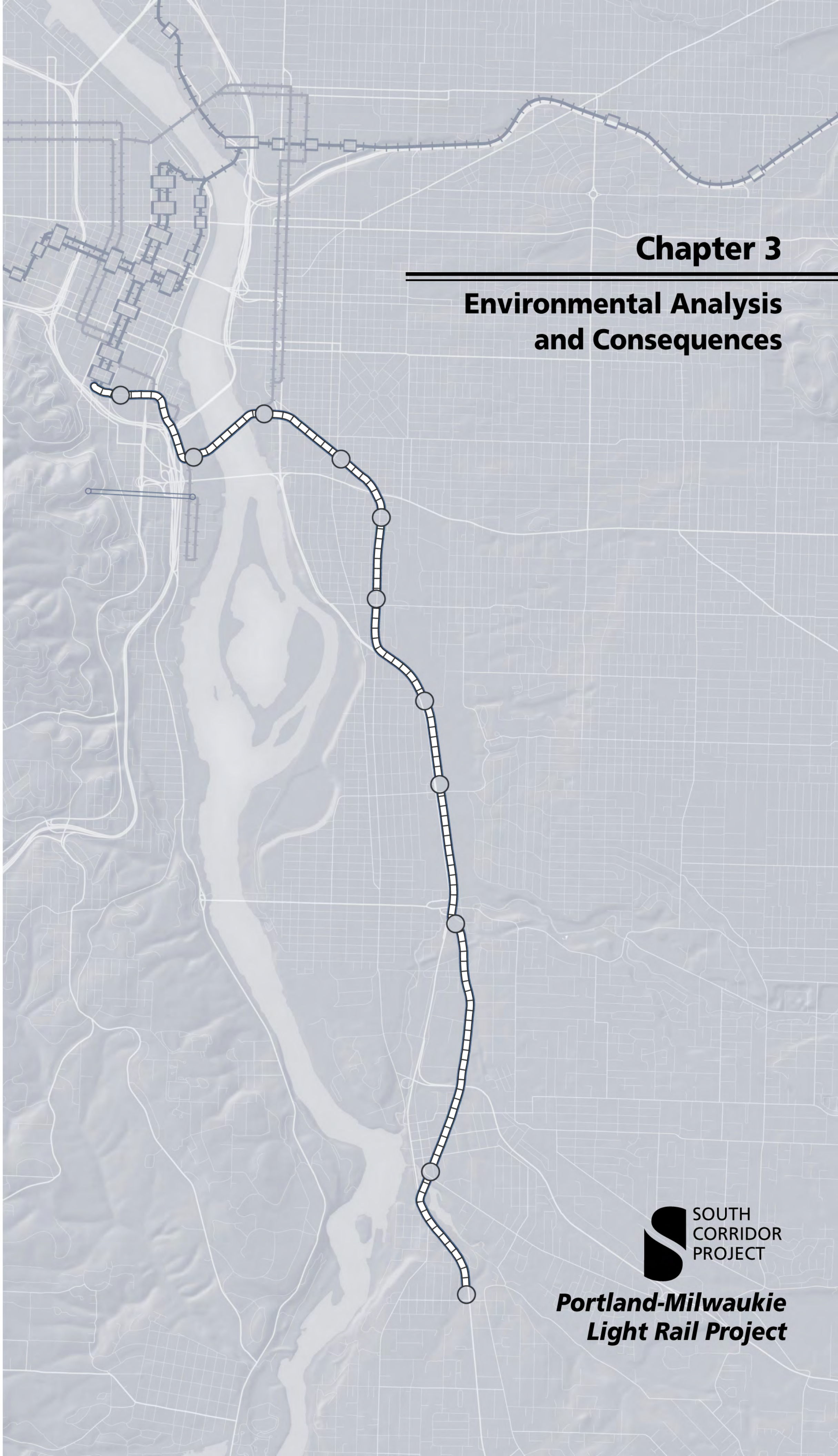
Chapter 3

Environmental Analysis and Consequences



SOUTH CORRIDOR PROJECT

Portland-Milwaukie Light Rail Project

3. ENVIRONMENTAL ANALYSIS AND CONSEQUENCES

CHAPTER CONTENTS

This chapter discusses the environmental analysis and effects associated with the proposed project, including the development and operation of light rail and the completion of the streetcar loop. The chapter includes seventeen sections, covering topics including multiple aspects of the built environment (e.g., acquisitions and displacements, land use), the natural environment (e.g., ecosystems, water quality), historic and cultural resources, and safety and security.

Each section in this chapter provides an overview of the affected environment, presents an analysis of the potential environmental consequences that would result from the No-Build Alternative and the Locally Preferred Alternative (including options and related facilities), and proposes mitigation and enhancement strategies to minimize negative environmental effects. The analysis of impacts in each section covers long-term, short-term (construction), and cumulative impacts.

The analysis of long-term impacts of the project covers the permanent changes that would occur with the completed project. This includes the light rail facilities and related improvements such as reconstructed streets, sidewalks, and landscaping, and any mitigation measures developed as part of the project. The ongoing operation of the project is also considered in the long-term impacts analysis.

The analysis of short-term or construction effects covers the activities required to build the light rail project, including all of the heavy construction activities and staging that would occur during the construction period. Typical construction impacts would include the following:

- Land use and economics – construction-related land use and economic impacts would typically consist of short-term increases in construction and related employment and temporary access, parking and localized effects on surrounding land uses, including businesses.
- Social and neighborhoods – construction-related impacts to neighborhoods could result from increased traffic congestion, truck traffic, noise, vibration, and dust. Temporary street closures, traffic, and bus reroutes and traffic detours could temporarily increase or decrease traffic within neighborhoods.

- Noise and vibration – the operation of machinery used in construction (e.g., bulldozers, scrapers and pavers, pile drivers, and jackhammers) would typically generate noise and vibration during construction. Pile driving would likely occur where new structures would be constructed.
- Ecosystems, water quality, and soils – construction impacts typically include water quality related impacts, fish and wildlife habitat removal or temporary disruption, and soil erosion from ground cover removal.
- Hazardous materials – disturbing hazardous materials can cause contamination in waterbodies, groundwater or soils; hazardous materials that are used or stored on sites can be dangerous to construction workers and release contaminants into the environment.
- Public utilities and services – temporary interruption of some utilities and services could occur during construction.
- Air quality – construction-related impacts could occur from truck and equipment emissions, dust from excavation and demolition, and emissions from increased congestion.

The FEIS also considers the secondary or indirect effects to the environment with the project in place. As defined under 40 CFR Section 1508.8(b), indirect effects "are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems."

The analysis of cumulative impacts considers the overall changes to the environment over time, including past, present, or reasonably foreseeable future actions, and evaluates the added effects of the proposed project. For example, the proposal to build a new Willamette River bridge would be considered within the context of other changes to the river over time.

3.1 ACQUISITIONS AND DISPLACEMENTS

This section discusses the effects of potential property acquisitions and displacements of existing uses that may be required to construct and operate the Portland-Milwaukie Light Rail Project. The secondary effects of the property acquisitions and displacements, including changes in employment, tax revenues, or changes in community character, are discussed in Section 3.2, Land Use and Economy, and Section 3.3, Community Impact Assessment. For additional information on the properties identified as being affected, see Appendix G of this FEIS, Properties Affected by Acquisitions.

3.1.1 Affected Environment

The project area includes public and private properties, the Willamette River, and railroad and public rights-of-way. Most of the land within the project area is developed, although vacant lots, parks, and other lands are interspersed among the residential, institutional, and employment uses. The project area is within the cities of Portland, Milwaukie, Gresham, and an unincorporated area of Clackamas County.

Starting from the north, the Portland-Milwaukie Light Rail Project begins in downtown Portland, a high-density area with mixed uses that includes commercial and residential tower developments. It continues to the South Waterfront area, where there are established as well as planned development areas with a mix of uses, including residential, office/commercial, and institutional (Oregon Health and Science University (OHSU)). The corridor then crosses the Willamette River. On the east side of the river, properties include institutions such as the Oregon Museum of Science and Industry (OMSI) and the Portland Opera, as well as businesses and waterfront uses in an industrial area. Moving south in the corridor, uses are primarily industrial with some commercial and residential neighborhoods nearby. The project would occupy property owned by the Union Pacific Railroad (UPRR) from southeast Portland into downtown Milwaukie. Residential neighborhoods lie to the east of the UPRR. The corridor then passes primarily industrial and commercial uses as it approaches downtown Milwaukie, with a residential neighborhood located on the east side of the tracks between the Springwater Corridor Trail and SE Mailwell Drive. In Downtown Milwaukie there is a mix of uses including commercial, residential, governmental, and educational. From downtown Milwaukie to SE Park Avenue, there is a mix of uses that include properties owned by the State of Oregon as well as businesses, residences, and a planned park adjacent to SE McLoughlin Boulevard. In Gresham, the land uses around the Ruby Junction Facility include a varied mix of single-family residences, service businesses, and industrial businesses.

A relocation plan completed for TriMet by Universal Field Services (2009) researched in detail the potential for available property for industrial, commercial, and residential relocations. The relocation plan concluded that the existing and recent past vacancy rates for industrial and office property indicate that the supply of vacant properties appears to be adequate to allow relocation. The plan also concluded that there is an adequate supply of residential properties on the market to accommodate relocations needed by the project.

Section 3.2, Land Use and Economy, and Section 3.3, Community Impact Assessment, provide further details on land use and economic and social conditions in the project area. These sections also provide more detail on secondary impacts of property acquisitions and displacements.

3.1.2 Environmental Impacts

3.1.2.1 Long-Term Impacts

The construction and operation of a major transportation improvement such as the Portland-Milwaukie Light Rail Project typically require the acquisition and use of property. In most locations of the project corridor, the light rail project has been routed to use public and available railroad right-of-way where they coincide with the travel markets that need to be served. In these locations, easements are typically obtained from the right-of-way owner, including cities, counties, the state, and railroads. TriMet has established policies and programs for transportation improvement projects that need to acquire right-of-way or other property interests, which can involve moving households and businesses. TriMet's goal is to serve all property owners and occupants fairly and equitably in accordance with applicable federal and state laws. Since the Portland-Milwaukie Light Rail Project would involve federal funding, it will comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Relocation Act) (42 USC Sec. 4601) and associated regulations contained in 40 CFR part 24. TriMet has condemnation authority under Chapter 35 of the Oregon Revised Statutes. In addition, TriMet is a municipal government agency and can acquire or condemn property for public purposes, as authorized in ORS 267.200(2) and ORS 267.225(2).

The estimates of impacts to property assumed that there is potential for acquisition and/or displacement if part of a proposed transit facility (such as rails, station platforms, substations, relocated traffic lanes, sidewalks, or turn lanes) would physically touch a property, structure, or other improvement. A full acquisition would occur when the entire parcel is expected to be needed, and a partial acquisition would occur when a portion of a property is needed, but when most of the parcel is left intact and the functional use of the parcel can still reasonably continue.

A project element is considered as having the potential for causing a displacement if any one or more of the following circumstances occurs:

- Any building used for residential, social/recreational, institutional or business purposes lies in the path of a portion of the proposed transit facility or related improvements, such that it could not continue to function in its current use
- Vehicular access to a building would be completely and permanently eliminated and could not be restored by reconfiguring the access or building

Not all impacts to buildings have been considered displacements for the Portland-Milwaukie Project Final Environmental Impact Statement (FEIS). Where discussions with business owners have indicated that they can continue to function on their remaining property, even with the loss of a building, no displacement has been identified.

Table 3.1-1 provides a summary of the permanent displacements and full or partial acquisitions associated with the LPA to Park Avenue, the LPA Phasing Option, the MOS to Lake Road, and the Related Bridge Area Transportation Facilities. Figure 3.1-1 provides a map of the areas where property acquisitions are expected. A listing of affected properties by alternative is provided in Appendix G, Properties Affected by Acquisitions. For an analysis of potential economic impacts associated with acquisitions and displacements, see Section 3.2, Land Use and Economy.

<u>No-Build Alternative</u>

The No-Build Alternative is not expected to displace any residences or businesses or require any other form of property acquisition.

<u>Locally Preferred Alternative (LPA) to Park Avenue</u>

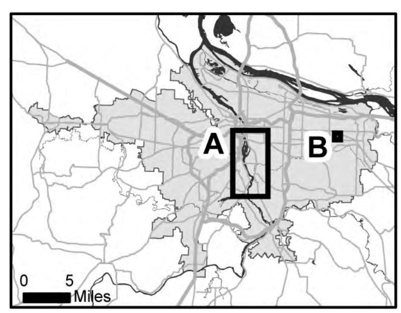
The LPA to Park Avenue would require the acquisition of approximately 94 to 95 tax lots, which would potentially displace 11 residences, 57-58 businesses, and 3 parking lots. The full acquisitions also include 3 currently vacant buildings and 13 vacant tax lots. The affected residences consist of seven single-family homes and one multifamily dwelling with four units. Most of the business displacements would be in southeast Portland, between the Willamette River and SE Ellis Street.

Several smaller commercial businesses and one residence would be displaced in downtown Milwaukie where the alignment follows the UPRR/Tillamook Branch line. Ten residences and eight businesses would be displaced along the alignment from SE Lake Road to SE Park

Portland-Milwaukie Light Rail Project

Properties Potentially Affected by Acquisitions, All Alternatives

Figure 3.1-1



Metro

TRIMET

Sept 2010

Avenue: six residences within the city of Milwaukie, and four residences and eight businesses in Clackamas County. A permanent easement has been identified as being needed across two properties in downtown Milwaukie to access a tax lot that will be acquired in full as part of the project. The tax lot is currently accessed from the railroad right-of-way.

The project is also identifying a potential full acquisition of a parcel on the east bank of the Willamette River, where the construction of the bridge will be near a mooring and loading dock for the Portland Spirit, affecting dock access. This will affect the operations of the business, and could require its temporary or permanent relocation. The project is exploring options with the property owner to avoid displacing the business; these options include modifying operations or evaluating bridge construction approaches to avoid impacts to the dock.

Table 3.1-1
Summary of Full and Partial Acquisitions and Breakdown of Displaced Uses

	Tax Lots to be Fully Acquired	Tax Lots to be Partially Acquired	Tax Lots to have Permanent Easements	Breakdown of Displaced Uses				
				Businesses	Residences	Parking Only	Vacant Buildings	Vacant Lots
LPA to Park Ave.*	93-95	112-120	2	56-58	11	3	3	13
MOS to Lake Rd.	77-78	107	2	52-53	1	3	4	15
Related Bridge Area Facilities	0	6	0	0	0	0	0	0
Ruby Junction**	9-14	0-1	0	5-9	6-9	0	0	0
TOTALS (Range)***	91 to 109	114 to 127	2	61 to 67	10 to 20	3	3 to 4	13 to 15

* The low end of the range represents the LPA Phasing Option, and a potential displacement due to altered waterfront access..

** The low end of the range represents Ruby Junction phasing.

*** The range represents the total acquisitions associated with Related Bridge Area Facilities, which includes streetcar and SW Moody Avenue, and SE Water Avenue improvements, and the Ruby Junction Maintenance Facility when paired with either the MOS to Lake Road (lowest) or the LPA to Park Avenue (highest). The LPA Phasing Option, which falls between the range of the MOS to Lake Road and the LPA to Park Avenue, represents the lowest value for Ruby Junction paired with the lowest value for the LPA to Park Avenue. The range also reflects a property acquisition and business displacement due to an access impact; if access can be maintained the impacts will be avoided. Some tax lots contain both a business and a residence.

There would be partial acquisitions from approximately 120 tax lots along the LPA to Park Avenue alignment. Most of the partial acquisitions are caused by the intersection improvements and reconstruction of streets. These improvements are typically assumed to meet current standards, and include improving sidewalks, adding street landscaping, and upgrading stormwater treatment facilities. At the north end of the alignment, frontage would be acquired from 11 tax lots along SW Lincoln Street. Right-of-way would also be needed from tax lots between SW Harbor Drive and the Willamette River. On the east side of the Willamette River, partial acquisitions would occur along the alignment between OMSI and SE Harold Street. In Milwaukie, right-of-way would be acquired from tax lots as the alignment follows the UPRR Tillamook Branch line. Partial acquisitions would be required from 19 tax lots from SE Lake

Road to SE Park Avenue, including several tax lots belonging to the North Clackamas Park and Recreation District, the City of Milwaukie, and single-family tax lots.

Partial acquisitions will also be required away from the LPA to Park Avenue alignment in several areas where mitigation is being provided to address traffic impacts due to the project. This will affect intersections at SE Johnson Creek Boulevard and SE 32nd Avenue, SE Johnson Creek Boulevard and SE 42nd Avenue, and SE Park Avenue and SE Oatfield Road. The SE Johnson Creek Boulevard and SE 32nd Avenue intersection will require partial acquisitions from six tax lots. Partial acquisitions will be required from six tax lots at the SE Park Avenue and SE Oatfield Road intersection. The SE 42nd Avenue and SE Johnson Creek Boulevard intersection will require temporary construction easements from four tax lots.

LPA Phasing Option

The LPA Phasing Option would defer the need for one full acquisition and eight partial acquisitions due to the deferral of new pedestrian bridges at the Clinton and Rhine stations. This would result in 93 to 95 full acquisitions, displacing 56 to 58 businesses and 11 residences.

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road would end at SE Lake Road in the city of Milwaukie. The MOS to Lake Road includes a Lake Road Park-and-Ride, which would require the acquisition of five tax lots not included in the LPA to Park Avenue and would displace three businesses. Overall, the acquisitions associated with the MOS to Lake Road would displace 52-53 businesses, 1 residence, 4 vacant buildings, and 3 parking lots.

The MOS to Lake Road would reduce the overall total of full and partial acquisitions required, compared to the LPA to Park Avenue. With the five full acquisitions mentioned above, the total number of full acquisitions would be 77 to 78; a reduction of 17 full tax lots when compared to the LPA to Park Avenue.

The MOS to Lake Road would require partial acquisitions from 107 tax lots; this is a reduction of 13 partial tax lots when compared to the LPA to Park Avenue.

Related Facilities

Related Bridge Area Transportation Facilities

Related Bridge Area Transportation Facilities would require the partial acquisition of six tax lots not otherwise impacted by the light rail project—three tax lots south of the Ross Island Bridge on the west side of the Willamette River and three tax lots on the east side of the Willamette River. Additional square footage would be required from some tax lots impacted by the light rail project, increasing the amount of property required.

Ruby Junction Maintenance Facility

A total of 15 tax lots would be acquired (14 full, 1 partial) for the expansion of the Ruby Junction Facility, displacing an estimated eight light industrial businesses and nine residences. Under the LPA Phasing Option, there would be 9 full acquisitions with the acquisition of five properties deferred until later expansion phases. Some of these tax lots support both residential and business uses.

3.1.2.2 Short-Term Impacts (Construction)

No-Build Alternative

With the No-Build Alternative, the light rail project would not be developed, and no displacement impacts are anticipated.

Locally Preferred Alternative (LPA) to Park Avenue

If construction involves only a temporary use of land, TriMet could negotiate a temporary construction easement (TCE) from the property owner. All permanent acquisitions and displacements that are anticipated for the project, including those for staging, are discussed above. TriMet or the construction contractor may also need the use of additional properties for construction staging, including equipment storage, contractor offices, and other activities. While these areas are generally confirmed during final design and are leased rather than permanently acquired, TriMet has identified the properties most likely to be used for construction staging.

For this FEIS, several tax lots have been identified as potential staging sites and include property owned by the Oregon Department of Transportation (ODOT), the City of Portland, UPRR, Oregon Department of State Lands (DSL), and others. Permits to work within ODOT, City of Portland, UPRR, Oregon DSL, and other rights-of-way will be required. Appendix G includes maps of potential staging sites. Staging areas will be selected from these potential sites during final design and construction.

TriMet is expected to need temporary construction easements for most properties that immediately abut the project footprint. For instance, in areas where improvements to sidewalks or utilities are needed but they are at the edge of the public right-of-way, TriMet will need easements onto private property to complete construction.

LPA Phasing Option

Short-term impacts for the LPA Phasing Option will be similar to those of the LPA to Park Avenue. However, when project features that were deferred in the LPA Phasing Option are constructed, temporary easements for construction may again be needed in locations along the alignment corridor.

Minimum Operable Segment (MOS) to Lake Road

Short-term impacts for the MOS to Lake Road are similar to those for the LPA to Park Avenue.

Related Facilities

Related Bridge Area Transportation Facilities

Short-term impacts of the Related Bridge Area Transportation Facilities are the same as those described for the LPA to Park Avenue. Staging locations would be shared for these facilities if construction occurs in the same timeframe as the project.

Ruby Junction Maintenance Facility

No additional parcels have been identified for temporary construction easements or staging. The construction of the facility is expected to be largely accommodated within the areas currently owned by TriMet and within the parcels identified for permanent acquisition for the MOS to Lake Road, the LPA to Park Avenue, and the LPA Phasing Option.

3.1.2.3 Secondary and Cumulative Impacts

The No-Build Alternative would not have secondary or cumulative effects due to property acquisitions or displacements. Indirect impacts such as changes in demand or potential redevelopment activities by others are discussed in more detail in the Sections 3.2 and 3.3.

The LPA to Park Avenue, the LPA Phasing Option, and the MOS to Lake Road would add to previous displacements and land acquisitions in the region, such as those needed to develop I-5, I-405, and other highways in the project area. Potential future redevelopments of properties near the light rail project could cause land values to rise and some existing tenants may choose to move from the area to find more affordable accommodations. However, property owners not affected by acquisitions could see long-term benefits from the transit improvements, and this could also encourage more demand for properties in underutilized areas along the corridor.

Partial acquisitions of frontage along the transit corridors can reduce the buffer between traffic and adjacent residences and businesses, further reduce setbacks to be nonconforming with current regulations, and add to gradual erosion of the usability of sites over time. Loss of industrial land in particular can be susceptible to pressures to convert to non-industrial uses if the number of establishments and size of tax lots are reduced below a “critical mass.”

3.1.3 Mitigation

Summary of Mitigation and Minimization Activities

Direct property acquisition and relocation impacts for federally funded projects must be mitigated through financial compensation and technical assistance, regulated in accordance with the federal Uniform Relocation Act and Oregon Revised Statues.

The Uniform Relocation Act requires fair and equitable treatment of all property owners as well as businesses or residents displaced as a direct result of programs or projects. Its primary purpose is to ensure that people will not suffer disproportionate injuries as a result of programs and projects designed for the benefit of the public as a whole and to minimize the hardship for directly displaced people.

TriMet’s policies for implementation of the Uniform Relocation Act are outlined in its publication *Acquisition and Relocation Assistance for Transportation Projects.* These policies incorporate federal and state guidance on programs needed to assist businesses and residents in relocating and to provide for their compensation. TriMet’s policies are posted online at: http://trimet.org/pdfs/publications/acquisition-relocation.pdf.

TriMet conducted relocation planning to identify the needs of those who will potentially be displaced in comparison to the resources available to meet those needs. In a report prepared during preliminary engineering, as of October 2009 there were 509 commercial properties for sale and nearly 1,300 commercial properties for lease in the greater Portland metropolitan area, not including Beaverton and Hillsboro. There were also between 9 and 135 potential replacement residences for each residence potentially displaced when taking into account housing needs and monthly payments. The plan concluded that there appears to be adequate property available to meet the needs of potential relocation.

Owners of property are offered "just compensation" for the required property or property interest. Just compensation is the estimated value of all the land and improvements within the needed area based on recent similar sales in the area. Where displacements are unavoidable, relocation assistance will be available to assist displaced residents and businesses. Relocation assistance differs for displaced residences compared to businesses, but eligible parties would typically receive assistance to cover moving expenses. Residents may also be eligible for housing replacement payments, as necessary, to ensure that the replacement dwelling meets federal standards for decent, safe, and sanitary housing.

In addition, TriMet is working with Portland State University and the Portland Development Commission to develop a special program to assist businesses that will be displaced as a result of the project. This is a project-specific extension of existing TriMet programs to provide relocation assistance to displaced businesses. The program is designed to help ease the transition to new locations by providing a range of advisory services in coordination with Portland State University, the Portland Development Commission, Portland Community College, the State of Oregon, and other business planning services. The program will include providing business development advice, help with business practices such as accounting, and other needed assistance. Goals of the program are to retain the businesses within the metropolitan area and minimize the potential disruption that relocation may have on a business.

Mitigation Commitments

TriMet will conduct property acquisitions and provide for relocation of displaced parties in compliance with 49 CFR Part 24, Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended. This will include providing business advisory services for displaced businesses, with access to resources at Portland State University, the Portland Development Commission, Portland Community College, the State of Oregon, and other business planning services.

3.2 LAND USE AND ECONOMY

The section describes the general land use and economic conditions and potential impacts of the project. Sections 3.2.1 through 3.2.3 summarize information on existing and planned land uses in the Portland-Milwaukie corridor; identify expected direct and indirect consequences of the No-Build Alternative, the LPA to Park Avenue, including the LPA Phasing Option, the MOS to Lake Road, and the Related Bridge Area Transportation Facilities; and describe potential mitigation measures. Sections 3.2.4 through 3.2.6 describe the existing economic conditions, potential economic impacts of the alternatives, and potential mitigation measures for the economic impacts.

3.2.1 Affected Environment

This section describes the land use planning and policy framework in the jurisdictions affected by the proposed project, the existing and planned land use conditions, and potential land use impacts of the alternatives, including the LPA Phasing Option, and the Related Bridge Area Transportation Facilities. The analysis reviews land uses by jurisdiction and subarea, then describes existing and planned land uses within one-half mile of station areas and within 200 feet of the alignment between station areas.

3.2.1.1 Planning and Policy Framework

In Oregon, land use planning and development is guided by statewide planning goals and objectives implemented through local land use plans and codes.

State Land Use Planning

In 1973, the State of Oregon implemented a comprehensive system of land use planning that requires all cities and counties to adopt and implement comprehensive plans. The urban growth boundary (UGB) is one tool in the state's land use planning program that assists in managing growth and the economy, planning transportation, and protecting natural resources. Oregon has developed a set of 19 Statewide Planning Goals that express the state's policies on land use and on related topics, such as citizen involvement, housing, economic development, and natural resources. Under Goal 14, Urbanization, every city in the state must establish a UGB that contains sufficient urban land to accommodate new population and jobs for 20 years. In the Portland area, Metro is responsible for the UGB that includes 25 cities and the urban portion of three counties. Urban growth must occur only within approved UGBs. This requirement improves the efficiency of public infrastructure investments such as light rail, because light rail can serve a more concentrated population within a limited urban area.

Goal 12, Transportation, as authorized by ORS 197.040 and implemented through the Transportation Planning Rule (TPR) and Oregon Administration Rules 660-012-0000, strengthens the connection between land use and transportation planning, requiring state and local governments to plan and develop transportation facilities and services in close coordination with urban development plans. It encourages coordinated land use and transportation plans that make it more convenient for people to walk, bike, use transit, and drive less. The TPR applies to Metro, the regional government and federally recognized Metropolitan Planning Organization (MPO), and requires the preparation of transportation system plans. As part of this, the TPR requires metropolitan areas to set standards for reducing vehicle miles traveled (VMT) per capita.

Goal 9, Economic Development, requires plans to designate the type and level of public facilities and services appropriate to support the degree of economic development and revitalization that the plans target. Goal 15, Willamette River Greenway, instructs local governments to develop plans to protect, conserve, enhance, and maintain the natural, scenic, historical, agricultural, economic, and recreational qualities of lands along the Willamette River as the Willamette River Greenway.

In 1996, the Oregon Legislature enabled the Metro region to approve land use final orders (LUFOs) to address the multi-jurisdictional land use aspects of light rail projects in the

South/North Corridor Project. The LUFO is intended to provide a single process for considering consistency with the Statewide Planning Goals for light rail projects that traverse multiple jurisdictions, rather than requiring individual land use findings for each jurisdiction. TriMet is responsible for completing LUFO applications for its projects. The local jurisdictions review the project applications through participation in the Project Steering Committee. Metro Council issues the determinations based on consistency with Statewide Planning Goals.

Regional Plans and Policies

Regional plans and policies include the 2040 Growth Concept, the Regional Framework Plan, Urban Growth Management Functional Plan (Functional Plan), and the Regional Transportation Plan (RTP).

2040 Growth Concept

The 2040 Growth Concept and map, adopted in 1995, articulate graphically where growth should occur in the region (see Figures 3.2-1 and 3.2-2). The 2040 Growth Concept map and associated policies direct growth to a hierarchy of interrelated mixed-use corridors (e.g., SE McLoughlin Boulevard) and urban centers: Portland Central City, Regional Centers (e.g., Clackamas Regional Center), and Town Centers (e.g., Milwaukie). This strategy is intended to limit the expansion of the urban area and to concentrate growth in mixed-use areas that can be better served by transit and alternative modes. The 2040 Growth Concept envisions that all Regional Centers will be connected by light rail to the Portland Central City. Currently, six of the seven designated Regional Centers within Oregon are linked by light rail or commuter transit to the Portland Central City.

In September 2005, the region received a forecast that more than one million more people would live here within 25 years. In response, Metro has undertaken five years of study, analysis, and collaboration with regional partners, including elected officials and residents. Metro is in the process of updating regional policies aimed at protecting our valuable farm and forest land while maintaining and investing in our town and regional centers, transportation corridors, and employment areas.

Key decisions in 2010 related to the Growth Concept and other regional plans include: the adoption of the 2035 RTP; designation of urban and rural reserves outside the current UGB for future population and employment growth; adoption of an integrated regional investment strategy; creation of the climate change action plan to meet Oregon's greenhouse gas reduction goals for 2020 and 2050; and the creation of a Climate Prosperity Project to foster a green economy.

These efforts build on the strong foundation of the 2040 Growth Concept, which calls for focusing development in city and town centers, along transportation corridors, and near employment areas. These decisions will be codified within the Regional Framework Plan and Urban Growth Management Functional Plan and RTP as described below.

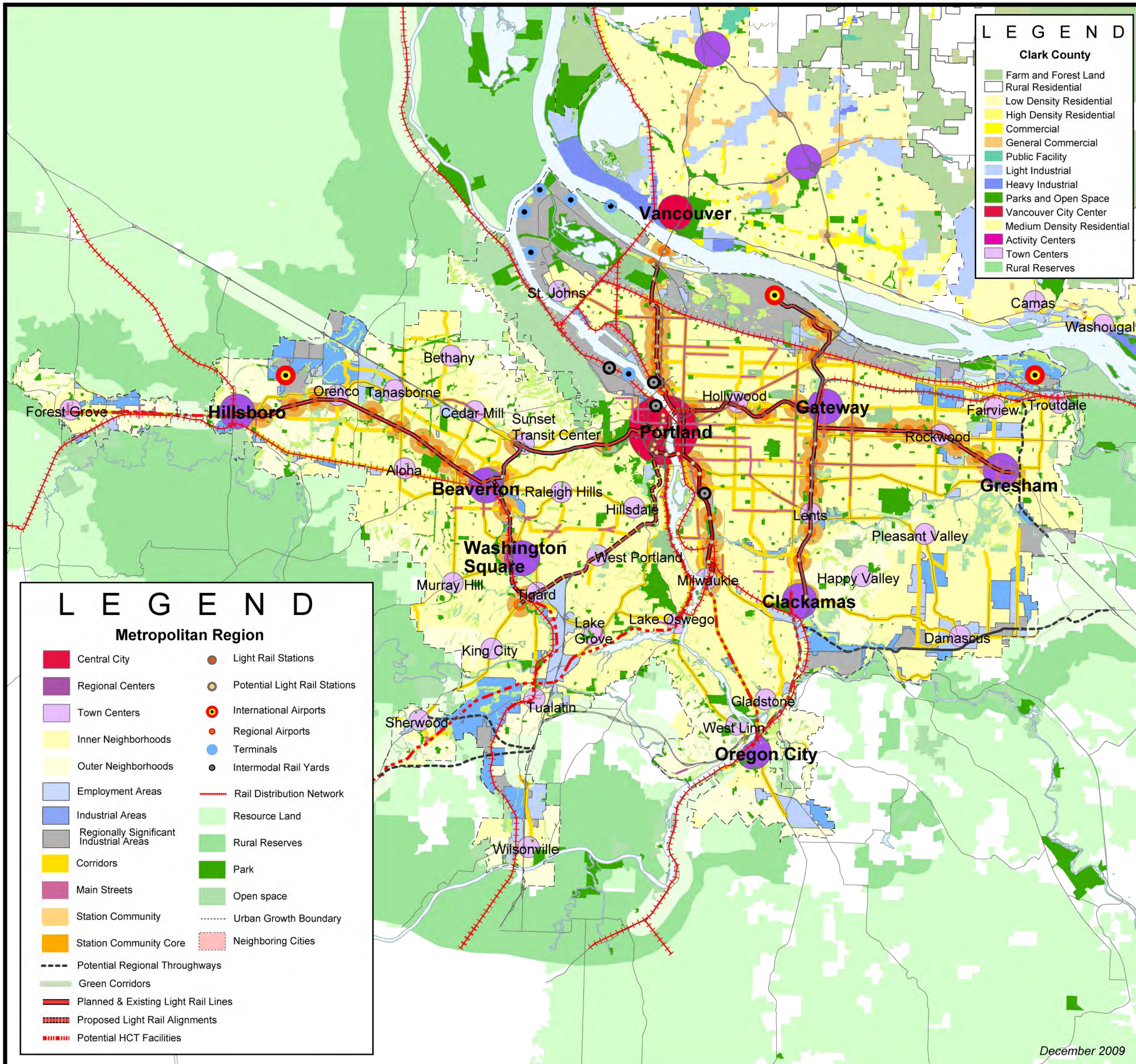
The Regional Framework Plan and Urban Growth Management Functional Plan

The *Regional Framework Plan* integrates land use, transportation, and other important regional policies consistent with the 2040 Growth Concept. The *Functional Plan* implements the 2040

Portland - Milwaukie Light Rail Project

2040 Growth Concept

Figure 3.2-1



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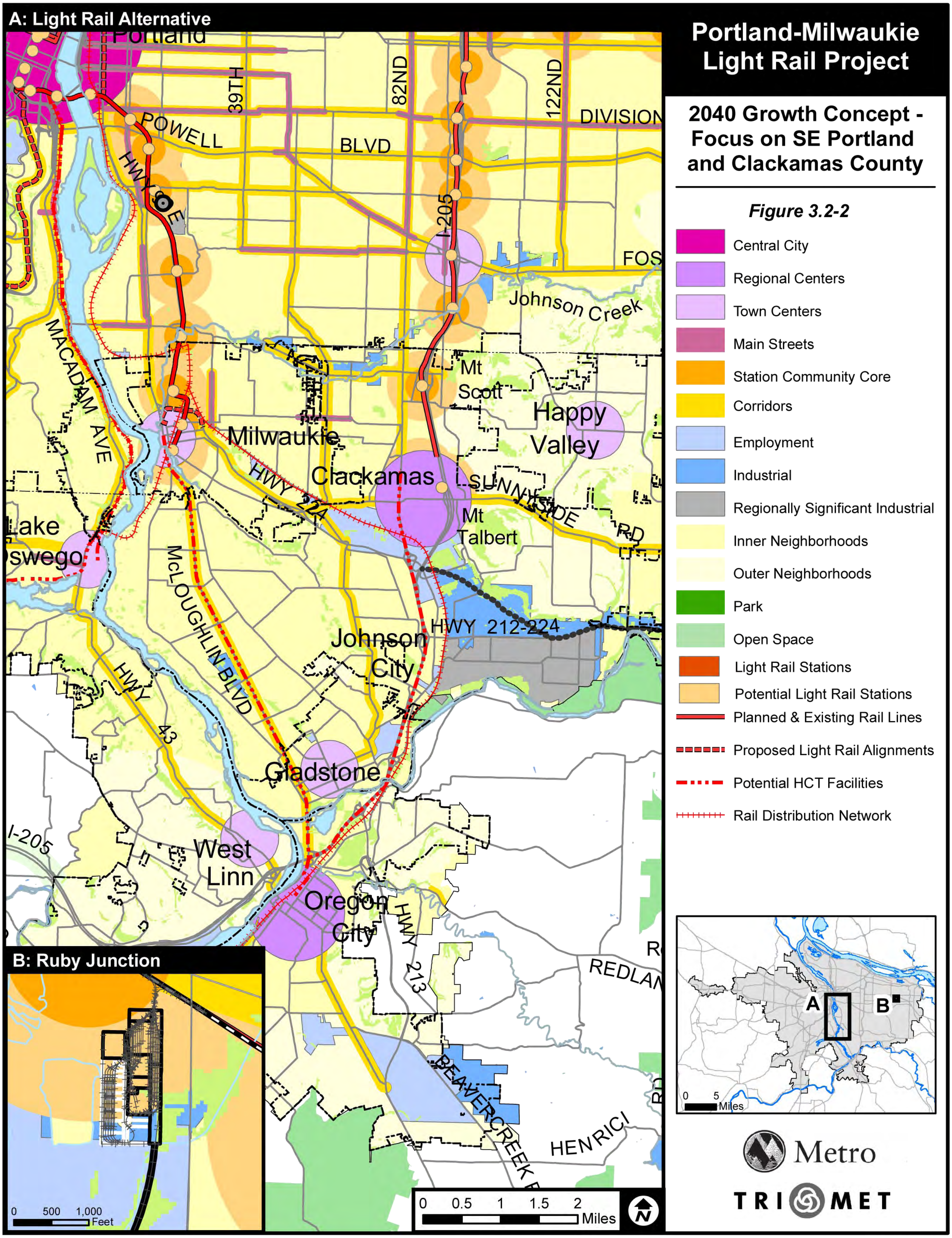


December 2009

Growth Concept and the *Regional Framework Plan*. The *Functional Plan* requires cities and counties to designate boundaries for the 2040 Growth Concept Design Types, including the Portland Central City, Regional Centers, and Town Centers.

Metro Regional Transportation Plan

Metro has responsibility for planning the regional aspects of the transportation system of the urban area. The Portland-Milwaukie Light Rail Project is included in the current RTP.

On June 10, 2010, the Joint Policy Advisory Committee on Transportation and the Metro Council approved the 2035 Regional Transportation Plan for the purpose of completing a federal and state-required air quality conformity analysis of the proposed system. This considered public comments on a draft RTP that Metro voted to accept in December 2009. The RTP is arranged by high priority mobility corridors, which provide a framework for how the goals and policies of the RTP are to be implemented. The Portland-Milwaukie corridor is identified as one of the mobility corridors in the RTP. The plan proposes a high functioning and integrated transportation system where residents have safe and realistic options for multimodal travel: walking, biking, and riding transit. Proposed projects include high capacity transit connections within the region. The plan recommends how to invest more than $20 billion in anticipated federal, state, and local transportation funding in the Portland metropolitan area during the next 25 years.

The new RTP focuses on outcomes and achieving the region’s 2040 Growth Concept—a publicly supported vision for directing growth toward centers, corridors, and employment areas. The plan invests in the region’s downtowns, main streets, employment areas, and major travel corridors to help attract growth in these areas. Well-developed centers and corridors manage growth in a way that makes daily life more convenient for residents by minimizing the distances they must travel to work. They also create centers of activity that can be served by multiple transportation options. These compact communities also result in lower greenhouse gas emissions and lower costs for providing roads and utilities.

City of Portland Plans and Policies

The City of Portland is in the process of updating its 1980 Comprehensive Plan in concert with an update to the 1988 Central City Plan, based on input from an extensive public engagement process called visionPDX. The final result, called the Portland Plan, is anticipated to be adopted and implemented in 2011. Until then, the 1980 Portland Comprehensive Plan governs land uses.

Portland Comprehensive Plan

The Portland Comprehensive Plan includes a number of policies that support transit and additional development around transit stations. The policies that support additional development are balanced by policies that protect industrial land and guide infill development.

Policy 6.24, Public Transportation, in the Portland Comprehensive Plan focuses on the development of a public transportation system that efficiently and conveniently connects downtown Portland with regional destinations, Town Centers, main streets, and station communities. The policy identifies light rail transit, along with buses, as the foundation of the regional transportation system intended to reinforce the 2040 Growth Concept. The policy also plans for streetcar lines in the Portland Central City to connect new or redeveloping neighborhoods to resources such as employment.

The Portland Comprehensive Plan reinforces the position of downtown as the principal commercial, service, cultural, and high-density housing center in the region (Policy 2.10). Transit corridors and transit stations are envisioned as areas where there is a mix of uses that support transit and higher density residential development within one-half mile of transit stations and one-quarter mile of transit centers (Policies 2.12, 2.17, 2.18, and 6.19).

The Portland Comprehensive Plan has policies that seek to ensure the stability of land uses and neighborhoods. There is a strong policy for preserving industrially zoned land within the city and encouraging the growth of industrial activities (Policy 2.14). Sensitive development within existing neighborhoods is the objective of policies that encourage infill and redevelopment at densities consistent with the surrounding neighborhood (Policy 2.19).

Streetcar System Concept Plan (2009)

On September 9, 2009, the Portland City Council adopted a resolution to accept the Streetcar System Concept Plan (SSCP). The SSCP is anticipated to be an integral element of the city's update to the comprehensive land use plan discussed above and will be included in the updated Portland Comprehensive Plan (Portland Plan). The Portland SSCP identifies potential corridors to expand service and effectively serve those Portland neighborhoods and business districts that are anticipated to have an influx of new residents.

Central City Plan

The Central City Plan provides the vision and framing policies for the area with the highest density development in the region. The Portland-Milwaukie Light Rail Project affects four of the Central City Plan subdistricts: the Downtown Portland District, the University District, the South Waterfront subdistrict, and the Central Eastside Industrial District (CEID). The Downtown District is largely designated for Central Commercial use. This designation permits high-density office, retail, and residential developments in single-use or mixed-use projects. The CEID is still composed primarily of industrial uses and is designated as an industrial sanctuary to help preserve land for existing and future industrial uses. The area south of SE Caruthers Street is one of the areas designated for industrial uses. The area surrounding the OMSI and the Portland Opera building, centered on SE Sherman Street, is designated for a broader range of mixed employment uses. The South Waterfront subdistrict is an area in transition from heavy industrial uses to intensive mixed uses, for which separate planning documents were developed. Due to the dynamic changes under way in the area, the South Waterfront Plan is described in more detail below.

A key transportation policy states that the Portland Central City will become more accessible to the rest of the region and accommodate more growth by extending the light rail system, improving other forms of transit, and enhancing street and highway access. New surface parking development is also severely limited in the Portland Central City.

South Waterfront Plan (2002)

The South Waterfront Plan sets a goal of providing 10,000 jobs and 3,000 housing units within the South Waterfront subdistrict by 2019. Important plan objectives are to achieve an overall mode split of at least 30 percent non-single occupant vehicle travel and a work trip split of at least 40 percent by 2019. The plan calls for transportation projects to connect the South Waterfront District to the regional light rail system by 2022.

Since the adoption of the South Waterfront Plan, OHSU has been evaluating development options for its property between the Ross Island and Marquam bridges. OHSU has indicated that its plans will be consistent with the South Waterfront Plan, although changes to some elements such as streets, open space, and the Willamette River Greenway could be needed to accommodate OHSU's development vision.

Johnson Creek Basin Protection Plan (1991)

The Johnson Creek Basin Protection Plan provides identification, analysis, and regulation for lands within the Johnson Creek basin watershed and the significant natural resources associated with the basin such as floodplains and wetlands. The plan identifies two natural resource sites within the project area: Site 2, Crystal Springs, and Site 3, City of Portland/Milwaukie Limit. The plan is implemented through the Johnson Creek Plan District and is intended to be used in conjunction with environmental zoning placed on significant resources and functional values in the Johnson Creek basin, to protect resources and functional values in conformance with Goal 8.11.d of the City of Portland Comprehensive Plan and Statewide Planning Goal 5.

Neighborhood Plans

Each neighborhood along the project alignment has an adopted neighborhood plan. They include the Hosford-Abernethy Plan, Brooklyn Neighborhood Plan, and the Sellwood-Moreland Neighborhood Plan. The policies of neighborhood plans are adopted as part of the Portland Comprehensive Plan. The neighborhood plans support the project by including denser residential and other transit-oriented uses around transit stations.

Street/Boulevard Plans

The project passes through or is in an area of influence of several adopted Street or Boulevard Plans: the South Waterfront North District Street Plan (2007, in the process of being updated), the Inner Powell Boulevard Street Plan (2008), the Central Eastside Street Plan (2009), and the Division Green Street/Main Street Plan (2006). The South Waterfront North District Street Plan plans a new street network in the area of the South Waterfront Station. The Inner Powell Boulevard Street Plan recommends resolving the barrier that the SE 17th Avenue and SE Powell Boulevard intersection creates for pedestrians and bicyclists. The Central Eastside Street Plan will guide circulation and access for trucks and truck loading, and bicycle, pedestrian, and transit users as the area redevelops. The goal of the Division Green Street/Main Street Plan is to provide "cohesiveness and pedestrian amenities along the street," and one of the emphases of the plan is to balance all modes of travel.

City of Milwaukie Land Use Planning Framework

Milwaukie Comprehensive Plan

This plan identifies downtown Milwaukie as a Town Center consistent with the 2040 Growth Concept. Transit policies call for actively supporting and participating in high capacity transit planning and development and locating transit-oriented development around transit stations, along major transit routes, and in the designated Town Center area. In December 2007, the City of Milwaukie adopted the revised Transportation System Plan (TSP) as the Transportation Element of the Milwaukie Comprehensive Plan. The Proposed Transit Section of the TSP shows the Portland-Milwaukie Light Rail Project alignment as a high capacity transit route.

Downtown and Riverfront Framework Plan

This plan implements the Town Center designation in the 2040 Growth Concept. The Town Center boundaries include the Portland-Milwaukie Light Rail Project area along the Union Pacific Railroad (UPRR) rail line (Tillamook Branch). The key land use concepts are minimum densities and mixed uses, but the Downtown and Riverfront Framework Plan calls for a variety of strategies to support a revitalized downtown for Milwaukie. These include strategies to highlight the unique characteristics of downtown subareas and to implement a unified plan for streets, parks, and open space connecting downtown and the riverfront.

South Downtown Concept

The City of Milwaukie is in the process of developing a South Downtown concept. The project is situated at the southern end of SE Main Street, overlooking the Willamette River, proximate to future parks, development, and natural areas and anticipates a light rail station to serve the area.

During 2008 and 2009, the city created a Pattern Language for the South Downtown. The work is a framework for new development in the South Downtown intended to enhance the natural features and be consistent with the community's vision for a new downtown neighborhood. The concept includes a new public plaza, adjacent development, and a unique vision for construction, maintenance, and tenancy. Additional work is under way to determine the steps necessary to implement the concept.

Ongoing Studies

The City of Milwaukie is working on several code update projects that would improve the city's land use and development permit review process. The city is also considering urban renewal to help further Milwaukie's redevelopment efforts.

Clackamas County Land Use Planning Framework

Clackamas County Comprehensive Plan

The Clackamas County Comprehensive Plan identifies a high capacity transit route generally following SE McLoughlin Boulevard from the Portland city limits to Oregon City. The Transportation Element of the plan also includes a design plan for the McLoughlin Corridor, which suggests strategies supporting higher density redevelopment along SE McLoughlin

Boulevard and residential neighborhoods to the west and identifies improvements to intersections, including the intersection of SE McLoughlin Boulevard and SE Park Avenue.

McLoughlin Area Plan

Clackamas County has just initiated a McLoughlin Area Plan for the area between SE River Road and Gladstone. The first phase of the process is devoted to developing the community's vision for the area. Later phases will include planning, programming, and development of the area along SE McLoughlin Boulevard.

City of Gresham Plans and Policies

The City of Gresham's Comprehensive Plan, Volume II consists of goals, policies, actions, measures, and implementation strategies to meet the intent of the goals and carry out the policies. The plan includes goals and policies that support industrial uses (Section 10.313 Industrial Land Use), expanded regional transit service, and support of adopted regional strategies for transit improvements as well as inter-agency coordination (Section 10.320.2 Transit System).

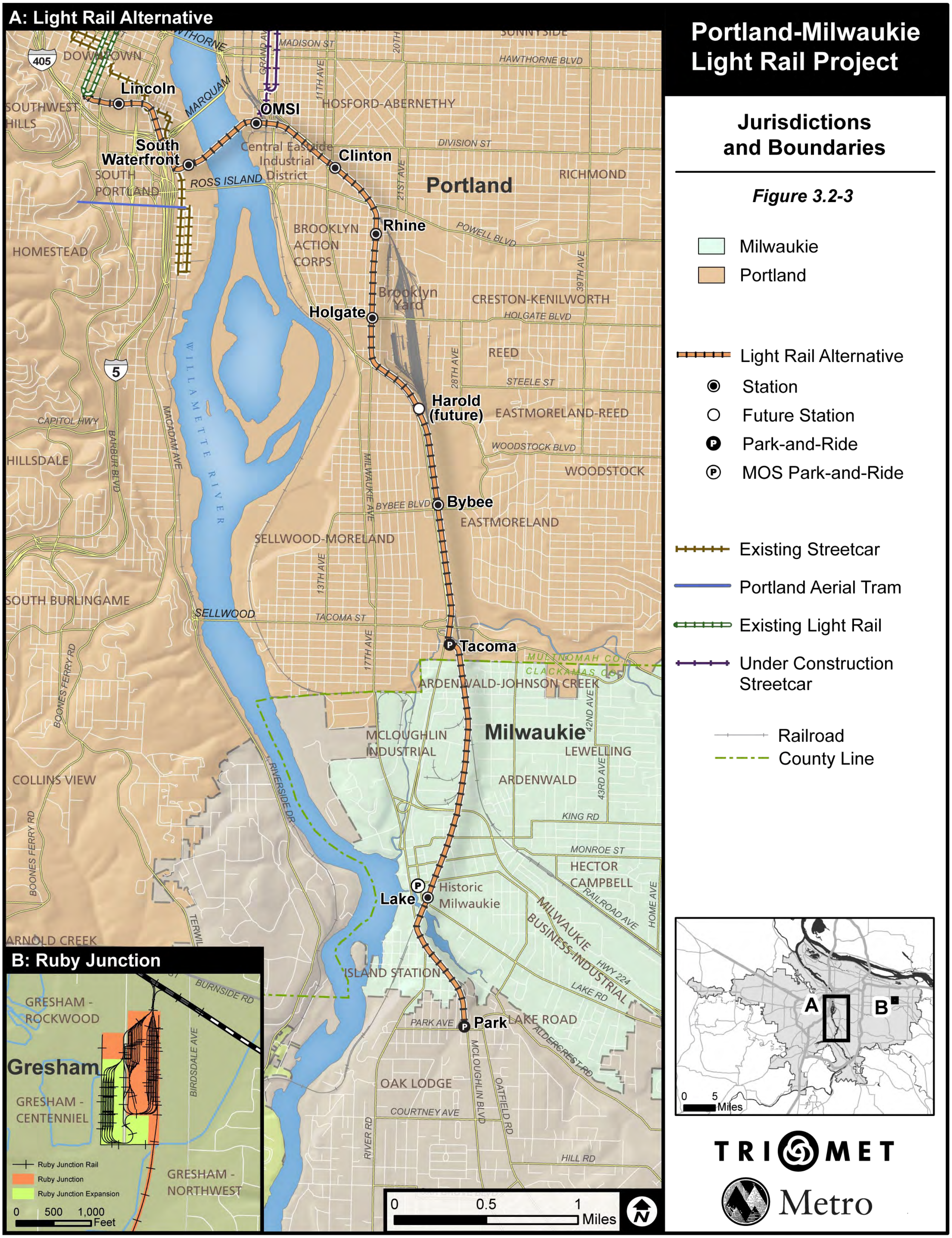
3.2.1.2 Existing and Planned Land Uses

The metropolitan area includes Multnomah, Clackamas, and Washington counties in Oregon, and Clark County in Washington. Figure 3.2-3 shows the jurisdictions and boundaries for the Portland-Milwaukie Light Rail Project. The LPA to Park Avenue extends from the Downtown Portland Transit Mall in downtown Portland to SE Park Avenue in Clackamas County. The MOS to Lake Road terminates at SE Lake Road in Milwaukie. The Ruby Junction Facility is in Gresham, east of Portland. The streetcar connections and improvements to SE Water Avenue and SW Moody Avenue are all within the City of Portland. The existing and planned land uses are described from north to south, in four general areas: downtown Portland to southeast Portland (just past the SE Martin Luther King Jr. Boulevard viaduct), southeast Portland to Milwaukie, and Milwaukie ending at SE Park Avenue in Clackamas County. The existing and planned land uses around the Ruby Junction Facility in Gresham are also described.

Existing Land Uses in the Project Area

Land use in the project area is diverse. It ranges from downtown Portland's high-density, mixed-use central business district and the redeveloping area of the southwest waterfront to the older industrial areas of the CEID, Brooklyn Yard, and the North McLoughlin Industrial District to historic downtown Milwaukie, to more suburban Clackamas County. The most recent development activity in the project area has occurred in the Portland State University (PSU) and South Waterfront areas and is dominated by condominium, apartment, student housing, and institutional buildings. The CEID has also experienced considerable redevelopment.

The Brooklyn Yard continues to be a major rail operations hub, as the UPRR has consolidated operations from the Albina Yard and concentrated them at the Brooklyn Yard. Accordingly, rail and truck movements have recently increased in the Brooklyn Yard.



December 2009

Many of the other established neighborhoods, which include the Hosford-Abernethy, Brooklyn, Sellwood-Moreland, Eastmoreland, and Ardenwald neighborhoods, feature mostly single-family residences built between approximately 1910 and 1940. The North McLoughlin Industrial District provides land and buildings for industrial use. In recent years in downtown Milwaukie, a mixed-use residential building has been developed, two commercial buildings on SE Main Street have been extensively remodeled, and Milwaukie High School has undergone improvements including a new fine arts building. The areas south of downtown Milwaukie along SE McLoughlin Boulevard to SE Park Avenue have not experienced recent major redevelopment. Development immediately adjacent to the roadway is limited up to SE Park Avenue, but the surrounding areas are largely developed. The land uses around the Ruby Junction Facility include a varied mix of single-family residences, service businesses, and industrial businesses. For a more detailed description of the existing land uses in the corridor, see the *Land Use and Economy Results Report* (Metro 2008).

<u>Planned Land Uses in the Project Area</u>

The Portland-Milwaukie Light Rail Project area, in the context of the region, is largely developed, and in most areas the existing land uses are consistent with adopted comprehensive plans. However, there are several locations where the density of development is far lower than is permitted today in comprehensive plans and zoning codes. The South Waterfront District, the CEID, and downtown Milwaukie are the most prominent areas, but there are also vacant and redevelopable parcels throughout the project area. The density of development in the South Waterfront District has substantially increased in the past few years, and there are programs and policies in place to continue encouraging dense development of this area.

Milwaukie's Riverfront Park project is planned as a centerpiece of downtown Milwaukie once completed. The park has been a passive recreation area for years, and plans have been drafted and modified with extensive citizen input. Milwaukie Riverfront Park will include an amphitheatre for performances, a festival lawn, two overlooks for river viewing, and pathways for pedestrians and bikers. The project will restore natural features and provide a central gathering place for residents.

In support of the South Downtown concept process described above, the City of Milwaukie and TriMet are working on plans for transit-oriented development (TOD) on vacant land at the corner of SE 21st Avenue and SE Lake Road. Current options show a range of building footprints from 2,500 to 7,500 square feet.

The Ruby Junction Facility area is zoned heavy industrial but currently includes single-family residences, service businesses, and industrial businesses.

Figure 3.2-4 illustrates planned land uses according to the comprehensive plan designations, and Figure 3.2-5 illustrates existing zoning in the Portland-Milwaukie Light Rail Project Corridor.

3.2.2 Environmental Consequences for Land Use

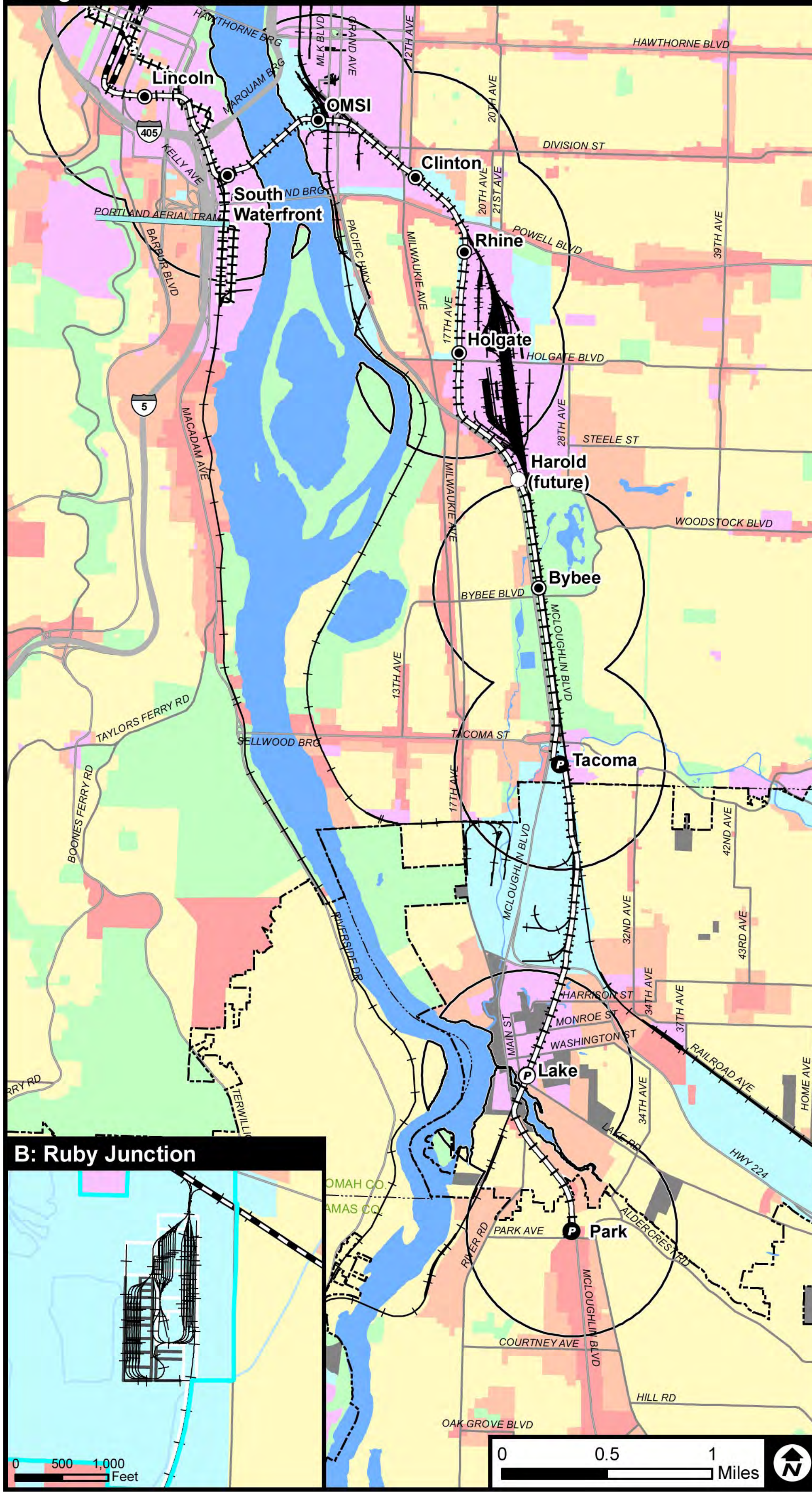
This section describes the project's compatibility with land use plans and potential impacts on land uses.

Portland-Milwaukie Light Rail Project

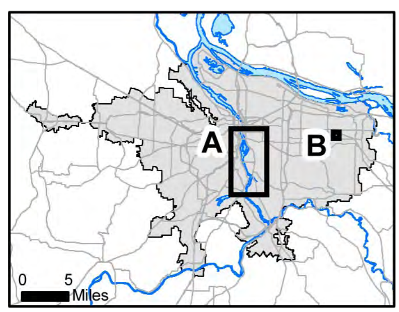
Comprehensive Plan

Figure 3.2-4

A: Light Rail Alternative



	Commercial
	Industrial
	Multi Family
	Mixed Use
	Parks & Open Spaces
	Rural Residential
	Single Family
	Public Facilities
	1/2 Mile from Station
	Light Rail Alternative
	Station
	Future Station
	Park-and-Ride
	MOS Park-and-Ride
	Existing MAX
	Existing Streetcar
	Under Construction Streetcar
	Railroad
	County Line



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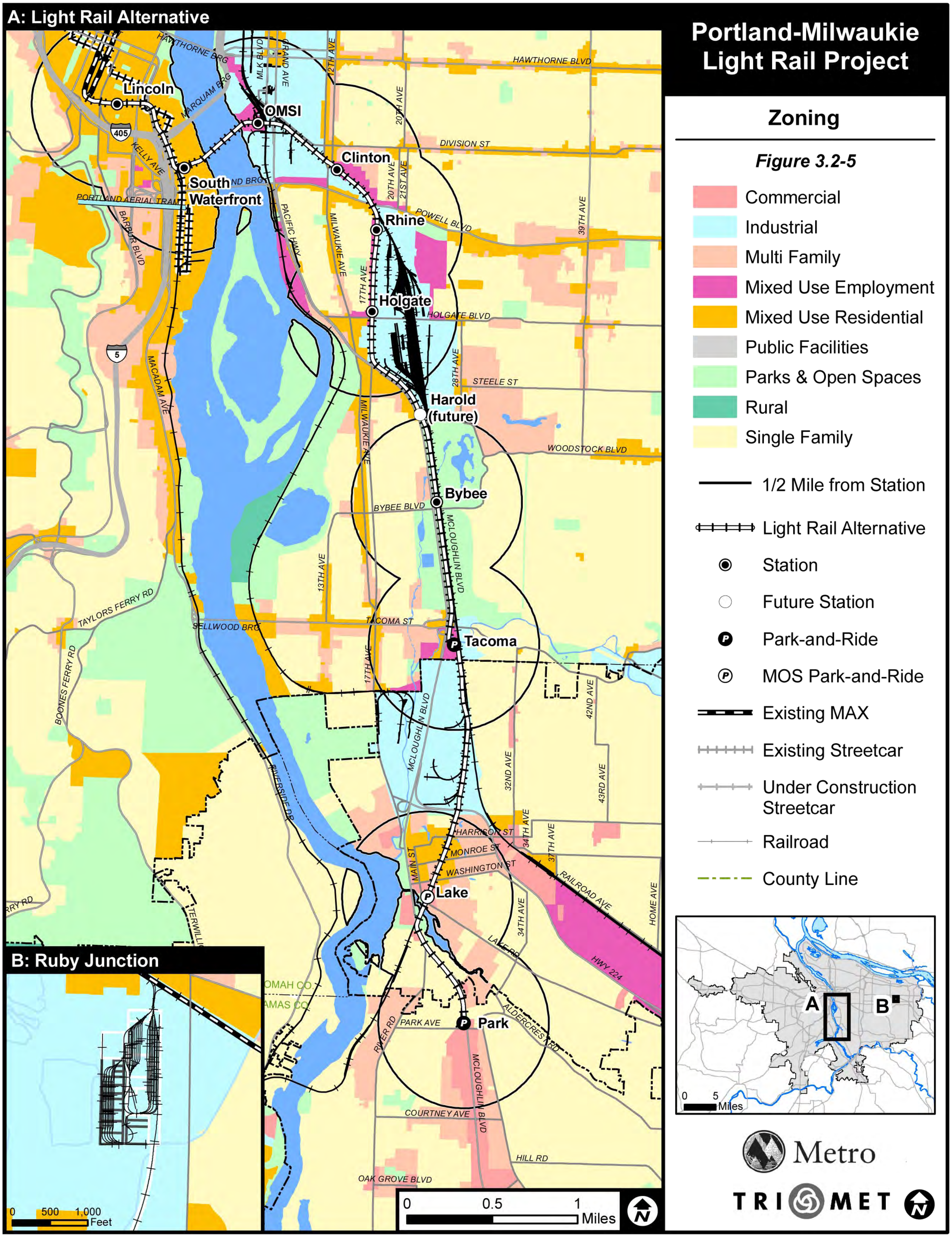

A: Light Rail Alternative
Portland-Milwaukie Light Rail Project
Zoning
Figure 3.2-5
Commercial
Industrial
Multi Family
Mixed Use Employment
Mixed Use Residential
Public Facilities
Parks & Open Spaces
Rural
Single Family
1/2 Mile from Station
Light Rail Alternative
Station
Future Station
Park-and-Ride
MOS Park-and-Ride
Existing MAX
Existing Streetcar
Under Construction Streetcar
Railroad
County Line
Lincoln
OMSI
Clinton
South Waterfront
Rhine
Holgate
Harold (future)
Bybee
Tacoma
Lake
Park
B: Ruby Junction
HAWTHORNE BRG
HAWTHORNE BLVD
DIVISION ST
POWELL BLVD
HOLGATE BLVD
STEELE ST
WOODSTOCK BLVD
BYBEE BLVD
TACOMA ST
SELLWOOD BRG
TAYLORS FERRY RD
BOONES FERRY RD
MACADAM AVE
BARBUR BLVD
KELLY AVE
MARQUAM BRG
PORTLAND AERIAL TRAM
MLK BLVD
GRAND AVE
12TH AVE
20TH AVE
21ST AVE
39TH AVE
28TH AVE
17TH AVE
13TH AVE
MILWAUKIE AVE
PACIFIC HWY
MCLOUGHLIN BLVD
RIVERSIDE DR
42ND AVE
43RD AVE
32ND AVE
34TH AVE
37TH AVE
HARRISON ST
MONROE ST
WASHINGTON ST
MAIN ST
RAILROAD AVE
HOME AVE
LAKE RD
HWY 224
ALDERCREST RD
PARK AVE
RIVER RD
COURTNEY AVE
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June 2010

3.2.2.1 Compatibility with Adopted Plans and Policies

This section describes compatibility of the alternatives with adopted plans and policies discussed in Section 3.2.1.1.

<u>No-Build Alternative</u>

Compatibility with Statewide Planning Goals

The No-Build Alternative would be consistent with Statewide Planning Goals. However, it is far less likely than the proposed project to achieve the goals for focused growth reduction in VMT per capita called for in Goal 12 as implemented by the TPR.

Compatibility with Regional and Local Plans

The No-Build Alternative would not deliver the transportation and mobility improvements to support the long-range plans of Metro at the regional level and of Portland, Milwaukie, and Clackamas County at the localized level, all of which anticipate intensified development in this corridor, supported by a strong multimodal transportation system. Without light rail, areas anticipating higher rates of growth, such as downtown Portland, the South Waterfront District, the Portland east side, and Milwaukie, would likely have a more difficult time achieving high levels of transit usage (see Chapter 2, Alternatives). The lack of transit infrastructure investment would likely slow or discourage growth in these areas, because congestion and more limited mobility choices would make the areas less attractive for businesses and residents. This could also create more pressure for growth in less congested areas, typically on the fringes of the urban area.

The No-Build Alternative does not change any plan designations, so it would not prevent the 2040 Growth Concept from being achieved, but it could hinder its implementation. The multimodal transportation improvements in the RTP would not provide service to the designated Regional Centers and Town Centers to the degree envisioned in the 2040 Growth Concept.

<u>Locally Preferred Alternative (LPA) to Park Avenue</u>

Compatibility with State Plans

The LPA to Park Avenue implements the TPR to a greater extent than the No-Build Alternative, because it would provide the capacity and reliability of transit service sufficient to support plans for transit-oriented redevelopment in the cities and station areas. This more intensive growth would be in accordance with Goal 12 as implemented by the TPR. The project is compatible with Goal 9, because it provides improved facilities to serve areas targeted in plans for economic development. The project is compatible with Goal 15, the Willamette River Greenway, because the project will be designed to meet the City of Portland’s and City of Milwaukie’s greenway regulations that implement Goal 15 (although analysis of permit requirements is not part of the FEIS). For example, where the project crosses the Willamette River it will include setbacks consistent with the City of Portland Willamette River Greenway Plan and South Waterfront greenway regulations, and will improve the recreational and scenic resources in accordance with the plans governing the area. On the east side of the Willamette River crossing, the project will also include replacement of the existing trail and landscaping where impacted by construction of the new bridge. In Milwaukie, the crossing of Kellogg Lake will include removal of invasive species and revegetation with native species, providing a long-term water quality and fish habitat benefit related to stream cooling and large woody debris, which is consistent with the goals of preserving the natural environment of the Willamette River Greenway.

Compatibility with Regional and Local Plans

As noted above, the Oregon Legislature enabled the Metro region to approve land use final orders (LUFOs) to address the multi-jurisdictional land use aspects of light rail projects in the South/North Corridor Project. In July 2008, the Metro Council held a public hearing to consider amending existing LUFOs for light rail in the Portland-Milwaukie area to reflect changes adopted as part of the South Corridor Project. The amended LUFO was adopted in July 2008. Local comprehensive plans and zoning are required to become consistent with the land use order.

The LPA to Park Avenue would be compatible with regional plans and policies. The regional 2040 Growth Concept creates, and the *Functional Plan* implements, the idea of regional transit connecting the most active centers of Portland and Milwaukie. The RTP identifies light rail as the preferred public transportation mode to serve and connect the Portland Central City and the Regional Centers, while Town Centers can be served at a secondary level by light rail. The LPA to Park Avenue directly links transportation and land use through TOD in downtown Portland, in the South Waterfront area, in the southeast Portland station areas, and in the Milwaukie Town Center. The 2035 RTP supports construction of light rail between Portland and Milwaukie.

The LPA to Park Avenue is also compatible with all local plans. The Portland Comprehensive Plan supports and encourages light rail and streetcars as a means to increase access into the downtown core and increase the proportion of all trips occurring on transit. The Central City Plan and South Waterfront Plan depend on light rail to achieve their development objectives. Individual neighborhood plans along the corridor anticipate light rail and support connecting their neighborhoods to the Portland Central City through light rail. Local street design plans fuse with the project design, including its associated pedestrian and bicycle improvements. The project is consistent with all the plans either directly (such as with the Inner Powell Boulevard Street Plan) or generally (such as with the Division Green Street/Main Street Plan). The project is consistent with these local plans because it provides transit improvements, increases pedestrian and bicycle accommodations, and also provides replacement street trees and new street lighting.

The project will meet the requirements of the Johnson Creek Protection Plan and other federal, state, and local requirements through the design approach and mitigation actions described in Section 3.8, Ecosystems, and Section 3.9, Water Quality and Hydrology.

The Milwaukie Comprehensive Plan and Downtown and Riverfront Framework Plan implement Milwaukie’s designation as a Town Center. The goals of these plans will be achieved more quickly through light rail service to the city.

The project would be consistent with the goals of the Clackamas County Comprehensive Plan, which identifies SE McLoughlin Boulevard as a high capacity transit corridor.

LPA Phasing Option

Compatibility with State Plans

The LPA Phasing Option implements the TPR to a similar extent as the LPA to Park Avenue, because it would provide the level and capacity of transit service to support plans for transit-oriented redevelopment in the cities and station areas that support more intensive growth, in accordance with Goal 12 as implemented by the TPR. The LPA Phasing Option will be compatible with other state plans and goals, similar to the LPA to Park Avenue.

Compatibility with Regional and Local Plans

The LPA Phasing Option is compatible with the intent of the LUFO. The LPA Phasing Option is compatible with regional and local plans, similar to the LPA to Park Avenue. The LPA Phasing Option is compatible with City of Portland local plans and policies. However, it does not implement all plans to the same degree as the LPA to Park Avenue because of the deferred pedestrian and bicycle facilities at the Clinton and Rhine stations. The LPA Phasing Option is compatible with the City of Milwaukie's Plans, Clackamas County's Comprehensive Plan, and the City of Gresham Comprehensive Plan.

Minimum Operable Segment (MOS) to Lake Road

Compatibility with State Plans

The MOS to Lake Road implements the TPR to a greater extent than the No-Build Alternative, because it would provide the level and capacity of transit service to support plans for transit-oriented redevelopment in the cities and station areas that support more intensive growth, in accordance with Goal 12 as implemented by the TPR. It would be slightly less consistent with the TPR than the LPA to Park Avenue, because the latter would serve a larger population and geographic area within the UGB.

Compatibility with Regional and Local Plans

The MOS to Lake Road would have the same compatibility with regional plans and policies as the LPA to Park Avenue for the project area within the City of Portland. However, it would not completely implement the policies of the City of Milwaukie TSP, which identifies a high capacity transit corridor extending south to SE Park Avenue. The park-and-ride at SE Lake Road is conditionally compatible with the TSP, as long as it does not impede pedestrian connectivity to downtown and the river and has parking spaces dedicated for downtown rather than just for commuter uses.

The MOS to Lake Road is not as compatible as the LPA to Park Avenue with the Downtown and Riverfront Framework Plan, which identifies the area as a pedestrian "campus" setting with increased pedestrian connectivity to the river. The Lake Road Park-and-Ride would take up an area that could otherwise be used for TOD. Traffic analysis shows queues of automobiles accessing the park-and–ride, which may somewhat impede pedestrian access in those areas and take up parking for downtown uses (see Chapter 4, Transportation). On the other hand, automobile uses (parking and "drop off" area) are identified for the site in Milwaukie's Downtown and Riverfront Framework Plan.

The MOS to Lake Road is less compatible with the emerging vision of the South Downtown concept (this concept is in the planning process and not an adopted plan), which identifies TOD (two- and three-story buildings abutting the right-of-way with pedestrian areas and walkways dispersed throughout the development). With the MOS to Lake Road, the Lake Road Park-and-Ride would occupy that area, but other TOD opportunities would still be available.

The MOS to Lake Road would not completely fulfill the policies of the Clackamas County Comprehensive Plan, which identifies SE McLoughlin Boulevard as a high capacity transit corridor, but it would serve the northern portion of the corridor and provide a location for future connections in the corridor.

Related Bridge Area Transportation Facilities

Compatibility with State Plans

The Related Bridge Area Transportation Facilities would support the TPR to a greater extent than the No-Build Alternative, because they would provide the level and capacity of transit service to support plans for transit-oriented redevelopment in Portland Central City that would, in turn, support more intensive growth, in accordance with Goal 12 as implemented by the TPR. They also would support Goal 9, which emphasizes services and infrastructure to support economic development and has policies to encourage compatible development within industrial and commercial areas.

Compatibility with Regional and Local Plans

The 2040 Growth Concept map designates the Portland Central City as the employment and cultural hub of the Portland metropolitan area. The 2040 Growth Concept is predicated on implementation of more intense and improved transit network and facilities, aimed at attracting greater market shares of travel to, from, and within activity centers such as Portland Central City. Likewise, the City of Portland's *Plan and Policy* contains Policy 5.4, calling on the city to improve transit service to provide better circulation within and between districts of Portland Central City, and Objective 5.4.4, which calls for identifying a strategy for developing the Portland Central City streetcar system and integrating it with other transit services. This is being accomplished by the Portland Streetcar System Concept Plan (SSCP). The Portland Streetcar Loop Project is included in the SSCP, and the light rail project would complete a connection between the eastside loop and the South Waterfront Streetcar. Improvements to a realigned SE Water Avenue and reconstruction of SW Moody Avenue are being developed in partnership with the City of Portland and are designed to support local plans for the CEID and the South Waterfront District.

Ruby Junction Maintenance Facility

Compatibility with State Plans

The Ruby Junction Facility, either fully expanded or developed in phases, supports the TPR more than the No-Build Alternative by providing the necessary facility to store and repair the additional light rail vehicles required to expand the regional light rail system. The increased capacity of the facility allows for the operation of additional light rail vehicles, which subsequently provides the opportunity for increased development associated with high capacity transit.

Compatibility with Regional and Local Plans

The City of Gresham Comprehensive Plan, Section 10.313 Industrial Land Use Implementation Strategy 2 states that the City will establish three industrial districts, including “a heavy industrial district for industrial uses which process, fabricate, utilize heavy equipment or require substantial areas for outdoor storage.” The project is in an area designated as heavy industrial and would be utilized for storage of light rail vehicles; thus it meets the intent of this strategy. The project would implement several Transit System goals and policies with Section 10320.2 of the City of Gresham Comprehensive Plan that calls for expanded service and service area of light rail including logical extensions of light rail. Section 10320.2 also includes a policy that states that the City shall support adopted regional strategies and priorities for transit improvements. The project is part of an adopted regional strategy. Therefore, the expansion of the Ruby Junction Facility, including the phasing option, is compatible with local plans and policies.

3.2.2.2 Impacts on Existing and Planned Land Uses

<u>No-Build Alternative</u>

The No-Build Alternative would not develop light rail connecting downtown Portland, the South Waterfront, and Milwaukie and would not connect this part of the region to the existing regional light rail system. This alternative would avoid direct impacts of building and operating the Portland-Milwaukie Light Rail Project, and there would not be a need to acquire property or displace existing uses. The region would still make other transportation improvements in and around the project corridor, but these would be localized changes rather than improvements along the length of the corridor, and they would not improve overall connections between activity centers and would not provide additional transportation mobility or a more competitive travel mode choice.

<u>Locally Preferred Alternative (LPA) to Park Avenue</u>

Regional Land Use Impacts

The light rail project will augment the regional transportation system, increasing access and mobility within the UGB. Of particular importance to the region will be increased access to two key regional institutions, OHSU and OMSI, and to the new jobs that light rail will facilitate at these institutions.

Local Land Use Impacts

This section provides a summary of the local land use impacts on existing and planned land uses for the LPA to Park Avenue. The analysis proceeds segment by segment from north to south. At some stations, the understanding of the impacts has been enhanced by the station area planning work performed as part of the development of the Portland-Milwaukie Light Rail Project. Metro, TriMet, and their partners have conducted station area assessments to help maximize the ability of the light rail project to help support land use goals. Station area plans help to coordinate the design of the project with the plans and decisions of local jurisdictions and adjacent property owners and are part of an ongoing process that continues through final design and into construction and operation. The station area planning process has featured open public workshops and meetings designed to help identify local area goals and the potential for redevelopment near stations. As the project continues toward final design and permitting phases, similar efforts are anticipated. The project clearly recognizes that local governments control the decisions about land use, including zoning and specific development approvals.

Impacts from conversion of land from existing uses to a transportation use would be minor in the context of both local and regional land supply. Some of the properties to be partially acquired by the project will leave sufficient land for redevelopment following light rail construction, which would reduce long-term impacts compared to full acquisition. Because much of the alignment follows existing rights-of-way, the acquisition impacts are localized.

There has been a substantial increase in the density of jobs and housing in the South Waterfront District area, as well as new transportation options in the form of the Portland Streetcar extension and the Portland Aerial Tram. By 2030, the South Waterfront Station is projected to serve about 400 percent more households than existed in 2005 and about 95 percent more employees (see Table 3.2-1 below). A portion of the job growth is expected to occur on the vacant OHSU and Oregon University System (OUS) properties located between the Ross Island and Marquam bridges. The project would support accelerated growth in housing and jobs by increasing access to the entire South Waterfront District area from throughout the region. The light rail and the bridgehead transportation projects would provide the transit options needed to support the high-density land uses planned for, and being developed in, the area.

In terms of impacts on land supply and the overall land use patterns, the alignment between downtown Portland and the west side of the Willamette River would require a few building acquisitions and business displacements. While these effects impact individual employees and business owners, the experience of other light rail projects is that overall employment in the corridor increases as a result of the light rail investment, and many of the displaced businesses typically have been able to relocate within the region. Acquisition of properties at fair market value and relocation assistance will be provided (see Section 3.1, Acquisitions and Displacements, for additional information).

In the CEID (beginning around SE Water Avenue), in Brooklyn Yard, and in the North Milwaukie Industrial District, parcels with industrial and commercial uses would be acquired and their uses displaced. In the CEID, the area is fairly densely developed adjacent to the UPRR lines. The light rail project requires additional right-of-way width that results in the conversion of industrial land to transportation use, displacing warehouse, service, and manufacturing businesses. The Willamette River Bridge will also affect dock access for a water-dependent use, which could result in its displacement, although a full displacement may be avoided through coordinated planning between TriMet and the business owner. Along SE 17th Avenue, the alignment shifts from the east to the west side of the road, converting some of the fronting industrial and commercial land uses such as office and service businesses in the area. The project also affects parcels owned by Portland General Electric (PGE), as well as parcels used by TriMet for parking and storage. TriMet expects to consolidate operations and its command center at its Center Street headquarters, while moving administrative functions off-site. Along SE McLoughlin Boulevard, near SE Harold Street, the project would also displace industrial and commercial uses, including offices used by UPRR. As the project progresses south through the Eastmoreland residential neighborhood, most of the acquisition would be from the UPRR rail alignment. Approaching the boundary between the cities of Portland and Milwaukie, the alignment would acquire properties and displace industrial uses to accommodate the Tacoma Station and Park-and-Ride and place light rail facilities within the UPRR corridor. South of the Tacoma Station in Milwaukie, west of the UPRR rail lines between the Tacoma Station and SE Hanna Harvester Drive, there would be three industrial acquisitions. Through Milwaukie and along the west side of SE McLoughlin Boulevard, the project will affect a series of bordering properties in order to accommodate light rail. This includes a section on the west side of SE McLoughlin Boulevard that would place the planned Trolley Trail to the west of the light rail alignment and the acquisition of groupings of commercial properties where the Park Avenue Station and Park-and-Ride would be located. South of downtown Milwaukie, where SE 22nd Avenue meets SE McLoughlin Boulevard, light rail trackway would be over SE 22nd Avenue in the public right-of-way in front of commercial buildings. Access from local streets would be maintained; however, the raised structure would create visual changes, affecting the setting or visibility of the adjacent commercial uses.

Overall, the acquisitions represent a small fraction of the total industrial and commercial land in those areas, and no major changes to area land use patterns would be expected as a result.

With respect to the potential for infill development, areas to the west of the alignment south of the Rhine Station to Milwaukie offer more opportunities for infill development and redevelopment than areas to the east side of the alignment. Redevelopment on the east side is limited by the TriMet bus storage facilities, the Brooklyn Yard, the UPRR line, Eastmoreland Golf Course, and the topography.

A series of residential acquisitions and displacements would occur between SE Lake Road and SE Park Avenue. No major changes to area land use patterns would be expected, although there may be sporadic infill development.

Other changes as a result of the project are likely to have minor or beneficial effects on area land uses. The project has a number of intersection improvements that will consolidate and improve safety for at-grade rail crossings of the UPRR and light rail lines, providing improved safety for vehicles and pedestrians. Some of these improvements, as well as restricted turning movements for some intersections along SE 17th Avenue, would cause minor delays in travel times and minor out-of-direction travel. In downtown Milwaukie, the gated at-grade crossings of SE Harrison Street, SE Washington Street, SE Adams Street, and SE Monroe Street would stop east-west traffic when trains are crossing and cause delays. The new crossings are unlikely to affect land use in the immediate area.

Light rail is likely to advance the timing and intensity of development allowed by the comprehensive plans in Portland, Milwaukie, and unincorporated Clackamas County, particularly in station areas or as a result of transit-oriented developments. Based on these changes in development potential, the cities of Portland and Milwaukie and Clackamas County may decide to rezone industrial or residential single-dwelling zoned sites to mixed-use designations in select areas near or adjacent to stations. Overall, the project will likely encourage land uses to intensify within existing zoning and comprehensive plan constraints. Other potential developments in station areas, including public investment in a SE Lake Road TOD site related to the Lake Road Station, or similar transit-oriented developments near the Tacoma or Park Avenue stations and park-and-rides, may further stimulate infill and redevelopment in those areas. Table 3.2-1 presents a summary of station-area zoning and potential for transit-oriented development. However, since the future potential developments would require the actions of others, and are not assumed as part of the project, their effects are generally discussed in 3.2.2.4, Land Use Secondary and Cumulative Impacts.

Table 3.2-1
Current Zoning and Potential Transit-Oriented Development Opportunities

Station Area	Current Zoning	Potential TOD
Lincoln Station	- Central Residential (RX): This zone promotes medium- and high-rise apartments and condominiums, typically mixed with some other use. The RX zones are positioned close to transit options. - Central Commercial (CX): Development in this zone is intended to be very intense with high building coverage, large buildings, and buildings placed close together. Development is intended to be pedestrian-oriented with a strong emphasis on a safe and attractive streetscape - Open Space (OS): Zoning intended to preserve and enhance public and private open, natural, and improved park and recreational areas identified in the Comprehensive Plan.	The station area surrounding Lincoln Station is a high density mixed-use residential and commercial area that includes PSU and its supporting uses. The area supports pedestrian uses through a network of public walkways, plazas, and open spaces designed by renowned landscape architect Lawrence Halprin. The station area is in the North Macadam Urban Renewal Area. Current zoning promotes high density residential and commercial mixed uses in support of transit and pedestrian fluidity. TOD is planned for the area at the PSU University Place Hotel and adjacent properties. Further TOD could be incorporated onto underutilized sites in the surrounding area and would be consistent with current zoning.
South Waterfront Station	- Central Commercial (CX): Development is intended to be very intense with high building coverage, large buildings, and buildings placed close together. Development is intended to be pedestrian-oriented with a strong emphasis on a safe and attractive streetscape. - High Density Residential (RH): Density is not regulated by a maximum number of units per acre. Rather, the maximum size of buildings and intensity of use is regulated by floor area ratio (FAR) limits and other site development standards. Generally the density will range from 80 to 125 units per acre. Allowed housing is characterized by medium to high height and a relatively high percentage of building coverage. The major types of new housing development will be low-, medium-, and high-rise apartments and condominiums. Generally, RH zones will be well served by transit facilities or be near areas with supportive commercial services.	The station area is in the North Macadam Urban Renewal Area. Currently, the area is undeveloped. A 26-acre OHSU campus is planned adjacent and north of the station area. Development is also planned adjacent and south of the station.
OMSI Station	– General Employment (EG): The zones allow a wide range of employment opportunities without potential conflicts from interspersed residential uses. The emphasis of the zones is on industrial and industrially related uses. Other commercial uses are also allowed to support a wide range of services and employment opportunities. - General Industrial (IG): Zone where most industrial uses may locate, while other uses are restricted to prevent potential conflicts and to preserve land for industry. – Heavy Industrial (IH): The zone provides areas where all kinds of industries may locate	The area is currently used for industrial and institutional uses such as the Portland Opera and OMSI. The station is in the Central Eastside Urban Renewal Area. The employment zone allows for a mix of uses. Redevelopment and expansion of the institutions near and around the station is planned. A small amount of further redevelopment such as retail redevelopment could occur near the station within existing zoning.

Table 3.2-1
Current Zoning and Potential Transit-Oriented Development Opportunities

Station Area	Current Zoning	Potential TOD
	including those not desirable in other zones due to their objectionable impacts or appearance. The development standards are the minimum necessary to ensure safe, functional, efficient, and environmentally sound development.	
Clinton Station	– General Employment (EG): The zones allow a wide range of employment opportunities without potential conflicts from interspersed residential uses. The emphasis of the zones is on industrial and industrially related uses. Other commercial uses are also allowed to support a wide range of services and employment opportunities. - General Industrial (IG): Zone where most industrial uses may locate, while other uses are restricted to prevent potential conflicts and to preserve land for industry. - Central Employment Zone (EX): The zone allows mixed uses and is intended for areas in the center of the city that have predominantly industrial-type development. The intent of the zone is to allow industrial, business, and service uses that need a central location. Residential uses are allowed, but are not intended to predominate or set development standards for other uses in the area. The development standards are intended to allow new development that is similar in character to existing development.	Station area planning identified 26.7 acres vacant or redevelopable property within ¼ mile. Land uses directly along the station corridor of the station are chiefly industrial, light industrial, and general commercial with residential areas to the north. Large property owners near the station include: - NW Natural Gas's southeast distribution center is west of the station across SE 11th Ave. - A lumberyard is south of the station where SE Gideon St. dead-ends. - Portland Fire and Rescue Station is south of the station. TOD is limited in the area adjacent and south and west of the station by the IG zone designation. The area north of the station is zoned EG and EX, which allows more flexibility for potential TOD.
Rhine Station	– General Employment (EG): The zones allow a wide range of employment opportunities without potential conflicts from interspersed residential uses. The emphasis of the zones is on industrial and industrially related uses. Other commercial uses are also allowed to support a wide range of services and employment opportunities. - General Industrial (IG): Zone where most industrial uses may locate, while other uses are restricted to prevent potential conflicts and to preserve land for industry. – Single-Family Residential (R2, R5): The single-dwelling zones are intended to preserve land for housing and to provide housing opportunities for individual households.	Station area planning identified 20 acres of vacant or redevelopable land within ¼ mile. The area east of the station is mainly industrial. The west side of the station area has a band of commercial uses along SE 17th Ave. with a single-family residential neighborhood behind it. TOD potential within existing zoning is primarily along the west side of SE 17th Ave. However, project-related street improvements make the lot depths too short for a large development.
Holgate Station	– General Employment (EG): The zones allow a wide range of employment opportunities without potential conflicts from interspersed residential uses. The emphasis of the zones is on industrial and industrially related uses. Other commercial uses are also allowed to support a wide range of services and employment opportunities. - General Industrial (IG): Zone where most	Land use to the east of the station is generally industrial. Station area planning identified 16.7 acres of vacant or redevelopable land within ¼ mile. TriMet offices, and service and storage hub are adjacent and northeast of the station. The Southern Pacific rail yard is east past TriMet and industrial buildings. The west side of SE 17th Ave. is mostly commercial with residential areas further west. Overall, TOD could occur within existing zoning on

Table 3.2-1
Current Zoning and Potential Transit-Oriented Development Opportunities

Station Area	Current Zoning	Potential TOD
	industrial uses may locate, while other uses are restricted to prevent potential conflicts and to preserve land for industry. – Single-Family Residential (R2, R5): The single-dwelling zones are intended to preserve land for housing and to provide housing opportunities for individual households.	underutilized parcels on the west side of SE 17th Ave. north of the station and on the east side of SE 17th Ave. south of the station. A few small vacant parcels near the station could allow small scale TOD.
Bybee Station	OS – Open space, intended to preserve and enhance public and private open, natural, and improved park and recreational areas identified in the Comprehensive Plan. – Single-Family Residential (R5): The single-dwelling zones are intended to preserve land for housing and to provide housing opportunities for individual households. - Medium Density Multi-dwelling (R1): The R1 zone is a medium density multi-dwelling zone. It allows approximately 43 units per acre.	The immediate station area is dominated by public open space that is unlikely to convert to a more intensified use. Eastmoreland Public Golf Course is just past the tracks both to the east and southeast. Westmoreland Park is southwest of the station across SE McLoughlin Blvd. The areas past the park and open space are predominately single-family residential neighborhoods except for Westmoreland Union Manor, which provides senior housing. Significant redevelopment is limited due to existing zoning and uses.
Tacoma Station	– General Employment (EG): The zones allow a wide range of employment opportunities without potential conflicts from interspersed residential uses. The emphasis of the zones is on industrial and industrially related uses. Other commercial uses are also allowed to support a wide range of services and employment opportunities. – General Commercial (CG): Intended to allow auto-accommodating commercial development in areas already predominately built in this manner and in most newer commercial areas. The zone allows a full range of retail and service businesses with a local or regional market. Industrial uses are allowed but are limited in size to avoid adverse effects different in kind or amount than commercial uses and to ensure that they do not dominate the character of the commercial area. Development is expected to be generally auto-accommodating, except where the site is adjacent to a transit street or in a Pedestrian District. - General Industrial (IG): Zone where most industrial uses may locate, while other uses are restricted to prevent potential conflicts and to preserve land for industry. - Medium Density Multi-dwelling (R1): The R1 zone is a medium density multi-dwelling zone. It allows approximately 43 units per acre. – Single-Family Residential (R2): The single-dwelling zones are intended to preserve land for housing and to provide housing opportunities for individual - Manufacturing (M): The purpose of this manufacturing zone is to promote clean, employee-intensive industries which may also	Station area planning identified 22.9 acres of vacant or redevelopable land within ¼ mile. Directly surrounding the station to the southeast and southwest are predominately industrial uses with some general commercial areas. In the peripheries of the station area there is multifamily and single-family residential housing. Within existing zoning, there is opportunity for development and redevelopment adjacent to the station and a small amount of medium density residential development opportunity west of SE McLoughlin Blvd. With the LPA Phasing Option, the new station would still be an improvement to the area, with the potential for future opportunities for joint development of TOD with a future structured parking facility.

Table 3.2-1
Current Zoning and Potential Transit-Oriented Development Opportunities

Station Area	Current Zoning	Potential TOD
	include related accessory uses, such as commercial and office uses, which serve the industrial area.	
Lake Road Station	- Downtown office (DO): The Downtown Office Zone is established to provide for office, entertainment, and hotel uses along high-visibility major arterial streets, as designated by the City of Milwaukie's Transportation System Plan. Retail commercial uses are limited to support the primary uses (office, entertainment, and hotel establishments) and encourage retail development along SE Main Street. The desired character for this zone will vary depending on the nature of the proposed use and individual site features. – Downtown Residential (DR): The Downtown Residential Zone is established to increase housing opportunities in proximity to downtown shopping, transit, and open space amenities. The major types of new housing will be apartments and condominiums. Minimum densities of 30 units per acre will ensure that land is used efficiently and will increase the customer base for nearby businesses. Additionally, the higher densities will support urban features such as parking under structures and durable building materials. Development at minimum densities of 10 units per acre up to a maximum of 30 units per acre will be permitted in a defined portion of the Downtown Residential Zone to provide a transition to lower density residential zones. The desired character for the Downtown Residential Zone includes buildings located close to and oriented to the public sidewalk, with off-street parking located under or internal to building sites. - Downtown Open Space (DOS): The Downtown Open Space Zone is established to implement the "Public" designation of the Milwaukie Comprehensive Plan and to provide a specific zone to accommodate open space, park, and riverfront uses. The Downtown Open Space Zone is generally applied to lands that are in public ownership along the Willamette River, Kellogg Creek, Spring Creek, and Johnson Creek in the downtown area. The desired character for the Downtown Open Space Zone includes parkland, open space, and riverfront amenities.	Station area planning identified 23.4 acres of vacant or redevelopable land within ¼ mile. Lake Road Station is on the southern edge of central Milwaukie. Lake Road Station is surrounded by offices and commercial uses to the east, west, and north of the station. Station zoning is mostly downtown zoning guided by Milwaukie Downtown Design Guidelines, which were established to support the City's plans for downtown and the riverfront. TOD is planned for the "triangle site" east of the station and the site is proposed for purchase by TriMet to be made available for TOD. TOD opportunities may be possible through redevelopment of lots west of the station and between SE Washington and SE Monroe streets north of the station. The MOS to Lake Rd. would reduce TOD opportunity by using available redevelopable land for transportation-associated uses and structures such as the park-and-ride.
Park Avenue Station	- General Commercial (C3): General commercial includes office, retail, and service commercial uses. - Single-dwelling Residential (R7): This zone is for urban low density residential development	Station area planning identified 30.8 acres of vacant or redevelopable land within ¼ mile. Both to the west and east of the station are residential neighborhoods. Commercial uses predominate south of SE Park Ave. along SE McLoughlin Blvd.

Table 3.2-1
Current Zoning and Potential Transit-Oriented Development Opportunities

Station Area	Current Zoning	Potential TOD
	within a minimum lot size of 7,000 feet. – High Density Residential (HDR): High density residential areas, which include provision for residential development at densities that are supportive of public service and facility capacities in locations with good access to employment, shipping areas, open space, and public transportation. – Medium Density Residential (MR1): Medium density residential includes single-family, multifamily, and two- and three-family. Mixed-use developments are a conditional use.	TOD opportunities in the Park Avenue Station area within existing zoning are primarily redevelopment of parcels directly south of the station area. These opprotunities would be the same with the LPA Phasing Option.

Table 3.2-2 provides the results of the project's station area analysis conducted during the development of the SDEIS. The analysis does not cover all stations, since some were found to have transit-supportive development in place (i.e., the Lincoln Station) or have already been the subject of area planning (South Waterfront). The stations below were identified by the project partners for the more detailed analysis of TOD potential.

Table 3.2-2
Assessments of Redevelopment Potential Within 1/4 Mile of Selected Stations

City/Station	Acres of Redevelopable Land	Potential Residential Units (existing zoning)	Potential Commercial Acreage (existing zoning)
Portland Stations			
Clinton	26.7	106	21.0
Rhine	20.0	72	14.0
Holgate	16.7	89	11.9
Harold	11.2	145	11.2
Bybee	1.2	23	0.0
Milwaukie Stations			
Lake Road	23.4	29.4	14.0
Park Avenue	30.8	23.2	14.3

Source: Portland-Milwaukie Light Rail Project Station Area Planning Study Final Report, Metro 2009.

LPA Phasing Option

The LPA Phasing Option would have similar regional and local impacts as the LPA to Park Avenue. The deferred parking, pedestrian, and bicycle features at the Clinton and Rhine stations could initially avoid property impacts. The reduced amenities may make TOD slightly less attractive to developers, although the additional access provided by the station is a major improvement.

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road would have the same impacts as the LPA to Park Avenue in Portland. In Milwaukie one difference would be that, although there would be fewer residential and commercial displacements overall, there would be more concentrated displacements in downtown Milwaukie. A larger area and integral block of downtown Milwaukie would be converted to transportation use from commercial use. Compared to the LPA to Park Avenue, the MOS to Lake Road would require a higher level of street improvements and widening of city streets and intersections in order to serve the access needs of the park-and-ride. The Lake Road Park-and-Ride would result in redevelopment that could affect the site design of the planned TOD near the Lake Road Station. The park-and-ride, at a location that is a major gateway to the city, is a more auto-oriented than pedestrian-oriented use, which can potentially cause conflicts with local pedestrian uses and impede connections from the downtown to its riverfront and the nearby parks.

Related Facilities

Related Bridge Area Transportation Facilities

The completion of the streetcar connections to the shared transitway and the related modifications to SE Water Avenue and SW Moody Avenue do not require any additional full acquisitions other than those identified for the proposed project; land uses are anticipated to remain the same mix of industrial and recreational and cultural uses. The double-track facilities for streetcar and the multimodal improvements to SW Moody Avenue also support the planned intensification of land uses in the South Waterfront area.

Ruby Junction Maintenance Facility

TriMet's existing Ruby Junction Facility in Gresham could be expanded to support the extra light rail service for the Portland-Milwaukie Light Rail Project and other planned system improvements. The expansion of the maintenance facility would require the full acquisition of 14 parcels and one partial acquisition. The 14 parcels that would be fully acquired currently include single-family residences, service businesses, and industrial businesses, and are all zoned for heavy industrial uses. In several cases, there are several uses occurring on a single property. Because the existing facility is located in an area primarily composed of light manufacturing uses and is industrially zoned, the expansion of the maintenance facility would not appreciably change land use patterns. The LPA Phasing Option would have similar regional and local impacts as the LPA to Park Avenue except that it would convert less land to transportation-supportive industrial use in the Ruby Junction area.

