Chapter 3

Environmental Analysis and Consequences
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3. ENVIRONMENTAL ANALYSIS AND CONSEQUENCES

This chapter discusses the environmental analysis and effects associated with the proposed light rail project. The chapter includes sixteen 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 and Light Rail Alternatives (including alignment and design options), and proposes possible mitigation and enhancement strategies to minimize negative environmental effects. Maps showing the light rail alternative and options are included in Chapter 2, Alternatives Considered (Figures 2.1-1 through 2.1-3).

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 Light Rail Alternative. The secondary effects of the property acquisitions and displacements, including changes in employment, tax revenues, or changes in community character, are discussed in Sections 3.2, Land Use and Economics, and 3.3, Community Impact Assessment. For additional information on the properties identified as being affected, see Appendix G of this SDEIS and the Acquisitions and Displacements Results Report (Metro, April 2008).

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 and Milwaukie and an unincorporated area of Clackamas County.

Starting from the north, the Portland-Milwaukie Corridor 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 (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. As the corridor moves south, uses are primarily industrial with some commercial and residential neighborhoods nearby. The corridor then passes primarily industrial and commercial uses until it approaches downtown Milwaukie, where 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.

The existing and recent past vacancy rates for industrial and office property range from 5 to 12 percent in the greater Portland area as of the third quarter 2007, which is considered to be a market that is in balance with the supply of property appearing to be adequate to meet demand. However, as vacancy rates in certain areas of the region dip and market prices and overall demand for industrial and office space continue to rise, the market responds with increased development activities that increase supply over time. The region’s management of the urban land supply through regulation of the urban growth boundary and local government provision of urban services such as sewer and water also influences the market.

Chapter 3.2, Land Use and Economics, provides a more detailed discussion of 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 Consequences

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 requires the acquisition and use of property. In most locations of the corridor, the light rail project has been routed to use public and available railroad rights-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 must comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 USC 4601) and associated regulations contained in 40 CFR part 24. TriMet is empowered by the State of Oregon to acquire private property for public purposes.

The light rail alternatives and options are currently at an early stage of planning and design, and some details of the project remain to be developed during final design after project approval. However, the conceptual engineering information currently available is sufficient to allow this SDEIS to identify properties that are likely to be affected and to evaluate the effects of full or partial acquisitions and potential displacements.

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 is when the entire parcel is expected to be needed, and a partial
acquisition is when a portion of a property is needed and some of the parcel is left intact. For an analysis of potential economic impacts associated with displacements, see Section 3.2.

A project element is considered as having the potential for 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.

Table 3.1-1 provides a summary of the permanent displacements and full or partial acquisitions associated with the 2003 Locally Preferred Alternative (LPA) and the design options. 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. The potential displacements will be refined as the project moves into Preliminary Engineering.

Early relocation planning will be conducted during upcoming project development. For instance during preliminary engineering, additional market analysis will be conducted to assess opportunities for relocation for affected property owners. This information will be included in the Final Environmental Impact Statement.

<table>
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<th>Table 3.1-1</th>
<th>Summary of Full and Partial Acquisitions and Breakdown of Displaced Uses</th>
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<td>Tax Lots to be Fully Acquired</td>
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Ruby Junction is an operations and maintenance facility located in Gresham near SE 199th Avenue and SE Burnside Street. For more information see Appendix G: Properties Affected by Acquisitions and Appendix H: Conceptual Design Information.
**No-Build Alternative**

The No-Build Alternative is not expected to displace any residences or businesses nor require any other form of property acquisition.

**Light Rail Alternative**

**2003 Locally Preferred Alternative**

The 2003 LPA would require the acquisition of approximately 55 tax lots, which would potentially displace two residences, 46 businesses and two parking lots. The total includes three apparently vacant buildings and 10 vacant tax lots. The affected residences consist of an apartment over a restaurant and a single-family house. Most of the business displacements would be in southeast Portland, between the Willamette River and SE Harold Street. Several vacant tax lots or buildings along the east side of SE McLoughlin Boulevard between SE Tacoma and SE Ochoco Streets would also be acquired. One large industrial and several smaller commercial businesses would be displaced in the City of Milwaukie.

There would be partial acquisitions from approximately 67 tax lots along the 2003 LPA alignment. At the north end of the alignment, frontage would be acquired from two tax lots on the corner of SW 5th Avenue. Additional right-of-way would be needed from tax lots between SW Harbor Drive and the Willamette River. On the east side of the Willamette River, most partial acquisition of right-of-way would be between OMSI and SE Harold Street. Additional right-of-way would be acquired in Milwaukie from tax lots on the east side of the alignment’s proposed right-of-way where it crosses SE Main, SE Harrison, SE Monroe, and SE Washington Streets, and SE 21st Avenue.

**Willamette River Crossing Options**

The Willamette River crossing options would require the acquisition of parts of currently undeveloped parcels in the South Waterfront area, but there would be no additional displacements compared to the 2003 LPA between downtown and the west side of the Willamette River. On the east side of the Willamette River, the crossing options would displace an additional three to four businesses on five tax lots, depending on whether the crossings land on SE Sherman Street (three businesses) or SE Caruthers Street (four businesses).

Partial acquisition associated with the crossing options would affect seven tax lots if the crossings land on SE Sherman Street and eight tax lots if the crossings land on SE Caruthers Street.

On the east side of the river for the Meade-Sherman and Porter-Sherman options, partial acquisitions would affect five of the same tax lots as the 2003 LPA and one south of SE Sherman Street at the river, but fewer tax lots associated with OMSI. Partial acquisition for the Meade-Caruthers and Porter-Caruthers options would affect one additional tax lot than the SE Sherman Street options the tax lots affected south of those options. The SE Caruthers Street options would affect two of the same tax lots as the 2003 LPA.
Bus/No Bus, Bridge Type, and Elevation Options

The No Bus option would not change the 2003 LPA’s property impacts. The type of bridge (concrete segmental or cable-stayed) and the elevation options would also not change property impacts, based on the level of engineering currently available.

Alignment and Terminus Options

2003 LPA to Park

The 2003 LPA to Park option would displace an additional seven businesses and two residences when compared to the 2003 LPA. Adding the extension to SE Park Avenue to the rest of the 2003 LPA would displace a total of 53 businesses and four residences. The alignment does not include the Lake Road Park and Ride, requiring five fewer full acquisitions in Milwaukie and avoiding impacts to three businesses and three vacant lots.

Partial acquisitions for the extension would affect a total of 82 tax lots, an additional 15 tax lots compared to the 2003 LPA, including several tax lots belonging to the North Clackamas Park and Recreation District, the City of Milwaukie, the Oak Lodge Sanitary District, and several single-family tax lots.

Tillamook Branch Line Alignment

The Tillamook Branch Line Alignment would result in an additional 7 full acquisitions and an additional 10 partial acquisitions compared to the 2003 LPA, displacing a total of 55 businesses and four residences. This increase in acquisitions is related to the extension to SE Park Avenue. For a comparable segment (to Lake Road Station), following the Tillamook Branch Line alignment rather than the 2003 LPA would require four fewer full acquisitions, avoiding displacement impacts to one business, two vacant buildings and a vacant lot, and five fewer partial acquisitions in that segment.

Maintenance Base

The Light Rail Alternative would require expansion of the existing Ruby Junction Operations Facility on NW Eleven Mile Avenue in Gresham. The expansion of the current Ruby Junction maintenance facility would require the full acquisition of 14 parcels, and the partial acquisition of one parcel. This partial acquisition would be required for the construction of a cul-de-sac and would not displace the use on the property. Initial drive-by counts estimate that six light industrial or manufacturing uses, not including one vacant factory, and seven single-family residences (SFRs), not including a vacant SFR, would be displaced to make room for this expansion. In many cases there appears to be multiple uses occurring on a single property.

3.1.2.2 Short-Term Impacts (Construction)

No-Build Alternative

The light rail project would not be developed and no displacement impacts are anticipated.
Light Rail Alternative

If construction involves only a temporary use of land, TriMet could negotiate a construction easement 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. Typically, these areas are identified during final design and are leased rather than permanently acquired.

3.1.2.3 Secondary and Cumulative Impacts

The No-Build Alternative would not require the acquisition of properties or the displacement of businesses or residences and would not add to past or future actions that displace uses.

Impacts from the 2003 LPA and the other alignment and terminus options 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 alternatives could cause land values to rise and some existing tenants may choose to move from the area to find more affordable accommodations.

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.” These indirect impacts are discussed in more detail in the land use and socioeconomic sections.

3.1.3 Potential Mitigation Measures

Direct property acquisition and relocation impacts would be mitigated through financial compensation and technical assistance, regulated in accordance with the federal Uniform Relocation Assistance and Real Property Acquisition Act of 1970 (Uniform Relocation Act) as amended, FHWA’s Federal Aid Policy Guide, Oregon Revised Statutes, and ODOT guidance.

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 their 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 provide for their compensation. TriMet’s policies are posted online at: http://trimet.org/pdfs/publications/acquisition-relocation.pdf.

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 residences and businesses.
3.2 LAND USE AND ECONOMY

The purpose of this section is to describe the general land use and economic conditions and potential impacts as related to the project. Sections 3.2.1 through 3.2.3 provide a summary of information on existing land uses in the Portland-Milwaukie Light Rail project corridor, identify expected direct and indirect consequences of the No-Build and project alternatives, and describe potential mitigation measures for the Portland-Milwaukie Light Rail Project. Further details on land use and economic conditions and impacts are provided in the Land Use and Economy Results Report, (Metro, May 2008). Sections 3.2.4 through 3.2.6 describe the existing economic conditions, potential economic impacts of the No-Build and Light Rail Alternative, and potential mitigation measures for the Portland-Milwaukie Light Rail Project.

3.2.1 Land Use Affected Environment

This section describes the 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 No-Build and Build Alternatives. 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 state-wide land use goals and objectives that are 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, which express the state’s policies on land use and on related topics, such as citizen involvement, housing, and natural resources. Under Goal 14, 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. Growth must occur only within approved UGBs. This requirement improves the efficiency of public infrastructure investments such as light rail because it can serve a more concentrated population within a limited urban area.

Goal 12, as implemented through the Transportation Planning Rule (TPR), strengthens the connection between land use and transportation planning. For example, it requires local jurisdictions to consider street and building designs that encourage more transit use and are pedestrian and bicycle friendly. The TPR also applies to Metro, the regional government and Metropolitan Planning Organization (MPO). The TPR requires metropolitan areas to set standards for reducing vehicle miles traveled (VMT) per capita.
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). The 2040 Growth Concept map articulates visually where growth should occur in the region (see Figures 3.2-1 and 3.2-2). The associated policies direct growth to a hierarchy of interrelated mixed-use corridors (e.g., SE McLoughlin Boulevard) and urban centers: the Central City (Portland), Regional Centers (e.g., Clackamas Regional Center), Town Centers (e.g., Milwaukie). The 2040 Growth Concept envisions that all Regional Centers will be connected by high capacity transit to the Central City. Currently, four of the seven designated Regional Centers are linked by light rail to the Central City: Gresham, Gateway, Beaverton, and Hillsboro. By 2009, two of the remaining three, Wilsonville and Clackamas, will be connected to the Central City via commuter or light rail transit.

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 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 Central City, Regional Centers, and Town Centers.

Metro Regional Transportation Plan

Metro is also the federally recognized Metropolitan Planning Organization (MPO), which has responsibility for planning the transportation system of the urban area. The Regional Transportation Plan (RTP) envisions light rail and rapid bus as the backbone of the transit system, connecting Regional Centers to each other and to the Central City. The Regional Transit System, as shown in the 2035 RTP, includes planned or proposed light rail lines between Portland and Milwaukie. The 2035 RTP Project List includes the Milwaukie Light Rail Extension.

City of Portland Plans and Policies

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.

The 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 are a mix of uses that supports transit and higher density residential development within one-half mile of transit stations and one-quarter mile of transit centers that support the use of transit (Policies 2.12, 2.17, 2.18, and 6.19).

The Comprehensive Plan also 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).
Figure 3.2-2

Portland-Milwaukie Light Rail Project

2040 Concept - Focus on SE Portland and Clackamas County

Central City
Regional Centers
Town Centers
Main Streets
Station Community Core
Corridors
Employment
Industrial
Regionally Significant Industrial
Inner Neighborhoods
Outer Neighborhoods
Park
Open space
Light Rail Stations
Potential Light Rail Stations
Planned & Existing Rail Lines
Proposed Light Rail Alignments
Potential HCT Facilities
Rail Distribution Network

Portland-Milwaukie Light Rail Project

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Central City Plan

The Central City Plan is one of two significant community plans applicable to the Portland-Milwaukie Light Rail Project. The 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: Downtown Portland District, the University District, South Waterfront, and the Central Eastside Industrial District (CEID).

A key transportation policy states that the 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 Central City.

South Waterfront Plan (2002)

This is the second major community plan applicable to the project. The South Waterfront Plan sets a goal of providing 10,000 jobs and 3,000 housing units within the district 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 to the regional light rail system by 2022.

Since the adoption of the South Waterfront Plan, the Oregon Health and Science University (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 greenway could be needed to accommodate OHSU’s development vision.

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 an eastside light rail line by including denser residential and other transit-oriented uses around transit stations.

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 Plan shows a High-Capacity Transit Route, with both the 2003 LPA and Tillamook Branch Line alignments.
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 Line). The key land use concepts are minimum densities and mixed uses, but the plan calls for a variety of strategies to support a revitalized downtown. 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.

Clackamas County Land Use Planning Framework

Clackamas County Comprehensive Plan

The Comprehensive Plan identifies a high-capacity transit route for SE McLoughlin Boulevard from Portland 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 SE Park Avenue.

