3.14 Water Quality and Hydrology

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 in a waterway or its floodplain could affect the severity of floods during storm events. For this reason, 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 groundwater resources can be found in Section 3.17, Geology and Groundwater.

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.

3.14.1 Changes or New Information Since 2013

The Columbia River Crossing (CRC) Final EIS and Record of Decision were completed in 2011, with design refinements addressed in NEPA re-evaluations in 2012 and 2013. Since then, the following changes and new information have affected the potential impacts to water quality and hydrology:

- 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 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 to the CRC project's LPA to develop a Modified LPA, including design options.

Table 3.14-1 compares the impacts and benefits of the CRC LPA as identified in the Final EIS (2011) 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 Columbia River Crossing LPA Effects and 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.	Similar as CRC	N/A
Hydrology	Potential to cause long-term hydrologic effects to waterbodies due to an increase in impervious surfaces.	Same/similar as CRC	N/A
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.	Same/similar as CRC	N/A
New and Rebuilt Impervious Surfaces (acres)[a]	267 acres (PGIS)	207.2 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.

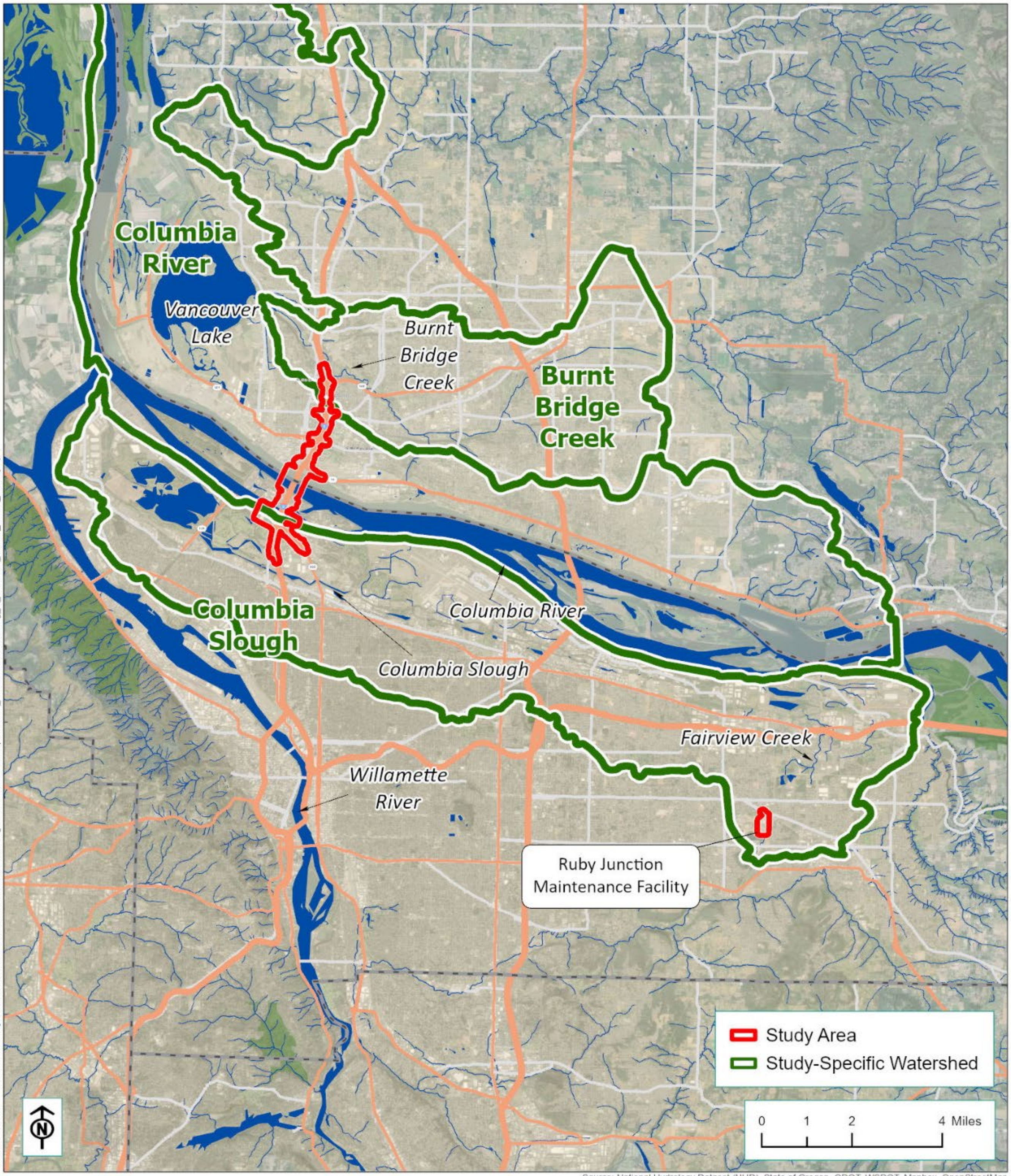
a Terminology and methodology was updated between the CRC project and IBR Program to be consistent with regional stormwater management guidance. CIA encompasses both PGIS and non-PGIS.

