Lake Oswego to Portland Transit Project

Ecosystems

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TriMet and Metro

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1. INTRODUCTION

This report contains the detailed analysis and documentation that is the basis for Chapter 3, Section 3.8 on ecosystems in the Lake Oswego to Portland Transit Project (LOPT) Draft Environmental Impact Statement (DEIS) published by the Federal Transit Administration in December 2010. This chapter of the report includes a summary of the project background, the Purpose and Need, the alternatives/options considered and the description of the alternatives analyzed.

1.1 Project Background

Transit improvements in the Lake Oswego to Portland corridor have been studied several times in recent history. In the 1970s and 80s, a light rail alignment through Johns Landing was studied as part of the Westside Corridor Alternatives Analysis, and in the 1990s potential light rail alignments through Johns Landing were studied as part of the South/North Corridor Study.

The Willamette Shore Line right of way was first established in 1885-1887 as the Portland and Willamette Valley Railroad, which began operation in July 1887. The Southern Pacific Railroad (SPRR) later purchased the railway in 1914. The railroad had a major impact on the development of southwest Portland. Initially, 14 trains operated between Portland and Oswego (as it then was known), and it became the main transportation link for developing residential communities along the route. The line was electrified in 1914 and passenger traffic hit its peak in 1920 with SPRR running 64 daily trains between Portland and Oswego. Passenger service ended on October 5, 1929, while freight service continued until 1983.

In August of 1984, the Interstate Commerce Commission granted SPRR permission to abandon the line. In 1988, the Willamette Shore Line Consortium (the Consortium) purchased the 6.3-mile-long line from SPRR for approximately $2 million. The Consortium, comprised of the City of Lake Oswego, City of Portland, Oregon Department of Transportation (ODOT), Clackamas County, Multnomah County, Metro, and TriMet, purchased the line to preserve it for future passenger rail transit use. TriMet holds title for the Consortium and the City of Lake Oswego provides maintenance services funded by the Consortium.

In 2005, with the endorsement of the Joint Policy Advisory Committee on Transportation, the Metro Council directed staff to initiate the Lake Oswego to Portland Transit and Trail Alternatives Analysis. The alternatives analysis focused on improving the ability to serve travel demand in the corridor through improved transit service and development of a multi-use pathway.

1.2 Purpose and Need

The **Purpose** of the project is to optimize the regional transit system by improving transit within the Lake Oswego to Portland transit corridor, while being fiscally responsive and supporting regional and local land use goals. The project should maximize, to the extent possible, regional resources and economic development opportunities, and garner broad public support. The project should build on previous corridor transit studies, analyses, and conclusions and should be environmentally sensitive.

The **Need** for the project results from:

- Historic and projected increases in traffic congestion in the Lake Oswego to Portland corridor due to increases in regional and corridor population and employment;
- Lengthy and increasing transit travel times and deteriorating public transportation reliability in the corridor due to growing traffic congestion;
- Increasing operating expenses, combined with increasingly scarce operating resources and the demand for more efficient public transportation operations;
- Local and regional land use and development plans, goals, and objectives that target the corridor for residential, commercial, retail, and mixed-use development to help accommodate forecast regional population and employment growth, and previous corridor transit studies, analyses, and conclusions;
- The region's growing reliance on public transportation to meet future growth in travel demand in the corridor;
- The topographic, geographic, and built-environment constraints within the corridor that limit the ability of the region to expand the highway and arterial infrastructure in the corridor; and
- Limited options for transportation improvements in the corridor caused by the identification and protection of important natural, built, and socioeconomic environmental resources in the corridor.

1.3 Alternatives/Options Considered

Metro's 2004 Regional Transportation Plan (RTP) identified the need for a refinement plan for a high capacity transit option for the corridor, which included an analysis of several modal alternatives. Metro initiated the corridor refinement plan in July 2005 and issued the *Lake Oswego to Portland Transit and Trail Alternatives Analysis Evaluation Summary Public Review Draft* in June 2007.

On December 13, 2007, after reviewing and considering the alternatives analysis report, public comment, and recommendations from the Lake Oswego to Portland Transit and Trail Project Citizen Advisory Committee (CAC), the Lake Oswego to Portland Transit and Trail Project Management Group (PMG), Steering Committee, and partner jurisdictions and agencies, the Metro Council approved Resolution No. 07-3887A. The resolution adopted the *Lake Oswego to Portland Transit and Trail Alternatives Analysis: Alternatives to be Advanced into a Draft Environmental Impact Statement and Work Program Considerations* (December 13, 2007). (See Section 2.1 for additional detail on the process used to identify and narrow alternatives.) It also selected the No-Build, Enhanced Bus, and Streetcar alternatives to advance into the project's DEIS for further study, and directed staff to conduct a refinement study to identify design options in the Johns Landing Area and terminus options to advance into the project's DEIS. The resolution called for further refinement of the trail component to move forward as a separate process.

1.3.1 Alternatives Analysis

The project's alternatives analysis process developed a wide range of alternatives for evaluation and early screening, which included: a No-Build Alternative, widening of Highway 43, reversible lanes on Highway 43, river transit (three options), bus rapid transit (BRT) (three options); commuter rail, light rail, and streetcar (a wide range of alignment alternatives and terminus alternatives and options).

Through a screening process that assessed the ability of the alternatives to meet the project's Purpose and Need, the initial range of possible alternatives was narrowed. Appendix C of the DEIS provides a summary of the technical evaluation of the alternatives and options considered during the alternatives analysis phase.

The following alternatives were selected for further study through the alternatives analysis phase: 1) No-Build Alternative, 2) Bus Rapid Transit Alternative, and 3) Streetcar Alternative. Following is a description of those alternatives as they were studied in the alternatives analysis (see the *Lake Oswego to Portland Transit and Trail Study Evaluation Summary Public Review Draft* for more information).

- **No-Build Alternative.** Similar to the project's current No-Build Alternative, as described in Section 1.4.1.

- **Bus Rapid Transit Alternative.** The Bus Rapid Transit Alternative would operate frequent bus service with Line 35 on Highway 43 between downtown Portland and downtown Lake Oswego, generally in mixed traffic, with bus station spacing that would be longer than TriMet typically provides for fixed-route bus service. Transit queue bypass lanes would be constructed at congested intersections, where feasible.

- **Streetcar Alternative.** The Streetcar Alternative would extend the existing Portland Streetcar line, which currently operates between NW 23rd Avenue and SW Lowell Street, to downtown Lake Oswego. Study of this alternative includes an evaluation of whether the Willamette Shore Line right-or-way would be used exclusively of whether it would be used in combination with SW Macadam Avenue or other adjacent roadways.

1.3.2 Scoping/Project Refinement Study

This section describes the alignment and terminus options developed, evaluated, and screened in 2009 as a part of the project's scoping and refinement study phase. In November 2010, Metro published the *Lake Oswego to Portland Transit Project Refinement Report*, which detailed the study's results and summarized public comment. This phase focused on refinements in two areas: 1) alignment options for the Johns Landing area; and 2) terminus options in the Lake Oswego area. In summary, the project's Purpose Statement during the refinement phase was to:

- Optimize the regional transit system;
- Be fiscally responsive and maximize regional resources;
- Maximize the economic development potential of the project;
- Be sensitive to the built and social environments; and
- Be sensitive to the natural environment.

The options, evaluation measures, and results of the Johns Landing streetcar alignment refinement process and the Lake Oswego terminus refinement processes are summarized below.

A. Johns Landing Streetcar Alignment Refinement. For the refinement of streetcar design options within the Johns Landing area, the project used the following criteria: streetcar operations, streetcar

performance, financial feasibility, traffic operations, accessibility and development potential, neighborhood sustainability, and adverse impacts to the natural environment. Measures for each of the criteria were developed and applied to each of the alignment options studied, which included:

- Hybrid 1: Macadam Avenue In-Street
- Hybrid 2: East Side Exclusive
- Hybrid 3: Macadam Avenue with New Northbound Lane
- Willamette Shore Line
- Full Macadam In-Street

B. Lake Oswego Terminus Option Refinement. For the refinement of terminus options in the Lake Oswego area, the project used the following criteria: expansion potential and regional context, streetcar operations, streetcar performance, financial feasibility, traffic operations, accessibility and development potential, and neighborhood sustainability. Measures for each of the criteria were developed and applied to each of the alignment options studied, which included: a) Safeway Terminus Option; b) Albertsons Terminus Option; and c) Trolley Terminus Option.

On June 1, 2009, in consultation with FTA and based on the findings of the analysis, public and agency comment and recommendations from the Lake Oswego to Portland Project Management Group, the Lake Oswego to Portland Transit Project Steering Committee selected the following options in the Johns Landing area to advance into the DEIS: Willamette Shore Line; Hybrid 1 – Macadam Avenue In Street (Boundary Street to Carolina Street); and Hybrid 3: Macadam Avenue with New Northbound Lane (Boundary Street to Carolina Street).

1.4 Description of Alternatives Analyzed in this Technical Report and the DEIS

This section summarizes the roadway and transit capital improvements and transit operating characteristics for the No-Build, Enhanced Bus, and Streetcar alternatives. Table 1-1 provides a summary of the transit capital improvements associated with the three alternatives, and Table 1-2 summarizes the operating characteristics of the alternatives. A more detailed description of the alternatives may be found in the *Lake Oswego to Portland Transit Project Detailed Definition of Alternatives Report* (Metro/TriMet: January 2010). Detailed drawings of the Streetcar Alternative, including the various design options, can be found in the *Streetcar Plan Set,* November 2009.

1.4.1 No-Build Alternative

This section describes the No-Build Alternative, which serves as a reference point to gauge the benefits, costs, and effects of the Enhanced Bus and Streetcar alternatives. In describing the No-Build Alternative, this section focuses on: 1) the alternative's roadway, bicycle and pedestrian, and transit capital improvements; and 2) the alternative's transit operating characteristics. This description of the No-Build Alternative is based on conditions in 2035, the project's environmental forecast year.

1.4.1.1 Capital Improvements

Following is a brief description of the roadway, bicycle and pedestrian, and transit capital improvements that would occur under the No-Build Alternative. Table 1-1 provides a summary of the transit capital improvements associated with the No-Build Alternative and Table 1-2 summarizes the operating characteristics of the alternatives. Figure 1-1 illustrates the location of those improvements.

- **Roadway Capital Improvements**. The No-Build Alternative includes the existing roadway network in the corridor, with the addition of roadway capital improvements that are listed in the financially constrained road network of Metro's 2035 RTP.[1]Following is a list of the roadway projects that would occur within the corridor by 2035.
  - *Moody/Bond Avenue Couplet* (create couplet with two lanes northbound on SW Bond Avenue and two lanes southbound on SW Moody Avenue);
  - *South Portal* (Phases I and II to extend the SW Moody Avenue/SW Bond Avenue couplet to SW Hamilton Street and realign SW Hood Avenue to connect with SW Macadam Avenue at SW Hamilton Street);
  - *I-5 North Macadam* (construct improvements in the South Waterfront District to improve safety and access); and
  - *Macadam Intelligent Transportation Systems* (install system and devices in the SW Macadam Avenue corridor to improve traffic flow).

[1] Metro, 2035 Regional Transportation Plan, approved Dec. 13, 2007.

Table 1-1 Transit Capital Improvements for the No-Build, Enhanced Bus, and Streetcar Alternatives (2035)

Capital Improvements	No-Build	Enhanced Bus	Streetcar[1]
New Streetcar Alignment Length[2]	N/A	N/A	5.9 to 6.0
One-Way Streetcar Track Miles			
Portland Streetcar System	15.7	15.7	26.2 to 27.0
Proposed Lake Oswego to Portland Project	0	0	10.5 to 11.3
Streetcar Stations			
Portland Streetcar System	69	69	79
Proposed Lake Oswego to Portland Project	0	0	10[3]
Streetcars (in service/spares/total)			
Portland Streetcar System	17/5/22	17/5/22	27/6/33
Proposed Lake Oswego to Portland Project	N/A	N/A	10/1/11
Streetcar Operations and Maintenance (O&M) Facilities			
Number of Facilities[4]	1	1	2
Maintenance Capacity (number of Streetcars)	36	36	36
Storage Capacity (number of Streetcars)	25	25	33
Line 35 Bus Stops			
Line 35 Bus Stops (Lake Oswego to SW Bancroft St.)	26	13	0
Buses (in service/spares)			
TriMet Systemwide	607/712	619/725	601/704
Difference from No-Build Alternative	N/A	13	- 8
Transit Centers[5]	1	1	1
Park-and-Ride Facilities			
Joint Use Surface – Lots/Spaces	3/76	3/76	3/76
Surface – Lots/Spaces	0/0	0/0	1/100
Structured – Lots/Spaces	0/0	1/300	1/300

Note: LO = Lake Oswego; O&M = operating and maintenance.

[1] The transit capital improvements of the Streetcar Alternative summarized in this table would not vary by design option, except when shown as a range and as noted for new streetcar alignment length and one-way track miles. The first number listed is under the Willamette Shore Line design option and the second number listed is under the Macadam design options (in the Johns Landing Segment).

[2] Under the No-Build and Enhanced Bus alternatives, the Portland Streetcar System would include two streetcar lines: a) the existing Portland Streetcar Line, between NW 23rd Avenue and SW Bancroft Street, and b) the Portland Streetcar Loop, which is currently under construction and will be completed when the Milwaukie Light Rail and Streetcar Close the Loop project are constructed. The Streetcar Alternative would extend the existing Portland Streetcar line south, from SW Bancroft Street to Lake Oswego. One-way track miles are calculated by multiplying the mileage of double-tracked sections and adding that to the mileage of single-track sections. Alignment length and one-way track miles are presented as a range, because they would vary by design option. The number of streetcar stations, streetcars in service or as spares and the number and size of streetcar O&M facilities would not change by streetcar design option.

[3] Two optional stations are also being considered for inclusion in the Streetcar Alternative (see Figure 1-5 and Figure 1-6): 1) the Pendleton Station under the Macadam In-Street and Macadam Additional Lane design options in the Johns Landing Segment; and the E Avenue Station in the Lake Oswego Segment.

[4] There is an existing streetcar operations and maintenance (O&M) facility at NW 16th Avenue, between NW Marshall and NW Northrup streets; under the Streetcar Alternative, additional storage for eight vehicles would be provided along the streetcar alignment under the Marquam Bridge. There would be no change in the number or size of bus O&M facilities under any of the alternatives or design options. Bus stops are those that would be served exclusively by Line 35 between Lake Oswego and SW Bancroft Street

[5] Under the No-Build and Enhanced Bus alternative, the Lake Oswego Transit Center would remain at its current location (on 4th Street, between A and B avenues); under the Streetcar Alternative, the transit center would be moved to be adjacent to the Lake Oswego Terminus Station.

Source: TriMet, January 2010.

Table 1-2 Streetcar and Bus Network Operating Characteristics of No-Build, Enhanced Bus, and Streetcar[1] Alternatives (2035)

Operating Characteristics by Vehicle Mode	No-Build	Enhanced Bus	Streetcar
Streetcar Network Operating Characteristics[1]			
Weekday Streetcar Vehicle Miles Traveled			
Systemwide	2,180	2,180	3,200 or 3,230
Difference from No-Build Alternative	N/A	0	1,020 or 1,050
Weekday Streetcar Revenue Hours			
Systemwide	267	267	326 or 332
Difference from No-Build Alternative	N/A	0	59 or 65
Corridor Weekday Streetcar Place Miles[2]	N/A	N/A	89,000 or 91,320
Corridor Streetcar Round-Trip Time[3]	N/A	N/A	37 or 44 minutes
Corridor Streetcar Headways[4]			
Lake Oswego to PSU	N/A	N/A	7.5 / 7.5 minutes
Bus Network Operating Characteristics			
Weekday Bus Miles Traveled			
Systemwide	76,560	77,560	75,520
Difference from No-Build Alternative	N/A	1,000	-1,040
Weekday Bus Revenue Hours			
Systemwide	5,300	5,400	5,210
Difference from No-Build Alternative	N/A	100	-90
Line 35 (bus) Weekday Place Miles[2]	37,000	57,840	0
Line 35 (bus) Headways[4]			
Lake Oswego to Downtown Portland	15 / 15 min.	6 / 15 min.	N/A
Oregon City to Lake Oswego	15/15 min.	15/15 min.	15/15 min.

Note: N/A = not applicable; LO = Lake Oswego; O&M = operating and maintenance; PSU = Portland State University.

[1] The operating characteristics of the Streetcar Alternative summarized in this table would not vary by design option, except when shown as a range and as noted for streetcar vehicle miles traveled, place miles, and round-trip time. The first number listed is under the Willamette Shore Line Design Option and the second number listed is under the Macadam design options (in the Johns Landing Segment).

[2] Place miles are a measure of the passenger carrying capacities of the alternatives, similar to airline seat miles. Place miles = transit vehicle capacity (seated and standing) of a vehicle type, multiplied by the number vehicle miles traveled for that vehicle type, summed across all vehicle types. The No-Build Alternative bus place miles are based on lines 35 and 36.

[3] Round-trip run time for the proposed streetcar line would include in-vehicle running time from SW Bancroft Street to the Lake Oswego Terminus Station and back to SW Bancroft Street; it does not include layover time at the terminus.

[4] Headways are the average time between transit vehicles per hour within the given time period that would pass by a given point in the same direction, which is inversely related to frequency (the average number of vehicles per hour in the given time period that would pass by a given point in the same direction). Weekday peak is generally defined as 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m.; weekday off-peak is generally defined as 5:00 to 7:00 a.m., 9:00 a.m. to 4:00 p.m. and 6:00 p.m. to 1:00 a.m. There would be streetcar service every 12 minutes between SW Bancroft Street and the Pearl District (via PSU) under the No-Build and Enhanced Bus alternatives. The peak headways shown for the No-Build Alternative are the composite headways for Lines 35 and 36.

Source: TriMet – January 2010.

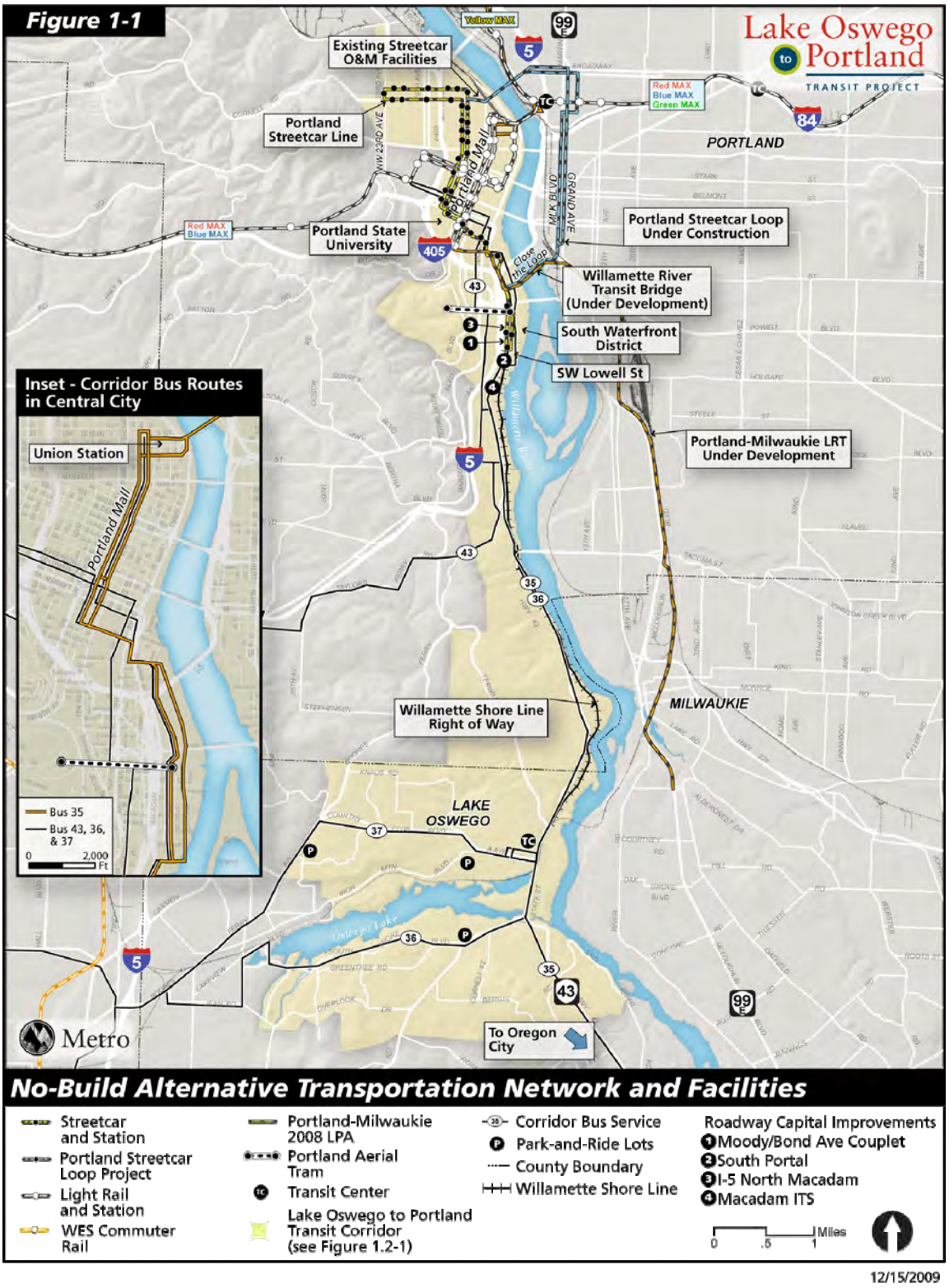

FIGURE 1-1 NO-BUILD ALTERNATIVE TRANSPORTATION NETWORK AND FACILITIES

- **Bicycle and Pedestrian Improvements**. The No-Build Alternative includes the existing bicycle and pedestrian network in the corridor, with the addition of bicycle and pedestrian capital improvements that are listed in the financially constrained road network of Metro's 2035 RTP. Following is a list of the bicycle and pedestrian projects that pedestrian projects proposed to occur within the corridor by 2035.
  - *Lake Oswego to Portland Trail* (extension of a multiuse path between Lake Oswego and Portland);
  - *I-5 at Gibbs Pedestrian/Bicycle Overcrossing* (construct a bicycle and pedestrian bridge over I-5 in the vicinity of SW Gibbs Street); and
  - *Tryon Creek Bridge* (construct a new pedestrian/bicycle bridge near the mouth of Tryon Creek).

- **Bus Capital Improvements.** There are currently two primary bus capital facilities in the corridor: *Lake Oswego Transit Center* (on 4th Street, between A and B avenues); and *Portland Mall* (bus and light rail lanes and shelters on NW/SW 5th and 6th avenues between NW Glisan Street and SW Jackson Street). These bus facilities would remain as-is under the No-Build Alternative. (The financially constrained transit project list of the RTP includes relocation of the Lake Oswego Transit Center to be adjacent to the Lake Oswego to Portland Streetcar alignment, which is also in the financially constrained project list. Neither would occur under the No-Build Alternative.) No additional bus capital improvements are planned for the corridor under the No-Build Alternative by 2035.

- **Light Rail Capital Improvements.** Under the No-Build Alternative, TriMet's existing Yellow Line light rail service would continue to operate on the Portland Mall (with a station at PSU added), across the Steel Bridge and into North Portland. Yellow Line facilities and service would be extended north from the existing Expo Center Station, across the Columbia River into Vancouver, Washington, and south from the Portland Mall, generally via SW Lincoln Street, across the Willamette River to Milwaukie, Oregon. In addition, downtown Portland would be served by the following TriMet light rail lines: Blue Line (Gresham to Hillsboro); Red Line (Beaverton to Portland International Airport); and Green Line (downtown Portland to Clackamas Town Center).

- **Excursion Trolley Capital Facilities.** Under the No-Build Alternative there would be no changes to the existing excursion trolley capital facilities that are located or operate within the corridor. Those excursion trolley capital facilities include approximately six miles of single-tracked Willamette Shore Line tracks and related facilities; stations at SW Bancroft and Moody streets and at N State Street at A Avenue; a trolley barn at approximately N State Street at A Avenue; and typically one vintage and/or other trolley vehicle propelled by externally attached diesel units.

- **Streetcar Improvements and Vehicles.** Under the No-Build Alternative, the existing Portland Streetcar Line would continue to operate between NW 23rd Avenue and SW Lowell Street. In addition, the No-Build Alternative includes the Eastside Streetcar Project (currently under construction), which would extend streetcar tracks and stations across the Broadway Bridge, serving NE and SE Portland on N and NE Broadway and NE and SE Martin Luther King Boulevard and Grand Avenue to OMSI. With the Close the Loop Project, the Eastside Streetcar will be extended across the Willamette River, to complete the planned Streetcar Loop, via a new

transit, bicycle, and pedestrian bridge to be constructed under the Milwaukie Light Rail Project, connecting to the Streetcar line in the South Waterfront District. Under the No-Build Alternative in 2035, there would be 22 streetcars in the transit system (including spares), an increase of 11 compared to existing conditions.

- **Park-and-Ride Facilities.** Under the No-Build Alternative, the park-and-ride facilities in the corridor would be those that currently exist: a shared-use 30-space park-and-ride lot at Christ Church (1060 SW Chandler Road); a shared-use 34-space park-and-ride lot at Lake Oswego United Methodist Church (1855 South Shore Boulevard); and a shared use 12-space park-and-ride lot at Hope Church (14790 SW Boones Ferry Road).

