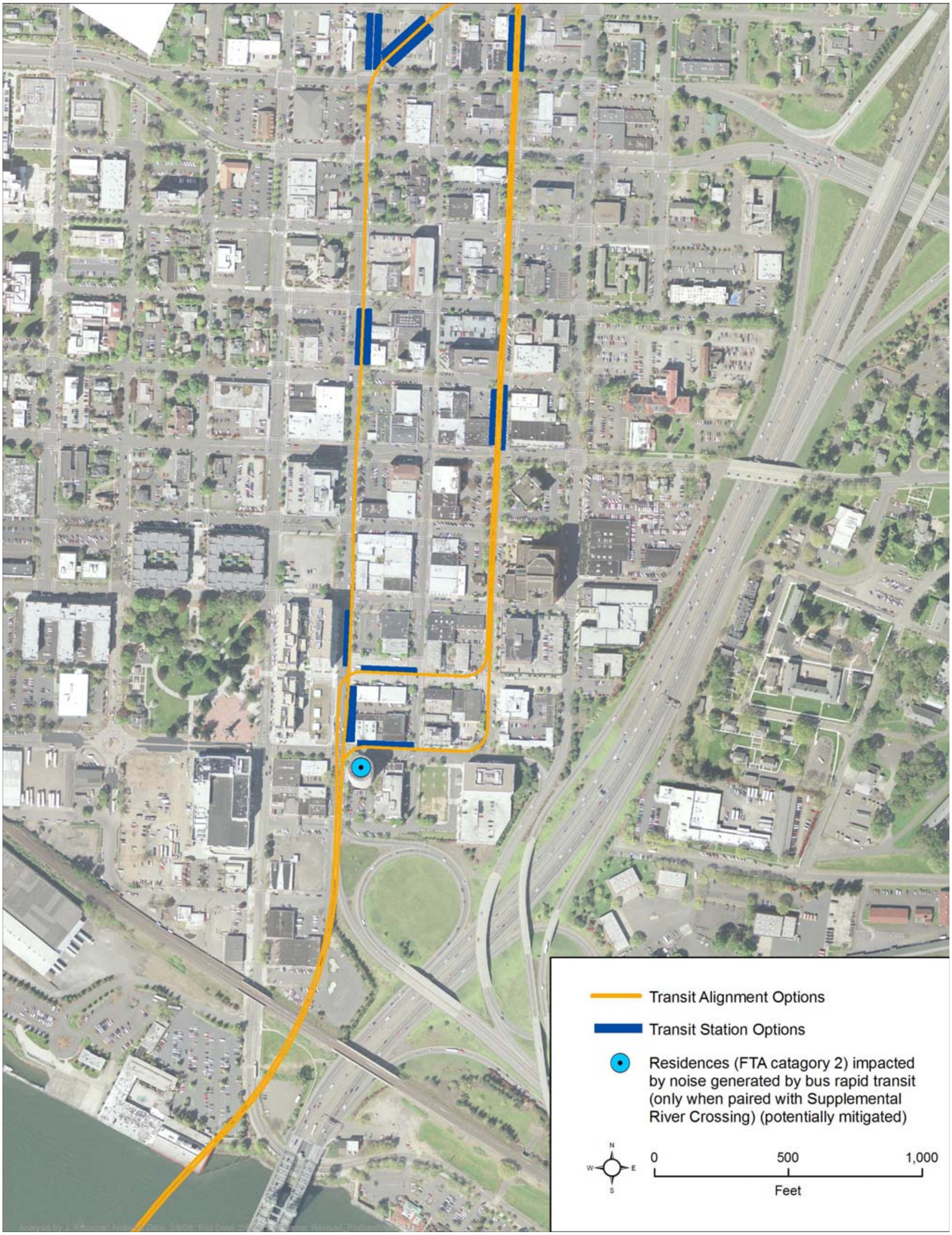


Exhibit 3.11-21 (page 1 of 2)
Transit Noise Impacts and Potential Mitigation in Northern Vancouver

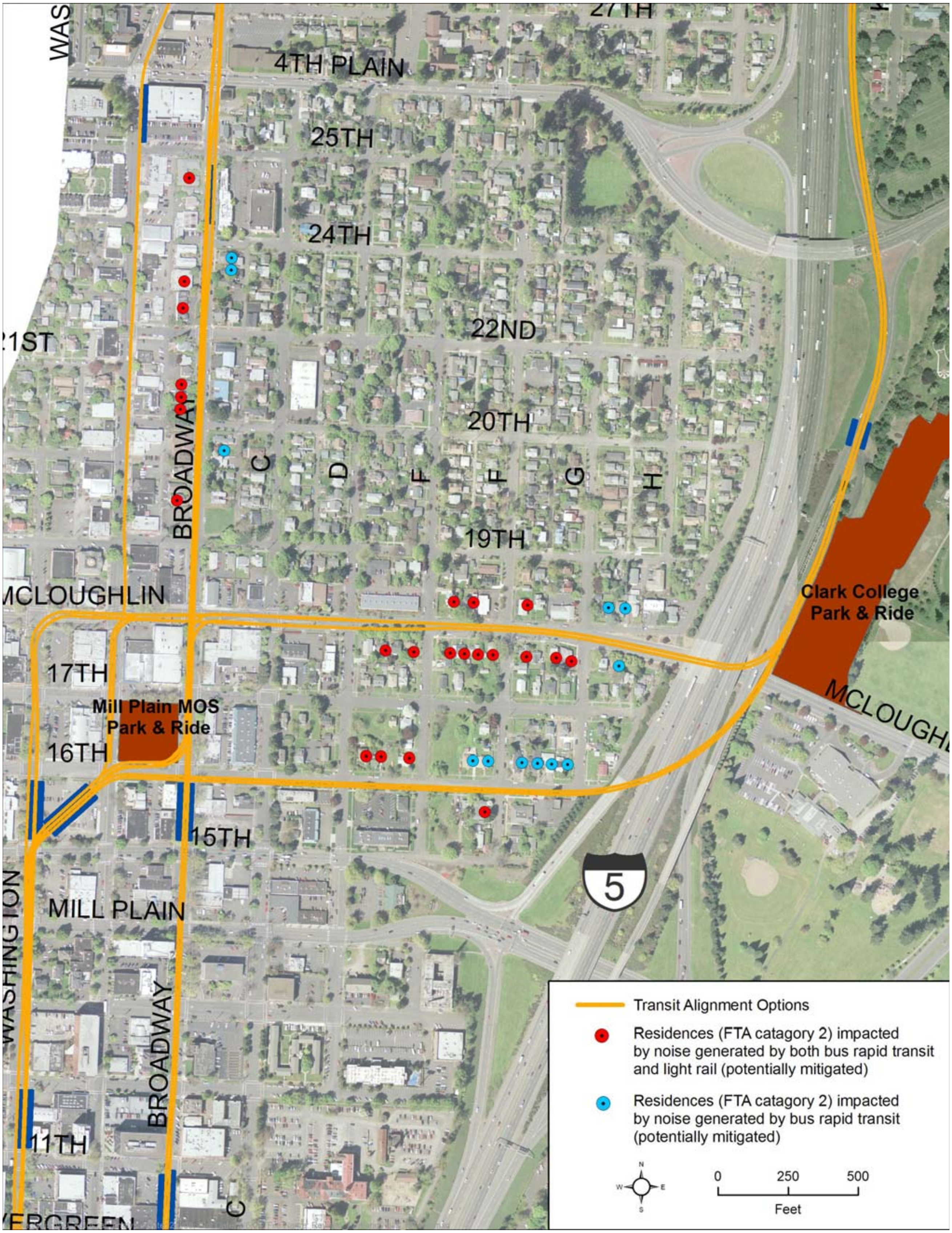


Exhibit 3.11-21 (page 2 of 2)
Transit Noise Impacts and Potential Mitigation in Northern Vancouver

Vibration impacts would occur only with the light rail mode. With the McLoughlin alignment, there would be vibration impacts at 12 residential locations along McLoughlin Boulevard. With the 16th Street alignment, there are five predicted vibration impacts. An additional 35 vibration impacts are predicted along the Kiggins Bowl terminus where the guideway would be below the grade of the adjacent neighborhood, from 26th to 33rd Streets.

TWO-WAY BROADWAY OR BROADWAY-MAIN COUPLET

With the Lincoln terminus option (D), the two-way Broadway alignment option would have more noise impacts than the Broadway-Main couplet alignment option. Tables in the earlier full alternatives noise discussion list the number of transit noise impacts associated with each alignment option, including how noise would vary by transit mode and frequency of transit service. These impacts are illustrated in Exhibit 3.11-21.

Vibration impacts would occur only with the light rail mode. With the two-way Broadway alignment, up to 24 vibration impacts are predicted along Broadway. With the Broadway-Main couplet alignment, the same vibration impacts would occur on Broadway, and there would be eight more along Main Street. No vibration impact is expected at the Medical Center, but vibration levels would exceed the residential criteria at the Fire Department on 37th Street.

Transit Operations

For the Kiggins Bowl terminus, adding more frequent service (Increased operations) with bus rapid transit would increase the total noise impacts on McLoughlin to 34, including 19 severe impacts. Noise impacts are projected at all residences along McLoughlin Boulevard. More frequent bus rapid transit headways would also increase noise levels with the 16th Street option, impacting one more receiver and elevating two of the moderate impacts to severe impacts. Increased transit operations for light rail would increase the number of moderate noise impacts by three along McLoughlin, but would not result in any increases in noise impacts along 16th Street.

For the Lincoln terminus, adding more frequent service with bus rapid transit would result in the same number of total impacts on Broadway but would elevate 20 moderate impacts between East 18th and 29th Streets to the severe threshold. Eight additional noise impacts are expected north of 29th Street, including the Fire Department on East 37th Street. Under the Broadway-Main couplet alignment, there would be eight additional severe noise impacts with Increased versus Efficient bus rapid transit operations. Increased transit operations for light rail would increase the number of moderate noise impacts by six along Broadway.

3.11.4 Temporary Effects

Potential noise and vibration construction impacts were addressed qualitatively, based on factors such as expected construction duration, general types of construction activity, extent of construction area, and potential for traffic rerouting.

Project Construction Phases and Noise Levels

Building the CRC alternatives would require typical roadway and structural construction equipment. The maximum noise levels of such equipment range from 60 to 80 dBA for smaller equipment such as compressors or welders, 80 to 90 dBA for large equipment such as excavators or pavers, and over 100 dBA for pile drivers.

CRC project construction would occur in several steps or phases, shown in Exhibit 3.11-22. The worst-case noise levels for each phase are shown in this table and are based on periods of maximum construction activity. The actual noise levels experienced during construction would generally be lower than those shown. In some locations, night time construction will be desirable or required in order to comply with permit conditions, manage traffic, reduce business impacts, or reduce schedule duration. Such activities would have potential impacts on residences and other noise sensitive uses. Night construction and other activities will likely require the project to obtain a variance from local noise ordinances.

Exhibit 3.11-22
Noise Levels for Typical Construction Phases

Scenario	Equipment	Lm[a]	Leq[b]
Construction preparation	Air compressors, backhoes, concrete pumps, cranes, excavators, forklifts, haul trucks, loaders, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment	94	87
Construction of new structures and roadway paving	Air compressors, backhoes, cement mixers, concrete pumps, cranes, forklifts, haul trucks, loaders, pavers, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment, welders	94	88
Miscellaneous activities, including striping, lighting and signs	Air compressors, backhoes, cranes, forklifts, haul trucks, loaders, pumps, service trucks, tractor trailers, utility trucks, welders	91	83
Demolition of existing structures	Air compressors, backhoes, concrete saws, crane, excavators, forklifts, haul trucks, jackhammers, loaders, power plants, pneumatic tools, pumps, service trucks, utility trucks	93	88

Source: CRC Noise and Vibration Technical Report.

a Lm (dBA) is an average maximum noise emission for the construction equipment under the given scenario.

b Leq (dBA) is an energy average noise emission for construction equipment operating under the given scenario.

Note: Combined worst-case noise levels for all equipment at a distance of 50 feet from work site.

Pile driving can generate some of the highest maximum construction sound levels. Pile driving will likely be required during bridge construction over the Columbia River and North Portland Harbor, and in the construction of interchanges, elevated transit guideways and other project elements. Noise levels during pile driving would likely be high near each of these locations. Pile driving can produce maximum short-term noise levels of 99 to 105 dBA at 50 feet. Actual levels can vary and would depend on the pile driving equipment and pile type, and the distance and topographical conditions between the pile-driving location and the receiver location.

Noise from pile driving also has the potential to affect fish and wildlife. In deep water, pile driving has the potential to produce noise levels of 190 dB at 150 feet from the source. Noise attenuates more quickly in shallow water. Studies have shown that waterborne noise levels of 180 dB or more can injure fish and potentially cause mortality. Section 3.14, Ecosystems, discusses potential noise impacts to fish and wildlife.

The potential sites for a bridge assembly/casting yard are unknown at this time, but it is unlikely that it would be adjacent to a residential or other noise-sensitive use. However, truck traffic could increase noise levels along access and haul routes to and from the site. If the site is located adjacent to noise sensitive uses, then mitigation (discussed below) would be required to comply with local noise regulations, which will depend upon the jurisdiction in which the site is located.

Construction Vibration

Vibration from construction is caused by equipment operations, and is usually highest during pile driving, soil compacting, jack-hammering, and construction related demolition activities. Although it is conceivable for ground-borne vibration from construction to cause building damage, vibration from construction is almost never of sufficient amplitude to cause even cosmetic damage to buildings. The primary concern is that the vibration can be intrusive and annoying to building occupants.

Construction activities can result in vibration effects to surrounding receivers. Major vibration-producing activities would occur primarily during demolition and preparation for the new bridges. Activities that have the potential to produce high levels of vibration include pile driving, vibratory shoring, soil compacting, and some hauling and demolition activities. Vibration effects from pile driving or vibratory sheet installations could occur within 50 to 100 feet of sensitive receivers. However, it is unlikely that vibration levels would exceed the USDOT guidelines for preventing damage to buildings.

3.11.5 Potential Mitigation

Potential Mitigation for Long-term Effects

POTENTIAL MITIGATION FOR TRAFFIC NOISE

Noise walls, to the extent they are reasonable and feasible, are the most common type of highway noise mitigation. The noise walls currently along I-5 between Fourth Plain and SR 500 provide some noise reduction, but a number of residences behind the walls exceed the impact criteria. This could improve with sound walls that are higher or closer to the receivers.

Both the supplemental and replacement alternatives would include new noise walls to reduce noise substantially throughout the project corridor compared to existing and projected No-Build noise levels. Several noise-sensitive land uses, currently without noise wall mitigation, are exposed to high traffic noise levels, as shown in the maps in this section. Many of these land uses would receive long-term noise reduction benefits with the potential mitigation. Potential mitigation measures could reduce traffic noise impact sites to 52 compared to 215 unmitigated noise impacts under the No-Build Alternative. Even so, the number of residual impacts could be higher than 52, depending on final decisions regarding sound walls. A number of factors, such as visual impacts, safety, and structural issues, in addition to noise levels, must be considered. High noise walls, for example, could reduce traffic noise impacts from the bridge over the North Portland Harbor. However, high noise walls on the bridge would also have substantial visual and structural implications.

Portland. For the I-5 crossing over North Portland Harbor, a noise wall on each side of the bridge structure could mitigate all noise impacts predicted to occur to the floating homes. This may not be reasonable given the visual and structural implications of installing sound walls on the bridge. Additional mitigation of transit noise impacts, as determined according to FTA criteria, could be done in coordination with traffic noise mitigation.

Fort Vancouver. A noise wall along the east side of I-5 near the Fort Vancouver area could mitigate all traffic noise impacts predicted at the 24 residential land uses. In addition, the noise wall would provide a noise reduction benefit for 21 residential uses where noise levels are below the impact criteria.

East side of I-5, North of Mill Plain. A noise wall along the east side of I-5 from Fourth Plain to about 500 feet past 37th Street could mitigate all but four of the 35 predicted residential traffic noise impacts. The areas of the Vancouver Barracks Post Cemetery expected to have noise impacts could also be mitigated with this wall. In addition, the noise wall would provide a noise reduction benefit of 3 dBA or more for 21 homes in the area that do not exceed impact guidelines.

West side of I-5, North of Mill Plain. A noise wall on the west side of I-5 between Mill Plain and Fourth Plain could mitigate traffic noise impacts predicted at 35 residences and would further benefit 20 homes in the area that do not exceed impact guidelines. A noise wall along the west side of I-5 from Fourth Plain to just north of the SR 500 interchange could mitigate noise impacts at 76 of 82 residences and would benefit 22 homes in the area not exceeding impact guidelines. Six residences located near required openings in the wall (for the overpasses), would receive some noise reduction benefit but it would not be feasible to achieve the required noise reduction to fully mitigate the noise impact at these homes.

How does sound insulation work?

Residential sound insulation could include adding an extra layer of glazing to windows, sealing holes in exterior surfaces that act as sound leaks, or providing forced ventilation and air-conditioning so that windows adjacent to the sound source do not need to be opened. The extent of any building insulation measures would be determined during the final design phase of the project.

POTENTIAL MITIGATION FOR TRANSIT NOISE AND VIBRATION

Sound insulation of residences is a potential mitigation measure for either light rail or bus rapid transit. This approach could mitigate the interior noise levels for all receivers impacted by transit. This mitigation approach could augment noise mitigation in areas also impacted by Traffic Noise such as the floating homes in North Portland Harbor. However, the exterior noise levels would remain high, especially with the bus rapid transit option.

Where light rail wheel squeal is likely to occur, at the proposed 90-degree curves at Main Street and McLoughlin or Main Street and 16th, trackside lubricators could be installed if needed after project completion.

Potential vibration impacts associated with the operation of light rail could be mitigated with vibration absorbing material incorporated into the track bed. The selected vibration mitigation method would depend on the track type and level of vibration impact.

Potential Mitigation for Temporary Effects

A variety of best management practices for noise mitigation could be included in construction contract specifications in order to reduce noise and vibration effects during construction. These may include:

- Require all engine-powered equipment to have mufflers installed according to the manufacturer's specifications.
- Require all equipment to comply with pertinent EPA equipment noise standards.
- Limit jackhammers, concrete breakers, saws, and other forms of demolition to daytime hours of 8:00 a.m. to 5:00 p.m. on weekdays, with more stringent restrictions on weekends.
- Minimize noise by regular inspection and replacement of defective mufflers and parts that do not meet the manufacturer’s specifications.
- Install temporary or portable acoustic barriers around stationary construction noise sources and along the sides of the temporary bridge structures where feasible.
- Locate stationary construction equipment as far from nearby noise-sensitive properties as possible.
- Shut off idling equipment.
- Notify nearby residents whenever extremely noisy work would occur.
- Restrict the use of back-up beepers during evening and nighttime hours.
- Monitor any sensitive buildings where construction vibration impacts are a concern.

3.12 Energy

Policies at the federal, state and local levels support energy conservation for all sectors, including transportation. Transportation energy efficiency is largely regulated though requirements on vehicle manufacturers rather than transportation infrastructure. There are no established standards to determine when a transportation project has an energy "impact." This DEIS compares the relative energy demands of the different CRC alternatives and discusses options that could reduce energy consumption during project construction and operations. This information is based on the CRC Energy Technical Report.

3.12.1 Existing Conditions

This section gives an overview of national and state energy supply and demand, with a focus on transportation demand and on petroleum—the primary energy source for transportation.

National Energy Demand

At the national level, industrial uses had the highest share of energy demand in 2005. However, the transportation sector's energy demand is expected to grow by 1.4 percent annually—to a 29.9 percent share by 2030—and will exceed the industrial sector's demand. Of the total energy projected to be used by transportation in 2030, 97.4 percent is expected to come from liquid fuels and other petroleum products. Even with improvements in fuel consumption rates and increasing use of alternative fuel sources, the high passenger travel demand and increasing use of trucks for freight is expected to result in a substantial increase in energy demand. The transportation sector (including aviation, marine, freight rail and roads) accounts for about 68 percent of our nation's petroleum consumption.

Washington and Oregon Energy Demand

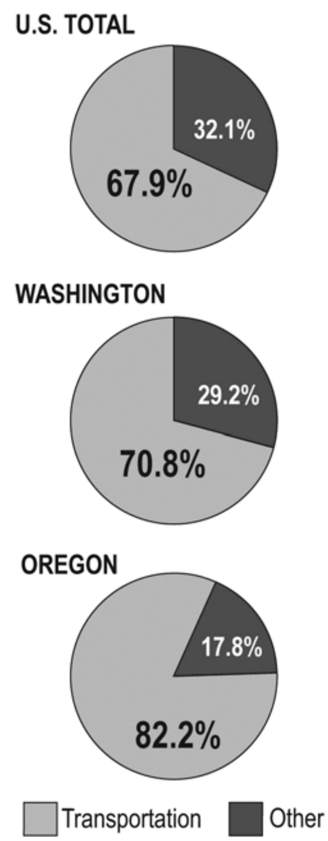
The total demand for all energy sources in Washington State has grown steadily, although the per capita consumption rate has declined several times since the early 1970s. The demand for energy from coal and natural gas in Oregon and Washington is substantially lower than the national average, but is offset by the demand for hydro-electric power. Washington is the leading hydroelectric power producer in the nation. However, as of 2004, energy derived from petroleum products accounted for the largest single share (42.0 percent) of energy consumed in Washington, slightly higher than the 2005 national demand of 40.5 percent. In 2000, approximately 47 percent of Oregon's energy consumption came from petroleum. Since then, petroleum's share of total demand has decreased, but still accounts for the largest share of energy consumption at 35.7 percent, notably lower than the national average. As illustrated in Exhibit 3.12-1, the transportation sectors in Washington and Oregon (including aviation, marine, freight rail and roads) account for about 71 percent and 82 percent, respectively, of each state's total petroleum consumption. In Washington, state-wide petroleum demand in the industrial sector is nearly four times that of Oregon, increasing Washington's non-transportation use of petroleum.

Measuring Energy

Different energy sources (petroleum, natural gas, hydropower, wind, solar) are typically measured in different units, such as gallons of fuel or watts of electricity. To compare energy amounts for all sources, this report converts them all to British thermal units (Btus). For example, the energy content of one gallon of diesel is about 130,000 Btus. One kilowatt-hour of electricity is about 3,400 Btus.

Exhibit 3.12-1

How much of our petroleum demand is consumed by transportation?



Aviation, marine, freight rail, and roadways.
Source: EIA, 2006.

The trend toward more fuel-efficient vehicles is expected to continue in the future because of recent government requirements for higher fuel-efficiency standards and rising petroleum prices. Promoting alternative fuel sources for transportation, such as ethanol, biodiesel, compressed natural gas, liquefied petroleum gas, and electricity has also been increasing. Nonetheless, petroleum demand in Washington, Oregon and the project area is projected to increase.

Washington and Oregon Petroleum Supply

Because gasoline and diesel are the primary energy sources for the transportation sector, the analysis of energy supply focuses on petroleum-based fuel sources. 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. Oregon imports 100 percent of its petroleum, of which approximately 90 percent comes from Washington refineries. Both states' future supply of petroleum is largely dependent on domestic production and reserves. Oil production from the North Slope peaked in 1988 and is projected to continue declining.

Peak Oil and Global Supply and Demand

Peak oil refers to the time frame in which the maximum global petroleum production rate is reached, after which the rate of production enters a terminal decline. Peak oil and its relevance to the CRC project is discussed in the Cumulative Impacts section.

Energy Use in the CRC Project Area

The estimated existing daily energy use for the regional transit system (including the regional MAX light rail system and all of C-TRAN's and TriMet's buses and other transit vehicles) is approximately 2.8×10^9 Btus. For cars and trucks crossing the river on I-5 and I-205, the estimated daily energy use is about 1.3×10^9 Btus. The estimate for existing and future highway energy use is based only on the crossing portion of highway trips. It does not estimate regional highway energy demand or even project wide demand. The reason for setting these boundaries for the highway energy estimates is twofold. First, the impact on highway energy demand outside the corridor would be minimal. Second, highway speeds and congestion have a strong influence on fuel efficiency and thus energy demand. Traffic analysis completed for the CRC project provides reliable speed and congestion estimates for the river crossing, but not elsewhere in the region. For these two reasons, highway-related energy demand is based on the estimated traffic volumes, vehicle types and travel speeds for the crossings themselves. This captures the most meaningful effects and provides a reliable comparison among alternatives, even though it does not capture all of the potential highway energy savings.

The analysis of transit-related energy demand looks more broadly, primarily because this allows the analysis to capture the effect that the CRC alternatives have on transit operations outside the immediate project area.

3.12.2 Long-Term Effects of Project Alternatives

By 2030, energy consumption by vehicles on regional roadways, including I-5 and I-205, will increase substantially over existing conditions. This will occur largely because population growth will increase the number of cars, trucks, and buses on the road. At the same time, average vehicle fuel efficiency is expected to improve as new, more fuel efficient and alternative fuel vehicles replace old ones. Exhibit 3.12-2 shows predicted fuel consumption in the year 2030.

Highway energy use is projected to decrease for all of the build alternatives compared to the No-Build Alternative. Highway-related energy savings would likely be greater than shown as this table indicates only the energy reductions associated with the actual river crossing. The lower energy demand for the highway crossing is due to three primary factors:

- Increased I-5 bridge capacity decreases the duration of congestion and increases average speeds. This improves fuel efficiency. Compared to stop and go traffic, fuel efficiency improves as average speeds increase, until the speeds reach free flow conditions.
- CRC provides high-capacity transit that is expected to divert a portion of personal vehicular travel demand to transit, which uses less energy per passenger.
- Tolling the I-5 crossing is expected to deter some trips across the river, which reduces energy demand.

Total energy use would rise with Alternatives 4 and 5 primarily due to the increased level of transit operations. Total energy use would decline with Alternatives 2 and 3 compared to the No-Build Alternative.

Alternative 1: No-Build

Exhibit 3.12-2
Future 2030 Energy Consumption (Million Btu)

	Alternative 1 No Build
I-5 crossing	793.6
I-205 crossing	831.7
Highway Crossing Subtotal	**1625.3**
Conventional bus	3,238.1
Biodiesel bus[a]	0
Light rail	520.8
Transit Subtotal	**3758.9**
Total	**5384.2**

Source: CRC Energy Technical Report.

[a] Both transit operators have commitments to biodiesel utilization, and have begun investing in biodiesel vehicles. But for the No-Build analysis, no assumptions were made about the percentage of the vehicle fleets that may one day run on biodiesel. There is similar support for diesel/electric hybrid vehicles, though no assumptions for such were made in this analysis

The No-Build Alternative is projected to have higher energy consumption than Alternatives 2 or 3 (by about 3 percent), and lower than Alternatives 4 and 5 (by about 6 percent).

Alternative 2: Replacement Crossing with Bus Rapid Transit

Compared to the No-Build Alternative, Alternative 2 would decrease daily energy demand by about 3 percent in the measured area. The replacement crossing would have the greatest reduction in congestion, which would improve energy efficiency (Exhibit 3.12-3). Energy use differences between terminus options would be minimal.

Exhibit 3.12-3
Energy Effects Summary for Alternative 2 (Million Btu)

Alternative 2: Replacement Crossing with Bus Rapid Transit				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)[b]	Mill Plain MOS (D)[b]
I-5 crossing	702.60	702.60	712.44	719.46
I-205 crossing	769.10	769.10	769.10	769.10
Highway crossing subtotal	1,471.70	1,471.70	1,481.54	1,488.56
Conventional bus[b]	3,231.70	3,231.70	3,231.70	3,231.70
Biodiesel bus	24.00	23.83	23.66	23.42
Light rail	520.80	520.80	520.80	520.80
Transit subtotal[c]	3,776.40	3,776.33	3,776.16	3,775.92
Total	5,248.10	5,248.03	5,257.70	5,264.49

Source: CRC Energy Technical Report.

[a] Transit energy use is calculated for the entire transit system, where as highway crossing calculations are based on 0.9 mile segment of the river crossing.

[b] Conventional bus energy consumptions should be assumed to be slightly higher with the two MOS options, as the transit service will leave areas to be served by conventional C-TRAN fixed-routes.

[c] MOS energy savings are based on model results for reduced project length with light rail as the Mode.

Note: The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 3: Replacement Crossing with Light Rail

Alternative 3 would decrease daily energy demand by about 3 percent, compared to No-Build. The replacement crossing would have the greatest reduction in congestion, which would improve energy efficiency (Exhibit 3.12-4). Energy use differences between terminus options would be minimal.

Exhibit 3.12-4
Energy Effects Summary for Alternative 3 (Million Btu)

Alternative 3: Replacement Crossing with Light Rail Transit				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)[b]	Mill Plain MOS (D)[b]
I-5 crossing	702.60	702.60	712.44	719.46
I-205 crossing	769.10	769.10	769.10	769.10
Highway crossing subtotal	1,471.70	1,471.70	1,481.54	1,488.56
Conventional bus[b]	3,217.70	3,217.70	3,217.70	3,217.70
Biodiesel bus	0.00	0.00	0.00	0.00
Light rail	553.00	549.13	545.26	539.73
Transit subtotal[a]	3,770.70	3,766.83	3,762.96	3,757.43
Total	5,242.40	5,238.53	5,244.49	5,245.99

Source: CRC Energy Technical Report.

[a] Transit energy use is calculated for the entire transit system, where as highway crossing calculations are based on 0.9 mile segment of the river crossing.

[b] Conventional bus energy consumptions should be assumed to be slightly higher with the two MOS options, as the transit service will leave areas to be served by conventional C-TRAN fixed-routes.

[c] MOS energy savings are based on model results for reduced project length with light rail as the Mode.

Note: The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Alternative 4 would increase daily energy demand by about 6 percent in the measured area. The supplemental crossing would not have as much reduction in congestion, although the higher toll and more frequent transit service would result in fewer auto trips across the river. Energy use differences between terminus options would be minimal (Exhibit 3.12-5).

Exhibit 3.12-5
Energy Effects Summary for Alternative 4 (Million Btu)

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)[b]	Mill Plain MOS (D)[b]
I-5 crossing	651.20	651.20	660.32	666.83
I-205 crossing	815.50	815.50	815.50	815.50
Highway crossing subtotal	1,466.70	1,466.70	1,475.82	1,482.33
Conventional bus[b]	3,661.80	3,661.80	3,661.80	3,661.80
Biodiesel bus	52.60	52.23	51.86	51.34
Light rail	548.10	548.10	548.10	548.10
Transit subtotal[a]	4,262.50	4,262.13	4,261.76	4,261.24
Total	5,729.20	5,728.83	5,737.58	5,743.57

Source: CRC Energy Technical Report.

[a] Transit energy use is calculated for the entire transit system, where as highway crossing calculations are based on 0.9 mile segment of the river crossing.

[b] Conventional bus energy consumptions should be assumed to be slightly higher with the two MOS options, as the HCT service will leave areas to be served by conventional C-TRAN fixed-routes.

[c] MOS energy savings are based on model results for reduced project length with light rail as the mode.

Alternative 5: Supplemental Crossing with Light Rail

Alternative 5 would increase daily energy demand by about six percent in the measured area. The supplemental crossing would not have as much reduction in congestion as the replacement crossing, although the higher toll and more frequent transit service would result in fewer auto trips across the river. Energy use differences between terminus options would be minimal (Exhibit 3.12-6).

Exhibit 3.12-6
Energy Effects Summary for Alternative 5 (Million Btu)

Alternative 5: Supplemental Crossing with Light Rail Transit				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)[b]	Mill Plain MOS (D)[b]
I-5 crossing	651.20	651.20	660.32	666.83
I-205 crossing	815.50	815.50	815.50	815.50
Highway crossing subtotal	1,466.70	1,466.70	1,475.82	1,482.33
Conventional bus[b]	3,633.30	3,633.30	3,633.30	3,633.30
Biodiesel bus	0.00	0.00	0.00	0.00
Light rail	587.00	582.89	578.78	572.91
Transit subtotal[a]	4,220.30	4,216.19	4,212.08	4,206.21
Total	5,687.00	5,682.89	5,687.90	5,688.54

Source: CRC Energy Technical Report.

a Transit energy use is calculated for the entire transit system, where as highway crossing calculations are based on 0.9 mile segment of the river crossing.

b Conventional bus energy consumptions should be assumed to be slightly higher with the two MOSs, as the HCT service will leave areas to be served by conventional C-TRAN fixed-routes.

c MOS energy savings are based on model results for reduced project length with LRT as the Mode.

3.12.3 Long-term Effects of Project Components

This section describes impacts of the components that comprise the project alternatives.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The highway improvements associated with the replacement crossing would reduce energy demand relative to the highway improvements associated with the supplemental crossing because the additional capacity would decrease the amount of time cars spend in stop and go traffic. This improves fuel efficiency.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Light rail would reduce energy demand relative to bus rapid transit, although the difference is minor. Both modes would reduce energy demand compared to providing no high-capacity transit system in the CRC corridor.

The additional electrical energy consumed by daily operations of maintenance bases would be negligible compared to the energy consumed for transportation. Expanding either the bus maintenance base in east Vancouver or the light rail maintenance base in Gresham would not measurably affect long-term energy use.

Transit Terminus and Alignment Options (with all Alternatives)

The Lincoln terminus would use slightly less energy than the Kiggins Bowl terminus, because it is a more direct and shorter route to North Vancouver.

The transit component of full-length terminus options would consume more energy than the transit components of either of the minimum operable segment (MOS) terminus. The Clark College MOS would require approximately 1.4 percent less energy. The Mill Plain MOS, which represents the shortest high-capacity transit line length, would have the lowest energy use by approximately 2.4 percent compared to a full-length terminus. Construction energy demand would be lower for the minimum operable segments.

The transit alignment options would not affect the overall energy demand of the project, as summarized above for the alternatives.

Transit Operations

Increased transit operations (service frequency) would increase the transit operational energy demand compared to the Efficient operations option. While the Increased transit operations would result in fewer autos crossing the river, and thus some reduction in highway energy demand, that decrease is not proportional to the added energy demand from the substantial increase in transit service associated with the Increased versus Efficient transit operations.

Tolling Scenarios

Tolls on the I-5 crossing are included in all build alternatives. Other tolling scenarios were studied to analyze how tolling would affect demand on the roadway.

Under tolled scenarios, the replacement crossing would result in 178,000 daily vehicle trips across the I-5 bridges and 213,000 vehicle trips across the I-205 bridges. If no toll were collected in 2030, the I-5 crossing's daily traffic levels would increase by 32,000 vehicles (18 percent). I-205's daily traffic would decrease by 13,000 vehicles (6 percent). Without tolling, an additional 19,000 (5 percent) cross-river vehicle trips would be made in 2030.

Due to the supplemental bridge's assumed higher toll, less available highway capacity, and provision of an enhanced transit system, daily I-5 vehicle crossings would be 13,000 vehicles per day lower compared to the replacement bridge, while I-205's crossings would increase by 6,000 vehicles per day. Overall, there would be 7,000 fewer vehicle crossings of the Columbia River via I-5 and I-205.

The No Toll scenario would have the highest daily energy use. Compared to the No Toll scenario, the Standard Toll on I-5 scenario would consume approximately 1.9 percent less and the Standard Toll on

Both I-5 and I-205 would require approximately 3.6 percent less operational energy.

3.12.4 Temporary Effects

The method used to estimate energy use from construction is based on applying a factor to construction cost estimates. This provides a straightforward albeit relatively simplistic approach for comparing the relative energy demand of alternatives.

Estimating Construction Energy Use

The approach for estimating energy use during construction is based on a method developed by the California Department of Transportation. It estimates energy requirements for a variety of construction activities (building structures, electrical substations, site grading, etc.) by relating project costs to the amount of energy needed to manufacture, process, and install construction materials and structures.

Based on this estimating method, Alternative 3 (replacement crossing with light rail) would require the most energy to construct (estimated at about 7.28×10^{12} Btus), followed by Alternative 2 (3.2 percent lower), Alternative 5 (about 19.7 percent lower), and Alternative 4 (about 23.3 percent lower). Energy to construct Alternative 4, the lowest-cost full alternative, is estimated at about 5.90×10^{12} Btus. The two minimum operable segments are shorter and less expensive to build, and would thus require less construction energy.

For the components that make up the alternatives, light rail construction would consume more energy than bus rapid transit; and, constructing the Kiggins Bowl terminus (A) would use more energy than the Lincoln terminus (B).

