3.12.5.3 Columbia River North Watershed

The total PGIS in this watershed will be increased by approximately 13 acres, most of which may be attributed to the reconfigured interchanges and increased number and length of merge lanes for I-5. The project will create approximately 92 acres of new and rebuilt PGIS while reducing existing PGIS by about 79 acres. Approximately 21 acres of existing PGIS, mostly on I-5, will be resurfaced. Water quality facilities, shown on Figure 3-35 and Figure 3-36, are proposed for approximately 88 acres of new and replaced PGIS and about 19 acres of resurfaced and existing PGIS. In contrast, runoff from less than 3 acres of PGIS is currently treated. In addition, water quality facilities will be provided for approximately 17 acres of existing PGIS outside the project footprint. This includes: 1) streets outside the project footprint from which runoff will drain to water quality facilities proposed for the LRT guideway and at the Fourth Plain interchange; and 2) a portion of Fourth Plain Boulevard east of I-5 proposed as an "equivalent" area (see Water Quality Facility CR-M).

Flow control is not required for this watershed and none is proposed. In addition, no new outfalls are proposed.

Both the SR 14 and Mill Plain interchanges will be reconstructed and their footprints will be very different from what currently exists. From the SR 14 north, I-5 will be widened to accommodate additional merge lanes, and existing pavement will be replaced or resurfaced. Reconstructing the two interchanges, combined with the extent of pavement reconstruction between the SR 14 and Fourth Plain interchanges, provides an opportunity to install new conveyance systems. These new systems will allow runoff from I-5 to be separated from runoff from the urban areas to the west. Water quality facilities will be provided at the SR 14 and Mill Plain interchanges to handle runoff from the new, replaced, and resurfaced PGIS from Fourth Plain Boulevard south. The existing stormwater conveyance system under this portion of I-5 will continue to handle runoff from the urban areas to the west. North of the Fourth Plain interchange, the existing conveyance system is shallow enough to allow retrofitting with water quality facilities at the Fourth Plain interchange. Any discharge from water quality facilities will be released to the stormwater system that currently serves I-5.

The LRT guideway will be located on city streets, and existing grades will be generally maintained. Unlike in the Columbia Slough and Columbia River South Watersheds, the proposed LRT track will be located for the most part on Vancouver city streets. With the exception of the above-grade guideway between 6th Street and the new southbound Columbia River bridge, the LRT track could be subject to use by buses and would not be considered non-polluting. This is a conservative determination, one that could change should buses be excluded from the guideway. Although the above-grade guideway would be considered non-polluting, proposed grades are such that sand might be applied to the tracks to aid traction. Similar to the transit bridge across North Portland Harbor, a manhole sediment trap or other sediment reducting BMP will be provided in the stormwater conveyance system at the north end of the structure.

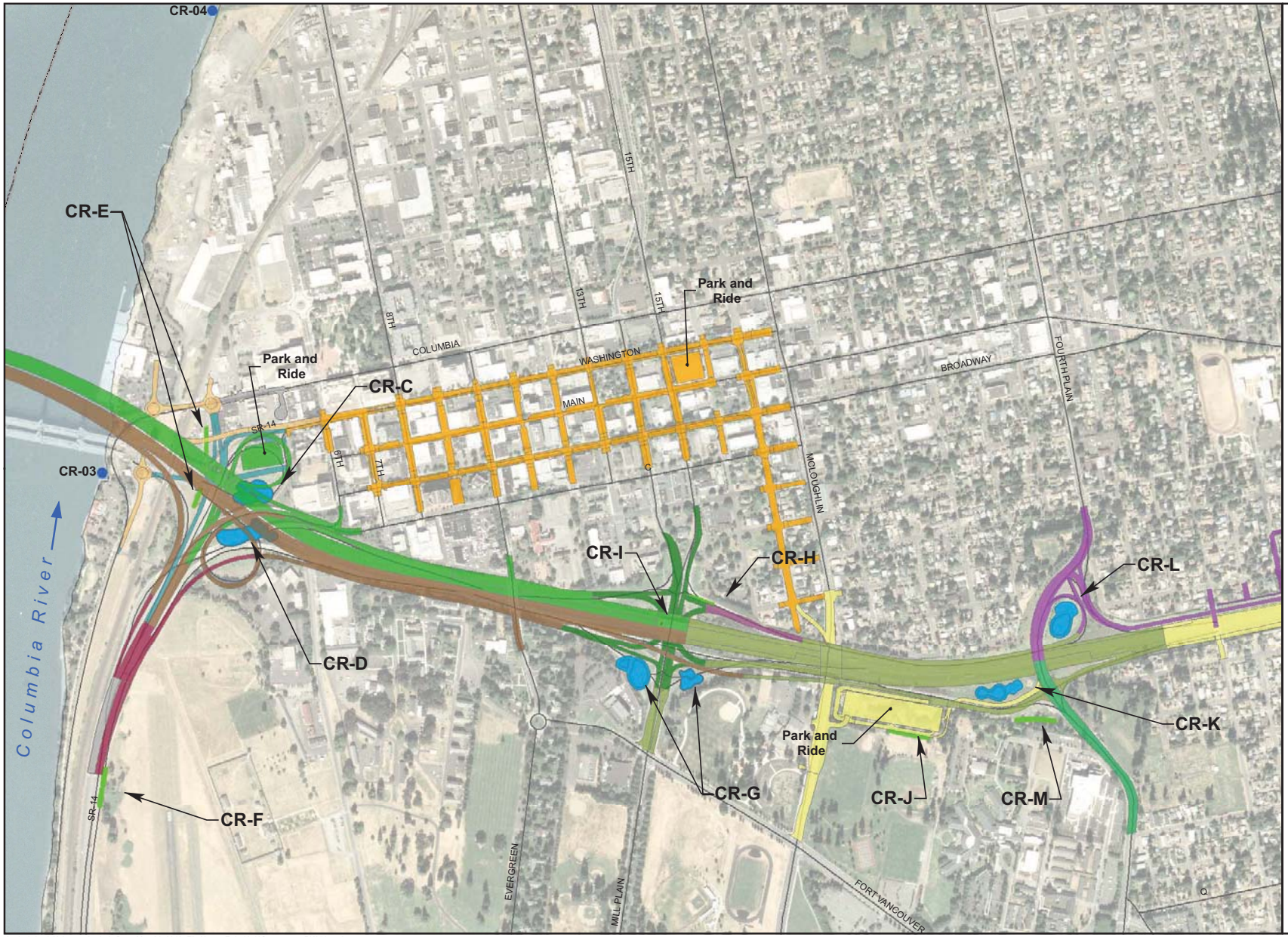


Figure 3-35.
Proposed Water Management Facilities - Washington State (1 of 2)

Areas Draining to Water Quality Facilities

- CR-C
- CR-D
- CR-E
- CR-F
- CR-G
- CR-H
- CR-I
- CR-J & CR-M
- CR-K
- CR-L
- Exclusive Guideway
- Transit Treatment Facilities
- Not Treated

Stormwater Facility Type

- Constructed Wetland
- Bioretention Pond
- Biofiltration Swale
- Proprietary Cartridge Vault
- Outfalls

W N S E

0 200 400 600 800 1,000
Feet

Columbia River CROSSING

Analysis by J. Koloszar; Analysis Date: Mar. 31, 2010; File Name: Ex3_13-10Stormwater_RK251.mxd

