

INTERSTATE 5 COLUMBIA RIVER CROSSING

Indirect Effects Technical Report for the Final Environmental Impact
Statement



May 2011

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Cover Sheet

Interstate 5 Columbia River Crossing

Indirect Effects Technical Report for the Final Environmental Impact Statement:

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Appendix A: Literature Review

ACRONYMS

APE	area of potential effect
APTA	American Public Transportation Association
BNSF	Burlington Northern Santa Fe Railroad
CAO	Critical Areas Ordinance
CD	collector distributor
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRC	Columbia River Crossing
CTR	Commute Trip Reduction (Washington)
C-TRAN	Clark County Public Transportation
DEIS	Draft Environmental Impact Statement
DOT	U.S. Department of Transportation
ECO	Employee Commute Options (Oregon)
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GMA	Growth Management Act
LPA	Locally Preferred Alternative
LRV	light rail vehicle
MAX	Metropolitan Area Express
Metro	Metropolitan Regional Government
NEPA	National Environmental Policy Act of 1969
OAR	Oregon Administrative Rule
ODOT	Oregon Department of Transportation
OTC	Oregon Transportation Commission
RCW	Revised Code of Washington
ROD	Record of Decision
RTC	Regional Transportation Commission
SMA	Shoreline Management Act
SPUI	single-point-urban-interchange
TDM	transportation demand management
TOD	transit-oriented development
TriMet	Tri-County Metropolitan Transportation District
TSM	transportation system management

UGA	Urban Growth Area
WSDOT	Washington State Department of Transportation
WTC	Washington Transportation Commission

1. Introduction

This report documents a comprehensive assessment of potential indirect effects, across all disciplines, of the Locally Preferred Alternative (LPA) of the Columbia River Crossing (CRC) project. In order to assess indirect effects on the different elements of the environment, this report first evaluates potential induced growth or indirect land use effects. Following this analysis of induced growth, the report then describes how these changes in land use could be expected to affect various elements of the environment influenced by development patterns. In addition, the LPA was analyzed to determine if it would result in indirect effects to disciplines unrelated to potential induced growth; no other indirect effects were found.

Disciplines that are not discussed in this report are not anticipated to experience indirect effects.

1.1 Description of Alternatives

This technical report evaluates the CRC project's locally preferred alternative (LPA) and the No-Build Alternative. The LPA includes two design options: The preferred option, LPA Option A, which includes local vehicular access between Marine Drive and Hayden Island on an arterial bridge; and LPA Option B, which does not have arterial lanes on the light rail/multi-use path bridge, but instead provides direct access between Marine Drive and the island with collector-distributor (CD) lanes on the two new bridges that would be built adjacent to I-5. In addition to the design options, if funding availability does not allow the entire LPA to be constructed in one phase, some roadway elements of the project would be deferred to a future date. This technical report identifies several elements that could be deferred, and refers to that possible initial investment as LPA with highway phasing. The LPA with highway phasing option would build most of the LPA in the first phase, but would defer construction of specific elements of the project. The LPA and the No-Build Alternative are described in this section.

1.1.1 Adoption of a Locally Preferred Alternative

Following the publication of the Draft Environmental Impact Statement (DEIS) on May 2, 2008, the project actively solicited public and stakeholder feedback on the DEIS during a 60-day comment period. During this time, the project received over 1,600 public comments.

During and following the public comment period, the elected and appointed boards and councils of the local agencies sponsoring the CRC project held hearings and workshops to gather further public input on and discuss the DEIS alternatives as part of their efforts to determine and adopt a locally preferred alternative. The LPA represents the alternative preferred by the local and regional agencies sponsoring the CRC project. Local agency-elected boards and councils determined their preference based on the results of the evaluation in the DEIS and on the public and agency comments received both before and following its publication.

In the summer of 2008, the local agencies sponsoring the CRC project adopted the following key elements of CRC as the LPA:

- A replacement bridge as the preferred river crossing,
- Light rail as the preferred high-capacity transit mode, and
- Clark College as the preferred northern terminus for the light rail extension.

The preferences for a replacement crossing and for light rail transit were identified by all six local agencies. Only the agencies in Vancouver – the Clark County Public Transit Benefit Area Authority (C-TRAN), the City of Vancouver, and the Regional Transportation Council (RTC) – preferred the Vancouver light rail terminus. The adoption of the LPA by these local agencies does not represent a formal decision by the federal agencies leading this project – the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) – or any federal funding commitment. A formal decision by FHWA and FTA about whether and how this project should be constructed will follow the FEIS in a Record of Decision (ROD).

1.1.2 Description of the LPA

The LPA includes an array of transportation improvements, which are described below. When the LPA differs between Option A and Option B, it is described in the associated section. For a more detailed description of the LPA, including graphics, please see Chapter 2 of the FEIS.

1.1.2.1 Multimodal River Crossing

Columbia River Bridges

The parallel bridges that form the existing I-5 crossing over the Columbia River would be replaced by two new parallel bridges. The eastern structure would accommodate northbound highway traffic on the bridge deck, with a bicycle and pedestrian path underneath; the western structure would carry southbound traffic, with a two-way light rail guideway below. Whereas the existing bridges have only three lanes each with virtually no shoulders, each of the new bridges would be wide enough to accommodate three through-lanes and two add/drop lanes. Lanes and shoulders would be built to full design standards.

The new bridges would be high enough to provide approximately 95 feet of vertical clearance for river traffic beneath, but not so high as to impede the take-offs and landings by aircraft using Pearson Field or Portland International Airport to the east. The new bridge structures over the Columbia River would not include lift spans, and both of the new bridges would each be supported by six piers in the water and two piers on land.

North Portland Harbor Bridges

The existing highway structures over North Portland Harbor would not be replaced; instead, they would be retained to accommodate all mainline I-5 traffic. As discussed at the beginning of this chapter, two design options have emerged for the Hayden Island and Marine Drive interchanges. The preferred option, LPA Option A, includes local vehicular access between Marine Drive and Hayden Island on an arterial bridge. LPA Option B does not have arterial lanes on the light rail/multi-use path bridge, but instead provides direct access between Marine Drive and the island with collector-distributor lanes on the two new bridges that would be built adjacent to I-5.

LPA Option A: Four new, narrower parallel structures would be built across the waterway, three on the west side and one on the east side of the existing North Portland Harbor bridges. Three of the new structures would carry on- and off-ramps to mainline I-5. Two structures west of the existing bridges would carry traffic merging onto or exiting off of I-5 southbound. The new structure on the east side of I-5 would serve as an on-ramp for traffic merging onto I-5 northbound.

The fourth new structure would be built slightly farther west and would include a two-lane arterial bridge for local traffic to and from Hayden Island, light rail transit, and a multi-use path

for pedestrians and bicyclists. All of the new structures would have at least as much vertical clearance over the river as the existing North Portland Harbor bridges.

LPA Option B: This option would build the same number of structures over North Portland Harbor as Option A, although the locations and functions on those bridges would differ, as described below. The existing bridge over North Portland Harbor would be widened and would receive seismic upgrades.

LPA Option B does not have arterial lanes on the light rail/multi-use path bridge. Direct access between Marine Drive and the island would be provided with collector-distributor lanes. The structures adjacent to the highway bridge would carry traffic merging onto or exiting off of mainline I-5 between the Marine Drive and Hayden Island interchanges.

1.1.2.2 Interchange Improvements

The LPA includes improvements to seven interchanges along a 5-mile segment of I-5 between Victory Boulevard in Portland and SR 500 in Vancouver. These improvements include some reconfiguration of adjacent local streets to complement the new interchange designs, as well as new facilities for bicyclists and pedestrians along this corridor.

Victory Boulevard Interchange

The southern extent of the I-5 project improvements would be two ramps associated with the Victory Boulevard interchange in Portland. The Marine Drive to I-5 southbound on-ramp would be braided over the I-5 southbound to the Victory Boulevard/Denver Avenue off-ramp. The other ramp improvement would lengthen the merge distance for northbound traffic entering I-5 from Denver Avenue. The current merging ramp would be extended to become an add/drop (auxiliary) lane which would continue across the river crossing.

Potential phased construction option: The aforementioned southbound ramp improvements to the Victory Boulevard interchange may not be included with the CRC project. Instead, the existing connections between I-5 southbound and Victory Boulevard could be retained. The braided ramp connection could be constructed separately in the future as funding becomes available.

Marine Drive Interchange

All movements within this interchange would be reconfigured to reduce congestion for motorists entering and exiting I-5 at this location. The interchange configuration would be a single-point urban interchange (SPUI) with a flyover ramp serving the east to north movement. With this configuration, three legs of the interchange would converge at a point on Marine Drive, over the I-5 mainline. This configuration would allow the highest volume movements to move freely without being impeded by stop signs or traffic lights.

The Marine Drive eastbound to I-5 northbound flyover ramp would provide motorists with access to I-5 northbound without stopping. Motorists from Marine Drive eastbound would access I-5 southbound without stopping. Motorists traveling on Martin Luther King Jr. Boulevard westbound to I-5 northbound would access I-5 without stopping at the intersection.

The new interchange configuration changes the westbound Marine Drive and westbound Vancouver Way connections to Martin Luther King Jr. Boulevard and to northbound I-5. These two streets would access westbound Martin Luther King Jr. Boulevard farther east. Martin Luther King Jr. Boulevard would have a new direct connection to I-5 northbound.

In the new configuration, the connections from Vancouver Way and Marine Drive would be served, improving the existing connection to Martin Luther King Jr. Boulevard east of the interchange. The improvements to this connection would allow traffic to turn right from Vancouver Way and accelerate onto Martin Luther King Jr. Boulevard. On the south side of Martin Luther King Jr. Boulevard, the existing loop connection would be replaced with a new connection farther east.

A new multi-use path would extend from the Bridgeton neighborhood to the existing Expo Center light rail station and from the station to Hayden Island along the new light rail line over North Portland Harbor.

LPA Option A: Local traffic between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel via an arterial bridge over North Portland Harbor. There would be some variation in the alignment of local streets in the area of the interchange between Option A and Option B. The most prominent differences are the alignments of Vancouver Way and Union Court.

LPA Option B: With this design option, there would be no arterial traffic lanes on the light rail/multi-use path bridge over North Portland Harbor. Instead, vehicles traveling between Martin Luther King Jr. Boulevard/ Marine Drive and Hayden Island would travel on the collector-distributor bridges that would parallel each side of I-5 over North Portland Harbor. Traffic would not need to merge onto mainline I-5 to travel between the island and Martin Luther King Jr. Boulevard/Marine Drive.

Potential phased construction option: The aforementioned flyover ramp could be deferred and not constructed as part of the CRC project. In this case, rather than providing a direct eastbound Marine Drive to I-5 northbound connection by a flyover ramp, the project improvements to the interchange would instead provide this connection through the signal-controlled SPUI. The flyover ramp could be constructed separately in the future as funding becomes available.

Hayden Island Interchange

All movements for this interchange would be reconfigured. The new configuration would be a split tight diamond interchange. Ramps parallel to the highway would be built, lengthening the ramps and improving merging speeds. Improvements to Jantzen Drive and Hayden Island Drive would include additional through, left-turn, and right-turn lanes. A new local road, Tomahawk Island Drive, would travel east-west through the middle of Hayden Island and under the I-5 interchange, improving connectivity across I-5 on the island. Additionally, a new multi-use path would be provided along the elevated light rail line on the west side of the Hayden Island interchange.

LPA Option A: A proposed arterial bridge with two lanes of traffic, one in each direction, would allow vehicles to travel between Martin Luther King Jr. Boulevard/ Marine Drive and Hayden Island without accessing I-5.

LPA Option B: With this design option there would be no arterial traffic lanes on the light rail/multi-use path bridge over North Portland Harbor. Instead, vehicles traveling between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel on the collector-distributor bridges that parallel each side of I-5 over North Portland Harbor.

SR 14 Interchange

The function of this interchange would remain largely the same. Direct connections between I-5 and SR 14 would be rebuilt. Access to and from downtown Vancouver would be provided as it is

today, but the connection points would be relocated. Downtown Vancouver I-5 access to and from the south would be at C Street rather than Washington Street, while downtown connections to and from SR 14 would be made by way of Columbia Street at 4th Street.

The multi-use bicycle and pedestrian path in the northbound (eastern) I-5 bridge would exit the structure at the SR 14 interchange, and then loop down to connect into Columbia Way.

Mill Plain Interchange

This interchange would be reconfigured into a SPUI. The existing “diamond” configuration requires two traffic signals to move vehicles through the interchange. The SPUI would use one efficient intersection and allow opposing left turns simultaneously. This would improve the capacity of the interchange by reducing delay for traffic entering or exiting the highway.

This interchange would also receive several improvements for bicyclists and pedestrians. These include bike lanes and sidewalks, clear delineation and signing, short perpendicular crossings at the ramp terminals, and ramp orientations that would make pedestrians highly visible.

Fourth Plain Interchange

The improvements to this interchange would be made to better accommodate freight mobility and access to the new park and ride at Clark College. Northbound I-5 traffic exiting to Fourth Plain would continue to use the off-ramp just north of the SR 14 interchange. The southbound I-5 exit to Fourth Plain would be braided with the SR 500 connection to I-5, which would eliminate the non-standard weave between the SR 500 connection and the off-ramp to Fourth Plain as well as the westbound SR 500 to Fourth Plain Boulevard connection.