3.12.5 Potential Mitigation

Potential Mitigation for Temporary Effects

A variety of potential measures could reduce energy consumption from construction. As the project advances in design, and more detail is available on construction needs and activities, additional analysis will help identify specific measures and approaches for reducing energy consumption during construction. Potential measures include:

- Construction materials reuse and recycling.
- Encouraging workers to carpool.
- Turning off equipment when not in use to reduce energy consumed during idling.
- Maintaining equipment in good working order to maximize fuel efficiency.
- As practical, routing truck traffic through areas where the number of stops and delay would be minimized, and using off-peak travel times to maximize fuel efficiency.
- As practical, scheduling construction activities during daytime hours or during summer months when daylight hours are the longest to minimize the need for artificial light.

Potential Mitigation for Long-Term Effects

Energy consumption is projected to increase by 2030 under all scenarios—build or No-Build. Some of the most effective project level measures for reducing transportation energy demand are proposed among the CRC components (see list below). Other potential measures for reducing travel demand include transportation demand management and transportation system management measures outlined in Chapter 2 of this

DEIS. Improved integration of the two transit systems (C-TRAN and Tri-Met) with a single system transit pass would also improve transit ridership and reduce vehicular trip demand.

In addition to the strategies described above, the CRC alternatives include a variety of components that would help reduce energy consumption relative to the No-Build Alternative:

- Fast and reliable high-capacity transit service.
- Tolling vehicles crossing the bridge.
- Improving bike and pedestrian facilities and connections.
- Improving highway operations with auxiliary lanes and better functioning interchanges, thus reducing congestion and improving fuel efficiency.
- Eliminating bridge lifts (with Alternatives 2 and 3) and improving safety, thus reducing congestion and improving fuel efficiency.

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3.13 Electric and Magnetic Fields

Electromagnetic fields (EMF) are produced by many natural sources such as lightning, and human-made sources such as cell phones, electric appliances, and light rail transit systems. Exposure to high levels of EMF has been associated with potential effects on human health.

This section assesses the potential for human health impacts from exposure to EMF during operation of the CRC light rail options. Light rail uses an overhead electrical system (the catenary) to power the trains, and thus creates electric and magnetic fields. Bus rapid transit and roadway options generate only minor EMF emissions. The information in this section is based on the CRC Electromagnetic Fields Technical Report.

Units for Electric and Magnetic Fields

You can think of voltage as "electrical pressure" in an electrical line. It is measured in volts (V) or kilovolts (kV). This pressure produces an electrical field that extends out from the line and is measured in volts per meter (V/m). Current in an active electrical line also produces a magnetic field around the line. Magnetic fields are measured in units of gauss (G). Since most magnetic field exposures involve very low levels, they are typically measured in milligauss (mG or 1/1,000th of a gauss).

Electrical systems can be either direct current (DC) or alternating current (AC). The electricity in wall sockets and power lines is alternating current. Direct current powers the MAX light rail system in Portland. The frequency of alternating current is measured in Hertz (Hz).

3.13.1 Existing Conditions

Effects Guidelines

There are no federal laws that limit exposure to electric or magnetic fields. Several agencies, such as the U.S. Food and Drug Administration, Department of Defense, and U.S. Environmental Protection Agency, have considered developing standards. The Federal Communications Commission (FCC) has recently adopted and enforces limits for exposure in the workplace and public areas for AM and FM radiofrequency radiation, television, and wireless sources. Schools, day care facilities, hospitals, senior living facilities, research facilities and universities are sensitive receptors to EMFs.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) in association with the American Conference of Governmental Industrial Hygienists (ACGIH) and the World Health Organization have developed voluntary occupational guidelines for EMF exposure. These guidelines are intended to prevent potential effects such as nerve stimulation or inducing currents in human cells (these effects have been shown to occur in higher frequency EMF than typically occurs in residences or occupations).

Exhibit 3.13-1 shows exposure guidelines that have been developed by ICNIRP and ACGIH. The values shown in the table may be exceeded for several minutes.

Exhibit 3.13-1
Exposure Guidelines for 60 Hz Electromagnetic Fields

Exposure at 60 Hz	Electric Field (kV/m)	Magnetic Field (mG)
International Commission on Non-Ionizing Radiation Protection		
Occupational	8.3	4,200
General Public	4.2	833
American Conference of Governmental Industrial Hygienists		
Occupational Exposure Should not Exceed	25	10,000
Prudence Dictates Use of Protective Clothing Above this Level	15	–
Exposure of Workers with Cardiac Pacemakers Should not Exceed this Level	1	1,000

Source: ICNIRP, 1998.
kV/m: kilovolts per meter.
mG: milligauss.

In Oregon, the electrical field exposure standard is 9 kilovolts per meter (kV/m) within the right-of-way of an electrical transmission line. Washington State has no standards relating to electric and magnetic field exposure.

Existing Electric and Magnetic Field Levels

Natural sources of electric and magnetic fields include the earth itself, which generates a weak magnetic field from currents flowing within the magma of the earth's core. Air turbulence and other atmospheric activity such as lightning can also create electric fields.[31]

The existing MAX light rail line uses a 750-volt direct current (DC) system to deliver power to the cars from the overhead electrical lines (catenary wires). Other elements of the light rail system—such as lighting, signals, and switches—use either alternating current (AC) or DC electricity for power. Generally, strong magnetic fields are not associated with operation of light rail. Measurements taken of the TriMet MAX system in Portland at distances of 10, 20, and 30 meters (about 32, 65, and 98 feet, respectively) from the MAX light rail track gave the results shown in Exhibit 3.13-2.

Exhibit 3.13-2
Magnetic Field Strength at Distance from MAX Light Rail Tracks (mG)

	10 Meters	20 Meters	30 Meters
Horizontal	167.0	44.6	13.3
Vertical	17.8	8.22	3.43

Source: Edelson and Holmstrom, 1998.

The highest measured values (167 milligauss [mG]) are well below the ICNIRP standard of 833 mG for general public exposure to magnetic

[31] WHO, 2005.

fields. The magnetic field strengths become less with increasing distance from the track.

Magnetic fields were measured on the MAX light rail system in 2007 and ranged from 107 to 601 mG at electrical substations, and from 47 to 551 mG at light rail stations. These field intensities are also below the general public exposure standards. Measurements at other light rail systems have produced similar results.

The existing light rail system exposes the general public and train operators to electric and magnetic fields at stations and inside the light rail cars. Magnetic field measurements taken inside the cars (between the Delta Park and Killingsworth stations) fluctuated between approximately 0.38 to 8.13 mG when measured at approximate seat height, indicating that EMF emissions are extremely low within the light rail vehicles.

3.13.2 Long-term Effects from Project Alternatives

The CRC alternatives with light rail (Alternatives 3 and 5) would be expected to have similar EMF levels to those measured on the existing MAX light rail system. Where people could be exposed (within and near the light rail right-of-way, near power substations, or in the light rail vehicles) EMF emissions would be below occupational exposure guidelines. While light rail transit would generate higher EMF intensities than bus rapid transit, none of the options or alternatives would pose substantial EMF exposure risks to human health. There would be lower exposure with the MOS options (C and D) than with the full length transit terminus options (A and B). However, because emissions would be below occupational exposure guidelines, these differences would not be substantial.

3.13.3 Long-term Effects from Project Components

None of the project components or various options that make up the project alternatives would be expected to pose substantial EMF exposure risks to human health. Where people would be exposed, EMF emissions would be expected to be below occupational exposure guidelines.

3.13.4 Potential Mitigation of Adverse Effects

The levels of anticipated EMF are below exposure standards for both the workplace and general public. Thus, mitigation would not be necessary. However, because MAX electric power substations tend to generate the highest EMF intensities in the field measurements, it may be prudent to locate these facilities away from sensitive receivers.

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3.14 Ecosystems

This section discusses how the project could affect plants and animals in the project area. It considers endangered and other protected species, common species, and nuisance species, such as invasive weeds. The discussion includes effects to the habitats that these species depend on, as well as potential direct effects to the fish, animals, or plants, including aspects of water quality and fill and construction activities within waters that relate directly to aquatic species. The information presented in this section is based on the Ecosystems Technical Report.

Section 3.16, Hydrology and Water Quality, focuses on issues such as how the project could affect stormwater, surface water, jurisdictional waters, temperature, and flooding. Section 3.15, Wetlands and Jurisdictional Waters, addresses how the project could affect wetlands as a result of altering the soil, hydrology, or plants in the wetlands and their buffers. It also addresses the direct effects of removing and adding materials, such as bridge piers or fill, to waterways such as the Columbia River.

Many federal, state, and local laws and regulations govern and protect terrestrial and aquatic habitats and the plants and animals that inhabit them. Although water quality, wetlands, and fish habitats are functionally linked, this DEIS separates their discussion into different sections of the document, because different laws, agencies, and permits must be addressed for each of these issues. Among those laws and regulations protecting species and their habitats are the federal and states' Endangered Species Acts (ESA), Magnuson-Stevens Fishery Conservation Management Act (MSFCMA), and local land use permitting. Compliance with the federal ESA and MSFCMA occurs through consultation with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS).

This project team has discussed potential impacts with these agencies based on current designs. Once a locally preferred alternative is selected, this project will continue coordination, and prepare a Biological Assessment for review by NMFS and USFWS. Approval of the project, including impact avoidance and minimization measures, would occur through the issuance of a Biological Opinion for those species and habitats that may be affected by the project. Both NMFS and USFWS may require that certain conservation measures and terms and conditions are met in order to provide clearance of the project. Compliance with the federal ESA suffices for compliance with the Oregon ESA. The Washington ESA has no formal ESA consultation process.

State and federal water quality standards and removal and fill activities within wetlands and waters are also regulated. Among these regulations that relate to plants and animals are the states' Section 401 Clean Water Act water quality certifications and Washington Department of Fish and

How can I learn more?

The Ecosystems Technical Report provides a detailed, technical discussion on the potential impacts of the project to habitats, plants, and animals.

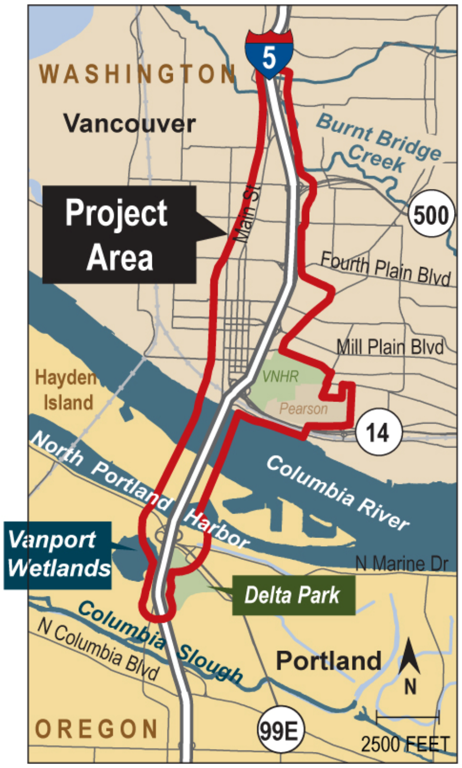
What laws apply to different species?

Federal, state and local laws and regulations that apply to various animals, plants and their habitats include:

- Federal and State Endangered Species Acts
- Magnuson-Stevens Fishery Conservation Management Act
- Bald Eagle and Golden Eagle Protection Act
- Marine Mammal Protection Act
- Migratory Bird Treaty Act
- Oregon Fish Passage Statute
- Washington Hydraulic Project Approval
- Sections 401 and 404 Clean Water Act
- Washington Priority Habitat and Species
- Washington Shoreline Management Act
- City of Portland Environmental Zones
- City of Vancouver Critical Areas Ordinance

Key laws and regulations are discussed in Sections 3.14 through 3.16 of this DEIS. For more detail, see the CRC Ecosystems Technical Report, Chapters 4 and 10.

Exhibit 3.14-1
Natural Resource Features in the Project Area



DIMENSIONS ARE APPROXIMATE.

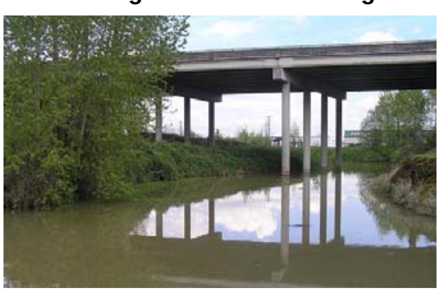
TERMS & DEFINITIONS
Fish Habitat Terms

Riffle – a shallow, fast-moving stream section with water broken by rocks and boulders

Glide – a section of stream with little or no turbulence

Pool – a deep, slow moving area with smooth water surface

Exhibit 3.14-2
I-5 Crossing the Columbia Slough



Wildlife's hydraulic project approval. Further discussions of these regulatory processes are located in their respective sections of this document.

3.14.1 Existing Conditions

Plants and animals depend on certain habitat conditions in order to survive. When discussing the effects that the project could have on fish, wildlife, and plants, it is important to consider the habitat where these species live. The CRC project includes proposed improvements along five miles of roadway, and crosses large and small bodies of water as well as densely-developed land and open space (Exhibit 3.14-1). This means that the potential habitats in the project area and the project's effects on them could vary widely. This section discusses the important habitat features on land and in the water in the project area, and then describes the protected, common, and nuisance species that live there.

Aquatic and Riparian Habitats

Major aquatic resources in the project area include (from south to north) the Columbia Slough, the Columbia River (both the North Portland Harbor channel on the south side of Hayden Island and the main channel on the north), and Burnt Bridge Creek. These aquatic habitats could be directly affected by the project from in-water construction work, construction near riparian areas, re-routing of stormwater drainage from the roadway and bridges, or permanent structures placed into or removed from these waterways.

This section describes the habitat found in these waterways and what aspects of that habitat are important to fish and wildlife. The Water Quality and Hydrology section of the DEIS provides more detailed information on the condition of the water in these rivers and streams, and the Wetlands section describes fill or removal activities that could take place in streams and rivers.

COLUMBIA SLOUGH

The Columbia Slough is located south of the project area. A portion of the slough can be seen in Exhibit 3.14-2. Habitat quality is compromised by high water temperature, high chemical and heavy metal levels, low oxygen levels, and presence of fecal coliform. Historic and modern land uses around the waterway have contributed to these issues, as industrial and stormwater discharges have increased pollutant and turbidity levels and decreased the oxygen available for fish. Vegetation clearing and lack of shading have increased temperatures above those preferred by native fish, and channel alterations and upstream dams have reduced the rate of flow, which has led to excess sedimentation.

Although still impaired, this waterway has shown improvement over the last ten years as habitat restoration, flow management, and source control measures have been implemented along its length. In the project area, levees with limited tree cover line the banks, resulting in low-quality riparian habitat. Near the project, the Columbia Slough provides glide habitat for fish. The City of Portland and the Metro regional government have designated the slough, its riparian zones, and associated remnant sloughs and ponds (including Vanport Wetlands) as special habitat areas, as discussed further in the Terrestrial Habitats section below. There are no fish passage barriers between I-5 and the slough's outlet to the Willamette River. Its flow and surface level is affected by tides and upstream dams, pumps, and outfalls. The existing roadway and transit overpasses provide a small area of shading in the slough.

COLUMBIA RIVER

The Columbia River and its tributaries are the dominant aquatic system in the Pacific Northwest. In the project area, river height and flow rate are influenced by tides and upstream dams. Developed uses of the river include commercial transport, power generation, irrigation, and recreation. Washington, Vancouver, Portland, and Metro have all designated the Columbia River and its shoreline as special environmental zones.

Exhibit 3.14-3
Columbia River Main Channel and I-5 Bridges

Because the project is within a developed area, riparian habitat quality along both the north and south banks of the Columbia River is poor (see Exhibit 3.14-3). Dikes and levees, particularly when reinforced with rip rap or concrete as is the case near the crossing, make poor quality riparian habitat. The river in this area offers glide habitat for fish, with primarily sandy substrate. Water quality is limited by elevated temperatures, industrial and agricultural chemicals, arsenic, and dissolved copper. The average depth near the project is about 27 feet. The main channel is dredged to a depth of about 40 feet to allow ships to pass, and levees or dikes have been built along the banks in many areas to provide flood control. Hydroelectric dams upstream impound water, raising its temperature, making fish passage more difficult, and creating bottlenecks where predators have access to migrating salmon.

Exhibit 3.14-4
North Portland Harbor Channel and I-5

The North Portland Harbor channel, on the south side of Hayden Island, supports several floating home communities and commercial and recreational moorages (see Exhibit 3.14-4). Average depth in this channel is about 14 feet, with deeper water on the south side. The south shore supports active industrial uses. Piers and moorages line the shore, providing very low quality riparian habitat. Piers and floating homes provide shade and refuge for both predatory fish and juvenile salmon. Utility lines on the piers and a large number of parked vessels increase the likelihood that hazardous materials could leak or spill into the aquatic habitats here. Glide habitat is available in North Portland Harbor. The City of Portland and Metro have designated North Portland Harbor as an environmental protection zone and high-value riparian habitat area, respectively.

The I-5 crossing influences aquatic habitat conditions in the main channel and North Portland Harbor. Bridge piers in the river provide refuge from the current for both predatory fish and juvenile salmon. Fish are attracted by shading under the pile caps and interruptions in the current provided by the in-water structures. Attractants such as bridge piers may increase predation rates on juvenile salmon.[33] The bridge decks also provide some shading to the water, although it is not measurable in terms of habitat quality. Untreated stormwater runoff

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[33] Pribyl et al., 2004.

discharges to the river from the bridge, incrementally impacting its water quality.

BURNT BRIDGE CREEK

Exhibit 3.14-5
Burnt Bridge Creek

At the northern end of the project area, Burnt Bridge Creek provides glide, riffle, and pool habitat for fish, accommodating most of their lifecycle habitat needs. Depths range between several inches and several feet. There are no barriers to fish passage in the creek. In-water habitat is warmer than recommended for native fish. A recreational trail provides access to many parts of the stream.

Just north of the project area, Burnt Bridge Creek crosses under I-5 in a large culvert, interrupting the generally good quality riparian habitat in this section. Near I-5, the creek occupies a narrow forested ravine (see Exhibit 3.14-5) which has been designated as a Riparian Habitat Conservation Area by the Washington Department of Fish and Wildlife and City of Vancouver. This habitat is likely to support species of interest such as various migratory birds, songbirds, and native turtles.

Terrestrial Habitats

Historically, the project area was forested, with forested wetlands on the Oregon shore and Hayden Island, and forested uplands on the Washington side. The Oregon shore was part of a large floodplain wetland system and included many sloughs, back channels, and small or seasonal lakes. In the immediate project area, land was converted to agricultural use such as pasturage, and more recently to commercial, recreational, and residential uses. Urban development began in the Vancouver area in the mid-19th century, and supports commercial, industrial, residential, and recreational development today. Urban development has substantially degraded habitat in all parts of the project area, particularly for land-based species.

Exhibit 3.14-6 shows the amount of different habitat types within the project area.[34] As shown, by far the largest amount of land is occupied by urban habitats. Open water also makes up a substantial amount of habitat in the project area, as this classification includes the Columbia River and North Portland Harbor. Less than five percent of the project area is classified as either wetland or forest habitat, with most of this occurring as small patches isolated from other natural areas.

[34] Habitat classifications are based on Johnson and O'Neil, 2001.

Exhibit 3.14-6
Habitat Types in the Project Area

Habitat Classifications	Acres in the Project Area
Urban and Mixed Environs	1059.4
Lakes, Rivers, Ponds, and Reservoirs	251.4
Westside Riparian Wetlands	29.2
Westside Lowland Conifer-Hardwood Forest	20.8
Herbaceous Wetlands	15.5
Total	**1376.3**

Source: CRC Ecosystems Technical Report

Exhibit 3.14-7
Locally Designated Priority Habitats

Habitat Classifications[a]	Acres in the Project Area
Washington Priority Habitats	188.1
Vancouver Critical Areas	242.1
Metro Goal 5	483.04
City of Portland Environmental Zones (E-zones)	242.52

Source: CRC Ecosystems Technical Report.
[a] These habitats overlap and cannot be totaled.

Both state and local jurisdictions have designated certain habitats as being of high priority for their habitat or ecological value, requiring land use permitting processes if impacted. Exhibit 3.14-7 shows the amount of land of each priority type within the project area. Note that these amounts overlap. For example, the open water habitat of the Columbia River is located within a Washington priority habitat, a Portland environmental zone (E-zone), and a Goal 5 habitat for Metro. The Ecosystems Technical Report, included as an electronic appendix to this DEIS, provides more detail on each habitat classification.

Terrestrial wildlife habitat occurs in the project area in city parks, managed wetlands, riparian areas, and small pockets of woodland. However, urban industrial, commercial, recreational, and residential development occupies most of the land around the CRC project. The north and south ends of the project come closest to relatively large or intact habitat areas, adjoining Vanport Wetlands on the south and the Burnt Bridge Creek Greenway on the north.

URBAN AND MIXED ENVIRONS

A densely developed urban environment does not necessarily exclude wildlife from the area. Bridges are used as habitats by some species such as raptors and swallows. These species typically prefer nesting/denning sites on tall structures (or trees and cliffs, where available) near open water and can nest and breed successfully on bridges or other structures. The superstructure of the existing bridge is good breeding habitat for certain raptors, and the bridge underside and piers provide good potential habitat for swallows.

Interstate 5 serves as an important barrier to wildlife passage for land-based species. Underpasses and stream crossings provide for some connectivity, but these are not well-suited to wildlife. Although there are some natural areas near I-5 (Vanport Wetlands to the south, Burnt Bridge Creek to the north), the existing corridor does not cross or divide these habitats in the project area.

WETLANDS

The Wetlands and Jurisdictional Waters section of this DEIS discusses wetland habitats in the project area in detail. This section focuses on their value to fish, wildlife, and rare plants.

Several wetlands are located in the project area in Oregon. In the project area, Walker Slough, Schmeer Slough, a small wetland between Expo Road and the MAX rail line, and several roadside drainage ditches offer small patches of wetland habitat. They are connected by culverts to other wetlands or streams, but have barriers to fish passage. Noxious weeds are pervasive in each, making them of low-quality habitat for rare or protected plant species. These ditches and swales could offer habitat for waterfowl and other migratory birds.

The Vanport Wetlands supports a variety of habitats appealing to birds and terrestrial species. Culverts, pipes, and pump stations present barriers to fish passage. West of the project area, a wildlife corridor with few developed interruptions connects this wetland to other large remnants of the floodplain wetland system, increasing its value to wildlife that need larger areas of habitat. Large numbers of ducks, geese, swallows, and other migrating birds use this habitat. Although noxious weeds are present in the wetland, it is actively managed for habitat value and has the potential to support rare plant species, although none have been documented there.

In Washington, a wetland complex adjoins Burnt Bridge Creek. Although much smaller than the Vanport site, these offer relatively high value habitat because they are connected to a forested riparian corridor, contain open water, grassland, and forested sections that appeal to many birds and bats, and connect with Burnt Bridge Creek during high water, providing backwater habitat for fish.

FOREST

Small patches of forested area can be found near the Interstate, totaling less than 21 acres between Victory Avenue and SR 500. The largest patches are located at the north end of the project area near Kiggins Bowl and Burnt Bridge Creek, where they have grown on steep slopes that were never developed. Because they are small and isolated from each other, they do not provide good habitat for larger terrestrial species, but many birds utilize forested patches in urban areas for nesting.

Plants and Animals

This section describes the protected, common, and nuisance species that can be found in the project area, and how the project could affect them and the habitats they depend on. Lists of species described here are not intended to be exhaustive; other protected, common, and nuisance species could occur in the project area.

Many different laws and regulations concern the treatment of certain fish, wildlife, and plant species. At a national level, the Endangered Species Act lists endangered and threatened species that receive special protection both for individual animals or plants and for their critical habitats. Both Oregon and Washington also maintain similar lists of endangered or threatened species that carry protections at a state level.

Other laws protect certain species even when they may not be endangered or threatened. For example, migratory birds cannot have their nests disturbed when eggs or nestling birds may be present. States track populations of rare plants and discourage activities that could harm them. The project examined the possible effects the alternatives could have on these protected species and the habitats they depend on.

The CRC team solicited input from regional Native American tribes on several occasions to determine which plants and animals are of important cultural significance as traditional food, craft, and medicinal sources. The species identified include wapato, cattail, camas, salmon, smelt (eulachon), lamprey, and others. These species are found in some of the aquatic and wetland habitats in the project area.

Many common animals have adapted to urban and suburban settings like the project area. They may not be specifically protected by conservation laws, but project staff looked for their presence in the project area and analyzed the effects the alternatives could have on them.

State and local regulations actively discourage the presence or introduction of certain species. These are often termed nuisance species, and plants may be considered invasive or noxious weeds. These species generally aggressively harm or replace native plants, animals, or crops and can be very difficult to remove once they establish a foothold. Studies for this DEIS examined how the project might affect the presence or spread of noxious species in the project area.

PROTECTED SPECIES

Certain animal or plant species have special legal protection because their populations have declined substantially from historic levels, and their survival as a species may be at risk. These species may be listed under the federal or states' Endangered Species Acts (ESA). In addition, species may be listed as sensitive or as species of concern, which offers limited protective regulations above those in place from other laws and regulations.

Bald eagles were taken off the federal ESA list in August 2007, but are still listed as threatened under Oregon and Washington state ESAs. Bald eagles use the Columbia River and environs to forage for fish and duck, but no nesting or breeding sites are known within one mile of the project. They are protected under the Bald Eagle and Golden Eagle Protection Act and Migratory Bird Treaty Act. Peregrine falcons were taken off the federal ESA list in 1999, but were listed as threatened under the Oregon ESA until March 2007. They are protected under the Migratory Bird Treaty Act. Peregrine falcons utilize the existing bridge structure year-round.

The project area is located in the Pacific flyway, the major north-south route for migratory birds that extends from Patagonia to Alaska. Many migratory birds such as geese, ducks, and swallows use the area for resting, feeding, and breeding.

Protected fish and habitats that they depend on are present or potentially present in all aquatic resources in the project area. The Columbia River and North Portland Harbor are known to support listed anadromous salmonids, including Chinook salmon, chum salmon (*O. keta*), sockeye salmon, steelhead trout, and coho salmon. Habitat use for these species is primarily migration, holding, and rearing. Chum salmon are known to spawn in the Columbia River upstream of the project area, near the mouth of Camas Creek.[35]

Bull trout are federally threatened and have been documented overwintering and feeding in the Lower Columbia River at very low abundance. The Bull Trout Lower Columbia Recovery Team considers the mainstem Columbia to contain core habitat necessary for full recovery of the species.[36]

The National Marine Fisheries Service (NMFS) has determined that the southern distinct population segment (DPS) of green sturgeon may occur in Washington coastal waters.[37] Northern and southern DPSs were delineated in 2003; in 2006, the southern DPS was listed as threatened, while the northern DPS was classified as a species of concern. Southern green sturgeon spawn in the Sacramento River, California, while northern green sturgeon spawn in the Klamath and Rogue Rivers. Genetic and tagging data indicate that the stocks commingle in the Columbia River estuary during the summer as sub-adults and adults.

Northern (Steller) sea lions are listed as threatened under the federal ESA as well as by both Oregon and Washington. California sea lions are not listed under the ESA, but like the Steller sea lions, they are protected under the Marine Mammal Protection Act (MMPA).

Species of concern that occur in the project area include cutthroat trout, Pacific and river lamprey, and the northern DPS of green sturgeon.

Exhibit 3.14-8 summarizes the protected aquatic species known to use or potentially be using waterways in the CRC project area, including Northern sea lions, as well as fish.

During 2005 and 2006, the CRC project team conducted field surveys for rare plants where construction might occur. No state or federally listed or proposed plants were found. In Oregon two rare plants (bristly sedge and Columbian watermeal) are reported historically within two miles of the project. In Washington, the rare plants tall bugbane and small-flowered trillium are reported to occur within two miles of the project. Five other rare plants (Torrey’s peavine, diffuse montia, western yellow oxalis, Idaho gooseberry, and snapdragon skullcap) occurred historically in the

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[35] B. Meyer, NMFS, personal communication.

[36] USFWS, 2002.

[37] NMFS, 2007.

project area in Washington, although no current populations have been found. None of the historic rare plant populations occurred in the project construction footprint where direct impacts are likely to occur.

Coordination with the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), Washington (WDFW) and Oregon Departments of Fish and Wildlife (ODFW), among others, has been occurring through the regular meetings of the CRC Interstate Collaborative Environmental Process (InterCEP) group. Presence of and effects to the species and habitats in the project area are regularly discussed at these meetings. Potential effects to these species, based on current project designs, are discussed below. They will be further addressed as project planning continues and through other regulatory processes such as Section 7 ESA consultations, the Fish and Wildlife Coordination Act, and WDFW's hydraulic project approval.

Exhibit 3.14-8
Protected Aquatic Species Found in the CRC Project Area

Common Name *Scientific Name* ESU/DPS[a] (Where Appropriate)	Federal Status	OR Status	WA Status	Presence Confirmed	Habitat Used
Chinook salmon *Oncorhynchus tshawytscha*					
Lower Columbia River ESU[b,c]	threatened	sensitive critical	candidate	yes	migrating/holding
Upper Columbia River-Spring Run[b,c]	endangered	N/A	candidate	yes	migrating/holding
Snake River Fall-Run[c]	threatened	threatened	candidate	yes	migrating/holding
Snake River Spring/Summer-Run[c]	threatened	threatened	candidate	yes	migrating/holding
Steelhead trout *Oncorhynchus mykiss*					
Lower Columbia River DPS[b]	threatened	sensitive critical	candidate	yes	migrating/holding
Middle Columbia River[b]	threatened	sensitive critical	candidate	yes	migrating/holding
Upper Columbia River[b]	endangered	N/A	candidate	yes	migrating/holding
Snake River Basin[b]	threatened	sensitive vulnerable	candidate	yes	migrating/holding
Sockeye salmon *Oncorhynchus nerka* Snake River	endangered	none	candidate	yes	migrating/holding
Coho salmon *Oncorhynchus kisutch* Lower Columbia River[c]	threatened	endangered	none	yes	migrating/holding
Chum salmon *Oncorhynchus keta* Columbia River ESU[b]	threatened	sensitive critical	candidate	yes	migrating/holding
Coastal cutthroat trout *Oncorhynchus clarki clarki* Southwestern Washington/Columbia River	species of concern	sensitive critical	N/A	yes	unknown
Bull trout *Salvelinus confluentus* Columbia River DPS	threatened	sensitive critical	candidate	yes	unknown; potentially overwintering and feeding
Pacific lamprey *Lampetra tridentata*	species of concern	sensitive vulnerable	N/A	yes	unknown
River lamprey *Lampetra ayresi*	species of concern	none	candidate	no	unknown
Green sturgeon *Acipenser medirostris* Northern DPS	species of concern	none	N/A	no	unknown
Southern DPS	threatened	none	N/A	no	unknown
Northern (Steller) sea lion *Eumetopias jubatus*	threatened	threatened	threatened	yes	feeding, resting
California sea lion *Zalophus californianus*	protected (MMPA)[d]	none	none	yes	feeding, resting

Source: Streamnet 2008, USFWS 2008.

[a] ESU: Evolutionarily Significant Unit DPS: Distinct Population Segment.

[b] Critical Habitat present.

[c] Essential Fish Habitat present.

[d] MMPA: Marine Mammal Protection Act.

COMMON SPECIES

Common animals found in the project area include rock doves, crows, European starlings, sparrows, Canada geese, wood ducks, and other urban-adapted birds; deer, raccoons, rabbits, nutria, coyotes, and garter snakes; and trout, sculpin, minnows, shellfish, great blue herons, toads, turtles, and frogs in waterways and wetlands. Salmon and other aquatic species eat smaller aquatic organisms in the project area such as adult and larval insects, sand shrimp, crabs, and zooplankton.

Wapato and cattail, herbaceous wetland plants with important cultural significance as traditional food and medicinal sources for several Native American tribes, occur in wetlands in the project area, including Vanport Wetlands, Schmeer Slough, and Burnt Bridge Creek Wetlands. Smelt and other important traditional fish resources are found in the Columbia Slough and Columbia River, and may occur in Burnt Bridge Creek, although their presence has not been documented.

NUISANCE SPECIES

Noxious weeds grow throughout the project area within most vegetated areas that are not regularly maintained. Exhibit 3.14-9 lists plants that can overrun native species and degrade habitat in the CRC project area.

Exhibit 3.14-9
Noxious Weeds Found in the Project Area

Botanical Name	Common Name	OR Status[a]	WA Status[b]
Agropyron repens	Quackgrass	B	N/A
Centaurea pratensis	Meadow knapweed	B	B
Cirsium arvense	Canada thistle	B	C
Cirsium vulgare	Bull thistle	B	C
Clematis vitalba	Old man's beard	B	C
Conium maculatum	Poison hemlock	B	C
Convolvulus arvensis	Field bindweed	B	C
Cytisus scoparius	Scot's broom	B	B
Daucus carota	Wild carrot	N/A	B
Geranium robertianum	Herb-Robert's	N/A	B
Hedera helix	English ivy	B	C
Hypericum perforatum	St. John's wort	B	C
Phalaris arundinacea	Reed canarygrass	N/A	C
Polygonum cuspidatum	Japanese knotweed	B	B
Rubus discolor	Himalayan blackberry	B	N/A
Verbascum thapsis	Common mullein	N/A	Monitor

Source: CRC Ecosystems Technical Report.

[a] In Oregon, Class B weeds are non-native plants that have economic impacts and are known to have established footholds within the state.

[b] In Washington, Class B weeds have limited footholds in the state and control is required where possible. Class C weeds are widely established and control requirements may vary by local jurisdiction.

States do not generally keep lists of nuisance animal species, but several non-native animals that harm native species and tend to proliferate are present near the bridge. These include European starlings, which can compete for food and destroy the nests of native songbirds; bullfrogs and carp, which prey on young amphibians and fish; and nutria, a water-dwelling South American rodent that competes with native beaver and otters.

3.14.2 Long-term Effects of the Project Alternatives

Long-term effects to aquatic habitats would occur from bridge piers in the water and pollutants from the roadway or transit facilities entering aquatic habitats. The effects from each alternative are described below.

The project alternatives are not likely to have adverse effects on plant species of cultural importance to Native Americans. None of the wetlands containing traditional plant resources would be impacted, as described in Section 3.15, Wetlands and Jurisdictional Waters. None of the alternatives are likely to have long-term effects on rare plants or nuisance plant and animal species.

Long-term effects to terrestrial habitats from the project could include vegetation removal, grading, filling, or paving land, or building structures on land. The differences between the alternatives would be very small.

Alternative 1: No-Build

Existing conditions include the release of untreated stormwater runoff from I-5 and the I-5 crossing to the Columbia River. This would continue under the No-Build Alternative, and the pollutant load in the stormwater would likely increase. The existing bridge and roadway alignment overlays locally and regionally designated habitats. For example, the current condition encroaches upon 35.4 acres of Washington Priority Habitats, 79.8 acres of City of Vancouver Critical Areas, 72.1 acres of Metro-designated Goal 5 habitat, and 30.4 acres of City of Portland E-zone. The bridge structure used by peregrine falcons would remain. Traffic congestion is likely to worsen, adding to noise and water quality concerns. Lift-span operation and congestion have been linked to a high rate of vehicle collisions, as described in the Traffic section of this DEIS. Collisions can increase the risk of leaks or spills of hazardous materials reaching aquatic habitats. In the long term, these effects could negatively affect fish, wildlife, and their habitats.

The No-Build Alternative could have benefits over the build alternatives for habitats in the Columbia Slough and Burnt Bridge Creek. Interchange and transit construction would increase paved area and runoff loads for Burnt Bridge Creek. In addition, new roadway runoff from the I-5 crossing would not be sent to the Columbia Slough drainage, which is one of the stormwater management options being considered with the build alternatives.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Long-term ecosystem impacts are summarized in Exhibit 3.14-10, and shows both overall impacts and net increases in impact area for locally and regionally designated habitats.

