3.19 Cumulative Effects

Cumulative effects are the effects of a given project combined with the effects from past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively substantial actions that take place over a period of time. Input from resource agencies, Indian tribes, and the public helped define the scope and scale of this cumulative effects analysis.

To address cumulative effects related to the CRC project, the project team established a time frame of reference for evaluating how past actions have shaped existing conditions and how future actions might further change them. For the built environment, the past that is most relevant to cumulative effects runs from 1960 (prior to the opening of Interstate 5 [I-5]) to the present day. For the natural environment, analysis looks at broad changes beginning in the 1800s to capture a longer history of the effects of development on natural resources in the area. To determine base thresholds, the cultural environment team solicited input from the Cultural Resources/Section 4(f) Workgroup, which is composed of local and state agency representatives, the Washington Department of Archaeology and Historic Preservation (DAHP) and the Oregon State Historic Preservation Office (SHPO).

This section evaluates the potential cumulative effects of the CRC project's locally preferred alternative (LPA), by discipline. The information in this section is based on more detailed information in the CRC Cumulative Effects Technical Report, included as an electronic appendix to this FEIS. Unlike other sections in Chapter 3, this section does not have a detailed discussion of the individual components of the project. This section also does not propose extensive mitigation, since many of the impacts discussed herein are the cumulative impacts of past projects and are not caused by the CRC project. Mitigation measures for CRC-related impacts are discussed in the other sections of Chapter 3.

3.19.1 Past Actions

The following outlines the general past trends and major actions that have shaped the current built, natural and cultural environment in the study area.

Although Native Americans occupied or traveled through the CRC project area for thousands of years, those activities had relatively little effect on current environmental conditions in the CRC project area. In the 1800s European-American settlement began, and the Portland and Vancouver area population began to increase dramatically. The following key historical events provide a basis for analysis of past actions that have helped shape current environmental conditions:

- Pre-1800s – Native American paths along the Siskiyou Trail on what is now the I-5 corridor connected tribes from the Pacific Northwest to California's Central Valley.

- 1810 to 1850 – Settlement of Fort Vancouver and the Hudson's Bay Company brought commercial fur trapping to the Columbia River and associated waterways. Fur trappers from the Hudson Bay Company operating out of Fort Vancouver adopted the Siskiyou Trail as a major transport corridor between the Northern Oregon Territory and California.
- 1846 – Ferry service across the Columbia between Vancouver and Portland was established and offered intermittently by various operators (The Columbian 2008).
- 1890s – Implementation of a trolley line system in Portland and Vancouver encouraged greater urbanization and development of neighborhoods east of the Willamette in Oregon and north to Fourth Plain Boulevard in Vancouver.
- 1905 – Pearson Airfield became a dirigible landing area. It was officially dedicated as Pearson Airfield in 1925. The automobile was introduced in the early 1900s, and by the 1930s many middle class families could afford cars and travel greater distances for work, shopping, or leisure.
- 1910 to present – Railroad construction, including a rail bridge over the Columbia River in 1910, allowed increased freight transport and increased the viability of the Ports of Vancouver and Portland for interstate trade. Industrialized farming, irrigation and water impoundment, and grain shipment increased.
- 1917 – The Columbia River Interstate Bridge opened in 1917 and allowed easier transport of cargo and people between Vancouver and Portland, as well as the broader Pacific Northwest.
- 1930s to 1970s – Several dams were built on the Columbia River between the 1930s and 1970s to provide electricity and irrigation water for the Pacific Northwest. Over-fishing and construction of these dams dramatically decreased salmon runs. This had a negative impact on the economic well-being of Native American tribes, for whom the salmon were and are an important material and cultural resource.
- 1940s – Mobilization of shipyard manufacturing in support of World War II brought wartime employment to the Portland and Vancouver areas and created a housing shortage. Many nearby areas were impacted by this temporary increase in housing demand and resulting building boom.
- 1948 – In 1948, the Columbia River flooded, displacing approximately 20,000 public housing residents in the City of Vanport, including many minorities. Relocation occurred throughout the area, and the Vanport community's residential base never recovered to 1948 pre-flood levels.
- 1950s – Post World War II housing construction was financed through federal grants and GI loans and created a greater supply and demand of outer urban and suburban housing in both Oregon and Washington.
- 1952-1960s – Construction of the interstate highway system in the 1950s and early 1960s greatly increased freight and automobile traffic. The new highway separated many neighborhoods in Portland and Vancouver. Construction of the interstate highway system also increased access to downtown Vancouver.
- 1958 – The Vancouver-Portland Interstate Toll Bridge was constructed in 1958. This development doubled automobile capacity across the Columbia,

reduced congestion, and allowed increased commuting across the Columbia. This bridge now carries southbound I-5 traffic.

- 1960s – Portland International Raceway and Delta Park were established on former roads and land from the Vanport Community that was destroyed by floods in 1948.
- 1970s to present – Growth management and implementation of Oregon planning laws in the 1970s have limited urban sprawl in the Portland metropolitan area. As the area's economy shifted from timber processing and sales to high tech and services, there was a high demand for professional workers. This encouraged commuting throughout the Portland metropolitan area, including Vancouver, which increased commuting across the Columbia River.
- 1990 – The Washington Growth Management Act, passed in 1990, establishes urban growth boundaries similar to those in Oregon, restricting unplanned urban sprawl and concentrate growth in existing urban areas.

3.19.2 Recently Constructed Projects

Some of the more noteworthy recent transportation and development projects in or near the CRC area that may affect similar resources are listed below. These projects give a sense of the recent development trends in the area, and except for the Heritage Place mixed-use development in Vancouver (1999), were completed after January 1, 2001. Some of these actions create additional travel demand or affect travel behavior and generally support or directly increase the density of housing and commercial and retail enterprises in the project area.

Recent Transportation Projects

- Failing Street Pedestrian Bridge rehabilitation
- Interstate MAX (MAX Yellow Line along Interstate Boulevard)
- Salmon Creek widening of I-5 north of the CRC project area
- Delta Park widening of I-5 south of the CRC project area
- Columbia River Confluence Land Bridge (Vancouver)

Recent Development

- Esther Short Park and Propstra Square (Vancouver)
- Heritage Place mixed-use development (Vancouver)
- The Vancouver Center mixed-use development (Vancouver)
- The Lewis and Clark Plaza housing and public space (Vancouver)
- The Esther Short Commons residential and retail development (Vancouver)
- The Vancouver Convention Center and Hilton Hotel (Vancouver)
- The new City Hall (originally the Columbian Building) (Vancouver)
- The West Coast Bank Building commercial and residential mixed-use (Vancouver)

- The Northwynd at Columbia Shores commercial and residential mixed-use (Vancouver)
- 400 Mill Plain Boulevard Office Building (Al Angelo Company Building) (Vancouver)
- Conversion of 7th Street Transit Station to Turtle Place (Vancouver)
- The new Vancouver Community Library (Vancouver)
- The Waterside Condominiums (Portland)
- Salpare Bay Condos (Portland)
- Expo Center, replacement of Exhibit Halls A, B, C, and D (Portland)
- Bridgeton Neighborhood hotel, condominium and apartment development (Portland)
- Rivergate Industrial District marine terminal and industrial development (Portland)

Reasonably Foreseeable Future Projects

Multiple plans lay out lists of reasonably foreseeable future projects. These plans include Transportation System Plans, neighborhood plans, and comprehensive plans, among others. A list of the projects and plans considered is included in the CRC Cumulative Effects Technical Report, included as an electronic appendix to this FEIS.

The No-Build Alternative includes a list of projects through 2030, including present projects and planned improvements, for which need, commitment, financing, and public and political support are identified and are reasonably expected to be implemented. These projects meet the criteria of being "reasonably foreseeable." All transportation improvements assumed in the No-Build Alternative are included in either Metro's Regional Transportation Plan (RTP) (including amendments) or the Southwest Washington Regional Transportation Council's (RTC's) Metropolitan Transportation Plan (MTP). Transportation infrastructure projects under way or planned through 2030 within the CRC project area are listed in Appendix A of the Cumulative Effects Technical Report, which includes highway and transit projects on both sides of the Columbia River.

The No-Build Alternative does not assume any major capacity improvements on I-5 near the CRC project area. Outside of the project area, there are minor I-5 capacity enhancements and several major maintenance projects specifically identified in the financially constrained regional transportation plans of both Metro and RTC. Capacity improvements on I-5 will provide additional vehicular and freight mobility and reduce travel times. These projects will also require materials, equipment, and energy to complete, and will have temporary traffic impacts associated with construction.

Projects more specific to the immediate area include: infrastructure associated with higher-density residential communities along Marine Drive in Portland, the revitalization of downtown Vancouver, general infrastructure improvements such as sewer and water facility expansions which further enable development, and local transportation improvements such as the planned interchange at SR 500 and St. John's Boulevard in Vancouver.

Some of the other anticipated projects near the CRC projects include those listed below. The relevant cumulative effects of these projects are discussed below and in Sections 3.19.3 through 3.19.24.

Riverwest – Riverwest is a $165 million public-private mixed-use development that includes four multi-story buildings. The project site adjoins the I-5 right-of-way just south of Evergreen Boulevard. The development includes the new Vancouver Community Library which opened in July 2011. During project construction, there may be temporary traffic impacts, although these should conclude before the CRC project begins construction.

Vancouver Waterfront – This project is a large-scale mixed-use development with significant amounts of new office space, public space, and residential uses. Pedestrian amenities from the east side of the Vancouver shoreline would cross under the CRC improvements and extend through the Columbia West development. The project will provide new parking, and generate a substantial amount of new traffic. It is related to new underpasses through the BNSF berm and the extension of Main Street to the Columbia River. During project construction, there may be temporary traffic impacts, although these should conclude before the CRC project begins construction.

West Barracks – The federally-established Vancouver National Historic Reserve (VNHR) includes many buildings previously used by the United States military. The VNHR partners—including the City of Vancouver, National Park Service, State of Washington, and Fort Vancouver National Trust—are working with private sector partners to renovate 16 historic buildings on the West Barracks for a variety of uses, from education and the arts to recreation and hospitality.