3.2.1.2 Existing and Planned Land Use

Portland/Vancouver Metropolitan Region

The metropolitan region includes Multnomah, Clackamas, and Washington Counties in Oregon, and Clark County in Washington. The Light Rail Alternative features the 2003 LPA, with a variety of design and alignment options for crossing the Willamette River, serving Milwaukie, and extending light rail beyond downtown Milwaukie to SE Park Avenue. Figure 3.2-3 shows the jurisdictions and boundaries in the Portland-Milwaukie Light Rail Project corridor. The existing and planned land use are described from north to south for each segment beginning in downtown Portland, to Southeast Portland, south through Milwaukie, and ending at SE Park Avenue in Clackamas County.

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 to the older industrial areas of the CEID, Brooklyn Yard, and the McLoughlin Industrial area, to historic downtown Milwaukie. 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 and apartment towers. The CEID has also experienced considerable redevelopment. The Brooklyn Yard continues to be a major rail operations hub, with few recent changes in surrounding rail- and freight-oriented development. Many of the other established neighborhoods, which include the Hosford-Abernathy, Brooklyn, Sellwood-Moreland, Eastmoreland, and Ardenwald neighborhoods, feature mostly older single-family residences. The McLoughlin Industrial area provides land and buildings for industrial use. In downtown Milwaukie, a new mixed-use residential building in downtown has been developed, which is the first significant new development there in many years. The areas south of downtown Milwaukie along SE McLoughlin Boulevard to SE Park Avenue have not experienced recent major redevelopment, although development adjacent to the roadway is limited up to SE Park Avenue. For a more detailed description of the existing land uses in the corridor, see the Land Use and Economy Results Report.
Planned Land Uses in the Project Area

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 permitted by comprehensive plans and zoning codes. South Waterfront, CEID, and downtown Milwaukie are the most prominent areas but there are also scattered vacant and redevelopable parcels throughout. 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. For a more detailed description of the planned land uses in the corridor, see the Results Report.

3.2.2 Impacts on Land Use

This section describes potential impacts on land use measures for the No-Build Alternative and Light Rail Alternative. Generally, the impacts for the 2003 LPA are presented to represent the Light Rail Alternative. If there are differences among the options, those are called out in the text.

3.2.2.1 Compatibility of the Alternatives with Adopted Plans and Policies

This section describes compatibility of the alternatives with Adopted Plans and Policies as detailed in Section 3.2.1.1.

No-Build Alternative

Compatibility with State Planning Goals

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

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 by 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 Eastside and Milwaukie, would likely have a more difficult time achieving high levels of transit usage (see Chapter 2). The lack of transit infrastructure investment would likely slow or discourage growth in these areas, as congestion and more limited mobility choices would make the areas less attractive for businesses or 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.
Figure 3.2-4

Portland-Milwaukie Light Rail Project

Comprehensive Plan

- Commercial
- Industrial
- Multi Family
- Mixed Use
- Parks & Open Spaces
- Rural Residential
- Single Family

1/2 Mile from Station

- Light Rail alternative
- Station location
- Existing Streetcar
- Portland Aerial Tram
- Light Rail: Under Construction
- Portland Streetcar Loop Project
- County line

Portland – Milwaukie
LIGHT RAIL PROJECT

Metro

November 2007
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 location
- Existing Streetcar
- Portland Aerial Tram
- Light Rail: Under Construction
- Portland Streetcar Loop Project
- County line

Portland-Milwaukie Light Rail Project

November 2007
**2003 LPA and Associated Options**

**Compatibility with State Plans**

The Light Rail Alternative supports the TPR more 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.

**Compatibility with Regional and Local Plans**

The Light Rail Alternative would be compatible with regional plans and policies. The Region 2040 Growth Concept creates and the Functional Plan implements the idea of regional transit connecting higher-density centers such as Portland and Milwaukie. The Design Type designations reflect the adopted Land Use Final Order (LUFO) for the full South/North Corridor. The RTP identifies light rail as the best public transportation mode to serve and connect the Central City and Regional Centers, while Town Centers can be served at a secondary level by light rail. The Light Rail Alternative directly links transportation and land use through transit-oriented development in downtown Portland, in South Waterfront, in the SE Portland station areas and in the Milwaukie Town Center. The 2035 RTP supports construction of light rail between Portland and Milwaukie.

The Light Rail Alternative is also compatible with local plans in Portland and Milwaukie. Portland’s comprehensive plan supports and encourages light rail as a way to increase access into the downtown core and increase the proportion of all trips occurring on transit. The Central City Plans and South Waterfront plans 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 Central City through light rail.

The Milwaukie Comprehensive Plan and Downtown Plan implement Milwaukie’s designation as a town center. The goals of those plans will be achieved more quickly through light rail service to the city and the development of stations at SE Harrison Street and at SE Lake Road.

The extension of the 2003 LPA to Park would be consistent with the goals of the Clackamas County Comprehensive Plan, which identifies SE McLoughlin Boulevard as a high-capacity transit corridor.

**3.2.2.2 Impacts on Existing and Planned Land Uses**

**No-Build Alternative**

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 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.
Regional Land Use Impacts from the Light Rail Alternative

The metropolitan region includes Multnomah, Clackamas, and Washington Counties in Oregon, and Clark County in Washington. Figure 3.2-3 shows the jurisdictions and boundaries in the Portland-Milwaukie Light Rail Project corridor. The Portland to Milwaukie Light Rail Project will augment the regional 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 on both campuses.

Local Land Use Impacts from the Light Rail Alternative

This section provides a summary of the local land use impacts on existing and planned land uses. The analysis proceeds segment by segment from north to south, first describing the 2003 LPA and then describing differences, if any, that would occur with the different alignment and design options.

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 its partners have initiated a station area assessment process 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 featured open public workshops and meetings designed to help identify local area goals and the potential for redevelopment near stations. The process clearly recognizes that local governments control the decisions about land use, including zoning and specific development approvals. As the project progresses and a new Locally Preferred Alternative is identified, the station area planning and design processes will become more detailed to identify station features and attributes that can help support nearby land uses, both existing and planned.

2003 LPA and Associated Options (Light Rail Alternative)

Impacts from conversion of land from existing uses to a transportation use would be minor in the context of both localized and regional land supply. In addition, some of the properties to be acquired by the project will become available for redevelopment after light rail construction is completed, which would further minimize long-term impacts. Much of the alignment follows existing rights-of-way and the acquisition impacts in the corridor are localized, primarily occurring in a limited number of station areas.

While individual uses such as industrial and business would be affected, the affected properties represent a small fraction of the total properties in their plan areas, and no major changes to area land use patterns would be expected. This includes the Central Eastside Industrial District and Brooklyn Yard in Portland and the Milwaukie Industrial Area, where parcels with industrial uses would be acquired and their uses displaced. In these areas, the impacts are mostly in station areas. There would be no full acquisitions impacting parcels that have planned developments under review by either the City of Portland or the City of Milwaukie.

Light rail is likely to advance the timing and intensity of development allowed by the comprehensive plans in Portland and Milwaukie. Based on these changes in development potential, the City of Portland may decide to re-zone a few industrially zoned sites to mixed use designations. Overall, the project will allow land uses to change within existing zoning and comprehensive plan constraints.
For a more detailed description of potential land use effects in each area along the corridor, see the Results Report.

**River Crossing Options**

The four Willamette River crossing options present the potential to provide more support for planned land uses than the 2003 LPA. There has been a substantial increase in the density of jobs and housing in the South Waterfront 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 stations are projected to serve about 400 percent more households than existed in 2005 and about 95 percent more employees. A portion of the job growth is expected to occur on the vacant OHSU property located between the Marquam and Ross Island Bridges. All of the proposed light rail bridge alignments would support accelerated growth in housing and jobs by increasing access to the entire South Waterfront area from throughout the region. The Portland-Milwaukie Light Rail project would encourage the levels of transit needed to support the high-density land uses planned in the area.

The Willamette Crossing options include stations at SE Sherman Street and SE Caruthers Street. The Sherman Street Station option would directly serve OMSI. The Caruthers Street Station would support planned development north of SE Caruthers Street. The area south of SE Caruthers Street is currently zoned for heavy industrial.

In terms of impacts on land supply and the overall land use patterns, the Willamette River crossing options would not create a major difference compared to the 2003 LPA. Both require some building acquisitions and business displacements (see Section 3.2.5.1). While these effects may create hardships for the 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 can relocate within the region.

**2003 LPA Extension to Park**

The Park Avenue extension would serve areas that are projected to undergo growth in employment, with lower levels of growth in households. Areas to the west and to the south along SE McLoughlin Boulevard offer opportunities for infill development and redevelopment. Most of the parcels identified for full or partial acquisition would be from private and public land on the west side of SE McLoughlin Boulevard. The businesses that would be displaced at the Bluebird Street and Park Avenue Station areas are not expected to affect the overall patterns of land use in the area, and property not required for the permanent light rail facilities could be made available for redevelopment.

Access to SE McLoughlin Boulevard for some of the properties on SE 22nd Avenue and SE River Road would be altered, but not significantly. The gated at-grade crossing would stop all traffic except southbound right-turn movements when trains are crossing and cause delays, whereas the elevated crossing would avoid this impact. However, these differences are unlikely to have different impacts on land use in the immediate area.

**Tillamook Alignment**

The Tillamook Branch Line alignment would eliminate the Milwaukie Station and Park and Ride and would have a station at SE Monroe Street instead of SE Harrison Street. The differences in impacts would be minor. Acquisition needs in the industrial area would be less than the 2003 LPA,
and would not affect overall land use patterns. The impacts of the SE Monroe Station are similar to those at SE Washington Street. One advantage of the Monroe Station is that it is closer to bus lines in downtown Milwaukie.

**Maintenance Base**

TriMet’s existing Ruby Junction Operations 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 support single-family residences, service businesses, and industrial businesses, and are all zoned heavy industrial. In many cases there appear to be multiple uses occurring on a single property. Because the existing facility is located in an area with other light-manufacturing uses, the expansion would not appreciably change land use patterns.

**3.2.2.3 Short-Term Impacts (Construction)**

**No-Build Alternatives**

While there would not be construction of light rail in the corridor, the planned improvement projects for pedestrian, bicycle, roadway, and boulevard would be constructed. Impacts would be more localized and short-term than under the Light Rail Alternative.

**Light Rail Alternative and Options**

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 appraised of project developments. This is true for the 2003 LPA and options.

Construction related impacts are discussed in further detail below.

**3.2.2.4 Secondary and Cumulative Impacts and Land Use**

Cumulative land use impacts of the Portland-Milwaukie Light Rail Project are most directly related with 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 Light Rail Alternative. In contrast, by not supporting the planned growth in the inner neighborhoods, the No-Build Alternative could effectively induce growth farther out from designated planned population and employment centers and indirectly increase pressure to expand the UGB.
3.2.3 Potential Land Use Mitigation Measures

No mitigation is required for consistency with plans and policies for the 2003 LPA and associated options because there would be no adverse impacts to land use plans or policies.

3.2.4 Economic Existing Conditions

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 has been steadily increasing since. In Oregon, the job growth has been positive each year since the first quarter of 2004 but has slowed through 2007 (Office of Economic Analysis for the State of Oregon [OEA]). Again following national trends, Oregon is projected to face a slowing economy in 2008 with a recovery in 2009. Manufacturing is expected to stabilize, but retail and services will feel the impact from decreased consumer spending.

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 has shown strong economic growth over recent years, with occasional downturns that follow national conditions. The Portland area 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. Despite the decline, this was the second-fastest growth rate of all regions in Oregon. Slowing was more evident in Washington County and less so in Multnomah County; Clackamas County had no slowdown. Layoffs at Intel and Freightliner have brought down manufacturing employment close to 2006 levels. Despite the slowdown, the metropolitan area continues to have one of the most rapid job growth rates in the state. All of the broad private sector industries are growing, but the pace of growth has slowed.

In the Portland region, commercial and industrial vacancy rates remain balanced; they are low enough to be stimulating some speculative industrial development yet high enough to allow some fluidity. The availability of industrial and office space affects the ability of displaced businesses to be successfully relocated to sites with similar characteristics.