- **Operations and Maintenance Facilities.** Under the No-Build Alternative, there would be one operations and maintenance facility within the corridor, which would be the existing streetcar maintenance building and storage yard on NW 16th Avenue under I-405. With the Streetcar Loop and Close the Loop Projects, the storage yard could accommodate 25 streetcars and the maintenance facility would have the capacity to service 36 streetcars (an increase in capacity of 13 and 18 vehicles, compared to existing conditions, respectively).

1.4.1.2 Transit Operations

This section summarizes the transit operating characteristics that would occur under the No-Build Alternative, focusing on bus and streetcar operations (see Table 1-2). Figure 1-1 illustrates the transit network for the No-Build Alternative in the vicinity of the corridor.

- **Bus Operations.** Bus operations under the No-Build Alternative would be similar to TriMet's existing fixed-route bus network with the addition of improvements included in the 2035 RTP's 20-year financially constrained transportation system (see Figure 1-1). Transit service improvements within the No-Build Alternative would be limited to those that could be funded using existing and readily-foreseeable revenue sources. Systemwide, those bus operations improvements would include: 1) increases in TriMet bus route frequency to avoid peak overloads and/or maintain schedule reliability; 2) increases in run times to maintain schedule reliability; and 3) incremental increases in TriMet systemwide bus service hours consistent with available revenue sources and consistent with the 2035 RTP's 20-year financially-constrained transit network, resulting in annual increases in service hours of approximately 0.5 percent per year. Specifically, the No-Build Alternative would include the operation of the TriMet bus route Line 35 between downtown Portland and Lake Oswego (continuing south to Oregon City).

- **Streetcar Operating Characteristics**. Under the No-Build Alternative, the City of Portland, through an operating agreement with the Portland Streetcar, Inc. (PSI), would continue to operate the existing Portland Streetcar line between Northwest Portland and the South Waterfront District, via downtown Portland (see Figure 1-1). On average weekdays in 2035, the Streetcar line would operate every 12 minutes during the peak and off-peak periods. Further, the City of Portland would operate the Streetcar Loop Project, serving downtown Portland, the Pearl District, northeast and southeast Portland, OMSI and the South Waterfront District. Frequency on the line for an average weekday in 2035 would be every 12 minutes during the peak and off-peak periods.

1.4.2 Enhanced Bus Alternative

This section describes the roadway, bicycle and pedestrian, and transit capital improvements and transit operating characteristics under the Enhanced Bus Alternative, generally compared to the No-Build Alternative. The intent of the Enhanced Bus Alternative is to address the project's Purpose and Need without a major transit capital investment.

1.4.2.1 Capital Improvements

This section summarizes the transit, bicycle and pedestrian, and transit capital improvements that would occur under the Enhanced Bus Alternative, compared to the No-Build Alternative (see Table 1-1 and Figure 1-2).

- **Roadway Capital Improvements.** Except for the addition of a two-way roadway connection between the proposed 300-space park-and-ride lot and Foothills Road, there would be no change in roadway improvements under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Bicycle and Pedestrian Improvements.** There would be no change in bicycle and pedestrian improvements under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Bus Capital Improvements.** Under the Enhanced Bus Alternative, the 26 bus stops that would be served by Line 35 between downtown Lake Oswego and SW Bancroft under the No-Build Alternative would be consolidated into 13 bus stops, which would continue to be served by the Line 35 (the other 13 bus stops would be removed). The bus stops served by Line 35 between Lake Oswego and Oregon City would be unchanged under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Light Rail Capital Improvements.** There would be no change in light rail capital improvements under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Excursion Trolley Capital Improvements.** There would be no change in excursion trolley capital improvements under the Enhanced Bus Alternative, from the No-Build Alternative.

- **Streetcar Improvements and Vehicles.** There would be no change in streetcar improvements and vehicles under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Park-and-Ride Facilities.** In addition to the park-and-ride facilities included under the No-Build Alternative, the Enhanced Bus Alternative would include a 300-space structured park-and-ride lot that would be located at Oswego Village Shopping Center on Highway 43 in downtown Lake Oswego. The park-and-ride lot would be served by Lines 35 and 36.

- **Operations and Maintenance Facilities.** There would be no changes to the region's operations and maintenance facilities under the Enhanced Bus Alternative, compared to the No-Build Alternative, except that the capacity of TriMet's bus operating and maintenance facilities at either the Center or Powell facility would be expanded to accommodate the additional 13 buses under the Enhanced Bus Alternative (see the *Detailed Definition of Alternatives Report* for additional information).

1.4.2.2 Transit Operations

This section summarizes the corridor's transit operations under the Enhanced Bus Alternative, focusing on bus and streetcar operations. Figure 1-2 illustrates the transit network for the Enhanced Bus Alternative in the vicinity of the corridor.

- **Bus Operations.** Except for changes to the routing, frequency, and number of stops of Line 35 and the elimination of Line 36 service between downtown Portland and downtown Lake Oswego, bus operations under the Enhanced Bus Alternative would be identical to the bus operations under the No-Build Alternative. Under the Enhanced Bus Alternative, Line 35's routing between Oregon City and Lake Oswego would remain unchanged relative to the No-Build Alternative. Further, between Lake Oswego and downtown Portland there would be two routing changes to Line 35, compared to the No-Build Alternative: 1) the bus would be rerouted to serve the new park-and-ride lot at the Oswego Village Shopping Center; and, 2) in downtown Portland, Line 35 would be rerouted to serve SW and NW 10th and 11th avenues, generally between SW Market and Clay streets and NW Lovejoy Street/Union Station to address the travel markets.

- **Streetcar Operating Characteristics.** Under the Enhanced Bus Alternative, there would be no change in streetcar operating characteristics, compared to the No-Build Alternative.

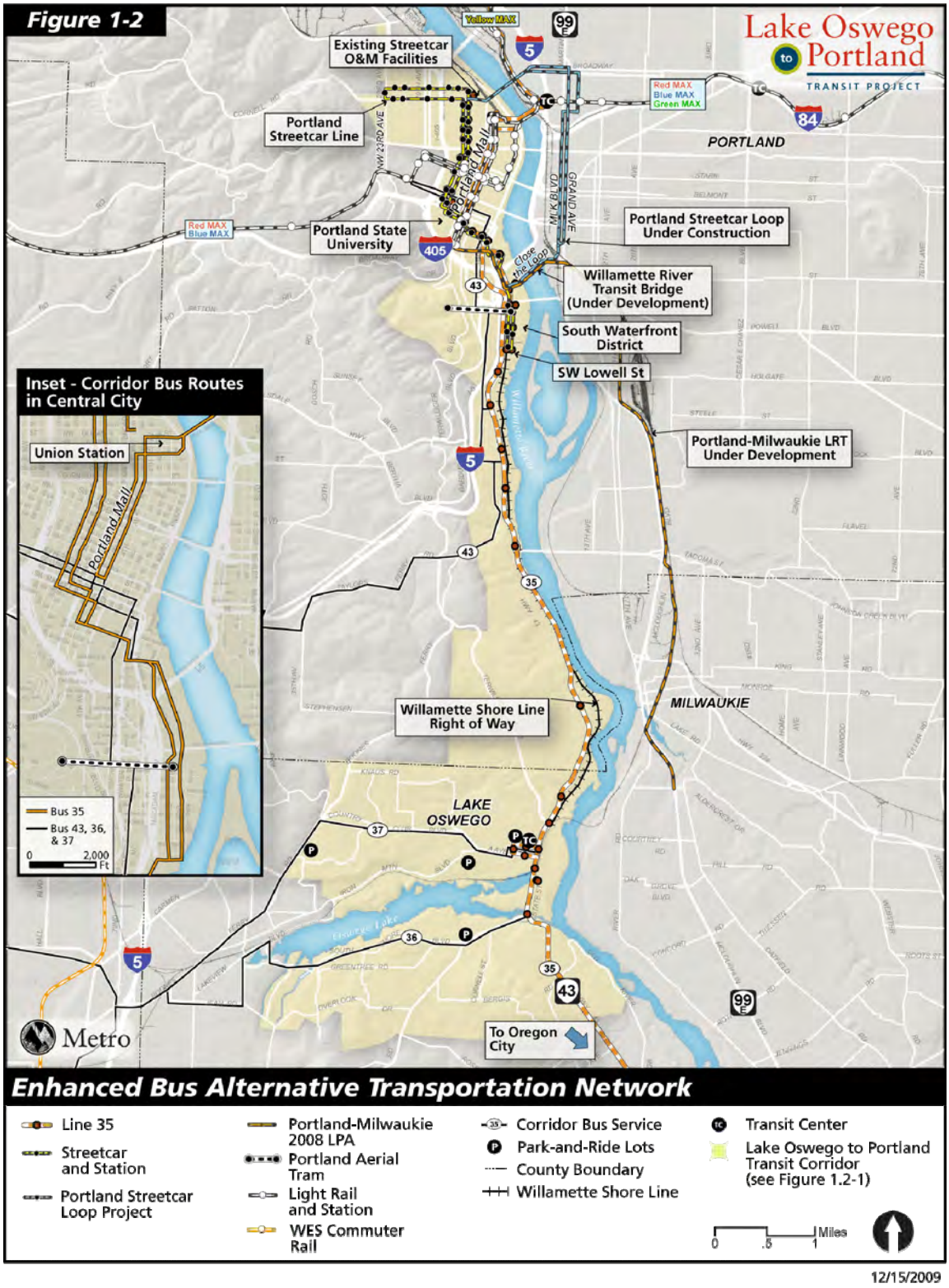

FIGURE 1-2 ENHANCED BUS ALTERNATIVE TRANSPORTATION NETWORK

1.4.3 Streetcar Alternative

This section describes the roadway, bicycle and pedestrian, and transit capital improvements and transit operating characteristics under the Streetcar Alternative, generally compared to the No-Build Alternative.

1.4.3.1 Capital Improvements

This section summarizes the transit, bicycle and pedestrian, and transit capital improvements that would occur under the Streetcar Alternative, generally compared to the No-Build Alternative (see Table 1-1 and Figure 1-3). This section provides a general description of the capital improvements that would occur under the Streetcar Alternative, independent of design option, and it highlights the differences between design options within three of the corridor's segments.

A. Summary Description

Following is a general description of the roadway, bicycle and pedestrian, and transit improvements that would occur under the Streetcar Alternative. The next section provides a description of differences in capital improvements for design options that are under consideration in three of the project's six segments. See Figure 1-4 for an illustration of the project segments and the design options under consideration.

- **Roadway Capital Improvements.** There would be no roadway improvements under the Streetcar Alternative in the following corridor segments: 1) Downtown Portland; and 2) South Waterfront. The roadway capital improvements that would occur under the other corridor segments are described below for those segments. Changes to traffic controls at signalized and non-signalized intersections would occur throughout the corridor to accommodate the safe and efficient operation of the streetcar and local traffic. The *Detailed Definition of Alternatives Report* and the *Streetcar Plan Set* provide additional details on changes to traffic operations at intersections under the Streetcar Alternative.

- **Bicycle and Pedestrian Improvements.** There would be no change in bicycle and pedestrian improvements under the Streetcar Alternative, compared to the No-Build Alternative, except as noted in the following segment-by-segment description.

- **Bus Capital Improvements.** Under the Streetcar Alternative, all 26 bus stops that would be served by Line 35 on Highway 43 between downtown Lake Oswego and the Sellwood Bridge and on SW Macadam Boulevard north of SW Corbett Street under the No-Build Alternative would be removed, because Line 35 service would be replaced in the corridor by streetcar service. The bus stops served by Line 35 between Lake Oswego and Oregon City would be unchanged under the Streetcar Alternative, compared to the No-Build Alternative. In addition, under the Streetcar Alternative,

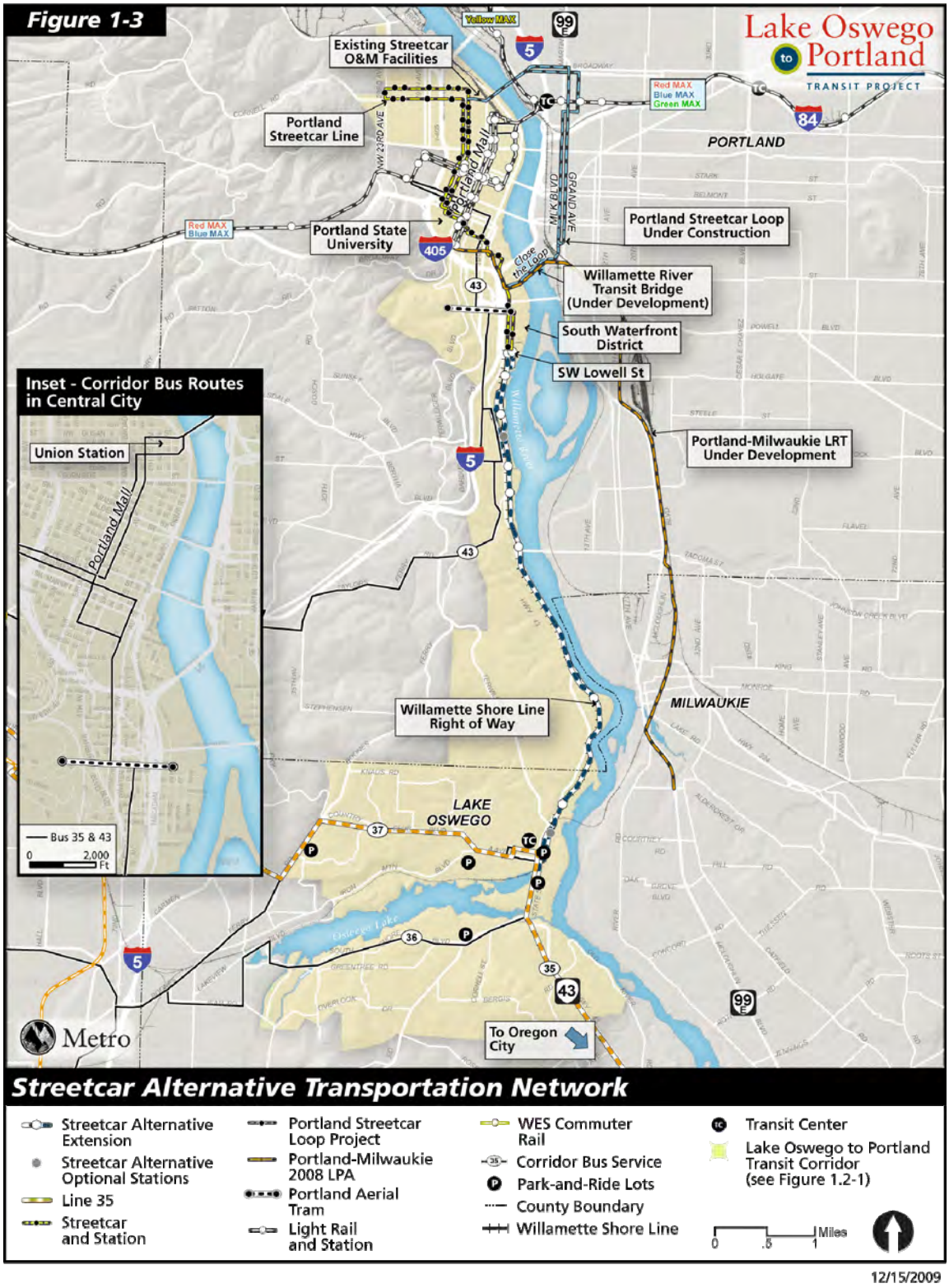

FIGURE 1-3 STREETCAR ALTERNATIVE TRANSPORTATION NETWORK

the Lake Oswego Transit Center would be relocated to be adjacent to the Lake Oswego Terminus Station, from its existing location on 4th Street, between A and B avenues. The changes to the bus capital improvements under the Streetcar Alternative would not vary by any of the design options under consideration.

- **Light Rail Capital Improvements.** There would be no change in light rail capital improvements under the Streetcar Alternative, compared to the No-Build Alternative.

- **Interim Excursion Trolley Capital Improvements.** Under the Streetcar Alternative, there would no longer be an operating and maintenance agreement between the City of Lake Oswego and the Willamette Shore Line Consortium that would allow for the operations of the excursion trolley between SW Bancroft Street and Lake Oswego. Further, the Oregon Electric Railway Historical Society would no longer operate the vintage excursion trolley on the Willamette Shore Line alignment under agreement with the City of Lake Oswego, as they currently do and as they would under the No-Build and Enhanced Bus Alternatives.

- **Streetcar Improvements and Vehicles.** The Streetcar Alternative would extend streetcar tracks and stations south from the existing Portland Streetcar line that operates between NW 23rd Avenue and SW Bancroft Street. Compared to existing conditions and the No-Build Alternative, the Streetcar Alternative would add approximately 5.9 to 6.0 one-way miles of new streetcar tracks and catenary (overhead electrical wiring and support) and ten new streetcar stations between SW Bancroft Street and Lake Oswego. Except when crossing over waterways, roadways, or freight rail lines or through an existing tunnel, the new streetcar line would generally be at the same grade as existing surface streets. Of the approximately six miles of new streetcar tracks, 5.3 miles would be double-tracked (i.e., two one-way tracks) and 0.7 miles would be single-tracked (i.e., inbound and outbound streetcars would operate on the same tracks; see Figure 1-4 for an illustration of the location of single and double-track segments). The new streetcar stations would be of a design similar to the existing streetcar stations in downtown Portland and the Pearl District.

- **Park-and-Ride Facilities.** In addition to the park-and-ride facilities included under the No-Build Alternative, the Streetcar Alternative would include: a) a 100-space surface park-and-ride lot served by the proposed streetcar line at the B Avenue Station; and b) a 300-space structured park-and-ride lot that would be served by the proposed streetcar line at the Lake Oswego Terminus Station. The size and location of these park-and-ride lots would not vary by any of the design options under consideration.

- **Operations and Maintenance Facilities.** With the Streetcar Alternative, a new storage facility that would accommodate eight streetcars would be located adjacent to the streetcar alignment under the Marquam Bridge. The size and location of the streetcar operating and maintenance facilities would not vary by any of the design options under consideration.

B. Segment by Segment Description and Design Option Differences

For the purposes of description and analysis, the Lake Oswego to Portland Corridor has been divided into six segments for the Streetcar Alternative – those segments and design options within three of the segments are illustrated schematically in Figure 1-4. Figure 1-3 illustrates the proposed roadway improvements, streetcar alignment, stations, and park-and-ride lots that would occur in the corridor under the Streetcar Alternative. Figures 1-5 and 1-6 provide more detailed illustrations of the streetcar design options currently under study.

1. Downtown Portland Segment. There would be no roadway or bicycle and pedestrian improvements within the Downtown Portland Segment under the Streetcar Alternative, compared to the No-Build Alternative. Under the Streetcar Alternative, a connection would be added between westbound streetcar tracks on SW Market Street to southbound tracks on W 10th Avenue, which would allow inbound streetcars from Lake Oswego to turn back toward Lake Oswego, providing increased operational flexibility. There are no streetcar alignment design options within this segment and there would be no new streetcar stations within this segment.

2. South Waterfront Segment. The South Waterfront Segment extends between SW Lowell Street to SW Hamilton Court. Streetcar tracks would be extended south of their existing southern terminus at SW Lowell Street, within the right of way of the planned Moody/Bond Couplet extension, to SW Hamilton Street. There would be two new streetcar stations within this segment (Bancroft and Hamilton stations).

3. Johns Landing Segment. The Johns Landing Segment extends between SW Hamilton Court to SW Miles Street. This segment includes three design options: Willamette Shore Line; Macadam In-Street; and Macadam Additional Lane. Under all options, the streetcar alignment would extend south from SW Hamilton to near SW Julia Street, generally within the existing Willamette Shore Line right of way. The three design options would include two new streetcar stations at varying locations, described below. To the south, all three options would share a common alignment between SW Carolina and SW Miles Street, generally via the existing Willamette Shore Line right of way, and they would share one common station at SW Nevada. Following is a description of how the design options would differ:

a. ***The Willamette Shore Line Design Option*** would continue the extension of streetcar tracks south within the existing Willamette Shore Line right of way from SW Julia Street to SW Carolina Street (extending to SW Miles Street). There would be three new streetcar stations (Boundary, Nebraska, and Nevada stations).

b. ***The Macadam In-Street Design Option*** would locate the new streetcar tracks generally within the existing outside lanes of SW Macadam Avenue, approximately between SW Boundary and Carolina streets. Between approximately SW Julia and Boundary streets, the streetcar alignment would be within the right of way of SW Landing Drive, which would be converted from a private to a public street. There would be three new streetcar stations (Boundary, Carolina, and Nevada stations). An optional station at Pendleton Street is also under consideration.

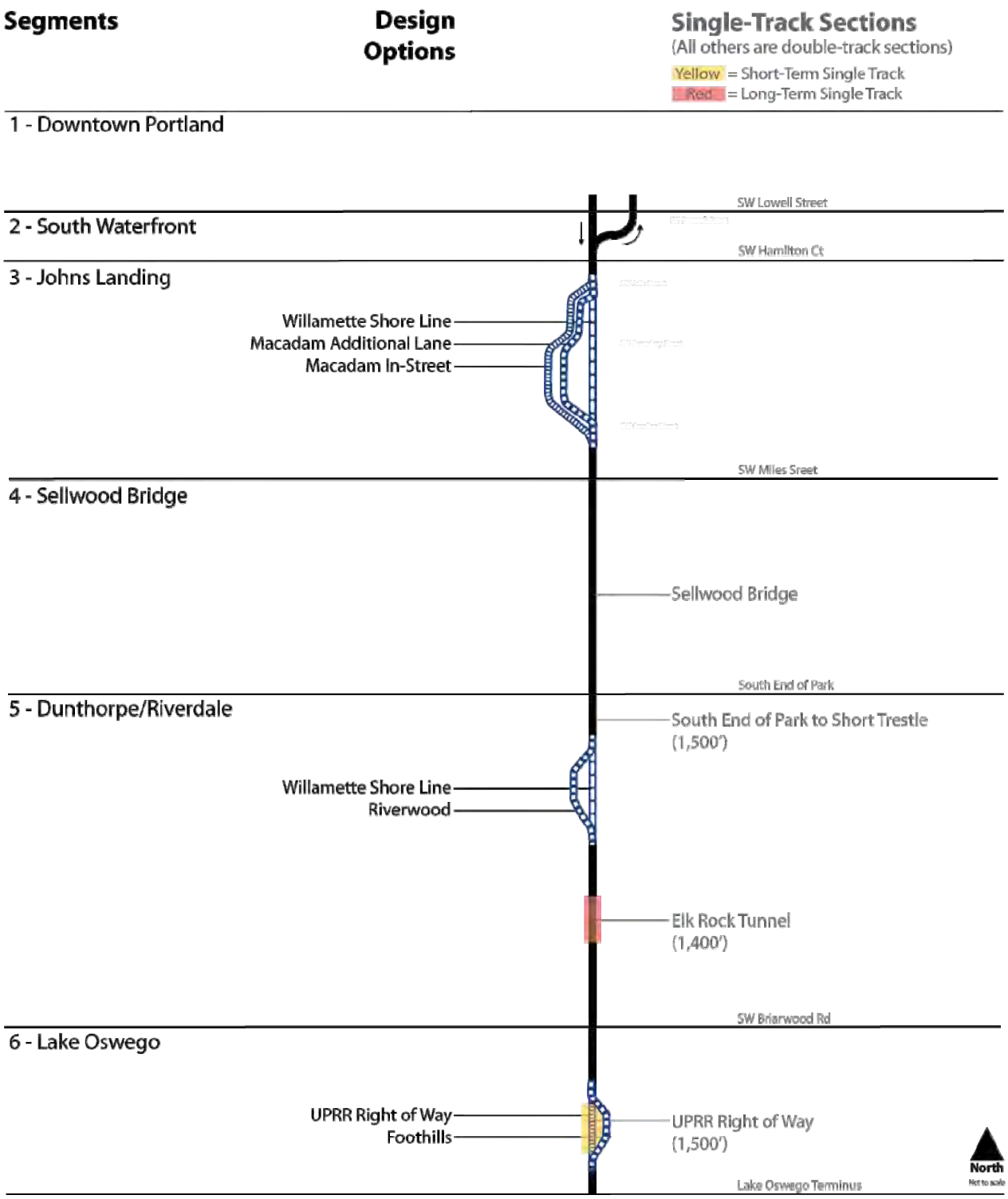

FIGURE 1-4 STREETCAR ALTERNATIVE DESIGN OPTION LOCATIONS

c. ***The Macadam Additional Lane Design Option*** would be similar to the Macadam In-Street Design Option, except that the new northbound streetcar tracks would be located within a new traffic lane just east of the existing general purpose lanes – streetcars would share the new lane with right-turning vehicles. Between approximately SW Julia and Boundary streets, the streetcar alignment would be within the right of way of SW Landing Drive, which would be converted from a private to a public street. There would be three new streetcar stations (Boundary, Carolina, and Nevada stations). An optional station at Pendleton Street is also under consideration.