East and South Barracks – Planning has been completed for the transfer of the South and East Barracks to the National Park Service. In 2011, the U.S. Army Reserve vacated and relinquished all lands and structures within the East and South Vancouver Barracks to the National Park Service. In preparation for this transfer, a master plan has been established for this area.

Bradwood Landing Liquid Natural Gas (LNG) – The Bradwood Landing project is no longer considered reasonably foreseeable because the proponent company, NorthernStar Energy, has declared bankruptcy and has put the project on hold indefinitely. If another investor chose to fund the project and restart the permitting process, the Federal Energy Regulatory Commission (FERC) license would still be applicable; however, it is not possible to predict whether or not any new investors will support the project.

This project is intended to import and store LNG to provide a new source of natural gas to the Pacific Northwest. LNG is natural gas cooled to about -260 degrees Fahrenheit (F) to reduce its volume, allowing it to be more easily transported long distances across oceans in specially designed ships from its point of origin to foreign markets. NorthernStar, the project developer, proposes to provide up to 1.3 billion cubic feet per day of natural gas to the region through interconnects at two industrial facilities, an intrastate pipeline and an interstate pipeline system.

The waterway for LNG marine traffic would extend from the boundary of the U.S. territorial sea, located 12 nautical miles off the Pacific Coast, up the Columbia River approximately 38 miles to the LNG terminal. The proposed LNG terminal is located at the former town site of Bradwood, in Clatsop County, Oregon, and would occupy about 40 acres of land within a 411-acre site controlled by NorthernStar. About 46 acres within a 58-acre area in the Columbia River would be dredged to create a ship maneuvering area for the terminal berth.

Jantzen Beach Redevelopment – Redevelopment plans for the Jantzen Beach SuperCenter are in preliminary stages. The redevelopment project intends to transform the area from a conventional suburban shopping center to a more urban retail center with mixed land uses, including expanding the existing Target store to include a grocery and pharmacy. The City of Portland, the developers, and the CRC project team are sharing information, such as the preliminary transportation circulation plan for the center, and officials representing the SuperCenter initiated site plan review with the City of Portland. An important element of the plan is to construct a local east-west road that would allow traffic to move across the interstate without interfering with traffic on the I-5 ramps.

West Hayden Island – The City of Portland is in the process of developing a concept plan for the Port of Portland–owned West Hayden Island (WHI). The Port requested this planning as part of their proposal for a combination of marine terminal facility development and open space uses on WHI. The Port's conceptual plans for the future development of WHI include an arterial road connection between WHI and Marine Drive as well as rail infrastructure improvements. In this FEIS, the analysis of Hayden Island local roads and the Hayden Island interchange includes estimated auto and truck trips that would be generated by the Port of Portland's proposed WHI marine terminal development. Based on current assumptions regarding the Port's proposed facility, the additional traffic generated would not significantly impact the roadway facilities that would be constructed as part of the CRC LPA Option A or Option B. This is because the marine terminal facilities under consideration rely mostly upon access via barge and railroads, not trucks.

The primary difference between the two LPA options relative to the Port's proposed WHI development would be that LPA Option A would include a local multimodal bridge that could potentially address the proposed Port facility's need for a connection between WHI and Marine Drive. With LPA Option B, the proposed local multimodal bridge over North Portland Harbor would carry only light rail transit, bicycles and pedestrians; it would not include traffic lanes. Vehicle movements between the Oregon mainland and Hayden Island would instead be accommodated by highway ramps adjacent to the I-5 mainline. Therefore, if the Port's WHI proposal is constructed, the cumulative impacts associated with bridge construction across North Portland Harbor could be lower with CRC LPA Option A than with Option B.

3.19.3 Acquisitions

Most of the area directly affected by the project is already occupied by public right-of-way as a result of previous transportation projects. The original construction of I-5 during the late 1950s and early 1960s required substantial property acquisitions and displacements near the immediate project area. For example, when the segment of I-5 known as the Minnesota Freeway was constructed from the Rose Garden area to the Columbia River Slough in northeast Portland, it removed over 180 dwellings and displaced more than 400 residents (Kramer 2004).

The real estate acquisitions required for the LPA are relatively minor for a project of this size, and are substantially smaller than the acquisitions associated with past major transportation projects in the corridor. There will be very few residential displacements in neighborhoods that were directly affected by the original construction of I-5. Most of the full acquisitions would be commercial properties, and the likelihood of finding suitable, local replacement spaces for the businesses is high.

The highest potential for cumulative acquisition-related impacts of concern is on Hayden Island, where the LPA would acquire 32 floating homes and displace 39 businesses. Though the project will assist in relocating these businesses, some may not relocate at all, and others may not relocate on the island. Effects on the floating home residents may be exacerbated by other future land use changes on Hayden Island and shortages in the supply of available moorage space, as state and federal regulations make it difficult to permit new moorages. Other future land use changes could also result in business displacements. The City of Portland recently completed a plan for the island that allows for substantial changes to the island's development, which could result in significant changes in the land use and business mix on the island.

It will be important to carefully consider mitigation for displaced floating homes, and to coordinate with the City of Portland's land use planning efforts for Hayden Island.

3.19.4 Economics

Past transportation and development projects have helped to solidify I-5 as a critical component of the region's transportation network and regional infrastructure. Demand on I-5 comes from freight and public and personal vehicle use. Freight needs are a major driver for future improvements needed along the I-5 corridor.

The ports of Portland and Vancouver are critical to the economic growth and prosperity of the region. In order for the ports to remain competitive, efficient and cost-effective multimodal transportation systems must be available. Reducing freight travel times by investing in transportation infrastructure improvements that improve access and decrease congestion helps maintain the area's competitiveness. The total annual tonnage moving through the two ports is expected to double from approximately 300 million tons in 2000 to almost than 600 million tons in 2035. This growth has implications for the transportation network as products move to and from the regional marketplace.

The No-Build Alternative would retain the existing I-5 crossing and make only minor preservation improvements to the highway within the project area. However, many other projects are planned that will improve I-5 access to and from regional centers, local collectors, and arterials.

The LPA would positively contribute to other projects aimed at reducing congestion and enhancing freight mobility by further relieving congestion. Congestion relief in the main project area would greatly benefit freight traffic generated by Swan Island, the Rivergate area, the Port of Portland, and the Port of Vancouver. Incremental benefits include decreased travel times, increased mobility, and increased reliability of travel times.

If proposed CRC improvements are not constructed, economic development planned for the area may occur more slowly, as business owners may be more reluctant to locate in an area with poor access and mobility for employees and customers. Customers may elect to shop in other areas with easier access and better mobility.

With the extension of the regional light rail system and the improvements to freight mobility, the proposed project would contribute to lasting trends from other past, present, or reasonably foreseeable actions that would have a cumulative effect on economic activity.

3.19.5 Environmental Justice

The original construction of I-5 in the late 1950s and early 1960s cleared entire blocks for the development of the roadway, dividing neighborhoods, displacing residences, and affecting businesses. Some of these neighborhoods were composed of a higher percentage of minority and low-income persons than in Portland and Vancouver as a whole. The construction of I-5 through Vancouver changed the city by closing 5th Street (the route heading east) and encouraging development of housing to the north of downtown. Fewer displacements occurred in Vancouver than Portland because the area was less densely developed than Portland at that time.

More recent transportation projects have not had disproportionate high and adverse effects on low-income and minority populations. The LPA creates only slightly widened roadway profiles along I-5, and will not divide existing communities. It is also likely to reduce highway-related noise impacts at most homes adjacent to I-5. Tolling is not expected to have a negative impact on low-income populations, as transit, biking, and walking offer toll-free transportation options, and carpooling reduces the impact of the toll. Additionally, tolls will be used to help finance the project, without which auto access, mobility and safety would not be improved and the extension of light rail transit into Vancouver would not be possible. National as well as local surveys of transit users have found that low-income populations tend to use transit at a higher rate than other income groups.

In the last few decades there has been increased attention to community outreach and input associated with highway and transit project development. Historically, most projects were not planned and implemented with extensive input from and communication with the public. It is now an important component of project development to involve communities who would be affected by a proposed project. Thus, project teams attempt to minimize the impacts via extensive outreach and incorporation of community input.

3.19.6 Land Use

The LPA is consistent with local plans and policies, including transportation system plans, which encourage investment in inner urban infrastructure, multimodal transportation, freight mobility, economic development, and compact urban development. In Oregon, local plans and regulations implement Oregon's Statewide Planning Goals, including Goal 5 which establishes standards for the protection of natural resources. The LPA will comply with these local land use regulations, including Portland's environmental overlay zoning (E-zones).

The project's greatest direct impacts on land use would occur as a result of the park and ride facilities. Adding transit stations in downtown Vancouver and on Hayden Island could result in more mixed use and compact housing development around these stations.

Vancouver's downtown has changed greatly during the past decade. The focus of the downtown and waterfront areas has broadened from just professional offices to tourism and recreation, retail shopping, meeting and convention activities, housing, and entertainment. Along with revitalizing overall downtown activity, new residential opportunities and revitalization of the retail core and central waterfront have been emphasized. New office and mixed-use development has increased in the last decade, with projects such as the Vancouver Center, West Coast Bank Building, Public Service Center, Convention Center, and numerous smaller projects. New and growing uses in the downtown include eateries, bars/taverns, a new playhouse, and personal services.

On Hayden Island the primary land use close to I-5 is commercial, including the Jantzen Beach SuperCenter (a large shopping mall) and surrounding retailers. Residential uses in the area include manufactured homes and floating homes associated with small marinas, as well as other low- to medium-density developments.

Under the LPA, subsequent development would be planned according to the local jurisdictions. The LPA will continue the trend of roadway development, and will balance that development with the improvement of transit, bicycle, and pedestrian infrastructure.