Exhibit 3.14-10
Summary of Ecosystem Impacts for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric[a]	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Columbia River aquatic habitat	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.
	STHB has most improvement – slightly less fill in Columbia River. Same treatment as three-bridge option			
Columbia Slough aquatic habitat	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.
Burnt Bridge Creek aquatic habitat	<200 sq. ft of buffer directly impacted.	<200 sq. ft of buffer directly impacted.	<200 sq. ft of buffer directly impacted.	<200 sq. ft of buffer directly impacted.
Fish predation	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.
	Benefit. STHB design would have fewest piers in the water.			
Peregrine Habitat	Existing habitat would be removed.	Existing habitat would be removed.	Existing habitat would be removed.	Existing habitat would be removed.
Washington Priority Habitat impacted (total acres [net acres])[b]	45.8 [10.4] 44.0 [8.6]	45.7 [10.3] 43.9 [8.5]	45.7 [10.3] 43.9 [8.5]	45.7 [10.3] 43.9 [8.5]
City of Vancouver Critical Areas impacted (total acres [net acres])[b]	90.2 [10.4] 85.8 [6.0]	89.3 [9.5] 84.9 [5.1]	89.3 [9.5] 84.9 [5.1]	89.3 [9.5] 84.9[5.1]
Metro Goal 5 lands impacted (total acres [net acres])[b]	112.2 [40.1] 109.2 [37.1]	112.2 [40.1] 109.2 [37.1]	112.2 [40.1] 109.2 [37.1]	112.2 [40.1] 109.2 [37.1]
City of Portland E-zone impacted (total acres [net acres])[b]	43.5 [10.1] 41.9 [8.5]	43.5 [10.1] 41.9 [8.5]	43.5 [10.1] 41.9 [8.5]	43.5 [10.1] 41.9 [8.5]

Source: CRC Ecosystems Technical Report.

a Values for the replacement design and the stacked transit/highway bridge (STHB) design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

b Acreages shown first are total impacts including existing impacts, values in brackets is the increase in impacted areas relative to existing impacts.

Alternative 2 would have six piers for each bridge (totaling 18 piers), in the Columbia River. The stacked transit/highway bridge (STHB) would also have six piers per bridge in the Columbia River (totaling 12 piers), and slightly less volume and area in the river. Piers, particularly in water less than 20 feet deep, attract fish and may lead to an increase in predation rates on juvenile salmon.[38] Fewer piers would result in less shading and water flow interruptions, which could result in less predation on juvenile salmon (many of which are protected under the federal ESA and are of cultural importance to Native Americans).

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[38] Pribyl et al., 2004.

on juvenile salmon (many of which are protected under the federal ESA and are of cultural importance to Native Americans).

Although the Columbia Slough would not be directly impacted by the build alternatives, additional treated stormwater is proposed to drain to this waterway. The overall pollutant loading for the project area is likely to decrease. Further discussion of pollutant loading is discussed in the Hydrology and Water Quality section of this document. The STHB design may result in slightly less pollutant loading in the Columbia Slough and the project overall due to the decrease in new surfaces that would need to be treated.

Impacts to Burnt Bridge Creek are anticipated to occur as a result of construction activities within the Priority Habitat overlay. The Lincoln terminus and MOS designs would impact approximately 1.25 acres within this area, due primarily to existing infrastructure already present in the overlay. The Kiggins Bowl terminus option would have approximately 1.3 acres of impact in this area (a net increase of 0.05 acre) as a result of the new guideway to Kiggins Bowl.

Project design, construction, and conservation measures will be part of the ESA consultation with NMFS and USFWS as project planning continues. Adverse effects to protected plants and terrestrial wildlife species are not anticipated at this time, with the exception of peregrine falcons that utilize the existing bridge. The new bridge design will likely not include towers or other large structures above the roadway deck and may not provide suitable habitat for these birds. Without suitable mitigation, the falcons could leave the area.

City of Portland E-zones, City of Vancouver Critical Areas, Washington Priority Habitats, and Metro-identified Goal 5 areas would be impacted by Alternative 2. Total impacts vary depending on terminus option, Marine Drive interchange design, and whether STHB is proposed. Impacts occur near Burnt Bridge Creek, the Columbia River and North Portland Harbor, and near the Expo Center. Overall, net impacts (those impacts from proposed designs relative to existing impacts) show a relatively slight increase. For example, the Kiggins Bowl terminus would impact a total of 45.8 acres of Priority Habitat, resulting in a net increase of 10.4 acres of impacted habitat. The majority of this impact is related to the bridges over the Columbia River. The implementation of the STHB would decrease the total impact to Priority Habitats for the Kiggins Bowl terminus to 44.0 acres, and net increase of 8.6 acres. The other terminus options with STHB show similar reductions in total and net impacts for the locally designated habitats. In addition, the Lincoln terminus and MOS designs would impact approximately 0.05 acre less Priority Habitat near Burnt Bridge Creek because the guideway east of the highway would not be constructed.

Alternative 3: Replacement Crossing with Light Rail

Alternative 3 would have the same impacts for ecosystem resources as Alternative 2 (Exhibit 3.14-11), with the exception that light rail would require approximately 1 acre less new paved surface at the Expo Center transit station, resulting in approximately 0.5 acre less impact to a City of Portland E-zone.

Exhibit 3.14-11
Summary of Ecosystem Impacts for Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit				
Environmental Metric[a]	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Columbia River aquatic habitat	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.	Second most improvement. Least untreated runoff would enter aquatic habitats.
	Most improvement – STHB has slightly less fill in Columbia River. Same treatment as three-bridge option.			
Columbia Slough aquatic habitat	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.
Burnt Bridge Creek aquatic habitat	<200 sq. ft of buffer directly impacted.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.
Peregrine Habitat	Existing habitat would be removed.	Existing habitat would be removed.	Existing habitat would be removed.	Existing habitat would be removed.
Fish predation	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.	Benefit. Design would have fewer piers in the water.
	Benefit. STHB design would have fewest piers in the water.			
Washington Priority Habitat impacted (total acres [net acres])[b]	45.8 [10.4] 44.0 [8.6]	45.7 [10.3] 43.9 [8.5]	45.7 [10.3] 43.9 [8.5]	45.7 [10.3] 43.9 [8.5]
City of Vancouver Critical Areas impacted (total acres [net acres])[b]	90.2 [10.4] 85.8 [6.0]	89.3 [9.5] 84.9 [5.1]	89.3 [9.5] 84.9 [5.1]	89.3 [9.5] 84.9 [5.1]
Metro Goal 5 lands impacted (total acres [net acres])[b]	112.2 [40.1] 109.2 [37.1]	112.2 [40.1] 109.2 [37.1]	112.2 [40.1] 109.2 [37.1]	112.2 [40.1] 109.2 [37.1]
City of Portland E-zone impacted (total acres [net acres])[b]	43.0 [9.6] 41.4 [8.0]	43.0 [9.6] 41.4 [8.0]	43.0 [9.6] 41.4 [8.0]	43.0 [9.6] 41.4 [8.0]

Source: CRC Ecosystems Technical Report.

a Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

b Acreages shown first are total impacts including existing impacts, values in brackets is the increase in impacted areas relative to existing impacts.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Long-term ecosystem impacts for Alternative 4 are summarized in Exhibit 3.14-12.

Exhibit 3.14-12
Summary of Ecosystem Impacts for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric[a]	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Columbia River aquatic habitat	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.
Columbia Slough aquatic habitat	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.
Burnt Bridge Creek aquatic habitat	<200 sq. ft of buffer directly impacted.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.
Peregrine Habitat	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.
Fish predation	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.
Washington Priority Habitat impacted (total acres [net acres])[b]	41.0 [5.6]	40.8 [5.4]	40.8 [5.4]	40.8 [5.4]
City of Vancouver Critical 1 Areas impacted (total acres [net acres])b	85.4 [5.8]	85.0 [5.4]	85.0 [5.4]	85.0 [5.4]
Metro Goal 5 lands impacted (total acres [net acres])[b]	105.3 [33.2]	105.3 [33.2]	105.3 [33.2]	105.3 [33.2]
City of Portland E-zone impacted (total acres [net acres])[b]	42.0 [11.6]	42.0 [11.6]	42.0 [11.6]	42.0 [11.6]

Source: CRC Ecosystems Technical Report.

a Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

b Acreages shown first are total impacts including existing impacts, values in brackets is the increase in impacted areas relative to existing impacts.

Alternative 4 would have the same impacts as Alternative 2, with a few exceptions. Alternative 4 would include retrofitting the ten piers of the existing bridges, increasing their area by a total of 0.5 acre and their volume by a total of approximately 3,800 cubic yards. In addition, the supplemental bridge would consist of six additional piers, adding approximately 1.14 acres in area and approximately 33,000 cubic yards in volume.

The overall pollutant loading for the project area is likely to decrease, but the ability to treat all the stormwater from the existing bridges is limited.

Further discussion of pollutant loading is discussed in the Hydrology and Water Quality section of this document.

With all the build alternatives, project design, construction, and conservation measures will be part of the formal ESA/EFH consultation and MMPA permitting with NMFS and USFWS as project planning continues. Adverse effects to protected plants and terrestrial wildlife species are not anticipated at this time, with the exception of peregrine falcons that utilize the existing bridge. The supplemental bridge design would retain the towers and other large structures, but disturbance from construction would likely occur.

City of Portland environmental overlay zones, City of Vancouver Critical Areas, Washington Priority Habitats, and Metro-identified Goal 5 areas would be impacted by Alternative 4. Total impacts vary slightly depending on terminus option. Impacts occur near Burnt Bridge Creek, the Columbia River and North Portland Harbor, and near the Expo Center. Overall, net impacts (those impacts from proposed designs relative to existing impacts) show a relatively slight increase. For example, the Kiggins Bowl terminus option would impact a total of 41.0 acres of Priority Habitat, resulting in a net increase of 5.6 acres of impacted habitat. The majority of this impact is related to the bridges over the Columbia River. The other terminus options would impact approximately 0.2 acre less Priority Habitat and 0.4 acres of Critical Area near Burnt Bridge Creek because the guideway east of the highway would not be constructed.

Alternative 5: Supplemental Crossing with Light Rail

Long-term ecosystem impacts for Alternative 5 are summarized in Exhibit 3.14-13.

Exhibit 3.14-13
Summary of Ecosystem Impacts for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit				
Environmental Metric[a]	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Columbia River aquatic habitat	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.	Some improvement. Less untreated runoff would enter aquatic habitats.
Columbia Slough aquatic habitat	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.	Additional treated stormwater would enter system.
Burnt Bridge Creek aquatic habitat	<200 sq. ft of buffer directly impacted.	No impacts anticipated.	No impacts anticipated.	No impacts anticipated.
Peregrine Habitat	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.	Existing habitat would be disturbed for several years.
Fish predation	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.	Adverse. Design would keep existing piers and add new ones.
Washington Priority Habitat impacted (total acres [net acres])[b]	41.0 [5.6]	40.8 [5.4]	40.8 [5.4]	40.8 [5.4]
City of Vancouver Critical 1 Areas impacted (total acres [net acres])[b]	85.4 [5.8]	85.0 [5.4]	85.0 [5.4]	85.0 [5.4]
Metro Goal 5 lands impacted (total acres [net acres])[b]	105.3 [33.2]	105.3 [33.2]	105.3 [33.2]	105.3 [33.2]
City of Portland E-zone impacted (total acres [net acres])[b]	41.5 [11.5]	41.5 [11.1]	41.5 [11.1]	41.5 [11.1]

Source: CRC Ecosystems Technical Report.

[a] Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

[b] Acreages shown first are total impacts including existing impacts, values in brackets is the increase in impacted areas relative to existing impacts.

Alternative 5 would have the same impacts for ecosystem resources as Alternative 4, with the exception that light rail would require approximately 1 acre less new paved surface at the Expo Center transit station, resulting in approximately 0.5 acre less impact to a City of Portland E-zone.

3.14.3 Long-term Effects of Project Components

Certain project components differ only slightly in their effects on ecosystem resources, and are not considered here. These include interchange options, pedestrian and bicycle facilities, transit operations options, tolling scenarios, and transportation system/demand management options.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The replacement crossing would have six piers per bridge in the Columbia River, and the supplemental crossing would have six piers for the supplemental bridge and retain the ten piers from the existing bridges. More of the piers for the supplemental crossing would be located in water less than 20 feet deep, where fish are more likely to congregate and piers can contribute to increased predation on juvenile salmon. Reduction in total and shallow-water piers for the replacement crossing would be an improvement over existing, No-Build, and supplemental crossing conditions.

The stacked transit/highway bridge option for the replacement crossing would further reduce the number of piers in the river over existing, supplemental, or standard-design replacement crossings. This option would put approximately 18 percent less structure in the water, assuming 96-inch vertical piles are used to support the piers. It may, however, result in additional smaller piers in shallow-water habitat near the south shore of the Columbia River main channel, which could negatively impact fish.

Realigning Marine Drive south of the Expo Center would impact the Vanport wetland, which is a mitigation site owned and maintained by the Port of Portland. Construction would impact approximately 0.48 acres of wetland and 1.58 acres of E-zone. Two piers would be placed in the wetland, both approximately 10 ft in diameter, causing a direct impact of 0.003 acre. Long-term effects on vegetation (mature cottonwood trees) below the alignment in the Vanport and Expo Center wetlands cannot be quantified due to the preliminary design of this option. The diagonal realignment of Marine Drive would not impact the Vanport wetland or its associated E-zone, and would impact approximately the same area of the Expo Center wetland and its E-zone as the standard Marine Drive alignment.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Light rail is likely to generate slightly lower pollutant loads to stormwater runoff than bus rapid transit, which would benefit aquatic habitats and sensitive aquatic species. Light rail vehicles do not carry fuel on board, lessening the potential for spills and leaks of petroleum related to transit vehicles. The light rail braking system does not use copper brake pads, which would reduce the transit contribution of copper in stormwater runoff.

Bus rapid transit would require adding approximately 1 acre more new paved surface at the Expo Center transit station for a turn-around area.

This could have an adverse effect on habitat and water quality in this area, compared to light rail.

Bus rapid transit could potentially require expanding the C-TRAN bus maintenance facility in east Vancouver at 65th Avenue. Vegetative cover at this facility consists of residential/commercial lawn and trees, and agriculture. No threatened, endangered, or sensitive species or species of interest likely occur in the area. Expansion of the facility would result in the removal of lawn, approximately fifty immature broadleaf trees, and approximately ten mature broadleaf trees. In addition, expansion would convert pervious surfaces to impervious, requiring integration of stormwater controls.

Likewise, light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. Vegetative cover at the Ruby Junction maintenance facility consists of developed land (no vegetation), with small portions of residential lawn and mature trees. No threatened, endangered, or sensitive species or species of interest likely occur in the area. Expansion of the facility would result in the removal of lawn and approximately two dozen conifers and broadleaf trees. In addition, the expansion would convert pervious surfaces to impervious, requiring integration of stormwater controls.

Transit Terminus Options (with all Alternatives)

With the exception of the riparian buffer of Burnt Bridge Creek, the Kiggins Bowl and Lincoln terminus options would have no other appreciable differences in impacts to ecosystems resources, as the same routes and options are allowable for either south of the Mill Plain area. Therefore this section addresses the differences in Northern Vancouver, where the two options would diverge. The Kiggins Bowl terminus would have a greater effect in this area than the Lincoln terminus, impacting approximately 1.3 acres of Washington Priority Habitat near Burnt Bridge Creek, while The Lincoln terminus would affect approximately 1.25 acres of Priority Habitat in this area.

Either minimum operable segment would avoid the Kiggins Bowl Terminus option’s impact to the Burnt Bridge Creek riparian buffer and Kiggins Bowl habitat area zone, but they would have the other impacts associated with the full-length terminus options near the Columbia River and in Oregon.

Transit Alignment Options (with all Alternatives)

The transit alignment options (adjacent vs. offset; two-way Washington vs. Broadway-Washington; two-way Broadway vs. Broadway-Main; or 16th Street vs. McLoughlin) would have no measurable differences in long-term ecosystems effects.

3.14.4 Temporary Effects

Aquatic Habitats

No construction would occur in or adjoining the Columbia Slough, so no temporary effects to its aquatic and riparian habitats would occur from the CRC project.

In-water construction would occur in the Columbia River under all build alternatives. If used, coffer dams around bridge piers would disrupt stream flow during construction and pile driving. Disrupted stream flow would make it more difficult for fish to travel through the construction area. In-water work would increase turbidity, making it difficult for fish to see or absorb oxygen from the water. Underwater noise from pile driving and heavy machinery could injure or kill nearby fish. In addition, construction activities could limit recreational fishing activities due to access and safety concerns. Construction-related contaminants could enter the water during this work. In-water construction duration would likely be shorter for the stacked transit/highway bridge replacement crossing design. This would reduce the duration of negative temporary effects.

No construction would occur in Burnt Bridge Creek. Construction within the creek's adjoining riparian habitat would occur with the Kiggins Bowl Terminus option and the I-5/SR 500 interchange improvements. This could cause temporary increases in erosion, which could increase creek turbidity and lower the quality of fish habitat during construction.

The potential sites for a bridge assembly/casting yard are unknown at this time. However, they are likely to be adjacent to the Columbia River, Willamette River, or other water body in the region. The existing conditions on the assembly/casting yard could range from a developed and paved port terminal to a currently undeveloped site. Because the site will be adjacent to the water, it would have the potential to impact the same species identified for constructing the bridge, as well as other species that may be unique to the particular sites. The development and operations of the assembly/casting yard would be subject to the same federal and state environmental regulations that apply to other aspects of project construction, as well as any other federal, state or local regulations that may apply to the particular site. Before any site is selected, a thorough, site-specific environmental impact analysis will be conducted. All necessary permits will be secured prior to site development and operations.

Terrestrial Habitats

Habitat provided by the existing bridges would be disturbed during construction of any of the build alternatives. Construction noise, lights, and other effects could degrade nesting, roosting, and feeding habitat for birds and bats. Disruptive activity could occur during migration or nesting seasons, and could lower reproductive success or prevent the use of the bridge habitat for several years.

Vegetation adjoining the highway and interchanges that may serve as food, cover, or breeding habitat for terrestrial species may be removed during construction. These areas will be replanted when the project is finished, but species utilizing these areas would be temporarily impacted.

Plants and Animals

Both adult and juvenile migrating salmon and other aquatic species, such as smelt and lamprey, would pass through in-water construction areas. Disturbance from this could kill fish, delay migration, or lower reproductive success. Invertebrates could be displaced from the river bed during in-water construction work, but are likely to return rapidly once that work is over.

Construction could substantially disturb the peregrine falcons using the existing bridge structure. All of the build alternatives would include several years of noise, vibration, and crane lifting. The No-Build Alternative would avoid these impacts.

Noise, lights, vegetation removal, and other disturbance from roadway and transit construction could negatively affect breeding, foraging, and dispersal of both common and protected terrestrial species such as rabbits and other small mammals, birds that may avoid loud machinery, and migratory birds that may no longer rest or feed near the construction areas. Lights used for night work could disturb nocturnal animals such as owls or bats, or disrupt night-migrating birds.

Vegetation removal is likely along the existing roadway, especially near interchanges where alterations are planned. No rare or protected plant species have been identified that would be affected, although some areas contain mature trees. Exposed soil during construction could temporarily increase the presence of noxious weeds along the roadway, as these plants frequently colonize disturbed areas.

3.14.5 Potential Mitigation for Adverse Effects

The CRC project team has considered adverse effects to ecosystems while developing the alternatives. The project avoided certain adverse impacts by deciding not to pursue options such as a trenched tunnel crossing, substantial use of coffer dams during construction, or placement of a park and ride facility in Cold Canyon. The project team has designed construction footprints to avoid and minimize potential adverse effects to wetlands in the Delta Park area, and waterway effects from in-water piers. Throughout the project, the project team will continue to work with the appropriate regulatory agencies to avoid ecosystems impacts, and to minimize and mitigate ecosystems impacts that cannot be avoided.

The project will use best management practices during construction to first avoid and then minimize unavoidable impacts to ecosystems, fish, and wildlife. Both WSDOT and ODOT utilize standard specifications and special provisions to direct contractors to avoid and minimize impacts. In addition, standard terms and conditions of approvals from regulatory agencies have been incorporated into the preliminary designs analyzed in this document. The project could reduce impacts associated with in-water work by avoiding the most critical fish migration seasons, and by using coffer dams and bubble curtains to reduce noise and turbidity effects. Mitigation for effects to aquatic habitat could include shallow water habitat restoration.

Replanting riparian areas will help limit long-term effects of ground disturbance to habitat. These measures include removing noxious weeds and replanting native plants that are more likely to support sensitive wildlife species. Current riparian habitat along the Columbia Slough, North Portland Harbor, and the Columbia River is of low quality, with low vegetation cover and rip-rap or concrete surface in many areas. This presents an opportunity to enhance local habitat to mitigate for adverse ecosystems effects from the project. The Wetlands and Jurisdictional Waters section of this DEIS presents more detail on mitigation measures for potential impacts to wetland habitats.

The project team could schedule disruptive activities, such as vegetation or structure removal, outside of bird nesting seasons. The project team could install exclusionary devices on the bridge to prevent nests from being established when demolition or disruptive activities are scheduled.

Platforms could be built to mitigate for the replacement crossing's removal of the peregrine falcon habitat.

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3.15 Wetlands and Jurisdictional Waters

This section describes the existing wetlands and jurisdictional waters that could be affected by the project and discusses the functions that they currently provide. It also analyzes the effects that each alternative could have on wetlands and jurisdictional waters, and what steps will be taken to avoid, minimize, or compensate for any adverse effects. The Ecosystems and Water Quality sections of this DEIS provide more information on the effects that wetlands impacts have on fish, wildlife, and water quality. The information presented in this section is based on the CRC Wetlands and Jurisdictional Waters Technical Report, which is included as an electronic appendix to this DEIS.

The federal Clean Water Act gives environmental oversight to the U.S. Army Corps of Engineers for waterways and their associated wetlands. State governments generally share this jurisdiction. Wetlands and waterways regulated by this law are called “jurisdictional” waters and wetlands. Adding or removing bridge piers or other structures in a river, or filling, excavating, or building in a jurisdictional wetland require joint federal, state, and local permitting.

Are all wetlands and streams “jurisdictional”?

Very complex regulations determine which wetlands and waterways are jurisdictional. For the purposes of this DEIS summary, all wetlands and waterways that are potentially jurisdictional were considered, and this section refers to them all as simply wetlands or waterways. Final determinations of the boundaries and legal status of each would be made by the appropriate agencies.

In addition, Executive Order 11990 – Protection of Wetlands requires federal agencies to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Each agency shall avoid undertaking or providing assistance for new construction located in wetlands unless the agency finds that there is no practicable alternative to such construction, and that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use. In making this finding, the head of the agency may take into account economic, environmental, and other pertinent factors.

Wetlands perform functions that are valuable to fish, wildlife, environmental quality, and surrounding communities. Wetlands provide flood protection, improve water quality in rivers and streams, recharge groundwater, and provide breeding and rearing habitat for many birds, fish, and other wildlife. Because these functions are very difficult and expensive to successfully replicate, federal and state laws require that any project with the potential to impact wetlands must try to avoid and minimize impacts wherever possible, and if impacts are not avoidable, must compensate for these impacts by restoring or creating new wetland areas to ensure that the overall environmental functions provided to the area are not diminished.

In Oregon, the ratio of replaced wetland area to affected wetland area reflects the likelihood of mitigation project success and the need to maintain wetland acreage and functions. Typical ratios include 1:1 for restoration, 1.5:1 for creation, 3:1 for enhancement, and 2:1 for enhancement of cropped wetlands (ORS 141-085-0136). Within its borders, the City of Portland (COP) regulates wetland buffers when the wetland is within a mapped environmental zone overlay. If the CRC project is not exempt from environmental zone regulations (COP Code Section 33.430.080) and the project does not meet the City’s development standards (COP Code Section 33.430.140 through .190), environmental review and mitigation will be required by the City. The mitigation site plan must demonstrate that the mitigation will replace all of the resources and functions affected, will be within the same watershed as the affected environmental zone, and that a suitable mitigation site is owned by the applicant.

In Washington, the mitigation ratio is based on the type of compensation, the affected wetland's category, and/or any special characteristics of the affected wetland. A wetland is classified into one of four categories based on its Washington State Wetland Rating System score. Category 1 wetlands are those that receive a score greater than 70 (out of 100 possible points), Category 2 wetlands are those that receive a score between 51 and 69, Category 3 wetlands are those that receive a score between 30 and 50, and Category 4 wetlands are those that receive a score lower than 30. Consideration beyond the rating score is given to wetlands containing special characteristics. Typical ratios range from 1:1 for re-establishment or creation and rehabilitation of Category 4 wetlands to 24:1 for enhancement only of Category 1 forested wetlands.[38] In the project area in Washington, wetland buffers are regulated by the City of Vancouver under its critical areas protection ordinance. Compensatory mitigation is required to address affected functions by achieving a functional equivalency or improvement and providing a similar wetland or buffer function. Approval criteria require no net loss of functions or values for any activity impacting a critical area.

Different jurisdictions use various ways of measuring the environmental functions provided by wetlands. All wetlands identified in both Oregon and Washington were compared using both states' assessment methods to allow for an equal comparison of existing qualities and potential impacts. For comparative purposes, this section describes wetland functions based on the Washington State wetland rating system, which consolidates ratings of many individual functions into water quality (removing pollutants), hydrological (providing flood control), and habitat (supporting fish and wildlife) values. The CRC Wetlands Technical Report, provided as an electronic appendix to this DEIS, provides detailed information on the scoring of each wetland in both Oregon and Washington rating systems.

Many jurisdictions also restrict activities within a certain distance of wetlands, known as buffer zones. This analysis considers effects to wetlands, waters, and designated buffers.

3.15.1 Existing Conditions

This section describes the location, size, and functional values of wetlands and jurisdictional waters that have been field-identified in the project area. Exhibit 3.15-1 shows the locations of these wetlands relative to the project area. More detailed maps of each wetland and buffer area follow.

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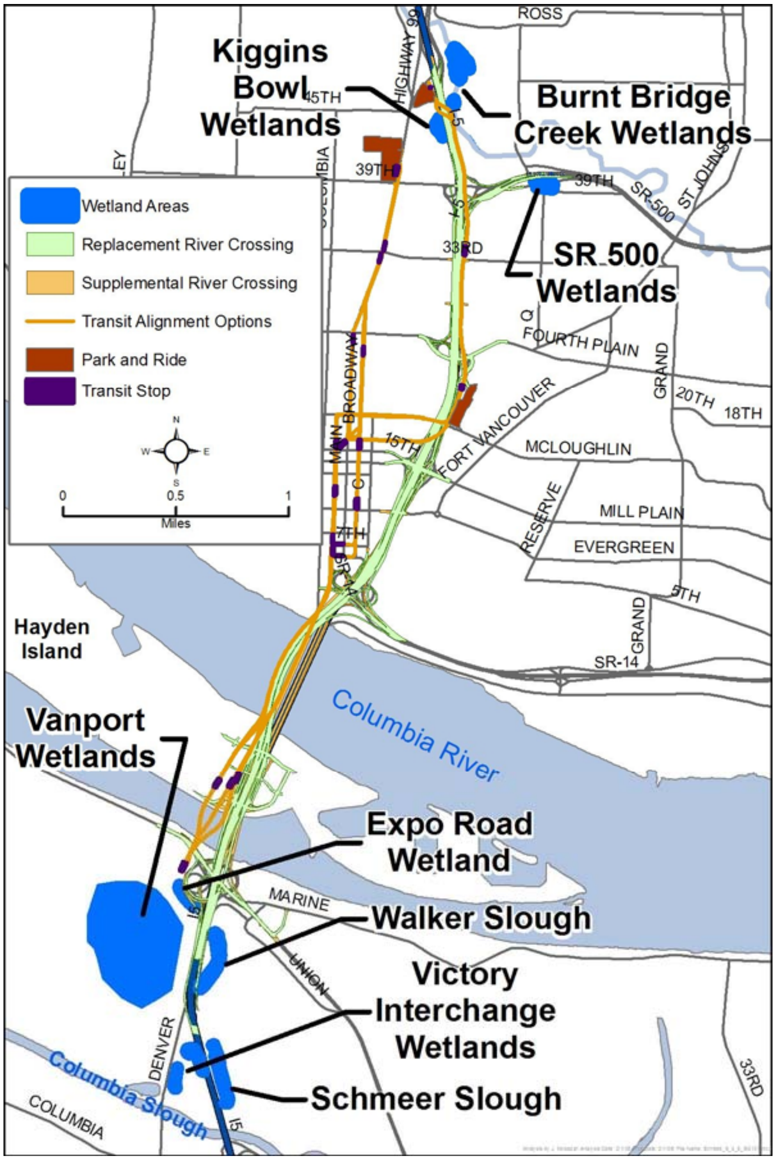
[38] Hruby, 2004.

Exhibit 3.15-1
Identified Wetlands in the CRC Project Area



Source: CRC Wetlands and Jurisdictional Waters Technical Report.

In Oregon, as discussed below, there are large wetlands west of the project area, remnants of the extensive wetland system that historically existed on the floodplain of the Columbia River prior to development. Large portions of this system, including the project area, were altered by building dikes and levees, draining land, and adding fill material to low spots; first for agricultural purposes and then for urban development. Despite the reduction in area from historic size, the remaining wetlands in the project area perform important functions and have high value due to their relative rarity in the urban area.

In Washington, as described below, wetlands are localized near Burnt Bridge Creek and the SR 500 interchange at the northernmost extent of the project. Topographic position, historic aerial photos, and early descriptions of the area indicate that wetlands were not present in the remainder of the project area in Washington prior to development.

Several constructed wetlands, built to manage stormwater runoff, are located near the roadway in the project area in both Oregon and Washington. Creating wetlands is an improved technique to manage stormwater runoff compared to traditional drainage pipes, because wetlands store water and allow it to infiltrate into the ground, providing better flood control; wetlands slow down the speed of the water, allowing sediment and many pollutants to settle out; and wetlands allow water to percolate into the ground, where it eventually recharges underground aquifers used for water supply.

Exhibit 3.15-2 summarizes the size and functional assessments of the surveyed wetlands in the project area. The scale used ranges from 0 to 32 for water quality and hydrologic functions and 0 to 36 for habitat function. Higher numerical values denote higher functions. The CRC Wetlands and Jurisdictional Waters Technical Report provides more detail on how the functions are assessed and includes field data sheets for each wetland.

Exhibit 3.15-2
Existing Wetland Conditions

Wetland	Size (acres)	Water Quality Function	Hydrologic Function	Habitat Function
Victory Interchange wetlands	0.5	14	12	7
Schmeer Slough	2.5	14	10	10
Walker Slough	2.7	10	16	15
Expo Road	0.3	14	16	8
Vanport Wetlands	88.7	26	24	22
SR 500 Wetlands	0.5	16	14	3
Kiggins Bowl Wetlands	0.9	8	4	14
Burnt Bridge Creek Wetlands	1.9	14	16	22

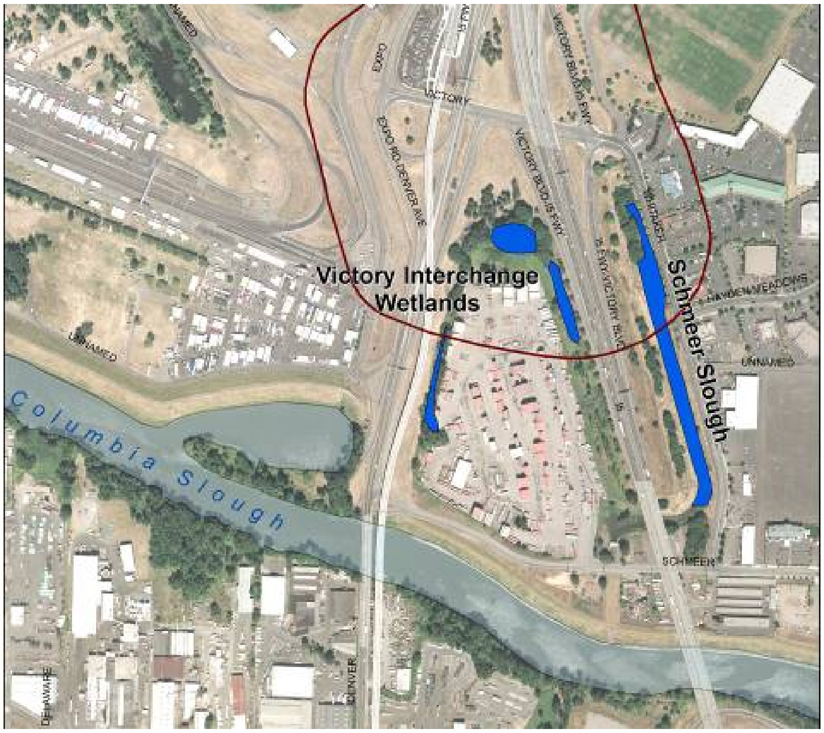
Source: Data compiled from the CRC Wetlands Technical Report and Wetland Delineation Report.

Wetlands in Oregon (North Portland and Hayden Island)

This area includes a complex of small wetland systems, some of which are connected by culverts near the I-5 roadway. These wetlands are remnants of the former slough system that have been modified to increase drainage and convey stormwater from the surrounding area to the Columbia Slough.

The Victory interchange wetlands consist of three distinct wetland areas located south of Victory Boulevard, between the existing light rail tracks and the I-5 roadway (see Exhibit 3.15-3). None of the project alternatives would directly impact these wetlands. The northern and eastern portions are flooded during the wet season, and the southwestern part is flooded most of the year. They support reed canarygrass, blackberry, willows, cottonwood, poplars, horsetail, and common rush. This wetland complex has a medium functional value for water quality and flood control and a low value for habitat.

Exhibit 3.15-3
Wetlands near Victory Boulevard



Note: Delineated wetlands are shown in blue. The red line represents the project study area and extends approximately 300 feet from the likely impacted right-of-way.

Schmeer Slough is located on the east side of I-5 and connects (by pipes) Expo Road wetland and Walker Slough to the north with the Columbia Slough to the south. Water levels are typically between 2 and 2.5 feet in depth. This wetland supports cottonwood, Pacific willow, native blackberry, several species of grass, and horsetail. It has medium functional value for water quality, and low values for flood control and habitat.

Walker Slough, shown in Exhibit 3.15-4, is a year-round flooded wetland on the east side of I-5 in Delta Park. It supports wooded, shrub, and seasonal grassland areas. It has two stretches of open water connected by a culvert beneath an access road, and connects to Schmeer Slough to the south via underground pipes. Stormwater from the surrounding area is conducted to Walker Slough via several underground pipes. Walker Slough supports Oregon Ash, cottonwood, willows, slough sedge, nodding beggarstick, and reed canarygrass. It has a low value for water quality, and moderate values for flood control and habitat.

The Expo Road wetland is located between the MAX tracks and the Marine Drive interchange. It connects by culvert to Walker and Schmeer sloughs to the southeast and ditches within the Peninsula Drainage District No. 1 to the northwest. It is forested, and supports plants such as willow, cottonwood, Himalayan blackberry, and reed canarygrass. It has moderate values for water quality and flood control functions, and a low value for habitat.

Vanport Wetlands is a large (about 90 acres) wetland area managed by the Port of Portland as a mitigation site. It includes areas of forest, shrubs, grassland and seasonal open water. Because of its relatively large size and diversity of habitats, it has the highest values for functions of any of the wetlands in the project area. It has high value for water quality and flood control functions, and moderate value for habitat.

Exhibit 3.15-4
Wetlands near Marine Drive

Note: Delineated wetlands are shown in blue. The red line represents the project study area and extends approximately 300 feet from the likely impacted right-of-way.

Based on mapped soils and aerial photographs, there may be one other wetland near this part of the project area, between Vancouver Way and Marine Drive. As project staff did not have permission to enter this property, the presence of a wetland could not be verified.

Wetlands in Washington

No wetlands were identified in the south Vancouver portion of the project area. There are several natural, constructed, and potential wetland sites around the northern portion of the project area near Burnt Bridge Creek and SR 500.

The SR 500 wetlands are on the east side of the project area, as shown in Exhibit 3.15-5. They are part of a stormwater system that eventually discharges to Burnt Bridge Creek. The SR 500 wetlands are within an area classified as Critical Lands.[39] They support eastern cottonwood,

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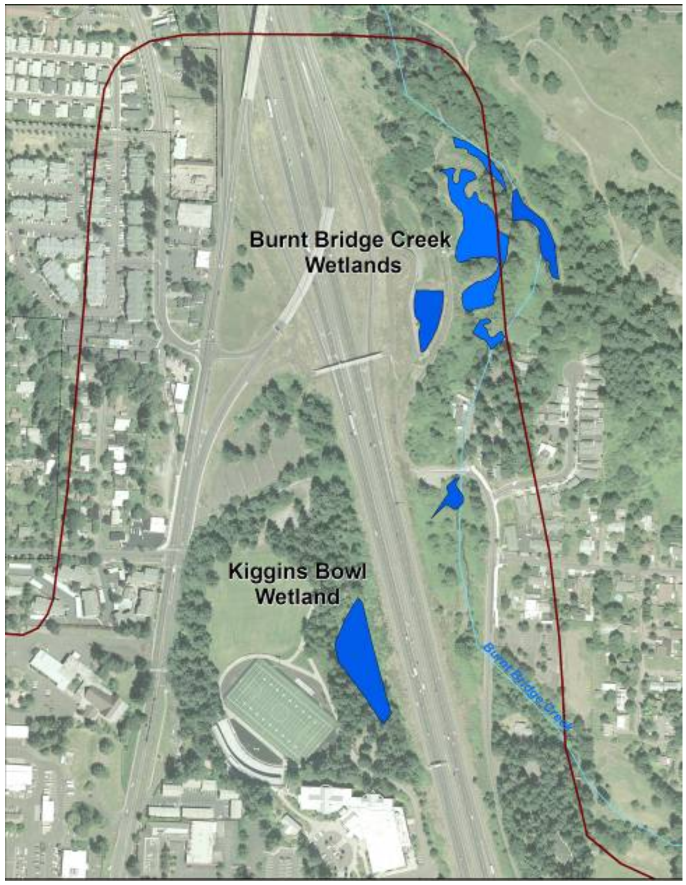
[39] Clark County, 2007.

common rush, and several types of grass. They have moderate functional values for water quality and flood control, and a low value for habitat.