Additionally, several improvements would be made to provide better bicycle and pedestrian mobility and accessibility, including bike lanes, neighborhood connections, and access to the park and ride.

SR 500 Interchange

Improvements would be made to the SR 500 interchange to add direct connections to and from I-5. On- and off-ramps would be built to directly connect SR 500 and I-5 to and from the north, connections that are currently made by way of 39th Street. I-5 southbound traffic would connect to SR 500 via a new tunnel underneath I-5. SR 500 eastbound traffic would connect to I-5 northbound on a new on-ramp. The 39th Street connections with I-5 to and from the north would be eliminated. Travelers would instead use the connections at Main Street to connect to and from 39th Street.

Additionally, several improvements would be made to provide better bicycle and pedestrian mobility and accessibility, including sidewalks on both sides of 39th Street, bike lanes, and neighborhood connections.

Potential phased construction option: The northern half of the existing SR 500 interchange would be retained, rather than building new connections between I-5 southbound to SR 500 eastbound and from SR 500 westbound to I-5 northbound. The ramps connecting SR 500 and I-5 to and from the north could be constructed separately in the future as funding becomes available.

1.1.2.3 Transit

The primary transit element of the LPA is a 2.9-mile extension of the current Metropolitan Area Express (MAX) Yellow Line light rail from the Expo Center in North Portland, where it currently

ends, to Clark College in Vancouver. The transit element would not differ between LPA and LPA with highway phasing. To accommodate and complement this major addition to the region's transit system, a variety of additional improvements are also included in the LPA:

- Three park and ride facilities in Vancouver near the new light rail stations.
- Expansion of Tri-County Metropolitan Transportation District's (TriMet's) Ruby Junction light rail maintenance base in Gresham, Oregon.
- Changes to C-TRAN local bus routes.
- Upgrades to the existing light rail crossing over the Willamette River via the Steel Bridge.

Operating Characteristics

Nineteen new light rail vehicles (LRV) would be purchased as part of the CRC project to operate this extension of the MAX Yellow Line. These vehicles would be similar to those currently used by TriMet's MAX system. With the LPA, LRVs in the new guideway and in the existing Yellow Line alignment are planned to operate with 7.5-minute headways during the "peak of the peak" (the two-hour period within the 4-hour morning and afternoon/evening peak periods where demand for transit is the highest) and 15-minute headways during off-peak periods.

Light Rail Alignment and Stations

Oregon Light Rail Alignment and Station

A two-way light rail alignment for northbound and southbound trains would be constructed to extend from the existing Expo Center MAX station over North Portland Harbor to Hayden Island. Immediately north of the Expo Center, the alignment would curve eastward toward I-5, pass beneath Marine Drive, then rise over a flood wall onto a light rail/multi-use path bridge to cross North Portland Harbor. The two-way guideway over Hayden Island would be elevated at approximately the height of the rebuilt mainline of I-5, as would a new station immediately west of I-5. The alignment would extend northward on Hayden Island along the western edge of I-5, until it transitions into the hollow support structure of the new western bridge over the Columbia River.

Downtown Vancouver Light Rail Alignment and Stations

After crossing the Columbia River, the light rail alignment would curve slightly west off of the highway bridge and onto its own smaller structure over the Burlington Northern Santa Fe (BNSF) rail line. The double-track guideway would descend on structure and touch down on Washington Street south of 5th Street, continuing north on Washington Street to 7th Street. The elevation of 5th Street would be raised to allow for an at-grade crossing of the tracks on Washington Street. Between 5th and 7th Streets, the two-way guideway would run down the center of the street. Traffic would not be allowed on Washington between 5th and 6th Streets and would be two-way between 6th and 7th Streets. There would be a station on each side of the street on Washington between 5th and 6th Streets.

At 7th Street, the light rail alignment would form a couplet. The single-track northbound guideway would turn east for two blocks, then turn north onto Broadway Street, while the single-track southbound guideway would continue on Washington Street. Seventh Street will be converted to one-way traffic eastbound between Washington and Broadway with light rail operating on the north side of 7th Street. This couplet would extend north to 17th Street, where the two guideways would join and turn east.

The light rail guideway would run on the east side of Washington Street and the west side of Broadway Street, with one-way traffic southbound on Washington Street and one-way traffic northbound on Broadway Street. On station blocks, the station platform would be on the side of the street at the sidewalk. There would be two stations on the Washington-Broadway couplet, one pair of platforms near Evergreen Boulevard, and one pair near 15th Street.

East-west Light Rail Alignment and Terminus Station

The single-track southbound guideway would run in the center of 17th Street between Washington and Broadway Streets. At Broadway Street, the northbound and southbound alignments of the couplet would become a two-way center-running guideway traveling east-west on 17th Street. The guideway on 17th Street would run until G Street, then connect with McLoughlin Boulevard and cross under I-5. Both alignments would end at a station east of I-5 on the western boundary of Clark College.

Park and Ride Stations

Three park and ride stations would be built in Vancouver along the light rail alignment:

- Within the block surrounded by Columbia, Washington 4th and 5th Streets, with five floors above ground that include space for retail on the first floor and 570 parking stalls.
- Between Broadway and Main Streets next to the stations between 15th and 16th Streets, with space for retail on the first floor, and four floors above ground that include 420 parking stalls.
- At Clark College, just north of the terminus station, with space for retail or C-TRAN services on the first floor, and five floors that include approximately 1,910 parking stalls.

Ruby Junction Maintenance Facility Expansion

The Ruby Junction Maintenance Facility in Gresham, Oregon, would need to be expanded to accommodate the additional LRVs associated with the CRC project. Improvements include additional storage for LRVs and other maintenance material, expansion of LRV maintenance bays, and expanded parking for additional personnel. A new operations command center would also be required, and would be located at the TriMet Center Street location in Southeast Portland.

Local Bus Route Changes

As part of the CRC project, several C-TRAN bus routes would be changed in order to better complement the new light rail system. Most of these changes would re-route bus lines to downtown Vancouver where riders could transfer to light rail. Express routes, other than those listed below, are expected to continue service between Clark County and downtown Portland. The following table (Exhibit 1-1) shows anticipated future changes to C-TRAN bus routes.

Exhibit 1-1. Proposed C-TRAN Bus Routes Comparison

C-TRAN Bus Route	Route Changes
#4 - Fourth Plain	Route truncated in downtown Vancouver
#41 - Camas / Washougal Limited	Route truncated in downtown Vancouver
#44 - Fourth Plain Limited	Route truncated in downtown Vancouver
#47 - Battle Ground Limited	Route truncated in downtown Vancouver
#105 - I-5 Express	Route truncated in downtown Vancouver
#105S - I-5 Express Shortline	Route eliminated in LPA (The No-Build runs articulated buses between downtown Portland and downtown Vancouver on this route)

Steel Bridge Improvements

Currently, all light rail lines within the regional TriMet MAX system cross over the Willamette River via the Steel Bridge. By 2030, the number of LRVs that cross the Steel Bridge during the 4-hour PM peak period would increase from 152 to 176. To accommodate these additional trains, the project would retrofit the existing rails on the Steel Bridge to increase the allowed light rail speed over the bridge from 10 to 15 mph. To accomplish this, additional work along the Steel Bridge lift spans would be needed.

1.1.2.4 Tolling

Tolling cars and trucks that use the I-5 river crossing is proposed as a method to help fund the CRC project and to encourage the use of alternative modes of transportation. The authority to toll the I-5 crossing is set by federal and state laws. Federal statutes permit a toll-free bridge on an interstate highway to be converted to a tolled facility following the reconstruction or replacement of the bridge. Prior to imposing tolls on I-5, Washington and Oregon Departments of Transportation (WSDOT and ODOT) would have to enter into a toll agreement with U.S. Department of Transportation (DOT). Recently passed state legislation in Washington permits WSDOT to toll I-5 provided that the tolling of the facility is first authorized by the Washington legislature. Once authorized by the legislature, the Washington Transportation Commission (WTC) has the authority to set the toll rates. In Oregon, the Oregon Transportation Commission (OTC) has the authority to toll a facility and to set the toll rate. It is anticipated that prior to tolling I-5, ODOT and WSDOT would enter into a bi-state tolling agreement to establish a cooperative process for setting toll rates and guiding the use of toll revenues.

Tolls would be collected using an electronic toll collection system: toll collection booths would not be required. Instead, motorists could obtain a transponder that would automatically bill the vehicle owner each time the vehicle crossed the bridge, while cars without transponders would be tolled by a license-plate recognition system that would bill the address of the owner registered to that license plate.

The LPA proposes to apply a variable toll on vehicles using the I-5 crossing. Tolls would vary by time of day, with higher rates during peak travel periods and lower rates during off-peak periods. Medium and heavy trucks would be charged a higher toll than passenger vehicles. The traffic-related impact analysis in this FEIS is based on toll rates that, for passenger cars with transponders, would range from \$1.00 during the off-peak to \$2.00 during the peak travel times (in 2006 dollars).

1.1.2.5 Transportation System and Demand Management Measures

Many well-coordinated transportation demand management (TDM) and transportation system management (TSM) programs are already in place in the Portland-Vancouver Metropolitan region and supported by agencies and adopted plans. In most cases, the impetus for the programs is from state-mandated programs: Oregon's Employee Commute Options (ECO) rule and Washington's Commute Trip Reduction (CTR) law.

The physical and operational elements of the CRC project provide the greatest TDM opportunities by promoting other modes to fulfill more of the travel needs in the project corridor. These include:

- Major new light rail line in exclusive right-of-way, as well as express bus and feeder routes;
- Modern bicycle and pedestrian facilities that accommodate more bicyclists and pedestrians, and improve connectivity, safety, and travel time;
- Park and ride lots and garages; and
- A variable toll on the highway crossing.

In addition to these fundamental elements of the project, facilities and equipment would be implemented that could help existing or expanded TSM programs maximize capacity and efficiency of the system. These include:

- Replacement or expanded variable message signs or other traveler information systems in the CRC project area;
- Expanded incident response capabilities;
- Queue jumps or bypass lanes for transit vehicles where multi-lane approaches are provided at ramp signals for entrance ramps;
- Expanded traveler information systems with additional traffic monitoring equipment and cameras, and
- Active traffic management.

1.1.3 LPA Construction

Construction of bridges over the Columbia River is the most substantial element of the project, and this element sets the sequencing for other project components. The main river crossing and immediately adjacent highway improvement elements would account for the majority of the construction activity necessary to complete this project.

1.1.3.1 Construction Activities Sequence and Duration

The following table (Exhibit 1-2) displays the expected duration and major details of each element of the project. Due to construction sequencing requirements, the timeline to complete the initial phase of the LPA with highway phasing is the same as the full LPA.

Exhibit 1-2. Construction Activities and Estimated Duration

Element	Estimated Duration	Details
Columbia River bridges	4 years	<ul style="list-style-type: none"> • Construction is likely to begin with the bridges. • General sequence includes initial preparation, installation of foundation piles, shaft caps, pier columns, superstructure, and deck.
Hayden Island and SR 14 interchanges	1.5 - 4 years for each interchange	<ul style="list-style-type: none"> • Each interchange must be partially constructed before any traffic can be transferred to the new structure. • Each interchange needs to be completed at the same time.
Marine Drive interchange	3 years	<ul style="list-style-type: none"> • Construction would need to be coordinated with construction of the southbound lanes coming from Vancouver.
Demolition of the existing bridges	1.5 years	<ul style="list-style-type: none"> • Demolition of the existing bridges can begin only after traffic is rerouted to the new bridges.
Three interchanges north of SR 14	4 years for all three	<ul style="list-style-type: none"> • Construction of these interchanges could be independent from each other or from the southern half of the project. • More aggressive and costly staging could shorten this timeframe.
Light rail	4 years	<ul style="list-style-type: none"> • The river crossing for the light rail would be built with the bridges. • Any bridge structure work would be separate from the actual light rail construction activities and must be completed first.
Total Construction Timeline	6.3 years	<ul style="list-style-type: none"> • Funding, as well as contractor schedules, regulatory restrictions on in-water work, weather, materials, and equipment, could all influence construction duration. • This is also the same time required to complete the smallest usable segment of roadway – Hayden Island through SR 14 interchanges

1.1.3.2 Major Staging Sites and Casting Yards

Staging of equipment and materials would occur in many areas along the project corridor throughout construction, generally within existing or newly purchased right-of-way or on nearby vacant parcels. However, at least one large site would be required for construction offices, to stage the larger equipment such as cranes, and to store materials such as rebar and aggregate. Suitable sites must be large and open to provide for heavy machinery and material storage, must have waterfront access for barges (either a slip or a dock capable of handling heavy equipment and material) to convey material to the construction zone, and must have roadway or rail access for landside transportation of materials by truck or train.