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



Source: National Hydrology Dataset (NHD), State of Oregon, ODOT, WSDOT, Mapbox, OpenStreetMap

Hydrology

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. 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.

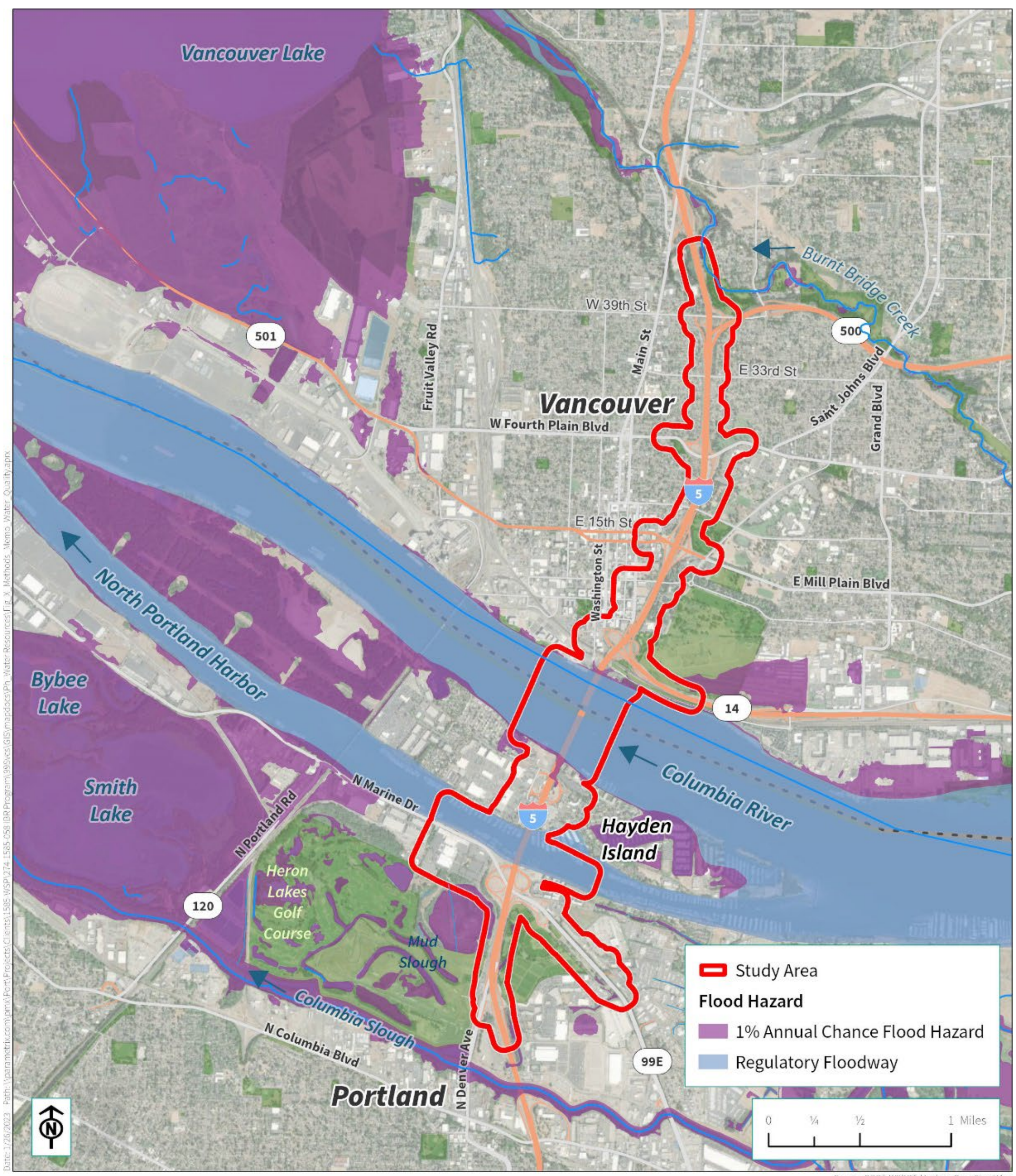
What is a watershed?