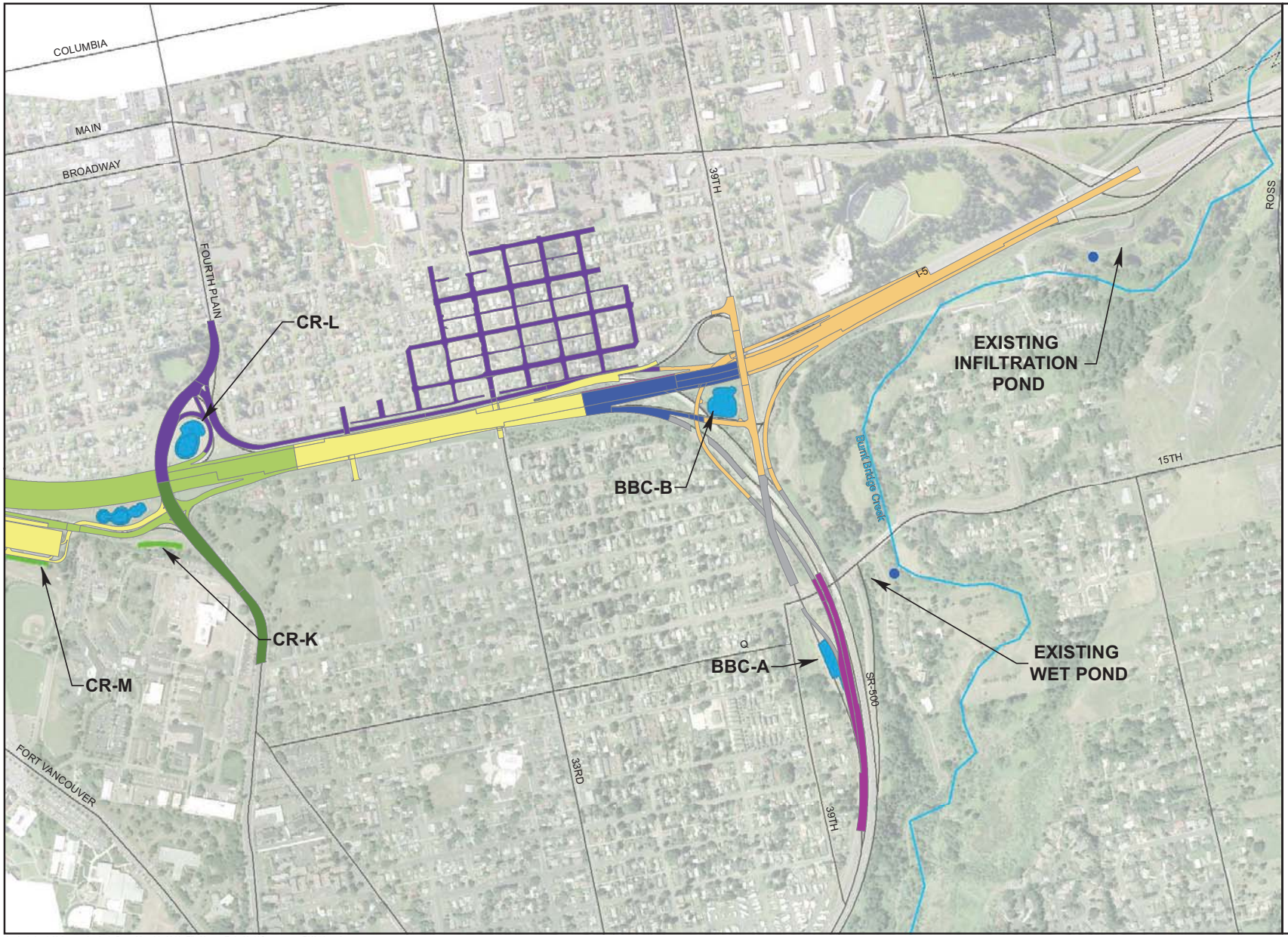


Figure 3-36.
Proposed Water Management Facilities - Washington State (2 of 2)

Analysis by J. Koloszar; Analysis Date: Mar. 31, 2010; File Name: Ex3_13-11Stormwater_RK251.mxd

As described in Section 3.12.1, soils in this area comprise the Wind River and Lauren Group. These soils belong to Hydrologic Group B and are considered suitable for infiltration. For this reason, the primary BMP proposed for water quality facilities in this watershed is a biofiltration pond. Bypasses will be provided to convey discharges in excess of the water quality design flow around each pond. Boreholes, to be drilled as the project design advances, will provide site-specific information on soil properties, infiltration rates, and depths to groundwater table (including seasonal variations and effect of river levels).

Table 3-27 summarizes project changes to PGIS and the areas from which runoff will be treated. The table includes areas of PGIS primarily in that are not within the project footprint but runoff from which would drain to proposed water quality facilities. Runoff from these areas is not currently treated. The paragraphs that follow describe the water quality facilities and the PGIS that will be treated by each. Any discharge from these facilities will be released to existing stormwater conveyance systems, the same systems that currently serve those areas. Flow control is not required or provided for runoff discharged to the Columbia River, and no new outfalls are proposed.

Table 3-27. Summary of Changes in PGIS – Columbia River North Watershed

	Area (acres)			
	Infiltrated	**Treated**	**Untreated**	**Total**
Existing PGIS	2.8	0.0	97.4	**100.2**
Post-Project PGIS				
Existing PGIS retained as-is	0.0	0.0	0.0	**0.0**
Existing PGIS resurfaced	13.1	5.6	2.6	**21.3**
Net change in existing PGIS	10.3	5.6	(94.8)	**(78.9)**
New and rebuilt PGIS	58.5	29.9	3.1	**91.5**
Net change in total PGIS	68.8	35.5	(91.7)	**12.6**
Existing PGIS not within footprint[a]	**9.0**	**8.3**	**0.0**	**17.3**

a These are areas from which runoff will drain to proposed water quality facilities or "equivalent" areas to compensate for new or rebuilt PGIS from which it may not be feasible to treat runoff.

The following sections describe individual proposed water quality facilities and the areas they serve. Since this watershed represents approximately 50 percent of the total project footprint, the water quality facilities proposed for the highway elements are grouped by interchange.

SR 14 Interchange

Runoff from PGIS at the SR 14 interchange, I-5 mainline, and CD roads between the SR 14 and Mill Plain interchanges, Evergreen Boulevard bridge over I-5, and park and ride structure at the SR 14 interchange will be conveyed to water quality facilities located within the SR 14 interchange footprint **(**Figure 3-35**)**. An oil-water separator will be provided to pretreat runoff from the parking structure.

Water Quality Facility CR-C

A bioretention pond is proposed west of I-5, between the highway and Main Street extension, to treat runoff from about 18.7 acres of PGIS comprising southbound I-5 (including 1.8 acres of

resurfaced pavement), ramps on the west side of the interchange, the SR 14 park and ride, and the west side of the Evergreen Boulevard bridge over I-5. Any overflow will be discharged to an existing stormwater conveyance system, the 60-inch diameter stormwater trunk currently serving I-5.

Water Quality Facility CR-D

Runoff from approximately 18.5 acres of northbound I-5 (including 2.0 acres of resurfaced pavement), ramps on the east side of the interchange, and east side of the Evergreen Boulevard bridge over I-5 will be conveyed to an bioretention pond located inside the loop ramp from northbound I-5 to C Street. Any overflow will be discharged to the existing 60-inch diameter stormwater trunk serving I-5.

Water Quality Facility CR-E

Two biofiltration swales are proposed adjacent to the intersection of Main Street and SR 14 to treat runoff from about 2.6 acres of new PGIS on SR 14 and Main Street. Outflow will be discharged to the Columbia River via one of the existing conveyance pipes in the vicinity.

Water Quality Facility CR-F

Runoff from approximately 3.0 acres of new and rebuilt pavement and from about 0.9 acres of resurfaced westbound lanes will be conveyed to a biofiltration swale located north of the highway. Flows from the swale will be discharged to the Columbia River (outfall CR-03) via an existing 6-foot-square culvert under I-5 and the BNSF railroad track. Runoff from the resurfaced eastbound lanes will be shed to the shoulder where it will be infiltrated, similar to what currently occurs.