Exhibit 3.15-5
Wetlands near SR 500

Note: Delineated wetlands are shown in blue. The red line represents the project study area and extends approximately 300 feet from the likely impacted right-of-way.

Exhibit 3.15-6
Wetlands near Burnt Bridge Creek



Note: Delineated wetlands are shown in blue. The red line represents the project study area and extends approximately 300 feet from the likely impacted right-of-way.

Kiggins Bowl wetland is located at the base of steep slopes separating I-5 from Kiggins Bowl (see Exhibit 3.15-6). The Kiggins Bowl wetland is located in an area classified as Critical Lands and as a Non-Riparian Habitat Conservation Area.[40] It supports cottonwood, willow, and reed canarygrass. It has low functional values for water quality and flood control, and moderate habitat value.

The Burnt Bridge Creek wetland complex comprises a series of wetlands between Burnt Bridge Creek and I-5 (see Exhibit 3.15-6). The wetland areas nearest the highway are stormwater detention ponds and a mitigation site managed by WSDOT, which receive stormwater from I-5. The Burnt Bridge Creek wetlands are located in an area classified as Critical Lands and as a Riparian Habitat Conservation Area.[41] They are seasonally flooded, and support shrubby plants like Pacific ninebark, blackberry, red osier dogwood, and understory species like reed canarygrass, meadow foxtail, and knotweeds. As a group, they have moderate values for water quality, flood control, and habitat.

[40] Clark County, 2007.

[41] Clark County, 2007.

Waterways

The project team analyzed potential structural work, fill, and excavation that could affect waterways near the CRC project. No project construction would occur in the Columbia Slough or Burnt Bridge Creek waterways. See the Ecosystems and Water Quality and Hydrology sections of this DEIS for detail on the watersheds, habitat values, and water quality issues pertaining to the waterways in the CRC project area. Potential effects to waterways by the project are discussed in the section below.

Construction activity would occur in the Columbia River and North Portland Harbor for any of the build alternatives, and is described in the Temporary Effects discussion later in this section. The existing bridge is supported by piers in both the Columbia River main channel and the North Portland Harbor channel.

3.15.2 Long-Term Effects of the Project Alternatives

Both direct and indirect effects to wetlands are possible from the CRC alternatives. Direct effects result from filling or dredging in surface water bodies, wetlands, or their buffers. These impacts can be quantified in terms of area or volume affected. Indirect effects can impact wetland functions even when the wetland or waterway itself is not altered. These effects can result from removing vegetation or disturbing soil near the wetland or waterway, increasing impervious surface nearby, or changing surface and subsurface water flow patterns.

In accordance with relevant state and federal regulations and Executive Order 11990, impacts to wetlands and jurisdictional waters were avoided and minimized to the extent practicable. The tables in each Alternative section below summarize the likely direct impacts of the project alternatives to waterways, wetlands, and adjoining buffer zones, including filling or excavation. Indirect long-term effects to wetland and waterway functions are discussed in Section 3.14, Ecosystems, and Section 3.16, Hydrology and Water Quality.

The following exhibits illustrate how the combined roadway and transit construction footprints would intersect with the identified jurisdictional waters, wetlands, and buffer areas. Likely impacts are discussed in detail in each alternative section, below.

Exhibit 3.15-7
Potential Impacts of Project Alternatives to Wetlands in Oregon

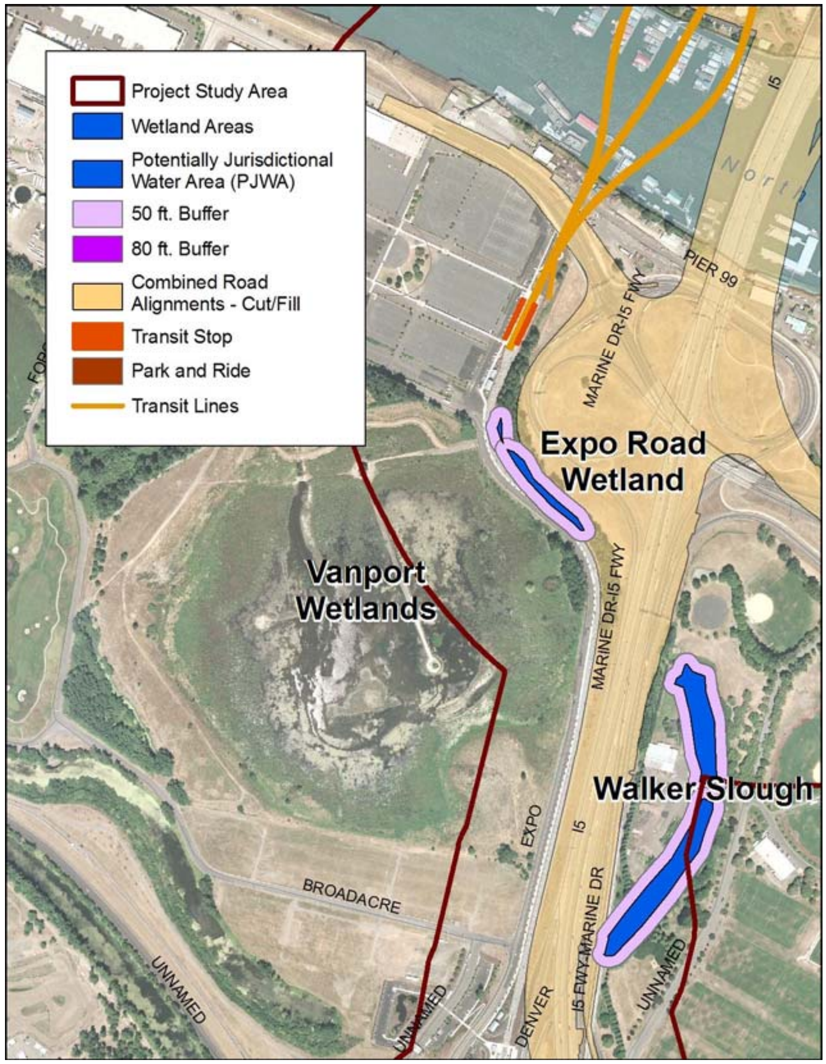


Exhibit 3.15-8
Potential Impacts of Project Alternatives to Wetlands near SR 500

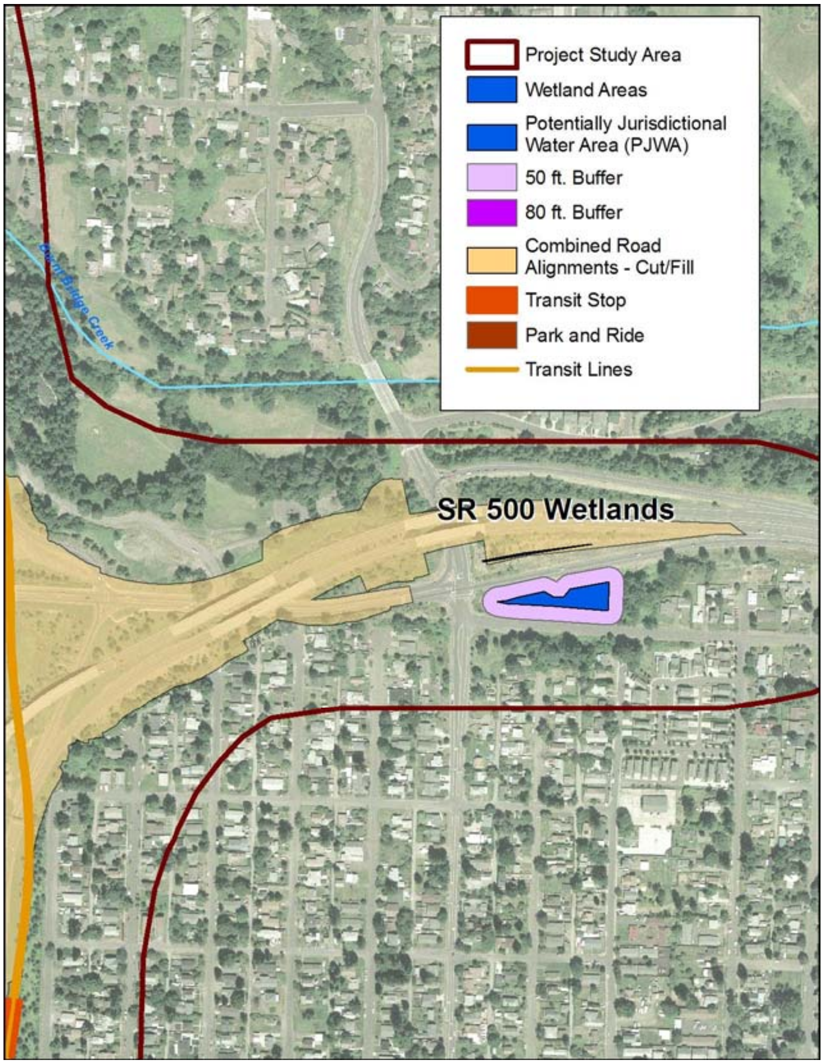
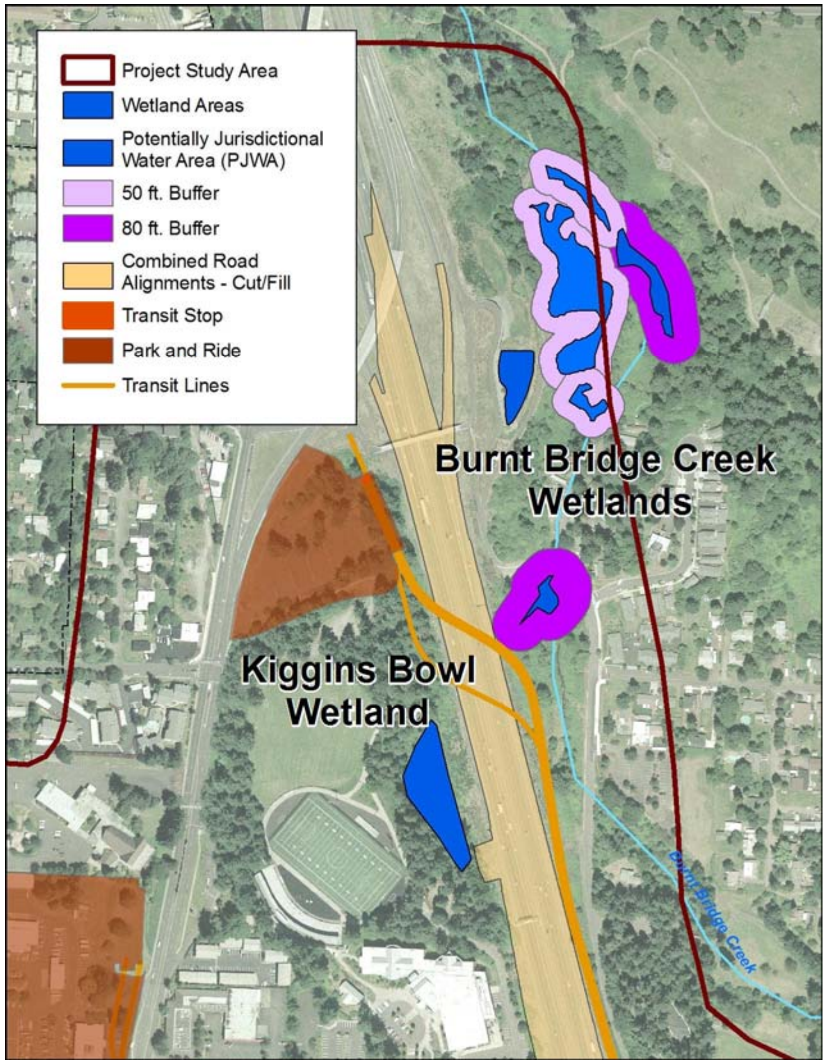


Exhibit 3.15-9
Potential Impacts of Project Alternatives to Wetlands near Burnt Bridge Creek



Alternative 1: No-Build

The No-Build Alternative would avoid direct impacts to wetlands or other waters of the States and U.S. The existing bridge piers in the Columbia River would remain.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.15-10
Summary of Direct Impacts (Fill or Remove) to Wetlands and Jurisdictional Waters

Alternative 2: Replacement Crossing with Bus Rapid Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Expo Road wetland (acres)	0.09	0.09	0.09	0.09
SR 500 wetlands (acres)	0.02	0.02	0.02	0.02
Kiggins Bowl wetland (acres)	< 0.01	<0.01	<0.01	<0.01
Total wetland impact (acres)	**0.11**	**0.11**	**0.11**	**0.11**
Expo Road buffer (acres)	0.98	0.98	0.98	0.98
Walker Slough buffer (acres)	0.13	0.13	0.13	0.13
Burnt Bridge Creek wetlands buffer (acres)	< 0.01	< 0.01	< 0.01	< 0.01
Total wetland buffer impact (acres)	**1.11**	**1.11**	**1.11**	**1.11**
Columbia River fill (acres)	3.04 2.81	3.04 2.81	3.04 2.81	3.04 2.81
Columbia River remove (acres)	0.75	0.75	0.75	0.75
Columbia River bridge piers (net cubic yards)	50,600 44,200	50,600 44,200	50,600 44,200	50,600 44,200

Source: CRC Wetlands and Jurisdictional Waters Technical Report.

[a] Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

As shown above for Alternative 2 with all terminus options, long-term direct impacts from the replacement crossing with bus rapid transit would include about 1.11 acres of buffer and about 0.11 acre of wetland. This total would be higher with the Marine Drive interchange southern realignment option due to impacts to Vanport Wetlands, which is discussed further in Section 3.15.3. The totals above include impacts to 0.09 acre of the Expo Road wetlands, 0.98 acre of the Expo Road wetlands buffer, and 0.13 acre of the Walker Slough buffer. Impacts to the SR 500 wetlands (which appear to be stormwater features unlikely to require a buffer) total 0.02 acre.

Direct impacts to waterways would occur from bridge piers in the Columbia River, including both the main channel and the North Portland Harbor channel. No in-water impacts will occur in other waterways.

Permanent bridge piers in the Columbia River (including North Portland Harbor) for Alternative 2 would cover an area of 3.04 acres and displace a volume of 86,900 cubic yards. Demolition of the existing bridges in the Columbia River and North Portland Harbor would result in removal activity in approximately 0.75 acre of waterway and 36,300 cubic yards of material for a net displacement of 50,600 cubic yards. The stacked transit highway bridge design would cover an area of 2.81 acres and displace a net volume of 44,200 cubic yards.

In addition to the waterways impacts shown above, constructing the transit alternatives could temporarily impact approximately 300 square feet of a potentially jurisdictional ditch associated with the Expo Road wetland. Both the highway footprint and transit alignments intersect this feature. Project construction would occur in and around the stormwater ditch associated with the Kiggins Bowl wetlands. The Kiggins Bowl terminus option would impact a small portion of this ditch, while the other terminus options would not.

Bus rapid transit vehicles carry fuel on board, which increases the risk (over light rail) of leaks or spills of petroleum from transit vehicles reaching wetlands and surface waters and degrading water quality. This is a potential indirect effect of Alternative 2. The Hydrology and Water Quality section of this DEIS discusses this in further detail.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.15-11
Summary of Direct Impacts (Fill or Remove) to Wetlands and Jurisdictional Waters

Alternative 3: Replacement Crossing with Light Rail Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Expo Road wetland (acres)	0.04	0.04	0.04	0.04
SR 500 wetlands (acres)	0.02	0.02	0.02	0.02
Kiggins Bowl wetland (acres)	< 0.01	<0.01	<0.01	<0.01
Total wetland impact (acres)	**0.06**	**0.06**	**0.06**	**0.06**
Expo Road buffer (acres)	0.43	0.43	0.43	0.43
Walker Slough buffer (acres)	0.13	0.13	0.13	0.13
Burnt Bridge Creek wetlands buffer (acres)	< 0.01	< 0.01	< 0.01	< 0.01
Total wetland buffer impact (acres)	**0.56**	**0.56**	**0.56**	**0.56**
Columbia River fill (acres)	3.04 2.81	3.04 2.81	3.04 2.81	3.04 2.81
Columbia River remove (acres)	0.75	0.75	0.75	0.75
Columbia River bridge piers (net cubic yards)	50,600 44,200	50,600 44,200	50,600 44,200	50,600 44,200

Source: CRC Wetlands and Jurisdictional Waters Technical Report.

[a] Values for the replacement design and the STHB design are the same unless otherwise noted. In cases where values differ between these designs, the STHB values are lined in the inset box.

Impacts to the Columbia River (including North Portland Harbor), Vanport Wetlands, the SR 500 wetlands, Walker Slough buffer, and Burnt Bridge Creek wetlands buffer would be the same as for Alternative 2. All terminus options would result in the same impacts.

Utilizing light rail transit vehicles would eliminate the need for a bus/rail transfer and turn-around facility, and would result in impacts to the Expo Road wetland and its buffer of 0.04 acre and 0.43 acre, respectively.

Light rail vehicles are electric powered, which reduces the risk of leaks or spills of petroleum from transit vehicles reaching wetlands and surface waters and degrading water quality. This is a potential indirect impact of Alternative 3. The Hydrology and Water Quality section of this DEIS discusses this in further detail.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.15-12
Summary of Direct Impacts (Fill or Remove) to Wetlands and Jurisdictional Waters

Alternative 4: Supplemental Crossing with Bus Rapid Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Expo Road wetland (acres)	0.13	0.13	0.13	0.13
SR 500 wetlands (acres)	0.03	0.03	0.03	0.03
Kiggins Bowl wetland (acres)	< 0.01	<0.01	<0.01	<0.01
Total wetland impact (acres)	**0.16**	**0.16**	**0.16**	**0.16**
Expo Road buffer (acres)	1.18	1.18	1.18	1.18
Walker Slough buffer (acres)	0.13	0.13	0.13	0.13
Total wetland buffer impact (acres)	**1.31**	**1.31**	**1.31**	**1.31**
Columbia River fill (acres)	1.93	1.93	1.93	1.93
Columbia River remove (acres)	0.25	0.25	0.25	0.25
Columbia River bridge piers (net cubic yards)	101,400	101,400	101,400	101,400

Source: CRC Wetlands and Jurisdictional Waters Technical Report.

Long-term direct impacts from the supplemental crossing with bus rapid transit (all terminus options) would include about 1.31 acres of buffer and about 0.16 acre of wetland. This total would be higher with the Marine Drive interchange southern realignment option due to impacts to Vanport Wetlands, which is discussed further in Section 3.15.3. The totals above include impacts to the Expo Road wetland of 0.13 acre, to the Expo Road wetland buffer of 1.18 acres, and to the Walker Slough buffer of 0.13 acre. Impacts to the SR 500 wetlands total 0.03 acre.

Additional permanent bridge piers in the Columbia River (including North Portland Harbor) over existing conditions for the supplemental crossing would cover an area of 1.93 acres and displace a net volume of 101,400 cubic yards. Demolition of the existing bridges in North Portland Harbor would result in removal activity of approximately 0.25 acre in area.

Bus rapid transit vehicles carry fuel on board, which increases the risk of leaks or spills of petroleum from transit vehicles, a potential indirect impact.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.15-13
Summary of Direct Impacts (Fill or Remove) to Wetlands and Jurisdictional Waters

Alternative 5: Supplemental Crossing with Light Rail Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Expo Road wetland (acres)	0.08	0.08	0.08	0.08
SR 500 wetlands (acres)	0.03	0.03	0.03	0.03
Kiggins Bowl wetland (acres)	< 0.01	< 0.01	< 0.01	< 0.01
Total wetland impact (acres)	**0.11**	**0.11**	**0.11**	**0.11**
Expo Road buffer (acres)	0.63	0.63	0.63	0.63
Walker Slough buffer (acres)	0.13	0.13	0.13	0.13
Total wetland buffer impact (acres)	**0.96**	**0.96**	**0.96**	**0.96**
Columbia River fill (acres)	1.93	1.93	1.93	1.93
Columbia River remove (acres)	0.25	0.25	0.25	0.25
Columbia River bridge piers (net cubic yards)	101,400	101,400	101,400	101,400

Source: CRC Wetlands and Jurisdictional Waters Technical Report.

For Alternative 5 with all terminus options, impacts to the Columbia River (including North Portland Harbor), Vanport Wetlands, the SR 500 wetlands, Walker Slough buffer, and Burnt Bridge Creek wetlands buffer would be the same as for Alternative 4.

Utilizing light rail transit vehicles would eliminate the need for a bus/rail transfer and turn-around facility, and would result in impacts to the Expo Road wetland and its buffer of 0.08 acre and 0.63 acre, respectively.

As with Alternative 4, light rail vehicles are electric powered, which reduces the risk of leaks or spills of petroleum from transit vehicles reaching wetlands and surface waters and degrading water quality, a potential indirect impact of this project. The Hydrology and Water Quality section of this DEIS discusses this in further detail.

3.15.3 Long-Term Effects of Project Components

Certain project components do not affect the wetlands or waters impacts analysis, and are not considered here. These include transit operations options, tolling scenarios, and transportation system/demand management options.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

Between 0.04 (light rail) and 0.09 (bus rapid transit) acre of the Expo Road wetland would be impacted with a replacement crossing. This is slightly less area of impact than the supplemental crossing, which would impact between 0.08 (light rail) and 0.13 (bus rapid transit) acre of this wetland. Highway interchange improvements associated with the replacement crossing would impact less than 0.02 acre of the SR 500 wetlands, while improvements associated with the supplemental crossing would impact less than 0.03 acre.

The replacement crossing would impact between 0.43 (light rail) and 0.98 (bus rapid transit) acre of the buffer zone in a 50-foot radius from the Expo Road wetland. This is slightly less of an impact than the supplemental crossing, which would impact between 0.63 (light rail) and 1.18 (bus rapid transit) acres of the buffer zone.

The replacement crossing would entail removal of 0.75 acre of existing structure or fill from the river. It would add 2.62 acres, resulting in a displaced volume of approximately 66,700 cubic yards from the river. The supplemental crossing would require 0.25 acre of removal and 1.93 acres of fill. A volume of approximately 101,400 cubic yards of the river would be displaced by the in-water structures.

The stacked transit/highway bridge design with the replacement crossing would put approximately 18 percent less structure in the water than the standard replacement crossing, assuming 96-inch vertical piles are used to support the piers. It may, however, result in additional smaller piers in shallow-water habitat near the south shore of the Columbia River main channel.

A Marine Drive southern realignment option, south of the Expo Center would impact the E-zone associated with Vanport Wetland, which is a mitigation site owned and maintained by the Port of Portland. Construction impacts within the wetland would be about 0.48 acre. Two piers would be placed in the wetland, both approximately 10 ft in diameter, causing a direct impact of 0.003 acre. Mitigation for this impact could require three times the standard DSL ratios because of impacts to a mitigation site. Long-term effects on vegetation (mature cottonwood forest) below the alignment at Vanport and the Expo Center wetlands cannot be quantified due to the preliminary design of this option. The diagonal realignment would not impact the Vanport, and would impact approximately the same area of the Expo Center wetland as the standard Marine Drive alignment.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Light rail vehicles are electric powered, which reduces the risk of leaks or spills of petroleum from transit vehicles reaching wetlands and surface waters and degrading water quality, a potential indirect impact of this project. Bus rapid transit vehicles carry fuel on board, which increases the risk of leaks or spills of petroleum from transit vehicles. The Hydrology and Water Quality section of this DEIS discusses this in further detail.

The bus rapid transit option would impact about 0.05 acre more in the Expo Road wetland and 0.55 acre more of its buffer zone, compared to light rail.

Both maintenance base stations are situated partially on hydric soils, and wetlands or waters are present in the vicinities. Aerial photographs identified constructed stormwater wetland facilities within 0.5 mile of the proposed bus rapid transit maintenance facility in Vancouver, and excavated ponds (former gravel quarries) within 0.5 mile of the proposed light rail maintenance facility in Gresham. However, no wetlands or waters are present within the bases' boundaries. No long-term direct, temporary direct, or indirect impacts to wetlands or other waters of the U.S. are anticipated from either an expanded maintenance base in Gresham or an expanded base in Vancouver.

Even if the No-Build Alternative is chosen and CRC is not built, regional transit services are likely to increase from other projects, and expansion of the vehicle maintenance facilities would likely occur. If one of the build alternatives is chosen for CRC, this project would contribute to the size of that expansion.

Transit Terminus Options (with all Alternatives)

The cut/fill line for the Kiggins Bowl terminus intersects with 13 square feet of the buffer zone (80-foot radius) of the Burnt Bridge Creek wetlands. The Lincoln terminus would avoid this impact.

The Kiggins Bowl Park and Ride may impact approximately 152 square feet of the stormwater feature and wetland at the east side of Kiggins Bowl. A smaller park and ride facility is planned for the other terminus options, which could reduce potential indirect impacts from this facility. Jurisdictional determination of this feature is pending, but it is being treated as a jurisdictional water at this time.

The Mill Plain and Clark College terminus options would avoid potential direct impacts to the Burnt Bridge Creek wetlands. The Kiggins Bowl Park and Ride would still be constructed, so shorter-length transit options could still impact the Kiggins Bowl wetland stormwater feature.

Transit Alignment Options (with all Alternatives)

The transit alignment options (adjacent vs. offset; two-way Washington vs. Broadway-Washington; or 16th Street vs. McLoughlin) would have no measurable differences in long-term wetlands effects.

3.15.4 Temporary Effects

The No-Build Alternative would not involve construction activities and so would not entail any temporary disturbance of jurisdictional waters, wetlands, or their functions.

No substantial differences between the alternatives are anticipated in terms of temporary effects from construction. Temporary wetland effects are generally indirect. For example, habitat function could be disturbed temporarily from nearby construction noise and lights. Altering vegetation, hydrology, and filling or excavating in wetlands or waterways are considered permanent changes.

How can I learn more?

The Ecosystems Technical Report provides detailed information on construction effects to the Columbia River.

The potential sites for a bridge assembly/casting yard are unknown at this time. However, they are likely to be adjacent to the Columbia River, Willamette River, or other water body in the region. The existing conditions on the assembly/casting yard could range from a developed and paved port terminal to a currently undeveloped site, and could contain wetlands. The development and operations of the assembly/casting yard would be subject to the same federal and state environmental regulations that apply to other aspects of project construction (depending on which state it is in), as well as any other federal, state or local regulations that may apply to the particular site. Before any site is selected, a thorough, site-specific environmental impact analysis will be conducted. All necessary permits will be secured prior to site development and operations.

All build alternatives would involve construction activities in the water of the Columbia River and North Portland Harbor. The Ecosystems section of this DEIS discusses the temporary effects of this activity to habitat functions, and the Water Quality section discusses its temporary effects to water quality and flood control functions.

3.15.5 Potential Mitigation for Adverse Effects

In accordance with state and federal regulations and Executive Order 11990, the project has avoided and minimized impacts to wetlands to the extent practicable during the design of the highway and transit alignments, and will continue to consider this as the design process moves forward and the project sponsors select a preferred alternative.

During construction, best management practices will be used to avoid impacts to wetlands from erosion, spills, damage to vegetation, or disruption of hydrology. Both WSDOT and ODOT utilize standard specifications and special provisions to direct contractors to avoid and minimize impacts. In addition, standard terms and conditions of approvals from regulatory agencies have been incorporated into the preliminary designs analyzed in this document. The project team will work collaboratively with local, state, and federal permitting agencies to seek compensatory mitigation objectives and site selection after a preferred alternative is selected.

The build alternatives would impact between about 1.9 and 3.1 acres of waterways, about 0.06 to 0.16 acre of existing wetlands, and 0.56 to 1.31 acres of buffer areas. The southern realignment option for Marine Drive would impact an additional 0.48 acre of wetland and 1.58 acres of E-zone at the Vanport Wetland. Mitigation for these direct impacts is regulated by federal, state, and local jurisdictions as described in the Existing Conditions discussion in this section, and would typically require restoring or enhancing degraded wetland areas or establishing new wetlands nearby to compensate for functions lost or degraded by those impacts. Because Vanport is already a wetland mitigation site, it could require a 9:1 mitigation ratio for any impacts to it.

Potential compensatory mitigation sites would be identified after the selection of a locally preferred alternative. Likely mitigation sites depend on the area needed for mitigation, current and future ownership of potential mitigation sites, and site characteristics. Preference would be given to sites near the potential impacts, for example, between the

Columbia Slough and Marine Drive and near Burnt Bridge Creek. Mitigation sites would be selected based on soil types and topographic position that would increase the likelihood of successful restoration or establishment of wetland conditions. Options for off-site mitigation could also be considered.

Mitigation needs for Oregon wetlands could range from 0.06 to 0.48 acre (not including potential Vanport impact mitigation from the Marine Drive southern realignment option) depending on the type of mitigation (restoration, creation, and/or enhancement) and the amount of affected wetlands associated with the selected alternative. Mitigation for Oregon wetland buffers would require a replacement of lost functions and would likely be between 0.56 acre and 1.31 acres depending on the amount of affected buffer.

Mitigation needs for Washington wetlands could range from 0.02 to 0.24 acre depending on the type of mitigation and the amount of affected wetlands associated with the selected alternative, assuming that impacts occur only to Category 3 or Category 4 wetlands. Mitigation for Washington wetland buffers would require the replacement of lost functions and values and would likely be less than 0.01 acre, depending on the amount of affected buffer, and pending jurisdictional determinations.

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3.16 Hydrology and Water Quality

Communities depend on clean and reliable water for domestic use, agriculture, industry, and recreation. Fish and many wildlife species depend on clean water habitats to live. In urban areas, pollutants that wash off roadways during storms are a major contributor to poor water quality in rivers and streams. Pollutants from roadways typically include fuel, oil, grease, and other automotive fluids; heavy metals such as copper and zinc; and small particles from erosion or road sanding, which turns waterways turbid. The design and placement of roadways and stormwater systems can affect how these pollutants are treated or released into the environment.

What is the difference between water quality and hydrology?

In this DEIS, **hydrology** refers to the flow of water—its volume, where it drains, and how quickly the flow rate changes in a storm. **Water quality** refers to the characteristics of the water—its temperature and oxygen levels, how clear it is, and whether it contains pollutants.

In addition to potential pollution concerns, placing structures such as bridge piers or roadways in a river or its floodplain may increase the height of floods during storm events. Although an individual road or structure may be small in relationship to the volume of a stream, collectively, all of the roads and structures built along a river can have a dramatic effect on the severity of floods. For this reason, any construction in streams and rivers or in their floodplains is strictly regulated, and must take into account any incremental contribution toward worsening flood conditions on the waterway.

This section examines the potential effects of the project options on both water quality and hydrology, and relates these potential effects to the context of existing conditions in the waterways and surrounding areas. Ground water and aquifers are discussed in Section 3.17 of this DEIS.

Although specific stormwater treatment designs have not yet been developed, this section discusses a conceptual design that has been developed for analysis purposes and to compare alternatives. This is just one of multiple treatment designs that will be considered. More detailed and technical discussions of the information presented in this chapter can be found in the Hydrology and Water Quality Technical Report and the Conceptual Stormwater Design Report.

3.16.1 Existing Conditions

Existing conditions in the watershed of each surface water feature are tied to the potential for water quality and hydrology impacts from the project. A watershed is the area of land that contributes water to a river or stream. This area will change based on the point along the river or stream course being examined—watersheds near the upstream ends are relatively small, while near the mouth of a river or stream the contributing watershed may be quite large.

TERMS & DEFINITIONS

303 (d) and TMDL

States monitor and regulate water quality in their rivers and streams. They are required to do this under section 303(d) of the federal Clean Water Act. If a water body is “303(d) listed”, that means it does not meet a particular water quality standard, determined by the state. Under this law, states also develop action plans to address water quality concerns, which include setting Total Maximum Daily Loads (TMDLs) for pollutants in a waterway.

Stormwater Runoff

When land is paved, covered by buildings, or compacted by heavy equipment, the surface of the ground becomes impervious. This means that water from rain or snow is no longer able to soak into the soil and recharge the underground water table. Instead, this water becomes runoff. It flows along the surface until it reaches a drain, stormwater pipe, ditch, stream, or other surface water body. In less-developed areas, soil and plants are able to help filter and absorb the water before it reaches waterways, keeping it relatively clean. Runoff that does not pass through vegetation and soil typically picks up oil or other pollutants on the surface of roads or buildings and carries them into streams or drainage systems, decreasing water quality.

Hard surfaces also send a much larger volume of water to streams more quickly than if the water had first soaked into the ground. This means that streams rise or flood much more quickly during storms, and can have higher peak flood levels. If stormwater is able to soak into the ground, it often slowly finds its way out again in seeps or springs, which help keep water flowing during the dry season. Impervious surfaces keep stormwater from recharging these springs, which leads to lower water levels and higher water temperatures during the summer. This can have an adverse effect on fish and water quality.

How can I learn more?

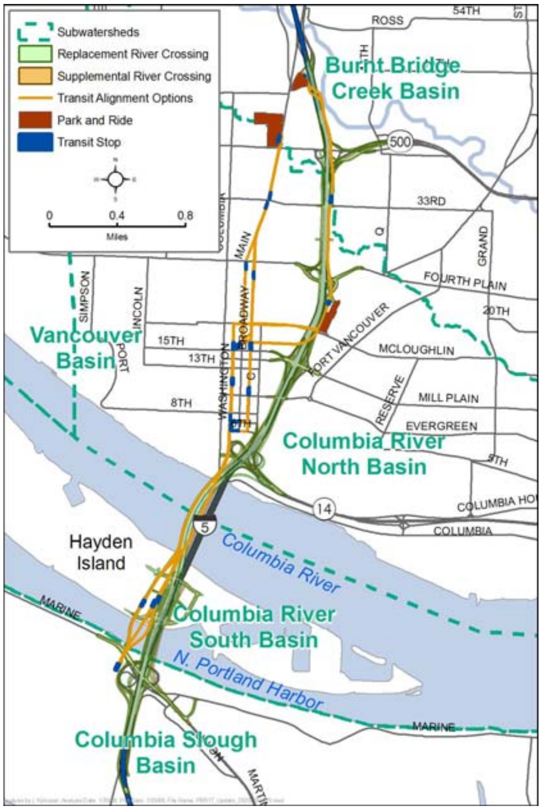
The Hydrology and Water Quality Technical Report describes in detail the existing conditions in nearby watersheds and water bodies.

Bioinfiltration swales, a type of constructed wetland, are a common and accepted mechanism to treat stormwater, and are being considered to treat stormwater from this project. Bioinfiltration swales are designed to allow water to infiltrate into the ground rather than discharging into streams and rivers. Soil and plants in this type of swale act to filter many of the pollutants present in runoff, sediments can drop out onto the bottom of the swale, and can add some flow control capacity during storm events.

Watersheds and Surface Water

This section discusses the project area's watersheds and their characteristics that are relevant to the project's potential impacts on water quality and hydrology.

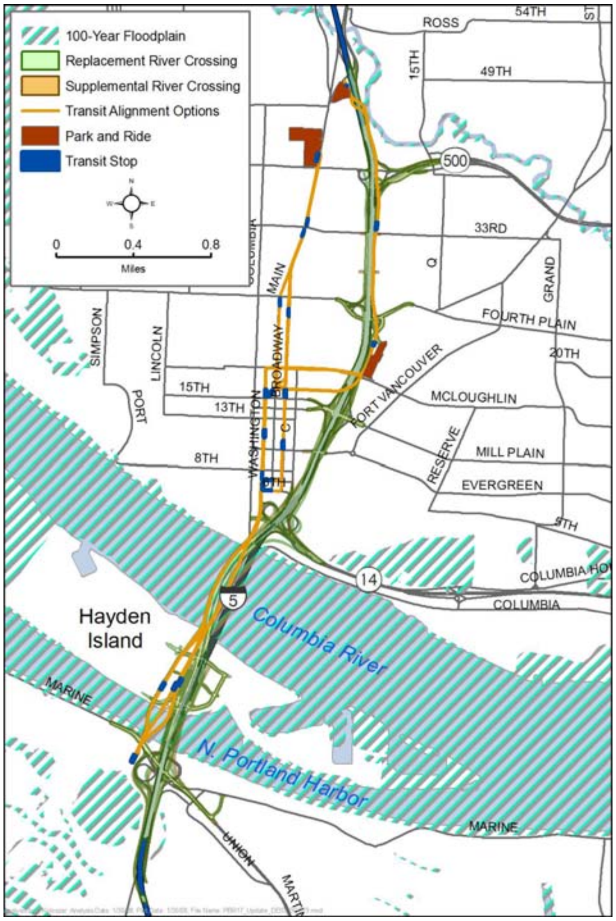
Exhibit 3.16-1
Map of Project Area Main Watersheds



Source: CRC Hydrology and Water Quality Technical Report.