3.2.2.3 Short-Term Impacts (Construction)

No-Build Alternative

While there would not be construction of light rail in the corridor under the No-Build Alternative, the planned improvement projects for pedestrians, bicycles, roadways, and boulevards would be constructed. Impacts would be more localized and short-term than with the light rail project.

Locally Preferred Alternative (LPA) to Park Avenue

Short-term impacts to existing land uses would be experienced mostly by businesses and residents in the project area for several years. It is not expected that any of these short-term impacts would change land use patterns or raise issues regarding compatibility with local land use plans and policies. The affected neighborhoods and jurisdictions will likely want to participate in a public involvement outreach program to keep residents and businesses apprised of project developments. Construction-related impacts are discussed in further detail below in Section 3.2.5.2.

LPA Phasing Option

Short-term impacts would be generally similar to those for the LPA to Park Avenue. However, as funding becomes available and features that were deferred under the LPA Phasing Option are constructed, several areas along the alignment may experience additional short-term impacts.

Minimum Operable Segment (MOS) to Lake Road

Short-term impacts for the MOS to Lake Road are similar to those for the LPA to Park Avenue.

Related Facilities

Related Bridge Area Transportation Facilities

Short-term impacts for the Related Bridge Area Transportation Facilities are the same as described for the LPA to Park Avenue. Staging locations would be shared for these facilities.

Ruby Junction Maintenance Facility

Short-term impacts to existing land uses would be limited because of the nature of the existing land uses in the area, topography, and the limited street network. Any short-term impacts are not anticipated to change land use patterns or raise issues regarding compatibility with local land use plans and policies.

3.2.2.4 Land Use Secondary and Cumulative Impacts

The No-Build Alternative, by not supporting the planned growth in the inner neighborhoods, could effectively induce growth farther out from designated planned population and employment centers and indirectly increase pressure to expand the UGB.

Cumulatively, the light rail project is consistent with state, regional, and local land use plan, policies, and goals. Land use impacts of the Portland-Milwaukie Light Rail Project are most directly related to regional and local plans to stimulate new development in the designated centers. Public investment and improvements are planned to support new private investment in the urban renewal areas and would be encouraged by the project. In particular, transit-oriented developments could create higher density mixed use activity centers in station areas, and local jurisdictions could revise zoning to allow higher density uses. This could alter the pattern of development, but would be subject to the approval of the local jurisdiction.

Transit-oriented developments in station areas are already assumed in much of the other analysis conducted in the FEIS, particularly the predictions of future population and employment and future traffic.

3.2.3 Land Use Mitigation Measures

No mitigation is required, because the project will not adversely affect land use patterns.

3.2.4 Economic Affected Environment

3.2.4.1 Regional Economy and Development Trends

The Portland-Vancouver metropolitan region is the economic center of an extensive geographic area that includes most of Oregon and southwest Washington. Over the past 20 years, Oregon and the Portland metropolitan area have been growing at a faster rate than the U.S. average. Mirroring national trends, non-farm employment in Oregon grew each year through the 1990s, declined between 2001 and 2003, and steadily increased through 2007. In Oregon, the job growth was positive each year since the first quarter of 2004 but slowed through 2007, and since then Oregon has suffered job losses each quarter in the following years, with the worst losses in 2008. Recovery to pre-recession job levels is expected by 2013 (Office of Economic Analysis for the State of Oregon [OEA]).[1]

[1] http://www.oregon.gov/DAS/OEA/docs/economic/oregon.pdf, August 27, 2009.

3.2.4.2 Local Economic Conditions

Section 3.2.1.2, Existing and Planned Land Uses, provides an overview of the land use and economic context for the project corridor. This section describes in more detail the current employment and economic conditions in the Portland region and in the corridor.

Generally, the Portland region showed strong economic growth through 2007, with recent downturns beginning in 2008 that have followed national conditions. Some measures, such as unemployment, have been higher than the national averages. The Portland region saw a slowdown in job growth—a drop from 2.7 percent in the fourth quarter of 2006 to 1.5 percent in the fourth quarter of 2007. The Portland region posted year-over-year employment gains in the first three quarters of 2008, but declines in the fourth quarter of 2008 and in the first two quarters in 2009 brought down total employment to pre-2007 levels.

In the Portland region, vacancy rates have been rising since the publication of the SDEIS in May 2008, and are generally expected to stabilize in the coming year.[2]

Table 3.2-3 shows the estimated number of households and jobs in 2005 within one-half mile of the planned station areas. By 2030, the projected growth in households and jobs would increase in accordance with the plan designations around each proposed station area. The projections are based on Metro's regional population and employment forecast.

Table 3.2-3
Population and Employment within One-Half Mile of Station, 2008 to 2030

Station	Households 2008	Households 2030	# of New Households	% Change	Jobs 2008	Jobs 2030	# of New Jobs	% Change
Lincoln Station*	5,508	7,407	1,899	34%	27,576	46,255	18,679	68%
South Waterfront Station	2,502	4,990	2,488	99%	6,940	21,257	14,317	206%
OMSI Station	768	2,043	1,275	166%	6,935	14,321	7,386	106%
Clinton Station	2,137	2,681	544	25%	5,846	8,292	2,446	42%
Rhine Station	2,045	2,019	- 26	-1%	5,621	10,601	4,980	89%
Holgate Station	1,656	1,345	- 311	-19%	3,800	6,825	3,025	80%
Harold Station (future)	2,439	1,785	- 654	-27%	2,058	3,685	1,627	79%
Bybee Station	1,890	1,962	72	4%	1,266	1,668	402	32%
Tacoma Station	1,641	1,739	98	6%	1,292	2,196	904	70%
Lake Road Station	1,428	1,987	559	39%	2,117	2,733	616	29%
Park Avenue Station	2,036	1,873	- 163	-8%	588	1,368	780	133%

Source: Metro 2010.
Note: Columns in table cannot be summed because there is overlap between the ½-mile station areas. Totals may not sum due to rounding.
* The project also includes a Jackson Station deferred from the Portland Mall light rail project; this station is within the one-half mile radius of the Lincoln Station, but the overlap is minor.

[2] Page 46 of http://www.oregon.gov/DAS/OEA/docs/economic/forecast0909.pdf.

Special Tax Districts – Urban Renewal

Within the Portland-Milwaukie Light Rail Project Corridor, there are special taxing districts that allow property tax increases to be redirected to beneficial public activities within the districts.

Two within Portland are the North Macadam Urban Renewal Area and the Central Eastside Urban Renewal Area. A primary objective of the South Waterfront subarea of the North Macadam Urban Renewal Area is the creation of a mixed-use central city neighborhood. The main goal of the Central Eastside Urban Renewal Plan is to maintain and enhance the district as an inner city job center.

Special Tax Districts – Enterprise Zone

A third special district is the Milwaukie/North Clackamas County Enterprise Zone, in which businesses can apply for short-term property tax abatements on new investments that increase employment. The enterprise zone covers all of the land zoned as industrial in northwest Milwaukie. It is bisected by the project. A wide range of industrial companies, from manufacturing firms to warehousing and distribution companies, are eligible for tax benefits under the state-established program guidelines.

River Users

The Portland-Milwaukie Light Rail Project requires a new Willamette River crossing. There are a variety of commercial, industrial, and private boat operators along this stretch of the river. The most frequent users operate on the river daily: barge traffic from Ross Island Sand and Gravel and tour boat traffic from the Portland Spirit. Bridge heights in a range of between 65 feet and 120 feet were analyzed for navigational impacts, as were vertical clearances. Ross Island Sand and Gravel, Zidell Marine Corporation, and commercial tour operators have a business interest in the navigational effects of any new bridge in this area. See Appendix O, Navigation, for additional information on the existing navigation users.

3.2.5 Economic Impacts

Economic and employment impacts as a result of the construction and operation of the project would be experienced throughout the region. The investment in light rail could result in increased development and increased property values in the corridor. The long-term benefits directly resulting from the project operations to the economy include employment and the economic multiplier associated with that employment and with the other services required to operate and maintain the light rail line. The direct negative impacts consist of the loss of tax revenues from the properties displaced by acquisition, as well as any jobs, services or products, and revenues lost by displaced businesses that elect not to relocate within the project area or the greater metropolitan region. However, these negative impacts are minor within the context of the regional economy. They may also be partially or fully offset by increased property values and the higher development densities that could be attracted to the corridor by the light rail project and its improved transportation service.

3.2.5.1 Long-Term Direct Impacts

The project is being developed to improve transportation service through increased connectivity, mobility, and travel time reliability. This should support development and redevelopment in the corridor, consistent with adopted land use plans. One or more of the jurisdictions along the alignment could choose to change zoning to afford different types of development in the corridor. This type of zoning change would be in alignment with comprehensive plans and local policies and could result in positive economic impacts.

In contrast, the No-Build Alternative would have little direct impact compared to the project, because the scale of other planned transportation improvements in the area is much smaller and does not cover the full length of the corridor that would be served by the project. Several areas, such as the South Waterfront District, would be less likely to develop as quickly without substantial improvements in transportation infrastructure. While the No-Build Alternative would avoid acquisitions and displacements and no tax revenues or employment income would be lost, there would also be fewer opportunities for redevelopment and revitalization near station areas.

Additional long-term direct impacts fall into the following categories. Each is described in further detail below.

- Employment impacts from transit operations
- Acquisition, displacement, and access changes
- Changes for river users
- Tax base and revenue impacts

Employment Impacts from Transit Operations

The No-Build Alternative assumes total operations costs in the Portland-Milwaukie Light Rail Project Corridor of $28.7 million. The project would have yearly operations costs of between $7.5 to $8.9 million more than for the No-Build Alternative. Based on these estimates, there could be between 18 and 32 additional full-time equivalent jobs to operate and maintain the additional transit services. The operations and employment numbers are in addition to the No-Build Alternative costs and represent increases in operating costs and employment. Operations and employment costs for the LPA Phasing Option would be lower than the LPA to Park Avenue, but would be higher than the MOS to Lake Road.

Acquisition, Displacement, and Access Changes

Business and Employment Impacts from Property Acquisitions

The number of jobs within one-half mile of stations is forecast to increase an average of nearly 50 percent by 2030 with some station areas slowing by up to 200 percent (see Table 3.2-3 above). This job growth is due to a variety of factors—transportation and transit are but two. The mobility and reliability provided by the project to areas around stations would help offset losses to employment that may occur as a result of project displacements, even with the worst case assumption that displaced businesses are not able relocate within the region. The LPA to Park Avenue would displace 57 to 58 businesses (potentially 56 with the LPA Phasing Option), and the MOS to Lake Road would displace 52 to 53 businesses. Nine businesses would be displaced with the expansion of the Ruby Junction Facility, resulting in a total of 61 to 67 business displacements for the project. Phased development of the facility would initially have four fewer business displacements in the vicinity of the Ruby Junction Facility than full build-out. Table 3.2-4 shows the estimated potential job displacement from business displacements, if none of the jobs were replaced in the local area. These numbers were estimated based on an analysis of business displacements (see Section 3.1, Acquisitions and Displacements) and TriMet's count of employees at registered businesses.

Table 3.2-4
Estimated Businesses and Jobs Affected by Displacements

	Estimated Businesses Affected	Estimated Jobs Affected
No-Build	0	0
LPA to Park Ave.*	56-58	663-850
MOS to Lake Rd.	52-53	651-726
Other Facilities		
Related Bridge Area Facilities	0	0
Ruby Junction**	5-9	21-79
Total (Range)***	61 to 67	730 to 929

Source: TriMet 2009.

* The low end of the range represents the LPA Phasing Option, and a potential business displacement due to waterfront access impacts.

** The low end of the range represents partial build out.

*** The range represents quantities associated with Related Bridge Area Facilities, which includes streetcar, SW Moody Avenue, and SE Water Avenue improvements, and the Ruby Junction Maintenance Facility when paired with either the MOS to Lake Road (lowest) or the LPA to Park Avenue (highest). The LPA Phasing Option, which falls between the range of the MOS to Lake Road and the LPA to Park Avenue, represents the lowest value for Ruby Junction paired with the lowest value for the LPA to Park Avenue. The range also reflects a property acquisition and business displacement due to an access impact; if access can be maintained the impacts will be avoided.

Several industrial areas along the route would be affected by acquisitions and related displacements of businesses. In several locations where the project requires parts of properties but not an entire property, businesses may have changes to entry or driveway access, loss of parking, and/or restrictions in loading areas. A charter boat/river cruise business will also be affected by a change in dock access, affecting some of its operations. The key industrial areas are the CEID, the SE 17th Avenue/Brooklyn Yard corridor, and the North Milwaukie Industrial Area. However, the light rail project uses an alignment that minimizes impacts to these areas compared to other alternatives previously considered, particularly in the North Milwaukie Industrial Area. The LPA to Park Avenue and the MOS to Lake Road would displace businesses in all three areas, including one business with a complex industrial operation that had previously been identified as a partial acquisition but had concerns that modifying its buildings would disrupt its business. The LPA Phasing Option would have fewer partial displacements in the SE 17th Avenue/Brooklyn Yard corridor due to the deferral of the pedestrian overpass at SE Rhine Street. Given the project's commitments to provide for compensation and relocation assistance, and the favorable vacancy rate in the regional market, it is expected that most commercial businesses would find opportunities to relocate locally. While the amount of redevelopable or vacant properties varies in areas along the project corridor, there remain opportunities for redevelopment in Portland as well as in Milwaukie and in north Clackamas County. Some specialized uses, such as the charter boat/river cruise operator near the Willamette River bridge, have more limited opportunities to relocate nearby. A combination of final design and construction approach refinements will be explored to avoid or minimize impacts, and where impacts cannot be avoided, compensation and relocation assistance will be provided as described in Section 3.1.3.

Access Changes

Portland State University to SE Powell Boulevard

Minimal right-of-way acquisition would be required on the west side of the Willamette River, including frontage of lots and the displacement of a radio station building at the corner of SW 1st Avenue and SW Lincoln Street. SW Lincoln Street would be rebuilt with light rail tracks in a center median, and a center platform station would be located west of SW 1st Avenue in the center of the roadway. SW Lincoln Street would be extended one block beyond SW 1st Avenue, creating a new intersection at SW Naito Parkway. This one-block extension would be exclusively for use by light rail trains, buses, pedestrians, and bicycles. In addition to changing access for private vehicles, approximately 35 on-street parking spaces would be eliminated on SW Lincoln Street, and seven off-street parking spaces are anticipated to be removed near SW Lincoln Street. However, the analysis provided in Chapter 4 concludes that overall parking supply appears to be adequate to serve demand, especially given the improved mobility to be provided by light rail.

On the east side of the river, the LPA to Park Avenue and MOS to Lake Road may displace approximately 25 on-street parking spaces in the Clinton Station area. The project would revise several area intersections, including at SE Clinton Street/SE 12th Avenue and SE Milwaukie Avenue/SE Gideon Street, which could affect overall travel times during the evening peak traffic hours (see Chapter 4, Transportation).

SE Powell Boulevard to Tacoma Station

Changes to driveway access would occur to all properties with access to SE 17th Avenue, which would become right-in/right-out only access for most of the length of SE 17th Avenue from SE Powell Boulevard to SE McLoughlin Boulevard. Several side streets would be similarly restricted to right-in/right-out only. This would improve safety by reducing conflicts between different travel modes, but would increase out-of-direction travel by up to five blocks. Both on-street and off-street parking for businesses would be reduced. Approximately over 100 on-street spaces on SE 17th Avenue would be removed. About 110 parking spaces for TriMet employees would be removed. If not replaced or protected by parking policies, the loss of these parking spaces could have a spillover parking impact on the Brooklyn neighborhood.

The project would involve modifications to intersections for freight routes serving Brooklyn Yard, but the project avoids potential impacts at SE Harold Street, one of the primary freight access points, by providing an overcrossing.

Tacoma Station to Lake Road Station

Where the light rail alignment would be built south of SE Mailwell Drive, access from some industrial buildings to loading bays on the rail line would be relocated. The industrial buildings would otherwise remain intact.

Since the project runs beside the Tillamook Branch line, it avoids reductions in existing street rights-of-way, access, or parking in the Milwaukie Industrial Area. In downtown Milwaukie, the project would reconstruct existing at-grade crossings of five downtown streets. SE Adams Street will be closed where it intersects with SE 21st Avenue. One driveway in the southeast corner of the intersection with SE Harrison Street will have the driveway re-angled. Overall, the area's circulation patterns and property accesses would still be maintained. The downtown area will lose 52 on-street and 6 off-street parking spaces. Current parking analysis shows 257 spaces in downtown Milwaukie that are 57 percent utilized. See Chapter 4, Transportation, for more information.

Changes for River Users – Bridge Height

With some exceptions, the current and likely future navigation activities would not be affected by the bridge height (77.52 feet). There is some potential that a combination of high river levels (particularly during flood events), coupled with the long-term effects of climate change, could temporarily restrict passage of the highest vessels north of the Willamette River bridge. These events are expected to occur within a narrow time window each year, mostly in winter. Given the limited activities that would be affected, the economic impacts are expected to remain minor and temporary. Individual private boat owners may be affected, but typically their maximum heights are lower than the industrial river users. Two river cruise excursion operations also could have limited periods when their passage would be restricted. See Section 4.3.4, Navigation Impacts, and Appendix O, Navigation, for additional information.

Tax Base and Revenue Impacts

Tax bases can be reduced when private properties are acquired for public use and removed from the public tax rolls. There can also be increases in the tax base if property values increase as a result of the project. Displaced businesses may close or move outside of a jurisdiction or the project area, and their current tax district would lose related tax revenue. The project could ultimately deliver benefits if land use or market changes increase the assessed values of private properties around light rail stations, but this analysis does not attempt to forecast such changes.

Table 3.2-5 shows the estimate of assessed value and estimated property tax impacts of acquired properties by alternative and by jurisdiction. Given the size of tax revenues overall to the jurisdictions affected, these effects on tax revenues are minor, especially if property values rise and economic development occurs as a result of the project.

Special Tax Districts

If the project were to displace properties included in an urban renewal district, the properties could no longer generate tax revenues to pay off the tax-revenue bonds. However, Portland's experience has shown that the value of the remaining properties surrounding light rail stations can exceed current projections with light rail investment. No companies enrolled in the North Clackamas County Enterprise Zone program are directly affected by the project. The City of Gresham has a Rockwood Urban Renewal District. The Ruby Junction Facility is outside, but immediately to the south, of this district, and therefore no urban renewal direct impact will occur as a result of the light rail project.

Income Tax Revenue

The degree to which new jobs created by construction and operation would be an economic benefit would depend on the source of funding for the project. Locally funded operations yield a smaller economic benefit than federally funded operations, because local money would be spent on other projects in the region if not on the light rail project.

3.2.5.2 Short-Term Impacts (Construction)

Short-term impacts include construction-related impacts. These can be divided into two general groups: positive impacts related to construction employment and related induced effects, and negative impacts associated with temporary increases in congestion, access issues, and the generation of noise and dust. These types of impacts are described in greater detail below.

Positive Construction Impacts

No-Build Alternative

The No-Build Alternative would have little to no impact on the local economy. There would be no income from construction. Increased bus service could require more full-time employees or could be accommodated by reallocating employees from other bus routes.

Locally Preferred Alternative (LPA) to Park Avenue, LPA Phasing Option, and Minimum Operable Segment (MOS) to Lake Road

The project would result in short-term regional income and employment benefits. The short-term income impacts from construction of the light rail project would include:

- Direct added income associated with new construction jobs
- Indirect added income from jobs created in industries that supply goods and services to the construction firms
- Induced added income based on increased spending resulting from direct and indirect income growth

The estimated cost of construction of the MOS to Lake Road or LPA to Park Avenue (including LPA Phasing Option) would range from $766 to $854 million dollars (not including right-of-way, insurance, or vehicle purchase costs). Employment impacts from construction expenditures would include the direct employment impacts of immediate construction hiring, as well as indirect and induced impacts. Indirect employment impacts would include employment by businesses that provide goods and services to the construction firms. Induced impacts would include jobs created as a result of additional purchases made by households due to increased incomes linked to direct or indirect employment impacts. Table 3.2-6 shows the expected construction effects of the project. The LPA to Park Avenue would increase the short-term impacts commensurate with the construction costs for that leg of the project, compared to the MOS to Lake Road.

Based on the analysis outlined above, short-term direct, indirect, and induced job or employment effects resulting from construction spending of the light rail project would generate between 13,000 and 14,500 jobs in the metropolitan area. (These are total full-time, part-time, and temporary jobs over the construction period.) This construction spending could generate over $500 million of added personal income from construction jobs, industries supplying construction materials, and other purchases from new income.

These employment and income impacts could be expected to dissipate relatively quickly following the end of the construction period.

Table 3.2-6
Short-Term Construction Effects: Direct, Indirect, and Induced Effects

	Construction Costs[1] (millions)	Construction Effects[2]	
		Jobs	Personal Income (millions)
LPA to Park Ave.[3]	$794-854	13,500-14,500	$532-573
MOS to Lake Rd.	$766	13,000	$513

Source: TriMet 2010, 1999 IMPLAN data.
[1] Construction costs do not include right-of-way, insurance, or vehicle purchase costs. The costs of construction at Ruby Junction are integrated into the MOS to Lake Road and LPA to Park Avenue estimates.
[2] Jobs and personal income impacts include direct, indirect, and induced employment and income generated by construction expenditures. These calculations are based on a regional input-output economic model. These are total full-time, part-time, and temporary jobs over the construction period. Benefits would dissipate after construction is complete.
[3] The LPA Phasing Option is the lower of the costs in the range, while LPA to Park Avenue is the higher cost.

Negative Construction Impacts (Congestion, Noise, and Dust)

No-Build Alternative

The No-Build Alternative would not result in construction impacts for the length of the corridor. Other transportation projects assumed in the No-Build Alternative could involve localized construction.

Locally Preferred Alternative (LPA) to Park Avenue

Temporary construction-related impacts to residences and businesses could result from access disruptions, increased traffic congestion, truck traffic, noise, vibration, and dust. Short-term impacts would be experienced mostly by businesses and residents along SW Lincoln Street, SW Harbor Drive, and SW Moody Avenue. Other areas of impact include the OMSI and Portland Opera area, areas of the CEID, SE Gideon and SE Clinton streets, along SE 17th Avenue, in Milwaukie, and along SE McLoughlin Boulevard to SE Park Avenue. There would likely be construction-related street or lane closures in downtown Portland, inner southeast Portland, downtown Milwaukie and south to SE Park Avenue, as well as in several nearby areas where minor street or intersection improvements are needed to mitigate project traffic impacts.

The construction of the new Willamette River bridge will be a major undertaking, and there are several other areas where substantial new structures will be developed, including for the park-and-rides and several of the other bridges and elevated structures. Depending on the construction methods used, the project will be bringing large volumes of materials as well as workers to these sites, and localized construction activities can last from one to three years or more. While truck traffic will generally be focused on highway and major arterials, the volumes can be high during the most intensive construction periods, such as for debris removal, excavation or fill, and during the pouring of concrete foundations. Construction methods that use precast sections for structures or supports can require hauling of oversize loads.

LPA Phasing Option

Construction impacts for the LPA Phasing Option would be similar to those for the LPA to Park Avenue.

Minimum Operable Segment (MOS) to Lake Road

Construction-related impacts will be similar for the MOS to Lake Road as for the LPA to Park Avenue, except that the MOS to Lake Road includes a park-and-ride at the Lake Road Station, so there will be additional construction activity at that location, resulting in higher levels of truck traffic and additional delay, dust, and noise. The MOS to Lake Road avoids localized construction impacts associated with the extension of light rail to SE Park Avenue.

Related Facilities

Related Bridge Area Transportation Facilities

Extensive construction activities will also be needed to develop the street improvements and streetcar facilities in the South Waterfront District and near OMSI. These activities include the construction of SE Water Avenue, the regrading and reconstruction of SW Moody Avenue, and the development of a temporary traffic detour route on the proposed future alignment of SW Bond Street in the South Waterfront District. The impacts would be similar to those described for other sections of the light rail project, but they increase the intensity of localized construction activities in the riverside areas.

Ruby Junction Maintenance Facility

The expansion of TriMet’s Ruby Junction Facility in Gresham would cause few traffic disruptions, because the properties to be acquired are on a dead-end street, bordered by a working gravel pit, and adjacent to the existing Ruby Junction Facility. However, these acquisitions would require the relocation of businesses and residences. Noise and dust generated by construction activities are not likely to be an issue, except to the existing employees of TriMet at the Ruby Junction Facility.

3.2.5.3 Indirect and Cumulative Impacts

No-Build Alternative

Not building the project would eliminate the potential indirect, or secondary, effects of displacements on interdependent businesses, which could happen when suppliers or clients are displaced or moved to a new location. The No-Build Alternative would not add to past or future impacts from displacements and would not support previous investments in the region’s light rail system.

Portland-Milwaukie Light Rail Project

The project offers a much greater potential for beneficial indirect impacts than the No-Build Alternative. TriMet's experience with previous projects has found that that new, concentrated mixed-use development is more likely to occur in response to fixed lines and stations than in response to bus stop locations, although supporting land use plans and policies and appropriate market conditions must also be in place to support redevelopment. Light rail increases transit access and pedestrian activity, especially in areas surrounding the stations. Improved transit access can improve the convenience and desirability of surrounding residential and commercial properties. Increased pedestrian activity can increase the patronage of adjacent retail uses. Overall, improved transit accessibility could result in increased land values in proximity to the stations.

Despite a short-term displacement in assessed value and property tax revenue caused by displacement of properties, properties close to some of the proposed light rail stations would likely experience an increase in value upon completion of the light rail project, thereby increasing property tax revenue in the long term. Though new development could provide expanded opportunities for housing and employment in the station areas, redevelopment of existing neighborhoods if currently zoned for higher densities or nonresidential uses could be a potential negative effect if it contributes to displacement of affordable housing and business space.

Initially, property acquisitions, business displacements, and construction activities could indirectly impact remaining local businesses. In the long run, however, given the improved transportation service and access, properties near station areas are expected to generate net growth in employment and consequently improve the economy in the project area. In the CEID, which includes OMSI, the project is being constructed in an area that has been experiencing high levels of construction activities for improvements of the SE Martin Luther King Jr. Boulevard viaduct (OR 99E), the City of Portland's Big Pipe project, and the eastside Portland Streetcar Loop Project. These projects are expected to be complete prior to the start of construction for the Portland-Milwaukie Light Rail Project, but ongoing disruptions can reduce the visibility of businesses and could discourage patrons.

In general, the secondary and cumulative impacts described above are positive. However, negative cumulative impacts could occur from right-of-way acquisition associated with the project. In some localized cases, access revisions can combine with the development of structures or other visual changes, affecting the setting or visibility of an adjacent use, particularly a business. In addition, potential development of vacant parcels or the redevelopment of other parcels in station areas can alter the characteristics of an area; generally, the higher levels of activity would be positive for businesses.

Displacements caused by the project would add to previous displacements in neighborhoods where land uses changed in the past and transportation projects were constructed to serve those uses. For example, partial acquisitions can reduce the land buffer between traffic and adjacent uses, reduce setbacks to be nonconforming with current regulations, and gradually erode the usability of sites over time. Loss of industrial land can cause additional conversions to non-industrial uses if the number of industrial establishments and size of lots fall below critical levels.

Ruby Junction Maintenance Facility

The original development of the Ruby Junction Facility (opened in 1984) and subsequent expansions and improvements since then displaced existing uses from that site, including single-family residences. This project will continue the trend of displacement of residences and businesses in the immediate area, but will not change the dominant use, which is industrial.

3.2.6 Mitigation Measures for Economic Impacts

3.2.6.1 No-Build Alternative

There are few direct economic impacts associated with the No-Build Alternative. Secondary impacts associated with increased traffic, delays, and reduced mobility compared to the light rail project could hamper economic vitality. Potentially available mitigation would increase bus service more than is currently programmed by TriMet to mitigate impacts associated with delay and mobility restrictions, though without an exclusive right-of-way, adding more buses to already congested roads would have more limited benefits than light rail.

3.2.6.2 Portland-Milwaukie Light Rail Project

Most of the project's direct impacts to land use and economic activity are caused by right-of-way acquisitions, and are mitigated through compensation and assistance, as described in Section 3.1, Acquisitions and Displacements. Where displacements are unavoidable, relocation assistance will be available to assist displaced residences and businesses.

The permanent or construction period loss of parking can also have adverse economic impacts on businesses. Where existing parking spaces cannot be replaced and parking demand could be expected to exceed the available parking spaces that remain after development of the project, replacement parking or other measures may need to be provided. For further detail, see Chapter 4, Transportation.

For secondary or indirect impacts, including future transit-oriented developments within station areas, the implementation of the light rail project would help to reduce potential demand for parking or traffic that might otherwise accompany new development. The individual parties proposing each development project would be responsible for meeting applicable local development and permitting requirements. No additional mitigation from the light rail project would be required.

Mitigation Commitments: Long-Term Impacts

No other mitigation for long-term impacts is required beyond those discussed above for acquisitions and displacements and transportation.

Mitigation Commitments: Short-Term Impacts

For construction, mitigation measures to reduce vicinity impacts to affected businesses during project construction include:

- Develop and implement a construction outreach plan that will ensure that impacted community members such as local residents, businesses, community members, institutions, and property owners are fully informed about potentially major disruptions such as temporary street closures; utility relocations; out of the ordinary construction noise, vibration, light, or glare; changes in transit service; and parking availability.

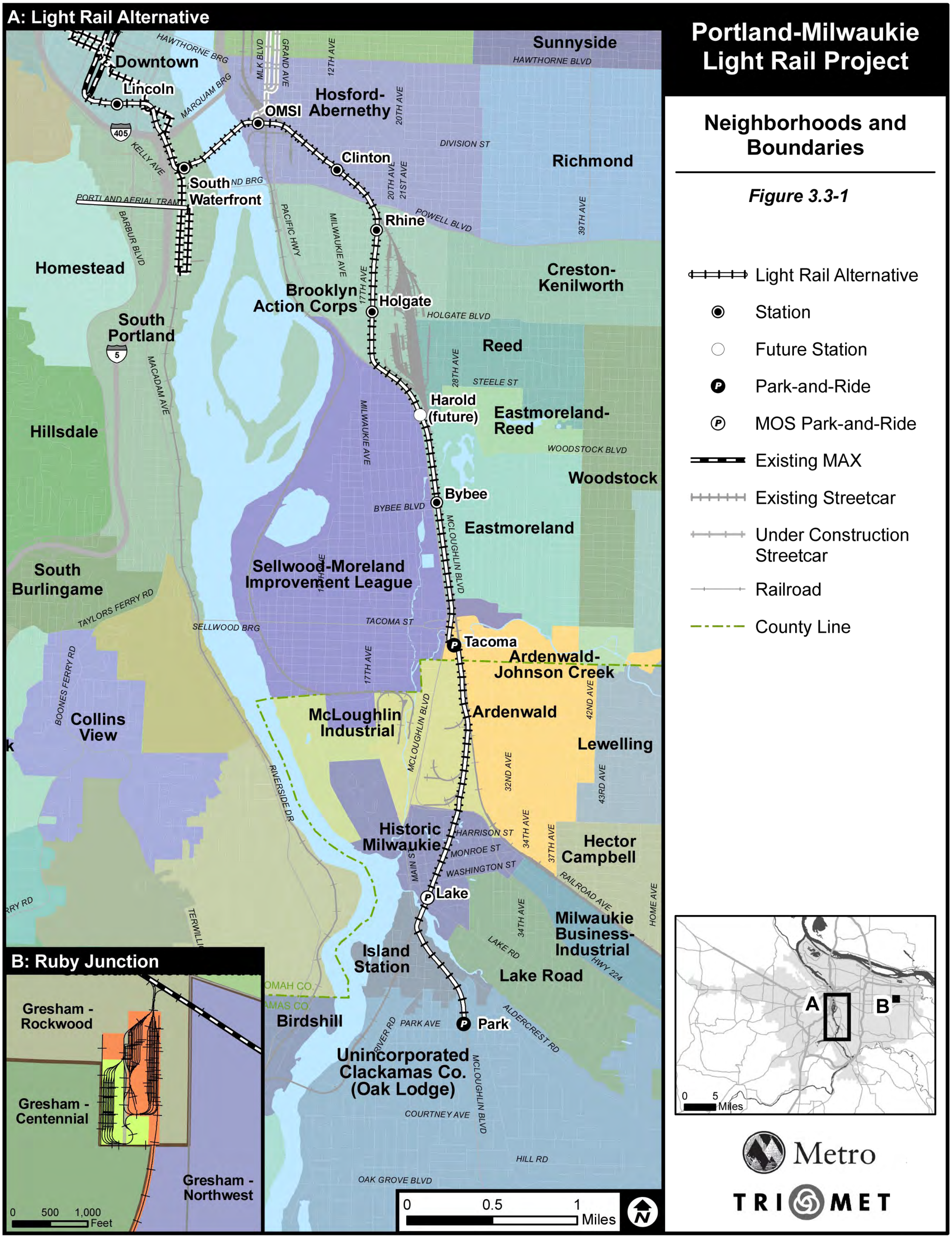
- Make a plan to establish effective communication with residents and businesses through means such as holding public meetings with project team members and the contractor and producing materials and processes to distribute information about construction updates, alerts, and construction schedules.
- Provide outreach to impacted community members such as affected business owners, institutions, chambers of commerce, merchants associations, ethnic community organizations, and others on construction business mitigation that will provide measures to assist impacted businesses maintain their customer base during construction; this could include promotional programs and other marketing or advertising programs to encourage patronage during construction.
- Provide clear signage to identify and make accessible paths to and from major transportation facilities, such as designated pedestrian routes, bicycle lanes, bus routes and stops, designated truck routes, and tunnel entrances.
- Provide a hotline service, ombudsman or other easily accessible points of contact for the public to leave construction complaints and obtain timely resolution.
- Maintain access to businesses and other properties during construction activities when possible and coordinate closely with businesses during times of limited access due to public safety or construction-related issues.

3.3 COMMUNITY IMPACT ASSESSMENT

The community impact assessment evaluates the potential effects on neighborhoods and communities in the project corridor. The analysis includes effects on minority and low-income populations, in accordance with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. The Executive Order states that “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States.”

3.3.1 Affected Environment

The proposed alignment of the Portland-Milwaukie Light Rail Project passes through 11 neighborhoods. The Ruby Junction Facility is located in Gresham, where a twelfth neighborhood is located. This section provides a summary of each neighborhood’s character and community facilities. The locations and boundaries of each neighborhood are shown in Figure 3.3-1. Additional information on neighborhood characteristics is available in the *Community Impact Assessment Results Report* (Metro 2008).



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3.3.1.1 County, Regional, and Neighborhood Socioeconomic Data

Data from the 2000 U.S. Census show that the population of the four-county region (Multnomah, Clackamas, Washington (Oregon), and Clark (Washington)) has been growing between 16 and 26 percent each decade since the 1970s. Generally, employment grew more quickly than population, particularly through the mid-1990s. Population and employment growth rates can vary considerably in shorter periods due to the fluctuations in the economy, such as the most recent economic downturn. Growth from 2006 to 2009 has slowed compared to the first half of the decade. However, over the longer term, overall growth rates for the region are expected to be similar to historic trends and exceed the national average, following a trend typical among population centers in the western states. Table 3.3-1 shows data by decade through 2005.

Table 3.3-1
Historical Growth in Population and Employment within the Four-County Portland-Vancouver Standard Metropolitan Statistical Area[1]

Year	Population[2]	% Change from Previous	Employment[3]	% Change from Previous
1975	1,106,800		441,500	
1985	1,289,200	16%	562,000	27%
1995	1,623,500	26%	809,900	44%
2005	1,946,000	20%	932,721	15%
2008	2,062,865	6%	979,090	5%

Source: Metro Data Resource Center 2010.
[1] Clackamas, Multnomah, and Washington counties in Oregon and Clark County in Washington.
[2] Source: U.S. Census and Metro.
[3] Source: Bureau of Labor Statistics.

Section 3.2, Land Use and Economy, discusses population and employment forecasts at the city, county, and localized county level. Metro's transportation model includes population and job growth forecasts allocated to a localized scale, which helps identify likely changes to neighborhoods with or without the light rail project. In Section 3.2, Table 3.2-3 shows how many new households and jobs are expected to be created between 2005 and 2030 within one-half mile of each station area.

Generalized socioeconomic information for the neighborhoods covering the Portland-Milwaukie Light Rail Project area is provided in Table 3.3-2 and illustrated in Figures 3.3-2 and 3.3-3. The socioeconomic characteristics of the block groups have been compared to data for the entire Tri-County area (Clackamas, Multnomah, and Washington counties), and significant differences from regional characteristics are noted in the discussion. Poverty statistics for each neighborhood refer to the percentage of households with incomes below the federally defined poverty level. Poverty data are based on data from the U.S. Census 2000. Employment data were collected by the State of Oregon Employment Department in 2000.

Table 3.3-2
Summary of Socioeconomic Data by Neighborhood

Neighborhood	Households	Population	Employment	% Minority[1]	% Hispanic[2]	% Poverty[3]	% Elderly[4]	% Renters[5]	Median Home Value[6]
Portland									
Downtown	6,488	10,225	106,639	23.7%	4.5%	32.1%	15.3%	91.9%	$469,000
South Waterfront[7]	0	0	0	0	0	0	0	0	N/A
Hosford-Abernethy	3,436	7,229	9,111	15.4%	3.8%	12.9%	8.8%	51.4%	$359,000
Brooklyn	1,690	3,595	9,282	14.8%	5.7%	11.9%	5.5%	63.2%	$330,000
Sellwood-Moreland	5,211	10,617	3,951	9.5%	3.0%	10.8%	13.1%	47.2%	$330,000
Eastmoreland	1,642	5,044	1,763	7.2%	2.6%	5.6%	11.5%	10.8%	$330,000
Milwaukie									
Ardenwald	1,861	4,455	1,860	8.1%	3.8%	13.9%	12.9%	40.6%	$240,150
McLoughlin Industrial	23	158	2,859	13.3%	3.2%	N/A[8]	1.3%	78.3%	$240,150
Historic Milwaukie	1,089	1,941	2,720	9.8%	5.8%	5.7%	16.9%	77.0%	$240,150
Island Station	417	873	51	13.3%	3.1%	4.6%	7.6%	68.8%	$257,000[9]
Clackamas County									
Oak Lodge	9,466	22,814	9,428	8.7%	6.3%	6.1%	17.9%	33.7%	$257,000[9]
Gresham									
Rockwood[10]	692	2,342	962	39.3%	46.6%	34.7%	8.5%	81.1%	$236,600
Tri-County Area	569,461	1,444,219	1,014,401	17.1%	8.0%	8.7%	10.4%	27.1%	N/A
Clackamas County	128,201	338,391	180,635	8.7%	4.9%	6.1%	11.1%	28.9%	$329,000
Multnomah County	272,098	660,486	555,161	20.8%	7.5%	11.4%	11.1%	43.1%	$287,000

Sources: 2000 Census, South Corridor Phases 1 and 2 Social and Neighborhood Impacts Results Reports (Metro 2002, 2008).

1 Minority- Percentage of residents whose race is not white alone.

2 Hispanic- Percentage of residents of Hispanic or Latino origin.

3 Poverty- Percentage of households with incomes below the federally specified poverty level.

4 Elderly- Percentage of residents who are age 65 or older (elderly).

5 Renter- Percentage of occupied housing units occupied by renters.

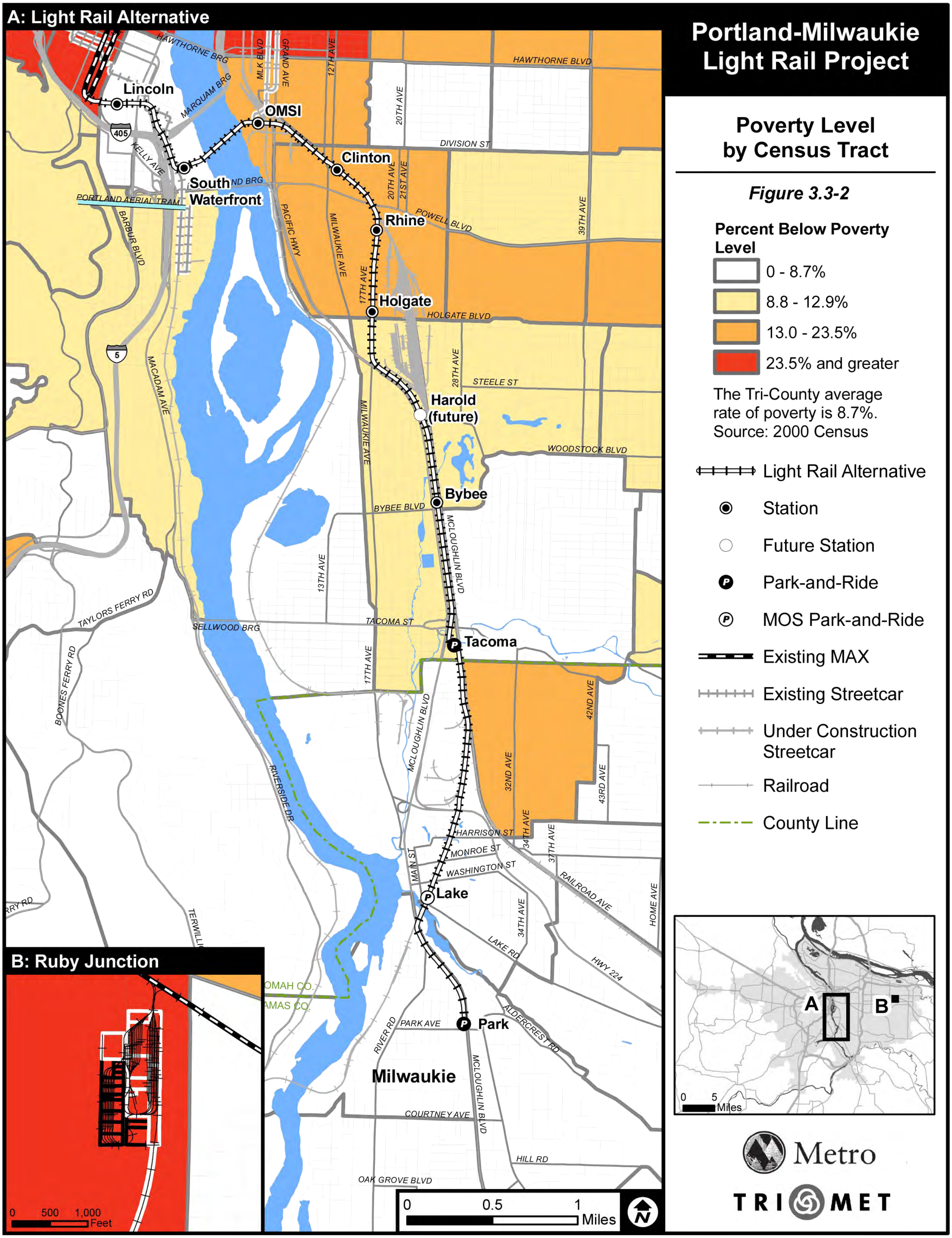
6 Median Home Price- Real estate values for Portland neighborhoods were provided by the Portland Office of Neighborhood Involvement. Values were derived from a 2006 market report provided by the Realtors Multiple Listings Service, which organizes its data by ZIP code. Because ZIP codes often extend across neighborhood boundaries, and some neighborhoods contain more than one ZIP code, only data from the predominant ZIP code or codes were used. The real estate information presented reflects statistics for the entire ZIP code to which each respective neighborhood belongs and therefore should be treated as guidelines only.

7 The South Waterfront District is part of the block group that covers downtown Portland. However, the district is covered by a census block that in 2000 did not have any residents. Therefore, although in the next census data would be applicable to this area, there are no socioeconomic characteristics for the area from the 2000 Census.

8 The number of households with poverty-level incomes was not available for this neighborhood due to the geographic level (block group rather than block) at which the results were released by the U.S. Census Bureau.

9 Median home prices for Island Station and Oak Lodge were derived from Zillow.com, a real estate website that provides data from recent home sales. MLS data for these neighborhoods is averaged over a large area, and is less reliable for local estimates than Zillow. These 2006-07 prices were for houses in the ZIP code for 97222, which includes Milwaukie and parts of Clackamas County, including Oak Lodge.

10 Population estimates for the Ruby Junction area of Rockwood neighborhood is based on Block Group 1 of Census Tract 98.01 (2000 Census). Median home price obtained in September 2009 from Zillow.com. Price is for mid-2006 for ZIP code 97030.



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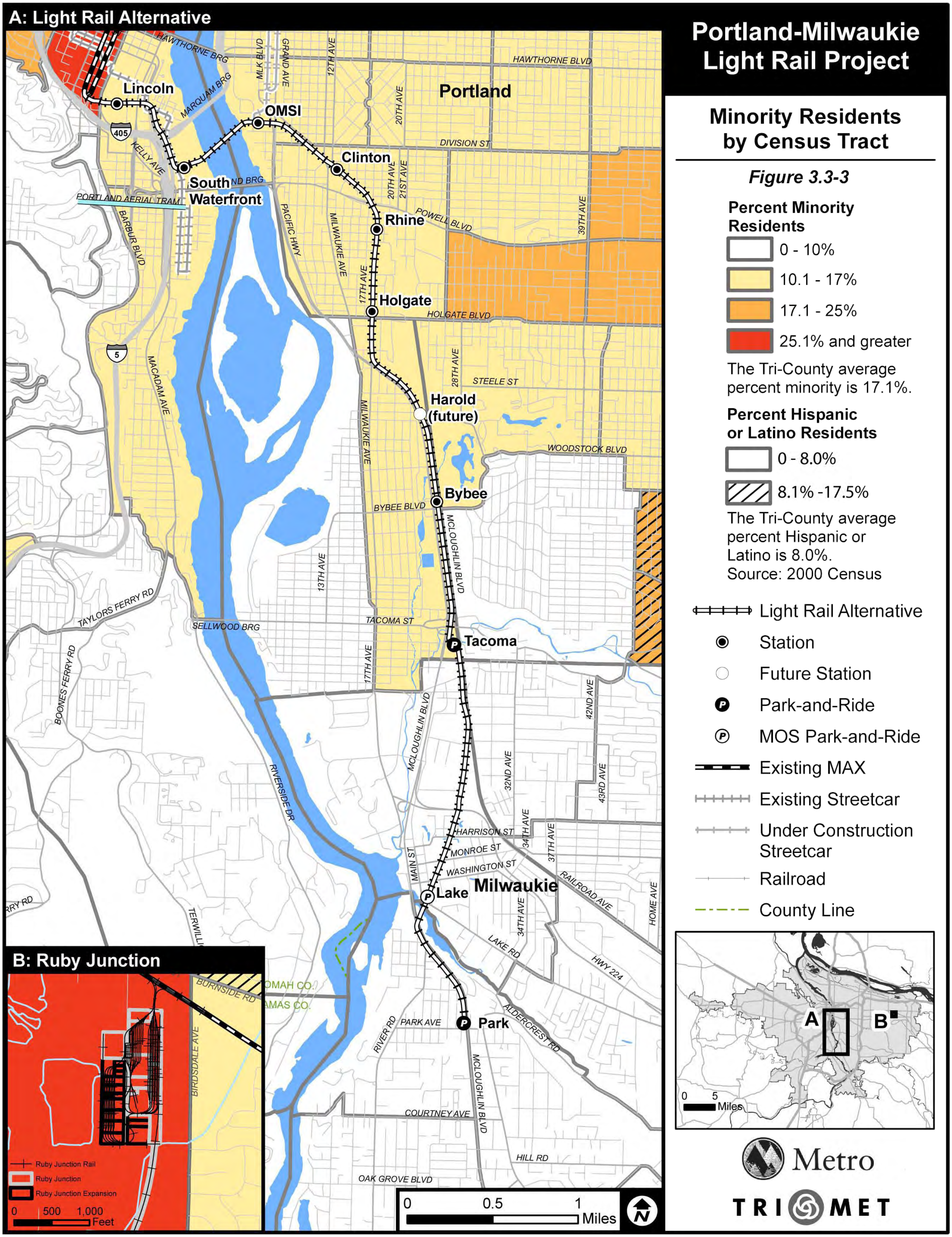


December 2009

To update census data after 2000, data from the U.S. Census Bureau's American Community Survey (ACS) were also used. The ACS provides comparable geographic data. The 2002 to 2005 and 2006 to 2008 three-year and one-year data were reviewed for changes in race for the Tri-County area, and the data indicate little change in the ratio of minorities for each county: Clackamas County, 10 percent; Multnomah County, 20 percent; and Washington County, 21 percent, for an area-wide average of 17 percent. The 2006-2008 ACS data on poverty showed increased poverty rates for the three counties since 2000: Clackamas, 9 percent; Multnomah, 15 percent; and Washington, 9 percent, for an area-wide average of 12 percent, up from 9 percent in 2000.

The analysis of socioeconomic characteristics includes census block groups where there are higher numbers of people who speak little or no English, or block groups where people are considered to be "linguistically isolated" by their unfamiliarity with English (Table 3.3-3). A linguistically isolated household is one in which all members of the household 14 years old and older have at least some difficulty with English. In 2000 (the most recent source of data at the block group level), there were three block groups in three neighborhoods—Brooklyn, Oak Lodge, and Rockwood—where the percentage of households with members speaking little or no English exceeded the percentage for the counties. The Rockwood neighborhood in Gresham has a rate of people who have difficulty speaking English six times higher than the county rate.

In 2008, the ACS data also showed that in Multnomah County approximately 9 percent of people spoke English "less than very well." In Clackamas County, the rate was 5 percent. This is almost a doubling in each county since 2000. More specific geographic data are not available for years after the 2000 census.

Table 3.3-3
Percentages of Homes with Limited English-Speaking Ability (2000)

			Persons Able to Speak English "not well" or "not at all"	
	Census Identification[1]	**Total Population**	**Number of Persons**	**% of Total Population**
Multnomah County		**618,617**	**29,981**	**5%**
Downtown and South Waterfront[2]	BG 1, CT 57	2,413	25	1%
Hosford-Abernethy	BG 1, CT 11.02	1,314	11	1%
Hosford-Abernethy	BG 3, CT 10	424	12	3%
Brooklyn	BG 2, CT 10	1,142	58	5%
Brooklyn	BG 6, CT 10	766	61	8%
Brooklyn	BG 3, CT 3.01	2,463	114	5%
Brooklyn and Eastmoreland	BG 2, CT 3.01	1,159	19	2%
Eastmoreland and Ardenwald	BG 4, CT 3.02	1,197	0	0%
Eastmoreland	BG 6, CT 3.02	1,244	8	1%
Sellwood-Moreland	BG 1, CT 2	867	0	0%
Sellwood-Moreland	BG 2, CT 2	1,750	10	1%
Sellwood-Moreland	BG 3, CT 2	1,279	27	2%

Table 3.3-3
Percentages of Homes with Limited English-Speaking Ability (2000)

	Census Identification[1]	Total Population	Persons Able to Speak English "not well" or "not at all": Number of Persons	Persons Able to Speak English "not well" or "not at all": % of Total Population
Clackamas County		**316,516**	**6,771**	**2%**
Ardenwald	BG 1, CT 209	875	0	0%
Ardenwald, Milwaukie Industrial, and Historic Milwaukie	BG 2, CT 209	1,268	21	2%
Milwaukie Industrial and Historic Milwaukie	BG 1, CT 208	1,400	17	1%
Milwaukie Industrial and Historic Milwaukie	BG 3, CT 208	1,467	8	1%
Island Station	BG 1, CT 212	2,322	9	0%
Oak Lodge	BG 2, CT 212	1,328	117	9%
Oak Lodge	BG 3, CT 214	913	24	3%
Gresham				
Rockwood	BG 1, CT 98.01	2,065	657	32%

Source: U.S. Census Bureau, Census 2000. Summary File 3 – Sample Data, Table P19.
[1] BG = block group; CT = census tract.
[2] South Waterfront is a relatively small part of the South Portland neighborhood, recently created out of several smaller neighborhoods south of the Marquam Bridge. The census block group discussed for Downtown in Section 2.2 also covers the light rail alignment in Downtown and the South Waterfront district of the South Portland neighborhood.

3.3.2 Environmental Consequences

This section summarizes how the Portland-Milwaukie Light Rail Project could affect neighborhood cohesion or character by impacts such as changing access and local circulation, creating noise and vibration, displacing residences or businesses, creating high visual impacts, or changing the availability of public services. These impacts are considered in terms of their overall potential to affect neighborhood livability, as well as to affect minority and low-income communities. Detailed analysis of these individual impacts can be found in related sections of the FEIS on transportation (Chapter 4), noise and vibration (Section 3.10), visual quality (Section 3.4), acquisitions and displacements (Section 3.1), and safety and security impacts (Section 3.16).

3.3.2.1 Long-Term Impacts

<u>No-Build Alternative</u>

The No-Build Alternative would not displace any residents or businesses or create any major capital improvements. Not building the light rail project would have minimal adverse impacts to neighborhood cohesion because there would be no visual, noise, vibration, or access changes to existing or future conditions as a result of not building the light rail line.

The No-Build Alternative also would not substantially enhance livability and connectivity by improving transit service and transit capacity to neighborhoods. Bus transit travel times between Milwaukie and downtown Portland would be one to four minutes slower than light rail travel and as much as 33 minutes slower for travelers to the South Waterfront. There would also be more congestion on SE McLoughlin Boulevard without light rail in the corridor.

Not building the light rail would fail to take advantage of improving connectivity to other projects being completed on or near the alignment, including the Portland Streetcar Loop Project. Not building the Willamette River bridge would mean that automobiles, pedestrians, buses, and cyclists would continue to share existing bridges, which are deficient in terms of their capacity to handle all of those traffic modes. An extension connecting the Portland Streetcar Loop Project to the South Waterfront Streetcar also would not be completed as planned, and the streetcar would terminate near OMSI.

Locally Preferred Alternative (LPA) to Park Avenue

Downtown [Portland]

The LPA to Park Avenue has limited displacements from downtown Portland to the South Waterfront District. Three low-density commercial buildings would be displaced, including a popular venue for live music. Along SW Lincoln Street, noise impacts would affect two apartment buildings and require mitigation, and vibration impacts would also affect two buildings and require mitigation. The existing center median and mature street trees on SW Lincoln Street between SW 4th and SW 1st avenues would be removed, creating visual impacts. However, the project will rebuild sidewalks and provide replacement landscaping, including street trees. Bus traffic would also increase on SW Lincoln Street and SW Hall Street due to the rerouting of up to three bus lines, which will be using the shared transitway over the Willamette River. With the light rail and additional bus traffic, congestion in the area would increase, and minor out-of-direction travel and slight delays at the intersections of SW 4th and SW 1st avenues would occur. There will be traffic noise impacts due to widening of the road in this area. The impacts to residences can be mitigated.

As the transitway extends west beyond SW 1st Avenue and crosses on a structure over SW Naito Parkway, residents in an apartment building would experience high visual impacts. Noise impacts previously predicted in the SDEIS would be avoided with the FEIS design because the light rail alignment has been moved farther away from the building.

The downtown Portland neighborhood is large, with high levels of activity. The changes are primarily within a several block area. The project will build on improvements from the Portland Mall Transit Project and the streetcar to provide improved transit service connecting between the southern end of downtown and central downtown and other neighborhoods, including the South Waterfront. These changes would be beneficial. Overall, the character, livability, and cohesion of the Downtown neighborhood would not be adversely affected since it is already intensively developed with residential and commercial uses and heavily trafficked.

While there is a relatively high representation of minority and low-income populations in downtown Portland compared to Multnomah County, the project would have positive impacts by enhancing multiple transportation options, including much higher levels of transit access and service to residential and employment centers. This effect is particularly important given that 12 percent of downtown Portland residents took public transit to work in 2005. Of the 17,300 daily work trips from the corridor to the Central Business District (CBD) in 2005, 5,000 (29 percent) were on transit. Another group that would benefit would be the elderly population and persons with disabilities, who may have more limited alternatives that may not include driving. No known publicly owned affordable housing units would be impacted. The light rail project would improve access to public facilities such as Portland State University, Portland Chinese School, and the Islamic School of Met, particularly from the east side of the Willamette River. Light rail would connect to the Portland Streetcar and its proposed connections and would improve connectivity within and between neighborhoods.

South Portland

South Waterfront is a relatively small part of the South Portland neighborhood, recently created out of several smaller neighborhoods south of the Marquam Bridge. The Willamette River bridge provides a multimodal connection between this neighborhood and the east side of Portland, with light rail line, streetcar and buses, sidewalks, and a new bicycle path connecting to the South Waterfront Station in an area planned for development with office and research facilities related to OHSU operations, which include medical offices in South Waterfront as well as additional medical facilities accessible via the aerial tram that is located in the vicinity. The sidewalk and bicycle path will also connect with a reconstructed SW Moody Avenue, and will provide for connections to a planned extension of the Willamette River Greenway trail, which currently ends near the Marquam Bridge to the north.

New retirement residences are currently under construction in the South Waterfront area. Building the light rail project will expand transportation options for the elderly living in those residences and help them to connect more easily to other neighborhoods near downtown and across the river. Finally, access to the OHSU facilities from the east side of Portland would be enhanced.

Hosford-Abernethy

The LPA to Park Avenue would displace 22 to 23 businesses and no residences within this portion of the alignment. The circulation in the industrial area of this neighborhood will be revised, with some existing rail crossings closed and consolidated with a nearby crossing. While this could create minor new delays and out-of-direction travel, the improved intersections will provide for a higher level of safety, and the new intersections will also feature sidewalks and amenities for bicyclists. Business displacements could temporarily affect existing jobs and future job opportunities in the area, but this is expected to be offset by an overall projected growth in jobs, improved access to other employment centers, and the creation of jobs that would occur with light rail construction. A large warehouse building that includes several businesses, including a wholesale food enterprise serving Asian restaurants and markets, would be displaced.

The LPA to Park Avenue would improve access for Hosford-Abernethy households, with the light rail system directly serving regional entertainment, employment, education, and public services facilities. The new light rail line would improve regional access for the neighborhood. The new light rail station and bus connections will improve access to downtown Portland and to areas to the southeast, and it will be one stop away from the Portland Loop Streetcar station at OMSI, adding connectivity to the neighborhoods to the north. Light rail as well as the street improvements and a new pedestrian bridge for a rail overcrossing at the station will also improve bicycle and pedestrian access in the area. Bicycles and pedestrians will have improved connections to the Springwater Trail and the Eastside Willamette River Greenway Trail.

The project is revising a number of rail crossings in this area to accommodate light rail and freight rail and improve traffic and nonmotorized circulation. The LPA to Park Avenue removes an existing pedestrian overcrossing of the UPRR, and provides a replacement ADA-compliant structure.[3] The project also includes a number of rail crossing safety features that would support a quiet zone, which would require approval by the Federal Railroad Administration, but could eliminate the need for warning horns by freight or Amtrak trains, except when tracks are obstructed. There would be moderate noise and vibration impacts to the Portland Opera building. The impacts can be mitigated.

Impacts on the cohesiveness of this part of the neighborhood will be minimal, since the light rail corridor follows the UPRR, which currently marks a division between the residential area and the industrial, commercial and institutional uses in the Central Eastside Industrial District. Major regional institutions such as OMSI and the Portland Opera would have improved access, as would employees and patrons of area businesses.

Brooklyn

As with the other neighborhoods listed above, higher capacity and faster access to downtown and the region via light rail could enhance livability in the Brooklyn neighborhood, with a light rail station directly serving the community. There would be no residents displaced in this neighborhood, although several businesses will be affected.

The project will be reconstructing much of the SE 17th Avenue corridor to accommodate light rail, which will run in a center median. At the intersection of SE 17th Avenue and SE Powell Boulevard, the project will reconstruct an overcrossing as well as the eastbound ramp from SE Powell Boulevard. The project will provide improved bicycle and pedestrian facilities in the area, improving operations, safety, and visibility for nonmotorized travelers. All along SE 17th Avenue, sidewalks and landscaping will be improved to include street trees and a natural stormwater treatment buffer. To accommodate the new station and a widened SE 17th Avenue with light rail, the project will realign the street in several locations, resulting in the removal of some existing buildings on the east and west sides of the street, and occupying other areas that are currently used for parking or light industrial storage. The LPA to Park Avenue also replaces an existing pedestrian bridge over the UPRR, although the LPA Phasing Option defers the replacement. The current views for some residents one block west of SE 17th Avenue would be affected, but the area is currently mostly parking or industrial uses. With the introduction of street trees, the change would be minor. None of the acquisitions extend beyond the first half block beyond SE 17th Avenue, further limiting the effects on the residential areas of the Brooklyn neighborhood to the west. There will be traffic noise and vibration impacts south of the Rhine

[3] This replacement structure would be deferred with the LPA Phasing Option. While this would remove an existing access route serving the neighborhood, the project still would provide other improvements to access, including redesigned streets and intersections with improved sidewalks, lighting, and bicycle facilities, as well as improvements at SE Powell Boulevard,that also serves this neighborhood.

Station, but they can be mitigated. Driveways and several side-streets along SE 17th Avenue would be restricted to right-in/right-out only. This would create out-of-direction travel of up to three blocks. The loss of off-street parking at TriMet's offices on SE 17th Avenue will be addressed via programs to reduce parking demand and by providing replacement for lost employee parking.

Some smaller-scale employment uses on the west and east sides of SE 17th Avenue would be displaced. These displacements could affect the small-scale, independent commercial character and function of this area of the Brooklyn neighborhood. Some of these uses may be able to relocate in the neighborhood or nearby. The nearest commercial- and industrial-zoned areas are along SE Powell Boulevard and SE Milwaukie Avenue within three to six blocks from SE 17th Avenue.

The future Harold Station is within the Brooklyn neighborhood, and is close to the Sellwood-Moreland, Eastmoreland, and Reed neighborhoods. This future station will provide improved access to transit in these neighborhoods. An elevated structure over SE Harold Street would maintain freight access to the UPRR yard to the east, but would be visible from the three adjacent neighborhoods.

Sellwood-Moreland and Eastmoreland

The LPA to Park Avenue would have little impact on neighborhood cohesion and livability, because building and operating the light rail project within the existing UPRR rail corridor minimizes impacts on these neighborhoods. No major changes to circulation within those neighborhoods would occur. The Bybee Station would provide an accessible point of access for neighborhood residents, and the light rail service will improve transit times and service frequency for residents in these established neighborhoods.

Ardenwald

At the north end of the neighborhood, the adjacent residential community would experience altered views due to light rail facilities, and impacts from increased traffic that would be attracted to the Tacoma Station. Congestion is likely to increase for the main access point of this neighborhood from SE McLoughlin Boulevard. The light rail alignment follows an existing rail right-of-way, so no new barriers to movement would be created, but some visual changes related to new structures could reinforce existing boundaries for the neighborhood.

The Tacoma Station and Park-and-Ride would introduce a new, multistory structure onto an undeveloped parcel, but the building and related facilities would be below the residential neighborhood in an area that is dominated by industrial and transportation uses. The LPA Phasing Option would develop the park-and-ride as a surface lot with fewer spaces than the LPA to Park Avenue structure. South of the Tacoma Station, the light rail would turn to the south and run parallel, at grade, to the UPRR tracks. The alignment would cross under the existing Springwater Corridor Trail. Pedestrian and bicycle connections to the Springwater Corridor Trail would be enhanced. The alignment would then cross to the east side of the UPRR Tillamook Branch line, on a retained earth structure transitioning to a bridge of up to 30 to 35 feet in height. Since the publication of the SDEIS in 2008, TriMet has reduced visual impacts to the Ardenwald neighborhood by modifying the design of the elevated structure, moving it farther west, and shortening the length of the overall structure. The project remains on the established border of the neighborhood, and does not intrude into the neighborhood.

While the poverty rate for the neighborhood is higher than in Clackamas County and the region overall, as is the rate of elderly population, both groups could expect to benefit from the project's enhanced transit service to regional destinations. Only a small part of this neighborhood is near the Tacoma Station and Park-and-Ride, but the station would be accessible via SE Tacoma Street. No displacements would result from the light rail project in this neighborhood.

The streets near the alignment contain a mix of older and newer homes of varying levels of condition. The line has an elevated structure that would be visible to some of the homes, but the alignment remains within a separate area dominated by transportation and industrial uses.

The LPA to Park Avenue would follow the existing UPRR right-of-way. There are some residences immediately adjacent to the existing railroad line at the ends of SE Roswell, SE Boyd, and SE Malcolm streets. A detailed noise and vibration analysis in this area has been conducted (see Section 3.10), and as several of these areas have existing high noise levels due to the current railroad traffic, the light rail project would not increase noise to levels that would constitute an impact.

The changes that would result from the light rail project in this neighborhood would be localized and would not result in changes to the neighborhood's overall character.

McLoughlin Industrial

This is an industrial neighborhood that has expressed concerns about light rail impacts to freight movement and parking. By following the UPRR alignment, the light rail project would avoid traffic, parking, and circulation impacts that were associated with previous alternatives that crossed area streets. The LPA to Park Avenue would serve employees and others destined for the area, as well as users of the Springwater Corridor Trail, a multi-use trail to the south of the Tacoma Station. Two buildings and the businesses they contain would be displaced. The construction of the LPA to Park Avenue track would require relocation of two freight rail spurs. The relocation of one of the spurs may eliminate access to some of the southernmost loading bays in the adjacent industrial building but would continue to allow access to most of the loading bays by the industrial tenants of that building. Those impacts are not expected to affect the industrial character of the area, which contains a mix of smaller and larger establishments, and has capacity for redevelopment.

Historic Milwaukie Neighborhood

This section of the alignment would develop a new station and place the light rail facilities along an existing rail corridor. All of the existing rail crossings will be rebuilt to meet Quiet Zone Standards (see Section 3.10, Noise) current safety standards, and the crossings will all include improved sidewalks on both sides of the cross streets. The introduction of light rail would improve regional access and mobility for area residents and businesses, as well as for the general population of Milwaukie. The Lake Road Station would directly serve the downtown area and is at the center of the City's revitalizing plan for its downtown. Travel time savings to destinations such as downtown Portland would be substantial compared to bus transit under the No-Build Alternative and would be competitive with automobile trips.

The LPA to Park Avenue would have little impact on overall neighborhood cohesion in the Historic Milwaukie neighborhood because it is along an existing railroad corridor. Southeast 26th Avenue would be shifted slightly east but still would provide a connection under Highway 224. The Tillamook Branch line already creates a barrier between residential areas, except at the street intersections. By following the existing railroad, the light rail project will cause few changes to circulation or access to services in downtown Milwaukie. Connectivity in the neighborhood would continue to be provided on SE Adams and SE Washington streets with little out-of-direction travel. There would be increased delays at cross-street intersections with the light rail line compared to current conditions with only freight travel on the rail line. The delay at light rail crossings could be up to 50 seconds, but during peak hours this delay is expected to average between 4 and 17 seconds in downtown Milwaukie. The number of trains along this corridor will increase from the current average of one freight train per day by adding frequent light rail service to the corridor.

During the public comment period following publication of the SDEIS, the local community identified concerns about the compatibility of light rail with nearby uses such as Portland Waldorf School, Milwaukie High School, and St. John the Baptist Church and School. A fence, retaining wall, and sections of six-foot-high safety walls between the light rail and freight tracks would be constructed along the length of the light rail segments between several intersections—Highway 224 and SE Harrison, SE Monroe, and SE Washington streets. These features will discourage unauthorized crossing of the tracks. While the fences will follow the alignment between intersections, the safety wall is only in the areas that are beyond a 250-foot sight line of each intersection. Crossings of light rail would be designed to incorporate both active and passive safety control measures to prevent conflicts between trains and pedestrians or vehicles. TriMet's Transit Police Division would provide security, as they currently do throughout the MAX system. Maintaining security and providing for emergency responses at all of the stations would be handled through TriMet's established fire, life, and safety programs, which feature cooperative and ongoing planning between TriMet and local jurisdictions. Additionally, TriMet considers best practices related to security in the design of its stations. These are derived from Crime Prevention Through Environmental Design (CPTED) concepts, which provide guidelines to deter criminal activity. See Section 3.16, Safety and Security, for more information.

Several properties in this area would have light rail noise or vibration impacts that would require mitigation. These are due to light rail operations as well as the rail crossings in downtown Milwaukie. Without mitigation, severe noise impacts due to light rail trains and bells are projected at five residences, with moderate impacts at an additional 15 residences. Vibration impacts at 24 properties would require mitigation, including several businesses with vibration-sensitive equipment or operations, apartments, and single-family residences. See Section 3.10, Noise and Vibration, for more information.

The LPA to Park Avenue would displace one residence and one business in Historic Milwaukie. This is a minor impact in the context of the household population overall and is not expected to alter the residential character of the area. No parking impacts are anticipated. See Section 3.16, Safety and Security, for information about safety and security concerns expressed by the public.

Island Station and Unincorporated Clackamas County (Oak Lodge)

The LPA to Park Avenue would serve the Oak Lodge and Island Station neighborhoods at the Park Avenue Station and Park-and-Ride, improving transit travel times and mobility for residents. The light rail alignment would cross over SE McLoughlin Boulevard on a new bridge structure beside an existing railroad trestle. The light rail will then curve to the west side of SE McLoughlin Boulevard, transitioning from the structure on piers to a retained fill structure and then to a surface alignment. This will also require the relocation of existing power lines and poles, reducing the number of poles but introducing some larger poles. The new structures would be within view of several commercial properties and a single-story apartment building near SE McLoughlin Boulevard, but are generally removed from residential areas and are primarily below most residential viewpoints. The light rail alignment is also being developed in conjunction with the Trolley Trail, a new regional trail project. Section 3.6, Parks and Recreational Resources, provides additional information on the proposed design approach for these two projects. The shared trail/light rail alignment in this area would remove some existing trees and vegetation as well as several residences along SE McLoughlin Boulevard, but it would also incorporate new landscaping. One road closure, SE Sparrow Street at SE McLoughlin Boulevard, would occur, and intersection improvements would be made at several other streets intersecting SE McLoughlin Boulevard.

The LPA to Park Avenue would displace ten residences and eight businesses between SE Lake Road and SE Park Avenue and have impacts on the front or side yards of additional properties. There are over 9,000 households in Oak Lodge and Island Station, so the displacement of ten residences on the boundaries of these neighborhoods is not expected to cause a change in the character or interactions of the neighborhoods.

The Park Avenue Station and Park-and-Ride would introduce a station, a multistory park-and-ride, and an elevated pedestrian bridge at SE Park Avenue and SE McLoughlin Boulevard. The park-and-ride would be below the sight line for most of the neighborhood. The LPA Phasing Option would develop a smaller initial parking structure with a lower profile. The project would also improve and widen several intersections near the station area. The right-of-way needed for the project and its related improvements would displace restaurants and auto-related commercial businesses in a commercial strip at SE McLoughlin Boulevard and SE Park Avenue, and will reduce the front and side yards of several residences. Additional traffic in this area would cause congestion at the intersection of SE Park Avenue and SE Oatfield Road, but traffic mitigation would restore the intersection to full operations.

Light rail noise levels would affect up to five residential properties to the west of the light rail alignment along SE McLoughlin Boulevard, but the project has identified noise walls to mitigate the impact. Vibration impacts would affect eight residences west of the light rail alignment, also requiring mitigation.

LPA Phasing Option

Long-term impacts associated with the LPA Phasing Option will be consistent with those for the LPA to Park Avenue for Downtown [Portland], South Portland, Sellwood-Moreland and Eastmoreland, McLoughlin Industrial, and Historic Milwaukie neighborhoods. The removal of the pedestrian overcrossings in the Hosford-Abernethy neighborhood will remove an existing access route, while at the Rhine Station a pedestrian bridge replacement would be deferred. Even with these deferrals, there will still be other bicycle/pedestrian improvements in the area as a result of the project. There will also be one fewer acquisition and eight fewer partial acquisitions as the result of the pedestrian overcrossings being deferred. In the Ardenwald and Unincorporated Clackamas County (Oak Lodge) neighborhoods, there would not be the introduction of a multi-story parking structure and the additional traffic associated with the larger-scale parking structure.

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road has the same impacts as the LPA to Park Avenue between downtown Portland and the terminus at SE Lake Road. The differences in the impacts are primarily in downtown Milwaukie, as described below, and there would be no changes to neighborhoods to the Oak Lodge neighborhood to the south (see Section 3.10 for noise impacts).

Historic Milwaukie

Under the MOS to Lake Road, the impacts from Highway 224 to downtown Milwaukie would be the same as for the LPA to Park Avenue, except for the impacts on displacements, noise, and vibration due to crossover tracks, the loss of land from the park-and-ride, changes to downtown plans, and increased traffic from the park-and-ride structure. The park-and-ride proposed for SE Lake Road would create queues that would block adjacent intersections at SE Monroe Street and SE Main Street and at multiple intersections along SE McLoughlin Boulevard. While the frequent service of light rail would stop traffic on the east-west streets to downtown Milwaukie, traffic analysis shows that traffic would still operate at acceptable levels.

The MOS to Lake Road would reduce overall displacement impacts compared to the LPA to Park Avenue, but none of the impacts are major enough to cause a change in neighborhood character or cohesion.

Related Facilities

Related Bridge Area Transportation Facilities

The Related Bridge Area Transportation Facilities are within the South Portland and Hosford-Abernethy neighborhoods. The impacts consist of changes to existing roadways and circulation, consistent with long range plans for these areas. In the South Waterfront District, changes to circulation will occur because SW Moody Avenue will be raised and widened to accommodate two streetcar tracks and the light rail crossing. Most of the surrounding area is still undeveloped, and no building displacements are expected along with these projects. Connectivity to the close-in east side to the north will be improved, as will light rail and streetcar connectivity to South Waterfront. On the east side, the area is largely industrial, with the exception of OMSI, the Portland Opera (offices), and a few retail businesses north of OMSI. In this area, the currently existing SE Water Avenue would be converted to a streetcar, bicycle, and pedestrian only route and a new SE Water Avenue would be located to the east. Since the streetcar will travel north from the bridge’s eastern terminus, it will provide improved connections to and from the other streetcar and light rail lines on both sides of the bridge, directly benefiting the Hosford-Abernethy neighborhood.

Ruby Junction Maintenance Facility

TriMet's existing Ruby Junction Operations and Maintenance Facility in Gresham would be expanded to support the Portland-Milwaukie Light Rail Project and other expansions on the system. The expansion would require enlarging the existing facility site, including the addition of new structures and storage tracks. Fourteen parcels would be impacted by the expansion of the Ruby Junction Facility in Gresham, Oregon. Within those fourteen parcels, six residences and ten businesses would be displaced; some parcels contain two buildings—a residence and a business. The project would displace these residences and businesses, leaving just one non-industrial parcel in this area, which is already separated by heavy industrial uses from other nearby neighborhoods and has steadily been converting to commercial and industrial uses. With a phased approach to the Ruby Junction expansion, the project would initially only impact nine parcels; four residences, three businesses, and two parcels that contain both a business and a residence. TriMet will provide compensation and relocation assistance to eligible displaced parties per the Uniform Relocation Act, as described in Section 3.1, Acquisitions and Displacements. Other potential effects to the community are limited because of the fragmented industrial/commercial/residential composition of the existing area, which has little cohesion between uses, and no community facilities. With a phased approach, one additional residence would remain, along with several businesses, but the overall effect would be the same.

3.3.2.2 Short-Term Impacts (Construction)

No-Build Alternative

The No-Build Alternative would not create short-term impacts due to construction, except for impacts from the separate projects assumed as part of the No-Build Alternative.

Locally Preferred Alternative (LPA) to Park Avenue and LPA Phasing Option, and the Minimum Operable Segment (MOS) to Lake Road

Temporary construction-related or short-term impacts on neighborhoods under the LPA to Park Avenue and the LPA Phasing Option, and the MOS to Lake Road could result from increased traffic congestion, truck traffic, noise, vibration, and dust. More detailed descriptions of specific types of environmental and transportation impacts are discussed in other sections of Chapter 3 and in Chapter 4. Drivers could experience delays at intersections where light rail crosses streets or follows the road rights-of-way. Construction of the park-and-ride structures at SE Tacoma Street and at either SE Lake Road or SE Park Avenue would temporarily disrupt traffic patterns, cause delays on side streets, and create noise, dust, and light impacts. Under the LPA Phasing Option, there could be a moderate reduction of construction at the Tacoma Station area, but in most areas the effects are similar to the LPA to Park Avenue's construction-related impacts.

Related Facilities

Related Bridge Area Transportation Facilities

Impacts associated with the development of streetcar and related improvements to SW Moody and SE Water avenues would be similar to those for construction activities for the LPA to Park Avenue and the MOS to Lake Road. The reconstruction of SW Moody Avenue with double-tracking of streetcar in the median might require a temporary road detour and a "bus bridge" for streetcar for travelers using SW Moody Avenue or streetcar to reach the currently developing areas of the South Waterfront District, which includes residential, restaurant, and office/commercial properties. While the construction of SW Moody Avenue with streetcar would temporarily increase travel times during construction, access to the neighborhood would be maintained. The development of the streetcar and reconstruction of SE Water Avenue in the Central Eastside Industrial District would also provide localized detours and delays, but alternate routes are available.

Ruby Junction Maintenance Facility

The construction at the Ruby Junction Facility would occur at the end of a dead-end road, which would be vacated unless a phased expansion approach to the Ruby Junction Facility is used. Most of the existing businesses and residences on the street will be relocated prior to construction. The people accessing the remaining businesses and residences may experience delays or detours during construction.

3.3.2.3 Indirect and Cumulative Impacts

No-Build Alternative

The lower capacity of a bus system to accommodate growth in ridership could cause an indirect increase in road congestion compared to the light rail project. Additionally, there would be no benefits from reduced travel time and improved service levels for people along the corridor. To the extent that congestion is forecast to be greater under the No-Build Alternative than with the light rail project, secondary effects of congestion-related delays could affect livability on residential streets near the major transportation corridors. The beneficial impacts of improved regional access that would come from high-speed, more reliable, and higher-capacity transit would not occur.

The No-Build Alternative would not add to past or future impacts from displacements, noise, vibration, and changes to the visual environment.

Locally Preferred Alternative (LPA) to Park Avenue and LPA Phasing Option, and the Minimum Operable Segment (MOS) to Lake Road

Many of the impacts on neighborhood cohesion and livability are by their nature secondary rather than direct. Secondary impacts not discussed above include the potential for beneficial redevelopment of vacant and underdeveloped land around station areas. Investment in station areas could enhance the surrounding areas by adding services and value to the neighborhood. Where lots are vacant or underdeveloped, property owners may find that property values increase. While this could be a net benefit to property values, low income residents in adjacent neighborhoods may find it difficult to keep up with rising housing values. Property owners may benefit from this, but existing renters may need to move from the area to find accommodations with similar affordability. Another potential negative secondary effect could be changed circulation and on-street parking if park-and-rides and transit stations cannot accommodate all of the demand. If such parking demand is created, city programs may be needed to manage the impacts.

For the light rail project, construction activities and business displacements could affect the success of those businesses left behind. For example, the light rail project would compound the construction impacts in the Central Eastside Industrial District, particularly near OMSI and the Portland Opera building, an area that has been subject to past and current disruptions from the City of Portland's Big Pipe project, the reconstruction of the SE Martin Luther King Jr. Boulevard viaduct, and the development of the Portland Streetcar Loop project to OMSI.

The Portland-Milwaukie Light Rail Project would be a major development in the corridor, which features established neighborhoods; the South Waterfront neighborhood is the only large area of vacant land for new development. Few other projects of a similar magnitude have occurred in these areas, and no others are currently planned. Therefore, the cumulative impacts of this project along with other actions are minimal compared to the direct displacement and construction impacts. However, on a more localized level, neighborhoods are subject to change over time as market conditions change, as businesses and residences move in or out, and as individual developments occur. These conditions could transform neighborhoods, but such changes would likely occur with or without the project, although the presence of light rail stations and improved access and activity could accelerate these changes.

Related Facilities

Related Bridge Area Transportation Facilities and Ruby Junction Maintenance Facility

Secondary and cumulative impacts for these facilities would be of the same type as for the light rail project but would be at smaller scale. Secondary impacts would be confined to the immediate areas around South Waterfront, the CEID and around the Ruby Junction Facility. Given the magnitude of the light rail activities proposed for the South Waterfront and CEID, these activities would have a minor additive effect.

3.3.3 Mitigation Measures

This section describes potential short- and long-term mitigation measures. In addition to those measures introduced below, other mitigation measures relevant to communities are listed in other sections of this report (e.g., land use and economics, displacements and acquisitions, etc.).

3.3.3.1 Short-Term Mitigation

Impacts from construction on land uses in neighborhoods and businesses are discussed in Section 3.2, Land Use and Economy. Chapter 4 provides mitigation for transportation impacts during construction, and other environmental topics in Chapter 3 provide specific mitigation resources for construction. With these other mitigation commitments, no further mitigation is required for community impacts.

3.3.3.2 Long-Term Mitigation

After the mitigation identified in other environmental topic areas (such as noise and vibration, transportation, and displacements/acquisitions), the light rail project would not have long-term impacts on neighborhood character or socioeconomic characteristics; no additional mitigation for neighborhood impacts is proposed.

3.3.4 Environmental Justice Compliance

This section describes the Portland-Milwaukie Light Rail Project's compliance with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Appendix B contains additional information. The principles of Environmental Justice (EJ) are to*:*

- Ensure the full and fair participation by all potentially affected communities in the transportation decision-making process
- Avoid, mitigate, or minimize disproportionately high and adverse human health and environmental impacts, including social and economic impacts, on minority and low-income populations
- Prevent the denial, reduction, or significant delay in the receipt of benefits by minority and low-income populations

Guidance on determining impacts states that a low proportion of minority or low-income population in an area does not eliminate the possibility of disproportionately high and adverse effects of a proposed action. EJ determinations are made based on effects, not population size. It is important to consider the comparative impact of an action among different population groups. The threshold of *disproportionately high and adverse impacts* requires impacts to be greater in magnitude or appreciably more severe for a low-income or minority community than those suffered by non-low-income or non-minority populations/communities.

The Portland-Milwaukie Light Rail Project's public involvement and decision-making processes are designed to ensure "full and fair participation by all potentially affected communities." Early in the project, staff evaluated 2000 U.S. Census data and reviewed past documentation of the project area to identify concentrations of low-income, Hispanic, or minority residents. No significant concentrations of these groups were identified. However, some limited areas of low-income, Hispanic, or minority residents were identified, so areas with potential concentrations of these groups were targeted for door-to-door canvassing and offered project briefings. More detailed descriptions of the public involvement effort for the project can be found in Chapter 6.

Potential minority and Hispanic populations or communities for this project were identified by comparing the 2000 U.S. Census minority or Hispanic proportion of the population of each census block group with the minority or Hispanic proportion of the population for all census tracts within the Metro Urban Growth Boundary (UGB). Similarly, potential low-income populations or communities were identified by comparing the 2000 U.S. Census proportion of households below poverty level of each census block group with the proportion of households below the poverty level within the UGB.

In addition, the same 2000 U.S. Census data were used to estimate the probable number of minority, Hispanic, and low-income displacements and the characteristics of potential rider populations receiving improved transit service.

In addition to census geographies, the analysis for the Portland-Milwaukie Light Rail Project looked at 2005 ACS data for changes in overall trends of population growth, poverty, and minority status at the county level. The ACS data were generally consistent with earlier 2000 U.S. Census data but, as sample data, these data have a wider margin of error.

Findings

According to the 2000 U.S. Census, 18.7 percent of residents within the Metro UGB were members of a minority group, compared to 17.1 percent within the Tri-County area and 10.5 percent in the Portland-Milwaukie Light Rail Project Corridor (represented by block groups adjacent to the light rail alignment) as shown in Table 3.3-4. ACS data from 2008 suggest little change in racial, ethnic, and low-income make-up in the project area. Residents of Hispanic origin comprise 8.3 percent of the population within the Metro UGB population, 8.0 percent in the Tri-County area, and 4.3 percent in the census block groups of the Portland-Milwaukie Light Rail Project Corridor. The census block group surrounding the Ruby Junction Facility reports substantially higher minority and Hispanic populations, 39.3 percent and 46.7 percent, respectively. A higher proportion of households within the Portland-Milwaukie Light Rail Project Corridor block groups (10.0 percent) had incomes below the federally defined poverty level[4] in 1999 than the proportion in either the Metro UGB (9.4 percent) or the Tri-County area (8.7 percent). The Rockwood area by the Ruby Junction Facility recorded 35 percent below the poverty level in 2000. Minority populations in the region have grown since 2000 (see Section 3.3.1.1). However, data by block group to assess changes at the corridor level are not available, so this analysis retains data from the 2000 Census.

Table 3.3-4
Comparison of EJ Population Ratios

Area	Population	% Minority	% Hispanic	% Poverty
Portland-Milwaukie Corridor Census Block Groups (2000)	23,404	10.6%	4.3%	10.0%
Metro UGB (2000)	1,190,993	18.7%	8.3%	9.4%
Tri-County area	1,444,219	17.1%	8.0%	8.7%

Source: Metro, U.S. Census 2000.
Note: Percent minority and percent Hispanic refer to proportion of populations, whereas percent poverty indicates the proportion of households below the poverty level.

As indicated by Table 3.3-2, Downtown [Portland] and Rockwood were the neighborhoods with a higher proportion of minority residents than average for the Metro UGB. Rockwood is exceptional in its high concentration of Hispanic and low-income residents, much higher than the average for the Metro UGB. Downtown [Portland], Brooklyn, Hosford-Abernethy, Sellwood-Moreland, and Ardenwald had higher proportions of low-income residents than the Metro UGB average.

Neighborhood Impacts and Benefits

The residential displacements expected to result from the light rail project would occur in the Historic Milwaukie, Island Station, and Oak Lodge neighborhoods, which have proportions of minority and low-income populations that are comparable to or below the county, tri-county, and

[4] The census compares household income to federal standards based on household size and composition in developing statistics to describe poverty rates by census tract (U.S. Census Bureau: 2000, Summary File 3 Technical Documentation).

state levels. This is a very low level of impact overall, considering the length of the new light rail corridor and the fact that residential displacements would be provided with compensation and relocation assistance. Similarly, as described in Section 3.1, displaced businesses would also be provided with compensation and relocation assistance. The project has also conducted a review of the available supply of comparable replacement property for displaced uses, and found that, for most properties, there is an adequate supply of replacement properties. Therefore, no disproportionate impacts are anticipated for the project.

Sections 3.1 and 3.2 discuss the number of businesses and other buildings that would be displaced by the Portland-Milwaukie Light Rail Project. The project could displace between 10 and 20 residences and 61 to 67 businesses (9 of the residences and 9 businesses are located near the Ruby Junction Facility). Determination of minority or Hispanic business ownership is not easily quantified or estimated, but there is no evidence to suggest that a concentration of minority or Hispanic businesses is located in any given area of the light rail corridor, including station locations. The affected properties and resulting displacements are also distributed throughout the corridor, with only one area (SE 17th Avenue) that has multiple properties affected. Compared to other linear projects, including highways or other major public works facilities, this represents a low number of property and business impacts. Up to 11 residential displacements are expected to result from the project. Ten of these are in the segment between the Lake Road and Park Avenue stations, and would only occur with the LPA to Park Avenue. These displacements would occur in areas that have relatively low levels of minority, Hispanic, or low-income populations. Additionally, 11 residential displacements are a low impact overall, considering the length of new light rail corridor to be provided and the fact that displacement would be mitigated by relocation assistance.

However, given the high proportion of Hispanic and minority populations in the block group around the Ruby Junction Facility, there is a high probability that employees and/or owners of businesses and residents there belong to a protected population under Executive Order 12898. See below for an analysis of impacts to the Rockwood neighborhood surrounding the Ruby Junction Facility.

The *Community Impacts Assessment Results Report* (Metro 2008) evaluates the environmental effects that could result in cohesion and livability impacts by neighborhood. None of the neighborhoods, including the few with minority or low-income populations greater than the regional average, were found to have adverse effects that would appreciably affect their character or function.

An analysis of probable racial, ethnic origin, and income characteristics of individuals living within a quarter-mile radius of stations was completed for the South Corridor light rail alternatives in 2002 to identify the characteristics of potential riders. Because this information was based on the 2000 U.S. Census, which is the latest available detailed information on socioeconomic characteristics by area, it remains a good indication of the likely benefits anticipated for the project. These characteristics of potential riders were evaluated to determine who would benefit from each of the alternatives. Although transit riders could live anywhere, those residing within one-quarter mile of stations are commonly considered to receive improved access to transit services. In 2002, this distance was thought to be no more than one-quarter mile; however, recent research indicates that one-half mile more accurately reflects travel behavior. This document generally uses one-half mile as the area that will capture walking trips to proposed light rail stations, but presents one-quarter mile data below for an assessment of the balance of overall impacts and benefits.

The light rail project would provide a direct transit benefit to low-income populations (see Table 3.3-5). These benefits also include the improved circulation for streetcar and the transit travel time savings for buses on the new transitway provided by the bridge. The proportion of low-income households within one-quarter mile of a station area for each of these alternatives is slightly higher than the average within the Metro UGB, likely because the project uses rights-of-way along several major existing transportation facilities that are commonly lower value properties, including the UPRR. While each of these alternatives would serve many minority and Hispanic people, none of the alternatives under consideration would provide a direct transit benefit to areas with a higher concentration of minority or Hispanic residents than the average concentration within the Metro UGB. The area with the highest concentration of minorities and low-income households, Rockwood, already has access to light rail.

Table 3.3-5
Characteristics of Potential Rider Populations

	Population	Probable Percent Minority	Probable Percent Hispanic	Probable Percent Below Poverty
LPA to Park Avenue (2000 population within 0.25-mile of stations)	9,530	13.2%	4.4%	12.6%
MOS to Lake Road (2000 population within 0.25-mile of stations)	8,605	13.5%	4.1%	12.9%
Metro UGB	1,190,993	18.7%	8.3%	9.4%

Sources: Metro, U.S. Census 2000, and E.D. Hovee & Company.

Note: In order to determine the exact proportion of minority, Hispanic, or persons below poverty level, a survey of all residents within the station areas would be necessary. In lieu of a survey, an estimate of the probable proportion of residents within a quarter-mile radius of alternative stations has been made. This has been done by taking a weighted average of representation of these groups within the census block groups that intersect the quarter-mile radius, applying it to the estimated population within the radius, summing results for stations by alternative, and dividing it by total population within alternative station radii.

Analysis for Ruby Junction Maintenance Facility

Fifteen parcels would be impacted by the expansion of the Ruby Junction Facility, located in the Rockwood neighborhood in Gresham, Oregon. Within those fifteen parcels, nine residences and eight businesses would be displaced; some parcels contain two buildings—a residence and a business. The project would displace these residences and businesses, leaving just one non-industrial parcel in this community. With the LPA Phasing Option, the project would initially impact nine parcels; four residences, three business, and two parcels that contain both a business and a residence. TriMet will offer compensation and relocation assistance to eligible parties per the Uniform Relocation Act, as described in Section 3.1, which would mitigate potential financial impacts due to relocation.

Census data for the area surrounding the Ruby Junction Facility indicate that 40 percent of the residents are minority and 35 percent have incomes below the poverty line (Table 3.3-2). Given these data, initial observations had indicated that the expansion of the Ruby Junction Facility could result in a disproportionate impact to low-income or minority populations.

The project team surveyed the properties that would be displaced or partially displaced by the expansion at the Ruby Junction Facility to determine whether those impacted by the project match the demographic characteristics of population in the area. The survey shows that the nine occupied residences that would be displaced differ somewhat from the characteristics of the census tract data as a whole, and more closely resemble those in Multnomah County. Only three of these nine residences (or 33 percent) reported Hispanic or Latino ethnicity. One residence indicated some other race alone, and five indicated Caucasian race. Additionally, only two of the nine residences (or 22 percent) potentially earn incomes below the poverty level, based on the number of occupants in the household and the total annual income reported. The survey indicated there are six people between 0 and 18 years of age, 17 people between 19 and 64 years of age, and three people aged 65 and older living in the Ruby Junction area residences.

These surveys indicate that fewer EJ populations will be impacted than would be expected from census data. However, Table 3.3-6 shows that compared to the project area and Multnomah County population data, the minority composition in the Rockwood neighborhood is about a third higher than the county and approximately 22 percent higher than the project area. The proportion of the low-income population in the surrounding Rockwood neighborhood is nearly double that of Multnomah County and approximately 46 percent higher than the project area. These findings indicate that, when assessed in isolation, the displacements at Ruby Junction would disproportionately impact EJ populations, even though the statistical sample size of the affected businesses and residences is low and the impacted properties are adjacent to an existing facility in an industrially zoned area. However, considering the overall displacements for the project, they do not represent a disproportionate impact. With the mitigation proposed that provides compensation and relocation assistance in accordance with federal regulations, impacts to Ruby Junction residents are not expected to be high.

Table 3.3-6
Rockwood Neighborhood Minority and Low-Income Populations

Area	Rockwood	Multnomah County	Project Area
Percent Minority	33%	24%	27%
Percent Low-Income	22%	12%	15%

Source: Columbia River Crossing survey of residents; county and project area data from 2000 Census.

Although displacements in the Rockwood neighborhood for the Ruby Junction Facility expansion must follow the Uniform Relocation Act, the nature of some of the displaced residences and businesses may require special consideration. Several of the properties being impacted house both an industrial type of business and a residence. This unique setting allows for small industrial business owners to live and work at the same location. While TriMet will work with the affected parties to find similar properties, continued live/work arrangements may not be possible under local zoning that could apply to a relocated household, including housing that meets federal standards for decent, safe, and sanitary housing. TriMet's commitments to meet the requirements of the Uniform Relocation Act, along with TriMet policy to provide assistance and compensation for qualified displaced businesses, would still mitigate the impact for the relocated business portion of a property that currently serves household and business functions. While a phased approach to expansion would reduce business and residential replacements, the remaining properties are concentrated in one area that is already bordered by industrial uses at the southern terminus at NW Eleven Mile Road. These remaining properties, which include one residence, would be in a similar setting to what they have today, although properties to the west and the northwest would be redeveloped to accommodate the expanded maintenance facility. On a weekly basis, the remaining properties would experience occasional delays due to the new light rail crossings of NW Eleven Mile Road. The remaining properties, as well as those that are nearby today, represent a mixture of uses that are not considered interdependent, particularly given the heavy industrial setting of the area. Other properties that are acquired and whose uses are displaced would receive the same relocation assistance and compensation mitigation as described for the full expansion of Ruby Junction.

Conclusion

In evaluating whether the Portland-Milwaukie Light Rail Project would result in high and adverse environmental or health impacts being borne disproportionately by low-income, minority, and Hispanic populations, guidelines indicate that offsetting benefits, mitigation and enhancement measures, design, comparative impacts, and the number of similar existing system elements in non-minority and non-low-income areas may be taken into account. The light rail project would provide the offsetting benefit of direct transit service to those station areas within neighborhoods containing above-average concentrations of minority, elderly, and low-income populations. These benefits would also relate to improved access to places of employment, education, and social services located throughout the region through improved connections to downtown Portland and to other lines to the regional light rail system.

Adverse impacts such as unmitigated noise impacts, traffic impacts, visual impacts, and displacements do not fall disproportionately on minority or Hispanic populations, because most of the affected neighborhoods have ratios of minorities below those of Multnomah County, the Metro UGB, and/or the Tri-County area. Only the Downtown (Portland) and Rockwood (Gresham) neighborhoods are higher than the Multnomah County, Metro UGB, and Tri-County levels. All but one neighborhood (Historic Milwaukie) have lower ratios of Hispanic populations than all three larger areas.

Adverse impacts such as unmitigated noise impacts, traffic impacts, visual impacts, and displacements do not fall disproportionately on low-income communities. The light rail project alignment would affect 4 of 11 neighborhoods having slightly higher ratios of low-income populations than Multnomah County. The Downtown (Portland) neighborhood has a noticeably higher proportion of low-income people than any of the three larger areas. Some of these people are likely to be students at Portland State University. The area of downtown Portland near the alignment does not appear to contain low-income housing or areas, and the project would provide offsetting benefits.

The exception to these conclusions is at the Ruby Junction Facility (in the twelfth affected neighborhood, but not part of the alignment itself), where there could be disproportional displacement impacts to low-income and minority persons, although the number of affected parties remains low compared to the total population in Gresham. In addition, with compensation and relocation assistance, impacts are expected to remain low. There are no anticipated noise impacts at Ruby Junction that cannot be mitigated (see Section 3.10.5.3).

Therefore, according to the definition established in Executive Order 12898, the light rail project would not result in disproportionately high and adverse human health, environmental, social, and/or economic impacts to minority, Hispanic or low-income populations.

Mitigation and Enhancements

The same mitigation measures described above for the general community would apply to EJ populations. These include the use of TriMet's public involvement programs that provide outreach and communications to a variety of populations, including populations whose primary language is not English, and the compensation and relocation programs offered as mitigation for displaced property owners, businesses, and residents.

3.4 VISUAL QUALITY AND AESTHETICS

The visual quality and aesthetics analysis considers potential changes to the quality of the visual environment, including regional landscape patterns and local visual resources. For additional background on the methods and setting for this analysis, see the *Visual and Aesthetic Resources Results Report* (Metro 2008).

This analysis describes:

- Visual character and patterns in the corridor
- Dominant and recognized visual features, including those identified through adopted Neighborhood Plans and previous planning efforts as important neighborhood features, or formally designated in local or state planning documents
- Neighborhoods within the corridor, including a discussion of the general types of viewers, and their exposure and sensitivity
- Changes to visual conditions as a result of the construction and operation of the project, including information now available through additional design modifications and refinements since the SDEIS
- Mitigation

3.4.1 Affected Environment

3.4.1.1 Introduction

The Portland-Milwaukie Light Rail Project lies in the urbanized northern portion of the Willamette River Valley. The Cascade Mountains and Mt. Hood provide a distant backdrop in the east; the Tualatin Mountains, also known as the West Hills, frame the western edge of the viewshed. The Portland region encompasses towns and suburbs that surround its largest city. Urban development of the region began in the mid-1800s, with the first major overland immigration to Oregon City. Inner southeast neighborhoods developed steadily between the turn of the century and 1930. This early development was closely related to the dense network of streetcars and interurban rail. New thoroughfares, including SE McLoughlin Boulevard, Highway 26, and Highway 224, were created to serve the expanding eastside urban and suburban areas.

Suburban development moved east in the 1920s and escalated after World War II. Older neighborhoods in Milwaukie share the same streetcar-oriented history and housing stock as many inner neighborhoods in Portland, but overall development patterns outside of downtown Milwaukie also reflect auto-oriented retail or industrial corridors. Today, the project area is mostly urbanized. Many inner eastside Portland neighborhoods have changed as a result of a broader pattern of revitalization and reinvestment in urban infrastructure, and suburban development is filling in the less dense southeastern portion of the project area. Regional and local plans have identified centers for focused growth and development.