Local Street Improvements

Continuous inflow biofiltration swales will be constructed on either side of approximately 1.6 acres of new streets. Based on the current layouts, runoff from approximately 0.8 acre of new construction on Columbia Street north of 4th Street will not be treated.

Mill Plain Interchange

Runoff from new ramps at this interchange, Mill Plain Boulevard, and the highway and CD road to the north will be conveyed to the following water quality facilities located within the interchange footprint. Overflows or outflows from these facilities will be discharged to the Columbia River (outfall CR-03) via the existing stormwater system serving I-5 (Figure 3-35).

Water Quality Facility CR-G

Two bioretention ponds are proposed on the east side of I-5. They will treat runoff from approximately 19.9 acres of PGIS comprising new ramps; new, replaced, and resurfaced highway; the new CD road to the north; and Mill Plain Boulevard. The area includes about 3.9 acres of resurfaced highway.

As design work progresses, the project team will evaluate options for diverting runoff into one of the proposed ponds from about 2.3 acres of PGIS served by an existing stormwater conveyance

system on Mill Plain Boulevard east of the project footprint. The existing drainage system discharges into the WSDOT stormwater trunk under I-5.

Water Quality Facility CR-H

Runoff from approximately 0.8 acre of the ramp from southbound I-5 to Mill Plain Boulevard will be directed to a biofiltration swale west of the ramp. Outflows from the swale will be discharged to the existing stormwater conveyance system under I-5.

Water Quality Facility CR-I

Grades are such that it would be difficult to convey runoff from about 5.3 acres of Mill Plain Boulevard in the immediate vicinity of the interchange to the bioretention ponds described under CR-F. Instead, it is proposed that this runoff be conveyed to proprietary cartridge filters. Based on available data, there appears to be adequate vertical separation between the low point on Mill Plain Boulevard and invert of the existing stormwater conveyance system under I-5 to install this type of facility and permit gravity discharge to that system. If necessary, an oil-water separator pretreatment facility would be provided to pretreat flows to the cartridge filters.

Fourth Plain Interchange

The Fourth Plain interchange will be replaced, access will be provided from Fourth Plain Boulevard to the proposed Clark College park and ride structure, and existing pavement will be resurfaced between the Fourth Plain and SR 500 interchanges (Figure 3-36**)**. The existing stormwater conveyance systems north of Fourth Plain would be retained by the project. Available data indicate that the main stormwater pipe under I-5 is shallow enough to permit flows to be redirected to water quality facilities located in the interchange.

Water Quality Facility CR-J

Drainage from the top surface of the Clark College park and ride (about 2.9 acres) will be conveyed to an oil-water separator and biofiltration swale located on the east side of the structure. An oil-water separator will be provided to pretreat the runoff.

Water Quality Facility CR-K

A bioretention pond is proposed southeast of the Fourth Plain interchange to handle runoff from about 10.9 acres of PGIS (including 5.6 acres of resurfaced highway) comprising I-5 mainline and access road to the Clark College park and ride.

Water Quality Facility CR-L

Runoff from approximately 3.6 acres of new and replaced pavement on Fourth Plain Boulevard and interchange ramps and tunnel northwest of the interchange, as well as runoff from about 9.0 acres of existing streets in the Shumway neighborhood to the north, will be conveyed to a bioretention pond located within the west interchange footprint.

It may be difficult to treat runoff from approximately 0.7 acre of rebuilt pavement on Fourth Plain west of the interchange. An “equivalent” area of PGIS will be treated in Water Quality Facility CR-M.

Water Quality Facility CR-M

A biofiltration swale is proposed in an existing drainage channel south of Fourth Plain Boulevard and east of the CD road. It will treat runoff from approximately 1.7 acres of new and rebuilt PGIS east of I-5 and about 0.8 acre of existing PGIS on Fourth Plain to compensate for the area west of the interchange that the project may not be able to convey to Water Quality Facility CR-L. Outflow from the biofiltration swales and any overflow from the bioretention ponds will be released to the Columbia River via the existing stormwater conveyance system under I-5.

LRT Guideway

The proposed approach to constructing the LRT guideway along Vancouver city streets is to excavate a slot within the existing pavement to facilitate single-track guideway construction. For single-track guideways, it was assumed that the remaining pavement will be resurfaced within each block. For double-track guideways, it is assumed that the entire street will need to be replaced. The pavement at intersections will need to be completely rebuilt, whether it is a single- or double-track guideway.

Runoff from about 12.0 acres of new guideway and replaced PGIS, the Mill Plain park and ride structure, and approximately 4.7 acres of resurfaced PGIS, will be directed to new catch basins located at replaced intersections along the at-grade guideway. With the exception of a portion of Washington Street between 10th Street and McLoughlin Boulevard, available data indicate that there is adequate vertical separation between existing grades and stormwater pipe inverts to install proprietary water quality systems such as cartridge filters. The new catchbasins will also intercept runoff from about 7.5 acres of existing street surface that slope towards the intersection but will not have any project-related improvements. Treating runoff from these streets would be considered a stormwater credit for the project. Based on available data, drainage to the sag curve on McLoughlin Boulevard under I-5 will need to be pumped to the existing WSDOT stormwater system under I-5.

The project area on Washington Street between 10th Street and McLoughlin Boulevard to the Columbia River drains to the Columbia River via outfall CR-04, located approximately 3,300 feet downstream from the existing I-5 bridges. Based on data provided by the City of Vancouver, there may not be adequate vertical separation between road and existing stormwater pipe inverts to permit the installation of proprietary filter cartridges. It is proposed that runoff from the guideway and roadway surface be discharged to the existing stormwater conveyance system untreated. Drainage from the top floor of the Mill Plain park and ride structure (about 1.0 acre) will be discharged to the adjacent City of Vancouver stormwater system via an oil-water separator and proprietary water quality facility. The 7.5 acres of existing street surfaces from which runoff will be treated (see the preceding paragraph) will more than compensate for the lack of treatment of 1.6 acres of new and rebuilt PGIS along this part of Washington Street.

The areas listed in Table 3-27 assume that buses will use the at-grade LRT guideway. Should buses vehicles be excluded, the area of new PGIS will decrease by about 3 acres.

It should be noted that the data provided by the City of Vancouver was provided on an as-is basis and will need to be verified by survey as design work progresses.

3.12.5.4 Burnt Bridge Creek Watershed

Project-related construction in the Burnt Bridge Creek watershed comprises the partial reconstruction of the SR 500 interchange to provide full connectivity between SR 500 and I-5 and associated improvements to both highways. The project will increase the total PGIS in the watershed by about 3 acre and will create approximately 9 acres of replaced and new PGIS, as shown on Table 3-28. About 10 acres of existing PGIS will be resurfaced. The table also includes areas of PGIS primarily in that area not within the project footprint but runoff from which would drain to proposed water quality facilities. Runoff from these areas is not currently treated. Unlike the other watersheds, runoff to Burnt Bridge Creek must be reduced to predevelopment (forested) conditions for peak discharges between 50 percent of the 2- and 50-year event.

An existing infiltration pond at the Main Street interchange will not be modified by the project. Rather, the project will significantly reduce the total PGIS draining to this facility, which includes approximately 5 acres of new and rebuilt PGIS, by about 4 acres. The infiltration pond was constructed as part of the I-5: Burnt Bridge Creek to NE 78th Street project, which was completed in 2003. Overflows from this pond during extreme runoff events are discharged to Burnt Bridge Creek via a spillway and open channel.