Table 3.2-1 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 3.2-1
Population and Employment within One-Half Mile of Station, 2005 to 2030

<table>
<thead>
<tr>
<th>Station</th>
<th>Households 2005</th>
<th>Households 2030</th>
<th># of New Households</th>
<th>% Change</th>
<th>Jobs 2005</th>
<th>Jobs 2030</th>
<th># of New Jobs</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 LPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lincoln</td>
<td>3,929</td>
<td>7,407</td>
<td>3,478</td>
<td>89%</td>
<td>32,482</td>
<td>46,255</td>
<td>13,773</td>
<td>42%</td>
</tr>
<tr>
<td>RiverPlace</td>
<td>1,399</td>
<td>4,534</td>
<td>3,135</td>
<td>224%</td>
<td>20,075</td>
<td>33,660</td>
<td>13,585</td>
<td>68%</td>
</tr>
<tr>
<td>OMSI (2003 LPA)</td>
<td>594</td>
<td>2,043</td>
<td>1,450</td>
<td>244%</td>
<td>7,416</td>
<td>14,321</td>
<td>6,904</td>
<td>93%</td>
</tr>
<tr>
<td>Clinton</td>
<td>2,020</td>
<td>2,681</td>
<td>661</td>
<td>33%</td>
<td>6,276</td>
<td>8,292</td>
<td>2,016</td>
<td>32%</td>
</tr>
<tr>
<td>Rhine</td>
<td>1,941</td>
<td>2,019</td>
<td>79</td>
<td>4%</td>
<td>8,593</td>
<td>10,601</td>
<td>2,008</td>
<td>23%</td>
</tr>
<tr>
<td>Holgate</td>
<td>1,375</td>
<td>1,345</td>
<td>-30</td>
<td>-2%</td>
<td>6,085</td>
<td>6,825</td>
<td>740</td>
<td>12%</td>
</tr>
<tr>
<td>Bybee</td>
<td>1,911</td>
<td>1,962</td>
<td>51</td>
<td>3%</td>
<td>1,315</td>
<td>1,668</td>
<td>353</td>
<td>27%</td>
</tr>
<tr>
<td>Tacoma (2003 LPA)</td>
<td>1,629</td>
<td>1,764</td>
<td>136</td>
<td>8%</td>
<td>1,777</td>
<td>2,396</td>
<td>619</td>
<td>35%</td>
</tr>
<tr>
<td>Milwaukie</td>
<td>908</td>
<td>1,400</td>
<td>492</td>
<td>54%</td>
<td>3,190</td>
<td>3,923</td>
<td>733</td>
<td>23%</td>
</tr>
<tr>
<td>Harrison</td>
<td>1,284</td>
<td>2,092</td>
<td>808</td>
<td>63%</td>
<td>3,239</td>
<td>4,324</td>
<td>1,085</td>
<td>33%</td>
</tr>
<tr>
<td>Lake</td>
<td>1,268</td>
<td>1,987</td>
<td>719</td>
<td>57%</td>
<td>1,983</td>
<td>2,733</td>
<td>750</td>
<td>38%</td>
</tr>
</tbody>
</table>

**Design Options**

<table>
<thead>
<tr>
<th>Station</th>
<th>Households 2005</th>
<th>Households 2030</th>
<th># of New Households</th>
<th>% Change</th>
<th>Jobs 2005</th>
<th>Jobs 2030</th>
<th># of New Jobs</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harbor Drive</td>
<td>2,631</td>
<td>6,000</td>
<td>3,369</td>
<td>128%</td>
<td>28,787</td>
<td>43,126</td>
<td>14,340</td>
<td>50%</td>
</tr>
<tr>
<td>SW (Meade-Caruthers)</td>
<td>905</td>
<td>4,490</td>
<td>3,585</td>
<td>396%</td>
<td>12,568</td>
<td>24,113</td>
<td>11,545</td>
<td>92%</td>
</tr>
<tr>
<td>SW (Meade-Sherman)</td>
<td>916</td>
<td>4,602</td>
<td>3,686</td>
<td>402%</td>
<td>12,083</td>
<td>23,452</td>
<td>11,369</td>
<td>94%</td>
</tr>
<tr>
<td>SW (Porter-Caruthers)</td>
<td>927</td>
<td>4,771</td>
<td>3,844</td>
<td>415%</td>
<td>11,140</td>
<td>22,220</td>
<td>11,079</td>
<td>99%</td>
</tr>
<tr>
<td>SW (Porter-Sherman)</td>
<td>953</td>
<td>4,990</td>
<td>4,037</td>
<td>423%</td>
<td>10,476</td>
<td>21,257</td>
<td>10,780</td>
<td>103%</td>
</tr>
<tr>
<td>OMSI (Caruthers)</td>
<td>687</td>
<td>1,999</td>
<td>1,312</td>
<td>191%</td>
<td>6,820</td>
<td>12,887</td>
<td>6,068</td>
<td>89%</td>
</tr>
<tr>
<td>OMSI (Sherman)</td>
<td>693</td>
<td>1,915</td>
<td>1,221</td>
<td>176%</td>
<td>6,961</td>
<td>12,816</td>
<td>5,855</td>
<td>84%</td>
</tr>
<tr>
<td>Harold</td>
<td>1,703</td>
<td>1,785</td>
<td>82</td>
<td>5%</td>
<td>3,072</td>
<td>3,685</td>
<td>613</td>
<td>20%</td>
</tr>
<tr>
<td>Tacoma (Tillamook)</td>
<td>1,608</td>
<td>1,739</td>
<td>131</td>
<td>8%</td>
<td>1,610</td>
<td>2,196</td>
<td>586</td>
<td>36%</td>
</tr>
<tr>
<td>Monroe</td>
<td>1,285</td>
<td>2,065</td>
<td>780</td>
<td>61%</td>
<td>2,775</td>
<td>3,732</td>
<td>957</td>
<td>34%</td>
</tr>
<tr>
<td>Bluebird</td>
<td>1,357</td>
<td>1,607</td>
<td>250</td>
<td>18%</td>
<td>1,023</td>
<td>1,578</td>
<td>555</td>
<td>54%</td>
</tr>
<tr>
<td>Park</td>
<td>1,796</td>
<td>1,873</td>
<td>77</td>
<td>4%</td>
<td>830</td>
<td>1,368</td>
<td>538</td>
<td>65%</td>
</tr>
</tbody>
</table>

**Special Tax Districts – Urban Renewal**

Within the Portland-Milwaukie Light Rail 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 2003 LPA. 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**

Any of the Build Alternatives would require 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. Based on a river user data collected in fall 2007, these operators would not significantly be impacted by a 75-foot navigational clearance. Other users responding to the survey reported vertical clearance needs ranging up to 87 feet. Ross Island Sand and Gravel, Zidell Marine Corporation, and commercial tour operators have a vested interest in the navigational clearance of any new bridge in this area. Individual private boat owners may be affected but typically their maximum heights are lower than the industrial river users so little impact is expected.

**3.2.5 Economic Impacts**

Economic and employment impacts as a result of the construction and operation of the Light Rail Alternative would be experienced throughout the region. The investment in light rail could result in increased development in the corridor and possible increases in 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 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 (see next section), as well as any jobs, services or products, and revenues lost by displaced businesses who elect not to relocate within the project area of the greater metropolitan region. However, these impacts are minor within the context of the regional economy. They may also be partially or fully offset by increased property values and achieving higher development densities in the corridor as a result of the light rail project.

**3.2.5.1 Long-Term Direct Impacts**

Due to the increased connectivity, mobility, and travel time reliability that will result from the Light Rail Alternatives, development is likely to accelerate in the corridor based on adopted land use plans. There is also the potential that one or more of the jurisdictions along the alignment will choose to change zoning to afford different types of development in the corridor. This 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 Light Rail Alternative because the scale of the planned improvements is much smaller and does not cover the full length of the corridor that would be served by the Light Rail Alternative. No known displacements mean that no tax revenues or employment income would be lost, but 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
- Displacements and access changes (including effects to 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 almost $7 million. The Build Alternatives would have operations and maintenance costs of between $1.1 and 2.2 million more than in the No-Build. Based on these estimates, there could be between six and 20 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 costs and represent increases in operating costs and employment.

Business and Employment Impacts from Property Acquisitions

As shown in Table 3.2-1, total job growth in the corridor is forecast to be around 54,000 to 59,000. This job growth would help offset losses to employment that may occur if the displaced businesses are not able relocate within the region. The 2003 LPA would displace 46 businesses. The Willamette River crossing options would displace three or four more businesses and the LPA with extension to Park would displace seven more businesses. The Tillamook option would displace two more businesses than the 2003 LPA. Table 3.2-2 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) and the State of Oregon’s count of employees at registered businesses.

<table>
<thead>
<tr>
<th>Alignment Options</th>
<th>Total</th>
<th>Jobs Displaced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 LPA</td>
<td>675</td>
<td>675</td>
</tr>
<tr>
<td><strong>Willamette Crossing Options</strong></td>
<td></td>
<td>(difference from 2003 LPA)</td>
</tr>
<tr>
<td>Meade Sherman</td>
<td>744</td>
<td>+69</td>
</tr>
<tr>
<td>Porter-Sherman</td>
<td>744</td>
<td>+69</td>
</tr>
<tr>
<td>Meade-Caruthers</td>
<td>897</td>
<td>+222</td>
</tr>
<tr>
<td>Porter-Caruthers</td>
<td>897</td>
<td>+222</td>
</tr>
<tr>
<td><strong>Alignment Option</strong></td>
<td></td>
<td>(difference from 2003 LPA)</td>
</tr>
<tr>
<td>2003 LPA with Tillamook Branch</td>
<td>705</td>
<td>+30</td>
</tr>
<tr>
<td>Alignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003 LPA Extension to Park</td>
<td>699</td>
<td>+24</td>
</tr>
</tbody>
</table>

Several important industrial areas along the route would be directly affected by displacement of businesses, dock or driveway access, loss of parking, and encroachment on loading areas. The key industrial areas are the CEID, SE 17th Avenue/Brooklyn Yard corridor, and the North Milwaukie Industrial Area. The 2003 LPA and all options would affect at least one of these important industrial areas. Given the vacancy rate in the regional market, it is expected that most commercial businesses would find opportunities to relocate, though perhaps not in the immediate area.
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 current terminus of SW Lincoln Street. Approximately 30 on-street parking spaces would be eliminated on SW Lincoln Street, but overall supply appears to be adequate to serve area land uses, especially given the improved mobility to be provided by light rail.

Approximately 50 parking spaces at OMSI and 20 off-street parking spaces between OMSI and the Clinton Street Station would be displaced. Some accesses could be affected by the need for signals at SE Clinton Street/SE 12th Avenue and SE Milwaukie Avenue/SE Gideon Street, which could cause some delays at the intersections during the evening peak traffic hours (addressed in Chapter 4).

SE Powell Boulevard to Tacoma Street 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. In all, 33 driveways and eight intersections would be 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 160 on-street spaces on SE 17th Avenue would be removed. About 110 parking spaces for TriMet employees would be removed. 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 no major restrictions in access would occur.

Tacoma Station to Lake Road Station

There would be one major industrial displacement and several partial acquisitions along the length of the 2003 LPA alignment from SE Sherrett Street to where the alignment joins the Tillamook Branch Line right-of-way. In Milwaukie, several small businesses, two residences and about 40 on- and off-street parking spaces would be displaced.

Closing SE Moore Street at SE Main Street (the frontage road that runs north-south beside SE McLoughlin Boulevard) would create out-of-direction travel of about 800 feet. Where the light rail alignment would be built south of SE Hanna Harvester Drive, two industrial buildings would lose access to their existing freight rail loading docks and bays. This could affect businesses that rely on rail access, but the buildings would otherwise remain intact and would have road access, maintaining their ability to provide for industrial uses.

In the industrial area, impacts on freight traffic at most side streets would involve delays during train crossings, and revisions to SE Main Street would cause out-of-direction travel of about one-half mile for drivers coming from the east side of the industrial area to SE McLoughlin Boulevard/SE Milport Road. These changes in access would cause longer travel times for the businesses in the area, but
overall accessibility would be maintained. Between Highway 224 and Lake Road, the 2003 LPA would run beside the Tillamook Branch Line and avoid reductions in existing street rights-of-way or parking.

**Effects to River Users**

In addition to the potential impacts described above, the proposed bridge across the Willamette River has the potential to affect river users. The proposed transit crossing is a fixed bridge, but the vertical and horizontal clearances have yet to be determined and will be based on a number of criteria, including potential impacts to river users. Based on a review of existing navigation, while there are a limited number of infrequent users that require a clearance above 70 feet, two large industrial users, RISG and Zidell Marine Corporation are important contributors to the local economy whose shipping and manufacturing operations would not be significantly impacted by a clearance of 75 feet.

**River Crossing Options**

Displacements by the Sherman Street Station options would be similar to that of the 2003 LPA. The SE Caruthers Street landing point and station may require acquisition and displacement of several businesses, including the Portland Spirit. As a water-dependent use, the Portland Spirit could be difficult to relocate in the immediate vicinity. The SE Sherman Street alignment does not create access limitations significantly different from the 2003 LPA. The SE Caruthers Street alignment may impede access to existing businesses that are accessible from SE Caruthers Street now, such as the Portland Opera building, whereas there are fewer business accesses affected by the SE Sherman Street landing options.

**Tillamook Branch Alignment**

There would be fewer impacts on access than in the 2003 LPA because the light rail tracks would follow an existing rail corridor, avoiding the industrial area. However, several buildings could lose rail side access.

**Maintenance Base Impacts**

Based on analysis completed for the Columbia River Crossing project, six businesses supporting 60 employees would need to be relocated to expand the existing Ruby Junction maintenance base. The business uses are a mixture of service and industrial.

**Tax Base and Revenue Impacts**

Tax bases can be impacted when private properties are acquired for public use and those properties are 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 the analysis of impacts does not attempt to forecast such changes.

Table 3.2-3 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 Light Rail Alternative.

### Table 3.2-3
**Estimate of Reductions in Tax Revenues from Full Acquisition of Properties by Alternative**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Estimated Assessed Value</th>
<th>Portland/ Multnomah County</th>
<th>Milwaukie/ Clackamas County</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 LPA</td>
<td>$39,429,600</td>
<td>$753,800</td>
<td>$93,300</td>
<td>$847,100</td>
</tr>
<tr>
<td><strong>Willamette Crossing Options</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003 LPA with Meade-Sherman</td>
<td>$42,167,100</td>
<td>$811,700</td>
<td>$93,300</td>
<td>$905,000</td>
</tr>
<tr>
<td>2003 LPA with Porter-Sherman</td>
<td>$42,167,100</td>
<td>$811,700</td>
<td>$93,300</td>
<td>$905,000</td>
</tr>
<tr>
<td>2003 LPA with Meade-Caruthers</td>
<td>$42,503,700</td>
<td>$819,000</td>
<td>$93,300</td>
<td>$912,300</td>
</tr>
<tr>
<td>2003 LPA with Porter-Caruthers</td>
<td>$42,503,700</td>
<td>$819,000</td>
<td>$93,300</td>
<td>$912,300</td>
</tr>
<tr>
<td>Tillamook</td>
<td>$38,547,200</td>
<td>$753,800</td>
<td>$70,600</td>
<td>$824,300</td>
</tr>
<tr>
<td>LPA to Park</td>
<td>$41,073,000</td>
<td>$753,800</td>
<td>$114,400</td>
<td>$868,200</td>
</tr>
</tbody>
</table>

Sources: Estimates of assessed value from Metro/metroscan 2006-07. Tax rates estimates from Multnomah County and Clackamas County Assessment and Taxation Division.