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, or even national boundaries.

The study area around the Ruby Junction Maintenance Facility in Gresham, Oregon lies within the 100-year floodplain of Fairview Creek (Figure 3.14-1). 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 3.14-1). 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.

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



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.

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 historic 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 Multnomah County. The slough and areas to its north are now 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.

Columbia River and North Portland Harbor

Within the study area, the Columbia River and North Portland Harbor are a highly managed and constrained 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 historic 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, historic off-channel areas have been filled, rechanneled, diverted, and otherwise developed for urban and agricultural use. The channelization of the watershed has combined with the development of the hydropower system to 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 [DDE 4,4']) • In Washington: • Vinyl chloride	• Dioxin • Total dissolved gas • Temperature
Burnt Bridge Creek	• Eutrophication (dissolved oxygen, pH) • Fecal coliform bacteria • Temperature	• None
Fairview Creek	• Biocriteria	• 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).

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 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 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.

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.

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

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, the No-Build Alternative would not result in long-term impacts to water quality and hydrology because it would not change existing conditions. 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 water quantity and quality standards at the time of construction, reducing the increase of flow from runoff in the Burnt Bridge Creek watershed. 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.

Similarly, the Modified LPA would manage flow control and runoff at the Ruby Junction Maintenance Facility via detention and infiltration. Runoff from some existing impervious surfaces and a few sections of new or modified roadway with the Modified LPA that currently drain to North Portland Harbor would instead be conveyed, treated, and discharged to the Columbia Slough. All other runoff generated by the Modified LPA 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 3.14-4 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, 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 bridge configuration.

Table 3.14-4. Contributing Impervious Area by Modified LPA Configuration (acres)

Modified LPA 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 Bridge Configuration	40.7	51.6	97.4	10.7	6.8	207.2
Modified LPA with Two Auxiliary Lanes and Double-Deck Fixed-Span Bridge Configuration	41.1	52.3	100.2	10.7	6.8	211.1
Modified LPA with Single-Level Bridge 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 bridge configurations would result in the same amount of CIA.

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 bridge, the single-level fixed-span and movable-span bridge configurations would have a greater amount CIA from the wider dimensions of the bridges and interchanges.

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 cause flooding, alterations in peak flows, increased runoff volumes to local receiving waters, and decreased 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 change in flow volume fluctuation, peak flows, and runoff quantities in these waterbodies would be minimal. 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).