Three sites have been identified as possible major staging areas:

1. Port of Vancouver (Parcel 1A) site in Vancouver: This 52-acre site is located along SR 501 and near the Port of Vancouver's Terminal 3 North facility.
2. Red Lion at the Quay hotel site in Vancouver: This site would be partially acquired for construction of the Columbia River crossing, which would require the demolition of the building on this site, leaving approximately 2.6 acres for possible staging.
3. Vacant Thunderbird hotel site on Hayden Island: This 5.6-acre site is much like the Red Lion hotel site in that a large portion of the parcel is already required for new right-of-way necessary for the LPA.

A casting/staging yard could be required for construction of the over-water bridges if a precast concrete segmental bridge design is used. A casting yard would require access to the river for barges, including either a slip or a dock capable of handling heavy equipment and material; a large area suitable for a concrete batch plant and associated heavy machinery and equipment; and access to a highway and/or railway for delivery of materials.

Two sites have been identified as possible casting/staging yards:

1. Port of Vancouver Alcoa/Evergreen West site: This 95-acre site was previously home to an aluminum factory and is currently undergoing environmental remediation, which should be completed before construction of the CRC project begins (2012). The western portion of this site is best suited for a casting yard.
2. Sundial site: This 50-acre site is located between Fairview and Troutdale, just north of the Troutdale Airport, and has direct access to the Columbia River. There is an existing barge slip at this location that would not have to undergo substantial improvements.

1.1.4 The No-Build Alternative

The No-Build Alternative illustrates how transportation and environmental conditions would likely change by the year 2030 if the CRC project is not built. This alternative makes the same assumptions as the build alternatives regarding population and employment growth through 2030, and also assumes that the same transportation and land use projects in the region would occur as planned. The No-Build Alternative also includes several major land use changes that are planned within the project area, such as the Riverwest development just south of Evergreen Boulevard and west of I-5, the Columbia West Renaissance project along the western waterfront in downtown Vancouver, and redevelopment of the Jantzen Beach shopping center on Hayden Island. All traffic and transit projects within or near the CRC project area that are anticipated to be built by 2030 separately from this project are included in the No-Build and build alternatives. Additionally, the No-Build Alternative assumes bridge repair and continuing maintenance costs to the existing bridge that are not anticipated with the replacement bridge option.

1.2 Defining Indirect Effects

The Council on Environmental Quality (CEQ) defines indirect effects as “later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems” 40 CFR 1508(b). For example, the visual impact a new river crossing may have on a historic building is a direct and immediate effect of the new river crossing. However, the visual impact that new development may have on a historic building is an indirect effect, if the pace of that development was accelerated by the creation of a new river crossing.

Distinguishing indirect effects from other types of effects is important and often nuanced. Compared with direct impacts, indirect effects are generally less immediate after a project action has occurred, and may take place in a more dispersed pattern or larger area than direct effects typically happen. Despite the distinction between direct and indirect effects, the National Environmental Policy Act of 1969 (NEPA) requires the same level evaluation for both, including disclosure and determination of significance.

Indirect effects differ from cumulative effects by being exclusive to changes brought on by the proposed action. Cumulative effects consider past, present, and reasonably foreseeable effects

from other actions to better understand a project's impacts in the context of other similar types of impacts that have, or are likely to, affect the same resources in order to facilitate decision making.

1.3 General Analytical Approach

The CRC project is a significant investment in transportation infrastructure within a key corridor between Portland, Oregon and Vancouver, Washington. This investment would substantially improve safety and mobility for I-5 users and transit patrons by implementing various design improvements to a 5 mile segment of I-5; adding a toll to the river crossing; extending light rail from North Portland over Hayden Island and through downtown Vancouver; adding new bicycle and pedestrian facilities and connections; and, in the case of LPA Option B, creating a new arterial connection between North Portland and Hayden Island. This type and magnitude of transportation improvement is expected to affect future travel behavior and thus the distribution of anticipated population and employment growth.

The key question regarding CRC's indirect effects is not so much *whether* the project will affect future land use patterns, but *how* it would do so. Will this multimodal project promote auto-oriented development or transit-oriented development, and to what extent? In general, auto-oriented development tends to occur at relatively low densities around the urban periphery. While local and regional land use plans allow some of this type of development, they generally attempt to limit it because it is considered to be an inefficient method of accommodating future population and employment growth and results in relatively higher costs, higher environmental impacts, and a greater demand for land and urban infrastructure and services. In contrast, transit-oriented development (TOD) is often higher density in an already urbanized area, and is typically considered to be a more efficient method of accommodating future growth. Concentrating growth in existing urban areas can help protect natural resources from the potentially adverse effects of development, such as habitat conversion and stormwater runoff from new impervious surfaces.

The description of indirect effects is based the following three primary steps of analysis:

1. *Identify the direct effects this project will have on travel patterns:* This information was developed using travel demand and traffic simulation modeling of the LPA and the No-Build alternatives to estimate how future travel patterns would differ with and without this project (Section 2).
2. *Determine likely land use changes as a result of the travel pattern changes from this project:* Using a comprehensive survey of literature and case studies as well as integrated land use/transportation/real estate modeling, the project team described how the project's impact on travel behavior would likely affect future development patterns (Section 2).
3. *Assess how these land use changes could affect the environment:* The final sections of this report interpret how anticipated land use changes could affect relevant elements of the environment. This assessment is broken into two areas, the built environment (Section 3) and the natural environment (Section 4).

Each of the LPA design and phasing options include the same high-capacity transit service, have similar effects on traffic congestion, and share much of the same project footprint. Because the options are similar, and exact predictions of where and how the project would influence land development are not possible, it is assumed that the indirect effects of LPA Option A and B (with and without highway phasing) would be substantially the same. As such, this technical report makes no distinction between options, describing the indirect effects of the project as the indirect effects of the LPA.

2. Indirect Land Use Effects

2.1 Overview of Analysis

The core of the indirect effects analysis is the estimate of the CRC project's induced land use changes. This estimate includes five analytical methods which are summarized in the May 2008 DEIS and described below.

1. Assessment of local plans to determine the intended urban form and how CRC's transportation improvements are expected to facilitate or hinder these land use changes;
2. A survey of national research and case studies on how transportation infrastructure can indirectly impact land use;
3. An analysis of growth management techniques in Washington and Oregon land use planning;
4. The results of travel demand modeling and operational analysis for the CRC project alternatives; and
5. Integrated land use/transportation modeling that estimates how the CRC project might or might not influence the location of future growth in housing and employment.

2.2 Local Plans

There are no building moratoriums in place that are contingent on the CRC project, or any plans that include different land use scenarios based on whether this project is constructed.¹ However, recent planning by the City of Portland for Hayden Island and by the City of Vancouver for its downtown area, rely on the transportation improvements offered by the project. The Hayden Island Plan outlines a vision for the future growth and development of the eastern half of Hayden Island (Exhibit 2-3). This plan includes the expectation that access to the island will be improved by the new I-5 interchange and light rail extension included by CRC. These access improvements are expected to facilitate new, transit-oriented development on the island. For example, the 80 acre Jantzen Beach Super Center immediately west of the I-5 interchange is expected to redevelop from a "big-box" regional commercial center into a medium-density mix of commercial and residential uses with up to 2,000 new housing units centered around the new light rail station.²

The Vancouver City Center Vision (VCCV)³ identifies high capacity transit through downtown Vancouver (Exhibit 2-4) as a key transportation goal and encourages further development in the downtown. The plan identifies several city blocks that may be available for development as a result of the CRC project. Another goal in the VCCV is extending Main Street to Columbia Way. By replacing the existing bridges and raising the grade of the freeway over the Vancouver waterfront and southern downtown area, the project would facilitate extending Main Street to Columbia Way. The Main Street extension would support the City's vision of providing greater connectivity to the waterfront and also benefit planned redevelopment of the Boise Cascade mill

¹ Per email from City of Portland dated June 11, 2009.

² Hayden Island Plan, City of Portland, adopted August 19, 2009.

³ Vancouver City Center Vision and Subarea Plan, City of Vancouver, adopted June 18, 2007.

property, the Red Lion Hotel and other properties along the Vancouver waterfront immediately west of I-5. This development is planned and moving forward separately from the project, but would be better integrated with the rest of downtown Vancouver through the extension of Main Street.

2.3 Survey of Research and Case Studies

National research and case studies revealed a variety of important factors that influence whether and how transportation investments change travel and land use patterns. In general, some transit projects tended to promote high-density development, particularly around new transit stations, while some highway projects increased automobile use when adding through-capacity and could have the potential to induce low-density, auto-oriented development further from urban centers. At the same time, other transit projects and highway projects did not have these effects. The most relevant findings from the national research were the answers to the following two questions:

- What factors were associated with highway projects that tended to increase auto use and low density development, and
- What factors were associated with high capacity transit projects that tended to increase transit-oriented and higher density development?

The factors identified in the national research are summarized in the left columns of Exhibit 2-1 and Exhibit 2-2. The right side of each exhibit identifies the extent to which each of those factors is or is not included in the CRC project and main project area.

Exhibit 2-1. Factors Associated with Highway Projects that Induce Auto Travel and Sprawl

Factors	Does the CRC Project Exhibit these Factors?
Does the CRC project provide new access to areas previously unserved or greatly underserved by local highways?	No. The CRC project is entirely within an urbanized area, and I-5 has been an interstate corridor since 1958. The project adds no new interchanges.
Does the CRC project provide new highway access to land on the urban edge?	No. CRC project improvements are located 7 miles inside Vancouver's Urban Growth Area boundary to the north, and over 13 miles inside Metro's Urban Growth Boundary to the south.
Does the CRC project substantially improve highway travel times?	Yes and No. The potential for travel time savings to induce auto use are minimized by the added toll. Drivers consider both the value of travel time and the cost of the trip, when determining if, when, how, and where to travel. Compared to the No-Build Alternative, the LPA would provide a 28-minute travel time savings for a round trip between 179th and I-84 during peak periods. The cost of the toll is equivalent to a travel time penalty that negates almost 43% of the trip-making effect of this travel time savings. The net effect of these countervailing factors is equivalent to a 18% decrease in travel time. However, the decrease in total travel time experienced by most individuals would be less than 18% per trip, as the calculation does not account for time spent traveling to and from the highway or traveling along I-5 beyond I-84. Therefore, improvements in highway travel times are not expected to have a substantial impact on induced demand or access to fringe areas.
Does the CRC project reduce auto travel costs?	No. The LPA adds a toll on the interstate that increases auto travel costs relative to the No-Build Alternative.

Factors	Does the CRC Project Exhibit these Factors?
Are local and regional land use regulations ineffective at managing growth?	No. Effective growth management controls backed by state law exist in the I-5 corridor on both sides of the river that require: <ul style="list-style-type: none"> • the vast majority of future growth to occur within urban growth areas that reduce sprawl and that are sized to meet population and employment forecasts; • comprehensive and subarea plans that implement efficient and sustainable urban development within urban growth areas; • minimum densities in urban areas; and, • protection for rural, agricultural, and environmentally sensitive areas.
Are there real estate markets supporting low-density development?	Yes and No. These areas are small and distant from the main project area. The minimum average densities required to be achieved in Vancouver growth management areas is notably higher than that required in Metro's "Inner Neighborhood" designation. In certain locations densities as high as those targeted for town centers, station areas, and main streets are anticipated. The minimum densities required in the urban growth areas of Washougal, Battle Ground, Camas, and Ridgefield are similar to the densities required in Metro's "Outer Neighborhoods." The two urban growth areas that allow low densities are Yacolt (20 miles from Vancouver) and La Center (15 miles from Vancouver). These growth areas are distant and quite small, representing only 0.9% of the County's population in 2004, and 1.7% of the County's projected population in 2024; no material urban sprawl is anticipated in these areas from the CRC project.

Exhibit 2-2. Factors Associated with High-capacity Transit Projects that Tend to Promote Higher Density and/or Transit-oriented Development

Factors	Does the CRC Project Exhibit these Factors?
Would the CRC project increase transit ridership?	Yes. The percentage of travelers over the new I-5 transit bridge using transit is projected to be almost twice as high with the project, compared to the No-Build Alternative. ^a
Does the CRC project provide new access to developable/redevelopable land previously unserved or underserved by transit?	Yes. The main project area is not currently served by high-capacity transit and there is substantial latent demand for cross-river transit service.
Are there real estate markets supporting such development?	Yes. Most recent and planned developments in downtown Vancouver are high-density and/or mixed use.
Is there positive public perception of transit?	Yes. Over 70% of residents polled support extending light rail across the river to Vancouver. ^b
Do local and regional land use regulations effectively manage growth?	Yes. The Portland Metro area has a long history of effective growth management. Vancouver/Clark County follow the state Washington Growth Management Act (GMA), and any Urban Growth Area (UGA) expansions are subject to state oversight.

a PM peak period transit mode split for the I-5 crossing.

b Riley Report/Portland-Vancouver Area Survey. Riley Research Associates. June 18, 2008. A scientific telephone poll of 504 randomly selected households in Multnomah, Washington, and Clackamas Counties in Oregon, and Clark County in Washington.

As evident from the exhibits above, and supported by the independent expert review panel, the CRC project is far more likely to encourage compact, higher density development in established urban areas than promote auto-oriented, lower density development on the urban fringe.

