3.14 Water Quality and Hydrology

> **What is the difference between water quality and hydrology?**
>
> In this analysis, water quality refers to the characteristics of the water—its temperature and oxygen levels, how clear it is, and whether it contains pollutants. Hydrology refers to the flow of water—its volume, where it drains, and how quickly the flow rate changes in a storm.

In urban areas, pollutants that wash off roadways during storms, such as automotive fluids, heavy metals, and small particles, degrade water quality in rivers and streams. The design and placement of roadways and stormwater systems can affect the quality and flow of water discharged from these features and the hydrology of the surrounding area. Placing structures such as bridge piers or roadways on a levee, in a waterway or its floodplain could affect the severity of floods during storm events. For this reason, modification to a levee or construction in waterways and their floodplains is strictly regulated and must consider the incremental contribution toward flood conditions.

The information presented in this section is based on the Water Quality and Hydrology Technical Report. Additional detail on the impact of water quality to fish is in Section 3.16, Ecosystems. Additional detail on groundwater resources can be found in Section 3.17, Geology and Groundwater. Additional detail on potential changes in precipitation patterns as a result of climate change is in Section 3.19, Climate Change.

3.14.1 Changes or New Information Since 2013

The Columbia River Crossing (CRC) Selected Alternative identified in the 2011 Record of Decision (ROD), as revised by the 2012 and 2013 re-evaluations, is referred to as the CRC Locally Preferred Alternative (LPA). Over the past 10+ years since the CRC LPA was identified, the physical environment in the study area, community priorities, and regulations have changed, which necessitated design revisions and resulted in the IBR Modified LPA (see Section 2.5.2). Evaluation of potential impacts associated with water quality and hydrology has been updated in this Draft SEIS to include:

- Changes to federal, state, and local regulations and permits.
- Changes in permitting processes, most notably for the Clean Water Act (CWA) Section 401 Water Quality Certification and Section 402 National Pollutant Discharge Elimination System (NPDES).
- Updates to Section 303(d)-listed impaired waters.
- Changes to climate predictions and modeling tools.
- Changes to constituents of emerging concern, including 6PPD-quinone.
- Addition, removal, and updating of data sources as appropriate.
- Expansion of the Ruby Junction Maintenance Facility in 2014.
- Changes in the project footprint necessitated by changed conditions.

Table 3.14-1 compares the impacts and benefits of the CRC LPA to those of the Modified LPA as a result of the changes listed above. Based on the analysis described in this section, water quality, hydrology, and stormwater management effects of the Modified LPA would be similar to those of the CRC LPA.

Table 3.14-1. Comparison of CRC LPA Effects and IBR Modified LPA Effects

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA Effects as Identified in this Section	Explanation of Differences
Water Quality	Beneficial effect on receiving water quality, as the design of the proposed facilities would include BMPs to remove pollutants in runoff from all roadway surfaces within the project footprint.	Beneficial effect on receiving water quality, as the design of the proposed facilities would include BMPs to remove pollutants in runoff from all roadway surfaces within the project footprint.	Negligible
Hydrology	Potential to cause long-term hydrologic effects to waterbodies due to an increase in impervious surfaces.	Potential to cause long-term hydrologic effects to waterbodies due to an increase in impervious surfaces.	Negligible
Stormwater management	• Could cause changes in peak flows and runoff volumes in local receiving waters because of the increased impervious surfaces in the study area. • Would improve treatment of existing impervious surfaces.	• Could cause changes in peak flows and runoff volumes in local receiving waters because of the increased impervious surfaces in the study area. • Would improve treatment of existing impervious surfaces.	Negligible
New and Rebuilt Impervious Surfaces (acres)[a]	267 acres (PGIS)	207 acres (CIA)	The design footprint of the Modified LPA has been reduced.
Total Suspended Solids Discharged from Impervious Surfaces (lbs/year)	19,579 lbs/year	16,694 lbs/year	The design footprint of the Modified LPA has been reduced. Pollutant loads are a function of treated and untreated areas. Both the CRC LPA and the Modified LPA would manage and treat all stormwater runoff from existing, new, or rebuilt impervious surfaces.

Note: Data are approximate and rounded.

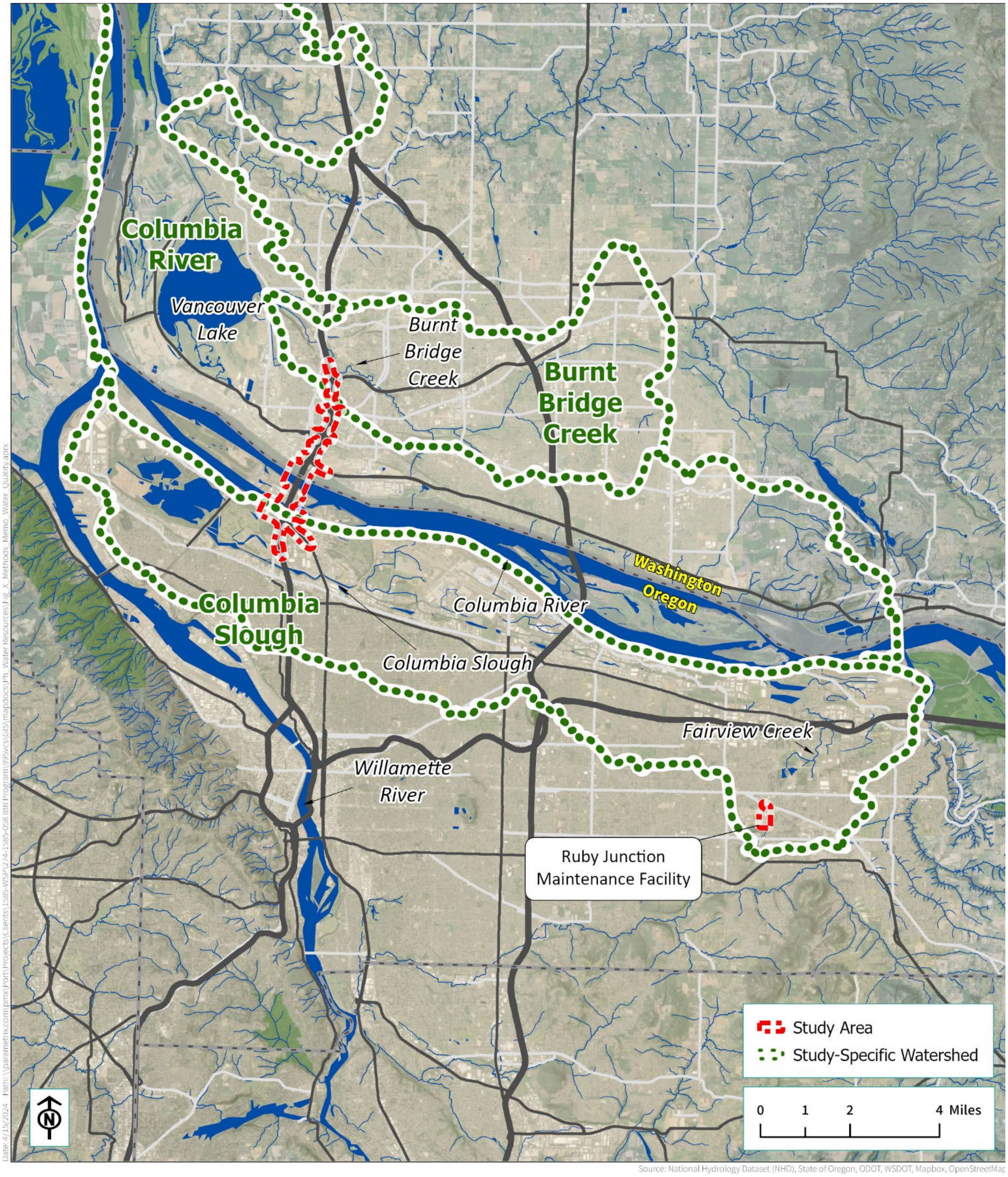
a Terminology and methodology was updated between the CRC project and IBR Program to be consistent with current regional stormwater management guidance. CIA encompasses both PGIS and non-PGIS.