The area around the project contains eight mapped surface water features. Three of these waterways (Burnt Bridge Creek, the Columbia River, and the Columbia Slough) may receive project runoff and are therefore the focus of this section. The designated watersheds of these water features are illustrated in Exhibit 3.16-1. The other five water features in the broader vicinity—Salmon Creek, Whipple Creek, Cold Creek, Cougar Canyon Creek, and Tenny Creek—would not receive any direct runoff or hydrology effects from the project. FEMA floodplains near the project area can be seen in Exhibit 3.16-2.

Exhibit 3.16-2
FEMA Floodplains near the Project Area



Source: CRC Hydrology and Water Quality Technical Report.

Since the regulatory process regulates specific water quality issues individually (for example, the amount of oxygen dissolved in the water, temperature, or nitrogen levels) there may be pollutants of concern that do not yet have regulatory standards set. For example, regulatory levels for copper are still in a state of flux for the waterways near CRC. The CRC project will work with regulatory agencies to determine appropriate thresholds for water quality impacts as project development continues.

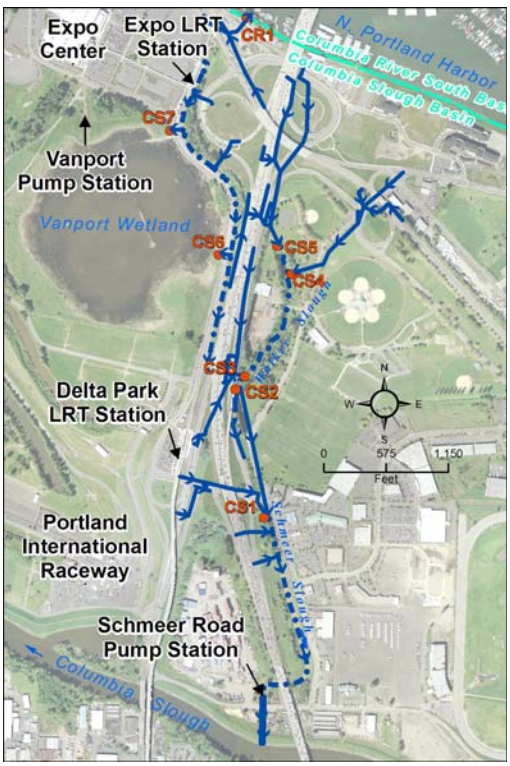
COLUMBIA SLOUGH

The Columbia Slough is a 19-mile long complex of shallow channels located in low-lying land south of the Columbia River. It is a remnant of an extensive wetland and slough system that existed on the Columbia River floodplain before development of the area. It drains about 32,700 acres of land, beginning near Fairview Lake about 12 miles east of the I-5 crossing, and flowing into the Willamette River about seven miles west of the I-5 crossing, near the confluence of the Willamette and Columbia Rivers.

Over the years, the slough system has been extensively dredged, diked, filled, and channelized. The upper and middle portions of the slough are highly managed by a system of pumps and levees that provide watershed drainage and flood control. The lower portion of the slough, which includes the waterway near the project area, is influenced by tides and by the amount of water released from dams upstream. Stream flow at the mouth reverses due to tidal influences, although this effect is not noticeable near the project area.

Near the project area, the Columbia Slough does not meet Oregon State water quality standards for temperature (it is too warm from spring through fall) and iron and manganese content. Total Maximum Daily Loads (TMDLs) have been set for contaminants of concern in the waterway, including chlorophyll *a*, DDE/DDT, dioxin, dissolved oxygen, fecal coliform, lead, PCB, pH, and phosphorus. The Oregon Public Health Division and City of Portland have issued warnings about eating fish from the slough due to contamination from PCBs, DDE, and DDT. The slough no longer receives discharges from Portland's combined sewer overflows.

Exhibit 3.16-3
Columbia Slough Stormwater Map



Source: CRC Conceptual Stormwater Design Technical Report.

The dashed lines are surface conveyances. Solid lines are pipes. Arrows show direction of flow, and points labeled CS/CR are stormwater outfalls.

Highway runoff typically contains suspended solids, oils, grease, copper, zinc, iron, manganese, and phosphorus.[42] Road de-icing (which happens infrequently in the project area) can contribute to low levels of dissolved oxygen. Fecal coliform, while not a product of roadway surfaces or activities, is known to be conveyed in road runoff. These are water

[42] EPA, 1993.

quality issues for the Columbia Slough that may be affected by the project alternatives. City of Portland guidelines do not require flow volume control for discharges to the Columbia Slough.[43] Flow levels in the slough are constrained by upstream water controls, pumps, dikes, and levees.

The Columbia Slough 100-year floodplain, as mapped by the Federal Emergency Management Agency (FEMA) extends only slightly into the project area, as shown in Exhibit 3.16-2.

Exhibit 3.16-3 shows existing stormwater outfalls from the I-5 roadway system that drain into the Columbia Slough. Runoff from the existing light rail track between Delta Park and the Expo Center stations also drains into the Columbia Slough system, after first flowing through Vanport Wetland, Schmeer Slough, or Northern Slough.

COLUMBIA RIVER/NORTH PORTLAND HARBOR

The river drains almost 220,000 square miles in seven states and Canada with land in forest, agricultural, residential, urban, and industrial uses. The Lower Columbia River, that section of the river most pertinent to the impact analysis, flows from Bonneville Dam at river mile 146 to the mouth of the river, and it drains an area of 18,000 square miles. Hayden Island divides the mainstem of the Columbia River, which flows to its north, from a side channel called the North Portland Harbor, which flows to its south. The I-5 highway crosses both channels near river mile 106.5.

Near the project area, the Columbia River fails to meet Oregon State water quality standards for temperature, PCBs, PAHs, DDE, arsenic, dioxin, and total dissolved gas. Upstream of the project area, it does not meet Washington State water quality standards for temperature. These water quality issues are not typically associated with highway runoff and the project alternatives are not likely to affect them. Flow control measures are not required for stormwater outfalls to the Columbia River by either Oregon or Washington.

The Columbia River 100-year floodplain has been mapped by FEMA, and portions near the project area are shown in Exhibit 3.16-2. Generally, the floodplain extends from the watercourse to the upper banks of the Columbia River and North Portland Harbor on Hayden Island, and to the levee system adjacent to the North Portland Harbor in North Portland. Impacts to 100-year floodplains will be analyzed in accordance with local regulations and Executive Order 11988 – Floodplain Management.

Exhibit 3.16-4 shows roadway areas and stormwater outfalls in the project area that drain directly to the Columbia River. Other private outfalls may exist that were not mapped. Stormwater from the existing I-5 bridge discharges directly to the river from road-side grates along the span. Runoff from the bridge is not treated prior to release into the Columbia River and North Portland Harbor. In South Vancouver, I-5 is generally below grade of the surrounding areas and the highway drainage system receives runoff from developed areas west of the highway, in addition to runoff from the road surface and right-of-way.

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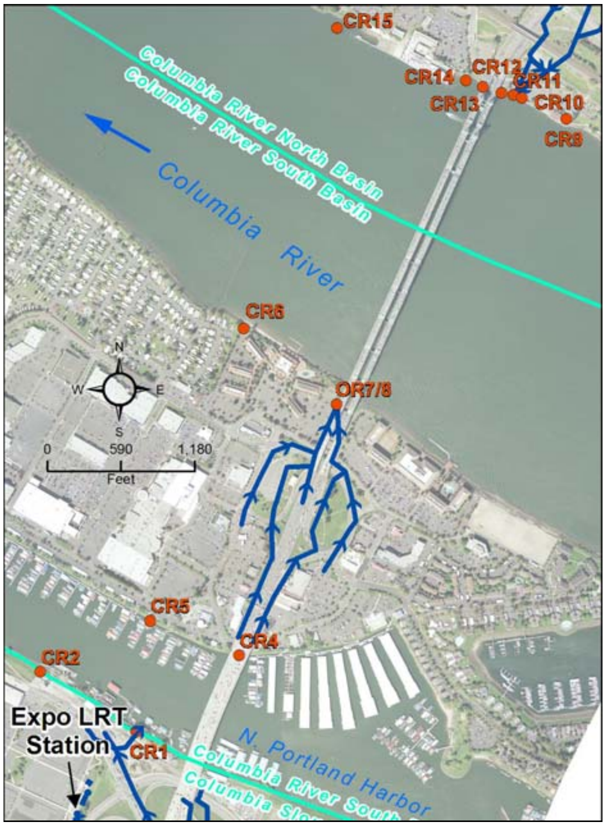
[43] City of Portland Bureau of Environmental Services, 2004.

Exhibit 3.16-4
Columbia River Stormwater Map



Source: CRC Stormwater Technical Report.

The solid lines are piped stormwater conveyances, arrows show direction of flow, and points labeled CR are stormwater outfalls.

BURNT BRIDGE CREEK

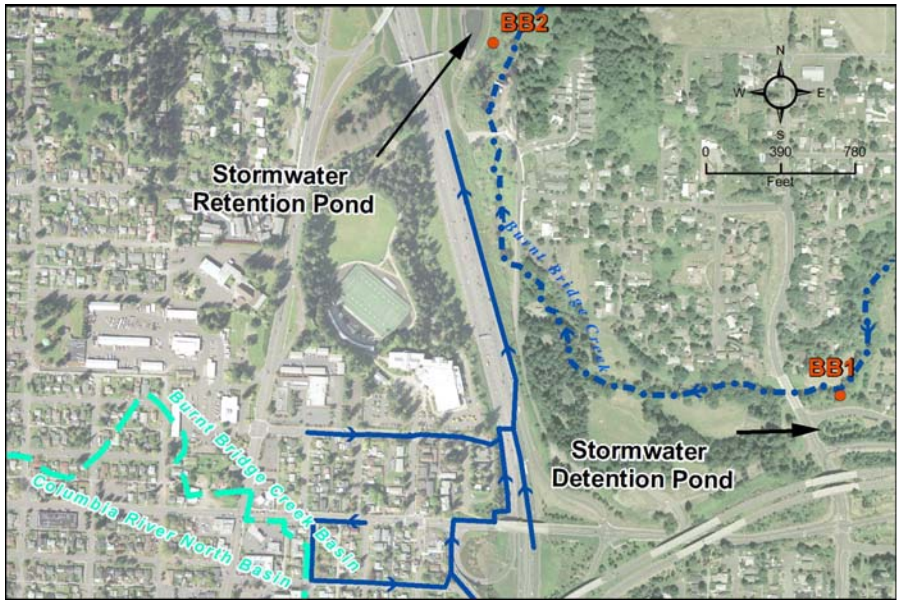
Burnt Bridge Creek originates in East Vancouver from field ditches that drain a large wetland area between NE 112th Avenue and NE 164th Avenue. The creek is approximately 12.9 miles in length and alternates between ditches and natural channels. Except for floodplains, parks, and wetlands, nearly the entire basin is urbanized. In the project area, the creek flows through a small canyon with a narrow floodplain. The creek passes under the existing highway in a culvert north of the project area.

The section of Burnt Bridge Creek in the project area does not meet Washington State water quality standards for temperature or fecal coliform. Of these water quality concerns, the project alternatives could affect fecal coliform. Washington regulations require including flow control measures to reduce runoff flow rates to pre-development conditions for new development that drains to Burnt Bridge Creek.

The Burnt Bridge Creek 100-year floodplain, as mapped by FEMA, is limited to the area immediately adjacent to the stream, as shown in Exhibit 3.16-2. This project would not extend into the 100-year floodplain of this stream.

As shown in Exhibit 3.16-5, several outfalls from I-5 discharge to Burnt Bridge Creek. There are also two constructed stormwater ponds that collect runoff from I-5. These ponds can release water to the creek during high flow events.

Exhibit 3.16-5
Burnt Bridge Creek Stormwater Map



Source: CRC Stormwater Technical Report.

The dotted lines are surface conveyances, and sold lines are pipes. Arrows show direction of flow. Points labeled BB are stormwater outfalls.

3.16.2 Long-term Effects of the Project Alternatives

The differences among the build alternatives are generally much less than the difference between them and the No-Build Alternative. The build alternatives would improve existing stormwater conditions. The No-Build alternative would keep the existing stormwater treatment levels.

All the build alternatives would require placement of material within the 100-year floodplain of the Columbia River. Given the size of the Columbia River in relation to the proposed structure that will be within the floodplain, no adverse impacts are anticipated to occur to the floodplain. In addition, volumes of fill for each of the alternatives are relatively similar when compared to the volume of the Columbia River floodplain. Executive Order 11988 and local and state regulations require more detailed analysis of floodplain impacts, including a no-rise analysis, prior to project approval. This analysis will be completed when more detailed design of piers is available.

Increases in impervious surface area are generally associated with both increased pollutant load in runoff and with increased stormwater flow control problems. Stormwater guidelines for WSDOT, ODOT, and the City of Portland were followed by the project team when developing the conceptual stormwater management plan. After considering areas requiring treatment and after applying technical feasibility criteria per the guidelines, between 35 and 38 acres of untreated impervious surface would remain for each of the build alternatives. The CRC Conceptual Design Stormwater Report fully discusses the applied guidelines.

There are no substantive differences among the build alternatives in the overall amount of new impervious surface area. Although these represent a very small percentage increase in paved area for the watersheds involved, this would be an incremental adverse effect on stream water quality. None of the alternatives is likely to measurably affect flow conditions within the project area. Except for Burnt Bridge Creek, flows in project area waters are controlled by tides, dams, or pumps.

Although the total amount of impervious surface area would increase for each of the build alternatives, the amount of untreated impervious surface would drop dramatically. This is because all new or reconstructed impervious area would be treated, while under the No-Build Alternative runoff from some existing impervious surfaces is not retained or treated, and a portion drains directly into surface water bodies without impediment. Any of the build alternatives would decrease the area contributing untreated runoff to waterways by more than 120 acres.

Total suspended solids and other pollutants entering waterways would decrease substantially in the overall project area from all build alternatives, the Burnt Bridge Creek and Columbia Slough drainages could have increases in certain pollutants compared to current conditions.

Another pollutant, dissolved copper, is known to have a harmful effect on fish.[44] Burnt Bridge Creek and the Columbia Slough could receive increased loads of dissolved copper. However, this increase in copper is due largely to the conceptual stormwater design used to conduct the DEIS analysis. This conceptual design, which is one of many under consideration, would collect runoff from the south portion of the I-5 river bridge and the highway across Hayden Island, and convey it to treatment facilities near Marine Drive before discharging into the Columbia Slough. This stormwater management design is preliminary and would require exceptions from design standards from FHWA and ODOT. Other approaches are also being considered.

Alternative 1: No-Build

If the CRC project does not go forward, several adverse long-term effects to water quality are anticipated.

Stormwater runoff from the I-5 crossing and much of the highway would continue to flow untreated to the Columbia River and other surface waters. As traffic and congestion continue to increase in the future, pollutant loads would also increase. The load of pollutants, like copper, could increase with more start-and-stop traffic, which increases brake pad wear.

The existing I-5 crossing would continue to be more vulnerable to collapse from a severe earthquake, which would cause major adverse impacts to water quality in the Columbia River and North Portland

[44] Hecht et al., 2007.

Harbor channel. In addition, the existing bridge will require repainting in the future that could introduce contaminants into the Columbia River.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.16-6
Water Quality Effects Associated with Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric[a]	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Approximate total impervious surface area (acres)	249	249	247	247
Approximate untreated impervious surface area (acres)	38	38	38	38
Total Suspended Solids (lbs./year)	43,293	43,293	43,177	43,177
Total Phosphorus (lbs./year)	109	109	108	108
Dissolved Copper (lbs./year)	8	8	8	8
Dissolved zinc (lbs./year)	49	49	49	49

Source: CRC Conceptual Design Stormwater Technical Report and CRC Hydrology and Water Quality Technical Report.

a The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

As shown in Exhibit 3.16-6, for the replacement crossing designs terminating at Kiggins Bowl or Lincoln, total impervious surface area would encompass approximately 249 acres, approximately 43 acres more than the existing condition. However, the amount of impervious surface without stormwater treatment would decline by approximately 124 acres, to a total of about 38 acres. Because the MOS designs do not include a guideway extending further north, they would encompass approximately 247 acres of impervious surface, of which 38 acres would remain untreated.

Pollutant loads from Alternative 2 would still be present, but would decline for all pollutants of concern compared to the existing condition, due to proposed treatment methods. Total suspended solids for these alternatives would total approximately 43,293 pounds per year. Total phosphorus loading would be approximately 109 pounds per year, dissolved copper loading would be approximately 8 pounds per year, and dissolved zinc loading would be approximately 49 pounds per year.

While the overall pollutant loading for the project area is expected to decrease, the Burnt Bridge Creek and Columbia Slough basins would experience increases in loads of certain pollutants. For example, dissolved copper would increase by 0.2 pounds per year to total 1.4 pounds per year in the Burnt Bridge Creek basin and by 0.5 pounds per year to total 2.4 pounds per year in the Columbia Slough Basin. Dissolved zinc would increase by 1.3 pounds per year to total 8.0 pounds per year in the Burnt Bridge Creek Basin and by 2.0 pounds per year to total 14.8 pounds per year in the Columbia Slough Basin. Effects on water quality and estimated concentration of pollutants in natural waters will be quantified after designs for infrastructure and treatment elements are advanced.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.16-7
Water Quality Effects Associated with Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit				
Environmental Metric[a]	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Approximate total impervious surface area (acres)	248	248	246	246
Approximate untreated impervious surface area (acres)	38	38	38	38
Total Suspended Solids (lbs./year)	43,235	43,235	43,119	43,119
Total Phosphorus (lbs./year)	108	108	108	108
Dissolved Copper (lbs./year)	8	8	8	8
Dissolved zinc (lbs./year)	49	49	49	49

Source: CRC Conceptual Design Stormwater Technical Report and CRC Hydrology and Water Quality Technical Report.
[a] The Stacked Transit/Highway Bridge design would perform the same as the three-bridge replacement design.

As shown in Exhibit 3.16-7, for the replacement crossing designs terminating at Kiggins Bowl or Lincoln, total impervious surface area would encompass approximately 248 acres, approximately 42 acres more than the existing condition. However, the amount of impervious surface without stormwater treatment would decline by approximately 124 acres, to a total of about 38 acres. Those replacement crossing designs terminating at the Clark College or Mill Plain would encompass approximately 246 acres of impervious surface, of which 38 acres would remain untreated.

As shown in Exhibit 3.16-7, pollutant loading would be similar to Alternative 2.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.16-8
Water Quality Effects Associated with Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Approximate total impervious surface area (acres)	234	234	232	232
Approximate untreated impervious surface area (acres)	35	35	35	35
Total Suspended Solids (lbs./year)	40,735	40,735	40,619	40,619
Total Phosphorus (lbs./year)	102	102	102	102
Dissolved Copper (lbs./year)	8	8	8	8
Dissolved zinc (lbs./year)	46	46	46	46

Source: CRC Conceptual Design Stormwater Technical Report and CRC Hydrology and Water Quality Technical Report.

For the supplemental crossing designs terminating at Kiggins Bowl or Lincoln, total impervious surface area would encompass approximately 234 acres, approximately 28 acres more than the existing condition (Exhibit 3.16-8). However, the amount of impervious surface without stormwater treatment would decline by approximately 127 acres, to a total of about 35 acres. Those supplemental crossing designs terminating at the Clark College or Mill Plain would encompass approximately 232 acres of impervious surface, of which 35 acres would remain untreated.

Pollutant loads from Alternative 4 would still be present, but would decline for all pollutants of concern compared to the existing condition, due to proposed treatment methods. Total suspended solids for these alternatives would total approximately 40,735 pounds per year. Total phosphorus loading would be approximately 102 pounds per year, dissolved copper loading would be approximately 8 pounds per year, and dissolved zinc loading would be approximately 46 pounds per year.

While the overall pollutant loading for the project area is expected to decrease, the Burnt Bridge Creek and Columbia Slough basins would experience increases in loads of certain pollutants. For example, dissolved copper would increase by 0.2 pounds per year to total 1.4 pounds per year in the Burnt Bridge Creek basin and by 0.2 pounds per year to total 2.1 pounds per year in the Columbia Slough Basin. Dissolved zinc would increase by 1.2 pounds per year to total 7.9 pounds per year in the Burnt Bridge Creek Basin, but would decrease by 0.1 pounds per year to total 12.7 pounds per year in the Columbia Slough Basin. Effects on water quality and ultimate concentration of pollutants in natural waters will be quantified after designs for infrastructure and treatment elements are advanced.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.16-9
Water Quality Effects Associated with Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit				
Environmental Metric	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College MOS (C)	Mill Plain MOS (D)
Total impervious surface area (acres)	233	233	231	231
Untreated impervious surface area (acres)	35	35	35	35
Total Suspended Solids (lbs./year)	40,677	40,677	40,561	40,561
Total Phosphorus (lbs./year)	102	102	101	101
Dissolved Copper (lbs./year)	8	8	8	8
Dissolved zinc (lbs./year)	46	46	46	46

Source: CRC Conceptual Design Stormwater Technical Report and CRC Hydrology and Water Quality Technical Report.

For the supplemental crossing designs terminating at Kiggins Bowl or Lincoln, total impervious surface area would encompass approximately 233 acres, approximately 27 acres more than the existing condition (Exhibit 3.16-9). However, the amount of impervious surface without stormwater treatment would decline by approximately 127 acres, to a total of about 35 acres. Those replacement crossing designs terminating at the Clark College or Mill Plain would encompass approximately 231 acres of impervious surface, of which 35 acres would remain untreated.

Pollutant loading is similar to Alternative 4.

3.16.3 Long-Term Effects of Project Components

This section discusses the specific impacts associated with project components and options. Tolling scenarios and transportation system/demand management options have no notable effect on water quality so are not specifically discussed below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

As discussed above, the replacement crossing would improve stormwater treatment compared to No-Build and the supplemental crossing. The supplemental crossing would improve stormwater treatment when considering the entire project area compared to the No-Build Alternative, but not by as much as the replacement crossing. Highway interchange options would not differ substantially in their stormwater effects. Impacts to the 100-year floodplain would be minor. A detailed no-rise analysis will be performed later in the design process.

The stacked transit/highway bridge design for the replacement crossing would reduce the pollutant load in stormwater from the crossing slightly more than the standard replacement crossing, the supplemental crossing, or No-Build. Transit vehicles would travel in the interior of the bridge structure, reducing the overall impervious surface area, and any pollutants associated with them would be collected and treated prior to discharge.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Pollutant constituents in runoff from non-electric bus rapid transit vehicles are comparable to those from other road vehicles. Constituents include metals, such as copper from brake-pad wear. Light rail does not use a braking system that contains copper, and light rail is not associated with many other pollutants typically contained in road runoff. The bus rapid transit option would also include slightly more new impervious surface area than light rail options. An additional 1 acre of impervious surface would be needed for bus rapid transit at the Expo Center station to allow for bus turnaround and passenger transfer to light rail. Extending the light rail line across the river would not require this much new impervious area at the Expo Center station. These factors mean that light rail options are likely to have fewer adverse effects to water resources when compared to bus rapid transit.

Bus rapid transit could potentially require expanding the C-TRAN bus maintenance facility in east Vancouver at 65th Avenue by approximately 6.7 acres. No floodplain encroachments are anticipated at this site. Associated stormwater treatment would result in minimal impacts to surface water or ground water resources.

Likewise, light rail would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham by approximately 10.5 acres. Portions of the site are located within the 100-year floodplain, however no structures are proposed to be erected within the floodplain. If structures were constructed, or the floodplain were otherwise encroached upon, balanced cut and fill would likely be required. Associated stormwater treatment would result in minimal impacts to surface water or ground water resources.

Even if the No-Build Alternative is chosen and CRC is not built, regional transit services are likely to increase from other projects, and expansion of the vehicle maintenance facilities would likely occur. If one of the build alternatives is chosen for CRC, this project would contribute to the size of that expansion.

Transit Terminus Options (with all Alternatives)

The terminus options would have potentially different effects on water quality only in the northern part of the project area where the Kiggins Bowl terminus is near steep slopes. This could potentially increase erosion that could affect Burnt Bridge Creek. If an accident were to occur in this part of the route during transit operation, then spills or leaks from the accident could potentially affect the creek. The Lincoln terminus does not run near steep slopes or surface waters.

The Kiggins Bowl terminus would also entail a larger increase in impervious area in the Burnt Bridge Creek watershed. The Lincoln terminus would drain into the Columbia River watershed, which is much larger than Burnt Bridge Creek’s. Small watersheds are affected more by a small increase in impervious area, so the same acreage of impervious surface could have greater water quality effects in Burnt Bridge Creek (Kiggins Bowl terminus) than the Columbia River (Lincoln terminus).

Compared to the full-length Kiggins Bowl terminus, building shorter-length routes to either the Clark College or Mill Plain transit centers would avoid the potential effects to Burnt Bridge Creek. Both MOS options would also have less impervious surface than the Kiggins Bowl terminus, though not substantially less because the MOS options would still include multiple park and rides. The shorter Mill Plain option would have slightly lower impacts to water resources than the Lincoln terminus option.

Transit Alignment Options (with all Alternatives)

The transit alignment options (adjacent vs. offset; two-way Washington vs. Broadway-Washington; two-way Broadway vs. Broadway-Main; or 16th Street vs. McLoughlin) would have no measurable differences in long-term water quality effects.

3.16.4 Temporary Effects

For the water quality analysis, temporary effects are those that would occur during construction, and that would likely cease once construction is finished. No CRC-related construction would occur if the No-Build Alternative is chosen, so no temporary effects are considered for that option.

Construction involves ground disturbance, which can increase soil erosion substantially. Construction that causes disturbance along river or stream banks would increase the potential for erosion into the water. If runoff contains extra sediment from erosion, waterways can become turbid (cloudy rather than clear), and can build up excessive sediment deposits. Section 3.14, Ecosystems, discusses the harmful effects of turbidity to fish.

The area of potential ground disturbance would differ only slightly among the roadway and terminus options. The Lincoln terminus option would result in ground disturbance of 373 acres for the supplemental crossing alternatives, and 384 acres of disturbance for the replacement crossing alternatives. The Kiggins Bowl terminus option would result in ground disturbance of 354 acres for the supplemental crossing alternatives, and 366 acres of disturbance for the replacement crossing alternatives. The MOS options would result in approximately two acres less disturbance than the Kiggins Bowl terminus for all build alternatives.

In the northern part of the project area the Kiggins Bowl terminus runs alongside Burnt Bridge Creek for about 1,400 feet and would slightly encroach on its protected buffer area. Construction of this alignment would have a higher potential for erosion or releases of hazardous materials that could affect the creek’s water quality.

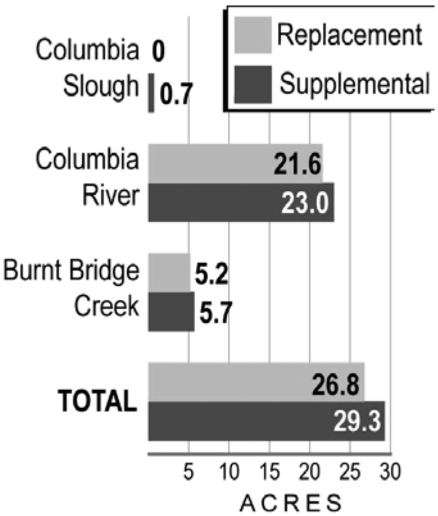
Topography in the area is generally flat, except near Burnt Bridge Creek. Outside of that area, none of the project alternatives are likely to cause substantial amounts of erosion that could create turbidity and sedimentation effects. Roadway construction of the I-5/SR 500 interchange (all build alternatives) may disturb steep slopes near Burnt

Bridge Creek. These activities could cause temporary degradation of water quality from erosion.

In-water construction work on the bridge piers in the Columbia River could stir up sediments on the river bed, which would increase turbidity and could release any pollutants from the sediment into the water.

Construction material or demolition debris that accidentally drops into the water can stir up sediments or physically harm organisms. Potentially harmful construction or demolition materials could include lead-based paint on portions of the existing I-5 bridges, wet concrete that substantially raises pH levels, or accidental fuel or other chemical releases from construction machinery. The replacement alternatives (2 and 3) would involve demolishing and removing the existing bridges. The supplemental alternatives (4 and 5) would involve extensive structural reinforcement of the existing bridges. Both activities would have the potential to release pollutants into the Columbia River.

Exhibit 3.16-10
Acres Of Below-Grade Roadway



Source: CRC Hydrology and Water Quality Technical Report.

Any below-grade construction may require groundwater pumping. Constructing roads or transit lines below the surrounding surface grade can alter groundwater conditions, if pumping is required to keep the site from flooding. If there are nearby hazardous materials sites, this can increase the likelihood of contaminated groundwater spreading out from the site. Exhibit 3.16-10 shows the amount of below-grade construction currently proposed in each watershed for the roadway and crossing options.

The potential sites for a bridge assembly/casting yard are unknown at this time. However, they are likely to be adjacent to the Columbia River, Willamette River, or other water body in the region. The existing conditions on the assembly/casting yard could range from a developed and paved port terminal to a currently undeveloped site. The casting/assembly yard activities may or may not increase stormwater runoff over existing conditions and may or may not increase pollutant loading. Before any site is selected, a thorough, site-specific environmental impact analysis will be conducted. All necessary permits will be secured prior to site development and operations.

3.16.5 Potential Mitigation for Adverse Effects

State and local regulations require mitigation measures so that long-term water quality and hydrology impacts associated with road or transit construction would be largely avoided or minimized. The project would not be constructed until state, federal, and local agencies approve the proposed impact minimization and mitigation methods.

The CRC project will develop plans to control construction-related risks from erosion, sedimentation, or accidental spills. Construction will not begin until these plans are approved by the appropriate agencies. Plans will specifically address spill prevention, in-water construction work, and could include specific water quality targets with penalties if these are not met. There may be special runoff control requirements to address the 303(d) listings of each of the waterways in the project area.

The project will use best management practices to minimize turbidity and release of pollutants during in-water construction in the Columbia River and North Portland Harbor. The project team will prepare applications

How can I learn more?

The Conceptual Stormwater Design Report includes detailed analysis of the design options for stormwater facilities in each watershed, and discusses the regulatory requirements that they address.

for dredging and fill activities under Section 404 of the Clean Water Act, administered by the U.S. Army Corps of Engineers, and will seek water quality certification under Section 401 of the Clean Water Act, administered by the Oregon Department of Environmental Quality and Washington State Department of Ecology.

Sites with existing soil or groundwater contamination near construction areas will be further studied and tested before any groundwater pumping occurs, in order to avoid causing such contamination to spread.

A flood-rise analysis will be conducted during the final design to calculate the impact that piers in the water will have on flood elevation, in accordance with local and state regulations and Executive Order 11988 – Floodplain Management. A rise, if any, would be very small, given the size of the Columbia River in comparison to the project. If necessary, appropriate compensation would be identified to negate flood rise impacts.

A stormwater collection and treatment system will be developed in final design. Until then, the project team has prepared a conceptual design in order to evaluate general feasibility and water quality effects associated with the build alternatives. The conceptual design was prepared to meet the requirements of Oregon and Washington Departments of Transportation, and the Cities of Portland and Vancouver. However, this is just one possible approach of many that will continue to be considered. In addition, following identification of a locally preferred alternative, the project team will prepare a Biological Assessment and through formal consultation procedures with NMFS and USFWS will further define stormwater treatment requirements.

The conceptual design prepared for DEIS analysis entails gravity pipe drainage systems that would collect and convey runoff from the new bridges, transit guideway, and road improvements. Basic treatment would reduce total suspended solids to the maximum feasible extent before runoff reaches surface waters. Because the transit facilities and roadways will be operated by different agencies with responsibility for maintenance, roadway and transit runoff would likely be directed to different facilities.

No mitigation of potential hydrologic or water quality effects from the No-Build Alternative would occur.

Potential Mitigation in Columbia Slough Watershed

The conceptual stormwater management approach used in the DEIS analysis would convey stormwater from the transit guideway and highway bridges and structures on Hayden Island through the collection system to new treatment swales or ponds near Marine Drive, rather than treating it on Hayden Island. The Marine Drive location has fewer space and land use constraints compared to Hayden Island. It would, however, transfer stormwater currently discharging to the Columbia River to the Columbia Slough. This would likely require a design exception. In addition, because the Columbia Slough is a much smaller waterway than the Columbia River, this could contribute to a more noticeable effect on water quality. This conceptual stormwater design would require exceptions from FHWA and ODOT design standards. Other stormwater treatment approaches will continue to be evaluated and considered, including options that would treat runoff on Hayden Island rather than conveying it to the Marine Drive area.

Potential Mitigation in Columbia River Watershed

The existing stormwater system in this area collects runoff both from I-5 and from about 250 acres of downtown Vancouver. The build alternatives would separate the highway runoff from this system and treat it in several bioinfiltration swales. During high-flow events, water from the highway would reconnect to the existing system and discharge to the Columbia River after a minimum residence time in the swales. Some parts of the highway that will not be reconstructed for this project will remain connected to the existing system and would continue to discharge to the river without treatment.

In the conceptual design used for DEIS analysis, runoff from the high point of the transit bridge over the river to its touchdown point in Vancouver would flow to a swale near SR 14 before discharging to the Columbia River through an existing outfall. In downtown Vancouver, if curbs separate the transit guideway from the existing roadway, engineered water quality treatment devices could treat transit runoff before releasing it to the City stormwater system.

Runoff from the Clark College Park and Ride could be treated either by swales or engineered water quality treatment devices, depending on the final layout.

Potential Mitigation in Burnt Bridge Creek Watershed

Existing stormwater retention ponds near the Main Street interchange and 15th Avenue and 41st Circle could be expanded under all build alternatives to handle highway and guideway runoff.

3.17 Geology and Soils

Understanding potential geologic and soils hazards and impacts is a priority for large infrastructure projects such as CRC. Bridges are vital links in the transportation system and are often especially vulnerable during earthquakes or landslides. The Pacific Northwest is a geologically active region and experiences earthquakes both large and small, as well as landslides and erosion along vulnerable slopes. Careful consideration of design, location, and construction techniques improves the safety of transportation structures during seismic events and increases stability in areas prone to erosion and landslides. This section also considers potential impacts to groundwater. The information presented in this section is based on the Geology and Soils Technical Report.

How can I learn more?

Chapter 4 of the Geology and Soils Technical Report gives a detailed, technical description of geologic conditions and hazards in the project area.

How strong is a 9.0 earthquake?

In the Richter scale for earthquake magnitude, each increase of one whole number (for example, from 6.0 to 7.0) is a ten-fold increase in earthquake strength. This means that shaking from a major subduction fault quake at a magnitude of Richter 9.0 could be more than 100 times stronger than from the most severe surface fault quakes with magnitudes of Richter 7.0.

3.17.1 Existing Conditions

The information presented here was gathered from published reports, previous investigations of the project area, and project-related geotechnical borings conducted in 2006. Once a preferred alternative or alignment has been identified, more detailed geotechnical evaluations will be performed in order to finalize design and construction details.

Earthquakes

Several types of earthquakes could occur in the project area. Exhibit 3.17-1 illustrates relative earthquake hazard for this area. There is a large, offshore subduction fault that occurs where the Juan de Fuca tectonic plate plunges under the North American Plate approximately 120 miles west of the I-5 crossing. This subduction fault is capable of producing a large earthquake of magnitude 9.0 on the Richter scale, which is similar in size and type to the Indonesian earthquake of December 2004. Geologists estimate that earthquakes of that size occur here, on average, every 350 to 700 years. The last such earthquake happened a little more than 300 years ago.

Exhibit 3.17-1
Earthquake Hazard Zone Map

Source: Mabey et al. 1993, 1994.