For the FEMA-designated floodways in the study area a hydraulic, or no-rise, analysis would be conducted for the Modified LPA during a later design phase when sufficient details are available. The installation of piers within the Columbia River and North Portland Harbor floodways are not expected to result in an increase to a FEMA Special Flood Hazard Area, including the floodway or 100-year floodplain. 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 with two auxiliary lanes would have a greater increase in impervious surface, and result in slightly increased pollutant loads, compared to the Modified LPA with one auxiliary lane. The Modified LPA with single-level movable-span bridges would have the potential for additional pollutants, and minor long-term water quality impacts, associated with the maintenance and operation of the lift span.

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. For various pollutants, Table 3.14-5 shows the levels of reduction predicted under the Modified LPA with one auxiliary lane and double-deck fixed-span bridges 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 3.14-5. 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
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; LPA = Locally Preferred Alternative

> **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.

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

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 (VMT) within the study area. Decreasing VMT would reduce idling and brake pad wear, which may reduce the amount of copper and other traffic-related pollutants currently carried by corridor runoff.

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 particulates making their way into adjacent waterbodies. Similarly, chemical anti-icing and de-icing agents can result in contaminants making their water 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, will be evaluated per regulatory guidance as the Modified LPA design progresses.

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 (Ecology). Runoff from the Modified LPA would continue to discharge to an existing infiltration pond in the Burnt Bridge Creek watershed; overflow from this pond during extreme runoff events is discharged to Burnt Bridge Creek via a spillway and open channel. Although the Modified LPA would increase the total CIA within this watershed, it would reduce the total impervious surface area draining to this facility. The Modified LPA would thereby reduce the overall volume of stormwater to the facility 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 a double-deck bridge or single-level configuration and with one or two auxiliary lanes would have similar temporary effects on hydrology, water quality, and stormwater as described below.

Hydrology

Construction of the Modified LPA 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. The hydrologic effect of these temporary structures is expected to be minor due to the width of the Columbia River and the regulation of river flows by upstream dams. 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.

> **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.

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 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

Temporary effects on the quality of receiving waters within the study area may include the following:

- Turbidity due to ground disturbance around waterways associated with construction or staging.
- Toxic contamination 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.
- Contamination from fertilizers, pesticides, or herbicides used during restoration or revegetation activities.
- Contamination of groundwater due to direct infiltration of toxic contaminants during groundwater pumping.
- Infiltration into groundwater from contaminated surface water.
- Turbidity due to riverbed disturbance during in-water work.
- Contamination due to spill or leak 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 bridges.
- Contamination due to disturbance of hazardous riverbed sediments during in-water work.

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 may release contaminants (e.g., petroleum-based fuel or other fluids) or toxic 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 may increase stormwater runoff and pollutant loading. Staging areas would meet all applicable permit and stormwater requirements during and following their use. When the construction staging sites have been confirmed, site-specific environmental analyses would be conducted to 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.

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 contamination 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. 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 the Modified LPA and the No-Build Alternative. With both alternatives potential impacts to receiving waters could result from land use development changes, with potential positive and adverse effects on water quality and quantity in waterbodies in the study area. However, in compliance with local land use plans, the Modified LPA may encourage higher-density development, such as transit-oriented development around light rail stations, in already urbanized areas. 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.

Development or redevelopment in and near the study area would require compliance with applicable City of Portland and City of Vancouver land use codes, including existing stormwater treatment regulations. Development and redevelopment would comply with the relevant laws, regulations, policies, and codes in force at the time. Regulatory approvals would be required for activities ranging from tree removal to stormwater treatment, environmental zone and critical areas protections. Local and state land use requirements 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. In light of these protections, indirect effects from the Modified LPA and potential future development is expected to be negligible.

3.14.6 Potential Avoidance, Minimization, and Mitigation Measures

Long-Term Effects

Regulatory Requirements

- As design progresses, complete a flood no-rise hydraulic analysis to determine the potential long-term impact of a rise in the flood elevation, per the regulatory requirement. If a rise in the base flood is predicted, the rise would be mitigated through floodplain excavation (cut/fill balance) activities.
- 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, to treat stormwater runoff prior to discharge into receiving waters.
- Select and design water quality BMPs to follow each jurisdiction’s requirements for reducing suspended solids, particulates, and dissolved metals and reflect latest climate models and treatment for new 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 they 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.