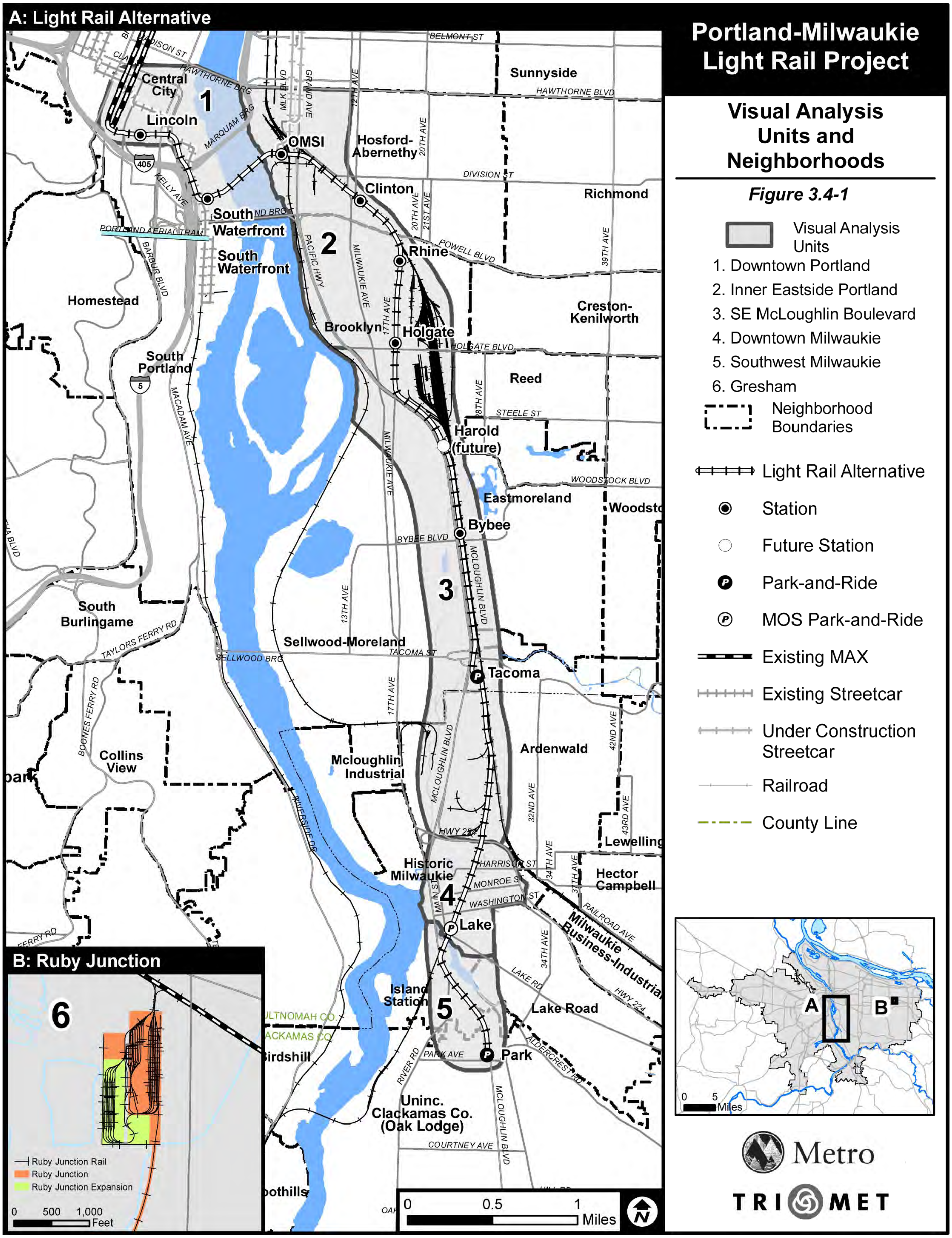
The visual resources identified in this analysis are focused on major public views, as well as dominant and recognized visual features (based on accepted practice in the field of visual analysis). Locations with notable views have also been identified informally by neighborhood groups through earlier phases of the project, including the *1998 South/North Corridor Project DEIS*, *2002 South Corridor SDEIS*, and the *2008 Portland-Milwaukie SDEIS*. The analysis also considers neighborhood features or views identified in local plans or ordinances. Figure 3.4-1 shows a map of the corridor and its visual analysis units. Appendix D, Visual Simulation Locations, provides the visual simulations, with before and after views and a mapping of the view locations.

3.4.1.2 Visual Analysis Units

Downtown Portland Visual Analysis Unit

The Downtown Portland Visual Analysis Unit (see Figure 3.4-1) extends from SW 5th Avenue and SW Lincoln Street to the Willamette River, and includes portions of the South Waterfront District. It is an urban environment with medium- to large-scale buildings and a small-grid, perpendicular street system. Southeast of downtown, the land slopes toward the river, and there are major transportation facilities such as Interstate 5 (I-5), Interstate 405 (I-405), and SW Naito Parkway. Between SW Naito Parkway and the Willamette River, the area includes new developments of the RiverPlace and South Waterfront areas, although the current character also features large undeveloped sites and an incomplete street system.

Major visual features in the Downtown Portland Visual Analysis Unit include the skyline of downtown Portland, views of the Willamette River, and downtown bridges. The City of Portland Central City Plan District notes a formalized minor viewpoint in the South Waterfront District approximately midway between the Marquam Bridge and the Ross Island Bridge in alignment with the City of Portland's proposed street network. The City of Portland's *Scenic Views, Sites, and Drives Inventory* formally identifies two view corridors in Portland Central City: SW Lincoln Street between SW 1st and SW 4th avenues and SW 1st Avenue from I-405 to SW Market Street. Throughout the unit, the West Hills form the western edge of the viewshed, and Mt. Hood and the Cascades may be viewed in the eastern distance under fair skies.


A: Light Rail Alternative
Portland-Milwaukie Light Rail Project
Visual Analysis Units and Neighborhoods
Figure 3.4-1
Visual Analysis Units
1. Downtown Portland
2. Inner Eastside Portland
3. SE McLoughlin Boulevard
4. Downtown Milwaukie
5. Southwest Milwaukie
6. Gresham
Neighborhood Boundaries
Light Rail Alternative
Station
Future Station
Park-and-Ride
MOS Park-and-Ride
Existing MAX
Existing Streetcar
Under Construction Streetcar
Railroad
County Line
Central City
Lincoln
OMSI
Hosford-Abernethy
Clinton
Sunnyside
Richmond
South Waterfront
Rhine
Brooklyn
Holgate
Creston-Kenilworth
Homestead
South Portland
Reed
Harold (future)
Eastmoreland
Bybee
Woodsto
South Burlingame
Sellwood-Moreland
Tacoma
Collins View
Mcloughlin Industrial
Ardenwald
Lewelling
Historic Milwaukie
Hector Campbell
Lake
Milwaukie Business-Industrial
Island Station
Lake Road
Park
Unic. Clackamas Co. (Oak Lodge)
B: Ruby Junction
Ruby Junction Rail
Ruby Junction
Ruby Junction Expansion
0 500 1,000 Feet
0 0.5 1 Miles
0 5 Miles
A
B
Metro
TRIMET

March 2010

Inner Eastside Portland Visual Analysis Unit

The Inner Eastside Portland Visual Analysis Unit was once the core of the city of East Portland and is now a mix of working industrial areas and pre-war, streetcar-oriented urban neighborhoods. Some of the most dominant visual features in this unit are the tall concrete structure of the Marquam Bridge carrying I-5 over the river; the SE Martin Luther King Jr. Boulevard/SE Grand Avenue (Highway 99E) couplet and viaduct, SE Powell Boulevard (Highway 26), and SE McLoughlin Boulevard (Oregon Highway 99E). The Union Pacific Railroad (UPRR) line also crosses the unit.

Other recognized landmarks and views include vistas across the Willamette River, the contemporary architecture of the Oregon Museum of Science and Industry (OMSI), views of the Marquam Bridge and the Ross Island Bridge, downtown Portland, the emerging South Waterfront skyline, Oregon Health & Science University (OHSU), the Portland Aerial Tram, and the West Hills. This visual analysis unit has one view identified as significant in the City of Portland's *Scenic Views, Sites, and Drives Inventory* and *Scenic Resource Protection Plan*. This is the view of downtown Portland and the Marquam Bridge near OMSI.

SE McLoughlin Boulevard Visual Analysis Unit

SE McLoughlin Boulevard is a major feature of this portion of the corridor, and it marks the boundaries between neighborhoods. North of SE Reedway Street, SE McLoughlin Boulevard is a multi-lane highway, fronted with vacant land and auto-oriented development. The nearby neighborhoods include single-family and multifamily housing of mixed quality and age. South of SE Reedway Street, the character of SE McLoughlin Boulevard changes dramatically to that of an urban parkway, with large deciduous trees on either side. Nearby land uses include large parks and golf courses and established residential neighborhoods. The UPRR corridor continues to run parallel to SE McLoughlin Boulevard and is wide enough to include trees and several wetlands.

Johnson Creek flows through the project area just south of the SE Tacoma Street overpass, where the creek crosses below SE McLoughlin Boulevard and the railroad. The Springwater Corridor Trail, which parallels Johnson Creek, intersects the corridor. South of SE Tacoma Street, development is generally composed of a loose-knit pattern of rail-oriented industrial uses, with much of the area featuring large-scale buildings. Formal landscaping is infrequent, and there are open areas for parking and for truck maneuvering and storage. Established adjacent single-family neighborhoods sit on a nearby hill, overlooking the corridor.

Downtown Milwaukie Visual Analysis Unit

This unit comprises the Historic Milwaukie neighborhood district. Although not a historic district listed in the National Register, the name reflects the City of Milwaukie-sanctioned neighborhood organization as defined by the City of Milwaukie Comprehensive Plan. It extends from approximately SE Railroad Avenue and Highway 224 west to the Willamette River and from Kellogg Lake on the south to approximately Highway 224 to the north. Highway 224 ramps to the north, providing a distinct visual boundary. To the west, the land slopes visibly down to the Willamette River.

Milwaukie's downtown area is a small town neighborhood that possesses a distinct visual character because of its commercial, office, and civic blocks surrounded by old houses and apartments on tree-lined, narrow streets. There are also newer developments of townhomes or other multifamily housing and commercial uses. The strong physical connection between downtown and the surrounding residential areas, the natural topography, and the presence of several dominant community features such as City Hall, Scott Park, St. John the Baptist Catholic Church, the Portland Waldorf School (formerly Milwaukie Junior High School), Milwaukie High School, and the Ledding Library make the Historic Milwaukie neighborhood district the visual center of this community. The vegetation and water features of Kellogg Lake and Robert Kronberg Park, with SE McLoughlin Boulevard to the west, provide a visual and physical contrast to the established downtown.

Southwest Milwaukie Visual Analysis Unit

The Southwest Milwaukie Visual Analysis Unit is centered on SE McLoughlin Boulevard, a regional arterial road that connects Clackamas County with Portland. To the north is a view of the Willamette River; to the south the dominant land feature is a ridge, which slopes down toward the Willamette River on the west. SE River Road closely follows the edge of the ridge. SE McLoughlin Boulevard skirts the bottom of the ridge, limiting visibility to the roadway from surrounding areas. As SE McLoughlin Boulevard runs south, it crosses Kellogg Creek and passes under the trestle for the Tillamook Branch line. The road continues south, passing areas lined with trees and other vegetation, until it reaches an area of low-density commercial buildings set back from the street with parking in front.

Northwest Gresham Visual Analysis Unit

The existing maintenance facility has the character of a rail yard, with large maintenance garages and little landscaping.

3.4.2 Environmental Impacts

3.4.2.1 Long-Term Impacts

Impacts to the visual and aesthetic environment are described as changes to the existing conditions that may be brought about by construction and operation of light rail and related facilities. These changes may detract from or enhance the visual environment. Each visual analysis unit within the corridor is characterized by its visual character and spatial pattern, recognized views, and other valued visual features. Local plans and policies identify two viewpoints in the project area: the view from OMSI toward the Willamette River and a minor viewpoint in the South Waterfront District toward the Willamette River, and two view corridors: SW Lincoln Street between SW 1st and SW 4th avenues and SW 1st Avenue from I-405 to SW Market Street. Other community-identified features and local policies were also used to help establish ratings of viewer sensitivity. Actions that could change the character of these features from their existing condition and affect viewers' responses to them could become visual impacts. The degree of these changes, coupled with viewer sensitivity, would define the severity of the visual impact. In most cases, greater contrast and incompatibility with existing character and pattern, along with higher levels of viewer sensitivity, would increase visual impact levels. The attributes of visual features that usually determine degree of change include:

- Topography – The visibility and scale of cut or fill relative to existing grades
- Vegetation – The degree of removal or replacement of existing vegetation and the relationship between remaining vegetation and location of proposed project elements
- Water – The physical or visual removal of a water feature; the design or structural compatibility of new elements over it or adjacent to it
- Structures – Color, scale, and type of project elements compared to the scale and type of existing structures and to existing topography
- Visual pattern – An increase or decrease in the size of the existing development, or a change in the arrangement and distribution of existing buildings, streets, land uses, and other neighborhood features
- Blocked or altered views – Changes to the character or extent of views, particularly for locations with designated public views

Because visual impacts rely on subjective criteria, this assessment focuses on those changes to the visual environment that may be measured in terms of high, moderate, or low degrees of change or impact. As shown in Table 3.4-1, each level describes how much the proposed project elements could change existing visual resources. High, moderate, and low levels of visual change are shown in Table 3.4-1.

For each of the changes the project causes, the analysis also considers the sensitivity of the viewer to these changes. "Viewer sensitivity" is the preferences, values, and opinions of different groups of viewers. This includes considerations of the length of time for which the project is seen, the distance of the viewer from the project, and the type of viewer (e.g., neighborhood resident or traveler on a highway).

Table 3.4-1
Characteristics of High, Moderate, and Low Levels of Visual Change

High Level of Visual Change	Moderate Level of Visual Change	Low Level of Visual Change[1]
Elevated structure	Minimum grade separation	At-grade/below-grade
Substantial property displacement	Low property displacement	Within existing right-of-way
Major new parking areas or structures	Minimum parking	No new parking
High view disruption	Moderate view disruption	Low view disruption
No screening of neighborhood	Inconsistent screening of neighborhood	Screening of neighborhood
Blocks scenic feature	Disruption of visual feature	No change to visual feature
Removal of all vegetation	Removal of some vegetation	Maintains pattern of vegetation
Changes out of scale to street	Changes to scale of street	Maintains existing scale

[1] Some changes associated with transportation projects, such as screening, landscaping, lighting, sound walls, pedestrian and bike improvements, etc., can be a positive improvement compared to existing conditions.

No-Build Alternative

The No-Build Alternative would include transportation improvements that are in the Regional Transportation Plan financially constrained network, and also considers current conditions in the corridor and urban development changes anticipated in adopted local and regional land use plans.

Other projects and additional development or redevelopment changes within the project area would have an effect on existing visual resources but would likely tend to be more gradual and localized rather than affecting the length of the corridor.

Locally Preferred Alternative (LPA) to Park Avenue

The implementation of the light rail project has the potential to cause several types of visual impacts, including:

- Disruptions to neighborhood pattern and scale
- Manipulation or removal of existing landforms, vegetation, and structures
- Introduction of new elements with prominent visual characteristics, such as overhead structures, retaining walls, catenary poles and wires, and stations or other structures that obstruct visual resources and views, such as parking garages
- Introduction of prominent new elements to formally designated visual resources such as views, viewpoints or view corridors

Potential long-term impacts to the visual and aesthetic environment of the Portland-Milwaukie Light Rail Project are summarized in Table 3.4-2 at the end of this section and are discussed below. The table considers a variety of factors, including the higher degree of design information now available for the LPA to Park Avenue, compared to the alternatives evaluated in the SDEIS. The analysis considers the level of visual change anticipated, the context and scale of the surrounding area, effects on major public views, the sensitivity of viewers, and design measures or features now incorporated as part of the project. As noted above, the ratings for the sensitivity of viewers can be more subjective than the other factors, but they consider the expectations of a viewer, the length of exposure he or she would have to the changed view, and the viewpoint, including proximity. For example, residential viewers would be considered highly sensitive to major changes of view and setting nearby because they would encounter the change on a daily basis. People at an established viewpoint, such as a public park, would also be more sensitive to change. Viewers in workplaces, particularly industrial areas, are expected to be less sensitive to changes in views than residential viewers. Motorists traveling through a corridor would be less sensitive to localized changes, but they would still notice major changes in views. Within each visual analysis unit there are many types of viewers. The text below describes the different types of viewers and their level of sensitivity to the project. Table 3.4-2 combines and averages levels of sensitivity for all types of viewers to provide one viewer sensitivity rating.

Visual impacts of the LPA Phasing Option are noted in the text below where deferred or modified facilities are proposed. Table 3.4-2 lists any differences to the degree of change, viewer sensitivity, or overall visual impact score. In most cases, the overall visual impacts of the LPA Phasing Option are consistent with the LPA to Park Avenue.

Downtown Portland Visual Analysis Unit

Portland Central City

The Portland-Milwaukie Light Rail Project would tie into the existing light rail line at SW 6th and SW 5th avenues. This would remove an existing building on SW Grant Street. Between

SW 4th Avenue and SW 1st Avenue, the existing center median and mature street trees would be removed. The Lincoln Station would be constructed, widening the overall streetscape to include a center platform and associated Overhead Catenary System (OCS) poles, wires, shelters, bollards/railings, benches, and signage. The widened right-of-way would affect a landscaped buffer and portions of parking areas on adjacent properties. However, the project would reconstruct the streetscape to include light rail, trees, vegetated water quality planters, a bike lane, and sidewalks. A one-story systems communications building would be constructed on a corner of a parcel to the north of the Lincoln Station. Landscaping and an existing building would be removed on the west side of SW 1st Avenue. An at-grade crossing and vegetation removal would occur at SW Naito Parkway. The intersection at SW 1st Avenue and SW Naito Parkway would be reconfigured. East of SW Naito Parkway, the light rail would cross over SW Harrison Street, SW Harbor Drive, SW Moody Avenue, and SW Sheridan Street on an elevated shared transitway. The transitway would originate from a retaining wall between SW Naito Parkway and SW Harrison Street and would reach approximately 20 feet in height.

These changes would impact foreground and middleground views along SW Lincoln Street and SW 1st Avenue by removing vegetation. The removal of the existing buildings at SW 1st Avenue and SW Lincoln Street and the extension of SW Lincoln Street into the transit corridor would enlarge the streetscape and open up views to the north, south, and particularly the east. This would create or enhance views toward the river and downtown for a variety of viewers, including pedestrians, drivers, transit riders, and bicyclists. However, the introduction of retaining walls in areas that were vegetated open space, particularly east of SW 1st Avenue, could reinforce a stronger, urban, hard-edged character, although the shared transitway overcrossing could add to the sense of arrival in downtown Portland.

The project could have secondary impacts on the multifamily residential property on the north side of SW Moody Avenue, east of SW Harbor Drive, because the transitway would be built within 25 feet of the property line (about 75 feet from the residential structure). These changes could affect the visual setting for the nearest residences, but most residents likely would be unaffected. At this location the transitway would be elevated above the street.

Viewer sensitivity in the Portland Central City neighborhood would be moderate. It is a dynamic, urban environment on the edge of the downtown core. Most viewers anticipate changes to the visual environment east of SW Naito Parkway where land has been rapidly developing. Viewers along SW Lincoln Street would have higher viewer sensitivity, and the change to the street landscaping would be more notable. Neighborhood residents, business people, and students would have a higher level of foreground visual impacts. Commuters would have moderate sensitivity to the shared transitway across SW Harrison Street and SW Harbor Drive due to the speed at which they would be traveling and the short duration they would be exposed to it.

Overall, there would be a high degree of visual change within affected blocks of the Portland Central City neighborhood, but considering the larger urban context and the moderate sensitivity of viewers, the visual impact would be moderate.

South Waterfront District and Willamette River

From SW Moody Avenue, which would be reconstructed to match the grade of light rail and would have double-track streetcar in the median, the shared transitway would curve to the south, running parallel to SW Harbor Drive and then to the east of SW Moody Avenue through a portion of the South Waterfront District area that is currently undeveloped but planned as a major new urban community. The light rail would cross SW Moody Avenue at grade, which is being raised in conjunction with the light rail project. The South Waterfront Station would be built to integrate with a new building planned by OHSU. Stormwater infiltration areas and new landscaping would be incorporated into numerous locations along the alignment. The alignment would then transition to the Willamette River bridge, which is a major new structure approximately 1,720 feet long, which will have two cable-stayed towers rising 180 feet above the capped piers in the river and large abutments on either side of the river. On the east side of the Willamette River, the bridge would cross land on a structure north of the Portland Opera building. On both the west and east banks, the bridge is designed to accommodate trail crossings underneath, including a planned trail on the west and a reconstructed 12-foot-wide asphalt trail on the east.

A high degree of visual change would occur within the Willamette River and adjacent areas with the introduction of the new bridge. On the west side, there are today few public viewpoints currently open, and in the future the area anticipates higher density development, including residential and commercial uses. The bridge would also be visible from waterfront locations farther north and south, although from the north the I-5 Marquam Bridge is already in the foreground of views looking south.

Impacts to views and viewer sensitivity along SW Moody Avenue and in the South Waterfront District would be low to moderate. Viewer sensitivity toward the South Waterfront District from Marquam Hill/OHSU and the Portland Aerial Tram would be low to moderate. However, the cable-stayed bridge type chosen was selected through a public forum that engaged area stakeholders and the public in determining which kind of bridge they felt was most appropriate for a new crossing in this area. Changes to the existing vacant industrial land would likely be an improvement. On the east side of the river, and for people on the river, the bridge would be highly visible. Boaters, tourists, recreational users, pedestrians, bicyclists, and patrons of eastside institutions and businesses would have moderate to high sensitivity to visual changes due to foreground, middleground, and background view impacts. However, the bridge would also introduce new viewpoints available from the abutments and the trail itself, offering more public viewing opportunities of downtown and up and down the river (under the LPA Phasing Option, the path width on the bridge around the abutments could be narrower – 14 feet rather than 22 feet – resulting in fewer viewing opportunities).

Viewer sensitivity would be low to moderate for viewers on I-5 whose short duration open views down the river to Ross Island and the Ross Island Bridge would be reframed by the new bridge. Viewer sensitivity would be high for those on the river whose views north and south would be framed by another overhead structure. Viewer sensitivity would be high for viewers on the east bank of the river at viewpoints north and south of the bridge. Their views upstream and/or downstream would be interrupted or framed by the new structure. Viewer sensitivity would be high for viewers on the west bank.

Overall, the degree of visual change would be high, viewers would have high sensitivity to visual change, and the visual impacts for the area would be high.

Inner Eastside Portland Visual Analysis Unit

Hosford-Abernethy Neighborhood

Proceeding past the eastside bridge abutment, the light rail alignment would pass on the shared transitway through the Central Eastside Industrial District and toward the Hosford-Abernethy neighborhood. The OMSI Station would be constructed east of the existing SE Water Avenue, and would include platforms and associated poles, wires, shelters, bollards/railings, benches, bike shelters, and signage. As part of the Related Bridge Area Transportation Facilities, this area would also have an adjacent streetcar station and tracks, poles, wires, and structures for the streetcar connection to the shared transitway. The light rail would cross on the shared transitway alignment under the SE Martin Luther King Jr. Boulevard viaduct. A new substation and a one-story systems communications building would be constructed east of the SE Martin Luther King Jr. Boulevard viaduct. Five buildings would be removed between the SE Martin Luther King Jr. Boulevard viaduct and SE Division Street, most of which are adjacent to the current UPRR tracks.

The light rail would cross SE 11th and SE 12th avenues at grade. Small- and large-scale industrial and commercial structures would be removed in the alignment and south of it, and several streets would be closed, realigned, or reconstructed. Road improvements would include crossing gates, street trees, curbs, sidewalks, designated bike lanes/routes, pedestrian stairs, and ramps. The Clinton Station would include platforms, shelters, and associated poles, wires, shelters, bollards/railings, benches, bike shelters, and signage. An existing pedestrian bridge over the UPRR tracks would be replaced by a new bridge that will be closer to the station. A new one-story systems communications building would be built east of the Clinton Station.

A moderate to high degree of change would occur in these areas, but viewer sensitivity is considered low to moderate in much of the area due to the industrial character of much of the development in the area, particularly along the UPRR tracks. The project has also refined its design to place the elevated pedestrian rail crossing closer to the new station, and has provided more details for the project’s circulation revisions. The reconfiguration of local streets and rail crossings, introduction of new stations, retaining walls, vegetated infiltration planters and water quality swales, and more track, poles, and overhead wires would not greatly alter the existing visual character of the neighborhood, and in several locations will improve the visual quality of the existing facilities. While the removal of existing structures and the creation of a larger transportation corridor from SE Grand Avenue to approximately SE Powell Boulevard would reinforce the separation between the south and north sides of the surrounding neighborhood, the project also introduces additional pedestrian-scale features, particularly at the rail crossings.

Viewer sensitivity would be higher near OMSI and the Portland Opera building, where pedestrians, patrons, trail users, recreationists, local employees, and other viewers would experience changes to existing views. As the light rail project moves into the Central Eastside Industrial District, viewer sensitivity is lower for commuters, residents, and businesses.

Overall, with a moderate to high degree of change and generally moderate sensitivity to changes in views, visual impacts would be moderate to high. The additional design efforts since the SDEIS have also provided more detail about visual amenities, such as new sidewalks and landscaping, that would be included as part of the project.

Visual impacts of the LPA Phasing Option would be the same as the LPA to Park Avenue except it would not include the development of a new pedestrian overcrossing of the UPRR at the Clinton Station. Deferring the pedestrian overpass would not alter the overall degree of change within the neighborhood or viewer sensitivity. The overall visual impacts would be the same as for the LPA Park Avenue.

Brooklyn Neighborhood

Beginning at SE Powell Boulevard, where the alignment runs along SE 17th Avenue, the existing streetscape would be redefined by the light rail project. The SE Powell Boulevard overcrossing would be rebuilt, including a new ramp to SE 17th Avenue. Industrial buildings would be removed for the new ramp and for the Rhine Station, redefining the edges of SE 17th Avenue. An existing pedestrian crossing over the UPRR would be removed and replaced with a new crossing a block north, connecting to the Rhine Station. SE 17th Avenue would be widened to accommodate light rail. TriMet has worked with the City of Portland to develop a design concept that improves the pedestrian scale and appearance of the street. The design includes widened sidewalks, street trees, lighting, and landscaping, including a landscaping strip for stormwater treatment. The trackway would run in the center of the street. In the sections between intersections, the center median would have curbs and the rail would be on rock ballast. The pattern of development along SE 17th Avenue would change as the street is widened to the west, removing buildings and reducing the scale of several parcels currently dedicated to parking. Removing structures along SE 17th Avenue would change foreground and middleground views for residents one block west of SE 17th Avenue by allowing views of the streetscape, station, and light rail facilities and the properties to the east. The wider sidewalks, street trees, and landscaping included in the project would help to improve the visual experience for these viewers, as well as for travelers along SE 17th Avenue.

Similar changes would occur approaching the Holgate Station, where a large building on the west side of SE 17th Avenue would be removed. A substation and communication building would be constructed north of SE Mall Street. South of SE Holgate Boulevard, widening SE 17th Avenue would change the streetscape. Buildings on the west side of the street would be removed, and other properties such as those with parking or open areas, would also be modified.

From SE 17th Avenue, the alignment would turn to the east toward SE McLoughlin Boulevard. Running the light rail on the west side of SE McLoughlin Boulevard would require removal of several manufacturing and storage buildings to widen the transportation corridor. Some of these buildings provide a visual buffer between the residential areas to the west of SE McLoughlin Boulevard and the rail and industrial uses on the east. A new bridge structure would cross SE Harold Street to avoid an at-grade crossing of a freight access roadway serving UPRR's Brooklyn rail yard.

The degree of change in the visual analysis unit would be moderate to high given the new stations, roadway widening, property displacement, limited screening of the adjacent neighborhood, and removal of vegetation as well as the replaced SE Powell Boulevard overcrossing.

Viewer sensitivity in most of this area is low to moderate due to the largely industrial and commercial uses along SE 17th Avenue and SE McLoughlin Boulevard. The adjacent residences on SE 16th Avenue and small businesses would be more sensitive to change, although most of their views are currently of the existing industrial and commercial uses and parking areas. Viewer sensitivity would be low for large numbers of travelers with short-term views of the alignment along SE Powell and SE McLoughlin boulevards.

Overall, the degree of change would be moderate to high and viewer sensitivity is generally low to moderate. While the project would reconfigure SE 17th Avenue and introduce stations, it will also provide an improved streetscape with landscaping, and the visual impacts to the Brooklyn neighborhood would be moderate.

Visual impacts of the LPA Phasing Option would be the same as the LPA to Park Avenue, except the LPA Phasing Option would not include the development of a new pedestrian overcrossing at the Rhine Station or a minor structural widening at the future Harold Station. These modifications would not significantly change the overall degree of change within the neighborhood or viewer sensitivity. The overall visual impacts would be the same as for the LPA Park Avenue.

SE McLoughlin Boulevard Visual Analysis Unit

Sellwood-Moreland Neighborhood

The light rail project follows the western edge of Eastmoreland, but would be visible from Sellwood-Moreland. The elevated structure and the future elevated Harold Station would be visible from SE McLoughlin Boulevard and the Sellwood-Moreland neighborhood, though the degree of change in this area would be low. This section of SE McLoughlin Boulevard is primarily industrial, with large industrial use buildings and heavy rail facilities visible to the north. The elevated light rail structure over SE Harold Street, as well as the future elevated Harold Station, would change visual features within an area dominated by industrial and transportation uses, removing some larger buildings and replacing them with the elevated facility and a future elevated station. This would alter some views into the rail yard, but also would replace some of the visual buffer provided by other buildings and structures that would be removed by the project.

Moving south, poles, overhead wires, and retaining walls would be seen against the existing vegetation screen bordering the Eastmoreland Golf Course and would partially obscure views of the clubhouse from SE McLoughlin Boulevard. The Bybee Station, including shelters, an equipment room, a communication building, fencing, retaining walls, stairs, elevators, and platform adjacent to SE McLoughlin Boulevard would create a moderate degree of change around the SE Bybee Boulevard overpass. The overpass structure would also be modified on the south side and along SE McLoughlin Boulevard to allow access to the station without requiring transit patrons to cross SE Bybee Boulevard.

From the west side of SE McLoughlin Boulevard, the light rail corridor would be somewhat visible to patrons of Westmoreland Park and residents on the eastern edge of the Sellwood-Moreland neighborhood. The scale, form, and pattern of development would not change. Light rail vehicles would be visible in the corridor, where now there are only UPRR rail tracks and trains. Views of the corridor would be filtered through existing vegetation and trees, as well as by the traffic on SE McLoughlin Boulevard. Overall the degree of change visible in the Sellwood-Moreland neighborhood would be low.

Viewer sensitivity would be low for large numbers of commuters with short duration views along SE McLoughlin Boulevard and for smaller numbers of recreationists and pedestrians with short duration views from the golf course and SE Bybee Boulevard overpass. Other viewers would be less sensitive to the new Bybee Station or changes to the overpass, since views are generally longer distance and currently dominated by the adjacent transportation uses.

Past the Bybee Station to the south, the light rail would rise on a retaining wall, reaching 20 feet in height before transitioning to a new bridge structure. A 20-foot by 250-foot vegetated stormwater facility would be constructed between SE McLoughlin Boulevard and the retaining wall and would provide some visual screening of the retaining wall. On the south end of the bridge structure, the light rail would descend on a retaining wall and cross underneath the SE Tacoma Street overpass. A new 108-foot-long bridge would be constructed to span Johnson Creek. A retaining wall ranging from 2 feet to 7 feet in height would be visible from SE McLoughlin Boulevard south of Johnson Creek.

Employees of businesses west of SE McLoughlin Boulevard would have middleground views of the Tacoma Station and Park-and-Ride. Viewers on the Springwater Corridor Trail to the south of the station would also see changes in their foreground views to the north. At three to four stories, the park-and-ride structure would be taller than surrounding development, but the structure would not be out of scale with other warehouse and industrial uses in the area. The Tacoma Station and Park-and-Ride could improve the visual environment by introducing an integrated site development for the area, providing visual and functional connections to adjacent properties, and landscaping, vegetation, lighting, and a more pedestrian focus.

Overall, the degree of change would be low, and visual sensitivity to the affected area of the Sellwood-Moreland neighborhood would be low, but could be moderate around the Bybee Station and the Tacoma Station. Visual impacts would be low to moderate.

Visual impacts of the LPA Phasing Option would be the same as the LPA to Park Avenue, except the LPA Phasing Option would not include the structural widening at the future Harold Station or the multi-floor parking structure at the Tacoma Station. These modifications would not change the overall degree of change within the neighborhood. The overall visual impacts would be low.

Eastmoreland Neighborhood

In the parkway portion of SE McLoughlin Boulevard, the light rail would run in an area that is within the UPRR corridor. A new bridge over Crystal Springs Creek would be constructed and would include retaining walls. The Bybee Station would be visible from the Eastmoreland Golf Course parking lot and clubhouse, although patrons on the course would be partially screened from the corridor by existing vegetation.

The primary change in the railroad corridor would be the materials used and the lighting levels at the Bybee Station. The light rail facilities in this railroad corridor would not substantially alter the existing visual environment, which is dominated by the rails, riprap, and grasses. The lighting levels required for the station would be visible from the Eastmoreland Golf Course parking lot, but would be less visible from other portions of the neighborhood. Trees are included in the design to screen the golf course parking lot from the station. Modification to the SE Bybee Boulevard overpass would include bus pullouts on new columns, but this modification would avoid altering Eastmoreland Golf Course property. Overall, the degree of change within the Eastmoreland neighborhood would be moderate.

Viewer sensitivity would be low to moderate throughout most of this neighborhood. The introduction of the light rail line along the east side of SE McLoughlin Boulevard would blend in with the existing scale and linear character of the corridor. Minimal changes to the visual environment would be seen only for short periods of time by large numbers of commuters and small numbers of pedestrians. Recreationists and residents living close to SE Bybee Boulevard would, however, have longer duration views of the modified overpass. These views could be moderate to highly sensitive if trees and shrubs were removed, or if the width and height of the overpass were increased or otherwise majorly altered. Neither the station nor the light rail would be visible to most travelers on SE Bybee Boulevard. Viewer sensitivity would be low for viewers along SE McLoughlin Boulevard.

Overall, the degree of change would be moderate, and viewer sensitivity would be moderate (low in most areas of the Eastmoreland neighborhood, but could be moderate to high around the SE Bybee Boulevard overpass). Visual impacts would be moderate.

Visual impacts of the LPA Phasing Option would be the same as the LPA to Park Avenue, except the LPA Phasing Option would not include widening the Bybee Bridge on the south for a bus pull-out or a second elevator at the Bybee Station. These deferrals would not alter the overall degree of change within the neighborhood or viewer sensitivity. The overall visual impacts would be the same as for the LPA to Park Avenue.

Ardenwald Neighborhood (includes Ardenwald-Johnson Creek)

After crossing Johnson Creek, the light rail project would curve to the southeast on a retaining wall reaching up to 7 feet in height, and intersections and driveways from SE Tacoma Street would be modified to provide access to the station. The Tacoma Station would include platforms, shelters, a park-and-ride, a substation building, a communication building, pedestrian connections, ramps, access roads, and associated poles, wires, signage, and landscaping, including stormwater plantings. An existing ramp from SE Tacoma Street would be widened to accommodate a pedestrian sidewalk on the west side of the ramp. South of the Tacoma Station, the light rail would turn to the south and run parallel, at grade, to the UPRR tracks. The alignment would cross under the existing Springwater Corridor Trail. Two industrial buildings would be removed. A retaining wall reaching up to 22 feet in height would transition to a bridge up to approximately 35 feet in height and 1,400 feet in length. The project would then cross to the east side of the UPRR Tillamook Branch line. The bridge would transition to a retaining wall on the south end and cross SE Mailwell Drive at grade. Since the SDEIS in 2008, TriMet has reduced potential visual impacts to the Ardenwald neighborhood by modifying the design of this bridge, including moving it west and shortening the length of the overall structure by two-thirds. Where the light rail tracks are at grade beside the UPRR Tillamook Branch line tracks, a six-foot safety wall would be constructed to the west of the project.

Development of the Tacoma Station, associated park-and-ride, and new bridge structures would result in a high level of change to the visual environment, introducing a new large structure, changing the pattern and character of development, removing landscaping, and introducing ramps, access roads, retaining walls, and pedestrian facilities. The changes would be in areas bordering the neighborhood but, because of topography, the station area is not highly visible to residential areas, and is located in an area dominated by industrial development and major transportation facilities. The Tacoma Station also provides opportunities to improve the visual environment by introducing vegetation, a pedestrian focus, and a new building into the area.

The sensitivity of travelers on SE McLoughlin Boulevard to the new station, park-and-ride, ramps, and retaining walls would be low to moderate for most viewers. Residents (between SE Roswell and SE Malcolm streets) east of the railroad tracks and SE McLoughlin Boulevard would see the light rail station, park-and-ride, retaining walls, and bridge crossing the UPRR tracks.

Overall, the degree of change would be high, the sensitivity of area viewers would vary by location but would be moderate, and visual impacts to the Ardenwald neighborhood would be moderate.

Visual impacts of the LPA Phasing Option would be the same as the LPA to Park Avenue, except the LPA Phasing Option would include a surface parking facility rather than the Tacoma Station multi-floor parking structure. Due to other light rail facilities and structures, including the guideway, street improvements, the station, and other features still occurring within the view of the neighborhood, the overall degree of change and viewer sensitivity would be similar to the LPA to Park Avenue. The overall visual impacts would remain moderate, as with the LPA to Park Avenue.

McLoughlin Industrial Neighborhood

Between the Tacoma Station and Highway 224, the project development in this industrial area would be as described above for the Ardenwald neighborhood. Viewer sensitivity would be low for employees and other viewers in the industrial area who would see the park-and-ride, light rail bridge spanning the UPRR Tillamook Branch line, and project elements such as poles and overhead wires for short durations of time. Travelers on SE McLoughlin Boulevard, as well as employees of the adjacent businesses, would have low sensitivity to the changes.

The light rail project would run at grade north of Highway 224. A retaining wall would be constructed, and the light rail alignment would drop below grade to cross under Highway 224. SE 26th Avenue would be realigned. Some vegetation would be removed on the northeast edge of Highway 224. Commuters along Highway 224 likely would not see the light rail and related retaining walls below. However, short duration views of the light rail overcrossing of the freight corridor would be visible by westbound travelers on Highway 224.

Overall, the degree of change would be moderate to high, but given the low viewer sensitivity, visual impacts would be low to moderate in the McLoughlin Industrial neighborhood.

Downtown Milwaukie Visual Analysis Unit

Historic Milwaukie Neighborhood

The light rail line would be located along an existing freight rail line throughout most of the Historic Milwaukie neighborhood (the neighborhood's name is from the City of Milwaukie, but does not designate the neighborhood as historic using federal criteria). Changes to visual resources include the introduction of the rail tracks, reconstruction of the at-grade crossings, intersection improvements, new crossing gates, stormwater quality facilities, and six-foot safety walls between the light rail and the railroad tracks in areas between intersections. The project would also have poles, wires, signage, and retaining walls parallel to the light rail line. While the existing rail right-of-way would not widen, construction of the retaining walls would remove some trees and vegetation. Two properties along the alignment would be acquired and their buildings removed. A substation would be constructed south of SE Monroe Street, and a communication building would be constructed north of SE Adams Street. The Lake Road Station would be constructed south of SE Adams Street and would include the platforms, shelters, retaining walls, and pedestrian connections from SE Lake Road. The degree of change in the Historic Milwaukie neighborhood would be moderate.

Residential and small commercial units surrounding the light rail alignment would be more sensitive to the gates, poles, wires, retaining walls, and safety walls. Travelers on SE Harrison, SE Monroe, and SE Washington streets would see the light rail elements as they travel from the east or west. The small businesses surrounding the Lake Road Station and travelers on local streets would be moderately sensitive to the new station and the bridge. Residences along SE Lake Road and bordering Kellogg Lake would be more sensitive to the new bridge, which would alter their views of a wooden rail trestle.

Viewer sensitivity would be moderate for those traveling by vehicle on streets crossing the alignment, and would be lower on SE McLoughlin Boulevard, given the short duration foreground views of trains, poles, and overhead wires. Viewer sensitivity would be moderate for pedestrians and local street users and businesses with longer duration views of poles, overhead wires, and trains within a commercial context. Viewer sensitivity would be high for residents located along the light rail alignment.

Overall, the degree of change would be moderate to high and viewer sensitivity would be moderate to high. Visual impacts to this portion of the Historic Milwaukie neighborhood would be moderate to high.

Southwest Milwaukie Visual Analysis Unit

Island Station Neighborhood

Views from this neighborhood south of downtown Milwaukie would include the light rail crossing of Kellogg Lake parallel to the existing Tillamook Branch line trestle. The bridge would be of a similar scale and height to most of that structure. The bridge would continue along the southern edge of Robert Kronberg Park and cross over SE McLoughlin Boulevard, with designs calling for a curved steel structure, which allows a more slender profile compared to a concrete structure. Here the alignment would curve southeast to run parallel with the west side of SE McLoughlin Boulevard. The light rail bridge requires the relocation of a section of an existing power transmission line that currently runs along SE McLoughlin Boulevard; the affected section is between the Tillamook Branch line and SE Bluebird Street. The line would be relocated to continue adjacent to the Tillamook Branch line, along existing right-of-way and an existing overhead utilities transmission corridor, and then would turn eastward at SE Bluebird Street to rejoin the existing transmission line corridor along SE McLoughlin Boulevard. Other existing poles and lines in the area will be consolidated, helping to reduce visual clutter compared to today. The relocated poles, which will be steel structures up to 6 feet in diameter and up to 90 feet tall, are of a similar height to the existing transmission facilities. Most of the land uses near these facilities are businesses, but there are some residences that will be near the new poles, typically across the street or backing to the existing transmission corridor.

South of SE Bluebird Street, the elevated structure descends on a retaining wall. The tracks would continue at grade, with the Trolley Trail (planned) to the west, toward the Park Avenue Station. The light rail project would remove mature trees and vegetation beside SE McLoughlin Boulevard and on the hillside. To accommodate light rail and the new trail, the project would require cutting into the hillside and constructing retaining walls, which would also remove trees and vegetation along part of the hillside, including on bordering private properties that would be partially or fully acquired by the project. Vegetation removal would alter the mature mixed vegetation that helps buffer the residential area from SE McLoughlin Boulevard. The degree of change to those residents would be high. Design concepts have been developed through a cooperative planning effort with Clackamas County, the trail owner, and include landscaping, a meandering pathway, and the use of terracing with additional vegetation along the hillside. These measures moderate the views for trail users and travelers on SE McLoughlin Boulevard, and also provide screening for residential viewers to replace lost vegetation. More detail is provided in Section 3.6, Parks and Recreational Resources.

Robert Kronberg Park users would have medium duration foreground views of the bridge support structure and underside of the track deck. Visual impacts of the structure also affect views of the existing railroad trestle, which is an historic resource discussed in more detail in Section 3.5. Northbound traffic on SE McLoughlin Boulevard would have greater duration views than southbound traffic due to the location of the existing railroad trestle and the curvature of SE McLoughlin Boulevard. Viewers traveling in vehicles would not have great sensitivity to a new structure, given the existing structure and the momentary views from vehicles. Several small commercial businesses on the west side of SE McLoughlin Boulevard would have foreground views of the elevated structure.

Residences with visual access to SE McLoughlin Boulevard would have long duration foreground views of the bridge and associated retaining structures, and their sensitivity would be high. A small number of residents with properties bordering SE McLoughlin Boulevard would also have high sensitivity.

Overall, the degree of change would be high and viewer sensitivity would be moderate to high. Viewer sensitivity for residents near the alignment and related facilities would be high. The visual impact to the Island Station neighborhood would be moderate to high.

Unincorporated Clackamas County/Oak Lodge

The light rail project would continue south to a new station and park-and-ride adjacent to SE McLoughlin Boulevard and SE Park Avenue, just inside the northern boundary of the Oak Lodge Community Planning Organization (Oak Lodge Community Council), within unincorporated Clackamas County. Two retail businesses and a vacant parcel would be replaced by the light rail project. A portion of SE Park Avenue would be modified for station and park-and-ride access improvements, including additional turn lanes and reconstructed sidewalks. An operator building, communication building, and a substation would be constructed to the west of station. The project would include a new elevated pedestrian crossing connecting the station to the new park-and-ride, access off of SE McLoughlin Boulevard, retaining walls, and landscaping including stormwater planters. There would also be a new traffic signal at SE Park Avenue and SE 27th Avenue to accommodate a trail crossing and an access driveway to the park-and-ride. The existing intersection of SE Park Avenue and SE McLoughlin Boulevard would be modified to provide a turn lane and to provide bus stops, including a bus pullout adjacent to the station. There would also be improvements to the intersection at SE Oatfield Road and SE Park Avenue, including signalization and widening approaching the intersection.

The park-and-ride structure would displace several commercial establishments, including a used car lot and several low, utilitarian-type buildings. The structure would be up to four stories on a sloped lot, and it would be taller than the current buildings that would surround it. Impacts to surrounding residents would be localized to immediately nearby properties, because the topography slopes up to the west, south, and east, effectively buffering views from residences located away from SE McLoughlin Boulevard. However, impacts to neighboring residences would be moderate to high given the scale of the structure.

Travelers on SE McLoughlin Boulevard would have low to moderate sensitivity to the tracks, station, and catenary wires; their sensitivity to the park-and-ride structure would be moderate due to its scale and to the varied scale and limited landscaping of current uses.

Overall, the degree of change would be high due to the displaced buildings and the park-and-ride structure. Viewer sensitivity would generally be moderate due to the auto-centric context of SE McLoughlin Boulevard, but bordering residential uses would be more sensitive to change. The visual impacts to unincorporated Clackamas County/Oak Lodge would be moderate to high due to the removal of existing trees and vegetation, the development of existing structures, and the light rail project.

Visual impacts of the LPA Phasing Option would be the same as the LPA to Park Avenue, except the LPA Phasing Option would include the Park Avenue Station with a smaller multi-floor parking structure, and would not include a pedestrian bridge between the station and the parking structure. The overall degree of change and viewer sensitivity would be slightly less than the LPA to Park Avenue. The overall visual impacts would be moderate.

<u>Minimum Operable Segment (MOS) to Lake Road</u>

The MOS to Lake Road would be the same as the LPA to Park Avenue between the Downtown Portland Visual Analysis Unit and the Downtown Milwaukie Visual Analysis Unit, but it would terminate at SE Lake Road. There it would require additional facilities in the station area to support its operation as an initial terminus, including the multistory park-and-ride structure associated with the Lake Road Station in the Historic Milwaukie neighborhood, roadway improvements, and an operator's building. However, there would not be a new bridge across Kellogg Creek associated with the MOS to Lake Road. More transit-related facilities would be visible and the project footprint would be larger in the Historic Milwaukie neighborhood. Additionally, there would be increased park-and-ride capacity with a larger park-and-ride structure at the Tacoma Station in the Ardenwald neighborhood.

Visual impacts in the Ardenwald neighborhood would be consistent with the LPA to Park Avenue. With the changes outlined above associated with the SE Lake Road terminus, the degree of change in the Historic Milwaukie neighborhood would be moderate to high and the overall impacts would be moderate to high. The MOS to Lake Road would not continue into the Southwest Milwaukie Visual Analysis Unit, the Island Station neighborhood, or unincorporated Clackamas County/Oak Lodge. Other than as noted above, the impacts are similar to those described for the LPA to Park Avenue. Potential long-term impacts of the MOS to Lake Road alignment are summarized in Table 3.4-2.

Related Facilities

Related Bridge Area Transportation Facilities

Implementation of the Related Bridge Area Transportation Facilities has the potential to cause several types of visual impacts, including:

- Alteration of neighborhood pattern and scale
- Manipulation or removal of existing landforms, vegetation, roadway elevations, and structures

The most prominent visual impact associated with the these improvements would be the increased elevation and retaining walls associated with the SW Moody Avenue reconstruction in the South Waterfront District, although this is expected to be temporary because in the long term the South Waterfront buildings are expected to provide street accesses level with the reconstructed roadway. Similar improvements are planned in the Central Eastside Industrial District, where SE Water Avenue would be reconstructed and a revised streetcar station and a streetcar connection to the transitway would be built. These transportation facilities would change streetscapes, altering views from the adjacent buildings, bridges, and nearby roadways. The existing relationship between the street and the buildings would also change. It is possible that views toward the Willamette River would be enhanced by the elevated perspective. Given that much of the South Waterfront District area is undeveloped, these impacts are considered minor. On the east side of the river, the improvements could improve the pedestrian environment and help introduce a human scale to an environment more traditionally dominated by industrial, freight, and rail activities. Potential long-term impacts of these facilities are summarized in Table 3.4-2.

Ruby Junction Maintenance Facility

The expansion of the Ruby Junction Facility will enlarge the footprint and facilities of an existing large industrial use, and will require the removal of a number of small single-family homes and other uses nearby, as well as some areas with existing landscaping and vegetation.

The overall area includes a mix of undeveloped tracts and industrial two-story box buildings with parking lots. The maintenance facility will continue to have the character of an industrial facility, with open areas and minimal landscaping, consistent with the industrial uses permitted in this area. While this would be a moderate degree of change, overall visual impacts resulting from this expansion are expected to be low because of the general consistency of the expanded facility with industrial uses, taken with the limited number of viewers with sensitivity to the change, particularly as residential uses are removed.

Visual impacts of the phased Ruby Junction expansion would involve less change but more residential and business viewers would remain in the vicinity. The development of some track, internal roadway, parking facilities, and other structures would be deferred. The character of the facility would continue to be consistent with the industrial uses permitted in the area. The degree of change would be similar to the changes associated with the LPA to Park Avenue. Sensitivity would be moderate because of the remaining residence and businesses, although the existing environment is already highly fragmented by a variety of uses. The overall visual impacts would be moderate.

Table 3.4-2
Summary of Potential Visual Quality and Aesthetic Impacts of the Portland-Milwaukie Light Rail Project

Alternative	Visual Analysis Unit	Neighborhood/ Geographic Area	Changing Features Visible from or within Neighborhood/Geographic Area (In Addition to Rails and Overhead Catenary System)	Viewer Sensitivity (H = High; M = Moderate; L = Low)	Degree of Change	Overall Score: Degree of Change Plus Viewer Sensitivity
LPA to Park Ave.	Downtown Portland	Portland Central City	New features within the neighborhood include: Lincoln Station; shared transitway overcrossing (SW Harrison St. connector, SW Harbor Dr., SW Moody Ave., and SW Sheridan St.); retaining walls; OCS spanwire poles; stormwater facilities; roadway/intersection reconfiguration and extension, and a communications building. Modified or replaced features include: street trees and landscaping. Removed features include: existing buildings.	M	H	M
LPA to Park Ave. (cont.)		South Waterfront and Willamette River	New features within the neighborhood/geographic unit include: shared transitway overcrossing (SW Sheridan St.); undercrossing (I-5 and I-405); abutments; retaining walls; OCS spanwire poles; fill/grading; South Waterfront Station; substation; communications building, and bridge with two 180-foot towers.	H	H	H

Table 3.4-2
Summary of Potential Visual Quality and Aesthetic Impacts of the Portland-Milwaukie Light Rail Project

Alternative	Visual Analysis Unit	Neighborhood/ Geographic Area	Changing Features Visible from or within Neighborhood/Geographic Area (In Addition to Rails and Overhead Catenary System)	Viewer Sensitivity (H = High; M = Moderate; L = Low)	Degree of Change	Overall Score: Degree of Change Plus Viewer Sensitivity
	Inner Eastside Portland	Hosford-Abernethy	New features within the neighborhood include: bridge with two 180-foot towers, OMSI Station; Clinton Station; retaining walls; crossing gates and signals; medians; sidewalk connections; stormwater facilities; substation; communications buildings; and fencing. Modified or replaced features include: lowering and reconstructing the eastside Willamette River Greenway Trail; landscaping; pedestrian overcrossings and associated stairs (deferred at the Clinton Station as part of the LPA Phasing Option), ramps, and protective screening; Oregon Pacific Railroad switching yard; roadway/intersection reconfiguration; and SE Powell Blvd. overcrossing and on- and off-ramps. Removed features include: existing buildings.	M	M-H	M-H
		Brooklyn	New features within the neighborhood include: Rhine Station; Holgate Station; Harold Structure will still be in the LPA Phasing Option but it won't be as wide (for future station); street trees, stormwater facilities; sidewalk connections; substation; and fencing. Modified or replaced features include: SE Powell Blvd. overcrossing and on- and off-ramps; pedestrian overcrossing and associated stairs, ramps, and protective screening (deferred at the Rhine Station as part of the LPA Phasing Option); building modifications; parking reconfiguration; roadway realignments; and intersection modifications. Removed features include: existing buildings.	L-M	M-H	M

Table 3.4-2
Summary of Potential Visual Quality and Aesthetic Impacts of the Portland-Milwaukie Light Rail Project

Alternative	Visual Analysis Unit	Neighborhood/ Geographic Area	Changing Features Visible from or within Neighborhood/Geographic Area (In Addition to Rails and Overhead Catenary System)	Viewer Sensitivity (H = High; M = Moderate; L = Low)	Degree of Change	Overall Score: Degree of Change Plus Viewer Sensitivity
LPA to Park Ave. (cont.)	SE McLoughlin Boulevard	Sellwood-Moreland	*No new features are within the neighborhood but are bordering.* New features visible from the neighborhood include: Bybee Station, stairs, and elevator; future elevated Harold Station and associated bridge structure (narrower with the LPA Phasing Option), Tacoma Station; 3- to 4-story park-and-ride (320-space surface parking facility lot as part of the LPA Phasing Option); retaining walls; bridges over Crystal Springs Creek; and elevated structure over Johnson Creek and SE McLoughlin Blvd. ramp. Removed features include: existing buildings and vegetation.	L-M (L*)	L	L-M
		Eastmoreland	New features within the neighborhood include: Bybee Station including stairs and elevators (one of two elevators deferred as part of the LPA Phasing Option); bridge over Crystal Springs Creek; retaining walls; elevated structure over SE McLoughlin Blvd. ramp; and stormwater facilities. Modified or replaced features include: new bus pullouts on the Bybee Bridge (southern pullouts deferred as part of the LPA Phasing Option). Removed features include: existing buildings and vegetation.	M	M	M
		Ardenwald (includes Ardenwald-Johnson Creek)	New features within or visible from the neighborhood include: Tacoma Station; 3- to 4-story park-and-ride (320-space surface parking facility as part of the LPA Phasing Option); retaining walls; stormwater facilities; elevated structure over Johnson Creek and SE McLoughlin Blvd. ramp; undercrossing of the Springwater Corridor Trail with retaining walls and new ramps; new sidewalk and stairway connections; safety walls; fencing; and elevated structure over Tillamook Branch line. Modified or replaced features include: road improvements/realignments and modifications to existing buildings.	M	H	M

Table 3.4-2
Summary of Potential Visual Quality and Aesthetic Impacts of the Portland-Milwaukie Light Rail Project

Alternative	Visual Analysis Unit	Neighborhood/ Geographic Area	Changing Features Visible from or within Neighborhood/Geographic Area (In Addition to Rails and Overhead Catenary System)	Viewer Sensitivity (H = High; M = Moderate; L = Low)	Degree of Change	Overall Score: Degree of Change Plus Viewer Sensitivity
LPA to Park Ave. (cont.)		McLoughlin Industrial	New features within the neighborhood include: undercrossing of the Springwater Corridor Trail with retaining walls and new ramps; new sidewalk and stairway connections; safety walls; fencing; structure over Tillamook Branch line; undercrossing of Highway 224 with retaining walls; and stormwater facilities. Modified or replaced features include: road improvements/realignments and removal or modifications to existing buildings. New features visible from the neighborhood include: Tacoma Station; 3- to 4-story park-and-ride (320-space surface parking facility as part of the LPA Phasing Option); and retaining walls.	L	M-H	L-M
	Downtown Milwaukie	Historic Milwaukie	New features within the neighborhood include: 6-foot safety walls; sidewalks; gate arms and cantilevers; fencing; stormwater facilities; a substation; a communication building; Lake Road Station; retaining walls; and an elevated structure over Kellogg Lake. Modified or replaced features include: sidewalk improvements and road modifications. Removed features include: an existing building.	M-H	M-H	M-H
	Southwest Milwaukie	Island Station	New features within the neighborhood include: elevated crossing of roadway (SE McLoughlin Blvd. and SE Bluebird St.) and Dogwood Park; retaining walls; and fencing. Modified or replaced features include: structural columns along SE McLoughlin Blvd., and power transmission lines and poles. Removed features include: vegetation.	M-H	H	M-H

Table 3.4-2
Summary of Potential Visual Quality and Aesthetic Impacts of the Portland-Milwaukie Light Rail Project

Alternative	Visual Analysis Unit	Neighborhood/ Geographic Area	Changing Features Visible from or within Neighborhood/Geographic Area (In Addition to Rails and Overhead Catenary System)	Viewer Sensitivity (H = High; M = Moderate; L = Low)	Degree of Change	Overall Score: Degree of Change Plus Viewer Sensitivity
LPA to Park Ave. (cont.)		Oak Lodge	New features within the neighborhood include: Park Avenue Station; 4-story park-and-ride and associated pedestrian stair and bridge over SE Park Ave. (355-space structural parking facility and no pedestrian bridge as part of the LPA Phasing Option); TriMet operator building; roadway and intersection improvements; stormwater facilities; fencing; retaining walls; roadway reconfiguration; and substation. Removed features include: buildings and vegetation.	M	H (M*)	M-H (M*)
MOS to Lake Rd.	Same as LPA to Park Ave. except that it would have a southern terminus at SE Lake Road. Additional impacts are noted below. No direct impacts from the project would occur in the Southwest Milwaukie Visual Analysis Unit.					
	SE McLoughlin Boulevard	Ardenwald	Modified features within the neighborhood include: increased park-and-ride size at Tacoma Station.	M	H	M
	Downtown Milwaukie	Historic Milwaukie	New features within the neighborhood include: structured park-and-ride at Lake Road Station.	M-H	M-H	M-H
Related Bridge Area Facilities	Downtown Portland	South Waterfront/ Willamette River	New features within the neighborhood include: regrading of SW Moody Ave. and retaining walls. Modified or replaced features include: roadway, sidewalk, and median reconfiguration; traffic signals; streetcar location; and landscaping.	H	H	H
	Inner Eastside Portland	Hosford-Abernethy	New features within the neighborhood include: retaining walls; landscaping; crossing gates; fencing; and streetcar structure. Modified or replaced features include: streetcar station; road reconfiguration; and landscaping.	M-H	H	M-H
Ruby Junction	Gresham	Rockwood	Expansion of an existing maintenance facility within an industrial area, requiring removal of nearby residences and smaller buildings.	L (M*)	L (L*)	L (M*)

* Rating with phasing option.

3.4.2.2 Short-Term Impacts (Construction)

Short-term impacts are related to construction. Construction in the project corridor would occur in stages over a period of up to several years, although any one location would likely experience construction activities that would be shorter. Construction is conducted in stages but begins with relocation of utilities, clearing, demolition, and regrading. These actions, some of which occur at night, remove existing visual features and create visual clutter. Construction equipment, trailers, workers' parking, construction materials, debris, lighting, and signage also change visual conditions in a corridor under construction. The areas affected could be larger than the permanent facility, in order to allow enough space for construction equipment and materials to be brought to the project. Where the project is permanently acquiring all or parts of adjacent parcels, demolition of existing structures may occur, and existing landscaping features or vegetation may be removed. The project may also require temporary construction easements for small strips of properties and in these locations landscaping features, walkways, driveways or vegetation could be affected.

3.4.3 Mitigation

Since the SDEIS, the project has developed additional design information and has identified design features and treatments that have helped minimize visual impacts compared to the SDEIS, although some visual impacts are unavoidable. In several areas, such as the Willamette River bridge, the project worked extensively with the City of Portland, advisory groups, and members of the public to develop a design proposal for an aesthetically pleasing bridge type that met the project's functional and affordability requirements. Throughout the project alignment, the project's design has considered opportunities to:

- Develop the alignment and other project-related facilities consistent with neighborhood pattern and scale
- Use project-related facilities to integrate vacant or unused areas into the neighborhood or to improve the visual character of neighborhood areas along the project corridor
- Buffer or reduce the loss of visual resources through use of street trees and/or landscaping as well as the thoughtful placement of other project elements
- Where possible, reduce obstructions or limitations to designated views, view corridors, viewpoints, and important neighborhood features affected by the project

Strategies for minimizing impacts to locations with high levels of long-term visual impacts include:

- Refinement of the design of bridge, ramps, and overhead structures to match scale and character of existing environment as much as practicable, sometimes referred to as context-sensitive design
- Use of elements such as landscaping or fencing to provide a buffer between the project and the neighborhood where impacts are high
- Replacement or restoration of removed vegetation and landscaping where possible
- Consideration of neighborhood plan recommendations related to visual and aesthetic concerns
- Creation of redevelopment opportunities or community places consistent with the established features of the surrounding area by making surplus land not required for the project available

Final design efforts will further explore opportunities to improve the visual character of impacted areas or locations where viewer sensitivity is high and the light rail facilities are prominent. In other areas, some project elements will constitute a major visual feature, and even with mitigation will affect visual resources and sensitive viewers. Some of the high visual impacts may be unavoidable, particularly where larger structures are introduced. Major new structures are needed in order to cross physical barriers in the project corridor, such as the Willamette River, or to avoid other facilities such as the existing freight and passenger rail lines or SE McLoughlin Boulevard.

Mitigation Commitments

The following areas were identified as having moderate to high impacts: South Waterfront and Willamette River, Hosford-Abernethy, Historic Milwaukie, Island Station (LPA to Park Avenue only), and Oak Lodge (LPA to Park Avenue only). In these locations, TriMet will continue to work during final design in coordination with local jurisdictions and neighborhood representatives to review further opportunities to minimize impacts through the use of design features and other measures to develop project elements that minimize effects to neighborhood scale and character. This includes working with the City of Portland's design review process, and with the City of Milwaukie Design and Landmarks Committee.

3.5 HISTORIC, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

This section identifies potentially significant historic, archaeological, and cultural resources in the Portland-Milwaukie Light Rail Project's Area of Potential Effect (APE), and identifies impacts and mitigation for the project.

Section 106 of the National Historic Preservation Act of 1966 requires that federally assisted projects take into consideration project effects on historic districts, sites, buildings, structures or objects, and archaeological sites or districts listed in or eligible for inclusion in the National Register of Historic Places (NRHP). Federal agencies must coordinate with the State Historic Preservation Office (SHPO) before undertaking projects that affect significant resources. The procedures for meeting the Section 106 requirements are defined in 36 CFR 800. The Advisory Council for Historic Preservation (ACHP) has also established procedures for the protection of historic and cultural properties that are in, or determined to be eligible for inclusion in, the NRHP (36 CFR 800), and when there are adverse effects, ACHP is invited as a consulting party. In addition, there are Oregon statutes that protect archaeological sites on both private and public lands. A Section 106 review also considers the City of Portland Historic Landmarks Commission requirements and the City of Milwaukie historic resource inventory and preservation ordinances. A separate federal regulation known as Section 4(f) restricts uses or adverse impacts of historic properties except under certain circumstances; these exceptions include a "*de minimis*" determination where only minor effects would occur. For further discussion of Section 4(f) requirements and findings, see Section 3.17 and Appendix K, Final Section 4(f) Evaluation.

The analysis, documentation, and coordination being conducted to satisfy Section 106 requirements for the Portland-Milwaukie Light Rail Project continue efforts that were conducted for the *Portland-Milwaukie Light Rail Project SDEIS, South-North Corridor Project DEIS*, and the *South Corridor SDEIS*. Additional details on the methods, coordination, and analysis used are available in the *Historic, Cultural and Archaeological Resources Results Report* (Metro 2010).

The project team conducted an inventory of resources in the APE, which has been defined as being the area within one-half block in each direction from the alignment within the Portland and Milwaukie downtown areas or areas with a similarly defined grid street pattern. In areas outside a defined grid street pattern, the APE extends approximately one block or 150 feet in each direction from the study alternatives. A wider area of effect was used for the proposed new Willamette River crossing because of the potential height and scale of that structure. For the new bridge across the Willamette River, the APE was 1,000 feet wide, centered on a midpoint of the proposed crossing alignment. The APE was expanded for the FEIS to include a 50-foot buffer surrounding areas around intersections or streets being improved and around full property acquisitions, staging areas, and other ancillary facilities, and to encompass modifications to the Union Pacific Railroad (UPRR) and Oregon Pacific Railroad (OPR) tracks for safety and to maintain operations for railroads in the project area.

FTA consulted with tribal nations, including the Confederated Tribes of the Grand Ronde Community of Oregon, Confederated Tribes of the Siletz Indians, Confederated Tribes of the Warm Springs Reservation of Oregon, the Cowlitz Indian Tribe, and a non-federally recognized tribe, the Chinook Indian Tribe. Consultations included correspondence and meetings with tribes as the SDEIS began development in August 2007, further invitations to discuss or comment on findings of the SDEIS in May and June 2008, and additional contacts and correspondence in December 2009 and February 2010. Additional information is provided in Appendix A.

3.5.1 Affected Environment

3.5.1.1 Historic Resources

There are 53 historic properties within the APE that meet the NRHP criteria of eligibility. To determine which properties meet the NRHP criteria, the project reviewed more than 80 potential historic resources in the SDEIS, and then reviewed an additional 61 buildings that were identified within an updated APE. The APE was updated to reflect additional preliminary engineering information available since the SDEIS, which included areas adjacent to the light rail alignment, including where related facilities or construction activities would occur, including around improved intersections, and near natural resource mitigation, or other facilities. The NRHP criteria for historic properties include:

- Criterion A. The property is associated with events that have made a significant contribution to the broad patterns of our history.
- Criterion B. The property is associated with the lives of persons significant in our past.
- Criterion C. The property embodies distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D. The property has yielded, or may be likely to yield, information important in prehistory or history. This criterion is generally associated with archaeological resources.

To be eligible, properties that qualify under one or more of the criteria must retain integrity of design, materials, feeling or setting. One building previously discussed in the 2008 SDEIS for the project, the State Highway Division Office and Garages at 9002 SE McLoughlin Boulevard, Milwaukie, is no longer in the APE. The NRHP-eligible resources are listed in Table 3.5-1. Sixteen of the properties were previously studied in the SDEIS, and SHPO concurred on the eligibility and findings. The remaining properties were identified after project refinements extended the APE, and FTA submitted additional information to the SHPO to reach concurrence on the determinations of eligibility and findings of effect. Figure 3.5-1 shows the locations of all properties.

3.5.1.2 Archaeological Resources

Seven archaeological sites have been recorded within the project APE. Six archaeological resources were previously recorded and one archaeological resource was recorded as part of the current project. Five of these resources either have been previously removed and will not be impacted by the project or have been determined not eligible for inclusion in the NRHP. The sixth resource is located within the project APE in Milwaukie and has not been evaluated for NRHP eligibility; current project designs indicate that the archaeological site may be impacted by construction activities; archaeological monitoring is recommended at that location. The seventh site, recorded as part of the current project, needs additional testing in order to complete a recommendation of its eligibility for listing in the National Register. Six additional archaeological sites containing historic-period and/or prehistoric materials have been recorded near the project area.

There are also locations along the corridor that have the potential to contain significant archaeological resources. The project inventory identified areas with high probabilities for encountering archaeological resources. The probability reflects available information about other known resources that may be nearby, as well as areas that are typically associated with the presence of Native American and historic-period Euroamerican archaeological sites. The project has conducted additional field surveys and assessments to assist in determining the likelihood that a significant archaeological resource is present in an area that could be disturbed by the project.

Table 3.5-1
Historic Resources and Effects

Map ID #	Address	Name/Type	Date Built	NRHP Status [1]	4(f) Status [2]	No-Build	LPA to Park Ave. [3]	MOS to Lake Rd.	Related Facilities: Related Bridge Area Facilities	Related Facilities: Ruby Junction [3]
1	2000 SW 5th Ave., Portland	Portland State University School Building	1965	Eligible	No use	No effect	Right-of-way (ROW) acquisition Not Adverse	ROW acquisition Not Adverse	Not Applicable	Not Applicable
2	2000 SW 1st Ave., Portland	Portland State University Building	1965	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
3	3121 SW Moody Ave., Portland	Zidell Companies industrial complex	Circa 1916	Eligible	No use	No effect	No effect	No effect	No effect	Not Applicable
4	3325 SW Moody Ave., Portland	industrial building	Circa 1951	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
5	2001 – 2011 SW 6th Ave., Portland	apartment	1902	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
6	2021- 2027 SW 6th Ave., Portland	apartment	Circa 1880	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
7	525 SW Jackson St., Portland	residence	1894	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
8	614 SW Jackson St., Portland	apartment	Circa 1928	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
9	1200 SW Naito Parkway, Portland	Hawthorne Bridge	1910	Eligible	No use	No effect	Indirect visual Not Adverse	Indirect visual Not Adverse	Not Applicable	Not Applicable
10	600 SE Powell Blvd.	Ross Island Bridge	1926	Eligible	No use	No effect	Indirect visual Not Adverse	Indirect visual Not Adverse	Indirect visual Not Adverse	Not Applicable
11	2425-2445 SE 8th Ave.	Royal Foods Warehouse & Office	1957	Eligible	Use	No effect	Full acquisition ADVERSE	Full acquisition ADVERSE	Not Applicable	Not Applicable
12	4784 SE 17th Ave.	Iron Fireman Building (now PECO Warehouse)	1927-28	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable

Table 3.5-1
Historic Resources and Effects

Map ID #	Address	Name/Type	Date Built	NRHP Status [1]	4(f) Status [2]	No-Build	LPA to Park Ave. [3]	MOS to Lake Rd.	Related Facilities: Related Bridge Area Facilities	Related Facilities: Ruby Junction [3]
13	2505 SE 11th Ave.	Ford Motor Assembly Plant	1914	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
14	619-627 SE Division Pl., Portland	industrial building	1959	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
15	OPR between SE 4th Ave., SE Caruthers St., and SE Water Ave., Portland	OPR Switching Yard	1900 Various dates	Eligible	De minimis use	No effect	ROW acquisition Moving some tracks Not Adverse	ROW acquisition Moving some tracks Not Adverse	ROW acquisition Moving some tracks Not Adverse	Not Applicable
16	1735 SE Franklin St., Portland	residence	Circa 1900	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
17	1528 SE Holgate Blvd., Portland	residence	Circa 1928	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
18	1534 SE Holgate Blvd., Portland	residence	Circa 1915	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
19	3330 SE 16th Ave., Portland	residence	Circa 1910	Eligible	No use	No effect	Indirect visual Not Adverse	Indirect visual Not Adverse	Not Applicable	Not Applicable
20	3338 SE 16th Ave., Portland	residence	Circa 1910	Eligible	No use	No effect	Indirect visual Not Adverse	Indirect visual Not Adverse	Not Applicable	Not Applicable
21	4038 SE 16th Ave., Portland	residence	Circa 1925	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
22	4244 SE 16th Ave., Portland	residence	Circa 1925	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
23	4326 SE 16th Ave., Portland	residence	Circa 1924	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
24	4414 SE 16th Ave., Portland	residence	Circa 1925	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
25	4806 SE 16th Ave., Portland	residence	Circa 1913	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
26	4816 SE 16th Ave., Portland	residence	Circa 1913	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
27	4904 SE 16th Ave., Portland	residence	Circa 1913	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable

Table 3.5-1
Historic Resources and Effects

Map ID #	Address	Name/Type	Date Built	NRHP Status[1]	4(f) Status[2]	No-Build	LPA to Park Ave.[3]	MOS to Lake Rd.	Related Facilities: Related Bridge Area Facilities	Related Facilities: Ruby Junction[3]
28	4914 SE 16th Ave., Portland	residence	Circa 1913	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
29	1635 SE Rhone St., Portland	residence	Circa 1926	Eligible	No use	No Effect	Partial ROW acquisition and noise Not adverse	Partial ROW acquisition and noise Not adverse	Not Applicable	Not Applicable
30	1625 SE Rhone St., Portland	residence	Circa 1913	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
31	7605 SE McLoughlin Blvd., Portland	Westmoreland Park	1937-1939	Eligible	Use	No effect	Duck pond for wetland mitigation ADVERSE	Duck pond for wetland mitigation ADVERSE	Not Applicable	Not Applicable
32	2425 SE Bybee Blvd., Portland	Eastmoreland Golf Course	1916	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
33	3236 SE Johnson Creek Blvd., Portland	residence	Circa 1936	Eligible	No use	No effect	Intersection improvement No effect	Intersection improvement No effect	Not Applicable	Not Applicable
34	5424 SE McLoughlin Blvd. between SE Rhone St. and SE Harold St., Portland	UPRR Brooklyn Yard	1912 – 1946	Eligible	De minimis	No effect	ROW acquisition and ca. 1966 freight office to be acquired Not Adverse	ROW acquisition and ca. 1966 freight office to be acquired Not Adverse	Not Applicable	Not Applicable
35	2535 SE Monroe St., Milwaukie	residence	Circa 1905	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
36	2606 SE Monroe St., Milwaukie	residence	Circa 1925	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
37	2607 SE Monroe St., Milwaukie	residence	Circa 1915	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
38	2206 SE Washington St., Milwaukie	R. Derwey House	1925	Eligible	Use	No effect	ROW acquisition/ visual and setting ADVERSE	ROW acquisition/ visual and setting ADVERSE	Not Applicable	Not Applicable

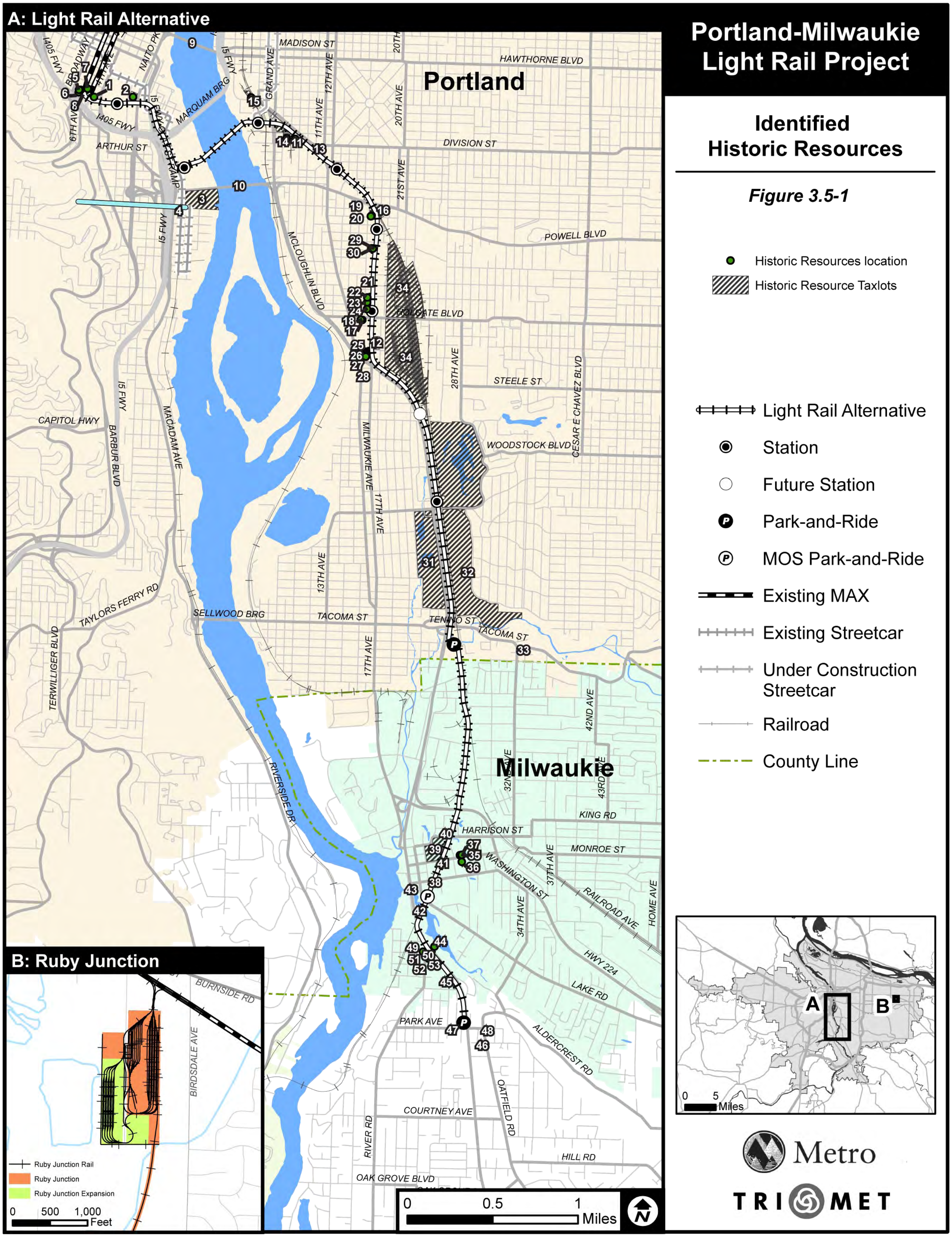
Table 3.5-1
Historic Resources and Effects

Map ID #	Address	Name/Type	Date Built	NRHP Status [1]	4(f) Status[2]	No-Build	LPA to Park Ave.[3]	MOS to Lake Rd.	Related Facilities: Related Bridge Area Facilities	Related Facilities: Ruby Junction[3]
39	2300 SE Harrison St., Milwaukie	Milwaukie Middle School (now Portland Waldorf School)	1937	Eligible	No use	No effect	Indirect visual Not Adverse	Indirect visual Not Adverse	Not Applicable	Not Applicable
40	2405 SE Harrison St., Milwaukie	Residence	1916	Eligible	No use	No effect	Indirect visual and noise Not Adverse	Indirect visual and noise Not Adverse	Not Applicable	Not Applicable
41	2326 SE Monroe St., Milwaukie	Spanish Revival Residence	1928	Eligible	De minimis	No effect	ROW acquisition and noise Not Adverse	ROW acquisition and noise Not Adverse	Not Applicable	Not Applicable
42	UPRR between SE Caruthers St. near OMSI to Milwaukie by Kellogg Lake Park	Tillamook Branch line and UPRR & trestle	1912	Eligible	De minimis	No effect	Partial ROW acquisition on railroad ROW Indirect visual to trestle Not Adverse	Partial ROW acquisition on railroad ROW Not Adverse	Not Applicable	Not Applicable
43	Approx. 11205 SE McLoughlin Blvd., Milwaukie	Kellogg Lake outlet	1930	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
44	12006 SE McLoughlin Blvd., Milwaukie	Birkemeier-Sweetland House	1878	Eligible	No use	No effect	No effect	Not effect	Not Applicable	Not Applicable
45	12320 SE 25th Ave., Milwaukie	residence	Circa 1900	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
46	13003 SE Oatfield Rd., Milwaukie	residence	Circa 1927	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
47	2616 SE Park Ave., Milwaukie	residence	Circa 1930	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
48	3020 SE Park Ave., Milwaukie	residence	Circa 1935	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
49	12025 SE River Rd., Milwaukie	residence	Circa 1925	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable

Table 3.5-1
Historic Resources and Effects

Map ID #	Address	Name/Type	Date Built	NRHP Status [1]	4(f) Status [2]	No-Build	LPA to Park Ave. [3]	MOS to Lake Rd.	Related Facilities: Related Bridge Area Facilities	Related Facilities: Ruby Junction [3]
50	12108 SE River Rd., Milwaukie	residence	Circa 1930	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
51	2311 SE Wren St., Milwaukie	residence	Circa 1938	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
52	2313 SE Wren St., Milwaukie	residence	Circa 1953	Eligible	De minimis	No effect	Partial acquisition and noise Not Adverse	Not Applicable	Not Applicable	Not Applicable
53	2316 SE Wren St., Milwaukie	residence	Circa 1922	Eligible	No use	No effect	No effect	No effect	Not Applicable	Not Applicable
Total	53									

[1] Determined eligible for inclusion in the National Register of Historic Places, with SHPO concurrence.
[2.] Use involves a direct impact or acquisitions; *de minimis* use involves an impact determined by FTA to be minor.
[3.] Including LPA Phasing Option.



December 2009

An area where there is a reasonable expectation that a significant archaeological site may be present is noted as having a high probability. Thirty-one high probability areas for the presence of Native American and historic-period Euroamerican archaeological sites were identified within the APE. The areas include the following:

- Five high probability areas (HPA-1, HPA-2, HPA-20, HPA-21, HPA-22) are in downtown Portland; one is near a recorded archaeological site that is outside of the project APE, three for historic archaeological resources are located along SW Lincoln Street where the corridor is wider than the historic-period street, and the other high probability area is associated with a work space where a significant archaeological site, now removed, was previously recorded.
- Two additional high probability areas (HPA-9 and HPA-10) are positioned where the alignment transitions between downtown Portland and the South Waterfront area.
- Three high probability areas are located on the east side of the Willamette River near the waterfront. One of these high probability areas (HPA-3) is located near a recorded archaeological site on the east side of the Willamette River. There is an additional high probability area (HPA-11) located between the UPRR and OPR rail facilities. The third high probability area (HPA-23) that is near these locations is found between SE Water Avenue and SE 2nd Avenue.
- Five high probability areas (HPA-24, HPA-25, HPA-26, HPA-27, and HPA-28) are located along the proposed alignment in the outer neighborhoods of Portland and Milwaukie at locations where historic-period residences were formerly located.
- Two high probability areas (HPA-4 and HPA-5) were previously noted as part of the *South Corridor Project SDEIS*. They are in the vicinity of Crystal Springs Creek and Johnson Creek.
- A high probability area (HPA-8) near SE McLoughlin Boulevard exists where the project will pass through an area recorded as a former historic brick factory.
- An additional high probability area is located within Westmoreland Park (HPA-12) and would be related to a wetland mitigation site for the project.
- One high probability area (HPA-29) is defined in the vicinity of Crystal Lake in the northern portion of the city of Milwaukie.
- Four high probability areas (HPA-6, HPA-7, HPA-16, and HPA-31) are located north and south of Kellogg Lake.
- Three high probability areas (HPA-13, HPA-14, and HPA-15) for historic archaeological resources are within downtown Milwaukie.
- A high probability area (HPA-30) was also identified near the intersection of SE McLoughlin Boulevard and SE Park Avenue in Milwaukie.
- Three high probability areas (HPA-17, HPA-18, and HPA-19) are within the APE of the Ruby Junction Facility. There are two identified sites containing prehistoric and historic-period archaeological resources in the vicinity. Maps indicate that a marsh was once present, and several areas within the expansion area do not appear to have been previously disturbed. A section of a historic railroad alignment is also within the APE. This resource has been determined not eligible for listing in the NRHP.

Full identification and evaluation of archaeological resources within some of the designated high probability areas is practically and logistically restricted due to factors such as property-owner consent or active use of areas, such as buildings, parking lots, or roads. For areas where access is limited by these factors, archaeological assessment will be completed immediately before or during construction at locations where construction activities may impact buried archaeological deposits.

Archaeological pedestrian survey and subsurface testing have been conducted within 6 of the 31 high probability areas identified within the project APE. These six high probability areas (HPA-6, HPA-7, HPA-12, HPA-16, HPA-17, and HPA-18) were not covered in pavement, capped by a building, or prohibited from access by the landowner at the time of the archaeological work. Archaeological fieldwork was conducted within these areas where there was access to the mineral ground surface in order to determine whether archaeological resources were present within the area and whether additional archaeological work such as testing or monitoring should occur. The results of the fieldwork are discussed below and summarized in the *Historic, Archaeological and Cultural Resources Results Report*, with further detail on file with the SHPO and FTA.

An archaeological pedestrian survey was conducted within HPA-6, HPA-7, HPA-12, HPA-16, HPA-17, and HPA-18. Archaeological shovel testing was also conducted at each of these locations, except for HPA-12, where pedestrian survey indicated that no additional work was needed. No archaeological materials or deposits were encountered in any of the high probability locations except for HPA-6, where a shallow, disturbed archaeological site was found. Because intact archaeological deposits may be found within this site, additional archaeological work is recommended to determine the site's eligibility for listing in the NRHP. Additional archaeological work is recommended at HPA-7, of the other five high probability areas within which fieldwork was conducted, in the area where deep fill was found capping the location and where the possibility that subsurface archaeological deposits are present at the location was not able to be assessed.

As a result of the archaeological investigations that have been conducted for the project thus far, four high probability areas have been investigated and found not to contain significant archaeological resources. Of the original 31 high probability areas identified, 27 areas are still considered to have a high probability for containing significant archaeological resources. Archaeological investigations at these locations will occur immediately before or during construction activities at the areas. The procedures and protocols the project will use for further investigations are described in more detail in Section 3.5.5, Mitigation Measures, and include an Inadvertent Discovery Plan that stipulates how the project will proceed if sensitive archaeological resources are encountered.

3.5.2 Environmental Impacts

3.5.2.1 Historic Resources

Of the 53 NRHP-listed or NRHP-eligible historic resources, up to 3 would experience adverse effects because of the light rail project. The NRHP-listed or NRHP-eligible historic resources and the project impacts on those properties are described in Tables 3.5-1 and 3.5-2.

Table 3.5-1 identifies the specific resources affected. The range of effects for the Portland-Milwaukie Light Rail Project alternatives is provided in Table 3.5-2 and summarized on the next page.

Table 3.5-2
Summary of Adverse Effects

Alternatives and Related Facilities	Properties with Identified Historic Resources	Historic Resources with Expected Adverse Effects
No-Build	0	0
LPA to Park Ave.[1]	53	3
MOS to Lake Rd.	44	3
Related Facilities		
Related Bridge Area Facilities	2	0
Ruby Junction[1]	0	0
Total (range)	46 – 55	3

[1] Including LPA Phasing Option.

No-Build Alternative

No adverse effects to historic resources are expected to occur with the No-Build Alternative.

Locally Preferred Alternative (LPA) to Park Avenue

Of the 53 NRHP-eligible historic resources identified that are located within the APE of the Portland-Milwaukie Light Rail Project, 37 would have no effects from the LPA to Park Avenue, 12 to 13 would have no adverse effects (one of these is counted under the MOS to Lake Road only), and 3 would have adverse effects. These effects are the same with the LPA Phasing Option. The three adversely affected resources are:

- Royal Foods Warehouse at SE 8th Avenue in Portland, which was built in 1957 and is considered NRHP-eligible for its architectural merit. The distinctive qualities of the architecture include the fenestration patterns consisting of vertical windows arranged in a horizontal pattern, the use of glass block interwoven with brick surfaces, and the cantilevered overhang on the second level of the front façade. This building illustrates the blending of traditional features, such as materials, with the mid-century modern streamlined forms. The project would require the full acquisition of the property and full demolition of the building. It is considered a Section 4(f) use, as discussed in Section 3.17 and Appendix K.
- Westmoreland Park at 7605 SE McLoughlin Boulevard, which was constructed in 1937–39 as a City of Portland park and is considered to be an NRHP-eligible Historic District for its contribution as a major recreational facility in Portland and its relationship to the Depression-era Works Progress Administration (WPA) program. The park was built in conjunction with the completion of SE McLoughlin Boulevard and was one of Portland's largest WPA projects. The project and the City of Portland Parks Bureau would modify the existing duck pond into a functioning riparian wetland as a wetland mitigation site. While this would be an ecosystem improvement, the visual change from pond to riparian wetland was determined an adverse effect by the SHPO in a project proposed by the City of Portland in 2003. The NRHP-eligible

Westmoreland Historic District would remain NRHP-eligible even though the duck pond would be converted to a wetland; this is still considered a Section 4(f) use.

- R. Derwey House at 2206 SE Washington Street, which was built in 1925. This Dutch Colonial style house was developed by a well-known Milwaukie jeweler and watchmaker named R. Derwey. It is architecturally significant as the best known example of a Dutch Colonial house in Milwaukie. The project would require the acquisition of land along the west side to within approximately 10 feet of the historic house. It is considered a Section 4(f) use.

The LPA to Park Avenue also requires the use of sections along the historic UPRR/Tillamook Branch line right-of-way, and would build a structure parallel to the existing tracks, including the Kellogg Lake trestle near downtown Milwaukie. The SDEIS analysis had concluded that the introduction of the new structure beside the trestle would change views of the trestle and would constitute a change in setting of the resource, resulting in a finding of adverse effect. However, as the project continued to be developed, FTA, TriMet, and Metro continued to coordinate with the SHPO to review the previous finding, since the project is avoiding direct alteration of the rail facility. The project provided additional information to the SHPO to support a finding of no adverse effect, because the primary characteristics of setting were being preserved by the project.

The project features several other railroad crossings and alignment sections involving the use of railroad right-of-way, including along the UPRR, as well as a crossing of a local railroad known as the Oregon Pacific Railroad, or OPR. The project's actions include changing elements of the railroad properties by relocating some of the tracks and removing a non-historic building in the UPRR Brooklyn Yard, but the project would not affect the characteristics for which the railroads are eligible for listing in the NRHP.

The other NRHP-eligible buildings in the APE not adversely affected could experience some secondary effects to their settings, such as the introduction of visual intrusions or the removal of existing landscape elements. These effects would not be considered substantial and would not render the properties ineligible for listing in the NRHP. Additional information is available in the *Historic, Cultural and Archaeological Resources Results Report* (Metro 2010).

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road has the same adverse effects to three properties as the LPA to Park Avenue, including the Royal Foods Warehouse, Westmoreland Park, and the R. Derwey House. The MOS to Lake Road avoids visual impacts to the Kellogg Lake trestle, and its APE does not extend south of downtown Milwaukie, where nine additional historic resources are located.

Related Facilities

Related Bridge Area Transportation Facilities

Two eligible historic resources, including the Ross Island Bridge and a large marine industrial property owned by the Zidell Companies, were identified in or near this segment of the project, but the project would have no effect on these resources.

Ruby Junction Maintenance Facility

No historic resources were identified for the Ruby Junction Facility expansion.

3.5.2.2 Archaeological Resources

No-Build Alternative

There would be no direct long-term impacts to historic-period or Native American archaeological sites with the No-Build Alternative. There is the potential for indirect effects to unidentified archaeological resources due to development of other transportation projects that would still occur even if the light rail project were not developed. These potential indirect effects cannot be quantified.

Locally Preferred Alternative (LPA) to Park Avenue

The LPA to Park Avenue (including with the LPA Phasing Option) will intersect the locations of five previously recorded archaeological resources, one recently recorded archaeological resource, and 25 high probability areas recommended for additional archaeological work. Four of the previously recorded resources either have been removed and will not be impacted by the project, or the recorded portions of them have been evaluated and determined to be not eligible for inclusion in the NRHP. The fifth recorded archaeological resource has not been evaluated for NRHP eligibility and is located within a portion of the proposed alignment near SE McLoughlin Boulevard in Milwaukie that may be impacted by the project, according to current construction plans. Archaeological monitoring is recommended during construction activities in the vicinity of this site (HPA-8). One recently recorded archaeological site at HPA-6 also may be impacted by the project.

Selection of the LPA to Park Avenue could result in long-term impacts to up to 25 high probability areas that have the potential for Native American and historic-period Euroamerican archaeological resources; 24 of these high probability areas have not been investigated for archaeological resources due to existing buildings or other physical access constraints, and one was partially investigated. The majority of the high probability sites are for historic-period Euroamerican archaeological resources. While these impacts would be due to construction activities, the potential for adverse effects to significant archaeological resources is considered a long-term (permanent) loss of the archaeological deposits. Construction activities could disturb buried archaeological sites and result in the permanent loss of the archaeological deposits due to destruction or removal.

The long-term effects to archaeological resources would result from the development of the light rail project within the high probability areas identified on each side of the Willamette River. Although the project has conducted additional field investigations, including subsurface explorations to help further define the potential presence of resources, resources in the probability areas could remain undetected and may not be avoided prior to construction.

The long-term effects of the LPA to Park Avenue on high probability areas include the new Willamette River bridge and its approaches, which involve structures that would have deep foundations. It also would relocate existing railroad facilities in a larger area north of the light rail alignment, where archaeological resources may be present. Despite many years of disturbance in the South Waterfront District and the Central Eastside Industrial District, archaeological sites have surfaced during recent construction activities. There are also recorded archaeological sites in or near portions of the LPA to Park Avenue APE. Because the waterfront and nearby areas have been subjected to continued ground disruptions during industrial developments and operations from approximately 1890 to the modern era, it is less likely that intact Native American archaeological resources would be present, and the most likely intact resources would be historic-period Euroamerican archaeological resources. However, SHPO records indicate that Indian camps were in the vicinity of the project on the east and west sides of the river. The lands along the Willamette River have been impacted by activities such as lumber mills, steel mills, electrical power plants, railroads, and other industrial enterprises, which filled many of the areas and conducted industrial operations. Several of these areas were subsequently subjected to further disturbances during the extensive dismantling, removal, and cleanup of industrial properties.

Other high probability areas where prehistoric archaeological resources could be impacted during construction include sites on both sides of the Willamette River, near Johnson Creek, along Crystal Springs Creek (both at a rail crossing as well as along the creek in Westmoreland Park, where the project proposes wetland mitigation), near Crystal Lake in Milwaukie, adjacent to Kellogg Lake, and possibly in the vicinity of the Ruby Junction Facility. Historic archaeological resources could be encountered throughout downtown Portland, on the east side of the Willamette River to where the alignment joins the UPRR, at Johnson Creek, in formerly residential areas in the outer neighborhoods of Portland and Milwaukie, in several areas of downtown Milwaukie, and along the west side of SE McLoughlin Boulevard. Other areas within the proposed project alignment may contain archaeological resources, but the areas have been previously impacted by modern and historical development and the potential for intact deposits to be found in these areas is lower than in the high probability areas.

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road has the same effects as the LPA to Park Avenue up to downtown Milwaukie, where it would terminate. It could result in long-term impacts to up to 22 high probability areas that have the potential for Native American and historic-period Euroamerican archaeological resources.

Related Facilities

Related Bridge Area Transportation Facilities

The development of connecting streetcar facilities and the related modifications to SE Water Avenue and SW Moody Avenue were assessed as part of the light rail project's review of the APE, and coordinated with the project's consultations with the SHPO. These facilities are adjacent to two high probability areas that would also be encountered by the LPA to Park Avenue. The development of the streetcar connections and SW Moody Avenue and SW Water Avenue modifications could result in long-term impacts to archaeological resources within these two areas, and the project's Memorandum of Agreement (MOA) defines the additional investigations, monitoring, and treatment plans to be used.

Ruby Junction Maintenance Facility

There is one previously recorded archaeological resource within the Ruby Junction Facility APE. This resource has been determined not eligible for inclusion in the National Register. There is one high probability area within the expanded Ruby Junction Facility construction footprint. (Two additional high probability areas were identified in the APE for the expanded area but are not within the direct construction footprint). With the phasing option, one of these would be outside the reduced footprint for the initial expansion.) This area has not been investigated for archaeological resources due to access constraints. The development of the facility could result in long-term impacts to archaeological resources within this area.

3.5.3 Short-Term Impacts (Construction)

3.5.3.1 Historic Resources

No-Build Alternative

The No-Build Alternative would not involve construction activities that would affect historic properties.

Locally Preferred Alternative (LPA) to Park Avenue

Short-term impacts are those that would result from construction activities, and the duration of the impact is limited to the duration of construction. Where major construction activities are directly on historic properties, they have been considered as part of the long-term impact assessment of effects. Otherwise, the construction impacts to historic properties would be impacts to the vicinity or indirect impacts, and include noise and vibration due to nearby construction activities, increased truck traffic, traffic congestion and changes to access, short-term loss of parking, increased dust, and short-term visual changes due to construction equipment, staging areas, material storage, etc. In addition, the project could acquire temporary construction easements along the property lines of some historic properties directly along the alignment, such as would be needed to construct curbs or sidewalks. Because these impacts are similar to those that would occur for the community at large, the discussion of the indirect effects of construction and their mitigation is discussed in more detail in Section 3.3, Community Impact Assessment. None of the short-term direct impacts on historic built environment resources would rise to a level that would alter the characteristics that make them eligible for the NRHP.

Minimum Operable Segment (MOS) to Lake Road

The short-term construction impacts for the MOS to Lake Road would be the same as for the LPA to Park Avenue.

Related Facilities

Related Bridge Area Transportation Facilities

Only two historic properties are within the vicinity of these facilities: the Ross Island Bridge and the Zidell property. The historic characteristics of these resources would not be adversely affected by construction.

Ruby Junction Maintenance Facility

No historic properties have been identified within the APE of the Ruby Junction Facility.

3.5.3.2 Archaeological Resources

Construction impacts involving the acquisition and demolition or disturbance of an archaeological site are considered as long-term impacts, and would be as described above for the light rail project and related facilities.

No-Build Alternative

The No-Build Alternative does not involve construction of light rail and would not result in effects to recorded archaeological sites or high and medium probability areas.

3.5.4 Indirect and Cumulative Impacts

The FEIS identifies five indirect effects to NRHP-eligible buildings that would be caused by the proposed project. The following buildings would have noise or vibration impacts requiring noise or vibration residential sound insulation treatments:

- **1635 SE Rhone Street** in Portland, with traffic noise impacts that would require residential sound insulation or window treatments.
- **2405 SE Harrison Street** in Milwaukie would have light rail transit (LRT) noise impacts that would require a noise wall, the location of which is to be determined. The noise wall would need to be approximately 220 feet in length with a height of 6 to 8 feet, depending on the placement relative to the tracks; alternatively, residential sound insulation could be used.
- **2326 SE Monroe Street** in Milwaukie would have light rail noise impacts that would be mitigated by using reduced level bells with shrouds (meeting the FTA moderate impact criteria), and further application of residential sound insulation may be required to eliminate residual noise impacts. Vibration impacts would be mitigated by treatments built into the project.
- **2206 SE Washington Street** in Milwaukie would have vibration impacts that would be mitigated by treatments built into the project.
- **2313 SE Wren Street** in Milwaukie would have light rail noise impacts that would require a noise wall. A noise wall of 6 to 8 feet in height is sufficient to mitigate noise from light rail vehicles, depending on the topographical conditions in the area; the affected home is on a hill overlooking the alignment. A detailed design is to be developed; however, this noise wall could be placed between the track and the trail, substantially below the grade of the house, or

it could be built into the retaining walls. This would be similar to fencing and other landscaping/plantings to provide screening to minimize visual impacts and the loss of vegetation in the backyard of the property.