Notes: Does not include partial acquisitions. Property tax estimates derived as the median of code area tax rates within each jurisdiction as follows: Portland/ Multnomah County average $21.858 per thousand ($21.806 in Willamette Crossing area); Milwaukie/Clackamas County average $17.371 per thousand. Calculations do not include possible increases of property values resulting from the proposed LRT project. Does not include impacts associated with Ruby Junction acquisitions.

#### Special Tax Districts

If the Light Rail Alternative 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 LRT stations can exceed current projections with light rail investment.

No companies enrolled in the North Clackamas County Enterprise Zone program are in the impact area of the alignment.

#### 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 Alternative.

#### 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 be accommodated by re-allocating employees from other bus routes.

Light Rail Alternative

The Light Rail Alternative would result in short-term regional income and employment benefits. The short-term income impacts from construction of the new LRT line 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
- Potential adverse short-term business income impacts related to access changes to businesses and construction impacts such as increased noise and dust

The estimated cost of construction of the build alternatives would range from $581.2 to $726.1 million dollars (not including right-of-way or vehicle purchase costs). Table 3.2-4 shows the expected construction impacts for the Light Rail Alternative. The benefits to the economy would be minimally different between LRT options, although extending the 2003 LPA to SE Park Avenue would increase the short-term impacts commensurate with the construction costs for that leg of the project. Direct, indirect, and induced income impacts from construction spending could generate between $390 and $490 million of added personal income from construction jobs, industries supplying construction materials, and other purchases from new income (as identified above). 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.

Based on the analysis outlined above, direct, indirect, and induced job or employment effects resulting from construction spending would generate between 9,870 and 12,330 jobs in the metropolitan region.

Regardless of the option selected, these employment and income impacts could be expected to dissipate relatively quickly following the end of the construction period.
Table 3.2-4
Short-Term Construction Effects by Option: Direct, Indirect, and Induced Effects

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Construction Costs 1 (millions)</th>
<th>Construction Effects 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low High</td>
<td>Low High Low High High</td>
</tr>
<tr>
<td>2003 LPA</td>
<td>$581.2 $638.7</td>
<td>9,867 10,843 $389.7 $428.3</td>
</tr>
<tr>
<td>Willamette Crossing Options</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003 LPA with Meade-Sherman</td>
<td>$605.9 $646.3</td>
<td>10,288 10,973 $406.3 $433.4</td>
</tr>
<tr>
<td>2003 LPA with Porter-Sherman</td>
<td>$611.6 $654.3</td>
<td>10,383 11,108 $410.1 $438.7</td>
</tr>
<tr>
<td>2003 LPA with Meade-Caruthers</td>
<td>$606.3 $647.9</td>
<td>10,293 11,001 $406.5 $434.5</td>
</tr>
<tr>
<td>2003 LPA with Porter-Caruthers</td>
<td>$607.4 $649.1</td>
<td>10,313 11,021 $407.3 $435.3</td>
</tr>
<tr>
<td>2003 LPA with Tillamook</td>
<td>$651.1 $721.9</td>
<td>11,054 12,256 $436.6 $484.1</td>
</tr>
<tr>
<td>2003 LPA to Park</td>
<td>$726.1</td>
<td>12,327 $486.9</td>
</tr>
</tbody>
</table>

1 Construction costs do not include right-of-way or vehicle purchase costs.
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.
Note: No construction or related employment benefits are anticipated at Ruby Junction.

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 could involve localized construction.

2003 LPA

Temporary construction-related impacts to residences and businesses could result from increased traffic congestion, truck traffic, noise, vibration, and dust. Short-term impacts would be experienced mostly by businesses and residents along SW Lincoln Street and SW River Parkway, on the east side in the industrial sanctuary area, along SE 17th Avenue and through Milwaukie. There would likely be construction-related street or lane closures in downtown Portland, inner Southeast Portland, and downtown Milwaukie. Additional small and localized impacts to private properties adjacent to the project would be expected to be identified during the final design phase. TriMet would work with affected businesses and residents to identify the construction practices that would best reduce those impacts.

Willamette River Crossing Options

On the west side of the river, all of the crossing options would have similar construction impacts. Construction along SW Moody Avenue to the vacant area owned by OHSU would avoid the 2003 LPA’s impacts on existing residences and businesses. On the east side of the river, the alignment
alternatives that land on SE Sherman Street would have similar impacts to the 2003 LPA, affecting parking and circulation for OMSI. The Sherman and Caruthers landing options would also affect Portland Opera parking and circulation operations.

### 2003 LPA with Extension to Park

Traffic could be redirected along SE McLoughlin Boulevard, but in general the right-of-way is large enough to accommodate construction without major disruption to cross-circulation. Noise and dust could affect the residences immediately west of the construction area.

### Tillamook Branch Line Alignment

The Tillamook Branch Line alignment would likely cause fewer disruptions to traffic circulation because the alignment would be constructed along existing railroad tracks. However, this option would cause short-term disruption to the industrial uses near the Tacoma Street Station and south of SE Mailwell Drive. Noise and dust could affect the residences immediately east of the construction area in the Ardenwald neighborhood.

### Maintenance Base

The expansion of TriMet’s Ruby Junction maintenance base in Gresham would cause few traffic disruptions, as the properties to be acquired are on a dead-end street, bordered by a working gravel pit. 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 maintenance base.

### 3.2.5.3 Indirect and Cumulative Impacts

#### No-Build Alternative

Not building the Light Rail Alternative 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 Southgate Cinema building site was previously purchased and demolished with the expectation that the site could be used for future LRT service. The building had been used for a variety of performing arts competitions. If the LRT is not built, the beneficial impacts associated with an LRT station in that area would not occur, though the site will still be used as a park and ride with 350 parking spaces.

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.

#### Light Rail Alternative

The Light Rail Alternative offers a much greater potential for beneficial indirect impacts than the No-Build Alternative. Portland’s experience has demonstrated 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. Improved transit accessibility could result in increased land values in proximity to the stations, particularly for the Light Rail Alternative. 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 non-residential uses could be a potential negative effect if it contributes to displacement of affordable housing and business space.

The 2003 LPA may have secondary impacts on the residential properties on the north side of SW River Parkway east of SW Harbor Drive because the structure for the LRT would be built up to the property line. These changes could affect the visual setting for the nearest residences, but most properties likely would be unaffected.

Initially, business displacement could indirectly impact remaining local businesses that are dependent on the potentially displaced businesses. In the long run, however, and given existing vacancy rates, the station areas are expected to generate net growth in employment and consequently improve the economy in the project area.

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 Build Alternatives. 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 mass levels.

### 3.2.6 Potential Economic Mitigation Measures

**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 Alternative could hamper economic vitality. Potentially available mitigation would increase bus service more than is currently programmed by TriMet, alter growth patterns, or build new roadways.

**Light Rail Alternative**

For the 2003 LPA or any of the options where displacements are unavoidable, relocation assistance will be available to assist displaced residences and businesses. If access to an existing business is proposed to be removed and its relocated access would not be adequate and safe, the use is assumed to be a displacement. Mitigation for displacements is described in the Displacements and Acquisitions Results Report.

The 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 Portland-Milwaukie Light Rail Project, replacement parking or other measures may need to be provided. For further detail, see Chapter 4, Transportation. Existing off-street parking lots could be configured to provide additional spaces and structured park and ride lots might replace some lost parking spaces.
3.3 COMMUNITY IMPACT ASSESSMENT

The community impact assessment evaluates the potential effects of the light rail alternative on neighborhoods and communities in the Portland-Milwaukie 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. Additional information and detail is available in the Community Impact Assessment Results Report (Metro, April 2008).

3.3.1 Affected Environment

The proposed alignment options of the Portland-Milwaukie Light Rail Project pass through 11 neighborhoods. This section provides a summary of the each neighborhood’s character and community facilities. The locations and boundaries of each neighborhood are shown in Figure 3.3-1.

3.3.1.1 County, Regional and Neighborhood Socioeconomic Data

Data from the 2000 U.S. Census show that the four-county region has been growing by up to 25 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, but overall growth rates for the region are expected to be similar to historic trends and exceed the national average. Table 3.3-1 shows data by decade through 2005.

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>% Change from Previous</th>
<th>Employment</th>
<th>% Change from Previous</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>1,106,800</td>
<td></td>
<td>441,500</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>1,289,200</td>
<td>16%</td>
<td>562,000</td>
<td>27%</td>
</tr>
<tr>
<td>1995</td>
<td>1,623,500</td>
<td>26%</td>
<td>809,900</td>
<td>44%</td>
</tr>
<tr>
<td>2005</td>
<td>1,946,000</td>
<td>20%</td>
<td>941,600</td>
<td>16%</td>
</tr>
</tbody>
</table>

Source: Metro Data Resource Center, November 2007

1 Clackamas, Multnomah, and Washington Counties in Oregon and Clark County in Washington.
2 Source: U.S. Census
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 3.2-1 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

<table>
<thead>
<tr>
<th>Neighborhood</th>
<th>Households</th>
<th>Population</th>
<th>Employment</th>
<th>% Minority</th>
<th>% Hispanic</th>
<th>% Poverty</th>
<th>% Elderly</th>
<th>% Renters</th>
<th>Median Home Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Downtown</td>
<td>6,488</td>
<td>10,225</td>
<td>106,639</td>
<td>23.7%</td>
<td>4.5%</td>
<td>32.1%</td>
<td>15.3%</td>
<td>91.9%</td>
<td>$469,000</td>
</tr>
<tr>
<td>South Waterfront</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Hosford-Abernethy</td>
<td>3436</td>
<td>7,229</td>
<td>9,111</td>
<td>15.4%</td>
<td>3.8%</td>
<td>12.9%</td>
<td>8.8%</td>
<td>51.4%</td>
<td>$359,000</td>
</tr>
<tr>
<td>Brooklyn</td>
<td>1,690</td>
<td>3,595</td>
<td>9,282</td>
<td>14.8%</td>
<td>5.7%</td>
<td>11.9%</td>
<td>5.5%</td>
<td>63.2%</td>
<td>$330,000</td>
</tr>
<tr>
<td>Sellwood-Moreland</td>
<td>5211</td>
<td>10617</td>
<td>3951</td>
<td>9.5%</td>
<td>3.0%</td>
<td>10.8%</td>
<td>13.1%</td>
<td>47.2%</td>
<td>$330,000</td>
</tr>
<tr>
<td>Eastmoreland</td>
<td>1,642</td>
<td>5,044</td>
<td>1,763</td>
<td>7.2%</td>
<td>2.6%</td>
<td>5.6%</td>
<td>11.5%</td>
<td>10.8%</td>
<td>$330,000</td>
</tr>
<tr>
<td>Milwaukie Ardenwald</td>
<td>1,861</td>
<td>4,455</td>
<td>1,860</td>
<td>8.1%</td>
<td>3.8%</td>
<td>13.9%</td>
<td>12.9%</td>
<td>40.6%</td>
<td>$240,150</td>
</tr>
<tr>
<td>McLoughlin Industrial</td>
<td>23</td>
<td>158</td>
<td>2,859</td>
<td>13.3%</td>
<td>3.2%</td>
<td>N/A</td>
<td>1.3%</td>
<td>78.3%</td>
<td>$240,150</td>
</tr>
<tr>
<td>Historic Milwaukie</td>
<td>1,089</td>
<td>1,941</td>
<td>2,720</td>
<td>9.8%</td>
<td>5.8%</td>
<td>5.7%</td>
<td>16.9%</td>
<td>77.0%</td>
<td>$240,150</td>
</tr>
<tr>
<td>Island Station</td>
<td>417</td>
<td>873</td>
<td>51</td>
<td>13.3%</td>
<td>3.1%</td>
<td>4.6%</td>
<td>7.6%</td>
<td>68.8%</td>
<td>$257,000</td>
</tr>
<tr>
<td>Clackamas County</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$257,000</td>
</tr>
<tr>
<td>Oak Lodge</td>
<td>9,466</td>
<td>22,814</td>
<td>9,428</td>
<td>8.7%</td>
<td>6.3%</td>
<td>6.1%</td>
<td>17.9%</td>
<td>33.7%</td>
<td>$257,000</td>
</tr>
<tr>
<td>Tri-County Area</td>
<td>569,461</td>
<td>1,444,219</td>
<td>1,014,401</td>
<td>17.1%</td>
<td>8.0%</td>
<td>8.7%</td>
<td>10.4%</td>
<td>27.1%</td>
<td>N/A</td>
</tr>
<tr>
<td>Clackamas County</td>
<td>128,201</td>
<td>338,391</td>
<td>180,635</td>
<td>8.7%</td>
<td>4.9%</td>
<td>6.1%</td>
<td>11.1%</td>
<td>28.9%</td>
<td>$329,000</td>
</tr>
<tr>
<td>Multnomah County</td>
<td>272,098</td>
<td>660,486</td>
<td>555,161</td>
<td>20.8%</td>
<td>7.5%</td>
<td>11.4%</td>
<td>11.1%</td>
<td>43.1%</td>
<td>$287,000</td>
</tr>
</tbody>
</table>

Source: Social and Neighborhood Impacts Results Report (Metro, November 2002)

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 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, while in the next census data would be applicable to this area, there are no socioeconomic characteristics for the area from the 2000 Census.
8 Median home prices were derived from Zillow.com, a real estate website that provides data from recent home sales. These 2006-07 prices were for houses in the ZIP code for 97222, which includes Milwaukie and parts of Clackamas County, including Oak Lodge.
Poverty Level by Census Tract

Figure 3.3-2

Percent Below Poverty Level

- 0 - 8.7%
- 8.8 - 12.9%
- 13.0 - 23.5%
- 23.5% and greater

The Tri-County average rate of poverty 8.7%.
The Tri-County average percent Minority is 17.1%.