Project-Specific Mitigation

Hydrology

- Offset potential rise in the base flood elevation through floodplain excavation (cut/fill balance) activities as determined through a flood no-rise hydraulic analysis.
- 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.

Water Quality

Where applicable in the project area the following proposed water quality treatment facilities would be used to treat stormwater runoff and mitigate for the addition of contributing impervious surfaces.

- Bioretention ponds/planters would provide water quality treatment via infiltration through a phosphorus-free, compost-amended soil medium. Vegetation in bioretention ponds provides uptake of some water. Runoff can infiltrate through the soil to groundwater when subsurface soils are suitable and/or can be collected in an underdrain for delayed downstream conveyance.
- Biofiltration swales would provide water quality treatment via filtration through vegetation planted along the facility length. Swales are not intended to provide infiltration to groundwater.
- In Washington, vegetated filter strips provide water quality treatment via filtration of runoff through plantings, typically along the sides of roads and sheet flow from the road surface. The facilities may be designed with a phosphorus-free, compost-amended soil that reduces the facility size. Vegetated filter strips are likely not feasible in the Oregon portion of the study area due to width requirements.
- Bioslopes (Oregon), or media filter drains (Washington), would provide treatment of sheet flow from the adjacent impervious surfaces via filtration through a narrow section of grass vegetation and infiltration through a media mixture. Bioslopes/media filter drains can provide water quality treatment for areas that otherwise have limited space for other types of treatment options.
- Proprietary facilities that have demonstrated effectiveness for enhanced treatment, as determined by Ecology's Technology Assessment Protocol program will be available for water quality treatment in Washington. Due to high maintenance costs, such facilities are generally not recommended by ODOT or the City of Portland. Engineered wetlands are not preferred by WSDOT, but they are accepted for use by the City of Vancouver.

Temporary Effects

Regulatory Requirements

The regulatory requirements for temporary effects would be the same as those listed for long-term effects with the addition of an SPCC plan and pollution control plan (PCP), and temporary erosion and sediment control.

Spill Prevention/Pollution Control Measures

- Contractor 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. 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.
- Contractor designate at least one employee as the erosion and spill control (ESC) lead. The ESC lead would be responsible for the implementation of the SPCC plan and PCP.

- Maintain applicable spill response equipment and material designated in the SPCC plan and PCP at the job site.
- With the exception of barges and stationary large equipment (cranes, oscillators) operating from barges or work platforms, fuel and maintain equipment at least 150 feet from the ordinary high water mark (OHWM) of any waterbody using secondary containment to minimize potential for spills or leaks entering the waterway.
- Clean and inspect all equipment to be used for construction activities prior to arriving at the project site to ensure that no potentially hazardous materials are exposed, no leaks are present, the equipment is free of noxious weeds, and the equipment is functioning properly. Daily inspection and cleanup procedures would be identified.
- Should a leak be detected on heavy equipment used for construction, immediately remove the equipment from the area and do not use again until adequately repaired. When off-site repair is not practicable, the SPCC plan and PCP would document measures to implement to (1) prevent and/or contain accidental spills in the work/repair area, (2) ensure that no contaminants escape containment to surface waters, and (3) prevent a violation of applicable water quality standards.
- Operate construction equipment from on top of floating barges, from the decks of temporary work bridges and platforms, the decks of the existing or replacement bridges, or from portions of the streambank above the OHWM. Barges and support vessels would be operated in the water.
- Provide suitable containment measures for all equipment (including barges, work decks, stationary power equipment, and storage facilities) in the SPCC plan and PCP to prevent and/or contain accidental spills to ensure no contaminants escape containment to surface waters and cause a violation of applicable water-quality standards.
- Design and install temporary work bridges and platforms, cofferdams, and drilled shaft isolation casings consistent with the ODOT Hydraulics Manual, which establishes criteria to avoid these structures being overtopped during high water events.
- Process water generated on site from construction, demolition or washing activities would be contained and treated to meet applicable water-quality standards before entering or re-entering surface waters.
- Do not conduct paving, chip sealing, or stripe painting activities during periods of rain or wet weather.
- In the SPCC plan and PCP, establish a concrete truck chute cleanout area to properly contain wet concrete as part of ODOT Standard Specification 00290.30(a).