Transit, particularly high-capacity transit, can be a catalyst for development around stations, a process often referred to as transit-oriented development (TOD). TOD is generally pedestrian-oriented and higher-density, which further supports nearby transit service. This type of development is sought after by jurisdictions because it reduces demand for additional roadway capacity and advances local and regional planning goals for focusing development along transportation corridors. The Cities of Vancouver and Portland are supportive of TOD where it is appropriate with the neighborhood character, zoning, and plan policies. Such development is encouraged by both the Vancouver City

Center Vision and the Hayden Island Plan, and is generally within the limits of the planned growth envisioned and modeled for urban centers.

The project, in conjunction with other reasonably foreseeable future actions, would convert existing land uses to transportation right-of-way. Although these conversions would reduce the area of land available to a small extent, they would cumulatively convert only a small portion of the total land in the Portland/Vancouver area over the next 20 years. The project's contribution of approximately 90 converted acres would not be substantial in a regional context, but does contribute to lasting trends from other past, present, or reasonably foreseeable actions that would have a cumulative effect on land use. These changes, which result from the extension of light rail transit and the development of mixed-use parking structures and other transportation infrastructure, are consistent with the goals and policies of adopted plans, and are allowed under local land use regulations.

3.19.7 Neighborhoods

There would be a range of adverse effects and benefits to neighborhoods resulting from the LPA, including acquisitions, sound walls to reduce highway noise, the addition of high-capacity transit, and TOD near stations.

On Hayden Island, the CRC project would displace approximately 32 floating homes and 39 businesses. The displacements would include the existing Safeway store, the only grocery store and pharmacy on the island. There are currently development proposals to locate a new pharmacy and one or two grocery stores on Hayden Island. If another grocery store or pharmacy does not open on the island, this would be a major impact to the neighborhood, as residents would have to travel off of the island to purchase groceries or prescription drugs.

High-capacity transit in Vancouver will influence neighborhood development, from the look and feel of the neighborhoods, to improving access, to adding the potential for TOD.

Past projects (such as the displacements associated with the 1960 construction of I-5 through North Portland) directly impacted neighborhoods in the I-5 corridor. These neighborhoods have experienced both incremental adverse effects as well as improvements since then. More recent transportation projects have generally provided net benefits through improved access, pedestrian-oriented development, mitigation, and other amenities. The CRC project is expected to continue this more recent positive trend. The exception would be on Hayden Island where, until displaced businesses relocate or are replaced on the island, the impacts would be more adverse than beneficial.

Historically, projects were not necessarily planned and implemented with extensive input from and communication with the public. Now, it is an important component of project development to involve communities who would be affected by a proposed project. Thus, project team will continue to attempt to minimize the impacts of proposed projects via extensive outreach and incorporation of community input.

3.19.8 Public Services and Utilities

The combined impact of the LPA with unrelated population and employment growth will likely create an increased demand for public services. However, because the growth in population and employment and changes in land use are included in local and regional plans, it is reasonable to assume that the public service and utilities sectors will have adequate time to adjust for future conditions.

The project would not result in any long-term adverse effect on public service providers. All negative effects would be temporary, involving the typical disruptions experienced during roadway construction activities. Therefore, the project would not contribute to a cumulative effect on public services.

3.19.9 Air Quality and Air Toxics

During the 1970s, pollutant concentrations in the Portland-Vancouver area exceeded the standards for carbon monoxide on one out of every three days, and ozone levels were often as high as 50 percent over the federal standard. Programs and regulations put into effect during the 1970s to control air pollutant emissions have been effective, and air quality in the area has improved. Recent regulations promulgated in the early 2000s, and most recently in February 2007, adopted further controls on vehicles and fuel formulations. These standards apply to all vehicles on the highway system and are responsible for substantial reductions in vehicle pollutant emissions since the 1970s and for projected vehicle pollutant emissions reductions over the next 25 to 30 years.

Traffic data used in the air quality analysis are based on projected 2030 population and employment information and include expected overall growth in the region and the project area. At the regional and subarea levels, future 2030 emissions of all pollutants analyzed are projected to be lower than existing conditions with both the LPA and No-Build Alternative. Regulations on other source types will also reduce additional future emissions. Therefore, the cumulative effects of air quality will improve with time despite the projected growth in the region and the projected increase in area traffic.

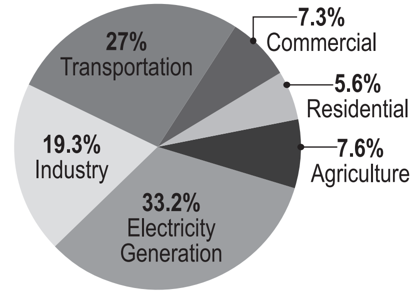
Greenhouse Gases

Greenhouse gases (GHGs) generally include six types of gas: Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perflourocarbons (PFCs), and sulfur hexafluoride (SF_6).

3.19.10 Climate Change

Based on best available science and best practice greenhouse gas (GHG) emissions measurement and modeling, the LPA would result in a net reduction of GHG emissions compared to the No-Build Alternative. Nonetheless, climate change can increase the vulnerability of a resource, ecosystem or human community, causing a proposed action to result in consequences that are more damaging than prior assessment of environmental impacts may have indicated. In this section, the CRC project team summarizes relevant information on climate change, climate change policies affecting the transportation sector, and project-level GHG emissions. In addition, this section provides an overview of the CRC project team's analysis of the potential effects climate

Exhibit 3.19-1
Source of U.S. Greenhouse Gas Emissions, 2004[a]



Source: EPA 2006.

a Excluding emissions in U.S., territories, which accounted for 0.88% of total emissions.

change may have on the CRC project, with special consideration given to the anticipated effects of climate change on the Columbia River, as a step toward assessing the LPA's vulnerability to the effects of climate change.

GHG Emissions from the Transportation Sector

Virtually all human activities have an impact on our environment, and transportation is no exception (Exhibit 3.19-1). Transportation is a substantial source of GHG emissions, and contributes to global warming through the burning of petroleum-based fuel. Any process that burns fossil fuel releases carbon dioxide into the air. Carbon dioxide (CO_2) is the primary GHG emitted by vehicles, and therefore it is the focus of this analysis. Unlike the pollutant emissions discussed in Section 3.19.9, GHG emissions have not, until very recently, been classified as pollutants.

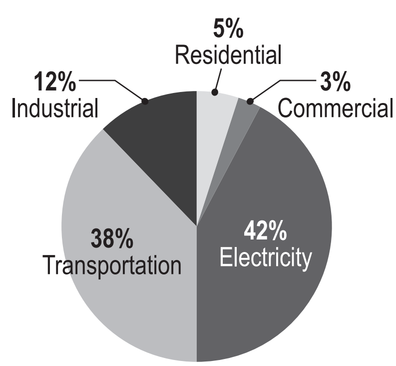
What is included in the transportation sector?

The transportation sector includes domestic air transport, road vehicles, rail, pipeline transport, national navigation, and non-specific transport. Consistent with IPCC guidelines, it does not include international aviation or marine vessels that use bunker fuels.

Changes in CO_2 emissions from fossil fuel combustion are influenced by many long-term and short-term factors, including population and economic growth, energy price fluctuations, technological changes, and seasonal temperatures. On an annual basis, the overall consumption of fossil fuels in the United States generally fluctuates in response to changes in general economic conditions, energy prices, weather, and the availability of non-fossil alternatives (EPA 2010). Over time, carbon emissions have increased with population growth and while the rate of growth should slow, total emissions are expected to continue to increase for the foreseeable future. The population, as well as the number of miles being driven, has grown and is expected to continue growing.

Exhibit 3.19-2

Greenhouse Gas Emissions in Oregon, 2008

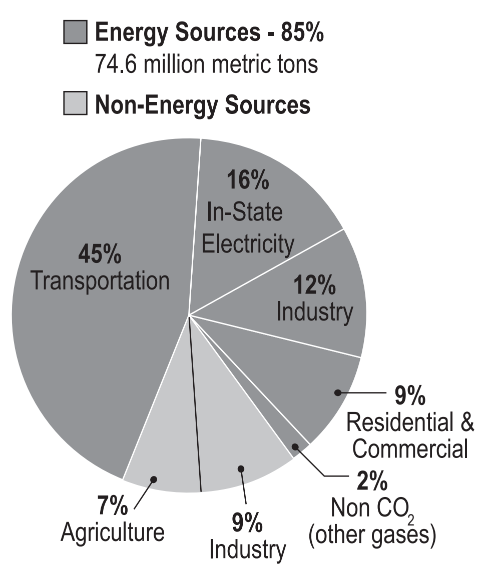


Source: Oregon Department of Energy January 2008.

Exhibit 3.19-3

Greenhouse Gas Emissions in Washington, 2004

TOTAL=88.3 million metric tons of CO_2 equivalent



Source: Washington Department of Community, Trade and Economic Development (Preliminary Estimate).

Transportation accounted for an estimated 38 percent of Oregon's CO_2e (equivalent) emissions in 2008 (Exhibit 3.19-2), with vehicle CO_2 emissions predicted to increase by 33 percent by 2025 because of increased driving.

Washington State estimates that, with the state's abundance of in-state hydropower for electricity generation, the transportation sector accounted for almost 50 percent of GHG emissions in Washington in 2004 (Exhibit 3.19-3).

Total future carbon emissions for the CRC project are difficult to estimate precisely because such a wide variety of factors could influence carbon emissions by 2030. Some of the factors that could change between now and 2030 include government regulations, price and availability of fuel and alternative energy sources, and vehicle technology (such as electric hybrid or fuel cell vehicles). That said, if historic and recent transportation trends continue, CO_2 emissions will continue to increase. By 2030, CO_2 emitted from vehicles on all regional roadways, including I-5 and I-205, is expected to increase over existing conditions. For example, the population is expected to increase in Clark County by 66 percent between 2005 and 2030, which could have a dramatic effect on vehicle miles traveled in the region. Without the CRC improvements, the four-county region (Washington, Clackamas, Multnomah, and Clark) is expected to produce 41 percent more GHG emissions by 2030 compared to existing conditions.