The impacts were reviewed by the Oregon SHPO and determined to be “no adverse effect,” but because mitigation required by FTA noise and vibration standards could cause potential adverse effects to the NRHP-eligible properties if not done appropriately, stipulations to avoid any adverse effect have been included in the MOA between the SHPO and FTA. These stipulations are summarized below under mitigation.

3.5.5 Mitigation Measures

3.5.5.1 Historic Resources

<u>Mitigation Commitments</u>

The Portland-Milwaukie Light Rail Project would have three adverse effects to historic resources, with mitigation defined in a signed MOA with the SHPO, FTA, and TriMet and executed for inclusion in the FEIS (see Appendix N). Mitigation measures defined in the MOA include documentation meeting the guidance provided by the Oregon SHPO. The properties with adverse effects requiring mitigation include:

- Royal Foods Warehouse and Office, 2425 SE 8th Avenue, Portland
- Westmoreland Park, 7605 SE McLoughlin Boulevard
- R. Derwey House, 2206 SE Washington Street, Milwaukie

Other Historic Resources

Several properties have been found to have “no adverse effect,” and will be minimally impacted. For those NRHP-eligible resources the following measures are included:

The FEIS has identified secondary impacts to five additional historic built environment resources at 2405 SE Harrison, 2326 SE Monroe, 2313 SE Wren, and 2206 SE Washington streets in Milwaukie and 1635 SE Rhone Street in Portland. These impacts are considered to have “no adverse effect,” and the impacts would not alter the characteristics for which these resources are considered eligible for the NRHP. However, because the impacts require noise and vibration mitigation and that mitigation could have adverse effects to the historic buildings if done inappropriately, the MOA includes a commitment that all noise and vibration impacts meet the Secretary of the Interior Standards for Rehabilitation.

For 2206 SE Washington Street, 2313 SE Wren Street, and 1635 SE Rhone Street, where a small right-of-way acquisition is required, the property owners will be fully compensated in accordance with FTA policy and the Uniform Relocation Assistance and Real Property Acquisition Policies Act. No additional mitigation will be required.

3.5.5.2 Archaeological Resources

Archaeological resources within the high probability areas may be affected by construction of the light rail project. Unlike historic buildings, many of the archaeological resources in the region are concealed beneath sidewalks, buildings, parking lots, and streets. The probability of encountering archaeological resources is based upon presence of preferred landforms or previous discoveries adjacent to or within the project area; however, it is usually not possible to locate archaeological resources before construction, when they are hidden under sidewalks and streets.

To minimize and mitigate the potential adverse effects if archaeological resources are encountered during construction, the MOA for the project defines the procedures and measures the project will follow as it continues beyond the FEIS and preliminary engineering and into construction. The MOA was developed through consultation among the lead agencies, FTA, SHPO, appropriate Tribes, the ACHP, and other affected parties (see Appendix N, Memorandum of Agreement).

For example, if in preparing for construction or during construction an archaeological site is found, project construction plans will be reviewed in order to determine whether the site can be avoided by the project. If the site cannot be avoided, the site will be evaluated for its potential eligibility for the NRHP.

Archaeological treatment plans will be developed for any sites that are determined significant under National Register criteria and that will be adversely affected by the project. To minimize harm and mitigate effects, the project will consider a variety of measures such as construction modifications, buffering, protective walls or fencing, and construction monitoring. Those sites that cannot be avoided may require a data recovery plan or other alternatives proposed as the mitigation for the adverse effect of the project. The options to be considered will take into account whether the significance of the resource calls for preservation in place, data recovery, documentation through monitoring, further research, or other mechanisms of mitigation.

Among the measures in the MOA are additional subsurface testing, further shovel tests, and other exploratory excavations for buried archaeological sites to be conducted during final design and in early construction for those areas with exposed ground surface where access was not granted by the landowner. These field efforts can reduce potential impacts and minimize delays during general construction. For areas that are unavailable for archaeological field inspection before construction due to the presence of an active transportation corridor, parking lot, or building, an archaeological monitoring plan will be followed, as defined in the MOA. The early archaeological field investigations and archaeological monitoring during project construction activities will be covered by the project's inadvertent discovery plan, which is also defined in the MOA. The plan provides procedures for notifying SHPO, the Tribes, and other parties with jurisdiction should resources be encountered, along with measures for documentation, resource recovery, and analysis.

The MOA commits the project to follow the guidance of the ACHP covering the recovery of information from archaeological sites (ACHP 1999 and ACHP 2008). The MOA defines the hierarchy for specific mitigation actions, considering the state and the nature of the resources discovered. The mitigation actions can include preservation in place for future study or use, recovery or partial recovery of archaeological data, public interpretive display, or any combination of these and other measures. Data recovery as mitigation for adverse effects will be allowed under specific conditions and will be guided by the project's data recovery plan.

As defined in the MOA, geotechnical exploration and general construction activities that result in excavating materials within the probability areas shall be monitored by a professional archaeologist and, if requested, monitors from appropriate Tribes will be invited. Construction staff will also be provided training and instruction on the project's protection plan for archaeological resources. The project will prepare a Monitoring Protocol before construction begins, in consultation with the federal agencies, the SHPO, Metro, TriMet, and appropriate Tribes.

3.6 PARKS AND RECREATIONAL RESOURCES

This section identifies parks and recreational resources in the project area and discusses potential impacts to these resources. Parks and recreational facilities in the project area are owned and managed by several entities, including Portland Parks and Recreation (PP&R), the City of Milwaukie, and the North Clackamas Parks and Recreation District (NCPRD). Metro also owns and manages public parks and open spaces within unincorporated Multnomah County and functions as an open space provider for the overall Portland metropolitan area. Portland, Milwaukie, Multnomah County, and Clackamas County have general parks goals and policies within their comprehensive plans.

Oregon's Department of Land Conservation and Development (DLCD) has specific planning goals that local jurisdictions must address in their comprehensive plans. In particular, Oregon Statewide Planning Goal 8 addresses the recreational needs of citizens and visitors and provides for the siting of necessary recreational facilities. Therefore, the analysis for this FEIS considers both existing parks and plans for future parks.

The light rail project is also subject to a federal regulation that protects parks, Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966. The USDOT Act of 1966 (49 USC 303 includes regulations that prohibit the use of parks, recreation areas, historic sites or nature refuges for transportation projects except in very unusual circumstances. These regulations, known as Section 4(f), require that USDOT agencies (including the Federal Transit Administration (FTA)):

… not approve the use of land from a significant publicly-owned park, recreation area or wildlife and waterfowl refuge or any significant historic site, unless there is no feasible and prudent alternative to the use of land from the property and the action includes all possible planning to minimize harm to the property resulting from the use.

Section 6009(a) of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Pub. L. 109-59, amended existing Section 4(f) legislation at Section 138 of Title 23 and Section 303 of Title 49, United States Code. Section 6009 provided for uses with minor or "*de minimis*" impacts, and directed the USDOT to issue regulations that clarify the factors to be considered and the standards to be applied when determining whether feasible and prudent alternatives could avoid the use of a Section 4(f) property. On March 12, 2008, the Federal Highway Administration (FHWA) issued a Final Rule on Section 4(f), which moves the Section 4(f) regulation to 23 CFR 774 and provides updated direction for Section 4(f) evaluations.

Additional details on parks and recreational resources as they relate to Section 4(f) issues are noted later in this section, summarized in Section 3.17, and in Appendix K, Final 4(f) Evaluation.

3.6.1 Affected Environment

Figure 3.6-1 and Table 3.6-1 detail the potential trail, recreational, and parkland resources within 150 feet of the project area (this is the area of potential effect, or APE) of the proposed project. As summarized in Table 3.6-1, not all of these resources were determined to be recreational resources (e.g., not all are open to the public or developed or programmed for recreational use).

As part of project planning and this FEIS, FTA, Metro, and TriMet have been coordinating with the agencies that have jurisdiction over these recreational resources to maximize benefits and avoid or minimize any impacts. Documentation of this coordination is provided in Appendix A, Agency Coordination and Correspondence.

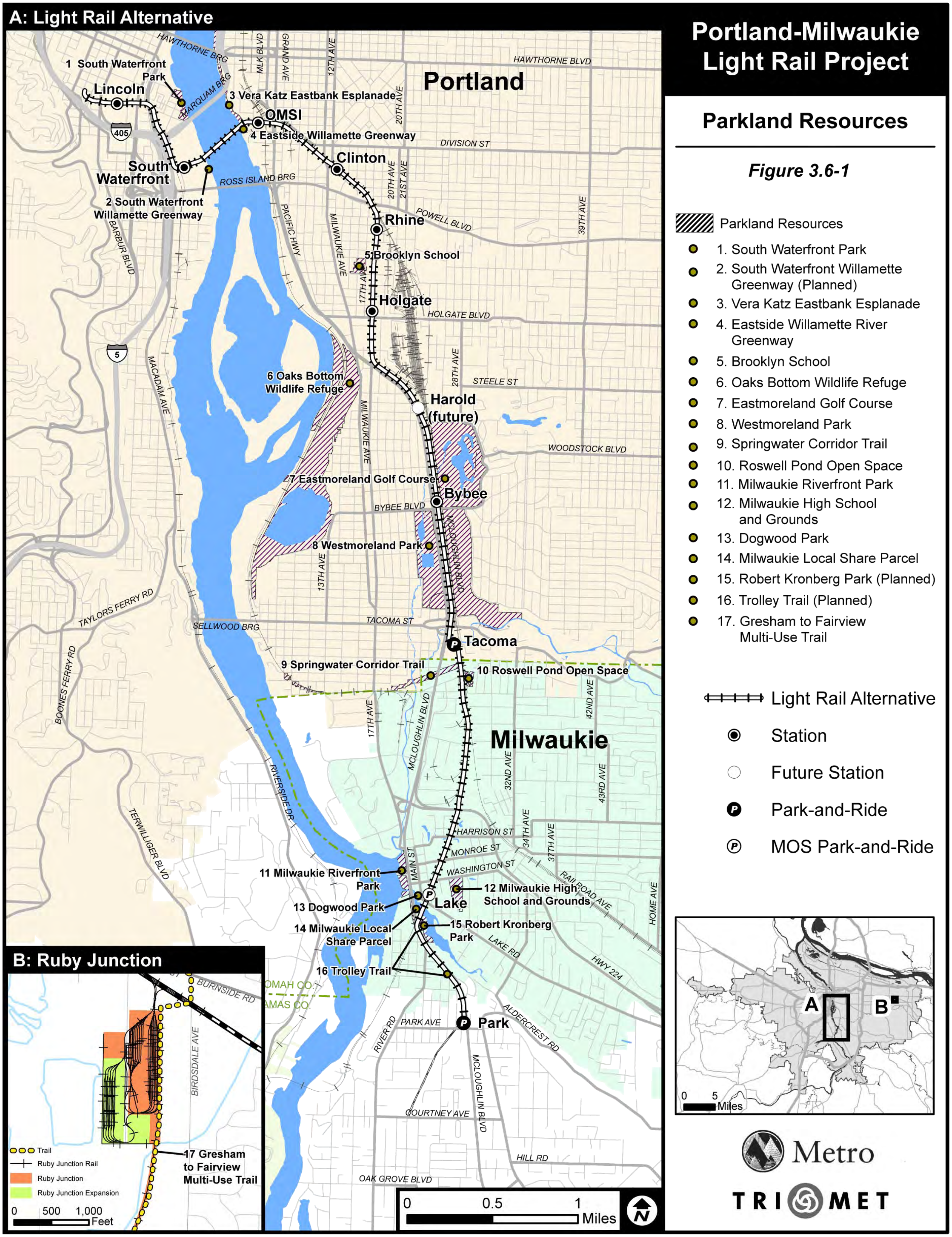
Table 3.6-1
Summary of Potential Parkland and Recreational Resources Evaluated

Property	Location	Owner/Custodian	Recreational Use	Within the APE?	Public Park or Recreational Resource?
South Waterfront Park	North of the Marquam Bridge on the west side of the Willamette River	Portland Parks and Recreation	Active and passive recreation	No	Yes
South Waterfront Greenway (Planned)	South of the Marquam Bridge on the west side of the Willamette River	Privately owned lands	Planned recreational trail yet to be developed	Yes	Not yet in place; no construction date determined
Vera Katz Eastbank Esplanade	North of the Hawthorne Bridge	Portland Parks and Recreation	Recreational trail	No	Yes
Eastside Willamette River Greenway	South of the Hawthorne Bridge and north of SE Caruthers St.	Portland Parks and Recreation	Recreational trail	Yes	Yes
Brooklyn School	SE 15th Ave. and SE Bush St.	Portland Public Schools	Educational resource	No	No
Oaks Bottom Wildlife Refuge	SE Sellwood Blvd. and SE 7th Ave.	Portland Parks and Recreation	Wildlife refuge	No	Yes
Eastmoreland Golf Course	7605 SE McLoughlin Blvd., Portland	Portland Parks and Recreation	Golf course; active recreation	Yes	Yes
Westmoreland Park	2425 SE Bybee Blvd., Portland	Portland Parks and Recreation	Active and passive recreation	Yes	Yes
Springwater Corridor Trail	Beginning south of SE Ivon St. and connecting to several parks and open spaces, including the I-205 Bike Path	Portland Parks and Recreation / Metro	Recreational trail	Yes	Yes

Table 3.6-1
Summary of Potential Parkland and Recreational Resources Evaluated

Property	Location	Owner/Custodian	Recreational Use	Within the APE?	Public Park or Recreational Resource?
Roswell Pond Open Space	East of the Tillamook Branch line alignment and south of the Springwater Corridor Trail	City of Milwaukie	Open drainage space	Yes	No
Portland Waldorf School	2300 Harrison St., Milwaukie	Privately owned	Private educational resource	Yes	No
Milwaukie Riverfront Park and Jefferson Street Boat Ramp	Adjacent to the east side of the Willamette River at SE Jefferson St., Milwaukie	City of Milwaukie	Active recreation	No	Yes
Milwaukie High School and Grounds	11300 SE 23rd St., Milwaukie	Milwaukie School District	Educational resource	No	No
Dogwood Park	Adjacent to Kellogg Lake, on SE Main St., Milwaukie	City of Milwaukie	Passive recreation	Yes	Yes
Milwaukie Local Share Parcel	Adjacent to Kellogg Lake, on SE McLoughlin Blvd., Milwaukie	City of Milwaukie /North Clackamas Parks and Recreation District	Passive recreation	Yes	Yes
Robert Kronberg Park (Planned)	Adjacent to Kellogg Lake, south of SE Lake Rd., Milwaukie	City of Milwaukie	Currently an open area; passive recreation planned	Yes	Not yet developed, but dedicated for future park use
Trolley Trail (Planned)	Beginning east of SE Jefferson St. Boat Ramp in Milwaukie, ending at Glen Echo Rd.	North Clackamas Parks and Recreation District	Multimodal recreational trail	Yes	Currently being designed; dedicated for future park use
Gresham to Fairview Multi-Use Trail	Gresham, adjacent to Ruby Junction	City of Gresham	Multimodal recreational trail	Yes	Planned

Note: APE = Area of Potential Effect



Portland-Milwaukie Light Rail Project
Parkland Resources
Figure 3.6-1
A: Light Rail Alternative
Portland
Milwaukie
Lincoln
South Waterfront
OMSI
Clinton
Rhine
Holgate
Harold (future)
Bybee
Tacoma
Lake
Park
1 South Waterfront Park
2 South Waterfront Willamette Greenway
3 Vera Katz Eastbank Esplanade
4 Eastside Willamette Greenway
5 Brooklyn School
6 Oaks Bottom Wildlife Refuge
7 Eastmoreland Golf Course
8 Westmoreland Park
9 Springwater Corridor Trail
10 Roswell Pond Open Space
11 Milwaukie Riverfront Park
12 Milwaukie High School and Grounds
13 Dogwood Park
14 Milwaukie Local Share Parcel
15 Robert Kronberg Park
16 Trolley Trail
HAWTHORNE BRG
MARQUAM BRG
ROSS ISLAND BRG
SELLWOOD BRG
MLK BLVD
GRAND AVE
12TH AVE
20TH AVE
21ST AVE
17TH AVE
13TH AVE
28TH AVE
39TH AVE
HAWTHORNE BLVD
DIVISION ST
POWELL BLVD
HOLGATE BLVD
STEELE ST
WOODSTOCK BLVD
BYBEE BLVD
TACOMA ST
PACIFIC HWY
MILWAUKIE AVE
MCLOUGHLIN BLVD
BARBUR BLVD
MACADAM AVE
TAYLORS FERRY RD
BOONES FERRY RD
TERWILLIGER BLVD
RIVERSIDE DR
42ND AVE
43RD AVE
32ND AVE
34TH AVE
37TH AVE
HARRISON ST
MONROE ST
WASHINGTON ST
MAIN ST
RAILROAD AVE
HOME AVE
LAKE RD
HWY 224
ALDERCREST RD
RIVER RD
PARK AVE
COURTNEY AVE
HILL RD
OAK GROVE BLVD
MULTNOMAH CO.
CLACKAMAS CO.
405
5
0 0.5 1 Miles
B: Ruby Junction
BURNSIDE RD
BIRDSDALE AVE
17 Gresham to Fairview Multi-Use Trail
Trail
Ruby Junction Rail
Ruby Junction
Ruby Junction Expansion
0 500 1,000 Feet
Parkland Resources
1. South Waterfront Park
2. South Waterfront Willamette Greenway (Planned)
3. Vera Katz Eastbank Esplanade
4. Eastside Willamette River Greenway
5. Brooklyn School
6. Oaks Bottom Wildlife Refuge
7. Eastmoreland Golf Course
8. Westmoreland Park
9. Springwater Corridor Trail
10. Roswell Pond Open Space
11. Milwaukie Riverfront Park
12. Milwaukie High School and Grounds
13. Dogwood Park
14. Milwaukie Local Share Parcel
15. Robert Kronberg Park (Planned)
16. Trolley Trail (Planned)
17. Gresham to Fairview Multi-Use Trail
Light Rail Alternative
Station
Future Station
Park-and-Ride
MOS Park-and-Ride
A
B
0 5 Miles
Metro
TRIMET

June 2010

3.6.2 Environmental Impacts

This section addresses the direct physical impacts to parks and recreational resources as well as indirect effects, such as those to setting or use and those resulting from noise (Section 3.10), visual (Section 3.4), or traffic, parking, or access (Chapter 4). Impacts are summarized in Tables 3.6-2 and 3.6-3.

3.6.2.1 Long-Term Impacts

No-Build Alternative

With the No-Build Alternative, transportation improvements would be limited to those included in the 2004 Regional Transportation Plan (RTP) 2030 financially constrained transit and road network. Under the No-Build Alternative, there would be no impacts to any of the recreational resources noted above.

Locally Preferred Alternative (LPA) to Park Avenue

South Waterfront Park

The LPA to Park Avenue would not have any direct impacts to South Waterfront Park and would not require any South Waterfront parkland. The light rail would be several hundred yards to the south of the park. The new Willamette River bridge would be visible from the park, but the Marquam Bridge/I-5 lies between the park and the light rail project.

South Waterfront Greenway (Planned)

The LPA to Park Avenue would cross over the planned South Waterfront Greenway, a future recreational greenway and trail system that PP&R has spent considerable effort in planning over the last ten years. The project will also participate in a City of Portland shoreline/aquatic habitat restoration project planned for an area south of the Ross Island Bridge, which also will be part of the planned South Waterfront Greenway. The City of Portland's *South Waterfront Plan* (2002) and the *South Waterfront Greenway Development Plan* (2004) include codes and guidelines to secure easements needed to develop the trail and greenway, which will link future development to South Waterfront Park. At this time, no easements for this future facility are in place in the APE. The LPA to Park Avenue would also provide a new multi-use path crossing over the river, linking the future South Waterfront Greenway with the Eastside Willamette River Greenway and the Springwater Corridor Trail. The shoreline/aquatic habitat improvement will also be coordinated with the planned greenway's multi-use path.

Eastside Willamette River Greenway

The LPA to Park Avenue alignment would cross over the Eastside Willamette River Greenway on an elevated structure, inhabiting air space above the trail and requiring the modification of the trail. The new bridge and related improvements would introduce abutment and embankment structures beside the trail, and it would reconstruct, lower, and realign a portion of the trail itself. The permanent modification of the trail will provide clearance of at least 14 feet 4 inches below the light rail project structures. Several design and construction actions would minimize the effects of the LPA to Park Avenue.

Table 3.6-2
Summary of Direct Impacts to Parks and Recreational Resources from the LPA to Park Avenue and the MOS to Lake Road

Name	Owner/Custodian	Alignment	Estimated Impacted Acres	Total Acreage of Resource
South Waterfront Greenway (Planned)	Privately owned lands	LPA to Park Ave.* and MOS to Lake Rd.	n/a	n/a
Eastside Willamette River Greenway Trail	City of Portland	LPA to Park Ave.* and MOS to Lake Rd.	< .05 acres	4.27
Springwater Corridor Trail	Metro/City of Portland	LPA to Park Ave.* and MOS to Lake Rd.	< 0.1 acres	350
Westmoreland Park	City of Portland	LPA to Park Ave.* and MOS to Lake Rd.	Approx. 1.0 to 1.5 acres (wetland enhancement)	42
Robert Kronberg Park	City of Milwaukie/North Clackamas Parks and Recreation District	LPA to Park Ave.*	Approx. 0.05 to 0.10 acres (temporary use)	3.5
Trolley Trail (Planned)	North Clackamas Parks and Recreation District	LPA to Park Ave.*	Approx. 1 acre (permanent use area)	17.41

* Including LPA Phasing Option.

Table 3.6-3
Potential Secondary Impacts to Parks and Recreational Resources from the LPA to Park Avenue and the MOS to Lake Road

Name	Owner/ Custodian	Alignments Impacting Park	Potential Impact
South Waterfront Greenway (Planned)	City of Portland	LPA to Park Ave.* and MOS to Lake Rd.	Visual
Eastside Willamette River Greenway	City of Portland	LPA to Park Ave.* and MOS to Lake Rd.	Visual
Springwater Corridor Trail	City of Portland	LPA to Park Ave.* and MOS to Lake Rd.	Visual
Dogwood Park	City of Milwaukie/North Clackamas Parks and Recreation District	LPA to Park Ave.* and MOS to Lake Rd.	Visual
Milwaukie Local Share Parcel	City of Milwaukie/North Clackamas Parks and Recreation District	LPA to Park Ave.* and MOS to Lake Rd.	Visual
Robert Kronberg Park	City of Milwaukie/North Clackamas Parks and Recreation District	LPA to Park Ave.*	Visual
Trolley Trail (Planned)	North Clackamas Parks and Recreation District	LPA to Park Ave.*	Visual

* Including LPA Phasing Option.

The reconstructed trail will be returned to a similar or better condition compared to today. It will be similar in width, grade, and lighting to the current pathway, and will still safely accommodate pedestrians, cyclists, and other nonmotorized modes.

The trail will maintain an open view to the river, except where it passes between the bridge abutment and landside pier. While the visual effects of the new bridge are considered high (see Section 3.4, Visual Quality and Aesthetics) because it offers a high degree of visual change in the area, the project, with considerable public input, has selected a cable-stayed bridge type, which has a distinctive appearance and offers a high degree of visual interest. The visual effects to the greenway would not create impairments that would adversely affect the activities, features, and attributes of the trail, which is part of a riverfront system that crosses below a number of bridges. In addition, the new bridge would feature a new trail across the Willamette River, providing direct connections to the Eastside Willamette River Greenway Trail as well as the City of Portland's separately planned South Waterfront Greenway and the street network to the west.

Eastmoreland Golf Course

The LPA to Park Avenue would be along the UPRR to the west of the Eastmoreland Golf Course land. It does not require land from the property, nor would it have any impacts to the golf course. The Bybee Station would be located near the golf course, improving public access to the facility.

Westmoreland Park

Westmoreland Park is to the west of the light rail alignment, and SE McLoughlin Boulevard lies between them. The construction and operation of the light rail facilities would not directly impact the park. The Bybee Station would improve public access to the park, which includes several ball fields and other passive and active recreational features. Through a partnership with the City of Portland, the light rail project also proposes a wetland restoration of an existing pond in Westmoreland Park as mitigation for the project's wetlands and water resources impacts on the nearby alignment. This is consistent with the City of Portland's long-range plan for the park adopted in 2003. Currently, the existing pond is used as a passive resource (duck pond) and is not used for fishing, swimming, wading, or other active recreational resources. It is anticipated that any changes will create added value to the park and the natural environment. FTA, Metro, and TriMet are coordinating planning efforts for the potential mitigation facility with PP&R.

Springwater Corridor Trail

The LPA to Park Avenue will provide a new station and park-and-ride south of SE Tacoma Street, north of the Springwater Corridor Trail, and it will provide direct connections between the trail and the station. These connections will improve access to the trail. The LPA Phasing Option would provide a similar benefit of access to the Springwater Corridor, although a pedestrian stairway would be deferred. After leaving the station, the light rail project would travel along the UPRR right-of-way and cross under the Springwater Corridor Trail's existing bridge above the UPRR. The LPA to Park Avenue is not anticipated to create proximity impacts that would substantially impair or diminish the trail characteristics so that it could not be used as a transportation or recreational resource for pedestrians, bicycles, or other nonmotorized modes. The trail in this area already crosses over a transportation corridor that has substantial traffic and freight rail traffic, with other industrial uses nearby.

Dogwood Park

This small park in downtown Milwaukie is near the new Lake Road Station at the southern end of downtown. The LPA to Park Avenue would have no direct physical effects on the park, but the station nearby is likely to improve access and draw more people into the area, which could increase the use of the park. The project will also be providing street and sidewalk improvements, which would benefit the park, and it includes a bridge to the north that would allow a future connection to Robert Kronberg Park to the south of Kellogg Lake. Noise levels in the park are not expected to impair the use of the park. The new station facility and its landscaping would be visible from the park, occupying a parcel that is currently undeveloped.

Milwaukie Local Share Parcel

The LPA to Park Avenue would have no direct physical effects to this city-owned parcel that is currently undeveloped but identified for park use. The parcel is bordered by SE McLoughlin Boulevard to the west and south, Kellogg Lake to the north, and the UPRR/Tillamook Branch line and its wooden trestle, with Robert Kronberg Park, to the east. The light rail project would develop a bridge within the UPRR right-of-way to cross over Kellogg Lake and over SE McLoughlin Boulevard. This bridge would be on the other side of the railroad trestle from the parcel, and would result in a change in views from the parcel but would still provide for future connections between the local share parcel and Robert Kronberg Park, as envisioned by the City of Milwaukie.

Robert Kronberg Park

The LPA to Park Avenue would not require any permanent use of right-of-way from the park property, but it would construct a new bridge beside the western boundary of the park. The new bridge would be within the UPRR right-of-way, adjacent to the existing wood trestle that separates Robert Kronberg Park from the Milwaukie Local Share Parcel. The bridge is being designed to accommodate the City of Milwaukie’s plans for a trail connecting the park to downtown Milwaukie. This would extend the access benefits that the light rail project provides to the city.

The light rail structure adjacent to the park is not anticipated to conflict with the City of Milwaukie’s general plans to develop the park. Because Robert Kronberg Park is adjacent to an existing freight railroad trestle that remains in operation, and because the park is also bounded by SE McLoughlin Boulevard, a busy thoroughfare, the LPA to Park Avenue is not expected to alter the park setting or atmosphere.

Specific park access plans will be defined through agreements between the North Clackamas Parks and Recreation District, City of Milwaukie, and TriMet during final design.

Trolley Trail (Planned)

The LPA to Park Avenue would extend light rail to a station and park-and-ride at SE Park Avenue, which requires the use of part of a 40-foot corridor purchased for the planned Trolley Trail. FTA, Metro, and TriMet have been coordinating with the NCPRD to explore options to minimize impacts to the development of the trail and to increase benefits to the public. The LPA to Park Avenue would place light rail on the west side of SE McLoughlin Boulevard, between the roadway and the planned Trolley Trail, which would be located along the western edge of the right-of-way originally purchased for the trail.

Current designs for the light rail project call for a bridge over SE McLoughlin Boulevard, curving southeast to align with the western edge of SE McLoughlin Boulevard. Light rail would remain elevated to cross over SE 22nd Street and SE River Road, and then would descend onto a retained fill structure to transition to an at-grade alignment. The trail would be alongside of the retaining wall and would cross under the bridge for the SE McLoughlin Boulevard overcrossing bridge. These elevated crossings were requested by the Oregon Department of Transportation (ODOT) to address safety and operating concerns about an at-grade crossing of SE McLoughlin Boulevard and the adjacent intersections, and they are consistent with plans for the trail, which also seek to avoid conflicts between the trail and cross-streets.

Once light rail is at grade beside SE McLoughlin Boulevard, there will be a 22-foot total trail cross section that would include a six-foot vegetated buffer area with a barrier that would run between light rail and the Trolley Trail. The trail itself will be a 12-foot paved trail with 2-foot shy on either side, consistent with the Trolley Trail Master Plan. To address uphill slopes to the west of the Trolley Trail corridor, a retaining wall will also be needed in some locations along the western edge of the corridor.

Longer term, the presence of light rail alongside the trail would alter the visual experience that users might otherwise have for the affected section of the trail, but the trail's function as part of a regional system would be maintained. Compared to the trail facility alone within the original trolley corridor, the light rail project would be introducing walls and adjacent structures in some areas. The light rail project includes features that reduce the potential for trail/cross-street conflicts because it closes the SE Sparrow Street intersection and signalizes the crossing at SE Park Avenue. In other parts of the shared corridor, light rail would remove trees and other natural vegetation, and add new vegetation, fencing, and a retaining wall. While light rail could function as a buffer from roadway traffic, in the at-grade section, light rail trains would be traveling by two times every 15 minutes (once each way) at speeds similar to the traffic on SE McLoughlin Boulevard (between 35 miles per hour and 45 miles per hour). However, light rail and trail operations will remain physically separated, avoiding conflicts between trains and trail users. In several areas where topography and available right-of-way allows, the current design provides for the trail to meander east, retaining trees and increasing the distance between the light rail project and the trail. Existing noise levels along the trail's right-of-way are relatively high due to traffic on SE McLoughlin Boulevard, and therefore the future trail is not considered a facility where quiet is an essential attribute of its use. Specific park access plans and final enhancement area designs will be defined through agreements between NCPRD and TriMet during final design.

At SE Park Avenue, a station would be located on the north side of the street, and a park-and-ride would be on the south side of the street, with the trail to the west of both. New signalized intersections with crosswalks would be provided on SE Park Avenue at SE McLoughlin Boulevard and at the Trolley Trail crossing of SE Park Avenue. An access point to the trail from the east would be provided at the north end near SE 22nd Street and at the south end at SE Park Avenue.

The amount of property needed to develop the light rail project within the Trolley Trail right-of-way is approximately one acre. TriMet will also obtain the additional property rights needed to partially realign the future trail immediately to the west of the current right-of-way to mitigate the use of trail land where the light rail will be located and to improve the buffer between the light rail and the Trolley Trail.

LPA Phasing Option

Except for a deferred stairway access at the Springwater Corridor Trail, the LPA Phasing Option would have similar effects as the LPA to Park Avenue.

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road would have the same impacts to parkland as the LPA to Park Avenue, except that it would not impact Robert Kronberg Park or the planned Trolley Trail. The MOS to Lake Road includes the Lake Road Station, and a park-and-ride facility at SE Washington Street and SE Main Street, so there may be minimal visual impacts to the Milwaukie Local Share Parcel and Dogwood Park.

Related Facilities

Related Bridge Area Transportation Facilities

The Related Bridge Area Transportation Facilities will have no impact on parks or recreational facilities.

Ruby Junction Maintenance Facility

The expansion of the Ruby Junction Facility is not expected to affect any park or recreation resources. The Gresham to Fairview Multi-Use Trail is planned to run along the east side of the existing TriMet facility, but would not be impacted by the expansion, which would occur to the west.

3.6.2.2 Short-Term Impacts (Construction)

Short-term effects from construction would include changes or restrictions in access, and increases in noise, dust, or delays in traveling to events or recreational resources. Mitigation measures such as signage, alternative traffic routing, and traffic control can mitigate delays and perceptions of decreased access. See Appendix K, Final Section 4(f) Evaluation, for more detail on mitigation for short-term impacts.

Construction will temporarily close or limit bicycle or pedestrian access and require a detour for the Eastside Willamette River Greenway Trail. During some periods of construction, the trail would be temporarily rerouted away from construction activities, and adequate notification, signage, and way-finding mitigation would be implemented to ensure a safe and continuous pathway for trail users.

The LPA to Park Avenue would not require changes to the use of the Springwater Corridor Trail during construction, but it may require modifying the abutment to a bridge for the trail above the UPRR. No long-term closure or reroutes are anticipated. If a temporary closure is necessary for safety reasons during construction, the closure would be brief and a temporary detour route will be provided to maintain the trail's function.

The LPA to Park Avenue requires a temporary use for construction staging within Robert Kronberg Park. The construction staging area will be located within a 50-foot-wide area immediately southeast of the light rail alignment, and after construction the area will be restored to its current condition or better. The park is currently open space and public access is not restricted, but it has no developed facilities and there is not yet an adopted master plan in place for the park. During construction, the site would generally remain open to public access except for the 50-foot staging area. The construction staging area will be used for approximately three and one-half years during the estimated four-year construction period.

For the Trolley Trail, TriMet and Clackamas County have developed an approach for completing the link from SE Park Avenue to Kellogg Creek prior to construction of the light rail in this area. Trail users for this section of trail would be directed to a sidewalk and bike lane on the east side of SE McLoughlin Boulevard and/or to SE River Road until the light rail and trail construction are completed in this section. Pedestrians and bicyclists would be able to use existing bike lanes and sidewalk on the east side of SE McLoughlin Boulevard.

3.6.3 Mitigation

3.6.3.1 Long-Term Mitigation

FTA, TriMet, and Metro are coordinating with PP&R, the City of Milwaukie, and the NCPRD for project features and appropriate mitigation measures to reduce impacts to the parks and recreation properties. Where the use of parkland is required, either during construction or permanently, TriMet will work with the park owner to determine appropriate compensation or other agreements needed to allow use of the land for the project. Further details on mitigation commitments for parks properties that would be used by the project are provided in Appendix K, Final Section 4(f) Evaluation.

3.6.3.2 Short-Term Mitigation

Like long-term mitigation, short-term mitigation measures would be closely coordinated with park owners. Mitigation measures could include providing detour routes around construction areas and temporarily modifying access points to maintain access to park resources where possible. Construction duration around park facilities will be minimized to the extent possible.

3.6.4 Section 4(f) Resources

3.6.4.1 Locally Preferred Alternative (LPA) to Park Avenue

Section 4(f) resources include publicly owned parks, recreation areas, wildlife and waterfowl refuges, and historic and cultural sites. The analysis of these resources helps FTA determine whether there would be any use or taking of Section 4(f) lands or whether there would be any impacts that would diminish the qualities that make them protected Section 4(f) resources.

Some of the park and recreational resources evaluated in the sections above are not considered Section 4(f) resources because they are not publicly owned. For the LPA to Park Avenue, the following planned or existing park and recreational resources within the project APE are considered Section 4(f) resources; along with the Section 4(f) use, if any:

- Eastside Willamette River Greenway (*de minimis* impact)
- Westmoreland Park (*de minimis* impact)
- Eastmoreland Golf Course (no use)
- Springwater Corridor Trail (*de minimis* impact)
- Dogwood Park (no use)
- Milwaukie Local Share Parcel (Planned) (no use)
- Robert Kronberg Park (Planned) (temporary use)
- Trolley Trail (Planned) (*de minimis* impact)

Section 3.17 provides further information on Section 4(f) uses, and Appendix K, Final Section 4(f) Evaluation, contains the Final Section 4(f) evaluation.

3.6.4.2 Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road would have the same use of Section 4(f) resources as the LPA to Park Avenue, except there would be no temporary use of Robert Kronberg Park and there would be no *de minimis* impact to the Trolley Trail during the initial period that the MOS to Lake Road is in place without the full project extension to SE Park Avenue. There would be a station and park-and-ride near Dogwood Park and the Milwaukie Local Share Parcel.

3.6.4.3 Related Facilities

Related Bridge Area Transportation Facilities

The Related Bridge Area Transportation Facilities will have no impact on parks or recreational facilities; therefore, no mitigation measures are planned for this area.

Ruby Junction Maintenance Facility

The expansion of the Ruby Junction Facility is not expected to affect any park or recreation resources.

3.6.5 Section 6(f) Resources

Section 6(f) restricts the conversion of uses for properties acquired or developed using monies from the Land and Water Conservation Fund (LWCF). Neither the LPA to Park Avenue nor the MOS to Lake Road would impact any resources that were federally funded by the LWCF.

3.7 GEOLOGY, SOILS, AND GROUNDWATER

This section discusses the effects to the Portland-Milwaukie Light Rail Project from geologic hazards and from the project to geology and groundwater resources. For a discussion of issues related to surface water, see Section 3.9, Water Quality and Hydrology.

3.7.1 Affected Environment

The project team reviewed existing geologic and groundwater (hydrogeologic) conditions within the project area, using a study area defined as a 1,000-foot buffer around the sites and alignment where the project would be built and operated.

3.7.1.1 Geology and Hydrogeology

Soils

Soils within the study area are developed on flood and alluvial deposits, with smaller areas developed from volcanic rocks. Soils within the study area that are classified as urban land are in locations where the original soils were removed or modified by cut, fill, and grading associated with land development. Where undisturbed, soils within the study area consist of sandy to clayey loam and vary in their ability to drain water to the subsurface.

Geology

The study area is underlain by rocks of Eocene to Pleistocene age and unconsolidated sediments of Quaternary age. The rock units include several members of the Columbia River Basalt Group (CRBG), conglomerate and associated rock groups of the Troutdale Formation, and basalts and pyroclastics of the Boring Lavas. Unconsolidated units include gravels, sands, and fine deposits related to the Plio-Pleistocene catastrophic floods and recent alluvium from the Willamette and Clackamas rivers and associated streams. Artificial fill is present along the east and west banks of the Willamette River in the vicinity of the Hawthorne and Ross Island bridges. The thickness and extent of the fill varies. Older fill may have been placed with little concern for material type and stability.

Soil, Aggregate, and Rock Resources

No active quarries with soil, aggregate, or rock resources were identified in the study area. The only aggregate quarry in the proximity of the study area is the Ross Island Sand and Gravel Company, at 4315 SE McLoughlin Boulevard.

Hydrogeology

The study area is underlain by eight hydrogeologic units. A hydrogeologic unit is any soil or rock unit that displays distinct properties regarding its ability to store or influence groundwater movement. Hydrogeologic units are directly influenced by the environment in which geologic materials were deposited, the type of material, its thickness, and its extent. In general, these physical attributes and their spatial relationships to one another help define the hydrogeologic setting. The eight hydrogeologic units in the study area are:

- Unconsolidated Sedimentary Aquifer (USA)
- Troutdale Gravel Aquifer (TGA) or the Consolidated Gravel Aquifer
- Confining Unit 1 (CU1)
- Troutdale Sandstone Aquifer (TSA)
- Confining Unit 2 (CU2)
- Sand and Gravel Aquifer (SGA)
- Older Rocks
- Undifferentiated Fine-Grained Sediments

The most productive zones for groundwater use in the study area are the USA and the TGA. The USA is composed of unconsolidated material associated with the Pleistocene-aged catastrophic flood deposits and Quaternary alluvium deposits. The TGA is composed of unconsolidated, semi-cemented and/or cemented material associated with the Pleistocene-aged Troutdale Formation. The USA and TGA contain the majority of water supply wells and will likely continue to be the source of water supply as demands increase.

Groundwater Resources

Shallow groundwater may be encountered by the project. These shallow groundwater areas include those underlain by Quaternary river channel deposits that are found along the project corridor. Shallow groundwater may discharge locally to surface water, which provides beneficial use to fish and aquatic organisms. Groundwater flow and movement is controlled in part by tidal fluctuations and the Columbia River.

Potable groundwater is an important resource for domestic, municipal, industrial, and irrigation use. However, no wells for potable water appear to be within the study area. There are irrigation and industrial wells in and near the study area, as well as monitoring wells used for ongoing groundwater quality and quantity management programs. There are a number of springs that feed streams in the area, including Crystal Springs, Crystal, and Spring creeks. The City of Portland drinking water originates from the Bull Run Reservoir and is augmented with water from the Portland Well Field located east of the Portland International Airport. The City of Milwaukie drinking water originates from seven groundwater production wells that collect water from the sand and gravel sediments of the TGA. These wells are located approximately 2,500 feet hydraulically up-gradient of the study area. The City of Milwaukie also purchases approximately 500,000 gallons of drinking water per day from the Clackamas River Water District.

3.7.1.2 Geologic Hazards

Tectonic Setting

The State of Oregon is on the North American continent crustal plate near a convergent plate boundary with the Juan de Fuca oceanic crustal plate, which lies approximately 100 miles off the Oregon coast. The oblique convergence of the North American Plate with the Juan de Fuca Plate has created northwest-trending fault zones and crustal blocks. This regional tectonic regime is capable of producing subduction zone earthquakes of magnitude (M) 8 or greater. The convergence of the two crustal plates has caused intraplate folding and faulting of rocks and shallow crustal ruptures in the vicinity of the project. In addition, volcanic activity associated with the Cascade Range is a source of seismic activity.

<u>Earthquakes</u>

Seismicity in the Portland metropolitan area has produced earthquakes with magnitudes of 5.3 in 1877, 5.5 in 1962, and 5.6 during the Scotts Mills earthquake in 1993. There are several crustal faults in the vicinity of the study area that likely are active and may be a potential seismic hazard. These include the Portland Hills Fault and the East Bank Fault. The Portland Hills Fault crosses the study area approximately one-quarter mile south of the intersection of SE Tacoma Street and SE Milwaukie Boulevard and near the intersection of SE Lake Road and SE Milwaukie Boulevard.

Relative earthquake hazards maps indicate that much of the area is categorized as having a high earthquake hazard (see Figure 3.7-1). The rating is based on combined effects of liquefaction susceptibility, lateral spread displacement, dynamic slope instability, and ground motion amplification. A review of hazards maps indicates that slope instability, liquefaction, and lateral spread displacement conditions are limited within the study area and are localized along the east and west banks of the Willamette River and in the South Waterfront, which includes areas with fill and other soils with high liquefaction potential. Therefore, the high relative earthquake rating is attributed to ground amplification conditions.

<u>Volcanic Hazards</u>

Primary volcanic hazards include ash fall, lahar, and flooding from Mount Saint Helens and Mount Hood. These hazards are limited within the vicinity of the project.

<u>Landslides</u>

Landslide hazard areas are typically defined as areas that, due to a combination of slope inclination, soil type, geologic structure, and presence of water, are susceptible to failure and subsequent downhill movement. No active and historically active landslides have been identified within the study area.

<u>Steep Slopes</u>

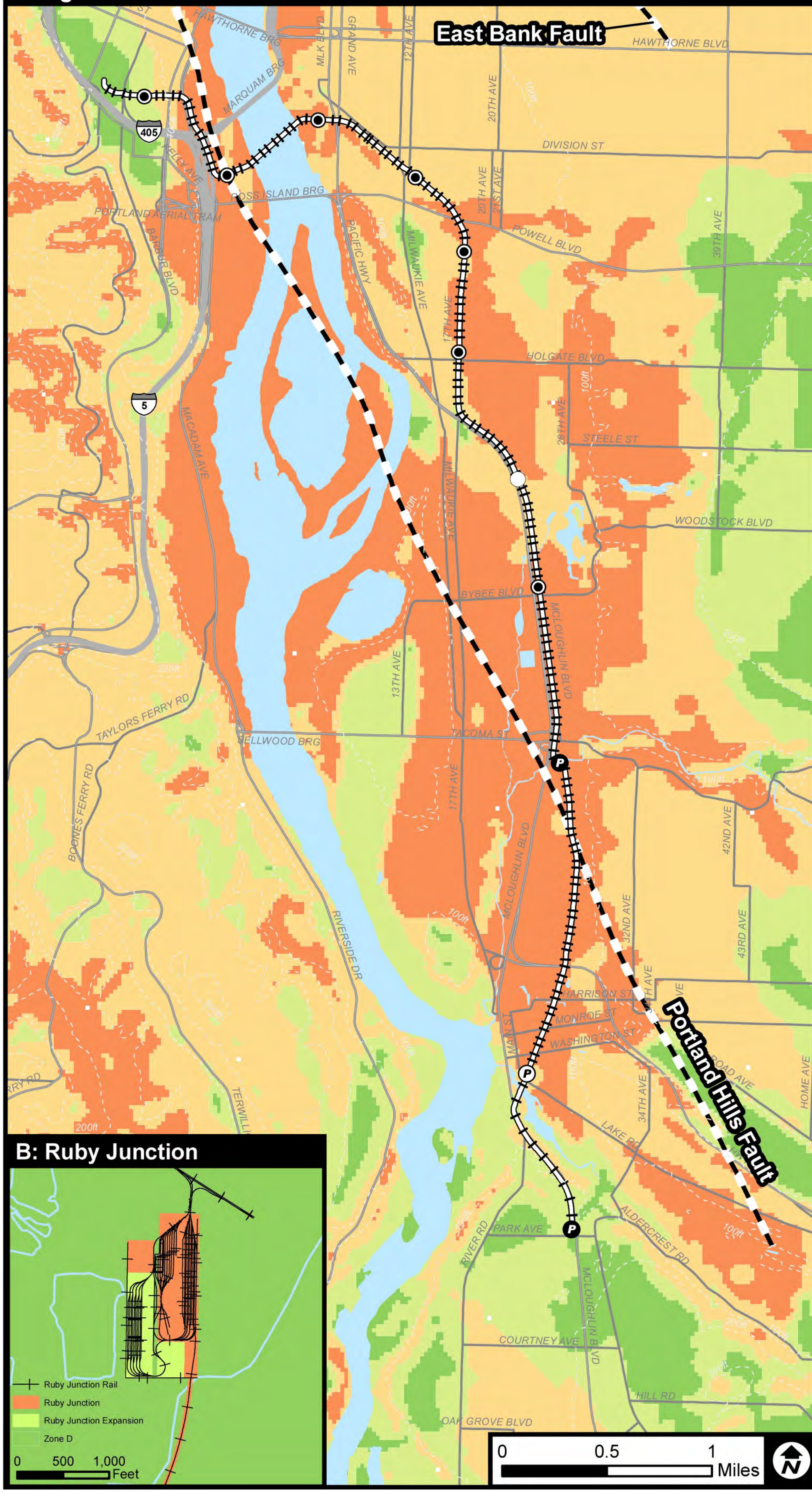
Steep slope hazard areas are typically defined as areas where there is no mapped or designated landslide hazard, but where there are slopes equal to or greater than 25 percent. Steep slope hazards present problems with stormwater runoff, erosion, and slope instability. Steep slopes in the study area are limited to areas along the east and west banks of the Willamette River, along the UPRR rail line near the Ardenwald neighborhood, and north and south of Kellogg Lake in Milwaukie. Outside of these identified areas, which are small in aerial extent, no significant steep slopes greater than 25 percent occur in the study area. However, there are localized areas where steep slopes have been observed, including along SE Harrison Street and areas adjacent to SE McLoughlin Boulevard, particularly south of downtown Milwaukie.

Portland-Milwaukie Light Rail Project

Relative Earthquake Hazard

Figure 3.7-1

A: Light Rail Alternative



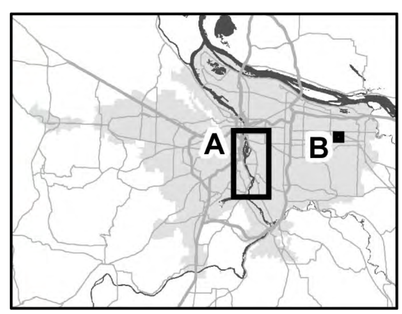
Highest Hazard

- A
- B
- C
- D

Lowest Hazard

- Faults
- 100ft Contours
- Light Rail Alternative
- Station
- Future Station
- Park-and-Ride
- MOS Park-and-Ride

This map shows relative areas having the greatest tendency to experience damage due to any combination of liquefaction, amplification of ground shaking or slope instability hazard. For every point on the map, the zone rating for each individual hazard was squared, and the resulting numbers were added together. The square root of this sum was calculated and rounded to the nearest whole number. Results of 4 or 5 are assigned to category A, 3 is asigned to category B, 2 is assigned to category C, and 1 or 0 is assigned to category D.



Metro

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June 2010

Hazardous Soil Properties

Two soil hazard types, high shrink-swell soils and hydric soils, have been identified in the study area. High shrink-swell soils are primarily clay soils that swell when moisture is absorbed. These soils typically occur in poorly drained bottomland and can exert pressures on solid structures and cause severe damage. Saum Silt Loam is identified as a potential shrink-swell soil within the study area near the southern terminus. Wapato Silt Loam has a shrink-swell potential and is located within the Johnson Creek drainage.

Hydric soils or wet soils are described as having a groundwater table within 1.5 feet of the ground surface, a condition that likely occurs during the wetter months of the year. The high water table creates areas of standing water, which can fill excavation sites. Wapato Silt Loam and Wollent Silt Loam have been identified as hydric soils. These soils are located in the Crystal Springs and Johnson Creek drainage basins.

3.7.2 Environmental Impacts

3.7.2.1 Long-Term Impacts

No-Build Alternative

The No-Build Alternative would not affect geologic or hydrogeologic resources or geologic hazards. The regional setting and local conditions would be unchanged, except for other projects that would occur even if the light rail project were not built. Soils in the region have a relatively high earthquake hazard rating and are susceptible to a major seismic event. Ongoing growth and development in the region may put a strain on existing groundwater and rock resources.

Locally Preferred Alternative (LPA) to Park Avenue

The LPA to Park Avenue generally crosses lands that are urbanized and is likely to have limited long-term effects on existing geologic and hydrogeologic conditions. The following effects could occur with the LPA to Park Avenue if not correctly mitigated. With appropriate engineering measures incorporated into the design of the project, the LPA to Park Avenue would not create any new geologic or hydrogeologic risks, and would minimize impacts from existing geologic or hydrogeologic conditions.

Earthquakes

- The project area is located in a seismically active region capable of producing earthquakes up to M9 for Cascadian Subduction Zone (CSZ) mega-thrust event and/or M6.8 for a Portland Hills Fault Zone (PHFZ) seismic event. The greatest threat from a seismic event is attributed to ground motion, liquefaction, and lateral spreading of soils. Adverse effects from a major seismic event include endangerment of public safety, damage to structures, and economic disruption.
- Engineered bridges and structures (including stations, elevated structures, retained cuts, retained fill or other structures) must be designed to meet applicable federal, state, and city seismic standards and building codes. The design of the new bridge and structures must be based on site-specific information, and advances in earthquake engineering, material science,

and construction techniques. For instance, the Willamette River bridge will include pier clusters that extend below the surface to the Troutdale Formation and that are anchored into a very dense layer of gravel and cobbles.

- Ground improvements such as cut and fill and soil stabilization measures are needed to limit liquefaction and lateral spreading. Ground improvements will occur in the South Waterfront District area, on the east bank of the Willamette River near OMSI, at the south abutment of the project's SW Harbor Drive overcrossing structure, and along Johnson Creek. The most significant ground improvements of up to a maximum 200 feet wide by 150 feet long will occur along the west bank of the Willamette River. With these ground improvements, the hazardous soils anticipated within the upper 10 feet will be cemented in place using deep soil mixing method. In addition, the project may accept, if appropriate, low level hazardous materials from Zidell Companies' property to use as fill material along the rail alignment and station area in the South Waterfront District, east of SW Moody Avenue.
- Construction of new or renovation of existing structures could produce settlement. This effect is thought to be minor.

Steep Slopes

- Further stabilization of existing slopes, through the use of retaining walls or other design measures, will be required. These slopes occur in several areas, including approaching the South Waterfront District, near the Tacoma Station, near Kellogg Lake, and along SE McLoughlin Boulevard where the project will cut into the hillside in order to accommodate the Trolley Trail to the west of the light rail alignment.
- Smaller areas of retained fill will be needed along the alignment in areas such as along the UPRR rail line and the Tillamook Branch line.

Scour

- Scour protection blankets will be placed around Tower 3 and Tower 4 of the Willamette River bridge structure and nearby underground utilities. Scour protection is necessary to limit exacerbation of existing sediment contamination (see Section 3.13, Hazardous Materials), and to protect the City of Portland's municipal water line and other utilities during future flood events. Improper placement of scour protection could result in settlement and potentially lead to compromising the water line. Mitigation of scour protection from an ecosystems perspective is addressed in Section 3.8, Ecosystems, and in the Biological Assessment for the project.

Geologic and Groundwater Resources

- Operation of the light rail project will not hinder the access to fill, top soil, quarry rock, and aggregate resources. Ongoing growth may put a strain on existing groundwater and rock resources.
- Relatively minor changes may be made to topography and drainage patterns.
- Groundwater resources are not currently being used within the project area. No adverse effects to future groundwater resources in the project area have been identified.

LPA Phasing Option

The LPA Phasing Option would have similar geologic and soils effects as described for the LPA to Park Avenue, with the surface park-and-ride being the primary area where the construction approach and the amount of grading or fill needed could be slightly different than for the LPA to Park Avenue.

Related Facilities

Related Bridge Area Transportation Facilities

The Related Bridge Area Transportation Facilities would have not adversely impact geology and soils. The facilities, such as the eastside streetcar connection and relocated SE Water Avenue and the development of streetcar connections in the reconstructed SW Moody Avenue, will require fill or regrading. In the South Waterfront District area, the streetcar tracks and SW Moody Avenue will be developed to match grades anticipated in the area's future development plans. This will entail additional fill and retaining structures along SW Moody Avenue.

Ruby Junction Maintenance Facility

The expansion of the Ruby Junction Facility is not expected to adversely affect geology, soils or groundwater resources. Although the Ruby Junction expansion area is underlain by gravel and is adjacent to an existing gravel operation, the expansion area includes existing residential, commercial, and light industrial uses that make it less attractive for use as a gravel quarry. The stormwater runoff from all impervious areas in the expansion area would be infiltrated to groundwater. The infiltration techniques will comply with the City of Gresham stormwater management requirements and will protect and/or improve the quality and quantity of existing groundwater flows.

The Ruby Junction Facility is also not in the likely path of a lahar from a volcanic eruption of either Mount St. Helens or Mt. Hood, and therefore no long-term effects from volcanic hazards are anticipated. The neighboring gravel operation has created a significant slope adjacent to the Ruby Junction Facility expansion area that could pose potential landslide concerns, particularly in the event of an earthquake. The Ruby Junction Facility site is also located in earthquake Zone D, the lowest relative earthquake hazard.

3.7.2.2 Short-Term Impacts (Construction)

Construction impacts are potential short-term impacts to resources within the study area that occur before or during construction of the Portland-Milwaukie Light Rail Project.

No-Build Alternative

The impacts of the No-Build Alternative on existing geologic or hydrogeologic resources would involve only the impacts of other projects that are expected to be developed in the area, even if light rail were not built.

Locally Preferred Alternative (LPA) to Park Avenue

With respect to geologic and hydrogeologic resources, the following beneficial effects could occur as a result of construction of the LPA to Park Avenue:

- Engineering improvements to areas underlain by historical artificial fill that may be inherently unstable due to the manner in which the fill was placed; the project will improve these areas in order to support construction
- For example, the construction of the Willamette River bridge will use artificial fill, which may require special design measures to strengthen or replace soil

The following potential adverse short-term effects could occur during construction, but would be addressed through adherence to best construction practices and typical construction permit conditions:

- Induced erosion from construction
- Degraded groundwater quality from construction

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road would involve the same construction conditions as the LPA to Park Avenue, except they would not occur in areas south of SE Lake Road.

Related Facilities

Related Bridge Area Transportation Facilities

The construction of the Related Bridge Area Transportation Facilities would have no meaningful effect on geology and soils. As described for the LPA to Park Avenue, near the Willamette River, the development of streetcar connections and modifications to SW Moody Avenue and SW Water Avenue would involve soil strengthening, structures, and transport of fill material into areas where grades would be changed, particularly in the South Waterfront District.

Ruby Junction Maintenance Facility

The Ruby Junction Facility construction would also have no meaningful effect on geology and soils. Construction would involve typical activities including excavation, regarding, and transport of fill material.

3.7.2.3 Cumulative Impacts

The surficial geologic units have been affected by prior activities along the alignment and would be affected by future developments as well. The small changes that would occur due to this project include reworking of disturbed soil, localized minor grade changes, minor changes in slope stability, and ground improvements. These activities would have little or no meaningful impact to geology or soils and are expected to be beneficial in several areas where previous development activity included artificial fill or structures not designed to current standards. No increase in significant cumulative impacts is expected.

3.7.3 Mitigation

The project incorporates design measures to minimize geologic impacts through the use of detailed geotechnical analysis and engineering specifications that meet the standards of applicable local, state, and federal design and construction codes. Construction standards and guidance used by TriMet, as well as guidance from ODOT, FTA, FHWA, and American Association of State Highway and Transportation Officials (AASHTO), will be followed to ensure that appropriate measures are employed.

Engineering and construction specifications will be further developed during final design to address soil and geologic conditions along the corridor, including:

- Provide protection and stabilization for steep slopes along the east and west banks of the Willamette River and in the vicinity of Waverly Heights, Milwaukie Heights along Kellogg Creek, and the Ardenwald neighborhood.
- Address unstable soils that will support foundations for the project. In areas where unstable soils are limited, they can be excavated and replaced by engineered fill, or addressed by other soil strengthening or ground stabilization measures, such as grouting. If this is not feasible, mat foundations, deep foundations, piles, or other forms of mechanical foundations can be used.
- Address the potential for seismic events through seismic upgrades for existing structures that will be altered or used, and design new structures to meet current standards. These measures could involve introduction of stabilizing soil or supporting structures on nonliquefiable soils or bedrock and more extensive foundation and structural design features.
- Continue to identify, characterize, and develop designs to address other geologic hazards.
- Establish erosion controls during construction through the implementation of erosion and sediment control plans (ESCPs) and grading permits. Mitigation should adhere to the applicable requirements of jurisdictions including ODOT’s Construction Project Pollution Control Manual or the City of Portland’s Erosion Control Manual.
- Establish erosion control at river and stream banks through the implementation of ESCPs for bridge crossings.
- Protect groundwater resources through stormwater management.

Site-specific design and construction measures to minimize construction impacts will be further defined in subsequent geotechnical evaluations and geotechnical design conducted during final design. In cases where avoidance of seismic hazards, steep slopes, known contamination sites, and hazardous soil types is not possible because of the distribution of these conditions throughout the project area, the effects of these conditions should be minimized through appropriate geotechnical and engineering controls. Erosion can be controlled through adherence to appropriate stormwater management controls, as described in Section 3.9, Water Quality and Hydrology.

For instance, final design efforts for the project will include subsurface investigations in proposed construction areas. The investigations will be conducted in accordance with generally accepted industry practice and will collect information to establish the design criteria for built structures. Separate geotechnical reports will be prepared during the engineering design portion of the project. The geotechnical reports will quantify the potential short-term construction impacts of the existing geologic and geotechnical conditions on the project, and will define appropriate design and construction.

3.7.3.1 Long-Term Mitigation

With measures incorporated in the current design and refined through the final design process, no additional mitigation is required to address effects related to long-term soil and geologic conditions.

3.7.3.2 Construction Mitigation

With measures incorporated in the current design and refined through the final design process, no additional mitigation is required to address construction effects related to soils and geology.

3.8 ECOSYSTEMS

The ecosystems section discusses the wetlands, vegetation, wildlife, fisheries species, and Threatened and Endangered Species (TES) that may be affected by the Portland-Milwaukie Light Rail Project. The Portland-Milwaukie Light Rail Project will be subject to federal, state, and local regulations concerning potential impacts to biological resources. Consequently, the ecosystems analysis provides documentation that will be considered in mitigation measures for the FEIS and also assumes compliance with requirements of permit decisions for the project. In addition, the Biological Assessment has been completed and provides further analysis of project effects on Endangered Species Act (ESA) species. A Biological Opinion was issued on June 23, 2010 and includes conservation measures for the project, which have been incorporated into the mitigation commitments listed in Appendix M; the Biological Opinion is in Appendix N. The principal regulations, ordinances, and permit actions that may apply to the light rail project are summarized in Table 3.8-1.

Table 3.8-1
Summary of Potential Natural Resource Permit Requirements

Regulation/Permit	Responsible Agency	Resource Studies	Regulated Resources
Federal			
National Environmental Policy Act (NEPA)	Federal Transit Administration (FTA)	NEPA Environmental Impact Statement (EIS) addressing natural resource conditions, impacts, and mitigation	All elements of the natural environment / ecosystems
Clean Water Act (CWA) Section 404 Individual Permit; Section 10 (Rivers and Harbors Act)	U.S. Army Corps of Engineers (USACE)	Alternatives analysis; wetland delineation study; wetland functional assessment and impact analysis; mitigation plan	Waters of the U.S., including wetlands
Endangered Species Act (ESA)	National Marine Fisheries Service (NMFS); U.S. Fish and Wildlife Service (USFWS)	Biological Assessment addressing project impacts to listed species, species proposed for listing, and candidate species, and their habitats	Vegetation, wildlife, fisheries, habitats

Table 3.8-1
Summary of Potential Natural Resource Permit Requirements

Regulation/Permit	Responsible Agency	Resource Studies	Regulated Resources
Fish and Wildlife Coordination Act	USFWS; NMFS; Oregon Department of Fish and Wildlife (ODFW)	Agency consultation; identify impacts to fish and wildlife resources; recommend mitigation	Vegetation, wildlife, fisheries, habitats
Magnuson-Stevens Fishery Conservation Management Act	NMFS	Identify potential impacts to Essential Fish Habitat (EFH)	Habitat for commercially significant fish
Migratory Bird Treaty Act	USFWS	Identify impacts to migratory birds	Wildlife
State			
Oregon Removal – Fill Permit	Oregon Department of State Lands (DSL)	Alternatives analysis; wetland delineation study; wetland functional assessment and impact analysis; mitigation plan	Waters of the state, including wetlands
Oregon State ESA	ODFW; Oregon Department of Agriculture (ODA)	Identify project impact to state-listed and candidate species	Vegetation, wildlife, fisheries
CWA Section 401 Water Quality Certification	Oregon Department of Environmental Quality (DEQ); U.S. Environmental Protection Agency (EPA)	Assess project compliance with state water quality standards; implement mitigation measures; stormwater management plan	Rivers, streams, other bodies of water
Oregon Fish Passage Statute	ODFW	Identify stream crossing and impacts to ability for fish to pass upstream and downstream	Native fish, streams, and culverts
Local			
Portland Greenway Review	City of Portland	Evaluation of impacts to native vegetation; mitigation or preservation of native vegetation	Greenway setback, vegetation, wildlife, fisheries
Environmental Overlay Zone	City of Portland	Identification of adverse impacts; mitigation plan	Streams, wetlands, wildlife habitat
City of Milwaukie Water Quality and Natural Resource Overlay Zones	City of Milwaukie	Protection of water quality resource areas and natural resources	Designated water quality resource areas and habitat conservation areas
City of Milwaukie Greenway	City of Milwaukie	Evaluation of proposed land use and compatibility with current land use and aesthetic and recreational value of greenway zone	Greenway zone, vegetation buffer
Setback Requirements	Clackamas County	Protection of river and stream corridors	Rivers and streams
Habitat Conservation Overlay Zone Water Quality Resource Area	City of Gresham	Protection of water quality resource areas and natural resources	Designated water quality resource areas and habitat conservation areas

In addition, Executive Order 11990 – Protection of Wetlands requires federal agencies to take action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Projects that receive federal funds are required to avoid new construction in wetlands unless there is “no practicable alternative to such construction and that the proposed action includes all practicable measures to minimize harm to wetlands, which may result from such use.” Economic, environmental, and other pertinent factors may all be taken into account in making this determination. In addition, Executive Order 11988 – Floodplain Management provides similar protection for floodplains. This is discussed in more detail in Section 3.9, Water Quality and Hydrology.

3.8.1 Affected Environment

The construction and operation of a light rail line has the potential to affect existing biological resources. These biological resources include wetlands and waterways, vegetation, wildlife, fisheries, and threatened and endangered species. The following discussions of the affected environment focus primarily on resources within a study area defined as 150 feet from the trackway centerline and from the outer edge of other project elements. The project study area includes expansion of TriMet’s Ruby Junction Facility in Gresham. The analysis also considers information from field observations, and it applies information from local, state, and federal agencies, which helps characterize ecosystem resources within the study area and beyond.

3.8.1.1 Wetlands

During the Draft Environmental Impact Statement (DEIS) process, 12 sites, labeled PM 0 through PM 11, were identified within the project study area as having the potential to have wetlands and/or waterways (i.e., non-wetland waters such as creeks, rivers, and lakes). Eight of these twelve sites contained wetlands, which are summarized in Table 3.8-2. Sites only containing waterways are also noted in Table 3.8-2 and are discussed further in Section 3.8.1.2. A total of approximately 3.88 acres of wetlands and 12.34 acres of waterways were delineated in the project study area. Wetlands and waterways are displayed in Figure 3.8-1. These features were delineated for the light rail project in 2009, using the on-site Level II USACE methodology, and one additional wetland in the study area was delineated by Clackamas County for the Trolley Trail project. The Oregon DSL concurred with the light rail project delineation on October 29, 2009 (WD#2009-0285), and concurred with the Trolley Trail delineation on May 23, 2008 (WD#2008-0175). The USACE concurred with the Trolley Trail delineation on February 5, 2009 (NWP-2008-230).

No wetlands or waterways occur within the Related Bridge Area Transportation Facilities portion of the project.

The Ruby Junction Facility is situated partially on hydric soils, but no wetlands or waters are present within the facility’s boundaries or planned expansion area. Wetlands or waters are present in the vicinity of the facility, but are outside the study area.

Table 3.8-2
Summary of Wetlands and Waterways within the Project Study Area

Site/Wetland	Waterway (acres)	Wetland Class[1]	Wetland Determination (acres)	Comments
PM 0	Willamette River (10.15)	NA	No wetland	No wetlands present along river banks within the project study area.
PM 1	Crystal Springs Creek (0.12)	RFT	Wetland (0.22)	Perennial stream bounded by emergent and scrub-shrub wetland.
PM 2	NA	S/F	Wetland (2.57)	Union Pacific Railroad (UPRR) Brooklyn Yard wetland mitigation site.
PM 3	NA	NA	No wetland	Feature identified in DEIS as potential wetland, further reviewed and determined to not meet wetland criteria.
PM 4	NA	DEP	Wetland (0.07)	Small, isolated wetland containing black cottonwood and Oregon ash trees.
PM 5	Johnson Creek (0.57)	RFT	Wetland (0.06)	Emergent wetland along flood bench just above ordinary high water but below top of bank.
PM 6	NA	DEP	Wetland (0.76)	City of Milwaukie Roswell retention facility supporting emergent, scrub-shrub, and forested wetland.
PM 7	Crystal Creek[2] and tributary (0.02)	RFT	Wetland (0.20)	Perennial stream and intermittent tributary supporting emergent, scrub-shrub, and forested wetland.
PM 8	Spring Creek (0.08)	NA	No wetland	No wetlands present along creek banks.
PM 9	Kellogg Lake (1.38)	RI	Wetland (<0.01)	Very small (0.001 acre) emergent fringe wetland adjacent to lake.
PM 10	NA	NA	Wetland (<0.01)	Several small ephemeral drainages mapped but deemed nonjurisdictional by USACE and DSL.
PM 11	Courtney Springs Creek [3] (0.02)	NA	No wetland	No wetlands adjacent to creek banks.

Source: URS 2002, DEA 2008, Portland-Milwaukie Light Rail Project Wetland Delineation Report, DEA 2009.

[1] Wetland class based on HGM methodology (Adamus 2001): NA = Not Applicable; RFT = Riverine Flow-Through; RI = Riverine Impounding; S/F = Slope/Flat; DEP = Depressional.

[2] Crystal Creek is not named by the U.S. Board on Geographic Names; for the purpose of this report, this project is using the name Crystal Creek to designate this unnamed stream that flows from Crystal Lake.

[3] Courtney Springs Creek is not named by the U.S. Board on Geographic Names; for the purpose of this report, this project is using the name Courtney Springs Creek to designate this unnamed stream that flows from Courtney Springs and that has been termed Linder Creek on an Oregon Department of Transportation sign where the stream passes under SE McLoughlin Boulevard.

3.8.1.2 Waterways

Transit improvements proposed as part of the project would cross the Willamette River and Kellogg Lake[5] as well as up to five streams, all located within the lower portion of the Willamette River basin. These streams include Crystal Springs Creek, Johnson Creek, Crystal Creek, Spring Creek, and Courtney Springs Creek. The MOS to Lake Road would not cross Kellogg Lake or Courtney Springs Creek. Additionally, the proposed expansion of the existing Ruby Junction Facility in Gresham would occur in proximity to Fairview Creek and, in a later phase of construction, would occur in a portion of the floodplain, which includes mostly cleared land within a developed urban area. These streams currently receive runoff from roadways and other surfaces. The majority of this runoff is not treated to current design standards for quality or quantity. The floodplains associated with the waterbodies are an integral part of the ecological function of the waterways, although within the project area, most of the floodplains include cleared areas. However, active restoration and preservation activities have helped maintain and improve functional values of Crystal Springs Creek and Johnson Creek.

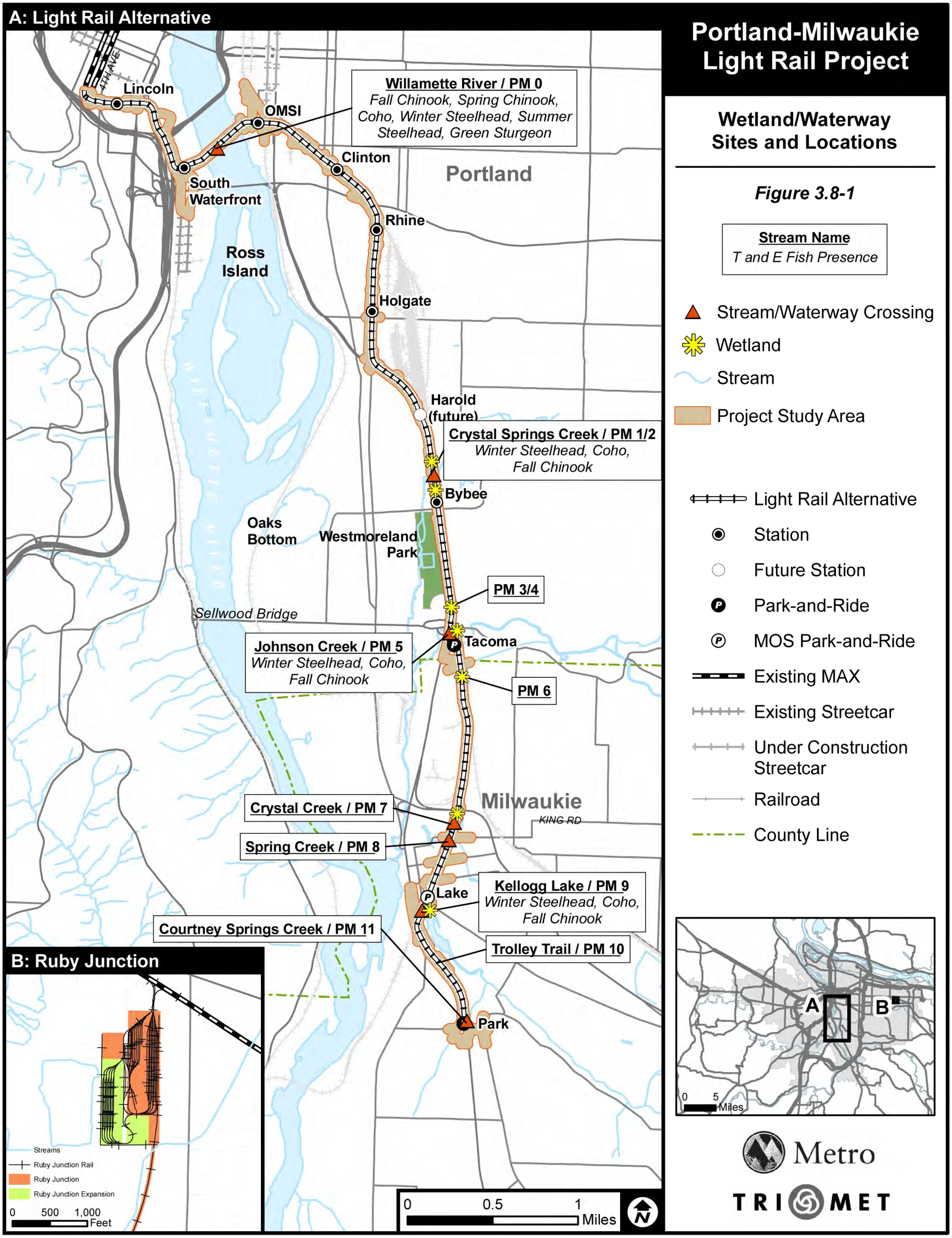
Figure 3.8-1 shows the rivers and streams in the analysis area. Table 3.8-3 identifies the project area streams affected by the project by alternative and project component. Table 3.8-4 summarizes existing conditions for each of these waterbodies. Additional details on waterways, including a floodplains map, as well as water quality and stormwater issues in the corridor, are provided in Section 3.9, Water Quality and Hydrology.

Table 3.8-3
Project Area Streams

Stream[1]	LPA to Park Ave.	MOS to Lake Rd.	Bridge Area Transportation Facilities	Ruby Junction
Fairview Creek				X
Willamette River	X	X	X	
Crystal Springs Creek	X	X		
Johnson Creek	X	X		
Crystal Creek	X	X		
Spring Creek	X	X		
Kellogg Lake/Creek	X			
Courtney Springs Creek	X			

[1] Streams are presented in order moving south along the alignment. Fairview Creek is associated with the Ruby Junction Maintenance Facility and is located northeast of the project area.

[5] A dam located at Kellogg Creek's SE McLoughlin Boulevard bridge impounds the creek to form Kellogg Lake. The proposed alignment crosses this impounded area. Although there are plans to remove the dam and return the creek to a free-flowing stream, a specific timeline is not available. Consequently, this report assumes the proposed project will cross the lake and refers to the affected waterbody as Kellogg Lake.


Portland-Milwaukie Light Rail Project
Wetland/Waterway Sites and Locations
Figure 3.8-1
A: Light Rail Alternative
11TH AVE
Lincoln
OMSI
South Waterfront
Clinton
Portland
Rhine
Ross Island
Holgate
Harold (future)
Bybee
Oaks Bottom
Westmoreland Park
Sellwood Bridge
Tacoma
Milwaukie
KING RD
Lake
Park
Willamette River / PM 0
Fall Chinook, Spring Chinook, Coho, Winter Steelhead, Summer Steelhead, Green Sturgeon
Crystal Springs Creek / PM 1/2
Winter Steelhead, Coho, Fall Chinook
PM 3/4
Johnson Creek / PM 5
Winter Steelhead, Coho, Fall Chinook
PM 6
Crystal Creek / PM 7
Spring Creek / PM 8
Kellogg Lake / PM 9
Winter Steelhead, Coho, Fall Chinook
Trolley Trail / PM 10
Courtney Springs Creek / PM 11
0 0.5 1 Miles
B: Ruby Junction
Streams
Ruby Junction Rail
Ruby Junction
Ruby Junction Expansion
0 500 1,000 Feet
Stream Name
T and E Fish Presence
Stream/Waterway Crossing
Wetland
Stream
Project Study Area
Light Rail Alternative
Station
Future Station
Park-and-Ride
MOS Park-and-Ride
Existing MAX
Existing Streetcar
Under Construction Streetcar
Railroad
County Line
A
B
0 5 Miles
Metro
TRIMET

June 2010

Table 3.8-4
Summary of Existing Conditions in Project Area Streams

Stream	Crossed by[1]	Supports TES Fish Species (Species)[2]	Approx. Basin Size (sq mi)	Approx. Wetted Width at Crossing (ft)[3]	Water Quality Limited Waterbodies for Following Parameters[4,5]	TMDL(s) Approved for Following Parameters[4,6]
Willamette River	LPA to Park Ave., MOS to Lake Rd.	Yes (Chinook, coho, cutthroat, steelhead)	11,500	1,500	aldrin, biological criteria, DDT, DDE, dieldrin, *E. coli*, fecal coliform, iron, manganese, mercury, PCBs, PAHs, pentachlorophenol	Dioxin; temperature; bacteria
Crystal Springs Creek	LPA to Park Ave., MOS to Lake Rd.	Yes (Chinook, coho, cutthroat, steelhead)	2	15	None	Bacteria; temperature; DDT; dieldrin
Johnson Creek	LPA to Park Ave., MOS to Lake Rd.	Yes (Chinook, coho, cutthroat, steelhead)	54	35	DDT, temperature, dieldrin, *E. coli*, fecal coliform, PCBs, PAHs	Bacteria; temperature; DDT; dieldrin
Crystal Creek	LPA to Park Ave., MOS to Lake Rd.	No	<1	<5	None; see Johnson Creek	None; see Johnson Creek
Spring Creek	LPA to Park Ave., MOS to Lake Rd.	No	<1	<5	None; see Johnson Creek	None; see Johnson Creek
Kellogg Lake/Creek	LPA to Park Ave.	Yes (Chinook, coho, cutthroat, steelhead)	15	200	E. coli	None
Courtney Springs Creek	LPA to Park Ave.	Yes (cutthroat)	<1	<5	None; see Kellogg Lake/Creek	None; see Kellogg Lake/Creek
Fairview Creek	none	No	7	NA	*E. coli*, fecal coliform	Bacteria; temperature

1 LPA to Park Avenue includes LPA Phasing Option.

2 Sources: PNW Ecosystem Research Consortium 2002, StreamNet 2007a, City of Portland 2007. TES = Threatened, Endangered, and Sensitive.

3 Wetted width is the distance between water's edge on each side of the stream as measured perpendicular to streamflow.

4 Source: DEQ 2007.

5 The 303(d) list is a list of waterbodies (or segments of waterbodies) that do not meet their designated water quality standards as defined by Section 303(d) of the federal Clean Water Act. These "impaired" waterbodies are reported to EPA every two years on the 303(d) list, which is maintained by DEQ.

6 A Total Maximum Daily Load (TMDL) is a quantitative analysis of a waterbody that includes two components: (a) a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and (b) an allocation of that total amount amongst the pollutant's sources (both point and nonpoint). TMDLs largely determine the regulatory environment under which municipalities manage their stormwater discharges.

Except for Fairview Creek, the LPA to Park Avenue will cross each of the waterways listed in Table 3.8-4. The MOS to Lake Road will cross each waterway except Kellogg Lake and Courtney Springs Creek. The crossings are in the following locations:

- Willamette River – between the Marquam and Ross Island bridges

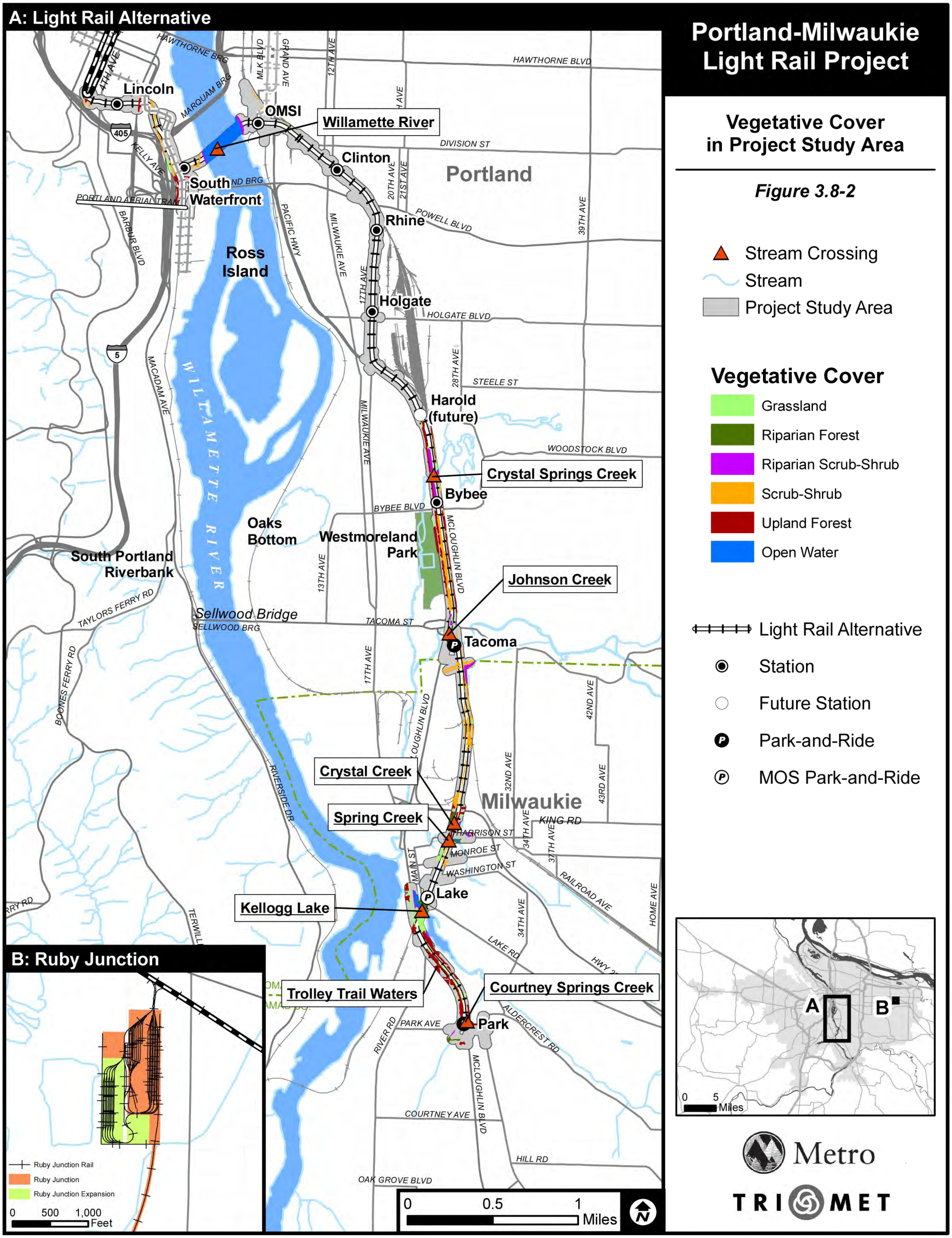
- Crystal Springs Creek – east of SE McLoughlin Boulevard and west of the UPRR alignment, approximately one-quarter mile north of the SE Bybee Boulevard bridge
- Johnson Creek – immediately east of SE McLoughlin Boulevard, approximately 100 feet south of the SE Tacoma Street bridge
- Crystal Creek – adjacent to the UPRR, between the Highway 224 and SE Harrison Street crossings
- Spring Creek – adjacent to the UPRR at its SE Harrison Street crossing
- Kellogg Lake – east of the existing UPRR crossing
- Courtney Springs Creek – to the west of SE McLoughlin Boulevard; north of SE Park Avenue

The Willamette River, Crystal Springs Creek, Johnson Creek, and Kellogg Lake are proposed to be crossed on new bridge structures. Crystal Creek, Spring Creek, and Courtney Springs Creek would cross existing culverts. At Crystal Springs Creek, a bridge will be constructed over an existing culvert in order to facilitate potential future removal of the culvert. Bridges with foundations below the ordinary high water (OHW) elevation would be constructed at the Willamette River and Kellogg Lake (if it remains in its current dammed condition). A culvert extension at Crystal Creek and culvert repairs at Spring Creek and Courtney Springs Creek would occur below OHW elevations. Crossings of Crystal Springs Creek and Johnson Creek would be located above the OHW elevation. See Section 3.9 for additional details on hydrological, stormwater, and floodplain issues.

3.8.1.3 Vegetation

The project study area consists primarily of developed land cover. Developed land cover includes commercial and residential buildings, roads, sidewalks, train yards and railways, and other infrastructure. The remainder of the project study area consists of several undeveloped areas primarily within road and railway rights-of-way, the banks of the Willamette River, Johnson Creek corridor, park areas adjacent to Kellogg Lake, the Eastmoreland Golf Course, and a few undeveloped lots. Most areas that do support vegetation have experienced some degree of past land disturbance and typically are dominated by non-native species such as Himalayan blackberry (*Rubus armeniacus*) and reed canarygrass (*Phalaris arundinacea*), among others.

Five general vegetation cover types have been noted within the alignment including grassland, scrub-shrub, riparian scrub-shrub, upland forest, and riparian forest. These vegetation cover types were based on previous studies associated with the South Corridor Project, which included the Portland-Milwaukie Light Rail Project alignment. Formally established vegetation classification systems, such as Franklin and Dyrness (1988), were not used because of the highly altered nature of the corridor. Such classification systems are based on relatively intact natural ecosystems, which the project corridor lacks. Table 3.8-5 lists the acreage of each plant community within the project study area. The vegetation cover estimates are based on a 150-foot buffer around project elements (i.e., a 300-foot-wide corridor centered on track centerline). A vegetation cover map is also provided in Figure 3.8-2.



Portland-Milwaukie Light Rail Project
Vegetative Cover in Project Study Area
Figure 3.8-2
A: Light Rail Alternative
B: Ruby Junction
Stream Crossing
Stream
Project Study Area
Vegetative Cover
Grassland
Riparian Forest
Riparian Scrub-Shrub
Scrub-Shrub
Upland Forest
Open Water
Light Rail Alternative
Station
Future Station
Park-and-Ride
MOS Park-and-Ride
Ruby Junction Rail
Ruby Junction
Ruby Junction Expansion
0 500 1,000 Feet
0 0.5 1 Miles
0 5 Miles
Portland
Milwaukie
Lincoln
OMSI
Clinton
South Waterfront
Rhine
Holgate
Harold (future)
Bybee
Tacoma
Lake
Park
Willamette River
Crystal Springs Creek
Johnson Creek
Crystal Creek
Spring Creek
Kellogg Lake
Trolley Trail Waters
Courtney Springs Creek
Ross Island
Oaks Bottom
Westmoreland Park
South Portland Riverbank
Sellwood Bridge
WILLAMETTE RIVER
HAWTHORNE BRG
HAWTHORNE BLVD
DIVISION ST
POWELL BLVD
HOLGATE BLVD
STEELE ST
WOODSTOCK BLVD
BYBEE BLVD
TACOMA ST
SELLWOOD BRG
TAYLORS FERRY RD
BOONES FERRY RD
MACADAM AVE
BARBUR BLVD
KELLY AVE
PORTLAND AERIAL TRAM
MARQUAM BRG
PACIFIC HWY
MILWAUKIE AVE
MCLOUGHLIN BLVD
RIVERSIDE DR
HARRISON ST
MONROE ST
WASHINGTON ST
KING RD
RAILROAD AVE
LAKE RD
ALDERCREST RD
PARK AVE
RIVER RD
COURTNEY AVE
HILL RD
OAK GROVE BLVD
MAIN ST
Metro
TRIMET

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In addition to these general vegetation types discussed below, wetland vegetation types including palustrine emergent, scrub-shrub, and forested were noted for each wetland area across the project corridor and are included in Table 3.8-5.

Table 3.8-5
Vegetation Cover Types/Plant Communities within the Project Study Area

Vegetation Type	Acres in LPA to Park Ave. Study Area[1]	Percent of LPA to Park Ave. Study Area	Acres in MOS to Lake Rd. Study Area[1]	Percent of MOS to Lake Rd. Study Area
Grassland	11.24	2.4%	6.07	1.6%
Riparian Scrub-Shrub	7.65	1.7%	6.80	1.7%
Scrub-Shrub	21.66	4.7%	21.66	5.5%
Riparian Forest	3.94	0.9%	2.27	0.6%
Upland Forest	24.82	5.4%	14.48	3.7%
Open Water	16.24	3.5%	13.69	3.5%
Developed Land	377.60	81.5%	325.90	83.4%
Total[2]	463.15	100%	390.87	100%

[1] Acreage data from GIS mapping based on revisions to data from *South Corridor Project SDEIS* (2002), updated in 2009. Cover type at the Ruby Junction Facility consists of developed, with small portions of residential lawn and mature trees. Percentage totals include rounding. Also includes LPA Phasing Option.

[2] Percentages may not sum due to rounding.

The following descriptions summarize each vegetation type:

<u>Grassland</u>

Grassland includes areas that are dominated by grasses and other annual and perennial herbaceous species and have little or no tree and shrub cover. Because much of the vegetation within the alignment has been altered by human activities such as landscaping, many of the dominant plants in these grasslands are non-native to the Pacific Northwest. Representative dominant grasses in the grasslands are sweet vernalgrass (*Anthoxanthum odoratum*), Kentucky bluegrass (*Poa pratensis*), tall fescue (*Festuca arundinacea*), colonial bentgrass (*Agrosotis tenuis*), perennial ryegrass (*Lolium perenne*), common velvetgrass (*Holcus lanatus*), reed canarygrass (*Phalaris arundinacea*), timothy (*Phleum pratense*), and meadow foxtail (*Alopecurus pratensis*). Common broadleaf species are Canada thistle (*Cirsium arvense*), bull thistle (*C. vulgare*), common dandelion (*Taraxacum officinale*), red clover (*Trifolium pratense*), white clover (*T. repens*), wild fennel (*Foeniculum sp.*), Queen Anne's lace (*Daucus carota*), hairy cat's ear (*Hypchaeris radicata*), English plantain (*Plantago lanceolata*), and chicory (*Cichorium intybus*). Non-native Himalayan blackberry (*Rubus armeniacus*) was also occasionally present, but provided relatively low percent cover.

Grassland typically occurs in disturbed areas scattered throughout the study area in small to moderate-sized patches. No native grassland or prairie habitat was encountered within the study area.

Scrub-shrub

Scrub-shrub is dominated by shrubs and/or small trees (typically less than 20 feet tall). Tree canopy cover is low to nonexistent, and herbaceous cover may range from high to very low depending upon the density and cover of the shrubs. Within the study area, scrub-shrub is most frequently composed of non-native Himalayan blackberry. Although not a true shrub, this highly invasive perennial vine forms dense, impenetrable stands, especially in open areas that experience recurrent disturbance (e.g., streambanks, roadsides). Other representative scrub-shrub species within the study corridor include Scotch broom (*Cytisus scoparius*), common snowberry (*Symphoricarpos albus*), red-osier dogwood (*Cornus stolonifera*), trailing blackberry (*Rubus ursinus*), and English hawthorn (*Crataegus monogyna*). Small trees and saplings of black cottonwood, Oregon ash (*Fraxinus latifolia*), willows (*Salix spp.*), and crab apple (*Malus fusca*), often contribute to the vegetative cover in this habitat as well. Grasses and forbs listed under the grass community were also commonly found.

Most scrub-shrub vegetation in the alignment consists of small, scattered stands of shrubs along streams and roadsides. This common cover type frequently consists of stands of Himalayan blackberry. The larger scrub-shrub stands are located along the west side of the UPRR tracks north of the SE Tenino Street-SE McLoughlin Boulevard ramp and south of SE Bybee Boulevard, and adjacent to the east and west sides of the tracks along the Tillamook Branch line.

Riparian Scrub-Shrub

Riparian scrub-shrub is similar to the scrub-shrub community with respect to plant community composition. The primary distinction is that the riparian scrub-shrub community occurs adjacent to aquatic features including rivers, lakes, and ponds. Scrub-shrub wetlands were also included in the riparian scrub-shrub plant community mapping classification. In addition to the species listed under the scrub-shrub plant community, other species commonly found in the riparian scrub-shrub community include Douglas spiraea (*Spiraea douglasii*), Nootka rose (*Rosa nutkana*), sumac (*Rhus sp.*), bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), slough sedge (*Carex obnupta*), and non-native reed canarygrass.

Within the project study area this habitat type occurs adjacent to the Willamette River, Crystal Springs Creek, Crystal Creek, and Kellogg Lake. Areas of this community bordering the Willamette River and portions of Crystal Springs Creek and Kellogg Lake contained a particularly high percent cover of Himalayan blackberry.

Upland Forest

Upland forest is dominated by broad-leaved deciduous trees, conifers, or a mix of both. Dominants may include big leaf maple, black cottonwood, Oregon ash, Oregon white oak (*Quercus garryana*), non-native oak species (*Quercus spp.*), red alder (*Alnus rubra*), Douglas fir (*Pseudostuga menziesii*) and western red cedar (*Thuja plicata*). These areas typically consist of second- or third-growth forest and treed areas with considerable overstory cover located within road and railway rights-of-way. The tree canopy can be relatively open to nearly closed and is dominated by trees well over 20 feet in height. Understory species may include common snowberry, Indian plum (*Oemleria cerasiformis*), hazelnut (*Corylus cornuta*), Douglas hawthorn (*Crataegus douglasii*), English hawthorn (*Crataegus monogyna*), Nootka rose, trailing blackberry, Himalayan blackberry, sword fern (*Polystichum munitum*), and English ivy (*Hedera helix*).

Within the study area, the larger stands of upland forest are located along SE McLoughlin Boulevard near Brooklyn Yard, the area due west of Highway 224, and areas adjacent to SE McLoughlin Boulevard south of Kellogg Lake.

Riparian Forest

Riparian forest is associated with streams, wetlands, and other bodies of water. This cover type is usually dominated by deciduous species such as Oregon ash, red alder, willow, black cottonwood, Oregon oak, and bigleaf maple, but may contain scattered Douglas firs and Western red cedars as well. Common shrubs and small trees include red-osier dogwood, English hawthorn, hazelnut, salmonberry, Himalayan blackberry, trailing blackberry, and Nootka rose. Dominant herbaceous species include stinging nettle (*Urtica dioica*), English ivy, and creeping buttercup (*Ranunculus repens*).

Within the project study area, riparian forest occurs along Johnson Creek, Crystal Creek, Spring Creek, and portions of Kellogg Lake.

Open Water

Open water consists of aquatic habitat that lacks significant vegetative cover and includes ponds and stream and river channels. Because of the absence of wetland vegetation, most of the waterways crossed by the alignment are classified as open water habitat. These waterways include the Willamette River, Crystal Springs Creek, Spring Creek, Johnson Creek, and Kellogg Lake. A more detailed discussion of these waterways is provided below under Fisheries and Threatened, Endangered, and Sensitive Species.

Developed Land

Developed land includes residential, commercial, and industrial developments as well as transportation corridors and other disturbed sites. Development varies from high intensity (e.g., dense residential developments, industrial complexes) to low intensity (e.g., large residential lots with trees and other vegetation). High intensity development includes areas where much of the land is covered by structures and impervious surfaces and contains little, if any, vegetation. Examples are commercial and industrial complexes, major roadways, and high density residential development. Low intensity development contains a combination of vegetated lands (either naturally or artificially) along with buildings, secondary roadways, rail lines, and other man-made structures. This category of developed land is typically found in suburban settings and includes lower density residential areas, recreational sites, and small parks and fields.

3.8.1.4 Wildlife

Wildlife species that occur within the project study area include amphibians, reptiles, birds, and mammals. Many of these species are commonly found in urban habitats. They are generally adapted to life in urbanized areas, often occurring in edge habitats that exist along the boundaries of different habitat types. Some of these common species are non-native, such as the bullfrog, European starling, and English sparrow.

At least 20 species of amphibians and reptiles potentially occur within the project study area and surrounding habitat areas, including native and non-native species. Among these species are the northwestern salamander, northern red-legged frog, western painted turtle, northwestern pond turtle, and northern alligator lizard. The amphibians are generally found in quiet waters that are often cold, clear, and well oxygenated. Reptiles would be expected to occur in moist areas of riparian and wetland habitats.

Bird species are the largest group of vertebrates that occur in urban areas. Notable bird species in the area include the great blue heron, red-tailed hawks, and osprey. Peregrine falcons are not known to nest in the project study area and there is no known suitable nesting habitat, but peregrine falcons may use some of the project study area for foraging and migration activities.

Bald eagles were delisted from the federal ESA in August 2007 but are still listed as threatened under Oregon's ESA; see Threatened, Endangered, and Sensitive (TES) species sections below.

Native mammals in urban areas are usually found near larger undisturbed habitats. Mammals that occur in the vicinity of the project include Virginia opossum, eastern cottontail, raccoon, coyote, fox squirrel, native mice and vole species, bat species, house mice, and Norway rat. Black-tailed deer would be expected in the larger woodland areas. Muskrat, non-native nutria, beaver, and river otter occur in the Willamette River and its tributaries.

Urban areas, which are usually characterized by fragmented noncontiguous habitats, generally limit movement of ambulatory wildlife (species that walk or run). Since the alignment is primarily located along existing streets and railroads, the few wildlife corridors that are near to or crossed by the alignment tend to be near streams. Wildlife species likely to be present at the Ruby Junction Facility, which is within an urbanized area, are similar to those within the light rail alignment study area.

3.8.1.5 Fisheries

Fisheries resources in the project area consist of both native and non-native species in a variety of urbanized stream habitats. Despite the degraded and altered condition of watersheds located in the project area, approximately half of the streams crossed by the project alignment are documented as supporting populations of resident and anadromous fish species. The remaining streams are much smaller, but may support resident and anadromous species during certain portions of the year.

3.8.1.6 Threatened, Endangered, and Sensitive Species

Threatened and endangered species, including those species proposed for listing or candidates for listing, are categorized as such under the federal ESA and the Oregon ESA. The federal government categorizes species as threatened or endangered, and also identifies candidate species that may become threatened or endangered and proposed listings, which initiates a federal review of a species' status. The Oregon ESA categorizes species of concern through the Oregon sensitive species lists compiled by Oregon Fish and Wildlife (ODFW) and the Oregon Department of Agriculture (ODA). In addition, the City of Portland and the Oregon Natural Heritage Information Center (ORNHIC) denote the special status of species.

Section 7 of the federal ESA ensures that through consultation and conferencing with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), federal actions do not jeopardize the continued existence of any federally listed threatened, endangered, or proposed species, or result in the destruction or adverse modification of critical habitat. Pre-consultation with the NMFS and USFWS was conducted during a series of site visits, meetings, and phone conversations in the preparation of the Biological Assessment for the light rail project.

County lists compiled by the USFWS identified 20 federal TES wildlife species and 11 federal TES plant species with potential to occur within Multnomah and Clackamas counties. The ORNHIC database provided 18 records of 10 state and federal TES wildlife and plant species within the two-mile search area, but all are outside of the 300-foot-wide project study area (Table 3.8-6). Several of these records are historic and represent species that are likely extirpated from the project area. No TES wildlife or plant species were recorded by ORNHIC within one mile of the Ruby Junction Facility.