Table 3-28. Summary of Changes in PGIS – Burnt Bridge Creek Watershed

	Area (acres)			
	Infiltrated	**Treated**	**Untreated**	**Total**
Existing PGIS	14.5	0.0	1.7	16.2
Post-Project PGIS				
Existing PGIS retained as-is	0.0	0.0	0.0	0.0
Existing PGIS resurfaced	9.0	0.0	1.2	10.2
Net change in existing PGIS	(5.5)	0.0	(0.5)	(6.0)
New and rebuilt PGIS	7.8	0.0	1.3	9.1
Net change in total PGIS	2.3	0.0	(0.8)	3.1
Existing PGIS not within footprint[a]	**1.9**	**0.0**	**0.0**	**1.9**

a These are areas from which runoff will drain to proposed water quality facilities or "equivalent" areas to compensate for new or rebuilt PGIS from which it may not be feasible to treat runoff.

The following paragraphs describe the new water quality facilities proposed for this watershed and the areas it serves. Figure 3-36 shows the facilities and contributing drainage area.

Water Quality Facility BBC-A

To meet flow control and water quality treatment requirements, runoff from approximately 0.9 acre of new and about 1.9 acres of "equivalent" existing PGIS on SR 500 will be conveyed to a bioretention pond adjacent to the new ramp from 39th Street to eastbound SR 500. The "equivalent" existing PGIS currently drains to the existing wet pond east of 15th Avenue and north of SR 500 (outside the project footprint). The latter "equivalent" area is required to compensate for the approximately 1.3 acres of new PGIS which cannot be treated.

Data from boreholes in the vicinity of 15th Avenue and 39th Street indicate an infiltration rate of 1 inch/hour may be readily achieved and preliminary sizing indicates that inflows up to the

1 in 100 year event can be infiltrated. Regardless, an overflow will be provided to convey excess runoff to Burnt Bridge Creek via the existing wet pond located to the north and ultimately to Burnt Bridge Creek via an existing outfall (BBC-01).

Water Quality Facility BBC-B

Topography in the vicinity of the existing infiltration pond at the Main Street interchange will preclude expanding this facility to accommodate additional runoff from the CRC project. Instead, a new bioretention pond, BBC-B, will be constructed immediately east of I-5 at the SR 500 interchange. This effectively reduces the area draining to the Main Street interchange facility by approximately 3 acres even accounting for new PGIS. Runoff from about 1.3 acres of new and 2.3 acres of overlay PGIS on I-5 south of 39th Street will be redirected to the new pond.

Again, data from boreholes in the vicinity of 15th Avenue and 39th Street indicate an infiltration rate of 1 inch/hour may be readily achieved, and preliminary sizing indicates that inflows up to the 1 in 100 year event can be infiltrated. An overflow will be provided to convey excess runoff to Burnt Bridge Creek via the existing infiltration pond located at the Main Street interchange to the north, and ultimately to Burnt Bridge Creek via outfall BBC-02.

3.12.5.5 Project Summary

Table 3-29 presents an overall summary of the project changes to PGIS and the areas from which runoff will be treated or infiltrated. The table includes areas of PGIS that are not within the project footprint but runoff from which will drain to proposed water quality facilities. Runoff from these areas is not currently treated. The project area currently provides treatment or infiltration for 25 acres of PGIS. The completed project will add 18 acres of net new PGIS, and will provide treatment for all of the new PGIS and for 168 acres of existing untreated PGIS. This scenario represents additional treatment of more than 10 times the net new PGIS area.

As noted in the prior subsections, the areas do not include staging areas outside the project footprint or casting yards that might be required for fabricating bridge elements. All new impervious surfaces at the Ruby Junction Maintenance Facility expansion area are being infiltrated, with no runoff to Fairview Creek.

Table 3-29. Summary of Changes in Total PGIS

	Area (acres)			
	Infiltrated	**Treated**	**Untreated**	**Total**
Existing PGIS	20	0	197	217
Post-Project PGIS				
Existing PGIS retained as-is	0	4	0	4
Existing PGIS resurfaced	22	12	9	43
Net change in existing PGIS	2	16	(188)	(170)
New and rebuilt PGIS	67	116	8	191
Net change in total PGIS	69	132	(180)	21
Existing PGIS not within footprint[a]	**11**	**8**	**0**	**19**

a These are areas from which runoff will drain to proposed water quality facilities or "equivalent" areas to compensate for new or rebuilt PGIS from which it may not be feasible to treat runoff.

The CIA, which encompasses both PGIS and non-PGIS, includes new and rebuilt impervious surfaces within the project footprint and existing impervious areas outside the project footprint that drain to the project footprint via direct flow or discrete conveyance. The CIA does not include those impervious areas that are outside the project footprint and that flow through the project, but whose conveyance or outfalls will not be modified by the project.

The total CIA for the project is estimated to be 291 acres and comprises:

- Approximately 191 acres of new and rebuilt PGIS created by the project within the project footprint. Runoff from about 183 acres will be treated or infiltrated as shown in Table 3-29.
- About 42 acres of existing PGIS within the project footprint will be resurfaced. Runoff from approximately 34 acres will be treated or infiltrated as shown in Table 3-29.
- Runoff from approximately 4 acres comprising the existing North Portland Harbor Bridge will be directed to new water quality facilities at the adjacent interchanges.
- Runoff from about 21 acres of existing PGIS mainly in downtown Vancouver will contribute runoff to the project from outside the footprint primarily via gutter flow. Runoff from about 19 acres will be treated or infiltrated as shown in Table 3-29. The project may be able to treat runoff from an additional 2 acres on Mill Plain Boulevard east of I-5 as described in Section 3.12.5.3.
- About 28 acres of new non-PGIS exclusive LRT guideway, bike/ped paths, and sidewalks will be created within the project footprint and approximately 4 acres of existing non-PGIS outside the project footprint will contribute runoff to the project primarily via gutter flow. Runoff from about 22 acres of bike/ped paths and sidewalks will be treated, either because it will commingle with street runoff or be shed to adjacent vegetated areas. Over 60 percent of the non-PGIS area from which runoff would not be treated comprise the elevated LRT guideway and adjacent bike/ped facilities. While not included in the areas receiving water quality treatment, runoff from the steep grades at the south and north ends of the elevated LRT guideway may be routed through sediment traps if operational considerations indicate that sand will need to be applied to the tracks to aid in traction.

Table 3-30 compares estimated average peak monthly runoff from the three watersheds with average flows in the three receiving waterbodies: Columbia Slough, Columbia River, and Burnt Bridge Creek. Peak runoff is for the areas of resurfaced, new, and rebuilt PGIS within the project footprint for each watershed, and is based on the average 24-hour precipitation measured at PDX. Peak runoff rates were determined using a single-event rainfall-runoff model. The average discharge in each receiving waterbody is from available USGS data as described in Section 3.12.1. The comparison is conservative, since the table compares peak with average flow rates. This is especially true for the Columbia Slough watershed, where peak runoff from the project will be significantly attenuated as it flows through the surface water drainage systems and then pump operation before discharging to the Columbia Slough.