Policies Regulating GHG Emissions

Numerous federal, state, and local policies are designed to regulate and mitigate GHG emissions. As described below, these policies include fuel efficiency standards, GHG reporting requirements, GHG reduction goals, project-level guidance, and climate response strategies. For additional information on laws and regulations affecting GHG emissions, please see the Energy Technical Report and Cumulative Effects Technical Report included as electronic appendices to this FEIS.

A discussion of energy consumption, as well as the calculations of the LPA's projected energy consumption, can be found in Section 3.12, Energy.

FEDERAL POLICIES

- First established in 1975, Corporate Average Fuel Economy (CAFE) regulations impose a tax on makers of new model year cars that fail to meet the minimum fuel economy standard. In 2011, the standard will change to include many larger vehicles.
- In 2007, President Bush signed into law the Clean Energy Act of 2007, which requires, in part, that automakers boost fleetwide gas mileage to 35 miles per gallon (mpg) by the year 2020. In 2009, President Obama revised the CAFE standards to hit an earlier target: a combined fleet average of 35 mpg by 2016.
- In addition to fuel economy standards, the EPA is seeking to establish GHG emission standards for light-duty vehicles. In 2009, EPA issued an "endangerment finding" that classified CO_2 and five other GHGs as threats to public health, establishing a legal basis for such regulations.

STATE AND REGIONAL POLICIES

- In 2007, the Washington legislature passed a statute that aims to achieve 1990 GHG levels by 2020 and a 50 percent reduction below 1990 levels by 2050.

- In 2007, the Oregon Climate Change Integration Act established goals to reduce emissions 10 percent below 1990 levels by 2020, with a 75 percent reduction below 1990 levels by 2050.
- In 2007, The Western Climate Initiative established a regional, economy-wide GHG emissions target of 15 percent below 2005 levels by 2020, or approximately 33 percent below business-as-usual levels (WCI 2010). Both Oregon and Washington are members of the Western Climate Initiative.
- In 2008, the Washington State Legislature approved the Climate Change Framework that established GHG reduction limits and directed the Washington State Department of Ecology (Ecology) to develop a comprehensive plan to reduce the state's emissions, including strategies to reduce emissions from transportation.
- In 2008, the governor signed Washington's Climate Change Framework/ Green-Collar Jobs Act (HB 2815), which includes statewide per capita VMT reduction goals as part of the state's GHG emission reduction strategy.
- In 2009, legislative and executive direction to prepare a climate response strategy for Washington State was established through Executive Order 09-05 and the State Agency Climate Leadership Act (SB 5560). The Act requires state agencies to develop an "integrated climate change response strategy" to "better enable state and local agencies, public and private businesses, nongovernmental organizations, and individuals to prepare for, and address, adapt to the impacts of climate change." WSDOT is among the six agencies leading the development of the initial climate change response strategy—due December 2011.
- In 2010, Oregon Senate Bill 1059a directed the Oregon Transportation Commission to "adopt a statewide transportation strategy on GHG emissions…," including the establishment of guidelines for developing land use and transportation alternatives that would decrease GHG emissions and the creation of a program to assist local governments in reducing GHG emissions from vehicles.
- In 2010, Washington Senate Bill 6373 modified the state's GHG reporting requirements so that they align more closely with the requirements established by the EPA in September 2009. In contrast to EPA's regulations requiring entities to report if their emissions exceed 25,000 metric tons of carbon dioxide equivalent per year ($MtCO_2e$/yr), Washington will require reporting from any source that emits greater than 10,000 ($MtCO_2e$/yr).

LOCAL POLICIES

- In 1993, Portland was one of the first U.S. cities to adopt a plan to address global warming. In 2001, Multnomah County joined Portland in adopting a revised plan, the Local Action Plan on Global Warming, outlining more than 100 short- and long-term actions to reduce emissions 10 percent below 1990 levels by 2010 (Portland & Multnomah 2005).
- In 2005, the mayors of Portland and Vancouver signed the U.S. Mayors' Climate Protection Agreement, committing to reduce carbon emissions in cities below 1990 levels.

- In 2009, the City of Portland and Multnomah County adopted a major revision to their Climate Action Plan, establishing a goal of reducing GHG emissions 80 percent below 1990 levels by 2050 and identifying actions to be taken by 2012 to begin to reduce emissions.

Project Emissions

As discussed in Section 3.1 (Transportation) of this FEIS, the CRC project constitutes a short section of I-5, and the LPA is projected to reduce personal vehicle travel demand compared to No-Build conditions. Nevertheless, the consumption of fuel for the movement of people and goods on I-5 across the Columbia River contributes to the cumulative effects of GHG emissions.

The project team estimated GHG emissions for the LPA. The methodology for estimating long-term energy use in the DEIS was based on methodologies outlined in the Oregon Energy Manual, and CO_2 emissions were estimated using data provided by the EPA. The methodology used in the FEIS was changed to utilize EPA's recently released Mobile Vehicle Emission Simulator (MOVES) model.

The CRC Energy Technical Report (included as an electronic appendix to this FEIS) has more information on carbon dioxide emissions and the methodology for calculating the potential effects of project alternatives on climate change.

Light rail is operated by electricity. Although light rail vehicles do not emit CO_2 during travel, the process of converting primary energy sources (e.g., coal, natural gas, etc.) to electricity does. In the DEIS, the electricity demand was assumed to be provided by Portland General Electric (PGE) and Clark Public Utilities (CPU). Data specific to PGE and CPU operations regarding the distribution of primary energy sources and emission factors for each primary energy source were used to calculate the CO_2e emissions. In this FEIS, the PGE and CPU specific data were substituted with data from EPA's Emission and Generation Resource Integrated Database (eGRID). eGRID is a comprehensive source of data on the environmental characteristics of almost all electric power generated in the U.S. eGRID is unique in that it links air emissions data, including CO_2e, methane, and nitrous oxide emissions, with electricity generation data for United States power plants. The decision to use eGRID data from the Northwest Power Pool (NWPP) was based on the following reasons:

- The distribution of primary energy sources from PGE and CPU change over time and the resulting carbon dioxide equivalent emission estimates could vary substantially, compared to eGRID NWPP data that is less volatile.
- Local electricity use may not have been generated locally since electricity is frequently distributed across the NWPP region.
- The State of Washington uses eGRID NWPP data for the climate registry; Ecology also uses this data for emissions inventory.
- Use of the eGRID NWPP data maintains uniformity between project level analyses and State of Washington procedures related to air quality conformity requirements.
- Metro, the elected regional government for the Portland metropolitan area completed a GHG Inventory in 2010, which utilizes eGRID NWPP data.

A sensitivity analysis was completed to compare the light rail CO_2e emission estimates based on the PGE and CPU localized data versus the eGRID NWPP data. While the light rail CO_2e emission estimates based on eGRID NWPP data were 5 to 7 percent higher compared to the estimates based on PGE and CPU data, the conclusions of both analyses were consistent; i.e., the LPA would result in higher light rail CO_2e emissions relative to the No-Build Alternative as a result of increased light rail transit service. Since the CO_2 equivalent emission estimates were higher using the eGRID NWPP data, the disclosure of operational impacts is, if anything, conservatively high.

A GHG emissions analysis was prepared for the CRC project and is detailed in the CRC Energy Technical Report, included as an electronic appendix to this FEIS. The report includes a macroscale analysis to provide a picture of the regional emissions, as well as a microscale analysis that focuses more on the project area. The results of the GHG analysis are summarized in Exhibit 3.19-4.

Exhibit 3.19-4
2030 No-Build and Locally Preferred Alternative (LPA) Greenhouse Gas Emissions

Scale	2030 No-Build CO_2e Emissions (Mt)	2030 LPA CO_2e Emissions (Mt)[c]
Macroscale (regional emissions)[a]	24,876	24,746
Microscale (local emissions)[b]	389	368

Source: CRC Energy Technical Report (included as an electronic appendix to this FEIS).

Notes: CO_2e: carbon dioxide equivalents; standard unit representing global warming potential. MT: metric ton.

a Includes interstates, highways, and principal arterials within Washington, Clackamas, Multnomah, and Clark Counties as well as light rail related emissions. Emissions are reported as daily estimates.

b Includes a 12.2-mile segment of I-5 between Portland and Vancouver. Emissions are reported for a 4-hour AM peak period and 4-hour PM peak period.

c Estimates for LPA Option A and B with or without highway phasing are the same.

The LPA is expected to reduce regional emissions by approximately 130 $MtCO_2e$ /day, which equates to a reduction of approximately 0.5 percent. For the 12.2-mile length of I-5 surrounding the CRC project area, the LPA is expected to reduce emissions by roughly 21 $MtCO_2e$ during the AM and PM peak periods, or 5.4 percent.

The reductions in GHG emissions associated with the LPA result from three primary factors. First, the LPA would toll the I-5 crossing, which is expected to decrease the number of cars crossing the River compared to the No-Build Alternative. Second, the LPA provides light rail transit that is expected to divert a portion of personal vehicular travel demand to transit. Third, the LPA decreases congestion on I-5, which increases average speeds and improves fuel efficiency. Since the fuel efficiency of passenger vehicles typically improves as speeds increase (up to approximately free flow conditions), less fuel would be consumed and a reduced amount of GHGs would be emitted.

The differences between LPA Option A and LPA Option B are not substantial enough to change traffic volumes or travel speeds in Metro's regional travel demand model at the macroscale (region) or the microscale (12.2 miles of I-5); therefore, the estimated energy consumption and CO_2e emissions are the same for both LPA design options. Additionally, the local street operations are very similar between LPA Option A and Option B and any differences would be negligible relative to the emissions associated with the region or the 12.2-mile segment of the I-5 mainline.