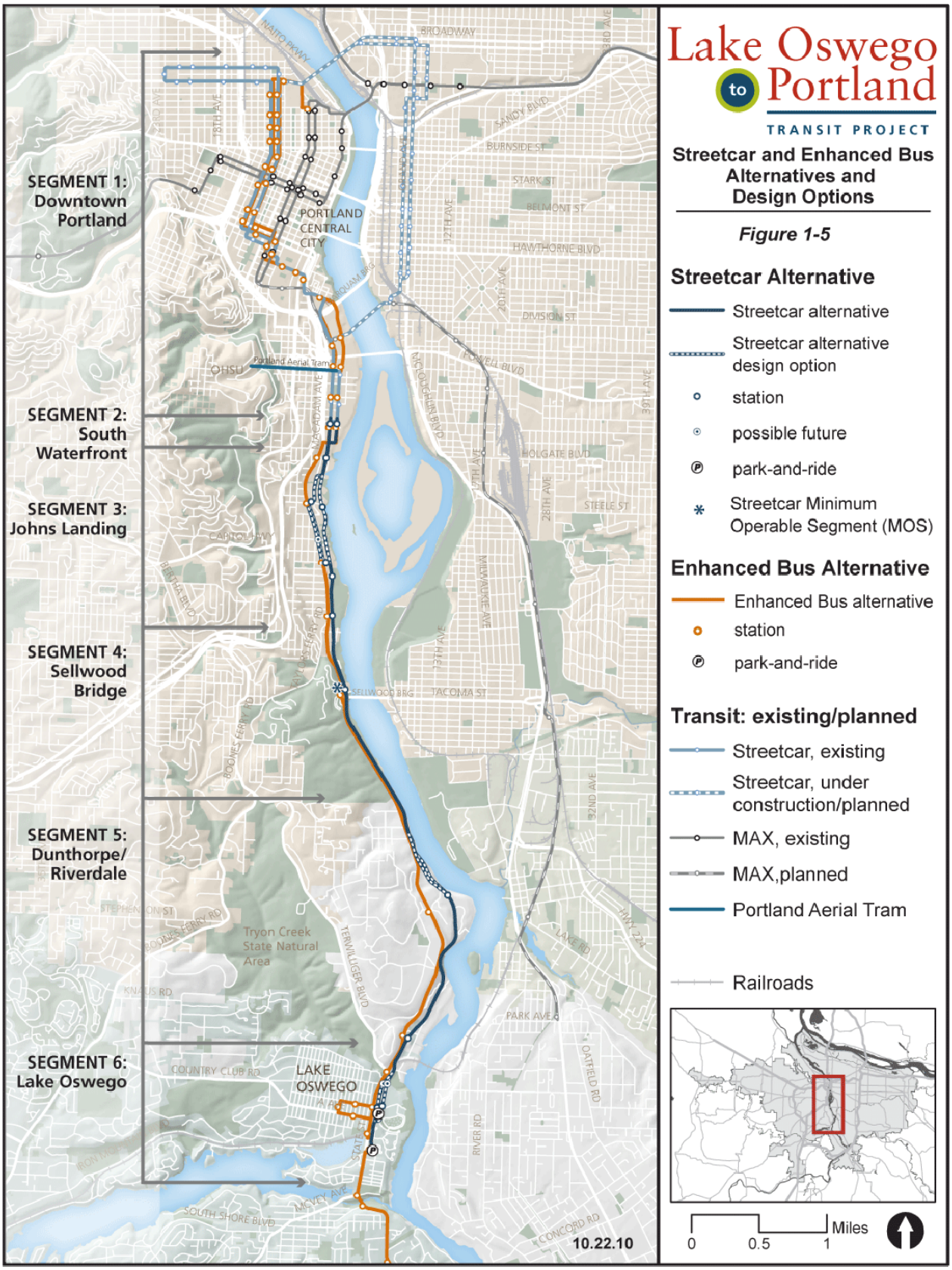

FIGURE 1-5 STREETCAR AND ENHANCED BUS ALTERNATIVES AND DESIGN OPTIONS

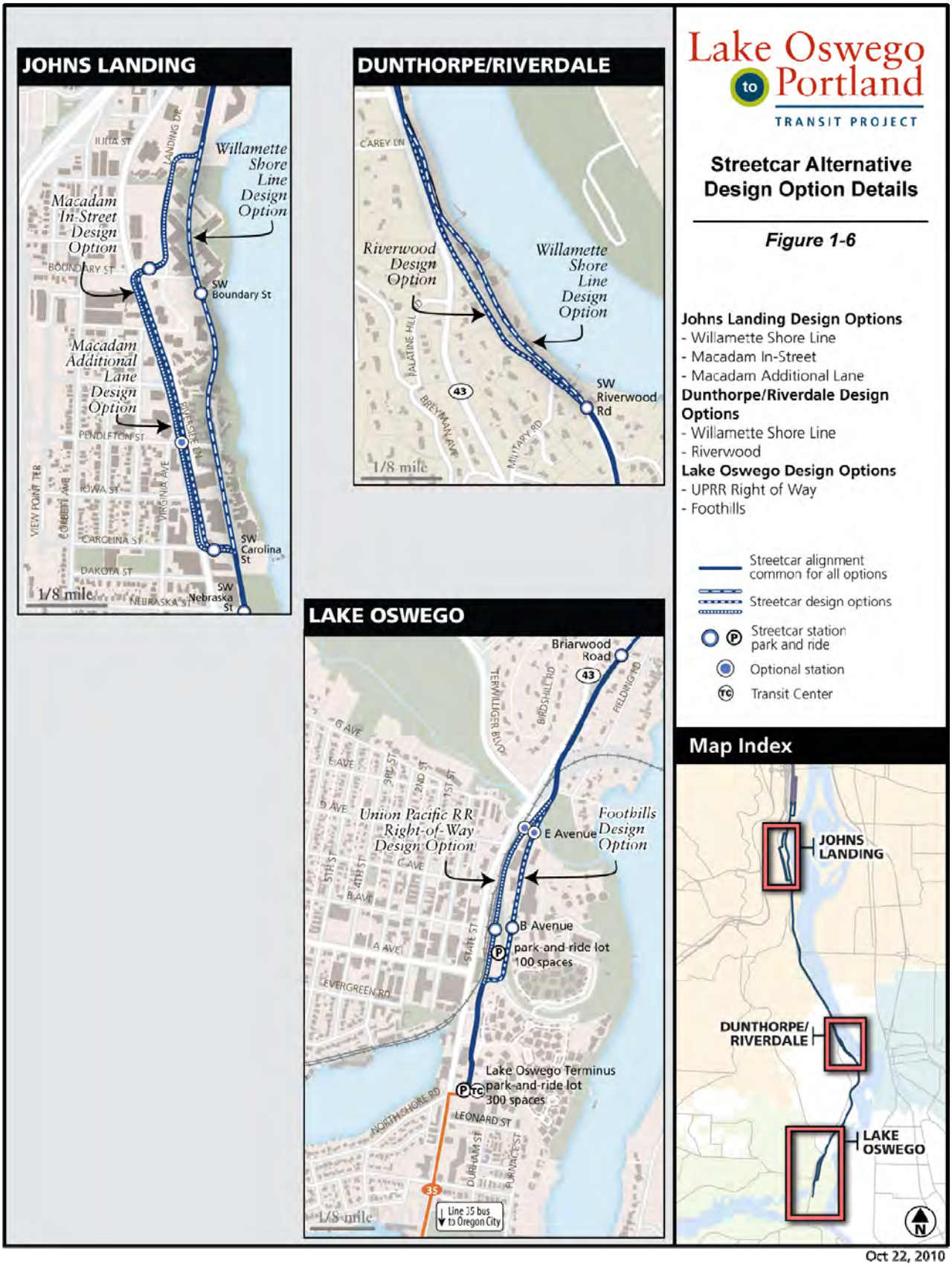

FIGURE 1-6 STREETCAR ALTERNATIVE DESIGN OPTIONS DETAILS

4. Sellwood Bridge Segment. The Sellwood Bridge Segment extends from Miles Street to the southern end of Powers Marine Park. Generally, the streetcar alignment would be located in the Willamette Shore Line right of way, except for the area between Stephens Creek and approximately 1,200 feet south of the Sellwood Bridge. In this area, the streetcar alignment would be constructed in conjunction with the planned west interchange improvements with the Sellwood Bridge (the streetcar would be located slightly east of the existing Willamette Shore Line right of way). The design and construction of the streetcar alignment under this design option would be coordinated with the design and construction of the new interchange for the Sellwood Bridge. There would be one new streetcar station within this segment (Sellwood Bridge Station).

5. Dunthorpe/Riverdale Segment. The Dunthorpe/Riverdale Segment extends between the southern end of Powers Marine Park and SW Briarwood Road. There are two design options in this segment: Willamette Shore Line Design Option and Riverwood In-Street Design Option. Both options would share a common alignment within the Willamette Shore Line right of way, generally north of where SW Riverwood Road intersects with Highway 43 and generally south of the intersection of SW Military Road and SW Riverwood Road. One new streetcar station is proposed within this segment, generally common to both design options (Riverwood Station). Following is a description of how the design options would differ:

a. ***The Willamette Shore Line Design Option*** would generally locate the new streetcar alignment in the existing Willamette Shore Line right of way between the intersections of SW Riverwood Road and Highway 43 and SW Riverwood Road and SW Military Road.

b. ***The Riverwood Design Option*** would locate the new streetcar alignment generally adjacent to Highway 43, north of SW Riverwood Road, and within the right of way of SW Riverwood Road, generally between where it intersects with Highway 43 (that intersection would be closed) and where it intersects SW Military Road. Except for the closure of the Highway 43 and SW Riverwood Road intersection, SW Riverwood Road would remain open to traffic with joint operation with streetcars.

6. Lake Oswego Segment. The Lake Oswego Segment extends between SW Briarwood Road and the Lake Oswego Terminus Station. There are two design options within this segment: the UPRR right-of-way design option and the Foothills Design Option. Both options would generally be the same in two sections: 1) the new streetcar line alignment would extend south from SW Briarwood Road to where the alignment would cross under the existing UPRR tracks; and 2) the new streetcar alignment would be located within a new roadway that would extend south from SW A Avenue to the alignment's terminus near the intersection of N State Street and Northshore Road. Both options would provide for a new bicycle and pedestrian connection under the existing UPRR tracks. There would be two stations within this segment, one that would be common to the two design options (Lake Oswego Terminus Station). An optional station at E Avenue is also under consideration.

This segment would include two park-and-ride lots, both of which would be generally common to the two design options. Following is a description of how the design options would differ:

a. ***The UPRR Design Option*** would extend the streetcar alignment south, generally in the UPRR right of way, from its under crossing of the existing UPRR tracks to SW A Avenue.

The B Avenue Station would be located on the west side of the 100-space surface park-and-ride lot.

b. ***The Foothills Design Option*** would extend the streetcar alignment south from its under crossing of the UPRR tracks to SW A Avenue generally within the right of way of a new general purpose roadway (Foothills Road), which would be built as part of the Streetcar Alternative.

1.4.3.2 Transit Operations

This section describes transit operations under the Streetcar Alternative, generally compared to the No-Build Alternative (see Table 1-2). Figure 1-3 provides an illustration of the transit lines in the vicinity of the corridor under the Streetcar Alternative. There would be no difference in transit operations under any of the design options under consideration.

The Streetcar Alternative would extend the existing Portland Streetcar line from its current southern terminus at Lowell Street to the Lake Oswego Terminus Station in downtown Lake Oswego, expanding the streetcar length from 4 miles to 9.9 to 10 miles (depending on design option). The total round trip running time of the streetcar line between 23rd Avenue and downtown Lake Oswego (10 miles) in 2035 would be 105 or 112 minutes, excluding layover (based on the Willamette Shore Line and Macadam design options in the Johns Landing Segment, respectively). In comparison, under the No-Build Alternative the round trip running time for the streetcar line between 23rd Avenue and Lowell Street (4 miles) would be 68 minutes.

With the extension of streetcar service to Lake Oswego, Line 35 service between Lake Oswego and downtown Portland would be eliminated. The remainder of Line 35 between Oregon City and Lake Oswego would be combined with Line 78, in effect to create a new route between Oregon City and Beaverton. The new bus route and other TriMet transit routes serving downtown Lake Oswego would be rerouted to serve the relocated Lake Oswego Transit Center, which would be adjacent to Lake Oswego Terminus Station.

1.4.3.3 Construction Phasing Options

This section summarizes Streetcar Alternative construction phasing options currently under consideration – neither the No-Build Alternative nor the Enhanced Bus Alternative include construction phasing options. Currently, there are two types of construction phasing options or scenarios under consideration: 1) finance-related and 2) external project related. The Streetcar Alternative evaluated in this Technical Report and the DEIS is as Full-Project Construction. Should the Streetcar Alternative with phasing be selected as the Locally Preferred Alternative, during preliminary engineering (PE) additional analysis of environmental impacts resulting from the interim project alignment (as opposed to Full-Project Construction) will be conducted and additional opportunity for public review and comment may be required.

A. Finance-Related Phasing Options
Following is a description of the two finance-related phasing options currently under consideration.

- **Full-Project Construction.** Under the first construction phasing option, the project would be constructed and opened in its entirety as described within Section 2.2.2.

- **Sellwood Bridge Minimum Operable Segment (MOS).** Under the Sellwood Bridge MOS phasing option, the Streetcar Alternative would be initially constructed between SW Lowell Street and the Sellwood Bridge, with a second construction phase between the Sellwood Bridge and the Lake Oswego Terminus Station occurring prior to 2035. Under this construction phasing option, there would be no additional park-and-ride facilities in the corridor, compared to existing conditions. Under this phasing option, Line 35 would operate between Oregon City and the Nevada Street Station; frequencies would be adjusted to meet demand. Service and bus stops served exclusively by Line 35 would be deleted between the Nevada Station and downtown Portland.

B. External Project Coordination Related Phasing Options
Following is a description of phasing options related to the coordination of the Streetcar Alternative, if it is selected as the LPA, and other external projects. These external project coordination related phasing options represent interim steps in the construction process that would be taken to implement the Streetcar Alternative.

- **South Waterfront Segment Phasing Options.** If the planned and programmed South Portal roadway improvements are not in place or would not be constructed concurrently with the Streetcar Alternative, there would be two options for proceeding with construction of the streetcar alignment in the segment: 1) a different streetcar alignment using the Willamette Shore Line right of way would be initially constructed within the South Waterfront Segment; or 2) the streetcar alignment and its required infrastructure improvements would be constructed consistent with the alignment under the Full-Project Construction phasing option, but other non-project roadway improvements would be constructed at a later date by others. If the Willamette Shore Line right of way were to be used, then, when the South Portal roadway improvements were made, the streetcar alignment would be reconstructed consistent. The transit operating characteristics of the Streetcar Alternative would not be affected by this phasing option.

- **Sellwood Bridge Segment Phasing Options**. The Sellwood Bridge Segment includes two phasing options for the Streetcar Alternative that reflect two potential phasing options or scenarios for construction of the project in relationship to construction of a proposed new interchange that is planned to occur with the Sellwood Bridge replacement project. If the new interchange is constructed prior to or concurrently with the Streetcar Alternative, the initial and long-term streetcar alignment would be based on the new interchange design. The new interchange design is the basis for the analysis in this technical report and the DEIS. If the proposed interchange is constructed after the Streetcar Alternative, then the initial streetcar alignment to be constructed would be in the Willamette Shore Line right of way. Subsequently, when the proposed interchange is constructed, the Sellwood Bridge replacement project would relocate the streetcar alignment with the new interchange design. Therefore, the long-term streetcar alignment would be the new interchange and the Willamette Shore Line phasing option would only be implemented as an interim alignment. Therefore, the two design options in this

segment do not constitute a choice of alignments – instead they represent two construction phasing scenarios, dependent upon how external conditions transpire.

- The Foothills Design Option. The Foothills design option of the Streetcar Alternative is based on roadway improvements that would occur under the City of Lake Oswego's Foothills redevelopment project. If those roadway improvements are not constructed prior to or concurrently with construction of the streetcar alignment, then the Lake Oswego to Portland Transit Project would construct the streetcar alignment and required infrastructure improvements using the same alignment and the roadway improvements would be added at a later date by others.

2. EVALUATION METHODS

2.1 Introduction to Ecosystems Technical Analysis Methods

Construction of the Project will be subject to Federal, state, and local regulations designed to protect biological resources.

2.2 Related Federal, State, and Local Laws and Regulations for vegetation, wildlife, fisheries and wetlands

Construction of the Project will be subject to Federal, state, and local regulations designed to protect biological resources. The principal regulations, ordinances, and permit actions that could apply to implementation of the selected alternative are discussed below and summarized in Tables 2-1, 2-2, and 2-3. Additional regulatory compliance may be identified as Project design progresses. This evaluation of alternatives and options does not provide the level of detail necessary for many of the individual permits identified below. Subsequent documentation, where necessary and appropriate, may be prepared, depending on the alternative selected. Such documentation may be submitted prior to the Final Environmental Impact Statement (FEIS) as a standalone study, or incorporated into the FEIS itself.

2.2.1 Federal Regulations

Several Federal regulations apply to the proposed Project, including the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and Clean Water Act (CWA). NEPA provides an interdisciplinary framework for Federal agencies to evaluate potential impacts resulting from a proposed Federal action. A key component of NEPA is the preparation of an Environmental Impact Statement (EIS) for major actions that may significantly affect the quality of the environment. Detailed descriptions of anticipated environmental impacts resulting from the proposed project, including measures for mitigating adverse impacts will be provided in the EIS.

The ESA was designed to protect critically imperiled species from extinction. The Act protects species that are officially listed as "endangered" or "threatened", or areas of critical habitat designated for these species. Regulatory approval for the proposed Project may be required under Section 7 of the ESA. As required by this statute, consultation with National Marine Fisheries Services (NMFS) and/or the U.S. Fish and Wildlife Services (USFWS) will be initiated to identify listed threatened and endangered species and their critical habitats that could be affected by the Preferred Alternative. As part of the FEIS, preparation of a Biological Assessment (BA) will likely be required for the Preferred Alternative because of the potential for impacts to Federally listed fish species and/or their habitats located in Tryon Creek, Stephens Creek, and potentially occurring in smaller tributaries to the Willamette River. The BA will evaluate the potential effects of the Preferred Alternative on listed species and designated critical habitat and potential impacts to Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation Management Act (MSA). A finding of effect on the species and designated critical habitat will be submitted for approval by NMFS and/or USFWS.

The CWA protects the physical, chemical, and biological integrity of the nation’s jurisdictional waters. Section 401 of the CWA authorizes the Environmental Protection Agency (EPA) to review Federal actions for potential water quality impacts. Federal actions must receive Section 401 water quality certification. In Oregon this responsibility is delegated to the Oregon Department of Environmental Quality (DEQ).

Section 404 of the CWA regulates the discharge of dredged or fill materials into "waters of the U.S." (waters). Because the proposed alignment and alternatives are located adjacent to the Willamette River and cross several of its tributaries, non-wetland waters could be affected. Section 404 is regulated by the U.S. Army Corps of Engineers (USACE) for most projects on non-tribal lands in Oregon. Applicants desiring a Department of the Army CWA Section 404 permit must demonstrate that all impacts to waters have been avoided to the maximum extent practicable and that unavoidable impacts are compensated for. Section 404(b)(1) guidelines state that an alternatives analysis must be prepared to demonstrate that the development footprint reduced impacts to the maximum extent practicable. This analysis must present alternatives in a comparative fashion to ensure that proposed activities would cause minimal effects to the environment. In general, projects required to complete an EIS fulfill this requirement through the NEPA process.

Table 2-1. Summary of Potential Federal Natural Resource Permitting Requirements

Regulation/Permit	Responsible Agency	Resource Studies	Regulated Biological Resources
National Environmental Policy Act (NEPA)	Federal Transit Administration (FTA)	NEPA EIS addressing natural resource conditions, impacts, and mitigation	Vegetation, wildlife, and fisheries
Clean Water Act (CWA) Section 404	U.S. Army Corp of Engineers (USACE) for discharge of fill material; U.S. Environmental Protection Agency (EPA) for water quality certification	Delineate and evaluate physical, chemical, and biological impacts to Waters of the US	Waters of the US, including wetlands
Rivers and Harbors Act Section 10	USACE	Ordinary High Water Line Boundary for River	Navigable Waters of the US, including Willamette River
Endangered Species Act (ESA)	National Marine Fisheries Service (NMFS); U.S. Fish and Wildlife Service (USFWS)	Biological Assessment (BA) addressing project impacts to listed species, species proposed for listing, candidate species, and designated critical habitats	Vegetation, wildlife, and Fisheries
Magnuson Stevens Fisheries Conservation Management Act (MSA	NMFS	Evaluation of project impacts on suite of commercially harvested marine fish species and their habitat, including Chinook and coho salmon. Evaluation is included in ESA Section 7 consultation BA	Commercially harvested marine fish species and their habitat, including Chinook and coho salmon
Fish and Wildlife Coordination Act	USFWS, NMFS, and ODFW	Agency consultation, identify impacts to fish and wildlife resources, and recommend mitigation	Vegetation, wildlife, and fisheries
Migratory Bird Treaty Act (MBTA)	USFWS	Identify impacts to migratory birds	Wildlife

In Oregon, wetland impact review is a coordinated process where the Oregon Department of State Lands (DSL) provides wetland boundary concurrence, which the USACE uses to process permit applications. Wetland permit applications are jointly filed with the USACE and the DSL. Issuance of

a CWA Section 404 permit is a Federal action. As such an application for regulated wetland impacts will trigger the following Federal coordination:

- ESA Section 7 consultation by the USFWS and/or NMFS;
- CWA Section 401 Water Quality Certification from the Oregon Department of Environmental Quality (DEQ); and
- Clearance from the State Historic Preservation Office (SHPO) under Section 106 of the National Historic Preservation Act (NHPA).

These Federal reviews will be handled through the NEPA process by the FTA, which is the lead Federal agency for the Project.

2.2.2 State Regulations

The proposed Project would be required to comply with several Oregon State natural resource regulations, including CWA Section 401, Water Quality Certification, the Oregon Removal - Fill Law, Oregon State ESA, and the State Fish Passage Law. Section 401 Water Quality Certification is administered by DEQ and will be required to ensure compliance with water quality standards. Section 404 is triggered by review for Section 401 Water Quality Certification.

The Oregon Removal - Fill Law requires a permit for any removal or fill activities within Essential Salmonid Habitat (ESH) or activities involving 50 cubic yards or more of disturbance in any other waters of the state (including wetlands). The Willamette River and many of its tributaries are considered ESH. Removal Fill permit applications are filed concurrently with CWA Section 404 permit applications using the Joint Permit Application (JPA). The DSL review of the joint application includes consultation with the Oregon Department of Fish and Wildlife (ODFW), DEQ, the Department of Land Conservation and Development (DLCD), the City of Portland, and the City of Lake Oswego.

The Oregon ESA (Oregon Revised Statutes (ORS) 496.171) is jointly administrated by the Oregon Department of Fish and Wildlife (ODFW), which manages animal resources, and the Oregon Department of Agriculture (ODA), which manages plant resources. The Oregon Natural Heritage Program (ONHP) plays a similar role in conservation efforts for invertebrate species. The Oregon ESA is limited to state-owned land, state-leased land and land over which the state has a recorded easement. In addition, endangered species management planning is limited to state agencies. Generally, the Federal and State ESA laws cover the same species, though there are instances where species occur under one jurisdiction but not the other. Species protected under both laws will be discussed in the NEPA evaluation. Compliance documentation for the Oregon ESA is typically waived for projects where NEPA and Federal ESA documentation (EIS and BA, respectively) is prepared.

The Oregon State Fish Passage Law (Oregon Administrative Rules (OAR) 635-412-0005 et seq.) is administered by ODFW and requires project activities to maintain upstream and downstream passage for native fish species. The law is applied if projects in or near streams involve specified trigger events. Such triggers include culvert replacement, removal, or improvements, such as those proposed under one of the alternatives being evaluated. In a limited set of circumstances, a waiver or exemption to the Fish Passage Law can be obtained.

Table 2-2. Summary of Potential State Natural Resource Permitting Requirements

Regulation/Permit	Responsible Agency	Resource Studies	Regulated Biological Resources
Oregon State ESA	Oregon Department of Fish and Wildlife (ODFW) and Oregon Department of Agriculture (ODA)	Identify project impacts to state-listed and candidate species	Vegetation, wildlife, and Fisheries
CWA Section 401 Water Quality certification	Oregon Department of Environmental Quality (DEQ); delegated by the U.S. Environmental Protection Agency (EPA)	Assess project compliance with state water quality Standards	Rivers, streams, and other waters
Oregon Removal-Fill Law	Oregon Department of State Lands	Wetland/ waterway boundary delineation, and assessment of impacts to regulated waters in terms of area and function	Wetland and other waters of the state
Oregon Fish Passage Law	Oregon Department of Fish and Wildlife (ODFW)	Evaluation of project impacts on fish passage conditions	Streams with current or historic native fish use

2.2.3 Local Regulations

Under Oregon land use regulations, local and state jurisdictions are required to compile inventories of wetland and natural areas and protect the highest-ranking inventoried sites. Within the project corridor, this protection is provided by DSL through its Lower Willamette River Management Plan and by the City of Portland through its Environmental Overlay Zone and Willamette River Greenway Overlay Zone, and by the City of Lake Oswego. Additional protection is provided through Clackamas County's setback requirements for buildings and structures along rivers or perennial streambeds. Additional environmental protection is afforded by Title 3 of Metro's Urban Growth Management Functional Plan. Compliance with Title 3 by city and county jurisdictions can be accomplished by adopting Metro's Water Quality and Floodplain Management Model Ordinance, or by demonstrating that plans and local implementing ordinances comply with Title 3 performance standards for flood protection and management.

The City of Portland (COP) regulates wetland buffers for wetlands that have been identified within a mapped environmental zone overlay. This includes most of the prominent, large, high-quality wetlands within the City. If a project is not exempt from environmental zoning regulations (COP Code Section 33.430.080) and/or the project does not meet the City's development standards (COP Code Section 33.430.140 through .190), environmental review and mitigation will be required by the City, which may include buffer mitigation. When necessary, mitigation site plans must demonstrate functional replacement of wetland/buffer resources within the same watershed as the affected environmental zone.