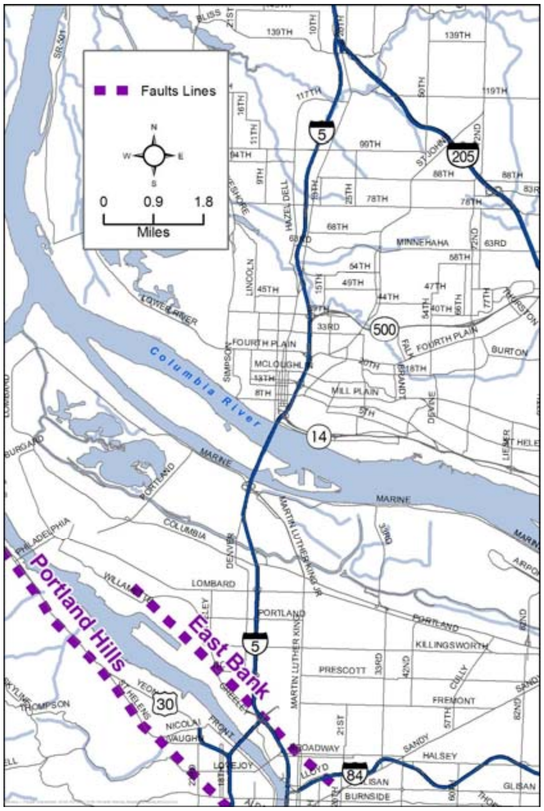
Smaller earthquakes are also possible along several near-surface faults located around the project area. Geologists estimate that the largest possible earthquake from these smaller faults would be about a magnitude 6.5 on the Richter scale. Although not as powerful as subduction fault earthquakes, those earthquakes originating from near-surface faults are strong enough to damage structures and destroy those built without adequate seismic considerations. Near-surface faults also produce many smaller earthquakes of lesser intensity, with more than a dozen such quakes large enough to feel every year in Washington and Oregon. Although no near-surface faults have been mapped inside the CRC project area, Exhibit 3.17-2 shows the locations of the closest known faults, located to the south of the project area.

Seismic activity in the Portland-Vancouver area varies widely in the potential severity of effects. The earthquake hazard zone map shows a map of the relative earthquake ratings in the project area. These ratings take into account a variety of potential earthquake effects to create a scale with A being the greatest hazard, to D being the least. Damage from earthquakes is not always directly related to how hard the shaking is. While shaking can certainly stress or damage structures, often a greater hazard results from how the ground under the structure reacts to the quake.

Loose, sandy soils, such as the first layer of substrate beneath the Columbia River and its historic flood plain, can lose strength in an earthquake, and may begin acting like a liquid. If these soils have roadways or other structures on them, the ground can suddenly stop providing support. Loose, soft soils may act as amplifiers during earthquakes, resulting in stronger shaking near the ground surface than in other areas with different types of soils.

Areas with steep slopes can also be vulnerable to failure during an earthquake. Sideways motion can cause slopes to collapse. Road or transit facilities near steep slopes can be in danger during earthquakes from landslides as well as direct effects of the shaking.

Exhibit 3.17-2
Mapped Faults Closest to the CRC Area



Source: CRC Geology and Soils Technical Report.

Soils and Bedrock

The Columbia River Crossing project is located in a relatively flat area covered by deep, unconsolidated deposits of sand, gravel, cobbles, and boulders.

Underlying these deposits is a rock-like, cemented sand and gravel layer known locally as the Troutdale Formation. The depth to the Troutdale Formation varies across the site, from approximately 100 feet below the North Portland Harbor crossing to more than 200 feet below the southern portion of the main river crossing to less than 50 feet near the north bank of the main river crossing.

In Oregon, the project area is located in the historic floodplain of the Columbia River. Before development and the creation of dikes and dams in the region which now generally limits the 100-year floodplain to the river channel, this area was part of a large river channel wetland complex. Soils were typically deep silts and sands, and the entire area is relatively flat and used to flood regularly. Since development began in the area, dikes and other flood protection techniques have disconnected the river from most areas of its former floodplain. Fill material, usually sand dredged from the Columbia River channel, was used to raise many of these low-lying areas prior to building the commercial, residential, industrial and recreational facilities the land now supports. These soils can be subject to liquefaction or amplification during an earthquake.

TERMS & DEFINITIONS
Liquefaction

Liquefaction is a phenomenon associated with earthquakes in which sandy to silty, water-saturated soils behave like fluids. As seismic waves pass through saturated soil, the structure of the soil distorts, and spaces between soil particles collapse, causing ground failure. In general, recently deposited loose sediment and areas with high water tables are the most vulnerable to liquefaction.

In Washington, the project area is located on a gently sloping terrace that is naturally above the river floodplain. Local areas of filled or excavated soil are not uncommon in the developed areas in or near the project in Washington. The only steep slopes mapped by the City of Vancouver in the primary project area are under the I-5 bridges, and near Burnt Bridge Creek, which is located near the SR 500 interchange.

The project area is not located in an area of where lava and lahar flows associated with volcanic eruptions has occurred within the past 20,000 years. Flows from currently active volcanoes could impact the Columbia River upstream of the project area (Mt. Hood and Mt. Adams), or downstream (Mt. St. Helens).

Groundwater

Near-surface groundwater in the project area is heavily influenced by the height of the water in the Columbia River. The river level can change based on tides or on releases of water from dams upstream. Near-surface groundwater is typically found within 20 feet of the surface in the project area. Local soils, slopes, and stormwater systems can heavily influence this, sometimes providing for better drainage, and sometimes contributing to surface ponding.

Groundwater conditions can affect the cost or practicality of options, alignments, construction techniques, or construction timing. In places where excavation is required, encountering near-surface groundwater requires pumping, diverting, or blocking the water from the construction area.

Deeper groundwater is part of the Troutdale aquifer, and is the source of drinking water in the Washington part of the project area. The EPA has designated this as a “sole-source” aquifer, which means that alternative supplies are not feasible. It is accessed both by private wells and municipal wells. One of Vancouver’s municipal wells is located within the project area. This project will require EPA review and approval to ensure that its activities do not create a substantial hazard to public health. In Oregon, although municipal water sources are outside of the project area, some private wells near the project are on record. Project alternatives were analyzed to see whether they have the potential to affect these groundwater resources. The Oregon portion of the project is not located over the Troutdale sole-source aquifer.

Existing Project Facilities

In 2006, a panel of geotechnical and bridge engineering experts reviewed seismic vulnerabilities for the existing I-5 bridges over the Columbia River.[45] The northbound span of the bridge was constructed in 1917, and full details of the foundation and pier construction are not known. In 1958, the southbound bridge span was constructed, and the original bridge was renovated to allow for a wider and higher shipping channel. The piers of the older bridge were also reinforced, although knowledge of and design for earthquakes was not well developed at that time. The piers of both bridges are built on top of wooden and steel pilings that do not extend into the underlying Troutdale Formation at the site. The piles were driven to a depth of not more than 70 feet into the alluvial sands, silts and gravels overlying the Troutdale Formation.

This seismic panel warned that the top layer of this substrate could experience liquefaction during a severe earthquake, and major seismic retrofitting of the existing structures would be required to enable them to withstand such an earthquake without collapsing. Both bridge structures have lift spans that are operated by large counterweights. These counterweights were also identified as a potential source of bridge instability during an earthquake.

[45] CRC Seismic Panel, 2006.

3.17.2 Long-term Effects of Project Alternatives

Long-term effects are those that continue after the construction of the project is complete, and are summarized in the following discussion. In the case of the No-Build Alternative, long-term effects are those that can be reasonably anticipated if the existing facilities receive only maintenance rather than expansion or replacement.

Alternative 1: No-Build

Under the No-Build Alternative, the CRC project would not go forward, and the seismic improvements planned for the build alternatives would not occur. The I-5 crossing would remain vulnerable to serious damage or collapse during a major seismic event.

The No-Build Alternative would not improve the ability of the elevated roadway on Hayden Island or the touchdown point in South Vancouver to withstand a major earthquake. Under the No-Build Alternative transit buses would continue to travel on the existing I-5 crossing and elevated roadway in the Hayden Island area, and would thus be subject to the existing, higher risk of earthquake damage than with the build options.

The No-Build Alternative would not disturb existing ground surfaces nor pose an additional risk to groundwater supplies.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.17-3
Seismic Vulnerability, Soils Impacts, and Groundwater Impacts from Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit				
Environmental Metric[a]	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Seismic vulnerability	Most improved	Most improved	Most improved	Most improved
Soils	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River, with slightly high risk.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River, with slightly lower risk.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River, with slightly lower risk.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River, with slightly lower risk.
Groundwater	Potential impacts to groundwater if not addressed for park and ride facilities and other excavation.	Potential impacts to groundwater if not addressed for park and ride facilities and other excavation.	Potential impacts to groundwater if not addressed for excavation.	Potential impacts to groundwater if not addressed for excavation.

Source: CRC Geology and Soils technical Report and CRC Seismic Panel Report.

[a] The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

As shown in Exhibit 3.17-3, the replacement crossing designs would result in long-term benefits by improving the ability of the river crossing to withstand a major earthquake by incorporating modern seismic standards into the design.

Soil disturbance would occur with this alternative. Although soil stabilization techniques would be employed during construction and operation, the potential exists for steep slopes to become destabilized.

The Kiggins Bowl terminus may result in slightly higher risk of steep slope disturbance due to the proposed construction of a transitway closer to steep slopes near Burnt Bridge Creek. The other terminus options, would still require construction activities related to roadways near the steep slopes of Burnt Bridge Creek, but not to the same extent as with the Kiggins Bowl terminus.

Groundwater impacts are not anticipated to occur with this alternative if proper design and implementation of protection measures occurs. The Kiggins Bowl and Lincoln terminus options would result in the excavation for park and ride facilities that could impact groundwater flows and supply. The MOS options would not require excavation for park and ride facilities, but would still require excavation for other construction activities.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.17-4
Water Seismic Vulnerability, Soils Impacts, and Groundwater Impacts from Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit				
Environmental Metric[a]	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Seismic vulnerability	Most improved	Most improved	Most improved	Most improved
Soils	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River
Groundwater	Potential impacts to groundwater if not addressed for park and ride facilities and other excavation.	Potential impacts to groundwater if not addressed for park and ride facilities and other excavation.	Potential impacts to groundwater if not addressed for excavation.	Potential impacts to groundwater if not addressed for excavation.

Source: CRC Geology and Soils technical Report and CRC Seismic Panel Report.

[a] The Stacked Transit/Highway Bridge (STHB) design would perform the same as the three-bridge replacement design.

Alternative 3 would have the same impacts for seismic vulnerability, soils and groundwater as Alternative 2, as shown in Exhibit 3.17-4.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.17-5
Seismic Vulnerability, Soils Impacts, and Groundwater Impacts from Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Seismic vulnerability	Improved	Improved	Improved	Improved
Soils	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River.
Groundwater	Potential impacts to groundwater if not addressed for park and ride facilities and other excavation.	Potential impacts to groundwater if not addressed for park and ride facilities and other excavation.	Potential impacts to groundwater if not addressed for excavation.	Potential impacts to groundwater if not addressed for excavation.

Source: CRC Geology and Soils Technical Report and CRC Seismic Panel Report.

As shown in Exhibit 3.17-5, the supplemental crossing designs would result in long-term benefits by retrofitting the existing bridges to meet seismic standards for northbound traffic and building additional bridges for southbound traffic and public transit that exceeds seismic standards.

The supplemental crossing designs would have the same impacts for seismic vulnerability, soils and groundwater as Alternatives 2 and 3.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.17-6
Seismic Vulnerability, Soils Impacts, and Groundwater Impacts from Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit				
Environmental Metric	**Kiggins Bowl Terminus (A)**	**Lincoln Terminus (B)**	**Clark College MOS (C)**	**Mill Plain MOS (D)**
Seismic vulnerability	Improved	Improved	Improved	Improved
Soils	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River.	Mitigable impacts to steep slopes near Burnt Bridge Creek and Columbia River.
Groundwater	Potential impacts to groundwater if not addressed for park and ride facilities and other excavation.	Potential impacts to groundwater if not addressed for park and ride facilities and other excavation.	Potential impacts to groundwater if not addressed for excavation.	Potential impacts to groundwater if not addressed for excavation.

Source: CRC Geology and Soils Technical Report and CRC Seismic Panel Report.

Alternative 5 would have the same impacts for seismic vulnerability, soils and groundwater as Alternative 4, as shown in Exhibit 3.17-6.

3.17.3 Long-Term Effects of Project Components

This section describes the impacts of specific project components and options. Transit operations options, tolling scenarios, and transportation system/demand management options do not affect the geology and soils analysis, so are not specifically addressed below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

The replacement crossing designs would likely provide the greatest protection in the event of a severe earthquake, because all of the structures would be new. With the supplemental crossing designs, the existing 1917 and 1958 structures would be retrofitted. For the geologic analysis, there is no other substantial difference between the replacement and supplemental crossings.

The existing and proposed interchanges and bridge touchdown points between Marine Drive and South Vancouver are located in the highest risk earthquake zone. With No-Build, in an earthquake, elevated structures or embankments could be damaged or collapse. The build alternatives would improve the ability of the roadway to withstand a major earthquake because they will follow modern seismic standards.

Near Burnt Bridge Creek in the northern part of the project area, all existing and proposed roadway alignments come within 200-400 feet of a high-hazard earthquake area. Potential landslides and soil liquefaction could occur in this area during an earthquake, which could damage the roadway and any adjacent facilities.

As the stacked transit/highway bridge (STHB) design for the replacement crossing would entail greater weight loading of one bridge, it would likely require an additional set of piers and may require larger piers than the three-bridge replacement crossing. The STHB would be designed to the same standard of seismic safety as the three-bridge design.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

The transit mode choice between bus rapid transit and light rail transit, including their respective maintenance bases, has no meaningful effect geology, soils, and ground water.

Transit Terminus Options (with all Alternatives)

The Kiggins Bowl terminus has a slightly higher risk of landslides and erosion than the Lincoln terminus, although this could be mitigated through design and construction techniques.

The proposed Kiggins Bowl Park and Ride facility is located near steep slopes associated with Burnt Bridge Creek. The design of the Kiggins Bowl terminus would have the transit guideway cross I-5 on an elevated structure near Kiggins Bowl. Without proper construction techniques, construction near these areas could increase the potential for landslides or erosion. The Lincoln terminus would not change the current risk of landslide or erosion.

Park and ride structures could include underground parking. Deeper excavation is more likely to encounter groundwater. There is greater potential for this risk at the Kiggins Bowl Park and Ride facility. Facilities would need to be designed to avoid leaks into or flooding of the lower levels, which could impact groundwater resources.

Both the Clark College and Mill Plain terminus options would avoid the potential groundwater, erosion, or landslide concerns associated with the proposed Kiggins Bowl terminus. They would have all the other effects of the other terminus options.

Transit Alignment Options (with all Alternatives)

OFFSET OR ADJACENT

The proposed transit station and guideway on Hayden Island would be elevated under both alignment options. Hayden Island is in a high-risk earthquake hazard zone, where elevated structures can be at risk of damage or collapse.

BROADWAY-WASHINGTON OR TWO-WAY WASHINGTON

No differences in the geologic analysis are associated with the Broadway-Washington or two-way Washington alignment options in downtown Vancouver.

BROADWAY-MAIN OR TWO-WAY BROADWAY

No differences in the geologic analysis are associated with the Broadway-Main or two-way Broadway alignment options associated with the Lincoln terminus.

16th Street or McLoughlin

No differences in the geologic analysis are associated with the 16th Street or McLoughlin aligns options associated with the Kiggins Bowl and Clark College terminus options.

3.17.4 Temporary Effects Related to Geology

All build alternatives would include excavating surface soils, creating embankments, removing old roadways, and building access roads and equipment staging areas. These activities can increase erosion and downslope sedimentation. Building cut-banks and retaining walls can decrease slope stability in steep areas. Stormwater runoff during construction activity can include pollutants that can adversely affect groundwater quality.

Park and ride structures could include underground parking. Deeper excavation is more likely to encounter groundwater during construction activities. De-watering during construction would require appropriate techniques for ensuring groundwater and surface water quality and hydrology is maintained.

3.17.5 Potential Mitigation for Adverse Effects

Current seismic standards will be incorporated into the design and construction of all new structures for all of the build alternatives. With the supplemental crossing alternative, the old I-5 bridges would be seismically retrofitted to greatly decrease earthquake hazards. However, the retrofitted structures could not be built to the same standards as a new bridge.

For all build alternatives, ground improvement or deep foundations would be required beneath transit and roadway foundations, especially in the high-risk zones on Hayden Island and the touchdown point in South Vancouver.

For the Kiggins Bowl terminus, measures would be required to avoid increasing the risk of slides and erosion on steep slopes near Kiggins Bowl.

For all the build alternatives, construction and operation of park and rides and other project elements will be designed to first avoid, then minimize, and then mitigate for negative groundwater impacts. Continued coordination with EPA will occur to address the review approval process for impacts to the Troutdale sole source aquifer.

Following identification of a preferred alternative, the project team will conduct further site-specific geotechnical evaluation and evaluate construction best management practices. When it is not possible to avoid seismic hazards, steep slopes, or hazardous soil types, the project will seek to minimize the effect of these conditions by using appropriate geotechnical and engineering techniques.

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3.18 Hazardous Materials

The CRC alternatives could have both adverse and beneficial effects related to hazardous materials. The information presented in this section is based on the CRC Hazardous Materials Technical Report, which is included as an electronic appendix to this DEIS.

Project construction and operations employ a variety of hazardous materials (fuels, lubricants, asphalt, paint, solvents, etc.). Any time such materials are used there is a risk that they could be accidentally released to the environment.

Project construction will occur on some properties that are already contaminated, as is normal in a heavily developed area. There is a risk that disturbing these contaminated sites could expose workers and others to health hazards or could cause the contamination to spread. However, by studying and testing these sites prior to construction, and with appropriate measures to clean up contaminated sites, the overall results of the build alternatives are likely to be beneficial for both the environment and the community.

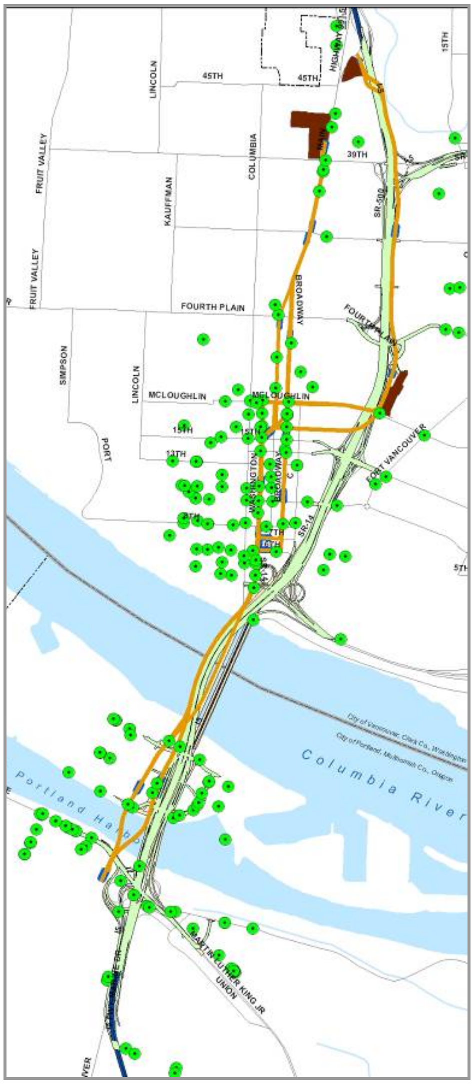
3.18.1 Existing Conditions

As shown on the maps on the following pages, the project alternatives cross properties that have a long history of development and have had varied uses over time. Agriculture, industry, commercial development, and even residential land uses can result in a variety of potentially hazardous materials being left in the soil and groundwater. Many of these contaminants can remain for decades in the ground, and can spread when they reach groundwater. These contaminants can cause harm to the environment, including soils, surface water, and ground water such as the Troutdale sole source aquifer, and to people, including nearby residents, employees, and construction or utility workers that may encounter the hazardous materials directly.

All of the build alternatives would acquire new property, demolish old structures, disturb the ground, and contact groundwater, thus involving a risk of encountering hazardous materials or contaminated soils or groundwater during construction. The existing highway right-of-way and transit maintenance bases also have sites of potential hazardous materials on or adjoining them. These sites may pose environmental, health, or liability concerns even if construction or acquisition related to the CRC project does not occur.

Because of these risks, it is important to look at the history and current uses of land near the project. This research provides a way to screen sites that may have potential hazards. Identifying high-risk sites early in the process provides essential liability protection for the project, both financially and in terms of worker protection. It is not always possible to identify all sites where hazardous material may be encountered, but performing due diligence helps to lower the risk. Once a preferred alternative or alignment is chosen, more detailed investigations of properties near the project will be performed.

Exhibit 3.18-1
Sites with Past or Present Hazardous Materials Concerns



Source: CRC Hazardous Materials Technical Report.

The project area is heavily urbanized, and many properties have a history of creating, using, or storing potentially hazardous material. Sites that are most likely to impact the project are those that could be acquired for right-of-way and those that are closest to the roadway and transit alignments. Exhibit 3.18-1 shows the locations of these potentially high-risk sites.

Based on initial research into land use history and search results of government databases that track sites with environmental concerns, the project identified 427 potential hazardous materials sites within 500 feet of the project area. Of these, 31 sites ranked as potentially high-risk. These sites were ranked based on criteria such as how close they are to the project, what type of environmental concern the site has, and whether contamination was cleaned up in the past or is known to currently exist on the site. The CRC Hazardous Materials Technical Report provides full details on the methods used to analyze the sites, and lists the individual rankings.

Potentially hazardous waste sites vary greatly in scope. Cleaning up a site where a home heating oil tank has leaked is usually relatively easy and inexpensive. Cleaning up a site that has a history of dumping or industrial activity could involve many different kinds of contaminants, and could be very difficult, time consuming, and expensive. All properties directly affected by the preferred alternative will need to be investigated more fully before the cost, delay, or liability associated with existing contamination can be realistically estimated. For this reason, the long-term effects described in the next section are qualitative in nature.

3.18.2 Long-Term Effects of the Project Alternatives

For the hazardous material analysis, long-term effects are those that occur after construction of the project is complete. For the build alternatives, these are typically beneficial effects that result from identifying and remediating existing hazardous sites. Long-term effects are tied closely to the discovery of sites that are discussed in the short-term effects section of this document. Long-term impacts are summarized in the following discussion and tables.

Alternative 1: No-Build

In the case of the No-Build Alternative, long-term effects are those that can be reasonably anticipated if the CRC build alternatives are not constructed.

If no construction or property acquisition occurs for this project, existing hazardous material sites would not be addressed by the project, and cleanup of these sites may not occur. This would present a higher long-term risk to the community and the environment than the build alternatives.

Long-term adverse effects from using the highway could also be greater if the existing crossing and roadway are kept. Much of the pollution that comes from roadways is from day-to-day leaks from vehicles or as a result of spills from accidents. Compared to modern roadway designs, the existing bridges and approaches have numerous sub-standard safety features that can increase the likelihood of accidents. Also, when it rains, contaminants from I-5 in the project area are washed directly into the Columbia River, creating a pathway for exposure.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.18-2
Summary of long-term Hazardous Materials Effects for Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Cleanup of existing hazardous materials sites	More cleanup sites – high environmental benefit.	Most cleanup sites – highest environmental benefit.	Fewer cleanup sites – some environmental benefit.	Fewer cleanup sites – some environmental benefit.
New hazardous materials spill potential	Reduce spill risk w/ lower congestion and collisions. BRT would slightly increase risk from transit. Separation of guideway would decrease transit spill risk.	Reduce spill risk w/ lower congestion and collisions. BRT would slightly increase risk from transit. At-grade transit would increase transit spill risk.	Reduce spill risk from lower congestion and collisions. BRT would slightly increase risk from transit.	Reduce spill risk from lower congestion and collisions. BRT would slightly increase risk from transit.
Risks of construction exposure	Low	Low	Low	Low
Pathways to groundwater	Improved stormwater containment.	Improved stormwater containment.	Improved stormwater containment.	Improved stormwater containment.

Source: CRC Hazardous Materials Technical Report.
[a] Values for the replacement design and the STHB design are the same unless otherwise noted.

The Lincoln terminus option is associated with the highest number of sites with potential contamination, so the long-term beneficial effect of investigating and/or cleaning up these sites would be slightly higher than for the other terminus options. As discussed in the Temporary Effects discussion of this section, most known hazardous materials sites would be affected by all terminus options, so the differences would be relatively minor.

For all the terminus options and the stacked transit/highway bridge design, replacing the river crossing and making the associated highway interchange improvements would improve safety and reduce congestion in the project area, which would lower the risk of hazardous materials from leaks and accidents over existing conditions. Roadway runoff from the new crossing and improved interchanges would be treated before entering streams or rivers, lowering the risk that hazardous materials spilled on the roadway or transit lines would enter the environment.

Alternative 2 includes bus rapid transit, which would have a slightly elevated risk of hazardous materials related to transit operations being released into the environment. Bus rapid transit would involve more vehicles, which would most likely be powered by on-board fuel tanks. More vehicles would increase the potential for transit-related collisions, and because buses carry fuel on board, this would increase the potential for leaks or spills of hazardous materials from transit vehicles.

The Lincoln terminus option travels through Vancouver primarily at grade, where intersections and streets shared with traffic could increase the potential for collisions and leaks or spills of hazardous materials compared to the Kiggins Bowl terminus option which routes the northern part of the transit guideway on a grade-separated structure in the highway right-of-way. The MOS options, are shorter, but additional driving in privately owned vehicles to reach these termini could result in the potential for collisions and leaks or spills of hazardous materials.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.18-3
Summary of long-term Hazardous Materials Effects for Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Cleanup of existing hazardous materials sites	More cleanup sites – high environmental benefit.	Most cleanup sites – highest environmental benefit.	Fewer cleanup sites – some environmental benefit.	Fewer cleanup sites – some environmental benefit.
New hazardous materials spill potential	Reduce spill risk from lower congestion and collisions. Separation of guideway would decrease transit spill risk.	Reduce spill risk from lower congestion and collisions. At-grade transit would increase transit spill risk.	Reduce spill risk from lower congestion and collisions.	Reduce spill risk from lower congestion and collisions.
Risks of construction exposure	Low	Low	Low	Low
Pathways to groundwater	Improved stormwater containment.	Improved stormwater containment.	Improved stormwater containment.	Improved stormwater containment.

Source: CRC Hazardous Materials Technical Report.

[a] Values for the replacement design and the STHB design are the same unless otherwise noted.

As shown in Exhibit 3.18-3, Alternative 3 would have the same long term benefits from cleanup of sites with known hazardous materials concerns and improved collection of roadway runoff as described above for Alternative 2.

Alternative 3 includes light rail, which would have fewer vehicles and would be powered with electricity rather than fuel carried on-board. Fewer vehicles would decrease the potential for collisions and electric power would decrease the likelihood of spills or leaks of petroleum from transit vehicles.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.18-4
Summary of long-term Hazardous Materials Effects for Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
Cleanup of existing hazardous materials sites	More cleanup sites – high environmental benefit.	More cleanup sites – high environmental benefit.	Fewer cleanup sites – some environmental benefit.	Fewer cleanup sites – some environmental benefit.
New hazardous materials spill potential	Some reduction in spill risk from lower congestion and collisions. BRT would slightly increase risk from transit. Separation of guideway would decrease transit spill risk.	Some reduction in spill risk from lower congestion and collisions. BRT would slightly increase risk from transit. At-grade transit would increase transit spill risk.	Some reduction in spill risk from lower congestion and collisions. BRT would slightly increase risk from transit.	Some reduction in spill risk from lower congestion and collisions. BRT would slightly increase risk from transit.
Risks of construction exposure	Low	Low	Low	Low
Pathways to groundwater	Improved stormwater containment.	Improved stormwater containment.	Improved stormwater containment.	Improved stormwater containment.

Source: CRC Hazardous Materials Technical Report.

a Values for the replacement design and the STHB design are the same unless otherwise noted.

As shown in Exhibit 3.18-4, sites with known environmental concerns would be investigated or cleaned up under Alternative 4, providing environmental benefit that would vary slightly with each terminus option, as further discussed in the Temporary Effects discussion below.

Alternative 4 would lower the risk of hazardous materials from leaks or traffic accidents compared to existing conditions. Higher accident rates increase the potential for spills of petroleum or other hazardous materials to the environment. The existing bridges, with sub-standard design features and high accident rates, would remain in service northbound, so risks in the northbound direction would remain the same or increase as the number of vehicles increases in the future. The southbound highway traffic would be placed on the new bridge where improved congestion and safety design would lower the risk of leaks and spills resulting from accidents.

Runoff from the existing bridges would continue to be discharged into the river, which would increase the potential for spills or leaks occurring on this portion of the roadway to reach surface water. Runoff from the new bridge would be treated before release.

Alternative 4 includes bus rapid transit, with slightly elevated operational risk of hazardous materials releases as described for Alternative 2.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.18-5
Summary of long-term Hazardous Materials Effects for Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit[a]				
	Kiggins Bowl Terminus (A)	**Lincoln Terminus (B)**	**Clark College Terminus (C)**	**Mill Plain Terminus (D)**
Cleanup of existing hazardous materials sites	More cleanup sites – high environmental benefit.	More cleanup sites – high environmental benefit.	Fewer cleanup sites – some environmental benefit.	Fewer cleanup sites – some environmental benefit.
New hazardous materials spill potential	Some reduction in spill risk from lower congestion and collisions. Separation of guideway would decrease transit spill risk.	Some reduction in spill risk from lower congestion and collisions. At-grade transit would increase transit spill risk.	Some reduction in spill risk from lower congestion and collisions.	Some reduction in spill risk from lower congestion and collisions.
Risks of construction exposure	Low	Low	Low	Low
Pathways to groundwater	Improved stormwater containment.	Improved stormwater containment.	Improved stormwater containment.	Improved stormwater containment.

Source: CRC Hazardous Materials Technical Report.

[a] Values for the replacement design and the STHB design are the same unless otherwise noted.

As shown in Exhibit 3.18-5, Alternative 5 would have the same long-term risks and benefits as Alternative 4, described above for the improved management of roadway runoff and the reduction of leaks and spills caused by collisions and leaks. It would improve these risks and benefits compared to the No-Build Alternative.

Alternative 5 includes light rail transit. As discussed above for Alternative 3, light rail would have fewer vehicles and would be powered with electricity. This would decrease the potential for collisions and would decrease the likelihood of fuel spills or leaks from transit vehicles.

3.18.3 Long-Term Effects of Project Components

This section describes the effects associated with project components and options. Certain components and options, including the stacked transit/highway bridge design, tolling scenarios, and transportation system/demand management do not affect the hazardous materials analysis, and are not specifically discussed below.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

Improved traffic safety with a new bridge and interchanges could result in a long-term benefit by reducing the number of accidents that result in spills of fuel or hazardous cargos. The replacement crossing would involve the most safety improvements and result in the largest reduction of congestion and crashes. The replacement crossing would generate the largest improvement in long-term operational risks. The supplemental crossing would improve operational risk over the No-Build Alternative, but less than the replacement crossing.

The Marine Drive southern alignment is located adjacent to the Harbor Oil Superfund site on N. Force Avenue. Construction and operation of this alignment may involve exposure to petroleum, pesticides, PCBs, and other contaminants at the Harbor Oil site.

If hazardous sites are identified that cannot be avoided by the project, cleanup or maintenance activities would occur. Legal restrictions could also be placed on hazardous sites that could interfere with construction or operation of the highway or transit options. The replacement crossing has a slightly higher range of hazardous sites likely to be encountered. This could result in the benefit of more long-term cleanup than the supplemental crossing.

Long-term health or liability consequences could occur if construction exposes people to contamination, or causes it to spread. The replacement crossing has a slightly higher range of hazardous sites likely to be encountered. This could result in more risk of health or liability consequences from construction exposure.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

Bus rapid transit would involve buses, which may be powered by on-board fuel tanks. The larger number of vehicles would increase the potential for collisions, and because buses carry fuel on board, this would increase the potential for leaks or spills of hazardous materials from transit vehicles.

Light rail would have fewer vehicles and would be powered with electricity. This would decrease the potential for collisions and would decrease the likelihood of spills or leaks from transit vehicles.

Both the bus and light rail maintenance facilities would use and store potentially hazardous materials such as fuel, oil, solvents, paint, and other potentially hazardous materials needed to maintain the vehicles. The CRC transit alternatives would contribute to an increase in the use of these materials, and could increase the long-term risk of spills or leaks to the environment or exposure to workers. TriMet and C-TRAN have both substantially reduced their use of such materials in the past decade and reduced the risk of spills or leaks.

Transit Terminus Options

The Lincoln terminus would entail detailed investigation and likely cleanup of the potentially hazardous materials site where the Lincoln Park and Ride is proposed. This would have beneficial long-term effects by reducing existing environmental or health concerns associated with that site.

Fewer potential hazardous materials sites are associated with the Kiggins Bowl terminus, which may therefore entail the least long-term health and environmental benefit from cleanup of existing sites. The Kiggins Bowl terminus would entail detailed investigation and possible cleanup of one high-risk hazardous materials site north of Clark College. If cleanup occurred, this would have beneficial effects by reducing existing environmental or health concerns associated with that site.

The Kiggins Bowl terminus would entail fewer at-grade intersections than the Lincoln terminus and would have a lower risk for leaks or spills of hazardous materials resulting from transit operations.

The Clark College terminus would avoid one high-risk site associated with the Kiggins Bowl terminus and therefore would potentially provide less long-term health and environmental benefit than an investigation and possible cleanup of the site.

The fewest potential hazardous materials sites are associated with the Mill Plain terminus, and this option may therefore entail the least long-term health and environmental benefit from investigation and cleanup of existing sites.

TRANSIT ALIGNMENT OPTIONS (WITH ALL ALTERNATIVES)

Offset or Adjacent

No differences in long-term hazardous materials risks or benefits are associated with the offset or adjacent alignment options.

Broadway-Washington or Two-way Washington

The Broadway-Washington couplet is associated with more potential hazardous materials sites and therefore could provide greater long-term benefit to human health and the environment by investigation and cleaning up of those sites. The two-way Washington option would encounter fewer sites.

Broadway-Main or Two-Way Broadway

These two alignment options are part of the Lincoln terminus. The Broadway-Main couplet is associated with more potential hazardous materials sites and therefore could provide greater long-term benefit to human health and the environment by investigation and cleaning up of those sites. This route would entail more at-grade intersections and would have a higher risk for leaks or spills of hazardous materials resulting from transit operations.

The two-way Broadway option would encounter fewer sites and therefore may entail less long-term benefit from investigation and cleanup. This route would entail fewer at-grade intersections and would have a lower risk for leaks or spills of hazardous materials resulting from transit operations.

Both would encounter substantially more sites and are likely to provide more long-term cleanup benefit than options associated with the Kiggins Bowl terminus. Both would also have more at-grade intersections and would have a higher risk for leaks or spills of hazardous materials than the Kiggins Bowl terminus options.

16th Street or McLoughlin

These two alignment options are part of the Kiggins Bowl terminus. Both options are associated with one known low-risk site. Because the McLoughlin option entails acquiring slightly more property, it has a higher potential for encountering sites with potential hazardous materials concerns than the 16th Street option.

Transit Operations

Efficient transit operations would entail fewer vehicles and would therefore slightly reduce the risk of leaks or spills resulting from collisions involving transit vehicles at shared intersections. The Increased operations option would slightly increase this risk.

3.18.4 Temporary Effects

This section outlines two types of potential temporary effects:

- The risk of a leak or spill associated with construction equipment and materials including fuels, lubricants, and other hazardous substances
- The risk of exposure or contaminant migration associated with encountering contamination in soil or groundwater during construction

Unlike the previous discussion of long-term effects, the risk of exposure can be estimated quantitatively, based on sites with known hazardous materials concerns located near or in the project footprint. Exhibit 3.18-1 illustrates the number of known sites. These are estimates only; new sites or currently existing but unknown concerns may be identified in the future.

Construction uses heavy machinery that relies on petroleum products for operation. These can spill or leak, potentially contaminating soil or groundwater, which would have to be cleaned up. Other potentially hazardous materials used during construction or demolition include paints, cleaning solvents, asphalt products, and other products that could leak or spill, requiring cleanup.