Table 3-30. Comparison of Project Runoff with Receiving Waterbody Discharge

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Columbia Slough												
Ave. Peak Project Runoff, Q_P cfs	1.4	1.0	0.8	0.4	0.4	0.4	0.2	0.5	0.8	1.0	1.6	1.8
Ave. Discharge in Waterbody, Q_R cfs	162	151	135	85	29	65	79	94	63	96	112	123
Ratio of Q_R to Q_P	120	150	180	220	70	170	400	200	80	90	70	70
Columbia River South												
Ave. Peak Project Runoff, Q_P cfs	1.0	0.7	0.6	0.3	0.3	0.3	0.1	0.3	0.6	0.7	1.1	1.3
Ave. Discharge in Waterbody, Q_R cfs	156,000	163,000	170,000	204,000	286,000	415,000	291,000	153,000	117,000	116,000	122,000	138,000
Ratio of Q_R to Q_P	160,000	220,000	310,000	730,000	1,000,000	1,500,000	2,100,000	460,000	210,000	160,000	110,000	110,000
Columbia River North (w/o infiltration)												
Ave. Peak Project Runoff, Q_P cfs	2.9	2.1	1.6	0.8	0.8	0.8	0.4	0.9	1.6	2.1	3.3	3.7
Ave. Discharge in Waterbody, Q_R cfs	156,000	163,000	170,000	204,000	286,000	415,000	291,000	153,000	117,000	116,000	122,000	138,000
Ratio of Q_R to Q_P	54,000	77,000	110,000	270,000	380,000	550,000	810,000	170,000	75,000	55,000	37,000	37,000
Columbia River North (w/infiltration)												
Ave. Peak Project Runoff, Q_P cfs	1.3	1.0	0.7	0.4	0.4	0.4	0.2	0.4	0.7	1.0	1.5	1.7
Ave. Discharge in Waterbody, Q_R cfs	156,000	163,000	170,000	204,000	286,000	415,000	291,000	153,000	117,000	116,000	122,000	138,000
Ratio of Q_R to Q_P	120,000	170,000	240,000	580,000	820,000	1,200,000	1,700,000	360,000	160,000	120,000	83,000	83,000
Burnt Bridge Creek (w/o infiltration)												
Ave. Peak Project Runoff, Q_P cfs	0.8	0.5	0.4	0.2	0.2	0.2	0.1	0.2	0.4	0.5	0.8	0.9
Ave. Discharge in Waterbody, Q_R cfs	46	53	39	21	19	14	9.1	7.4	7.0	9.8	34	41
Ratio of Q_R to Q_P	70	110	110	110	100	70	100	34	19	20	45	48
Burnt Bridge Creek (w/infiltration)												
Ave. Peak Project Runoff, Q_P cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ave. Discharge in Waterbody, Q_R cfs	46	53	39	21	19	14	9.1	7.4	7.0	9.8	34	41
Ratio of Q_R to Q_P	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: Q_P = flow rate of the project runoff in cfs; Q_R = flow rate of the receiving waterbody.

3.13 MITIGATION AND MONITORING

The project is anticipated to permanently impact approximately 0.55 acre and temporarily impact 1.18 acres of in-water habitat in the Columbia River and North Portland Harbor in Oregon. A mitigation site has been identified east of the project in the lower Hood River. Mitigation activities at this site are described in detail in Section 3.14.2. Mitigation will fulfill requirements determined by USACE and DSL during the course of the regulatory permitting process. No jurisdictional wetlands will be impacted in Oregon during construction or operation of the project, with the possible exception of impacts related to enhancement or restoration activities at the Hood River mitigation site. Additional required mitigation for these types of impacts is not anticipated.

The project is anticipated to permanently impact approximately 0.60 acre and temporarily impact 1.10 acres of the Columbia River in Washington. A mitigation site has been identified west of the project on the east bank of the Lewis River at the confluence with the Columbia River. Mitigation activities at this site are described in detail in Section 3.14.2. Mitigation will fulfill requirements determined by USACE, WDFW, and Ecology during the course of the regulatory permitting process. No jurisdictional wetlands will be impacted in Washington during construction or operation of the project, with the possible exception of impacts related to enhancement or restoration activities at the Lewis River mitigation site. Additional required mitigation for these types of impacts is not anticipated.

Mitigation activities will be funded by the CRC project and be permitted and constructed by third parties. Both mitigation sites will have a federal nexus through USACE permits and will need to undergo separate ESA Section 7 consultations to analyze their effects to listed species and critical habitat. Conditions of regulatory permits issued by USACE and the States of Oregon and Washington will require compliance monitoring for a minimum of 5 years after completion of the mitigation project.

3.14 INTERDEPENDENT AND INTERRELATED ACTIONS

An interrelated activity is an action that is part of a larger action and depends on the larger action for its justification. An interdependent activity is one that has no independent utility apart from the proposed action. To determine if an action is interrelated or interdependent, the “but-for” test can be applied. That is, the action is interrelated or interdependent if it would not occur “but for” the larger action.

3.14.1 Maintenance Activities

Among the interrelated or interdependent activities of this project are operation and maintenance activities in the long-term. WSDOT, ODOT, TriMet, C-TRAN, and the Cities of Vancouver and Portland all have established roadway maintenance and operations staff that will operate and maintain CRC after its construction in accordance with their standard operation procedures designed to meet operational and permitting needs, e.g., compliance with 4(d) and other programmatic approaches. Each agency will be responsible for maintaining elements of the roadway, guideway, trail, or other elements within their respective jurisdictions, unless inter-agency agreements between jurisdictions prevail. The majority of the maintenance and

operations resources are already provided for, as the roadway facility already exists and CRC is replacing and updating the highway facility. Coordination will be done with the respective maintenance program managers to plan and program additional funding or reallocate resources that may necessary to maintain and operate new infrastructure features such as stormwater facilities, additional lane miles that result from widening, fewer personnel needed to operate the bridge, etc.

3.14.2 Compensatory Mitigation

To offset project impacts to aquatic habitat in the Columbia River and North Portland Harbor, CRC will provide compensatory mitigation at two sites (one in Oregon and one in Washington). The mitigation design has not yet been developed, but the mitigation sites will comply fully with all regulatory permit terms and conditions. In Oregon, the compensatory mitigation will comply with the Section 404 permit issued by the USACE, the Section 401 permit issued by DEQ, and the Removal-Fill permit issued by DSL and would compensate for the temporary impact to 1.18 acres of open water habitat and permanent loss of 0.55 acre of open water habitat of the Columbia River and North Portland Harbor. In Washington, the compensatory mitigation will comply with the Section 404 permit issued by USACE, the Section 401 permit issued by Ecology, and the Hydraulic Project Approval issued by WDFW and would compensate for the temporary impact to 1.10 acres of open water habitat and permanent loss of 0.60 acre of open water habitat of the Columbia River.

CRC created a Conservation Measures Working Group consisting of staff from ODFW, WDFW, NMFS, and USFWS to prepare a methodology identifying goals and project selection criteria to evaluate and prioritize potential measures. This effort was discontinued as the project was refined to further minimize potential impacts to listed species. However, the CRC team adapted and applied the goals and project selection criteria approved by the group as general guidance for the mitigation site selection process. Compensatory mitigation sites or actions can also be considered conservation measures under Section 7(a)(1) of the ESA, but conservation measures are not considered mitigation.

3.14.2.1 Goals and Project Selection Criteria

The goals and project selection criteria used for mitigation site selection are listed below.

Goals

- To restore habitat types or aspects that have been lost or greatly reduced over the last approximately 75 years.
- To restore access to historical habitats for anadromous and resident aquatic species.
- To provide “connectivity” and not be physically isolated from other habitat areas.
- To address impaired watershed processes that affect the aquatic system, water quality, and related ecosystem services.
- To preserve, enhance, and protect natural processes in order to maintain the habitat restored.
- To help implement adopted recovery plans or develop information to help advance the science.

Project Selection Criteria

- Sites shall address recovery measures or critical limiting factors such as those identified in the Basin Recovery Plan Module or the Watershed Assessment and Action Plan.
- Shall be large enough (size and shape) to provide for complexity (i.e., multiple niche habitats within overall habitat) and provide some measureable and demonstrable improvement in function of system (e.g., within a watershed or some defined area).
- Avoid sites where success is not achievable. Sites where the natural conditions or functions have been so altered as to be irreversible or where adjacent land use would limit or preclude project success.
- Avoid sites that would conflict with existing management plans or strategies.
- Conduct restoration measures that will have demonstrable, measurable results and have a high likelihood of achievement.
- Funding and scope to ensure long-term monitoring (a "feedback loop") and be able to implement adaptive management.
- Activity shall have defined and supported goals, objectives, and success criteria so success can clearly be demonstrated.
- Ground activities such as aquatic or riparian habitat restoration and enhancement must have a mechanism for long-term protection (e.g., conservation easement or public ownership).
- Site selection will avoid locations where restoration actions conflict with other ESA-protected species.