The City of Lake Oswego regulates environmentally significant wetlands, stream corridors, and associated applicable buffers under Section 50.16 of the City Code. This section of code creates Resource Protection (RP) and Resource Conservation (RC) Overlay Districts. These overlay districts are shown on the Sensitive Land Atlas. Generally the significant wetlands and streams are designated RP and the surrounding buffers are designated RC. All wetlands and waterway resources identified within a property that are not already noted in the Sensitive Lands Atlas are subject to ranking and

evaluation by the City to determine, through an Economic, Social, Environmental, and Energy (ESEE) analysis, if the resources merit RC or RP designation. All wetlands include "RC" buffer areas, which have widths that are defined as follows:

Buffer = 30 feet:

- Class I Wetlands
- Class I Stream Corridors
- Class II Wetlands abutting Class I Stream Corridors

Buffer = 25 feet:

- Other Class II Wetlands
- Class II Stream Corridors

Buffer widths may be reduced if a qualified professional can demonstrate that doing so will not affect the functionality of the buffer in relation to the protected resource.

Table 2-3. Summary of Potential Local Natural Resource Permitting Requirements

Regulation/Permit	Responsible Agency	Resource Studies	Regulated Biological Resources
Willamette River Greenway Land Use Review	City of Portland, Bureau of Development Services; City of Lake Oswego	Evaluation of impacts to native vegetation; mitigation or preservation of native vegetation; conforming uses within designated setbacks	Vegetation, wildlife, and fisheries resources occurring in the Willamette River Greenway setback
Environmental Zone Overlay Districts	City of Lake Oswego	Identification and evaluation of impacts to wetlands or waters, including associated buffers identified in a zoning overlay district	Vegetation, wildlife, waters, wetlands, and fisheries; may include buffers
Environmental Zone Overlay	City of Portland	Identification and evaluation of impacts to wetlands or waters, including associated buffers identified in an environmental overlay zone	Vegetation, wildlife, waters, wetlands, and fisheries; may include buffers
Metro Functional Plan – Title 3	Metro	Evaluation of impacts on water quality, flood management, fish, and wildlife	Vegetation, wildlife, and fisheries

2.3 Data Collection

The following section details the methods used to establish the existing conditions found within the Project study area and additional projects that may occur in proximity to the proposed actions which could result in additive or cumulative impacts. This section addresses site investigations by field biologists, literature searches, and consultation with regulatory agency personnel.

2.3.1 Vegetation, including plant species and vegetation communities

Field evaluations for vegetation were conducted within the proposed right-of-way of the Streetcar Alternative. A map of vegetation types surrounding the right-of-way was prepared using aerial

photographs, National Wetlands Inventory (NWI) maps,[2] and existing vegetation maps. Vegetation polygons were classified using methods described in Johnson and O'Neil (2001). Maps indicating locations and aerial extent of vegetation types, sensitive plant associations, important wildlife habitat, and other key ecological features were generated and field-verified during field surveys.

Data collected included information on plant species composition, habitat quality, and structure of vegetation communities. The assessment of habitat quality included consideration of such factors as native species composition, past disturbance, edge effect, and degree of fragmentation and isolation. The relative function of each plant community in providing a habitat to wildlife was also evaluated.

Plant surveys were conducted within the right-of-way of the proposed project and alternatives during the blooming period to ensure positive identification. Surveyors walked the length of the proposed right-of-way for the streetcar alternative searching for sensitive plants, and recording the location of all identified noxious weeds. All identified noxious weed populations were mapped using GPS.

Impacts to vegetation were assessed within the right-of-way of the proposed Project and alternatives. Impacts were identified as areas where direct losses to vegetation would likely occur, and where potential indirect effects to vegetation may result from construction and operation of the proposed alternatives.

2.3.2 Wildlife, including wildlife species and habitat

Assessment of impacts to potentially occurring wildlife species were determined by identifying direct habitat loss and short and/or long-term impacts to habitat quality resulting from construction and operation of the proposed Project. Because focused surveys for most species were beyond the scope of this study, occurrence in the area was determined by incidental observations, records of positive sightings (i.e. ORNHIC database), habitat suitability, and consultation with resource agencies. No wildlife species surveys were conducted due to the high mobility of species likely to occur within the potentially affected area and the cost associated with such studies.

2.3.3 Fisheries, including fish species and aquatic and riparian habitats

As with assessment of wildlife species, discussed above, assessment of impacts to potentially occurring fisheries species were determined by identifying direct habitat loss and short and/or long-term impacts to habitat quality resulting from construction and operation of the proposed alternatives. Because focused surveys for aquatic species were beyond the scope of this study, occurrence in the area was determined by incidental observations, records of positive sightings (i.e. ORNHIC, Streamnet, and state and city records and studies), habitat suitability, and consultation with resource agencies. Reports documenting fisheries resources and habitat quality in the area of potential impact, as well as other related topics, were consulted in assessing potential habitats affected by the proposed alternatives.

The extent of anticipated Project impacts was evaluated in two distinct manners. Temporary, construction-related habitat impacts were established by considering the entirety of the Project footprint. Long-term/permanent habitat impacts were established by evaluating Project right-of-way expansion and/or modification to existing conditions in proximity to potential aquatic resources. This

[2] NWI maps are a series of topical maps to show wetlands and deepwater habitats prepared by the USFWS and updated by state and local governments.

approach to long-term/permanent habitat impacts overestimates potential habitat impacts, as it assumes all aquatic and riparian habitats within the right-of-way will be impacted, when it is more likely that many areas will have smaller permanent habitat impacts. Specifically, areas spanned by trestles and new crossing structures are assumed to have permanent impacts equal to the right-of-way within the 100-year floodplain. As design progresses, such assumptions can be refined and the impacts will better reflect the actual permanent loss of functioning habitats resulting from footings and new abutments or other structures.

2.3.4 Wetlands and Waterways

For the purpose of this wetlands/waterways analysis, the potentially affected area was limited to the right-of-way and anticipated construction limits of the Streetcar Alternative. Temporary impacts associated with construction are assumed to occur within the entirety of the construction limits. Permanent impacts may result from construction, but are also assumed to include all resources within the right-of-way.

In-office research was conducted prior to field studies to determine the known extent of wetlands or waters within the study area. Several sources were consulted, including the USFWS NWI, the USDA's National Resource Conservation Services (NRCS) digital soil survey for Multnomah and Clackamas County, the City of Portland's (COP) online mapping resource for known environmentally sensitive areas and recent aerial photography from the University of Oregon.

Linear depressions are common along the edges of railroad tracks. Minor linear depressions located at the base of the railroad embankment that lacked water, bed and banks, or scour marks were not delineated.

The geographic extent and location of wetlands in the study area were identified and delineated according to the guidelines in the 1987 USACE *Wetlands Delineation Manual* (Environmental Laboratory 1987), the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Regional Supplement) (USACE 2008) and Oregon Administrative Rules 141-090-0005 through 141-090-0055. Delineated wetland boundaries are subject to verification and approval by USACE and DSL.

2.3.5 TES Species

Threatened and endangered species (T&E) include those species listed as threatened or endangered, proposed for listing, or candidates for listing under the Federal ESA and the Oregon ESA. Sensitive species are categorized as such by federal agencies as species of concern (SOC) and by ODFW through the Oregon sensitive species lists. In addition, other entities may denote the special status of species including the City of Portland and the Oregon Natural Heritage Information Center (ORNHIC). T&E and sensitive species (collectively TES species) are addressed in this evaluation, with the latter being discussed if there is a presumption or evidence of their presence. TES species are identified in Table 4-4, with state and Federal T&E species presented first, followed by sensitive species.

Because identified Threatened, Endangered, and Sensitive (TES) species likely to occur in the Project vicinity and with the potential to be impacted by anticipated Project activities are limited to aquatic species (see Section 4.5), discussion relative to TES species will be similar, if not identical, to the discussion for fisheries resources. To minimize repetition, the TES species discussion will henceforth

reference the applicable aspects detailed in the fisheries discussion sections and focus on TES relevant exceptions or refinements not discussed in the fisheries discussion.

Although not listed under the ESA, the bald eagle remains protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (MBTA). Under both laws, the disturbance of eagles, their nests, and eggs is prohibited. On June 5, 2007, the USFWS issued the Bald Eagle Management Guidelines, which clarified its regulations regarding implementation of the Bald and Golden Eagle Protection Act. Consequently, a pre-field review for the bald eagle was conducted. This review included database searches, discussions with local experts, and an assessment of habitat within the vicinity of the proposed Project. Potential to harm individual birds at any life stage was also evaluated. Impacts on breeding and foraging success was assessed using existing and predicted levels of noise, light, vibration, and human activity during project construction and operation.

2.4 Impact Assessment Analysis Methods

Actions associated with the project alternatives were assessed for both long-term (permanent) and short-term (temporary) effects to ecosystem resources. Long-term impacts included the irreversible removal, disturbance, or destruction of these resources. Short-term impacts were generally associated with construction activities and included reversible effects to these resources. Impacts were further distinguished by whether an impact is considered "direct," resulting in an immediate effect on the resource under consideration, or "indirect," resulting in an effect to the resource that occurs further removed in time or location from the source of the impact.

Impacts to all resources were evaluated either quantitatively or qualitatively by alternative. Potential cumulative impacts resulting from the project alternatives were addressed qualitatively. Implementation of Project Alternatives were determined to have both positive and negative effects on ecosystem resources. Positive effects include supporting growth management policies which, 1) limit growth outside of the urban growth boundary, and 2) accommodate more growth where there is access to the transit system. These growth management policies serve to limit development in areas that provide habitat, maintain environmental resources, and limit increases in impervious surfaces. Negative effects are discussed in the following sections.

2.4.1 Vegetation and Wildlife

The finding of significance for impacts to ecosystem resources were based upon criteria outlined in NEPA (40 CFR 1508.27) guidelines, evaluation of technical data, consultation with resource agencies, and professional judgment and experience. Consideration was also given to input from the affected public, including the degree to which the significance of an activity may vary with setting, severity, duration, and likelihood of the impact. However, the primary criteria for determining significance of impacts to ecosystem resources was based on the sensitivity rating or status assigned to the resource by Federal, state, and local agencies. For instance, impacts to the habitat of Federally listed species would be considered of higher significance than impacts to locally sensitive species' habitat. Although an indirect measure of biological rarity, status generally reflects the biological vulnerability of species (or habitats) by considering such factors as geographical distribution, remaining population size, reproductive success, distribution and status of its habitat, and threats of elimination.

Project impacts to vegetation, wildlife, and wildlife habitats were determined through a qualitative assessment considering the following factors:

- The regional significance of the resource (e.g., priority habitats)
- Wildlife habitat value (including the site's role as a wildlife movement corridor)
- The degree of fragmentation and isolation of the habitat pre-and post-project implementation
- Overall habitat quality
- Potential for enhancement or restoration

Construction and operation impacts to wildlife, including disturbances from increases in human access, noise, and light, were assessed based on available data. Potential impacts to vegetation and wildlife were assessed using information presented in the water quality and hydrology results report for this project. Analysis from the results report were also used to determine the potential for direct impacts to vegetation due to increases in soil erosion and streambed scouring (e.g., uprooting of trees, shrubs, etc.).

2.4.2 Fisheries

Impacts to fisheries resources and habitats were evaluated by overlaying the proposed alternative development footprints on documented and field investigation-derived waterway polygons. Impacts within the 100-year floodplain were evaluated, where the 100-year floodplain has been established. For streams lacking a documented 100-year floodplain, effects within the riparian zone, as established by the fisheries biologist, of each aquatic resource were evaluated. After establishing the area of fisheries impact, the fisheries biologist consulted with the project engineers to determine if any additional impact avoidance or minimization opportunities existed. Specific direct and indirect impacts were calculated as follows:

- Direct impacts, were calculated using the full limits of construction. Total acreage of temporary and permanent impacts to aquatic systems supporting fisheries were combined to produce the most conservative estimate of impacts.
- Indirect impacts, both temporary and permanent, were qualitatively estimated based upon limits of construction, length of construction period, reduction/increase in local traffic patterns during construction, improvements to local stormwater resources due to final construction, and incorporation of Best Management Practices (BMPs).
- Cumulative impacts were calculated on a qualitative basis.

2.4.3 Wetlands and Waterways

Impacts to wetlands were evaluated by overlaying the proposed alternative development footprints on the delineated wetland and waterway polygons. After establishing the area of wetland impact, the wetland ecologist consulted with the project engineers to determine if any additional impact avoidance or minimization opportunities existed. Specific direct and indirect impacts were calculated as follows:

- Direct impacts, were calculated using the full limits of construction. Total acreage of temporary and permanent impacts to wetlands were combined to produce the most conservative estimate of impacts.
- Indirect impacts, both temporary and permanent, were qualitatively estimated based upon limits of construction, length of construction period, reduction / increase in local traffic

patterns during construction, improvements to local stormwater resources due to final construction, and incorporation of BMPs.

- Cumulative impacts were calculated on a qualitative basis.

2.4.4 TES Species

Discussion of TES species assessment methods are identical to those presented in Section 2.4.2.

3. CONTACTS, COORDINATION AND CONSULTATION

The following section details private, local, state, and Federal personnel or agencies contacted with regards to the proposed Project.

3.1 Vegetation

All information discussed in this section is the result of literature review and field investigations. No agency or outside professionals were contacted regarding vegetation resources.

3.2 Wildlife

All information discussed in this section is the result of literature review and field investigations. No agency or outside professionals were contacted regarding wildlife resources.

3.3 Fisheries

Mary Bushman, Biologist with the City of Portland Bureau of Environmental Services (BES) was contacted several times from December 2009 through February 2010 to discuss the City's on-going biological monitoring of the streams draining into the Powers Marine Park. The BES information was not published or available for use in analysis at the time this report was prepared.

3.4 Wetlands and Waters

James Holm, the U.S. Army Corps of Engineers Regulatory Specialist for Multnomah County was consulted to discuss whether the USACE would assert jurisdiction over waters and wetlands identified in the field.

3.5 TES Species

Mary Bushman, Biologist with the City of Portland Bureau of Environmental Services was contacted several times from December 2009 through February 2010 to discuss the City's on-going biological monitoring of the streams draining into the Powers Marine Park. The BES information was not published or available for use in analysis at the time this report was prepared.

4. AFFECTED ENVIRONMENT

The following section discusses the existing environmental conditions of the botanical resources, wildlife, fisheries, wetlands and waterways within the Project study corridor. Relevant TES species are discussed separately in Section 4.5. Descriptions represent a synthesis of field observations, literature search-derived documentation, and interviews with resource and regulatory agency personnel. Impacts to publicly owned public park and recreation areas, publicly owned wildlife and waterfowl refuges, and historic sites, are covered under federal codes known as "Section 4(f)" and discussed separately in Section 3.6 Parks and Recreational Resources of the *Lake Oswego to Portland Transit Project DEIS* (Metro, December 2010). Appendix E of the DEIS contains an inventory of Section 4(f) resources and a preliminary assessment of effects of the alternatives and design options on the identified resources in the corridor. More detailed information about the analysis methods, the identified resources, the evaluation of the study alternatives' effects on park and recreation resources and the preliminary Section 4(f) analysis can be found in the *Lake Oswego to Portland Transit Project: Park and Recreation Technical Report and Preliminary Section 4(f) Analysis* (DEA/URS and TriMet/Metro, December 2010).

4.1 Vegetation, including plant species and vegetation communities

The study area contains large sections of medium- and high-density commercial and residential development mixed with undeveloped natural areas. Areas of commercial development include commercial buildings, roads, sidewalks, and other infrastructure, with limited landscaped vegetation and patches of invasive vegetation species. Residential developments include some high-density neighborhoods with limited landscaped vegetation, and low-density residential areas characterized by mature landscaped vegetation and open lawns. Undeveloped areas include the banks of the Willamette River, areas that traverse the riparian areas of Stephens Creek and Tryon Creek corridors, park land associated with Cottonwood Bay, Willamette Park, Butterfly Park, Powers Marine Park, and a few undeveloped lots. The entire project area is broadly classified as developed or composed of westside coniferous/deciduous forest. Vegetated areas consist of woodland/herbaceous plant communities composed of landscaped vegetation, or a mix of landscaped and natural vegetation. Figure 4-1 depicts the general vegetation classifications within the study area.

Of note are individual Oregon white oak (*Quercus garryana*) trees located in Willamette Park in proximity to the rail alignment. Oregon white oaks are rare in the region and there is concern over potential impacts to these trees. Current design shows the Streetcar Alternative potentially impacting several white oaks by encroaching within the drip line. At this level of design, specific avoidance and minimization measures have not been evaluated, but which will be developed and employed to the extent practicable.

A more detailed description of vegetation observed by Segment and Design Option is presented below:

- *South Waterfront Segment*

Vegetation located in the right-of-way of the South Waterfront Segment was evaluated using aerial imagery. It was determined that plant species and vegetation communities are limited to isolated ornamental species.

The South Waterfront Segment could be affected by the timing of other projects in the vicinity. If planned South Portal roadway improvements are not in place, or would not be constructed concurrently with the Streetcar Alternative, there would be interim phasing options for proceeding with construction of the streetcar alignment. Under an interim phasing option the South Waterfront Segment is located in an area characterized by high density commercial development. No contiguous vegetation exists. Patches of vegetation within the proposed right-of-way is dominated by invasive species or cultivated shrubs. See the Section 3.17 Phasing Effects of the *Lake Oswego to Portland Transit Project DEIS* (Metro, December 2010) for more information on the phasing options.

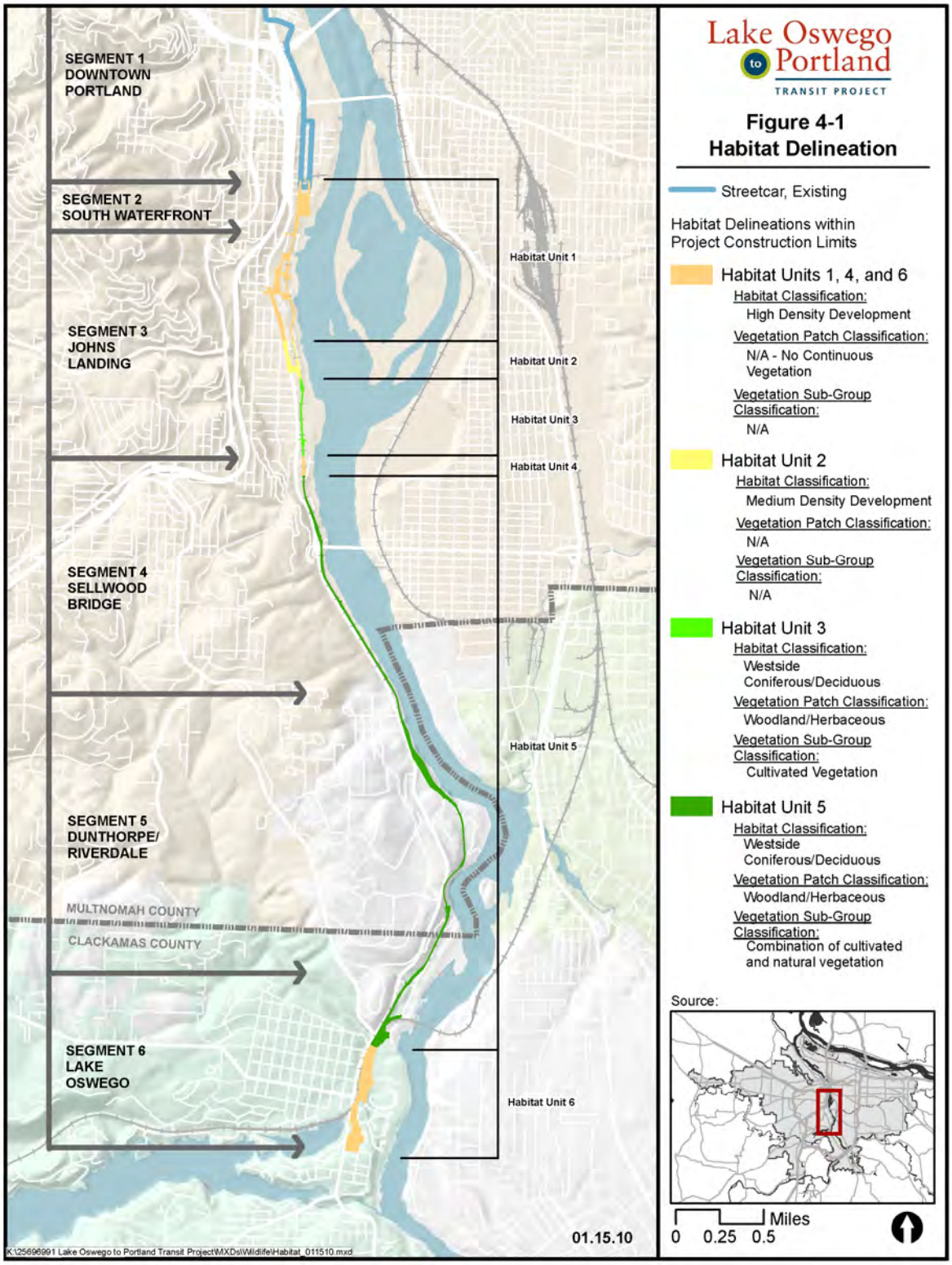

FIGURE 4-1 HABITAT DELINEATION

- *Johns Landing Segment - Willamette Shore Line Design Option*

The proposed right-of-way for the Willamette Shore Line Design Option is characterized by medium- to high-density development[3]. Vegetation within this segment/design option is composed primarily of cultivated lawn. The northern end of this segment contains large patches of invasive forb and shrub species. Willamette Park, located in the southern end of this segment is actively maintained, and thus does not contain the same level of invasive species. Native vegetation in this segment is primarily composed of Cottonwoods (*Populus balsamica*) located in the riparian zone, adjacent to the Willamette River, and isolated western red cedar (*Thuja plicata*), big leaf maple (A*cer macrophyllum*) located in Willamette Park. Oregon white oak (*Quercus garrayana*) is also present in this area.

- *Johns Landing Segment - Macadam Additional Lane Design Option*

Vegetation located within the right-of-way for the Macadam Additional Lane Design Option was evaluated using aerial imagery. It was determined that plant species and vegetation communities within the right-of-way were limited to ornamental trees planted along the edge of SW Macadam Avenue.

- *Johns Landing Segment – Macadam In-Street Design Option*

Vegetation within the right-of-way for the Macadam In-Street Design Option was investigated using aerial imagery. It was determined that plant species and vegetation communities within the right-of-way are limited to ornamental trees planted along the edge of SW Macadam Avenue.

- *Sellwood Bridge Segment*

The Sellwood Bridge Segment contains a combination of single-family residential development located in the northern portion, and the more natural parkland of the Butterfly Park and Powers Marine Park to the south. Vegetation in Butterfly Park is described as a multi-layer deciduous forest dominated by big leaf maple, with a recently restored riparian area surrounding Stephens Creek. Powers Marine Park is characterized by widely-spaced mature conifers (western red cedar [*T. plicata*] and douglas fir [*Pseudotsuga menziesii*]) with understory dominated by maintained lawns. Understory shrubs are absent from the area, with the exception of riparian habitats bordering the Willamette River.

- *Dunthorpe/Riverwood Segment - Willamette Shore Line Design Option*

Vegetation in the Dunthorpe/Riverwood Segment - Willamette Shore Line Design Option is composed of mature mixed deciduous-coniferous trees, dominated by ornamental varieties. Vegetation is dispersed throughout this low-density residential area, providing connectivity between upland open space (Riverview Cemetery, Lewis and Clark College), and the Willamette River. Patches of invasive species are present in the right-of-way, however surrounding areas are characterized as actively managed landscapes that, although predominantly composed of non-native species, do not include a high percentage of noxious weeds.

[3] Johnson and O'Neil (2001). Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press.

- *Dunthorpe /Riverwood Segment – Riverwood In-Street Design Option*

Vegetation within the proposed right-of-way for the Dunthorpe/Riverwood Segment – Riverwood In-Street Design Option was evaluated using aerial imagery. This analysis determined that vegetation is limited to cultivated vegetation located in adjacent private land.

- *Lake Oswego City Segment - Foothills Realignment Design Option*

Vegetation within the proposed right-of-way of the Lake Oswego City Segment-Foothills Realignment Design Option was evaluated using aerial imagery. No contiguous vegetation exists within the right-of-way of this design option as the track bisects a highly urbanized area consisting of parking lots, commercial buildings and industry.

- *Lake Oswego City Segment - Adjacent to UP Tracks Design Option*

Vegetation is the same as described for the Lake Oswego City Segment - Foothills Realignment Design Option.

4.2 Wildlife, including wildlife species and habitat

Wildlife species that occur within the study area include small mammals, reptiles, amphibians, and birds. Many of these species are commonly found in urban habitats and use available habitats for foraging, nesting, cover, and movement (habitat connectivity) purposes. They are generally adapted to life in urbanized areas, often occurring in edge habitats that exist along the boundaries of different habitat types. Bird species are the largest group of animals that occur in urban areas, including the study corridor. Raptor species, such as peregrine falcons and bald eagles use some of the study area for nesting, foraging and migration activities. A known peregrine nest is located in the South Waterfront segment.[4]

Mammals in urban areas are usually found near larger undisturbed habitats. Mammals expected to occur in the project vicinity include: Virginia opossum, Eastern cottontail, raccoon, coyote, fox squirrel, voles, bat species, house mice, and Norway rat. Occasionally, black-tailed deer may utilize habitat adjacent to the Willamette River and its tributaries, as well as forested habitat areas. Urban areas are usually characterized by fragmented non-contiguous habitats and generally limit movements of highly ambulatory species. The study area is primarily located along existing streets and railways which may create a barrier to wildlife movement. Relevant Threatened, Endangered and Sensitive (TES) wildlife species are discussed in section 4.5, below.