The Tri-County average percent Hispanic or Latino is 8.0%.
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 no member 14 years old and over speaks only English or speaks a non-English language and speaks English very well. In other words, all members of the household 14 years old and older have at least some difficulty with English. There are two block groups, one in the Brooklyn neighborhood and one in the Oak Lodge neighborhood, where the percentage of people who speak little or no English exceeded the percentage for the counties.

To update census data after 2000, the U.S. Census Bureau’s American Community Survey (ACS) were also used. The 2005 ACS data on race for the Tri-County area indicated little change in the ratio of minorities for each county: Clackamas County, nine percent; Multnomah County, 20 percent; Washington County, 20 percent, for an areawide average of 16.3 percent. The 2005 ACS data on poverty showed increased poverty rates for the three counties since 2000: Clackamas, 9.1 percent; Multnomah, 17.4 percent; and Washington, 10.3 percent, for an areawide average of 12.3 percent.

<p>| Table 3.3-3 |</p>
<table>
<thead>
<tr>
<th>Percentages of Homes with Limited English-Speaking Ability (2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons Able to Speak English “not well” or “not at all”</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Multnomah County</td>
</tr>
<tr>
<td>Downtown and South Waterfront</td>
</tr>
<tr>
<td>Hosford-Abernethy</td>
</tr>
<tr>
<td>Hosford-Abernethy</td>
</tr>
<tr>
<td>Brooklyn</td>
</tr>
<tr>
<td>Brooklyn</td>
</tr>
<tr>
<td>Brooklyn</td>
</tr>
<tr>
<td>Brooklyn and Eastmoreland</td>
</tr>
<tr>
<td>Eastmoreland and Ardenwald</td>
</tr>
<tr>
<td>Eastmoreland</td>
</tr>
<tr>
<td>Sellwood-Moreland</td>
</tr>
<tr>
<td>Sellwood-Moreland</td>
</tr>
<tr>
<td>Sellwood-Moreland</td>
</tr>
<tr>
<td>Clackamas County</td>
</tr>
<tr>
<td>Ardenwald</td>
</tr>
<tr>
<td>Ardenwald, Milwaukie Industrial, and Historic Milwaukie</td>
</tr>
<tr>
<td>Milwaukie Industrial and Historic Milwaukie</td>
</tr>
<tr>
<td>Milwaukie Industrial and Historic Milwaukie</td>
</tr>
<tr>
<td>Island Station</td>
</tr>
<tr>
<td>Oak Lodge</td>
</tr>
<tr>
<td>Oak Lodge</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau, 2005 American Community Survey. Table B16002.
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 SDEIS on traffic, noise and vibration, visual, displacements, and safety and security impacts.

3.3.2.1 Long-Term Impacts

No-Build Alternative

The No-Build Alternative would not displace any residents or businesses or create any major capital improvements and would have minimal impacts to neighborhood cohesion and livability.

The No-Build Alternative also would not enhance livability by improving transit service and transit capacity to neighborhoods compared to the Light Rail Alternative. Bus transit travel times between Milwaukie and downtown Portland would be one to four minutes slower than light rail travel and by 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.

Light Rail Alternative and Options

2003 Locally Preferred Alternative

Downtown Portland

The 2003 LPA has limited displacements from downtown Portland to the South Waterfront. At RiverPlace, visual impacts or noise and vibration impacts would affect nearby residences, but overall character, livability, and cohesion of downtown would not be adversely affected. While there is a relatively higher representation of minority and low-income populations in downtown Portland compared to Multnomah County, the project would enhance transit access to residential and employment centers. This effect is particularly important given that 12 percent of downtown Portland residents take public transit to work. Another group that would benefit would be the elderly who may have more limited alternatives to driving. No known publicly owned affordable housing units would be affected. With light rail, which would connect to the existing streetcar, would improve connectivity in and between neighborhoods.

Hosford-Abernethy

The 2003 LPA would improve access for Hosford-Abernethy households, with the light rail system directly serving regional entertainment, employment, education, and public services facilities. The Light Rail Alternative would improve access to the area by adding a light rail station with connections to the new bridge that also accommodates streetcar, bus, and a connecting trail. Business displacements could temporarily affect existing jobs and future job opportunities in the area, but this is expected to be offset by 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. South of the Clinton Street Station, reconstructed pedestrian walkways and a bridge would be installed over the freight and light rail lines.

**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.

Driveways and several side-streets along SE 17th Avenue would be restricted to right-in/right-out only in this neighborhood. This would create out-of-direction travel of up to five blocks. The loss of parking along SE 17th Avenue could also create an undersupply of parking, which could cause some overflow into the residential neighborhood. Removing employment uses along the west side of SE 17th Avenue would remove that buffer between residential uses to the west and street and light rail traffic. Several smaller-scale employment uses on the west side of SE 17th Avenue would be displaced. These effects would not be likely to change the overall character and function of the neighborhood.

**Sellwood-Moreland and Eastmoreland**

The 2003 LPA would have little impact on neighborhood cohesion and livability because overall impacts on these neighborhoods are low, with the light rail project within an existing transportation corridor. Light rail would provide improved transit times and service levels for residents in these established neighborhoods.

**Ardenwald**

While the poverty rate for the neighborhood is higher than in Clackamas County and the region, as is the rate of elderly, 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.

New traffic attracted to SE Tenino and Tacoma Streets could increase congestion for this neighborhood’s main access point from SE McLoughlin Boulevard. The Tacoma Station and Park and Ride would introduce a new large structure but would be below the residential neighborhood in an area that is dominated by industrial and transportation uses.

**McLoughlin Industrial District**

Also known as the Milwaukie Industrial Area, this is an industrial neighborhood that had previously expressed concerns about light rail impacts to freight movement and parking. However, the 2003 LPA includes two stations that would serve this area, providing benefits to employees and others destined for the area, as well as users of the Springwater Corridor, a multi-use trail. The 2003 LPA now includes off-street parking to replace the on-street parking that would be removed. While access for trucks would be maintained, delays of more than two minutes could result due to truck route modifications, delays at intersections for light rail trains, and increased queuing at intersections and several side streets.
Historic Milwaukie

The Light Rail Alternative would improve regional access and mobility for area residents and businesses, as well as for the general population of Milwaukie by providing stations directly serving the downtown area and its public facilities, including city hall and the high school. 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 to automobile trips.

The 2003 LPA would have little impact on overall neighborhood cohesion because there would be few changes to circulation or access to services in downtown Milwaukie. There would be an increase in delays at cross-street intersections with the light rail line than is currently the case with the freight rail lines.

The park and ride proposed at SE Lake Road would create queues blocking adjacent intersections at SE Monroe Street and SE Main Street, but this queuing would also occur under the No-Build Alternative. While light rail’s frequent service would stop traffic on the east-west streets to downtown, traffic analysis shows that traffic would still operate at acceptable levels.

While the community has identified concerns about the compatibility of light rail with nearby uses such as Portland Waldorf School, Milwaukie High School, or St. John the Baptist Church and School, the environmental analysis has not identified impacts that would appreciably degrade access or other conditions at these facilities. Any noise or vibration impacts that exceed FTA criteria would be mitigated. Crossings of light rail would be designed to incorporate both active and passive measures to prevent conflicts between trains and pedestrians or vehicles. The project has also convened a community-based group to review safety and security concerns, with recommendations that are included in Section 3.16, Safety and Security.

Willamette River Crossing Options

Impacts on the Portland downtown neighborhood would be similar to those for the 2003 LPA, except for a cluster of multi-family residences at RiverPlace, which would experience noise, vibration and visual impacts due to an overcrossing and light rail structure near the residential complex. The Willamette River crossing options all have alignments that avoid these impacts on the residential properties. They would place the light rail line and a South Waterfront station in an area yet to be developed. Otherwise, there would be little difference in the effects of the options compared to the 2003 LPA for the downtown Portland neighborhood to the South Waterfront.

Although the number of displacements would differ among the Willamette River crossing options and would be more than the 2003 LPA, the displacements are unlikely to affect the largely industrial character of the neighborhood, and nearby residential areas would experience little change. The Meade-Caruthers and Porter-Caruthers options would displace a river cruise operator, but other major regional institutions such as OMSI and the Portland Opera would have improved access, as would employees and patrons of area businesses.

Bus/No Bus Options and Bridge Type and Elevation Options

There would be some minor differences in neighborhood cohesion and livability between the bus/no bus options and the 2003 LPA. The bus/no bus options would still provide access and travel time benefits to residents, with existing development near RiverPlace more directly served by the 2003 LPA and future developments by the other options.
Aside from differences in visual effects (see Section 3.4), the elevation and bridge type options would have the same effects as the 2003 LPA.

**2003 LPA Extension to Park**

**Downtown Milwaukie**

The 2003 LPA to Park provides for one station at SE Washington Street rather than two (Harrison and Lake Stations) in downtown Milwaukie. Overall neighborhood effects would be similar to the 2003 LPA, but the 2003 LPA to Park would avoid the congestion effects of the Lake Street Station and Park and Ride.

**Island Station and Unincorporated Clackamas County (Oak Lodge)**

The 2003 LPA to Park would extend light rail to directly serve these neighborhoods with two stations improving travel times and mobility for residents. There, alignment would be along SE McLoughlin Boulevard at the edge of the neighborhoods and typically below grade. There are two options for crossing SE McLoughlin Boulevard, with an at-grade option potentially creating longer queues on the arterial, but the elevated option and station would have higher visual impacts. Closure of auto access between SE Sparrow Street and SE McLoughlin Boulevard would result in safer access from the neighborhood to SE McLoughlin Boulevard but could cause out of direction travel. The Bluebird Station would displace a small area of commercial properties but could also increase the accessibility and attractiveness of future uses. The Park Avenue Station and Park and Ride would displace restaurants and auto-related commercial businesses in commercial strips along SE McLoughlin Boulevard. There are vibration impacts for several residences immediately west of the light rail alignment but they would be mitigated.

**Tillamook Branch Line Alignment (Tacoma Street Station to SE Park Avenue)**

**Ardenwald**

The effects would generally be the same as under the 2003 LPA to Park, but the alignment would instead follow an existing railroad. There are some residences immediately adjacent to the existing railroad line at the ends of SE Roswell, SE Boyd, and SE Malcolm Streets. 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.

**McLoughlin Industrial District**

By following an existing railroad right-of-way, the Tillamook Branch Line alignment would avoid traffic and circulation impacts in the existing industrial area, although the option would cause the loss of access to loading bays on the Tillamook Branch Line by the industrial users in the Unisource industrial development.

**Historic Milwaukie**

The Tillamook Branch Line alignment would have a station at SE Monroe Street rather than on SE Harrison Street, but overall effects and benefits would be similar to the 2003 LPA.
Island Station and Unincorporated Clackamas County/Oak Lodge

The effects of the Tillamook Branch Line alignment on the Island Station neighborhood would be similar to the 2003 LPA to Park except there would be no Bluebird Station. This would offer somewhat lower access benefits for nearby residents, but the SE Lake Road and SE Park Avenue stations would still provide access to the light rail system.

Maintenance Base

TriMet’s existing Ruby Junction Operations Facility in the Rockwood neighborhood of Gresham would be expanded to support the Portland-Milwaukie Light Rail Project and other expansions on the system. There are a number of small single-family homes nearby that are surrounded by a mix of undeveloped tracts and industrial two-story box buildings with parking lots. The area around these homes and businesses is largely industrial and includes an active gravel pit to the south. The existing maintenance facility has the industrial character of a rail yard and is not landscaped.

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 the separate projects assumed as part of the No-Build Alternative.

Light Rail Alternative

Temporary construction-related or short-term impacts on neighborhoods under the 2003 LPA and design options could result from increased traffic congestion, truck traffic, noise, vibration, and dust. More detailed descriptions of specific types of environmental impacts are discussed in Chapters 3 and 4.

3.3.2.3 Indirect and Cumulative Impacts

No-Build Alternative

The lower capacity of a bus system to accommodate growth could cause an indirect increase in congestion compared to the Light Rail Alternative. 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 the Light Rail Alternative, 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.

Light Rail Alternative

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, property owners on low incomes in adjacent neighborhoods may find it difficult to keep up with rising property taxes. In addition, if property owners decide to sell or redevelop, existing tenants may be displaced and 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 ride and transit stations cannot accommodate all of the demand. For the 2003 LPA and all options, construction activities and business displacements could affect the success of those businesses left behind. Those potential impacts are discussed in more detail in the Land Use and Economy Results Report.

The Portland-Milwaukie Light Rail Project would be a major development in the corridor, which features established neighborhoods; the South Waterfront is the only large area of 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, 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.

3.3.3 Potential 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

Mitigation for impacts from construction on land uses in neighborhoods is discussed in Section 3.2, Land Use and Economy. In general, mitigation would consist of TriMet’s public information and coordination efforts that would focus on affected businesses, institutions and residents and on measures to help minimize impacts and address ongoing concerns. Mitigation for other short-term impacts is also identified by topic in each of the other results reports, and their combined effect would not result in community impacts requiring additional mitigation.

3.3.3.2 Long-Term Mitigation

After mitigation identified in other environmental topic areas (such as noise and vibration, transportation, and displacements/acquisitions), the light rail alternative would not have long-term impacts on neighborhood character, 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. 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 low-income, Hispanic or minority pockets 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 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 U.S. Census 2000 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 U.S. Census 2000 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 U.S. Census 2000 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 U.S. Census 2000 data but, as sample data, it has a wider margin of error.

**Findings**

According to the U.S. Census 2000, 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 LRT Alignment) as shown in Table 3.3-4. 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. 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\(^1\) in 1999 than the proportion in either the Metro UGB (9.4 percent) or the Tri-County area (8.7 percent).