The CRC project would decrease travel times, improve travel reliability, and reduce congestion. However, tolling the river crossing offsets much of the potential for inducing auto travel. It serves to reduce total auto trips and increase transit travel. The light rail extension into Vancouver further increases transit ridership, and promotes transit-oriented development around the

proposed light rail stations on Hayden Island and in downtown Vancouver. Ultimately, the transit and highway improvements are more likely to help realize long-term, regional land use visions by supporting concentrated growth in established urban centers.

2.4 Analysis of Washington and Oregon Growth Management

The national research and case studies emphasized the importance of land use regulations for influencing the type and magnitude of effect from transportation improvements. The jurisdictions on both sides of the river have strong growth management measures in place that have many similarities.

Both states mandate growth management. Oregon's Senate Bill 100, adopted in 1973, specifies 19 Statewide Planning Goals that are applicable to Oregon's 36 counties and 212 cities. When Washington adopted its Growth Management Act (GMA) in 1990, the Act applied to most counties and the cities therein, including Clark County and the City of Vancouver. Both growth management systems require the development and adoption of 20-year comprehensive plans with urban growth boundaries/areas that provide clear distinctions between rural and urban land. Both laws also encourage compact urban forms and multimodal transportation systems, established land use courts, require capital facility planning, allow for the collection of system development charges, and are tied to numerous implementing mechanisms.

The GMA includes 14 goals to guide the development and adoption of comprehensive plans and development regulations. These goals are very similar to the 19 Statewide Planning Goals in Oregon. They discourage sprawling development, encourage focusing growth and development in existing urban areas with adequate public facilities, encourage economic development throughout the state consistent with comprehensive plans, encourage efficient multimodal transportation systems, and require that adequate public facilities and services necessary to support development be available when new development is ready for occupancy.

Metropolitan Regional Government (Metro) is a regional government tasked with land use planning in the Portland metropolitan area in Oregon with a long history of effective growth management. The City of Portland has a sophisticated zoning code and development regulations that focus growth where desired, such as encouraging compact mixed-use development around transit facilities. After 19 years of planning and regulation under the state GMA, the City of Vancouver and Clark County have also developed robust growth management policies and regulations. The Vancouver Comprehensive Plan targets growth in designated urban centers and corridors connecting these centers in an approach comparable to Metro's 2040 Growth Concept that outlined a plan for accommodating regional growth expected in 50 years. Vancouver has a Transit Overlay District allowing for "higher densities and more transit-friendly urban design" than afforded by base zoning. Also, in preparation for the construction of the CRC project, the City of Vancouver has recently made changes to the downtown plan (VCCV) and is implementing regulations that encourage complementary development along the light rail alignment.

Clark County and the City of Vancouver have planned residential densities of approximately 16 and 20 persons per acre. This compares favorably to Metro's "inner neighborhood" and "outer neighborhood" areas that have a target of 14 and 13 persons per acre, respectively. Metro has other significant goals applied throughout its jurisdiction, tied to designations such as Regional, Town Centers and Main Streets with much higher density targets. The City of Vancouver has policy and regulations encouraging higher densities in planned sub-areas, downtown, and along transit corridors that are comparable to the densities targeted in Metro's Town Centers and Main Streets.

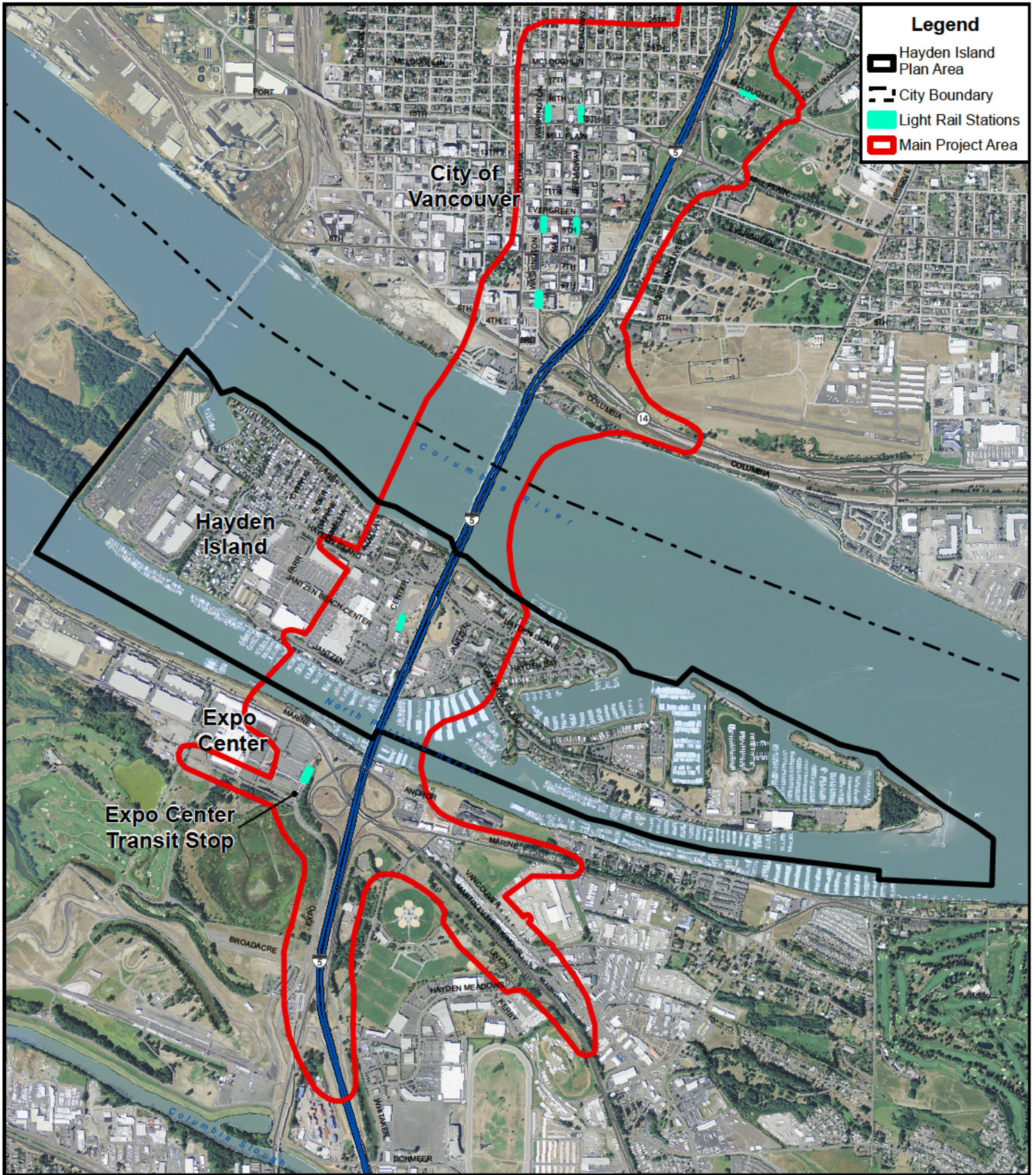


Exhibit 2-3. Hayden Island Plan, Geographic Extent
Indirect Effects Technical Report

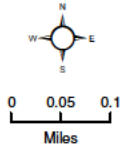
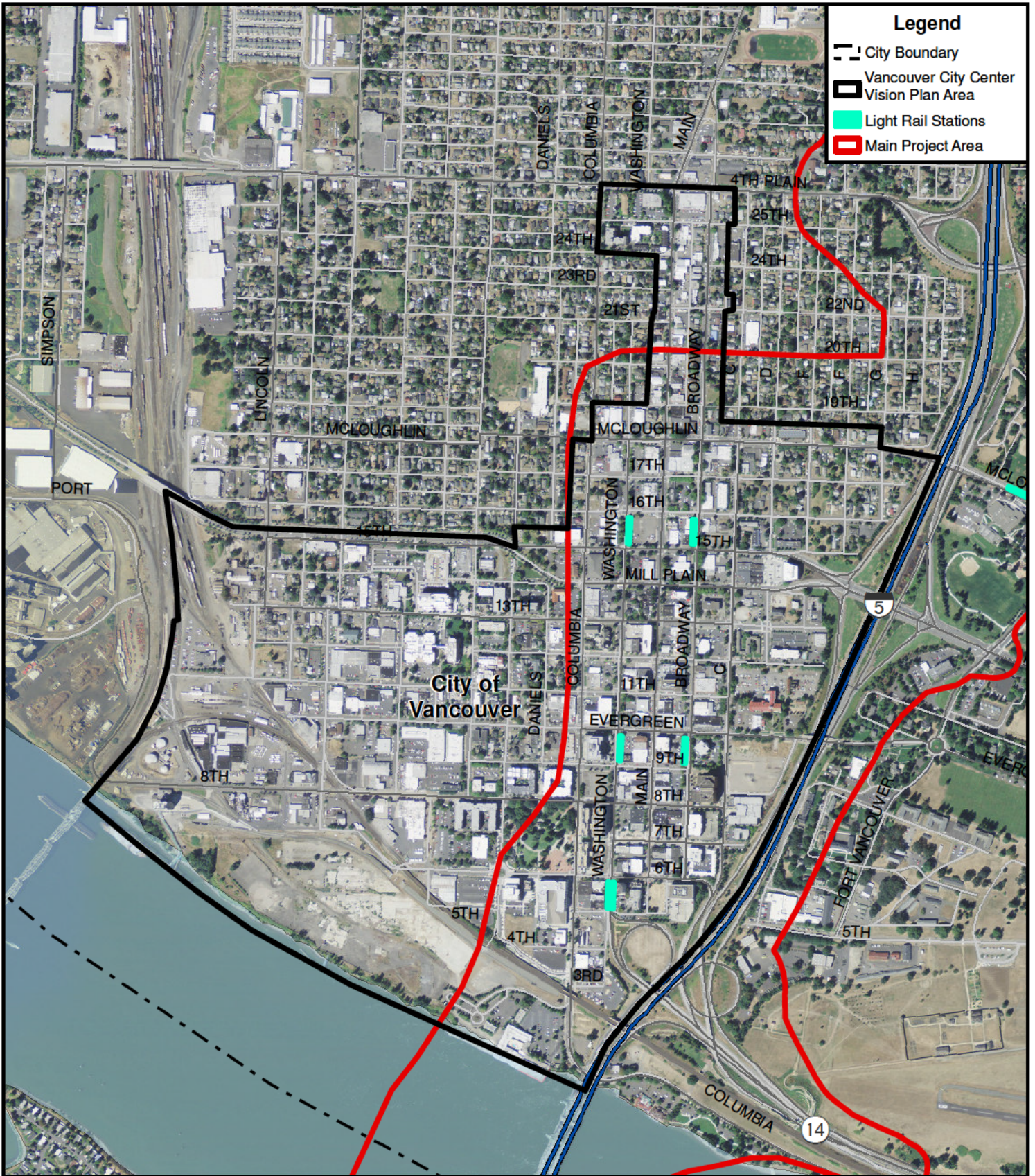


Exhibit 2-4. Vancouver City Center Vision, Geographic Extent Indirect Effects Technical Report



2.5 Travel Demand Modeling and Traffic Operations Analysis

Travel time and resulting accessibility can influence the demand for land at both the urban fringe and in established urban areas. Significant improvements in travel time from areas along the urban periphery to key destinations such as downtown Portland could increase pressure for suburban residential development in northern Clark County. At the same time, increases in transit ridership could promote higher density development around transit stations in the central Vancouver area. Travel demand modeling and traffic simulation can provide valuable information about how the CRC project might change travel behavior and, in turn, influence land use patterns.

Travel demand modeling and traffic simulation indicate that the CRC project has a far greater effect on transit ridership than I-5 travel times. Though the LPA would substantially reduce congestion within the main project area compared to the No-Build Alternative, travel times are not as dramatically changed because this project improves a relatively small portion of the region's highway system, and because the toll on the I-5 crossing would add a perceived penalty to auto travel. A 6-minute time penalty was included in the traffic modeling to simulate drivers' response to paying this fee. This penalty is based on the average value travelers place on their time⁴. With this 6-minute time-penalty incurred by the toll, the round trip travel time savings on I-5 between 179th Street north of Vancouver to I-84 near downtown Portland diminishes from a 28-minute savings to just a 16-minute savings.

Because of the toll and the introduction of a reliable and efficient transit alternative, modeling shows that the project would actually lower the number of vehicles using the I-5 crossing each day by about 3%.⁵ In contrast, transit ridership would increase over 275% during the p.m. peak period.⁶ These travel pattern changes suggest the project will not induce automobile demand, and thus should not increase development pressure along the urban periphery. The significant increase in transit ridership also suggests the project could spur development around the new light rail stations.

2.6 Transportation and Land Use Modeling (Metroscope)

The fifth method for evaluating this project's potential for inducing land use changes entailed review of Metroscope model analysis of transportation improvements in the I-5 corridor similar to the CRC project. Metroscope is an integrated land use and transportation model designed by Metro to predict how changes in transportation infrastructure could influence the future distribution of employment and housing throughout the region.

In 2010, Metro used a Metroscope model to forecast growth associated with transportation improvements of a 12-lane river crossing and light rail to Clark College. The model forecast the impacts with both a tolled and an untolled bridge. The model showed only minimal changes in

⁴ In October 2008, the project convened a panel of national experts to review the travel demand model methodology, including this method of simulating the toll's effect. The panel unanimously concluded CRC's methods and conclusions were valid and reasonable.