Table 3.8-6
Threatened, Endangered, and Sensitive Wildlife and Plant Species with Recorded Presence Near the Project

Common Name	Scientific Name	USFWS/ NMFS Status[1]	ODFW/ ODA Status[1]	Year Last Recorded by ORNHIC	Documented in Project Study Area
Amphibians and Reptiles					
Oregon slender salamander	Batrachoseps wrightorum	SOC	SV	1980s	No
Painted turtle	Chrysemys picta	--	SC	1991	No
Oregon spotted frog	Rana pretiosa	C	SC	1931	No
Birds					
American peregrine falcon[2]	Falco peregrinus anatum	DL	SV	2003	No
Bald eagle[2]	Haliaeetus leucocephalus	DL	T	2006	No
Purple martin	Progne subis	SOC	SC	1998	No
Mammals					
Townsend’s big-eared bat	Corynorhinus townsendii	SOC	SC	1928	No
Invertebrates					
Oregon floater (mussel)	Anodonta oregonensis	--	--	2001	No
Shortface lanx (limpet)	Fisherola nuttalli	--	--	1985	No
Oregon megomphix (snail)	Megomphix hemphilli	--	--	1996	No
Plants					
Tall bugbane	Cimicifuga elata	--	C	1994	No
White rock larkspur	Delphinium leucophaeum	SOC	E	1991	No
Willamette Valley daisy	Erigeron decumbens	E	E	1894	No
Oregon sullivantia	Sullivantia oregano	SOC	C	1976	No

Source: ORNHIC 2009.
[1] Status Codes: E= Endangered; T = Threatened; DL = Delisted; C = Candidate for listing as Threatened or Endangered; SOC = Species of Concern; SC = Sensitive Critical; SV = Sensitive Vulnerable.
[2] These species likely utilize portions of the project corridor currently for movement and foraging.

No TES wildlife or plant species were identified within the project study area, and therefore the project identifies no effect on these species. With the exception of bald eagles and sensitive species associated with riparian areas, little or no potentially suitable habitat for any TES wildlife or plant species have been observed. Bald eagles are likely to use the Willamette River within the stretch of the proposed crossing for foraging and movement to some extent, but no known nests are within 600 feet, the distance from construction thought to disturb the nesting activities. Known nests are located within one mile of the proposed alignment, but not within 0.25 mile, which is well beyond the distance that would disturb nesting activities. Sensitive wildlife and plant species, such as amphibians, turtles, and bats, could utilize riparian corridors and wetlands within the project corridor and at the Ruby Junction Facility.

As shown in the table above, the Willamette Valley daisy (*Erigeron decumbens var. decumbens*) is federally listed as endangered. The ORNHIC data acquired for the project area (including a two-mile radius) document an occurrence of the daisy in the vicinity of Gladstone, Oregon, in 1894. Historically, the Willamette Valley daisy was present within the project area, but currently the range of the daisy is limited to the southern end of the Willamette Valley (NatureServe 2009). Also, the daisy is commonly found in *Deschampsia caespitosa* (tufted hairgrass) valley prairie habitat with clay soils in valley bottoms (NatureServe 2009). Because prairie habitat is not found within the project study area, and because the project is outside the daisy's current observed range, it is highly unlikely for there to be any occurrence of the Willamette Valley daisy, and therefore, the project would not affect this species.

The Steller sea lion (*Eumetopias jubatus*) was originally listed as threatened on April 5, 1990, and individuals have been observed in the Columbia River, 13.8 miles from the project area, but not in the Willamette River.

Seven of the native fisheries species documented in project area streams are listed as threatened or endangered under the federal ESA, and several more are species of concern. As listed in Table 3.8-7, waterbodies within the project area that support some or all of these species include Crystal Springs Creek, Johnson Creek, Kellogg Lake/Creek, and the Willamette River (StreamNet 2009, City of Portland 2007, ODFW 2002). A more detailed listing of both native and non-native fish species and their presence in project area streams is provided in the *Ecosystems Results Report* (Metro 2008).

In addition to these fish species, the southern Distinct Population Segment (DPS) of eulachon (*Thaleichthys pacificus*), also known as Columbia River smelt, was listed as threatened on May 17, 2010 (75 FR 13012). Eulachon is an anadromous smelt that spawns in river systems between northern California and southern Alaska and is largely semelparous (dies after spawning). 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. Some spawning has also been documented to occur along medium-sized tributaries such as the Kalama, Lewis, and Sandy rivers. Soon after emergence, the larvae are carried downstream. Eulachon spawning has not been documented along the Willamette River (NMFS 2008), and the Columbia River mainstem is 13.8 river miles away from the project area. Due to the short time spent in freshwater during their life cycle and the distance from spawning habitat to the project area, it is unlikely for eulachon to be present within the project area. Moreover, in-water work will occur between July and October, when eulachon are not likely to be present in the Columbia River Basin. Therefore, this species will not be affected by the project.

Table 3.8-7
Fish Species with Federal Status Likely to be Present near the Project

Common Name	Scientific Name	Federal Status	State Status	Crystal Springs Creek	Johnson Creek	Kellogg Lake/ Creek	Willamette River
Native Species							
Lower Columbia River Coho Salmon ESU[1]	Oncorhynchus kisutch	LT	LE	X	X	X	X
Lower Columbia River Steelhead DPS[2]	O. mykiss	LT	SC	X	X	X	X
Upper Willamette River Steelhead DPS[2]	O. mykiss	LT	SC				X
Lower Columbia River Chinook Salmon ESU[1,2]	O. tshawytscha	LT	SC	X	X	X	X
Upper Willamette River Chinook Salmon ESU[1,2]	O. tshawytscha	LT	SC				X
Green Sturgeon, Southern DPS[3]	Acipenser medirostris	LT	--				X
Pacific Lamprey	Lampetra tridentatus	SOC	SV	X	X	X	X
Lower Columbia River Cutthroat Trout ESU	O. clarki	SOC	SC	X	X	X	X

Table Key: DPS = Distinct Population Segment, ESU = Evolutionarily Significant Unit, SOC = Species of Concern, LT = Listed Threatened, LE = Listed Endangered, SC = Sensitive Critical, SV = Sensitive Vulnerable.

Sources: Metro 2003, PNW Ecosystem Research Consortium 2002, StreamNet 2009, City of Portland 2007, ODFW 2002, NMFS 2007, ORNHIC 2009.

[1] Essential Fish Habitat, as designated in the Magnuson-Stevens Fishery Conservation Management Act, exists for these species in the project area.

[2] Critical Habitat, as designated under the Endangered Species Act, exists for these salmon and steelhead species within the project area.

[3] Southern DPS green sturgeon may occur in the lower Columbia River basin, including the Willamette River, to an unknown extent, but its presence is not considered likely.

The southern resident killer whale DPS (*Orcinus orca*) was listed as endangered on April 4, 2007 (72 FR 16284). Killer whales do not occur within the project area, but their recovery may be linked to Chinook salmon runs found in the Lower Willamette River and its tributaries.

Based on dam counts of adults returning through Willamette Falls (Sullivan Dam) and the Bonneville Dam between the 1940s to the present, the Upper Willamette River Chinook salmon population comprises an average of 13.5 percent of the overall Chinook population passing Bonneville Dam. This proportion does not account for individuals in the Lower Columbia River Chinook salmon ESU that are not counted at dams. Based on the dam counts at Willamette Falls, an average of over 94 percent of adults pass Willamette Falls by July 1 (the start of the in-water work period) each year. Juvenile Chinook salmon abundances are not known, but are assumed to be similar to the adult abundances. Passage rates of Upper Willamette River Chinook salmon are known based on passive integrated transponder tags placed in wild-spawned fish. These tags show that approximately 55 percent of juveniles pass Willamette Falls before July 1 each year, and approximately 75 percent pass before July 16 each year. In addition, approximately 8 percent of juveniles pass after October 31 (the end of the in-water work period), leaving approximately 37 percent of juveniles passing through during the in-water work window.

3.8.2 Environmental Consequences

The Portland-Milwaukie Light Rail Project has the potential to create long-term, short-term, and cumulative impacts to ecosystem resources. For this analysis, long-term impacts are likely to affect the area for the operational life of the proposed project. Direct impacts are those impacts that occur due to the operation of the project components within the physical footprint of the project. Indirect impacts are those impacts that take place later in time or outside of the physical footprint of the project. Short-term impacts are likely to affect the area only during and immediately after the construction period. Cumulative impacts are “those additive impacts from the incremental effects of a proposed action when placed in context with other past, present, and reasonable foreseeable future actions” (Council on Environmental Quality [CEQ] regulation, 40 CFR 1508.7; CEQ 1978).

3.8.2.1 No-Build Alternative

Long-Term Direct and Indirect Impacts

Existing conditions characterize the No-Build Alternative, which would not include light rail improvements within the corridor’s transportation system and, therefore, would have no direct impacts to wetlands, waterways, fisheries, wildlife, plants, and TES species.

Potential indirect adverse 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 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. Degraded water quality and certain pollutants (e.g., dissolved copper) have been shown to cause detrimental effects to aquatic species, including salmonids. While traffic and congestion would increase over time with all project alternatives, the No-Build Alternative would be associated with worse congestion than with the light rail project.

Furthermore, stormwater runoff from impervious surfaces would continue to flow untreated or undertreated to project-area receiving waters until redevelopment occurs. Most of the area’s transportation facilities and adjacent developments were built before current stormwater management practices were in place. For further detail, see Section 3.9, Water Quality and Hydrology.

Short-Term Impacts (Construction)

As stated above, existing conditions characterize the No-Build Alternative, which would not include any of the proposed changes to the corridor’s transportation system. Consequently, the No-Build Alternative would not include construction over the length of the corridor and, therefore, would avoid or have fewer short-term impacts to ecosystem resources.

Cumulative Impacts

Cumulative impacts of the No-Build Alternative may occur as a result of any or all of the past, present, and reasonably foreseeable 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 not retarding personal automobile usage in the region and by not encouraging growth in a manner that is consistent with regional land use and transportation goals encouraging more compact urban development that can reduce the extent of resource impacts per person.

3.8.2.2 Locally Preferred Alternative (LPA) to Park Avenue and Minimum Operable Segment (MOS) to Lake Road

Wetlands

Long-Term Direct Impacts

In accordance with relevant state and federal regulations and Executive Order 11990, TriMet has designed the light rail project to avoid and minimize impacts to wetlands and jurisdictional waters to the extent practicable. Estimated wetland impacts associated with the project are shown in Table 3.8-8. Wetland locations are shown in Figure 3.8-1. Wetland impacts are the same for both the LPA to Park Avenue and MOS to Lake Road alignments. Wetland impacts will not change if the phasing option is chosen for the LPA to Park Avenue alignment. Total wetland impacts would be approximately 1.04 acres and would occur at the following locations, as shown on Figure 3.8-1.

Table 3.8-8
Potential Wetland Impacts (Acres)

Wetland Impacts	LPA to Park Ave.[1]	MOS to Lake Rd.	Bridge Area Transportation Facilities	Ruby Junction
PM 1 and PM 2	1.03	1.03	None	None
PM 3 and PM 4	None	None	None	None
PM 5	None	None	None	None
PM 6	None	None	None	None
PM 7	0.01	0.01	None	None
PM 8	None	None	None	None
PM 9	None	None	None	None
PM 10	None	None	None	None
PM 11	None	None	None	None
Total	1.04	1.04	None	None

Source: DEA, Parametrix, Parsons Brinckerhoff 2009.
1 Including LPA Phasing Option.

Approximately 1.03 acres of impacts would occur at PM 1 and PM 2, with the majority of these impacts occurring at PM 2. PM 1 is a palustrine emergent riverine flow-through wetland, and PM 2 wetlands are palustrine emergent and scrub-shrub depressional wetlands. Site PM 2 is also a mitigation site; however, impacts to this wetland are not expected to require mitigation at a higher ratio than for a wetland not designated as a mitigation site. This is because of a pre-existing agreement between TriMet and the Oregon DSL, which was negotiated when a mitigation site was developed in the same area identified as a likely location for the light rail project. However, the USACE has not approved the mitigation plan, and USACE acceptance will be determined with the USACE final permit decision. The alignment would cross along the east edge of PM 2 wetlands, and due to site constraints related to the existing railway, roadway, and Crystal Springs Creek (i.e., PM 1), there is no practicable opportunity to fully avoid this feature. Minor impacts of only 0.01 acre would also occur to PM 7 wetlands in the vicinity of Crystal Creek that are riverine impounding wetlands. PM 7 wetlands that would be impacted are palustrine scrub-shrub, riverine impounded wetlands.

In addition to the wetland impacts described above, some minor impacts would occur to non-wetland, other water resources (i.e., waterways including rivers, lakes, and creeks). Impacts to these features are detailed in the section below.

Vegetation buffering the various wetlands and that would be impacted typically contains a high percent cover of non-native and often invasive plant species such as Himalayan blackberry (*Rubus armeniacus*). These vegetation areas are considered to be degraded habitats.

No additional wetlands impacts are anticipated as part of the construction of the Willamette River bridge, because no wetlands are present in that area of the project corridor.

Wetland compensatory mitigation activities at Westmoreland Park, which are discussed in Section 3.8.3.1 below, will benefit wetland habitat functions in the long term through creation and restoration of wetlands along Crystal Springs Creek. Creation and restoration activities will include grading and installation of wetland and riparian plants, and removal of concrete pond banks.

No long-term impacts to wetlands or other waters of the United States are anticipated from expanding the Ruby Junction Facility in Gresham.

Long-Term Indirect Impacts

Long-term indirect impacts to project area wetlands would be associated primarily with increases in impervious area and associated impacts to hydrology and water quality, which are detailed in Section 3.9, Water Quality and Hydrology. These impacts are considered indirect because they result from actions that occur outside of the wetlands, as opposed to direct impacts, which result from removal or fill activities in the wetlands that cause a loss of wetland acreage.

Short-Term Impacts (Construction)

Temporary construction impacts may result in soil compaction and/or soil erosion and vegetation removal in or adjacent to wetlands. Soil compaction could cause changes in hydrology. If the impacts are severe, they could be permanent and result in impacts to hydrology and vegetation. Soil erosion and vegetation removal may cause soils to enter the wetlands and waterways, possibly degrading water quality. Any removal of tree and shrub vegetation for construction would likely result in decreased shading of project area wetlands and potential habitat loss. Short-term impacts to a currently channeled stream and pond at Westmoreland Park would occur as part of wetland creation/restoration activities. Appreciable temporary effects are not anticipated as part of the project outside of the likely construction area, primarily because of the implementation of impact minimization measures, including replanting, erosion and sediment control, and stormwater management.

Cumulative Impacts

Potential cumulative impacts to wetlands include additive impacts from proposed projects that have been, or will be, constructed near the Portland-Milwaukie Light Rail Project. These impacts may be direct or indirect. Direct cumulative impacts include the filling and/or spanning of wetlands associated with other projects within the Portland-Milwaukie Light Rail Project area. Indirect cumulative impacts include increased sediment and pollutant load levels in wetlands and/or waterways located within the project area due to other projects within the same watersheds and/or hydrology sources. Past projects have developed the area from natural habitats to its current condition. Other planned future projects include the removal of the dam at the outlet of Kellogg Lake; contaminant cleanup and isolation at the Zidell property upland and in-water sites; replacement of the Sellwood Bridge; construction of the City of Milwaukie Riverfront Park; ongoing City of Portland and Reed College fish passage restoration projects in Crystal Springs Creek; enhancement of Oaks Bottom Wildlife Refuge; and Johnson Creek restoration. The majority of these projects will remediate or update facilities or properties that would not meet today's standards for environmental performance, and will result in a net increase in overall ecosystem functions in the area. In addition, the urbanized area will likely continue to develop pursuant to land and zoning regulations. Future development projects are expected to meet permitting requirements to protect and mitigate for sensitive environmental resources, including water resources.

Waterways

Long-Term Direct Impacts

The light rail project will cross or intersect major and minor watercourses and floodplains within the lower portion of the Willamette River basin. The LPA to Park Avenue alignment would cross the Willamette River, Crystal Springs Creek, Johnson Creek, Crystal Creek, Spring Creek, Kellogg Lake, and Courtney Springs Creek. The MOS to Lake Road alignment would cross each of these waterways except for Kellogg Lake and Courtney Springs Creek. The proposed Ruby Junction Facility expansion is located adjacent to Fairview Creek's floodplain but will not cross the stream. Figure 3.8-3 shows the project area streams affected by the LPA to Park Avenue and MOS to Lake Road alignments. Table 3.8-9 shows the area impacted by each crossing option at each stream.

Table 3.8-9
Permanent Footprint of Project Area Stream Crossings[1,2]

	Willamette River	Crystal Springs Creek[3]	Johnson Creek	Crystal Creek	Kellogg Lake	Total
Approximate Wetted Width[4] (feet)	1,500	20	35	<5	200	1,755
Estimated Bridge/Crossing Width (Linear Feet of Stream)	75	34	43	<20	40	212
Permanent Footprint (square feet)						
LPA to Park Ave.[5]	112,500	680	1,505	<100	8,000	122,785
MOS to Lake Rd.	112,500	680	1,505	<100	0	114,785

Source: Parametrix and TriMet 2009.

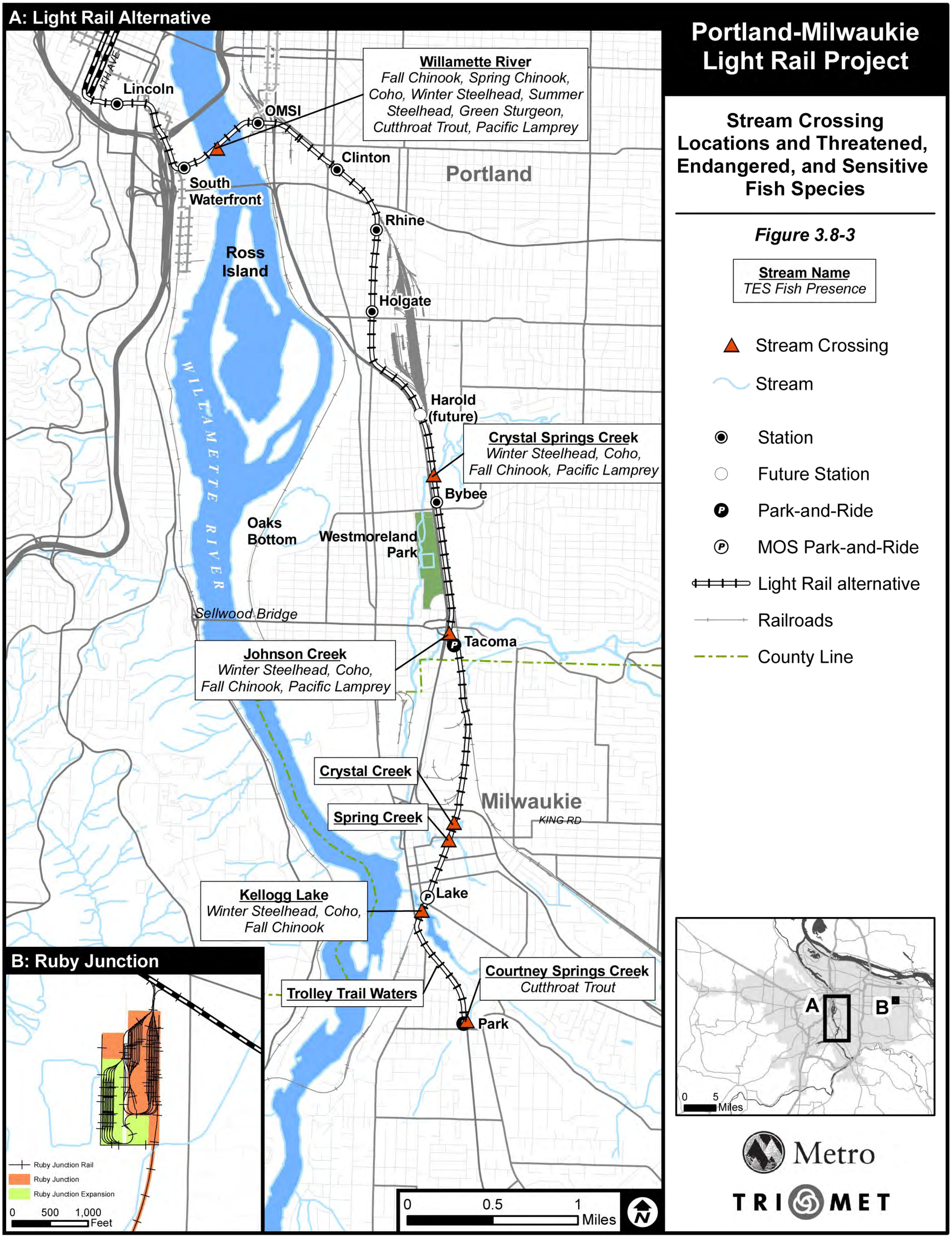
[1] A bridge's/crossing's footprint is the total area (square feet) of the bridge or culvert located above the stream/river. It approximates the shade produced by the structure. The crossing structure's footprint is calculated by multiplying the width of the bridge (row 1) by the stream's wetted width (row 2).

[2] Spring Creek and Courtney Springs Creek would be crossed on an existing culvert; therefore, the project would not include added footprint over those streams.

[3] Crystal Springs Creek is currently in a culvert and a new bridge would be constructed over the culvert.

[4] Wetted width is the distance between water's edge on each side of the stream as measured perpendicular to streamflow.

[5] Including LPA Phasing Option.



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Although the LPA to Park Avenue would cross up to seven waterways, in-water work will only occur at two waterways documented as supporting populations of resident and anadromous fish: the Willamette River and Kellogg Lake. In-water work will occur at the Willamette River during the summer preferred in-water work period of July 1 to October 31. At Kellogg Lake, in-water work will occur July 15 to September 30. Other construction below OHW includes a culvert extension at Crystal Creek, culvert repair at Spring Creek, and culvert repair at Courtney Springs Creek. However, these creeks are not documented as supporting populations of resident and anadromous fish species, though ODFW concluded that there was the historic presence of these fish in these waterways (Todd Alsbury, pers. comm., 2009). At Crystal Springs Creek and Johnson Creek, no in-water work will be occurring. However, piles will be driven in proximity to these waterways, and pile driving has been shown to create hydroacoustic impacts that may adversely affect fish species. Since both Crystal Springs and Johnson creeks support listed fish species, piles within 30 feet of the creeks will be driven within the preferred in-water work period of July 15 to August 31. Impacts to floodplains are discussed in more detail in Section 3.9, Water Quality and Hydrology.

For the following reasons, potential impacts to hydrology, geomorphology, and habitat resulting from the crossings are anticipated to be minor:

Willamette River

- Preliminary bridge designs suggest that the east bridge pier would be placed in water that is over 20 feet deep and, therefore, likely would not affect the integrity of shallow water (defined as <20 feet in depth) or near-shore and bank habitats that are considered valuable to native fish such as salmonids, lamprey, and sturgeon.
- The west bridge pier design has been modified so that over half of the pier would be located in deep water in order that effects to shallow water habitat are minimized.
- The piers for the bridge would likely be small (each approximately 100 feet wide) relative to the size of the Willamette River’s channel (approximately 1,400 feet wide). Depending on the final design of the bridge piers, total area and volume of the river impacted by the piers would likely be less than 10 percent of the water column. However, permanent scour protection that will be placed around the piers is extensive and will cause flood rise that cannot be mitigated through balanced cut and fill within the Willamette River floodplain (see Section 3.9 for further detail). The permanent scour protection will be placed in order to prevent scour-related hydraulic effects.
- Permanent scour protection would likely prevent scour on the west side of the river, which will protect shallow water habitat from toxic contamination by resuspension of riverbed sediments contaminated with PCBs and metals. Permanent scour protection in shallow water habitat would alter existing conditions of shallow water habitat and may adversely affect fish habitat. Permanent scour protection on the east side of the river would prevent much of the scour to the riverbed in deepwater habitat, the undermining of the City of Portland’s 36-inch diameter waterline and other utility lines; and the resuspension of known contaminants such as pesticides, PCBs, and metals. Though stabilizing sediments on both the west and east sides of the Willamette River would prevent contamination and benefit fish, permanent scour protection in shallow and deep water habitat would alter their existing conditions and may adversely affect fish habitat.

- In-water habitat impacts due to the installation of piers and scour protection in the Willamette River will be offset through the removal of identified derelict pile fields and through the creation and enhancement of shallow water and beach habitat within the active channel of the Willamette River at a site known as the Central District or South Waterfront Greenway, upstream of the Ross Island Bridge on the western bank. Further detail is included in Section 3.8.3.2.

Kellogg Lake

- In the project area, Kellogg Creek is impounded to form Kellogg Lake, which currently lacks the water velocity of a free-flowing stream and has very little habitat diversity. Consequently, the quality and diversity of the lake's fish habitat is low and, because velocities are very low, the impact of the in-water bridge structure to existing habitat and channel integrity, primarily by scouring, is minimal.
- The shafts of the in-water pier would likely be small (two 6-foot columns) relative to the size of Kellogg Lake (100 feet wide). Depending on the final design of the bridge pier, total area and volume of the waterbody impacted by the piers would likely be less than 10 percent of the water column. Analysis and reduction of hydraulic effects from piers could allow for unimpeded flow under most conditions.

Crystal Springs, Johnson, Crystal, Spring, and Courtney Springs Creeks

Crossings of the other streams would occur with the use of bridge structures above OHW (at Crystal Springs Creek and Johnson Creek), by utilizing and repairing existing culverts (Spring Creek and Courtney Springs Creek), or by extending an existing culvert (Crystal Creek). At all crossings, the project would adhere to applicable regulations and policies, including use of approved in-water work windows and stormwater management requirements. Unavoidable fill located in the channel or floodplain also would be offset by a balanced cut, reducing impacts to floodplain function and stream hydrology.

At Westmoreland Park, Crystal Springs Creek will be rechanneled and revegetated with wetland and riparian plants. The project will partially fund this City of Portland project to mitigate wetland impacts along the project corridor. Long-term effects of this project include controlling water temperatures, improving water quality, and restoring in-stream habitat complexity to benefit native fish species present in Crystal Springs Creek and the Johnson Creek watershed.

Fairview Creek

At the Ruby Junction Facility, no structures are proposed to be built within Fairview Creek or its floodplain. If structures were constructed in the floodplain or if it were otherwise encroached upon, balanced cut and fill would be required. In addition, necessary stormwater treatment from any new construction would result in minimal impacts to surface water or groundwater resources.

Long-Term Indirect Impacts

Long-term indirect impacts typically are associated with increases in impervious surface area. Impervious surface can have an adverse impact on hydrology and water quality for four reasons:

- It provides a surface for collecting pollutants and retaining heat.
- It prevents infiltration, increases runoff and, therefore, can provide a mechanism for efficiently transporting accumulated pollutants to project area streams and decrease groundwater recharge, which may decrease baseflows of waterways.
- Its construction can necessitate the permanent removal of the riparian vegetation that helps to moderate water quality by providing shade and filtering pollutants from runoff.
- It may increase runoff, which may increase peak flows and erosion, and consequently degrade instream habitat.

Table 3.8-10 shows the amount of impervious surface that would be created by the project. These quantities represent a small overall increase in total impervious surface area in each basin, with less than a 0.06-percent increase over all the basins combined for the LPA to Park Avenue. Additionally, approximately 50 percent of the total impervious surface areas for the light rail project would reconstruct existing impervious surface areas. Due to updated stormwater treatment that would be required under the City of Portland, City of Milwaukie, City of Gresham, and the Oregon DEQ permitting processes, the reconstructed areas would improve stormwater runoff water quality conditions over the No-Build Alternative.

Table 3.8-10
Total New Impervious Surface Area (acres) by Watershed[1,2]

					Related Facilities		
Basin	**Acres of Existing Impervious Surface Area by Watershed**	**No-Build**	**LPA to Park Ave.**	**MOS to Lake Rd.**	**Bridge Area Transportation Facilities**	**Ruby Junction**	**Maximum**
Lower Willamette River	27,517	0	8.3	8.3	4.7	**0**	**13.0**
Johnson Creek[3]	10,386	0	6.6-8.4	6.6	0	**0**	**8.4**
Kellogg Lake[4]	1,157	0	3.6	0.8	0	**0**	**3.6**
Columbia Slough[5]	1,338	0	0	0	0	0.7	**0.7**
Total	**40,398**	**0**	**18.5-20.3**	**15.7**	**4.7**	**0.7**	**25.7**

[1] Source: Metro 2009.
[2] Impervious surface area estimates do not include light rail track on ballast, which is considered pervious. However, these estimates do include paved track areas that are typically located around roadway intersections and shared roadways.
[3] The Johnson Creek watershed includes Crystal Springs Creek, Spring Creek, and Crystal Creek. This is the only watershed where the LPA Phasing Option would increase surface features compared to the LPA to Park Avenue.
[4] The Kellogg Creek watershed includes Courtney Springs Creek.
[5] The Columbia Slough watershed includes Fairview Creek.

Because the amount of new impervious surface added is relatively low compared to the overall size of the basins in which it is located and because the project would adhere to all applicable stormwater management guidelines, adverse hydrologic and water quality impacts resulting from impervious surfaces are unlikely to occur. Additionally, water quality impacts from added impervious surfaces may be partially offset through the reduction of on-road vehicle usage over time. Section 3.9, Water Quality and Hydrology, provides additional detail regarding indirect impacts to project area water quality and hydrology, including floodplains.

Short-Term Impacts (Construction)

The construction of light rail facilities and bridges at the project's stream crossings would involve work within and/or above streams and their riparian zones. Short-term impacts include placing obstructions in the water column, which may alter water flow in certain areas, turbidity due to sediment disturbance associated with in-water work, toxic contamination due to disturbance of hazardous sediments during in-water work, hydroacoustic impacts during pile-driving, and toxic contamination due to equipment leaks or spills in the vicinity of project waterways. These activities would have the potential to cause the following concerns:

- Construction and installation of temporary work bridges and permanent bridge piers in the Willamette River and Kellogg Lake could affect general fish species as well as endangered species. Intensive construction activities such as pile installation, the construction of cofferdams and dewatering, and placement of scour protection could also impact fish species, particularly if the most intensive in-water activities occur when endangered salmon or steelhead are migrating through the corridor.
- Dropped construction materials can physically harm fish and wildlife, create turbidity, and affect water quality.
- Chemical spills can be directly toxic. If spilled, materials such as fresh concrete and paint could affect stream chemistry and introduce toxins. The use of work barges in the Willamette River during construction also would elevate the potential for contaminant leaks and spills.
- Construction activities may remove riparian vegetation.

For the LPA to Park Avenue and the MOS to Lake Road, temporary effects would be largely confined to the immediate project area, and would be managed through the implementation of impact minimization measures, sediment and erosion control, stormwater management, and construction phasing to avoid critical fish migration periods. Additional measures are described under mitigation below.

Cumulative Impacts

Potential cumulative impacts to waterways include additive impacts from proposed projects that have been, or will be, constructed near the Portland-Milwaukie Light Rail Project. These impacts may be direct or indirect. Direct cumulative impacts include the filling and/or spanning of waterways associated with other projects within the Portland-Milwaukie Light Rail Project area. Indirect cumulative impacts include increased sediment and pollutant load levels in waterways located within the project area due to other projects within the same watersheds and/or hydrology sources. Past projects have developed the area from natural habitats to its current condition.

The Zidell Companies, a major landowner in the South Waterfront District, is working with DEQ to conduct an environmental cleanup and containment on and near the Zidell property on the west side of the Willamette River, between the Marquam Bridge and the Ross Island Bridge. Disturbance of the upland or in-water sites could result in degradation of water quality in the Willamette River. Sediment is proposed to be removed in several locations in this stretch of river, extending up to 200 feet out from the riverbank. A clean sediment cap would then be placed over the remaining sediments over the majority of this stretch, and would extend approximately 200 feet out from the riverbank. Issues associated with disturbance of contaminated sediment or the weakening of the proposed cap are being addressed through the implementation of a scour protection blanket in coordination with the Zidell Companies and DEQ.

Upland sources of contamination have not been fully controlled, but are proposed to be contained as part of this project. The Willamette River bridge footprint for the Portland-Milwaukie Light Rail Project passes over the site of the proposed sediment cap and over some of the land within the upland site boundary. Further information on this cleanup site is located in Section 3.13, Hazardous Materials.

In addition, the City of Portland's Willamette River Greenway Plan (see Section 3.6, Parks and Recreational Resources for more detail) includes a concept to create shallow water habitat along the west bank of the river within and adjacent to the Zidell Companies' property, contingent on that property's redevelopment. The proposed Willamette River bridge footprint would impact shallow water habitat and would be subject to Willamette River Greenway regulations. However, the Portland-Milwaukie Light Rail Project team would coordinate with the Zidell Companies and the City of Portland to ensure that the Willamette River bridge design is coordinated with both entities. Permanent scour protection would be part of the bridge design to avoid scour impacts to the greenway and Zidell's sediment cap.

Other planned future projects include residential and commercial development within the project area, the removal of the dam at the outlet of Kellogg Lake, replacement of the Sellwood Bridge, construction of the City of Milwaukie Riverfront Park, enhancement at Oaks Bottom Wildlife Refuge, and continuing restoration efforts in Crystal Springs Creek and Johnson Creek. The area will likely continue to develop pursuant to land and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources. Removal of the Kellogg Lake dam and restoration efforts in Crystal Springs Creek and Johnson Creek would likely help to increase overall ecosystem functions in the area.

Vegetation

Long-Term Direct Impacts

Total vegetation impacts, excluding areas of open water (i.e., Willamette River and Kellogg Lake), for the LPA to Park Avenue would be approximately 16 acres. For the MOS to Lake Road, vegetation impacts would be approximately 11 acres. Estimates for specific vegetation type impacts associated with the LPA to Park Avenue and the MOS to Lake Road are provided in Table 3.8-11.

Table 3.8-11
Potential Vegetation Cover Impacts

Vegetation Type	LPA to Park Ave. (acres)	% of LPA to Park Ave. Study Area	MOS to Lake Rd. (acres)	% of MOS to Lake Rd. Study Area
Grassland	2.8	14.2%	0.9	5.9%
Riparian Scrub-Shrub	2.1	10.4%	2.0	13.5%
Scrub-Shrub	6.6	33.4%	6.6	44.8%
Riparian Forest	0.9	4.4%	0.6	4.4%
Upland Forest	3.8	19.5%	1.3	8.9%
Open Water	3.6	18.1%	3.3	22.4%
Total[1]	19.8	100%	14.7	100%
Total without Open Water	16.2	81.9%	11.4	77.6%

Source: DEA 2008, 2009.
[1] Totals may not sum due to rounding.

Expansion of the Ruby Junction Facility would result in the removal of approximately 30 broadleaf and conifer trees scattered throughout the proposed 10.5-acre expansion area, which is mostly developed land with existing streets and buildings. Some of this vegetation removal would not occur during the initial expansion of the facility but could occur in a later phase of construction.

Long-Term Indirect Impacts

Indirect impacts to project area vegetation could result from changes in hydrological/drainage patterns and from the inability to restore the impacted area to natural conditions.

Short-Term Impacts (Construction)

Temporary disturbance to vegetation would occur during construction as a re3sult of direct removal of vegetation and potential soil compaction. Dust from construction also has the potential to adversely impact surrounding vegetation through settlement of dust on leaf surfaces, thereby reducing photosynthetic efficiency. Temporary impacts to vegetation would be minimized by limiting construction staging and access corridors to the minimum size practicable and siting such areas in areas of previous disturbance whenever possible. All temporarily disturbed areas would be revegetated with native plant species and restored to pre-project conditions or better. Revegetation areas would be monitored for five years following construction to ensure plant survival success. Revegetation in riparian areas would be monitored per the requirements of the Watershed Revegetation Program of the City of Portland Bureau of Environmental Services. Silt fencing and other sediment and erosion control methods would be utilized to minimize the potential short-term impacts to adjacent vegetation during construction.

Cumulative Impacts

Other past projects related to urban development have transformed the area from natural habitats to its current condition. Potential cumulative impacts to vegetation include these past as well as future projects that are near the Portland-Milwaukie Light Rail Project. These impacts may be direct or indirect. Direct cumulative impacts include the removal of vegetation as a result of other projects within the Portland-Milwaukie Light Rail Project area. Indirect cumulative impacts include temporary vegetation removal; modification of soils, hydrology, or other existing growing conditions; and weedy invasion due to disturbance.

Planned future projects include residential and commercial development. In addition, the City of Portland has adopted a plan for the South Waterfront Greenway in the South Waterfront District. The plan proposes recreational trails and landscaping enhancements along the western Willamette riverfront between the Marquam Bridge and the Ross Island Bridge and south. Plans include planting of native trees, shrubs, and grasses along this trail for a width of approximately 100 feet from the top of the riverbank. Development of the trail is contingent on the development of the properties by private parties and the integration of a recreation easement along the alignment, so implementation of the trail could take many years. Shallow water habitat enhancement is also proposed for part of this area. Across the Willamette River, the Eastside Willamette River Greenway provides a trail and a strip of native trees and shrubs along the top of the east bank of the Willamette River.

The LPA to Park Avenue and the MOS to Lake Road alignments pass over these greenways and their associated vegetation. Shading and piers associated with the other nearby bridges already decrease potential vegetative productivity in this area, and the light rail project would increase these effects. Similar effects would be expected in several other locations along the alignment where new or expanded bridge structures are planned, including at Crystal Springs Creek, Johnson Creek, and Kellogg Lake, where an existing trestle over Kellogg Lake includes shading and piers, and a new bridge for light rail would increase shading and potentially decrease vegetative productivity.

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. These activities could help improve vegetation cover, and restore areas previously distributed by past development.

Wildlife

Long-Term Direct Impacts

Potential long-term direct impacts of the light rail project include disturbance of foraging, resting, nesting/denning, and movement activities along the Willamette River banks and the area between Milwaukie and Johnson Creek. The LPA to Park Avenue alignment would result in disturbance of wildlife activities within the currently vegetated land west of SE McLoughlin Boulevard (an area currently planned for development of the Trolley Trail (Figure 3.8-3; see Section 3.6, Parks and Recreational Resources). Disturbance of the existing grassland beside Robert Kronberg Park, located south of Kellogg Lake, could impact foraging by Canada geese and activities of moles, voles, and other small mammals to a minor extent.

Impacts to wildlife species due to the expansion of the Ruby Junction Facility would be relatively minor due to its currently developed condition.

Long-Term Indirect Impacts

Long-term indirect impacts to project area wildlife from the LPA to Park Avenue and the MOS to Lake Road alignments could include disturbance to existing nesting/denning and movement activities as a result of operation of the light rail. Light rail operations for the LPA to Park Avenue could also disturb habitat east of SE McLoughlin Boulevard and south of SE Lake Road.

Short-Term Impacts (Construction)

Short-term impacts may include visual and auditory disturbance and removal of vegetation during construction. Short-term impacts would be expected within an additional 25 feet on both sides of the physical edges of the proposed project. Birds protected by the Migratory Bird Treaty Act, which includes the majority of wild bird species in Oregon, that are nesting in areas cleared or graded during construction could be adversely affected. These impacts could be avoided or minimized by several methods, including avoidance of primary nesting periods, or field surveys before construction to identify potential nesting sites before clearing.

Cumulative Impacts

Direct cumulative impacts include increased transportation-related disturbance, increased habitat fragmentation, increased incidence of wildlife mortality, and permanent vegetation removal to accommodate facilities, residences, 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.

Fisheries

Long-Term Direct Impacts

Potential long-term direct impacts to project area fisheries resulting from the LPA to Park Avenue or the MOS to Lake Road would be related to changes to habitat. Either of the project alignments would create new in-water structures (piers) in the Willamette River. The LPA to Park Avenue would also place an in-water pier in Kellogg Lake. These structures could serve as refugia habitat for native and non-native piscivorous (predator) fish species. Shading from the Willamette River bridge deck would be minimal due to its height over the water, but piers could provide cover for piscivorous fish species and encourage their use of the mainstem of the Willamette River, which could contribute to increased predation rates on salmonids. Existing hydrology and river bottom topography would also be impacted through introduction of bridge footings in a waterway, which would cause scour and resuspend Willamette River contaminated sediments. Scour would be prevented in part by the placement of permanent scour protection. While scour protection would minimize scour and resuspension of contaminated sediments, it would permanently alter substrate and habitat conditions as well as benthic communities. Hydrology would also be impacted by flood rise caused by the placement of piers and scour protection within the water column. In addition, filling of wetlands and impacts to floodplains could alter off-channel habitat used by fish. Table 3.8-9 summarizes the permanent footprint of the LPA to Park Avenue and the MOS to Lake Road at each of their stream and river crossings. No direct impacts to fisheries are expected from the expansion of the Ruby Junction Facility.

Hydraulic analysis conducted for the project by West Consultants indicates that up to 0.06 feet of net flood rise is anticipated to occur in the vicinity of the proposed Willamette River bridge. It is anticipated that this rise will not be able to be mitigated for by downstream floodplain removal along the Willamette River. Therefore, the project proposes to pursue a Conditional Letter of

Map Revision for the flood rise. Flooding is a sporadic event and the minor net rise would not increase the frequency of flooding. The increase in flood levels is also minor in terms of its extent of additional areas affected, and has a low potential to cause additional impacts to fisheries or their habitat, particularly outside of the immediate vicinity of the bridge.

Long-Term Indirect Impacts

Potential long-term indirect impacts to project area fisheries are similar to those outlined above for waterways and in Section 3.9, Water Quality and Hydrology. In summary, the LPA to Park Avenue and MOS to Lake Road alignments could cause indirect impacts to both water quality and hydrology. These impacts would result primarily from the addition of new impervious surfaces. Based on an analysis of the proposed project, if impacts to stream hydrology and water quality occur, they would likely be detectable only at the local scale. Potential impacts to water quality likely would be offset by updated stormwater treatment in redeveloped impervious surface areas, and less congestion and personal vehicle use compared to the No-Build Alternative. Enhanced stormwater treatment in redeveloped areas and mitigation for floodplain fill would help offset hydrologic impacts.

Short-Term Impacts (Construction)

Construction activities would temporarily impact a total of between 182 and 222 lineal feet of potentially fish bearing streams in the following locations:

- 105 lineal feet at the Willamette River
- 34 lineal feet at Crystal Springs Creek
- 43 lineal feet at Johnson Creek
- 40 lineal feet at Kellogg Lake (LPA to Park Avenue only)

Crystal Creek, Spring Creek, and Courtney Springs Creek would be crossed by the LPA to Park Avenue alignment; Crystal and Spring creeks would be crossed by the MOS to Lake Road alignment. These crossings would occur on existing culvert structures, which may require some repairs and upgrades. A culvert extension will be necessary at Crystal Creek. Substantial short-term impacts are not anticipated at these creeks, but minor impacts may occur during the repair/modification of these culverts.

Potential short-term impacts to project area fisheries resulting from the construction of either the LPA to Park Avenue or the MOS to Lake Road are similar to those outlined above for project area waterways. Turbidity from project activities could affect fish by silting spawning beds, reducing the fishes’ ability to see and successfully capture prey, causing physical abrasion of tissue such as gills, and limiting self-defense and predator avoidance behavior. Other potential water quality impacts (e.g., changes in pH due to concrete spills and the potential for encountering contaminated sediments in the Willamette River) could directly and indirectly affect fish as well as their prey. Additional discussion is provided in Section 3.9, Water Quality and Hydrology, and Section 3.13, Hazardous Materials.

In addition to these water quality concerns, during construction of the Willamette River crossing, stream flow would be disrupted by in-water work area isolation with the use of cofferdams, pile driving, and other construction activities required to install bridge supports. Disrupted stream flow could make navigation through the project area more difficult for both adult and juvenile fish. Noise and vibration impacts would be expected from pile driving and possibly other construction methods. Underwater noise from pile driving and associated heavy machinery likely would have injurious, and potentially lethal, effects to fish. Fish salvage during installation of cofferdams also could cause stress, injury, and/or death for handled fish.

Potential short-term impacts would be mitigated by completing all work during specified in-water work windows and by other impact minimization measures, sediment and erosion control, and stormwater management.

Cumulative Impacts

Past projects have developed the area from natural habitats to its current condition, and include changes to area waterways. Direct cumulative impacts include the filling and/or spanning of waterways and associated riparian areas associated with other projects within the Portland-Milwaukie Light Rail Project area. Indirect cumulative impacts include increased sediment and pollutant load levels in waterways located within the project area due to other projects within the same watersheds and/or hydrology sources.

As discussed in the Waterways section above, other factors that influence cumulative effects include the cleanup of contaminated properties and sediments on the west side of the Willamette River. Disturbance of contaminated sediments or of the in-water sediments cap or upland contamination could release contaminants into the Willamette River, where they could harm fish and other aquatic life.

As discussed under the Vegetation section above, there are proposed shoreline and offshore habitat improvements in the City of Portland's plan for the Willamette River Greenway for the west side of the Willamette River. The bridge crossing would likely produce shade that would inhibit full production of riparian vegetation within the shadow. Moreover, placement of bridge piers close to the riverbank would also decrease riparian habitat productivity, resulting in less large woody debris recruitment; would create passage impediments for salmonids; and would decrease benthic organism production.

Other planned future projects include residential and commercial development within the project area, the removal of the dam at the outlet of Kellogg Lake, and continuing restoration efforts in Crystal Springs Creek and Johnson Creek. The area will likely continue to develop pursuant to land and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources. Removal of the Kellogg Lake dam and restoration efforts in Crystal Springs Creek and Johnson Creek would likely help to increase overall ecosystem functions in the area, particularly fish usage.

Climate change is an additional area of concern for fisheries, since temperatures affect water quality and quantity, factors critical to aquatic ecosystem functions. However, as shown in Section 3.11, Air Quality, the project would help reduce greenhouse gas emissions, and would not increase the effects of climate change.

TES Species

As part of the development of the FEIS, FTA has conducted a Section 7 ESA consultation with NMFS and USFWS, which included the development of a Biological Assessment, and resulted in a Biological Opinion for the project (Appendix N). The Biological Assessment stated that the project may adversely affect listed anadromous salmonids and the southern DPS of green sturgeon. It also stated that the project may affect, but is not likely to destroy or adversely modify, designated critical habitat. The LPA to Park Avenue or MOS to Lake Road may adversely affect essential fish habitat under the Magnuson-Stevens Fishery Conservation and Management Act of 1976, primarily because the development of the Willamette River bridge itself would be considered a modification to the habitat as defined under the this act. Project design, construction, and conservation measures will be part of the consultation with NMFS and USFWS as project planning continues. Adverse effects to protected plants and terrestrial wildlife species are not anticipated at this time. Further discussion of direct, indirect, and cumulative impacts on TES species follows; Table 3.8-12 summarizes the analysis of effects on ESA species.

Table 3.8-12
Determinations of Effect for Listed Species and Designated Critical Habitat

ESU/DPS	Determination of Effects to Species	Determination of Effects to Designated Critical Habitat
Southern DPS **Green sturgeon** Acipenser medirostris	May Affect, Not Likely to Adversely Affect	N/A[1]
Columbia River ESU **Chum salmon** Oncorhynchus keta	May Affect, Not Likely to Adversely Affect	N/A[2]
Lower Columbia River ESU **Coho salmon** Oncorhynchus kisutch	May Affect, Likely to Adversely Affect	N/A[3]
Lower Columbia River DPS **Steelhead** Oncorhynchus mykiss	May Affect, Likely to Adversely Affect	Affect
Upper Willamette River DPS **Steelhead** Oncorhynchus mykiss	May Affect, Likely to Adversely Affect	Affect
Lower Columbia River ESU **Chinook salmon** Oncorhynchus tshawytscha	May Affect, Likely to Adversely Affect	Affect
Upper Willamette River ESU **Chinook salmon** Oncorhynchus tshawytscha	May Affect, Likely to Adversely Affect	Affect

[1] For the southern DPS of green sturgeon, critical habitat does not extend into the Willamette River.
[2] Critical habitat for Columbia River chum salmon does not extend into the Willamette River.
[3] Critical habitat for Lower Columbia River coho salmon has not been designated yet.

Long-Term Direct Impacts

Impacts to listed threatened and endangered plant and wildlife species are unlikely to occur because of the absence of these species in or near the project corridor. Sensitive species may occur in the project corridor, likely within riparian and wetland areas. Long-term direct impacts to these species and their habitats would include permanent alteration of habitat components—including vegetation, food, and cover—to accommodate project facilities and the possibility of occasional fatalities from being struck by trains or buses.

Depending on the alternative to be built, the project would permanently impact up to 222 lineal feet of TES fish-bearing streams, place bridge piers within the Willamette River and Kellogg Lake, and create shadowing at the stream crossings. In-water structures and stream shadowing could directly affect juvenile salmonids through increased predation risk.

The new structure in the Willamette River would affect usage of benthic habitats by lamprey, white sturgeon, salmonids, and their prey. Shadowing caused by the bridge is less of a concern than for other stream crossings due to the height of the bridge, which allows more light to penetrate, and shadows would move throughout the day. Given the size of piers in the context of the size of the river, impacts are more related to pier placement than the number or the size of piers. However, the cable-stayed bridge type, with its higher clearance and fewer in-water structures, that was chosen for the light rail project has comparatively lower potential for impacts than the concrete segmental bridge types that were proposed in the SDEIS but have since been eliminated.

Killer whales will experience no effects as part of this project. Due to their absence within the action area, killer whales will not experience disturbance or harassment as part of this project, and do not need to be addressed under the Marine Mammal Protection Act.

Other project elements, as discussed in the mitigation section below, may increase habitat functions to offset these negative impacts. Other direct impacts to TES fish species located in project area streams would be similar to those outlined above for project area waterways and fisheries.

Long-Term Indirect Impacts

Impacts to listed threatened and endangered plant and wildlife species are unlikely to occur due to the absence of these species in or near the project corridor. Sensitive species may occur in the project corridor, likely within riparian and wetland areas. Long-term indirect impacts to these species and their habitats would include permanent alteration of habitat components including vegetation, food, and cover to accommodate project facilities. Impacts to listed fish species would primarily be associated with water quality and growth pattern changes. Potential impacts to water quality likely would be offset by enhanced stormwater treatment in redeveloped impervious surface areas, and less traffic congestion and personal vehicle use compared with the *No-Build* Alternative. Likewise, growth pattern changes would be accomplished through implementation of existing growth management and land use policies, which would offset negative impacts to TES species.

Short-Term Impacts (Construction)

Short-term direct and indirect impacts to TES plants and wildlife are not anticipated. Impacts to sensitive wildlife could occur where the alignment crosses potential habitats such as wetlands, riparian areas, and native, forested habitats, and could include visual and auditory disturbance and removal of vegetation during construction.

The project would temporarily impact from 182 to 222 lineal feet of TES fish-bearing waterbodies, including the Willamette River, Crystal Springs Creek, Johnson Creek, and Kellogg Lake. The LPA to Park Avenue would impact Kellogg Lake, while the MOS to Lake Road would not.

These four waterbodies are known to support seven TES fish species. Impacts to these species are similar to those outlined above for project area waterways and fisheries. Migrating adult salmonids, as well as outmigrating and rearing juveniles, would pass through the project area during in-water work and be subjected to these hydrology, water quality, and noise impacts, which could cause fish to avoid the work area and delay migration. Delayed outmigration of juvenile salmonids could cause juveniles to reach estuarine and marine habitats later than normal and disrupt juvenile development. Delayed adult upriver migration could delay spawning and therefore decrease production. Effects to salmonids during rearing could include harassment, direct injury (including lethal effects), and avoidance of the work area.

Temporary construction impacts to Chinook salmon will be related to hydroacoustic impacts that will be limited to approximately 20 cumulative minutes over a 12-hour period (with an additional 12 hours without any pile driving) per day. Therefore, given the short amount of exposure that the population could experience each day, and the limited exposure during in-migration and out-migration between July 1 and October 31, population-wide effects on Chinook salmon will not occur as a result of the project. In addition, proposed habitat enhancements will negate any long-term adverse impacts to Chinook salmon within and upstream of the project area.

Cumulative Impacts

Direct cumulative impacts to TES species are similar to those listed above for fisheries and wildlife. In addition, due to the range of many of the TES species, particularly salmonid species that migrate, long-term changes to the water quality and hydrologic conditions in the Columbia River system (e.g., Willamette River), including the development of dams, diversions, channelization, and urbanization, have cumulatively contributed to the degradation and loss of habitat for TES species.

3.8.3 Mitigation

The Portland-Milwaukie Light Rail Project is being designed to first avoid and then minimize and compensate for all unavoidable impacts. The project has avoided and minimized impacts through many years of project planning and design, including the design and analysis of alternatives and alignment options that were considered but not advanced due to impacts to ecosystem and other resources (see Chapter 2). Certain alignment options and design specifics also have been modified to reduce impacts to resources. These avoidance and minimization efforts will continue (with ongoing agency input) through final design and construction, and as a result of the project's incorporation of the requirements for local, state, and federal regulations and permit conditions, including the conditions stipulated in the Biological Opinion issued by NOAA Fisheries on June 23, 2010. These regulatory and permit requirements involve the following:

- In-Water Work Periods. All work within the active channels of project waterways will be completed in accordance with the Oregon Guidelines for Timing of In-Water Work to Protect

Fish and Wildlife Resources (ODFW 2008). Specific to this project, these in-water work periods are: Johnson Creek and tributaries (Crystal Springs, Crystal, and Spring creeks), July 15 to August 31; Kellogg Creek and tributaries (Courtney Springs Creek), July 15 to September 30; and Willamette River, July 1 to October 31.

- Cessation of Work. Project operations shall cease under high-flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage. The project shall ensure that cofferdams are not overtopped.
- Piling Installation. When possible, a vibratory hammer shall be used to install pilings. If the use of an impact hammer is necessary to install the piling to the load-bearing depth, the piling will be installed first with a vibratory hammer, until it proves no longer effective, and then proofed with an impact hammer. A bubble curtain will be used, according to NMFS and USFWS (2006) specifications. It will distribute small air bubbles around 100 percent of the piling perimeter for the full depth of the water column. If the water velocity in the waterway is greater than 1.6 feet per second, a confined bubble curtain will be used. Another, more effective attenuation method may be used with agency approval.
- Contaminated Sediments. Resuspension of contaminated sediments in the water column will be minimized during in-water work at the Willamette River and Kellogg Lake. Sediments within the footprint of the work bridges or areas of riverbed disturbance at the Willamette River would be capped with a clean sand layer prior to pile installation. At Kellogg Lake, similar measures may be taken if deemed necessary.
- Hydroacoustic Monitoring. Hydroacoustic monitoring of impact pile installation will occur according to a protocol approved by NMFS.
- Piling Removal. Temporary piles shall be removed with a vibratory hammer and shall never be intentionally broken by twisting or bending. Except when piles are hollow and when they were placed in clean, sand-dominated substrate, the holes left by the removed pile shall be filled with clean, native sediments immediately following removal. No filling of holes shall be required when hollow piles are removed from clean, sand-dominated substrates.
- Fish Capture and Removal. In accordance with an approved fish salvage plan, a qualified biologist will capture and remove fish in any area that is to be isolated from the active channel of any project waterway.
- Fish Passage. Fish passage must be provided for any adult or juvenile fish within the action area during construction, unless passage did not exist prior to construction. After construction, fish passage that meets NMFS's fish passage criteria (NMFS 2008a) must be provided for the life of the project.
- Fish Screens. NMFS must review and approve all fish screens for surface water diverted by gravity or pumps that exceeds the flow rate of 3 cubic feet per second. Each fish screen must be installed, operated, and maintained according to NMFS's fish screen criteria (NMFS 2008a).
- Surface Water Diversion. Surface water may be diverted only if water from developed sources is unavailable or inadequate. When surface water is diverted, water shall only be taken from the source with the greatest flow, and a fish screen that meets the above criteria shall be

utilized. No water will be diverted from Crystal Springs Creek, Johnson Creek, Crystal Creek, Spring Creek, or Courtney Springs Creek.

- Construction Discharge Water. All water discharged during construction (e.g., concrete washout, pumped water for work area isolation, and drilling fluids) shall be treated with the best available technology in order to remove any contaminants, sediments, debris, etc. Pollutants such as green concrete, contaminated water, silt, welding slag, sandblasting abrasive, or grout cured less than 24 hours shall not be allowed to contact any wetland, waterbody, or stream channel below OHW.
- Staging Areas. The environmental impacts of heavy machinery on-site will be minimized to the greatest extent possible. A vehicle staging area will be located 150 feet or more from any waterbody or in an isolated hard zone. Vehicles will be fueled, maintained, and stored in this location. Vehicles and equipment will be inspected daily for fluid leaks before operation within 50 feet of any waterbody, and will be repaired, if necessary, before leaving the staging area. Inspections will be documented in a record that will be available for review on request. Vehicles will be steam-cleaned before operation below OHW and as often as necessary to ensure that mud, grease, external oil, and other contaminants do not enter surface water. Generators, pumps, cranes, and any other stationary equipment operated within 150 feet of waterbodies shall be diapered, contained, and maintained as necessary to prevent contaminants from entering surface waters.
- Preconstruction Activity. Before significant alteration to the action area, the clearing limits shall be flagged, and erosion and sediment controls shall be installed and properly functioning.
- Site Preparation. Native materials found on-site (e.g., large wood, vegetation, topsoil, and channel bed materials) shall be preserved to the greatest extent possible and used in restoration.
- Pesticide-Treated Wood. Pesticide-treated wood will not be installed below OHW. During the removal of pesticide-treated wood piers on-site, no wood debris shall be allowed to fall into the water, and any debris falling into the water shall be removed immediately. Pesticide-treated wood and debris will be disposed of properly, and will be stored in a dry place away from OHW until disposal.
- Erosion and Sediment Control Plan and Pollution Control Plan. These plans shall describe practices that will be used to: contain and control a spill of hazardous materials; avoid or minimize pollution and erosion at all roads, stream crossings, drilling sites, construction sites, borrow pits, equipment and material storage sites, fueling operations, and staging areas; control dust pollution; prevent construction debris from dropping into any waterbody, and to remove any material that does drop with a minimum of disturbance; avoid or minimize resource damage if the action area is inundated by precipitation or high stream flow; stabilize all disturbed soils following any break in work, unless construction will resume within four days; and inspect erosion and sediment controls, monitor in-stream turbidity, and make repairs to best management practices that are not functioning correctly.
- Site Stabilization. All disturbed areas shall be stabilized following any break in work unless construction will resume within four days.

- Work Area Isolation. Any action, except for piling installation or removal, that involves a substantial amount of excavation, backfilling, embankment construction, or similar work below OHW where adult or juvenile fish are reasonably certain to be present, or 300 feet or less upstream from spawning habitats, must be effectively isolated from the active stream. A work area isolation plan will be developed and reviewed by NMFS before the commencement of this work.
- Site Restoration. Any action that results in significant disturbance of riparian vegetation, soils, streambanks, or the stream channel must clean up and restore those features after the action is complete. If disturbance is to occur, a notification shall be sent to NMFS explaining how site restoration will be completed.
- Scour Protection. Permanent scour protection will be necessary at the Willamette River bridge's two in-water tower structures. The scour protection installed around the western tower will minimize potential disturbance to the Zidell Companies' sediment cap and to contaminated materials within their sediment management area. Scour protection will also be provided for the west work bridge piles below OHW inside Zidell's sediment management area, in addition to the scour protection around the western tower. Permanent scour protection at the eastern tower will prevent the undermining of the City of Portland's 36-inch critical water line and other nearby utility lines.

The project would mitigate its potential short- and long-term impacts through full compliance with all applicable regulations as summarized in Table 3.8.1. It should be noted that further refinement of mitigation designs, including determination of the size and location of mitigation features, would occur during final design and project permitting. Discussions with federal, state, and local agencies to determine appropriate mitigation measures have been initiated and will continue during the final design and permitting.

3.8.3.1 Wetlands

The project will meet the requirements of Section 404 and Oregon Removal-Fill permit conditions to be approved by the USACE and Oregon DSL. Unavoidable impacts to wetlands will be mitigated through compensatory wetland mitigation (CWM), as coordinated with USACE and the Oregon DSL.

The project will meet wetlands mitigation requirements through partial funding of the City of Portland's Westmoreland Park Restoration Project. If for some reason the Westmoreland Park Restoration Project is not a feasible means to mitigate wetland and fish passage impacts, the Portland-Milwaukie Light Rail Project will purchase necessary credits at the Foster Creek wetland mitigation bank.

3.8.3.2 Waterways

The project's final design will follow the City of Portland's stormwater management program and *2008 Stormwater Management Manual*, and will meet the City of Portland's stormwater criteria along the entire light rail alignment. At the Ruby Junction Facility, the City of Gresham stormwater requirements will be met (City of Gresham 2003). The City of Gresham stormwater requirements are similar to the City of Portland requirements.

Additional discussion of mitigation measures related to waterway, water quality, and hydrologic mitigation impacts is provided in Section 3.9, Water Quality and Hydrology.

As noted for wetlands, the mitigation site at Westmoreland Park will improve Crystal Springs Creek functions by rechannelizing and revegetating the stream with wetland and riparian plants. The project will partially fund this City of Portland project to mitigate wetland impacts along the project corridor. Long-term effects of this project include controlling water temperatures, improving water quality, and restoring in-stream habitat complexity to benefit native fish species present in Crystal Springs Creek and the Johnson Creek watershed.

The light rail project is partnering with the City of Portland on a planned city project that would provide creation and enhancement of shallow water and active channel areas at a site located south (upstream) of the Ross Island Bridge on the western bank (and adjacent to two derelict pile fields that are proposed to be removed by the project). The site is known as the Central District and is part of the planned South Waterfront Greenway and consists of two properties. The city's project would upgrade an existing path to meet City of Portland greenway standards (two separated paths for bicycles and pedestrians), while excavating the existing bank to provide approximately 25,500 square feet of shallow-sloped beach habitat and 17,400 square feet of riparian fringe. The major bank work would consist of an approximately 500-foot-long section that was excavated up to 60 feet from its current location. Additional bank work in the northern portion of the site may be conducted, but would likely be limited to minor bank reshaping and enhancement activities. Activities at this site would begin in 2012. Long-term benefits of the project include restoring in-stream habitat complexity to benefit native fish species that use the Willamette River and its tributaries. Kellogg Lake is not anticipated to need scour protection and therefore would not require floodway mitigation. In addition, the project will also remove approximately 20,000 square feet of derelict piles from the Lower Willamette River as part of shallow-water habitat enhancements.

3.8.3.3 Vegetation

Impacts to vegetation removal will be addressed through restoration and enhancement activities complying with local, state, and federal regulatory and permitting requirements, including the City of Portland Willamette River Greenway, the City of Portland Environmental Overlay Zone, the City of Milwaukie Greenway (Kellogg Lake), and Clackamas County river and stream setback requirements. Sites to be mitigated include Crystal Springs, Johnson, Crystal, Spring, and Courtney Springs creeks.

3.8.3.4 Wildlife

The Migratory Bird Treaty Act, enacted in 1918, prohibits the taking, killing, or possessing of native migratory birds, including eggs, nests, and feathers (16 USC 703-712). "Migratory birds" are generally defined as all birds occurring in the United States in the wild except house sparrows, European starlings, and pigeons. "Take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12).

Mitigation to avoid construction impacts to birds protected by the Migratory Bird Treaty Act includes:

- Where native vegetation removal is unavoidable, remove potential bird nest trees outside of nesting season (approximately March 1 to September 1).
- If clearing is necessary during the bird nesting season, have a qualified biologist survey the clearing areas for migratory bird nests prior to clearing.

3.8.3.5 Fisheries

The project will mitigate detrimental effects to fish habitats, including impacts to both quality and quantity, through compliance with federal, state, and local regulations, including the conditions stipulated in NOAA Fisheries Biological Opinion.

3.8.3.6 TES Species

Impacts to threatened and endangered plants and wildlife are not anticipated. Impacts to sensitive wildlife may occur, but through compliance with other local, state, and federal permitting requirements, including for riparian areas, waterways, ESA species, and vegetation, no further mitigation is required.

3.9 WATER QUALITY AND HYDROLOGY

This section discusses the hydrology and water quality issues associated with the construction and operation of the Portland-Milwaukie Light Rail Project.

3.9.1 Affected Environment

The Portland-Milwaukie Light Rail Project is located in the lower portion of the Willamette River basin and includes a new bridge located at river mile 13.8. Land use in the vicinity of the project is primarily urban. Current land uses are dominated by single-family residential with pockets of other urban land use types (e.g., multifamily residential, mixed-use commercial, and industrial).

Water resources in the project area are protected by regulations addressing stormwater quality and quantity and restrictions on modifying floodplains. The regulations and standards are intended to accomplish the following:

- Maintain pre-development flow rates and timing (known as the hydrograph)
- Prevent flooding conditions from worsening
- Protect new facilities considered in the floodplain from damage
- Protect water quality

In general, regulations governing stormwater discharge have been developed and implemented primarily at the local level, while floodplain regulations (e.g., Executive Order 11988 – Floodplain Management) are developed at the federal level and implemented at the local level. The State of Oregon does not have specific stormwater quantity control or floodplain development guidelines; however, under authority of the U.S. Environmental Protection Agency (EPA), they implement federal water quality regulations. Federal, state, regional, and local agencies also have natural resource management regulations that protect water quality, hydrologic, and floodplain functions.

At the regional level, Title 3 of Metro Code Section 3.07 (Urban Growth Management Functional Plan) was established to protect the region’s health and public safety by reducing flood and landslide hazards, controlling soil erosion, and reducing pollution of the region’s waterways.[6] Title 3 contains performance standards to protect against flooding, to protect regionally significant fish and wild habitat areas, and to protect and enhance water quality in streams, rivers, and wetlands. The South Waterfront area is exempt from Title 3 regulations.

Much of the project study area, which is defined as the area within 200 feet of the project facilities, is covered with impervious surfaces such as streets, roofs, and parking areas. Impervious surfaces have an adverse impact on the hydrology of a basin and the water quality within its receiving streams because they provide a medium for collecting pollutants and a mechanism (stormwater runoff) for efficiently transporting these pollutants to local streams. Consequently, the primary indicator of a project’s effect on water resources is the amount of impervious area it adds to a watershed.

Figure 3.9-1 shows the project corridor crossing or intersecting up to four major waterbodies, three minor streams, and four Federal Emergency Management Agency (FEMA)-designated 100-year floodplains.

Waterbodies that could be affected by the proposed LPA to Park Avenue and MOS to Lake Road include the Willamette River, Crystal Springs Creek, Johnson Creek, Crystal Creek, Spring Creek, Kellogg Lake,[7] Courtney Springs Creek, and Fairview Creek.[8] Under the MOS to Lake Road, the crossing of Kellogg Lake and Courtney Springs Creek would not occur. All of these streams have hydrology and water quality issues typical of urban streams. For example, four of the above-listed waterbodies are listed on the Oregon Department of Environmental Quality (DEQ) 303(d) list (City of Portland 2008; DEQ 2009). Significant portions of most of these streams also have been channelized and are largely disconnected from their floodplains due to flood control projects in the early part of the twentieth century.

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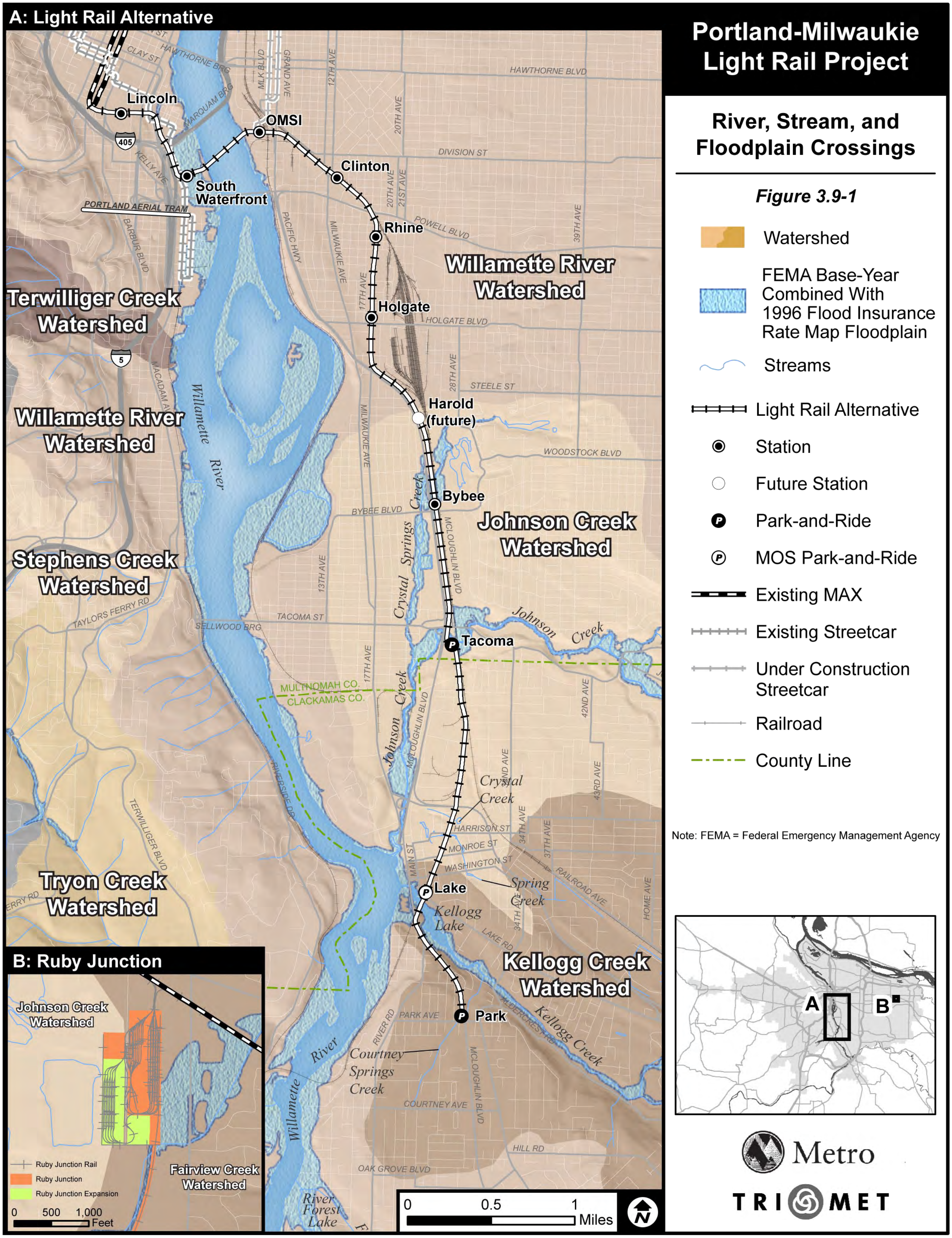
[6] Source: Metro Urban Growth Management Function Plan (http://www.oregonmetro.gov/index.cfm/go/by.web/id=274).
[7] A dam located at Kellogg Creek’s SE McLoughlin Boulevard bridge impounds the creek to form Kellogg Lake. The proposed alignment crosses this impounded area. Although there are plans to remove the dam and return the creek to a free-flowing stream, a specific timeline is not available. Consequently, this report assumes the proposed project will cross the lake and refers to the affected waterbody as Kellogg Lake.
[8] The expansion of the existing Ruby Junction Facility would be within Fairview Creek’s floodplain.



Portland-Milwaukie Light Rail Project
River, Stream, and Floodplain Crossings
Figure 3.9-1
A: Light Rail Alternative
B: Ruby Junction
Watershed
FEMA Base-Year Combined With 1996 Flood Insurance Rate Map Floodplain
Streams
Light Rail Alternative
Station
Future Station
Park-and-Ride
MOS Park-and-Ride
Existing MAX
Existing Streetcar
Under Construction Streetcar
Railroad
County Line
Note: FEMA = Federal Emergency Management Agency
Lincoln
OMSI
South Waterfront
Clinton
Rhine
Holgate
Harold (future)
Bybee
Tacoma
Lake
Park
Terwilliger Creek Watershed
Willamette River Watershed
Stephens Creek Watershed
Tryon Creek Watershed
Johnson Creek Watershed
Kellogg Creek Watershed
Fairview Creek Watershed
Willamette River
Crystal Springs Creek
Johnson Creek
Crystal Creek
Spring Creek
Kellogg Lake
Kellogg Creek
Courtney Springs Creek
River Forest Lake
PORTLAND AERIAL TRAM
HAWTHORNE BLVD
DIVISION ST
POWELL BLVD
HOLGATE BLVD
STEELE ST
WOODSTOCK BLVD
BYBEE BLVD
TACOMA ST
SELLWOOD BRG
TAYLORS FERRY RD
MULTNOMAH CO.
CLACKAMAS CO.
MCLOUGHLIN BLVD
MILWAUKIE AVE
RIVERSIDE DR
TERWILLIGER BLVD
HARRISON ST
MONROE ST
WASHINGTON ST
RAILROAD AVE
LAKE RD
PARK AVE
RIVER RD
COURTNEY AVE
HILL RD
OAK GROVE BLVD
Ruby Junction Rail
Ruby Junction
Ruby Junction Expansion
0 500 1,000 Feet
0 0.5 1 Miles
Metro
TRIMET

June 2010

Table 3.9-1 summarizes the baseline conditions of the waterways within the proposed project corridor. Because of anticipated impacts, additional detail regarding the Willamette River, Johnson Creek, and Kellogg Lake is provided in the sections following.

Table 3.9-1
Summary of Existing Conditions in Project Area Streams[1]

Stream	Crossed by Alignment[4]	Approx. Basin Size (sq mi)	Average/100-Year Flows (cubic feet per second)	Approx. Wetted Width at Crossing (ft)	303(d) Listed for Following Parameters[2]	TMDLs Approved for Following Parameters[2,3]
Willamette River	LPA to Park Ave., MOS to Lake Rd.	11,500	32,000/ 400,000	1,200	Aldrin, biological criteria, DDT, DDE, dieldrin, *E. coli*, fecal coliform, iron, manganese, mercury, PCBs, PAHs, and pentachlorophenol	Dioxin, temperature, bacteria
Crystal Springs Creek	LPA to Park Ave., MOS to Lake Rd.	2	17/NA	15	None	Bacteria, temperature, DDT, dieldrin
Johnson Creek	LPA to Park Ave., MOS to Lake Rd.	54	76/2,780	35	*E. coli*, fecal coliform, PCBs, and PAHs	Bacteria, temperature, DDT, dieldrin
Crystal Creek	LPA to Park Ave., MOS to Lake Rd.	<1	NA/NA	<5	Not listed; tributary of Johnson Creek	Not listed; tributary of Johnson Creek
Spring Creek	LPA to Park Ave., MOS to Lake Rd.	<1	NA/NA	<5	Not listed; tributary of Johnson Creek	Not listed; tributary of Johnson Creek
Kellogg Lake	LPA to Park Ave.	15	NA/1,990	400	E. coli	None; tributary of Willamette River
Courtney Springs Creek	LPA to Park Ave.	<1	NA/NA	<5	Not listed; tributary of Kellogg Creek	None; tributary of Kellogg Creek
Fairview Creek	Ruby Junction	7	NA/NA	NA	*E. coli*, fecal coliform	Bacteria, temperature

[1] Sources: PNW Ecosystem Research Consortium 2002; Willamette Partnership 2005; StreamNet 2007a; City of Portland 2007, 2008b; DEQ 2009.

[2] Every two years, Oregon DEQ assesses water quality and prepares an integrated report that meets the requirements of the federal Clean Water Act (CWA) for Section 305(b) and Section 303(d). Section 303(d)-listed waters are those that do not meet water quality standards. For those waters, the development of a Total Maximum Daily Load (TMDL) is required.

[3] A Total Maximum Daily Load (TMDL) is a quantitative analysis of a waterbody that includes two components: (a) a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and (b) an allocation of that total amount among the pollutant's sources (both point and nonpoint). TMDLs largely determine the regulatory environment under which municipalities manage their stormwater discharges.

[4] LPA to Park Avenue includes Phasing Option.

The lower Willamette River is within a highly urbanized area with residential, commercial, industrial, and recreational uses. This lower portion of the river is largely channelized, with much of its banks either constrained by riprap or the Portland sea wall. Most of the river's original off-channel and floodplain habitats have been eliminated or are highly degraded, and its channel largely lacks topographic and habitat diversity. Upstream from Oregon City, the river is regulated by 11 multipurpose flood control/recreation/hydropower reservoirs operated by the USACE. These facilities have substantially altered the hydrology of the river compared to its original state. Table 3.9-2 summarizes, by cubic feet per second (cfs), the average flow and flood flows in the Willamette River in the vicinity of the project area.

Table 3.9-2
Estimated Average and Flood Flows in the Willamette River

Average Flow[1]	Peak 1996 Flood Flow[1]	100-Year Flood Flow (FEMA estimate)[2]
32,000 cfs	460,000 cfs	375,000 cfs

[1] Source: USGS 2002.

[2] Source: Bridge Hydraulics and Scour Assessment (West Consultants 2010).

Flooding in February 1996 within downtown Portland was, in many areas, more extensive than the 100-year floodplain area shown on the Flood Insurance Rate Map (FIRM). However, in the proposed project area, the 1996 flood areas were very similar in extent to the 100-year floodplain.

General water quality issues in the portion of the Willamette River located in the project area include aquatic ecosystem degradation, soil erosion from changing land use, and elevated concentrations of nutrients, synthetic compounds, and trace elements (e.g., heavy metals). The river is on DEQ's 303(d) list of water quality limited waterbodies because it does not meet water quality standards for the following parameters: dieldrin, DDT, DDE (common pesticides that are now banned by EPA), polycyclic aromatic hydrocarbons (PAHs), *E. coli*, aldrin, biological criteria, fecal coliform, polychlorinated biphenyls (PCBs), manganese, mercury, iron, and pentachlorophenol (DEQ 2009). In addition to these 303(d) listings, DEQ also has set Total Maximum Daily Loads (TMDLs) for the Willamette River for dioxin (2,3,7,8-TCDD), bacteria, and temperature, and has established a pollutant reduction target for mercury (City of Portland 2008b; DEQ 2009). The river bottom and adjacent land along the Willamette River where the project will cross have been analyzed by various property owners and Oregon DEQ. Although a Superfund site is located a few river miles downstream, toxin levels at this location are thought to be low enough to not warrant Superfund designation.

Johnson Creek flows through three cities (Gresham, Portland, and Happy Valley) and two counties (Clackamas and Multnomah) before its confluence with the Willamette River at approximately river mile 18 in the City of Milwaukie (JCWC 2009). At the proposed light rail crossing, Johnson Creek flows beneath both SE McLoughlin Boulevard and the Goodwill facility access road bridges. These bridges are elevated relatively high above the creek due to the creek's high banks and floodplain. Johnson Creek supports three ESA-listed fish species (Chinook salmon, coho salmon, and steelhead) (StreamNet 2009a) and is included on DEQ's 303(d) list for *E. coli* (fall/winter/spring/summer), fecal coliform (fall/winter/spring/summer), PCBs, and PAHs

(COP 2008a; DEQ 2009). The DEQ also developed TMDL standards for temperature, DDT, dieldrin, and bacteria for Johnson Creek in 2006 (JCWC 2008, COP 2008b).

Lower Kellogg Creek, which is listed for *E. coli*, has a large channel that drops steadily until reaching Kellogg Lake, a man-made, urban lake located in downtown Milwaukie (WES Watershed Action Plan 2009). Kellogg Lake's outlet (control dam) is located at SE McLoughlin Boulevard, less than 100 feet from its confluence with the Willamette River. The Kellogg Lake dam has a fish ladder, and Kellogg Creek/Lake supports three federally listed species (Chinook salmon, coho salmon, and steelhead) (StreamNet 2009a). No TMDLs have been approved for the watershed; however, because Kellogg Lake is a tributary to the Willamette River, it is included in all Willamette River TMDLs by reference (City of Portland 2008).

3.9.2 Environmental Impacts

Project-related impacts are divided into short- and long-term impacts. Long-term impacts are likely to affect the area for the operational life of the proposed project, while short-term impacts are likely to affect the area only during and immediately after the construction period.

Analyses of impacts for water resources are based on the preliminary designs as described in Chapter 2. This level of design is adequate for analyzing and disclosing the project's anticipated impacts and mitigation measures. Final design and natural resource permitting will confirm the details of water quality requirements and include addressing these requirements in final designs as required by the local permitting agencies. This FEIS is using the most currently available estimates of volumes for removal/fill activities and hydraulic impacts on streams.

Chapter 2 also describes the proposed stormwater management approach, including a description of and the location of proposed water quality facilities.

3.9.2.1 Long-Term Impacts

<u>No-Build Alternative</u>

The No-Build Alternative represents existing conditions for flooding, water quality, and hydrology in the project area. The No-Build Alternative would not include new light rail facilities in the area and, therefore, would avoid light rail project-related impacts. However, background development and other projects would occur. Such development would increase impervious surface area and its related water quality impacts.

The No-Build Alternative would result in continued stormwater runoff from impervious surfaces. This runoff would flow untreated to project area streams and typically would not be improved unless areas are redeveloped to current standards.

Additionally, with time and increasing traffic and congestion, pollutant loading likely would increase. Increased traffic and congestion leads to increases in metals, oil, and grease on roadways and parking lots. These pollutants subsequently are transported to project area streams by stormwater runoff. The No-Build Alternative is associated with a greater increase in vehicle miles traveled and worse congestion than with the light rail project, and so pollutant transport is expected to be greater with the No-Build Alternative than with the light rail project. The No-Build Alternative is also associated with less intense development near transit facilities and therefore would likely contribute to lower density development, more “green field” development (versus infill development), and more development near upper reaches of the Willamette River’s tributaries.

Portland-Milwaukie Light Rail Project

Linear development projects typically have the potential to impact water resources in a variety of ways. Generally, these impacts can be categorized into hydrologic and water quality impacts. Hydrologic impacts typically include:

- Alterations to the stormwater hydrograph (increased volume, altered timing)
- Impacts to floodplains, their storage capacity, and associated flooding conditions
- Reduced infiltration and groundwater recharge
- Decreases in channel conveyance

Water quality impacts typically include:

- Increased export of pollutants from impervious surfaces and compacted soils
- Decreased pollutant filtration
- Increased water temperatures as a result of riparian vegetation removal
- Export of pollutants from motor vehicles using park-and-ride lots and other associated infrastructure

These impacts to project-area water quality and hydrology would be caused primarily by creation of impervious surfaces and encroachment upon floodplains and stream channels.

The LPA to Park Avenue includes crossings of the Willamette River, Crystal Springs Creek, Johnson Creek, Crystal Creek, Spring Creek, Kellogg Lake, and Courtney Springs Creek, all of which are located within the lower portion of the Willamette River basin (Figure 3.9-1 and Table 3.9-3). The MOS to Lake Road includes the same crossings except Kellogg Lake and Courtney Springs Creek would not be crossed. Expansion of the existing Ruby Junction Facility could also indirectly impact Fairview Creek.

Table 3.9-3
Project Area Streams with Crossings

Stream[1]	LPA to Park Ave.[2]	MOS to Lake Rd.	Location of Crossing and Key Features
Willamette River	X	X	Between the Marquam and Ross Island bridges. Two piers in the Willamette River.
Crystal Springs Creek	X	X	Spans culverted creek approximately one-quarter mile north of the SE Bybee Blvd. bridge. New structures, but none below Ordinary High Water (OHW).

Table 3.9-3
Project Area Streams with Crossings

Stream[1]	LPA to Park Ave.[2]	MOS to Lake Rd.	Location of Crossing and Key Features
Johnson Creek	X	X	Spans creek immediately east of SE McLoughlin Blvd., approximately 100 feet south of the SE Tacoma St. bridge. New structures, but none below OHW. An existing bridge would be modified to accommodate pedestrian access to the Tacoma Station.
Crystal Creek	X	X	Spans stream between Highway 224 and SE Harrison St. Crossing requires extension of existing culvert under UPRR alignment (34-foot-long, 3-foot-diameter corrugated metal pipe), all below OHW.
Spring Creek	X	X	Spans culverted stream adjacent to the Tillamook Branch line at SE Harrison St. crossing. Crossing requires repair of existing culvert (200-foot-long, 3-foot-diameter steel pipe), all below OHW.
Kellogg Creek/Lake	X		Immediately south of SE Lake Road and east of the existing Tillamook Branch trestle crossing. One H-pier consisting of two 6-foot-diameter columns will be constructed in the lake bed, with the remainder of piers above OHW.
Courtney Springs Creek	X		West of SE McLoughlin Blvd., approximately 100 feet north of SE Park Ave. Park-and-ride construction requires repair to portions of existing culvert, all below OHW.

[1] Fairview Creek is proximate to the proposed Ruby Junction Facility, which would be expanded as part of the light rail project. It is not crossed by either the LPA to Park Avenue or the MOS to Lake Road but could be indirectly affected by the proposed expansion of the maintenance facility.
[2] Including LPA Phasing Option.

Impacts Associated with Impervious Surfaces

Unmanaged stormwater runoff from impervious surfaces can have an adverse impact on hydrology and water quality because it collects pollutants and prevents them from filtering into the ground. Stormwater runoff can then transport accumulated pollutants to project-area streams. The alignment of the proposed project and associated construction will create up to 26 acres of impervious surface by replacing existing and adding new impervious surface. Approximately half of the light rail project's total impervious area would be constructed on existing impervious areas. However, the light rail project will also convert 1.0 acre of existing impervious surface to open space and 8.3 acres to pervious tie and ballast track. Up to 12.6 acres will be pollutant-generating impervious surfaces, or PGIS. The LPA Phasing Option has a higher amount of PGIS due to its surface parking facility at the Tacoma Station, where the LPA to Park Avenue would have a parking structure. This adds about 1.8 acres of impervious surface compared to the LPA to Park Avenue. Tie and ballast track, bicycle/pedestrian paths and sidewalks, and streetcar tracks do not generate pollutants. Stormwater runoff from these surfaces will still be managed, improving the existing treatment condition across the project alignment.

Table 3.9-4 shows the total amount of impervious surface that would be created by the light rail project. The new impervious surfaces related to the light rail project represent a small overall increase in total impervious surface area in each basin. Approximately 50 percent of the light rail project's total impervious area would be constructed on existing impervious areas. Most of these areas were developed before the existence of current stormwater controls, and therefore have little, if any, stormwater controls. Because current regulations require that stormwater from redeveloped areas be managed, the project would improve water quality conditions over the No-Build Alternative, helping to offset potential water quality and quantity impacts resulting from new impervious surfaces. Similarly, the Willamette River crossing structure includes bus lanes, and buses would be rerouted from existing bridges that have antiquated (if any) stormwater treatment to a structure that complies with current regulations. For the MOS to Lake Road, a 275-space park-and-ride is proposed near Kellogg Lake, which also would increase impervious surfaces within the basin, but less than the LPA to Park Avenue, which would extend to the other side of Kellogg Creek.

Table 3.9-4
Total New Impervious Surface Area (acres) by Watershed[1,2]

Basin	Acres of Existing Impervious Surface Area by Watershed	No-Build	LPA to Park Ave.[2]	MOS to Lake Rd.	Related Facilities: Bridge Area Transportation Facilities	Related Facilities: Ruby Junction	Max Total
Lower Willamette River	27,517	0	8.3	8.3	4.7	**0**	**13.0**
Johnson Creek[3]	10,386	0	6.6-8.4	6.6	0	**0**	**8.4**
Kellogg Lake[4]	1,157	0	3.6	0.8	0	**0**	**3.6**
Columbia Slough[5]	1,338	0	0	0	0	0.7	**0.7**
Total	**40,398**	**0**	**18.5-20.3**	**15.7**	**4.7**	**0.7**	**25.7**

[1] Source: Metro 2009.

[2] Impervious surface area estimates do not include light rail track on ballast, which is considered pervious. However, these estimates do include paved track areas that are typically located around roadway intersections and shared roadways.

[3] The Johnson Creek watershed includes Crystal Springs Creek, Spring Creek, and Crystal Creek. This is the only watershed affected by differences in the LPA Phasing Option of the LPA to Park Avenue.

[4] The Kellogg Creek watershed includes Courtney Springs Creek.

[5] The Columbia Slough watershed includes Fairview Creek.

Because the amount of new impervious surface added is relatively low compared to the overall size of the basins in which it is located and because the light rail project would adhere to all applicable stormwater management regulations, adverse hydrologic impacts resulting from impervious surfaces are unlikely to occur. Additionally, although operation of light rail facilities could potentially release very small amounts of pollutants (primarily sediment, oil and grease, and metals), pollutant generation typically is very low and, as stated above, the Portland-Milwaukie Light Rail Project would adhere to all applicable stormwater regulations.

Consequently, adverse water quality impacts associated with impervious surfaces and light rail operation would not result in violations of applicable water quality regulations or appreciable worsening of project area waterbodies, including those identified on DEQ's 303(d) list as being water quality limited.

Impacts Associated with Channel/Floodplain Encroachments at Stream Crossings

With the exception of modifications of existing culvert at Crystal Creek, repair of the culvert at Spring Creek crossings, and existing metal culvert repairs for park-and ride construction near Courtney Springs Creek, only the Willamette River and Kellogg Lake bridges would include new permanent structures located below the OHW elevation. Due to the limited impacts and proposed floodplain mitigation, none of the creeks that would be crossed, with the exception of the Willamette River, would have capacity or hydrology impacts.

The light rail project would place between 5.2 to 5.3 acres of light rail facilities and related fill and roadway improvements in floodplains. It would encroach upon the FEMA-designated floodplains of Crystal Springs Creek, Johnson Creek, and the Willamette River. Under the LPA to Park Avenue, the project also would encroach on the Kellogg Lake floodplain. At the Ruby Junction Facility, floodplain impacts would not occur if only the initial phase of the facility expansion is constructed, but could still occur later. The acreage of light rail and other transportation facilities located in a floodplain was used to provide rough estimates of floodplain impacts. These acreages are reported below where the project encroaches upon a floodplain (Table 3.9-5).

Table 3.9-5
Combined Acreage of Facilities in Mapped Project-Area Floodplains

Floodplain/Stream[1]	Alternatives			Related Facilities	
	No-Build	LPA to Park Ave.	MOS to Lake Rd.	Ruby Junction	Bridge Area Transportation Facilities
Willamette River	0.0	3.9	3.9	0.0	2.3
Crystal Springs Creek	0.0	1.1	1.1	0.0	0.0
Johnson Creek	0.0	0.2	0.2	0.0	0.0
Kellogg Lake	0.0	0.1	0.0	0.0	0.0
Fairview Creek	0.0	0.0	0.0	<0.01	0.0
Total	0.0	5.3	5.2	<0.01	2.3

[1] FEMA has not mapped floodplains for Crystal, Spring, and Courtney Springs creeks. Consequently, they are not included in this analysis.
[2] Acreage includes structures in floodplains as well as piers and scour protection features in floodway.

Impacts to 100-year floodplains will be addressed in accordance with local regulations and Executive Order 11988 – Floodplain Management, based on final design information. As required by these regulations, all lost storage would be mitigated by creating additional storage volume elsewhere in the floodplain, except for project elements west of the Willamette River where Metro Title 3 and City of Portland ordinance provide an exemption. Project impacts to the Willamette River floodway will require a Conditional Letter of Map Revision, which is described below.

Willamette River

The proposed Willamette River bridge structure will have two tower structures on capped piers in the river. These pier structures will alter localized hydraulic conditions, and permanent scour protection will be necessary at the bridge's two in-water tower structures and will entail up to 91,000 square feet, varying in depth from 4 to 7.5 feet (scour protection details can be found in *Bridge Hydraulics and Scour Assessment Detailed Report*, WEST Consultants 2010). The scour protection is designed to minimize potential disturbance to contaminated sediments. However, longer-term impacts from scour could occur with the permanent pier structure during a 500-year flow event, causing existing sediment to be mobilized around the structure. Lesser volumes may be mobilized in smaller flood events.

The proposed Willamette River bridge structure and associated scour protection will cause a 0.6-inch rise in the 100-year flood profile upstream of the structure (0.5 inch associated with the structure and 0.1 inch associated with the scour protection) (*Bridge Hydraulics and Scour Assessment Detailed Report*, WEST Consultants 2010). Because of the rise and the encroachment into the floodway, and because there are no opportunities to affect or mitigate the encroachment and net rise within this section of river, the approval of this project is subject to 44 CFR Part 65.7 and would require that a Conditional Letter of Map Revision (CLOMR) be submitted to the City of Portland and FEMA. An accepted CLOMR is FEMA's comment on a proposed project that would affect the hydrologic or hydraulic characteristics of a flooding source and modify a floodway. Then, once the project is completed, the City of Portland will need to request a revision to the Flood Insurance Rate Map. However, the effect of the minor net rise in flood levels is not anticipated to represent an increased risk of flooding or the exposure of new areas to flooding compared to existing conditions.

Kellogg Lake

Fill from the permanent piles below existing OHW will cover approximately 60 square feet of the lake bottom in Kellogg Lake with the LPA to Park Avenue. Potential floodplain impacts are not anticipated to create an appreciable change in existing conditions within this segment for the following reasons:

- The size of the H-pier relative to the size of the channel (total area and volume of the river/lake impacted by the pier) likely would be less than 10 percent.
- Kellogg Creek is impounded to form Kellogg Lake, which lacks the velocity of a free-flowing stream; consequently, because velocities are very low, the ability of the bridge pier to impact (primarily by scouring) channel integrity is very low. The future condition of the creek/lake is unknown.
- Adherence to applicable regulations and fluvial performance standards will be conditions of permits to be approved by regulatory agencies prior to project construction.

Related Facilities

Related Bridge Area Transportation Facilities

The effects of the Related Bridge Area Transportation Facilities are included within the calculation of fill and the creation of impervious surfaces that would occur with the LPA to Park Avenue.

Ruby Junction Maintenance Facility

The expansion of the Ruby Junction Facility is within the Fairview Creek drainage area and has a total area of an approximate 20 acres of which 16.8 are existing pollutant-generating impervious surface and currently infiltrated. This facility would be expanded to approximately 30 acres, potentially in phases, in order to meet the needs of the Columbia River Crossing Project and the Portland-Milwaukie Light Rail Project, both of which are expected to be constructed at approximately the same time. Three of the 14 parcels that would be added to the maintenance facility are located within the 100-year floodplain of Fairview Creek. Work in these three parcels would not occur in the initial phase of the expansion but would occur in a later phase. The parcels presently contain several buildings and some paved surfaces. No new structures are planned to be constructed in the floodplain and the existing buildings will be removed. The expansion would include the addition and replacement of some impervious surface for a total net gain of 0.7 acres of pollutant-generating impervious surface. This phasing approach would be similar, because it involves converting properties that are mostly impervious today. Of this impervious surface, less than 0.01 acre is within the 100-year floodplain of Fairview Creek.

Summary of Long-Term Impacts

The No-Build Alternative would not include any long-term impacts to water resources, but it would forgo improvement to the existing conditions of project-area runoff and stormwater management facilities. For the light rail project, however, once minimization and mitigation measures are implemented, and because it would adhere to all applicable stormwater management regulations, adverse hydrologic and water quality impacts resulting from the light rail project are unlikely to occur. Potential effects of the project include the addition of new impervious surfaces and floodplain fill, increased pollutant loading, one river crossing, one lake crossing, and as many as five stream crossings.

Table 3.9-6 shows an ordinal scale used to summarize the adverse impacts associated with the project. Impacts were considered detectable if a noticeable change to the existing conditions of the receiving waterbody or floodplain would be expected. Impacts were considered significant if the water quality or hydrologic changes would substantially alter existing conditions. Table 3.9-7 summarizes the assessment of long-term impacts for the project.

Table 3.9-6
Ordinal Scale of Impacts

Impact Level	Local Impacts	Basin-Wide Impacts
1	Not Detectable	Not Detectable
2	Detectable	Not Detectable
3	Detectable and Significant	Not Detectable
4	Detectable and Significant	Detectable
5	Detectable and Significant	Detectable and Significant

Table 3.9-7
Summary of Long-Term Impacts[1, 2]

Alternative[3]	Basin	Water Quality	Ordinal Value	Hydrology	Ordinal Value	Floodplain	Ordinal Value
No-Build	All	None	1	None	1	None	1
LPA to Park Ave., MOS to Lake Rd., and Related Bridge Area Facilities	Willamette River	Although unlikely, discharge to the Willamette River could have a detectable impact locally.	2	Direct impacts to the Willamette River would have a local impact. Detectable impacts from increased runoff are not anticipated.	2	3.9 acres of light rail facilities would be located in the Willamette River floodplain and floodway. The SW Moody Ave. improvements with streetcar would occupy 2.3 acres in floodplain. South Waterfront floodplain is exempt from balanced cut and fill requirements.[4]	2
LPA to Park Ave. and MOS to Lake Rd.	Crystal Springs Creek	Discharge to Crystal Springs Creek could have a detectable impact locally.	2	Although unlikely, increased runoff could be detected locally. Direct impacts to the stream channel are not anticipated.	2	Up to ~1.1 acres in floodplain; all fill would be mitigated via balanced cut/fill.	2
LPA to Park Ave. and MOS to Lake Rd.	Johnson Creek	As described for Crystal Springs.	2	As described for Crystal Springs.	2	Up to ~0.2 acres in floodplain; all fill would be mitigated via balanced cut/fill.	2
LPA to Park Ave.	Kellogg Lake	As described for Crystal Springs.	2	As described for the Willamette River.	2	Up to ~0.1 acres in floodplain; all fill would be mitigated.	1
MOS to Lake Rd.	Kellogg Lake	As described for Crystal Springs.	2	As described for the Willamette River.	2	No floodplain impacts anticipated.	1
Ruby Junction Facility	Fairview Creek	As described for Crystal Springs.	2	As described for Crystal Springs.	2	Three parcels in 100-year floodplain will be acquired; however, no structures will be built within floodplain.	1

[1] The ordinal scale of impacts is described in Table 3.9-6 in relationship to whether impacts are detectable and/or significant at the local and/or basin level.

[2] Impacts described here reflect the greatest impact associated with the proposed alignment options and other project components. These impacts are assessed assuming full implementation of required mitigation measures. Impacts can be further minimized by application of typical permit requirements as outlined in Chapter 5 of the *Water Quality and Hydrology Results Report* (Metro 2008). There are no long-term impacts assumed for Crystal Creek or Spring Creek, which are in culverts.

[3] LPA to Park Avenue includes Phasing Option.

[4] Floodway fill also cannot be mitigated by balanced cut, and will require a Conditional Letter of Map Revision through FEMA.