It should be noted that the estimates for the LPA do not account for the benefits related to reduced congestion from fewer highway collisions or the elimination of congestion associated with bridge lifts. As a result, the total emission reduction benefits associated with the LPA, relative to No-Build, are conservatively low. The CRC Energy Technical Report (included as an electronic appendix to this FEIS) provides additional information on these and other considerations.

According to the U.S. Department of Energy, the average American household produces 59 tons of carbon per year, and 11.7 tons of it is related to transportation.

Climate Change Mitigation Measures

Currently no local, state, or federal regulations identify a threshold for CO_2 emissions from transportation projects that trigger mitigation requirements, and the LPA would reduce emissions compared to the No-Build Alternative. Nonetheless, aspects of the LPA reflect guidelines established by international, national, and state organizations to encourage infrastructure design that reduces GHG emissions (IPCC 2007; CCIG 2008). Several of these recommendations and relevant LPA design features are described below:

- Providing bicycle and pedestrian infrastructure: The LPA includes a bicycle and pedestrian multi-use path across the river that would provide upgraded safety and convenience compared to the No-Build Alternative; the path is separated from motor vehicle traffic.
- Providing transit options: Currently, the only transit option between Portland and Vancouver is buses that flow and stop with traffic. The LPA will provide light rail transit that will operate on a separate guideway, unaffected by vehicle congestion.
- Implementing tolls: The CRC project is proposing including a highway toll structure that would implement higher tolls during peak periods. Traffic modeling shows that variable tolls would cause a mode shift to transit and nonmotorized transit (bicycle and pedestrian) or encourage people to not make certain trips.
- Increasing efficiency of transportation systems: The elimination of bridge lifts, establishment of variable toll pricing, addition of auxiliary lanes between closely spaced interchanges in the project area, and construction of intersection improvements proposed for the CRC project will reduce congestion and stop-and-go conditions and thereby improve energy efficiency.
- Supporting transit-oriented development: The LPA provides an opportunity for transit-oriented development, consistent with existing land use plans for the Cities of Portland and Vancouver.
- Replacing aging infrastructure in existing corridors: The LPA will upgrade an existing facility in an urban area instead of creating a new transportation corridor.

TERMS & DEFINITIONS:

Adaptation

The Intergovernmental Panel on Climate Change (IPCC 2001) defines adaptation as "adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in human processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change" (IPCC 2001).

Climate Change and Adaptation Measures

The CRC project team followed the WSDOT Guidance for Project-Level Greenhouse Gas and Climate Change Evaluations. The team received technical support from the WSDOT Air/Noise/Energy Program to evaluate existing climate change projections, identify the variable conditions expected as a result of climate change, and assess the project's resiliency to climate change impacts. Recognizing that the effects of climate change may alter the function, sizing, and operation of the LPA, the CRC project team evaluated research conducted by the University of Washington's Climate Impacts Group (CIG) to ensure that the LPA is designed to perform under the variable conditions expected as a result of climate change. Based on the best available science, the effects of climate change in the project area are projected as follows:

- It is highly likely that as a result of natural- and human-caused climate change, average annual air temperatures will increase.
- Warmer winter temperatures in the Columbia River Basin will result in lowered snowpack and higher winter base flows. Lower base flows are expected in the spring and summer months, and an increased likelihood of more intense storms may increase the chance of flooding.
- Average annual precipitation is likely to stay within the range of 20th century variability.
- Sea level rise in the Pacific Northwest will vary with regional rates of uplift, but would be similar to the global average increase of 1.3 feet by 2100.
- Climate change could negatively impact salmon and trout populations in the Columbia River Basin. However, climate change–induced impacts are anticipated to be less severe than human activities that destroy or degrade freshwater habitat (Bisson 2008).

The project team considered the information on climate change with regard to preliminary design and potential for changes in the surrounding natural environment. As part of its standard design, the LPA has incorporated features that will provide greater resilience and function with the potential effects brought on by climate change.

In addition, the consideration of climate change projections is an important element in the long-term sustainability of the project. Specifically, the CRC Sustainability Strategy specifies LPA activities to "design, construct, maintain, and operate the project to resiliently adapt to climate change." As detailed in the Strategy, the following aspects of the LPA consider the anticipated effects of climate change, and/or incorporate elements to improve the project's resilience to anticipated climate change–induced impacts:

- The LPA will avoid fragmentation and degradation of significant floodplain hydrology by sensitively locating new and modified transportation and utility project components. Climate change is anticipated to bring more frequent flooding and reduced water quality, especially in unmanaged systems. The Columbia River is a highly managed system (Hamlet et al. 2003). Nonetheless, conserving floodplains is an urgent and necessary form of ecosystem-based climate change adaptation (Opperman et al. 2006).
- The LPA will maximize management of stormwater by restoring existing unused impervious paved areas to natural, permeable, and vegetated conditions to the maximum extent practical. The project team included treatment devices such as bioretention ponds, soil-amended bio-filtration swales, bioslopes, and constructed treatment wetlands in the conceptual stormwater management design. In addition to improving water quality in

How do you estimate the impact of climate change on river levels?

Studies that have modeled future climate and river flow used existing data about the Columbia River Basin to predict trends over the next 50 to 100 years, taking into account the effects of global warming and other emergent conditions in the basin. These studies suggest that in the next century the flow pattern of the Columbia River could be transformed from a primarily snow-melt fed river to one supported by a mix of rainfall and diminished snow-melt.

CRC Sustainability Strategy

The lead agencies and project partners developed the Columbia River Crossing Sustainability Strategy (Strategy) to explain how the project is connected to regional and state sustainability goals, and develop a "triple bottom line" approach to measuring and minimizing the project's impacts in order to promote a healthy and balanced environment, society, and economy. The Strategy was developed from a framework of aspirational principles, and includes both strategic goals and specific tactical activities to be implemented during project phases. The Strategy addresses a comprehensive array of resource impacts and project activities, including but not limited to climate change impacts and adaptation. The full Strategy is included as Appendix C to this FEIS.

the region, these devices would reduce adverse impacts to the hydrologic system and improve the project area's water provisioning services, which will in turn reduce the likelihood and magnitude of increased flood risk.

- The LPA bridge design will accommodate projected climate change–induced rise in the Columbia River's high water levels.

Finally, while the following activities are not CRC project commitments, the Strategy provides the following recommendations for improving the project's ability to withstand disruption caused by climate change–induced impacts in future project phases:

- Continue to reduce vulnerability and increase resilience (e.g., to water level rise and extreme storm events, respectively) through project operations and maintenance by integrating adaptive climate change features and performance mechanisms into the design.
- Evaluate the climate change analysis methodologies and related projections to assess probable outcomes for the CRC project area over the next 50 to 100 years, and consider opportunities for adaptive management and participation in the carbon market.

Based on the available information, the CRC project team concludes that the proposed project has carefully considered and disclosed GHG emissions, and has used existing climate change projections to assess the project's resiliency to the effects of climate change.

3.19.11 Electric and Magnetic Fields

A survey conducted under the National Institutes of Health (NIH) characterized the personal magnetic field exposure in the general population (Enertech Consultants 1998). For the average 24-hour exposure period, approximately 14 percent, 6 percent, and 2.5 percent of the general population were exposed to magnetic field strengths exceeding 2 mG, 3 mG, and 5 mG, respectively. Only 0.46 percent of the general population was exposed to a 24-hour average exceeding 10 mG. The highest average magnetic field exposure occurred at work, and the lowest at home, in bed. The average magnetic field in homes is 1.7 mG.

The LPA includes light rail transit, which generates electric and magnetic fields (EMF) and would therefore add to cumulative EMF exposure. Standards for EMF exposure guidelines are established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the American Conference of Governmental Industrial Hygienists (ACGIH). The ICNIRP magnetic field exposure guideline for the general public is 833 milliGauss (mG) (should not be exceeded for more than several minutes). EMF levels from the light rail system are well below the ICNIRP exposure standards. There would be a slight increase in cumulative exposure for those persons riding or working on the light rail system. However, it is not anticipated that human health would be adversely affected by the addition of light rail-generated EMF.

3.19.12 Energy and Peak Oil

The long-term energy demand estimates prepared for the CRC project are influenced by cumulative factors. Those estimates are based on travel demand forecasts that factor in projected regional changes in land use patterns, employment, population growth, and other programmed transportation improvements.

The cumulative energy impact of primary concern is "peak oil." Peak oil refers to the point in time at which the maximum global petroleum production rate is reached, after which the rate of production enters a terminal decline. Peak oil results from many incremental actions, few of which are individually important. However, the potential impact of reaching peak global petroleum production is an important consideration for projects, such as CRC, that are intended to address transportation needs for decades to come.

Oil production in the United States—the world's third largest oil producing nation—reached its peak around 1970 and has been declining since then. Most estimates place peak global production sometime between 1990 and 2040.

What does the U.S. Department of Energy say about peak oil?

A report by the U.S. Department of Energy (Hirsch et al. 2005) included the following conclusions:

- World oil peaking is going to happen, and will likely be abrupt.
- The problem is the demand for liquid fuels (growth in demand mainly from the transportation sector).
- Mitigation efforts will require substantial time.
- Both supply and demand will require attention.
- More information is needed to more precisely determine the peak time frame.

When oil production drops below oil demand, it is likely to cause petroleum prices to increase. There are uncertainties, however, regarding peak oil's timing and the availability of substitute fuels. Peak oil's effect on transportation fuel prices and travel behavior will depend largely on when peak oil occurs and the availability of substitute fuels.

Peak oil's potential effects on economic activity and travel behavior could affect travel behavior in the region. The concern is that if substitute fuels are not readily available as petroleum supplies decrease, the rising cost and reduced supply of petroleum could directly reduce auto and truck travel, and could result in dramatic reductions in economic activity, which, among other effects, could further reduce vehicle trips below forecasts. These vehicle trip forecasts influence the proposed size, design, and financing of transportation facilities. If fuel prices increase faster than expected, then the number of 2030 highway trips could be lower than forecasted. However, even with relatively substantial fuel price increases, the future demand would still likely be greater than the expanded highway capacity. Because fuel costs represent only a portion of total transportation costs (which include everything from car payments, to insurance and maintenance), even large growth in fuel costs translates to a smaller growth rate in total transportation cost, which more directly affects travel demand in the long term.