BMP = best management practice; CIA = contributing impervious area; CRC = Columbia River Crossing; EIS = Environmental Impact Statement; lbs = pounds; LPA = Locally Preferred Alternative; N/A = not applicable; PGIS = Pollution Generating Impervious Surfaces

3.14.2 Existing Conditions

For this analysis, waterbodies and their contributing watersheds have been delineated based on their hydrologic connectivity to the study area. Watersheds into which runoff is, or could be, discharged are referred to as “receiving waters.” Figure 3.14-1 shows the study area and watersheds.

Figure 3.14-1. Water Quality and Hydrology Study Area and Study-Specific Watersheds



Hydrology

> **What is a watershed?**
>
> A watershed is an area of land from which all precipitation and surface water drains to the same place and, generally, the same waterbody. Watersheds vary in shape and size, as determined by topography and geology, and can cross county, state, and national boundaries.

The study area lies within the main Columbia River valley, except for a small area north of the SR 500 interchange that is located in the Burnt Bridge Creek watershed. Burnt Bridge Creek flows into Vancouver Lake before discharging to the Columbia River. The Columbia River and North Portland Harbor (a branch of the Columbia River south of Hayden Island) both cross under I-5 within the study area, while the Columbia Slough and Burnt Bridge Creek cross I-5 south and north of the study area, respectively. As a result of the Portland Metro Levee System, runoff from the Delta Park area between North Portland Harbor and the lower Columbia Slough, which was formerly part of the Columbia River floodplain, is now discharged to the lower Columbia Slough via pump stations. The Columbia Slough, which parallels the Columbia River floodplain, discharges near the confluence of the lower Willamette River and Columbia River.

The study area around the Ruby Junction Maintenance Facility in Gresham, Oregon lies within the 100-year floodplain of Fairview Creek (Figure 3.14-2). Fairview Creek discharges into the upper Columbia Slough downstream of the maintenance facility.

In the study area, floodplains designated by the Federal Emergency Management Agency (FEMA) include those adjacent to the Columbia Slough, the Columbia River, and Burnt Bridge Creek (Figure 3.14-2). These floodplains are confined to the immediate vicinity of the streams by levees or, in the case of Burnt Bridge Creek, by steep slopes. For reference, the FEMA-modeled water surface elevation of the 100-year floodplain at the existing Interstate Bridge crossing of the Columbia River is approximately 32 feet referenced to the North American Vertical Datum of 1988.

Local Climate

The climate within the study area is characterized by short, dry, warm summers, with a typically cool and wet spring, fall, and winter. The Coast Range to the west of the study area offers limited shielding from Pacific Ocean storms, while the Cascade Mountains to the east provide an orographic lift of moisture-laden westerly winds, resulting in moderate rainfall. See Section 3.19, Climate Change, for a discussion of potential climate change trends.