The ordinal scale of impacts is defined differently for water quality, hydrologic, and floodplain impacts. For water quality, if stormwater entering a receiving body from a paved park-and-ride lot would have a direct pathway for pollutant and temperature loading with no opportunity for dilution, treatment or natural attenuation, the impact likely would be detectable and significant in the receiving waterbody, particularly during low-flow summer months and/or in a relatively small waterbody. For hydrologic impacts, if the peak runoff rate associated with the two-year design storm from the new and redeveloped impervious areas within a basin would be greater than five percent of the average annual flow in the receiving waterbody, the impact likely would be locally detectable and significant and detectable but not significant at the basin level. For floodplain impacts, if the amount of fill placed in the floodplain exceeds 500 cubic yards, it is likely that the impact would be locally detectable and significant, and detectable but not significant at the basin level.

Portland-Milwaukie Light Rail Project

For the Willamette River bridge crossing, the total in-water work construction time entails approximately 16 weeks for the installation of both the temporary and permanent components. Permanent components of the bridge design are outlined below:

- Two in-water piers (for the bridge towers), each consisting of a set of up to nine 10-foot-diameter drilled shafts
- One concrete pile cap for each pier (each pile cap will be approximately 100 feet in diameter and 14 feet deep; pile caps will be placed at the waterline, i.e., the bottom of the pile cap will be at an approximate elevation of -5 feet [City of Portland datum])
- Up to 18 navigation assistance piles as required by U.S. Coast Guard
- Scour protection

Fill from the permanent piles below ordinary high water level in the Willamette River will cover approximately 1,415 square feet, of which approximately 550 square feet will be within shallow water. For permanent piles, total exposed volume below ordinary high water will be approximately 1,210 cubic yards. For each 96-foot-diameter pile cap (one on the west side and one on the east side), the total volume below ordinary high water will be approximately 3,750 cubic yards for a total of approximately 7,500 cubic yards.

The anticipated Kellogg Lake light rail bridge will be a box girder structure with multiple spans. The box girders, pier foundations, and abutments will be cast-in-place and founded on drilled shafts and driven piles. Additionally, structural provision for a future pedestrian path under the bridge will be included. It is anticipated that the truss for this path will be installed by the City of Milwaukie.

3.9.2.2 Short-Term Impacts (Construction)

Short-term impacts could include increased rates and volumes of sediment-laden runoff during excavation, potential accidental spills and leaks from construction vehicles and equipment, and removal of riparian vegetation. Short-term sediment and erosion impacts are more likely to occur near stream crossings, where slopes are greater and construction activities occur closer to the receiving water, and where controls may be more difficult to implement and maintain. The likelihood of spills affecting surface waterbodies also would be greatest in these areas. Although other, larger areas of construction than the ones near stream crossings would exist in the Portland-Milwaukie Light Rail Project, the remainder of the project corridor is relatively flat; therefore, sediment and erosion impacts would be less likely to occur and spills would be less likely to reach surface waterbodies.

No-Build Alternative

Existing conditions for flooding, water quality, and hydrology would continue with the No-Build Alternative, which would not include any of the proposed changes to the corridor's transportation system. Consequently, the No-Build Alternative would not include construction of light rail and, therefore, would avoid short-term impacts caused by light rail construction. Other projects in the corridor would still be constructed and could create short-term impacts.

Portland-Milwaukie Light Rail Project

Short-term impacts to water resources from construction of the light rail project could occur at stream crossings, where major structures such as the new Willamette River bridge or, with the LPA to Park Avenue, the bridge over Kellogg Lake, would be placed. Short-term impacts also could occur during construction of stations and park-and-ride facilities, particularly the Bybee, Tacoma, and Lake Road stations, and the Tacoma Park-and-Ride, which are located in proximity to stream crossings and/or within floodplains. If the MOS to Lake Road is constructed, a park-and-ride facility would be constructed near Kellogg Lake.

Bridge construction at stream crossings would involve work within and/or above streams and floodplains; therefore, there is the potential for water quality concerns. Dropped construction materials can physically harm organisms, stir up sediments, and affect water quality. Chemical and concrete spills can be directly toxic and affect pH. Construction of bridge piers in the Willamette River also could disturb bed sediments, create turbidity, and perhaps release contaminated sediments into the water column. PCBs, butylins, metals, and PAHs, which are documented in Willamette River bed sediments in the project area, could be disassociated from parent sediments and become dissolved in the water column. The extent of this potential effect would depend on the location of bridge piers, construction techniques, environmental chemistry, contaminant concentrations, and a variety of other factors at the time of re-suspension.

As described above, the total in-water work for the Willamette River bridge crossing construction entails approximately 16 weeks for the installation of both the temporary and permanent components. Temporary components of the bridge design are outlined below:

- Two 100-foot-diameter cofferdams for construction of the in-water piers
- Up to 126 piles (maximum 36-inch diameter) for two work bridges, one from each bank to the permanent pier locations, of which up to 114 piles would be located below ordinary high water level
- Temporary bridge structures will be in place for three or four years. The temporary sheet piles and sand, gravels, and cobbles for the cofferdams will cover approximately 15,700 square feet, of which 3,900 square feet will be within shallow water. The temporary pipe piles for work bridges will cover approximately 850 square feet, of which approximately 400 square feet will be located in shallow water. Total volume of temporary sheet pile and sand, gravels, and cobbles below ordinary high water will be approximately 12,800 cubic yards, and total volume of temporary pipe piles will be 1,070 cubic yards.

At Kellogg Lake, the total in-water work construction time entails approximately 12 weeks for the installation of both the temporary piles for the work bridges and the permanent in-water H-pier columns. The temporary piles for work bridges below existing OHW will cover approximately 200 square feet. As with the Willamette River bridge, impacts due to disturbing sediments could occur during construction of the Kellogg Lake bridge piers, although flows are less erosive in the lake than in the Willamette River.

Short-term impacts at waterbody crossings also could include removal of riparian vegetation, primarily at the Kellogg Lake and Johnson Creek crossings.

The Portland-Milwaukie Light Rail Project will obtain all necessary permits and will comply with all applicable stormwater regulations, including those required to alleviate short-term impacts during project construction. Additionally, all in-water work will be conducted during agency coordinated and approved in-water work windows. Details regarding construction equipment, methods, timing, and sequencing would be defined through final design and permitting for the project.

Summary of Short-Term Impacts

The No-Build Alternative would not include construction and, therefore, would avoid any short-term impacts to water resources. Although anticipated to be detectable only at the local scale, construction of the light rail project likely would have some level of effect on the water quality and hydrology of each basin in which it is located. As part of Section 402 of the CWA, the National Pollutant Discharge Elimination System (NPDES) permitting program requires sources of point and nonpoint pollutants to have an NPDES permit, which is administered by DEQ. In the City of Portland, NPDES 1200-C Stormwater Discharge Permits are required for any construction project lager than one acre to control erosion and reduce sedimentation into waterways.

Pollution reduction requirements outlined in the City of Portland *Stormwater Management Manual* require 70 percent removal of total suspended solids (TSS) from 90 percent of the average annual runoff. Also, in watersheds with established TMDLs or that are on the DEQ's 303(d) list of impaired waters, such as the case for the Portland-Milwaukie Light Rail Project, stormwater management facilities must be capable of reducing the pollutants of concern, as approved by City of Portland Bureau of Environmental Services.

Specific pollutants of concern outlined by the City of Portland in its *Stormwater Management Manual*, typically associated with stormwater runoff, include the following:

- Suspended solids (sediment)
- Heavy metals (dissolved and particulate, such as lead, copper, zinc, and cadmium)
- Nutrients (such as nitrogen and phosphorus)
- Bacteria and viruses
- Organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers)
- Floatable trash and debris

The ordinal scale of impacts in Tables 3.9-7 and 3.9-8 reflect the greatest approximated project impact at a local and/or basin level and can further be minimized upon implementation of design standards and criteria outlined in the City of Portland *Stormwater Management Manual* along with regulatory permit compliance. This will also allow the project to minimize its effects on the specific water quality parameters of concern for each of the identified waterbodies.

Table 3.9-8 summarizes the assessment of impacts for the project using the ordinal scale presented in Table 3.9-6.

Table 3.9-8
Summary of Short-Term Impacts[1,2]

Alternative[3]	Basin(s)	Water Quality	Ordinal Value	Hydrology	Ordinal Value	Floodplain	Ordinal Value
No-Build	All	None	1	None	1	None	1
LPA to Park Ave., MOS to Lake Rd. and Related Bridge Area Facilities	Willamette River	Potential impacts include sediment-laden runoff, accidental spills, and leaks from construction equipment.	3	Potential impacts include increased runoff from vegetation clearing, soil compaction, and dewatering portions of the river during in-water construction.	3	Potential impacts include temporary decreases in floodplain storage.	2
LPA to Park Ave., MOS to Lake Rd.	Crystal Springs Creek	Potential impacts include sediment-laden runoff, accidental spills, leaks from construction equipment, and removal of riparian vegetation.	3	Potential impacts include increased runoff from vegetation clearing and soil compaction.	2	Potential impacts include temporary decreases in floodplain storage.	2
LPA to Park Ave., MOS to Lake Rd.	Johnson Creek	Same as Crystal Springs above.	3	Same as Willamette River above.	3	Same as Crystal Springs above.	2
LPA to Park Ave., MOS to Lake Rd.	Crystal Creek	Same as Crystal Springs above.	3	Same as Willamette River above.	3	Same as Crystal Springs above.	2
LPA to Park Ave., MOS to Lake Rd.	Spring Creek	Same as Crystal Springs above.	3	Same as Willamette River above.	3	Same as Crystal Springs above.	2
LPA to Park Ave.	Kellogg Lake	Same as Crystal Springs above.	3	Same as Crystal Springs above.	2	Same as Crystal Springs above.	2
MOS to Lake Rd.	Kellogg Lake	Same as Crystal Springs above.	3	Same as Crystal Springs above.	2	No floodplain impacts anticipated.	1
Ruby Junction	Fairview Creek	Potential impacts include sediment-laden runoff, accidental spills, and leaks from construction equipment.	2	Potential impacts include increased runoff from vegetation clearing and soil compaction.	2	No short-term floodplain impacts are anticipated.	1

[1] The ordinal scale of impacts is described in Table 3.9-6 in relationship to whether impacts are detectable and/or significant at the local and/or basin level.
[2] Impacts assume typical permit requirements.
[3] LPA to Park Avenue includes Phasing Option.

3.9.2.3 Cumulative Impacts

Past and future development within the watershed, including transportation but also other urbanization projects that have occurred in this region, has cumulatively affected the health of the watershed by removing natural cover, creating impervious surfaces, channelizing streams, disconnecting streams from floodplains, altering flow regimes, and discharging contaminants into waterbodies.

With or without the implementation of the light rail project, continued development and redevelopment activities are expected along the project corridor and throughout the Portland metropolitan area. The region's land use plans envision most of the future growth in population and employment being focused on established regional and urban centers connected by high quality multimodal transportation systems. The No-Build Alternative would not include one of the major transportation investments assumed in regional growth management plans. The most likely effect would be increased pressure to develop in areas with lower congestion, which tend to be on the outskirts of the region. These areas would experience an increase in impervious surfaces as they are further developed. They also would carry higher rates of automobile use and lower rates of transit use, bicycling, or walking compared to the more dense central areas of the region.

In contrast, the light rail project would help facilitate future development that reduces dependence on vehicular travel and is consistent with regional growth plans and density goals. Much of this development would occur in previously disturbed areas already covered with impervious surfaces. Additionally, by focusing development in underutilized urban areas, development pressure in outlying rural areas would be lessened. This would help preserve forests and farmland in headwater reaches, limit sprawl, and reduce associated water resource issues. For these reasons, after implementation of the project and with other mitigation, it is not expected that the light rail project would worsen conditions in the project corridor's receiving waterbodies.

Climate Change

Climate change is predicted to affect the hydrologic functions of river systems worldwide including the Willamette River. The project has reviewed best available science on the potential effect global climate change may have on water surface elevations (river stages) of the Willamette River at the project site in Portland, Oregon in a technical memorandum (*Willamette River Stage and the Effect of Global Climate Change,* Parametrix 2010). In general, the stage of the Willamette River at the project site is affected by three variables: the hydrology (flow rate) of the Willamette River, the stage of the Columbia River, and tidal elevation. As shown by the analysis in the technical memorandum all three of these interrelated variables will be affected by global climate change over the next 100 years.

The detailed conclusions of this technical memorandum were intended to support a determination of how global climate change may affect navigation on the Willamette River at the project site so that informed design decisions can be made about the appropriate height of the project's Willamette River bridge.

Detailed results are available in the technical memorandum and summarized in Appendix O, but based on the methods and assumptions described in the technical memorandum, the following key results are relevant for the purposes of evaluating potential impacts to navigation to the Willamette River by the year 2100.

- Willamette River stage may increase by 1.8 to 2.5 feet during winter months (median 1.9 feet)
- Effect of tide on the Willamette River stage is 0.0 to 1.0 feet (median 0.5 feet)
- Estimated sea level change is -0.6 feet to 4.8 feet (median 1.5 feet)

The estimated net result is approximately 3.4 feet increase in Willamette River stage by the year 2100 due to global climate change. This increase, taken with the net rise due to the construction of the bridge in the floodway, could still result in a statistically similar increase in the Willamette River stage by year 2100. The best available science does not allow any conclusions to be drawn about the frequency of these increased stages; however, based on the literature reviewed, it can be concluded that the increases are likely to occur primarily in the winter months, and it is likely that summer flows will be lower than currently measured.

3.9.3 Mitigation Measures

The project team considered and incorporated mitigation and minimization measures during the development of project alternatives and options. These project design and mitigation measures include both mandatory and voluntary elements that are designed to avoid or reduce impacts to water resources. Additional detail on mitigation would be developed during the final design stage and through project permitting.

3.9.3.1 Mitigation for Long-Term Effects

<u>Mitigation for Impacts Associated with New and Redeveloped Impervious Surfaces</u>

Hydrologic and water quality impacts will be minimized by following the City of Portland's stormwater management program and *2008 Stormwater Management Manual*; the project will meet the City of Portland's stormwater criteria along the entire light rail alignment. The City of Portland criteria were developed to manage stormwater to meet EPA's Clean Water Act and Safe Drinking Water Act. Through the application of the City's *Stormwater Management Manual*, the project will incorporate design criteria, best practices, and standards that will protect water quality in rivers and streams (including 303(d)-listed waters), and protect watershed health as well as protect groundwater as a drinking water resource.

At the Ruby Junction Facility, the project will adhere to the City of Gresham's water quality regulations, which are similar to the City of Portland's standards.

Examples of typical measures include collecting stormwater runoff from impervious surfaces in the project area and directing it to structural best management practices (BMPs) for treatment. Water quality benefits are realized when suspended sediment and other pollutants are settled out of the water; filtered through the use of separators, screens, filter media, or soils; and/or taken up by plants. Hydrologic benefits are realized when stormwater is collected on-site and discharged to the receiving stream at a slower rate (detention) and/or lower volume (retention). Hydrologic and water quality impacts also may be mitigated by retaining and infiltrating stormwater on-site such that little or none is discharged to surface waterbodies.

Nonstructural BMPs also can be used to minimize water quality impacts. Nonstructural BMPs are source control activities related to maintenance, pollution prevention or other housekeeping activities that help prevent stormwater from coming in contact with pollutants.

Water quality and hydrologic measures implemented as part of the light rail project will include minimizing impervious surface area (especially new impervious surfaces) and implementing structural and nonstructural BMPs (especially on-site treatment facilities). All measures implemented for the light rail project would not only meet applicable regulations (including treatment of TMDL-specified parameters), they would also consider treatment of constituents of particular concern, such as copper, zinc, and 303(d)-listed parameters as required by the local jurisdictions. See Section 2 of the *Water Quality and Hydrology Results Report* (Metro 2008) and COP 2008b for further detail on recommended and required stormwater treatment BMPs.

Mitigation for Direct Impacts at Stream Crossings

With the exception of a culvert extension at Crystal Creek and partial culvert repairs at Spring Creek and Courtney Springs Creek, of the seven waterway crossings, only the Willamette River and Kellogg Lake bridges would require piers or abutments to be located below the OHW elevation. However, at all locations where new crossing structures are required, the potential long-term impact of a rise in the flood elevation would be addressed by a flood-rise analysis conducted during final design. If flood rise exceeds that allowed, the rise would be offset through floodplain excavation activities. The project also would adhere to applicable regulations and fluvial performance standards negotiated with regulatory agencies prior to project construction. As described above, preliminary analysis indicates that the proposed Willamette River bridge structure will cause a rise (maximum increase of 0.06 inches) in the 100-year flood profile upstream of the structure (*Draft Bridge Hydraulics and Scour Assessment Report*, WEST Consultants 2010), which requires that a Conditional Letter of Map Revision (CLOMR) be submitted to the City of Portland and FEMA before project approval and construction.

Mitigation for Channel/Floodplain Impacts

The light rail project will mitigate channel/floodplain impacts through full compliance with applicable regulations and implementation of other project design features to help maximize benefits to water resources. Local jurisdictions require balanced cut for fill placed in the 100-year floodplain and prohibit encroachments into floodplains (of width 15 feet or greater) unless technical analysis shows that the development would not result in an increase in the base flood elevation in areas such as the South Waterfront that are exempted. Removal of existing structures in the floodplain also may be used to partially or fully account for mitigation of floodplain impacts. In addition to including the same volume of fill, floodplain mitigation should occur at the same land surface elevation as the impact. Wherever possible, it would be beneficial for floodplain cuttings to be incorporated with projects that improve water quality, such as revegetating riparian areas that are currently in a degraded state.

For this project, floodplain mitigation will occur at Crystal Springs Creek, Johnson Creek, and Kellogg Lake for removal and fill within the floodplain. A CLOMR will likely be required for the Willamette River for the placement of permanent piers and scour protection. Further analysis of the rise due to proposed site conditions will be conducted during further design phases.

3.9.3.2 Mitigation for Short-Term Effects

The light rail project will mitigate its potential short-term impacts through full compliance with applicable regulations including the erosion control manuals and requirements of the local jurisdictions. Mitigation of short-term impacts primarily consists of erosion control BMPs that prevent off-site sediment transport. Some of the erosion control BMPs required by state and local jurisdictions to comply with the NPDES permitting program include the following:

- Using straw, plastic, or other coverings for exposed ground
- Protecting large trees and other components of vegetative buffers
- Restricting vegetation clearing activities and site grading to dry weather periods
- Installing natural or synthetic geomembranes to prevent soil from eroding
- Using barrier berms (such as hay bales or check dams), silt fencing, and/or temporary sediment detention basins to help control sediment transport

Potential mitigation measures to help control accidental spills and leaks could include diapering dump trucks, routine inspection and cleaning of heavy equipment, and mandatory presence of spill control kits. Mitigation measures to protect riparian vegetation could include protecting large trees and other components of vegetative buffers, limiting construction footprints, and replanting after construction is complete. Restoration of the streambanks and the riparian zones will occur through streambank reshaping and planting and maintenance of native ground covers, shrubs, and trees. Criteria will be monitored and met to ensure compliance with permit requirements. Success criteria include, but are not limited to, ground cover, proportion of invasives, proportion of shrubs and trees, and survival.

3.10 NOISE AND VIBRATION

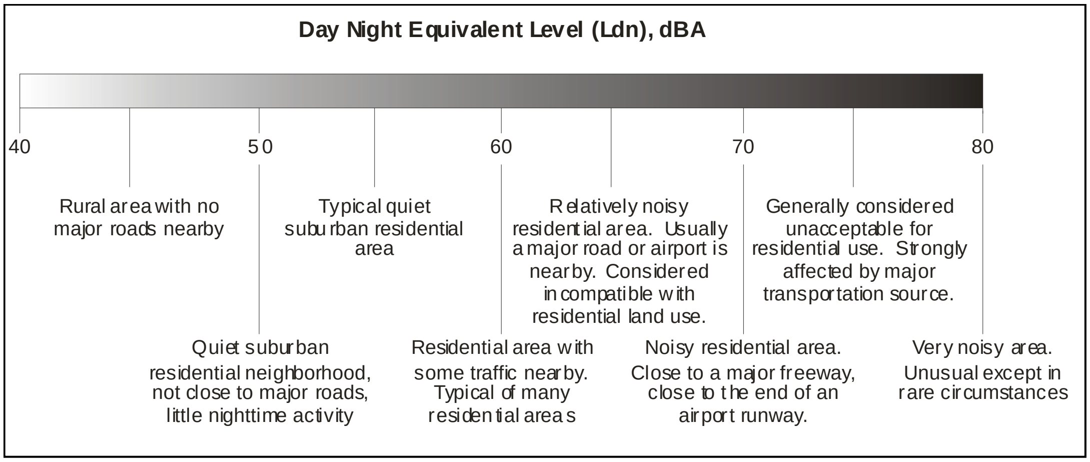
This section provides the results of the noise and vibration impact assessment conducted for the Portland-Milwaukie Light Rail Project. Complete details on the analysis along with a detailed introduction to transit noise and vibration analysis are given in the *Portland-Milwaukie Light Rail Project Noise and Vibration Results Report* (Metro 2010).

3.10.1 Introduction to Noise

Noise is defined as unwanted sound, which is measured in terms of sound pressure level and is usually expressed in decibels (dB). The human ear is less sensitive to higher and lower frequencies than to mid-range frequencies. Therefore, a weighting system that filters out higher and lower frequencies in a manner similar to the human ear was developed. Measurements made with this weighting system are termed “A-weighted” and are specified as “dBA” readings.

The L_{max} is the loudest instantaneous noise level during a pre-set measurement period. The equivalent sound level (L_{eq}) is the level of a constant sound for a specified period of time that has the same sound energy as an actual fluctuating noise over the same period of time. The day-night sound level (L_{dn}) is an L_{eq} over a 24-hour period, with a 10 dBA penalty factor added to nighttime sound levels occurring between 10 p.m. and 7 a.m. The L_{dn} is the primary noise level descriptor for light rail noise at residential land uses. The peak-hour L_{eq} is used for all traffic and light rail noise analysis for locations with daytime use, such as schools and libraries. Figure 3.10-1 is a graph of typical L_{dn} noise levels and residential land use compatibility.

Figure 3.10-1
Typical Ldn Noise Levels and Compatible Land Uses



Source: FTA 2006.

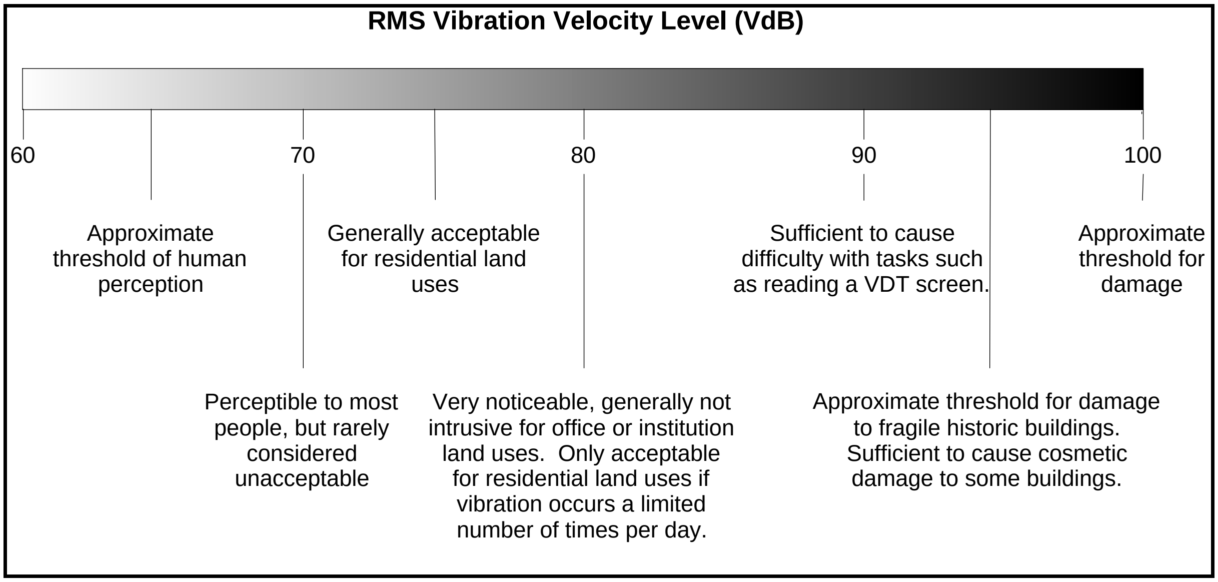
3.10.2 Introduction to Vibration

There are two components of vibration, ground-borne noise and ground-borne vibration. Ground-borne noise is normally associated with subway systems and is not an issue on this project because all alignments are at-grade or elevated. Ground-borne vibration is defined as a rapidly fluctuating motion that is transmitted through the ground from the vibration source to a receiver. Although ground-borne vibration attenuates over distance, some soil types transmit the vibration quite efficiently, while others do not. The response of humans, buildings, and sensitive equipment to vibration is described in this section in terms of the root-mean-square (RMS) velocity level in decibel units (VdB). As a point of reference, the average person can just barely perceive vibration velocity levels below 70 VdB. Figure 3.10-2 compares typical ground-borne vibration levels.

3.10.3 Impact Criteria and Methods for Noise and Vibration

This section provides the methods for the noise and vibration analysis. More detailed information on the criteria and methods used in this analysis is provided in the *Portland-Milwaukie Light Rail Project Noise and Vibration Results Report* (Metro 2010).

Figure 3.10-2
Typical Vibration Levels



Source: FTA 2006.

3.10.3.1 FTA Noise and Vibration Criteria

The impact criteria given in the Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration (FTA, revised May 2006), is based on research of community reaction to noise, and it reflects changes in noise exposure by using a sliding scale. The FTA Noise Impact Criteria group noise-sensitive land uses into the following three categories that are taken directly from the FTA Manual:

- **Category 1.** Buildings or parks where quiet is an essential element of their purpose.
- **Category 2.** Residences and buildings where people normally sleep. This includes residences, hospitals, and hotels where nighttime sensitivity is assumed to be of utmost importance.
- **Category 3.** Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches.

The L_{dn} descriptor is used to characterize noise exposure for residential areas (Category 2). Maximum one-hour L_{eq} during the period that the facility is occupied is used for other noise-sensitive land uses, such as school buildings (Category 3). The Portland-Milwaukie Light Rail Project corridor was examined extensively, and the only Category 1 land use identified in the corridor is the Mission Control production studio. There are no noise impact criteria for commercial or industrial land use under FTA criteria.

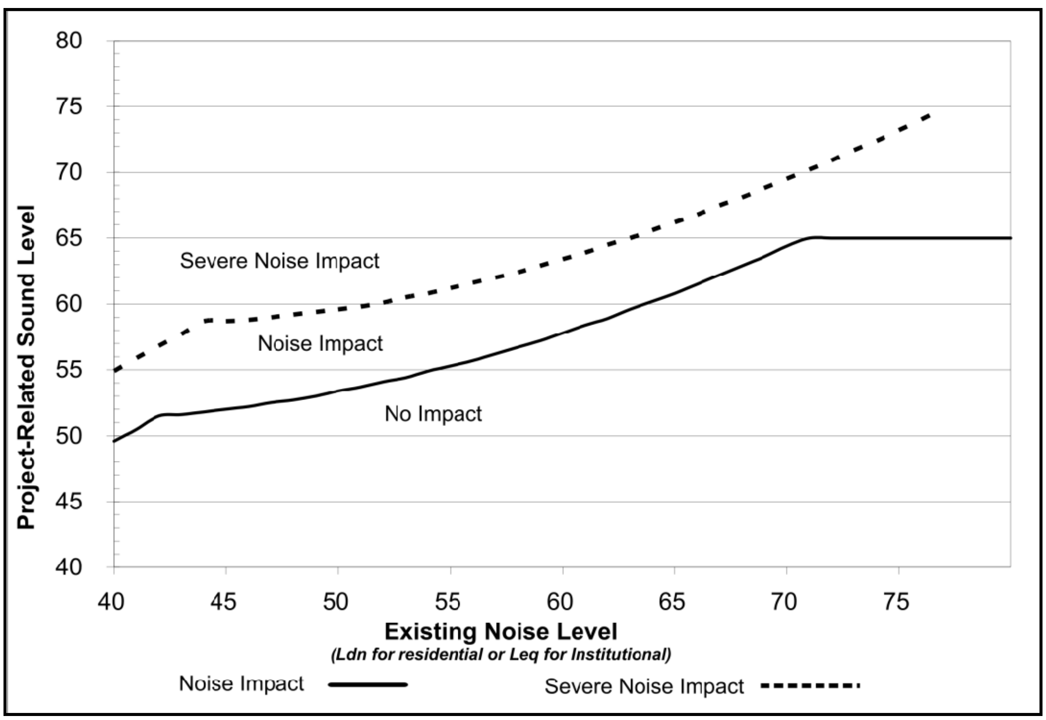
There are two levels of impact—severe and moderate—included in the FTA noise criteria. The interpretation of these two levels of impact is summarized below:

- **Severe.** Severe noise impacts are considered “significant,” as this term is used in the National Environmental Policy Act (NEPA). Noise mitigation will normally be specified for severe, or significant, impact areas unless there is no practical method of mitigating the noise.

- **Moderate.** In this range, other project-specific factors, such as the types and number of noise-sensitive land uses that are affected, existing outdoor-indoor sound insulation, and the cost-effectiveness of mitigating noise, must be considered to determine the magnitude of the impact and the need for mitigation.

The noise impact criteria for light rail operations are summarized in Figure 3.10-3. The bottom axis of the graph represents the existing L_{dn} at the receiver location, and the side axis represents the noise resulting from the project. The graph shows that as the existing noise exposure increases, the amount of the allowable increase in the overall noise exposure caused by the project decreases. For example, a receiver with an existing L_{dn} of 65 dBA would have an impact if project noise levels equaled, or were greater than, 61 dBA L_{dn}, and the impact would be considered severe if the project L_{dn} was greater than 66 dBA L_{dn}. This can be seen by using Figure 3.10-3, and following the bottom (existing noise level) over to 65 dBA and then looking up to where the moderate or severe lines cross the 65 dBA line.

Figure 3.10-3
FTA Noise Impact Criteria for Category 1 or 2 Land Uses



3.10.3.2 Ground-Borne Vibration and Ground-Borne Noise Criteria

The FTA also provides criteria for acceptable levels of ground-borne vibration. The criteria are based in part on the following:

- The threshold of vibration perception for most humans is around 65 VdB. Levels in the 70 to 75 VdB range are often noticeable but acceptable, and levels greater than 80 VdB are considered unacceptable for most land uses if not limited to a few occurrences daily (see Figure 3.10-2).

- For light rail systems with 10 to 20 trains per hour throughout the day, limits for acceptable levels of residential ground-borne vibration are usually between 70 and 75 VdB.
- Light Rail Transit (LRT) vibration is rarely high enough to cause building damage; the primary concern is that vibration could be intrusive to building occupants or interfere with sensitive equipment.
- The vibration analysis includes a 5 VdB safety factor to ensure a conservative analysis.[9]

Based on this information, the FTA vibration criteria for ground-borne vibration are 72 VdB for Category 2 (residential) structures and 75 VdB for Category 3 (institutional) structures. Table 3.10-1 provides a summary of the vibration criteria for the Portland-Milwaukie Light Rail Project.

Table 3.10-1
FTA Vibration Impact Criteria for Frequent Events*

Land Use Category	Category Comment	Ground-borne Vibration (VdB re 1 micro in/sec)	Ground-borne Noise (dBA re 20 micropascal)
1	Low interior vibration and noise is essential	65	n/a
2	Residential & sleep	72	35
3	Institutional & daytime	75	40
--	Concert hall, TV/Recording Studio**	65	25
--	Auditorium**	72	30
--	Theatre**	72	35

*Vibration and ground-borne noise levels for frequent events, which are defined as greater than or equal to 70 events per day.
** See section 12.2.2 of FTA Manual re: potential for structural damage to fragile structures if operational during transit events.
Source: FTA 2006.
-- Special buildings do not fall into any FTA land use categories.

3.10.3.3 Traffic Noise Criteria

Under FTA criteria, a traffic noise analysis is required only for projects that are considered to have Type 1 highway/roadway improvements under the Federal Highway Administration (FHWA) criteria. Type 1 highway/roadway changes include construction of a highway/roadway on a new location, or involve the physical alteration of an existing highway/roadway that significantly changes either the horizontal or vertical alignment, or increases the number of through lanes. Adding turn lanes, or alternative turn lanes, does not qualify as a capacity increase and is not typically considered a Type 1 highway improvement. The light rail project applies the FHWA criteria in several locations where traffic lanes will be relocated to accommodate light rail. Added guidance on Type 1 projects can be found in the *Portland-Milwaukie Light Rail Project Noise and Vibration Results Report* (Metro 2010).

[9] Noise does not require an additional factor because noise travels through air, which is fairly consistent, whereas vibration is traveling through different strata which can affect the overall level.

For roadways that meet the above requirements, the FTA requires that a traffic noise analysis, meeting the appropriate state and federal requirements, be performed. The traffic noise abatement criteria (NAC), against which the project traffic noise levels are evaluated, are taken from Title 23 of the Code of Federal Regulations (CFR) Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise. The criterion applicable for residences, churches, schools, recreational uses, and similar areas is an exterior hourly equivalent sound level (L_{eq}) that approaches or exceeds 67 dBA. The criterion applicable for other developed lands, such as commercial and industrial uses, is an exterior L_{eq} that approaches or exceeds 72 dBA. There are no criteria for undeveloped lands or construction noise.

ODOT considers a traffic noise impact to occur when predicted project traffic noise levels approach, within 2 dBA, the NAC, or substantially exceed existing levels. The substantial increase criterion is sometimes important in areas where existing shielding is removed, thereby increasing the traffic noise levels at homes that once had buildings blocking traffic noise.

The FHWA defines land use by types, which are defined in Table 3.10-2. Locations where a traffic noise analysis was required were investigated and categorized using FHWA land use types. The Type A category is only used for locations that are currently quiet, and where quiet is essential to the purpose of the site. An example of a Type A use would be the Grotto or other quiet place of worship. There are no Type A land uses in the project corridor.

Residential land use, schools, parks and playgrounds, churches, and hospitals are all considered Type B land uses, and traffic noise impacts would occur if future project-related noise levels meet or exceed 65 dBA L_{eq}, or have an increase of 10 dBA or more over the existing conditions. Commercial properties and other developed lands not included in the Type A or B categories are considered Type C, and traffic noise impacts occur at 70 dBA L_{eq}. A summary of the FHWA and ODOT noise regulations is contained in Table 3.10-2.

Table 3.10-2
FHWA Traffic Noise Abatement Criteria

Land Use Category and Description		FHWA NAC	ODOT NAC (2 dB approach)
		Hourly L_{eq} (dBA)	
Type A:	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose	57 (exterior)	55 (exterior)
Type B:	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals	67 (exterior)	65 (exterior)
Type C:	Developed lands, properties or activities not included in the above categories	72 (exterior)	70 (exterior)
Type D:	Undeveloped land	—	—

3.10.3.4 Local Noise Regulations

Local (state, city, and county) regulations are not applicable to public transit in public right-of-way or to traffic on public roadways. They are applicable to ancillary facilities, such as park-and-rides and maintenance bases, and to construction noise. In the City of Portland, construction noise and noise from ancillary facilities are regulated under Title 18, Chapter 10, Maximum Permissible Sound Levels. The regulations limit noise from ancillary facilities at residential lands uses to no more than 60 to 65 dBA during daytime hours (7:00 a.m. to 10:00 p.m., Monday through Saturday), and 55 to 60 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) and on Sundays. Construction noise is exempt from the criteria Monday through Saturday, between the hours of 7:00 a.m. and 10:00 p.m.

The City of Milwaukie has a noise control ordinance contained in the Milwaukie Municipal Code, Chapter 8, Section 08. The regulations are similar to the City of Portland's, with noise levels restrictions of 60 to 65 dBA during daytime hours (7:00 a.m. to 10:00 p.m., Monday through Saturday), and 55 to 60 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) and on Sundays. Construction is exempt from the criteria Monday through Saturday, between the hours of 7:00 a.m. and 10:00 p.m.

The City of Gresham also has a noise control ordinance contained in the City's Municipal Code, Chapter 7, Section 20. Under the City of Gresham criteria, the maximum allowable noise levels are based on the time when the noise is present. Between the hours of 7:00 a.m. and 10:00 p.m., the maximum allowable noise levels are 60 dBA, and during nighttime hours of 10:00 p.m. and 7:00 a.m., the maximum allowable levels are reduced to 50 dBA. These regulations are only applicable to the proposed expansion at the Ruby Junction Facility in Gresham, off NW Eleven Mile Road, if .residential receptors remain nearby.

3.10.3.5 Light Rail Noise and Vibration Analysis Methods

The light rail noise and vibration analysis was performed in accordance with the Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration (FTA, revised May 2006). Models were developed to predict noise and vibration using the methods given in the FTA manual. Inputs to the models include the track type (elevated, at-grade, and embedded), distance from the light rail tracks to sensitive properties, train speed, number of trains per hour per day, and special trackwork such as switches. The FTA manual provides the following factors for special and elevated trackwork:

- At-grade ballast and tie track + 0 dBA
- Jointed track and switches + 5 dBA
- Elevated trackway + 4 dBA
- Embedded trackway + 3 dBA

The analysis also assumes that the light rail vehicle operators will briefly sound the low warning bell when departing from station platforms, which produces a maximum level of 60 dBA at 50 feet. For those areas where the light rail will be in a shared corridor with freight and Amtrak trains, noise related to light rail warning horns and warning bells for crossing gates is also included in the noise model. Noise impacts were evaluated using measured noise levels from TriMet's newest light rail vehicle types. Reference noise levels for crossing gate bells were also used in the analysis.

The proposed light rail alignment will be in a shared corridor with freight and Amtrak trains beginning at SE 7th Avenue and SE Sherman Street and ending at SE 17th Avenue and SE Pershing Street. It will also be in a shared freight and Amtrak train corridor beginning near SE McLoughlin Boulevard at SE Reedway Street and ending at SE McLoughlin Boulevard near SE Bluebird Street in Milwaukie. The project assumes a successful application for a quiet zone exemption or a light rail horn waiver. Under the quiet zone exemption, neither the light rail nor Amtrak or freight trains would be required to sound the vehicle-mounted horns unless there was an obstruction on the tracks or in case of emergency.

During preliminary engineering, the project held “pre-diagnostic” review of the intersections with staff from the Federal Railroad Administration (FRA), Union Pacific Railroad (UPRR), Portland and Western Railroad, ODOT Rail, City of Portland, and City of Milwaukie to discuss and refine designs of the shared crossings and to incorporate the appropriate supplemental safety measures in order to qualify for quiet zone consideration. These supplemental safety measures have been compared to FRA’s on-line quiet zone calculator (http://safetydata.fra.dot.gov/quiet/), and these improvements appear to conform to the standards. The Cities of Portland and Milwaukie are supportive of these supplemental safety measures, and they are the jurisdictions that would apply for the quiet zone exemption.

The establishment of a quiet zone often requires that supplemental safety measures (SSMs) be used in place of the locomotive horn to provide an equivalent level of safety at at-grade crossings. By adopting an approved SSM at each public grade crossing, a quiet zone of at least a half-mile long can be established. These measures are in addition to the standard safety devices required at most public grade crossings (e.g., stop signs and flashing lights with gates that do not completely block travel over the tracks). The project is proposing to use a four-quadrant gate system. This measure involves the installation of at least one gate for each direction of traffic to fully block vehicles from entering the crossing. The other option being considered is gates with medians or channelization devices. This measure keeps traffic in the proper travel lanes as it approaches the crossing. This denies the driver the option of circumventing the gates by traveling in the opposing lane.

Other options, such as increased monitoring by law enforcement for grade crossing violations or instituting public education and awareness programs that emphasize the risks associated with grade crossings, were not considered sufficient given the high volume of rail traffic on the UPRR mainline at the SE 8th, SE 9th, SE 11th, and SE 12th avenues at-grade crossings.

Locomotive horns are extremely loud, producing up to 105 dBA at 50 feet, and the existing horn noise is one of the major noise sources in the vicinity of SE 8th through SE 11th and SE 12th avenues. Freight train crossings are currently less frequent along the Tillamook Branch line compared to the UPRR mainline, but they are still a noise source. Since sound barriers are not feasible at at-grade crossings, the establishment of quiet zones was the best overall option for the Portland-Milwaukie Light Rail Project. Establishment of the project’s quiet zones will not be completed prior to completion of the environmental review process. However, this document provides a discussion of the main considerations in adopting the quiet zone, including engineering feasibility, receptiveness of the local public authority, consultation with the railroad, and preliminary cost estimates, and it summarizes the planning and interagency coordination that has occurred to date. Finally, it describes the four-quadrant gate systems proposed and the project’s commitments for supporting the process to obtain the quiet zone exemption, including commitments for all associated equipment required for the exemption.

Light rail vibration impacts were determined using the equations provided by the FTA and measured vibration levels from TriMet’s light rail vehicles. The measured levels were adjusted for ground type using data from propagation tests performed along the project corridor, and a 5 VdB safety factor was included in the vibration projections to ensure that all possible vibration impacts are identified. The corrected vibration levels were compared to the appropriate vibration criteria, and vibration impacts were identified.

3.10.3.6 Traffic Noise Analysis Methods

There are several areas where roadway modifications are necessary to accommodate light rail, including two locations that meet the FHWA criteria for a Type 1 study. The first is a roadway realignment along SW Lincoln Street, between SW 4th Avenue and SW 1st Avenue, where the addition of the light rail and station to the center of the roadway requires the widening of the roadway. The second area is from SE Powell Boulevard to SE McLoughlin Boulevard and includes the reconstruction of the overpass over SE Powell Boulevard, the removal of buildings that currently shield residences along SE 17th Avenue, and the widening of SE 17th Avenue to allow for the light rail to be placed in the center of the roadway.

In addition to these two locations where roadway realignment and displacements could result in traffic noise impacts, other locations where existing shielding will be removed to accommodate the light rail were also considered for potential traffic noise impacts. This occurs along SE McLoughlin Boulevard between the Lake Road Station and the Park Avenue Station under the LPA to Park Avenue. After a review of the area, the structures to be removed, and the topography between the remaining structures and SE McLoughlin Boulevard, no additional traffic noise impacts were identified.

Other roadway modifications that did not require a traffic noise analysis include improvements to SE Division Street and in the vicinity of the proposed Park Avenue Park-and-Ride. New medians proposed near gated crossings and an updated at-grade crossing near SE Division Place and SE 9th Avenue are all planned as part of the project to increase safety along the corridor. There will also be some intersection improvements at the Tacoma Park-and-Ride and along SE Oatfield Road. However, none of these improvements meet the requirement for an FHWA traffic noise study, because they do not add capacity or significantly change the vertical or horizontal alignment of any roadways.

Traffic noise levels for the realigned roadways were calculated using the FHWA Traffic Noise Model (TNM version 2.5 - USDOT 2004), developed for FHWA. Inputs to the model included existing and proposed roadway alignments, traffic volume and speed information from roadway traffic counts, and data generated by Metro and DKS Associates (see Chapter 4 of the *Transportation Results Report,* Metro 2010). Noise emission levels used in the model were nationwide averages for automobiles, medium trucks, and heavy trucks provided by the FHWA and built into the FHWA Traffic Noise Model.

3.10.3.7 Fixed Noise Sources and Ancillary Facilities

As required by the FTA, fixed sources, such as park-and-rides, maintenance bases, power substations, and other fixed ancillary and support facilities must meet any local noise ordinances or regulations. For these sites, actual measured noise levels, noise levels from similar projects, and standard acoustical formulas and calculations are used to predict future operational noise levels. The predicted levels are then compared to the applicable regulations. Where noise levels are predicted to meet or exceed the FTA criteria, noise impacts are identified and mitigation measures will be investigated. Mitigation that is deemed feasible and reasonable can be recommended for inclusion with the project.

3.10.4 Affected Environment

The project corridor was examined to identify noise-sensitive and vibration-sensitive locations and to select locations for supplemental noise monitoring. Noise and vibration measurement locations used in the analysis are shown in Figure 3.10-4.

Land use along the Portland-Milwaukie Light Rail Project Corridor includes single-family and multifamily residential, office and commercial, industrial, institutional, educational, and recreational. Residential land use on the west side of the Willamette River includes the Village at Lovejoy Fountain and the American Plaza Towers Condominiums, both on SW Lincoln Street, and the RiverPlace Square Apartments and Marriott Residence Inn, both in the RiverPlace community. Other noise- and vibration-sensitive uses include the Mission Control production studio on SW 1st Avenue and the International School on SW Sherman Street. There are also commercial, industrial, and undeveloped land uses near the proposed Willamette River crossing.

Sensitive land uses on the east side of the Willamette River include OMSI, the Portland Opera Offices, and the Willamette River Greenway. Land use along the shared corridor between SE 7th Avenue and SE 12th Avenue is predominantly commercial and industrial; however, there are residential land uses on SE Caruthers Street, SE 9th Avenue, and along SE 12th Avenue. There is also a church located near the at-grade crossing on SE 12th Avenue north of SE Clinton Street.

South of SE Powell Boulevard, land use directly adjacent to the alignment is primarily commercial and industrial, and includes Portland General Electric and TriMet’s bus maintenance facility. There are also two residences on SE 17th Avenue. Land use along SE 16th Avenue, directly west of the project corridor, is virtually all residential between SE Powell Boulevard and SE Holgate Boulevard. Project corridor land use south of SE Holgate Boulevard is primarily commercial and industrial to SE McLoughlin Boulevard. There are four residences along SE 16th Avenue, just north of SE McLoughlin Boulevard.

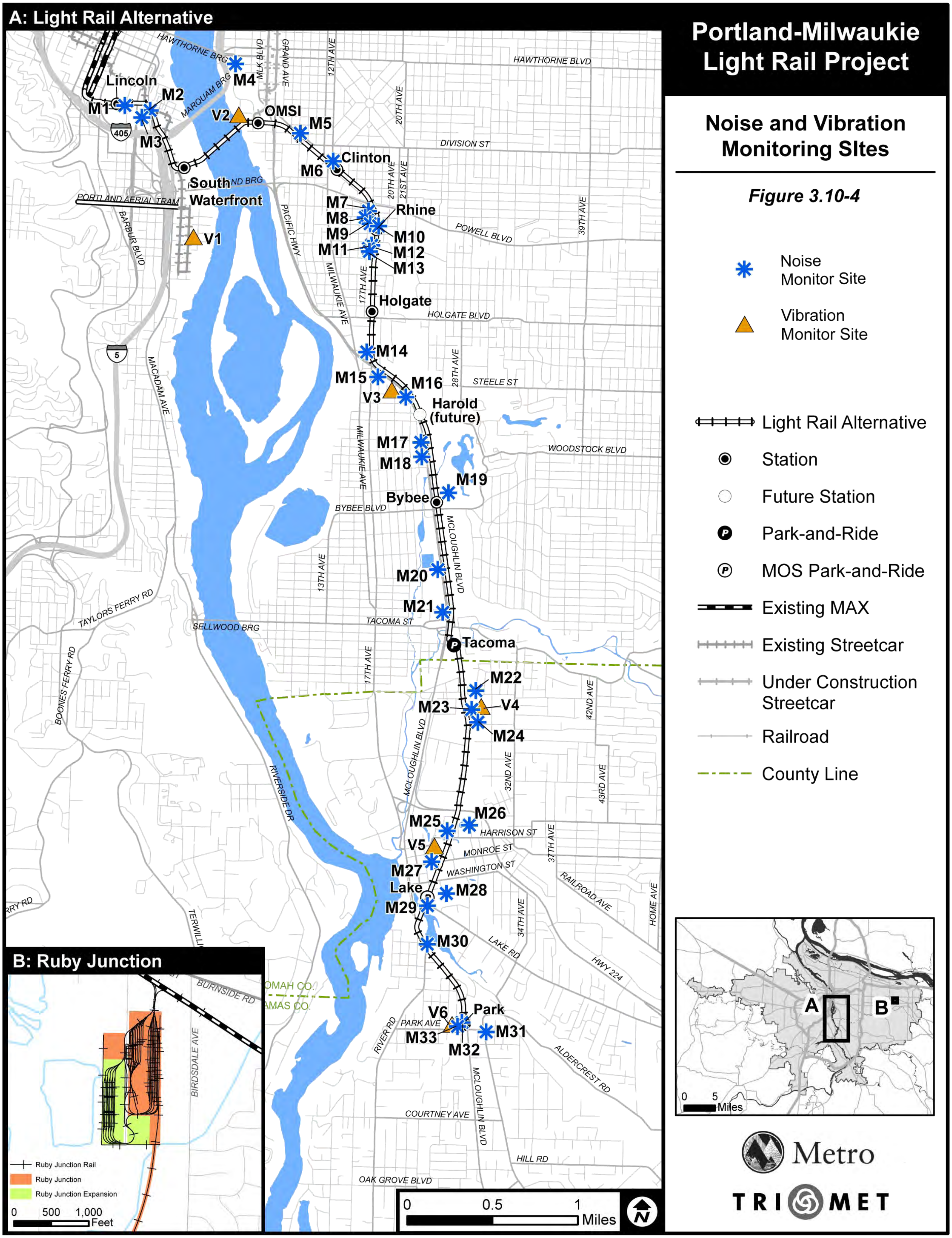
Land use along SE McLoughlin Boulevard includes commercial and industrial uses, a golf course and the UPRR train tracks to the east, and residences on the west side of SE McLoughlin Boulevard. Westmoreland Park is located on the west side of SE McLoughlin Boulevard, south of SE Bybee Boulevard.

South of SE Tacoma Street, east of the alignment is the Ardenwald residential community, and to the west, the land use is mainly commercial and light industrial. South of Highway 224, land uses include single-family and multifamily residential, the Portland Waldorf School, St. John the Baptist Catholic School, Milwaukie High School, the Ledding Library, Dogwood Park, the

Portland-Milwaukie Light Rail Project

Noise and Vibration Monitoring SItes

Figure 3.10-4



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planned Robert Kronberg Park, and commercial and retail space. The land uses south of downtown Milwaukie include the primarily single-family residential area to the west of the alignment, and multifamily residential area on the east side of SE McLoughlin Boulevard. There are also some other commercial uses including retail shops; however, none are considered noise or vibration sensitive under the FTA criteria.

South of downtown Milwaukie there are two large multifamily apartment complexes on the east side of SE McLoughlin Boulevard, and one smaller multifamily apartment on the west side of SE McLoughlin Boulevard. South of SE Bluebird Street to the proposed Park Avenue Park-and-Ride, land use is virtually all single-family residential. There are also three commercial structures near SE Bluebird Street and south of SE Park Avenue. Land use along SE McLoughlin Boulevard is primarily commercial.

Land use near the Ruby Junction Facility includes residential, commercial, and light industrial. Ruby Junction may be expanded in several phases to accommodate the future system needs with the Portland-Milwaukie Light Rail Project and the Columbia River Crossing Project. In the full expansion plan, 14 properties adjacent to the current facility would be displaced, while in an initial first phase, 9 would be displaced. The site was investigated for noise-sensitive land uses, and the only remaining noise-sensitive property under the Phase 1 acquisitions is a single-family residence to the south of the facility, partially shielded from the maintenance facility by an existing commercial use. There are three other properties, also south of the facility, that are used for light to medium commercial and industrial activities. The only other use near the base is a quarry, and no other noise-sensitive uses were identified.

3.10.4.1 Ambient Noise Environment

Measured noise levels were taken from on-site monitoring between October 24 and October 30, 2007, and November 18 and December 12, 2009, along with measured noise levels from the *South Corridor Noise and Vibration Results Report* (Metro 2002). Some noise monitoring data presented in previous South Corridor studies have been removed from the analysis because they were no longer needed based on the selected Locally Preferred Alternative (LPA). Additional noise monitoring was performed at several locations along SE 16th Avenue and SE 17th Avenue and near the SE Park Avenue terminus due to proposed roadway improvements and potential displacements. Finally, some measurements were updated to reflect current conditions along the corridor.

Existing noise levels along the project corridor range from 52 dBA L_{eq} to 76 dBA L_{eq}. Major existing noise sources include Amtrak trains, freight trains, the Brooklyn Yard freight rail operations, major arterial roadways, and TriMet’s bus maintenance facility. A summary of the measured data is given in Table 3.10-3, with the locations shown in Figure 3.10-4.

Some of the highest noise levels in the corridor are currently from freight train warning horns, which begin well before the trains enter all at-grade crossings, and continue through the crossings. A maximum noise level of 105 dBA at 50 feet is typical for freight train horns.

Table 3.10-3
Existing Conditions Noise Levels*

M#[1]	Location[2]	L_{eq}[3]	L_{dn}[4]
M1	2211 SW 1st Ave. (American Plaza Towers)	66	64
M2	SW Grant St. near SW River Pkwy.	69	69
M3	25 SW Sherman Street (International School Main Campus)	71	71
M4	SE Clay St. at SE Water Ave.	69	69
M5	SE Caruthers St. at SE 8th Ave.	70	71
M6	SE Clinton St. at SE 12th Ave.	68	72
M7	3301 SE 16th Ave.	64	62
M8	3355 SE 16th Ave.	60	58
M9	3384 SE 16th Ave.	62	60
M10	1704 SE Haig St.	71	69
M11	3626 SE 16th Ave.	56	57
M12	1635 SE Rhone St.	65	64
M13	3704 SE 16th Ave.	59	59
M14	4806 SE 16th Ave.	60	61
M15	5147 SE 18th Ave.	67	69
M16	5411 SE McLoughlin Blvd.	76	74
M17	5912 SE 23rd Ave.	68	69
M18	6106 SE 23rd Ave.	69	70
M19	Eastmoreland Golf Course	62	63
M20	Westmoreland Park	68	70
M21	2516 SE Nehalem St.	64	66
M22	8825 SE 28th Ave.	60	62
M23	2700 SE Boyd St.	66	74
M24	SE Malcolm St. (90 feet east of center of near tracks)	60	68
M25	10506 SE 24th Ave.	52	54
M26	10500 SE 26th Ave.	58	60
M27	2171 SE Monroe St.	60	62
M28	Milwaukie High School	58	60
M29	2046 SE Lake Rd.	58	60
M30	SE McLoughlin Blvd. at SE River Rd.	72	72
M31	12810 SE Oatfield Rd.	72	70
M32	SE McLoughlin Blvd. at SE Park Ave.	67	66
M33	SE 27th Ave. at SE Park Ave.	61	60

* Noise data from on-site monitoring between October 24 and October 30, 2007, and November 18 and December 12, 2009, and updated data from the *South Corridor Noise and Vibration Results Report* (Metro 2002).

[1] Monitoring locations shown in Figure 3.10-4.

[2] Address nearest monitoring site.

[3] Peak hour daytime L_{eq} in dBA.

[4] 24-hour L_{dn} noise level in dBA.

Using reference noise levels for light rail operations based on TriMet's light rail vehicles, a single train is 75 dBA L_{max} at 50 feet when traveling at 40 miles per hour (mph). Reference noise measurements were also taken for buses during normal operation. Reference bus pass-by measurements included acceleration from a stop, climbing up a hill, and traveling at-grade. The measured bus noise levels are used to predict bus-related noise levels along the shared corridor. Maximum noise levels ranged from 81 to 82 dBA L_{max} at 50 feet for at-grade operation, to 82 to 85 dBA L_{max} for a bus traveling uphill.

The analysis of potential noise impacts near the Ruby Junction Facility reflects the standards of the City of Gresham noise ordinance. Land use near the facility is mostly commercial and industrial, with several single-family residences along NW Eleven Mile Road. Typical daytime noise levels in these types of mixed use areas range from 60 to 85 dBA depending on the activity, although the City of Gresham's ordinance is focused on noise sources that exceed a standard threshold, regardless of ambient noise. Nighttime noise levels can vary greatly depending on the level of commercial and industrial activities that continue to operate at night. Because the Ruby Junction Facility has nighttime operations, and there also appear to be some shipping and receiving facilities in the vicinity, current noise levels could vary by as much as 50 to 60 dBA L_{max} for a low, to the upper level of 80 to 85 dBA L_{max} during heavy truck pass-bys.

3.10.4.2 Ambient Vibration Environment

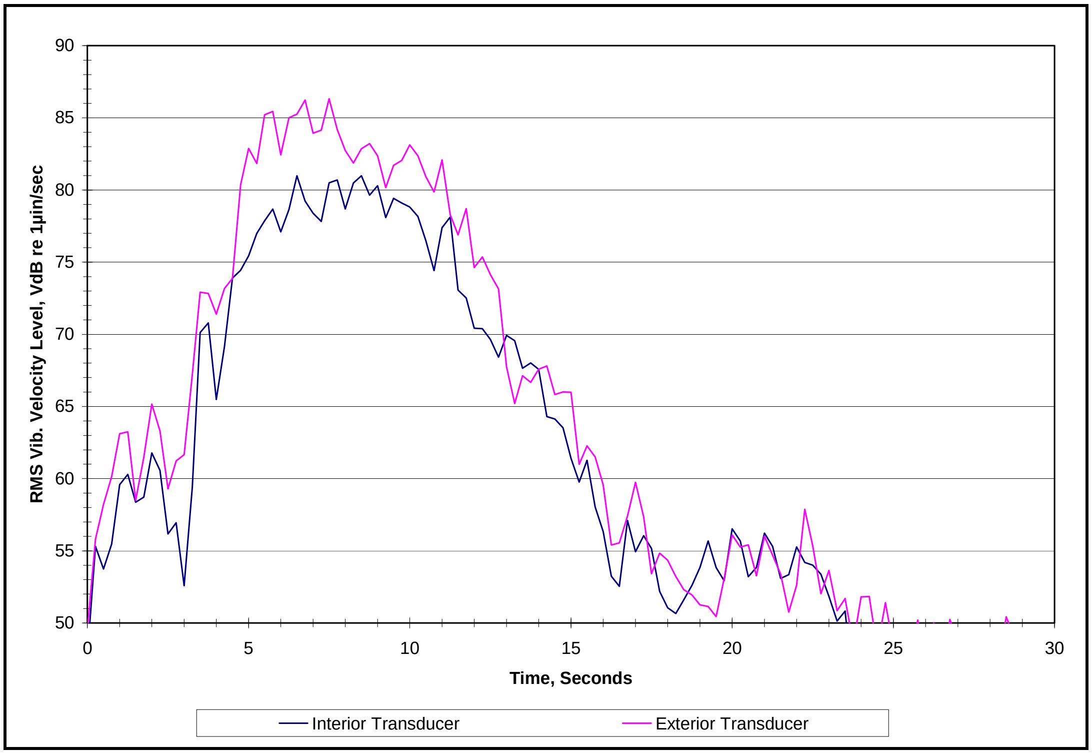
Vibration propagation measurements were performed at six locations along the project corridor. Current vibration levels in the project corridor range from 30 to 55 VdB, excluding Amtrak and freight trains, where levels frequently exceed 80 VdB at locations near the tracks. The vibration test and measurement locations, V1 through V6, are shown in Figure 3.10-4. Vibration propagation information from the initial *South/North Corridor Project Draft Environmental Impact Statement* (Metro 1998) was used for the analysis for sites in the Portland business district, for the Portland Opera Offices, and along the alignment to the Tacoma Park-and-Ride.

A separate analysis of noise and vibration was performed for the Digital One/Mission Control building at 2112 SW 1st Avenue. Details on this analysis can be found in the Assessment of the Impact of TriMet Light Rail Sound and Vibration on the Digital One/Mission Control Facility, Daly, Standlee & Associates, Inc., December 2009 (DSA 2009). A summary of the results of this analysis are included in this document.

Supplemental vibration propagation measurements were performed near the Portland Waldorf School and at the proposed Park Avenue Station location. The additional measurements were taken to verify the efficient vibration propagation levels presented in the DEIS (Metro 1998). These more recent propagation measurements were used for the Ardenwald neighborhood, downtown Milwaukie, and residential areas along the Trolley Trail to the Park Avenue Park-and-Ride.

To better quantify vibration transmission at the Portland Waldorf School, a freight train pass-by vibration measurement was performed at the building nearest the tracks. The purpose of the pass-by measurement was to obtain the building's coupling loss. The coupling loss is the reduction of vibration that occurs due to a building's foundation. Figure 3.10-5 is a plot of the interior and exterior vibration levels measured at the Portland Waldorf School building nearest the tracks. Peak VdBs measured outside of the Portland Waldorf School during a typical freight train pass-by were 85 to 86 VdB. At the same time, peak levels measured inside the school ranged from 80 to 81 VdB, indicating a coupling loss of approximately 5 VdB.

Figure 3.10-5
Freight Train Pass-By Test at the Portland Waldorf School



Further details on the measured vibration propagation characteristics, along with graphs of the frequency content, are provided in the *Portland-Milwaukie Light Rail Project Noise and Vibration Results Report* (Metro 2010).

3.10.5 Environmental Consequences

Project noise impacts are presented in two separate categories: fixed guideway and traffic. Fixed guideway impacts include all light rail operations as well as bus and streetcar operations in the shared transitway between SW 1st Avenue and SE 7th Avenue at SE Division Street. The project applied the operating plan for the year 2030 for the LPA to Park Avenue, including its assumptions about train frequencies. Trains may run less frequently for initial year operations, or for the MOS to Lake Road or for the LPA Phasing Option, and resulting noise levels then could be lower than projected. The fixed guideway noise analysis, where the roadway crossings are shared with freight, also includes crossing gate warning bell noise, because these bells would be required for safety and would sound every time the light rail passes through a gated crossing. Crossing gate bells were modeled using the FRA-recommended maximum sound level of 85 dBA at 10 feet. This includes the gated crossings at SE 8th, SE 11th, and SE 12th avenues in Southeast Portland and at SE Mailwell Drive, just north of Milwaukie, and the four gated crossings in downtown Milwaukie including SE Harrison, SE Monroe, SE Washington, and SE 21st/SE Adams streets. For the pedestrian warning bells located near SE Sherman Street at SE Water Avenue and on SE 17th Avenue near SE Pershing Street, a level of 75 dBA L_{max} at 10 feet was assumed.

Traffic noise analysis using FHWA criteria was performed for the realignments of SW Lincoln Street and SE 17th Avenue, and addresses noise levels generated by all forms of traffic using these modified city streets.

TriMet and Metro have been working with the cities of Portland and Milwaukie, ODOT Rail, the FRA, and the UPRR, the Portland and Western Railroad, and others to design roadway crossings that are shared by light rail and freight tracks. These intersections have been designed to lower risks for the public and to allow for the successful quiet zone application. The cities will be responsible for applying for the quiet zones in coordination with the project during final design, but TriMet and its consultants will perform all necessary analyses and document preparation to support the quiet-zone applications, and the project will cover all costs associated with establishing the quiet zones. The project has used the FRA's on-line quiet zone calculator and, based on this preliminary review, the project partners believe that these quiet zone applications for shared roadway crossings in southeast Portland and Milwaukie will be successful. Additional information is provided in Section 3.10.3.5, Light Rail Noise and Vibration Analysis Methods.

Under the quiet zone scenario, the only other additional noise source besides the trains (light rail, Amtrak, and freight trains) related to at-grade shared crossings would be the crossing gate bells sounding as the gates are lowered and again when they are raised. Neither the light rail nor freight or Amtrak trains would be required to sound the vehicle-mounted horns unless there were an obstruction on the tracks or in case of emergency.

The vibration analysis was performed mainly for light rail vehicles and the streetcar in the shared transitway. Vibration from buses is not predicted to cause impacts. The results are presented in the following sections.

3.10.5.1 Light Rail and Shared Transitway Noise Analysis

Buses and light rail would operate on the shared transitway between SE 7th Avenue/SE Division Place and SW 1st Avenue/SW Lincoln Street. Streetcars would eventually operate across the Willamette River bridge between SW Moody Avenue and SE Water Avenue. No light rail noise impacts are predicted near the beginning of the corridor at the Unitus Credit Union Building, the Village at Lovejoy Fountain Apartments or the American Plaza Towers. The light rail is in the center of the roadway, moving at a slow speed due to curves and the station, and therefore light rail noise levels are within the FTA criteria at both residential locations.

The results of sound predictions for the Digital One/Mission Control building suggest transit noise impacts will be minimal at the Mission Control studios (DSA 2009). Currently, traffic noise from vehicles along SW Naito Parkway is audible in several of the video rooms located in the northeast corner of the building. Airborne sound associated with light rail and bus pass-by events is also predicted to be audible in the rooms located along the north side of the building. According to the DSA analysis, the highest potential for impacts at the Mission Control facility will be in the rooms that are used to show clients a finished work product. A moderate noise impact was identified along the northern side of the building under FTA criteria, with exterior levels that exceed the criteria by 1 dBA L_{eq}.

The RiverPlace Square Apartments are located within 100 feet of the elevated shared transitway corridor alignment. The combined noise from light rail, buses, and streetcar on the structure are predicted to remain below the impact criteria, with future project-related noise levels of 59 to 61 dBA L_{dn}. The low noise levels are due to the slow speeds in this area, along with a high existing L_{dn}. This analysis also assumes that if any light rail wheel squeal were present on the 300-foot-radius curve, trackside lubricators would be installed. Noise levels at the International School are also predicted to be below the FTA impact criteria, with peak hour levels of 58 to 59 dBA L_{eq}.

Noise levels at the exterior of the Portland Opera Offices are predicted to be below the FTA criteria for a Category 3 land use by 1 to 3 dBA. The main project-related noise source at this location is related to the operation of buses in the shared transitway, which was not included in the previous analysis. The Portland Opera building is considered a Category 3 structure because it is sometimes used for practice. The Portland Opera Offices have an existing noise level of 69 dBA L_{eq}. Based on the existing noise levels, the FTA impact criterion is 69 dBA L_{eq} for a moderate impact. Project-related peak hour L_{eq} at the Portland Opera Offices are predicted at 66 to 68 dBA, which is below the moderate impact FTA criterion. An inspection of the building will be performed to ensure compliance with the FTA criteria.

There are several single-family homes along the corridor between SE McLoughlin Boulevard and SE Powell Boulevard. Light rail noise levels, including warning bells at gated crossings where appropriate, were evaluated at 13 residences along this segment of the corridor, and future project-related levels are predicted to range from 57 to 64 dBA L_{dn}. This area has a high existing L_{dn} due to traffic and existing freight train operations, and therefore no project noise impacts were predicted in this segment.

South of SE Powell Boulevard, where the alignment transitions to the center of SE 17th Avenue, there are no light rail noise impacts predicted. Homes that have some shielding removed, near SE 16th Avenue, have light rail noise levels of 55 to 59 dBA L_{dn}, with the higher level due in part to the crossing gate bells near SE Pershing Street. Most other homes along SE 16th Avenue, between SE Pershing and SE Lafayette streets, have some shielding from existing structures and project noise levels of 52 to 55 dBA L_{dn}. There are two single-family residences on SE 17th Avenue at SE Rhone Street, where light rail noise levels are predicted at 59 dBA L_{dn}; however, the FTA impact criterion is 61 dBA for a moderate impact, and therefore no light rail impact was identified. The remaining homes in this segment are sufficiently set back from the alignment as not to exceed the FTA criteria.

No noise impacts are predicted for the alignment along the east side of SE McLoughlin Boulevard to the Tacoma Park-and-Ride. Existing noise from vehicle traffic on SE McLoughlin Boulevard and freight and Amtrak trains will continue to be the dominant noise source in this segment of the corridor.

South of the Tacoma Station, along the Ardenwald neighborhood, future light rail noise levels are predicted to range from 55 to 61 dBA L_{dn}. At the north end of the neighborhood, near SE Van Waters Street, the homes are 300 to 350 feet from the alignment, and light rail noise levels are predicted at 55 to 58 dBA L_{dn}, with a criterion of 59 to 65 dBA for a moderate impact. Approximately 20 single-family residences, located along the UPRR alignment between SE Roswell Street and SE Olsen Street, are predicted to have light rail noise levels ranging from 59 to 61 dBA L_{dn}. The criterion for a moderate impact along this area is 66 dBA L_{dn} because residences in this area are predicted to have existing L_{dn} noise levels of at least 68 dBA (see M23 and M24). No noise impacts were identified in this area because of a higher existing L_{dn} between

SE Roswell Street and SE Olsen Street. Homes located near the crossing bells on SE Mailwell Drive are predicted to have combined noise levels of 59 dBA L_{dn}. The predicted light rail noise levels are below the FTA criteria throughout this area, and no noise impacts are predicted. Additional noise analysis will be performed to assess any reflected noise off of retaining walls or safety walls that are required along the corridor during final design.

South of Highway 224, noise impacts were identified at four single-family residences. Two of the four impacts meet the 64 dBA L_{dn} severe impact criteria due to the warning bells at the SE Harrison Street crossing. The other two impacts are predicted at 63 dBA L_{dn}, which is 4 dBA over the moderate impact criterion of 59 dBA L_{dn}. The primary reason for all four noise impacts is noise from the warning bells; however, the noise level from light rail vehicles also meets the moderate impact criteria at two of the four single-family residences.

The Portland Waldorf School, like all schools, libraries, colleges, and universities, is considered a school under FTA criteria. Light rail and warning gate noise levels at the Portland Waldorf School are predicted at 56 to 58 dBA L_{eq} during peak operational hours. This is below the FTA criterion of 64 dBA for a Category 3 institutional land use. This analysis includes noise related to the warning bells at the SE Harrison Street and SE Monroe Street gated crossings. The train speed used in the analysis of 35 mph is taken from the most current project demand forecast for project operations.

Moderate noise impacts are predicted at two different Category 2 residential buildings at the Spring Creek Apartments, located south of SE Harrison Street and east of the alignment. There are six impacts predicted for units in the building closest to the at-grade crossing as a result of the combined noise from the light rail vehicle and warning bells at the gates. An additional six moderate impacts were identified at the units located nearest the proposed alignment because of their proximity to the tracks.

One severe and two moderate noise impacts are predicted at the single-family residences located near the at-grade crossing on SE Monroe Street. The severe impact is primarily due to crossing gate bells at the at-grade crossing. A moderate noise impact is also predicted at the single-family residence on SE Lake Road near the elevated structure. The impact here is primarily a result of the light rail on the elevated structure, with some contribution from the warning bells near SE Adams Street. The light rail noise contribution at this location is 59 dBA L_{dn}, which equals the criterion of 60 dBA, and the noise from the crossing gates, approximately 350 feet away, produces an L_{dn} of 51 dBA, which is just enough to increase the total noise to 60 dBA L_{dn}.

Due to topographical conditions, a retaining wall is required along portions of the east side of the alignment between Highway 224 and SE Monroe Street. In addition, a safety wall is required between the existing freight train tracks and the light rail tracks along this entire area. A detailed review of the proposed wall locations and configuration was performed using preliminary engineering information. The light rail alignment is between the retaining wall and the safety wall and therefore no increase in light rail noise is predicted. There were also concerns about the wall's effect on noise from freight and Amtrak trains; however, the safety wall is between the mainline and the sensitive receivers. This wall, while not predicted to result in any appreciable noise reduction from locomotives or rail horn noise, could provide some reduction in noise from rail cars, because the majority of noise from the cars is from the wheel/rail interface. Therefore, no increase is predicted from any potential reflections off either of the walls. Significant noise impacts are not anticipated, but if they are found to occur they will be mitigated under the methods noted here.

South of the Lake Road Station, along the Trolley Trail, there are 11 moderate noise impacts predicted. The impacts at most residences are due to the proximity of the homes to the tracks and faster light rail speed, and for six of the homes, the proximity to the crossover near the station is also a contributor to the overall project noise levels. Peak hour light rail noise levels along the Trolley Trail are predicted to range from 66 dBA L_{eq} at the northern end, where the alignment is elevated, to a low of 60 dBA L_{eq} at the southern end of the ballast and tie section approaching the Park Avenue Station. Existing peak hour noise levels along the Trolley Trail, due to the high volume of traffic on SE McLoughlin Boulevard, are predicted at 68 dBA L_{eq}. Under FTA criteria, a Category 3 impact occurs if project noise levels meet or exceed 68 dBA L_{eq}, and since the light rail project noise levels will be below these levels, no noise impact was identified along the trail. Figure 3.10-6 contains the approximate location of the noise impacts. Table 3.10-4 provides a summary of the transit noise impacts. This does not include Ruby Junction, which is assessed as a fixed facility using the City of Gresham noise ordinance, consistent with FTA guidance.

3.10.5.2 Traffic Noise Impacts

A traffic noise analysis was required for SW Lincoln Street, between SW 4th Avenue and SW 1st Avenue, where the addition of the light rail and station to the center of the roadway requires the widening of the roadway. The realignment of SE Powell Boulevard and SE 17th Avenue to accommodate the light rail down the center of the roadway also required a traffic noise analysis. The traffic study along SE Powell Boulevard and SE 17th Avenue also includes the removal of buildings shielding residences near SE 16th Avenue and SE Powell Boulevard and again between SE Rhone Street and SE Holgate Boulevard. (Existing cinder block walls along the TriMet parking areas are expected to remain or would be replaced with similar barriers, and therefore are included in the traffic noise model.) Complete details on the traffic noise modeling for SE 17th Avenue can be found in the *Portland-Milwaukie Light Rail Project Noise and Vibration Results Report* (Metro 2010).

Table 3.10-5 provides a summary of traffic noise levels along SW Lincoln Street and the SE Powell Boulevard and SE 17th Avenue areas. The table includes noise levels for the current conditions and future conditions with the project using year 2030 traffic data.

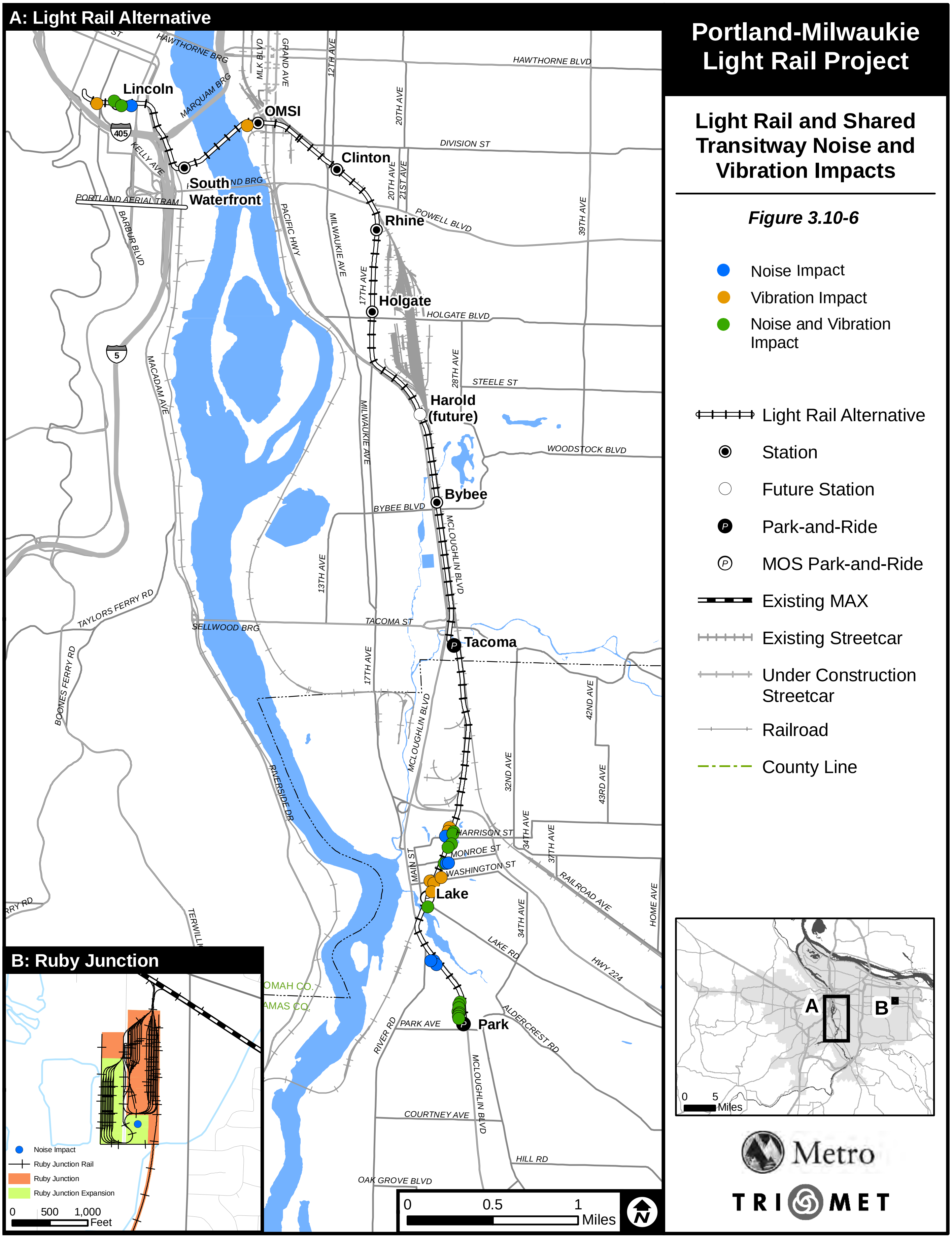


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Table 3.10-4
Light Rail and Fixed Guideway Noise Impacts without Mitigation Measures

Rec.#[1]	Area Description[2]	Land Use Type[3]	Noise Level	Project Noise Contributions				Total Project Noise[5]	Criteria[6]		Impacts[7]	
			Existing[4]	Light Rail	Bus	Street-car	Bells		Moderate	Severe	Moderate	Severe
Downtown Portland												
S1	Unitus Credit Union/PSU Classrooms	3	66	62	--	--	--	62	67	72	--	--
R1 R1a	Village at Lovejoy Fountain Apartments (MFR)	2	66	55	--	--	--	55	62	67	--	--
R2 R2a	American Plaza Towers (MFR)	2	66	55	--	--	--	55	62	67	--	--
D1	Digital One/Mission Control	1	66	52	63	48	--	63*	62	67	1	--
R3	RiverPlace Square Apartments (MFR-bldg. nearest to tracks)	2	66	52	60	50	--	61	62	67	--	--
R4	RiverPlace Square Apartments (MFR-north bldg.)	2	66	50	58	48	--	59	62	67	--	--
R5	RiverPlace Square Apartments (MFR-east bldg.)	2	66	50	58	48	--	59	62	67	--	--
S2	International School (play area)	3	66	49	58	45	--	59	67	72	--	--
S3	International School (main bldg.)	3	70	49	58	45	--	58	70	74	--	--
East Bank Waterfront to SE Powell Boulevard Underpass												
O1	Portland Opera (northeast)	3	69	54	65	50	56	66	69	74	--	--
O2	Portland Opera (southwest)	3	69	61	66	57	56	68	69	74		--
R10	SE Caruthers St. at SE 8th Ave. (SFR)	2	71	59	--	--	63	64	66	70	--	--
R11	SE Division at SE 9th Ave. (SFR)	2	68	57	--	--	54	59	63	68	--	--
R12	SE 12th Ave. at SE Clinton St. (SFR)	2	68	53	--	--	54	57	63	68	--	--
S4	SE 12th Ave. at SE Clinton St. (church)	3	68	53	--	--	54	57	68	73	--	--
R13	SE 16th Ave. at SE Woodward St. (SFR)	2	68	57	--	--	--	57	63	68	--	--
SE Powell Boulevard Underpass to Tacoma Station												
R14	SE Pershing St. at SE 16th Ave.	2	67	59	--	--	56	59	63	67	--	--

Table 3.10-4
Light Rail and Fixed Guideway Noise Impacts without Mitigation Measures

Rec.#[1]	Area Description[2]	Land Use Type[3]	Noise Level	Project Noise Contributions				Total Project Noise[5]	Criteria[6]		Impacts[7]	
			Existing[4]	Light Rail	Bus	Street-car	Bells		Moderate	Severe	Moderate	Severe
	(SFR)											
R15	SE Rhone St. and SE 17th Ave. (SFR)	2	64	59	--	--	--	59	61	65	--	--
R16	SE Rhone St. to SE Bush St. (SFR)	2	59	55	--	--	--	55	58	63	--	--
R17	SE Bush St. to SE Center St. (SFR)	2	59	55	--	--	--	55	58	63	--	--
R18	SE Bush St. to SE Center St. (SFR)	2	59	54	--	--	--	54	58	63	--	--
R19	SE Center St. to SE Boise St. (SFR)	2	59	55	--	--	--	55	58	63	--	--
R20	SE Boise St. to SE Mall St. (SFR)	2	62	55	--	--	--	55	59	64	--	--
R21	SE Mall St. to SE Holgate Blvd. (SFR)	2	62	52	--	--	--	52	59	64	--	--
R22	SE Schiller St. and SE 17th Ave. (SFR)	2	61	55	--	--	--	55	59	64	--	--
R23	SE Schiller St. and SE 17th Ave. (SFR)	2	66	55	--	--	--	55	62	67	--	--
R24	SE McLoughlin Blvd. at SE Ellis St. and SE Reedway St. (SFR)	2	68	58	--	--	--	58	63	68	--	--
Tacoma Station to Highway 224												
R25	N of SE Roswell St. (SFR uphill)	2	62	55	--	--	--	55	59	64	--	--
R26	N of SE Roswell St. near UPPR (SFR)	2	70	58	--	--	--	58	65	69	--	--
R27	SE Roswell St. - SE Boyd St. (SFR)	2	74	61	--	--	--	61	66	72	--	--
R28	SE Boyd St. - 1/2 block south (SFR)	2	74	59	--	--	--	59	66	72	--	--
R29	SE Malcolm St. - 1/2 block north and south house (SFR)	2	74	59	--	--	--	59	66	72	--	--

Table 3.10-4
Light Rail and Fixed Guideway Noise Impacts without Mitigation Measures

Rec.#[1]	Area Description[2]	Land Use Type[3]	Noise Level	Project Noise Contributions				Total Project Noise[5]	Criteria[6]		Impacts[7]	
			Existing[4]	Light Rail	Bus	Street-car	Bells		Moderate	Severe	Moderate	Severe
R30	SE Malcolm St. South and SE Olsen St. (SFR)	2	74	58	--	--	54	59	66	72	--	--
Highway 224 to Lake Road Station (MOS to Lake Road)												
R31	Crystal Lake Apartments (MFR)	2	66	55	--	--	--	55	62	67	--	--
R32	North of SE Harrison St. (west – SFR)	2	62	54	--	--	--	54	59	64	--	--
R33	North of SE Harrison St. (west – SFR)	2	62	53	--	--	63	63*	59	64	2	--
R34	North of SE Harrison St. (east – SFR)	2	62	59	--	--	63	64*	59	64	--	2
S6	Portland Waldorf High School Bldg.	3	62	53	--	--	57	58	64	69	--	--
S7	Portland Waldorf Main Bldg.	3	62	52	--	--	54	56	64	69	--	--
R35	Spring Creek Apartments (closest MFR to tracks)	2	62	60	--	--	55	61	59	64	6	--
R36	Spring Creek Apartments (closest MFR to crossing)	2	62	55	--	--	58	60	59	64	6	--
R37	SE Monroe St. (SFR nearest tracks)	2	62	55	--	--	63	64*	59	64	--	1
R37A	SE Monroe St. (SFR 2nd home)	2	62	54	--	--	62	63*	59	64	1	--
R37B	SE Monroe St. (SFR 3rd home)	2	62	54	--	--	61	62*	59	64	1	--
R38	SE Lake Rd. (SFR)	2	62	58	--	--	51	59*	59	64	1	--
Lake Road Station to Park Avenue Station (LPA to Park Ave.)												
R39	SE Bluebird St. (MFR)	2	72	62	--	--	--	62	66	71	--	--
R40	SE River Rd. at SE McLoughlin Blvd. (SFR west)	2	72	65	--	--	--	65	66	71	--	--
R41	SE River Rd. at SE McLoughlin Blvd. (SFR west)	2	72	62	--	--	--	62	66	71	--	--
R42	SE Wren St. (closest SFR)	2	68	64	--	--	--	64*	63	68	1	--
R43	SE Wren St. (other SFR)	2	65	61	--	--	--	61*	61	66	2	--

Table 3.10-4
Light Rail and Fixed Guideway Noise Impacts without Mitigation Measures

Rec.#[1]	Area Description[2]	Land Use Type[3]	Noise Level	Project Noise Contributions				Total Project Noise[5]	Criteria[6]		Impacts[7]	
			Existing[4]	Light Rail	Bus	Street-car	Bells		Moderate	Severe	Moderate	Severe
R44	SE Sparrow St. (nearest MFR east side of SE McLoughlin Blvd.)	2	65	57	--	--	--	57	61	66	--	--
R45	South of SE Sparrow St.	1	65	58	--	--	--	58	61	66	--	--
R46	SE Lark St. at SE 27th Ave. (2 SFR)	2	65	58	--	--	--	58	61	66	--	--
R47	SE 27th Ave.	2	65	62	--	--	--	62*	61	66	1	--
R48	SE 27th Ave.	2	65	61	--	--	--	61*	61	66	1	--
R49	SE 27th Ave. (SFR near switch)	2	65	61	--	--	--	61*	61	66	6	--
R50	SE 27th Ave. (SFR near station)	2	65	54	--	--	--	54	61	66	--	--

See Section 3.10.5.3 for Ruby Junction Facility noise impacts.

[1] Receiver numbers as shown on impact figures.
[2] General description of sensitive receivers: SFR = single-family residence / MFR = multifamily residence / Comm = commercial.
[3] Land use type by FTA criteria (2 = residential).
[4] Existing L_{dn} for Category 2 and L_{eq} for Category 1 or 3 land uses.
[5] Project L_{dn} for Category 2 and L_{eq} for Category 1 or 3 land uses. ***** exceeds criteria.
[6] FTA impact criteria for moderate and severe impacts – compare to Project L_{dn}.
[7] Number of noise impacts.

Along SW Lincoln Street, traffic noise impacts are predicted for 12 units at the Village at Lovejoy Fountain Apartments with balconies facing SW Lincoln Street on floors 2, 3, 4, and 5. Traffic noise impacts are also predicted for the first five floors of the American Plaza Towers at those five units that have balconies facing SW Lincoln Street. The impacts at both buildings are due to a combination of added bus traffic, the proximity of the buses to the buildings, and roadway realignment, and they result in predicted noise measurements that exceed standards by 2 to 3 decibels.

The analysis along SE Powell Boulevard and SE 17th Avenue identified traffic noise impacts at two single-family residences located on SE 17th Avenue, north of SE Rhone Street. Noise levels at these homes currently exceed traffic noise impact criteria, and the project would result in a two-decibel increase. Several other homes that are currently shielded by a building at the intersection of SE 17th Avenue and SE Pershing Street are predicted to have noise levels increase by up to 8 dBA, with future levels of 64 dBA L_{eq}; however, they remain below the NAC of 65 dBA and do not have a 10 decibel increase, so there is no noise impact based on criterion. Other residences along the corridor can expect increases of 0 to 4 dBA. The locations of the two residential noise impacts, along with the modeling locations, are shown in Figure 3.10-7.

Table 3.10-5
Traffic Noise Impacts Before Mitigation

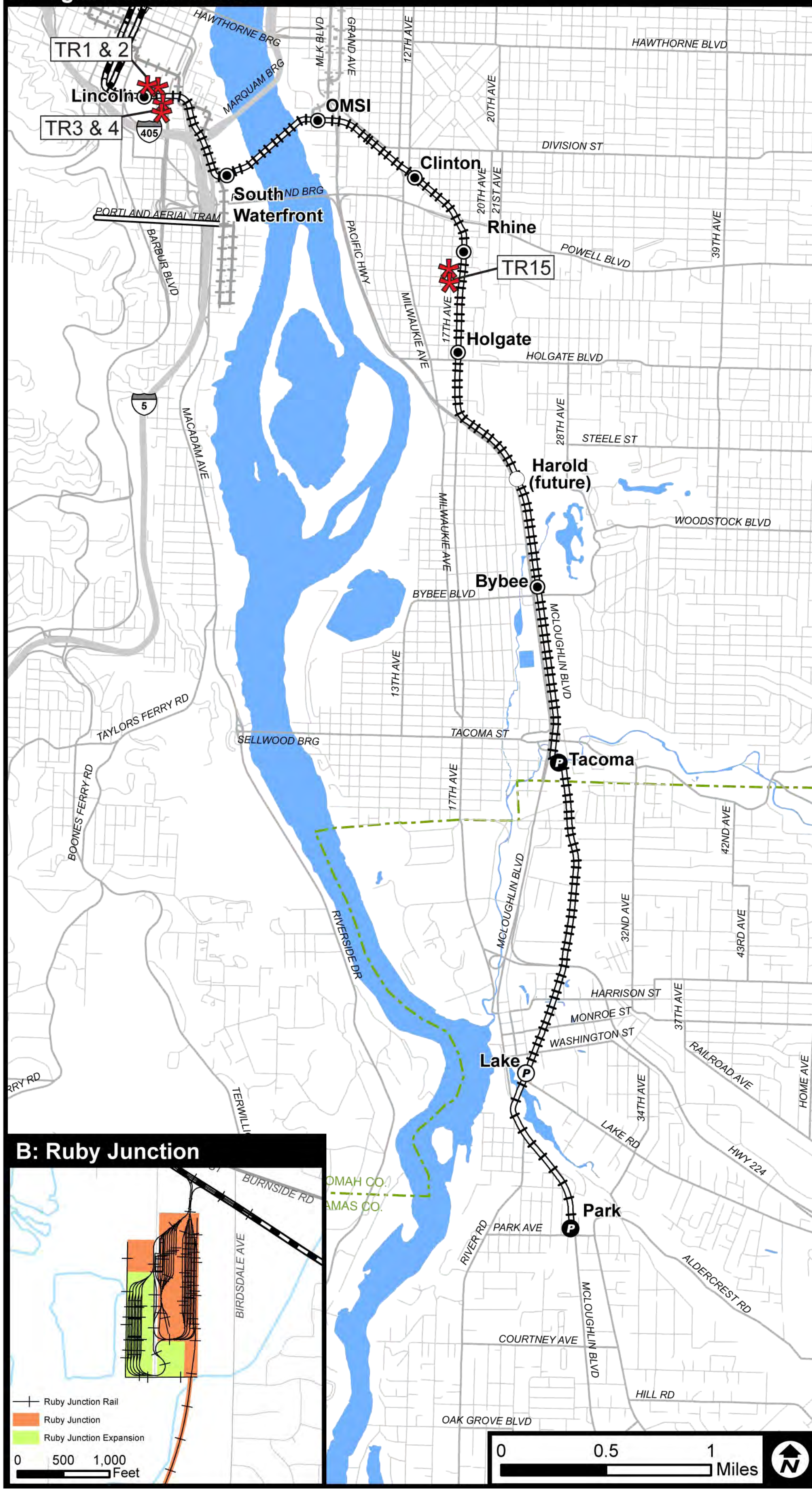
Rec. #[1]		Land Use Type[2]	Units[3]	NAC[4] (L_{eq} dBA)	Traffic Noise Levels (L_{eq} dBA)		Number of Impacts[7]	Change in Levels (dB)[8]
					Existing[5]	Build[6]		
TR1	Lovejoy Fountain 2nd & 3rd floors	B	6	65	65	67*	6	2
TR2	Lovejoy Fountain 4th & 5th floors	B	6	65	65	66*	6	1
TR3	American Plaza Ground & 2nd floors	B	2	65	65	68*	2	3
TR4	American Plaza 3rd, 4th & 5th floors	B	3	65	65	67*	3	2
TR5	SFR on SE 16th	B	3	65	60	62	-	2
TR6	SFR on SE 16th / SE Pershing	B	3	65	57	59	-	2
TR7	SFR on SE 16th / SE Pershing	B	2	65	56	64	-	8
TR8	SFR on SE 16th / SE Pershing	B	3	65	59	61	-	2
TR9	SFR on SE 16th/ SE Haig	B	5	65	54	55	-	1
TR10	SFR on SE 16th/ SE Haig	B	2	65	57	57	-	0
TR11	SFR on SE 16th	B	2	65	55	55	-	0
TR12	SFR on SE 16th/ SE Rhine	B	3	65	56	56	-	0
TR13	SFR on SE 16th/ SE Lafayette	B	3	65	57	57	-	0
TR14	SFR on SE 16th/	B	4	65	58	60	-	2

Table 3.10-5
Traffic Noise Impacts Before Mitigation

Rec. #[1]		Land Use Type[2]	Units[3]	NAC[4] (L_{eq} dBA)	Traffic Noise Levels (L_{eq} dBA)		Number of Impacts[7]	Change in Levels (dB)[8]
					Existing[5]	Build[6]		
	SE Rhone							
TR15	SFR on SE 17th/ SE Rhone	B	2	65	67	69*	2	2
TR16	SFR on SE 16th/ SE Rhone	B	2	65	57	59	-	2
TR17	SFR on SE 16th	B	2	65	56	60	-	4
TR18	MFR on SE 16th	B	5	65	57	60	-	3
TR19	MFR on SE 16th	B	6	65	58	62	-	4
TR20	School Grounds	B	1	65	53	55	-	2
TR21	SFR on SE 16th/ SE Center	B	1	65	59	62	-	3
TR22	SFR on SE 16th/ SE Center	B	5	65	54	55	-	1
TR23	SFR on SE 16th	B	4	65	55	58	-	3
TR24	SFR on SE 16th/ SE Boise	B	3	65	58	61	-	3
TR25	SFR on SE 16th/ SE Boise	B	5	65	54	56	-	2
TR26	SFR on SE 16th/ SE Boise	B	3	65	58	61	-	3
TR27	SFR on SE 16th	B	3	65	55	58	-	3
TR28	SFR on SE 16th	B	10	65	54	56	-	2
TR29	SFR on SE 16th/ SE Mall	B	3	65	59	61	-	2
TR30	SFR on SE 16th/ SE Mall	B	3	65	55	56	-	1
TR31	SFR on SE 16th	B	2	65	61	63	-	2
TR32	TriMet Entrance	C	1	70	65	65	-	0

[1] Noise modeling locations shown in Figure 3.10-7.
[2] Land use type by FHWA for traffic noise criteria.
[3] Number of individual residences or structures represented by each receiver.
[4] ODOT noise abatement criteria.
[5] Existing modeled noise levels. ***** exceeds criteria.
[6] Future (year 2030) traffic noise levels with proposed project. **Bold** typeface exceeds criteria.
[7] Number of noise impacts with proposed project.
[8] Change in noise levels between existing and future with the project.

A: Light Rail Alternative



Portland-Milwaukie Light Rail Project

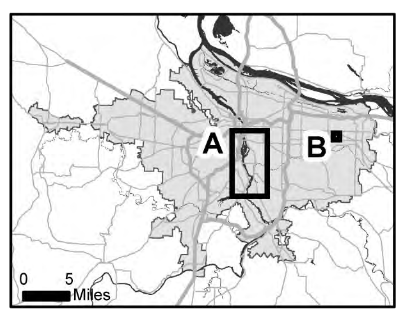
Traffic Noise Impacts

Figure 3.10-7

* Traffic Noise Impact

Notes:
TR 1 & 2 = Lovejoy Fountain
TR3 & 4 = American Plaza
TR15 = Two homes SE 17th Ave

Light Rail Alternative
Station
Future Station
Park-and-Ride
MOS Park-and-Ride
Existing MAX
Existing Streetcar
Under Construction Streetcar
Railroad
County Line



Metro

TRIMET

December 2009

3.10.5.3 Noise at Park-and-Rides and Ruby Junction Maintenance Facility

Noise related to the operation of the Tacoma Station and Park-and-Ride is not expected to change the existing noise environment more than 1 to 2 dBA. Under the MOS to Lake Road, operation of the 275-space park-and-ride garage on SE Washington Street is also not projected to increase noise by more than 1 dBA in the downtown Milwaukie area. The Park Avenue Station and Park-and-Ride would shield residential areas from both bus traffic and passenger vehicles accessing SE McLoughlin Boulevard, and no noise impacts are projected in this area either.

The additional light rail traffic to and from the maintenance facility is not projected to result in any additional noise impacts given the industrial area in which the Ruby Junction Facility is located and the slow speed of the train yard operations. There are, however, improvements at the facility that were analyzed for potential noise impacts. Improvements at Ruby Junction would include the addition of a new light rail washing station to the west of the current facility. To accommodate this facility, new crossing gates would be required to allow for the trains to cross NW Eleven Mile Road.

With a full build-out, the project would acquire all noise-sensitive properties adjacent to the facility. With a two-phased approach, the only remaining noise-sensitive property under the Phase 1 acquisitions is a single-family residence to the south of the facility, partially shielded from the maintenance facility by an existing commercial use. The remaining residence is approximately 120 feet south of a proposed at-grade crossing of NW Eleven Mile Road, which will require the addition of crossing gates. The gates have warning bells that sound for approximately 10 seconds whenever the gates are lowered, but not when they are raised. The gates would operate whenever a train travels from the new wash area back to the main maintenance area. The new wash area is predicted to be used on Tuesdays between the hours of 7:00 a.m. and 10:00 p.m., when approximately 12 vehicle crossings would occur. An additional 30 crossings are predicted to occur on Tuesday nights and Wednesday mornings, during the nighttime hours of 10:00 p.m. to 7:00 a.m.

Because this is a fixed facility, the noise criteria applicable to the facility are those from the City of Gresham, provided in Chapter 7, Section 20 of the City’s Municipal Code. The maximum allowable noise levels between the hours of 7:00 a.m. and 10:00 p.m. are 60 dBA, and during nighttime hours of 10:00 p.m. and 7:00 a.m., the maximum allowable levels are reduced to 50 dBA.

An analysis of the maximum noise levels from the combined noise resulting from the light rail operation with the crossing gate bells was performed to determine whether if the operation would meet or exceed the City of Gresham criteria. The analysis assumes that the train crossing would be approximately 120 feet from the residence and the crossing gates approximately 100 feet from the residence. The reference level for the crossing bells of 75 dBA at 10 feet was used for the analysis.

The combined noise for a single crossing at the residence was calculated at 56 dBA, which is an exceedance of the nighttime criteria in the City of Gresham. No exceedance of the daytime criteria is predicted. The primary reason for the exceedance is noise related to the crossing bells, which contributes 55 dBA to the overall noise levels. The analysis assumed a slow light rail crossing speed of under 25 mph, which contributes 50 dBA to the total noise levels at the residence.

3.10.5.4 Vibration Impacts

Since the initial analysis, there have been several changes in the project that have affected the overall vibration levels and number and severity of potential impacts. Slight changes in the alignment location, additional crossovers, and changes in train speed have affected impacts in downtown Portland and in the Milwaukie area. As noted above in Section 3.10.3.5, the vibration analysis includes a 5 VdB safety factor that is added to the calculation.