Global demand for liquid fuels is projected to grow by 21 percent by 2030, driven in large part by transportation needs (EIA 2010). Petroleum accounts for the largest percentage of liquid fuels globally. Local transportation energy demand is expected to grow as well, although the LPA is projected to reduce future transportation petroleum demand compared to the No-Build Alternative. At the global scale, these fuel savings will be very small, but incrementally more beneficial than the No-Build Alternative.

The LPA includes a number of elements that would reduce adverse impacts related to peak oil. These include:

- The bridge and highway improvements are focused on replacing or updating aging infrastructure, not on building new highway corridors.

- The LPA includes substantial improvements to public transportation, with projected increases in transit mode share in the afternoon peak direction from 8 percent with the No-Build Alternative to 15 percent with light rail transit.
- It provides substantially improved facilities for non-motorized transport (such as walking and bicycling).
- It supports land use planning that seeks to control sprawl, concentrate development, and decrease auto dependency.
- It includes road use pricing (highway tolling).
- Because of the addition of high-capacity transit and the bridge toll, the LPA is projected to have lower daily I-5 river crossings than under the No-Build Alternative.
- It improves highway operations at a key pinch point, which improves fuel efficiency and lowers emissions.
- It increases highway safety, which decreases collisions and congestion, further improving fuel efficiency.

Another concern is the ability of existing transportation infrastructure to adapt to post-peak oil vehicles and technology. Based on current and prototype future alternative fuel vehicles, it is highly likely that the CRC infrastructure (transit guideway, bridges, highway, and bike and pedestrian paths) will be able to accommodate foreseeable changes in vehicle technology and fuels. Electric hybrids, electric plug-ins, and vehicles powered by biodiesel, ethanol, or hydrogen fuel cells are being designed to operate on modern roads and highways. The light rail transit guideway can be used by vehicles powered by a variety of fuels. The capacity of the proposed bicycle and pedestrian facilities can accommodate substantial growth in non-motorized transportation demand. It is likely that the proposed CRC infrastructure could readily accommodate or adapt to the transition to substitute fuel vehicles, higher than projected growth in non-motorized modes, and higher growth in transit demand.

There is substantial uncertainty regarding the timing of peak oil, the future availability of substitute fuels and technology, and the effects of peak oil on transportation. It is reasonable, however, to conclude that the CRC project can address reasonably foreseeable impacts associated with peak oil, and reduce the project's incremental adverse impact.

Outside the purview of CRC, numerous other measures will influence the timing and impact of peak oil at the global and local scale. These other actions include national and international energy policies, global oil prices, fuel and transportation taxes and fees, alternative fuel and technology research and development, agricultural policy and practices, local land use regulations, and other measures.

3.19.13 Noise and Vibration

The analysis of noise impacts is based on reasonably foreseeable changes in traffic resulting from background land use, population, and employment changes through 2030. In the project area there are currently an estimated 231

Has transportation infrastructure been able to adapt to change?

Transportation infrastructure has proven to be relatively adaptable. For example, the northbound I-5 bridge over the Columbia River was built in 1917 as a two-lane bridge that originally carried electric trolley cars and Model T autos (which ran on either gasoline or ethanol). While the bridge is now out-of-date in terms of seismic safety and traffic safety design standards, the bridge has accommodated nearly a century of changes in transportation technology, energy policy and prices, vehicle types, and travel behavior.

traffic noise impacts to noise-sensitive land uses along I-5. That number would rise to 275 under the No-Build Alternative.

Under the No-Build Alternative no new noise walls would be constructed. Background traffic growth would cause a general increase in traffic noise levels throughout the project area. Growth in aviation activity would likely also increase noise levels in some areas.

The LPA would include noise walls, reducing noise levels substantially along I-5 from existing conditions and the No-Build Alternative. Several noise-sensitive land uses currently with no or only partial noise wall mitigation are exposed to traffic noise levels that exceed the relevant criteria. Many of these land uses would receive long-term noise reduction benefits with the proposed mitigation. While noise from other sources could continue to grow over time, the LPA would likely reduce noise impacts, compared to the No-Build Alternative. The LPA, therefore, would not contribute to lasting trends from other past, present, or reasonably foreseeable actions that have had a cumulative effect, raising noise levels within the area. Vibration impacts are very modest for the LPA and can be mitigated.

3.19.14 Archaeological Resources

Based on extensive background research, archaeological reconnaissance, and predictive models, the construction of the CRC project is highly likely to encounter historic and could encounter prehistoric archaeological resources. Recent archaeological investigations demonstrate the potential for encountering archaeological remains associated with early residences, businesses, and industries, as well as Native American use.

Both shores of the Columbia River have been the location of extensive development in the past 200 years. Several types of historic era development occurred within or immediately adjacent to the present I-5 transportation corridor. Over time, dredging and filling along the shores have altered the banks of the Columbia River. Intensive residential, commercial, and transportation investments have had major impacts on the cultural and historic landscape in the I-5 corridor and vicinity.

Past activities have had a dramatic impact on the preservation of archaeological resources in the project area. Many have been lost or altered, although some have been preserved under fill during previous construction projects, and some have been recovered, studied, and archived as part of more recent construction projects. Unrelated future actions are likely to disturb or destroy additional archaeological resources, although some will likely be preserved or restored as well.

The project's incremental impact to the loss of the area's archaeological resources is not certain. There is a high likelihood that archaeological resources will be discovered prior to and during construction of the LPA. Measures will be taken to protect, preserve, or document the presence of these resources. The project would make a minor contribution to the cumulative effect on archaeological resources of the area.

3.19.15 Historic Resources

Past activities have had a dramatic impact on the preservation of historic resources in the project area. Many were demolished and the historic contexts largely altered to the extent that, except for a few places such as the Vancouver National Historic Reserve (VNHR), the northbound I-5 bridge, and other existing National Register sites in the project area, the area would not be easily recognized by people from the historic periods prior to the 1950s. Unrelated future actions are likely to demolish additional historic resources, although some future actions will likely preserve or restore other resources.

The project's incremental impact to the loss of the area's historic fabric is relatively small compared to the combined effects of these other projects and developments. The divide between Vancouver's downtown and the VNHR separates the major commercial and civic center from the historic resources and context of the Fort and barracks. The LPA would minimally widen this divide, and introduce new, taller sound walls which will, at least visually, contribute to this division. However, the LPA also includes construction of a lid over I-5 (the Evergreen Community Connector). As envisioned, the structure provides a pedestrian way across I-5 between the Riverwest development in downtown Vancouver and the Post Hospital building in the VNHR, contributing, along with the landscaping and interpretive features atop the Connector, to a restoration of the cultural landscape in this area.

The LPA is being designed to avoid most of the areas with concentrations of historic resources and to minimize such impacts that cannot be avoided.

3.19.16 Parks and Recreation Areas

The CRC project would improve access to recreational resources in Portland and Vancouver, and would result in improved pedestrian and bicycle access in the area, particularly between Oregon and Washington. The project would also have relatively minor impacts to a variety of public parks and recreational facilities. None of these resources would be displaced.

Park and trail development have been ongoing efforts in the region. These efforts will continue and are supported by current plans and programs. The impacts from the project would be small in the context of local park resources, and are balanced by public investments in parks elsewhere in the area, such as Esther Short Park in downtown Vancouver, the development of the Confluence Land Bridge over SR 14 in Vancouver, and the potential opening of the Vanport Wetlands mitigation site to the public.

Other development unrelated to CRC would result in loss of park and recreation properties; the extent of such loss is currently not known but likely is small. Park impacts that would result from the LPA combined with other past and foreseeable future changes (including park expansions) are not expected to result in adverse cumulative effects. The conversion of parks to other uses is rare, and when conversion is necessary, there is typically a replacement of the land and function. The LPA includes, for example, new areas that will be used as parks and trails. Cumulatively, there is likely to be a net gain over time in the total area of park land in the study area.

3.19.17 Visual Quality and Aesthetics

Cumulative visual impacts occur when the character of a place changes (for example from an agricultural landscape to residential development) or when the vividness, unity, or intactness of the visual environment changes over time. In the project area, visual character has steadily progressed from frontier and rural to suburban and urban. The I-5 corridor has steadily grown in footprint and intensity of use as a major transportation route. Overall, impacts from the project will continue and reinforce the I-5 urban transportation corridor character.

The LPA would not make a substantive difference to the cumulative effects of past, present, and reasonably foreseeable future actions on visual quality and aesthetics, because it would replace the highway facilities that exist in approximately the same location as today. Visual impacts from the LPA would occur from the greater height and width of the Columbia River bridge decks; the widened or higher ramps for reconfigured interchanges at Marine Drive, Hayden Island, SR 14, Mill Plain, and SR 500; the widening of the I-5 corridor and the addition of new, taller sound walls; the loss of the historic current bridge structure; and from new transit stations and an accompanying park and ride structure. The more urban visual character would add to the cumulative effects of other present and planned development projects contributing to the increasingly urban visual quality of the study area.

As discussed in the Visual Quality and Aesthetics Technical Report (included as an electronic appendix to this FEIS), the project's direct effects on visual quality would be a mixture of beneficial and detrimental changes. The Portland/Vancouver area would have an increasingly urban visual character, to which the project would make a small contribution.

3.19.18 Ecosystems

Historically, many activities, including deforestation, urbanization, agriculture, over-fishing, and hydroelectric, irrigation and flood control projects, have contributed to a loss of habitat and a reduction in fish and wildlife. For example, based on data from land surveys for the General Land Office between 1851 and 1895, it is estimated that combined riparian/wetland forest and wetlands/wet prairie habitat in the Portland Urban Growth Boundary area has declined from approximately 8 percent of the total vegetation cover historically to less than 2 percent currently—an overall decrease of 75 percent of wetland cover type (Christy et al. 1993; Metro 2010). Comparable data are not available for historical vegetation cover in the Vancouver area. However, given the close geographical proximity and the similar land use history, relative losses of wetland vegetation types in the Vancouver portion of the project area are likely to be consistent with those across the river in Portland.