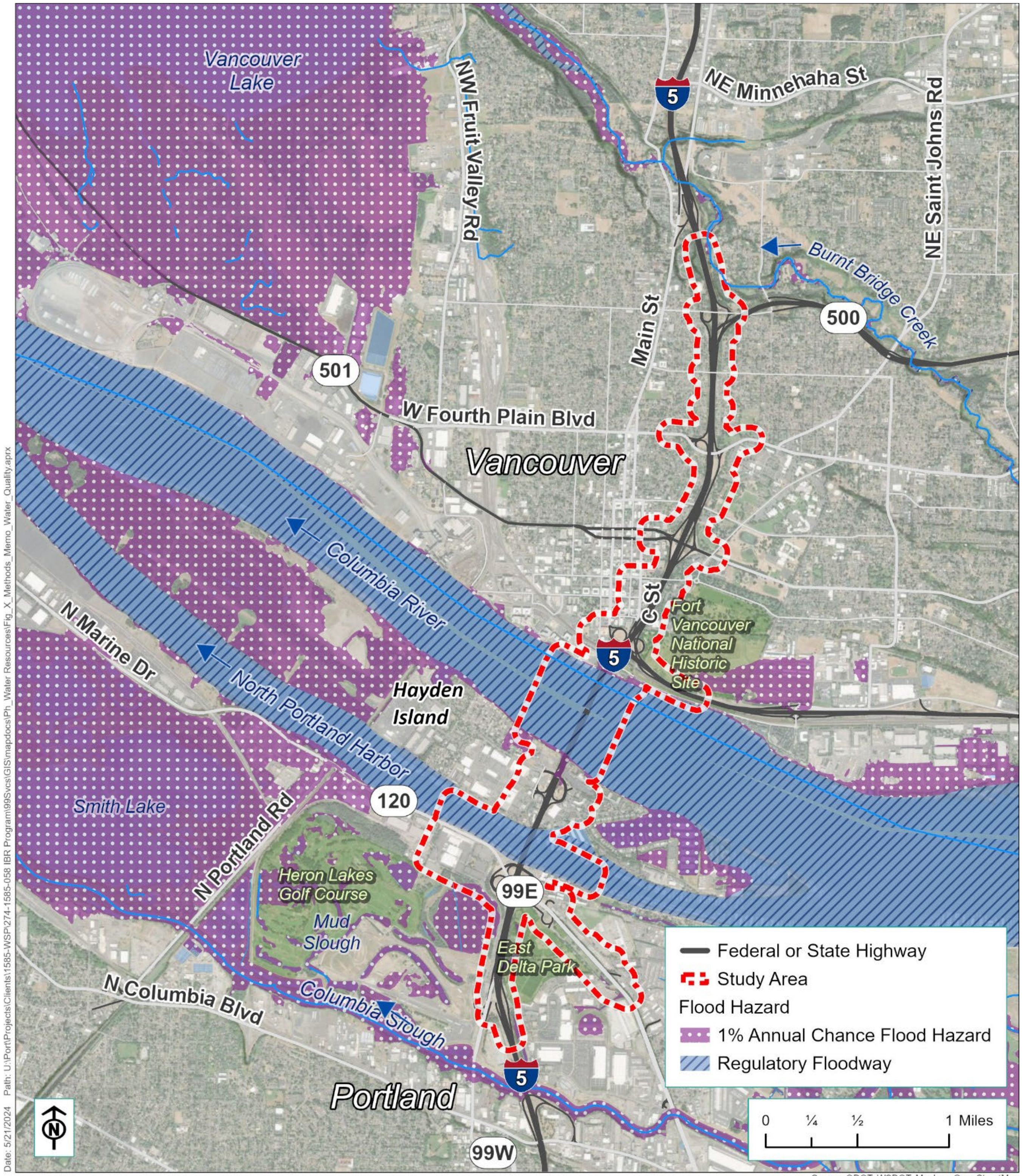
Receiving Waters

Columbia Slough

The Columbia Slough is a slow-moving, low-gradient drainage channel running nearly 19 miles from Fairview Lake in the east to the Willamette River in the west. The slough is a remnant of the historical system of lakes, wetlands, and channels that once dominated the south floodplain of the Columbia River. Its watershed drains approximately 32,700 acres of land in portions of Troutdale, Fairview, Gresham, Maywood Park, Wood Village, and unincorporated Multnomah County. The slough and areas to its north are currently intensively managed to provide drainage and flood control with pumps, weirs, and levees.

The slough is divided into upper, middle, and lower reaches. The upper and middle reaches receive water from Fairview Lake, Fairview Creek, and Wilkes Creek, as well as groundwater, natural springs, and overland flow and stormwater outfalls from industrial, commercial, and residential land uses in the surrounding area. The lower reach is tidally influenced while flows in the middle and upper reaches are controlled by pumping and gravity gates.

Figure 3.14-2. Federal Emergency Management Agency Floodplain Boundaries in the Study Area



Source: ODOT, WSDOT, Mapbox, OpenStreetMap

Columbia River and North Portland Harbor

Within the study area, the Columbia River and North Portland Harbor are a constrained and highly managed waterway primarily influenced by upstream dams. Development of the hydropower system on the Columbia River has significantly influenced peak seasonal flows in the river, as well as their velocity and timing. Annual spring flows to the Columbia River estuary have been reduced on average by 50% to 55% from historical levels, while winter flows between October and March have increased by 35% compared to historical rates. The Columbia River is tidally influenced in its lower reaches below the Bonneville Dam, including the study area. Flows and water surface elevations in this area are influenced by tidal fluctuations, resulting in minimal streamflow at times and daily elevation changes.

The study area in the vicinity of the Columbia River is highly urbanized with a complex system of roadways (including I-5, state highways, local access roads, and residential streets), parking lots, and other impervious surfaces. Over the past 150 years, historical off-channel areas have been filled, rechanneled, diverted, and otherwise developed for agricultural and urban use. The channelization of the watershed has combined with the development of the hydropower system to dramatically alter the historical hydrologic regime.

For the stormwater analysis, the Columbia River watershed has been divided into the south and north sides of the river. The Columbia River South watershed includes the portion of the study area that discharges to North Portland Harbor and to the Columbia River south of the Oregon-Washington state line, including the Hayden Island area. The Columbia River North watershed includes the study area from the Oregon-Washington state line north to the SR 500 interchange.

Burnt Bridge Creek

Burnt Bridge Creek is a small tributary to the lower Columbia River. It originates east of Vancouver and flows west to its outlet at Vancouver Lake, then drains into the Columbia River via Lake River. Within the study area, the creek meanders through Leverich Park, northeast of the I-5/SR 500 interchange, before turning north to parallel I-5. Within the study area, development in the vicinity of Burnt Bridge Creek is similar to the vicinity of Columbia River.

Historically, Burnt Bridge Creek has been prone to flooding. Development of the study area has increased peak flows, reduced base flows, and altered the timing of flows compared to historical conditions. Several actions have been taken to reduce or relieve flooding, including channel modification, installation or upsizing of culverts, installation of storm lines, and construction of drainage systems. Additional flow control elements, along with stormwater treatment facilities and habitat enhancements, were added as part of the Burnt Bridge Creek Greenway Improvement Project.

Fairview Creek

Fairview Creek is a 5-mile-long urban stream that originates in a wetland near Grant Butte in Gresham and drains to Fairview Lake, approximately 11 miles east of the study area. Fairview Creek is a tributary to the eastern portion of the Columbia Slough. Historically, Fairview Creek had been a tributary of the Columbia River, but water from the wetlands where it originates was diverted into an artificial channel that drains into the Columbia Slough, which is a tributary of the Willamette River. In 1960, water managers built a dam along Fairview Creek to create Fairview Lake for water storage and recreation. The creek’s 6.5-square-mile watershed receives stormwater runoff from the cities of Gresham, Wood Village, and Fairview.

Water Quality

States are required to monitor and regulate water quality in their rivers and streams under Section 303(d) of the CWA. Waterbodies that fail to meet the water quality standards for one or more pollutants are referred to as being “303(d)-listed.” Under Section 303(d), states also must develop action plans to address water quality concerns, including setting Total Maximum Daily Loads (TMDLs) for particular pollutants in a waterway.

Table 3.14-2 presents the 303(d)-listed waterways in the study area and water quality standards they do not currently meet. Table 3.14-2 also shows the pollutants for which TMDLs have been established.

Table 3.14-2. Water Quality-Limited Waterways within the Study Area

Waterway	303(d) Listing Factors	Established TMDLs
Columbia Slough	• Toxics (iron) • Biocriteria [a] • Aquatic weeds	• Toxics (lead, PCBs, DDE/DDT, dieldrin, dioxin) • Eutrophication (pH, dissolved oxygen, phosphorus, and chlorophyll a) • Bacteria • Temperature
Columbia River (includes North Portland Harbor)	• In Oregon: – Toxics (PCBs, PAHs, DDT metabolites [4,4'-DDE]) • In Washington: – Vinyl chloride	• Dioxin • Total dissolved gas • Temperature
Burnt Bridge Creek	• Eutrophication (dissolved oxygen, pH) • Fecal coliform bacteria • Temperature	• None
Fairview Creek	• Biocriteria [a]	• Bacteria • Temperature

a Biological criteria (biocriteria) are a way of describing the qualities that must be present to support a desired condition in a waterbody. Biocriteria are based on the numbers and kinds of organisms present and are regulatory-based biological measurements. Oregon Department of Environmental Quality defines biocriteria as the measure by which "Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities" (Oregon Administrative Rule 340-041-0011).