- *South Waterfront Segment*

Wildlife and wildlife habitat located in the right-of-way of the South Waterfront was evaluated using aerial imagery. This analysis determined that habitat within this segment is severely degraded.

The South Waterfront Segment could be affected by the timing of other projects in the vicinity. If planned South Portal roadway improvements are not in place, or would not be constructed concurrently with the Streetcar Alternative, there would be two interim phasing options for proceeding with construction of the streetcar alignment. Wildlife and wildlife habitat occurring

[4] TriMet, *Portland-Milwaukie Light Rail Project Supplemental Draft Environmental Impact Statement*, May 2008.

within right-of-way for an interim phasing option wildlife and wildlife habitat is limited. Cover is present in the form of cultivated vegetation; however it is neither abundant nor structurally diverse. Existing patches of vegetation are fragmented and likely provide suitable cover to smaller mammals and birds. Wildlife habitat in the right-of-way of the proposed South Waterfront interim options is considered highly degraded. See the Section 3.17 Phasing Effects of the *Lake Oswego to Portland Transit Project DEIS* (Metro, December 2010) for more information on the phasing options.

- *Johns Landing Segment - Willamette Shore Line Design Option*

Wildlife habitat in the proposed right-of-way for the Willamette Shore Line Design Option is present, however, it is considered severely degraded, particularly in areas located in the northern part of the segment. Disturbance includes paved parking lots, an existing rail line, and commercial development. Habitat is limited to ornamental trees and shrubs, which may provide cover for small passerine birds and mammals, and large tress and open space of Willamette Park. This habitat, though fragmented, may provide connectivity to riparian habitats along the east bank of the Willamette River. Wildlife species observed in the right-of-way for the Willamette Shore Line Design Option included house finch, tree swallow, and house sparrow.

- *Johns Landing Segment - Macadam Additional Lane Design Option*

Wildlife and wildlife habitat within the right-of-way for the Macadam Additional Lane Design Option was evaluated using aerial imagery. This analysis determined that wildlife habitat is severely degraded in this area, and use by wildlife species is unlikely due to limited habitat and heavy automobile use along SW Macadam Avenue.

- *Johns Landing Segment – Macadam In-Street Design Option*

Wildlife and wildlife habitat within the right-of-way for the Macadam In-Street Design Option was evaluated using aerial imagery. This analysis determined that wildlife species do not likely use areas located within the right-of-way due to the limited habitat and high automobile use along SW Macadam Avenue.

- *Sellwood Bridge Segment*

The Sellwood Bridge Segment contains a combination of single-family residential development in the northern portion, and the more natural parkland of the Butterfly Park and Powers Marine Park to the south. Wildlife habitat is lacking in the more developed areas; however, Butterfly Park and Powers Marine Park both provide wildlife habitat. Butterfly Park is characterized by a multi-layer deciduous forest, with overhanging vegetation and flowing water in Stevens Creek. Powers Marine Park is characterized by open, park-like habitat with widely space mature conifers. Both areas provide large trees, nesting area, and cover, and may serve as a corridor connecting upland areas with the Willamette River. Mourning doves, bald eagles, and osprey were observed in this area.

- *Dunthorpe/Riverwood Segment - Willamette Shore Line Design Option*

Wildlife habitat in the Dunthorpe/Riverwood Segment-Willamette Shore Line Design Option is provided by mature multi-layer vegetation, and the presence of small ponds on some residential properties. Habitat feature include nesting areas, large trees, and cover.

- *Dunthorpe/Riverwood Segment – Riverwood In-Street Design Option*

Wildlife and wildlife habitat within the proposed right-of-way for the Dunthorpe/Riverwood Segment–Riverwood In-Street Design Option was evaluated using aerial imagery. This analysis determined that wildlife may cross the right-of-way if moving between upland areas around SW Military Road and the Willamette River. No wildlife habitat exists within the proposed right-of-way.

- *Lake Oswego City Segment - Foothills Realignment Design Option*

Wildlife and wildlife habitat within the proposed right-of-way of the Lake Oswego City Segment-Foothills Realignment Design Option was evaluated using aerial imagery. This analysis determined that wildlife habitat within the right-of-way of this design option is severely degraded.

- *Lake Oswego City Segment - Adjacent to UP Tracks Design Option*

Wildlife and wildlife habitat is as described for the Lake Oswego City Segment - Foothills Realignment Design Option.

4.3 Fisheries, including TES species and aquatic and riparian habitats

Fisheries resources in the study area include perennial, intermittent, and ephemeral streams with the potential to provide habitat for fish. Waterbodies in the study area originate in the hills west of the corridor (the southern extent of Portland's West Hills) and discharge into the Lower Willamette River Subbasin. Tryon Creek, Stephens Creek, and Terwilliger Creek comprise the named drainages crossed by the Willamette Shore Line right-of-way. Smaller unnamed drainages are found within the Johns Landing, Sellwood Bridge, and Dunthorpe/Riverdale segments of the corridor, with the majority in the Powers Marine Park area (See Figure 4-2).

Stream habitat quality varies within the study area, with all streams demonstrating some degree of impairment from urban development. Current impacts include invasive species, encroachment, deforestation, stream channelization/piping, channel incision, floodplain filling, stormwater runoff, and alterations disconnecting stream flows from historic channels and flood prone areas. Intensity of existing impacts is typically dependent on adjacent land uses and existing barriers to fish passage and upstream habitat access. Aquatic resources are described in the following paragraphs.

The **Lower Willamette River Subbasin** is the basin into which all streams within the study area discharge. While the study alternatives would not cross the Willamette River, there are portions of the study area that fall within the Willamette River's 100-year floodplain. The Lower Willamette

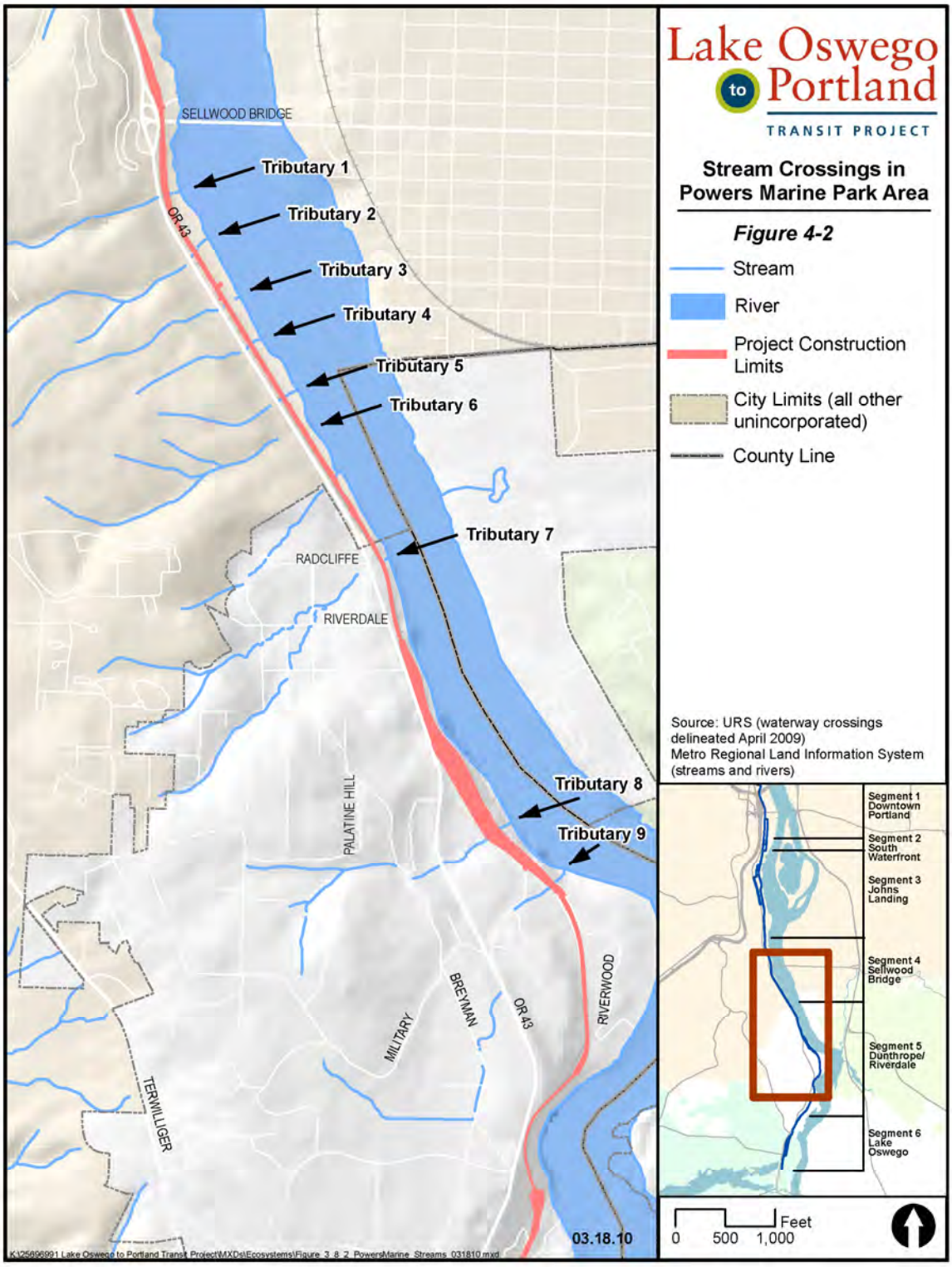

FIGURE 4-2 STREAM CROSSINGS IN POWERS MARINE PARK AREA

Subbasin supports numerous native and non-native species, including Lower Columbia River Chinook salmon and Upper Willamette River Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River coho salmon (*O. kisutch*), resident and coastal (Columbia River) cutthroat trout (*O. clarki*), Lower Columbia River steelhead and Upper Willamette steelhead (*O. mykiss*), green sturgeon (*Acipenser medirostris*), and Pacific lamprey (*Lampetra tridentatus*) and Western brook lamprey (*L. richardsoni*).[5] Although bull trout (*Salvelinus confluentus*) typically are found in cold, clear streams at relatively high elevations, they may use portions of the Columbia River, and perhaps Willamette River, seasonally for migratory purposes, though their presence in the study area is very unlikely and is not documented in existing literature.

- *Johns Landing Segment - Willamette Shore Line Design Option*

Terwilliger Creek and three unnamed tributaries are a mix of perennial and intermittent streams that drain the hills west of Johns Landing. The Terwilliger Creek watershed is approximately 345 acres in area, the lower portion of which has been piped under the developed portion of Johns Landing, including the project corridor. The unnamed tributaries are similarly piped under Johns Landing and the project corridor. No fish or amphibian passage is expected in any of these drainages.

- *Sellwood Bridge Segment*

Stephens Creek watershed comprises approximately 760 acres with land use dominated by residential development and the Riverview Cemetery. Upstream fish passage is blocked by the culvert under Highway 43, but Pacific and Western brook lamprey, Lower Columbia River Chinook and Lower Columbia coho salmon, resident and coastal cutthroat trout, and steelhead are all present downstream of the barrier culvert (Graham and Ward 2002).[6] The City of Portland has completed a stream restoration project to enhance fish habitat at the confluence of Stephens Creek with the Willamette River.[7]

The seven unnamed tributaries in the Powers Marine Park area are a mix of perennial and intermittent tributaries to the Willamette River. The City of Portland's Bureau of Environmental Services (BES) is currently evaluating these drainages for suitable fish habitat and fish use. These creeks originate on the steep slopes of Palatine Hill, passing under Highway 43 through culverts that create complete barriers to upstream fish. Culvert crossings under the existing rail alignment may present upstream passage barriers for fish, as well.[8]

- *Dunthorpe/Riverwood Segment - Willamette Shore Line Design Option and Dunthorpe/Riverwood Segment - Riverwood In-Street Design Option*

Three unnamed tributaries in the Dunthorpe/Riverdale segment are a mix of perennial and intermittent tributaries to the Willamette River. These creeks originate on the steep slopes of Palatine Hill, passing under Highway 43 in culverts and frequently flowing into manmade, ornamental water

[5] Tinus, E. S., J. A. Koloszar, and D. L. Ward. 2003. Abundance and distribution of fish in City of Portland streams, Volume 1 & 2. Final report to the City of Portland, Portland, Oregon.
[6] Graham, J. C., and D. L. Ward. 2002. Distribution of fish in Portland tributary streams. Final Report by the Oregon Department of Fish and Wildlife to the City of Portland Endangered Species Act Program, Portland, Oregon.
[7] Communication from Nancy Gronowski, Park Planner with Portland Parks and Recreation. May 5, 2010.
[8] Bushman, M. 2010. Personal Communication with Mary Bushman, Bureau of Environmental Services. January 2010.

features before cascading down to the Willamette River. The gradient of these streams in their lower watersheds likely precludes habitat access by fish resources, though no studies have been conducted to confirm this assumption.

- *Lake Oswego City Segment - Foothills Realignment Design Option and Lake Oswego City Segment - Adjacent to UP Tracks Design Option*

Tryon Creek is the largest tributary watershed within the study area (4,200 acres). Approximately 640 acres surrounding the mainstem of Tryon Creek is protected in the Tryon Creek State Natural Area Park. Fish and amphibian passage is limited by a 400-foot culverted section located under the existing rail alignment and Highway 43. Tryon Creek maintains habitat for resident and coastal (Columbia River) cutthroat trout and Lower Columbia River steelhead trout in its lower, middle and upper watershed, while providing habitat for Pacific lamprey, Western brook lamprey, Lower Columbia River chinook salmon and Lower Columbia River coho salmon in stream reaches below the Highway 43 culvert..[9,10]

The culvert under Highway 43 is considered a partial upstream fish passage barrier by ODFW.[11] In 2008, the Oregon Department of Transportation completed the initial phase of a stream enhancement project upstream and downstream of the Highway 43 culvert and modified the culvert to improve fish passage. The City of Portland's Bureau of Environmental Services is conducting the second phase of the project that will enhance riparian conditions from the confluence with the Willamette River upstream to the work completed in the initial phase.[12]

The ODFW has conducted fish presence, distribution, and density studies within Tryon and Stephens creeks. Sampling results indicate that both native and non-native species can be found in these streams, including threatened, endangered, and sensitive (TES) species.[13] Studies on these two creeks indicate that the culverts that convey these streams through the project corridor constitute a partial passage barrier for Tryon Creek[14] and a complete passage barrier in the case of Stephens Creek.[15] The Tryon Creek culvert is ranked as the City's highest fish passage priority by BES.[16] Additional features of streams crossed by the existing rail alignment are detailed in Table 4-1.

[9] Henderson Land Services. 2007. Tryon Creek @ Hwy 43 Culvert Alternates Analysis. June 2007.
[10] Graham, J. C., and D. L. Ward. 2002. Distribution of fish in Portland tributary streams. Final Report by the Oregon Department of Fish and Wildlife to the City of Portland Endangered Species Act Program, Portland, Oregon.
[11] Henderson Land Services. 2007.
[12] Tryon Creek Confluence Habitat Enhancement Project. City of Portland on-line webpage. Accessed on 7/15/2010 at: http://www.portlandonline.com/bes/index.cfm?a=225319&c=46964
[13] Graham and Ward 2002.
[14] Henderson Land Services 2007
[15] Tinus et al. 2003
[16] Communication from Kaitlin Lovell, Biologist with Bureau of Environmental Services, May 5, 2010.

Table 4-1. Stream Crossings within the Project Corridor

Stream Name (or Identifier)	Segment	Station [1] (Approx)	Culvert ID Number	Description/Notes
Terwilliger Creek	3	Varies	N/A	Creek is piped under much of Johns Landing and does not daylight within the project corridor. Creek alignment has been altered such that it flows south, under Macadam Avenue, until it turns east at SW Carolina Street and continues in its pipe out to the Willamette River.
Unnamed Tributary to Terwilliger Creek #1	3	Varies	N/A	Creek is piped under much of Johns Landing and does not daylight within the project corridor. Creek is intercepted by the piped section of Terwilliger Creek and conveyed in the same pipe to the Willamette River.
Unnamed Tributary to Terwilliger Creek #2	3	Varies	N/A	Creek is piped under much of Johns Landing and does not daylight within the project corridor. Creek is intercepted by the piped section of Terwilliger Creek and conveyed in the same pipe to the Willamette River.
Unnamed Tributary to Willamette River #1	3	Unknown	N/A	Creek is piped under much of Johns Landing and does not daylight within the project corridor.
Stephens Creek	4	1093+43	46	Twin 48-inch pipe culverts convey Stephens Creek under the rail grade, which is downstream from the Highway 43 culverts, which are identified fish passage barriers.
Unnamed Tributary to Willamette River #2	4	2009+46	40	Single 24-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #3	4	2016+78	39	Single 24-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #4	4	2025+86	36	Single 48-inch wood box culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #5	4	2026+04	34	Single 18-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #6	4	2033+39	31	Single 12-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #7	4	2037+35	29	Single 24-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #8	4	2042+90	27	Culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #9	5	2053+64	25	Culvert conveys tributary down steep hillslope to Willamette River. Gradient of downstream reach prevents upstream passage of fish.
Unnamed Tributary to Willamette River #10	5	Approx. 2063+60	N/A	Trestle Crossing over tributary.
Unnamed Tributary to Willamette River #11	5	Approx. 2067-2074	N/A	Trestle Crossing over tributary.
Tryon Creek	6	3017+00	1	An eight foot concrete box culvert conveys Tryon Creek under combined rail crossing and Highway 43 crossing. Total culvert length is 400 feet. Culvert is believed to be fish passage barrier for certain species under certain flow conditions.

Source: Information based on URS field survey of project corridor, fall 2009. DEA Impact Analysis of URS GIS data, Fall 2009.
[1] *Lake Oswego to Portland Transit Project Streetcar Plan Set*, URS, 2009.

4.4 Wetlands and Waterways

On June 3, 4 and 10 and November 12, 2009, URS biologists visited the proposed corridor to assess the presence and extent of wetlands and streams. The study identified four wetland areas and 24 waterways. The wetlands observed within the proposed study corridor can be generally characterized as palustrine emergent communities that are slightly topographically depressional and located adjacent to the railway embankment. Figure 4-3 depicts the locations of identified wetlands.

The project study corridor consists mainly of an existing railroad track with several driveway / roadway crossing and numerous culverted stream crossings. The track sits on a bermed grade, which creates several linear ditches or swales along the western edge. Some linear features also were observed along the eastern edge. The grade itself is comprised of a gravel berm on a cut and filled slope. The following is a brief summary of wetland and waterways identified through field studies performed by URS Corporation. A thorough discussion of wetlands and waters has been provided in the attached Wetlands and Other Waters Delineation Report, prepared by URS Corporation for TriMet in April, 2010 and included as an appendix.

Table 4-2 Summary Description of Wetlands within the Study Corridor

Site/ Wetland	Cowardin Class[1]	HGM Class[2]	Size AC/Sq Ft[3]	Comments
Wetland A	PSSC	RFT	0.07/3,049	Stormwater ditch with scrub/shrub habitat. Outflows via rock –lined ditch with no ordinary high water (OHW) line to a grated inlet.[4] Unknown offsite path.
Wetland B	PEMB	DEP	0.01/435	Isolated wetland with emergent habitat, stormwater collection point. Overflows via culvert to an infiltration area on the east side of the tracks.
Wetland C	PEMC	RFT	0.03/1,307	Ditch and stream-fed outfall collection with emergent habitat. Continues to the Willamette River in an unnamed waterway identified as ditch [2].
Wetland D	PEMC	DEP	0.01/435	Depressional area that collects groundwater discharge at toe of slope in emergent habitat. General low point that outflows via culvert to ponds to the east.
		SUM	**0.12/5,226**	

Source: Wetland Delineation conducted by URS, April and November 2009 in compliance with the USACE 1987 Wetlands Delineation Manual and the Western Mountains, Valleys, and Coast Regional Supplement (2010); GIS impact analysis conducted by David Evans and Associates, Jan. 2010.

[1] Cowardin Class based on Cowardin 1979: PSSC = Palustrine Scrub-shrub seasonally flooded; PEMB = Palustrine Emergent Saturated; PEMC = Palustrine Emergent Seasonally Flooded

[2] Hydrogeomorphic (HGM) Class based on Adamus 2001: RFT = Riverine Flow-Through; DEP = Depressional.

[3] The USACE and DSL have not verified the wetland delineation report prior to submittal of this document.

[4] The Ordinary High Water (OHW) line is the mark left on stream banks by regular high water flow at the 2-year return interval.

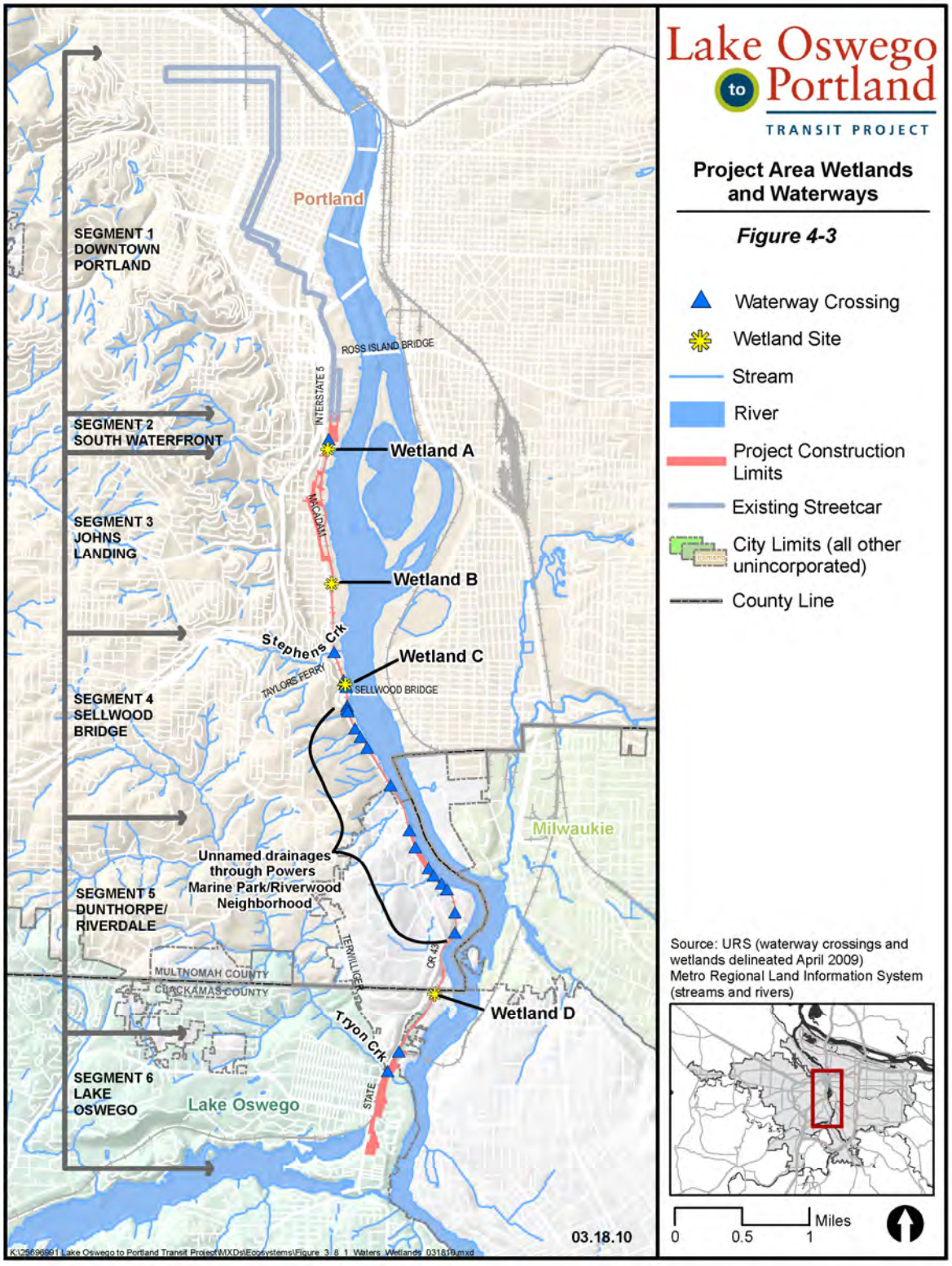

FIGURE 4-3 PROJECT AREA WETLANDS AND WATERWAYS

Four small wetlands sites (Wetland A through Wetland D) were identified within the project corridor study area. Wetlands found within the project corridor are supported by drainage where it is intercepted by the railroad berm, which acts as a hydrologic impoundment and results in seasonally saturated or inundated soil conditions. The source of drainage is either stormwater discharge from upslope impervious areas or natural drainage features (or a combination of the two). The majority of water entering the rail corridor comes from culverts that outfall above the tracks. This drainage flows down gradient through ditches at the base of the railroad embankment until it reaches a culvert inlet, which allows conveyance to the eastern side of the railroad (towards the Willamette River). Only where culverts are placed too high, too far away from the incoming drainage, or where the gradient is nearly flat do wetland conditions develop; the majority of drainage channels are linear and unvegetated.

The study area contains 24 observed waterways, including the Willamette River, Stevens Creek, Tryon Creek, several unnamed tributaries to Terwilliger Creek and other unnamed waterways identified as Streams 1-13 and Ditches 1-6. The majority of these waters currently receive runoff from roadways and other surfaces outside of the study area. Runoff is not treated to current design standards for quality or quantity. Most of these linear drainage channels eventually discharge to the Willamette River. Floodplains associated with the stream crossings are minimal as the majority of waterways have been culverted and channelized prior to being routed under the existing rail infrastructure. No study alternatives would cross the Willamette River; therefore, impacts to the river would be limited to indirect / cumulative impacts.