⁵ 184,000 cars would travel over the I-5 bridges under the No-Build scenario versus 178,500 with a replacement crossing, a toll on I-5, and light rail.

⁶ With a replacement crossing, a toll on the I-5 bridges, and light rail, 6,100 people would ride transit during the PM peak period compared to 2,200 people for the No-Build alternative.

employment location and housing demand compared to the No-Build Alternative. Essentially, the model verified previous analyses that found the project would not significantly induce growth or sprawl. Compared to the No-Build Alternative, for a tolled facility, Metroscope estimated a 0.03 percent decrease in households in north Clark County and a 0.51 percent increase in the southern, more urban, half of the county. Even with no toll, the model forecast only a slight increase in households in north (0.85 percent) and south Clark County (0.66). Metroscope estimated a 1.5 percent employment gain in North and northeast Portland along the I-5 corridor, compared to the No-Build Alternative, with smaller percentage employment increases and decreases in other areas of the region (Metro 2010).

2.7 Conclusion

Large transportation projects have the potential to have far reaching effects on travel and land use patterns. However, the CRC project, because of its context, its multimodal character, and the inclusion of a new toll, will have the most pronounced and predictable effects immediately surrounding the new infrastructure. Specifically, the project is expected to promote development on Hayden Island and in downtown Vancouver, particularly around the proposed new light rail stations. More generally, the project is not expected to induce automobile demand or development pressure on the urban periphery, but the project is likely to redistribute a very small amount of future job and housing growth within the region.

It is impossible to predict specific, induced land use changes from this project, but the preceding analysis does provide a good indication of the general location and type of development that would be induced by the CRC project. The most pronounced indirect land use changes as a result of this project will be on Hayden Island and in downtown Vancouver, where the transportation improvements from this project are anticipated in local plans, and are necessary for these areas to fully develop as these plans envision. Improved multimodal access to Hayden Island would allow for a more cohesive community, with more residences and new locally-focused commercial services replacing some of the dispersed, auto-oriented regional retail outlets. The anticipated redevelopment of the Jantzen Beach Super Center into a mixed-use community is perhaps the most significant potential change expected on the island. The redevelopment could occur with or without the project but the project could induce it to happen sooner and with an orientation to the proposed light rail transit station rather than the auto-oriented character of the existing development. Exhibit 2-5 shows existing land uses on Hayden Island and around the Expo Center light rail station, while Exhibit 2-6 shows the zoning in this area. The zoning allows for higher residential and commercial densities on the island, notably west of the I-5 interchange where the Jantzen Beach Super Center is currently located.

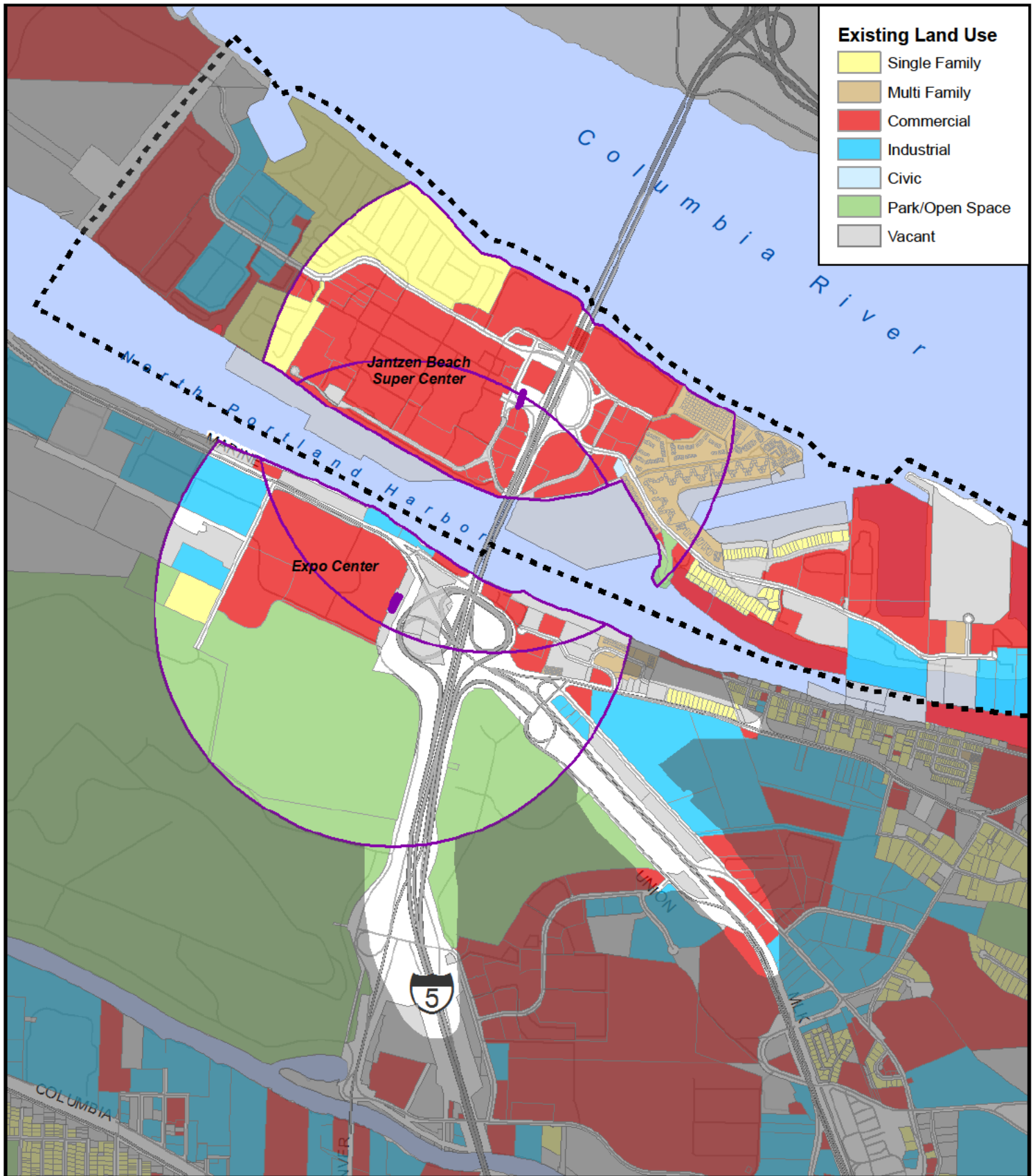
Transit-oriented development (TOD) is expected around the light rail transit stations in downtown Vancouver as well. Studies of high-capacity transit projects indicate that areas within walking distance, or approximately a half mile, of new light rail transit stations can attract new development⁷. Exhibit 2-7 and Exhibit 2-8 show the existing land uses and zoning in Vancouver around these light rail transit stations and in the area of the VCCV. The areas around the downtown light rail transit stations are zoned “City Center Mixed Use”, which allows high-density residential and commercial uses. Recent development in downtown Vancouver means that many areas around the new light rail station are already built up, but there are still some vacant and underutilized parcels that offer potential for these stations to spur added density of

⁷ Reconnecting America (2007), *TOD 101: Why Transit-Oriented Development And Why Now?*, Reconnecting America; at www.reconnectingamerica.org/public/download/tod101full

jobs and housing. In Vancouver, the stations between 15th and 16th Streets are most likely to spur development as this area has several vacant or underdeveloped parcels and generally lower densities, although nearby lower density residential zoning and height restrictions reflect the intent for this area to serve as a transition from the downtown to northern neighborhoods. Although moving forward independently of the CRC project, planned waterfront redevelopment in Vancouver may be accelerated because of the improved connectivity to the existing downtown street grid.

In addition to stimulating and promoting job growth and residential demand around the new transit stations on Hayden Island and in downtown Vancouver, the project is also expected to redistribute small amounts of future job growth to the I-5 corridor in North and Northeast Portland and housing growth to southern Clark County. This slight increase in demand for jobs and housing is expected to occur in already urbanized areas. It is important to note that all development – be it adjacent to new or existing light rail stations or dispersed throughout an urbanized area – will have to comply with local plans and development regulations. As described in Sections 3 and 4, such development would be subject to numerous federal, state, and local regulations that have the effect of minimizing adverse impacts to built and natural resources.

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Existing Land Use

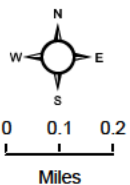
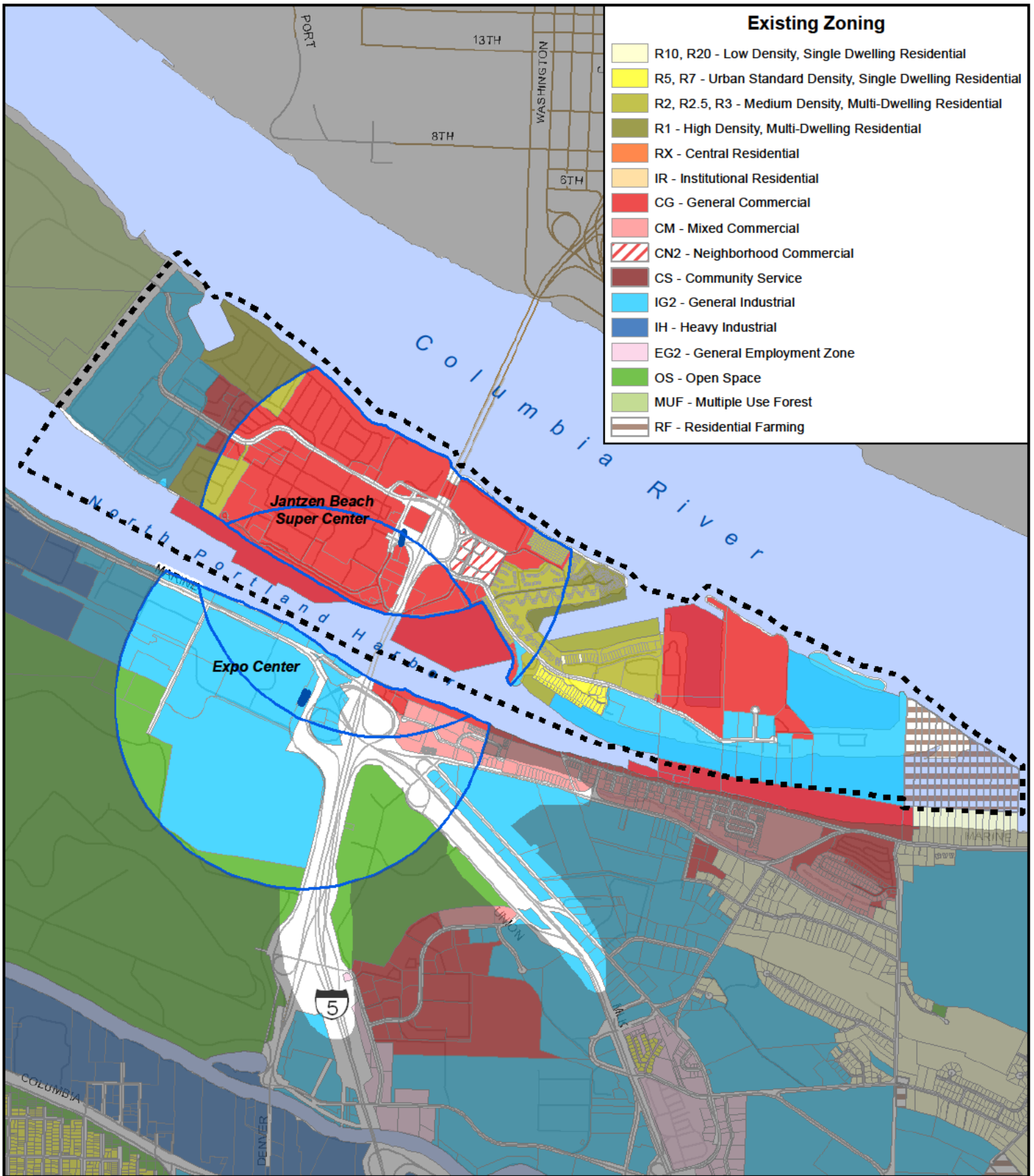
- Single Family
- Multi Family
- Commercial
- Industrial
- Civic
- Park/Open Space
- Vacant

- Hayden Island Plan Area
- Light Rail Stations
- 0.5 Mile LRT Station Buffers

Exhibit 2-5. Current Land Uses for Hayden Island and Around Expo Center

Source: Metro, RLIS Lite GIS Data, taxlot.shp, May 2009.





- Hayden Island Plan Area
- Light Rail Stations
- 0.5 Mile LRT Station Buffers

Exhibit 2-6. Current Zoning for Hayden Island and Around Expo Center



Source: Metro, RLIS Lite GIS Data, zoning.shp and taxlot.shp, Aug. 2010.