4,4'-DDE = dichlorodiphenyldichloroethylene; DDT = dichlorodiphenyltrichloroethane; PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenyl; TMDL = Total Maximum Daily Load

Stormwater

The purpose of stormwater management strategies is to reduce stormwater runoff peak flows and pollutants discharged into receiving waters from impervious surfaces. Measures (e.g., installing perimeter protection/silt fences, inspecting equipment, implementing spill containment, restricting work during rain or wet weather) used to achieve these reductions are referred to as best management practices (BMPs), and are established in regulatory permits and guidance (see Section 3.14.6, Potential Avoidance, Minimization, and Compensatory Mitigation Measures, for more detail). Current regulations require BMPs when roadways are reconstructed or when new impervious surface is added. BMPs have been shown to effectively reduce sediment, metals, and other pollutants from runoff. Their effectiveness in removing polycyclic aromatic hydrocarbons (PAHs), microplastics, and

What is stormwater infiltration?

Stormwater infiltration is the process by which stormwater sinks into the soil, becoming groundwater that, in turn, feeds rivers and lakes. Stormwater infiltration can occur naturally, where soil conditions and geography allow, or in artificially created stormwater infiltration facilities.

constituents of emerging concern, including 6PPD-quinone (a byproduct of tire dust that is toxic to salmonids), are less well known.

Within the study area, surface water runoff from I-5 is generally confined to the paved roadway by continuous curbs and concrete barriers. Closed (pipe) drainage systems convey flows to surface water outfalls. Runoff from the bridges across North Portland Harbor and the Columbia River drains through scuppers to the water surface below. Most stormwater from I-5, including interchange areas, currently flows directly into receiving waters without treatment to remove roadway pollutants. There are several minor exceptions:

- The Burnt Bridge Creek watershed includes a treatment and infiltration pond that reduces sediment, metals, and other pollutants from runoff. Overflows from this pond are discharged to an existing wet pond in the vicinity that provides infiltration.
- A 3-acre area within the Columbia Slough watershed infiltrates in adjacent pervious area and does not discharge to existing outfalls.
- About 3 acres of runoff from SR 14 is dispersed to adjacent areas, where it infiltrates or evaporates.
- Runoff from the existing Ruby Junction Maintenance Facility partially drains to Fairview Creek through a proprietary stormwater filtration system and partially is infiltrated using dry wells contributing to groundwater within the Columbia Slough watershed.

Table 3.14-3 shows the existing impervious area and treated and untreated stormwater areas for each receiving waterbody in the study area. The contributing impervious area (CIA) represents the acreage of impervious surface within the study area that drains to each waterbody. Of the 177.6 total acres of CIA within the study area, approximately 21.2 acres are infiltrated. The remaining 156.4 acres discharge to receiving waters without treatment.

Table 3.14-3. Existing Impervious Area and Treated and Untreated Stormwater (acres)

Receiving Waterbody	Total Contributing Impervious Area	Infiltrated Impervious Area	Treated Impervious Area Draining to Outfall(s)	Untreated Impervious Area Draining to Outfall(s)
Columbia Slough	38.5	3.0	0.0	35.5
Columbia River South (Oregon)	45.8	0.0	0.0	45.8
Columbia River North (Washington)	76.4	3.0	0.0	73.4
Burnt Bridge Creek	9.6	7.9	0.0	1.7
Fairview Creek	7.3	7.3	0.0	0.0
Total	**177.6**	**21.2**	**0.0**	**156.4**

3.14.3 Long-Term Benefits and Effects

Table 3.14-4 summarizes the water quality and hydrology effects of the Modified LPA, including design options, and No-Build Alternative followed by a discussion of the effects.

Table 3.14-4. Summary of Water Quality and Hydrology Effects from the Modified LPA Design Options and No-Build Alternative

Water Quality and Hydrology Consideration	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration, One Auxiliary Lane, with or without C Street Ramps, Centered I-5 or I-5 Westward Shift, all Park-and-Ride Site Options	Modified LPA with Double-Deck Fixed-Span Configuration, Two Auxiliary Lanes, C Street Ramps, Centered I-5, all Park-and Ride Site Options	Modified LPA with Single-Level Fixed-Span Configuration[a], One Auxiliary Lane, C Street Ramps, Centered I-5, all Park-and-Ride Site Options	Modified LPA with Single-Level Movable-Span Configuration, One Auxiliary Lane, C Street Ramps, Centered I-5, all Park-and-Ride Site Options
Water Quality and Stormwater Management	• No change, (area would remain untreated until stormwater treatment could be addressed according to state prioritization and available funding).	• Beneficial effect on receiving water quality (due to BMPs to remove pollutants). • Could cause changes in peak flows and stormwater runoff volumes.	• Beneficial effect on receiving water quality (due to BMPs to remove pollutants) with slight increase to pollutant loads. • Could cause changes in peak flows and stormwater runoff volumes.	• Beneficial effect on receiving water quality (due to BMPs to remove pollutants). • Could cause changes in peak flows and stormwater runoff volumes.	• Potential for additional and accidental minor spills of materials and pollutants used for maintenance and operation of the movable-span configuration.
Contributing Impervious Area	178 acres total: • 0 acres treated. • 21 acres infiltrated. • 157 acres untreated.	207 acres total: • 190 acres treated. • 17 acres infiltrated. • 0 acres untreated.	211 acres total: • 194 acres treated. • 17 acres infiltrated. • 0 acres untreated.	211 acres total: • 193 acres treated. • 18 acres infiltrated. • 0 acres untreated.	214 acres total: • 197 acres treated. • 17 acres infiltrated. • 0 acres untreated.
Total Suspended Solids	• 120,272 lbs/year.	• 16,694 lbs/year.	• 17,037 lbs/year.	• 16,984 lbs/year.	• 17,336 lbs/year.
Hydrology	• No change (continued release of stormwater with degraded quality into receiving waters).	• Potential to cause long-term hydrologic effects due to an increase of 30 acres of contributing impervious area.	• Potential to cause long-term hydrologic effects due to an increase of 34 acres of contributing impervious area.	• Potential to cause long-term hydrologic effects due to an increase of 33 acres of contributing impervious area.	• Potential to cause long-term hydrologic effects due to an increase of 37 acres of contributing impervious area.

a The long-term effects associated with the single-level fixed-span configuration would be approximately the same for all bridge type options.

BMP = best management practice; lbs = pounds

No-Build Alternative

Under the No-Build Alternative, most of the existing impervious surface area along roadways in the study area would remain untreated, which would allow for the continued release of stormwater with degraded quality into the study area's receiving waters. However, with no way to quantify future emissions or other pollutants, such as 6PPD-quinone and for the purposes of the present analysis, it is assumed that the No-Build Alternative would maintain existing water quality conditions and would not result in long-term changes (either increased or decreased impacts). Therefore, in this section, the No-Build Alternative is discussed only in comparison to the Modified LPA.