<table>
<thead>
<tr>
<th>Area</th>
<th>Population</th>
<th>% Minority</th>
<th>% Hispanic</th>
<th>% Poverty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland-Milwaukie Project Corridor</td>
<td>23,404</td>
<td>10.6%</td>
<td>4.3%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Census Block Groups (2000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro UGB (2000)</td>
<td>1,190,993</td>
<td>18.7%</td>
<td>8.3%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Tri-County area</td>
<td>1,444,219</td>
<td>17.1%</td>
<td>8.0%</td>
<td>8.7%</td>
</tr>
</tbody>
</table>


Note: Percent minority and percent Hispanic refer to proportion of populations, whereas percent poverty indicates the proportion of households below the poverty level.

Downtown Portland was the only neighborhood with a higher proportion of minority residents than average for the Metro UGB. None had a higher concentration of Hispanic residents 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 one to two residential displacements expected to result from any of the alternatives or options in the corridor would occur in areas that have relatively low levels of minority, Hispanic, or low-income populations. This is a very low level of impact overall, considering the length of new light rail corridor and the fact that displacements would be mitigated by relocation assistance. Therefore, no disproportionate impacts are anticipated for the project.

Sections 3.1 and 3.2 discuss the number of displaced businesses and other buildings by the Portland-Milwaukie Light Rail Project. 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 are located in any given area of the corridor, including station locations. The affected properties and resulting displacements are also distributed throughout the corridor, with only one area (SE 17th Avenue) affecting multiple properties. Compared to other linear projects, including highways or other major public works facilities, this represents a low number of property and business impacts.

The Community Impacts Assessment Results Report 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.

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\(^1\) 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).
An analysis of probable racial, ethnic origin, and income characteristics of individuals living within a quarter-mile radius of stations was performed for the South Corridor light rail alternatives in 2002 to identify the characteristics of potential riders. Because this information was based on the U.S. Census 2000, 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 LRT stations, but presents one-quarter mile data below for an assessment of the balance of overall impacts and benefits.

The Light Rail Alternative, as represented by the 2003 LPA and any of the options, would provide a direct transit benefit to low-income populations (see Table 3.3-5). 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.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Population</th>
<th>Probable Percent Minority</th>
<th>Probable Percent Hispanic</th>
<th>Probable Percent Low-Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 LPA (2000 population within 0.25-Mile of Stations)</td>
<td>13,959</td>
<td>10.6%</td>
<td>5.8%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Metro UGB</td>
<td>1,190,993</td>
<td>18.7%</td>
<td>8.3%</td>
<td>9.4%</td>
</tr>
</tbody>
</table>

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.

Expansion of the Ruby Junction maintenance base in Gresham is a required part of the Light Rail Alternative for which there is no alternative. Initial observations indicate that expansion of Ruby Junction could result in a disproportionate impact to low-income or minority populations. Census data for that specific area (covering 2,256 people) shows the area to be 40 percent minority and have 35 percent below the poverty line.

**Conclusion**

In evaluating if 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 Alternative
would provide the offsetting benefit of direct transit service to those station areas within neighborhoods containing concentrations of minority and low-income households that exceed the average concentration of low-income households in the corridor. 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 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. Three of 11 neighborhoods have ratios higher than the Multnomah County level but still lower than the Tri-County area. Only the downtown Portland neighborhood is 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 LRT alignment would affect three 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 maintenance base where there could be disproportional 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.

Therefore, according to the definition established in Executive Order 12898, the Light Rail Alternative 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**

Potential impact-specific mitigation measures for the alternatives and design options are reviewed in Chapters 3 and 4 of this SDEIS and discussed in detail in other environmental topics that would be likely to affect minority or low-income residents. Detailed analyses are included in the Displacement and Acquisitions, Community Impacts Assessment, Visual and Aesthetics Resources Impacts, Noise and Vibration Impacts, and the Traffic Impacts Results Reports. A Safety and Security impacts analysis is also provided in this SDEIS.
3.4 VISUAL QUALITY AND AESTHETICS

3.4.1 Introduction

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 more details, see the Visual and Aesthetic Resources Results Report (Metro, April 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, their exposure, and sensitivity
- Changes to visual conditions as a result of the construction and operation of the project

3.4.2 Affected Environment

3.4.2.1 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 reinvestment, while suburban development is rapidly 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 DEIS and 2002 South Corridor 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 provides the simulations with before and after views and a mapping of the view locations.
1. Downtown Portland
2. Inner Eastside Portland
3. SE McLoughlin Boulevard
4. Downtown Milwaukie
5. Southwest Milwaukie

Visual Analysis Units

Figure 3.4-1

1. Downtown Portland
2. Inner Eastside Portland
3. SE McLoughlin Boulevard
4. Downtown Milwaukie
5. Southwest Milwaukie
### 3.4.2.2 Visual Analysis Units

#### Downtown Portland Visual Analysis Unit

The Downtown Portland Visual Analysis Unit (see Figure 3.4-1) extends from SW Fifth 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 irregular, street system.

Major visual features in the downtown 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 network. The City’s *Scenic Views, Sites, and Drives Inventory* formally identifies two view corridors in the Central City: SW Lincoln Street between SW 1st and SW 4th Avenues and SW 1st Avenue from I-405 to 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.

#### 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 (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 and Ross Island Bridges, downtown Portland, the emerging South Waterfront skyline, Oregon Health and Science University (OHSU), and the West Hills. This Visual Analysis Unit has one view identified as significant in the City’s *Scenic Views, Sites, and Drives Inventory* and *Scenic Resource Protection Plan*. This is the view of the city 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- and multi-family 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 nearby 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 single-family neighborhoods sit on a 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 traditional downtown neighborhood with an affiliated community group, the Historic Milwaukie Neighborhood District Association. 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, which 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 multi-family 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 from the established downtown.

**Southwest Milwaukie Visual Analysis Unit**

The Southwest Milwaukie 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 Oatfield Road, which runs west of SE McLoughlin Boulevard, closely follows the edge of the ridge. 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.

**Gresham – Maintenance Base**

The existing Ruby Junction maintenance base is located in Gresham. The surrounding area includes a number of small single-family homes nearby surrounded by a mix of undeveloped tracts and industrial two-story box buildings with parking lots. The existing maintenance facility has the character of a rail yard and is not landscaped.
3.4.3 Environmental Consequences

3.4.3.1 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 the light rail alternatives. These changes may detract 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 significant view corridors in the project area: the view from OMSI toward the Willamette River and a minor point in the South Waterfront district toward the Willamette River. 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 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 proposed project elements could change existing visual resources. High, moderate, and low levels of visual change would be characterized as follows (see Visual and Aesthetic Resources Results Report, Appendix B, Analysis Methods for more detail).

For each of these changes, the accompanying consideration is 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 in 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**

<table>
<thead>
<tr>
<th>High Level of Visual Change</th>
<th>Moderate Level of Visual Change</th>
<th>Low Level of Visual Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated structure</td>
<td>Minimum grade separation</td>
<td>At-grade/below-grade</td>
</tr>
<tr>
<td>Substantial property displacement</td>
<td>Low property displacement</td>
<td>Within existing ROW</td>
</tr>
<tr>
<td>Significant new parking</td>
<td>Minimum parking</td>
<td>No new parking</td>
</tr>
<tr>
<td>High view disruption</td>
<td>Moderate view disruption</td>
<td>Low view disruption</td>
</tr>
<tr>
<td>Visual connection to neighborhood</td>
<td>Inconsistent screening of neighborhood</td>
<td>Screening of neighborhood</td>
</tr>
<tr>
<td>Blocks scenic feature</td>
<td>Disruption of visual feature</td>
<td>No change to visual feature</td>
</tr>
<tr>
<td>Removal of all vegetation</td>
<td>Removal of some vegetation</td>
<td>Maintains pattern of vegetation</td>
</tr>
<tr>
<td>Changes out of scale to street</td>
<td>Changes to scale of street</td>
<td>Maintains existing scale</td>
</tr>
</tbody>
</table>

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 in the Regional Transportation Plan Financially Constrained network. The increased frequency of buses on SE McLoughlin Boulevard would not be a significant change nor would it adversely affect sensitive viewers. 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.

### Light Rail Alternative

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 that obstruct visual resources and views.
- Introduction of prominent new elements to formally designated visual resources such as views, viewpoints or view corridors.

Potential long-term impacts of the Portland-Milwaukie Light Rail Project are summarized in Table 3.4-2. The table considers a variety of factors, including the level of visual change anticipated, the context and scale of the surrounding area, effects on major public views, and the sensitivity of viewers. As noted above, the ratings for the sensitivity of viewers can be more subjective than the other factors, but it considers 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.

**Table 3.4-2**
**Summary of Potential Impacts of the Portland-Milwaukie Light Rail Project**

<table>
<thead>
<tr>
<th>Design Option</th>
<th>Visual Analysis Unit</th>
<th>Neighborhood/Geographic Area</th>
<th>Changing Features (In Addition to Rails and Overhead Catenary System)</th>
<th>Viewer Sensitivity</th>
<th>Degree of Change</th>
<th>Overall Score: Degree of Change Plus Viewer Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 LPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Downtown Portland</td>
<td>New station, remove existing buildings, street trees and landscaping, new overpass, and retaining walls</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Willamette River</td>
<td>New bridge, crossing riverfront trails and landing beside OMSI</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner Eastside Portland</td>
<td>Building removals, new station, OCS lift, retaining walls, roadway improvements and sidewalks; replaced pedestrian overpass</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brooklyn</td>
<td>New station, roadway/sidewalk improvements, building removal; replaced pedestrian overpass</td>
<td>L-M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE McLoughlin Boulevard</td>
<td>New station, stairs, retaining walls; removed vegetation</td>
<td>H</td>
<td>M</td>
<td>L-M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sellwood-Moreland</td>
<td>Removed vegetation; new station, stairs/elevators; retaining walls</td>
<td>H</td>
<td>M</td>
<td>L-M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eastmoreland</td>
<td>New station, P/R, retaining walls, road improvements</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ardenwald</td>
<td>New station, multistory P/R, retaining walls, overpass, road improvements, vegetation removal</td>
<td>M</td>
<td>H</td>
<td>M-H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>McLoughlin Industrial</td>
<td>New stations, multistory P/R, retaining walls, building removal</td>
<td>H</td>
<td>M</td>
<td>M-H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Downtown Milwaukee</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willamette River Crossing Options</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Bus</td>
<td></td>
<td>Downtown Portland</td>
<td>Similar to 2003 LPA with bus</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Willamette River</td>
<td>Similar to 2003 LPA with bus</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner Eastside Portland</td>
<td>Similar to 2003 LPA with bus but no bus facilities required</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Design Option</td>
<td>Visual Analysis Unit</td>
<td>Neighborhood/Geographic Area</td>
<td>Changing Features (In Addition to Rails and Overhead Catenary System)</td>
<td>Viewer Sensitivity</td>
<td>Degree of Change</td>
<td>Overall Score: Degree of Change Plus Viewer Sensitivity</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------</td>
<td>------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Meade-Sherman</strong></td>
<td>Downtown Portland</td>
<td>Central City</td>
<td>New station, remove landscaping, tracks, new overpass, retaining walls, elevated station</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Waterfront and Willamette River</td>
<td>Bridge crossing proposed, Greenway Trail, and intersecting future development areas in South Waterfront</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inner Eastside</td>
<td>Hosford-Abernethy</td>
<td>New station, OCS lift, building removal, retaining walls, roadway improvements, bridge landing near Portland Opera building, near end of Greenway Trail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Porter-Caruthers</strong></td>
<td>Downtown Portland</td>
<td>Central City</td>
<td>New station, remove landscaping, tracks, overpass, retaining walls, elevated station</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Waterfront and Willamette River</td>
<td>Bridge crossing proposed Greenway Trail and intersecting future development areas in South Waterfront</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inner Eastside</td>
<td>Hosford-Abernethy</td>
<td>New station, OCS lift, building removal, retaining walls, roadway improvements, bridge landing near OMSI and over Greenway Trail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Meade-Caruthers</strong></td>
<td>Downtown Portland</td>
<td>Central City</td>
<td>New station, remove landscaping, tracks, overpass, retaining walls, elevated station</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Waterfront and Willamette River</td>
<td>Bridge with a more transverse route over the river, over proposed Greenway Trail and intersecting future development areas in South Waterfront, landing near OMSI, over Greenway Trail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inner Eastside</td>
<td>Hosford-Abernethy</td>
<td>New station, OCS lift, building removal, retaining walls, roadway improvements, bridge landing near OMSI and over Greenway Trail</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Table 3.4-2
Summary of Potential Impacts of the Portland-Milwaukie Light Rail Project (continued)

<table>
<thead>
<tr>
<th>Design Option</th>
<th>Visual Analysis Unit</th>
<th>Neighborhood/Geographic Area</th>
<th>Changing Features (In Addition to Rails and Overhead Catenary System)</th>
<th>Viewer Sensitivity</th>
<th>Degree of Change</th>
<th>Overall Score: Degree of Change Plus Viewer Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porter-Sherman</td>
<td>Downtown Portland</td>
<td>Central City</td>
<td>New station, remove landscaping, tracks, overpass, retaining walls, elevated station</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Waterfront and Willamette River</td>
<td>Bridge with a more transverse route over the river, over proposed Greenway Trail and intersecting future development areas in South Waterfront, landing near Portland Opera and end of Greenway Trail</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner Eastside Portland</td>
<td>New station, OCS lift, building removal, retaining walls, roadway improvements, bridge landing near OMSI and over Greenway Trail</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Willamette River Bridge Representative Concepts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72’</td>
<td>Downtown Portland</td>
<td>Willamette River</td>
<td>Bridge height</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>65’</td>
<td>Downtown Portland</td>
<td>Willamette River</td>
<td>Bridge height</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Cable-stay</td>
<td>Downtown Portland</td>
<td>Willamette River</td>
<td>Bridge style</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Concrete</td>
<td>Downtown Portland</td>
<td>Willamette River</td>
<td>Bridge style</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>2003 LPA-Park</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevated</td>
<td>Downtown Milwaukie</td>
<td>Historic Milwaukie</td>
<td>Similar to 2003 LPA but does not require park and ride downtown; station locations also differ</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>Southwest Milwaukie</td>
<td>Island Station</td>
<td>Elevated station; elevated crossing of roadway and over park, partly beside existing rail trestle</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>Oak Lodge</td>
<td></td>
<td>New station with multi-story parking, building and tree removal; roadway and intersection improvements.</td>
<td>M</td>
<td>H</td>
<td>M-H</td>
</tr>
<tr>
<td>At-Grade</td>
<td>Downtown Milwaukie</td>
<td>Historic Milwaukie</td>
<td>Similar to 2003 LPA but does not require park and ride downtown; station locations also differ</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>Southwest Milwaukie</td>
<td>Island Station</td>
<td>Station; building and tree removal</td>
<td>L</td>
<td>L-M</td>
<td>M</td>
</tr>
</tbody>
</table>