In downtown Portland, a crossover switch would result in vibration impacts at the Unitus Credit Union building, which also houses several PSU classes. Because of their proximity to the new alignment and efficient vibration propagation, the Village at Lovejoy Fountain Apartments were also identified as having nine vibration impacts for units on the second, third, and fourth floors (three units per floor). Although the current projections estimate up to nine impacts at the Village at Lovejoy Fountain Apartments, the actual number would likely be lower due to the large foundation that supports the building. This is also likely the case for the Unitus Credit Union building. Additional testing is being conducted to determine the coupling factor and verify the vibration impact during final design and to determine appropriate mitigation to reduce vibration to acceptable levels. It is likely that some of the vibration impacts will be eliminated following the testing, because the 5 VdB safety factor will no longer be needed with updated measurements.

The results of vibration predictions for the Digital One/Mission Control building suggest there are no vibration impacts (DSA 2009). Vibration propagation measurements were performed by DSA, and DSA's analysis of project-related vibration levels inside the building's sensitive rooms were all below the 65 VdB FTA criteria for a vibration-sensitive building, such as a recording studio.

Vibration at other sensitive properties, such as the RiverPlace Square Apartments and the International School, is predicted to remain below the threshold for mitigation because of added vibration reduction from the elevated structure. The reduced level of vibration impact when compared to the previous studies is a result of the realignment of the guideway farther away from the apartments. There is a potential for vibration levels to exceed 72 VdB near the crossovers at the South Waterfront Station, and therefore future development should be compatible with the vibration projections.

Vibration impacts were also identified at the Portland Opera Offices because of the nearby rail turnouts and rail crossing diamond and proximity of the alignment to the building. As with other potential vibration impacts, additional vibration propagation testing will be performed to verify the impact, to better understand the coupling loss related to the building, and to further confirm mitigation measures to reduce vibration to acceptable levels. The only other vibration impacts north of downtown Milwaukie are at two single-family homes north of SE Rhone Street on SE 17th Avenue. The reference vibration levels for these sites were taken from the measurements at OMSI, and therefore may not accurately predict the vibration level in this area. During final design, additional testing will be performed to verify the impacts and assist with mitigation. These two homes were also identified with traffic noise impacts. The low number of impacts along SE 17th Avenue is a result of the distance between residences and the alignment, reduced propagation characteristics, and shielding by existing buildings and block walls in the parking areas. There are no vibration impacts identified along the alignment from SE Holgate Boulevard to the Tacoma Park-and-Ride because of land use and distance from the tracks. Between the Tacoma Park-and-Ride and Highway 224, vibration levels range from 49 to 71 VdB, and no exceedance of the FTA criteria was identified.

Vibration impacts in the downtown section of Milwaukie are similar to those in previous studies and are a result of efficient propagation characteristics in the downtown segment. On the north side of SE Harrison Street there are four homes with vibration impacts, two on the west side of the alignment and two on the east side of the alignment. Vibration impacts were also identified at up to 12 multifamily units at the apartments just south of SE Harrison Street, at a single-family residence on SE Monroe Street, and at another single-family residence near the Lake Road Station.

There was no vibration impact predicted at the Portland Waldorf School. The distance between the school and tracks and the 5 VdB coupling loss all contribute to a predicted vibration level at the school of 71 to 73 VdB, with an impact criterion of 75 VdB. There are vibration impacts predicted at two commercial structures: the Business Center on SE Washington Street and the building that houses Jenco Scientific and Electrodyne Inc. Vibration levels at these three commercial uses are predicted at 82 VdB. Vibration levels at the Tartan and Thistle restaurant on SE 21st Avenue are also predicted to exceed the criteria, with future vibration levels of 76 VdB.

South of the Lake Road Station, vibration impacts were identified at eight single-family residences. Five of the eight impacts are a result of the proximity of the residences to a double crossover near the terminus. The other three impacts are because of the proximity to the tracks and high train speed. Table 3.10-6 summarizes the project vibration impacts.

Table 3.10-6
Light Rail Vibration Levels without Mitigation

Rec. #	Area Description[1]	Land Use Type[2]	Vibration Criteria[3]	Vibration Level[4]	Exceeds Criteria[5]	Number of Impacts[6]
Downtown Portland						
S1	Unitus Credit Union/PSU Classrooms	3	75	79*	4	1
R1 R1a	Village at Lovejoy Fountain Apartments (MFR)	2	72	72*	0	9
R2 R2a	American Plaza Towers (MFR)	2	72	70	--	--
D1	Digital One/Mission Control	1	65	57 (interior)	--	--
R3	RiverPlace Square Apartments (MFR-angled)	2	72	62	--	--
R4	RiverPlace Square Apartments (MFR-north)	2	72	51	--	--
R5	RiverPlace Square Apartments (MFR-east)	2	72	51	--	--
S2	International School (play area)	3	75	57	--	--
S3	International School (main bldg.)	3	75	57	--	--
East Bank Waterfront to SE Powell Boulevard Overpass						
O1	Portland Opera (Northeast)	3	75	80*	5	1
O2	Portland Opera (Southwest)	3	75	67	--	

Table 3.10-6
Light Rail Vibration Levels without Mitigation

Rec. #	Area Description[1]	Land Use Type[2]	Vibration Criteria[3]	Vibration Level[4]	Exceeds Criteria[5]	Number of Impacts[6]
R10	SE Caruthers St. and SE 8th Ave. (SFR)	2	72	61	--	--
R11	SE Division at SE 9th Ave. (SFR)	2	72	57	--	--
R12	SE 12th Ave. and SE Clinton St. (SFR)	2	72	53	--	--
S4	SE 12th Ave. and SE Clinton St. (Church)	3	72	55	--	--
R13	SE 16th Ave. at SE Woodward St. (SFR)	2	72	57	--	--
SE Powell Boulevard Overpass to Tacoma Station						
R14	SE Pershing St. at SE 16th Ave. (SFR)	2	72	55	--	--
R15	SE Rhone St. and SE 17th Ave. (SFR)	2	72	74*	2	2
R16	SE Rhone St. to SE Bush St. (SFR)	2	72	57	--	--
R17	SE Bush St. to SE Center St. (SFR)	2	72	56	--	--
R18	SE Bush St. to SE Center St. (SFR)	2	72	56	--	--
R19	SE Center St. to SE Boise St. (SFR)	2	72	57	--	--
R20	SE Boise St. to SE Mall St. (SFR)	2	72	57	--	--
R21	SE Mall St. to SE Holgate Blvd. (SFR)	2	72	55	--	--
R22	SE Schiller St. and SE 17th Ave. (SFR)	2	72	56	--	--
R23	SE Schiller St. and SE 17th Ave. (SFR)	2	72	56	--	--
R24	SE McLoughlin Blvd. at SE Ellis St. – SE Reedway St. (SFR)	2	72	>50	--	--
Tacoma Station to Highway 224						
R25	North of SE Roswell St. (SFR up hill)	2	72	49	--	--
R26	North of SE Roswell St. near UPPR (SFR)	2	72	62	--	--
R27	SE Roswell St. – SE Boyd St. (SFR)	2	72	71	--	--
R28	SE Boyd St. - 1/2 block south (SFR)	2	72	65	--	--
R29	SE Malcolm St. - 1/2 block north and south house (SFR)	2	72	65	--	--
R30	SE Malcolm St. South & SE Olsen St. (SFR)	2	72	61	--	--
Highway 224 to Lake Road Station Terminus (MOS to Lake Rd.)						
R31	Crystal Lake Apartments (MFR)	2	72	66	--	--
R32	North of SE Harrison St. (west – SFR)	2	72	73*	1	2
R33	North of SE Harrison St. (west – SFR)	2	72	70	--	--
R34	North of SE Harrison St. (east – SFR)	2	72	82*	10	2
S6	Portland Waldorf School	3	75	73	--	--

Table 3.10-6
Light Rail Vibration Levels without Mitigation

Rec. #	Area Description[1]	Land Use Type[2]	Vibration Criteria[3]	Vibration Level[4]	Exceeds Criteria[5]	Number of Impacts[6]
S7	Portland Waldorf School Main Bldg.	3	75	71	--	--
R35	South of SE Harrison St. (closest MFR to track)	2	72	83*	11	6
R36	South of SE Harrison St. (MFR)	2	72	75*	3	6
R37	SE Monroe St. (SFR)	2	72	76*	4	1
R37A	SE Monroe St. (SFR 2nd home)	2	72	68	--	--
R37B	SE Monroe St. (SFR 3rd home)	2	72	62	--	--
S8	Church	3	75	59	--	--
S9	SE Washington Street "L" Bldg.	3	75	82*	7	1
S10	Tartan and Thistle	3	75	76*	1	1
S11	SE Washington St. (Center)	3	75	82*	7	1
S12	SE 21st at SE Adams St. (Jenco Scientific and Electrodyne Inc.)	3	75	82*	7	1
R38	SE Lake Rd. (SFR by structure)	2	72	69	--	--
Lake Road Station to Park Avenue Station Terminus (LPA to Park Ave.)						
R39	SE Bluebird St. (MFR)	2	72	60	--	--
R40	SE River Rd. at SE McLoughlin Blvd. (SFR west)	2	72	67	--	--
R41	SE River Rd. at SE McLoughlin Blvd. (SFR west)	2	72	60	--	--
R42	SE Wren St. (closest SFR)	2	72	64	--	--
R43	SE Wren St. (other SFR)	2	72	56	--	--
R44	SE Sparrow St. (nearest MFR east side of SE McLoughlin Blvd.)	2	72	60	--	--
R45	South of SE Sparrow St. (SFR behind displacement)	2	72	61	--	--
R46	SE Lark St. at SE 27th Ave. (2 SFR)	2	72	62	--	--
R47	SE 27th Ave. (SFR south of displacement)	2	72	73*	1	1
R48	SE 27th Ave. (SFR south of displacement)	2	72	74*	2	1
R49	SE 27th Ave. (SFR near switch)		72	73*	1	6
R50	SE 27th Ave. (SFR near station)	2	72	60	--	--

1 General description of sensitive receiver location: SFR = single-family residence / MFR = multifamily residence / Comm = commercial.
2 Land use type by FTA criteria.
3 FTA vibration criteria.
4 Predicted maximum vibration level during train pass-by – ***** indicates a vibration impact.
5 Amount of project vibration exceeds the FTA criteria.
6 Estimated number of structures or apartments predicted to exceed the criteria.

3.10.6 Short-Term Impacts (Construction)

Noise and vibration related to construction would result from the operation of heavy equipment needed to construct bridges, retaining walls, roads, park-and-ride facilities, and transit centers. Local ordinances regulate construction noise (see Section 3.10.3.4, Local Noise Regulations), and the contractor would be required to adhere to these regulations. Construction outside normal weekday and Saturday, daytime hours (7:00 a.m. to 10:00 p.m.) may require a noise variance from the city or county where the work is being performed. However, during daytime hours of 7:00 a.m. to 10:00 p.m., Monday through Saturday, all construction except pile driving is exempt from the local regulations, and virtually any construction activity can take place. Pile driving is normally limited to: 7:00 a.m. to 7:00 p.m. Monday through Friday and 8:00 a.m. to 5:00 p.m. on Saturdays.

3.10.6.1 Construction Noise

Major noise-producing equipment used during construction preparation could include saw cutters, concrete pumps, cranes, excavators, haul trucks, loaders, tractor trailers, impact hammers, and vibratory equipment. Other less notable noise-producing equipment that may be used during this phase include backhoes, air compressors, forklifts, pumps, power plants, service trucks, and utility trucks.

Near downtown Portland, at the start of the alignment, major construction activities would include utilities relocation, building demolition, paving, track installation, and construction of the Lincoln Station. Noise levels could range from 80 to 88 dBA at the nearest receivers, including the Unitus Credit Union, Village at Lovejoy Fountain Apartments, American Plaza Condominiums, the Digital One/Mission Control building, and other nearby buildings.

Maximum noise levels for construction of bridges and other structures would range from 80 to 94 dBA at the receiver locations within 50 to 100 feet of the construction. Buildings with potential construction noise effects include the Portland Opera Offices, RiverPlace Square Apartments, the International School, the Marriott Residence Inn, and other sensitive buildings near the waterfront on SW Moody Avenue, and along the elevated guideway by SW Harbor Way. Following heavy construction, general construction such as the installation of bridge railings, signage, roadway striping, and other general activities would still occur. These less intensive activities are not expected to produce noise levels above 80 dBA at 50 feet except during rare occasions and for short periods. Pile driving may be used in this segment of the corridor, and a more detailed discussion of pile driving noise is provided below. Locations nearest the corridor will have the highest noise levels.

Construction in the corridor along SE Division Street to SE Powell Boulevard, and again from SE Powell Boulevard to SE McLoughlin Boulevard, would include utilities relocation, demolition, paving, track installation, and construction of the Clinton and Holgate stations. As with other areas, noise levels will range from 80 to 94 dBA at 50 to 100 feet. Construction noise effects along the SE McLoughlin Boulevard corridor are not predicted to result in substantial effects to sensitive properties due to the distance between the corridor and sensitive properties.

The Tacoma Park-and-Ride construction is also not projected to cause substantial increases in noise at noise-sensitive properties. The nearest residences to the west are over 500 feet from the site, and to the east the residences are over 700 feet from the site. Construction of the retained fill and elevated structure and installation of track along the Ardenwald neighborhood are predicted to increase noise at residences located near the alignment. During periods of heavy construction, noise levels at the nearest residences could reach 75 to 80 dBA L_{max} for short periods of time.

General construction of the alignment from Highway 224 through the downtown Milwaukie segment is expected to produce noise levels in the range of 80 to 94 dBA at 50 to 100 feet. Pile driving for the Kellogg Lake structure could also result in increased noise levels at nearby homes. Construction of the elevated structure and installation of retaining walls along SE McLoughlin Boulevard from SE Lake Road to the Park Avenue Station is predicted to result in noise levels at the single-family and multifamily residences in the range of 70 to 90 dBA during periods of heavy construction. Pile driving may be used in this part of the segment also, and the discussion of pile driving is provided below.

Pile Driving

Pile driving could be required for the river crossing and for elevated structures. Potential locations where pile driving may be required include the structure over SW Harbor Drive, Willamette River bridge abutments, the SE Powell Boulevard overpass, the elevated structure built to accommodate the future Harold Station, pedestrian overcrossings, the Tacoma Park-and-Ride structure, the retained fill and structure near the Ardenwald neighborhood, the Kellogg Lake bridge, the SE McLoughlin Boulevard overpass, and the Park Avenue Park-and-Ride. Pile driving can produce maximum short-term noise levels of 99 to 105 dBA at 50 feet. More detail on construction noise and vibration is given in the *Portland-Milwaukie Light Rail Project Noise and Vibration Results Report* (Metro 2010).

Noise from pile driving also has the potential to affect fish and wildlife, as discussed in further detail in Section 3.8, Ecosystems.

3.10.6.2 Construction Vibration

Major vibration-producing activities would occur primarily during demolition and preparation for the new bridges. Activities with the potential to produce a high level of vibration include pile driving, vibratory shoring, soil compacting, and some hauling and demolition activities. Vibration effects from pile driving or vibratory sheet installations could occur within 50 to 200 feet of sensitive receivers. There are areas in the corridor with efficient vibration propagation (meaning that vibration dose not reduce with distance as much as would be normally expected), such as the downtown Milwaukie area, where vibration from construction equipment may carry much farther, and with less attenuation than one would normally expect. Because of the efficient propagation of vibration in the downtown Milwaukie area, vibration effects will be noticeable farther away from the tracks than in most other areas of active construction.

3.10.7 Project Noise Abatement and Mitigation Measures

As required by the FTA, noise and vibration impacts associated with the project will be mitigated, except where no reasonable form of mitigation exists. This section provides commitments to specific mitigation measures for each noise impact of the project, and where no reasonable form of mitigation exists, it provides an explanation of the conditions that foreclose the possibility of mitigating the adverse impact. Table 3.10-7 provides a summary of noise impacts without and with the recommended noise and vibration mitigation measures.

Table 3.10-7
Summary and Comparison of Transit Noise and Vibration Impacts without/with Mitigation

Alternative	Light Rail & Shared Transitway Noise Impacts[1]		Traffic Noise Impacts[3, 4]	Vibration Impacts[5]
	Moderate	Severe		
LPA to Park Ave.[6]	29	3	19	40
LPA to Park Ave. with Mitigation[6]: Noise walls, Insulation, and adjustable directional bells	9 (exterior)	0	0	9
MOS to Lake Rd.	18	3	19	32
MOS to Lake Rd. with Mitigation: Noise walls, insulation, and adjustable directional bells	9 (exterior)	0	0	9

[1]Noise impact count is for number of residential units along with schools, churches, and other sensitive uses, assuming a quiet zone or light rail horn waiver.

[3]Traffic noise impacts occur along SW Lincoln Street and SE 17th Avenue due to the realignment of project roadways and removal of shielding.

[4]Traffic noise levels after mitigation would involve 19 properties with exterior noise levels exceeding FTA standards; however, sound insulation would reduce interior noise levels to meet applicable Department of Housing and Urban Development (HUD) standards, mitigating the impact.

[5]Vibration impact count is for number of residential units along with number of structures for schools, churches, and other sensitive uses.

[6]LPA Phasing Option would have some effects as the LPA to Park Avenue. See Section 3.10.9 for Ruby Junction mitigation.

The noise mitigation is divided into two sections, one for mitigation of noise from light rail, buses, streetcars, and warning bells (where applicable), and a second section for traffic noise mitigation. Finally, a third section provides potential mitigation for vibration impacts.

3.10.7.1 Light Rail, Bus, Streetcar, and Warning Bell Noise Mitigation

Mitigation measures evaluated for reducing noise impacts from light rail include:

- **Sound Barriers.** Construction of noise barriers between a roadway or trackway and the affected receivers would reduce noise levels by physically blocking the transmission of noise. The heights of barriers depend on the proximity of the roadway or tracks to the barrier, location of the noise-sensitive properties, and topographical conditions. Typically, barriers for light rail range from four to eight feet tall.
- **Track Lubrication at Curves.** Trackside lubricators can be effective at reducing wheel squeal that sometimes occurs on tight-radius curves. There are currently several areas on existing light rail alignments that use trackside lubricators, and their effectiveness at reducing wheel squeal is documented. Therefore, wayside lubricators will be installed at all curves with a radius of 300 feet or less that are near any noise sensitive properties.

Building Sound Insulation. Insulating affected structures can reduce noise levels inside homes that would be impacted by noise. This technique does not reduce exterior noise levels and would be used as a final measure to reduce noise to acceptable levels for sensitive receptors such as residences. On several previous projects, TriMet has developed a sound insulation program to mitigate operational noise impacts when other forms of mitigation were not feasible. TriMet typically provides mitigation at the noise source whenever possible; however, options such as noise walls, upgraded windows or wall insulation can be considered if sound mitigation at the source is not possible.

Warning bells would be required for the gated crossings. Regardless of the mitigation option, it must be noted that the crossing gate bells and warning lights must still operate every time the gates are raised or lowered. Typical warning bells at FRA crossings produce 85 dBA at 10 feet, and for pedestrian crossings not in FRA corridors, the levels typically used by TriMet are also 85 dBA at 10 feet. In some cases the warning bells are a major contributor to noise at sensitive structures near at-grade crossings. A description of the different crossing gate bell mitigation measures evaluated is provided below.

- **Adjustable Crossing Bells.** Adjustable crossing bells are electronic versions of the standard crossing bells used at crossings for freight trains. Adjustable bells typically have variable outputs ranging from 75 dBA to 105 dBA at 10 feet. The bells adjust their loudness based on the current ambient noise using a built-in microphone. When traffic is heavy, the bells increase their level, and when traffic is reduced, the bell levels also reduce. Because of TriMet policy, a minimum level of 85 dBA at 10 feet was used for gated crossing bell noise levels
- **Directional Bells and Bell Shrouds**. Directional bells are electronic bells with built-in funnels that direct the sound at the intersection. Bell shrouds are metal plates installed inside an non-directional electronic bell that help to direct the noise from the bell directly toward traffic, reducing the noise that is transmitted toward nearby noise-sensitive properties. Directional bells and bells with shrouds have been shown to reduce noise from crossing bells by 3 to 5 dBA.

A moderate noise impact was identified on the second floor of the Digital One/Mission Control building. The project will provide upgraded windows for those rooms facing the alignment that are considered sensitive and crucial to the facility's operation. The project will also add an interior wall to reduce noise transmission to Mission Control facilities.

No noise mitigation is recommended for the RiverPlace Square Apartments or the International School, because no impacts were identified. Trackside lubricators will be used on the tight radius curve near the apartments to make sure that there is no wheel squeal from the light rail or streetcars.

Because of the noise related to buses, light rail, and streetcar traffic, it is recommended that future developers in the South Waterfront area, within 100 to 300 feet of the alignment, consider methods to maintain interior noise levels compatible with the proposed uses. For residential land uses, the interior noise level of 45 dBA L_{dn} recommended by the U.S. Department of Housing and Urban Development (HUD) is used as the target noise level for living and sleeping areas.

No noise impact was identified at the Portland Opera Offices, and no mitigation is proposed. Light rail and warning bell noise impacts were identified at four single-family residences north of SE Harrison Street and at up to 12 units at the Spring Creek Apartments, with two of the single-family impacts in the severe category. An additional three severe noise impacts were identified on SE Monroe Street, due mainly to bells, and a moderate impact was identified near the elevated structure over SE Lake Road.

Mitigation of these impacts will require a combination of directional bells, noise wall(s), and sound insulation. The only mitigation measure for bell noise is to commit to use directional bells. These mitigation measures will be effective at reducing noise levels at six apartments and two homes. The remaining 12 impacts are at three single-family residences on SE Harrison Street and six units at the Spring Creek Apartments, and three homes on SE Monroe Street.

A noise wall will be used to mitigate one of the single-family residential impacts on the north side of SE Harrison Street, east of the tracks. Because of topography and right-of-way, the noise wall would need to be approximately 220 feet in length with a height of 6 feet (approximately station 429 to station 431 (stations from 25% design drawings)). The 6-foot wall would be required because of the area's difficult topographical conditions. A second residence, closest to SE Harrison Street, would also receive benefit from the noise wall; however, noise from the crossing bells would still result in noise levels that exceed the FTA criteria. Therefore, sound insulation will be used to mitigate the noise related to bells at this single residence. Also, if a reasonable and feasible wall cannot be constructed due to sight distance and other safety issues, then sound insulation will be used to mitigate both of these impacts.

Because the multifamily units at the Spring Creek Apartments are located uphill from the tracks, a noise wall would not be effective at reducing the noise impacts, and therefore sound insulation will be used to mitigate the remaining impacts at the Spring Creek Apartments.

Mitigation for the one severe and two moderate impacts on SE Monroe Street will include installing directional bells. This will reduce the project noise levels to 1 to 2 dB over the FTA moderate impact criteria. The project will provide residential sound insulation to all three homes, eliminating all noise impacts in this area.

The only remaining impact near downtown Milwaukie would be to a single-family residence located near the Lake Road Station. Mitigation for this home will include a noise wall on the elevated structure. The structure-mounted wall would be approximately 200 feet (station 458 to station 460) in length and 4 feet above the top of the rail.

South of the Lake Road Station, under the LPA to Park Avenue, there are 11 residential impacts. Three of the impacts are to single-family residences along SE Wren Street. Mitigation could include a noise wall along the west side of the alignment or sound insulation. A sound wall approximately 350 feet in length (from station 474+50 to station 478) will be installed and is sufficient to mitigate all light rail noise impacts in this area. The wall height is dependent on the horizontal placement and final elevation of a retaining wall, which may be used as a base for the sound wall.

The remaining eight noise impacts will be mitigated with a noise wall along the western edge of the alignment. The noise wall will be an effective method of eliminating the noise impacts in this area. The noise wall would be approximately 675 feet long with a height of 6 feet above the top of the rail. The wall will go from station 492 to station 498+75. Table 3.10-8 provides a summary of the noise impacts and mitigation measures.

For mitigation of impacts at Ruby Junction, see Section 3.10.8.

3.10.7.2 Traffic Noise Mitigation

Traffic noise mitigation is normally performed using noise walls. Noise walls for traffic noise can be anywhere from 8 to 10 feet up to 20 feet in height. The two primary factors that determine the height of noise walls are area topographical conditions and the level of heavy truck traffic. Because the only traffic noise impacts are in locations where a noise wall would not be feasible, no sound walls are proposed for traffic noise mitigation. In the past, TriMet has used sound insulation to mitigate traffic noise impacts when a noise wall was not a feasible option. TriMet's policy is to provide mitigation at the source whenever possible, sound insulation is only considered when all other methods are not feasible or reasonable forms of mitigation.

The traffic noise impacts at the Village at Lovejoy Fountain Apartments and the American Plaza Towers exist at units that are above the revised roadway, and therefore noise barriers would not be effective at reducing noise levels from buses and other vehicles on SW Lincoln Street. Therefore, noise impacts at these multifamily buildings will be mitigated using sound insulation.

The FTA criteria are only for exterior noise levels. For interior levels the FTA recommends that any sound insulation provide at least a 5 dBA reduction of noise levels and provide a maximum interior noise level of 65 dBA or less from transit noise. Proposed upgrades to buildings where sound insulation is proposed will include the necessary improvements to the buildings to meet the FTA requirements. During final design, measurements will be taken at units to determine the exterior/interior sound loss with the existing windows. Based on these measurements, the final determination of sound insulation will be developed.

Traffic noise impacts were also identified at two single-family residences on SE 17th Avenue. The two homes just north of SE Rhone Street have direct pedestrian access to SE 17th Avenue, and therefore noise walls are not a feasible option for mitigation. Because a sound wall is not feasible, residential sound insulation will be used to mitigate the impacts at these two homes. No other traffic noise impacts are projected for the Portland-Milwaukie Light Rail Project. Table 3.10-8 provides a summary of the noise impacts and mitigation measures.

Table 3.10-8
Summary of Noise Mitigation Measures for Light Rail, Bus, Streetcar, Warning Bell, and Traffic Noise

Rec. #[1]	Area Description[2]	Impact Type[3]	Noise Levels		Criteria FTA/FHWA	Mitigation[6]	Exterior Level with Mitigation[7]	Residual Impacts[8]
			Existing[4]	Project[5]				
Downtown Portland								
TR1	Village at Lovejoy Fountain 2nd & 3rd floors	Traffic	65	67*	65 (FHWA)	Sound Insulation	67	Interior (0) Exterior (17)
TR1a	Village at Lovejoy Fountain 4th & 5th floors	Traffic	65	66*	65 (FHWA)	Sound Insulation	66	
TR2	American Plaza Ground & 2nd floors	Traffic	65	68*	65 (FHWA)	Sound Insulation	68	
TR2a	American Plaza 3rd, 4th & 5th floors	Traffic	65	67*	65 (FHWA)	Sound Insulation	67	
D1	Digital One/Mission Control	LRT/Bus	66	63*	62	Sound Insulation	63	Interior (0) Exterior (1)
East Bank Waterfront to SE Powell Boulevard Overpass								
No noise impacts in this area								
SE Powell Boulevard Overpass to Tacoma Station								
TR15	2-SFR on SE 17th Ave. at SE Rhone St.	Traffic	65	67*	65 (FHWA)	Sound Insulation	67	Interior (0) Exterior (2)
Highway 224 to Lake Road Station (MOS to Lake Rd.)								
R33	North of SE Harrison St. (east – SFR)	Bells/LRT	62	63*	59	Sound Insulation (or walls) & directional bells	63	None Exterior (1 on Harrison)
R34	North of SE Harrison St. (west – SFR)	Bells/LRT	62	64*	59	Sound Insulation (or walls) & directional bells with shrouds	63	None Exterior (1 on Harrison)
R35	Spring Creek Apartments (closest MFR to tracks)	Bells/LRT	62	61*	59	Insulation and directional bells with shrouds	61	Interior (0) Exterior (6)
R36	Spring Creek Apartments (closest MFR to crossing)	Bells/LRT	62	60*	59	Insulation and directional bells	58	None
R37	SE Monroe St. (SFR nearest tracks)	Bells	62	64*	59	Insulation and directional bells	61	None Exterior (1)
R37A	SE Monroe St. (SFR 2nd home)	Bells	62	63*	59	Insulation and directional bells	60	None Exterior (1)

Table 3.10-8
Summary of Noise Mitigation Measures for Light Rail, Bus, Streetcar, Warning Bell, and Traffic Noise

Rec. #[1]	Area Description[2]	Impact Type[3]	Noise Levels		Criteria FTA/FHWA	Mitigation[6]	Exterior Level with Mitigation[7]	Residual Impacts[8]
			Existing[4]	Project[5]				
R37B	SE Monroe St. (SFR 3rd home)	Bells	62	62*	59	Insulation and directional bells	59	None Exterior (1)
R38	SE Lake Rd. (SFR)	LRT	62	60*	59	Noise wall or Insulation	59	None with Wall Exterior (1 w/insulation)
Lake Road Station to Park Avenue Station (LPA to Park Ave.)								
R42	SE Wren St. (closest SFR)	LRT	68	64*	63	Noise wall	59	None
R43	SE Wren St. (other SFR)	LRT	65	61*	61	Noise wall	56	None
R47	SE 27th Ave. (SFR south of displacement)	LRT	65	62*	61	Noise wall	57	None
R48	SE 27th Ave. (SFR south of displacement)	LRT	65	61*	61	Noise wall	56	None
R49	SE 27th Ave. (SFR near switch)	LRT	65	61*	61	Noise wall	56	None
Ruby Junction Facility (Phasing Option Only)								
Ruby	NW Eleven Mile Rd. (SFR near Ruby Junction)	Ruby Junction	N/A	N/A	50 (nighttime) City of Gresham	Noise insulation or acquisition and relocation	N/A	None

1 Receiver numbers as shown on Figure 3.10-6.
2 General description of sensitive receiver.
3 Impact type: LRT = light rail; Bells = warning bells at crossing gates; Traffic = traffic noise impact; Bus = bus traffic.
4 Existing L_{dn} for Category 2 and L_{eq} for Category 1 or 3 land uses.
5 Project L_{dn} for Category 2 and L_{eq} for Category 1 or 3 land uses. ***** exceeds criteria.
6 Proposed mitigation methods.
7 Noise level with mitigation measures
8 Number of remaining noise impacts with mitigation. Interior noise levels would be mitigated to meet HUD standards, reducing the impact. Exterior noise levels would exceed FTA criteria.
9 Applies City of Gresham noise ordinance threshold. Existing and combined noise levels are not applicable.

3.10.8 Light Rail Vibration Mitigation

This section provides commitments to specific mitigation measures for each vibration impact of the project, and where no reasonable form of mitigation exists, it provides an explanation of the conditions that foreclose the possibility of mitigating the adverse impact. The following vibration mitigation measures were evaluated for use on this project:

- **Ballast Mats.** Ballast mats are a rubber-type material that is placed between the track ballast and the supporting concrete base. Ballast mats can be effective at reducing vibration when the frequency of the vibration impact is included as a design consideration.
- **Resilient Fasteners.** Resilient fasteners are vibration-reducing fasteners that attach between the rail and ties. As with ballast mats, fasteners can be effective at reducing vibration when the frequency of the vibration impact is included as a design consideration. For locations with embedded track, rail boots can accomplish similar vibration reduction.
- **Tire Derived Aggregate (TDA).** TDA normally consists of 12 inches of shredded rubber ballast under the standard ballast.
- **Use of Ballasting Track (with Ballast Mats) instead of Paved Track.** Vibration mitigation can be more effective with ballasted track. Ballasted track with ballast mats could be considered where paved track has been specified for urban design effect only (not to support bus operations).
- **Special Trackwork at Crossovers and Turnouts.** The FTA cites that light rail train wheels over rail gaps of special trackwork may increase light rail noise by 5 dB and vibration by about 10 VdB in some conditions. The use of spring-rail, flange-bearing or moveable-point frogs in place of standard rigid frogs allows the gap to remain closed, reducing vibration levels.
- **Floating Slab.** A floating slab is typically an isolated slab of concrete set in a supporting concrete base.
- **Rail Grinding/Wheel Truing.** These regular maintenance activities can address impacts that are only slightly above the threshold.

Vibration impacts were identified at 45 structures, including 39 single-family and multifamily units, the Unitus Credit Union building, the Portland Opera Offices, and four businesses in downtown Milwaukie. Vibration mitigation measures including crossover modification, ballast mats, TDA, 12Hz resonance floating slab, and resilient fasteners will be used to reduce vibration levels. The vibration mitigation commitments herein are firm commitments to meet the FTA vibration criterion applicable at each location. However, if during final design it is determined that the relevant vibration criterion can be achieved by a less costly means, or that the vibration impact at that location will not occur even without mitigation, then the mitigation measure may be dropped or modified, but only with FTA’s written approval. Table 3.10-9 provides a summary of the vibration mitigation measures and resulting vibration levels.

Vibration impacts along SW Lincoln Street will include a combination of mitigation measures, including special trackwork at the crossover, and either rail boots or resilient fasteners between SW 4th Avenue and SW 1st Avenue.

Vibration mitigation for the Portland Opera Offices will include special trackwork. Even with the proposed vibration mitigation, there is still a potential for a vibration impact at the Portland Opera Offices as a result of its proximity to the crossover for the streetcar connection. Because the tracks are on a retained fill, actual vibration levels will likely be lower than stated, and further research and measurements will be performed during final design to determine whether vibration levels at the Portland Opera Offices will actually exceed the FTA criteria.

There is also the potential for vibration impacts at two single-family residences and six multifamily units in downtown Milwaukie as a result of their proximity to the tracks and efficient vibration propagation. The vibration impacts at the two-single family residences on SE 17th Avenue will be mitigated with ballast mats. Vibration impacts in downtown Milwaukie will be mitigated with TDA or floating slabs, whichever is necessary to meet FTA vibration criteria, and an evaluation of vibration propagation in the area during Final Design will determine which mitigation measure is needed. The single impact near the Lake Road Station will be mitigated with resilient fasteners. Finally, vibration impacts south of the Lake Road Station will be mitigated with ballast mat and special trackwork, as needed.

It is important to note that the vibration projections contain a 5 VdB safety factor and that during final design it is possible that many of the predicted vibration impacts may be eliminated. Additional testing during final design will be conducted to verify the vibration projections, and confirm the most cost-effective vibration mitigation measures. The testing will also measure the coupling factor of the foundations of the potentially affected buildings to determine any reduction in vibration levels as the vibratory waves meet the foundations of the buildings. As shown in Figure 3.10-5, Freight Train Pass-By Test at the Portland Waldorf School, even a single-story building with a slab-at-grade foundation can provide a reduction in vibration levels of 2 VdB or more. Many of the structures along the corridor with vibration impacts have larger foundations than the Portland Waldorf School and would be expected to have a similar or greater coupling loss at their foundations. Significant vibration impacts not anticipated but found to occur will be mitigated under the methods noted here.

Table 3.10-9
Light Rail Vibration Mitigation Measures

Rec. #	Area Description[1]	Land Use Type[2]	Vibration Criteria[3]	Vibration Level[4]	Mitigation[5]	Level with Mitigation[6]	Impacts with Mitigation[7,8]
Downtown Portland							
S1	Unitus Credit Union/PSU Classrooms[8]	3	75	79*	Flange bearing crossover	74[9]	0
R1 R1a	Lovejoy Fountain Apartments (MFR)	2	72	72*	Rail boot	68	0
East Bank Waterfront to SE Powell Boulevard Overpass							
O1	Portland Opera Offices	1	75	80*	Flange bearing crossover	75[9]	1
SE Powell Boulevard Overpass to Tacoma Station							
R15	SE Rhone St. and SE 17th Ave. (SFR)	2	72	74*	Ballast mats	63	0

Table 3.10-9
Light Rail Vibration Mitigation Measures

Rec. #	Area Description[1]	Land Use Type[2]	Vibration Criteria[3]	Vibration Level[4]	Mitigation[5]	Level with Mitigation[6]	Impacts with Mitigation[7,8]
Highway 224 to Lake Road Station (MOS to Lake Rd.)							
R32	North of SE Harrison St. (west – SFR)	2	72	73*		59	0
R34	North of SE Harrison St. (east – SFR)	2	72	82*		72	2
R35	South of SE Harrison St. (closest MFR to track)	2	72	83*		72	6
R36	South of SE Harrison St. (MFR)	2	72	75*			0
R37	SE Monroe St. (SFR)	2	72	76*	Tire derived aggregate		0
S9	SE Washington St. "L" Bldg	3	75	82*		72	0
S10	Tartan and Thistle Restaurant	3	75	76*		65	0
S11	SE Washington St. (Center)	3	75	82*		72	0
S12	SE 21st at SE Adams St. (Jenco Scientific and Electrodyne Inc.)	3	75	82*		71	0
R38	SE Lake Rd. (SFR by structure)	2	72	72*	Resilient fasteners	69	0
Lake Road Station to Park Avenue Station (LPA to Park Ave.)							
R47	SE 27th Ave. (SFR south of displacement)	2	72	73*	Ballast mats	63	0
R48	SE 27th Ave. (SFR south of displacement)	2	72	74*	Flange bearing crossover	59	0
R49	SE 27th Ave. (SFR near switch)		72	73*		58	0

1 General description of sensitive receiver location: SFR = single-family residence / MFR = multifamily residence / Comm = commercial.
2 Land use type by FTA criteria.
3 FTA vibration criteria.
4 Predicted maximum vibration level during train pass-by – ***** indicates a vibration impact.
5 Potential vibration mitigation measures pending additional testing during final design.
6 Vibration levels with proposed mitigation.
7 Residual vibration impacts.
8 Additional testing will be performed at all residences, the Unitus Credit Union building, Lovejoy Fountain Apartments, and Portland Opera building, and all residential structures to determine the level of mitigation required.
9 Assumes a 5 VdB reduction for special trackwork.

3.10.9 Fixed Noise Sources and Ancillary Facilities

The only fixed noise source noise impact identified was to a single-family residence south of the Ruby Junction Facility due to noise from a new at-grade crossing. The at-grade crossing requires the installation of crossing gates, and the combined noise levels from the gates and light rail vehicles exceed the nighttime criteria by up to 6 dBA. The recommended mitigation for the single noise impact would be to provide the residence with a sound insulation package. This package would ensure that the interior noise levels are mitigated within the recommendation of the FTA and meet the U.S. Housing and Urban Department criteria for living quarters. If this mitigation is found to be ineffective in reducing interior noise levels, TriMet will offer to acquire the property and provide relocation assistance, consistent with mitigation commitments in Section 3.1.

3.10.9.1 Construction Noise and Vibration Mitigation

Several construction noise and vibration abatement methods can be implemented to limit the impacts. Operation of construction equipment will be prohibited within 1,000 feet of any occupied dwelling unit at nighttime hours (10 p.m. to 6 a.m.) or on Sundays or legal holidays, when noise would have the most severe effect. All engine-powered equipment will be required to have mufflers installed according to the manufacturer's specifications, and all equipment will be required to comply with pertinent equipment noise standards of the U.S. Environmental Protection Agency. If specific noise complaints are received during construction, the contractor, at its own expense, will be required to implement one or more of the following noise mitigation measures, as directed by the project manager:

- Locate stationary construction equipment as far from nearby noise-sensitive properties as possible.
- Shut off idling equipment.
- Reschedule operations to avoid periods of noise annoyance identified in the complaint.
- Notify nearby residents whenever extremely noisy work will be occurring.
- Install temporary or portable acoustic barriers around stationary construction noise sources.

3.11 AIR QUALITY

This section summarizes relevant air quality regulations and existing air quality in the Portland metropolitan area and discusses the environmental consequences and potential mitigation measures for the project alternatives. The *Air Quality Results Report* (Metro 2010) contains additional information.

3.11.1 Affected Environment

The federal government has established National Ambient Air Quality Standards (NAAQS) to protect the public from air pollution. In addition, the Oregon Department of Environmental Quality (DEQ) has established State Ambient Air Quality Standards (SAAQS), which are at least as stringent as the NAAQS (see Table 3.11-1). The U.S. Environmental Protection Agency (EPA) has delegated air quality program implementation to DEQ.

Table 3.11-1
Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	Federal	Oregon
Carbon Monoxide	8-hour	9 ppm	9 ppm
	1-hour	35 ppm	35 ppm
Lead	Rolling 3-Month Average	0.15 μg/m^3	0.15 μg/m^3
Ozone	8-hour	0.075 ppm	0.075 ppm
Nitrogen Dioxide	Annual Arithmetic Mean	0.053 ppm	0.053 ppm
	1-hour (effective late March 2010)[1]	0.100 ppm	
Sulfur Dioxide	Annual Arithmetic Mean	0.03 ppm	0.02 ppm
	24-hour	0.14 ppm	0.10 ppm
	3-hour	N/A	0.5 ppm
PM_{10}	24-hour Average	150 μg/m^3	150 μg/m^3
$PM_{2.5}$	3-year Average Annual Arithmetic Mean	15 μg/m^3 35 μg/m^3	15 μg/m^3
	3-year Average of the 98th Percentile 24-hour Concentrations		35 μg/m^3

[1]The three-year average of the 98th percentile daily maximum one-hour average nitrogen dioxide concentrations must be less than 100 parts per billion.
Sources: EPA Office of Air Quality Planning and Standards (OAQPS) and DEQ 2006.
Notes: ppm = parts per million; μg/m^3 = micrograms per cubic meter; PM_{10} = particulate with an aerodynamic diameter of less than or equal to 10 micrometers; $PM_{2.5}$ = particulate with an aerodynamic diameter of less than or equal to 2.5 micrometers.

Geographic areas in which concentrations of a pollutant exceed the ambient air quality standards are classified as nonattainment areas (i.e., they do not attain the standards). Areas previously designated as nonattainment areas that are now in compliance with air quality standards are classified as maintenance areas. Federal regulations require states to prepare a State Implementation Plan (SIP) that identifies emission reduction strategies for nonattainment and maintenance areas. The Portland/Vancouver metropolitan area is a carbon monoxide (CO) maintenance area. DEQ has identified measures to ensure compliance and maintain healthy air quality in the region.

As a result of the federal Clean Air Act Amendments of 1990, Oregon developed regulations designed to ensure that transportation plans and regionally significant transportation projects are consistent (i.e., in conformance) with the SIP. There are two parts to demonstrating conformity for transportation projects. In the first part, a region-wide estimate of the pollutant emissions is made. These estimated emissions must not exceed the “budget” levels established for on-road motor vehicles by plans approved for the region by the Oregon Environmental Quality Commission and the EPA. The second part requires that vehicle emissions from an individual project (e.g., a hot spot) does not cause or contribute to a violation of the NAAQS.

A light rail line connecting Portland to Milwaukie and a streetcar loop connection are included in the 2035 RTP financially constrained network and in the 2010-13 Portland area *Metropolitan Transportation Improvement Program* (MTIP). Both the RTP financially constrained network and the MTIP have been determined to conform to the SIP. Metro prepared the conformity determinations for these plans, and Metro and JPACT approved the 2035 RTP on June 10, 2010. The updated air quality conformity analysis, continues to show the RTP conforms to the SIP. In the 1980s, the Portland/Vancouver metropolitan area was also designated as a nonattainment area for ground level ozone. Over the following years, air quality improved, and on April 30, 1997, EPA redesignated the area as a maintenance area for ground level ozone. EPA set a new ozone standard, which became effective in September 1997, but was remanded in May 1999. In March 2002, the D.C. District Court rejected all remaining challenges to the new ozone standard. Under this new standard, one-hour values would no longer be evaluated for attainment purposes. Future compliance would be assessed using the three-year average of the fourth highest eight-hour average value. Under EPA's 2004 ozone implementation rules (40 CFR 51.900), neither general conformity nor transportation conformity is required for areas attaining the eight-hour ozone standard. This means that new transportation project plans will no longer need to demonstrate conformance to the ozone maintenance plans in the Portland-Vancouver Air Quality Management Area. The Ozone Maintenance Plan indicates that DEQ and Metro will informally track volatile organic compounds (VOCs) and nitrous oxides (NO_x) (along with air toxics and greenhouse gas emissions) when Metro assesses conformity. Thus, emission estimates of VOCs, NO_x, fine particulate matter ($PM_{2.5}$), and carbon dioxide (CO_2) have been included for informational purposes only and not for conformity purposes. Lead and sulfur dioxide (SO_2) emission estimates were not developed because the transportation sector impacts from these pollutants are known to be minimal. For example, concentrations of lead have dropped to nominal values as the use of lead in gasoline was phased out. For SO_2, the transportation sector is currently not a primary contributor of emissions in the state.

The Clean Air Act Amendments of 1990 identified 188 air toxics, also known as hazardous air pollutants (HAPs). The EPA defines air toxics as pollutants that cause or may cause cancer or other serious health effects. The EPA assessed this expansive list of toxics and identified a group of 21 as Mobile Source Air Toxics (MSATs), which are set forth in an EPA final rule, Control of Emissions of Hazardous Air Pollutants from Mobile Sources (66 FR 17235). From the list of 21 MSATs, EPA identified seven toxics as the priority MSATs. These are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter (POM). While these MSATs are considered the priority transportation toxics, the EPA stresses that the lists are subject to change and may be adjusted in future rules.

The EPA is responsible for the establishment of NAAQS, national guidance, and guidelines for the uniform and scientifically reliable study of air pollutants. To date, there are no NAAQS for MSATs, and there are no established criteria for determining when MSAT emissions should be considered a significant issue. However, the EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources, 66 FR 17229 (March 29, 2001). This rule pertains to gasoline- and diesel-powered vehicles. The rule does not apply to all electric vehicles, like light rail, but does apply to gasoline- or diesel-powered cars, trucks, buses, and diesel locomotives. That is, very low or no emission vehicles such as electric-powered light rail are not a primary concern for air toxics. However, to the extent that a light rail project may influence motor vehicle travel, especially at congested intersections and at park-and-ride lots, assessment of air toxics from on-road motor vehicles may be considered.

In its September 2009 interim guidance for MSATs in National Environmental Policy Act (NEPA) documents, the FHWA has identified three levels of analysis:

- No analysis for projects with no potential for meaningful MSAT effects;

- Qualitative analysis for projects with low potential MSAT effects; or
- Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects. (Greater potential for MSAT effects typically occurs for roadways with an annual averaged daily traffic (AADT) volume of 140,000 to 150,000 vehicles or more per day in the design year.)

The maximum volume along the light rail project corridor is approximately 69,000 vehicles per day. Further, the project does not create or significantly alter a major intermodal freight facility that could have the potential to concentrate high levels of diesel particulate matter in a single location or create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 or greater by the design year. Thus, following the FHWA guidance listed above, a qualitative analysis for the Portland-Milwaukie Light Rail Project FEIS was completed. A simplified calculation method was used to estimate annual study area emissions of MSATs based on vehicle miles traveled (VMT) for the No-Build Alternative and the light rail project.

3.11.2 Environmental Consequences

3.11.2.1 Long-Term Impacts

The project area is located within the Portland CO and ozone maintenance area. Thus, the primary pollutants of concern for transportation projects are CO and ozone precursors (NO_x, and VOCs). Other pollutants of concern are fine particulate matter and MSATs. For these pollutants, a comparison between existing conditions and future conditions with and without the light rail project was made for the region. In addition, a projection of greenhouse gas emissions is included. Because CO is subject to the transportation conformity regulations, the analysis for CO includes a “hot spot” analysis of the impacts of the worst intersections as well as the regional emissions forecast. These analyses allow a comparison between existing conditions and future conditions with and without the light rail project.

Estimated region-wide total average weekday emissions of CO from vehicles (auto, truck, and transit) are shown in Table 3.11-2. VMT are projected to increase for the 25-year period between the existing (2005) and future (2030) scenarios as a result of growth in the region. The VMT for the No-Build Alternative are based on the conditions that would exist if the light rail is not built. The LPA to Park Avenue, LPA Phasing Option, and MOS to Lake Road VMT estimates reflect the changes in driving patterns if the light rail is built and also includes vehicle trips related to light rail transit (e.g., driving to park-and-rides) (see Table 3.11-2). The table also shows lower VMT with light rail than under the No-Build Alternative.

Despite the increase in VMT in the future, vehicle CO emissions are expected to be lower. This is possible because the projected increase in VMT would be more than offset by anticipated reductions in vehicle CO emissions due to improvements in technology, a compact urban form and land use pattern within the region, and more stringent vehicle inspection and maintenance programs. Regional CO emissions are expected to decrease for all future conditions relative to existing conditions.

Table 3.11-2 also shows, for informational purposes, the projected emission estimates for NO_x, VOCs, $PM_{2.5}$, and CO_2 for each alternative. Just as for CO, the regional vehicle-related emissions of $PM_{2.5}$, VOCs, and NO_x are projected to decrease between 2005 and 2030 due to improvements in vehicle emissions technology.

Greenhouse Gas Emissions

Unlike the decrease shown for other pollutants, Table 3.11-2 shows an increase in CO_2 emissions from 2005 to 2030 for the No-Build Alternative conditions as well as with the project, although the increase with the project is less than under the No-Build Alternative. This is because the current CO_2 emission factor from MOBILE6.2 (EPA's approved on-road emissions model) is only a function of the type and amount of fuel consumed and holds this constant between 2005 and 2030. Actual emissions depend on fuel usage, and CO_2 emissions increase as VMT increase. The recently enacted Corporate Average Fuel Economy (CAFE) fuel standards will decrease the emissions as a result of better fuel economy. These fuel standards have not been incorporated in the MOBILE6.2 emissions model. Regardless, CO_2 emissions would be slightly lower with the LPA to Park Avenue, LPA Phasing Option, and the MOS to Lake Road than with the No-Build Alternative.

Table 3.11-2
Estimated Regional Average Weekday Pollutant Emissions[1] for Motor Vehicles (tons/day)

Alternative	Vehicle Miles Traveled (VMT)[2]	CO	VOCs	NO_x	$PM_{2.5}$	CO_2
Existing Conditions (2005)	41,663,269	896.1	51.2	96.6	1.90	24,810
No-Build (2030)	58,479,607	584.5	18.0	15.9	0.82	36,292
LPA to Park Ave. (2030), including streetcar[3]	58,419,469	584.0	18.0	the	0.82	36,255
MOS to Lake Rd. (2030), including streetcar	58,416,647	583.9	18.0	15.9	0.82	36,253

Source: Air Sciences 2010.

[1] Emission factors are based on peak daily speed. They also include greenhouse gases (CO_2).

[2] VMT includes transit vehicles, which are not included in other measures of VMT shown in this FEIS (Chapter 4, Transportation and Section 3.12, Energy.)

[3] LPA Phasing Option values are similar to those for LPA to Park Avenue and the MOS to Lake Road.

Air Toxics

Table 3.11-3 shows the projected emission estimates for the MSATs for each alternative. Since naphthalene accounts for about 87 percent of the POM mass for mobile sources, naphthalene is used to represent POM emissions. For each alternative in this FEIS, the amount of MSATs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. Because the VMT estimate for the No-Build Alternative is higher than the VMT for the light rail project alternatives, lower levels of MSATs are expected from the light rail project compared to the No-Build Alternative. In addition, because the estimated VMT under each of the light rail project alternatives are nearly the same (they vary by less than 1 percent), it is expected that there would be no appreciable difference in overall MSAT emissions among the alternatives. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent from 1999 to 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in virtually all locations.

Table 3.11-3
Estimated Regional MSAT Pollutant Emissions (pounds/day)

Alternative	Benzene	1,3 Butadiene	Formaldehyde	Acrolein	Naphthalene/POM	Diesel PM
Existing Conditions (2005)	3206.3	387.8	1210.3	58.2	66.6	2,333.0
No-Build (2030)	1073.0	126.3	414.2	20.1	46.7	180.5
LPA to Park Ave. (2030) including streetcar*	1071.9	122.1	414	20.1	46.7	180.3
MOS to Lake Rd. (2030) including streetcar	1071.9	122.1	414	20.1	46.7	180.3

Source: Air Sciences 2009.

* LPA Phasing Option would be similar to those for the LPA to Park Avenue and the MOS to Lake Road.

Three intersections throughout the corridor were selected for analysis based on their projected 2030 traffic volumes or level of service (LOS). The selected intersections, or "hot spots," are those whose conditions would be most likely to have high CO concentration impacts. The highest CO concentration modeled for each intersection is shown in Table 3.11-4. Both one-hour and eight-hour CO concentrations were forecasted.

The results of the hot spots analysis show that all of the intersections modeled have maximum one-hour and eight-hour CO concentrations below the NAAQS of 35 parts per million (ppm) and 9 ppm, respectively. In addition, the results show that there would be either an improvement or no difference in localized CO concentrations between the existing and the future conditions for all alternatives. A comparison of the conditions with the LPA to Park Avenue and MOS to Lake Road to the No-Build Alternative shows that there would be no appreciable difference. Traffic volumes will increase between 2005 and 2030 but are more than offset by reductions in individual vehicle emissions resulting from technology improvements over the same period. As a result, the estimated one-hour and eight-hour CO concentrations for future years are lower than existing conditions. The light rail project has the potential to increase localized traffic volumes, delay, and queuing when compared to the No-Build Alternative conditions. However, because future individual vehicle emission rates would be reduced and conditions are already congested at most intersections under the No-Build Alternative conditions, very little change in CO concentrations is predicted.

Maintenance of light rail transit vehicles would occur at the TriMet Ruby Junction Facility in Gresham. Stationary sources such as maintenance facilities are subject to the permitting regulations of DEQ, and no impacts are expected as a result of maintenance facility operations.

Table 3.11-4
Highest Projected 8-Hour and 1-Hour Carbon Monoxide Concentrations Near Intersections (ppm)[1]

	SE McLoughlin Blvd./SE Harrison St. (Milwaukie)	SE Powell Blvd./SE Milwaukie Ave. (Portland)	SE Courtney Ave./ SE McLoughlin Blvd. (Milwaukie)
	1-Hour CO Concentration (federal standard 35 ppm)		
Scenario			
Existing (1-hour)	6.3	7.1	6.3
Opening Year No-Build (2015)	4.5	4.9	4.8
Opening Year LPA to Park Ave. (2015)	4.5	4.9	4.9
Opening Year MOS to Lake Rd. (2015)	4.5	4.9	4.6
Design Year No-Build (2030)	4.1	4.7	4.6
Design Year LPA to Park Ave. (2030)	4.1	4.7	4.8
Design Year MOS to Lake Rd. (2030)	4.7	4.7	4.5
	8-Hour CO Concentration (federal standard 9 ppm)		
Scenario			
Existing	5.3	5.9	5.3
Opening Year No-Build (2015)	3.9	4.2	4.1
Opening Year LPA to Park Ave. (2015)	3.9	4.2	4.2
Opening Year MOS to Lake Rd. (2015)	3.9	4.2	4.0
Design Year No-Build (2030)	3.6	4.1	4.0
Design Year LPA to Park Ave. (2030)	3.6	4.1	4.1
Design Year MOS to Lake Rd. (2030)	3.6	4.1	3.9

[1] ppm = parts per million; forecasts assume ambient background concentrations of 2 ppm.

3.11.2.2 Short-Term (Construction) Impacts

The primary impacts of construction would be the generation of dust from site clearing, excavation, and grading, and impacts to traffic flow in the project area. In addition, construction machinery, particularly with diesel engines, can affect air quality and cause localized concentrations of pollutants. The use of newer construction equipment can reduce diesel emissions, because new construction equipment is subject to exhaust emission standards similar to those imposed on on-road diesel engines. Traffic congestion increases idling times and reduces travel speeds, which results in increased vehicle emission levels. Construction of concrete structures may have associated dust-emitting sources, such as concrete mixing operations. Stationary sources such as concrete mix plants are generally required to obtain air contaminant discharge permits from the DEQ and to comply with regulations to control dust and other pollutant emissions. The No-Build Alternative would have the lowest construction impacts because it involves a smaller set of projects that would be constructed as part of the regional transportation improvement plan, and the LPA to Park Avenue would have the highest impact because it involves the highest amount of construction over the largest area.

Greenhouse Gas Emissions

The light rail project is likely to have higher CO_2 emissions than the No-Build Alternative during construction. However, the current methods for calculating CO_2 emissions from construction are primitive at best. The use of energy consumption for construction CO_2 is based on older methodologies and is likely overly conservative because these methodologies are designed to show whether a project or action would disrupt energy supply, but they are not intended for detailed estimates of fuel consumption. There are also many factors in the engineering and construction approach that would influence amount of CO_2 released. Thus, given the uncertainty, construction level CO_2 estimates were not attempted, because such estimates could lead to an inaccurate estimate of CO_2 impacts. However, the mitigation section describes emissions minimization measures that are available.

In addition, the long-term benefits of lower greenhouse gas emissions as a result of the project will offset construction period emissions and result in a long-term net reduction in greenhouse gas production compared to the No-Build Alternative.

3.11.2.3 Indirect and Cumulative Impacts

The forecast traffic volumes used to analyze air quality impacts of the light rail project include traffic from all sources. Background concentrations representing the cumulative emissions of other sources in the area are added to the predicted local concentrations for CO at intersections. Because of these inclusive analysis methodologies, the impacts shown throughout this section represent indirect and cumulative air quality impacts.

3.11.2.4 Compliance with State Implementation Plans

The Portland-Milwaukie Light Rail Project is included in the 2035 RTP financially constrained network and in the 2010-13 Portland area MTIP. Both the RTP financially constrained network and the MTIP have been determined to conform to the SIP. The long-term impacts analysis conducted for the FEIS also shows that the project would not cause or contribute to a violation of the NAAQS; the project therefore meets air quality conformity requirements.

The hot spots analysis performed for the SDEIS analyzed localized impacts at three intersections in the Portland-Milwaukie corridor that, based on traffic analysis findings, are expected to have the highest CO concentrations. The results showed that even at these highest impact locations, the NAAQS are not expected to be violated in the design year at any location for any alternative.

3.11.3 Mitigation

3.11.3.1 Long-Term Impact Mitigation

The results of the regional conformity and the local hot spots analyses show that no exceedances of the air quality standards are expected as a result of any project alternative; therefore, no mitigation is required. No localized impacts are predicted as a result of the construction of park-and-ride facilities; therefore, no mitigation is needed.

3.11.3.2 Short-Term Impact Mitigation

Construction contractors will comply with state regulations (OAR 340-208-0210) requiring that reasonable precautions be taken to avoid dust emissions. TriMet is assessing the use of incentives with the contractors to encourage best management practices with regard to air quality and diesel-powered construction equipment. This includes incentives for using low-sulfur fuel for diesel equipment and cleaner fuels for other equipment, properly maintaining equipment, reducing idling, retrofitting diesel engines with verified technologies, and replacing older equipment and engines.

Other best practices that are commonly used include applying water or suppressants during dry weather and taking other measures, such as truck and equipment washing, to prevent the transport of dirt and dust from construction areas onto nearby roads. To reduce the effect of construction delays on traffic flow and resultant emissions, road or lane closures could also avoid peak traffic periods, when detours or other measures would still result in extended periods of congestion. TriMet will also develop its procurements and specifications to encourage construction contractors to utilize newer equipment, since more recent engines are cleaner, particularly diesel. The contractor will also be encouraged to consider other construction approaches that minimize the use of fossil fuels and reduce localized exposure to emissions, particularly diesel.

For instance, staging areas for truck and motorized equipment with diesel-powered engines should be located where they have a minimum impact on sensitive populations, such as residences, schools, hospitals, and nursing homes. Also, trucks and other diesel-powered equipment can limit idling to five minutes, when the equipment is not in use or in motion, except:

- When traffic conditions or mechanical difficulties, over which the operator has no control, force the equipment to remain motionless
- When operating the equipment’s heating, cooling or auxiliary systems is necessary to accomplish the equipment’s intended use
- To bring the equipment to the manufacturer’s recommended operating temperature
- When the outdoor temperature is below 20° F
- When needing to repair equipment
- Under other circumstances specifically authorized by the Engineer

Strategies to minimize the occurrence and effect of roadway congestion during construction in the project area will be developed throughout the final design phase, as described in Chapter 4, Transportation.

3.12 ENERGY ANALYSIS

This section summarizes transportation energy consumption in the Portland metropolitan area for the No-Build Alternative and the Portland-Milwaukie Light Rail Project, considering consumption impacts during construction and operation. For more detailed information on the methodologies used here, see the *Energy Results Report* (Metro 2008).

3.12.1 Affected Environment

3.12.1.1 Base Year (2005) Transportation Energy Consumption

Base year (2005) transportation energy consumption in the Portland metropolitan area includes energy used for motor vehicles (automobiles, trucks, and motorcycles), the LRT system, transit vehicle maintenance and operation of maintenance facilities, and park-and-ride lots. Table 3.12-1 summarizes daily energy consumption for these activities. Base year (2005) total daily transportation energy consumption in the Portland metropolitan area is estimated at 353.152 x 10^9 (Billion) Btu[10] per day (Btu/day).[11]

Table 3.12-1
Transportation Operations Energy Consumption in Base Year of 2005
(Billions of Btu[1]) Portland Metropolitan Area

Vehicle and Facility Operations	Daily VMT[1]	Daily Fuel Consumption[2] (Gallons)	Daily Energy Consumption (Billions of Btu*)
Motor Vehicle Operations Totals (All vehicles except transit)	41,600,013	2,530,296	322.220
Motor Vehicle Maintenance[3]			28.908
Total Motor Vehicle Energy Usage			351.128
Transit Bus Vehicles	63,256	10,041	1.393
Non-Fuel Source Transit System[4]	12,130		0.339
LRT Maintenance Facility Operation[5]			0.029
Bus Vehicle Maintenance[5]			0.108
Bus Maintenance Facility Operation[5]			0.147
Park-and-Ride Operation[5]			0.008
Total Transit Energy Usage			2.024
Combined Energy Usage			353.152

Note: * Btu = British Thermal Unit, Btu/gallon of gasoline = 125,000 (gross), Btu/gallon of diesel = 138,700 (gross) .
[1] Metro 2002.
[2] Caltrans 1997.
[3] Caltrans 1983.
[4] Includes MAX, Portland Streetcar, and Tram; energy calculated as (8.2 kWH/car mile) x (13,127 car miles) x (3,412 Btu/kWH).
[5] TriMet 2007.

3.12.2 Environmental Consequences

This section summarizes the energy analysis for the Portland-Milwaukie Light Rail Project for:

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[10] Note: Energy consumption is measured in British thermal units (Btu [both singular and plural]). One Btu is the quantity of energy necessary to raise one pound of water one degree Fahrenheit at one atmosphere of pressure. For comparison, 1 gallon of diesel fuel = 138,700 Btu and 1 gallon of gasoline = 125,000 Btu. Also, 1 U.S. barrel of crude oil = 42 gallons of gasoline.
[11] Note: this number varies from the 2005 estimate presented in the SDEIS. The 2005 base year was updated to reflect the most recently available RTP network model outputs developed by Metro.

- Energy that would be consumed during operation of the light rail project (long-term or direct impacts), compared to the No-Build Alternative.
- Energy that would be consumed during construction of the light rail project (short-term or indirect impacts), compared to the No-Build Alternative.
- Projected long-term energy savings for the transportation system with the operation of the light rail project, compared to the No-Build Alternative.

The Related Bridge Area Transportation Facilities (i.e., the operation of the streetcar across the bridge and related roadway improvements) are incorporated within the regional transportation system forecasts that form the basis for the assessment of energy use. If they were not included as part of the light rail project, they would have a very minor difference in energy use (less than 1 percent) on a system-wide level. In general, long-term energy use would decrease slightly with the streetcar elements, since they improve transit services, increasing ridership. Short-term energy use is slightly higher with those elements of the project included, because they involve additional construction compared to the light rail facilities alone.

3.12.2.1 Summary of Long-Term Impacts

Direct (long-term) energy impacts would consist of energy consumed for operation of the vehicle transportation system and includes all modes operating within the regional transportation system, including cars, trucks, buses, and light rail. The energy consumed by light rail would result from maintenance, repair, and operation of the light rail system and the operations, maintenance facilities, and park-and-ride lots (although the park-and-rides may be deferred under the LPA Phasing Option) used for light rail transit. Table 3.12-2 summarizes the predicted operational energy use for the Portland-Milwaukie Light Rail Project in the year 2030. The comparisons assume that gasoline prices would have to increase significantly to trigger a major change in gasoline consumption.

Compared to the No-Build Alternative, the light rail project would reduce operational energy use. For example, the No-Build Alternative would consume the most energy, with use peaking at 495.458 x 10^9 Btu/day. With the LPA to Park Avenue, the LPA Phasing Option, or the MOS to Lake Road in place, the regional transportation system would consume less energy, or up to 546 billion Btu/day, which equates to 4,368 gallons of gasoline per day (or 3,937 gallons of diesel per day). While the regional energy savings of approximately 0.1 percent is small in percentage terms, this is largely due to size of energy consumption considered at the regional level. The difference between the LPA to Park Avenue and the MOS to Lake Road themselves is smaller: the LPA to Park Avenue would consume less than 0.01 percent more energy daily than the MOS to Lake Road (the LPA Phasing Option consumption energy savings compared to No-Build would be less than that for the LPA to Park Avenue and the MOS to Lake Road), but all project scenarios would have a beneficial effect on energy consumption by lowering regional demand. Compared to the No-Build Alternative, this would also reduce the consumption of fossil fuels, a major source of greenhouse gas emissions, as discussed in Section 3.11, Air Quality.

Table 3.12-2
Summary of Daily Corridor Transportation Operations Energy Consumption in 2030 (Billions of Btu[1]) Portland-Milwaukie Light Rail Project

Energy Usage	No-Build	MOS to Lake Rd.*	LPA to Park Ave.**
Motor Vehicle Operations Totals	452.225	451.674	451.701
Motor Vehicle Maintenance	40.573	40.523	40.526
Total Motor Vehicle Energy Usage	492.798	492.197	492.227
Transit Bus Vehicles	2.002	2.027	2.027
Commuter Rail Vehicles	0.005	0.005	0.005
Non-Fuel Source Transit System	0.303	0.327	0.330
LRT Maintenance Facility Operation	0.036	0.039	0.039
Bus Vehicle Maintenance	0.156	0.158	0.158
Rail Vehicle Maintenance	0.000	0.000	0.000
Bus Maintenance Facility Operation	0.147	0.147	0.147
Park-and-ride Operation	0.011	0.012	0.012
Total Transit Energy Usage	2.660	2.715	2.718
Combined Energy Usage	495.458 [2]	494.912	494.945

* The Ruby Junction Facility and Bridge Area Transportation Facilities, including streetcar, are within these regional transportation system calculations. Modeling includes the completion of the Portland Streetcar Loop.

** The LPA Phasing Option values are similar to those of the MOS to Lake Road and the LPA to Park Avenue.

Sources: DEA 2009, Metro 2009, TriMet 2009, Caltrans 1974.

[1] Btu = British Thermal Unit. Btu/gallon of gasoline = 125,000 (gross), Btu/gallon of diesel = 138,700 (gross)

[2] This number differs from the SDEIS. The No-Build has been updated to reflect the most recent RTP network model outputs.

3.12.2.2 Short-Term Impacts (Construction)

For the purpose of assessing indirect (short-term) impacts to energy consumption that would occur from construction of the Portland-Milwaukie Light Rail Project, the analysis focused on the greatest effect alternative (LPA to Park Avenue), which entails the most construction and therefore consumes the most energy during construction. As shown in Table 3.12-3, construction energy usage would be 2,943.6 x 10^9 Btu/day. The level of energy required for project construction is based on preliminary engineering and anticipated construction costs, and factors are then applied to estimate likely levels of energy consumption.

Table 3.12-3
Summary of Construction Energy Consumption (Billions of Btu[1]) Portland-Milwaukie Light Rail Project Alternatives

No-Build	Greatest Effect Alternative (LPA to Park Ave.)*
0	2,943.6

* The Ruby Junction Facility and the Related Bridge Area Facilities, including streetcar, are within these calculations.

Sources: Metro 2009, TriMet 2009, Parametrix 2010.

[1] Btu = British Thermal Unit. One gallon of gasoline = 125,000 Btu. One gallon of diesel = 138,700 Btu.

3.12.2.3 Summary of Total Energy Impacts

Table 3.12-4 summarizes the operational annual energy use for the Portland-Milwaukie Light Rail Project.

Table 3.12-4
Summary of Annual[1] Energy Consumption by Alternatives (Billions of Btu[2])

Alternative	Motor Vehicle[3] Annual Energy Use	Bus Annual Energy Use	LRT Annual Energy Use	Total Annual Operations Energy	Annual Operational Energy Savings[4]
No-Build	167,551.32	783.70	120.70	168,455.72	0.0
MOS to Lake Rd.*	167,346.98	792.88	130.22	168,270.08	185.64
LPA to Park Ave.*	167,357.18	792.88	131.24	168,281.30	174.42

* The Ruby Junction Facility and the Related Bridge Area Facilities, including the streetcar facilities, are assumed within these regional transportation system calculations of energy use. The LPA Phasing Option would be similar to LPA to Park Avenue and the MOS to Lake Road.

Sources: DEA 2009, Metro 2009, TriMet 2009.

1 Assumes an annualization factor of 340 days per year.

2 Btu = British Thermal Unit. One gallon of gasoline = 125,000 Btu. One gallon of diesel = 138,700 Btu.

3 Not including buses.

4 As compared to No-Build Alternative.

3.12.2.4 Cumulative Energy Impacts

The light rail project is expected to have beneficial effects but would not be likely to alter energy supply or consumption at a regional level, and, therefore, cumulative effects of this project with other projects and ongoing increased demand for energy are expected to be limited. Construction and operation of the project is not expected to affect local or regional fuel availability or require the development of new energy sources. Compared to the No-Build Alternative, operation of either the LPA to Park Avenue, the LPA Phasing Option, or the MOS to Lake Road would cumulatively reduce overall VMT and associated energy consumption in the Portland metropolitan area.

3.12.3 Mitigation

One of the goals for the Portland-Milwaukie Light Rail Project is to reduce long-term demand for energy. Operation of either the LPA to Park Avenue, the LPA Phasing Option, or the MOS to Lake Road would not affect regional power supply and would reduce overall energy consumption for the total transportation system compared to the No-Build Alternative. Therefore, no mitigation measures are necessary to meet this goal.

3.13 HAZARDOUS MATERIALS

This section identifies known and suspected hazardous materials sites in the vicinity of the Portland-Milwaukie Light Rail Project and evaluates short-term and long-term impacts of the construction and operation of the light rail project. The section provides minimization and mitigation measures to address identified impacts.

For the purposes of this FEIS, a hazardous material is soil, sediment, water, and/or building materials that contain detectable concentrations of a regulated organic and/or inorganic contaminant. Unchecked, hazardous materials could impact the project in terms of financial liability from property acquisition; exacerbation of existing contamination; risk to workers, the public, and/or the environment; project schedule delay; and increased project cost. Conversely, identifying and remediating hazardous materials can have long-term benefits to human health and the environment.

3.13.1 Affected Environment

3.13.1.1 Project Study Area

The project study area is defined as a 500-foot buffer, which encompasses the locations most likely to have direct impacts from construction and operation of the light rail project, including its alignment and related facilities.

3.13.1.2 Project Elements

The light rail project consists of an array of project elements that support light rail, streetcar, bus, bicycle, and pedestrian travel, as well as providing for related street improvements, stations, and park-and-rides.

Certain project elements, such as structures, will require more complex and intensive construction activities and/or operation than others. For instance, construction of the Willamette River bridge is the most substantial structural element of the project, and this element sets the sequencing for other project components. The river crossing and adjacent transit improvement elements will require the majority of construction activity necessary to complete this project.

In general, project construction activities that create significant subsurface disturbances have the greatest potential to exacerbate existing contamination or generate hazardous or non-hazardous waste requiring special handling and disposal. These activities include excavation, fill, grading, foundation installation, scour protection, sediment capping, soil stabilization, dewatering, demolition of acquired structures, and utility line installation.

3.13.1.3 Physical and Environmental Setting

The project corridor lies within the Portland Basin. Elevations in the project study area range from 10 feet mean sea level (MSL) in the Willamette River floodplain to about 45 feet MSL in upland areas. The Willamette River is the dominant topographic feature within the project study area. The river intersects the project study area at river mile (RM) 13.5. The river is approximately 1,000 feet wide and extends to a depth of approximately -70 feet MSL. In-water sediments at RM 13.5 are deposited along the west side of the river, creating a broad, shallow water environment approximately 350 feet wide. A fairly thin and steep depositional shelf is observed on the east side of the river. Sediment in the river is contaminated from historical riverside industry and stormwater discharge. Willamette River surface water quality also can be impaired from combined sewer and stormwater overflow events.

The river has a number of small tributary creeks that intersect the light rail project and provide localized drainage. These include Crystal Springs Creek, Johnson Creek, Crystal Creek, Spring Creek, Kellogg Lake, and Courtney Springs Creek. Surface water quality is impaired in Johnson Creek, and sediments in Kellogg Lake are contaminated from commercial and industrial activity. Kellogg Lake has been dammed at the mouth of Kellogg Creek since the early 1900s.

A succession of fill material was placed along the east and west sides of the Willamette River to accommodate the growth of riverside industrial uses. Fill also is present in areas throughout the project study area. The thickness, extent, and composition of the fill vary. Where undisturbed, soils consist of sandy to clayey loams that vary in their ability to infiltrate water to the subsurface. Underlying these units are unconsolidated sediments related to Pleistocene-aged catastrophic flood deposits and Quaternary alluvial deposits of the ancestral Willamette River. These sediments consist of sands and gravels, with local accumulations up to 250 feet thick. These in turn are underlain by ancestral Columbia River consolidated sedimentary deposits of the Troutdale Formation.

The most productive zones for groundwater use in the project study area are the Unconsolidated Sedimentary Aquifer (USA) and the Troutdale Gravel Aquifer (TGA), which compose the upper sedimentary subsystem of the Troutdale Aquifer. The USA is composed of unconsolidated material associated with the catastrophic flood deposits and alluvium deposits. The TGA is composed of unconsolidated, semi-cemented and/or cemented material associated with the Mio-Pliocene-aged Troutdale Formation. The USA and TGA contain the majority of water supply wells and will likely continue to be the source of water supply as demands increase. However, there is no drinking water beneficial use of groundwater within the project study area. That is, drinking water is supplied by City of Portland and City of Milwaukie municipal water systems from sources outside the project study area. Within the project study area, groundwater is extracted from the Troutdale Aquifer for irrigation, industrial, and commercial use. Groundwater resources within the project study area are not considered part of the Troutdale Sole Source Aquifer designated by the EPA.

3.13.1.4 Hazardous Material Sites

For the purposes of this FEIS, a hazardous materials site is a location or facility that potentially contains a recognized environmental condition (REC). The term “recognized environmental condition” is defined by American Society of Testing Materials E-1527 as:

> ...the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws.

A review of regulatory database records from federal and state sources was conducted on October 22, 2007, by Environmental Data Resources to provide information on sites with RECs within the project study area. A supplemental web-based database search was conducted independently by project staff on November 10, 2009, to account for any changes in the regulatory environment within the project study area. The review of sites found 374 potential hazardous materials sites within the project study area. This number is not unusual for an established urban area that includes waterfront, rail corridors, major highways, and a number of industrial areas.

Hazardous material sites identified in one or more of the listed databases were ranked based on a assessment of their potential to act as a contaminant source. Ranking was based on the following criteria:

- Location of the site in relation to proposed property acquisitions or construction activities.

- Type of database listing. Identified sites were assigned a database class (A, B, or C) based on the regulatory significance of the database listing for that site, where A represents a high possibility that hazardous substances are present in soil, groundwater, sediment, or surface water at the site and C indicates a low possibility.
- Status of cleanup – Active, Inactive,[12] or unknown.

Identified hazardous material sites were ranked on a relative scale of 0 to 5 (low to high) for being a potential source of contamination within the project study area. Ranking is based on the following criteria: proximity of the site to the light rail project; if the site will be acquired; if a release occurred; and status of the site. Out of 374 sites identified during the database search, 42 sites have a #4 ranking, indicating a moderate to high potential as a source of contamination, and 17 sites have a #5 ranking, indicating a high potential to be a source of contamination. These 59 sites are referred to as higher priority sites because of their potential to cause environmental effects.

Project elements that require intensive or complex construction activities and are co-located with higher priority sites have the greatest potential to exacerbate existing contamination during construction or may pose long-term effects during operation, or both (Figure 3.13-1).

3.13.1.5 Regulatory File Review and Other Investigations

Based on the ranking results and the complexity of construction and long-term issues for a selected set of sites, a review of files from the Department of Environmental Quality (DEQ) was performed on three hazardous material sites (all ranked #4 or #5) that represented the highest levels of concern for the light rail project. These sites were in the South Waterfront District or the Central Eastside Industrial District, along the Willamette River. These are the areas where the project will have the most intensive construction activity in order to build the new bridge, and where there are the largest sites with high levels of contamination in both upland and in-water media. The file review provided the project with further understanding of the contaminant release, type of contaminants, affected media, and current status of these sites.

In addition, the project reviewed the results of earlier field surveys and tests at Kellogg Lake in Milwaukie, where contaminated sediments exist and where the project is developing a new structure that will involve in-water construction.

Summary of Sites of Concern

Zidell Companies Property

A property owned by Zidell Companies (Zidell) extends along the west bank of the Willamette River between the I-5 Marquam Bridge and just south of the US 26 Ross Island Bridge. The site is approximately 32.2 acres. Approximately 15.7 acres are currently undeveloped (Figure 3.13-2). Zidell continues a ship-building operation on a portion of the property located south of the Ross Island Bridge.

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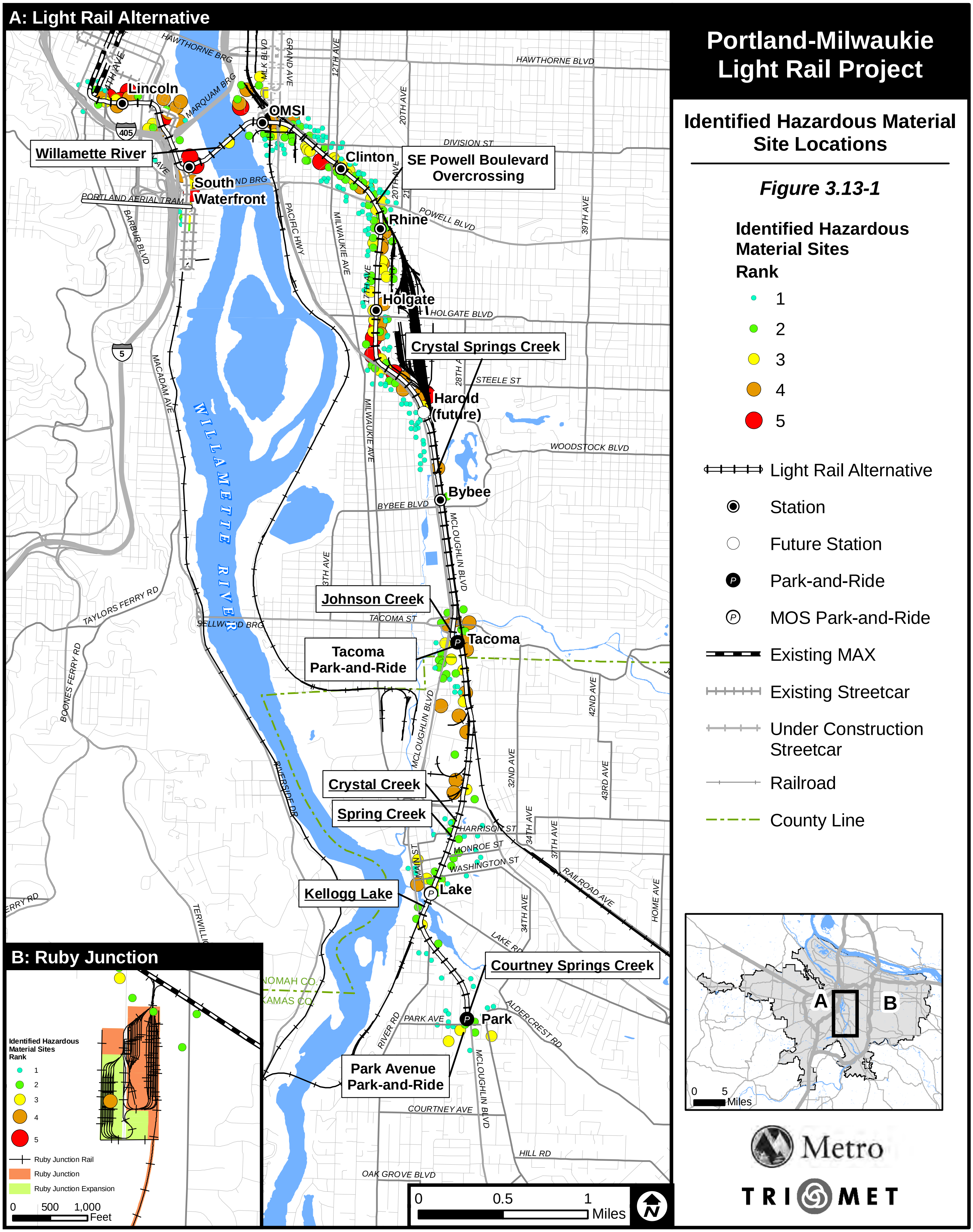
[12] All sites are considered active unless identified as having no further action or inactive status.



December 2009

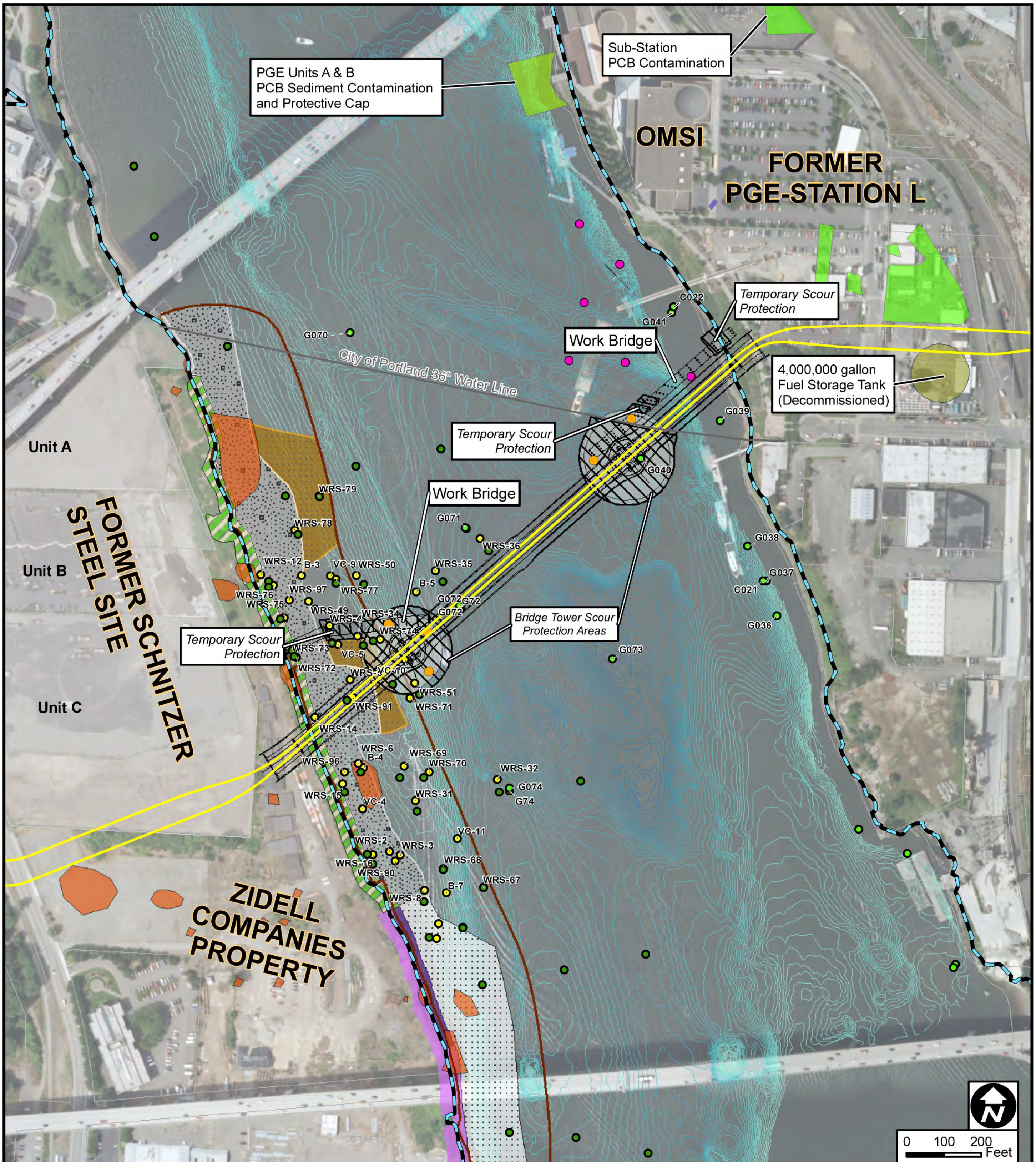


Figure 3.13-2: Willamette River Area - Sites of Concern

Existing Conditions

- Zidell Property Sediment Sample Locations
- Approximate 2009 City of Portland Downtown Sample Locations
- Approximate 2009 City of Portland Sample Locations
- TriMet Sample Locations
- Ordinary High Water
- PCB Contaminated Sediments
- Hot Spot Locations

Zidell Property Remedial Actions Features*

- Sediment Management Area
- Vegetated Soil
- Sand
- Type A Rock Armor
- Type B Rock Armor

Light Rail Project Bridge Features

- Tower Scour Areas
- Scour Protection Areas

Bathymetry
0ft 70ft

*Source: Zidell Initial Remedial Design Report, July 2009

June 2010

Industrial activities have been conducted on this site from the 1890s to the present. Zidell has operated at the site from the 1940s; activities include dismantling and selling the scrap of World War II-era ships and constructing barges and other crafts. The World War II-era ships were dismantled alongside a dock at the site, and petroleum products were pumped off the ships into portable storage tanks on the docks. Many oil spills on the property were documented from the 1960s to 1980s. A dock fire occurred in 1956 that destroyed several oil tanks. Ship-related transformers may have also been kept on-site. Ship paint was sandblasted off, and the material was allowed to enter the Willamette River. This debris would often contain lead-based paint. Asbestos containing material (ACM) incorporated into ship construction was removed from the ships and piled along the river bank. Oil from decommissioned ships was recovered and processed using oil/water separators and an old ship hull floating on the river. Soil, sediment, and groundwater contamination have resulted from spills to surface soils and the Willamette River, past operating practices, open burning, and uncontrolled filling.

Contaminants identified in the soil include: metals, petroleum hydrocarbons, asbestos, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). Surface and near-surface soil contaminants may pose the most significant threat to human health via direct contact, ingestion or possibly inhalation. Chlorinated volatile organic compounds (CVOCs) have been detected in sludges from oil/water separators. Areas with high levels of contamination in soil (commonly known as "hot spots") are displayed on Figure 3.13-2.

Contaminants identified in groundwater include: metals, CVOCs, PAHs, and PCBs. Pesticides and herbicides have been detected on-site, although they are thought to originate from the adjacent former Schnitzer Corporation site. Groundwater beneficial use in the immediate vicinity of the Zidell property appears limited. However, groundwater does discharge to the Willamette River.

Contaminants identified in sediments include: metals (antimony, arsenic, cadmium, chromium, lead, mercury, copper, nickel, and zinc), tributyltin, PAHs, and PCBs. Approximately 17 acres of sediments within 100 feet of the west bank of the Willamette River are impacted by PCBs and metals. Sediments contaminated with PCBs are thought to pose a threat to the health of aquatic organisms.

Proposed Remedial Actions (RAs) for the Zidell Property

The Zidell property's proposed RAs for contaminated sediment consist of hot spot removal, select dredging, placement of a sediment cap, and long-term monitoring and maintenance of a sediment management area that extends into the river and downstream of the property. The sediment cap encompasses an area of approximately 16 acres, extending from Zidell's barge ramp to the Marquam Bridge (Figure 3.13-2). The proposed sediment cap design consists of different rock type armaments. Within the footprint of the project study area, the sediment cap consists of Type A rock armor and a thin layer sand cap. The Type A rock armor is composed of a 24-inch-thick layer of clean sand and gravel material. Long-term maintenance and monitoring of the cap will be conducted to determine the effectiveness of the remedy. Currently, DEQ is reviewing the Zidell Initial Remedial Design Report, which was submitted in July 2009. The final sediment cap is anticipated to be completed by the winter of 2012.

The remedial design of the river embankment is an important component for bridge design and construction. The remedial design for both the embankment and the sediment cap will be shaped by a number of factors that include, but are not limited to, requirements of federal agencies (National Oceanic and Atmospheric Administration, U.S. Army Corp of Engineers (USACE), U.S. Fish and Wildlife Service), state agencies (DEQ, Oregon Department of State Lands [DSL]), and city departments (Bureau of Environmental Services, Bureau of Development Services, Bureau of Parks and Recreation, Portland Development Commission), as well as input from the private sector and environmental groups. Remedial design (50 percent) will be consistent with Zidell's submittal of a 404 permit application and Biological Assessment. A wide range of design options will be considered for fish habitat, capping material, embankment slopes, step backs, armament, and grade. In addition, the design and permitting of the RAs is likely to need to address the requirements of the City of Portland's Willamette River Greenway. Long-term maintenance and monitoring of the embankment cap will be conducted to determine the effectiveness of the remedy.

RAs for upland soils include:

- Implementation of interim source control measures to prevent releases of contaminants to the Willamette River through control of stormwater runoff from uplands and riverbank soils
- Excavation of approximately 8,000 cubic feet of contaminated soil exceeding Oregon DEQ's recommended concentrations and/or containing ACMs or asbestos-containing soils; soil would be staged in one on-site management area before disposal off-site
- Excavation and on-site consolidation of contaminated soils exceeding cleanup levels in the greenway and/or right-of-way to non-greenway areas prior to soil capping (Note: The size or boundaries of these areas have not been determined)
- Placement of an engineered soil cap over residual soil contamination that still exceeds state and federal agency-recommended concentrations; the cap dimensions have not been approved
- On-site soil management, which includes storage, characterization, and disposal and/or containment of soils disturbed by the remedial action
- Long-term monitoring to ensure that the above measures are effective

Legal restrictions limiting in-water and uplands development may also be put in place. In-water restrictions and other institutional controls may require approval by DSL and/or Zidell.

OHSU/ Former Schnitzer Corporation Property

The former Schnitzer Corporation property is an approximately 13.5-acre parcel. The property is currently owned by OHSU and is separated into three units: A, B, and C (Figure 3.13-2). Unit A is the northernmost unit and is 3.4 acres in area. Unit A borders the I-5 Marquam Bridge to the north, SW Moody Avenue to the west, and the Willamette River and the Zidell property to the east. Some construction has occurred on Unit A related to the City of Portland's Combined Sewer Overflow project, including a pipeline installation. DEQ has allowed Cirque du Soleil to set up large tents and other temporary support structures about once a year on Unit B, and has allowed parking on other portions of the Schnitzer property. Recently a parking lot has been constructed on the northern portion of Unit B. The southernmost portion of the property, Unit C, is 10.2 acres in area and is currently undeveloped.

The Miller Products Company operated a pesticide and agricultural products manufacturing facility on Unit A from the 1920s to the 1960s. Miller Products housed its plant on the northern third of the property. A main environmental feature was a holding pond (sludge pond) that contained lime sludge from the pesticide production process. The facility was purchased by R.W. Grace in 1965. Units B and C were occupied by Barde Steel Company (a plate and structural steel warehouse) and Alaska Junk Company (a metals salvaging, ship dismantling, and automobile shredding operation). All three units were purchased by Schnitzer in 1972, and donated to OHSU by Schnitzer in 2004.

Contaminants identified in Unit A soils at the site to date include chlorinated pesticides, PCBs, petroleum hydrocarbons, CVOCs, and metals. Metals are primarily found in fill debris, which contains metal pipes, drums, cans, and sheet metal. The highest concentrations of pesticides have been identified in the former sludge area and building footprints. Contaminants identified in Unit C soils at the site to date include lead, PCBs, and PAHs.

Contaminants identified in Unit A groundwater at the site to date include metals and volatile organic compounds, and hydrogen sulfide. Hydrogen sulfide is thought to be a by-product of sulfur compounds associated with sludges. Inhalation of hydrogen sulfide is considered a threat to site workers.

Remedial Actions for the former Schnitzer Corporation Property

Direct contact with soil contamination was the primary concern driving much of the remedial work. RAs on Unit B are complete and consist of a soil cap. Phase I of the RAs for Units A and C is complete and included removal of surface soils and a one-foot gravel/geotextile cap as an interim remedial action measure (Figure 3.13-2). Phase II RAs for Units A and C are pending. RAs for these units include capping during site development that will be completed by OHSU; these RAs were initiated with submittal of the Draft Phase II work plan in July 1997.

Portland General Electric (PGE) Property – Station L

A site that was formerly owned by PGE is located on the eastern bank of the Willamette River. The 28-acre site is bounded by SE Market Street, SE Water Avenue, and SE Caruthers Street (Figure 3.13-2). PGE donated the northern 18 acres to the Oregon Museum of Science and Industry (OMSI) on December 31, 1986. OMSI currently operates on the majority of the property once held by PGE. PGE still maintains a substation on the northeast corner of the property. PGE is responsible for cleanup of donated land. PGE entered into a Consent Order (ODEQ ECSR-NWR-88-02) in March 1988.

The PGE Station L steam power generation facility was constructed around 1910, and served communities in Oregon and Washington until approximately 1975. In addition to the steam plant, many related facilities and activities occurred at Station L. These facilities included fuel storage, two electrical substations, underground storage tanks, aboveground storage tanks, a warehouse, utility pole storage, a staging area, and a motor pool. Several areas on the site were used for the storage of electrical equipment. PCB oils were generally used in electrical equipment from the mid-1930s to the 1970s.

Releases of PCBs and petroleum products to site soils and groundwater are known to have occurred. Willamette River sediments are known to be contaminated with PCBs. This contamination likely occurred from releases of oil from transformers. Areas of the site with potential environmental concerns are shown on Figure 3.13-2.

Soils with elevated concentrations of petroleum hydrocarbons were detected beneath a helipad at the site. PCBs were detected in surface soils throughout the site. In approximately 1993, a 4-million-gallon aboveground storage tank was demolished in the southeast corner of the site after petroleum-contaminated soil was discovered beneath the tank. A limited area of gasoline-contaminated groundwater is also present in the northern portion of the site.

In contaminated sediments in the area, the maximum residual concentration of PCBs is approximately 21 parts per million (ppm), with an average concentration of 8 ppm. For comparison, the USACE sediment screening levels for PCBs in fresh water is 0.06 ppm. The impacted sediments are located just west of the turbine building at OMSI.

Remedial Actions for the PGE Property

The Consent Order specifies that remedial work be conducted in three phases. The first two phases dealt with PCBs contamination caused by release of transformer fluid into Willamette River sediments. This area is also referred to as Units A and B, which consist of an 80-foot-by-120-foot area bordering the eastern bank of the Willamette River. Phase I involved the removal of PCB-contaminated sediment exposed by low river conditions in Units A and B in the summer of 1988. Phase II involved removal and capping. River sediment remediation, including dredging of 17 tons of river sediment and capping, was conducted from July 1990 to January 1991. The regulatory order also required dredging sediments to a depth of 2 feet below the river bed, coating contaminated concrete with a special sealant, and capping the contaminated area with at least 6 feet of a multilayer cap composed of sand, gravel, and riprap. DEQ issued a Certificate of Completion for Phases I and II of the sediment cleanup in April 1991. Monitoring of the sediment cap is ongoing through 2020.

Phase III required that PGE investigate the nature and extent of chemicals present in sediment, soil, groundwater, surface water, and structures on the upland portion of Station L. This area is also referred to as Unit C, which is approximately 18 acres. The work was completed by PGE in July 1993. A No Further Action for the site was issued by DEQ on September 26, 1994. A Willamette River sediment cap monitoring program is ongoing until 2020.

Kellogg Lake

The light rail project team also reviewed information for Kellogg Lake, because sediments within the lake are known to be contaminated and in-water work activities are proposed. The site contamination stems from a sawmill formerly located near the dammed mouth of the lake, and historic discharges from unidentified upland and upgradient sources. Under request from the City of Milwaukie as part of a proposed restoration of the lake, a limited sediment evaluation was conducted in the summer of 2002. The evaluation indicated that surface sediments within the lake had detectable concentrations of pesticides (DDT, chlordane), PCBs, and PAHs that exceeded USACE sediment evaluation framework screening levels.

3.13.2 Environmental Impacts

3.13.2.1 Long-Term Impacts

This section discusses future long-term effects from the operation and maintenance of the light rail project, and provides a comparison to the No-Build Alternative. Potential long-term impacts include financial liability or costs arising from the ownership, operation, and maintenance of the light rail project in hazardous material areas.

Operation of transit may result in release of hazardous substances or petroleum products into the environment from accidental spills. These releases, which would primarily be related to maintenance operations, since the light rail vehicles do not contain fuel, can migrate to surface water or groundwater, and/or affect properties outside of the right-of-way. Impacts include road closures and delays, cleanup costs, and regulatory fines.

Scour around Willamette River pier structures could also result in long term-impacts to the environment. Preliminary scour modeling indicates that substantial scour footprints would occur during a 100-year flood event around each pier tower if not mitigated correctly (see Figure 3.13-2). Resulting scour could resuspend contaminants into the water column, redeposit contaminants down river, and/or expose new contaminant surfaces. Scour around the west tower piers could undermine Zidell's proposed sediment cap. Scour around the east tower piers could compromise the integrity of the City of Portland's 36-inch water line (see Figure 3.13-2).

Long-term liability could result from the ownership of, or becoming legally obligated to, a property that is undergoing investigation, cleanup, and/or requirements associated with long-term operation of cleanup action. Liability may come in the form of restriction in current or future property use, and/or incurring costs for cleanup, and/or interfere with project operation and maintenance. Liability regulations require that the potential purchaser apply an all appropriate inquiry, or AAI, prior to property transaction as a means of safeguarding and managing liability. In this way RECs are disclosed prior to the sale of the property. This may result in responsibility for cleanup by the seller and or reduction in the property's value. Of the properties that may be fully or partially acquired, 66 have been identified as hazardous material sites (ranked 3, 4, or 5). Of these 66 sites, 33 (including 1 at Ruby Junction) have potentially significant environmental issues (ranked 4 or 5). A summary of these sites is displayed in Table 3.13-1.