Modified LPA

The Modified LPA includes a stormwater conveyance and detention system that would comply with all federal, state, and local water quantity and quality standards at the time of construction. The proposed design for the Modified LPA includes inlets, catch basins, and gravity pipe drainage systems that would collect and convey runoff from the new bridges, transit guideway, and road improvements to stormwater treatment facilities. The treatment facilities would reduce total suspended solids, particulates, and dissolved metals to the maximum extent practicable before runoff reaches surface waters or is infiltrated.

The Modified LPA would also cross the Portland Metro Levee System with the extension of light-rail north from Expo Center, with modifications to the I-5 mainline north of North Victory Boulevard, with the North Portland Harbor bridges, and with local road revisions of N Marine Drive and N Expo Road. Such modifications may include activities to restore temporarily disturbed portions of the levees, or permanent modifications where proposed infrastructure would intersect with the existing levees or where access to the levees would change as a result of reconfiguration of the roadways. Modifications may also include improvements to existing levee function, if such improvements are requested or required. Modifications or improvements would be coordinated with the USACE and the Urban Flood Safety and Water Quality District for consistency with the planned future condition of the levees. The assessment presented below of long-term effects to water quality and hydrology associated with the Modified LPA includes effects associated with potential modifications to the federal levee system.

The Modified LPA would manage flow control and runoff in the Burnt Bridge Creek watershed and at the Ruby Junction Maintenance Facility via detention and infiltration. In the North Portland Harbor area runoff from some existing impervious surfaces, and a few sections of new or modified roadway with the Modified LPA, would be conveyed, treated, and discharged to the Columbia Slough. All other runoff generated by the Modified LPA, regardless of bridge configuration, would be conveyed, treated, and discharged within the watershed in which it is generated.

The Modified LPA would increase contributing impervious surface compared to existing conditions. Table 3.14-5 shows how the Columbia River bridge configurations would change the amount of CIA by acre. The Modified LPA with the I-5 mainline westward shift, SR 14 interchange without C Street ramp, and the different park-and-ride site options would not increase the amount of CIA compared to the Modified LPA alone, and therefore would have the same hydrology, water quality, and stormwater effects as the Modified LPA with one auxiliary lane and the double-deck fixed-span configuration.

The long-term hydrological effects resulting from changes in impervious area would be a small percentage of the study area watersheds, ranging from an increase of 0.007% in the Columbia Slough watershed to a decrease of -0.011% in the Fairview Creek watershed. The Modified LPA with two auxiliary lanes would result in a slight increase in the CIA compared to the Modified LPA with one auxiliary lane because of the additional pavement. Compared to the Modified LPA with the double-deck fixed-span configuration, the single-level fixed-span and movable-span configurations would have a greater amount CIA from the wider dimensions of the bridges and interchanges.

Table 3.14-5. Contributing Impervious Area by Bridge Configuration

Bridge Configuration	Columbia Slough (acres)	Columbia River South (acres)	Columbia River North (acres)	Burnt Bridge Creek (acres)	Fairview Creek (acres)	Total Project (acres)
No-Build Alternative (Existing Conditions)	38.5	45.8	76.4	9.6	7.3	177.6
Modified LPA with One Auxiliary Lane and Double-Deck Fixed-Span Configuration	40.7	51.6	97.4	10.7	6.8	207.2
Modified LPA with Two Auxiliary Lanes and Double-Deck Fixed-Span Configuration	41.1	52.3	100.2	10.7	6.8	211.1
Modified LPA with Single-Level Configuration[a] and One Auxiliary Lane	40.4	52.4	100.2	10.7	6.8	210.5

a The single-level fixed-span and single-level movable-span configurations (any bridge type options) would result in the same amount of CIA.

Hydrology

The addition of impervious surface, such as new roadway, within a watershed generates additional stormwater runoff and reduces stormwater infiltration into groundwater. These changes have the potential to increase flooding, alter peak flows, increase runoff volumes to local receiving waters, and decrease water infiltration and groundwater recharge. The magnitude of the effects depends on a variety of factors, including the degree of increase in CIA and the characteristics of the receiving water. The Modified LPA would comply with the stormwater design requirements in place at the time of construction, including requirements that may be updated to reflect climate-induced changes to rainfall patterns.

The change in flow volume fluctuation, peak flows, and runoff quantities in these waterbodies would be minimal for any of the Modified LPA bridge configurations compared to the No-Build Alternative. These impacts would be further minimized using flow controls (engineered measures to control the amount and velocity of stormwater discharging into a receiving water) for discharges to Fairview Creek and Burnt Bridge Creek. Flow control would not be required for the Columbia River or Columbia Slough, because they are considered large waterbodies that are exempt from flow control requirements (BES 2020).

In 2024, the City of Portland updated its building code and zoning code for development within floodplains. The updates are intended, in part, to comply with the recommendations of the 2016 Federal Emergency Management Agency (FEMA) National Flood Insurance Program Biological Opinion (BO) that was issued by NOAA Fisheries in 2016. For the FEMA-designated floodways in the study area—in compliance with Executive Order 11988 for Floodplain Management—a location hydraulic study would be conducted for the Modified LPA and the analysis would be included in the Final SEIS. Based on a preliminary hydraulic assessment, there may be a small net rise to the base flood elevation of the Columbia River and North Portland Harbor. During the final design phase, this preliminary assessment would be confirmed with the hydraulic analysis once design concepts progress to a sufficient level of detail. If the hydraulic analysis shows a resulting rise in the base flood elevation, mitigation would be explored. Mitigation measures could include alternative pier cap shapes to improve hydraulic efficiency and cutting of soils to compensate for reduced flood storage capacity. Currently, the potential areas of cut are anticipated to be entirely within the footprint of the Modified LPA. The results of hydraulic analysis and coordination with the City of Portland would determine whether the needed cut volume would require the acquisition of additional property. If mitigation measures cannot reduce base flood elevation change from the IBR Program to zero net rise, the change would be documented in a floodplain evaluation report and a public notice that would include the reasons for this finding and alternatives considered. Prior to construction, a floodplain permit from the City of Portland would be required. If the Modified LPA results in a net rise of base flood elevations, a Conditional Letter of Map Revision would be required from FEMA prior to issuing the floodplain permit.

No new or expanded roads or facilities are proposed for the Burnt Bridge Creek floodway. A small area within the study area at the Ruby Junction Maintenance Facility is mapped within the 100-year floodplain of Fairview Creek. The new or expanded roads or facilities with the Modified LPA would not encroach upon the Special Flood Hazard Area for Fairview Creek and, therefore, no increase in 100-year flood elevations is expected.