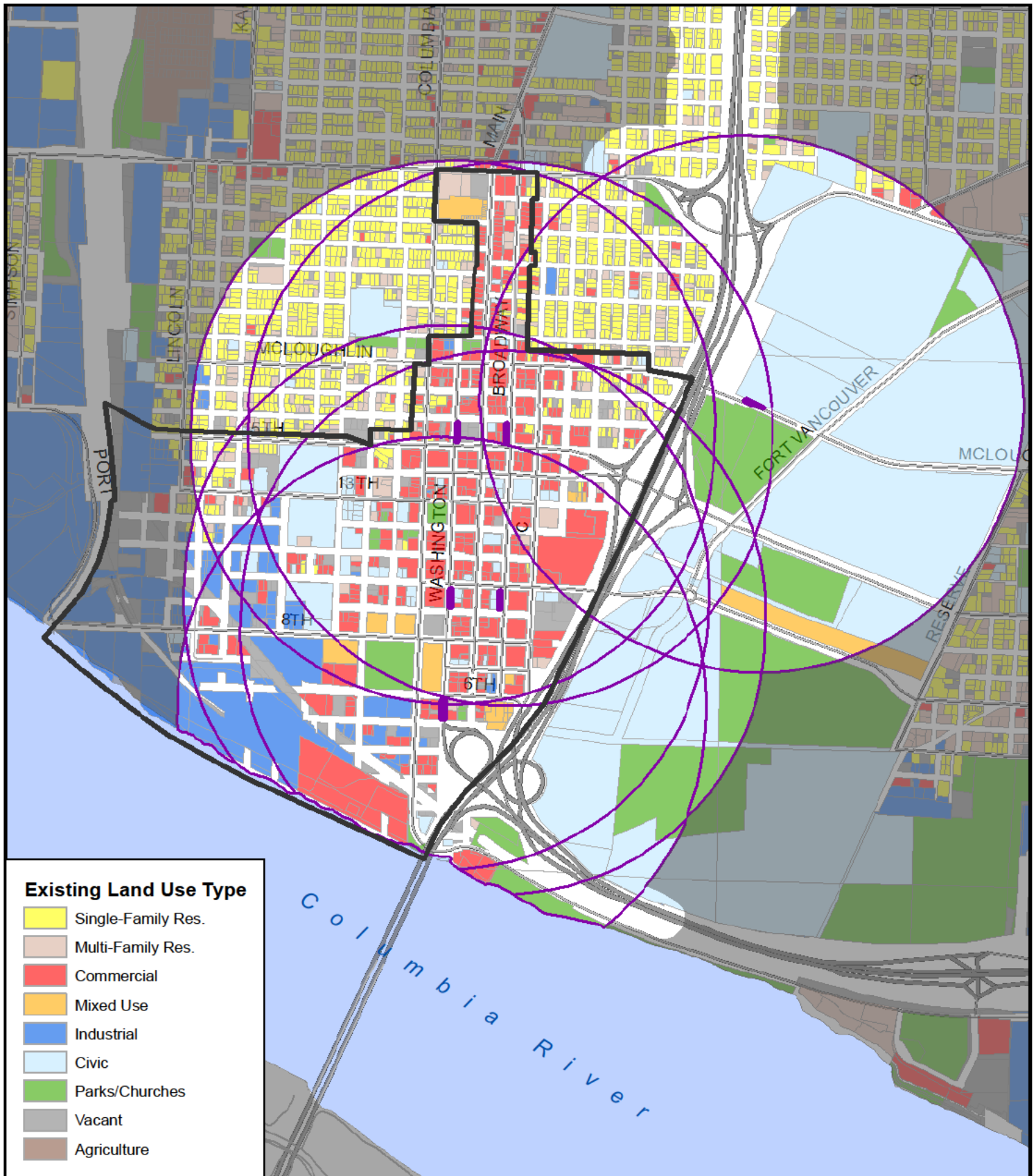


Exhibit 2-7. Current Land Uses for Vancouver City Center Plan Area and Vancouver LRT Station Areas



Source: Clark County, WA, Assessors Office, GIS Digital Data, landuse.shp, 2010. Includes edits based on existing conditions.

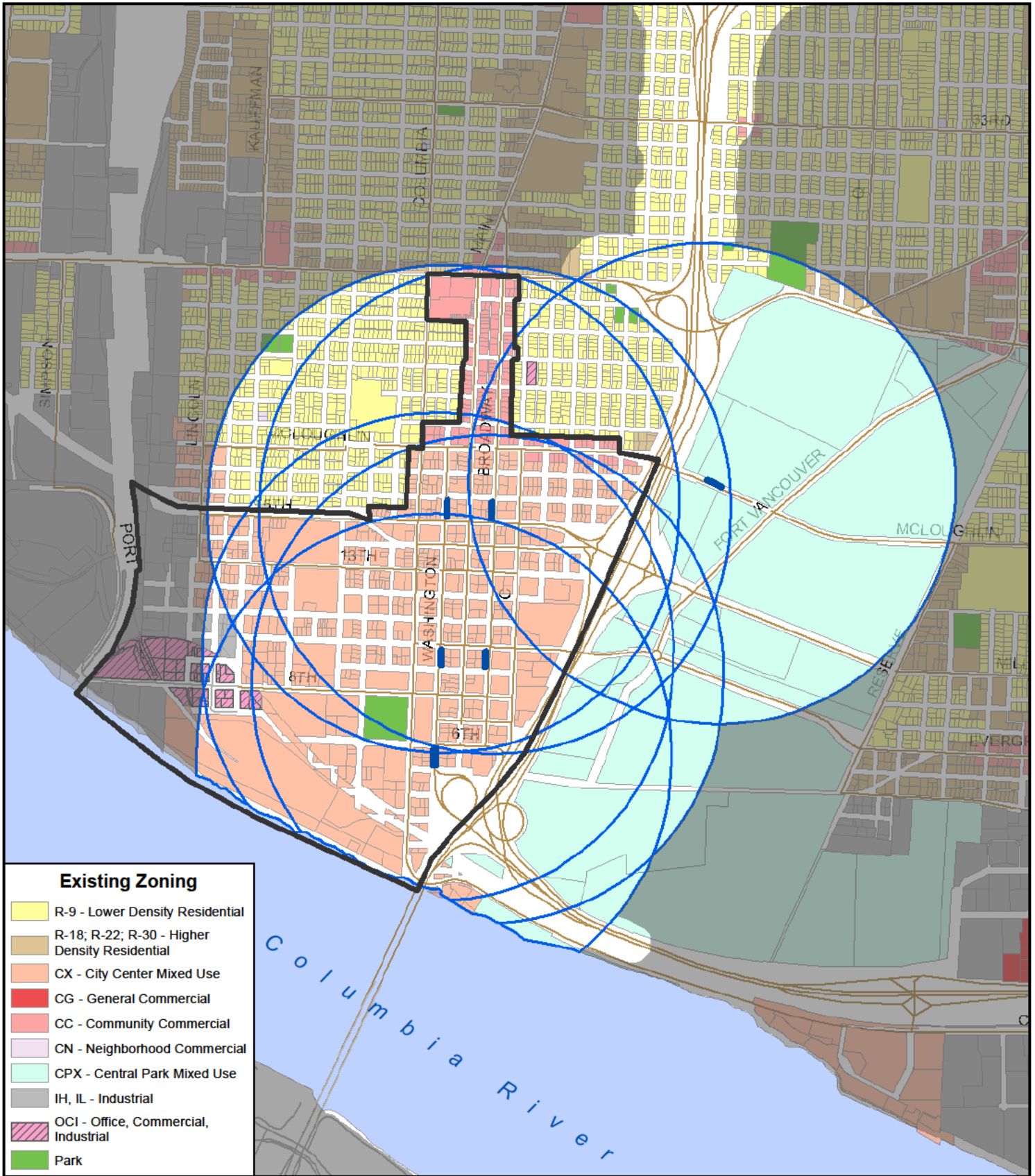


Exhibit 2-8. Current Zoning for Vancouver City Center Plan Area and Vancouver LRT Station Areas



Source: Clark County, WA, Assessors Office, GIS Digital Data, taxlot.shp, 2009.

3. Built Environment

Land use changes resulting from transportation investments can result in significant beneficial and adverse indirect effects related to the built environment. In some cases, the LPA's indirect land use effects are similar to its direct effects. In other cases, the nature of land use development, including resulting changes in trip patterns and employment and population density, has unique built environment effects. In this section, all anticipated land use effects on and to the built environment are discussed, including effects to the following resource areas:

- Air quality
- Economics
- Environmental justice
- Historic and Archaeological Resources
- Neighborhoods
- Parks and Recreation
- Public Services and Utilities
- Visual Quality and Aesthetics

3.1 Air Quality

As described in Section 2, Hayden Island and downtown Vancouver are anticipated to experience the most pronounced land use changes as a result of the LPA. Improved multimodal access to Hayden Island is likely to result in new residences and new locally-focused commercial services replacing some of the existing dispersed, auto-oriented regional retail outlets. In Vancouver, the LPA is likely to support added density of jobs and housing in areas around the downtown light rail transit stations. In addition to development near new light rail stations, a small percentage increase in employment (North and Northeast Portland) and housing demand (southern Clark County) are expected to occur.

The degree to which new development anticipated under the LPA increases or decreases motor vehicle trips in the region, in subareas, and near specific intersections, determines whether air quality and energy usage is positively or adversely affected compared with the No-Build Alternative. As it is impossible to predict specific, indirect land use changes at the parcel level that would result from the LPA, new trip patterns serving new land uses can only be qualitatively addressed.

The LPA primarily encourages development activity near light rail specifically, and in urban areas with transit service generally, rather than dispersed, auto-oriented development at the urban periphery. As such, it can be assumed that over the long-term, auto trips and emissions in the region would be reduced relative to the No-Build Alternative. At the subarea or intersection level, a TOD or other development may result in more jobs and residences, and therefore more auto trips. However, increases in auto trips at these more localized locations should be limited by the convenience of the light rail system provided by the LPA, as well as other existing transit service in these areas. It is assumed that many of those traveling to a TOD's retail and office uses, and many of those traveling from a TOD's residential uses, will do so via transit, biking and walking.

Although it is difficult to predict with certainty whether the LPA’s indirect land use changes will result in improved air quality compared with the No-Build Alternative, other factors influencing air quality are likely to overshadow the relative effects of the two alternatives. Reduced transportation emissions in the main project area have already occurred and are projected to continue due to on-going advances in cleaner fuels and emission control technologies. As a result, air quality improvements are anticipated under the LPA and the No-Build Alternative. The largest share of the region’s auto emissions come from Interstates and other highways; potential new traffic generated by any induced development is likely to be very small compared to the existing and anticipated interstate and local traffic volumes.

3.2 Economics

Indirect economic analysis considers the effects the project might have on commercial locational decisions; the scale and timing of development; and the resultant travel patterns for goods and people based on accessibility and travel time changes caused by a project. The underlying hypothesis of this analysis is that transportation investment can affect the scale and timing of development, as well as the locational decisions of businesses and households.

As discussed in Section 2 of this technical report, the most significant indirect land use effect of the LPA is to encourage TOD activity, particularly in downtown Vancouver and on Hayden Island. TOD potential was estimated by analyzing policies and land uses within a 0.25 mile radius of each proposed station area. This analysis considers existing zoning and comprehensive plan designations; existence of transit-oriented overlay zoning; existing land uses; ownership; ratio of building value to property value (a proxy for redevelopment potential); and amount of vacant, developable area around each station. Exhibit 3-1 below provides a rating of the potential for TOD activity within 0.25 mile of station areas, characterized as low, moderate, or high.

Exhibit 3-1. Transit-oriented Development Potential by Station

Station	Rating of TOD Potential
Oregon	
Expo Center Station	Low
Hayden Island Station	High
Washington	
Station between 5th and 6th Streets	Moderate
Station between 9th Street and Evergreen Boulevard on Washington Street	Moderate to High
Station between 9th Street and Evergreen on Broadway Street	Moderate to High
Station between 15th and 16th Streets on Washington Street	High
Station between 15th and 16th Streets on Broadway Street	High
Clark College Station (Terminus)	Low to Moderate

In general, stations with commercial or medium-to high-density residential dominated zones were considered to have higher TOD potential, as were areas with multiple vacant parcels. Station areas with a lower building value/total value ratio relative to the range of building value/total value ratios for all station areas were considered to have higher TOD potential. Station areas where multiple parcels were owned by one agency or individual were seen as higher potential for TOD when the property owner was amenable to mixed-use and/or transit focused development.

TOD was expected to be low when:

- a station area has a strong auto-orientation and poor pedestrian links;

- much of the land is owned by and planned for a specific use, such as medical office or university use;
- few vacant or underused sites were available for development; and
- when parcel assembly for development is expected to be difficult.

The proposed Hayden Island station and the stations between 15th and 16th were considered to have the highest TOD potential. Many business acquisitions are required for the project on Hayden Island, and much redevelopment is expected sometime after completion of the interstate and transit construction. The City of Portland has completed the Hayden Island Plan (City of Portland 2009) which outlines a vision for the future of the island in anticipation of the CRC project and encourages TOD.

The stations between 15th and 16th Streets in downtown Vancouver are considered to have high TOD potential for two reasons. First, they are currently on the northern fringe of the downtown core and there exist several vacant or underdeveloped parcels. Second, the zoning around these stations is very conducive to TOD (mixed-use, commercial, and high-density residential).