In addition, the potential sites for a bridge assembly/casting yard are unknown at this time. However, they are likely to be adjacent to the Columbia River, Willamette River, or other water body in the region. The existing conditions on the assembly/casting yard could range from a developed and paved port terminal to a currently undeveloped site. The construction activities on the site would include using fuels and other hazardous materials, as well as the risk of release. The project could involve rehabilitation, demolition, or removal of structures that contain hazardous materials, such as lead paint, asbestos, or other chemicals that are known to have adverse health effects. In such cases, special testing, worker and environmental protection techniques, and waste disposal practices are required.

If the project cannot reasonably avoid a known hazardous site, or if a previously unknown hazardous site is discovered during construction, adverse temporary effects could occur:

- Project workers, neighboring communities, or the environment could be exposed to hazardous materials by construction activity.
- Work could stop in the area near the hazardous site.
- Delays in the project schedule and increases in cost could result from notifying the appropriate government agency, identifying who is responsible for the hazardous material, and finding out the type of contamination and how far it has spread.
- Cleaning up the hazardous site and disposal of any contaminated material would likely be required and could be complex and expensive.

Alternative 1: No-Build

As no CRC-related construction would occur with the No-Build Alternative, there would be no elevated risk of leaks or spills during construction or exposure or migration of hazardous materials due to construction.

Alternative 2: Replacement Crossing with Bus Rapid Transit

Exhibit 3.18-6
Known Hazardous Materials Sites Associated with Alternative 2

Alternative 2: Replacement Crossing with Bus Rapid Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
High-risk sites	21-27	23-29	20-26	20-26
Total sites	134-167	159-201	133-166	132-165

Source: CRC Hazardous Materials Technical Report.

[a] Values for the replacement design and the STHB design are the same unless otherwise noted.

Between 20 and 29 relatively high-risk sites and between 131 and 201 total sites are associated with the Alternative 2 terminus options, as shown in Exhibit 3.18-6. These include sites in the construction footprint and the C-TRAN maintenance facility.

Alternative 3: Replacement Crossing with Light Rail

Exhibit 3.18-7
Known Hazardous Materials Sites Associated with Alternative 3

Alternative 3: Replacement Crossing with Light Rail Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
High-risk sites	21-27	23-29	20-26	20-26
Total sites	134-167	159-200	133-165	131-164

Source: CRC Hazardous Materials Technical Report.
[a] Values for the replacement design and the STHB design are the same unless otherwise noted.

As the highway and transit routes would be the same, all terminus options for Alternative 3 would have the same short-term risks as the corresponding terminus associated with Alternative 2, as shown in Exhibit 3.18-7. These totals include the TriMet Ruby Junction maintenance base.

Alternative 4: Supplemental Crossing with Bus Rapid Transit

Exhibit 3.18-8
Known Hazardous Materials Sites Associated with Alternative 4

Alternative 4: Supplemental Crossing with Bus Rapid Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
High-risk sites	20-21	21-22	20-21	20-21
Total sites	124-157	149-191	123-156	122-155

Source: CRC Hazardous Materials Technical Report.
[a] Values for the replacement design and the STHB design are the same unless otherwise noted.

Between 20 and 22 relatively high-risk sites and between 122 and 191 total sites are associated with the Alternative 2 terminus options, as shown in Exhibit 3.18-8. These include sites in the construction footprint and the C-TRAN maintenance facility.

Alternative 5: Supplemental Crossing with Light Rail

Exhibit 3.18-9
Known Hazardous Materials Sites Associated with Alternative 5

Alternative 5: Supplemental Crossing with Light Rail Transit[a]				
	Kiggins Bowl Terminus (A)	Lincoln Terminus (B)	Clark College Terminus (C)	Mill Plain Terminus (D)
High-risk sites	20-21	21-22	20-21	20-21
Total sites	124-157	149-191	123-156	122-155

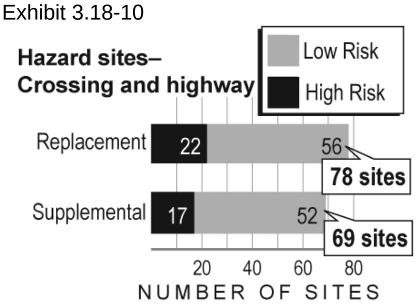
Source: CRC Hazardous Materials Technical Report.

[a] Values for the replacement design and the STHB design are the same unless otherwise noted.

As the highway and transit routes would be the same, all terminus options for Alternative 5 would have the same short-term risks as the corresponding terminus associated with Alternative 4, as shown in Exhibit 3.18-9. These totals include the TriMet Ruby Junction maintenance base.

Multimodal River Crossing and Highway Improvements (Replacement Crossing with Alternatives 2 and 3; Supplemental Crossing with Alternatives 4 and 5)

Exhibit 3.18-10



Source: CRC Hazardous Materials Technical Report.

Both the replacement crossing and associated highway improvements would acquire land for highway right-of way. As illustrated in Exhibit 3.18-10, seventy-eight total sites, with 22 of those considered high risk, are associated with the replacement crossing and highway improvements. Sixty-nine total sites, with seventeen of those considered high-risk, are associated with the supplemental crossing and highway improvements.

Transit Mode (BRT with Alternatives 2 and 4; LRT with Alternatives 3 and 5)

The bus rapid transit and light rail components of the project would entail the expansion of the associated maintenance bases. Expanding C-TRAN's existing bus maintenance facility in Vancouver to accommodate bus rapid transit or expanding TriMet's existing light rail maintenance facility in Gresham for light rail would have similar risks for exposure to hazardous materials.

Even if the No-Build Alternative is chosen and CRC is not built, regional transit services are likely to increase from other projects, and expansion of the vehicle maintenance facilities would likely occur. If one of the build alternatives is chosen for CRC, this project would contribute to the size of that expansion.

Both proposed maintenance base sites have past environmental concerns, such as fuel spills or leaks from underground tanks, reported in agency databases. These past problems are recorded as currently cleaned up. Both are located near manufacturing or auto-maintenance facilities that have also reported past environmental concerns. At this time, no serious, ongoing concerns are known near either maintenance base site. However, the land use history of both sites gives them a relatively high risk for encountering hazardous material during acquisition of property or construction.

Transit Terminus Options (with all Alternatives)

The different transit terminus options would affect the likelihood of encountering hazardous materials sites during construction. The site totals listed in the summary tables for each Alternative include transit-affected sites only when they would not already be affected by the associated highway options. This section considers the transit terminus options without regard to the highway alternatives, in order to clearly compare the terminus options. Maps and comparative charts on this and the following pages show the total number of sites and their approximate locations near each terminus option.

The terminus options have identical routes and risk potential between the Expo Center station in Oregon and the proposed Mill Plain station in Vancouver. This portion of the route would contain between three and six high-risk hazardous materials sites, and between 51 and 83 total sites.

The Lincoln terminus would encounter 15 high-risk sites, and between 86 and 137 total sites. The Kiggins Bowl terminus would encounter 14 high-risk sites, and between 70 and 101 total sites. The ranges result from the alignment options described below. The Lincoln terminus options would entail construction near the City of Vancouver Well Field #3 facility. Possible spills, leaks, or accidents during construction activity could increase the risk of contamination to the well field.

The Lincoln terminus Park and Ride location has been identified as having potential contamination. This could potentially increase costs and cause delays during construction, and would have a risk of contaminant exposure or spreading from construction activities.

The Clark College terminus is associated with twelve high-risk and between 70 and 100 total sites. The Clark College terminus would also entail constructing a park and ride at the Lincoln site, which is an additional high-risk site.

The Mill Plain terminus is associated with 12 high-risk sites and between 68 and 99 total sites. This terminus would also entail constructing a park and ride at the Lincoln site, which is an additional high-risk site.

TRANSIT ALIGNMENT OPTIONS (WITH ALL ALTERNATIVES)

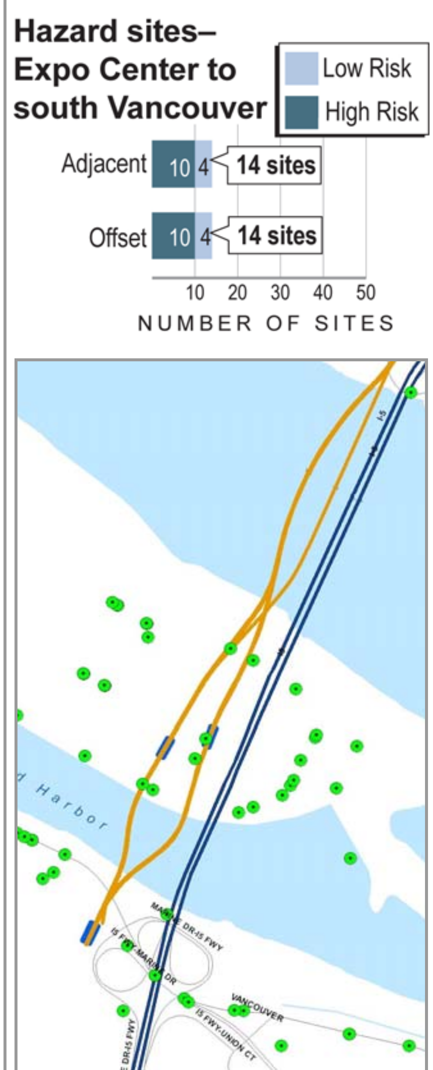
Offset or Adjacent

As illustrated in Exhibit 3.18-11, the same number of both high and low risk sites could affect either the offset or the adjacent alignment options. Of the 14 total sites, 10 could affect both options, while four sites would be more likely to affect one or the other.

Broadway-Washington or Two-way Washington

As illustrated in Exhibit 3.18-12, both the two-way Washington Street option and the Washington-Broadway couplet have two potentially high-risk sites identified. Construction of the Washington-Broadway couplet option could be affected by 83 low-risk sites. Because the two-way Washington Street alignment would acquire right-of-way and break ground on one street rather than two, it is likely to encounter fewer low-risk sites, with 52 known.

Exhibit 3.18-11



Source: CRC Hazardous Materials Technical Report.

Exhibit 3.18-12

Source: CRC Hazardous Materials Technical Report.

<u>Broadway-Main or Two-Way Main</u>

As illustrated in Exhibit 3.18-13, three high-risk sites could affect either of the Lincoln Terminus alignment options. Fifteen low-risk sites are associated with the two-way Broadway option, for a total of 18 known sites along the route. Because the couplet design would run transit along two streets rather than one, a larger number of low-risk sites (35) were identified for that option.

<u>16th Street or McLoughlin</u>

As illustrated in Exhibit 3.18-14, both the 16th Street and McLoughlin Boulevard alignment options have one low-ranked site along the route. North of Clark College, one high-risk hazardous site has been identified along the Kiggins Bowl terminus route.

3.18.5 Potential Mitigation for Adverse Effects

Potential Mitigation Related to Construction and Acquiring Right-of-Way

Specific measures for avoiding or reducing adverse hazardous materials impacts during construction would be developed during final design. To reduce the risk of liability and decrease the short-term effects of hazardous materials sites to the project, an environmental site assessment would be completed at each site proposed for acquisition or easements. Performing this as part of legal due diligence provides liability protection, both when potential contamination is identified during the investigation, and if previously unknown contamination is discovered after acquiring a site.

If these investigations indicate uncertainty about the environmental conditions on the site or show the potential for contamination or hazardous materials, the project team would conduct further onsite testing. Testing could include sampling soil, groundwater, or building materials, as applicable, to determine the type and extent of potential contamination, and reduce the risk of exposure to workers, neighbors, and the environment.

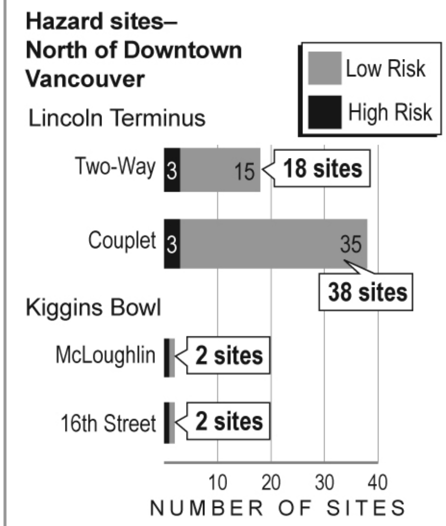
Detailed investigation of potentially contaminated sites may be followed by negotiation with potentially responsible parties and state environmental agencies to determine responsibility for the cost of cleaning up hazardous materials sites.

Certified inspectors would survey all structures that will be demolished or modified for asbestos-containing materials. Where asbestos is identified, the project team would prepare abatement plans, and abatement would be performed by a licensed abatement contractor. This would reduce the risk of asbestos exposure to workers and neighbors.

Lead-based paint surveys would also be conducted on all structures where lead is likely to be present. The risk of exposure would be minimized by following best management practices for lead abatement.

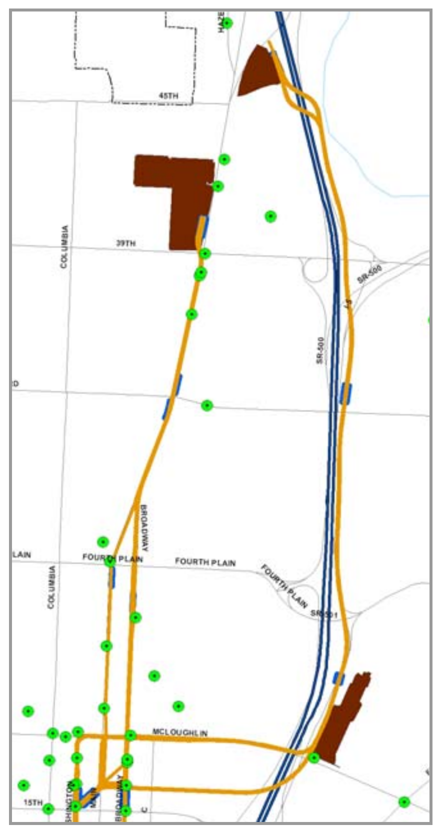
In addition, to reduce the risk that hazardous materials used during construction, such as asphalt, fuel, raw concrete, paint, solvents, or landscaping chemicals, could be released, the construction contractor would prepare a pollution control plan. The plan would outline methods

Exhibit 3.18-13



Source: CRC Hazardous Materials Technical Report.

Exhibit 3.18-14
Hazard Sites North of Downtown Vancouver



Source: CRC Hazardous Materials Technical Report.

for safely storing, using, and disposing of these products, and construction will follow best management practices to reduce the risk of spills or leaks.

Cleanup of Hazardous Sites

Removal actions, remediation, or containment would be conducted on each site directly impacted. These activities would vary by site depending on conditions, the type and extent of contamination, the likely paths of exposure, and whether soil, groundwater, or building materials are contaminated. Impacts to groundwater would be assessed in relation to the Troutdale sole-source aquifer. The project team would develop cleanup plans together with the appropriate regulatory agencies.

In order to protect workers, plans would be developed that provide emergency procedures and practices for safe working conditions. Personal protective equipment and other safety equipment would be provided and used appropriately.

Contaminated or hazardous materials removed from project sites would be stored and disposed of as specified by the appropriate regulatory agencies.

For sites where cleanup systems may operate beyond the construction phase, such as certain groundwater treatment systems, appropriate monitoring would occur to ensure that the system functions and to determine when the site has been adequately cleaned up.

3.19 Cumulative Effects

Cumulative effects refer to the impacts from the CRC project when added to the impacts from other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively substantial actions that take place over a period of time. Input from resource agencies, Tribes, and the public helped define the scope and scale of the cumulative effects analysis.

To address cumulative effects, the project team established a time-frame of reference for evaluating how past actions have shaped existing conditions, and how future actions might further change them. For the built environment, the “past” runs from 1960 (prior to the opening of I-5) to the present day. For the natural environment, an earlier base year is evaluated to capture a longer history of the effects of development on natural resources in the area. To determine base thresholds the cultural environment team solicited input from the Cultural Resources/Section 4(f) Workgroup, which is composed of local and state agency representatives, the Washington Department of Archaeology and Historic Preservation (DAHP), and the Oregon State Historic Preservation Office (SHPO).

Past Actions

Native Americans have occupied or traveled through the CRC project area for thousands of years. Those activities had little effect on current environmental conditions in the CRC project area. In the 1800s European-American settlement began and the Portland and Vancouver area population began to increase dramatically. The following key historic events provide a basis for analysis of past actions that have helped shape current environmental conditions:

- Pre-1800s – Native American paths along Siskiyou Trail on what is now the I-5 Corridor connected tribes from the Pacific Northwest to California’s Central Valley.
- 1810 to 1850 – Settlement of Fort Vancouver and the Hudson Bay Company. Commercial fur trapping on the Columbia and associated waterways. Fur trappers from the Hudson Bay Company operating out of Fort Vancouver adopted the Siskiyou Trail as a major transport corridor between the Northern Oregon Territory and California.
- 1846 – Ferry service across the Columbia between Vancouver and Portland was established and offered intermittently by various operators.[46]
- 1890s – Trolley line system in Portland and Vancouver encouraged greater urbanization and development of neighborhoods east of the Willamette in Oregon, and north to Fourth Plain Boulevard in Vancouver.
- 1905 – Pearson Airfield became a dirigible landing area. It was officially dedicated as Pearson Airfield in 1925. The automobile was

[46] http://www.columbian.com/history/transportation/ferry1.cfm, accessed on September 27, 2007.

introduced in the early 1900s and by the 1930s many middle class families could afford cars and travel greater distances for work, shopping, or leisure.

- 1910 to present – Railroad construction, including a rail bridge over the Columbia River in 1910 allowed increased freight transport and increased the viability of the ports of Vancouver and Portland in interstate trade. Industrialized farming, irrigation and water impoundment, and grain shipment increased.
- 1917 – The Columbia River Interstate Bridge opened in 1917 and allowed easier transport of cargo and people between Vancouver and Portland, as well as the broader Pacific Northwest.
- 1930s to 1970s – Several dams were built on the Columbia River between the 1930s and 1970s to provide electricity and irrigation water for the Pacific Northwest. Over-fishing and construction of these dams dramatically decreased salmon runs. This had a negative impact on the economic well-being of Native American tribes, for whom the salmon are an important material and cultural resource.
- 1940s – Mobilization of shipyard manufacturing in support of World War II brought wartime employment in the Portland and Vancouver area and created a housing shortage. Many nearby areas were impacted by this temporary increase in housing demand and resulting building boom.
- 1948 – In 1948 the Columbia River flooded and displaced approximately 20,000 public housing residents in the City of Vanport, including many minorities. Relocation occurred throughout the area and the Vanport community's residential base never recovered to those levels supported in 1948.
- 1950s – Post World War II housing construction was financed through federal grants and GI loans and created a greater supply and demand of outer urban and suburban housing both in Oregon and Washington.
- 1952-60s – Construction of the interstate highway system in the 1950s and early 1960s greatly increased freight and automobile traffic. The new highway separated neighborhoods in Portland and Vancouver. Construction of the interstate highway system also increased access to downtown Vancouver.
- 1958 – The Vancouver-Portland Interstate Toll Bridge was constructed in 1958. This development doubled automobile capacity across the Columbia, reduced congestion and allowed further commuting across the Columbia. This bridge now carries southbound traffic.
- 1960s – Portland International Raceway and Delta Park were established on former roads and land from the Vanport Community that was destroyed by floods in 1948.
- 1970s to present – Growth management and implementation of Oregon planning laws in the 1970s have limited urban sprawl in the Portland metropolitan area. As the area's economy shifted from timber processing and sales to high tech and services, there was a high demand for professional workers. This encouraged commuting

from throughout the Portland Metropolitan Area, including Vancouver, which increased commuting across the Columbia.

- 1990 – The Washington Growth Management Act passes in 1990. This act seeks to restrict unplanned urban sprawl and concentrate growth in existing urban areas.

Recently Constructed Projects

Some of the more noteworthy recent transportation and development projects in or near the CRC area are listed below. The development projects give a sense of the recent development trends in the area. The projects will create additional travel demand, and generally increase the density of housing, commercial, and retail enterprises in the project area.

RECENT TRANSPORTATION PROJECTS

- Failing Street Pedestrian Bridge rehabilitation
- Interstate Max (Max, Yellow line along Interstate Boulevard)
- Widening of I-5 north of the CRC project area

RECENT DEVELOPMENT

- Esther Short Park and Propstra Square (Vancouver)
- Heritage Place retail development (Vancouver)
- The Vancouver Center mixed use development (Vancouver)
- The Lewis and Clark Plaza housing and public space (Vancouver)
- The Esther Short Commons residential and retail development (Vancouver)
- The Vancouver Convention Center and Hilton Hotel (Vancouver)
- The Columbian Building office space (Vancouver)
- The West Coast Bank Building commercial and residential mixed use (Vancouver)
- The Northwynd at Columbia Shores commercial and residential mixed use (Vancouver)
- The Waterside Condominiums (84 units) Portland
- Salpare Bay Condos (204 units) Portland

Reasonably Foreseeable Future Projects

Multiple plans lay out lists of reasonably foreseeable future projects. These plans include Transportation System Plans, neighborhood plans, and comprehensive plans, among others. A list of the projects and plans considered is included in the Cumulative Impacts Technical Report.

The No-Build Alternative includes a list of projects through 2030, including present projects and planned improvements for which need, commitment, financing, and public and political support are identified and are reasonably expected to be implemented. These projects meet the criteria of being “reasonably foreseeable”. All transportation improvements included in the No-Build Alternative are included in either Metro’s 2025 Regional Transportation Plan (RTP) (including amendments) or the Regional Transportation Council’s (RTC) 2030

Metropolitan Transportation Plan (MTP). Transportation infrastructure projects under way or planned through 2030 within the CRC project limits are listed in Appendix A, which includes highway and transit projects on both sides of the Columbia River.

With the exception of the I-5 widening to six lanes from Lombard Street to Victory Boulevard (the Delta Park Highway Widening Project), the No Build alternative does not assume any major capacity improvements on I-5 near the CRC project. Outside of the project area, there are minor I-5 capacity enhancements and several major maintenance projects, specifically identified in the financially constrained regional transportation plans of both Metro and RTC. Capacity improvements on Interstate 5 will provide additional vehicular and freight mobility and reduce travel times. The projects will also require materials, equipment, and energy to complete. The projects have temporary traffic impacts associated with construction.

Projects more specific to the immediate area include local transportation improvements, infrastructure associated with higher density residential communities along Marine Drive in Portland, the revitalization of downtown Vancouver, and general infrastructure improvements such as sewer and water facility expansions which further enable development.

Some of the other anticipated projects near the CRC projects include:

Riverwest – This site adjoins the I-5 right-of-way, just south of Evergreen Boulevard. The development will include a new main library for the Fort Vancouver Regional Library System. Riverwest is a $165 million public-private mixed-use development that includes four multi-story buildings. During project construction, there may be temporary traffic impacts, though these should conclude before the CRC project begins construction.

Columbia West Renaissance – The project is a large-scale mixed-use development. Significant amounts of new office space, public space, and residential uses are planned. Pedestrian amenities from the east side of the Vancouver shoreline would cross under the CRC improvements and extend through the Columbia West development. The project will provide new parking, and substantial new traffic generation. It is related to new underpasses through the BNSF berm, and the possible extension of Main Street to the Columbia River. During project construction, there may be temporary traffic impacts, although these should conclude before the CRC project begins construction.

West Barracks - The federally-established Vancouver National Historic Reserve (VNHR) includes many buildings previously used by the United State military. The VNHR partners—including the City of Vancouver, National Parks Service, State of Washington, U.S. Army and the VNHR Trust—are working with private sector partners to renovate 16 historic buildings on the West Barracks for a variety of uses, from education and the arts to recreation and hospitality.

Planning is in its early stages for transferring the south and east barracks to the City. These areas will later be integrated with the master plans for the West Barracks. The rehabilitation of the Reserve is closely related to the east-west circulation issues between the east and west sides of the Interstate.

Closed Denny's site – On the site of a closed Denny's restaurant, private developers are planning 60,000 sf of office space. The site is just west of the Mill Plain interchange. It should be completed in 2008. The project will need a design that is integrated with or at least compatible with the Mill Plain interchange. During project construction, there may be temporary traffic impacts, though these should conclude before the CRC project begins construction.

Columbia River Channel deepening – The Columbia River Channel Deepening project is a major transportation, economic development, and international trade project for the region. Nearly half of the Columbia River federal deep-draft navigation channel was deepened from 40 to 43 feet by the end of 2006. The channel deepening includes both navigation improvement and expanded restoration components. Most of the dredge material will be disposed at upland sites for beneficial uses. The project minimizes unavoidable impacts and compensates for any unavoidable impacts through substantial mitigation endeavors. There will be 15.4 acres of wetland, 50 acres of riparian habitat, and 171.4 acres of agricultural land impacted. These impacts will be offset by 736 acres of wetland and riparian mitigation.

Favorable Biological Opinions were issued by the federal environmental agencies in May 2002, and Oregon and Washington state environmental agencies approved and issued permits for 401 Water Quality Certifications and Coastal Zone Management Consistency in June 2003. On January 9, 2004, the Corps issued their Record of Decision (ROD) for the project.

Hayden Island Neighborhood Plan and Jantzen Beach Center Redevelopment - The Portland Bureau of Planning is developing and implementing an area plan for Hayden Island. The Hayden Island Plan will include: comprehensive plan and zoning designations, a street plan, development standards, a conservation strategy, and an affordable housing preservation strategy. This process will take into consideration both East and West Hayden Island and the Columbia River Crossings Project. The entire project is being conducted with a large amount of community and stakeholder involvement.

Redevelopment plans for the shopping center are in preliminary stages. The redevelopment project intends to transform the area from a conventional suburban shopping center to a more Main Street atmosphere. The City of Portland, the developers, and the CRC project team are sharing information, such as the preliminary transportation circulation plan for the Center. An important element of the plan is to construct a connecting facility that would allow traffic to move across the Interstate without interfering with traffic on the I-5 ramps.

3.19.1 Acquisitions

Most of the area directly affected by the CRC alternatives is already occupied by public right-of-way resulting from previous transportation projects. The original construction of I-5 during the later 1950s and early 1960s had substantial property acquisitions and displacements near the immediate project area. For example, when the segment of Interstate 5 known as the Minnesota Freeway was constructed from the Rose Garden area to the Columbia River Slough in northeast Portland, it removed over 180 dwellings and displaced more than 400 residents.[47]

The real estate acquisitions required for the CRC alternatives are relatively minor for a project of this size, and are substantially smaller when compared to the acquisitions associated with past major transportation projects in the corridor. There will be very few residential displacements in neighborhoods that were directly affected by the original construction of I-5. Most of the full acquisitions would be commercial properties and the likelihood of finding suitable, local replacement space for the businesses is high.

The highest potential for cumulative acquisition-related impacts of concern is on Hayden Island, where the alternatives would acquire or cause the relocation of 13 to 23 floating homes and the relocation of four to 14 businesses. Effects on the floating home residents may be exacerbated by unrelated future land use changes on Hayden Island and shortages in the supply of available moorage space, as state and federal regulations make it difficult to permit new moorages. While the commercial property acquisition is a very small share of the total retail space on Hayden Island, unrelated, future land use changes are expected that could also result in business displacements. The City of Portland is currently preparing a sub-area plan for the island that contemplates allowing substantial changes to the island's development, which could result in substantial changes in the land use and business mix on the island.

It will be important to carefully consider mitigation for displaced floating homes, and to coordinate with the City of Portland's on-going land use planning efforts for Hayden Island.

3.19.2 Economics

Past transportation and development projects have helped to solidify I-5 as a critical component of the region's transportation network and regional infrastructure. Demand on I-5 comes from freight, public, and personal vehicle use. Freight needs are a major driver for future improvements needed along the I-5 corridor.

The ports of Portland and Vancouver are critical to the economic growth and prosperity of the region. In order for the ports to remain competitive, efficient and cost-effective multimodal transportation systems must be available. Reducing freight travel times by investing in transportation infrastructure improvements that improve access and decrease congestion helps maintain the area's competitiveness. The total annual tonnage moving through the two ports is expected to double from approximately 300 million tons in 2000 to almost than 600 million tons in 2035. This growth has implications for the transportation network as products move to and from the regional marketplace.

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[47] Kramer, 2004.

The No-Build Alternative would retain the existing I-5 crossing and makes only minor preservation improvements to the highway within the project area. However, many other projects are planned that will improve I-5 access to and from regional centers, local collectors, and arterials.

The CRC project would positively contribute to other projects aimed at reducing congestion and enhancing freight mobility by further relieving congestion. Congestion relief in this area would greatly benefit freight traffic generated by Swan Island, the Rivergate area, the Port of Portland, and the Port of Vancouver. Incremental benefits would include decreased travel times, increased mobility, and increased reliability of travel times.

If proposed CRC improvements are not constructed, economic development planned for the area may occur more slowly as business owners may be more reluctant to locate in an area with poor access and mobility for employees and customers. Customers may elect to shop in other areas with easier access and mobility.

3.19.3 Environmental Justice

The construction of I-5 in the early 1960s cleared entire blocks for the development of the roadway, dividing neighborhoods and displacing residents. Some of these neighborhoods were composed of more minority and low-income persons than in Portland and Vancouver as a whole. The construction of I-5 through Vancouver changed the city by closing Fifth Street (the route heading east) and encouraging development of housing to the north of downtown. Fewer displacements occurred in Vancouver than Portland because the area was less densely developed than Portland at that time.

More recent transportation projects, similar to the CRC project, have not had disproportionate high and adverse effects on low-income and minority populations. The CRC build alternatives create only slightly widened roadway profiles along I-5, and will not divide existing communities. They are also likely to reduce highway-related noise impacts at homes adjacent to I-5. Tolling scenarios could result in negative impacts to low-income populations, but could be mitigated via program funding.

Additionally, recent emphases on transit and alternative transportation mode development generally provide greater benefit to lower-income populations who ride transit in higher proportions than higher-income populations.

There is now increased attention to community outreach and input associated with highway and transit project development. Historically, most projects were not planned and implemented with extensive input and communication with the public. It is now an important component of project development to involve communities who would be affected by a proposed project. Thus, project teams attempt to minimize the impacts via extensive outreach and incorporation of community input.

3.19.4 Land Use

The build alternatives are consistent with local plans and policies, which encourage investment in inner urban infrastructure, multimodal transportation, freight mobility, economic development, and compact urban development. The greatest direct impacts on land use would occur as a result of the park and ride facilities. Adding transit stations in Hayden Island and downtown Vancouver could result in more mixed use and compact housing development around stations.

Vancouver's downtown has changed greatly during the past decade. The focus of the downtown and waterfront areas has broadened from employment-related uses to tourism and recreation development, retail shopping, meeting and convention activities, housing, and entertainment. Along with revitalizing overall downtown activity, new residential opportunities and revitalization of the retail core and central waterfront have been emphasized. New office and mixed-use development has increased in the last decade, with projects such as the Vancouver Center, West Coast Bank Building, Public Service Center, Convention Center, and numerous smaller projects. New and growing uses in the downtown include eateries, bars/taverns, a new playhouse, and personal services.

On Hayden Island the primary land use close to I-5 is commercial, including the Jantzen Beach Center (a large shopping mall) and surrounding retailers. Residential uses in the area include manufactured homes and floating homes associated with small marinas, as well as other low to medium density developments. The City of Portland has initiated a planning effort for Hayden Island, which could change the development patterns on the island.

Under any of the build alternatives, subsequent development would be planned according to the local jurisdictions. The build alternatives will continue the trend of roadway development, and will balance that development with the improvement of transit, bicycle, and pedestrian infrastructure.

Transit, particularly high-capacity transit, can be a catalyst for development around stations, a process often referred to as transit-oriented development (TOD). Transit-oriented development is generally pedestrian-oriented and higher-density, which further supports the nearby transit service. This type of development is sought after by jurisdictions because it reduces demand for additional roadway capacity and advances local and regional planning goals for focusing development along transportation corridors. The Cities of Vancouver and Portland are supportive of TOD where it is appropriate with the neighborhood character, zoning, and plan policies. Such development is encouraged by both the Vancouver City Center Vision and the draft Hayden Island Concept Plan, and is generally within the limits of the planned growth envisioned and modeled for urban centers.

3.19.5 Neighborhoods

There would be a range of adverse effects and benefits to neighborhoods resulting from the build alternatives, including limited acquisitions, sound walls to reduce highway noise, the addition of high-capacity transit and transit-oriented development near stations.

On Hayden Island, the CRC project would displace approximately 13 to 23 floating homes. By removing several homes within this neighborhood, and more importantly separating one group of homes from the larger collection of floating homes in this particular community, cohesion may be impacted. Also on Hayden Island, the project could displace the existing Safeway, the only grocery store on the island. This could be avoided through design changes still under study or potentially mitigated through relocation assistance that would allow the grocery store to move elsewhere on Hayden Island prior to project construction.

High-capacity transit in Vancouver will influence neighborhood development, from the look and feel of the neighborhoods, to improving access, to adding the potential for transit-oriented development.

Past projects (such as the displacements associated with the 1960 construction of I-5 through North Portland) directly impacted neighborhoods in the I-5 corridor. These neighborhoods have experienced both incremental adverse effects as well as improvements since then. More recent transportation projects have generally provided net benefits through improved access, pedestrian oriented development, mitigation, and other amenities. The CRC project is expected to continue this more recent trend. Historically, projects were not necessarily planned and implemented with extensive input and communication with the public. Now, it is an important component of project development to involve communities who would be affected by a proposed project. Thus, project teams attempt to minimize the impacts of proposed projects via extensive outreach and incorporation of community input.

3.19.6 Public Services and Utilities

The combined impact of the CRC alternatives, and unrelated population and employment growth, will likely create an increased demand for public services. However, because the growth in population and employment and changes in land use are included in local and regional plans, it is reasonable to assume that the public service and utilities sectors will have adequate time to adjust for future conditions.

3.19.7 Air Quality and Air Toxics

During the 1970s, pollutant concentrations in the Portland-Vancouver area exceeded the standards for carbon monoxide on one out of every three days, and ozone levels were often as high as 50 percent over the federal standard. Programs and regulations put into effect during the 1970s in order to control air pollutant emissions have been effective, and air quality in the area has improved. Recent regulations promulgated in the early 2000s, and most recently in February 2007, adopted further controls on vehicles, and control of fuel formulations. These standards apply to all vehicles on the highway system and are responsible for substantial reductions in vehicle emissions since the 1970s and projected vehicle emissions reductions over the next 25 to 30 years.

Traffic data used in the air quality analysis are based on projected 2030 population and employment information and include expected overall growth in the region and the project area. Background concentrations representing the cumulative emissions of other sources in the area are added into the predicted local concentrations for carbon monoxide at intersections. For all pollutants analyzed, future 2030 emissions with or without the CRC project are projected to be about 30 to 90 percent lower than existing conditions.

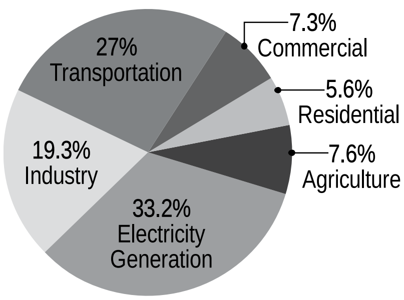
3.19.8 Climate Change

This section summarizes potential cumulative impacts associated with climate change and discusses future uncertainty and risk associated with climate change. Climate change, also referred to as global warming, is an increase in the overall average atmospheric temperature of the earth. The Intergovernmental Panel on Climate Change (IPCC) stated: "Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations."[48] In the coming decades, scientists anticipate that as atmospheric concentrations of greenhouse gases continue to rise, average global temperatures and sea levels will continue to rise as a result and precipitation patterns will change.

Greenhouse Gases

Greenhouse gases generally include six types of gas. Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perflourocarbons (PFCs), and sulfur hexafluoride (SF_6).

Exhibit 3.19-1
Source of U.S. Greenhouse Gas Emissions, 2004[a]



Source: EPA 2006.

[a] Excluding emissions in U.S., territories, which accounted for 0.88% of total emissions.

Virtually all human activities have an impact on our environment, and transportation is no exception (Exhibit 3.19-1). Transportation is a substantial source of greenhouse gas emissions, and contributes to global warming through the burning of petroleum-based fuel. Any process that burns fossil fuel releases carbon dioxide into the air. Carbon dioxide is the primary greenhouse gas emitted by vehicles, and therefore it is the focus of this analysis.

Changes in CO_2 emissions from fossil fuel combustion are influenced by many long-term and short-term factors, including population and economic growth, energy price fluctuations, technological changes, and seasonal temperatures. On an annual basis, the overall consumption of fossil fuels in the United States generally fluctuates in response to changes in general economic conditions, energy prices, weather, and the availability of non-fossil alternatives.[49] Over time, carbon emissions increase with population growth. The population, as well as the number of miles being driven, has grown and is expected to continue growing, but standards for vehicle fuel efficiency have not changed since 1991.