In Oregon, CRC selected the Hood River Off-Channel Reconnection because it is consistent with the six goals and all but one of the project selection criteria. In Washington, CRC selected the Lewis River confluence side channel restoration project because the restored shallow water off-channel habitats will provide high-value tidal rearing habitat for juvenile salmonids. This site is consistent with all of the Goals and project selection criteria. CRC will fund each site and private project proponents will construct and maintain them.

Because CRC is providing funding for the restoration sites, they are interrelated actions to the CRC project. The direct and indirect effects to listed species and designated critical habitats from these actions must be considered in this BA; however, a more detailed analysis of negative and beneficial effects from these projects will occur through separate Section 7 ESA consultations as requested by USACE. The private project proponents will initiate separate Section 7 ESA consultations for both restoration sites as actions requiring federal permits. Therefore, in order to identify the potential direct and indirect effects of the interrelated mitigation actions, the CRC project identified federally listed species potentially present in the vicinity of the mitigation sites, designated and proposed critical habitats and anticipated effects from mitigation activities on these species and critical habitats. To determine available habitats and anticipated impacts of project activities, site visits were made for both mitigation sites and information evaluated from each project's proponent.

3.14.2.2 Oregon Compensatory Mitigation: Lower Hood River Powerdale Corridor Off-Channel Wetland Reconnection

The Lower Hood River Powerdale Corridor Off-Channel Wetland Reconnection restoration site is located upriver and approximately 60 miles east of the CRC project in the Hood River watershed in Hood River County (Township 3N, Range 10E, Section 6; HUC 17070105). The restoration site is part of a 400-acre parcel owned by Columbia Land Trust. CRC is providing funding for the design and restoration of a historic side channel of the Hood River as compensation for the CRC project's waterway impacts. The Council will obtain permits from the USACE, creating the nexus for an independent Section 7 consultation. Columbia Land Trust/Hood River Watershed Council will prepare a separate BA for the restoration site.

The CRC project will temporarily impact 1.18 acres of open-water habitat over its construction period and cause permanent loss of 0.55 acre of open-water habitat in the Columbia River and North Portland Harbor (1.73 acres impact total). The proposed compensatory mitigation is located on the Hood River between RM 1.0 and 2.0 where the Mount Hood Railroad (MHRR) has cut off and isolated a historic side channel and an associated 21-acre wetland. The purpose of the mitigation project is to restore connectivity of the side channel and the wetland with the mainstem Hood River, greatly improving habitat complexity for migrating and rearing salmonids. The proposed mitigation project will install a bridge at the upstream end (RM 2.0) and an outlet bridge or trestle at the downstream end (RM 1.0) to reconnect 1 mile of side channel and the wetland. The bridge structures will pierce the 20-foot-high levee that has been a barrier to natural stream functions at this site for almost a century, while allowing the MHRR to continue its operations.

Oregon has not established mitigation ratios for impacts to jurisdictional waterways (such as the Columbia River). The proposed CRC mitigation will restore and enhance a side channel of the Hood River at a ratio of more than 10 times the area of the project impacts. Other proposed aquatic habitat improvements include:

- Addition of large wood in the side channel to form log jams for salmonid rearing habitat,
- Grading to improve side channel function,
- Removal of debris or spoils from past activities,
- Removal of decommissioned irrigation pipe, and
- Planting the enhanced wetland and riparian area with native vegetation.

The final design and construction sequence of the mitigation will be based upon construction and staging methods, site topography, groundwater levels, and stream flow. Construction methods will include the use of land-based heavy equipment, such as tracked excavators and dump trucks, to excavate the channel and haul off spoils material, as well as to breach the railroad embankment at the upstream and downstream ends of the project.

Prior to breaching the embankments, the project will likely install lateral cofferdams to isolate the work area and prevent fish or other aquatic life from moving into the in-water work area. The cofferdams will likely be comprised of steel sheeting forced into the stream bed by an excavator. Cofferdams will be installed starting at the upstream end and working downstream to decrease the potential for fish entrapment. Once construction work in the side channel is complete, the water will then be allowed to flow through the new stream bed. The restored channel will be re-

watered slowly to limit the amount, duration, and extent of turbidity. Turbidity is not expected to extend more than 100 feet upstream and 300 feet downstream from the channel inlet and outlet. Some increase in sedimentation may also occur intermittently for weeks or months within the new channel and in the Hood River immediately downstream of the outlet until riparian and wetland vegetation is established.

Most of the construction will be performed below the OHW elevation of the Hood River, but will be isolated from the main river channel due to the presence of existing levees. The channel reconnection will occur during the designated in-water work window (July 15 to August 31). Standard minimization measures (MMs) and BMPs (such as site dewatering, fish exclusion, and TESC and SPCC plans) will be implemented to minimize potential impacts to listed species. Construction staging will occur on upland areas only.

A construction start date is not available, but construction is estimated to take up to two construction seasons, including site preparation, excavation, and planting. It is unknown at this time whether there will be funding for long-term monitoring and implementation of adaptive management.

3.14.2.3 Washington Compensatory Mitigation: Lewis River Confluence Side-Channel Restoration

The CRC project will temporarily impact 1.10 acres of open-water habitat and cause permanent loss of 0.60 acre of open-water habitat in the Columbia River (1.70 acres impact total). CRC is proposing off-site compensatory mitigation on the east bank of the Lewis River at its confluence with the Columbia River. This site is located downriver and approximately 10 miles northwest of the CRC project in the Lewis River watershed in Clark County (Township 4N, Range 1W, Section 2; HUC 170800020506). The restoration site is a 640-acre privately owned site managed by Wildlands of Washington, Inc. (Wildlands). The CRC project is providing funding for a conservation easement on approximately 80 acres of the property, of which 18.1 acres are proposed for restoration of historic side channels to mitigate for the CRC project's waterway impacts. In Washington, mitigation ratios for impacts to jurisdictional waterways such as the Columbia River are not established under regulatory law. The proposed mitigation will restore side channels of the Lewis River at a ratio of more than 10 times the area of the project impacts. Wildlands will be obtaining permits from USACE, providing a nexus for an independent Section 7 consultation. Wildlands will prepare a separate BA or use an existing programmatic BO for the mitigation site.

Historically the east bank of the Lewis River at the confluence of the Columbia River had multiple side channels with an open hydraulic connection to the Columbia River. Between the years 1965 to 1973, USACE filled the side channels through deposition of dredge spoils. Restoration will consist of removing the dredge spoils to reconnect the channels to the Lewis and Columbia Rivers. The mitigation project would restore over 21,100 linear feet of historic side channels of the Lewis River, totaling 18.1 acres. The intent of the restoration project is to provide high-value tidal rearing habitat for juvenile salmonids.

Construction methods will include the use of land based heavy equipment such as tracked excavators and dump trucks. Fill material will be removed from the side channels and hauled off site. The project will improve aquatic habitat and complexity in the side channels by adding large wood to form engineered log jams, removing invasive plant species, and planting native riparian vegetation.

When channel work is completed, the project will breach a levee at the upstream and downstream ends of the channel, restoring the surface-water connection between the Lewis and Columbia Rivers. Levee breaching will occur only during the designated in-water work window (August 1 to 15). The restored channels will be re-watered slowly to limit the amount, duration, and extent of turbidity. Turbidity from channel reconnection is not expected to extend more than 100 feet upstream and 300 feet downstream from the inlet and outlet. Some increase in sediment input may also occur in the new channel and mainstem river intermittently for weeks or months until riparian and wetland vegetation is established. The final design and construction sequence of the reconnected side channels will be based upon construction and staging methods, site topography, groundwater levels, and stream flow.