Table 3.13-1
Summary of Sites with Complex Contamination Issues that Would Potentially Be Acquired by the Portland-Milwaukie Light Rail Project

Site ID	Name	Address	Ranking
1	PGE Station L/OMSI	1701 SE Water Ave.	4
6	PGE Station L	1841 SE Water Ave.	5
12	Majestic Cleaners West & Laundry Inc.	1975 SW 1st Ave.	5
16	2020 SW 4th Ave.	2020 SW 4th Ave.	5
17	Budget Rent A Car System Inc.	2033 SW 4th Ave.	4
19	245 SW Lincoln St.	245 SW Lincoln St.	5

Table 3.13-1
Summary of Sites with Complex Contamination Issues that Would Potentially Be Acquired by the Portland-Milwaukie Light Rail Project

Site ID	Name	Address	Ranking
23	Red Lion Hotel - Downtown	310 SW Lincoln St.	4
32	South Waterfront Redevelopment Area 3	SW River Pkwy., SW River Pkwy./ SW Harbor Dr.	5
34	Risberg S Truck Line	2339 SE Grand Ave.	4
84	NW Natural Gas Portland Gas & Coke Gas	2630 SE 9th Ave.	5
93	SW Moody Ave. - Right-Of-Way	SW Moody Ave.	5
97	Adeline Landis	1267 SE Gideon St.	5
116	North Pacific Lumber Co.	1505 SE Gideon St.	4
129	Zidell Marine Corporation	3121 SW Moody Ave.	5
167	Kalacraft, Inc., Pai Custom Cabinet Inc.	3600 SE 17th Ave.	4
168	PGE, Central Service Center	3700 SE 17th Ave.	4
172	Portland General Electric Company	3840 SE 17th Ave.	4
194	Pmt Properties	4621 SE 17th Ave.	5
200	Peco Mfg. Co. Inc.	4707 SE 17th Ave.	5
205	Columbia Battery Mfg. Co.	4915 SE 17th Ave.	5
214	Piper Storage & Transport Inc.	5200 SE McLoughlin Blvd.	5
216	ADM Company, Minnesota Corn Processors, LLC	5300 SE McLoughlin Blvd.	4
223	Hydraulic Oil - UPRR 05-0701	5425 SE McLoughlin Blvd.	5
224	UPRR – Brooklyn Yard	5424 SE McLoughlin Blvd.	4
225	Brooklyn Yard	Brooklyn Yard	5
250	Old Shell Station/Oregon Worsted Co.	8118 SE McLoughlin Blvd.	4
276	West Coast Training Inc.	2525 SE Stubb St.	4
279	ODOT Region 1	9002 SE McLoughlin Blvd.	4
338	City Of Milwaukie	11100 SE McLoughlin Blvd.	4
360	Schnitzer – SW Moody Ave. Units A, B & C	2750 SW Moody Ave.	5
371	VLF	301 SW Lincoln St.	4
372	Groundwater	SE 1st Ave. and Stephens	5
RUBY JUNCTION	Coachman Body and Frame	1841 Eleven Mile Road	4

No-Build Alternative

The No-Build Alternative has no potential for impacts from property acquisition liability. For the purposes of this FEIS, the environmental conditions and local settings would remain unchanged and are used for comparison purposes.

The No-Build Alternative would not have impacts due to construction, operation, and maintenance of the light rail project, but the region would continue to operate bus transit service and related facilities to serve the travel needs along the corridor, and these facilities and services involve the use of hazardous materials. Further, the No-Build Alternative would not include remediation of sites that, if properly completed, would reduce overall environmental hazardous materials.

Locally Preferred Alternative (LPA) to Park Avenue

The LPA to Park Avenue has the potential to have impacts from property acquisition liability. This includes properties that will be fully or partially acquired or have permanent easements for the LPA to Park Avenue. Of these properties, 65 (not including 1 at Ruby Junction) have been identified as hazardous material sites (ranked 3, 4, or 5). Thirty-two (32) properties are ranked as priority sites (a ranking of 4 or 5). The project will require property acquisition, which may result in ownership of properties undergoing some form of actions overseen or conducted by regulatory agencies. Actions may include site investigation, cleanup, or long-term operation, maintenance or monitoring of an RA.

Of particular concern are potential long-term liabilities to future RAs conducted by Zidell. Operation and maintenance of the LPA to Park Avenue may affect the integrity, operation, and/or monitoring of future RAs conducted by Zidell. These RAs include, but are not limited to, in-water sediment cap, limited dredging, soil removal and capping, embankment modifications, and deed restrictions on land use. Scour protection is being placed around the west tower piers to ensure that sediments within Zidell's proposed sediment cap are not compromised. TriMet is working with Zidell and DEQ to coordinate placement of TriMet's scour protection and placement of Zidell's sediment and embankment modifications. This effort is more fully described in the Biological Assessment and the Joint Permit Application.

The Ruby Junction Facility would contain most of the project's operating and maintenance materials, which include hazardous materials. Additionally, the project's Willamette River bridge could result in changes in hydrology and could cause sediment scour, potentially causing the spread of contaminated materials. However, the project design includes measures to minimize these effects.

The LPA to Park Avenue has a potential for impacts from legacy sites. These effects are expected to be significant if not mitigated correctly. A number of priority hazardous material sites occur within or near the physical footprint of the LPA to Park Avenue alignment and its facilities. Of particular concern are the Zidell Site (ESCI No. 689), the PGE Station L (ESCI No. 51), Former Schnitzer Steel Property (ESCI No. 875), Majestic Cleaners (ESCI No. 2459), Southwest Waterfront Redevelopment Area 3 (ESCI No. 2492), NW Natural Gas, Portland Gas & Coke (ESCI No. 1488), PECO Manufacturing Company, Inc. (ESCI No. 1973), SW Moody Ave. Right-of-Way (ESCI No. 1401), and Columbia Battery Manufacturing Co. (ESCI No. 4282). These sites have not completed their cleanup actions and/or have not received a No Further Action determination by the DEQ. In addition, a potential legacy site could be discovered during project construction activities.

LPA Phasing Option

The LPA Phasing Option will have the same potential impacts as the LPA to Park Avenue.

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road has the potential to have impacts from property acquisition liability. This includes properties that will be fully or partially acquired, or will have permanent easements. Of these properties, 65 have been identified as hazardous material sites. Thirty-three (33) properties (not including 1 at Ruby Junction) are ranked as priority sites, and are the same properties affected by the LPA to Park Avenue until the MOS to Lake Road reaches SE Lake Road, where additional properties would be acquired to develop a park-and-ride near the Lake Road Station. As with the LPA to Park Avenue, the primary sites of concern for the MOS to Lake Road are near the Willamette River bridge crossing. The MOS to Lake Road would avoid the new bridge structure in Kellogg Lake, where hazardous sediments exist.

Related Facilities

Related Bridge Area Transportation Facilities

The Related Bridge Area Transportation Facilities are within the same project study area as the LPA to Park Avenue; they involve construction largely within existing rights-of-way, but are adjacent to several of the sites of highest concern, including the Zidell and former Schnitzer Steel sites on the west side of the Willamette River, and the PGE property on the east side. However, since they involve little acquisition of additional parcels in comparison with the other project elements, their impacts are relatively minor compared to what the project would encounter with the light rail facilities alone.

Ruby Junction Maintenance Facility

The light rail project includes expansion of the Ruby Junction Maintenance Facility. Expansion will require 14 properties to be fully acquired, 1 property to be partially acquired, as well as modifications to the existing building structure. A review of the DEQ facility profiler indicates that 8 sites have releases of environmental contaminants that exist at or near the facility. Of these sites, 1 (Coachman Body and Frame) will be acquired. Potential effects of acquisition include cleanup and/or liability issues related to property acquisition. The phased expansion of Ruby Junction would defer acquisitions of five parcels, but none contain an identified release site.

3.13.2.2 Short-Term Impacts (Construction)

The potential short-term effects to the physical environment or to people during construction include potential spread of contamination in areas where hazardous materials exist, releases of new contamination, and effects on construction workers from hazardous materials.

The environmental media that can be affected include soils, sediments, surface water, stormwater, and groundwater, which can be affected by the exacerbation of existing contamination or the release of hazardous substances during construction activities. Effects from hazardous materials may cause a risk to human health or the environment, raise liability issues, increase project costs, or cause schedule delays.

The degree to which existing contamination can be exacerbated and released into the environment is attributed to the type, intensity, and duration of construction activities, and by the nature and extent of contamination. Types of construction activities that can exacerbate contamination include, but are not limited to: excavation, grading, dewatering, drilling, dredging, and demolition. The type, intensity, and duration of these activities will be defined during the design phase and contractor procurement.

Documented contaminants at identified hazardous material sites include chlorinated solvents, petroleum hydrocarbons, pollutant metals, pesticides, and PCBs. Unidentified hazardous material sites likely exist within the project study area. The nature and extent of contamination in areas where below-grade construction will be conducted will need to be evaluated on a site-by-site basis before significant construction begins, in order to limit effects to the environment.

Construction equipment can release petroleum products into the environment from the improper transfers of fuels or spills. Other pollutants such as paints, acids for cleaning masonry, solvents, and concrete-curing compounds are present at construction sites and may enter the environment if not managed correctly.

Impacts to the environment from contamination are most critical in areas sensitive to human and ecological health, such as rivers, creeks, and residential areas. Within the light rail project area, these areas include, but are not limited to, Willamette River, Crystal Springs Creek, Johnson Creek, Spring Creek, Kellogg Creek, and Courtney Springs Creek.

Sediment quality can be impacted by exacerbating existing contamination through construction activities. These activities include pier installation, pile installation and removal, barge support, and scour protection placement. Exacerbation can occur from redepositing contaminated sediments or exposing residual contaminated surfaces. Exacerbation of sediment contamination can also lead to impacts to surface water quality through resuspension into the water column. In addition, effects could be realized to sediment and surface water quality if the integrity of the City of Portland's water main is compromised during pile installation or scour protection placement. A compromised water pipe would release chlorinated water under pressure and likely exacerbate existing contamination.

The project can also achieve environmental benefits through the cleanup and/or containment of residual soil and sediment contamination during construction. This potential cleanup of contaminated soil and sediment might not otherwise be realized, or it may occur at a later date than it would with the light rail project. TriMet is considering accepting soil material containing low levels of contamination to be used as fill material under the light rail alignment between SW Moody Avenue and the riverbank. The fill material would be capped to limit direct contact, and this action would be subject to compliance with applicable hazardous material regulations and DEQ-approved treatment plans for the Zidell property.

Surface and subsurface soils often are the most likely media to be affected by an initial contaminant release or releases. Common contaminant release mechanisms include spills, below-ground disposal, leaking underground storage tanks, and soil leaching. Contaminated soil can also spread to other environmental media such as sediments, surface water, and groundwater during construction activities such as excavation, grading, and utility work.

Precipitation events can generate stormwater runoff at construction sites. Without adequate management and treatment, stormwater quality can be diminished and soil erosion can occur. Stormwater quality can also be affected by a direct release of a hazardous substance to stormwater lines during construction. Effects to stormwater quality can further exacerbate surface water, groundwater, and sediments. Infiltration of stormwater at stormwater treatment facilities into subsurface soils where contaminated materials are present could result in the migration of contaminants to groundwater and/or surface water.

Surface water quality can be affected by near-water or in-water construction activities. Near-water activities such as embankment modifications have the potential to allow contaminated soils to migrate to surface water. In-water activities such as barge support, pier installation, and temporary pile installation and removal have the potential to resuspend contaminated sediments into the water column.

Groundwater conditions can also be affected by construction. Groundwater conditions can be affected by the exacerbation of existing contamination during construction in the following ways. Existing contamination to or below the water table could be affected by project construction if it results in: (1) downward migration of surface contamination; (2) downward migration of mobile contamination along conduits or preferential pathways; (3) leaching of exposed contamination; (4) migration of contamination from dewatering activities; (5) infiltration of impacted stormwater; and (6) accidental release of hazardous substances or petroleum products.

The most significant effects to groundwater quality during construction could occur in areas where: (1) abundant or gross contamination is present in saturated or unsaturated soils; (2) contaminants are soluble in water and/or are in a dense non-aqueous form; (3) the depth to the water table is shallow; and/or (4) construction activities extend to or below the water table. These conditions or a combination of these conditions could allow contamination to migrate downward and affect groundwater quality if not mitigated correctly. However, the current use of groundwater for drinking water or other beneficial use in the project study area is limited.

Effects to worker safety and public health from hazardous materials can occur during construction, although the handling of contaminated materials is regulated at the state and federal levels. Potential exposure routes include dermal contact and ingestion of contaminated soil and water, and inhalation of contaminated vapors or particulates. Potential receptors include construction workers, excavation workers, transients, and residents (adults/children). Health effects are dependent on the type of contaminants, duration, dosage, exposure route, and age.

Identified contaminants such as chlorinated solvents, metals, pesticides, and PCBs are mainly associated with long-term chronic effects to human health; however, these contaminants and/or unidentified contaminants do have the potential to cause acute effects to human health.

Hazardous and non-hazardous wastes can be generated during construction activities when contaminated materials are encountered. Waste can consist of contaminated soils, sediments, and groundwater generated from excavation, drilling, dewatering activities, and building materials containing lead or asbestos from demolition. Wastes can be harmful to human health and/or the environment and require management in accordance with applicable federal and state regulations. Characterizing, managing, storing, and disposing of hazardous waste can increase project costs and cause schedule delays, and are a source of liability to the project.

The project could also demolish or alter buildings and structures that have lead or ACMs, and will need to have proper abatement conducted prior to any demolition, renovation, or repair activities. Abatement must follow state guidelines and be conducted by licensed abatement firms. Abatement materials must be properly disposed of at authorized solid waste facilities. In general, buildings and structures that were built before 1980 have a higher likelihood of containing asbestos. The Environmental Protection Agency issued a ban and phase-out rule for asbestos in 1989.

Locally Preferred Alternative (LPA) to Park Avenue

The LPA to Park Avenue has the potential for impacts to the environment from exacerbation of existing contaminated soils or accidental release during construction. These potential impacts are expected to be significant if not mitigated correctly. Construction activities for the LPA to Park Avenue are relatively intensive and complex, with a higher occurrence of excavation and grading activities on properties outside of the right-of-way to support the installation of bridge abutments, overpasses, and utility corridors. Of particular concern is the exacerbation of existing soil contamination from ranked #4 and #5 sites or from unidentified sites along the east side and west side of the Willamette River bridge as a result of bridge construction.

The LPA to Park Avenue has a potential for impacts to sediment quality from construction activities. Of most concern are impacts to shallow water environments along the west side of the Willamette River that have been identified for fish habitat, migration, and rearing. Sediments within Kellogg Lake are contaminated from historical industrial activities that include a former sawmill and flour mill, although the sediments are limited in their ability to migrate because they are currently contained behind a dam.

While water quality issues are also discussed in Section 3.9, Water Quality and Hydrology, the presence of contaminated sites within the LPA to Park Avenue project study area can carry specific environmental consequences. The LPA to Park Avenue could impact stormwater quality due to the erosion of exposed contaminated surfaces during precipitation events when stormwater is not controlled or adequately treated, and/or release to stormwater occurs during construction. Surface water quality can also be affected by construction, such as through exacerbation of contaminated soils and sediments during construction. These effects are of most concern in the Willamette River, where modifications to the embankments and pile installation and removal are proposed at or near identified hazardous material sites. The LPA to Park Avenue has a potential for impacts to groundwater quality from the exacerbation of existing contamination during construction activities. However, these effects are not expected to be significant, because there is limited groundwater beneficial use within and in the vicinity of the project study area, and construction activities that extend to or below the water table are limited.

LPA Phasing Option

The LPA Phasing Option would have the same potential impacts as the LPA to Park Avenue.

Minimum Operable Segment (MOS) to Lake Road

The short-term impacts of the MOS to Lake Road are similar to those described for the LPA to Park Avenue, except that the project would terminate in downtown Milwaukie, avoiding one site of highest concern, and several other contaminated sites of lesser concern near the Park Avenue Station. Construction activities would also include the development of a park-and-ride structure adjacent to the Lake Road Station.

Related Facilities

Related Bridge Area Transportation Facilities

The Related Bridge Area Transportation Facilities including streetcar and the reconstruction of SW Moody Avenue are within the same project study area as the LPA to Park Avenue. They are within areas that have several of the previously contaminated sites of highest concern, including the Zidell property, but they are adjacent to the facility. The types of construction impacts would be similar to the LPA to Park Avenue, but they would be more localized, and they would not involve the sediment or shoreline contamination concerns of the LPA to Park Avenue. The properties affected would also be the same as those identified for the LPA to Park Avenue, and no other full acquisition of properties is needed for the right-of-way to be used by these additional facilities.

Ruby Junction Maintenance Facility

The light rail project includes expansion of the Ruby Junction Facility. Expansion will require 15 properties to be acquired (9 for the LPA Phasing Option) as well as modifications to the existing building structure. A review of the DEQ facility profiler indicates that a number of RECs exist at or near the facility. Potential effects include liability issues in property acquisition, and site investigation and cleanup to accommodate modifications to building structures. These effects will be more fully realized as further details on facility expansion become available.

3.13.2.3 Cumulative Impacts

The light rail project is not expected to reduce and not expected to add to the number of hazardous materials sites along the corridor. With the project’s commitments to adhere to applicable regulations regarding the handling and treatment of contaminated materials during construction and during long-term operation of the light rail project, the project would have a beneficial effect on the environment. Existing sites as well as currently unidentified sites, if any, would be cleaned up or contained. Near station areas, the project could also encourage the redevelopment of other adjacent sites that may have contamination, which would create a beneficial cumulative effect to the environment.

3.13.3 Mitigation

The following presents the anticipated practices and procedures that the project will undertake to comply with applicable federal and state hazardous materials regulations and permits. These are project-wide regulatory and permitting requirement commitments, and therefore apply to the LPA to Park Avenue, and LPA Phasing Option or MOS to Lake Road, and all related facilities. These permits and requirements are expected to include:

- Focused site assessments conducted before construction to assess potential effects to the environment or construction activities. Focused site assessments will characterize and evaluate potential existing impacts to soil, sediment, and groundwater that could be exacerbated through the construction process. Areas of focused assessment include, but are not limited to, the South Waterfront District, SE Powell Boulevard overpass, and Kellogg Lake. Findings will be used to support an avoidance or mitigation strategy, or help guide appropriate cleanup actions.
- A temporary in-water sediment cap placed in the footprint of the temporary work bridges to be used during construction of the permanent Willamette River bridge. The sediment cap will limit the exacerbation of sediment contamination during pile installation and removal. Preliminary design and specifications for the sediment cap will be outlined in the design report. The sediment cap will consist of at least a two-foot layer of sand placed in the pier structure footprint of each tower.
- Armament to prevent scour of contaminated sediments around in-water pier structures for the Willamette River crossing. Preliminary design and specifications for the armament is described in the light rail project's Biological Assessment and 401 Water Quality Certification. Armament will consist of layered sand, cobbles, and ballast rock.
- Construction Stormwater Pollution Prevention Plans (SWPPPs) to prevent or minimize soil or sediment from being carried into surface water by stormwater runoff. Plans will be required for all permitted construction sites and are subject to approval from the regulatory agencies, and must comply with City of Portland Codes (CPC) Title 10. Plans are to be prepared and put in place prior to clearing, grading, or construction.
- National Pollutant Discharge Elimination System (NPDES) Construction General Stormwater (1200-CA) Permits to cover all TriMet construction activities that would disturb more than one acre. Under the conditions of these permits, TriMet must submit to the regulatory agencies a Notice of Intent (NOI) to discharge stormwater associated with construction activities and to meet stormwater pollution prevention requirements. Permits are subject to approval from the DEQ pursuant to Oregon Administrative Rules (OAR) 340-045
- Health and Safety Plans (HASPs) for construction activities to minimize exposure to construction and excavation workers and reduce the risk to human health and the environment. Construction will be conducted under site-specific HASPs prepared by the contractors.
- Spill Control and Prevention Plans (SCPPs) to address the use, storage, and disposal of asphalt, fuel, raw concrete, striping paint, solvents, spray paint, landscaping chemicals, etc. SCPPs will be used to limit the generation and exacerbation of hazardous substances or petroleum products, and will outline best management practices (BMPs) to be used by contractors. Plans will be required for all permitted construction sites and are subject to approval from the DEQ pursuant to OAR 340-142.
- Contaminated Media Management Plans (CMMPs) to properly characterize, manage, store, and dispose of contaminated materials encountered during construction activities. The CMMP will outline roles and responsibilities of personnel; health and safety requirements; methods and procedures for characterizing, managing, storing, and disposing of waste; and reporting requirements.

- Phase I Environmental Site Assessments (ESAs) for the potential for encountering hazardous materials or incurring environmental liability for purchased properties. A Phase I ESA is also often conducted for leased properties to establish environmental baseline conditions prior to occupation of the site. Phase II ESAs may be conducted based on the results and recommendations of the Phase I ESA for that property and the project requirements.
- Where buildings are to be demolished or removed, hazardous building materials surveys identify any ACMs and lead-based paint. Any ACMs or lead-based paint identified will be abated and disposed in accordance with state and federal regulations. If residential buildings are to be demolished or removed, the septic systems, if present, should be decommissioned in accordance with local and state regulations.
- Lead and Asbestos Surveys, prior to acquisition of buildings or structures, will be required, consistent with OAR 248. Based on survey results, abatement will be conducted prior to demolition, renovation, and/or repair.

3.14 UTILITIES

This section provides a review of potential long-term effects as well as short-term, temporary construction effects on utilities. The summary below is not meant to be a comprehensive listing of all utility conflicts, but rather to highlight congested areas where extensive utility relocation is anticipated and to identify major utility crossings, which could have greater impacts to the project's scope and schedule.

3.14.1 Affected Environment

The Portland-Milwaukie corridor currently has both aerial and underground utilities. Aerial utilities include electrical services and communications facilities. Aerial communication facilities are typically on electric distribution poles but can also be on their own structures. Electrical service providers within the Portland-Milwaukie Corridor include Portland General Electric (PGE) and PacifiCorp. Communication providers in the project study area include Qwest, Sprint, T-Mobile, Verizon, Level 3 Communications, and Comcast.

Below-grade or underground utilities include water, sanitary facilities, storm facilities, and natural gas. Electrical services and communication facilities can also be located underground. Underground utilities in the project study area include City of Portland Water Bureau; City of Portland Bureau of Environmental Services, including storm and sanitary; City of Portland electrical facilities; ODOT storm facilities and electrical facilities; City of Milwaukie water, wastewater and stormwater; Oak Lodge Sanitary District; Oak Lodge water district; and Northwest Natural Gas; and can include the electrical and communication providers listed above.

3.14.2 Environmental Impacts

The conceptual engineering efforts for the Portland-Milwaukie Light Rail Project have involved initial reviews of major utilities to identify locations where the light rail alignment and existing major utilities may be in conflict. In general, the light rail would be developed to allow utilities to cross under or above the alignment, because ongoing utility maintenance or improvements could conflict with light rail operations. Specific utility impacts are typically identified during the advanced engineering phase of the light rail project after a preferred alternative has been identified. For example, a higher level of detailed engineering information is required to verify site-specific conditions, such as depth of excavation for construction, or how the drainage system would be constructed. Therefore, the utility's facility and infrastructure impacts identified for this FEIS represent typical conditions as well as any major conflicts that have been identified in available engineering documents.

The impact of the Portland-Milwaukie Light Rail Project on utilities would be either a longitudinal impact or a crossing impact. A longitudinal impact is where the utility is located along or parallel with the light rail alignment. A crossing impact is when the light rail alignment intersects the utility's facilities. The greatest potential impacts to the utilities are the longitudinal impacts, because more of a utility's facilities would require relocation outside of the light rail operating envelope. There is an increased potential for longitudinal impacts on major arterial roads such as SE 17th Avenue and SE McLoughlin Boulevard, because major roadways such as these are typically utility corridors. There is also an increased potential for a longitudinal impact to underground communications lines, typically fiber optic cable, along the Union Pacific Railroad (UPRR) right-of-way.

Construction impacts occur when the alignment requires placing tracks or other structures where a utility, such as a power line, is located. A reduction in clearance could occur when a grade-separated option or an increase in existing grade could reduce an aerial utility's clearance. The alignment could involve lowering the grade and exposing or reducing the depth of cover of an underground utility. Underground utilities in direct conflict with tracks are normally moved in order to facilitate future utility maintenance without disruption to transit service. New drainage or stormwater features could also affect a utility's location.

Private utilities located within public right-of-way typically pay for their own relocation costs as part of their permitting agreement to use public right-of-way. An exception to this could be a specific provision in a franchise agreement. In contrast, a private utility that is located on private property is typically there by an easement agreement. Private utilities located within an easement usually have the right to be reimbursed the cost of their relocation. Public utility relocation costs are normally paid for by the project.

There may be temporary utility impacts such as service disruption during construction activities, but in general these impacts are short in duration and the conditions for service interruptions are often controlled by permits required by local jurisdictions. All affected utility owners would be contacted, and proper coordination would ensure minimum disturbance to system users. Typically, new facilities such as poles or ducts or other utility lines are installed and then service is switched over, minimizing any disruption of service.

3.14.2.1 Long-Term Impacts

<u>No-Build Alternative</u>

The No-Build Alternative is not expected to have long-term impacts on utility facilities. Although other transportation improvement projects are programmed to be developed in the area, utility conflicts would be addressed through the individual projects' design and construction measures, and long-term effects are not anticipated.

Locally Preferred Alternative (LPA) to Park Avenue

The LPA to Park Avenue is not anticipated to pose long-term impacts to utilities, because site-specific conflicts would be addressed by design measures, such as relocating utilities as appropriate. For underground utilities, there is the potential for stray electrical current to accelerate corrosion, but the project would be designed to include measures to minimize stray current.

The electric energy demands for the light rail project could also require upgrades to electrical transmission systems along the corridor, which could involve increasing the capacity of transmission lines, replacing poles or towers, and improving electrical substations. Necessary improvements would be determined through consultation with the electrical utility providers, but would usually involve upgrading existing transmission facilities rather than creating new facilities. However, at a system level, the light rail project represents a small fraction of regional energy consumption needs (see Section 3.12, Energy Analysis), and the existing regional providers have adequate long-term capacity to meet regional needs with the addition of the light rail project.

LPA Phasing Option

The long-term impacts for the LPA Phasing Option would be similar to those for the LPA to Park Avenue.

Minimum Operable Segment (MOS) to Lake Road

Construction impacts to utilities for MOS to Lake Road are anticipated to be the same as those for the LPA to Park Avenue, except that there would not be any impacts to Clackamas County sanitary and storm facilities.

Related Facilities

Related Bridge Area Transportation Facilities

The Related Bridge Area Transportation Facilities are anticipated to have the same impacts as the LPA to Park Avenue and the MOS to Lake Road.

Ruby Junction Maintenance Facility

The expansion of the TriMet Ruby Junction Facility in Gresham is not expected to affect the provision of any public services or utilities.

3.14.2.2 Short-Term Impacts (Construction)

No-Build Alternative

The No-Build Alternative would still involve the construction of other projects in the area, some of which could affect aboveground or belowground utility facilities. However, the No-Build Alternative does not call for other projects along the full corridor connecting Portland and Milwaukie and would not involve the extent of potential relocations for both aboveground and belowground facilities as anticipated for the LPA to Park Avenue and the MOS to Lake Road.

Locally Preferred Alternative (LPA) to Park Avenue

The various options being considered for the LPA to Park Avenue would involve construction of an alignment that could conflict with existing utilities. Construction of light rail would require the relocation of utilities that are within the light rail alignment to minimize conflicts with the long-term operations of the light rail system. Intersecting utilities may be raised or lowered, depending on the project profile, and parallel utilities currently within the project's proposed alignment would be relocated outside the rail alignment. Roadway improvements or modifications required for the light rail project, including travel lanes, turn lanes, bicycle lanes, and sidewalks, could also affect the location of utilities. Underground utilities would typically be located within the modified roadway or beside the light rail alignment. Overhead utilities would more typically be moved to the edges of the modified rights-of-way. For example, power or telephone poles and overhead lines may be relocated to the side, placing them closer to other existing uses alongside the alignment. TriMet would employ standard construction measures to minimize the potential for damage or disruption to utilities during construction. Specific utility impacts are identified below.

City of Portland

Sanitary and Storm Facilities (Bureau of Environmental Service [BES]): The proposed light rail track crosses numerous City of Portland storm and sanitary pipes, ranging in size from 6 inches to 116 inches in diameter, and in age from new to over 100 years old. Pipes or manholes under the tracks are to be relocated. Pipes that cross the tracks may be "lined," depending on pipe material, age, and condition. In total, approximately 120 pipe conflicts exist.

The following are noteworthy examples of work scope:

- The storm sewer and sanitary sewer along SW Lincoln Street between SW 5th Avenue and SW Naito Parkway would require extensive reconstruction due to the track alignment down the center of SW Lincoln Street. New storm and sanitary lines and manholes would be placed on SW Lincoln Street in accordance with the BES design guidelines in order to maintain required clearances between their facilities and the track. Existing service laterals would be connected to the new storm and sanitary systems where appropriate. The roadway may be closed temporarily, with appropriate traffic control, on one side while construction is under way, reversing the closure where appropriate to complete the storm and sanitary sewer construction. All existing storm and sanitary main lines that cross the track throughout SW Lincoln Street and the remaining alignment will be lined from manhole to manhole, with pre- and post-construction video inspection (new mainlines that cross the track will not be lined).
- At the intersection of SW Moody Avenue and SW Porter Street, the track crosses the existing 72-inch sanitary main line on a proposed 14-foot fill section of roadway. Geotechnical testing is under way to determine whether mitigation is required for the pipe or the soil surrounding the pipe as a result of the additional loading caused by the fill of proposed SW Moody Avenue. The investigation is not expected to cause an impact to the level of service of existing SW Moody Avenue. A 42-inch sanitary sewer pipe at SW Moody Avenue will be relocated as part of the City of Portland's SW Moody Avenue project. This relocation work shall be done during the SW Moody Avenue reconstruction, when traffic will be detoured around the project.

- At SE 4th Avenue, drainage for water quality facilities and the proposed OMSI station would be conveyed to a new storm system that ties in at SE 4th Avenue and SE Caruthers Street. The storm system will be outside of the project corridor and will require the temporary closure of parts of the roadway of SE 4th Avenue and SE Caruthers Street.
- Twelve locations contain large diameter pipes crossing the proposed track alignment. The project proposes to protect pipes using a polyester sock lining impregnated in epoxy resin. This construction technique is preferred because it eliminates deep trenched pipe work and significantly reduces traffic impacts. The locations and descriptions of the large diameter pipes are as follows:
- SE Clinton Avenue – 66-inch concrete pipe
- SE Powell Boulevard – 116-inch, 90-inch, and 90-inch brick pipes
- SE Rhine Street – 56-inch concrete pipe
- SE Holgate Boulevard – 62-inch brick pipe
- SE McLoughlin Boulevard and SE 18th Avenue – 54-inch concrete pipe
- SE Insley Street – 96-inch concrete pipe
- SE Harold Street – 48-inch concrete pipe
- SE Bybee Boulevard – 48-inch concrete pipe
- SE Tacoma Street – 39-inch concrete pipe
- SE Umatilla Street – 61-inch concrete pipe (crosses under light rail station)
- SE 17th Avenue from SE Rhone Street to SE Center Street contains a section of sanitary sewer in direct conflict with the proposed track alignment. This section of sewer would need to be relocated to the west of the alignment, in property that would be acquired by the project to create a southbound traffic lane. This activity will precede civil construction and require appropriate traffic control.

Aerial Electrical Utilities: There exist several overhead electric lines that cross the proposed SW Harbor Drive overcrossing at SW River Parkway from the adjacent Pacific Power and Light substation. The lines would need to be raised to achieve clearance requirements with the light rail's overhead catenary system. This work would be conducted in advance of the light rail project construction efforts and is expected to be conducted on private property.

At SE 4th Avenue, a PGE transmission tower would need to be relocated due to the proposed alignment of the trackway. The relocation of the tower would cause the twin wooden pole directly south of the tower to be rebuilt as a steel mono-pole. The construction of utilities outside the limits of the project corridor will be minimized. This work would be conducted in advance of the light rail project construction efforts.

Aerial Communication Facilities: There is a potential conflict with one or more communications companies on any of the electrical distribution lines, both crossings and longitudinal, discussed above. Typically, communications lines are mounted on poles owned by the power company and relocated when the poles move.

Underground Electrical Utilities: Existing PGE underground power between SW 5th and SW 1st avenues along SW Lincoln Street will need to be relocated due to the alignment of the proposed trackway. This work would be done in advance of the public utility relocations and may require the temporary closure of portions of the roadway. Appropriate traffic control will be provided to minimize impacts. Electrical vaults and access points would be placed such that future maintenance may be performed with limited impact to the transportation system.

At SE Water Avenue, existing PGE underground utilities will be relocated due to the alignment of the proposed trackway. Electrical vaults and access points would be placed such that future maintenance may be performed with limited impact to the transportation system.

Underground Communication Facilities: Longitudinal conflicts with existing underground communication facilities will be mitigated by relocating the facilities outside of the proposed trackway. All crossing conflicts with access points that fall under the proposed trackway will be relocated.

Water Facilities (Portland Water Bureau): A 16-inch water main in SW Lincoln Street, between SW 4th and SW 1st avenues would need to be relocated as a result of the proposed track alignment. Construction of the new water main may require part of the road to be closed for extended durations, which would be handled with appropriate traffic control.

A 24-inch water main at SW Lincoln Street and SW Naito Parkway will be relocated. All water main crossings with the proposed light rail track would be encased in a steel pipe for ease of future maintenance and to enhance the cathodic protection (corrosion resistance) of the water main. At water main crossings, the trench will need to be larger and deeper to account for the additional size requirements of the steel casing. The easternmost lane of travel on SW Naito Parkway may be closed temporarily to complete this work.

At SW Moody Avenue, a 30-inch water main and 12-inch water main would be relocated as part of the City of Portland's SW Moody Avenue project.

A 36-inch water main crosses the Willamette River close to the proposed footing of the Willamette River bridge and the proposed piles of the associated work bridge. Pile locations for the work bridge will be selected to be clear of the existing water main. Bridge pier, work bridge, and the tower structures for the Willamette River bridge will avoid the City of Portland water main under the Willamette River and will also incorporate protective measures during construction.

At SE 7th Avenue and SE Caruthers Street, an existing 36-inch cast iron water main would be fitted with a steel casing for the section under the proposed light rail track. Construction would be required adjacent to the existing UPRR freight railroad. No notable impacts to SE 7th Avenue or SE Caruthers Street are expected for this work.

Along SE 17th Avenue, a water main located between SE Pershing Street and SE Rhone Street, and under SE McLoughlin Boulevard and SE Schiller Street, is in direct conflict with the proposed track alignment and would need to be relocated. In addition, crossing water mains would be lowered, encased, and protected from stray current. All water service laterals crossing the track or connected to a new water main will require new pipe, and connections to the buildings would be conducted by Portland Water Bureau crews.

At SE Reedway Street, a 60-inch concrete cylinder transmission line crosses the proposed alignment. Project scope is to install a precast concrete box over the pipe, similar to work completed on the South Corridor Project on the same water main at I-205. This mitigation does not require the 60-inch water main to be cut and placed out of service.

NW Natural Gas: The existing NW Natural Gas (NWNG) infrastructure in SW Lincoln Street between SW 5th Avenue and SW 1st Avenue will be relocated as a result of the proposed trackway. This work would be done in advance of the public utility work and may require temporary closure to parts of SW Lincoln Street and minor service interruptions to customers that are fed from this system.

A 16-inch high pressure gas line and a 6-inch gas line are located under the proposed SW Harbor Drive structure adjacent to SW River Parkway. Portions of the 6-inch gas line may need to be relocated due to the proposed SW Harbor Drive structure footings. The 16-inch high pressure gas line is to be protected in place.

There are two gas lines that cross the Willamette River near the proposed footing of the Willamette River bridge and the proposed piles of the associated work bridge. Extensive efforts are under way to locate the existing 12-inch gas line (not in use) and the existing 20-inch gas line. Both gas lines are to be protected in place.

A large NWNG facility is located between SE 9th Avenue and SE Clinton Street, adjacent to the existing UPRR tracks. This facility provides gas to Portland under the Willamette River via high pressure gas lines. Two main lines are to be relocated within NWNG private property, and excluding the tie-in work in SE Clinton Street and SE 9th Avenue, all the pipe work requires no traffic control. Pipe cutover work is restricted to early spring so as to avoid disruption to supply during months of peak usage.

Other smaller service gas pipes crossing the track, and not in direct conflict with the track slab, will remain in place and be protected against stray current by adding a geomembrane under the track slab during track construction.

City of Milwaukie

Sanitary and Storm Facilities: There exist several crossings (SE Harrison, SE Monroe, SE Washington, and SE Adams streets, SE 21st Avenue, SE Mailwell Drive, SE Lake Road, SE 26th Avenue, and the North Industrial Freight Rail relocation) with the proposed track alignment and the City of Milwaukie's sanitary and storm system that need to be addressed. Excavation in the roadway will cause partial closure of the road and require traffic control. This work would be performed in advance of civil/track construction.

Aerial Electrical Utilities: The City of Milwaukie is requiring overhead power lines to be undergrounded at SE Harrison, SE Monroe, SE Washington, and SE Adams streets and at SE 21st Avenue. This will require a duct bank of conduits to be placed under the future light rail tracks and to be bored under the existing UPRR tracks. This work would be performed in advance of the civil/track construction and will require excavation in the roadway, temporary closure, and traffic control.

At Kellogg Lake, a power line will need to be relocated to build the proposed bridge across the lake. This work is minor and design can be done to minimize power delivery impacts as well as impacts to adjacent uses.

Along SE McLoughlin Boulevard, from the Tillamook Railroad Bridge to SE River Road, a section of 115-kilovolt transmission power lines and poles needs to be relocated for a three-block area due to a direct conflict with the proposed light rail structure. New self-supporting 90-foot poles are required to reroute the power line via adjacent streets (UPRR right-of-way and SE Bluebird Street). The construction of these poles will be performed in advance of the civil/track construction and should not impact travel on adjacent SE McLoughlin Boulevard. Other existing aerial utilities in the area will also be consolidated where possible, and some will be undergrounded or integrated within the project, helping to reduce the large array of poles and lines occurring in the vicinity. Related neighborhood and visual impacts are discussed in Sections 3.3 and 3.4.

From SE River Road to SE Park Avenue, along the North Clackamas County right-of-way for the proposed Trolley Trail, approximately 5,000 linear feet of 13-kilovolt power line including a power pole will require relocation. This work is not expected to have notable impact to roadway or adjacent facilities, and the power line would remain in the same vicinity.

Aerial Communication Facilities: Communications lines will also require undergrounding according to the City of Milwaukie requirements, as noted above for aerial electric utilities. All communications line crossings at SE Harrison, SE Monroe, SE Washington, and SE Adams streets, SE McLoughlin Boulevard, SE Lake Road, and SE 21st Avenue will be placed in the common duct bank with the undergrounded electrical utilities. This work would be done concurrently or with a similar schedule to the underground electrical utilities, so as to not require additional impacts to the roadway during construction. This work would be performed in advance of civil/track construction.

Milwaukie Water: At each road crossing in Milwaukie (SE Harrison, SE Monroe, SE Washington, and SE Adams streets, SE 21st Avenue, SE Mailwell Drive, SE Lake Road, and SE 26th Avenue), water lines will be reconstructed/relocated and placed in a steel casing to enhance future maintenance access and protect against stray current. At water main crossings, the trench will need to be larger and deeper to account for the additional size requirements of the steel casing. Excavation in the roadway will cause partial closure of the road and require traffic control. This work would be performed in advance of civil/track construction.

Clackamas County

Sanitary and Storm Facilities: An Oak Lodge Sanitary District pump station is located at the corner of the Park Avenue Station site, with connecting conveyance pipes. The pump station will not be affected by the proposed work.

LPA Phasing Option

The short-term impacts for the LPA Phasing Option would be similar to those for the LPA to Park Avenue.

Minimum Operable Segment (MOS) to Lake Road

Construction impacts to utilities for the MOS to Lake Road are anticipated to be the same as for the LPA to Park Avenue except there would not be any impacts to Clackamas County sanitary and storm facilities, and it would not affect the aerial power line between SE River Road and SE Park Avenue.

Related Facilities

Related Bridge Area Transportation Facilities

Construction impacts to utilities for the area of the Related Bridge Area Transportation Facilities are discussed above under the City of Portland. Design of the facilities will avoid impacts to the Eastside Combined Sewer Overflow Project.

Ruby Junction Maintenance Facility

The expansion of the TriMet Ruby Junction Facility in Gresham is not expected to affect the provision of any public services or utilities.

3.14.3 Mitigation

All affected utility companies would be contacted during the preliminary engineering phase to help locate and map potentially affected utilities and to develop plans to coordinate either protection of the facilities within the construction area or relocation of impacted facilities. Proper coordination and the use of standard construction techniques would ensure minimum disturbance to system users and avoid damage or impacts to existing facilities that do not require relocation. Typically, new facilities such as poles or ducts are installed and then service is switched over, thereby minimizing any disruption of service. With these measures in place, no significant impacts to utilities are expected and no additional mitigation measures would be required. However, the relocation of utilities can involve impacts of its own, including the need to reconstruct or widen existing street rights-of-way, which can result in effects on adjacent properties, and in limited cases could require acquisition of additional property.

Near SE 17th Avenue, TriMet would coordinate with the City of Portland to identify design measures to avoid conflicts with the Eastside Combined Sewer Overflow Project.

For the Willamette River bridge, specific requirements will be incorporated into the Design-Build contract to ensure protection of the existing 36-inch water main and 12-inch (inactive) and 20-inch gas mains. These requirements would include accurate location of the lines, monitoring of vibrations and settlement during installation of temporary work bridge and cofferdams, and installation of rock aggregates to protect the lines from scour. Methods of installing cofferdams, sheets, and support piles for the work bridge will be limited to those which minimize transmitted vibrations to the lines.

3.15 PUBLIC SERVICES

This section describes existing conditions and potential impacts of the Portland-Milwaukie Light Rail Project to major public services provided within the Portland-Milwaukie corridor, including law enforcement, fire and emergency services, schools, hospitals, and other public service facilities. The section primarily focuses on impacts to the service providers' ability to fulfill their missions to the community, including impacts to their facilities, service, and response routes. Section 3.16, Safety and Security, describes safety issues for light rail, including at stations and park-and-rides and on board the light rail trains.

3.15.1 Affected Environment

Figure 3.15-1 depicts the law enforcement, fire, emergency services, schools, hospitals, and other public service facilities found in the Portland-Milwaukie corridor.

3.15.1.1 Law Enforcement, Fire, and Emergency Medical Services

City of Portland Police Bureau

Portland Police Bureau (PPB) provides law enforcement for the city of Portland as well as for some areas outside of the city limits. PPB headquarters is located in downtown Portland, and there are three precincts: Central, North, and East.[13] The Portland-Milwaukie Light Rail Project would travel within the Central precinct. The Central precinct station is at 1111 SW 2nd Avenue, approximately one-half mile north of the project corridor. Typically police responders use main thoroughfares, such as SE 17th Avenue and SE McLoughlin Boulevard, as emergency access routes.

City of Portland Fire and Rescue

Portland Fire and Rescue (PF&R) is Oregon's largest fire and emergency services provider. It provides fire, emergency response, and special response services within the city limits and contracted areas outside of the city limits. PF&R has 31 stations within the City of Portland. Four stations serve areas near the proposed project:

- Station 1, at 55 SW Ash Street (downtown Portland), which serves Old Town/Chinatown and other areas because of technical rescue skills
- Station 4 (Portland State University), which serves downtown, South Portland (formerly Corbett-Terwilliger-Lair Hill), and Homestead neighborhoods from its location at 511 College Street
- Station 23 (Lower Eastside), which serves the Hosford-Abernethy and Brooklyn neighborhoods, from its location at 2915 SE 13th Place
- Station 20 (Sellwood-Moreland), which serves Sellwood-Moreland, Ardenwald, and Eastmoreland neighborhoods, from 2235 SE Bybee Boulevard

SE Martin Luther King Jr. Boulevard, SE Division Street, and SE 11th and SE 12th avenues are major emergency response routes for Station 23. Within and near the project corridor, SE 17th

[13] For information on TriMet security provided by local police bureaus, refer to the *Safety and Security Results Report*.

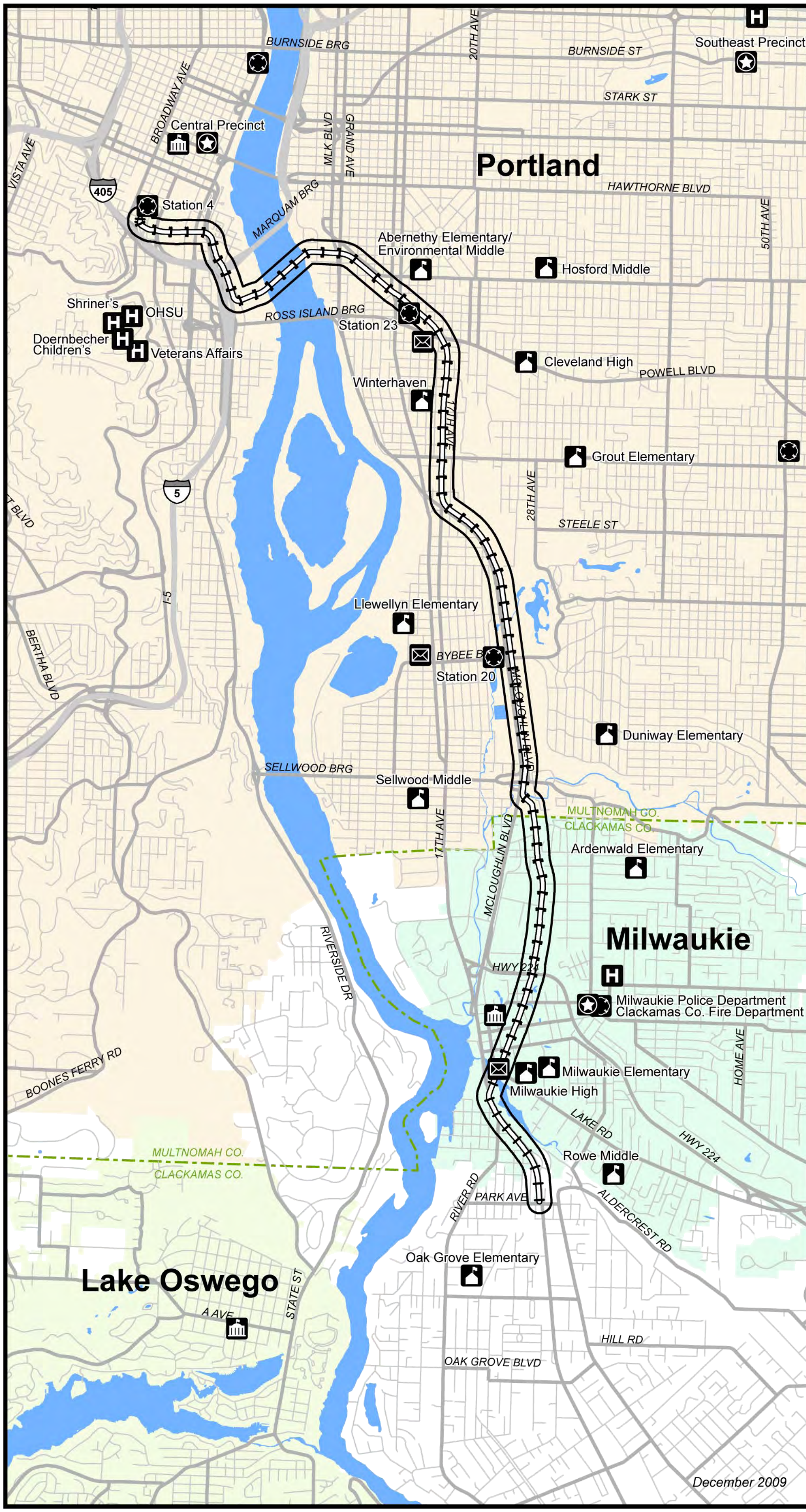
Portland-Milwaukie Light Rail Project

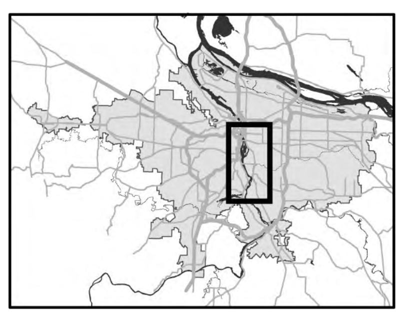
Public Services Locations in Project Area

Figure 3.15-1

- City Hall
- Police Department
- Fire Station
- Hospital
- Public School
- Post Office

- Project Area
- Light Rail Alternative





0 0.5 1 Miles

Avenue and SE McLoughlin Boulevard are considered primary emergency routes. SE 13th Avenue, SE Bybee Boulevard, and SE Harney Street near SE 28th Avenue are major emergency routes for Station 20.

Three PF&R administrative offices are within two blocks of the Clinton Station: the Emergency Medical Services administrative office, which is temporarily located at 2915 SE 13th Place, the Logistics Department located at 1135 SE Powell Boulevard, and the Fire Prevention Division located at 1300 SE Gideon Street.

City of Gresham Facilities

There are no City of Gresham public services facilities within the area required for the expansion of the Ruby Junction Facility.

City of Milwaukie Police Department

City of Milwaukie Police Department (PD) provides law enforcement within the jurisdiction of Milwaukie. Critical access routes for law enforcement are defined as the entire transportation network within the city limits. Milwaukie's Police Station is located at the Milwaukie Public Safety Building located at 3200 SE Harrison Street, approximately one-third mile east of the project corridor.

Clackamas County Sheriff

Clackamas County Sheriff's Office (CCSO) has 17 patrol districts that provide patrol, incarceration, civil process, and search and rescue services for approximately 1,893 square miles within Clackamas County. The OR 99E patrol district, which covers the southernmost end of the project corridor, is bounded to the north by Milwaukie's southern city boundary, to the south by Gladstone's northern city boundary, to the west by the Willamette River, and to the east by SE Webster Road and Highway 224.

Critical north/south access routes for the CCSO include OR 99E (SE McLoughlin Boulevard), SE River Road, and SE Oatfield Road. Critical east/west access routes include SE Park Avenue, SE Courtney Avenue, and SE Oak Grove Boulevard. Patrol deputies are dispatched out of the North Station (12800 SE 82nd Avenue in Clackamas) and use the Oak Lodge Sub-Station (2930 SE Oak Grove Boulevard in Milwaukie).

Clackamas County Fire District #1

Clackamas County Fire District #1 (CCFD #1) provides fire, rescue, and emergency service to five cities as well as to unincorporated areas countywide. These include Milwaukie, areas south of Milwaukie, and Oak Lodge. CCFD #1 has 17 fire stations strategically located throughout

Clackamas County to cover a total service area of 197 square miles. Three stations serve areas near the proposed project:

- Station 2: Serves Milwaukie and is located at 3200 SE Harrison Street, approximately one-third mile east of the project corridor
- Station 3: Serves the Oak Grove community and is located at 2930 Oak Grove Boulevard

- Station 4: Serves the Lake Road, Westwood, Johnson City, and Webster neighborhoods, as well as the Milwaukie Expressway and the I-205 freeway and is located at 6600 SE Lake Road

All nonresidential through streets with centerlines that are within the CCFD #1 service district are considered critical access routes for fire and emergency vehicles. CCFD #1's Milwaukie Fire Station is located at the Milwaukie Public Safety Building at 3200 SE Harrison Street, approximately one-third mile east of the project corridor.

3.15.1.2 School Transportation

Portland

Portland Public Schools provides bus transportation for elementary students living one mile or more from the school, for middle school students living one and one-half miles or more from the school, and for high school students who reside more than one and one-half miles from the school they attend (within their attendance boundary) and one mile or more from TriMet or other public services. Measurement is determined from the street immediately in front of the student residence to the closest stop. Students attending Portland public high schools are provided free TriMet bus passes.

General transportation routes are developed to keep the students' travel time to 60 minutes or less. Major bus routes near the project corridor are SE 17th Avenue, SE Milwaukie Avenue, SE Holgate Boulevard, and SE Tacoma Street. Portland Public Schools in the project study area are listed in Table 3.15-1.

Table 3.15-1
Portland Public Schools within the Portland-Milwaukie Light Rail Project Area

	Location	2008 Enrollment
Elementary Schools		
Abernethy Elementary School	2421 SE Orange Avenue, Portland	349
Winterhaven School (K-8)	3830 SE 14th Avenue, Portland	345
Grout Elementary School	3119 SE Holgate Boulevard, Portland	339
Llewellyn Elementary School	6301 SE 14th Avenue, Portland	396
Duniway Elementary School	7700 SE Reed College Place, Portland	411
Middle Schools		
Hosford Middle School	2303 SE 28th Place, Portland	531
Sellwood Middle School	8300 SE 15th Avenue, Portland	474
High Schools		
Cleveland High School	3400 SE 26th Avenue, Portland	1516

North Clackamas County School District

North Clackamas School District provides bus transportation for high school and middle school students living one and one-half miles or more from school and for elementary students living one mile or more from school. Major bus routes near the project corridor are SE McLoughlin Boulevard, SE Park Avenue, and SE River Road. SE Washington Street is a primary bus route for Milwaukie High School, which is located approximately 200 feet from the project corridor.

To access Oak Grove Elementary School, buses cross SE McLoughlin Boulevard. Critical transportation times for the bus routes are between 7 a.m. and 8 a.m. in the morning and between 2 p.m. and 5 p.m. in the evening. North Clackamas Schools in the project study area are listed in Table 3.15-2.

Table 3.15-2
North Clackamas Public Schools within the Portland-Milwaukie Light Rail Project Area*

	Location	2008 Enrollment
Elementary Schools		
Ardenwald Elementary School	3606 SE Lake Road, Milwaukie	264
Milwaukie Elementary School	11250 SE 27th Avenue, Milwaukie	279
Oak Grove Elementary School	2150 SE Torbank Road, Milwaukie	559
Middle Schools		
Rowe Middle School	**4444 SE Lake Road, Milwaukie**	**720**
High Schools		
Milwaukie High School	11300 SE 23rd Avenue, Milwaukie	1240

* Two private schools in Milwaukie are also near the proposed alignment but are not evaluated in this section because they are not public services: Portland Waldorf School (SE Harrison Street) and St. John the Baptist Catholic School (SE Washington Street). Potential effects to these schools are discussed in Section 3.3, Community Impact Assessment.

3.15.1.3 Postal Service and Solid Waste

Three U.S. Postal Service (USPS) offices lie within the Portland-Milwaukie corridor. One is located at 1410 SE Powell Boulevard, Portland; the second is located at 6723 SE 16th Avenue, near SE Bybee Boulevard; and the third is located at 11222 SE Main Street, Milwaukie.

Portland's residential garbage and recycling service is provided by 21 private garbage and recycling companies franchised by the City of Portland. The City of Milwaukie's residential garbage and recycling services are provided by seven franchised garbage companies. Metro operates two transfer stations, one in Oregon City and one in Northwest Portland. The transfer stations accept trash and recyclables from citizens, businesses, and commercial waste haulers. Hazardous waste facilities are next to these stations.

3.15.1.4 Other Public Facilities

Milwaukie City Hall is within a one-quarter mile of the project corridor. Milwaukie Providence Hospital, which has emergency facilities, is located within one-half mile of the project corridor. OHSU Center for Health and Healing is within a one-quarter mile of the project corridor. OHSU Hospitals and emergency facilities are within three-quarter mile of the project corridor.

3.15.2 Environmental Impacts

3.15.2.1 Long-Term Impacts

<u>No-Build Alternative</u>

Population and employment are projected to increase through the year 2030 in the Portland metropolitan area including the project corridor. As the region and the communities along the

Portland-Milwaukie corridor grow, there will be increased demand for public services, which will create a need for additional services and facilities to maintain adequate service levels. Transportation forecasts for the region also predict increased congestion on roadways. With the No-Build Alternative, the future congestion could result in inadequate service, delays during peak hours, and slower emergency response times.

Locally Preferred Alternative (LPA) to Park Avenue

The development of light rail could require the response of emergency services at any of its new facilities, including bridges, elevated structures, and tracks within their own right-of-way, stations and park-and-rides, and other structures. For information on TriMet security provided by local police bureaus, refer to the *Safety and Security Results Report* (Metro 2008) and Section 3.16, Safety and Security.

Fire and Emergency Medical Services and Law Enforcement

City of Portland Police Bureau, Portland Fire and Rescue

No PPB or permanent PF&R facilities would be relocated by construction of the LPA to Park Avenue. Gate closures associated with light rail trains are in the down position for approximately 50 seconds as the light rail vehicles pass through, which can delay emergency vehicles. In downtown Portland, and specifically for SW Naito Parkway, which is a southbound fire response route, new traffic signals, increased crossing of transit vehicles, and other obstacles associated with light rail vehicles passing through a busy urban environment (such as crossing gates) could increase emergency response time for emergency providers using critical access routes in the area.

The new bridge across the Willamette River, while not for single-occupancy vehicle use, will be used by emergency vehicles if an incident occurs on the bridge. As part of the public safety programs discussed in Section 3.16, specific emergency response plans, routing, and training for emergency services staff will be conducted to incorporate the new bridge into emergency services operations.

Light rail would still allow movements along SE 17th Avenue, a critical response route, but there may be access restrictions placed on side streets and increased potential for delays. Southeast 11th and SE 12th avenues have been identified as major emergency response routes for PF&R's Station 23. Delays from gated crossings at the intersections of SE 11th and SE 12th avenues and SE Milwaukie Avenue could increase response times. Response plans would be needed for sections of the light rail alignment that are along the UPRR right-of-way and not directly accessible via streets.

City of Milwaukie Police Department

No City of Milwaukie PD facilities would be relocated by the LPA to Park Avenue. No facilities would be detrimentally affected. The LPA to Park Avenue does not involve major modifications to police response routes. The installation of crossing arms and the more frequent rail traffic crossing SE Harrison, SE Monroe, and SE Washington streets and SE 21st Avenue could increase delays for police response if the response coincides with when a train is passing, which would typically occur every 7.5 minutes. TriMet's operations and communications systems and protocols are also designed to allow adjustments in operations in the event of a major emergency.

Clackamas County Fire District #1

No CCFD #1 facilities would be relocated for the LPA to Park Avenue, and after the project is complete, none would be detrimentally affected. The LPA to Park Avenue does not involve major modifications to the fire district response routes, and response times are not expected to be appreciably affected. Chapter 4, Transportation, identifies the need for improvements to SE Johnson Creek Boulevard to avoid congestion and delays along this critical response route for CCFD; increased delays due to congestion are expected with or without the light rail project. If future improvements include traffic signals, Opticon Systems, which clear the way for emergency vehicles by turning traffic lights green, would mitigate impacts. Speed cushions may be used instead of signals as a traffic calming feature. Speed cushions are allowed on emergency routes. The installation of crossing arms on SE Harrison, SE Monroe, and SE Washington streets and SE 21st Avenue, which are one block apart, could cause an increase in response times if the response coincides with when a train is passing. TriMet has specifications in place to ensure that gate crossings allow emergency vehicles to safely cross the light rail tracks.

School Transportation

The LPA to Park Avenue would not require the removal of public schools or major facilities owned by Portland Public Schools, North Clackamas School District schools, or private entities. All major routes providing access to the schools would remain open after the completion of the project. Some bus and access routes for schools such as Milwaukie High School and Oak Grove Elementary School may be minimally affected by movement restrictions, gated crossings, or other modifications required for the safe operation of light rail, but vehicle and walk routes would be maintained. (See Chapter 4, Transportation, for more discussion.) Light rail also would greatly improve accessibility for transit users, including visitors, employees, and students at the schools.

Postal Service and Solid Waste

After the project is complete, no transportation or facilities of the USPS would be detrimentally affected. Similarly, the project is not expected to affect routes or recycling and garbage stations/transfer stations handling solid waste. No facilities would be relocated as a part of this project, although some routes may need to be modified because of turn restrictions or other roadway alterations required for the project.

Other Public Facilities

Access to Milwaukie City Hall, located at 10722 SE Main Street, would not be adversely affected by the project. Although the installation of crossing arms may temporarily delay some vehicles when trains are passing, the facility is not an emergency facility. There would also be increased public transit access to the facility via Lake Road Station, which is approximately one-quarter mile away.

As with other locations with crossing arms, the rail crossing at SE Harrison Street could add up to 50 seconds to a vehicle accessing the Milwaukie Providence Hospital Emergency Department if a train is passing at the same time. Although the project will not directly impede access to the facility, an alternative emergency response route to the hospital from the southwest may need to be developed. There will be no long-term detrimental impacts to the OHSU Center for Health and Healing or OHSU Hospitals on Marquam Hill or at the future Schnitzer Campus. Light rail will improve access to the facilities for staff, patients, and visitors.

Minimum Operable Segment (MOS) to Lake Road

The long-term impacts for MOS to Lake Road would be the same as for the LPA to Park Avenue except there would be no impact on Oak Grove School and its associated school bus route, and there would not be any potential increase in emergency response times south of SE Lake Road due to light rail facilities.

LPA Phasing Option

The impacts associated with the LPA Phasing Option are consistent with those for the LPA to Park Avenue.

Related Facilities

Related Bridge Area Transportation Facilities

The impacts associated with the Related Bridge Area Transportation Facilities would be the same as those under the LPA to Park Avenue or the MOS to Lake Road.

Ruby Junction Maintenance Facility

The expansion of the Ruby Junction Facility in Gresham is not expected to adversely affect public services facilities or the City’s ability to provide public services in the area.

3.15.2.2 Short-Term Impacts (Construction)

No-Build Alternative

There would be no construction impacts with the No-Build Alternative.

Locally Preferred Alternative (LPA) to Park Avenue

Fire and Emergency Medical Services and Law Enforcement

City of Portland Police Bureau, Portland Fire and Rescue

During construction of the LPA to Park Avenue, there would be closures of streets or lanes in downtown Portland and inner southeast Portland. SE 17th Avenue, as a primary response route, would be affected. Closures and delays may require alternative response routes or construction, staging, and traffic control measures to avoid delays to emergency response. All closures would require notification and coordination with police, fire, and rescue services.

City of Milwaukie Police Department and Clackamas County Fire District #1

For the LPA to Park Avenue, there would be construction-related street or lane closures that could affect patrol and response routes. With much of the construction taking place along the railroad right-of-way through downtown Milwaukie, the number of affected locations would be limited. However, the industrial area between SE Tacoma Street and Highway 224 has a limited street network, and construction would affect the major streets including SE Ochoco Street and SE Main Street. Construction would involve an at-grade or elevated crossing on SE McLoughlin Boulevard and at SE Park Avenue, which are primary routes for many public service providers. Several side streets to SE McLoughlin Boulevard would also be restricted or modified. Closures and delays may require alternative response routes or other construction coordination, staging, and traffic control measures to avoid delays to emergency response.

School Transportation

Bus routes are adjusted every year to meet student needs. Therefore, coordination with the school districts prior to construction can minimize the impacts of street or lane closures in downtown Portland, inner southeast Portland, Milwaukie, and North Clackamas County. In downtown Milwaukie, where both public and private schools are near the alignment, walk routes could be affected by construction. Appropriate control measures, including bypasses or detours, signage, and flaggers, would be available to minimize impacts, as addressed by construction traffic management plans for the project. These plans would be developed in coordination with the city, schools, and others. Additional details are provided in Chapter 4, Transportation.

Postal Service and Solid Waste

Construction activities and lane closures should not prevent the use of postal service or solid waste facilities, none of which are directly on the alignment. Construction activities may require coordination for the pickup of solid waste or delivery of mail at individual addresses directly along the alignment.

Other Public Facilities

Construction activities and lane closures should not prevent the use of the OHSU Center for Health and Healing or OHSU Hospitals and emergency facilities. Construction activities and lane closures should not prevent the use of Milwaukie City Hall. However, during construction, emergency vehicle detour routes to Milwaukie Providence Hospital may need to be established.

LPA Phasing Option

The impacts associated with the LPA Phasing Option are consistent with those for the LPA to Park Avenue.

Minimum Operable Segment (MOS) to Lake Road

Construction impacts will be the same for the MOS to Lake Road as they would be for the LPA to Park Avenue except there would be no temporary impacts to emergency responder or school access routes on SE McLoughlin Boulevard south of SE Lake Road and SE Park Avenue.

<u>Mitigation Related Facilities</u>

Related Bridge Area Transportation Facilities

Short-term impacts for the Related Bridge Area Transportation Facilities would be similar to those for the LPA to Park Avenue and the MOS to Lake Road.

Ruby Junction Maintenance Facility

There are no public services facilities located within the Ruby Junction Facility expansion area, and no adverse effects are anticipated. With the phasing option for Ruby Junction, the project would introduce two at-grade rail crossings with gates, which would be used typically weekly to transport light rail vehicles to and from a car wash facility. These crossings could delay emergency responders to the one residence and four businesses that are at the south end of NW Eleven Mile Road. These delays would be momentary if an emergency occurred, as TriMet staff would control the trains and could clear the crossing.

3.15.3 Mitigation

Short-term impacts related to the Portland-Milwaukie Light Rail Project could include impacts to intersections where light rail crosses streets at-grade, where light rail is constructed adjacent to roads, and where park-and-ride construction impacts nearby streets. There would likely be construction-related street or lane closures in downtown Portland, inner southeast Portland, and downtown Milwaukie. TriMet will work closely and communicate with the police departments, fire and rescue providers, schools, USPS, and hospitals regarding construction detours and changes that would occur as a result of the completed project. Construction period communications and coordination, including contacts, will be further defined through a detailed construction management plan to be developed during final design. Final design coordination and review will also continue coordination with potentially affected public services providers.

3.16 SAFETY AND SECURITY

This section describes the safety and security conditions in the project study area and evaluates potential effects of the light rail project. The FEIS also has a related section, Section 3.15, Public Services, which evaluates effects on a variety of service providers and facilities, including fire, police, emergency medical services, and hospitals. Section 3.15 focuses on impacts to the provision of services, including impacts to emergency response routes. This section focuses on public safety and security factors for the light rail facilities.

3.16.1 Affected Environment

Figure 3.15-1 in the Public Services section shows fire, emergency services, law enforcement, and other public service providers found in the project study area.

3.16.1.1 Law Enforcement, Fire, and Emergency Medical Services

City of Portland Police Bureau

Portland Police Bureau (PPB) provides law enforcement for the City of Portland as well as some areas outside of the city limits. PPB provides law enforcement services from police headquarters in three precincts: central, north, and east. The Portland-Milwaukie Light Rail Project will be located within the central precinct. PPB central precinct headquarters is located in downtown Portland approximately one-half mile north of the project study area. The central precinct encompasses 43 square miles and serves a population of nearly 170,000. There are 153 officers, including officers in specialty units such as mounted police and Neighborhood Response Team in the central precinct. Three Neighborhood Response Team officers serve as liaisons between the various businesses and neighborhood associations within the project corridor and PPB to solve problems as they relate to crime, nuisance, and livability issues.

City of Portland Fire and Rescue

Portland Fire and Rescue (PF&R) is Oregon's largest fire and emergency response provider. PF&R has 31 stations within the City of Portland. Four stations serve the proposed project study area:

- Station 1, located at 55 SW Ash Street (downtown Portland), which serves Old Town/Chinatown and other areas because of technical rescue skills
- Station 4 (Portland State University), which serves downtown, South Portland (formerly Corbett-Terwilliger-Lair Hill), and Homestead neighborhoods from its location at 511 SW College Street
- Station 23 (Lower Eastside), which serves the Hosford-Abernethy and Brooklyn neighborhoods, from its location at 2915 SE 13th Place
- Station 20 (Sellwood-Moreland), which serves Sellwood-Moreland, Ardenwald, and Eastmoreland neighborhoods, from 2235 SE Bybee Street

While each station is responsible for specific parts of the city, stations support one another to ensure 24-hour emergency operational readiness.

City of Milwaukie Police Department

The City of Milwaukie Police Department (PD) provides law enforcement within the jurisdiction of Milwaukie, backup to the Clackamas County Sheriff's Office, response to major crimes in Clackamas County and direct support to the City of Portland. Milwaukie's Police Station, which is where all officers are dispatched from, is in the Milwaukie Public Safety Building at 3200 SE Harrison Street, approximately one-third mile east of the project corridor. The City of Milwaukie has one chief, two captains, eight police sergeants, and 27 officers that service approximately five square miles.

Clackamas County Sheriff's Office

Clackamas County Sheriff's Office (CCSO) provides patrol, incarceration, civil process, and search and rescue services for approximately 1,893 square miles within Clackamas County. In addition to enforcing state statutes and county ordinances, patrol deputies provide direct assistance to city residents as well as routine emergency backup for city police officers and specialized units. There are 152 sworn officers in the CCSO.

The Highway 99E patrol district, which covers the southernmost end of the project corridor including the Oak Lodge and Oak Grove neighborhoods, is bounded to the north by Milwaukie's southern city boundary, to the south by Gladstone's northern city boundary, to the west by the Willamette River, and to the east by SE Webster Road and Highway 224. There are typically four officers who service the Highway 99E patrol district at one time. The officers are dispatched from the North Station at 12800 SE 82nd Road in Clackamas. The patrol district is broken up into grid units. The project is in the B1 grid.

Clackamas County Fire District Number One

Clackamas County Fire District Number One (CCFD #1) provides fire, rescue, and emergency medical service to five cities including Milwaukie and the unincorporated areas of Clackamas County within the project study area. Three stations serve areas near the proposed project:

- Station 2: Serves Milwaukie and is located at 3200 SE Harrison Street, approximately one-third mile east of the project corridor.
- Station 3: Serves the Oak Grove Community and is located at 2930 Oak Grove Boulevard.
- Station 4: Serves the Lake Road, Westwood, Johnson City, and Webster neighborhoods, as well as the Milwaukie Expressway and the I-205 freeway, and is located at 6600 SE Lake Road.

3.16.1.2 Safety Statistics by Neighborhood

TriMet's service district serves 570 square miles in the urban portions of the tri-county area. TriMet's 52-mile light rail system and 81 bus lines provided an average of 324,080 weekday trips in fiscal year 2009. On average, about three incidents are reported per day for the entire transit system including on buses, MAX trains, and on TriMet property. Generally, these are unarmed and nonviolent incidents. During both calendar years 2007 and 2008, there were approximately 35 million boardings on the MAX system, with a total of 619 reported crimes for calendar year 2007, and 507 reported crimes for calendar year 2008.

City of Portland and City of Milwaukie

Table 3.16.1 shows City of Portland, City of Milwaukie, and Clackamas County crime statistics[14] for neighborhoods affected by the light rail project. For comparison purposes, the multiple crime categories were collapsed into three categories: serious crimes, property crimes, and misdemeanors.

Table 3.16-1
Number of Crimes in Portland and Milwaukie, January–June 2009

	Serious Crimes	Property Crimes	Misdemeanors	Total
Portland				
Downtown	126	784	1544	2454
South Portland	7	121	61	189
Hosford-Abernethy	18	209	160	387
Brooklyn	6	95	78	179
Sellwood-Moreland	6	192	74	272
Eastmoreland	0	61	18	79
Ardenwald	3	6	6	15
Milwaukie				
Ardenwald[1]	1	24	23	48
McLoughlin Industrial	0	14	9	23
Historic Milwaukie	5	44	37	86
Island Station	4	23	8	35
Clackamas County				
99E Patrol District - B1	34	92	112	238

Sources: Portland Police Bureau 2009, Milwaukie Police Department 2009, Clackamas County Sheriff's Office 2009.
[1]Part of the Ardenwald neighborhood is within the City of Portland and part within the City of Milwaukie.

In the City of Portland, property crimes and misdemeanors make up the majority of total crimes and are concentrated in the downtown area. On the west side of the river, the project corridor is mostly in South Portland, which in general has less crime than the central downtown. Other than in downtown Portland, few serious crimes are reported for all neighborhoods. However, somewhat higher levels of property crimes and misdemeanors are shown in the closer-in southeast neighborhood of Hosford-Abernethy compared to other neighborhoods along the project corridor, although these are not reported per capita. The crimes appear to cluster around busy streets and intersections such as SE Powell Boulevard and SE Holgate Boulevard. Property crimes and misdemeanors make up the majority of total crimes within the City of Milwaukie, with most occurrences taking place within the Ardenwald and Historic Milwaukie neighborhoods.

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[14] For the City of Portland, serious crimes include murder, sexual assault, sex crimes, robbery, and aggravated assault. Property crimes include residential burglary, nonresidential burglary, theft from automobiles (car prowl), bike theft, motor vehicle theft, and vandalism. Misdemeanors include arson and other larceny incidents. For the City of Milwaukie, serious crimes include rape, robbery, aggravated assault, and sex crimes. Property crimes include simple assault, violations of weapons laws, drug laws, and liquor laws, disorderly conduct, trespass/threats, curfew, and runaway. Forgery/counterfeit and fraud were not included in the analysis. Clackamas County serious crimes include sex crimes, robbery, and assault. Property crimes include theft. Misdemeanors include criminal mischief.

Clackamas County crime statistics are reported at the patrol district level and are not available at the neighborhood level, so comparison to other neighborhood crime levels along the corridor is not appropriate. Property crimes in the Highway 99E patrol district within the project corridor are concentrated along SE McLoughlin Boulevard. Crimes are mostly property crimes, burglary, theft, robbery, and stolen vehicles.

3.16.2 Impact Assessment

Public safety and security planning are major considerations in the development of light rail projects such as the Portland-Milwaukie Light Rail Project. Public involvement efforts for the project have also highlighted a number of questions and concerns from the community about how the project will manage safety and security. Concerns were raised during the comment period for the Supplemental Draft Environmental Impact Statement (SDEIS). In response, a Safety and Security Task Force was formed. The task force was made up of citizens and culminated in the Safety and Security Task Force Report provided to the Project Steering Committee. The report identified concerns and actions related to the light rail project. Recommendations were categorized in the following manner:

- Current TriMet practice and policy (already included in the light rail project)
- Issues to be addressed during Supplemental Draft Environmental Impact Statement (published May 2008)
- Issues to be addressed during design and construction (2009 to 2015)
- System-wide policy decision (for consideration by TriMet policy makers)

During the SDEIS public comment period (May to June 2008), many people submitted comments related to safety and security. These comments included concerns about:

- Potential for crime along the light rail corridor, including fear of increased incidence of crime as a result of the project
- TriMet fare and behavior enforcement practices, specifically a perceived lack of personnel
- The proximity of light rail vehicles to schools, specifically in downtown Milwaukie
- Livability concerns with nuisance behavior
- Presence of homeless individuals and the perception of safety near parks and trails
- Light rail transit station placement and access
- Vehicular, pedestrian, and bike crossings of the light rail alignment

This section describes impacts related to the No-Build Alternative and the Locally Preferred Alternative (LPA) to Park Avenue; impacts related to the Minimum Operable Segment (MOS) to Lake Road would be comparable to those of the LPA to Park Avenue.

<u>No-Build Alternative</u>

With future growth in households and employment in the corridor, there would be increased demand for emergency services and law enforcement services. As the population grows, there is the potential for the incidence of crime to grow as well. Increased traffic would be a by-product of the growth and is likely to increase congestion on roadways, which has the potential to slow emergency response time, as discussed in Section 3.15. Because no new light rail stations or facilities would be built along the corridor with the No-Build Alternative, local opportunities to improve conditions through light rail-related improvements to streets, intersections, sidewalks and lighting, additional safety and security patrols in station areas, and overall higher activity levels would not occur.

<u>Locally Preferred Alternative (LPA), LPA Phasing Option, and Minimum Operable Segment (MOS) to Lake Road</u>

Households and employment growth are forecast to be the same both under the No-Build Alternative and with LPA to Park Avenue, LPA Phasing Option, and MOS to Lake Road. As with the No-Build Alternative, regionally and locally there will be increased demand for public safety and security services to meet the demands of growth. Increased traffic would also occur at levels similar to the No-Build Alternative, and this increased traffic is likely to increase congestion on roadways and slow emergency response times, as discussed in more detail in Chapter 4, Transportation, and in Section 3.15, Public Services.

TriMet develops and operates its light rail projects to provide a transportation benefit to the community, to support long-range land use plans and economic development goals, and to minimize other environmental impacts. Based on the agency's experience with its existing system and on national information, crime levels along light rail project corridors are typically closely related to the existing crime conditions that prevail in the surrounding community.[15] Light rail stations are places that attract people and can be a place where incidents occur. Similarly, vehicles at park-and-rides can be potential targets for vandalism and theft.

The rates and types of existing crimes in future station areas provide one measure of the potential for crime. When stations are developed in these areas, TriMet's Transit Police Division would provide security, as they currently do throughout the MAX system. Maintaining security and providing for emergency responses at all of the stations would be handled through TriMet's established fire, life, and safety programs, which feature cooperative and ongoing planning between TriMet and local jurisdictions. This allows TriMet and its local partners to identify and address safety concerns and response needs at all phases of system development and operation.

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[15] Numerous reports have been written and studies conducted across the United States and Europe regarding general crime patterns and criminal behavior. A study of transit security by the U.S. Department of Transportation noted that transit stations with high crime rates are generally located in neighborhoods with high crime rates (USDOT: Transit Security: A Description of Problems and Countermeasures, Mauri, Ronald et a1., October 1984, reprint May 1985). Similarly, a study of' the Los Angeles Green Line light rail revealed that inner city stations showed a decrease in crime that generally followed a decrease in crime throughout Los Angeles County; crime in the higher income western suburbs did not increase after the Green Line was built (Liggett, R ., A. Loukaitou-Sideris, and H. Isek, Journeys to Crime: Assessing the Effects of a Light Rail Line on Crime in the Neighborhoods, 2002). In 2006, RTD of Denver, which administers the FASTRACKS light rail system, conducted a review of one Denver light rail station and revealed that crime rates at the station directly correlated to the amount of crime in the surrounding neighborhood (Denver Regional Transportation District, Technical Memorandum: Neighborhood vs. Station Crime Myths and Facts, November 16, 2006).

In general, the majority of crimes that occurred between January 2009 and June 2009 were reported in the downtown Portland area, which is typical of urban centers where large numbers of people are present and overall activity levels are high. Likewise, this pattern is seen to a smaller degree in downtown Milwaukie and along the commercial areas of SE McLoughlin Boulevard in Clackamas County, which have higher crime rates than the surrounding and more residential neighborhoods. There were somewhat higher numbers of crimes committed in the statistical areas that encompass the proposed site for the Clinton Station most likely because of its proximity to the busy SE Powell Boulevard and SE Milwaukie Avenue intersection. The proposed Tacoma Station is located in a quiet commercial and industrial area and near the Ardenwald neighborhood, where relatively few crimes are committed.

TriMet considers safety and security management an integral part of its mission for developing and operating an effective light rail system. Safety and security are key factors in the planning and design of light rail stations and other facilities. The agency uses a combination of design, public education, and operations measures to lower the potential for crime and to minimize potential conflicts among trains, people, and other vehicles. The agency also has an established transit rider security program that combines TriMet enforcement with public safety resources from other jurisdictions.

TriMet's Transit Police Division (TPD) is a special unit within the PPB and is made up of contracted law enforcement officers from police agencies in the region, providing TriMet's police force with qualification and training standards commensurate to those used by local agencies. The TPD then provides officers with specialized training and procedures for the conditions unique to transit facilities and operations. To provide more focused deployment and presence, central, westside, eastside, and south precincts have been established, with offices in downtown Portland, Hillsboro, Gresham, and Clackamas County, respectively. The TPD currently consists of 58 sworn officers. TriMet's Director of Safety and Security and the TPD commander meet regularly with various community members, law enforcement agencies, and security partners to evaluate issues and collaborate on solutions. TriMet's police officers spend the majority of their time patrolling buses, trains, and stations. They coordinate security efforts with local and regional law enforcement agencies, and their efforts are supplemented by contracted security personnel, TriMet operators, supervisors, fare inspectors, customer service staff and maintenance workers, who also provide a presence throughout the system and who are trained to identify and respond to security concerns.

In addition to enforcement, security improvements and crime reduction can be greatly affected by technology, community outreach, and system design and maintenance.

- TriMet uses security cameras, which serve as a deterrent to criminal activity and as evidence for prosecuting crimes. Closed-circuit television (CCTV) cameras are on every MAX train, and in all parking garages and elevators, in addition to most MAX stations.
- Before opening a new light rail line, TriMet takes special care to educate new users, especially children, on how to be safe around its system.
- TriMet has replaced all of the original, older-model ticket vending machines and has doubled field technician staffing to two shifts a day, seven days a week to address ticket vending machine issues. Reliable ticket vending machine operation reduces opportunities for fare evasion.

- Thirty TriMet staff members are dedicated to checking fares, and they issue warnings, citations, and exclusions for riders without a valid fare. Another 46 TriMet supervisors check fares as a part of their daily duties.
- The TriMet Code includes penalties for fare evasion and rowdy or intimidating behavior on the system. Riders can also be immediately excluded from the system for up to six hours, and can receive longer exclusion periods of up to 90 days. Juvenile detention allows for a safety hold of up to 36 hours for repeat offenders violating the TriMet code or engaged in certain criminal activity, so that officials can work with the youths and their families to stop the activity.

Furthermore, a system design that deters crime and promotes safety is of utmost importance. In planning the proposed light rail alignment and station locations, TriMet is designing its facilities to be responsive to the neighborhood context and to maximize community benefits. TriMet evaluates safety and security considerations in making choices about station siting, layout, platform design, and park-and-ride facilities, beginning with the project's earliest planning stages. This allows crime prevention principles to be fully incorporated into the project.

TriMet considers best practices related to security in the design of its stations. These are derived from Crime Prevention Through Environmental Design (CPTED) concepts, which provide guidelines to deter criminal activity in a number of areas, described as follows:

- Design and Maintenance. Station security starts with good design and upkeep. Generally, physical attributes that correlate with lower crime rates include well-kept and well-lit neighborhoods, office and industrial parks, good building stock, and few vacant spaces.
- Natural Surveillance. This concept is to keep activity areas and people visible at stations, in parking areas, and while connecting to stations. Strategies include good platform visibility, street-level windows, adequate lighting, and pedestrian-friendly designs. The activity levels on surrounding streets or neighborhoods, and the presence of passersby, transit personnel, and other riders waiting for transit or on transit all contribute to "the number of eyes" on the station area, thus helping to reduce the potential for safety concerns.
- Territorial Reinforcement. This concept is to promote a sense of ownership among users that translates into a deterrent to intruders. Examples include features that define property lines and distinguish public from private spaces through the use of plantings, landscaping design, pavement materials, and fencing.
- Natural Access Control. This concept denies access to potential targets and creates a sense of risk in potential offenders. This is achieved by clearly delineating public routes through landscaping and design and preventing access to private property through physical barriers.
- Target Hardening. This concept concerns features that manage entry and access, and includes CCTV.

According to these principles, station areas should be easily accessible to law enforcement personnel and should maximize opportunities for natural surveillance. The design of the station and surroundings should promote personal safety and security by providing good sight-lines and avoiding conditions such as tall landscaping or other features that could obscure the presence of individuals and block CCTV cameras from capturing activity on transit property. Well-lit, bright environments with high degrees of visibility from nearby streets or public areas also help deter vandalism and increase the perception of security. Though the lights from stations should be shielded from adjacent neighborhoods, the safety of pedestrians walking to those neighborhoods must be considered in design. Bright designated station areas and walkways with appropriate landscaping, free of entrapment areas, deter crime. Stations should be kept clean, and signs of vandalism should be removed immediately to send the message that the community is in control.

Ruby Junction Maintenance Facility

The light rail project would require expansion of the existing Ruby Junction Facility on NW Eleven Mile Avenue in Gresham. The light rail vehicles using the maintenance facility would not be carrying any passengers, and the proposed expansion would not result in any adverse effects to safety and security.

3.16.3 Mitigation Measures

This section describes mitigation measures related to the No-Build Alternative and the LPA to Park Avenue; mitigation measures related to the MOS to Lake Road would be comparable to those of the LPA to Park Avenue.

No-Build Alternative

There would be no mitigation measures with the No-Build Alternative.

Portland-Milwaukie Light Rail Project

The project is incorporating safety and security programs and measures that are based on TriMet's existing programs and its responses to ongoing safety and security issues throughout the MAX system. These programs and measures are designed to adapt and respond to public concerns and questions regarding safety issues related to specific conditions that may occur throughout the system, including issues identified in public comments on the Portland-Milwaukie Light Rail Project.

As it has during the development of the FEIS, TriMet's final design and operations planning for the project will continue to allow the agency to develop and refine specific safety and security measures in consultation with the public and the corridor jurisdictions. Security measures will take into account and respond to the ideas from the Safety and Security Task Force Report. These efforts will include the following:

- As part of the FEIS and preliminary engineering efforts, TriMet formed a Project Safety and Security Committee composed of internal operations staff, staff from local jurisdictions, project design staff, and maintenance staff. The committee is charged with ensuring that CPTED principles and lessons from past projects are being applied to the project. The committee is helping further refine the mitigation commitments for the project.
- To enter final design, TriMet will be required by FTA to prepare a Safety and Security Management Plan. This plan will define the safety and security activities and methods for identifying, evaluating, and resolving potential safety hazards and security vulnerabilities, and establishing responsibility and accountability for safety and security during each phase—preliminary engineering through startup. A Safety and Security Certification Program, also a

required element, will verify that identified safety-critical items have been designed and constructed into the system. These reports will be reviewed by the FTA's Project Management Oversight Committee and FTA staff.

- During final design, TriMet engineering staff will meet regularly with a Fire, Life, and Safety Committee composed of police, firefighters, and safety personnel along with internal staff to ensure that project operations will be safe. During operations, a similar committee structure is used system-wide to review procedures, staffing levels, and safety and security measures. This allows TriMet and its partners to identify and respond to localized security concerns that may occur over time.

Other potential measures to address safety and security concerns along the Portland-Milwaukie Light Rail Project include the following:

- To address the issue of light rail safety for school children, TriMet would educate new users, especially children, on how to be safe around its system, particularly before opening a new light rail extension. By collaborating with teachers and parents, TriMet has developed an extensive safety outreach program especially for schools located close to light rail service.
- To address the issue of safe roadway crossings, TriMet would convey to the public that light rail trains pass through gated crossings with a brief signal cycle. The system would operate with computer controls and operator procedures that minimize the potential for conflicts.
- To address the issue of safe pedestrian crossings, TriMet would evaluate the pedestrian and bicycle network along the proposed light rail alignment and add Z-crossings where needed. After station platforms have been sited, the pedestrian network may be re-evaluated and the Z-crossings refined. The Z-crossings control movements of pedestrians by turning pedestrians toward the direction of approaching trains before they cross each track. Z-crossings may be used at locations where pedestrians are likely to run unimpeded across the tracks, such as at isolated, midblock or pedestrian-only crossings.
- To address the issue of vandalism and graffiti, TriMet has quick clean-up response time mechanisms in place. Murals and etched glass are used at station platforms to deter vandalism.
- To address the issue of isolation of passengers on light rail trains at night, TriMet would encourage riders to implement personal safety strategies such as choosing to sit near the driver in the front of the train. Since 2003, TriMet has used an educational campaign "See Something, Say Something" to encourage riders to play a more active role in reporting suspicious activity to TriMet personnel. TriMet has also increased the penalty for disruptive behavior on buses and light rail to help maintain the safety and integrity of the transit system. TriMet employs more than 2,600 staff members who receive system safety and security training. Most of the employees work in the community and serve as "eyes and ears" and are visible deterrents to crime.
- Consistent with TriMet's commitments and practices throughout the MAX system, TriMet will provide police and security officers and fare inspectors on the light rail system. A visible security presence helps to reduce the potential for crimes against transit users, school children, or others. TriMet and its partners continuously monitor the staffing levels, hours, routes, and

locations for security personnel in order to help address emerging concerns throughout the light rail system.

Ruby Junction Maintenance Facility

The light rail project would require expansion of the existing Ruby Junction Facility on NW Eleven Mile Avenue in Gresham. The light rail vehicles using the maintenance facility would not be carrying any passengers, and the proposed expansion would not result in any unique safety and security conditions requiring additional mitigation beyond those practices currently applied for the facility, which has restricted access.

3.17 SECTION 4(F)

This section summarizes how the Portland-Milwaukie Light Rail Project is responding to a federal environmental law known as Section 4(f), which protects parks, recreation areas, historic and cultural resources, and nature refuges. This section summarizes the 4(f) analysis and evaluation that is attached in Appendix K, Final Section 4(f) Evaluation.

3.17.1 Applicable Regulations

The United States Department of Transportation (USDOT) Act of 1966 (49 USC 303) includes regulations that prohibit the use of parks, recreation areas, historic sites or nature refuges for transportation projects except in very unusual circumstances. These regulations, known as Section 4(f), require that USDOT agencies (including the FTA):

> …not approve the use of land from a significant publicly-owned park, recreation area or wildlife and waterfowl refuge or any significant historic site, unless there is no feasible and prudent alternative to the use of land from the property and the action includes all possible planning to minimize harm to the property resulting from the use.

A use is generally defined as a transportation activity that permanently or temporarily acquires land from a Section 4(f) property. Section 6009(a) of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Pub. L. 109-59, amended existing Section 4(f) legislation at Section 138 of Title 23 and Section 303 of Title 49, United States Code. Section 6009 directed the USDOT to issue regulations that clarify the factors to be considered and the standards to be applied when determining whether feasible and prudent alternatives could avoid the use of a Section 4(f) property. On March 12, 2008, the Federal Highway Administration (FHWA) issued a Final Rule on Section 4(f), which moves the Section 4(f) regulation to 23 CFR 774 and provides updated direction for Section 4(f) evaluations.

Section 6009 of SAFETEA-LU also provided regulations simplifying the processing and approval of projects that have only *de minimis* impacts or uses of lands protected by Section 4(f). This revision provides for minor uses of Section 4(f) properties under specific conditions. If USDOT determines that a transportation use of Section 4(f) property (including any impact avoidance, minimization, and mitigation or enhancement measures) results in a *de minimis* impact on that property, an analysis of avoidance alternatives is not required and the Section 4(f) evaluation process is complete.

The Final Section 4(f) Evaluation provided in Appendix K addresses the Portland-Milwaukie Light Rail Project and its Locally Preferred Alternative (LPA) to Park Avenue, the Minimum Operable Segment (MOS) to Lake Road, and Related Bridge Area Transportation Facilities. It identifies potential uses of Section 4(f) properties as outlined in 23 CFR 774. A previous Draft Section 4(f) Evaluation was released for public review in May of 2008 as part of the *Portland-Milwaukie Light Rail Project SDEIS*.

Section 4(f) properties may not be used for any transportation project receiving federal funds or approval from a USDOT agency, except where *de minimis* impacts occur, where there is a specific exception to a use in Section 4(f) regulations, or where no feasible or prudent alternative exists. Section 4(f) ensures that all possible planning has been done to minimize harm to those properties covered by the act.

3.17.2 Section 4(f) Resources

3.17.2.1 Park and Recreational Resources

Table 3.17-1 summarizes the park and recreational resource uses as identified for the project. Properties not identified were either not affected by the Portland-Milwaukie Light Rail Project or they do not qualify for Section 4(f) protection. This includes future planned parks and recreation facilities not currently in public ownership or control, such as sections of the City of Portland's Willamette River Greenway in the South Waterfront and Central Waterfront areas, where the lands are currently still in private ownership.

Table 3.17-1
Portland-Milwaukie Light Rail Project - Summary of Park and Recreational Resource Use

Name	Owner/Custodian	Type of Use and Project Element Involved	Description of Project Activity	Approximate Area of Use	Total Acreage of Resource
Eastside Willamette River Greenway Trail	City of Portland	De minimis LPA to Park Ave. MOS to Lake Rd.	Reconstruction of trail under a new Willamette River bridge, and construction of a bridge abutment	< 0.05 acre Temporary use area and lowering of trail	4.27
Springwater Corridor Trail	Metro / City of Portland	De minimis LPA to Park Ave. MOS to Lake Rd.	Reconstruction of abutment of trail bridge over light rail; new trail access; potential sidewalk improvements	< 0.1 acre use area beneath trail	n/a
Westmoreland Park	City of Portland	De minimis[1] LPA to Park Ave. MOS to Lake Rd.	Partly funding city project to restore stream and wetland functions to replace a constructed pond; mitigates light rail wetland impacts	Restoring 3 acres of the pond, including 1.03 acres for wetland mitigation	
Trolley Trail (Planned)	North Clackamas Parks and Recreation District	De minimis LPA to Park Ave.	Use of trail right-of-way (ROW)	0.87 acres permanent use area	17.41

[1]Westmoreland Park is a Section 4(f) resource as a park as well as an historic resource under Section 106.

3.17.2.2 Historic and Cultural Resources

Table 3.17-2 summarizes the historic resources used by the project.

Table 3.17-2
Portland-Milwaukie Light Rail Project - Section 4(f) Historic Sites Used

Name/Type	Address	Built Date	Section 106 Status[1]	Section 106 Finding[2]	Type of Section 4(f) Use	Description of Use
PSU/School	2000 SW 5th Ave.	1965	Determined Eligible	ROW acquisition; No adverse effect	De minimis LPA to Park Ave. MOS to Lake Rd.	No adverse effect; partial acquisition of property behind the building
Royal Foods/Warehouse/ Office	2425-2445 SE 8th Ave.	1957	Determined Eligible	Full or partial demolition; Adverse effect	Use LPA to Park Ave. MOS to Lake Rd.	Adverse effect due to full acquisition and demolition
Residence	1635 SE Rhone St.	1926	Determined Eligible	Partial ROW acquisition; No adverse effect	De minimis LPA to Park Ave. MOS to Lake Rd.	No adverse effect; minor acquisition required for sidewalk and streetscape treatments
Westmoreland Park	7605 SE McLoughlin Blvd.	1937	Determined Eligible	No ROW acquisition; Adverse effect	Use LPA to Park Ave. MOS to Lake Rd.	Adverse effect due to enhancement of park feature as mitigation for project wetland impacts
Brooklyn Yard	2001 SE Holgate Blvd.	1912-1946	Determined Eligible	ROW acquisition; No adverse effect	De minimis LPA to Park Ave. MOS to Lake Rd.	No adverse effect; partial acquisition and relocation of one facility in yard; no change of use
R. Derwey House	2206 SE Washington St.	1925	Determined Eligible	ROW acquisition – Impacts setting; Adverse effect	Use LPA to Park Ave. MOS to Lake Rd.	Adverse effect due to partial acquisition and change of setting
Spanish Revival House	2326 SE Monroe St.	1928	Determined Eligible	ROW acquisition; No adverse effect	De minimis LPA to Park Ave. MOS to Lake Rd.	No adverse effect; partial acquisition but no change of setting
Oregon Pacific Railroad	Various locations along the alignment	Various	Determined Eligible	Direct use of ROW; No adverse effect, railroad only (not trestle)	De minimis LPA to Park Ave. MOS to Lake Rd.	No adverse effect; partial use of ROW and relocation of yard facilities

Table 3.17-2
Portland-Milwaukie Light Rail Project - Section 4(f) Historic Sites Used

Name/Type	Address	Built Date	Section 106 Status[1]	Section 106 Finding[2]	Type of Section 4(f) Use	Description of Use
Union Pacific Railroad (excluding trestle)	Various locations along the alignment	1900	Determined Eligible	Direct use of ROW; No adverse effect, railroad only (not trestle)	De minimis LPA to Park Ave. MOS to Lake Rd.	No adverse effect; partial use of ROW and relocation of yard facilities
Railroad Trestle	At Kellogg Lake	1900	Determined Eligible	Indirect, visual; No adverse effect	De minimis LPA to Park Ave.	No adverse effect; use of ROW but no direct alterations; change of setting, decreased visual opportunities
Residence	2313 SE Wren Street	1953	Determined Eligible	Partial acquisition; no adverse effect	De minimis LPA to Park Ave.	No adverse effect; use of small area at rear of lot; removal of trees

[1]Listed or Determined Eligible for Listing in the National Register of Historic Places; Oregon SHPO has concurred.

[2]Determination of Effect with concurrence by the Oregon SHPO.

3.17.3 Conclusion

Based on the analysis presented in Appendix K, Final Section 4(f) Evaluation, FTA determines that:

- there is no feasible and prudent alternative that completely avoids the use of Section 4(f) property;
- the LPA to Park Avenue is the alternative that causes "least overall harm" and still meets the project's purpose and need; and
- the LPA to Park Avenue incorporates all possible planning to minimize harm to Section 4(f) resources.

Locally Preferred Alternative (LPA) to Park Avenue

The LPA to Park Avenue would result in a permanent use of three historic Section 4(f) resources. It has been designed to minimize its effects on the other Section 4(f) resources that are along its alignment, with either *de minimis* or temporary use of other Section 4(f) resources. The LPA to Park Avenue is the only feasible and prudent alternative that has been found to satisfy the project's purpose and need for a major transit investment. The LPA to Park Avenue involves the same full use of Section 4(f) resources as does the MOS to Lake Road or the LPA Phasing Option. While the LPA to Park Avenue does involve *de minimis* impacts to the historic trestle and the Trolley Trail, *de minimis* findings do not require further evaluation of avoidance alternatives.

The LPA to Park Avenue would provide multimodal transportation options, support land use goals, contribute to the decrease in congestion, and provide better connections throughout the region. It would therefore best meet the project purposes of maintaining livability, supporting land use goals, minimizing environmental impacts, reflecting community values, and optimizing the transportation system.

Minimum Operable Segment (MOS) to Lake Road

The MOS to Lake Road does not offer the opportunity to avoid any Section 4(f) resources that require a full use under the LPA to Park Avenue. Because it has the same full uses of Section 4(f) properties, it does not represent a separate Section 4(f) avoidance alternative. The MOS to Lake Road, which is similar to a previously considered alternative terminating in downtown Milwaukie (as evaluated in the 2008 SDEIS), represents an interim phasing approach for the project, and is not considered an alternative to ultimately building and operating the LPA to Park Avenue. Further, because the MOS to Lake Road would have a terminus at SE Lake Road and requires developing a park-and-ride in downtown Milwaukie, it carries higher traffic impacts within the downtown area and increases the right-of-way acquisition in downtown to provide for a park-and-ride. The City of Milwaukie has stated that the park-and-ride structure required for the MOS to Lake Road is inconsistent with the city's plans for its downtown revitalization, which includes goals for a pedestrian scale downtown area and a stronger connection between the downtown area and the Willamette River waterfront. The MOS also has one less station and a lower supply of parking than the LPA to Park Avenue. It has lower ridership and lower transportation system benefits, and lower levels of environmental benefits. All of these factors show that the MOS to Lake Road would have higher localized impacts and lower local and regional mobility benefits than the LPA to Park Avenue. It also offers less opportunity for efficient transit connections from areas to the south. The region's *High Capacity Transit Plan*, an element of the adopted RTP, also identifies a future extension of light rail to Oregon City, which would further extend the benefits of light rail. As a stand-alone project, the MOS to Lake Road, with a permanent terminus at SE Lake Road, would therefore not fully achieve the project's purposes of maintaining the livability of the region, supporting land use goals, optimizing the transportation system, and reflecting community values.