Transportation accounts for an estimated 38 percent of Oregon's carbon dioxide emissions, with vehicle CO_2 emissions predicted to increase by 33 percent by 2025 because of increased driving (Exhibit 3.19-2).

What is included in the transportation sector?

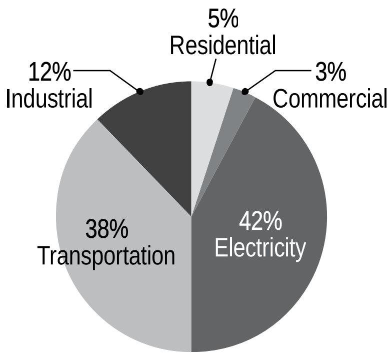
The transportation sector includes domestic air transport, road vehicles, rail, pipeline transport, national navigation, and non-specific transport. Consistent with IPCC guidelines, it does not include international aviation or marine bunker fuels.

Washington State predicts that, with the state's reliance on in-state hydropower for electricity generation, the transportation sector accounts for almost 50 percent of greenhouse gas emissions in Washington (Exhibit 3.19-3).

48 IPCC, 2007.

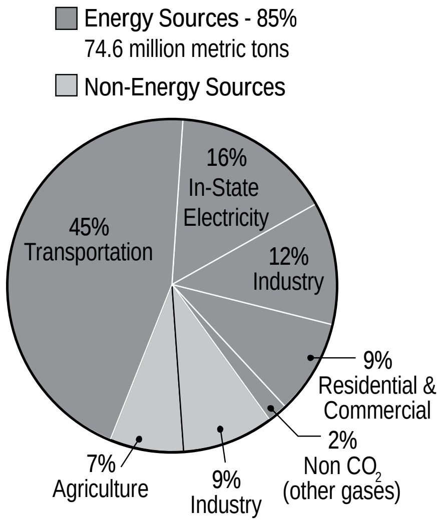
49 Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks. 1990-2006 February 2008).

Exhibit 3.19-2
Greenhouse Gas Emissions in Oregon, 2008



Source: Oregon Department of Energy January 2008.

Exhibit 3.19-3
Greenhouse Gas Emissions in Washington, 2004
TOTAL=88.3 million metric tons of CO_2 equivalen**t**



Source: Washington Department of Community, Trade and Economic Development (Preliminary Estimate)

Future carbon emissions for the CRC project are difficult to estimate precisely because such a wide variety of factors could influence carbon emissions by 2030. Some of the factors that could change between now and 2030 include government regulations, price and availability of fuel and alternative energy sources, and vehicle technology (such as electric hybrid or fuel cell vehicles).

The National Highway Traffic and Safety Administration (NHTSA), which is part of U.S. DOT, establishes and amends the Corporate Average Fuel Economy (CAFE) standards for vehicles. The CAFE program gives manufacturers an incentive to sell more fuel-efficient light trucks and automobiles. Congress sets CAFE standards for cars. EPA reports the CAFE results for each manufacturer to NHTSA annually, and NHTSA determines if they comply with CAFE standards and assesses penalties as required. A tax is imposed on makers of new model year cars that fail to meet the minimum fuel economy level of 22.5 mpg. In 2011, the standard will change to include many larger vehicles.

A discussion of greenhouse gas emissions, as well as the calculations of emissions by alternative, are found in Section 3.12, Energy.

On December 19, 2007, President Bush signed into law the Clean Energy Act of 2007, which requires in part that automakers boost fleetwide gas mileage to 35 mpg by the year 2020. The current CAFE standard for cars, set in 1984, requires manufacturers to achieve an average of 27.5 miles per gallon, while a second CAFE standard requires an average of 22.2 miles per gallon for light trucks such as minivans, sport utility vehicles, and pickups. The new rules require that these standards be increased such that, by 2020, the new cars and light trucks sold each year deliver a combined fleet average of 35 miles per gallon. It is unclear how the phase-in of these new cars will impact the overall fuel efficiency of the fleet mix between now and 2030. It is partially dependent on the economy; for example, how many people buy new vehicles before 2030.

If historic and recent transportation trends continue, CO_2 emissions will continue to increase. By 2030, CO_2 emitted from vehicles on all regional roadways, including I-5 and I-205, are expected to increase over existing conditions. For example, the population is expected to increase in Clark County by 66 percent between 2005 and 2030, which could have a dramatic effect on vehicle miles traveled in the region. Without the CRC improvements, the highway crossing would produce 40 percent more greenhouse gas emissions by 2030 than under existing conditions and the regional transit system would produce 30 percent more.

Several jurisdictions in the project area have goals to reduce greenhouse gases. The Washington legislature passed a statute that aims to achieve 1990 greenhouse gas levels by 2020, and a 50 percent reduction below 1990 levels by 2050. The goals of the Oregon Climate Change Integration Act seek to reduce emissions 10 percent below 1990 levels by 2020 and achieve a 75 percent reduction below 1990 levels by 2050. Regulations implementing these goals have not been issued yet. Both Oregon and Washington are members of the Western Climate Initiative, which announced a regional, economy-wide greenhouse gas emissions target of 15 percent below 2005 levels by 2020, or approximately 33 percent below business-as-usual levels.[50]

In 1993, Portland was one of the first U.S. cities to adopt a plan to address global warming. In 2001, Multnomah County joined Portland in adopting a revised plan, the Local Action Plan on Global Warming, outlining more than 100 short- and long-term actions to reduce emissions 10 percent below 1990 levels by 2010.[51] In addition, mayors of Portland and Vancouver signed the U.S. Mayors' Climate Protection Agreement committing to reduce carbon emissions in cities below 1990 levels.

[50] See Western States Initiative webpage at http://www.westernclimateinitiative.org/Index.cfm.

[51] See 2005 Global Warming Progress Report by City of Portland and Multnomah County on more information regarding CO2 reductions in the metro region.

3.19.9 Long-Term Impacts

The CRC project constitutes small section of I-5; nevertheless, the consumption of fuel for the movement of people and goods on I-5 across the Columbia River could potentially cause cumulative long-term impacts on the environment. CRC project could reduce greenhouse gas emissions in the project area with the build alternatives. The guidelines set out by international, national, and state organizations primarily focus on improving vehicle efficiency and low-carbon fuel[52]; however, they do suggest measures for infrastructure that could reduce greenhouse gas emissions, such as:

- **Providing bicycle and pedestrian infrastructure**. The build alternatives include a bicycle and pedestrian multi-use path across the river, completely separated from vehicle traffic.
- **Providing transit options**. Currently, the only transit option from Portland to Vancouver or vice-versa is on buses that flow and stop with traffic. The build alternatives will provide high capacity transit (light rail or bus rapid transit) that will operate on a separate guideway, unaffected by vehicle congestion.
- **Implementing tolls**. The CRC project is considering a wide-range of scenarios for tolling the build alternatives, including increasing tolls during peak-periods to encourage off-peak driving. Traffic modeling shows that variable tolls would cause mode shift to transit and non-motorized transit (bicycle and pedestrian), or encourage people to not make certain trips.
- **Increasing efficiency of transportation systems**. The elimination of bridge lifts, variable pricing with tolls, the addition of auxiliary lanes between closely spaced interchanges in the project area, and the intersection improvements proposed for the CRC project will minimize congestion and stop-and-go conditions, which lead to inefficient use of energy.
- **Supporting transit orientated development**. The build alternatives provide an opportunity for transit-oriented development, consistent with existing land use plans for the City of Portland and the City of Vancouver.
- **Replacing aging infrastructure in existing corridors**. The build alternatives will upgrade an existing structure in an urban area instead creating a new transportation corridor.

The project team estimated greenhouse gas emissions for the CRC alternatives. The methodology for estimating long-term energy use was based on methodologies outlined in the Oregon Energy Manual, and CO_2 emissions were estimated using data provided by the Environmental Protection Agency (EPA). Other factors taken into account were:

- Vehicle trips[53]
- Expected advancements in vehicle technology

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[52] IPCC (2007), The State of Oregon Governor's Climate Change Integration Group (January 2008).

[53] Vehicle demand and transit demand is based on the regional, system-wide demand for people to drive their cars or take transit in the project area, including I-5 and I-205 river crossings.

- Expected advancements in fuel technology
- Current and future transit technology (electric for light rail and bio-diesel for buses)

The analysis shows that all build alternatives are projected to reduce personal vehicle travel demand over No-Build conditions and improve the operations of the I-5 crossing, as described in the Traffic section of this DEIS.

CO_2 emissions account for 94 to 95 percent of greenhouse gases emitted by the transportation sector.[54] As a result, the EPA uses CO_2 emission estimates as a representative indicator of greenhouse gas emissions. The general equation for estimating CO_2 emissions can be expressed as:

$$EM = FC \times EF$$

EM = Emissions of CO_2 (lbs)
FC = Fuel consumed (gallons)
EF = Emission factor (lbs of CO_2/gallon) (based on fuel type)

The CRC Energy Technical Report has more information on CO_2 emissions, and the methodology for calculating alternatives' potential affect on climate change

The fuel consumed (FC) is the amount of fuel that would be used to operate a vehicle or bus. The emission factor (EF) is the amount of CO_2 that would be emitted during combustion of a gallon of fuel. Based on data from the EPA, the emission factors used in this analysis were 19.4 pounds of CO_2 per one gallon of gasoline and 22.2 pounds for one gallon of diesel.[55] The emission factor for biodiesel can vary slightly depending on the blend, but was assumed to be equal to diesel (22.2 lbs of CO_2/gallon of biodiesel) for this analysis, which is consistent with EPA conclusions that biodiesel emits the same amount of CO_2 compared to diesel.[56]

When fuel burns, the carbon and hydrogen separate. The hydrogen combines with oxygen to form water and carbon combines with oxygen to form carbon dioxide (CO_2). The carbon content of fuel assumed in this analysis is the recommended EPA quantities for the amount of carbon in a typical gallon of gasoline or diesel.[57]

Light rail is operated by electricity. Although light rail vehicles do not individually emit CO_2 during travel, the process of converting fuel to electricity does. The electricity used to operate light rail would most likely come from sources available in the project area. Approximately 40 percent of the total electricity needed for light rail would be provided by Portland General Electric, based on the location of two substations in the Portland area. From these substations, 42 percent would come from coal and 13.9 percent would come from natural gas (the remaining portions would come from non-CO_2 emitting sources, such as hydropower, nuclear, wind, etc). Approximately 60 percent of the total electricity needed would be provided by Clark County Public Utilities, based on the location of three substations in the Vancouver area. From

[54] EPA (2005). Other greenhouse gases cover a broad array of gases other than CO2, principally methane (CH4), nitrous oxide (N2O) and sulfur hexaflouride (SF6).

[55] EPA, 2005a.

[56] The reduction in CO2 emissions from using biodiesel comes from the energy saved in harvesting the fuel, which was not computed in this analysis.

[57] EPA, 2005b.

these substations, 7 percent would come from coal and 28 percent would come from natural gas. The remaining portions would come from non-CO_2 emitting sources, primarily hydropower.

Exhibit 3.19-4 summarizes the potential daily energy use and CO_2 emissions for the alternatives in 2030.

Exhibit 3.19-4
Full Alternatives Summary of Daily Energy Use and CO_2 Emissions

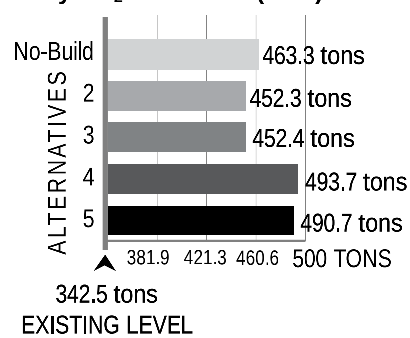
Alternative	Energy Consumed (mBtu)	Electricity Consumed (kWh)	Gasoline Consumed (gal)	Bio/Diesel Consumed (gal)	CO_2e Emissions (tons)
Existing	4,014.4	77,355.3	8,343.0	19,585.2	342.5
Alternative 1 (No-Build)	5,384.2	152,628.0	10,661.0	25,536.6	463.3
Alternative 2 (Replacement, BRT)	5,248.1	152,628.0	9,598.0	25,520.9	452.3
Alternative 3 (Replacement, LRT)	5,242.3	162,063.3	9,598.0	25,231.8	452.4
Alternative 4 (Supplemental, BRT)	5,729.2	160,645.6	9,622.0	28,790.3	493.7
Alternative 5 (Supplemental, LRT)	5,687.1	172,053.3	9,622.0	28,172.0	490.7

Source: CRC Cumulative Effects Technical Report.

The replacement crossing with associated highway improvements, a toll on I-5, and light rail or bus rapid transit (Alternative 2 or 3) would reduce CO_2 emissions about two to three percent lower than the No-Build Alternative. This reduction is due to fewer auto trips over the river, more people riding on public transit, and reduced traffic congestion, which improves fuel efficiency.

Alternatives 4 and 5 were estimated to increase CO_2 emissions relative to No-Build, primarily because they include aggressive increases in the frequency of light rail or bus rapid transit and other bus routes without realizing proportional decreases in auto travel. Buses powered by petroleum diesel or bio-diesel emit CO_2, and a portion of the electricity that powers light rail comes from power plants that emit CO_2.

Exhibit 3.19-5
Daily CO_2 Emissions (tons)



Source: CRC Energy Technical Report

It is important to note that the total CO_2 emission estimates do not capture all of the potential reductions in CO_2 emissions associated with the highway improvements. They capture only the reductions associated with changes in highway travel speeds and the number of vehicles on the crossing itself. It is likely that the decreased congestion both north and south of the river, due to the replacement crossing and to a lesser extent the supplemental crossing, would further reduce CO_2 emissions compared to No-Build. In addition, the model does not capture a potential mode shift to bicycle and pedestrian that is expected with a toll and an improved bicycle and pedestrian path.

Carbon emissions will tend to be lower with a higher toll, or by tolling both I-5 and I-205, because tolling decreases the number of cars driving over the crossing and increases the number of people riding transit or carpooling.

According to the U.S. Department of Energy, the average American household produces 59 tons of carbon per year, and 11.7 tons of it is related to transportation

TERMS & DEFINITIONS

Adaptation

The intergovernmental Panel on Climate Change (IPCC 2001) defines adaptation as "adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in human processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change."

How do you estimate the impact of climate change on river levels?

Studies that have modeled future climate and river flow used existing data about the Columbia River Basin to predict trends over the next 50 to 100 years, taking into account the effects of global warming and other emergent conditions in the basin. These studies suggest that in the next century the flow pattern of the Columbia River could be transformed from a primarily snow-melt fed river to one supported by a mix of rainfall and diminished snow-melt.

Potential Mitigation and Adaptation

Currently no local, state, or federal regulations identify a threshold for CO_2 emissions for transportation projects. However, potential measures for reducing adverse impacts to climate change from all alternatives could include:

- Implement programs that further encourage use of public transit
- Promote compact and transit-oriented development which encourages walking
- Provide safe and well-lighted sidewalks to encourage walking
- Provide safe and more accessible connections to paths for bicyclists and pedestrians
- Offer ride-share and commute choice programs
- Construct with materials and build systems that meet efficiency standards for equipment and lighting design
- Recycle building materials, such as concrete, from project
- Use sustainable energy to provide electricity for lighting and other operational demands
- Plant vegetation to absorb or offset carbon emissions
- Promote fuel-efficiency improvements, such as a low carbon fuel standard
- Promote diesel engine emission reduction
- Consider clean energy certificates or other carbon offsets for energy used

In addition to reducing CO_2 emissions, the CRC project may need to adapt to the effects brought about by climate change. The IPCC defines adaptation as "adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. Adaptation refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change."[58] In October 2002 the U.S. DOT Center for Climate Change and Environmental Forecasting, with the support of the EPA, Department of Energy, and the U.S. Global Change Research Program sponsored an interdisciplinary workshop to define research priorities regarding the potential impacts of climate variability and change on transportation. The priority areas identified at the workshop include: 1) assessment of potential impacts on critical infrastructure locations and facilities, 2) development of improved tools for risk assessment and decision-making, and 3) assessment of response strategies. The CRC project is proposed infrastructure that could be impacted by climate change.

The CRC project team considered some of the potential risks that could be caused by climate change, and potential adaptation measures to mitigate risk. The CRC project's location relative to the Columbia River

[58] IPCC, 2001.

raises special concerns related to climate change. The Columbia River's water levels are affected by the amount of snow that falls during the winter and the amount of precipitation that falls as rain year round. The factor that affects these precipitation patterns most is the temperature of the atmosphere.

The effects of climate change on the river's flow and peak flow cycle have been the focus of several climate prediction models[59] over the last 10 years. Studies conclude that the increase in winter rain (which would historically fall as snow) will lead to increased winter flow of the Columbia River and a weaker snow-melt increase during the spring and summer. Under the worst case scenario, the water level of the Columbia River would rise another 5 feet during winter flow in 2030 compared to existing conditions.

Based on the information available, potential adaptation measures could include:

- Raising the height of the crossing to account for potential rise in the Columbia River water level
- Ensuring that the design and the materials used to build the crossing can withstand major storms and droughts
- Avoiding and minimizing construction in 100-year or 500-year floodplains

3.19.10 Electric and Magnetic Fields

Standards for electric and magnetic field (EMF) exposure guidelines are established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the American Conference of Governmental Industrial Hygienists. A survey conducted under the National Institutes of Health characterizes the personal magnetic field exposure in the general population.[60] The results indicate that approximately 14 percent of the general population is exposed to a 24-hour average magnetic field strength exceeding 2 mG. About 25 percent of people spend more than one hour at fields greater than 4 mG, and 9 percent spend more than one hour at fields greater than 8 mG. Approximately 1.6 percent of people experience at least one gauss (1,000 mG) during a 24-hour period.

Any of the CRC alternatives that involve extending light rail would add to EMF exposure. However, EMF levels from the light rail system are well below the ICNIRP exposure standards. There would be a slight cumulative increase for those persons riding or working on the light rail system. However, it is not anticipated that human health would be adversely affected by light rail-generated EMF.

3.19.11 Energy and Peak Oil

Cumulative effects related to energy use are partially incorporated into the long-term energy demand estimates prepared for the CRC project. Those estimates are based on travel demand forecasts that factor in

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[59] Hamlet and Lettenmaier, 1999.

[60] Enertech Consultants, 1998.

projected local changes in land use patterns, employment, population growth, and other programmed transportation improvements.

The cumulative energy impact of primary concern is "peak oil." Peak oil refers to the point in time at which the maximum global petroleum production rate is reached, after which the rate of production enters a terminal decline. Peak oil results from many incremental actions, few of which are individually important. However, the potential impact of reaching peak global petroleum production is an important consideration for projects, such as CRC, intended to address transportation needs for decades to come.

Oil production in the United States—the world's third largest oil producing nation—reached its peak around 1970 and has been in a declining trend since then. Most estimates place peak global production occurring some time between 1990 and 2040.

When oil production drops below oil demand, it is likely to cause petroleum prices to increase. There are uncertainties, however, regarding peak oil's timing and the availability of substitute fuels. Peak oil's effect on transportation fuel prices and travel behavior will depend largely on when peak oil occurs and the availability of substitute fuels.

What does the U.S. Department of Energy say about peak oil?

A report by the US Department of Energy[61] included the following conclusions:

- World oil peaking is going to happen, and will likely be abrupt.
- The problem is the demand for liquid fuels (growth in demand mainly from the transportation sector).
- Mitigation efforts will require substantial time.
- Both supply and demand will require attention.
- More information is needed to more precisely determine the peak time frame.

Peak oil's potential effects on economic activity and travel behavior could affect the CRC project. The concern is that if substitute fuels are not readily available as petroleum supplies decrease, the rising cost and reduced supply of petroleum could directly reduce auto and truck travel, and could result in dramatic reductions in economic activity, which, among other effects, could further reduce vehicle trips below forecasts. These vehicle trip forecasts influence the proposed size, design, and financing of transportation facilities. If fuel prices increase faster than expected, then the number of 2030 highway trips could be lower than forecasted. However, even with relatively substantial fuel price increases, the future demand would still be greater than the expanded highway capacity. Because fuel costs represent only a portion of total transportation costs (which include everything from car payments, to insurance and maintenance) even large growth in fuel costs translates to a smaller growth rate in total transportation cost, which is what most directly affects travel demand in the long term.

Global oil demand is projected to grow by 37 percent by 2030, driven in large part by transportation needs;[62] local transportation energy demand is expected to grow as well, although the CRC build alternatives are projected to reduce future transportation petroleum demand compared to No-Build. At the global scale, these fuel savings will be very small but incrementally beneficial over the No-Build Alternative.

The CRC alternatives include a number of elements that would reduce adverse impacts related to peak oil. These include:

- The bridge and highway improvements are focused on replacing or updating aging infrastructure, not on building new highway corridors

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[61] Hirsch, 2005.

[62] EIA, 2006.

- They include substantial improvements to public transportation, with projected increases in transit mode share in the afternoon peak direction from 13 percent with the No-Build to as much as 21 percent with light rail transit
- They provide substantially improved facilities for non-motorized transport
- They support land use planning that seeks to control sprawl, concentrate development, and decrease auto dependency
- They include road use pricing (highway tolling)
- Because of the addition of high-capacity transit and the bridge toll, all build alternatives are projected to have lower daily I-5 river crossings than under the no-build.
- They improve highway operations at a key pinch point which improves fuel efficiency and lowers emissions.
- They increase highway safety which decreases collisions and congestion, further improving fuel efficiency.

Another concern is the ability of current transportation infrastructure to adapt to post-peak oil vehicles and technology. Based on the alternative fuel vehicles that are currently being researched and developed, it is highly likely that the CRC infrastructure (transit guideway, bridges, highway, and bike and pedestrian paths) will be able to accommodate foreseeable changes. Electric hybrids, electric plug-ins, and vehicles powered by bio-diesel, ethanol, or hydrogen fuel cells are being designed to operate on modern roads and highways. The CRC transit guideway, whether built for bus rapid transit or light rail, can be used by vehicles powered by a variety of fuels. The capacity of the proposed bicycle and pedestrian facilities can accommodate substantial growth in non-motorized transportation demand. It is likely that the proposed CRC infrastructure could readily accommodate or adapt to the transition to substitute fuel vehicles, higher than projected growth in non-motorized modes, and higher growth in transit demand.

There is substantial uncertainty regarding the timing of peak oil, the future availability of substitute fuels and technology, and the effects of peak oil on transportation. It is reasonable, however, to conclude that the CRC project can be relatively prepared, at the project level, to address reasonably foreseeable impacts associated with peak oil, and to reduce the project's incremental adverse impact.

Outside the purview of CRC, numerous other measures will influence the timing and impact of peak oil at the global and local scale. These other actions include national and international energy policies, international relations, fuel and transportation taxes and fees, alternative fuel and technology research and development, agricultural policy and practices, local land use regulations, and other measures.

Has transportation infrastructure been able to adapt to change?

Transportation infrastructure has proven to be relatively adaptable. For example, the northbound I-5 bridge over the Columbia River was built in 1917 as a two-lane bridge that originally carried electric trolley cars and Model T autos (which ran on either gasoline or ethanol). While it is now obsolete in terms of seismic safety and traffic safety design standards, it was able to periodically adapt to nearly a century of changes in transportation technology, energy policy and prices, vehicle types, and travel behavior.

3.19.12 Noise and Vibration

The analysis of noise impacts is based on reasonably foreseeable changes in traffic resulting from background land use, population, and employment changes through 2030. In the project area there are currently an estimated 211 traffic noise impacts to noise sensitive land uses and that number would rise to 221 under the No-Build Alternative. Under the No-Build Alternative, routine maintenance of existing noise walls in Vancouver would occur but no new noise walls would be constructed. Background traffic growth would cause a general increase in traffic noise levels throughout the project area. Growth in aviation activity would likely also increase noise levels in some areas.

The build alternatives, which would include noise walls, would reduce noise levels substantially along I-5 compared to existing conditions and the projected No-Build Alternative. Several noise-sensitive land uses currently with no or only partial noise wall mitigation are exposed to traffic noise levels that exceed the relevant criteria. Many of these land uses would receive long-term noise reduction benefits with the proposed mitigation. While noise from other sources could continue to grow over time, the CRC alternatives would likely reduce noise impacts, compared to the No-Build Alternative. Vibration impacts are very modest for all build alternatives and can be mitigated.

3.19.13 Archaeological Resources

Based on extensive background research, archaeological reconnaissance, and predictive models, the construction of the CRC project is highly likely to encounter historic and could encounter prehistoric archaeological resources. Recent archaeological investigations demonstrate the potential for encountering archaeological remains associated with early residences, businesses, and industries, as well as Native American use.

Both shores of the Columbia River have been the location of extensive development in the past 200 years. Several types of historic era development occurred within or immediately adjacent to the present I-5 transportation corridor. Over time, dredging and filling along the shores have altered the banks of the Columbia River. Intensive residential, commercial, and transportation investments have had major impacts on the cultural and historic landscape in the I-5 corridor and vicinity.

Past activities have had a dramatic impact on the preservation of archaeological resources in the project area. Many have been lost. Unrelated future actions are likely to disturb or destroy additional archaeological resources, although some will likely be preserved or restored as well.

The project’s incremental impact to the loss of the area’s archaeological resources is not certain. There is a high likelihood that archaeological resources will be discovered prior to and during construction of any of the CRC build alternatives. Measures will be taken to protect, preserve, or document the presence of these resources.

3.19.14 Historic Resources

Past activities have had a dramatic impact on the preservation of historic resources in the project area. Many were demolished and the historic contexts largely altered to the extent that, except for few places such as the Vancouver National Historic Reserve, the northbound I-5 bridge, and other existing National Register sites in the project area, the area would be not easily recognized by people from the historic periods prior to the 1950s. Unrelated future actions are likely to demolish additional historic resources, although some future actions will likely preserve or restore others.

The project's incremental impact to the loss of the area's historic fabric is relatively small compared to the combined effects of these other projects and developments. The options are being designed to avoid most of the areas with large concentrations of historic resources.

3.19.15 Parks and Recreation Areas

The CRC project would improve access to recreational resources in Portland and Vancouver, and would result in improved pedestrian and bicycle access in the area, particularly between Oregon and Washington. The project would also have relatively minor impacts to a variety of public parks and recreational facilities. None of these resources would be displaced.

Park and trail development have been ongoing efforts in the region. These efforts will continue and are supported by current plans and programs. The impacts from the project would be small in the context of local park resources and are balanced by public investments in parks elsewhere in the area, such as Esther Short Park in downtown Vancouver, the development of the Confluence Land Bridge over SR 14 in Vancouver, and the potential opening of the Vanport wetland mitigation site to the public.

Other development unrelated to CRC could result in loss of park or historic properties; the extent of such loss is currently not known but likely small. Park impacts that would result from the CRC project, combined with other past and foreseeable future changes (including park expansions), are not expected to result in adverse cumulative effects.

3.19.16 Visual Quality and Aesthetics

Cumulative visual impacts occur when the character of a place changes (for example from an agricultural landscape to residential development) or when the vividness, unity, or intactness of the visual environment changes. In the project area, visual character has steadily progressed from frontier and rural to suburban and urban. The I-5 corridor has steadily grown in footprint and intensity of use as a major transportation route. Overall, impacts from the project will continue and reinforce the I-5 urban transportation corridor character.

Visual impacts from the proposed CRC project would occur from the greater height and width of the Columbia River bridges, the widened or higher ramps for reconfigured interchanges at Marine Drive, Hayden Island, SR 14, Mill Plain, and SR 500, and the effective widening of the

I-5 corridor due to adding auxiliary lanes, a transit guideway, and guideway ramps along I-5.

3.19.17 Ecosystems

Historically, many activities, including deforestation, urbanization, agriculture, over-fishing, and hydroelectric, irrigation and flood control projects have contributed to a loss of habitat and a reduction in fish and wildlife. Growth and development will likely continue to impact portions of the project area. Environmental protection legislation began in the 1960s and has grown since then. Local, state, and federal regulations require certain protections of natural areas, which has slowed the destruction of these habitats and mandated replacement, and in some cases recovery, of their functions.

The direct effects resulting from the CRC project include disturbance to native vegetation and trees, wetlands impacts, removal and fill in the Columbia River, and impacts to fish. Disturbance to native vegetation and trees is anticipated in three areas: cottonwood trees near the Expo Center in Oregon, vegetation along the banks of the Columbia River, and the loss of trees at Kiggins Bowl. Alternatives 2 and 3 would also remove peregrine falcon habitat on the existing I-5 bridges. In the Columbia River, fill could impact fish habitat and fish both during construction and long term.

The impacts resulting from the project are small, but historic development and expected growth throughout the region will likely continue to have impacts on ecosystems. The mitigation measures that are likely under any of the build alternatives will serve to reduce harmful effects, and may improve parts of the local ecosystem relative to existing conditions.

3.19.18 Geology and Soils

Past activities in the project area include settlement and development of the region, clearing of native vegetation, filling of lowland areas, grading of slopes, and construction in earthquake prone areas. Current development projects, including roads, bridges, and buildings, are being constructed under updated codes which require additional protection against earthquakes or in sensitive zones (for example, landslide-prone areas). However, in some cases, future activities may include development and regrading in the area that could lead to soil erosion, even with erosion control practices in place.

The CRC project would have little direct impact on geology or soils, other than land clearing during construction and the potential for erosion. The primary geologic concern is high earthquake hazard rating of the soils underlying the river crossing area. The soils are susceptible to liquefaction in a major seismic event. The build alternatives would replace or upgrade the existing bridges to reduce the potential for collapse or other damage.

Small changes that would occur from the CRC project include: reworking disturbed soil, localized minor grade changes, minor changes in slope stability, and ground improvements. These activities would have little or no meaningful impact to geology or soils and are not expected to materially cause or increase any substantial cumulative impacts.

3.19.19 Water Quality and Hydrology

Increased urbanization and land use changes have decreased the amount of natural area and natural flow regimes in the project area. Flood control measures affect the entire lower Columbia River environment. Levees and river embankments were constructed in the early 1900s on both sides of the river, which isolated the majority of the historic floodplain from all but the highest flows.

A decrease in upstream heavy industrial activities and an emphasis on addressing known contamination sources have improved water quality in the Columbia Slough over the last 10 years, although the water quality remains substantially impaired.

All of the build alternatives would increase stormwater runoff volumes, but with mitigation will likely result in lower pollutant loading than under existing conditions. In the Columbia River basin, the increased water quantity is not a critical issue, due to the total volumes handled in the basin. Stormwater treatment plans for the crossing have not yet been finalized, but net benefits are likely given adequate water treatment options.

Past projects and land use actions followed then-current water quality regulations that were not as stringent as they are now. Local, state, and federal regulations require protection of water quality. Increased scrutiny by regulatory agencies on chemicals at much lower concentrations than current standards is occurring and may result in new standards. The combination of impacts from the CRC project, regulations, and other foreseeable actions is likely to result in water quality improvements relative to existing conditions.

3.19.20 Wetlands

Compared to historical conditions, there are very few wetlands remaining in the project area. This increases the importance of the remaining wetlands in providing habitat, water quality, and other benefits. Mechanical methods introduced to control water flow (dikes in the project vicinity and dams on the Columbia River), have reduced the presence of wetlands in the project area. Many of the habitat losses due to these activities are probably irrecoverable. Urbanization has further affected wetlands locally and regionally. Foreseeable growth in the region will likely affect portions of the project area. Local, state, and federal regulations require protection of wetlands and jurisdictional waters, slowing the destruction of these habitats and mandating replacement of their functions.

Functional improvements have occurred to some wetlands near the southern portion of the project since the original construction of I-5. The Port of Portland has an ongoing wetland restoration project at the 90-acre Vanport wetlands parcel adjoining the existing highway and light rail line to the west.

Impacts from the proposed CRC bridge piers would include minor fill to the Columbia River. The transit and highway improvements would impact less than 0.25-acre of wetlands (unless the Marine Drive southern realignment option is chosen, which would additionally impact approximately one-half acre of the Vanport Wetlands). In the context of widespread urban development in the project area, the potential impacts to wetlands resulting from the build alternatives are minor. Additionally, mitigation for these impacts would replace or likely improve local wetland functions.

3.19.21 Hazardous Materials

The CRC project area is heavily urbanized, and has a history of generation, use, and storage of hazardous materials. Hazardous material sites that are most likely to impact the project are those being acquired for right-of-way or near roadway or transit options. Disturbances to hazardous materials sites that might not otherwise occur would result in site cleanup and could increase demand for contaminated soil disposal facilities.

The evaluation of existing hazardous materials risks to the CRC project is based on a review of past actions, and their effects on existing and potential soil and groundwater contamination. There may also be unknown contamination that poses additional risk, caused by past land uses and actions in the corridor.

Future, unrelated development in the project area could both add exposure risks and add cleanup and remediation benefits. Population and employment growth could cause increased traffic that may result in slightly higher incidents of hazardous materials spills. Since 1964, several laws have been implemented that have led to improved handling of hazardous materials, reducing the amount of new hazardous materials releases into the soil and groundwater. Environmental liability laws generally require identification and cleanup of hazardous materials during property transfers, which have resulted in the overall reduction of hazardous material contamination near the project area.

Because the project is unlikely to create new hazardous material sites, and may identify or remediate existing hazardous material sites, it could contribute to a cumulative beneficial impact to groundwater, human, and ecological receptors in the project area.

3.19.22 Irreversible and Irretrievable Commitments of Resources

NEPA regulations from the Council on Environmental Quality (CEQ) require environmental analysis to identify "…any irreversible and irretrievable commitments of resources, which would be involved in the proposed action should it be implemented." (CFR 1502.16) Implementing the proposed improvements involves committing natural, physical, human, and fiscal resources. CEQ guidelines describe primary irreversible and irretrievable resource commitments as uses of nonrenewable resources throughout a project that may be irreversible if removal of the resources occurs and cannot be replaced within a reasonable time frame (for example, extinction of a threatened or endangered species), or if obstruction of the use of resources occurs after the project.

The proposed transportation improvements would involve a long-term conversion of land resources to provide right-of-way for the build alternatives. Although these transportation facilities conceivably could revert to urban land and open space, there is no reason to expect that such a conversion would be necessary or desirable. Wetlands would be filled where they cannot be avoided or impacts minimized. Unavoidable wetland impacts will be offset by compensatory mitigation. Fossil fuels used to power construction and daily vehicle operation are the major nonrenewable resource that would be consumed by the construction of the proposed project, and the energy consumption resulting from daily vehicle operations.

Considerable amounts of labor, and construction materials such as cement, aggregate, asphalt, sand, fill materials, lime, and steel would be expended on the road construction. Large amounts of labor and natural resources are used in the fabrication and preparation of construction materials. These materials are generally not retrievable, although they are not in short supply, and their use would not have an adverse impact upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of both state and federal funds that are not retrievable.

3.19.23 Temporary Construction Effects

Cumulative impacts during construction could result if other projects in the area are constructed at the same time or nearly the same time as CRC project construction. Simultaneous or sequential construction projects can increase congestion, employment and spending, community impacts, and natural resource impacts. The construction of CRC is likely to overlap with construction of many of the specific developments listed at the beginning of this section, as well as private developments that are not yet proposed. For example, bridge construction activity for this project will need to be coordinated with other in-water work that could occur simultaneously, such as the Columbia River Channel Improvement project, as well as with construction immediately adjacent to the project, such as the Riverwest project.

The temporary effects from the CRC construction, in combination with other construction, will cause delays and disruptions to local residents and businesses. Mitigation plans, including traffic control plans and business assistance, will reduce the negative consequences of the construction project, while the employment demands will result in positive economic outcomes for the region.

Other projects would have their own traffic control plans, but some may influence the travel route of commuters and trucks and could place more traffic in the CRC project corridor. Likewise, some of the projects are on planned haul routes and could influence the delivery of supplies and materials to the job sites for the CRC project.

Community impacts due to local traffic congestion and rerouting, as well as noise and air quality impacts, could occur where CRC construction overlaps with the construction of other projects. The highest potential for such impacts is likely near the bridge landing in Vancouver and on Hayden Island where other large construction projects are likely and where CRC construction duration and intensity will be high.

For the natural environment, most of the construction impacts would be localized such that cumulative effects would not be a serious additional concern. Other projects in the area would not be likely to directly impact the same localized waters, wetlands, or regulated habitats that the CRC project would affect. However, in the project area, there could be increased erosion potential during the construction period. This, combined with other construction projects in the area, could increase the risk of erosion and water pollution in the event of a storm while ground surfaces are exposed.

To reduce potential cumulative construction impacts, the project team would consider other planned projects while developing CRC construction and mitigation plans and traffic control plans.