Table 4-3. Summary of Project Area Streams

Stream	Streetcar Design Segment	Channel Width (OHWL)
Willamette River	None	1,200 (approximate/ varies)
Ditch 1	2	0.5
Stevens Creek	4	4
Ditch 2	4	1
Stream 1	4	0.5
Stream 2	4	2
Ditch 3	4	0.5
Ditch 4	4	2
Stream 3	4	3
Stream 4	4	3
Ditch 5	4	1
Stream 5	4	1
Stream 6	4	5
Stream 7	4	2
Stream 8	5	3
Stream 9	5	3
Irrigation Channel	5	2
Stream 10	5	4
Seep A	5	2
Stream 11	5	2
Stream 12	5	2
Stream 13	5	3
Ditch 6	6	0.5
Tryon Creek	6	10

Note: Ordinary High Water Line (OHWL) is the mark made upon the streambanks by regular high water flow at the 2-year return interval

Wetland locations by Segment and Design Option are discussed below:

- *South Waterfront Segment*

Within this segment, Wetland A was delineated. Wetland A comprises 0.07 acre, entirely within the study area. The Cowardin classification for Wetland A is Palustrine Scrub-shrub Seasonally Flooded (PSSC) and the HGM classification is Riverine Flowthrough. Conditions at Wetland A were documented with a single sample plot (SP-1). Wetland A is a vegetated stormwater ditch that runs parallel to the railroad on the western side. The wetland is dominated by Douglas' spiraea (*Spiraea douglasii*, FacW), broadleaf cattail (*Typha latifolia*, OBL), soft rush (*Juncus effusus*, FacW) and slough sedge (*Carex obnupta*, OBL). The wetland outflows via a rock-lined ditch with no OHWM to a grated inlet. Ultimate destination is unknown but the wetland presumably drains to the Willamette River. Wetland boundaries are defined by an obvious topographic rise to the west, east, and north and a shift to an unvegetated rock-lined ditch to the south.

- *Johns Landing Segment - Willamette Shore Line Design Option*

Within this segment, the northern portion of Wetland A was delineated. Wetland B was delineated and is located wholly within this segment. Wetland B comprises approximately 0.01 acres entirely within the study area and is described as an isolated wetland with emergent habitat that has formed within a constructed railroad ditch. It appears to be a stormwater collection point that overflows via a culvert to an upland infiltration area on the east side of the tracks. The wetland is dominated by broadleaf cattail (*Typha latifolia*, Obl). Wetland boundaries to the west and east are obviously topographically defined; boundaries to the north and south are characterized by a loss of vegetative cover. No waterways were identified in either the office research or field survey for this segment.

- *Johns Landing Segment - Macadam Additional Lane Design Option*

Wetlands and waterways were not investigated along the Macadam Boulevard option.

- *Johns Landing Segment – Macadam In-Street Design Option*

Wetlands and waterways were not investigated along the Macadam Boulevard option.

- *Sellwood Bridge Segment*

This segment includes Powers Marine Park and several single family residential areas. Wetland / waterway features are generally created when existing culverts are unable to pass water from the western hillslope under the railroad grade to the east and the Willamette River. This may be due to a lack of topographic gradient directing the drainage once it hits the embankment.

Wetland C comprises approximately 0.03 acres entirely within the study area. This emergent wetland appears to have developed within a former ditch that is stream-fed from an outfall. The ditch has filled with sediment and organic material, causing water to sheet flow across the trackway and allowing wetland conditions to develop. Drainage continues south to a storm drain via an unnamed waterway identified as Stream 1. Ultimate destination is unknown but the stream presumably drains to the Willamette River. This wetland is dominated by broadleaf cattail, field horsetail (*Equisetum arvense*, Fac), Pacific willow (*Salix lucida*, FacW) and red alder (*Alnus rubra*, Fac). Wetland boundaries are characterized by an obvious topographic break and a shift in dominance from

hydrophytic species to cleavers (*Galium aparine*, FacU) and field bindweed (*Convolvulus arvensis*, NOL).

Twelve waterways were identified in Segment 4, Sellwood Bridge: Stevens Creek, Ditches 2 through 5 and Streams 1 through 7, all contributory drainages to the Willamette River. A brief description of each waterway is given under the hydrology section.

- *Dunthorpe/Riverwood Segment - Willamette Shore Line Design Option*

Wetland D comprises 0.01 acres entirely within the study area. The Cowardin classification for Wetland D is Palustrine Emergent Seasonally Flooded (PEMC) and the HGM classification is Depressional. Conditions at Wetland D were documented with a set of paired plots (SP-5 and SP-6). This wetland is a depressional area that collects groundwater discharge at the toe of slope in emergent habitat. This wetland is located at a general low point that outflows via a culvert to constructed ponds to the east. Ultimate destination is unknown but the wetland presumably drains to the Willamette River. This wetland is dominated by field horsetail and American speedwell (*Veronica americana*, OBL). Wetland boundaries are characterized by an obvious topographic break and a shift in dominance from hydrophytic species to cleavers (*Galium aparine*, FacU) and field bindweed (*Convolvulus arvensis*, NOL). However, eight waterways were identified in the common corridor. Streams 8 through 13, Seep A and a feature identified as an irrigation ditch were located in this portion of the corridor. A brief description of each waterway is given under the hydrology section and within the Wetland Delineation Report.

- *Dunthorpe/Riverwood Segment – Riverwood In-Street Design Option*

No wetland communities were observed within this Design Option. Three waterways were delineated however: Streams 8, 9 and 11 were observed crossing the potential areas of improvement. Stream 10, observed within the Willamette Shoreline Design Option, was not observed within this design option. It is assumed to be conveyed through a culvert for a short distance under Riverwood Road.

- *Lake Oswego City Segment - Foothills Realignment Design Option*

No wetland communities were observed within this Segment. Ditch 6 was observed in the northern portion of this segment, and would be common to both design options. Tryon Creek also crosses this segment and would be common to both design options. Acreage of impacts to Tryon Creek were calculated at 0.1 acres for both Design Options, however the length of Creek crossing differs. The Foothills Realignment Design Option would impact a wider crossing of Tryon Creek (approximately 35-feet) and a greater area of impact. The creek in this area is deeply channelized and fairly wide.

- *Lake Oswego City Segment - Adjacent to UP Tracks Design Option*

No wetland communities were observed within this Segment. Ditch 6 was observed in the northern portion of this segment, and would be common to both design options. Tryon Creek also crosses this segment and would be common to both design options. Acreage of impacts to Tryon Creek were calculated at 0.1 acres for both Design Options, however the length of Creek crossing differs. The UP Track Design Option would cross Tryon Creek in a relatively narrower area (approximately 8-feet). While still highly channelized and deep, this design option would impact a smaller overall footprint of the creek bed.

4.5 Threatened, Endangered and Sensitive Species

Threatened and endangered species (TES), including those species proposed for listing or candidates for listing are categorized as such under the Federal ESA and the Oregon ESA. Sensitive species are categorized as Species of Concern (SOC) by federal agencies and by ODFW through the Oregon Sensitive Species lists. In addition, other entities may denote the special status of species including the City of Portland and ORNHIC. Table 4-4 lists TES species assumed to be present in Clackamas and Multnomah counties, with state and Federal T&E species presented first, followed by sensitive species.

Table 4-4 Species with Federal and/or State Status Potentially Occurring in the Project Vicinity

Common Name	Scientific Name	Federal Status	State Status	Tryon Creek	Stephens Creek	Willamette River	Occurs in Project Study Area	Critical Habitat in Study Area
THREATENED AND ENDANGERED								
MAMMALS								
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	LE	SV	-	-	-	No	NA
Steller sea lion (Eastern Stock)[2]	*(Eumetopias jubatus)*	LT	-	-	-	-[2]	No	No
AVIANS								
Bald eagle	*Haliaeetus leucocephalus*	-	LT	-	-	X	Yes	NA
Northern spotted owl	*Strix occidentalis caurina*	LT	-	-	-	-	No	No
Streaked horned lark	*Eremophila alpestris strigata*	C	SC	-	-	-	No	NA
FISH								
Lower Columbia River Coho Salmon ESU[1]	*Oncorhynchus kisutch*	LT	LE	X	X	X	Yes	No
Lower Columbia River Steelhead DPS	*O. mykiss*	LT	SC	X	X	X	Yes	Yes
Upper Willamette River Steelhead DPS	*O. mykiss*	LT	SV			X	Yes	Yes
Lower Columbia River Chinook Salmon ESU[1]	*O. tshawytscha*	LT	SC	X	X	X	Yes	Yes
Upper Willamette River Chinook Salmon ESU[1]	*O. tshawytscha*	LT	-	-	-	X	Yes	Yes
Bull trout	*Salvelinus confluentus*	LT	SC	-	-	X	No	No
Green sturgeon (southern DPS)	*Acipenser medirostris*	LT	-	-	-	X	Yes	No
Oregon chub	*Oregonichthys crameri*	LE	SC	-	-	-	No	No
Pacific eulachon/smelt (southern DPS)	*Thleichthys pacificus)*	LT	-	-	-	-	No	No
PLANTS								
Bradshaw's desert parsley	*Lomatium bradshawii*	LE	-	-	-	-	No	No
Nelson's checker-mallow	*Sidalcea nelsoniana*	LT	-	-	-	-	No	No
Water howellia	*Howellia aquatilis*	LT	-	-	-	-	No	No
White rock larkspur	*Delphenium leucophaeum*	SOC	LE	-	-	X	No	No
White-topped aster	*Sericocarpus rigidus*	SOC	LT	-	-	-	No	NA
Willamette daisy	*Erigeron decumbens var. decumbens*	LE	-	-	-	-	No	No

Table 4-4 Species with Federal and/or State Status Potentially Occurring in the Project Vicinity

Common Name	Scientific Name	Federal Status	State Status	Tryon Creek	Stephens Creek	Willamette River	Occurs in Project Study Area	Critical Habitat in Study Area
Northern wormwood	*Artemisia campestris var. wormskioldii*	C	-	-	-	-	No	NA
Oregon sullivantia	*Sullivantia oregano*	SOC	C	-	-	-	No	NA
Tall bugbane	*Cimicifuga elata var. elata*	-	C	-	-	-	No	NA
SENSITIVE SPECIES								
MAMMALS								
California wolverine	*Gulo gulo luteus*	SOC	-	-	-	-	No	NA
Camas pocket gopher	*Thomomys bulbivorus*	SOC	-	-	-	-	No	NA
Fringed myotis bat	*Myotis thysanodes*	SOC	SV	-	-	-	No	NA
Long-eared myotis bat	*M. evotis*	SOC		-	-	-	No	NA
Long-legged myotis bat	*M. volans*	SOC	SV	-	-	-	No	NA
Pallid bat	*Antrozous pallidus pacificus*	SOC	SV	-	-	-	No	NA
Red tree vole	*Arborimus longicaudus*	SOC	SV	-	-	-	No	NA
Silver-haired bat	*Lasionycteris noctivagans*	SOC	SV	-	-	-	No	NA
Townsend's western big-eared bat	*Corynorhinus townsendii townsendii*	SOC	SC	-	-	-	No	NA
Yuma myotis bat	*M. yumanensis*	SOC	-	-	-	-	No	NA
AVIANS								
Acorn woodpecker	*Melanerpes formicivorus*	SOC	-	-	-	-	No	NA
Band-tailed pigeon	*Patagioenas fasciata*	SOC	-	-	-	X	Yes	NA
Harlequin duck	*Histrionicus histrionicus*	SOC	-	-	-	-	No	NA
Lewis' woodpecker	*Melanerpes lewis*	SOC	SC	-	-	-	No	NA
Mountain quail	*Oreortyx pictus*	SOC	SV	-	-	-	No	NA
Northern goshawk	*Accipiter gentilis*	SOC	SV	-	-	-	No	NA
Olive-sided flycatcher	*Contopus cooperi*	SOC	SV	-	X	-	Yes	NA
Oregon vesper sparrow	*Pooecetes gramineus affinis*	SOC	SC	-	-	-	No	NA
Peregrine falcon	*Falco peregrinus anatum*	DL	SV	-	-	X	Yes	NA
Purple martin	*Progne subis*	SOC	SC	-	-	-	No	NA
Tricolored blackbird	*Agelaius tricolor*	SOC	-	-	-	-	No	NA
Western burrowing owl	*Athene cunicularia hypugaea*	SOC	SC	-	-	-	No	NA
Yellow-breasted chat	*Icteria virens gramineus affinis*	SOC	SC	-	-	-	No	NA
AMPHIBIANS & REPTILES								
Cascades frog	*Rana cascadae*	SOC	SV	-	-	-	No	NA
Coastal tailed frog	*Ascaphus truei*	SOC	SV	-	-	-	No	NA
Larch Mountain salamander	*Plethodon larselli*	SOC	SV	-	-	-	No	NA
Northern red-legged frog	*R. aurora aurora*	SOC	SV	-	-	-	No	NA
Northern Pacific pond turtle	*Actinemys marmorata marmorata*	SOC	SC	-	-	-	No	NA

Table 4-4 Species with Federal and/or State Status Potentially Occurring in the Project Vicinity

Common Name	Scientific Name	Federal Status	State Status	Tryon Creek	Stephens Creek	Willamette River	Occurs in Project Study Area	Critical Habitat in Study Area
Oregon slender salamander	*Batrachoceps writorum*	SOC	SV	-	-	-	No	NA
Oregon spotted frog	*R. pretiosa*	SOC	SC				No	NA
Western painted turtle	*Chrysemys picta bellii*	SOC	SC	-	-	-	Yes	NA
FISH								
Resident and coastal cutthroat trout (Columbia River ESU)	*O. clarki*	SOC	SV	X	X	X	Yes	NA
Green sturgeon (northern DPS)	*A. medirostris*	SOC	-	-	-	X	Yes	NA
Pacific lamprey	*Lampetra tridentatus*	SOC	SV	X	X	X	Yes	NA
Western brook lamprey	*L. richardsoni*	SOC	SV	X	X	X	Yes	NA
PLANTS								
Barrett's penstemon	*Penstemon barrettiae*	SOC	-	-	-	-	No	NA
Cliff paintbrush	*Castilleja rupicola*	SOC	-	-	-	-	No	NA
Cold-water corydalis	*Corydalis aquae-gelidae*	SOC	-	-	-	-	No	NA
Henderson's checker-mallow	*S. hendersonii*	SOC	-	-	-	-	No	NA
Howell's bentgrass	*Agrostis howellii*	SOC	-	-	-	-	No	NA
Howell's daisy	*E. howellii*	SOC	-	-	-	-	No	NA
Oregon fleabane	*E. oreganus*	SOC	-	-	-	-	No	NA
Pale larkspur	*D. leucophaeum*	SOC	-	-	-	-	Yes	NA
Pale blue-eyed grass	*Sisyrinchium sarmentosum*	SOC	-	-	-	-	No	NA
Peacock larkspur	*D. pavonaceum*	SOC	-	-	-	-	No	NA
Snake River goldenweed	*Pyrrocoma radiata*	SOC	-	-	-	-	No	NA
Thin leaved peavine	*Lathyrus holochlorus*	SOC	-	-	-	-	No	NA
Willamette Valley larkspur	*D. oreganum*	SOC	-	-	-	-	No	NA

Table Key: DPS = Distinct Population Segment, ESU = Evolutionarily Significant Unit, SOC = Species of Concern, LT = Listed Threatened, LE = Listed Endangered, C = Candidate, SC = Sensitive Critical, SV = Sensitive Vulnerable, DL = De-listed.
Sources: PNW Ecosystem Research Consortium (2002); StreamNet (2010); City of Portland (2007); ODFW (2002); NMFS (2007).
[1] Essential Fish Habitat, as designated under the Magnuson-Stevens Fishery Conservation Management Act, exists for these species in the project area.

Of the species identified in Table 3.8-5, only a subset is fully evaluated in this assessment. Exclusion of species from assessment is due to the absence of the species from the project vicinity, lack of suitable habitat conditions within the project area, or the presumed extinction of a species locally or regionally. Species excluded from evaluation are discussed in the following paragraphs.

MAMMALS

- Steller sea lions have not been documented in the Willamette River. [17] California sea lions (*Zalophus californianus*) have been positively identified in the Willamette River as far upstream as Willamette Falls.[18] However, no in-water construction activities would occur in the Willamette River. Presence of either sea lion species in any Willamette River tributary within the project area has not been recorded, and is unlikely due to the size of the tributaries relative to the size of the sea lions. In addition, if in-water work occurs in tributaries, it would occur during the ODFW-regulated in-water work windows, which are established during seasonal lulls between established salmon runs to be protective of ESA-listed salmon species. It is presumed that Steller sea lions would not be present in the Project vicinity during in-water work, as adult salmon, the prey that draws them upstream, are not abundant when such work would occur. Consequently, it is assumed that development of the Streetcar Alternative, should it be selected as the preferred alternative, would have no effect on Steller sea lions.
- The Columbia white-tailed deer population is geographically limited to the estuary of the Columbia River. As such, this species is not present in the Project area and will not be affected by project activities.

AVIANS

- The bald eagle (*Haliaeetus leucocephalus*) was de-listed from the Federal ESA in July 2001.[19] The bald eagle is listed in Table 3.8-5 due to the fact that it is still listed as "threatened" under the Oregon ESA and is protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (MBTA).
- The northern spotted owl is a late seral stage forest specialist, only making their nests in "old growth" forested habitat. Habitat necessary to support the northern spotted owl is not found within the Project vicinity nor does it serve as a connectivity corridor between suitable habitats. Consequently, the northern spotted owl is not expected to occur in the Project area and will not be affected by project activities.

FISH

ORNHIC, NMFS, and USFWS identify ten native TES fish species, comprising 13 Evolutionarily Significant Units (ESU)[20]/Distinct Population Segments (DPS)[21] that may occur in study area streams. Of these, four species, comprising six ESUs/DPS are listed as threatened under the Federal ESA, and three additional species are identified as SOC, are known to occur in the study area. As listed in Table 3.8-5, waterbodies within the study area that support some or all of these species

[17] NMFS 2008. Seal and Sea Lion Facts of the Columbia River and Adjacent Nearshore Marine Areas. March 2008.
[18] NMFS 2008.
[19] Federal Register. Volume 72. Pages 37346 – 37372. July 9, 2007.
[20] An ESU is a distinct local population within a species that has very different behavioral and phenological traits and thus harbors enough genetic uniqueness to warrant its own management and conservation agenda. NMFS uses the ESU as the smallest management unit warranting listing under the Endangered Species Act for anadromous salmonids, excluding steelhead, which employs the DPS terminology.
[21] A DPS is the smallest management unit warranting listing under the Endangered Species Act. Species, as defined in the ESA for listing purposes, is a taxonomic species or subspecies of plant or animal, or in the case of vertebrate species, a distinct population segment (DPS).

include the Willamette River, Tryon Creek, and Stephens Creek.[22,23] It is possible that the unnamed tributaries that drain to the Powers Marine Park area provide limited off-channel habitat for species in the Willamette River during periods of high water; however, such habitat is limited to stream reaches downstream of passage barriers under the existing rail line and Highway 43. The following species were evaluated, but precluded from further assessment:

- Bull trout have the potential to use the Willamette River as a migratory corridor. However, their presence in the river would not coincide with project activities that could potentially affect them.
- Green sturgeon (southern and northern DPS) are known to occur in the Columbia River and venture into the Willamette River. Since there are no barriers between documented occurrences in the Portland Harbor and the project area, it is possible that sturgeon could use portions of the Willamette River in proximity to the proposed project. However, sturgeon utilize deeper water segments of the riverine habitat, which are unlikely to be affected by project activities.
- Oregon chub (*Oregonichthys crameri*) are endemic to isolated populations in Benton, Lane, Linn, Marion, and Polk counties.[24] Occurrence records prior to 1990 include populations in the Clackamas River, though this population is believed to be no longer viable.[25] Habitat within Project area streams does not offer the components necessary to support Oregon chub, including the mainstream Willamette River.
- The southern DPS of eulachon (*Thaleichthys pacificus*), also known as Columbia River smelt, was listed as threatened on March 18, 2010.[26] Most eulachon production, currently and historically, has originated in the Columbia River Basin. Within the Columbia River Basin, the main spawning runs occur along the mainstem of the Columbia River (between the mouth and immediately downstream of the Bonneville Dam) and in the Cowlitz River in January, February, and March. Eulachon spawning has not been documented along the Willamette River, and the Columbia River mainstem is approximately 12 river miles (RM) away from the project area.[27] It is noted that stream habitat conditions in the mainstem Willamette River, within the Project vicinity, are similar to habitat conditions used by eulachon in the Columbia River. Critical habitat has not been designated for eulachon at the time of this assessment. Due to the short time spent in freshwater during their life cycle and the distance from known spawning habitat to the project area, it is unlikely for eulachon to be present within the action area.

[22] Streamnet. On-line query of fish distribution in project area streams. Accessed on 01/15/10 at: http://www.streamnet.org/
[23] Graham and Ward 2002.
[24] USFWS. Species Fact Sheet Oregon Chub. Accessed on 2/25/10 at: http://www.fws.gov/oregonfwo/Species/Data/OregonChub/
[25] Ibid.
[26] 74 Federal Register [FR] 13012.
[27] 75 Fed. Reg. 13012 / Vol. 75, No. 52 National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. ACTION: Final rule.

PLANTS

The USFWS identified three Federal TES plants species that may occur within Multnomah County[28] and five Federal TES plant species that may occur within Clackamas County.[29] The ORNHIC database identified five state and Federal TES botanical species within the two-mile search area. The majority of recorded occurrences are outside of the 250-foot wide study corridor. Several of these records are historic and represent species that are not likely still within the project area. Field investigations did not observe any TES plant species within the study area. Additional literature search and contact with state resource agencies identified botanical TES and terrestrial species that may occur in the study corridor, but were ruled-out upon further investigation. These species include:

- Bradshaw's desert parsley (*Lomatium bradshwii*) is a Willamette Valley species found in seasonally flooded prairie habitats.[30] No populations of this species have been observed in Clackamas and Multnomah counties. Consequently, the Project will have no effect on this species.
- Nelson's checker-mallow (*Sidalcea nelsoniana*) frequently occurs in Oregon ash (*Fraxinus latifolia*) swales and meadows with wet depressions, or along streams. The species also grows in wetlands within remnant prairie grasslands. Nelson's checker-mallow primarily occurs in open areas with little or no shade and will not tolerate encroachment of woody species.[31] This species' preferred habitat is not prevalent in the Project study corridor; however, populations of the species could be present. Field survey of the project study area by project botanists did not observe this species.
- Water howellia (*Howellia aquatilis*) was historically present within the project area, but currently the range is limited to Benton, Columbia, Marion, Multnomah, Polk, and Yamhill counties.[32] This species is found in small, vernal, freshwater wetlands, glacial pothole ponds, or former river oxbows that have an annual cycle of filling with water over the fall, winter and early spring, followed by drying during the summer months.[33] This specie's preferred habitat is not prevalent in the Project study corridor; however, populations of the species could be present. Field survey of the project study area by project botanists did not observe this species.
- Oregon sullivantia (*Sullivantia oregano*), a Federal SOC and state candidate species, was historically observed along Elk Rock between Portland and Lake Oswego, but was last

[28] U.S. Fish and Wildlife Service (USFWS). 2009. Federally Listed, Proposed, Candidate Species and Species of Concern Under the Jurisdiction of the Fish and Wildlife Service which may occur in Multnomah County, Oregon. Northwest Habitat Field Office. Portland, Oregon. Last updated May 16, 2009.

[29] U.S. Fish and Wildlife Service (USFWS). 2009. Federally Listed, Proposed, Candidate Species and Species of Concern Under the Jurisdiction of the Fish and Wildlife Service which may occur in Clackamas County, Oregon. Northwest Habitat Field Office. Portland, Oregon. Last updated May 16, 2009.

[30] USFWS. Species Fact Sheet Badshaw's desert parsely. Accessed on 2/25/10 at: http://www.fws.gov/oregonfwo/ Species/ Data/ BradshawsLomatium/

[31] USFWS. Species Fact Sheet Nelson's checker-,mallow. Accessed on 2/25/10 at: http://www.fws.gov/oregonfwo/ Species/Data/NelsonsCheckerMallow/

[32] USFWS. Species Fact Sheet Water howellia. Accessed on 2/25/10 at: http://www.fws.gov/oregonfwo/Species/Data/ WaterHowellia/

[33] USFWS. Species Fact Sheet Water howellia. Accessed on 2/25/10 at: http://www.fws.gov/oregonfwo/Species/Data/ WaterHowellia/

observed in 1976 and is now likely no longer found in the area.[34] Field survey of the project study area by project botanists did not observe this species.

- Northern wormwood (*Artemisia campestris var. wormskioldii*) is found in basalt, compacted cobbles and sand on the banks of the Columbia River, east of the Columbia River Gorge.[35] No populations of this species have been observed in Clackamas County and suitable habitat for this species does not occur the Project study area. Consequently, the project will have no effect on this species.
- Tall bugbane (*Cimicifuga elata var. elata*) is typically found in mixed coniferous forest habitats in moist soils. This specie's preferred habitat is not prevalent in the Project study corridor; however, populations of the species could be present. Field survey of the project study area by project botanists did not observe this species.
- White rock larkspur (*Delphenium leucophaeum*), a Federal SOC and state endangered plant occurs near Bishop's Close garden, where the Streetcar Alternative passes through Elk Rock Tunnel. Because the proposed project will not disturb species outside the tunnel in this portion of the alignment, no effect to the white rock larkspur is expected.
- Willamette Valley daisy (*Erigeron decumbens*) was historically present within the project area, but currently the range of the daisy is Benton, Lane, Linn, arion, Polk, and Yamhill counties.[36,37] This species found in seasonally flooded prairie habitats The project is outside the daisy's current observed range and is therefore highly unlikely to occur within the study corridor.