**Note:** The table details the potential impacts of the Portland-Milwaukie Light Rail Project for various design options, including changes to visual and geographic areas, and the overall score assessing the degree of change plus viewer sensitivity.
### Table 3.4-2
Summary of Potential Impacts of the Portland-Milwaukie Light Rail Project (continued)

<table>
<thead>
<tr>
<th>Design Option</th>
<th>Visual Analysis Unit</th>
<th>Neighborhood/Geographic Area</th>
<th>Changing Features (In Addition to Rails and Overhead Catenary System)</th>
<th>Viewer Sensitivity</th>
<th>Degree of Change</th>
<th>Overall Score: Degree of Change Plus Viewer Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oak Lodge</td>
<td></td>
<td></td>
<td>New station with multi-story parking, building and tree removal; roadway and intersection improvements.</td>
<td>M</td>
<td>H</td>
<td>M-H</td>
</tr>
<tr>
<td>SE McLoughlin Boulevard</td>
<td>Ardenwald</td>
<td></td>
<td>Raised structure to allow crossing of light rail to east side of Tillamook Branch; similar in scale to industrial/rail area features</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>McLoughlin Industrial</td>
<td></td>
<td>Elevated transition to cross rail tracks; similar in scale to industrial/rail area features</td>
<td>L-M</td>
<td>H</td>
<td>L-M</td>
</tr>
<tr>
<td>Downtown Milwaukie</td>
<td>Historic Milwaukie</td>
<td></td>
<td>Similar to 2003 LPA</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Southwest Milwaukie</td>
<td>Island Station and</td>
<td></td>
<td>Same as 2003 LPA – Park but without Bluebird station</td>
<td>M</td>
<td>M-H</td>
<td>M-H</td>
</tr>
<tr>
<td></td>
<td>Oak Lodge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Maintenance Base

Expanding the existing Ruby Junction maintenance base in Gresham would be consistent with the surroundings. Visual impacts resulting from an expansion are expected to be low because the added structures and uses are consistent with existing character and uses.

#### 3.4.3.2 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 utilities relocation, clearing and grading, and reconstruction. 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 can be larger than the permanent facility to allow construction equipment and materials to be brought to alignment.

All of the alternatives share a similar level of construction-period visual impacts, although where the alternatives offer a change in alignment (such as in the South Waterfront, North Milwaukie Industrial District, and the 2003 LPA to Park), the differences are more closely related to where the alignment is located in relation to viewers.
3.4.4 Mitigation

Given the types of visual impacts identified in the project area, important goals for mitigation of the visual impacts created by the proposed projects include the following:

- 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 alignment routes.
- Buffer or reduce the loss of visual resources.
- Reduce obstructions or limitations to designated views, view corridors, viewpoints, and important neighborhood features affected by the alignment alternatives.

In each affected neighborhood, potential mitigation measures would vary to assist project elements to fit neighborhood scale and character. In some neighborhoods, potential measures could improve the visual character of impacted areas or locations where viewers experience the impacts on a daily or long-term basis. In other areas, project elements would be a prominent visual feature even with mitigation and would have noticeable impacts on visual resources and sensitive viewers.

Representative mitigation measures recommended for long-term visual impacts include:

- Refinement to 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 corridor and the neighborhood.
- Replacing or restoring removed vegetation and landscaping where possible.
- Consideration of neighborhood plan recommendations related to visual and aesthetic concerns.
- Making surplus land not required for the project available to create redevelopment opportunities or community places consistent with the established features of the surrounding area.
3.5 HISTORIC, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

3.5.1 Introduction

This section identifies potentially significant historic, archaeological, and cultural resources in the Portland-Milwaukie Light Rail Project’s Area of Potential Effect (APE) and provides an evaluation of impacts of the project and its associated options.

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 (National Register). 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 on, or determined to be eligible for inclusion in, the National Register (36 CFR 800). 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. Review requirements for the properties that are included in the respective cities’ historic resource inventories but are not considered eligible for listing in the National Register will be specifically addressed during the preparation of the FEIS.

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 South-North Corridor 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, 2008).

The project team conducted an inventory of resources in the APE, which has been defined by FTA and SHPO as 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, approximately one block or 150 feet in each direction from the study alternatives was used. A wider area of effect was used for the proposed new Willamette River crossings because of the potential height and scale of those structures. For new bridges, the APE was 1,000 feet wide, centered on a midpoint of proposed crossing alignments.

3.5.2 Affected Environment

3.5.2.1 Historic Resources

The project surveyed more than 80 possible historic resources; including those on local and state inventories. The project identified 17 historic resources including 13 that previously received a determination of eligibility (DOE) for listing in the National Register, and four that were recommended as eligible. The 17 resources listed below are also shown on Figure 3.5-1.
3.5.2.2 Archaeological Resources

There are no known archaeological resource sites within the APE. However, there are locations along the corridor that have the potential to contain significant archaeological resources. The project inventory identified areas with high to moderate 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. An area where there is a reasonable expectation that a significant archaeological site may be present is noted as having a high probability. Moderate probability areas are noted where there is less certainty due to past impacts. Five archaeological sites have been recorded near the project APE; all five are historic-period resources, and a Native American artifact was found at one of the sites. Eight high probability areas and one moderate probability area for the presence of Native American and historic-period Euroamerican archaeological sites have been identified within the APE. The general location of these areas is shown on Figure 3.5-1. The areas include:

- Two high probability areas (HPA-1, -2) in downtown Portland near other recorded archaeological sites.
- A high probability area (HPA-3) near a recorded archaeological site on the east side of the Willamette River and would be encountered by all of the crossing options.
• Three high probability areas (HPA-4, -5, -8 [partial]) that were previously noted as part of the South Corridor SDEIS. They are in the vicinity of Crystal Springs, Johnson Creek, and a stream near SE Park Avenue south of Milwaukie, near SE McLoughlin Boulevard. The latter site is also encompassed by a larger area that contained a historic-period streetcar line connecting Portland to Oregon City.

• Two high probability areas (HPA-6, -7) on Kellogg Creek, as previously noted by the South Corridor Project.

• One moderate probability area (M-1) is along SW Lincoln Street where the corridor is wider than the historic-period street.

3.5.3 Environmental Consequences

3.5.3.1 Historic Resources

No-Build Alternative

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

Light Rail Alternative

The range of effects for the Light Rail Alternative’s various alignments and options is provided in Table 3.5-1 and summarized below. Table 3.5-2 identifies the specific resources affected.

<table>
<thead>
<tr>
<th>Alternatives and Options</th>
<th>Properties with Identified Historic Resources</th>
<th>Historic Resources with Expected Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternatives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No-Build</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2003 LPA</td>
<td>15 (+2)</td>
<td>3 (+1 and -1)</td>
</tr>
<tr>
<td>Options by Corridor Segments (When Combined w/2003 LPA)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willamette River Crossing – All Options (PSU to Powell)</td>
<td>15 (0)</td>
<td>3 (0)</td>
</tr>
<tr>
<td>Tillamook Branch Alignment</td>
<td>17 (+2)</td>
<td>3 (+1 and -1)</td>
</tr>
<tr>
<td>2003 LPA-Park (Hwy 224 to Park Ave)</td>
<td>17 (+2)</td>
<td>4 (+1)</td>
</tr>
<tr>
<td>Maintenance Base</td>
<td>15 (0)</td>
<td>3 (0)</td>
</tr>
</tbody>
</table>

* Total (The difference shows the change in the number of resources identified in the segment compared to the 2003 LPA. For a list of the identified resources, see Table 3.5-2.)
<table>
<thead>
<tr>
<th>Map ID #</th>
<th>Address</th>
<th>Name/Type</th>
<th>Date Built</th>
<th>Status</th>
<th>No-Build</th>
<th>2003 LPA</th>
<th>2003 LPA</th>
<th>2003 LPA</th>
<th>Ruby Junction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2000 SW 5th Ave</td>
<td>Portland State School Building</td>
<td>1965</td>
<td>PE</td>
<td>No effect</td>
<td>ROW acquisition; Not adverse</td>
<td>ROW acquisition; Not adverse</td>
<td>ROW acquisition; Not adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>2</td>
<td>1200 SW Naito Parkway</td>
<td>Hawthorne Bridge</td>
<td>DOE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Indirect – Visual; Not adverse</td>
<td>Indirect – Visual; Not adverse</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>3</td>
<td>600 SE Powell Blvd</td>
<td>Ross Island Bridge</td>
<td>1926</td>
<td>DOE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Indirect – Visual; Not adverse</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>4</td>
<td>2425-2445 SE 8th Ave</td>
<td>Royal Foods Warehouse &amp; Office</td>
<td>1957</td>
<td>PE</td>
<td>No effect</td>
<td>Partial or Full Demolition; Adverse</td>
<td>Partial or Full Demolition; Adverse</td>
<td>Partial or Full Demolition; Adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>5</td>
<td>4784 SE 17th Ave</td>
<td>Iron Fireman Building (now PECO Warehouse)</td>
<td>1927-28</td>
<td>DOE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>6</td>
<td>2505 SE 11th Ave</td>
<td>Ford Motor Assembly Plant</td>
<td>1914</td>
<td>DOE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>7</td>
<td>7605 SE McLoughlin Blvd</td>
<td>Westmoreland Park</td>
<td>1937-1939</td>
<td>DOE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>8</td>
<td>2425 SE Bybee Blvd</td>
<td>Eastmoreland Golf Course</td>
<td>1916</td>
<td>DOE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Map ID #</td>
<td>Address</td>
<td>Name/Type</td>
<td>Date Built</td>
<td>Status</td>
<td>No-Build</td>
<td>2003 LPA</td>
<td>2003 LPA-Park (Hwy 224 to Park Ave)</td>
<td>2003 LPA w/Tillamook Branch Alignment</td>
<td>Ruby Junction</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------</td>
<td>-------------------------------</td>
<td>------------</td>
<td>---------</td>
<td>----------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------</td>
<td>----------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>9</td>
<td>2001 SE Holgate Blvd</td>
<td>Brooklyn Yard &amp; Railroad</td>
<td>1912-1946</td>
<td>DOE</td>
<td>No effect</td>
<td>ROW acquisition; Not adverse</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>10</td>
<td>9002 SE McLoughlin Blvd</td>
<td>State Highway Division Office &amp; Garages</td>
<td>1920/1957</td>
<td>DOE</td>
<td>No effect</td>
<td>ROW acquisition – Impacts setting; Adverse</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>11</td>
<td>2206 SE Washington St</td>
<td>R. Derwey House</td>
<td>1925</td>
<td>DOE</td>
<td>No effect</td>
<td>ROW acquisition – Impacts setting; Adverse</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>12</td>
<td>2300 SE Harrison St</td>
<td>Milwaukie Middle School (now Portland Waldorf School)</td>
<td>c. 1937</td>
<td>DOE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>13</td>
<td>2405 SE Harrison St</td>
<td>Residence</td>
<td>1916</td>
<td>DOE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>14</td>
<td>2326 SE Monroe St</td>
<td>Spanish Revival Residence</td>
<td>1928</td>
<td>PE</td>
<td>No effect</td>
<td>Indirect – Visual; Not adverse</td>
<td>Not Applicable</td>
<td>ROW acquisition; Direct Not adverse</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Oregon Pacific and Union Pacific Railroads &amp; Trestle</td>
<td>c.1900</td>
<td>PE</td>
<td>No effect</td>
<td>Indirect; Not adverse, Railroad only (not trestle)</td>
<td>Not Applicable</td>
<td>Indirect – Visual; Impacts setting, potentially adverse, Trestle only</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>16</td>
<td>Approx. 11205 SE McLoughlin Blvd.</td>
<td>Kellogg Lake Outlet</td>
<td>c.1930</td>
<td>DOE</td>
<td>No effect</td>
<td>Not Applicable</td>
<td>No effect</td>
<td>No effect</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Map ID #</td>
<td>Address</td>
<td>Name/Type</td>
<td>Date Built</td>
<td>Status</td>
<td>No-Build</td>
<td>2003 LPA</td>
<td>Willamette River Crossings – All Options (PSU to Powell)</td>
<td>2003 LPA-Park (Hwy 224 to Park Ave)</td>
<td>2003 LPA w/Tillamook Branch Alignment</td>
</tr>
<tr>
<td>----------</td>
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<td>--------------</td>
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<td>------------------------------------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>17</td>
<td>12006 SE McLoughlin Blvd.</td>
<td>Birkemeier-Sweetland House</td>
<td>1878</td>
<td>DOE</td>
<td>No effect</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>No effect</td>
<td>No effect</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 adverse effects</td>
<td>1 adverse effect (for total of 3 when combined with 2003 LPA)</td>
<td>3 adverse, 1 potentially adverse</td>
<td>2 adverse, 1 potentially adverse</td>
</tr>
</tbody>
</table>
2003 Locally Preferred Alternative (2003 LPA)

Of the 17 eligible historic resources identified, 15 are located within the APE of the 2003 LPA. The 2003 LPA would have no effects or no adverse effects to 12 of the 15 historic resources and adverse effects to three historic resources along its alignment. The three adversely affected resources are:

- Royal Foods Warehouse at SE 8th Avenue in Portland, which would require the full acquisition of the property and partial to full demolition of the building.
- Oregon State Highway Division administrative building on SE McLoughlin Boulevard in the north industrial district in Milwaukie, which would require the acquisition of approximately 15 feet of the land parallel to McLoughlin Boulevard, in front of and along the west side of the building.
- R. Derwey House at 2206 SE Washington Street, which would require the acquisition of land along the west side to within approximately 10 feet of the historic house.