Most of the side-channel construction will be performed below the OHW elevation of the Lewis River, but will be isolated from the river due to existing levees. Standard BMPs (such as site isolation, fish exclusion, and TESC and SPCC plans) will be implemented to minimize the amount of sediment entering the Lewis or Columbia Rivers during earthwork.

Construction of the mitigation site is estimated to take up to 1.5 years, including site preparation, excavation, and planting. Monitoring of the mitigation site will occur for 10 years after construction to ensure the project has met performance standards for wetland enhancement and stream restoration.

3.14.3 Other Interrelated and Interdependent Actions

Additional interrelated and interdependent actions include the following:

- Utility relocation during construction of the project.
- Construction and operation of unanticipated staging and casting areas not covered by this BA.
- Acquisition and relocation of existing floating homes from moorages in North Portland Harbor will occur prior to construction of the North Portland Harbor Bridges. Up to 32 floating homes in the Portland Harbor will be displaced. Floating homes will be treated as real property unless it is determined there are sufficient replacement sites to which the floating homes can be economically relocated. If a sufficient number of replacement sites are not available, the floating homes will be purchased at fair market value and the occupants will be provided relocation assistance that may include payments, if necessary, to acquire decent, safe and sanitary replacement housing. The acquired floating homes will be sold on the condition that they are moved to other locations. The locations could be within North Portland Harbor, but may be in other portions of the lower Columbia River subbasin.
- Design and operation of a rebuilt pump station located at the downstream (west) end of an unnamed drainage channel between the Expo Center and Vanport Wetlands that flows west then south into the Columbia Slough. The pump station moves water from the

channel into the Columbia Slough. The MCDD operating as Peninsula Drainage District No. 1 plans to rebuild the pump station, but the design and construction is currently on hold until a determination of additional capacity needed to accommodate runoff from the CRC project is made (Section 3.12.1.1).

- Transit-oriented development on Hayden Island. The Hayden Island Plan outlines a vision for the future redevelopment of Hayden Island. The plan responds to the extension of light rail to Hayden Island by proposing transit-oriented development near the future location of the light-rail station. Under this plan, the 80-acre Jantzen Beach Super Center immediately west of I-5 will redevelop from "big box" regional commercial center into a medium-density mix of commercial and residential uses, with up to 2,000 new housing units centered on the new light rail station. The plan reduces industrially zoned lands by 81 acres, increases residentially zoned land by 69 acres, and increases commercially zoned land by 11 acres. (COP 2009a). This plan is based on the construction of transit and light rail stations, and is therefore interrelated.

Other projects in the action area are planned to occur regardless of the CRC project, and have independent justification and utility. Although they are not interrelated or interdependent actions, they are identified here to assist the reader in understanding the context of this BA. Of these projects, two listed below have no federal nexus and are described in Section 6.7. It should be noted that the *construction and operation* of these projects constitutes a cumulative effect, while the potential increased *rate* of development in these areas due to the CRC project is an indirect effect of the CRC project.

- **Redevelopment of downtown Vancouver along a transit corridor.** The VCCV plans for increased development in downtown Vancouver along a future high-capacity transit (bus or light rail) corridor. Future development along this corridor is likely to occur because downtown Vancouver is planning for and experiencing an overall growth trend that is expected to continue regardless of the project (approximately 16.5 acres have been identified as vacant and available for redevelopment). Because the development along a transit corridor is already planned independently in the VCCV plan, outside of the larger CRC action, and is not dependent on the CRC project's light rail for its implementation, it is not an interrelated or interdependent action. However, the construction of light rail along the corridor will potentially influence the rate of development. The potential indirect effects from the increased *rate* of development along the light rail corridor are discussed in Section 6.2.2.

- **Redevelopment of downtown Vancouver waterfront.** The City of Vancouver has approved a Master Plan for a 35-acre development along the Vancouver waterfront west of I-5. Development of this area is not tied to the project and will occur whether or not the project is constructed. However, the CRC project's extension of the Portland MAX light rail network and extension of Main Street will improve access to this area and potentially influence the rate of redevelopment. The potential indirect effects from the increased *rate* of redevelopment along the waterfront are discussed in Section 6.2.2.

- **WSDOT SR 500/St. John's Improvements, Vancouver.** This project is a federal action that involves road improvements and correction of a fish passage barrier east of the I-5 and SR 500 interchange. This project has completed a separate ESA Section 7 consultation and therefore will not be further discussed in this BA.

3.15 ACTION AREA

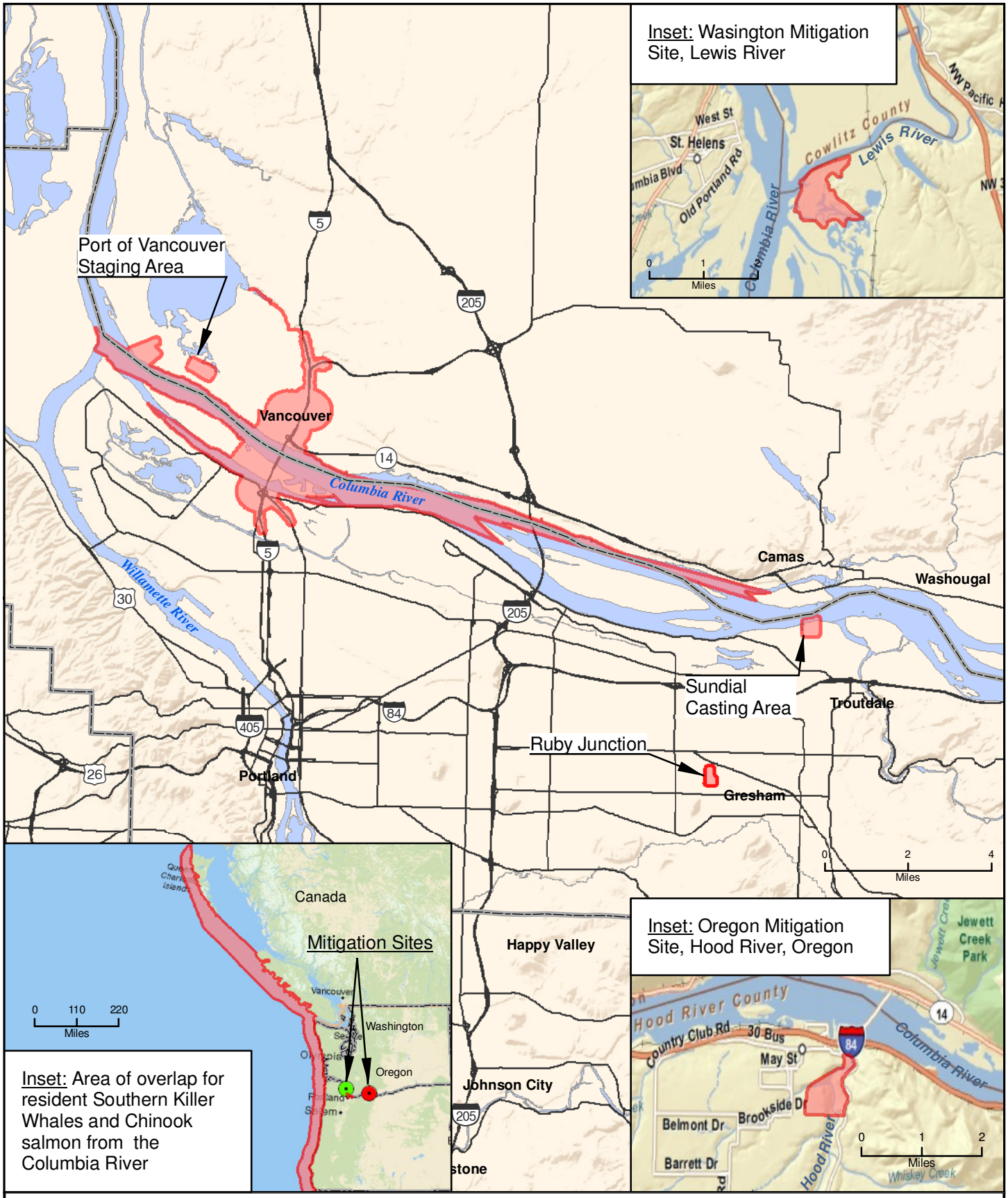
The action area is defined as: "all areas to be affected directly and indirectly by the federal action and not merely the immediate area involved in the action" (ESA, 50 CFR 17.11). The action area for the proposed action is defined by its direct and indirect effects including those from interrelated and interdependent actions or activities. The action area consists of the geographic extent of the physical, biological, and chemical impacts of the project. For our project, we have described the extent of the action area in terms of the terrestrial extent and the aquatic extent of all areas that could be potentially affected by the project (Figure 3-37).