[34] Oregon Natural Heritage Information Center (ORNHIC). 2009. Lake Oswego to Portland Transit Project Data Search for Sensitive Species. Conducted December 9, 2009.
[35] Oregon Department of Agriculture (ODA). Species Fact Sheet Northern Wormwood. Accessed on 2/25/10 at: http:// www.oregon.gov /ODA/PLANT/CONSERVATION/profile_arcawo.shtml
[36] NatureServe. Species occurrence search for Willamette Daisy, accessed on 2/25/10 .
[37] USFWS. Species Fact Sheet Willamette Daisy. Accessed on 2/25/10 at: http://www.fws.gov/oregonfwo/Species/Data /WillametteDaisy/default.asp

5. ENVIRONMENTAL CONSEQUENCES

The following section evaluates, in-depth, the anticipated effects to study area resources from the three alternatives under consideration. The alternatives include the No Build alternative, the Enhanced Bus alternative, and the Streetcar Alternative, as described in Section 1. Potential impacts evaluated include long-term direct effects (i.e. permanent), short-term direct effects (including construction-related direct effects), indirect effect, and cumulative effects.

5.1 No Build Alternative

5.1.1 Long-Term Direct Effects and Short-Term Direct Effects

No-Build Alternative would not include new transit construction and, therefore, would have no long-term or short-term direct effects to wetlands, waterways, vegetation, wildlife, fisheries or TES species or habitats as a result of construction or long-term operation.

5.1.2 Indirect Effects

Potential indirect effects associated with the No-Build Alternative could include increased pollutant loading associated with increasing traffic and congestion on roadways throughout the project area. Increased congestion accelerates brake pad wear and, because brake pads contain metals such as copper and zinc, increased wear results in increased deposition of metals on roadways and parking lots. These pollutants subsequently are transported to project-area streams and wetlands by stormwater runoff. The same rationale applies to other motor vehicle pollutants such as oil and grease, whose deposition on impervious areas and concentrations in stormwater runoff also increase with increasing traffic and congestion. While traffic and congestion would increase over time with all project alternatives, the No-Build Alternative would be associated with worse congestion than the Enhanced Bus or Streetcar alternatives.

Furthermore, most of the area's transportation facilities and adjacent developments were built prior to current stormwater management practices. Therefore, pollutant loading in stormwater runoff from impervious surfaces would continue to flow untreated or undertreated to project area streams and wetlands until redevelopment occurs. (See Section 3.9.3.4 for further discussion of potential effects to water quality/water quantity).

It is possible for the No-Build Alternative to result in long-term degradation of fisheries resources, including TES species and their designated critical habitats, as a result of incremental habitat impacts associated with the existing conditions. Should the No-Build Alternative become the preferred alternative, no measures retarding long-term indirect impacts associated with increasing peak hour vehicle trips would be implemented. Consequently, fish habitat would be incrementally impaired as a result of continuing stormwater pollutant loading. Untreated and undertreated stormwater runoff would have long-term negative impacts on fishes and fish habitats. Furthermore, culverts passing under the rail alignment may constitute a barrier to upstream fish passage, particularly in the Sellwood Bridge Segment. The No-Build Alternative would not provide the opportunity to replace these culverts with structures designed to allow for fish passage.

While no Section 7 ESA consultation would occur under the No-Build Alternative, it is anticipated that it could affect, and is likely adversely affect TES fish species within the study area and connected aquatic habitats. It would not destroy or adversely modify designated critical habitat; however, it is likely to adversely affect essential fish habitat (EFH), primarily because the existing

conditions incrementally degrade, over time, the aquatic habitats used by species regulated by the Magnuson-Stevens Fisheries Conservation Act (MSA).

5.1.3 Cumulative Effects

It is projected that there will be redevelopment and slow to moderate new development in the Portland Central City, South Waterfront area, Johns Landing/North Macadam area and in the Lake Oswego Town Center. The Foothills district located within the Lake Oswego Town Center is also expected to redevelop in the future. Future plans include mixed use development with associated urban infrastructure such as new roadway network. Additionally, bicycle and pedestrian facilities associated with the proposed construction of the Portland to Lake Oswego Trail project, may provide non-motorized vehicular facilities within the study area. However, use of such a trail system for peak hour transit is expected to have minimal effects on overall traffic patterns and congestion. Planned future projects also include street improvements and construction of a new bridge over Tryon Creek. It is unlikely that these actions would result in large amounts of vegetation removal. In addition, the metropolitan area will likely continue to develop pursuant to existing land use and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources.

Cumulative effects of the No-Build Alternative may occur as a result of any or all of the past, present, and reasonably foreseeable future infrastructure and development projects. Over time, these factors have reduced the extent and diversity of the region's ecosystems. The No-Build Alternative could exacerbate the decline of ecosystem health by failing to slow the increase in personal automobile usage in the region and encouraging growth in a manner that is inconsistent with regional density goals. As previously discussed, increased motor traffic on Highway 43 may lead to a degradation of wetlands and streams within the project due to increased pollutant loading. The No-Build Alternative would not create opportunities to treat additional runoff prior to discharge to area waterbodies.

5.2 Enhanced Bus Alternative

5.2.1 Long-Term Direct Effects

The Enhanced Bus Alternative would not result in long-term direct effects to wetlands, vegetation, wildlife, fisheries or TES species or habitats as a result of construction or long-term operation. It would change the existing bus service by eliminating some stops and increasing frequency without major modification to existing roadway infrastructure. An additional two-way road between the proposed 300-space park and ride lot and Foothills Road would accommodate some commuter traffic. The park and ride facility would be located within the existing Lake Oswego Shopping Center parking area, where no significant ecosystem resources exist.

5.2.2 Short-Term Direct Effects

No short-term direct effects to ecosystems are anticipated as a result of the Enhanced Bus Alternative.

5.2.3 Indirect Effects

Long-term indirect effects of the Enhanced Bus Alternative could increase transit ridership and could reduce the projected increase in peak hour vehicle use by commuters as the population and development increases. The Enhanced Bus Alternative would utilize existing infrastructure (roadway, bus stops) to improve transit. With the exception of a new park and ride facility, no additional impervious surface would be added. However, the buses would operate within a congested corridor,

thus contributing to increased adverse effects of traffic and congestion on roadways in the study area. Increased congestion could result in increased deposition of pollutants such as metals, oil and grease on roadways and these pollutants would subsequently be transported to area streams and wetlands by stormwater runoff. Compared with the No-Build Alternative, this alternative may result in a long-term benefit to water quality by reducing the number of peak hour vehicle trips and reducing overall traffic and congestion within the project corridor. With a reduction in vehicles and congestion on Highway 43, fewer pollutants would be added to roadway runoff, compared with the No-Build Alternative (See Section 3.9.3.4 for further discussion of potential effects to water quality/water quantity). Similar to the No-Build Alternative, the Enhanced Bus Alternative would not provide the opportunity to replace culverts passing under the rail alignment in the Sellwood Bridge Segment with structures designed to allow for fish passage compared to the Streetcar Alternative, nor would the Enhanced Bus Alternative result in the redevelopment of stormwater treatment facilities within the transit corridor, resulting in incremental degradation of study area receiving waters, albeit to a lesser degree than levels anticipated under the No Build alternative.

5.2.4 Cumulative Effects

Potential cumulative impacts of the Enhanced Bus Alternative could include increased transportation-related disturbance, increased habitat fragmentation, increased incidence of wildlife mortality, and permanent vegetation removal to accommodate facilities or other structures. Indirect cumulative impacts include temporary vegetation removal due to construction and modification of soils, hydrology, or other existing growing conditions from other projects. Past projects have developed the area from natural habitats to its current condition. Planned future projects include residential and commercial development. The area will likely continue to develop pursuant to land and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources.

5.3 Streetcar Alternative

5.3.1 Vegetation

5.3.1.1 Long-Term Direct Effects

Long-term direct impacts to vegetation would primarily result from the realignment and adding a second rail track. It is assumed that impacts to vegetation in high/medium density development would be limited to incidental removal of ornamental trees. In low-density residential and park settings tree removal may be more extensive, including contiguous vegetation patches with high habitat values, depending on the vegetation density within right of way. Total vegetation impacts exclude areas of open water (i.e., Willamette River tributaries). The majority of the impacts would occur between the Sellwood Bridge and Tryon Creek, where the alignment passes through the mature native and landscaped vegetation of Powers Marine Park and the residential community of Dunthorpe. Where the alignment traverses residential and commercial areas, impacts to vegetation would occur in isolated instances, and would not result in the loss of substantial amounts of vegetation.

5.3.1.2 Short-Term Direct Effects

Short-term, construction-related impacts associated with the Streetcar Alternative assume that the entire area within the proposed project construction limits will be disturbed. Areas outside the permanent right-of-way will be replanted with native vegetation. Additional temporary vegetation loss may occur in the riparian zone where culvert replacement, bridge construction or pier replacement on trestle structures would result in the temporary loss of riparian vegetation to accommodate construction. Table 5-2 (section 5.3.3.1, below) details anticipated temporary losses to riparian habitat resulting from the Streetcar Alternative.

5.3.1.3 Indirect Effects

Long-term indirect impacts to project area vegetation could result from changes in hydrological/ drainage patterns and in the inability to restore the impacted area to natural conditions. Soil compaction could cause changes in hydrology and the ability of the soil to support new vegetation growth. Vegetation removal would cause loss of habitat, thermoregulation, and filtration functions.

5.3.1.4 Cumulative Effects

Potential cumulative impacts to vegetation include additive impacts from proposed projects that have been, or will be, constructed in the area. These impacts include the temporary and permanent removal of vegetation, as a result of other projects within the corridor. Indirect cumulative impacts also include modification of soils, hydrology, or other existing growing conditions, and an increase in noxious weeds due to disturbance. Past projects altered the area from a natural habitat to its current condition. Planned future projects include street improvements, development of a pedestrian and bike trail connecting Lake Oswego and Portland and construction of a new bridge over Tryon Creek. It is unlikely that these actions would result in large amounts of vegetation removal. In addition, the metropolitan area will likely continue to develop pursuant to land and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources.

5.3.2 Wildlife

5.3.2.1 Long-Term Direct Effects

Long-term direct impacts of the Streetcar Alternative would include realigning and widening the rail line that would result in permanent loss of a small amount of habitat, including mature westside coniferous/deciduous forest located in Powers Marine Park and in the residential area of Dunthorpe. This may include areas important to wildlife for breeding, shelter, or foraging, and may cause some direct mortality to birds, small mammals, invertebrates, or other terrestrial organisms. Long-term impacts to wildlife could also occur as a result of proposed retaining walls and fencing along the right of way through in Segments 4 and 5. The height of the retaining walls varies from less than one foot in height to over 17 feet, not including the fence to be located atop the wall. Figure 5-1, depicts a generalized example of changes to the existing conditions as a result of the Streetcar Alternative. The presence of retaining walls could result in animals falling into the rail alignment or becoming trapped within the alignment, possibly resulting in mortality from streetcar activity.

5.3.2.2 Short-Term Direct Effects

Short-term construction-related impacts associated with the Streetcar Alternative are expected to include harassment and displacement due to increased activity and noise in the project area. Cover may be temporarily lost due to vegetation removal within the limits of construction. Should night-time construction occur, activity may be reduces among nocturnal wildlife who may be affected by lighting and increased activity and noise.

5.3.2.3 Indirect Effects

Long-term indirect impacts to project area wildlife from the Streetcar Alternative could include disturbance to existing nesting/denning and movement from upland areas near Powers Marine Park, Dunthorpe, and Tryon Creek to the Willamette River. The height of the retaining walls and fencing

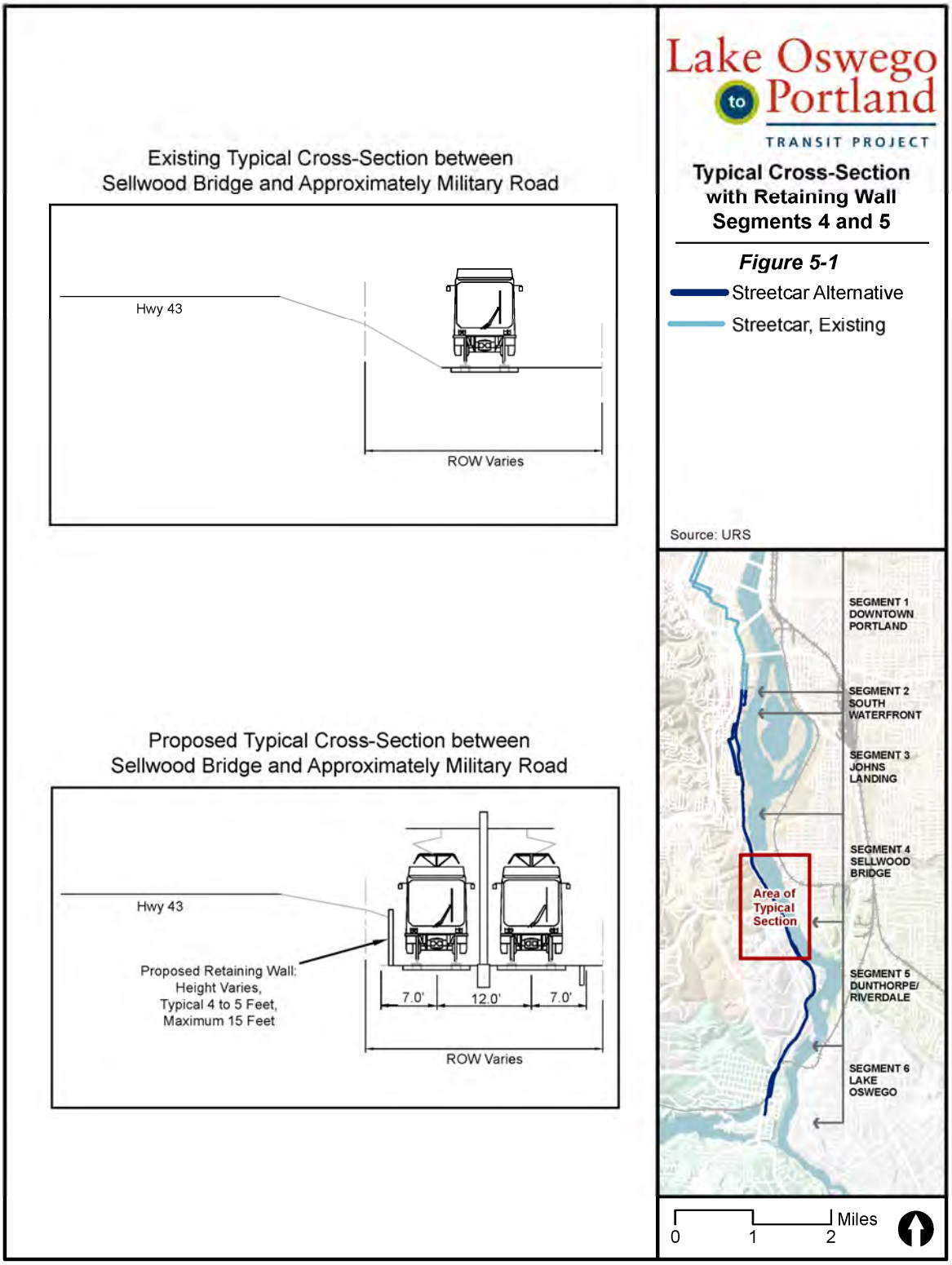

FIGURE 5-1 TYPICAL CROSS-SECTION WITH RETAINING WALL SEGMENTS 4 AND 5

could preclude species movement from adjacent habitats, resulting in an increase in habitat fragmentation and loss of connectivity. This is particularly relevant for species that transit between upland and riparian habitats.

5.3.2.4 Cumulative Effects

Potential cumulative impacts to wildlife may occur as a result of additive impacts from proposed projects that have been, or will be, constructed in the area. These impacts include the temporary and permanent removal of vegetation and consequent loss of habitat as a result of other projects within the corridor. Indirect cumulative impacts also include modification of soils, hydrology, thermal regime or other existing growing conditions, and a decrease in available cover. Past projects altered the area from a natural habitat to its current condition. Planned future projects include street improvements, development of a pedestrian and bike trail connecting Lake Oswego and Portland and construction of a new bridge over Tryon Creek. It is unlikely that these actions would result in large amounts of vegetation removal. In addition, the metropolitan area will likely continue to develop pursuant to land and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources.

5.3.3 Fisheries, including aquatic and riparian habitats

5.3.3.1 Long-Term Direct Effects

Long-term direct impacts to fisheries resources are limited to stream channel modification resulting from extension of culverts that convey streams under the railway right-of-way, a new crossing structure within the 100-year floodplain of Tryon Creek, and permanent loss of riparian habitat to accommodate new facilities. Such impacts are primarily within Segments 3 through 6 - Johns Landing, Sellwood Bridge, Dunthorpe/Riverdale, and Lake Oswego. Table 5-1 summarizes anticipated impacts of the Streetcar Alternative based on segments and design option.

Table 5-1.Summary of Potential Temporary and Permanent Direct Effects to Fisheries Resources by Segment and Design Option

Segment	Design Option	Permanent Stream Channel Alteration	Loss of Aquatic Habitats	Temporary In-Stream Construction Impacts	Permanent Loss of Riparian Habitat
1. Downtown Portland	Existing Alignment: SW 10th/SW 11th Avenues	No	No	No	No
2. South Waterfront[2]		No	No	No	No
3. Johns Landing	Willamette Shore Line	No	No	No	No
	Macadam In-Street	No	No	No	No
	Macadam Additional Lane	No	No	No	No
4. Sellwood Bridge[3]		Yes	Yes	Yes	Yes
5. Dunthorpe/Riverdale	Willamette Shore Line	Yes	Yes	Yes	Yes
	Riverwood	Yes	Yes	Yes	Yes
6. Lake Oswego	UPRR	Yes	Yes	Yes	Yes
	Foothills	Yes	Yes	Yes	Yes

Source: DEA Impact Analysis of URS GIS data, Fall 2009.

1 The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing Effects of the Lake Oswego to Portland DEIS for more information regarding phasing options and differences between those options for more information regarding phasing options and differences between those options.

The Streetcar Alternative would involve expanding the existing rail alignment to accommodate an additional parallel rail track through much of the corridor. In most areas, the widening could be accommodated within the existing right-of-way. In areas where the tracks would be installed in existing streets or other impervious surfaces, primarily Segment 3 (Johns Landing), no direct impacts to existing stream channels are anticipated, as stream channels in this segment are piped underground and would not be disturbed for construction or operations of the Streetcar Alternative. However, in areas where the existing rail alignment would be constructed on rock ballast, the addition of an additional parallel track would require expansion of the rock ballast by approximately 14 feet (on average) through the southern portion of Segment 3 (Johns Landing), all of Segments 4 and 5 (Sellwood Bridge and Dunthorpe/Riverdale), and the majority of Segment 6 (Lake Oswego). In these areas, existing culverts and ditches within the right of way would be replaced to accommodate the expanded ballast width.

Field investigations identified 56 culvert crossings under the existing rail alignment. These culverts include conveyances for Tryon Creek, Stephens Creek, seven unnamed tributaries that discharge to the Powers Marine Park (see Figure 4-2), and numerous ephemeral drainage culverts and stormwater conveyance culverts. Sheet CS-040 in the Streetcar Plan Set[38] details all drainage features discovered in the field. Of these culverts, 41 would be replaced or modified as a result of rail construction, including the culverts conveying all seven unnamed tributaries in the Powers Marine Park. Replacement of the Powers Marine Park culverts would require in-stream construction, and may require fish exclusion/fish salvage to minimize impacts to aquatic biota during construction. In general, culverts would be replaced in their existing locations, but will be sized appropriately for anticipated conveyance requirements and for fish passage, where appropriate. In most cases, replaced and modified culverts would be longer than the extent culverts, to accommodate the wider ballast footprint.

In the Powers Marine Park area (Segment 4), the culvert replacements of identified tributaries could result in the loss of aquatic habitat due to the longer length of the replacement structures. Analysis of conceptual level design estimates permanent stream habitat losses downstream of each culvert to be between zero and 20 linear feet, depending on specific culvert conditions, and totaling approximately 110 linear feet of stream, within the entire Segment. As discussed previously, this stream habitat is largely used as off-channel refugia from the Willamette River, during periods of high water. The loss of the upper extent of these streams may not impair or prevent such habitat use, but constitutes a decrease in the total off-channel habitat potentially available to aquatic species.

Within the Dunthorpe/Riverdale Segment (Segment 4), the culvert replacements of identified tributaries could result in the loss of aquatic habitat due to the longer length of the replacement structures. Analysis of conceptual level design estimates permanent stream habitat losses downstream of culverts to be between zero and 20 linear feet, depending on specific culvert conditions, and totaling approximately 60 linear feet of stream, within the entire Segment. As discussed previously, this stream habitat is largely used as off-channel refugia from the Willamette River, during periods of high water. The loss of the upper extent of these streams may not impair or prevent such habitat use, but constitutes a decrease in the total off-channel habitat potentially available to aquatic species.

The proposed design would not alter passage barriers that are associated with Highway 43, but may facilitate passage up to and under the rail alignment. While this will not allow access to any

[38] URS. 2009. *Lake Oswego to Portland Transit Project Streetcar Plan Set*. November 9, 2009. Portland, Oregon.

additional habitat, it could allow for future access to upstream habitat should the Highway 43 culverts be modified to allow passage at a future opportunity. As proposed, culverts that currently daylight from under Highway 43 would be connected as a continuous culvert under the new rail right of way, with no daylighted section between the highway and rail right-of-way. While this does not effectively eliminate existing fish habitat, it would change the existing conditions. Figure 5-2 depicts the anticipated change from existing conditions.

Unlike the No-Build and Enhanced Bus Alternatives, the Streetcar Alternative would involve permanent alteration of existing stream habitat and loss of seasonally available fish habitats. Where the No-Build and Enhanced Bus Alternatives would result in no changes to existing fish passage barriers, the Streetcar Alternative would allow for the removal of fish passage barriers associated with the rail alignment, allowing potential future habitat access.

Unlike the No-Build and Enhanced Bus Alternatives, the Streetcar Alternative would involve permanent loss of riparian vegetation. For the Streetcar Alternative, the expanded ballast needed to support two sets of tracks throughout much of the corridor, the proposed new bridge crossing over Tryon Creek, and new piers for replaced trestle structures would result in the permanent loss of riparian vegetation. The current level of design leaves uncertainty as to the potential permanent loss of riparian vegetation. The anticipated permanent losses (for operations) are expected to be less than the temporary losses (for construction) but cannot be effectively calculated currently. Table 3.8-8 details anticipated temporary losses to riparian habitat resulting from the Streetcar Alternative. The Willamette Shore Line right-of-way may be relocated and a bridge over Stephens Creek may be required due to the Sellwood Bridge Project. This may impact riparian vegetation, but is outside the scope of this project.

Table 5-2. Potential Temporary Riparian Vegetation Loss by Segment and Design Option

Segment	Design Option	Acres of Temporary Riparian Vegetation Impacted
1. Downtown Portland	Existing Alignment: SW 10th/SW 11th Avenues	0
2. South Waterfront[1]		0.02
3. Johns Landing	Willamette Shore Line	4.06
	Macadam In-Street	3.29
	Macadam Additional Lane	3.29
4. Sellwood Bridge[1]		5.74
5. Dunthorpe/Riverdale	Willamette Shore Line	0.9
	Riverwood In-Street	0.9
6. Lake Oswego	UPRR	2.16
	Foothills	1.86

All impacts calculated by DEA (2010) using GIS. Permanent impact footprint = proposed right of way within the 100-year floodplain.

1 The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing Effects of the Lake Oswego to Portland DEIS for more information regarding phasing options and differences between those options.