Many salmon species, in particular, have been significantly affected by the cumulative impacts of past activities in the Columbia River Basin. The Columbia River historically supported salmon and steelhead runs that numbered between 10 and 16 million adults annually. Since 1900, the abundance and distribution of Chinook, coho, sockeye, chum, and steelhead in the Columbia River Basin have declined. Beginning with Snake River sockeye in 1991, many of these runs have been listed under the Endangered Species Act as threatened or endangered and have been closely monitored and managed.

The natural abundance of most of the listed salmonids has increased since the mid-1990s, but declined since 2005. Risks from harvest and hatchery production to wild fish runs have lessened considerably for many populations since the mid-1990s and have remained largely stable since 2005 (Ford et al. 2010). Three species are discussed below and illustrate trends in abundance that are typical for most of the listed salmonids in the Columbia River. The three species occur in the lower Columbia River Basin, the middle Columbia River Basin, and the Snake River Basin, and although they each migrate through the mainstem Columbia River, their habitat use, distribution, and ecology within the Columbia River basin are distinctly different.

Columbia River chum runs in 1900 numbered over a million returning adults. By the late 1950s, the run had decreased to a few hundred fish (Small et al. 2006). The total number of chum salmon returning to the Columbia River in the last 50 years has averaged perhaps a few thousand per year, returning to a very restricted portion of the former range. With the exception of Grays River near the coast and small groups of chum spawning in creeks and in the mainstem Columbia River near Bonneville Dam, most populations were thought to be extinct (NWFSC 2003). A 5-year status review was recently conducted by NMFS. Despite increases in the Grays River and Lower Gorge populations in 2002, these populations have declined to previously depressed levels. NMFS concluded that the Columbia River chum salmon run remains at high risk of extinction (Ford et al. 2010).

Middle Columbia River steelhead runs in 1900 numbered approximately 100,000 returning adults; by 2005, the run had decreased to approximately 20,000 fish. This species occurs in the John Day, Umatilla/Walla Walla, and eastern Cascade slope (e.g., Deschutes) basins. The most recent status review indicates that spawning abundance in some basins has been relatively high (e.g., the John Day and Deschutes Basins), while in others it has remained relatively low (e.g., the Yakima River basin) (Ford et al. 2010). Of 20 individual populations in this run, five have met recovery criteria and seven show moderate risk of extinction (the remaining eight individual populations are extirpated or at high risk).

Snake River sockeye runs in 1900 numbered 45,000 to 55,000 returning adults. By 1988, only one returning adult was counted. This run has a very limited spawning distribution, making it especially vulnerable to threats. Snake River sockeye returns have increased since the early 1990s due to a number of factors, including improved downstream and ocean survivals, and increases in hatchery juvenile production. However, the status of the species has not improved significantly since it was listed in 1991 (Ford et al. 2010). Although adult returns of 650 in 2008 and 809 in 2009 were the highest since the hatchery program began, the population remains at high risk of extinction (Ford et al. 2010).

Substantive natural resource protection legislation began in the 1960s and has grown since then. Local, state, and federal regulations require certain protections of natural areas, which have minimized the destruction of these habitats and has mandated replacement, and in some cases recovery, of their functions. Despite legislation, however, growth and development continues to impact portions of the project area, and will likely continue to do so in the future.

Although the direct effects of the LPA would include disturbances to native vegetation, trees, and wetland buffers, the most significant ecosystems effects of the LPA are changes to aquatic habitat. The LPA would significantly improve runoff water quality as a result of improved stormwater management, although its in-water bridge piers would have adverse effects on protected fish species in the Columbia River similar to the effects of the existing I-5 bridge piers.

When considering the cumulative effects in the future, the project team looked at how climate change will likely modify fish habitat in the Pacific Northwest in multiple ways. The impacts of climate change on streamflow timing would result in a decreased ability of the reservoir system to meet minimum streamflow requirements for fish, a slight reduction in firm power production, and improved compliance with flood control targets (Hamlet and Lettenmaier 1999; Mote et al. 1999; Miles et al. 2000; Hamlet et al., in review). Related work funded by the Accelerated Climate Prediction Initiative showed that instream fish flow targets would suffer under the range of future climate conditions considered, even with changes in flood operation specifically designed to mitigate the effects of climate change (e.g., reduced flood storage, earlier refill) (Payne et al., in press). Changes in peak flow timing could alter fish migration patterns that have evolved to coincide with food availability and beneficial flushing events. Earlier peak flows could flush young salmon from rivers before they are physically mature enough for their migration, while lower summer flows could reduce the availability and accessibility of high quality habitat at higher elevations. In addition, parasites that infect salmon flourish in warmer water temperatures (USGCRP 2009).

A report published by the Independent Scientific Advisory Board Study (ISAB 2007) found that fish in the Columbia Basin could be more susceptible to these negative effects as nearly all of the streams and rivers in this basin would be altered in some way by climate change, resulting in potentially substantial losses in high quality salmon habitat. At the same time, however, other human activities that directly impact salmon (such as stormwater pollutants, industrial discharge, direct habitat loss, fishing, irrigation, flood control, and hydroelectric generation) have been subject to increasing levels of regulatory protection and enforcement. This trend could result in higher salmon populations in the future.

The projected impacts of climate change and other reasonably foreseeable actions could change the relative severity of the project's impact on salmon in the context of cumulative impacts. However, climate change impacts are expected to be significantly lower than other factors related to human activity. Lost or degraded freshwater habitat is identified as a primary contributor to the decline of salmon species in the Pacific Northwest (Bisson 2008).

Federal agencies, states, and tribes have implemented conservation and protection measures to reduce the extinction risk of listed fish. Future impacts to these species cannot be quantified; however, future projects in the Columbia River watershed would be required to avoid and minimize impacts to these species, and to mitigate for unavoidable impacts to habitat.

Section 7(a)(2) of the U.S. Endangered Species Act (ESA) requires the FHWA and FTA to consult with the National Marine Fisheries Service (NMFS) to ensure that the U.S. Department of Transportation's actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. This jeopardy analysis was presented in the CRC project's Biological Opinion (BO), included as Appendix N of the electronic appendices to this FEIS.

To complete this jeopardy analysis, NMFS reviewed the status of each listed species and its designated critical habitats, the environmental baseline in the action area (which includes other projects and past actions in the area), the effects of the action, and cumulative effects (which represent current and reasonably foreseeable non-federal projects and actions) [50 CFR 402.14(g)]. From this analysis, NMFS determined whether effects of the proposed action were likely, in view of existing risks and reasonably foreseeable actions, to appreciably reduce the likelihood of both the survival and recovery of the affected listed species. While not explicitly identified and analyzed, ongoing and future federal projects such as the Federal Columbia River Power System and salmon recovery efforts were taken into account during the project development and ESA analysis.

As discussed in the BO, NMFS concluded that the proposed action is not likely to jeopardize the continued existence of the 17 listed species analyzed in the consultation. NMFS also determined that the proposed action is not likely to result in the destruction or adverse modification of critical habitats designated for any of the listed species. The BO provided Reasonable and Prudent Measures to minimize the impact of incidental take of listed species, and listed Terms and Conditions under which the project must be implemented in order to ensure compliance with the ESA.

Further, future federal actions must comply with Section 7(a)(2) of the ESA, requiring federal action agencies to ensure that their actions do not result in jeopardy or adverse modification of critical habitat, and Section 9 of the ESA criminally and civilly prohibits any person to "take" a listed species or critical habitat in the future. When future federal actions occur, the CRC project would be analyzed as an existing condition, if the CRC project is in construction or has been completed. Any future actions that involve in-water work would require federal permitting and would be subject to federal regulatory protections as well as state and local regulations. Two of the reasonably foreseeable future actions listed at the beginning of Section 3.19 would likely involve in-water work (West Hayden Island development and potentially Vancouver waterfront development projects). The other reasonably foreseeable actions would not likely involve in-water work but would be expected to affect stormwater runoff. They could potentially increase pollutant loads in runoff, although they would be subject to local, and potentially state, stormwater regulations and permitting requirements.

As discussed in this document, local and state permit requirements are trending toward being more protective of natural resources through implementation of higher standards for stormwater treatment, site development, and natural resource protection. Therefore, while reasonably foreseeable future actions are likely to include projects that add new, adverse impacts on aquatic species, they are also projects that will provide beneficial effects.

Peregrine falcons make year-round use of the existing bridge structure, and replacement of the bridge may therefore result in a permanent loss of peregrine habitat. If, however, the peregrine falcons reestablish themselves on the replacement bridge structure, the habitat effects would be temporary. Regardless, long-term adverse effects to the overall viability of the peregrine falcon species are not anticipated.

Overall, the impacts resulting from the LPA are small, but historic development, expected growth, and increasing regulatory protections in the region will likely continue to have impacts on ecosystems. The mitigation measures that are included with the LPA will serve to reduce harmful effects, and may improve parts of the local ecosystem relative to existing conditions.

3.19.19 Geology and Soils

Past activities in the main project area include settlement and development of the region, clearing of native vegetation, filling of lowland areas, grading of slopes, and construction in earthquake-prone areas. Current development projects, including roads, bridges, and buildings, are being constructed under updated codes which require additional protection against earthquakes and measures to limit adverse effects in sensitive zones (for example, landslide-prone areas). However, in some cases, future activities may include development and regrading in the area that could lead to soil erosion, even with erosion control practices in place.

The LPA would have little direct impact on geology or soils, other than land clearing during construction and the potential for erosion. The primary geologic concern is a high earthquake hazard rating of the soils underlying the river crossing area. The soils are susceptible to liquefaction in a major seismic event. The LPA would replace or upgrade the existing bridges to reduce the potential for collapse or other damage.