Water Quality

Runoff from transportation facilities is typically associated with a number of pollutants, including suspended sediments, nutrients, PAHs, oils and grease, antifreeze from leaks, cadmium and zinc from mechanical and tire wear, 6PPD-quinone from tire wear and road dust, and copper from wear and tear of brake pads, bearings, metal plating, and engine parts. The Modified LPA includes the extension of light-rail into downtown Vancouver and other transportation systems management and travel demand management measures, which could reduce the number of vehicles, and therefore tires (i.e., the source of 6PPD-quinone), on study area roads compared to the No-Build Alternative. The Modified LPA would have a substantial beneficial effect on water quality because it would include stormwater treatment facilities to remove pollutants in runoff from all roadway surfaces within the project footprint. Methods proposed for mitigation and treatment of runoff are detailed in Section 3.14.6.

All design options would have similar impacts to water quality. The Modified LPA with two auxiliary lanes would have a greater increase in impervious surface and result in slightly increased pollutant loads, as compared to the Modified LPA with one auxiliary lane. The Modified LPA with the single-level movable-span configuration could have the potential for additional pollutants and minor long-term water quality impacts; it is difficult to collect stormwater from the movable portion of the bridge structure when lifting, lifted, and lowering, as well as accidental spills that could flow directly into the waterbody during over-water maintenance of the movable span. No matter which design option is selected, the Modified LPA would include stormwater treatment facilities that would treat runoff from all roadway surfaces within the project footprint.

For various pollutants, Table 3.14-6 shows the levels of reduction predicted under the Modified LPA with one auxiliary lane and double-deck fixed-span configuration compared to the No-Build Alternative. The greatest reduction would be in suspended solids, which would be reduced by approximately 86% compared to the No-Build Alternative.

Table 3.14-6. Contributing Impervious Area and Annual Pollutant Load Estimates for the Modified LPA

Environmental Metric	No-Build Alternative	Modified LPA with One Auxiliary Lane, Double-Deck Fixed-Span
Treated CIA (acres)	0.0	189.7
Infiltrated CIA (acres)	21.2	17.5
Untreated CIA (acres)	156.4	0.0
Total CIA (acres)	177.6	207.2

Environmental Metric	No-Build Alternative	Modified LPA with One Auxiliary Lane, Double-Deck Fixed-Span
Total Suspended Solids (lbs/year)	120,272	16,694
Total copper (lbs/year)	25.0	7.6
Dissolved copper (lbs/year)	6.3	5.7
Total zinc (lbs/year)	153.3	39.8
Dissolved zinc (lbs/year)	48.5	26.6

CIA = contributing impervious area; lbs = pounds

As shown in Table 3.14-4, the Modified LPA with one auxiliary lane and a double-deck fixed-span configuration would increase the CIA within the study area by 29.6 acres to 207.2 acres, as compared to the No-Build Alternative. The Modified LPA with the two auxiliary lanes and double-deck fixed-span configuration would increase the CIA within the study area by 33.5 acres, as compared to the No-Build Alternative, and the Modified LPA with the one auxiliary lane and single-level fixed-span or movable-span configuration would increase CIA by 32.9 acres.

Contributing impervious area (CIA)

For the Modified LPA, the CIA is defined as all new, rebuilt, or replaced impervious surface areas and contiguous existing impervious area that contribute stormwater runoff. The CIA does not include runoff from impervious surface area outside the Modified LPA footprint that flows through outfalls that would not be modified.

Of the total CIA, the Modified LPA would treat stormwater runoff from 189.7 acres and runoff from 17.5 acres would be infiltrated. This accounts for all the stormwater runoff from existing, new, or reconstructed impervious surface area within the project footprint, including runoff from bridges over the Columbia River. While infiltrated areas would not receive treatment, runoff would be naturally filtered through ground percolation before entering receiving waters through groundwater.

As discussed in Section 3.1, Transportation, daily traffic volume models show that the Modified LPA would slightly decrease vehicle miles traveled within the study area. Decreasing vehicle miles traveled would reduce idling and brake pad wear, which may reduce the amount of copper and other traffic-related pollutants currently carried by corridor runoff. The Modified LPA with a fixed-span bridge configuration would further reduce idling and brake pad wear compared to the Modified LPA with a movable-span bridge configuration, where traffic on I-5 would be stopped during a bridge lift.

Routine winter maintenance activities over a larger roadway area could also affect water quality under the Modified LPA. Highway sanding can result in large quantities of gravels and particulates making their way into adjacent waterbodies. Similarly, chemical anti-icing and de-icing agents can result in contaminants making their way into adjacent waterbodies. However, impacts from winter maintenance activities are expected to be minimal because the frequency of use is relatively low (approximately 30 days a year), and runoff from the roadways would be treated to reduce potential pollutant loads from these activities.

Stormwater

As described, the Modified LPA could cause changes in peak flows and runoff volumes in local receiving waters because of the increased CIA in the study area. The amount of flow control (detention or retention) provided, in combination with the stormwater treatment facilities, would be evaluated per regulatory guidance as the Modified LPA design progresses; the updated analysis would be provided in the Final SEIS. As noted in the discussion of hydrology above, the Modified LPA would comply with the stormwater design requirements in place at the time of construction, including requirements that may be updated to reflect climate-induced changes to rainfall patterns.

Within the Columbia Slough and the Columbia River watersheds, Oregon and Washington regulations do not require flow control for stormwater runoff. These large waterbodies are exempt from flow control requirements for direct discharges unless the stormwater conveyance systems carrying the flows have capacity limitations. Therefore, there are no flow control facilities proposed for the Modified LPA in these watersheds.

Within the Burnt Bridge Creek watershed, stormwater flow (volume) control is required by the Washington State Department of Ecology. Runoff from the Modified LPA would continue to discharge to an existing infiltration pond in the Burnt Bridge Creek watershed; overflow from this infiltration pond during extreme runoff events is discharged to Burnt Bridge Creek via a spillway and open channel. Although the Modified LPA design would increase the total CIA within the Burnt Bridge Creek watershed, it would reduce the total impervious surface area draining to this existing infiltration pond through the replacement of other existing water quality facilities with enhanced stormwater treatment. The Modified LPA would thereby reduce the overall volume of stormwater to the infiltration pond, reducing the frequency of discharges to Burnt Bridge Creek during extreme flow events. Therefore, no negative long-term effects on stormwater are likely for this watershed as a result of the Modified LPA.

For the Fairview Creek watershed, the Modified LPA would adhere to the City of Gresham's stormwater management requirements by infiltrating the stormwater. Thus, the Modified LPA would not have long-term effects on stormwater quantity for the watershed.

3.14.4 Temporary Effects

No-Build Alternative

The No-Build Alternative would not result in construction activities and would not have temporary effects on water quality and hydrology.

Modified LPA

The Modified LPA with any of the bridge configuration and bridge type options and with one or two auxiliary lanes and potential levee modifications would have similar temporary effects on hydrology, water quality, and stormwater as described below.