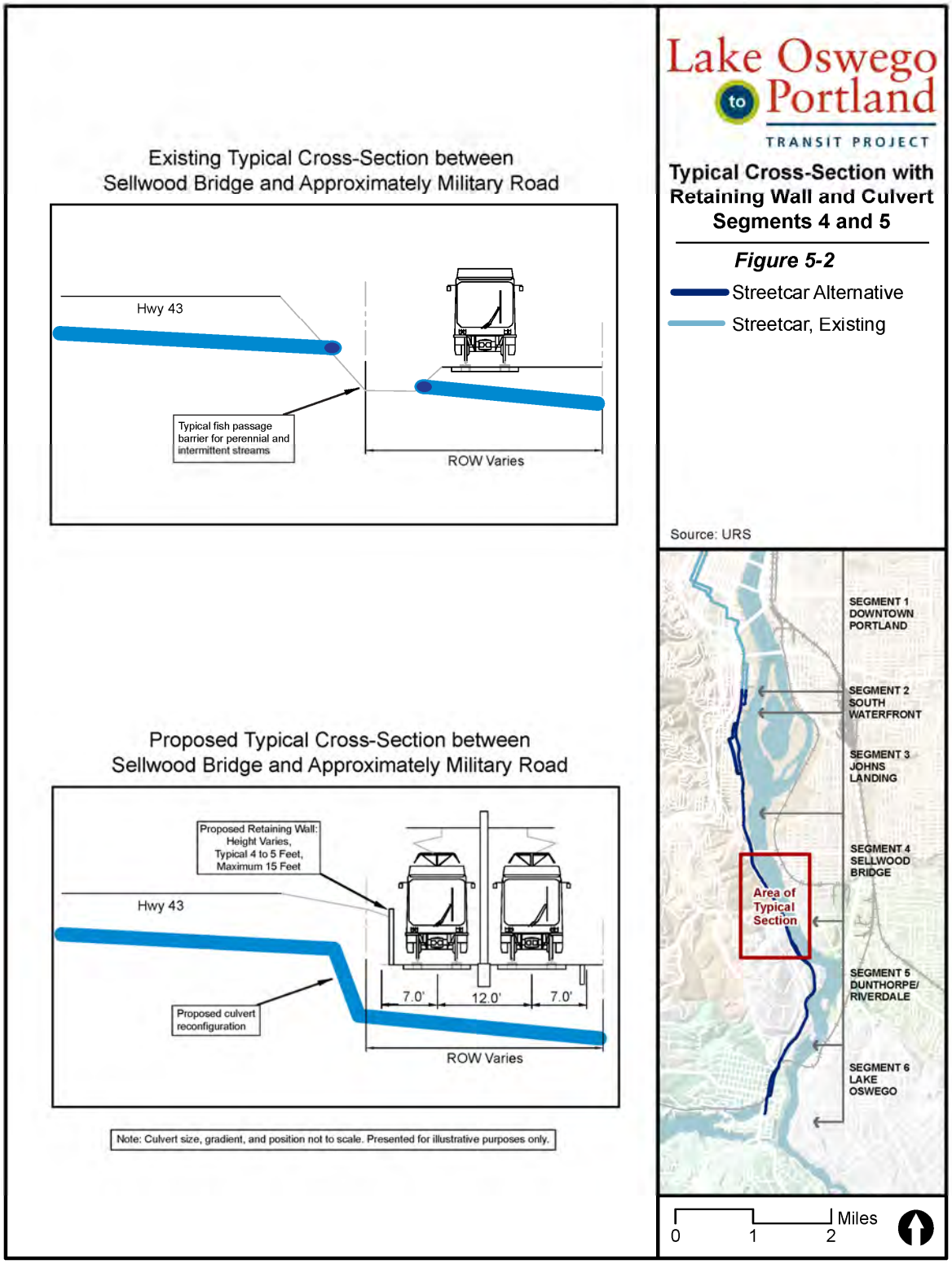

FIGURE 5-2 TYPICAL CROSS-SECTION WITH RETAINING WALL AND CULVERT SEGMENTS 4 AND 5

5.3.3.2 Short-Term Direct Effects

Unlike the No-Build and Enhanced Bus alternatives, the Streetcar Alternative would involve temporary loss of riparian vegetation. Short-term, construction-related impacts resulting from the Streetcar Alternative include temporary vegetation removal in the riparian zone and the potential for in-stream construction associated with culvert replacement. For the Streetcar Alternative, the expanded ballast needed to support two sets of tracks throughout much of the corridor, the proposed new bridge crossing over Tryon Creek, and new piers for replaced trestle structures would result in the temporary loss of riparian vegetation to accommodate construction. Table 5-3 details anticipated temporary losses to riparian habitat resulting from the Streetcar Alternative. While not part of the proposed project, potential impacts to riparian vegetation, as a result of relocating the Willamette Shore Line right-of-way, in conjunction with the Sellwood Bridge Project may necessitate a new bridge crossing structure over Stephens Creek.

Table 5-3. Potential Temporary Riparian Vegetation Loss by Segment and Design Option

Segment	Design Option	Acres of Temporary Riparian Vegetation Impacted
1. Downtown Portland	Existing Alignment: SW 10th/SW 11th Avenues	0
2. South Waterfront[1]	No design options	0.02
	Willamette Shore Line	0.02
3. Johns Landing	Willamette Shore Line	4.06
	Macadam In-Street	3.29
	Macadam Additional Lane	3.29
4. Sellwood Bridge[1]	No design options	5.74
5. Dunthorpe/Riverdale	Willamette Shore Line	0.9
	Riverwood	0.9
6. Lake Oswego	UPRR	2.16
	Foothills	1.86
	Maximum Possible Impacts	12.88

All impacts calculated by DEA (2010) using GIS. Permanent impact footprint = proposed right of way within the 100-year floodplain.
[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing Effects of the Lake Oswego to Portland DEIS for more information regarding phasing options and differences between those options.

Replacement of the seven Powers Marine Park tributary culverts and the three Dunthorpe/Riverdale tributary culverts would require in-stream construction, and may require fish exclusion/fish salvage to minimize impacts to aquatic biota during construction. In general, culverts would be replaced in their existing locations, but will be sized appropriately for anticipated conveyance requirements and for fish passage, where appropriate. In most cases, replaced and modified culverts would be longer than the extent culverts, to accommodate the wider ballast footprint. In-stream construction would likely be conducted during the ODFW in-stream work window and comply with standard BMPs for work in or near aquatic resources.

The Streetcar Alternative would involve expanding the existing rail alignment to accommodate an additional parallel rail track through much of the corridor. In most areas, the widening could be accommodated within the existing right-of-way. In areas where the tracks would be installed in existing streets or other impervious surfaces, primarily Segment 3 (Johns Landing), no direct impacts

to existing stream channels are anticipated, as stream channels in this segment are piped underground and would not be disturbed for construction or operations of the Streetcar Alternative. However, in areas where the existing rail alignment would be constructed on rock ballast, adding a parallel track would require expansion of the rock ballast by approximately 14 feet (on average) through the southern portion of Segment 3 (Johns Landing), all of Segments 4 and 5 (Sellwood Bridge and Dunthorpe/Riverdale), and the majority of Segment 6 (Lake Oswego). In these areas, existing culverts and ditches within the right of way would be replaced to accommodate the expanded ballast width. Expansion of the rock ballast within Segments 3 and 4 may encroach within the 100-year floodplain of the Willamette River and Stephens Creek. Development located within the 100-year floodplain can change erosion and deposition patterns, changes in conveyance capacity, and reduce the amount of available refuge habitat for species during high water events.

5.3.3.3 Indirect Effects

Long-term indirect impacts associated with the Streetcar Alternative that could affect fisheries resources includes creation or modification to stormwater generating surfaces and temporary riparian vegetation loss associated with construction activities. Such impacts apply to nearly all segments. Table 5-4 summarizes anticipated impacts by segment and design option.

Table 5-4. Summary of Potential Temporary and Permanent Indirect Effects to Fisheries-Related Resources by Segment and Design Option

Segment	Design Option	New Impervious Surface Area Created	Redevelopment of Existing Impervious Surface Areas	Construction-related Water Quality Impairment	Temporary Loss of Riparian Habitat
1. Downtown Portland	Existing Alignment: SW 10th/SW 11th Avenues	No	Yes	Yes	No
2. South Waterfront[1]		No	Yes	Yes	No
3. Johns Landing	Willamette Shore Line	Yes	Yes	Yes	No
	Macadam In-Street	Yes	Yes	Yes	No
	Macadam Additional Lane	Yes	Yes	Yes	No
4. Sellwood Bridge[1]		Yes	Yes	Yes	Yes
5. Dunthorpe/Riverdale	Willamette Shore Line	Yes	Yes	Yes	Yes
	Riverwood	Yes	Yes	Yes	Yes
6. Lake Oswego	UPRR	Yes	Yes	Yes	Yes
	Foothills	Yes	Yes	Yes	Yes

Source: Analysis of URS GIS data, Fall 2009.
[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the streetcar alignments. See Section 3.17 Phasing Effects of the Lake Oswego to Portland DEIS for more information regarding phasing options and differences between those options..

The Streetcar Alternative would require the creation of new impervious surface area and redevelopment of existing impervious surface areas within the corridor. For areas of new and redeveloped impervious surface area, stormwater capture and treatment is proposed in compliance with state and local regulations. Redeveloped impervious surface area may result in improvements to receiving waters, as existing impervious surface area that is untreated or undertreated would be brought into compliance with current regulations. Table 5-5 summarizes the anticipated area of new and redeveloped impervious surface area by segment and design option.

Table 5-5. New and Redeveloped Impervious Surface Area by Segment and Design Option

Segment	Design Option	Acres of New Impervious Surface Area	Acres of Redeveloped Impervious Surface Area
1. Downtown Portland	Existing Alignment: SW 10th/SW 11th Avenues	0.00	0.00
2. South Waterfront[1]	No design options	3.54	1.54
3. Johns Landing	Willamette Shore Line	0.69	0.29
	Macadam In-Street	6.15	0.58
	Macadam Additional Lane	7.20	1.51
4. Sellwood Bridge[1]	No design options	0.00	0.05
5. Dunthorpe/Riverdale	Willamette Shore Line	0.37	0.22
	Riverwood	2.46	1.58
6. Lake Oswego	UPRR	2.75	1.75
	Foothills	5.02	2.88
	Maximum Possible Impacts	18.22	7.56

Notes: All impacts calculated using GIS.
1 The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the streetcar alignments. See Section 3.17 Phasing Effects of the Lake Oswego to Portland DEIS for more information regarding phasing options and differences between those options.

With the Streetcar Alternative, stormwater generated from new and redeveloped impervious surface areas would be treated in compliance with current stormwater guidance. Consequently, the Streetcar Alternative may result in a long-term benefit to water quality, when compared to the No-Build and Enhanced Bus Alternatives, by increasing treatment of redeveloped impervious surface area, reducing the number of peak hour vehicle trips, and reducing overall traffic and congestion within the corridor.

5.3.3.4 Cumulative Effects

Slow to moderate new development and redevelopment in the Portland Central City, South Waterfront, Johns Landing/North Macadam, and in the Lake Oswego Town Center is projected to occur throughout the planning horizon of this analysis. Consequently, traffic and congestion are expected to increase within the project corridor as a result of population growth, particularly in regards to peak hour vehicle trips. The Streetcar Alternative would produce positive affects by reducing overall daily peak hour vehicle trips, thereby reducing additional pollutants to local aquatic habitats. This consequence is regarded as a positive effect of this alternative.

5.3.4 Wetlands

5.3.4.1 Long-Term Direct Effects and Short-Term Direct Effects

In accordance with relevant state and Federal regulations and Executive Order 11988, impacts to wetlands and jurisdictional waters would be avoided and minimized to the extent practicable. Estimated direct long-term and short-term impacts to wetlands and waterways are identical, as it is assumed the impacted wetlands or portions of waterways would be lost under both time horizons. Table 5-6 presents anticipated impacts to wetlands and waterways. Wetland locations are shown in Figure 4-3. Long term impacts to wetlands are anticipated to be minor, totaling 0.11 acres

(approximately 4,792 square feet). Impacted wetlands would result in minimal loss of water quality functions and loss of low-quality habitat for amphibians and insects.

Table 5-6 Wetland and Waterway Impacts by Segment and Design Option[1]

Segment	Design Option	Wetland Affected	Acres of Temporary Wetlands Impacts	Acres of Permanent Wetlands Loss
Potential Wetland Impacts				
1 - Downtown Portland	Existing Alignment on SW 10th / SW 11th Ave	NA	0.00	0.00
2 - South Waterfront[2]	None	Wetland "A"	0.07	0.07
3 - Johns Landing	Willamette Shore Line	Wetland "B"	0.01	0.01
	Macadam In-Street	Wetland "B"	0.01	0.01
	Macadam Add'l Lane	Wetland "B"	0.01	0.00
4 - Sellwood Bridge[3]	None	Wetland "C"	0.03	0.02
5 - Dunthorpe/Riverdale	Willamette Shore Line	Wetland "D"	0.01	0.01
	Riverwood	Wetland "D"	0.01	0.01
6 - Lake Oswego	UPRR	none	0.00	0.00
	Foothills	none	0.00	0.00
	Maximum Possible Impacts		0.12	0.11

Source: DEA Impact Analysis of URS GIS data, Fall 2009.

[1] All acreages based on field delineation conducted by URS. No jurisdictional determination has been made on the wetlands and waterways delineated by URS; some of the impacts may be to non-jurisdictional waters. All impacts calculated using GIS. Temporary impact footprint = construction limits. Permanent impact footprint = conservative estimate of all new development.

[2] The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and Moody/Bond Couplet are considered phasing options rather than design options. See Section 3.17 Phasing Effects of the Lake Oswego to Portland DEIS for more information regarding phasing options and differences between those options.

[3] The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and New Interchange are considered phasing options rather than design options. See Section 3.17 Phasing Effects of the Lake Oswego to Portland DES for more information regarding phasing options and differences between those options.

5.3.4.2 Indirect Effects

Indirect effects resulting from construction include grader and dozer traffic and material storage that may result in soil compaction, vegetation removal, and minor sedimentation from upgradient construction areas. Soil compaction could cause changes in hydrology and in the ability of the soil to support new vegetation growth. Vegetation removal could cause loss of habitat, thermoregulation, and filtration functions. Short-term impacts would be limited by the implementation of impact minimization measures, sediment and erosion control, and stormwater management. Project permits will require the preparation of a site restoration plan for short-term impacts to wetlands and waters so that temporary impacted functions will be restored upon project completion.

The indirect impacts of the Streetcar Alternative to wetlands would be negligible due to the existing impervious development upslope of the proposed streetcar. By increasing transit ridership, the Streetcar Alternative would reduce the number of additional peak hour vehicle trips by commuters as population and development increases. Additional impervious surfaces would have a minor affect on groundwater storage and associated base flow support to creeks that cross the alignment.

5.3.4.3 Cumulative Effects

Cumulative impacts to wetlands from implementation of the Streetcar Alternative may result in a positive effect on waters compared to the No-Build Alternative. The streetcar would likely result in fewer peak hour vehicle trips than the No-Build Alternative. Increased use of transit would result in a reduction in loading of stormwater pollutants to local waterways and wetlands from adjacent roadways due to less traffic and congestion. Areas of new construction or re-development would require construction of stormwater treatment systems to meet current standards for water quality prior to discharge.

By providing its ridership with an improved option, the Streetcar Alternative would limit the number of additional SOV commuters as the population and development increases. Additional impervious surfaces would have a minor affect on reduced groundwater storage and associated base flow support to creeks that cross the alignment. However, due to the existing impervious development upslope of the proposed streetcar, this indirect impact would be negligible.

Cumulative impacts from implementation of the street car may result in a positive effect on waters relative to the no-build growth scenario. The streetcar may result in the reduction of overall SOV daily trips through the use of less-polluting mass transit, reduction of pollutants into local waterways and wetlands from adjacent roadways due to less traffic, and construction of stormwater treatment systems to meet current standards for water quality prior to discharge.

5.3.5 TES Species

TES species likely to occur within the project study area or be impacted by the alternatives considered are limited to fish species. For this reason, much of the information presented in this section is effectively identical to the effects discussed in Fisheries (Section 5.3.3). To reduce redundancy, the entire discussion relative to impacts to fishes and fish habitat are not repeated here, but summarized; however, additional information relative to ESA compliance is presented in the following section.

Although designs for the Streetcar Alternative are currently conceptual and Section 7 ESA consultation is expected to occur in 2011, it is anticipated that the Streetcar Alternative may affect and is likely to adversely affect TES fish species and their habitats. Impacts to aquatic resources include: temporary construction within active stream channels; a new crossing structure within the 100-year floodplain of Tryon Creek; and removal of riparian vegetation within the 100-year floodplain of the Willamette River, Tryon Creek, Stephens Creek, and several unnamed tributaries to the Willamette River. This alternative is not likely to destroy or adversely modify designated critical habitat; however, the extent of existing aquatic habitats will be reduced, primarily through culvert extensions and changes in existing surface drainage patterns. This alternative is likely to adversely affect EFH. Project design, construction, and conservation measures will be part of the Section 7 consultation with NMFS and USFWS as project planning continues.

5.3.5.1 Long-Term Direct Effects

Direct Impacts associated with the Streetcar Alternative include the potential to directly affect TES species and their habitats include stream channel alteration, in-stream work associated with culvert replacement/modification, and permanent loss of riparian vegetation to accommodate new structures/rail width. Such impacts are largely contained in Segments 3 through 6 - Johns Landing,

Sellwood Bridge, Dunthorpe/Riverdale, and Lake Oswego. Table 5-7 summarizes anticipated impacts by segment and design option.

Table 5-7. Summary of Potential Temporary and Permanent Direct Effects to TES Fish Species and Habitats by Segment and Design Option

Segment	Design Option	Permanent Stream Channel Alteration	Loss of Aquatic Habitats	Temporary In-Stream Construction Impacts	Permanent Loss of Riparian Habitat
1. Downtown Portland	Existing Alignment: SW 10th/SW 11th Avenues	No	No	No	No
2. South Waterfront[1]	No design options	No	No	No	No
3. Johns Landing	Willamette Shore Line	No	No	No	No
	Macadam In-Street	No	No	No	No
	Macadam Additional Lane	No	No	No	No
4. Sellwood Bridge[1]	No design options	Yes	Yes	Yes	Yes
5. Dunthorpe/Riverdale	Willamette Shore Line	Yes	Yes	Yes	Yes
	Riverwood	Yes	Yes	Yes	Yes
6. Lake Oswego	UPRR	Yes	Yes	Yes	Yes
	Foothills	Yes	Yes	Yes	Yes

1 The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the streetcar alignments. See Section 3.17 Phasing Effects of the *Lake Oswego to Portland DEIS* for more information regarding phasing options and differences between those options.

Unlike the No-Build and Enhanced Bus alternatives, the Streetcar Alternative involves permanent alteration of existing TES aquatic habitats and permanent removal of riparian vegetation. Additionally, temporary construction would require in-stream work and may necessitate fish salvage/fish exclusion. Where the No-Build and Enhanced Bus Alternatives would result in no changes to existing fish passage barriers, the Streetcar Alternative would allow for the removal of fish passage barriers associated with the rail alignment, allowing for potential future habitat access.

5.3.5.2 Short-Term Direct Effects

Discussion of short-term, construction related impacts to TES species are identical to those presented in Section 5.3.3.2, above.

5.3.5.3 Indirect Effects

Discussion of short-term, construction related impacts to TES species are identical to those presented in Section 5.3.3.3, above.

5.3.5.4 Cumulative Effects

Discussion of cumulative impacts to TES species are identical to those presented in Section 5.3.3.4 above.

6. MITIGATION MEASURES

Mitigation measures for the LOPT Project are designed to first avoid and then minimize and compensate for all unavoidable impacts. Impact avoidance and minimization largely are addressed through project design, including alternatives and alignment options that were considered but not advanced due to impacts to ecosystems and other resources.

Impacted wetland and waterway functions would not be difficult to replace in-kind but may require the use of areas beyond the right-of-way as most of the existing right-of-way would be built out by the streetcar. Opportunities for onsite waterway mitigation exist within Powers Marine Park (expanding existing waters or enhancement of degraded waters). Other onsite opportunities for mitigating wetland or waterway impacts exist around Stephens and Tryon Creeks. Portions of these creeks may be enhanced by reestablishing a native riparian corridor, creating wetland floodplain, providing in-stream habitat features, or improving fish access. Enhancement of these onsite waters would likely occur in concert with fisheries mitigation.

If onsite mitigation is not feasible, offsite mitigation for wetland impacts will be required. The project corridor is not located within a mitigation bank service area. Therefore, offsite mitigation opportunities are limited to applicant-provided offsite wetland mitigation or monetary contribution to the DSL's In-Lieu Fee Program. Applicant provided offsite mitigation may include wetland restoration, creation, or enhancement within the Lower Willamette River Subbasin. However, due to the high cost and limited availability of urban land where offsite mitigation could take place, contribution to the DSL's In-Lieu Fee Program account would be the preferred offsite mitigation option. This option is acceptable with the DSL and may be acceptable to the USACE due to the small area of impact.

6.1 Vegetation

Vegetation impacted by the project would be replaced with native vegetation where appropriate and will be coordinated with regulatory agencies. Potential vegetation mitigation opportunities exist in areas adjacent to and nearby the streetcar alignment. Such opportunities occur in similar locations as described for wetland mitigation (below). Coordination with the City of Portland and City of Lake Oswego and other stakeholders in the areas adjacent to the Willamette River and Tryon Creek would also occur to ensure planned restoration and enhancement activities at these sites are supported for the Streetcar Alternative. Additionally, vegetation mitigation could include removal of invasive non-native species and replacement with desirable native species. The City of Portland also requires preservation or replacement of trees over six inches in diameter with similar sized trees.

6.2 Wildlife, including wildlife species and habitat

Conceptual mitigation strategies will be identified for significant impacts to wildlife habitats or populations. Mitigation for vegetation and wildlife impacts will be coordinated with mitigation planning for other related ecosystem impacts (e.g., wetlands).Mitigation could potentially include:

- Reducing habitat fragmentation and maintaining wildlife travel routes.
- Screening sensitive habitats from project view and noise.
- Enhancing vegetation associated with wetlands and water courses used by wildlife.
- Avoid removal of native vegetation

- Where native vegetation removal is unavoidable, remove potential bird nest trees outside of nesting season, and leave cut trees and large shrubs onsite to provide cover for small mammals, ground-nesting birds and herpetofauna
- Retain snags and downed woody material
- Provide for nesting and roosting habitats where practicable for native birds and bats
- Provide culverts and concrete box structures for small mammal and amphibian passage in order to reduce habitat fragmentation and facilitate movement of small mammals under retaining walls/fences
- Manage vegetation at culverts targeted for smaller mammal species to encourage the effectiveness of the crossing
- Provide terrestrial connectivity between the river and upland habitat communities by incorporating design elements that promote passage by terrestrial and aquatic species.

6.3 Fisheries, including TES species and aquatic and riparian habitats

Impacts to fisheries, including TES species may occur, but avoidance or minimization of impacts to riparian areas, waterways, and native, treed habitats could reduce negative effects. Additional mitigation measures would likely be developed in coordination with regulatory agencies and project sponsors during Section 7 consultation. Through the consultation process, the project team could mitigate impacts by:

- Developing alignment refinements and designs that avoid and minimize impacts to TES species.
- Identifying elements of the project that could enhance habitat and fish production to compensate for unavoidable impacts, such as:
    - Restoring shallow-water habitat in the lower Willamette River
    - Upgrading culverts and other passage constraints on smaller streams so that they are fish passable
    - Removing invasive vegetation and replace with native species,
    - Planting of large, native trees in riparian areas for shading and large woody debris recruitment
    - Replacing or restoring off-channel riparian and floodplain habitat
    - Integrating pervious pavement where practical
    - Designing infrastructure elements within floodplains to reduce stranding of fish during flood events
    - Implementing enhanced treatment for stormwater
- Reviewing listed species recovery plans to determine if conservation measures could be implemented to support management recommendations and recovery efforts.
- Coordinating planned restoration and enhancement efforts and locations with the plans and proposals of other parties active in the watershed.

- Removing existing abandoned piles in water.
- Developing construction practices that minimize unavoidable impacts, such as in-water work timing, isolation of in-water work areas when practical, and erosion and sediment control.
- Implementing fish exclusion and fish salvage actions, as required to preclude TES species from active in-stream work areas.

6.4 Wetlands

Mitigation measures were identified based upon estimated acreage of impacts and availability of candidate resources (qualifying land areas or existing wetlands) within the study corridor and surrounding region.

Unavoidable impacts to wetlands must be mitigated through compensatory wetland mitigation. Compensatory mitigation opportunities were ranked according to preference by the USACE as per the Wetlands Mitigation Final Rule established by the USACE and EPA in the Federal Register on March 4, 2008. Wetland mitigation will be coordinated with other ecosystem or water quality/hydrology mitigation planning, as practicable; to minimize mitigation costs and to incorporate a watershed- based assessment of mitigation options.

Due of the limited scale of anticipated wetlands and waterways impacts, wetland and waterway functions would not be difficult to replace in-kind. However, depending on design options selected, in-kind mitigation may require the use of areas beyond the existing right-of-way. Opportunities for on-site waterway mitigation exist within the Powers Marine Park area (expanding existing waters or enhancement of degraded waters). Other on-site opportunities for mitigating wetland or waterway impacts exist around Stephens and Tryon Creeks. Portions of these creeks could be enhanced by reestablishing a native riparian corridor, creating wetland floodplain, providing in-stream habitat features, or improving fish and wildlife access. Similar riparian enhancement of Stephen's Creek at its confluence with the Willamette River was completed by the City recently. Enhancement of these on-site waters could occur in concert with fisheries mitigation.

If on-site mitigation is not feasible, off-site mitigation for wetland impacts would likely be required. The corridor is not located within a mitigation bank service area. Therefore, off-site mitigation opportunities are limited to applicant-provided, off-site wetland mitigation or monetary contribution to the Oregon Department of State Land's (DSL's) In-Lieu Fee Program. Project sponsored off-site mitigation could include wetland restoration, creation, or enhancement within the Lower Willamette River Subbasin. However, due to the high cost and limited availability of urban land where off-site mitigation could take place, contribution to the DSL's In-Lieu Fee Program account could be the preferred off-site mitigation option. This option is acceptable with the DSL and may be acceptable to the USACE due to the small area of impact.

6.5 TES Species

Discussion of mitigation measures for TES species are identical to those presented in Section 6.3.

7. ADDITIONAL DOCUMENTATION

Wetland and waterway boundaries within the existing and proposed right-of-way along the study alternatives were documented in a wetland delineation report (Appendix A, available on request). The delineation report was be submitted to DSL and USACE for boundary concurrence and jurisdictional determination. If unavoidable wetland and/or waterway impacts are identified in the analysis, wetland functions will be assessed and documented in a wetland functional assessment report and a conceptual mitigation plan will be prepared.

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