TOD has moderate potential in the downtown core of Vancouver between 5th and 6th Streets and a moderate to high potential between 9th Street and Evergreen Boulevard. Ridership is expected to be high at these stations and economic development potential is high. There are pockets of vacant land and surface parking lots. The reason that these stations have a lower TOD rating than the ones described above is that high-quality, high-density infill development comprised of a mixture of condominiums, apartments, offices, and retail already exists in the vicinity of the stations, and the stations include uses unlikely to change such as Esther Short Park, the Vancouver Convention Center, and I-5. However, light rail transit could help support high-density, mixed-use development in addition to what currently exists in these station areas.

The existing Expo Center station area has low TOD potential largely due to the industrial zoning and emphasis on freight. In addition, much of the land in the vicinity of the existing station is composed of city or state right-of-way for interstate and local road networks, Expo Center parking, Delta Park, and the Vanport Wetlands. Though zoned industrial, the Vanport Wetlands have conservation zoning which limits development.

TOD in the vicinity of the proposed Clark College terminus is rated low to moderate. Constraints to TOD include the station's proximity to I-5, the 1,910-stall park-and-ride, and the College's ball fields. The moderate rating could come if the College were to revisit their master plan and focus future growth (student housing and services) closer to the station.

The TOD that could be stimulated by the light rail element of the LPA could be expected to increase the amount and density of jobs in Portland (Hayden Island) and Vancouver (downtown station areas). These in turn would increase the property taxes, revenues generated, and, in Washington, sales tax revenues. Improved transit connections could also increase accessibility and broaden the pool of labor available to downtown Vancouver and Portland firms. TODs are anticipated to result in the relocation of a number of existing businesses and the associated employees and sales. However, the benefits of increased high-capacity transit access combined with a transit overlay zone in a downtown area such as downtown Vancouver could stimulate new businesses. The type and scale of these benefits would depend on market conditions. Some incentives could be necessary to stimulate economic development if either the economy remains in recession and/or to initiate redevelopment. The Fourth Plain vicinity of downtown Vancouver is within a Community Renewal District, which would help to facilitate some economic development incentives. Some additional incentives may need to be explored. TOD is consistent with current long-range plans and growth assumptions. In addition to the Hayden Island Plan, the

VCCV created by Vancouver identifies high-capacity transit through downtown Vancouver as a key transportation goal that would encourage further development in the downtown.

Although to a lesser degree, the LPA may also encourage the redistribution of a very small amount of future growth in jobs and housing to close-in urban areas. However, these potential development pressures associated with the project would be consistent with, and are planned for, by the local jurisdictions in which they would occur.

3.3 Environmental Justice

Investment and redevelopment in downtown Vancouver could result in a rise in property values, increased rents, and demographic changes frequently characterized as gentrification. This may result in potential indirect effects to environmental justice populations. Though the LPA will not on its own cause gentrification, it may help accelerate it relative to the No-Build Alternative. If low-income renters were forced to move because rents increased in downtown, this could result in adverse effects. However, low-income homeowners could potentially benefit from the same rise in values and rents.

The City of Vancouver has adopted goals and policies that are supportive of affordable housing and a mix of housing types, and the Vancouver Housing Authority works to maintain affordable units in the City through voucher programs and the development of new affordable housing units. Even if low-income renters faced adverse effects, it is not clear that such effects would be disproportionate, as rising rent levels can also affect middle-income earners as well, including displacements. If adverse and disproportionate effects were experienced by low-income renters, these impacts may not be considered to be a “high” impact, as renters as a group typically move with some regularity and the vast majority of affordable rental properties in Vancouver would not experience indirect effects from the LPA. As a result, Environmental Justice populations in Vancouver are not anticipated to experience disproportionately high and adverse effects from the project’s indirect land use effects.

Disproportionately high and adverse indirect effects to Environmental Justice populations are even less likely to occur on Hayden Island, a community that has a lower percentage of minority and low-income persons than the City of Portland as a whole.

3.4 Historic and Archaeological Resources

Indirect effects include land use effects that could cause changes to the historic setting or use of historic resources after the project has been completed. Indirect effects may be either beneficial or adverse. 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” (typically ceremonial sites; traditional homes of a particular cultural group; or locations of historic, economic, artistic, or other cultural practices). No traditional cultural properties have been identified in the Area of Potential Effect (APE) identified for the LPA.

As discussed in Section 2 of this report, the LPA is anticipated to encourage higher density and more mixed-use development in Vancouver’s downtown and on Hayden Island, relative to the No-Build Alternative. These land use effects include anticipated TOD activity near several of the proposed light rail transit stations. Studies in Portland and other cities in the United States (Economic Technical Report) indicate that local comprehensive plans and overall economic conditions have a more substantial impact on land uses than capacity changes resulting from transit centers or widened highways. However, the project could result in increased pressure for

redevelopment of the historic built environment, particularly buildings. The redevelopment would be a beneficial effect if the activity was rehabilitation or restoration in a manner consistent with the Secretary of Interior's standards and guidelines for historic preservation programs. If the activity was inconsistent with the standards and guidelines, or if demolition of the historic built environment occurred, it would be considered an adverse effect.

Within 0.25 miles of the proposed transit station on Hayden Island there are no identified built environment historic properties. However, such properties exist in downtown Vancouver, and the LPA may help encourage their redevelopment. As mentioned above, such activity would be an adverse effect if it resulted in incompatible alterations or demolitions, yet such redevelopment could occur in a manner that preserves and maintains a structure's historic value into the future.

In addition to the historic built environment, potential development related demolition and construction could cause increased ground disturbance in areas containing archeological resources in Vancouver and on Hayden Island. In the case of both historic built environment and archeological resources, a variety of state and local regulations exist that provide some protection from adverse effects.

3.5 Neighborhoods

Neighborhood cohesion describes the livability of a neighborhood, and more specifically, the opportunities for residents to connect to one another within the neighborhood. These opportunities can be offered through gathering places such as schools, community centers, parks, or main street shops. High home ownership rates can also contribute to cohesion because there may be fewer turnovers in neighborhoods with high home ownership rates than in neighborhoods with high rental rates. Crime rates may affect cohesion because they are important factors in determining how safe residents feel in their homes and neighborhoods. Neighborhood associations and neighborhood activities such as meetings or production of a newsletter may also affect cohesion, because they bring residents together and give them a chance to connect with one another.

The LPA is likely to have the most notable indirect effects in the Hayden Island, Esther Short, Hough and Arnada neighborhoods, as these neighborhoods will have within them, or be adjacent to, light rail stations with a high likelihood of promoting TODs. As discussed in Section 3.2, the proposed light rail station called for in the Central Park neighborhood could have a moderate instead of low likelihood of promoting TODs if Clark College were to revisit their master plan and focus future growth (for example, student housing and services) closer to the station. It is important to note that the redevelopment anticipated on Hayden Island and in downtown Vancouver would not be caused by the project, rather the project would encourage and hasten such redevelopment. The provision of light rail stations could also affect the orientation of redevelopment should it occur.

The Hayden Island neighborhood would experience the most pronounced changes as a result of the redevelopment, because TOD is anticipated to replace some of the dispersed, auto-oriented, shopping centers that exist today. The anticipated redevelopment of the Jantzen Beach Super Center into higher density, mixed use development is perhaps the most significant change expected on the island, and is consistent with the 2009 Hayden Island Plan. This redevelopment would increase cohesion on the island by providing new opportunities for high-density housing and new opportunities for smaller-scale commercial services. Developing housing options in the center of the island close to transit would allow people to live closer to commercial services and encourage them to walk, bike, or take light rail to those services. Creating a less auto-oriented environment for residents to travel between home and their services provides more opportunities

for residents to interact with one another and easily access potential new community resources. Similarly, providing smaller-scale commercial services close to housing and transit would encourage residents to use services provided in their neighborhood, rather than needing to travel off of the island to access the same services.

In Vancouver's Esther Short, Hough, and Arnada neighborhoods, TOD would add to cohesion in similar ways as on Hayden Island. New housing and commercial services, particularly around light rail transit stations, would give residents the opportunity to walk, bike, or take transit to services close to their homes, therefore providing more chances for residents to interact with one another and utilize community resources. The Esther Short and Arnada neighborhoods have action plans that are specifically supportive of TOD-like development. The Esther Short Neighborhood Action Plan's Vision Statement calls for "mixed use development, like that developed around Esther Short Park since 1997," to "flourish throughout the downtown and on the waterfront." The Arnada Neighborhood Action Plan encourages "development that brings a balance of services, stores, restaurants and housing and employment opportunities to support Arnada's vision of a walkable community" while also wanting to ensure that the residents within Arnada are not negatively impacted by increased traffic impacts and demands for on-street parking. The Hough neighborhood action plan supports the development of light rail in Vancouver. The action plan does not specifically support or oppose TOD within its boundaries; rather it emphasizes the need to "Maintain a balance between commercial and residential land uses." As TOD is expected on land currently zoned for mixed-use development, and not on land zoned for single-family use, indirect effects in the Hough neighborhood appear consistent with the Hough Neighborhood Action Plan.

3.6 Parks and Recreation

Numerous publicly owned park and recreation facilities are within the main project area and are described in detail in the Parks and Recreation Technical Report. New development accelerated and facilitated through the LPA is not anticipated to result in the acquisition of, or block access to, these community resources. However, land use changes may still have beneficial or adverse effects to them. Beneficial effects include new park and recreation facility construction and operation and maintenance funding contributed by development. Adverse effects include the potential for additional residents and employees of new development to strain the capacity of existing and planned parks and recreation facilities.

The anticipated indirect beneficial and adverse effects of development in the main project area are discussed below, with the understanding that the LPA's effects on development will only be one contributing factor to the overall health of park and recreation resources. Though it is not possible to determine whether the beneficial effects of land use changes associated with the LPA will outweigh the adverse effects, it is clear the beneficial effects would at minimum help to mitigate adverse effects.

3.6.1 Beneficial Indirect Effects

The Cities of Vancouver and Portland have park impact fees, whereby new development, including development encouraged through the LPA, must contribute funds for the construction of new park and recreation facilities to offset the increased demand development has on existing facilities. In Vancouver, only residential development is assessed park impact fees, while in Portland residential and commercial development is assessed. In some cases, park and recreation facilities may also be built directly by the developer in lieu of an assessment, as will be the case of new park land to be constructed as a part of Vancouver's waterfront development. The City of

Vancouver also has a Real Estate Excise Tax on all real estate transactions which helps fund the construction of parks.

Although construction revenue raised through fees mentioned above generally won't cover the full cost of new facilities, it contributes significantly to the local match for external grants. New development also contributes to increased property tax revenues in both Cities that help fund park and recreation facility operations and maintenance. New development is especially helpful in raising property tax revenue, as new development is not constrained by the property tax increase caps that exist in Washington and Oregon.

3.6.2 Adverse Indirect Effects

Based on conversations with local park jurisdictions, park and recreation facilities within the main project area are currently well used. Some resources, such as community garden space and sports fields in Vancouver, have more demand than can currently be met. As the LPA will include improved bicycle, pedestrian, and transit access to a variety of these resources in Portland and Vancouver, residents of new development will have easy access to them. As TODs are frequently higher density, with less space devoted to yards or communal greenspace, residents of these developments may also have a greater per capita demand for off-site facilities. The extent to which this increased use occurs at existing, overcrowded facilities, will determine the extent to which individual resources experience adverse impacts.

New TOD is not, however, anticipated to create significant demand for the limited parking resources at or near park and recreation facilities. The developments would be located near light rail stations, in areas with improved bicycle and pedestrian facilities. In addition, parking throughout much of downtown Vancouver is currently metered, and additional residents and employees are not expected to compete with park users for parking spaces. Some competition for metered spaces could come from those visiting offices or retail, while large mixed-use projects normally include off-street parking to meet their parking demand.

Though development and new trips generated by development can affect the aesthetics of visual, noise, and air quality as experienced by park users, higher density and mixed-use development spurred by the project are not anticipated to have these negative impacts. Areas where development is expected to occur in Vancouver and Hayden Island are already urban environments. For those park and trail users that will be able to view new development, it will primarily block the view of other existing urban features and not detract from the experience of users traveling through or visiting the parks. As the environments are urban, and located near highways and highway interchanges, noise levels associated with the new development is not anticipated to be significant. As discussed in Section 3.1 of this report, air quality is expected to improve over time in both the LPA and No-Build alternatives.

3.7 Public Services and Utilities

Public service agencies that can be affected by indirect land use changes include schools, emergency responders, and hospitals. Public and private utilities – including water, sanitary sewer, electricity, natural gas, and communications service providers – can similarly experience indirect effects. These public and private agencies generally plan for service based on forecast population and development patterns reflected in the long-range comprehensive plans of the jurisdictions they serve. The service and utility providers evaluate future population growth and calculate needed future service increases such as increased numbers of police officers, expanded treatment plants, new equipment, or new station locations. Because the anticipated density increase in downtown Vancouver and on Hayden Island is consistent with current long-range

plans and growth assumptions, the project should not require changes to individual long-range service plans. To the extent that TOD development occurs sooner as a result of constructing the LPA, elements of individual service plans (such as changing service boundaries) may occur sooner than the long-range plans anticipated. Increased service provision is made easier by the fact that TOD activity will occur in urbanized areas already receiving public services and utilities, as well as general efficiencies in providing services in areas of concentrated rather than dispersed growth. Depending on the specific public service or utility, costs of expanding service may be covered in whole or in part through an expanded customer base and / or development fees. In addition to population levels and distribution, the transportation network is an important factor in providing public services, in particular, proving emergency and police services. Emergency and police service agencies reported use of specific roadways as emergency access routes as shown in Exhibit 3-2.