Hydrology

Construction of the Modified LPA, including construction of the new bridges and removal of the existing bridge would place temporary obstructions in the Columbia River and North Portland Harbor. Large temporary structures may be present in these areas for several years to assist with the construction of the Columbia River and North Portland Harbor bridges and the demolition of the existing bridge structures. The Modified LPA would also use cofferdams at some pier complexes to isolate the work area from active flow in the Columbia River and contain waste material and sediments. Given the scale of the Columbia River, its width, volume, and flow rates and the regulation of river flows by upstream dams, the hydraulic effect of these temporary

> **What are cofferdams?**
>
> A cofferdam is a temporary, watertight enclosure used to isolate work areas from surrounding waters. The Modified LPA could require cofferdams to isolate work areas in the Columbia River where new bridge pier foundations are constructed near the shore or where existing piers are removed.

structures is expected to be minor. Construction of the Modified LPA would require a floodplain permit from local jurisdictions and a hydraulic analysis to ensure there are no temporary adverse effects on the Columbia River's hydrologic regime.

Construction of depressed roadway sections (i.e., sections below the surrounding ground level) can have effects on groundwater. Construction below grade and near or beneath the water table may require groundwater pumping for dewatering. Pumping may affect groundwater flows to nearby waterways, as well as groundwater quality and stormwater quantity. However, since pumping would likely occur when the water table and river stages are high (e.g., during winter flows), this is not likely to have a substantial effect on the hydrology of affected waterways.

No temporary effects on the hydrology of Fairview Creek are anticipated for the expansion of the Ruby Junction Maintenance Facility since the required stormwater treatment facilities, which include infiltration for the entire expansion area, would be constructed ahead of and in preparation for construction of the expanded facilities.

Water Quality

Although there are numerous sources of chemical pollutants, there is a low risk that chemicals would actually enter the receiving waters. All reasonable precautions would be taken to avoid and minimize water quality impacts during construction activities including staging, construction of the new bridges, removal of the existing bridge, and modifications to levees. The measures are outlined in Section and would be developed in more detail once site--specific environmental analyses are conducted. The measures would ensure that water quality impacts during construction are minimized through the use of BMPs specified in the temporary erosion and sediment control plans (TESCPs) and spill prevention, control, and countermeasures (SPCC) plans developed for all necessary NPDES permits. Temporary effects on the quality of receiving waters within the study area may still be possible and may include the following:

- Increased turbidity due to ground disturbance around waterways associated with construction or staging.
- Discharge of pollutants to surface waters due to equipment leaks or spills in the vicinity of waterways.
- Groundwater contamination due to upland ground improvement activities including deep soil mixing with cementitious material and/or aggregate.
- Sediment and contaminant migration into groundwater or surface water from equipment pressure or steam cleaning operations following construction periods.
- Discharge of pollutants to surface waters due to the use of fertilizers, pesticides, or herbicides during restoration or revegetation activities.
- Contamination of groundwater due to direct infiltration of toxic contaminants during groundwater pumping from locations of known existing groundwater contamination.
- Infiltration of polluted surface water into groundwater.
- Increased turbidity due to riverbed disturbance during in-water work.
- Release of pollutants due to spills or leaks of cement during pier footing and column construction.
- Construction material or other objects falling into the Columbia River and North Portland Harbor during the construction of the new bridges and demolition of the old bridge.
- Release of existing contaminated sediments due to disturbance of riverbed sediments containing hazardous materials during in-water work. Sampling and analyzing potentially hazardous sediments prior to construction is addressed in the IBR Hazardous Materials Technical Report.

Throughout the study area, construction improvements would disturb the ground, which may expose soil to erosion from wind, rain, and runoff. Waterbodies in the study area could receive sediment-laden runoff by way of stormwater inlets, ditches, or other forms of conveyance, which could result in increased turbidity and excessive sediment deposits. Construction equipment operating on land could release pollutants (e.g., petroleum-based fuel or other fluids) or construction materials that could enter waterbodies by way of stormwater inlets, ditches, or other forms of conveyance.

Dewatering during construction may create a cone of depression and the potential for the movement of contaminated groundwater from nearby hazardous materials sites. A hazardous materials analysis indicated that there are potential high-risk sources of contamination near proposed depressed road sections.

Staging area activities also have the potential to increase stormwater runoff and pollutant loading. Staging areas would meet all applicable permit and stormwater requirements during and following their use. As with all construction activities, impacts to water quality would be minimized through the use of BMPs specified in the TESCPs and SPCC plans developed for all necessary NPDES permits.

Following construction, the use of fertilizers, pesticides, or herbicides during restoration and revegetation activities may affect the water quality of receiving waters. Their use, however, would be minimized, especially near receiving waters. The Modified LPA would adhere to requirements described in ODOT Standard Specifications 01040.00 to 01040.90 and/or WSDOT Standard Specification 8-02 “Roadside Restoration.”

Stormwater

Construction activities related to the Modified LPA would increase stormwater runoff within the study area and create temporary effects related to hydrology and water quality. In general, potential temporary effects could result from increased stormwater runoff due to ground disturbance, increased potential for pollutants in runoff in and around construction and staging sites and equipment, and increased construction-generated stormwater runoff due to groundwater pumping during depressed roadway construction.

The Columbia River and North Portland Harbor would experience an increase in stormwater volumes due to the impervious surfaces of nearby staging areas, barges, temporary work bridges, and other structures related to overwater construction. Temporary construction effects are not anticipated to affect Fairview Creek because stormwater is currently treated or infiltrated on-site at the creek, and this would continue during and after construction. Therefore, additional measures to treat stormwater are not needed. Stormwater conveyed off-site would require prescribed treatment to ensure that runoff was not turbid or contaminated.

3.14.5 Indirect Effects

Population growth and land use development are anticipated to occur under both the Modified LPA and the No-Build Alternative. Development can affect water quality and hydrology by increasing the amount of impervious area (for example, by adding rooftops and parking lots); this, in turn, increases stormwater runoff quantities and pollutant loads, resulting in potential impacts to receiving waters and floodplains. As described in Section 3.4, Land Use and Economic Activity, the Modified LPA is expected to facilitate higher-density development—such as transit-oriented development around light-rail stations—in already urbanized areas, consistent with local land use plans. Concentrating growth can help conserve natural resources from the potentially adverse effects of development on the urban periphery, such as habitat loss and contamination from stormwater runoff. Conversely, the No-Build Alternative, because it would not provide new high-capacity transit, would be less likely to result in dense growth and hence would be less protective of natural resources.

Any new development or redevelopment facilitated by the Modified LPA would have to comply with the relevant laws, regulations, policies, and codes in force at the time. These requirements, which include restrictions on tree removal, stormwater treatment and floodplain regulations, and environmental zone and critical areas protections, would limit negative impacts from development and redevelopment. These regulations require avoidance or minimization of impacts on environmentally sensitive resources, including those that address water quality and hydrology and floodplains. In light of these protections, indirect effects from the Modified LPA and potential future development are expected to be minimal.