Site Erosion/Sediment Control Measures

- Contractor 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 from all 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, nature of the materials or progress on the work. For additional details, consult ODOT Standard Specifications 00280.00 to 00280.90.
- As part of the TESCP, delineate clearing limits with orange barrier fencing wherever clearing is proposed in or adjacent to a stream/wetland or its buffer and install perimeter protection/silt fence as needed to protect surface waters and other critical areas. Location would be specified in the field, based upon site conditions and the TESCP. For additional silt fence detail, consult ODOT Standard Specification 00280.16(c).

- Contractor designate at least one employee as the erosion and spill control (ESC) lead. The ESC lead would be responsible for the implementation of the SPCC plan and PCP, and would also be responsible for ensuring compliance with all local, state, and federal erosion and sediment control requirements.
- All TESCP measures would be inspected and maintained as required by applicable permit requirements. Contractor would also conduct maintenance and repair of TESCP measures as described in ODOT Standard Specifications 00280.60 to 00280.70.
- For landward construction and demolition, locate project staging and material storage areas a minimum of 150 feet from surface waters, in currently developed areas such as parking lots or managed fields, unless a site visit by an ODOT/WSDOT biologist determines (and an ODOT/NOAA Fisheries liaison confirms) that the topographic features or other site characteristics allow for site use closer to the edge of surface waters.
- Complete excavation activities under dry or dewatered conditions where practicable. All surface water flowing toward the excavation would be diverted through utilization of cofferdams and/or berms. Cofferdams and berms must be constructed of sandbags, clean rock, steel sheeting, or other non-erodible material.
- Limit bank shaping to the extent as shown on the approved grading plans. Minor adjustments made in the field would occur only after engineer's review and approval.
- Install bio-degradable erosion control blankets on areas of ground-disturbing activities on steep slopes (1V:3H or steeper) that are susceptible to erosion and within 150 feet of surface waters. Areas of ground-disturbing activities that do not fit the above criteria would implement erosion control measures as identified in the approved TESCP. For additional erosion control blanket detail, consult ODOT Standard Specification 00280.14I.
- Cover erodible materials (material capable of being displaced and transported by rain, wind or surface water runoff) temporarily stored or stockpiled for use in project activities to prevent sediments from being washed from the storage area to surface waters. Temporary storage or stockpiles must follow measures as described in ODOT Standard Specification 00280.42.
- Stabilize all exposed soils as directed in measures prescribed in the ESCP. 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.
- 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.

Project-Specific Mitigation

Hydrology

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

Water Quality

- Contractor would prepare a TESCP and implement a Source Control Plan for clearing, vegetation removal, grading, ditching, filling, embankment compaction, or excavation.
- 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 WDFW, ODFW, NOAA Fisheries, and U.S. Fish and Wildlife Service. See Section 3.16, Ecosystems for specific mitigation measures.
- Contractor prepare a water quality sampling plan for conducting water quality monitoring for in-water work. This plan would identify a sampling methodology, as well as method of implementation.
- Stage construction equipment used for in-water work activities above the OHWM. Only the operational portion of construction equipment would enter the active stream channel (below the OHWM).
- Contain and treat process water generated on site from construction, demolition, or washing activities to meet applicable water quality standards before entering or re-entering surface waters.
- If in-water dredging is required outside of a cofferdam, use a clamshell bucket. 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.
- A mandatory "rest" period to allow turbidity to dissipate between dredging periods may be required.