3.15.1 Terrestrial Portion

In the terrestrial portion of the action area, the farthest reaching effects of the project were determined to be the extent of potential land use and traffic changes and, in areas where land use or traffic changes are not anticipated, the extent of construction noise. Potential effects from land use changes are defined by project land use planners to extend 0.50 mile from each of the transit stations in the project area (including the existing Expo Station, as the project will reconfigure the Marine Drive interchange and extend light rail to the north), in areas of Hayden Island included in the Hayden Island Plan, and in the area within the City of Vancouver included in the VCCV (see Figure 3-37 and Section 3.15 for details on extent).

In areas that are not anticipated to have potential land use and traffic changes, the extent of the action area is defined by the extent of construction noise. Noise is expected to be the project impact with the most far-reaching terrestrial environmental effects. Based on the types of construction equipment proposed for the project, noise levels associated with the majority of construction are not expected to exceed 90 A-weighted decibels (dBA) (WSDOT 2009). With multiple pieces of equipment operating with similar noise levels, using decibel addition, noise levels could reach as high as 93 dBA. Noise levels from general construction equipment would be expected to attenuate to ambient noise levels within 700 feet as it traveled over land.[11] However, peak noise levels will be generated by pile driving, which is one of the potential construction methods that may be used to construct bridge foundations, retaining walls, or tunnels. Pile driving could occur at any of the seven project interchanges and will occur in the Columbia River and North Portland Harbor. This activity, assuming use of an impact pile driver, would generate peak noise levels of approximately 110 dBA at 50 feet from the source, assuming use of an impact pile driver (WSDOT 2009). In-air noise levels from pile driving would be expected to attenuate to ambient noise levels within 3,200 feet (0.6 mile) as it traveled over land and by 9,000 feet (1.7 miles) as it traveled over water. Ambient noise levels in the action area are driven primarily by high traffic volumes on I-5. However, ambient noise levels in action area were determined from levels expected further from I-5 where I-5 noise is no longer dominating and pile driving noise would be. The ambient noise level is assumed to be 65 dBA, typical of an urban residential area (Cavananough and Tocci, 1998, as cited in WSDOT 2010).

[11] Using the spherical spreading model where $D_1 = D_0 * 10^{(\text{initial SPL} - \text{ambient}/\alpha)}$, where D_1 is the distance from the equipment at which noise attenuates to ambient levels, D_0 is the distance from the equipment at which the initial sound level was measured, and α is the variable for soft- or hard-site conditions. For our analysis ambient = 65 dBA, the initial sound level is 93 dBA at 50 feet from the source, and $\alpha = 25$ over land (soft site conditions) (WSDOT 2010).



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Action Area **Mitigation Sites**

Washington Project Site

Oregon Project Site

Figure 3-37. CRC Action Area

Source: Metro, RLIS Lite GIS Data, ugb_fill.shp, May 2009 and Clark County, WA, Assessors Office, GIS Digital Data, ugabnd.shp, July 2008.

Columbia River CROSSING

At the Alcoa, Port of Vancouver, Sundial, Red Lion, and Thunderbird staging/casting sites and at the Ruby Junction expansion site, general construction equipment has a maximum noise level is expected to attenuate to background within 700 feet of the project footprint (see Appendix A).

3.15.2 Aquatic Portion

Hydroacoustic impacts from impact pile driving are the farthest reaching extent of project aquatic impacts in the Columbia River and North Portland Harbor (see Section 6.1.1). Due to the curvature of the river and islands present, underwater noise from impact pile driving is expected to encounter land before it reaches ambient levels. Noise from impact pile driving is not expected to extend beyond Sauvie Island, approximately 5.5 miles downstream, and Lady Island, 12.5 miles upstream (see Appendix K).[12] This distance encompasses the Columbia River from approximately RM 101 to 118 (RKm 163 to 190). Within North Portland Harbor, underwater noise is expected to extend 3.5 miles downstream and 1.9 miles upstream.

The extent of the aquatic portion of the action area in Burnt Bridge Creek and the Columbia Slough is based on the distance to where stormwater pollutants are expected to dilute to background levels. In Burnt Bridge Creek, based on proposed treatment and infiltration methods, pollutant levels in stormwater runoff will outflow only in infrequent storm events. Therefore, any pollutants entering the creek are expected to dilute to background levels in close proximity to the outfall, and most definitely by the confluence with Vancouver Lake. In the Columbia Slough watershed, stormwater runoff from the project travels through open ditches before being pumped to the Columbia Slough. Based on the enhanced treatment proposed and some infiltration that will occur prior to the outfall to the Columbia Slough, pollutant levels are expected to dilute to background levels at or close to the Columbia Slough outfall, prior to reaching the salmon-bearing portion of the slough (see Section 5.2.2.2 for extent of salmon in Columbia Slough).

The action area encompasses portions of the Pacific Ocean because Chinook salmon from the Columbia River, which are affected by the CRC project, are available as prey for listed Southern Resident killer whales in areas off the Pacific coast. Therefore, NMFS has requested that the action area include the marine environment within 50 km of the Pacific coast from southern Oregon north to the Queen Charlotte Islands, where Southern Resident killer whales may overlap in distribution with Chinook from the Columbia River (Figure 3-37).

[12] No background noise levels for the project site are available. One measurement of 60 Pa or 136 dB peak has been reported for the lower Columbia River at RM 45 where the river is tidally influenced (Carlson et al. 2001). A crude approximation of the root mean square (RMS) values is approximately 121 dB RMS (subtracting 15 dB, Jim Laughlin 2009, personal communication).

The project action area also includes interrelated mitigation activities funded by the project in the Lewis and Hood Rivers (Figure 3-37). These sites will be consulted on as interrelated actions by their individual project proponents. The action area at these sites is defined by the immediate project footprint plus the extent of general construction noise for the terrestrial portion and the extent of turbidity from in-water work for the aquatic portion. The extent of general construction noise from construction equipment is estimated to extend less than 8,000 feet (0.7 mile) in all directions before it attenuates to ambient levels.[13] The extent of turbidity is expected to extend no more than 300 feet downstream and 100 feet upstream from in-water work.

The aquatic and terrestrial extent of the action area is shown in Figure 3-37. This action area encompasses all other project impacts including visual disturbance.

[13] Using the spherical spreading model where $D_1 = D_0 * 10^{(\text{initial SPL} - \text{ambient}/\alpha)}$, where D_1 is the distance from the equipment at which noise attenuates to ambient levels, D_0 is the distance from the equipment at which the initial sound level was measured, and α is the variable for soft- or hard-site conditions. For our analysis ambient = 40 dBA for a rural area (EPA 1978, as cited in WSDOT 2010), the initial sound level is 87 dBA at 50 feet from the loudest equipment (a clam shovel), and $\alpha = 25$ over land (soft site conditions) (WSDOT 2010).