Small changes that would occur as a result of the CRC project include reworking disturbed soil, localized minor grade changes, minor changes in slope stability, and ground improvements. These activities would have little or no meaningful impact to geology or soils, and are not expected to materially cause or increase any substantial cumulative impacts.

3.19.20 Water Quality and Hydrology

Increased urbanization and land use changes have decreased the amount of natural area and natural flow regimes in the project area. Flood control measures affect the entire lower Columbia River environment. Levees and river embankments were constructed in the early 1900s on both sides of the river, which isolated the majority of the historic floodplain from all but the highest flows.

A decrease in upstream heavy industrial activities and an emphasis on addressing known contamination sources have improved water quality in the Columbia Slough over the last 10 years, although the water quality remains substantially impaired. Climate change could affect future hydrologic conditions as noted above in Section 3.19.18.

The LPA would increase stormwater runoff volumes, but with mitigation will result in lower pollutant loading than under existing conditions. The LPA would increase overall impervious surface, but will treat all existing, new and rebuilt impervious surfaces, decreasing the amount of impervious surface contributing untreated runoff to rivers and streams by 219 acres. In the Columbia River Basin, the increased water quantity is not a critical issue, due to the total volumes handled by the basin. Stormwater treatment plans for the crossing have not yet been finalized, but net benefits are likely, given adequate water treatment options. Stormwater treatment plans for the crossing would meet all applicable jurisdictional requirements, including the use of enhanced treatment to address dissolved metals such as copper and zinc.

Past projects and land use actions followed then-current water quality regulations that were not as stringent as they are today. Local, state, and federal regulations require protection of water quality. Regulatory agencies are increasingly scrutinizing chemicals at much lower concentrations than current standards require, and this may result in new, more stringent standards. The combination of impacts from the CRC project, regulations, and other foreseeable actions is likely to result in water quality improvements relative to existing conditions.

3.19.21 Wetlands

As discussed in 3.19.18, compared to historical conditions, there are very few wetlands remaining in the project area. This increases the importance of the remaining wetlands in providing habitat, water quality, and other benefits. Mechanical methods introduced to control water flow (dikes in the project vicinity and dams on the Columbia River) have reduced the presence of wetlands in the project area. Urbanization has further affected wetlands locally and regionally. Foreseeable growth in the region will likely affect portions of the project area. Local, state, and federal regulations require protection of wetlands and jurisdictional waters, slowing the destruction of these habitats and mandating replacement of their functions.

Functional improvements have occurred to some wetlands near the southern portion of the project area since the original construction of I-5. The Port of Portland has an ongoing wetland restoration project at the 90-acre Vanport Wetlands parcel adjoining the existing highway and light rail line to the west.

Impacts from the CRC bridge piers would include minor fill to the Columbia River. The project's highway improvements would directly impact the buffers of three wetlands (LPA Option A with 0.41 acre and LPA Option B with 0.45 acre of impact), but would not directly impact any delineated wetlands. The highway phasing options would not directly impact delineated wetlands or wetland buffers. In the context of widespread urban development in the project area, the potential impacts to wetlands resulting from the LPA are minor. Although the affected wetlands perform important functions and are valuable due to their relative rarity, they are not of high quality. Additionally, mitigation for these impacts would replace or likely improve local wetland functions.

As a result of restoration programs and mitigation requirements to protect or compensate for future wetland impacts, wetland resources within the main project area will likely experience modest improvements over time. Although many future actions, including the CRC project, are likely to contribute cumulatively to these modest improvements, much of the historical wetland habitat losses are probably irrecoverable.

3.19.22 Hazardous Materials

The CRC main project area is heavily urbanized, and many of the past and present land uses have generated, used, and/or stored hazardous materials. Hazardous material sites that are most likely to impact the project are those being acquired for right-of-way or near the roadway or transit alignments.

For the LPA, disturbances to existing hazardous materials sites would result in site cleanup and could increase demand for contaminated soil disposal facilities. Cumulative exposure of construction and excavation workers or ecologic receptors to hazardous materials could occur. It is not anticipated that the operation or maintenance of the LPA would increase the occurrence or transport of hazardous materials within the study corridor.

The evaluation of risks to the CRC project from existing hazardous materials is based on a review of past actions and their effects on existing and potential soil and groundwater contamination. There may also be unknown contamination that poses additional risks, caused by past land uses and actions in the corridor.

Future, unrelated development in the project area could both add exposure risks and add cleanup and remediation benefits. Population and employment growth could cause increased traffic that may result in slightly higher incidents of hazardous materials spills. Since 1964, several laws have been implemented that have led to improved handling of hazardous materials, reducing the amount of new hazardous materials releases into the soil and groundwater. Environmental liability laws generally require identification and cleanup of hazardous materials during property transfers, which have resulted in the overall reduction of hazardous material contamination near the main project area.

Because the project is unlikely to create new hazardous material sites, and may identify or remediate existing hazardous material sites, it could contribute to a cumulative beneficial impact to groundwater and to human and ecological receptors in the main project area.

3.19.23 Irreversible and Irretrievable Commitments of Resources

NEPA regulations from the CEQ require environmental analysis to identify "…any irreversible and irretrievable commitments of resources, which would be involved in the proposed action should it be implemented" (CFR 1502.16). Implementing the proposed improvements involves committing natural, physical, human, and fiscal resources. CEQ guidelines describe primary irreversible and irretrievable resource commitments as uses of nonrenewable resources throughout a project that may be irreversible if removal of the resources occurs and cannot be replaced within a reasonable time frame (for example, extinction of a threatened or endangered species), or if obstruction of the use of resources occurs after the project.

The proposed transportation improvements would involve a long-term conversion of land resources to provide right-of-way for the LPA. Although these transportation facilities conceivably could revert to urban land and open space, there is no reason to expect that such a conversion would be necessary or desirable. Fossil fuels used to power construction and daily vehicle operation and used in the manufacture of construction materials are the major nonrenewable resources that would be consumed by the construction of the proposed project and the resulting daily vehicle operations.

Considerable amounts of labor and construction materials such as cement, aggregate, asphalt, sand, fill materials, lime, and steel would be used on project construction. Large amounts of labor and natural resources are used in the fabrication and preparation of construction materials. These materials are generally not retrievable, although they are not in short supply, and many can be recycled. Their use would not have an adverse impact upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of both state and federal funds that are not retrievable.

3.19.24 Temporary Construction Effects

Cumulative impacts during construction could result if other projects in the area are constructed at the same time or nearly the same time as CRC project construction. Simultaneous or sequential construction projects can increase congestion, employment and spending, community impacts, and natural resource impacts. The construction of CRC is likely to overlap with construction of many of the specific developments listed in the Reasonably Foreseeable Future Projects section under Section 3.19.2, Recently Constructed Projects, as well as private developments that are not yet proposed. For example, bridge construction activity for this project will need to be coordinated with other in-water work that could occur simultaneously, such as the Columbia River Channel Deepening project, as well as with construction immediately adjacent to the project, such as the Riverwest project.

The temporary effects from CRC construction, in combination with other construction, will cause delays and disruptions to local residents and businesses. Mitigation plans, including traffic control plans and business assistance plans, will reduce the negative consequences of project construction, while the project's employment demands will result in positive economic outcomes for the region.

Other projects would have their own traffic control plans, but some may influence the travel route of commuters and trucks and could place more traffic in the CRC project corridor. Likewise, some of the projects are on planned haul routes and could influence the delivery of supplies and materials to the job sites for the CRC project.

Community impacts due to local traffic congestion and rerouting, as well as noise and air quality impacts, could occur where CRC construction overlaps with the construction of other projects. The highest potential for such impacts is likely near the bridge landing in Vancouver and on Hayden Island, where other large construction projects are likely and where CRC construction duration and intensity will be high.

For the natural environment, most of the construction impacts would be localized such that cumulative effects would not be a serious additional concern. Other projects in the area would not be likely to directly impact the same localized waters, wetlands, or regulated habitats that the CRC project would affect. However, in the project area, there could be increased erosion potential during the construction period. This, combined with other construction projects in the area, could increase the risk of erosion and water pollution in the event of a storm when ground surfaces are exposed.

The project's temporary effects on energy demand and CO_2e emissions are associated with the construction, rather than operation, of the project. The energy use estimates for the construction of the project were based on construction cost estimates. While the construction dollar amount for the LPA is similar to the cost estimates listed in the DEIS, the amount of energy consumed and GHG emissions have increased. This is because some work elements were previously aggregated and did not contain a level of detail that could be used in the energy and GHG emission calculations, but still had an estimated dollar amount.

While the No-Build Alternative involves no CRC construction, it would still have construction-related GHG emissions. For example, potholes may need filling, the I-5 bridge deck would likely need to be resurfaced and striped, and additional local capacity improvements may be needed.

The temporary effects on energy consumption and GHG emissions for the LPA and the LPA with highway phasing are summarized in Exhibit 3.19-5.

Exhibit 3.19-5

Temporary Effects on Energy Use and CO_2e Emissions Associated with the LPA

	LPA Full Build		LPA with Highway Phasing	
Alternative Construction Element	**Energy Consumed (mBtu)[a]**	**CO_2e Emissions (MT)**	**Energy Consumed (mBtu)**	**CO_2e Emissions (MT)**
Project Cost (2009$)	**$2,748,885,746**		**$2,419,043,922**	
South Highway Approach	3,749,355	284,626	2,562,518	194,529
North Highway Approach	2,414,630	183,303	2,131,189	161,786
Columbia River Bridges	2,983,369	226,477	2,983,369	226,477
Transit	2,329,751	176,859	2,230,794	169,347
Total	**11,477,104**	**871,265**	**9,907,871**	**752,139**

Source: CRC Cumulative Effects Technical Report, included as an electronic appendix to this FEIS.

a mBtu = million British thermal units.

To reduce potential cumulative construction impacts, the project team has and would continue to consider other planned projects while developing CRC construction and mitigation plans and traffic control plans.