Exhibit 3-2. Service Critical Emergency Access Routes

Public Service Agency	Critical Access Routes
Oregon	
North Precinct Portland Police	N Interstate Avenue, N Denver Avenue, NE MLK Jr. Boulevard and N Greeley Avenue. I-5 is the only critical access route to/from Hayden Island.
Portland Fire & Rescue Station 17	N Interstate Avenue, N Denver Avenue, and NE MLK Jr. Boulevard, N Tomahawk Island. I-5 is the only critical access route to/from Hayden Island.
Washington	
Vancouver Fire Department Downtown Station #1	Main Street/SR 99, Fort Vancouver Way and P Street
Vancouver Fire Department Westside Station #2	Columbia Street, Main Street, 39th Street
Clark County Fire Marshal (District 6)	I-205, SR 99 and NW Hazel Dell Avenue
West Precinct City of Vancouver Police	Main Street/SR 99, Fort Vancouver Way, P Street, SR 500 to I-205
Clark County Sheriff's Office	NW Fruit Valley Road, NE Hazel Dell Road, NE St. Johns Boulevard, and NE Andresen Road (SR 500)

In general, the LPA will improve traffic conditions on I-5 relative to the No-Build Alternative, thus response times for mobile public services relying on I-5 will be positively affected with or without anticipated land use changes. Should specific TOD activity result in increased congestion on the critical emergency access routes shown in Exhibit 3-2, indirect adverse effects on response times of public services would result. However, anticipated development is consistent with the comprehensive plans of both communities, and each community has long-range transportation plans in place to accommodate the growth. In addition, during development review, specific development projects may be required to mitigate for potential impacts to the transportation system.

3.8 Visual Quality and Aesthetics

In order to describe the existing visual environment and understand the level of visual changes that could occur with the project, the project team defined five distinct “landscape units” in the main project area. The land use changes anticipated under the LPA primarily occur in two of these landscape units, the Columbia River landscape unit and the Vancouver Downtown-Residential landscape unit.

3.8.1 Columbia River Landscape Unit

The Columbia River landscape unit lies between Marine Drive and the Burlington Northern Santa Fe (BNSF) tracks on the north shore of the river. This unit includes the North Portland Harbor, Hayden Island, and the main river channel. The existing overall visual character in this unit is defined by the Columbia River, the I-5 bridges, and the near-continuous development along the shorelines. The antiquated steel structure of the towers and complexity of the trusses contrast with the sinuous lines of the river channel and the hill and mountain profiles on the horizon. The built environment in this area includes a mix of:

- small- to medium-sized 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.

Viewers in this area include travelers on I-5 and the I-5 Columbia River and North Portland Harbor bridges, those on side streets, boaters on the waterways, 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. Those living within this landscape unit are most likely to experience any indirect visual changes when they are outside their homes, for example, as pedestrians and vehicle passengers.

With the project, anticipated land use changes in this landscape unit are primarily around the proposed transit stations on Hayden Island. As these areas are already highly developed, new TOD buildings are anticipated to have either no effect on visual character or to have a positive effect on visual character, depending on the quality of design and materials used compared with what is being replaced (primarily existing buildings and parking lots). Views for boaters, air passengers, and pedestrians are unlikely to change significantly as views of new development is likely to be blocked by existing structures or will be in character with existing development. In some instances, existing views of the river, hills, and Mt. Hood may be obstructed by the new development. However, as most TOD activity is anticipated to the west of I-5, the impacts on Mt. Hood views from I-5 should be relatively minor.

3.8.2 Vancouver Downtown-Residential Landscape Unit

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 towards 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.

Development encouraged by the project is expected to occur in the more urban areas of this landscape unit, and buildings, street signs, street trees, and the miscellaneous furnishings typical of an urban core are in the fore and middle grounds of most views in downtown Vancouver. These elements tend to obstruct views of the existing I-5 bridges, as well as the river, hills, and Mt. Hood to most viewers in the area. The exception is views from the conference center and

hotels along the Vancouver shoreline, and the upper floors of taller downtown buildings. I-5 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, tourists, residents living adjacent to I-5, and people engaged in recreational 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 environment.

Anticipated indirect land use changes in this landscape unit are primarily around the proposed transit stations in downtown Vancouver. As these areas are already highly developed, new TOD buildings are anticipated to have either no affect or to have a positive effect on visual character, depending on the quality of design and materials used compared with what is being replaced. The view experienced by commuters, shoppers, visitors, and tourists on local streets is unlikely to be changed significantly, as new buildings would become part of the existing urban view. Views from those using I-5 are also unlikely to change significantly, as these views are already largely limited to that of the highway infrastructure. The aesthetic impacts of alterations to historic properties are discussed in Section 3.4.

4. Natural Environment

This section provides an overview of the proposed indirect LPA effects for the natural environment. Local, state, and federal regulations require protection of natural areas, slowing the destruction of these habitats and mandating replacement of their functions. The natural environment analyzed in this report includes the following resource areas:

- Ecosystems (terrestrial and aquatic habitats, and plant and animal species)
- Energy and Climate
- Geology and soils
- Hazardous materials
- Water quality
- Wetlands

There is significant overlap of potential effects between these resources, as discussed in the sections below.

4.1 Ecosystems

Under the LPA and the No-Build Alternative, potential positive and adverse impacts to species and habitats could occur from induced development and redevelopment activities. Species may be affected through the addition of impervious surfaces (particularly pollutant generating surfaces) and a decrease in aquatic, riparian, and terrestrial habitat. Although development and redevelopment activities may occur throughout the region under any alternative, the LPA is expected to promote more redevelopment of existing urban areas, and less development of functioning fish and wildlife habitat, relative to the No-Build alternative. The net indirect effects of the project would be beneficial, to the extent that it replaces existing uses built under more lenient environmental regulations and/or decreases development pressure on undisturbed habitat outside the urban core.

Under the LPA, redevelopment activities would be most pronounced near light rail stations in Downtown Vancouver and on Hayden Island. No listed terrestrial species are located at these sites, but runoff from stormwater could indirectly impact habitat associated with fish species. These impacts are expected to be mostly positive, as existing stormwater treatment regulations in Portland and Vancouver would cause many redevelopment projects to include improved stormwater management systems. Development and redevelopment, would comply with the relevant laws, regulations, policies, and codes in force at the time of the action. These regulatory approvals range from tree and street tree removal, to stormwater treatment, to environmental zone and critical areas protections, to more complicated processes for larger developments.

With the integration of local and state land use requirements, adverse impacts from development and redevelopment would be limited. Local regulations require the avoidance or minimization of impacts to protected resources. These resources include shorelines, wetlands, stream banks, and their buffers, resources that are often most important to juvenile salmonids and their habitat. With implementation of regulations such as environmental zones, the Shoreline Management Act (SMA), and Critical Areas Ordinance (CAO), impacts to existing resources would be negligible.

4.2 Energy and Climate Change

International, national, state, and local organizations have developed goals and guidelines for reducing greenhouse gas emissions. Though the guidelines primarily focus on improving vehicle efficiency and low-carbon fuels, they also suggest a variety of additional tools that could reduce greenhouse gas emissions, including more transit- and pedestrian-oriented development.

Through the construction of residential units and commercial properties adjacent to light rail, LPA related development will introduce more trip origins (residences) and destinations (offices and retail uses) that can be reached without the use of a private motor vehicle relative to the No-Build Alternative. This reduces overall energy usage and greenhouse gas emissions in two ways, by reducing private motor vehicle usage and by making transit more efficient. TOD can increase transit use during peak travel periods, as well as increase transit use during the off-peak when light rail typically carries fewer passengers per vehicle. So long as transit vehicles have additional capacity to serve new riders, each additional rider reduces the overall per rider energy usage and greenhouse gas emission. TODs, as well as other forms of high density development, tend to also be more energy efficient to heat and cool, reducing energy use thereby reducing greenhouse gas emissions.

4.3 Geology, Soils, and Groundwater

Groundwater quality can be affected by infiltration of untreated stormwater runoff. Land use changes around station areas are likely to result in an improvement in stormwater treatment as new development would be subject to current regulations and treatment requirements. Such changes would likely result in reduced risks to local groundwater quality, including the Troutdale Sole Source Aquifer, which currently receives local recharge from untreated stormwater in the main project area.

The greatest risk from earthquakes in the main project area occurs on Hayden Island and near the Columbia River and North Portland Harbor. Earthquake effects include ground motion amplification and soil liquefaction which have a high potential to impact public safety, cause structural damage, and result in economic disruption. Compared to the No-Build Alternative, the LPA may facilitate and accelerate development near the waterfront in Vancouver and on Hayden Island. Though earthquake risk is higher in these areas relative to the overall main project area, new and retrofitted buildings and structures would need to be built to current seismic safety standards, potentially increasing overall public safety and decreasing the likelihood of structural damage and economic disruption.

4.4 Hazardous Materials

The LPA would likely indirectly promote development and redevelopment of existing buildings and/or paved areas as opposed to development in natural areas. Redevelopment in older urban areas is more likely to encounter existing contamination; as a result, the LPA, compared to the No-Build Alternative, has a greater potential for indirect adverse effects related to contaminated soils during construction. However, because new development and redevelopment would be required to remediate known or discovered hazardous materials, the LPA's induced land use changes are more likely to have long-term beneficial effects relative to the No-Build Alternative.

Health effects have been documented from materials containing lead and asbestos. To the extent that induced land use changes involve the demolition, renovation, or repair of buildings and structures that have lead or asbestos containing materials, proper abatement must be conducted. Though the risks are no greater for TOD than other residential and commercial construction,

construction equipment can release fuels or vehicle fluids from spills. Other pollutants such as paints, acids for cleaning masonry, solvents, and concrete-curing compounds are present at construction sites and have the potential to be released to the environment. These releases can migrate to soil, surface water, or groundwater.

4.5 Water Quality and Hydrology

This section addresses water quality and hydrology of surface waters only. For groundwater effects, see Section 4.3.

As noted, population growth and development are anticipated to occur with the LPA and under the No-Build Alternative. Under either scenario, potential impacts to receiving waters could result from land use development changes, with potential positive and adverse impacts to water quality and water quantity in waterbodies throughout the region. However, the LPA is anticipated to encourage higher density in already urbanized areas relative to the No-Build Alternative. Concentrating growth can help protect natural resources from the potentially adverse effects of development on the urban periphery, such as habitat conversion and contamination from stormwater runoff.

With the LPA, applicable City of Portland and City of Vancouver land use codes would be triggered by development and redevelopment, in particular the need to upgrade to existing stormwater treatment regulations. Development and redevelopment would comply with the relevant laws, regulations, policies, and codes in force at the time of the action. Regulatory approvals range from tree and street tree removal, to stormwater treatment, to environmental zone and critical areas protections, to more complicated processes for larger developments.

With the integration of local and state land use requirements, negative impacts from development and redevelopment would be limited. Local regulations require the avoidance or minimization of impacts to protected resources. These resources include shorelines, wetlands, streambanks, and their buffers, resources that are often most important to juvenile salmonids and their habitat. With implementation of regulations such as environmental zones, the SMA, and CAO impacts to existing resources would be negligible.

Relevant stormwater regulations are listed in Exhibit 4-1.

Exhibit 4-1. Jurisdictional Stormwater Treatment Requirements

Jurisdiction	Water Quality Design Criteria	Flow Design Criteria
ODOT	Treat 85% of the cumulative runoff.	Not applicable. Flow control not required for receiving waterbodies in this portion of the action area.
WSDOT	Treat 91% of the runoff volume over the period of simulation.	Columbia River – n/a (Flow control not required this water body). Burnt Bridge Creek discharge must be reduced to pre-development (forested) flow rates from 50% of the 2-year to the 50-year peak flow.
City of Portland	70% removal of total suspended solids from 90% of the average annual runoff.	Flow control not required for receiving waterbodies in this portion of the action area. Not applicable.
City of Vancouver	Same as WSDOT.	Same as WSDOT.

4.6 Wetlands

Wetlands have not been identified in the areas on Hayden Island or in downtown Vancouver where the project is likely to have the greatest induced effects on land use and development. Stormwater runoff from these potential areas also does not flow to any identified wetlands. The project is not expected to generate any substantial new demand for development outside the UGB, but it could induce at least some development on currently undeveloped properties that contain wetlands, and could therefore result in indirect impacts to wetlands or wetland buffers. However, as discussed in Section 2, this kind of induced development is likely to be very minimal, and to the extent it occurs, it would be subject to federal and state regulations that require avoidance, minimization, and mitigation for wetland impacts. Therefore, little or no decreased wetland habitat function or disruption of wetland flow patterns would be expected to occur as a result of indirect effects of the LPA.

See the sections 4.1 and 4.5 of this report for discussion of indirect effects to jurisdictional waters.

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