3.14.6 Potential Avoidance, Minimization, and Compensatory Mitigation Measures

Long-Term Effects

Regulatory Requirements

- As design progresses, conduct a detailed hydraulic analysis of the affected floodplains. If a rise in the base flood elevation is predicted, assess mitigation through floodplain excavation (cut/fill balance) activities within the footprint of the Modified LPA and determine whether additional land may be required to accomplish the required mitigation. Conduct a location hydraulic study to document the impacts, mitigation measures, evaluation of alternatives, and findings in accordance with the provisions of 23 CFR 650A.
- Work with the City of Portland to ensure flood storage compensation does not jeopardize threatened and endangered species and their habitat (revised Floodplain Development Code Chapter 24.50 Flood Hazard Areas).
- Comply with ODOT and WSDOT stormwater management requirements and the Cities of Portland and Vancouver regulations for the portions of the Modified LPA along City-managed roads during construction and for the long-term treatment of stormwater runoff prior to discharge into receiving waters.
- Select and design water quality BMPs to ensure compliance with all federal, state, and local regulatory requirements, including construction and municipal stormwater permit requirements issued through CWA Section 401, to reduce suspended solids, particulates, and dissolved metals; to reflect the latest climate models; and to treat newly identified pollutants like 6PPD-quinone.
- Construct flow control facilities to infiltrate or reduce the flow rates of all study area runoff, pursuant to local regulatory requirements. Mitigation for increased runoff to the Columbia Slough or the Columbia River would not be required because these water bodies are exempt from stormwater quantity management. However, the effects of increased runoff would be reduced using stormwater infiltration. This would allow groundwater recharge to continue and minimize the increase in runoff volumes and peak discharges.

Program-Specific Mitigation

Hydrology

- Offset potential rise in the base flood elevation through floodplain excavation (cut/fill balance) activities as determined through a location hydraulic study.
- In the Burnt Bridge Creek watershed, construct infiltration facilities to provide complete infiltration of all Program-related runoff, such as providing underground injection control requirements, to the extent practicable, for the wellhead protection zone present in the watershed to manage stormwater volumes. As design progresses, select site-specific BMP facilities.

- Prepare stormwater monitoring plan(s) to evaluate the long-term performance and effectiveness of the updated stormwater conveyance and treatment systems. Based on the findings, complete modifications or enhancements to the system(s) to meet discharge performance criteria.
- Compensate for additional fill in floodplains to achieve a no net loss of floodplain as a result of removal of materials within the City of Portland Floodplain Hazard Areas.

Water Quality

Where applicable in the project area, the following proposed water quality treatment facilities would be used to treat stormwater runoff and mitigate the increase in contributing impervious surfaces. Definitions of these treatment facility types are presented in Section 7.2.2 of the Water Quality and Hydrology Technical Report.

- Treat stormwater runoff through bioretention ponds/planters, biofiltration swales, bioslopes (Oregon), and/or media filter drains (Washington) that provide water quality treatment via infiltration through a phosphorus-free, compost-amended soil medium and/or vegetation. Vegetation also provides uptake of some water.
- Water quality treatment facilities that have demonstrated effectiveness for advanced treatment will be designed according to each jurisdiction's specifications, such as the Washington State Department of Ecology's Technology Assessment Protocol program (Washington), the 2020 Stormwater Management Manual (Portland), and Vancouver's Surface Water Management Program.

Temporary Effects

Regulatory Requirements

Regulatory requirements for temporary effects of stormwater runoff during construction would include compliance with ODOT, WSDOT, Portland, and Vancouver's regulations including the preparation of an SPCC plan and pollution control plan (PCP), and TESCP. In addition, all federal, state, and local permits related to water quality and hydrology would be obtained. See Section 8 in the Water Quality and Hydrology Technical Report for a complete list of required federal, state, and local permits.

Spill Prevention/Pollution Control Measures

- Require the contractor to prepare an SPCC plan and PCP prior to beginning construction. These plans would be provided to the National Oceanic and Atmospheric Administration Marine Fisheries Service (NOAA Fisheries) for review and approval. The SPCC plan and PCP would identify the appropriate spill containment materials, as well as the means and methods of implementation, response, and reporting, in the event of a spill. All elements of the SPCC plan and PCP would be available at the project site at all times. For additional details, consult ODOT Standard Specification 00290.00 to 00290.90 and WSDOT Standard Specification 1-07.15.

Site Erosion/Sediment Control Measures

- Require the contractor to prepare and implement a TESCP to minimize impacts associated with clearing, vegetation removal, grading, filling, compaction, or excavation. The BMPs identified in the TESCP would be used to control sediments in areas impacted by vegetation removal or ground-disturbing activities. Additional temporary control measures may be required beyond those described in the TESCP if it appears pollution or erosion may result from weather, the nature of the materials, or progress on construction. For additional details, consult ODOT Standard Specifications 00280.00 to 00280.90 and WSDOT Temporary Erosion and Sediment Control Manual M3109.02.

- Stabilize all exposed soils as directed in measures prescribed in the TESCP. Hydro-seed all bare soil areas following grading activities and revegetate all temporarily disturbed areas with native vegetation indigenous to the location. For additional details, consult ODOT Standard Specifications 01030.00 to 01030.90 and WSDOT Temporary Erosion and Sediment Control Manual M3109.02.
- Where site conditions support vegetative growth, plant native vegetation indigenous to the location in areas temporarily disturbed by construction activities. Revegetation of construction easements and other areas would occur after the project is completed. Trees would be planted when consistent with highway safety standards. Riparian vegetation would be replanted with species native to geographic region. Planted vegetation would be maintained and monitored to meet regulatory permit requirements. For additional details, consult ODOT Standard Specifications 01040.00 to 01040.90 and WSDOT Temporary Erosion and Sediment Control Manual M3109.02.

Program-Specific Mitigation

Hydrology

- Minimize changes to groundwater hydrology by limiting groundwater pumping to areas where it cannot be avoided.

Water Quality

- Study, test, and remediate sites with existing soil or groundwater contamination near construction areas before any construction. See Section 3.18, Hazardous Materials for specific mitigation actions.
- Conduct in-water work during approved periods for the Columbia River as approved by the Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, NOAA Fisheries, and the U.S. Fish and Wildlife Service. See Section 3.16, Ecosystems, for specific mitigation measures.
- Stage construction equipment used for in-water work activities above the ordinary high-water mark. Only the operational portion of construction equipment would enter the active stream channel (below the ordinary high-water mark).
- If in-water dredging is required outside of a cofferdam, use a clamshell bucket within the established in-water work windows. Dredging, handling, and disposal of dredged materials shall be conducted consistent with the requirements and conditions of the regulatory permits issued for the Modified LPA.
- If required, monitor turbidity and provide a rest period to allow turbidity, if any, to dissipate between in-water work activities.