The 12 resources not adversely affected would experience some secondary effects to the setting with the introduction of visual intrusions. Design measures for using compatible materials and the Secretary of Interior Standards for the Treatment of Historic Properties will be considered to reduce visual impacts so they would not be considered substantial and would not render the properties ineligible for listing in the National Register. Secondary effects related to noise will be evaluated with the FEIS.

Willamette River Crossing Options – All

The Willamette River crossing options would all have one adverse effect to a property (Royal Foods Warehouse) that would also be affected by the 2003 LPA. There would be no adverse effects to three historic resources with any of the Willamette River crossing options. The bridge height and elevation design options would not change the effects of the 2003 LPA or the other river crossing alignment options.

Alignment and Terminus Options

2003 Locally Preferred Alternative (LPA) with Extension to Park

The 2003 LPA to Park would have two of the same adverse effects as the 2003 LPA. The 2003 LPA to Park would also involve one indirect (or secondary) effect that is potentially adverse by impacting the visual qualities of the railroad trestle (a primary contributing feature) south of SE Lake Road, where the extension would require a structure parallel to the existing trestle. Design options that are compatible with the historic resource and the Secretary of Interior Standards for the Treatment of Historic Properties will be considered to reduce the visual impacts to a level where the effects would be considered not adverse.

Tillamook Branch Line Alignment

The Tillamook Branch Line alignment avoids one adverse effect to an historic resource (the Oregon State Highway Division building) that would be adversely affected by the 2003 LPA. It also requires acquisition of land associated with the Spanish Revival Residence at 2326 SE Monroe, changing
direct secondary no adverse effects to direct no adverse effects. Otherwise, it would include the same effects to historic resources as the 2003 LPA to Park.

**Maintenance Base**

No historic resources were identified in or near the areas identified for the Ruby Junction Operations Facility expansion.

**3.5.3.2 Archaeological Resources**

**No-Build Alternative**

There would be no direct long-term impacts to historic-period or Native American archaeological sites consequent to selection of 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 this light rail project was not developed. These potential indirect effects cannot be quantified.

**Light Rail Alternative**

Selection of the Light Rail Alternative would result in construction-related impacts to eight high probability areas and one moderate probability area with the potential for Native American and historic-period Euroamerican archaeological resources within the APE. There is the potential for adverse effects to significant archaeological resources encountered during construction in this alternative. The effects would result from the long-term (permanent) loss of the archaeological deposits due to displacement. The impacts are therefore considered long-term impacts.

Long-term effects to archaeological resources would result from the development of the light rail project with the high probability areas identified on each side of the Willamette River. The location of specific archaeological items may not be determined prior to selection of the preferred alternative. After selection of a preferred alternative, the project will conduct additional investigations, including subsurface explorations in undeveloped areas and other methods in paved areas as appropriate, to help further define the potential presence of resources. Still, some resources could be undetected and may not be avoided prior to construction. Long-term effects could include the impacts of disturbances to buried archaeological sites encountered during construction and the permanent loss of the archaeological deposits from destruction or removal.

**2003 Locally Preferred Alternative**

Selection of the 2003 LPA could result in construction-related impacts to five high probability areas and one moderate probability area with the potential for Native American and historic-period Euroamerican archaeological resources within the APE. There is the potential for adverse effects to significant archaeological resources encountered during construction in this alternative. The effects could result from the long-term (permanent) loss of the archaeological deposits due to displacement.

**Willamette River Crossing Options**

There are long-term effects on high probability areas anticipated from selection of any of the Willamette River crossing options. Despite many years of disturbance in this area, archaeological
sites have surfaced during recent construction in the area and there are known archaeological sites near all of these alignments on both sides of the river; therefore, high probability areas have been identified on the west and east sides of the Willamette River that would be affected by any of these options. One high probability area has been identified on the east side of the Willamette River that all of the options would encounter, although the Porter-Caruthers and Meade-Caruthers options are closest to the high probability area.

The crossing areas themselves have been subjected to sustained, heavy impacts during industrial developments and operations from approximately 1890 to the modern era. The crossing areas west of the Willamette River were occupied by lumber mills, steel mills, and other industrial enterprises for over 60 years. These areas were filled and were impacted by industrial operations during that time. The crossing areas east of the Willamette River were occupied by an electrical power plant and a lumber mill during the same period and were similarly subjected to extensive and intensive disturbances during these industrial operations. Both areas were subjected to further disturbances during the extensive dismantling, removal, and cleanup of these industrial areas. However, intact archaeological features associated with the former lumber mill have recently been encountered during construction activity in the area.

Bus/No Bus Options

Long-term impacts may occur from the Bus option during development of bus facilities within the high probability locations on either side of the Willamette River. The No Bus option may have a slightly lesser effect on high probability areas because no additional facilities with the potential to impact archaeological sites would be constructed.

Bridge Type and Elevation Options

There are no additional known archaeological sites associated and no additional high probability areas would be affected by this option; these design options would follow the alignments being considered for the 2003 LPA or the Willamette River crossing options.

2003 LPA Extension to Park

This option affects eight high and one moderate probability areas that have the potential for Native American and historic period Euroamerican archaeological resources within the APE. The short-term impacts would be the same as the long-term impacts. The west side of SE McLoughlin Boulevard to SE Park Avenue also is the site of a former trolley line, which is a high probability area of historic archaeological resources but is also part of a larger high probability area for archaeological resources. This alignment option would have the potential to encounter these areas.

Tillamook Branch Line Alignment

For the portion of the Tillamook Branch Line alignment between SE Tacoma Street to downtown Milwaukie, there are no known archaeological sites and no high probability areas would be affected. From downtown Milwaukie to the Park Avenue Station, this alignment would have the same impacts as the 2003 LPA to Park and affect three high probability areas and one moderate probability area.
**Maintenance Base**

No archaeological resource impacts are anticipated.

**3.5.4 Short-Term Impacts (Construction)**

Short-term impacts are those that are a result of construction activities, and the duration of the impact is limited to the duration of construction. These could include impacts related to access and isolation, noise, soil disturbances, and vibration. If construction impacts involve the acquisition and demolition of a historic resource or the disturbance of an archaeological site, these would be a long-term impact. A temporary or short-term impact from construction could affect resources by temporarily removing access and creating dust, noise, vibration or other inconveniences. 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 Chapter 3.3, Community Impacts.

**No-Build Alternative**

Selection of 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.

**Light Rail Alternative**

There are eight high probability areas and one moderate probability area for Native American and historic-period Euroamerican archaeological resources within the APE for the Light Rail Alternative. There is the potential for adverse effects to significant archaeological resources encountered during construction in this alternative.

**2003 Locally Preferred Alternative**

There are five high probability areas and one moderate probability area for Native American and historic-period Euroamerican archaeological resources within the APE for the 2003 LPA. The 2003 LPA without buses on the Willamette River bridge crossing would not result in different effects compared to the 2003 LPA that would provide for buses on the bridge.

**Willamette River Crossing Options**

**Design Options**

The design options related to bridge height or type could apply to the alignments for the 2003 LPA or the other river crossing options and would not change the effects. There are no additional known archaeological sites or high probability areas associated with these options and no additional short-term effects have been identified.

**Alignment Options**

There is one known archaeological site near all four alignments, a high probability area on the west side of the Willamette River that would be affected by this option.
**2003 LPA Extension to Park**

This option affects eight high and one moderate probability areas that have the potential for Native American and historic period Euroamerican archaeological resources within the APE. The short-term impacts would be the same as the long-term impacts.

**Tillamook Branch Line Alignment**

For the portion of the Tillamook Branch Line alignment between SE Tacoma Street and downtown Milwaukie, there are no known archaeological sites and no high probability areas would be affected. Similar to the 2003 LPA to Park, this option affects three high probability areas and one moderate probability area having the potential to be archaeological sites. The short-term impacts would be the same as the long-term impacts.

**3.5.5 Indirect and Cumulative Impacts**

Indirect or secondary impacts are reasonably foreseeable effects that occur as a result of an action or of not doing an action, but are removed from the direct impacts of a project in place or time. Cumulative impacts are the sum of effects from past, current and other expected improvements or public actions. Generally, indirect impacts would be induced by the proposed action while cumulative effects are a project’s direct and indirect impacts added to the impacts from other past and foreseeable actions.

**No Build Alternative**

Selection of the No-Build Alternative would not result in any direct impacts, and therefore it would not increase cumulative impacts to prehistoric or historic-period archaeological sites. However, under the No-Build Alternative, there also would be less potential for discovery, identification and documentation of resources. While archaeological sites are protected by state and federal law, currently unidentified sites could be inadvertently disturbed by other development actions and may not be subject to the level of protection as a federally funded project such as light rail. Historic sites could also be adversely affected by the actions of others, which could range from modification to loss of association to demolition.

**Light Rail Alternative**

For the Light Rail Alternative and its options, other projects would still be developed in areas that may contain prehistoric or historic-period archaeological sites, with or without the light rail project. However, a light rail project serving a more compact urban area would likely mean that less surface area would be disturbed than other alternatives that would require extensive land development. Areas along the alignment have been developed over time, and both archaeological resources and historic resources have been adversely affected.

Under both the No Build and the Light Rail Alternative, other planned projects in the area could also affect resources. Most notably, for the 2003 LPA to Park and the Tillamook Branch Line alignment, the North Clackamas Parks and Recreation District (NCPRD) is planning to develop a regional trail that includes construction on the site of a former streetcar line connecting Portland to Oregon City. This would be a high probability area for historic archaeological resources and would an area shared with the light rail project if an extension to SE Park Avenue is developed.
3.5.6 Mitigation Measures

3.5.6.1 Historic Resources

The Portland-Milwaukie Light Rail Project may adversely affect up to four historic resources, depending on the alternative and options selected. Specific impacts and mitigation commitments for the new Locally Preferred Alternative (to be selected after this SDEIS is released) will be addressed in a formal Memorandum of Agreement (MOA) with the SHPO and executed for inclusion in the FEIS. However, mitigation measures that could be included are discussed below.

Some alternatives would result in the demolition or partial demolition of significant resources if they are built as currently designed. There are several options for mitigating effects of demolition. Selection of an alternative or design option that does not involve demolition is one possibility that would avoid affecting the resource. Changes in project design at the location of an affected resource could eliminate the need for demolition, although the alignments are based on a variety of factors and are already designed in large part to avoid impacts to adjacent properties. Relocation of the resource, either elsewhere on the property or off-site, may be another mitigation option. If these options are not practicable, documentation and salvage of the resource could mitigate for the loss. Such documentation would be required prior to any actions that would adversely affect the resource.

Other mitigation measures could include interpretation of the history and architecture of the resources, including educational opportunities. Off-site mitigation involves finding other opportunities in the community for mitigation measures that are not specific to the affected site. For example, providing assistance for rehabilitation or restoration of similar historic resources in the community could mitigate for the loss of particular resources.

Visual impacts to historic properties would generally be mitigated through design treatments. These design treatments could include use of construction materials to complement existing buildings and structures or landscape design to minimize the adverse visual effects. Should neither use of complementary materials nor landscape design constitute adequate mitigation, it may be necessary to mitigate adverse visual effects through documentation of the resource prior to any actions that would adversely affect the resource. It also may be appropriate for SHPO and appropriate local representatives to review alternative designs adjacent to historic resources to ensure compatibility with the resources.

For construction impacts, a variety of construction management and mitigation measures could be used to avoid impacts to building use and potential damage through vibration, dust, dirt, and other impacts. These measures, which are also described in community impacts and land use and economics, would serve to minimize impacts due to construction.

3.5.6.2 Archaeological Resources

Archaeological resources within eight high and one moderate probability areas may be affected by construction of the Light Rail Alternative. Unlike historic buildings, archaeological resources 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 prior to construction when they are hidden under sidewalks and streets. Because archaeological resources in urban settings are often identified only during construction of the preferred alternative, avoidance through redesign is usually not practicable until the preferred alternative has been selected and the Record of Decision finalized. The potential types of archaeological resources differ, but the treatment for potential mitigation would be similar.
Subsurface testing, shovel tests, and exploratory excavations for buried archaeological sites during preliminary engineering, final design, and in early construction could reduce potential impacts and minimize delays during general construction. The presence of archaeological sites at stream crossings could be determined during geotechnical or anticipatory explorations, as well as within other probability areas after street closures. These early actions would require an inadvertent discovery plan, which would be reviewed and approved by the SHPO and interested tribes. The plan would provide procedures for notifying SHPO and the tribes should resources be encountered, along with measures for documentation, resource recovery, and analysis.

ACHP has issued guidance for the recovery of information from archaeological sites (ACHP, 1999 and 2008). Mitigation is likely to focus on 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 is acceptable only when specific conditions are met and a data recovery plan has been prepared. Mitigation of adverse effects to archaeological resources will need to be defined in consultation with SHPO and other designated consulting parties.

Geotechnical exploration and general construction activities within the eight high and one moderate probability areas shall be monitored by a professional archaeologist and, if requested, monitors from appropriate Tribes will be invited. The archaeological monitoring would be undertaken within the framework of a Monitoring Protocol to be prepared in consultation with the federal agencies, the SHPO, Metro, TriMet, and appropriate interested Tribes.

If resources identified during construction cannot be avoided, then the mitigation would focus on documentation, data recovery and analysis. The final evaluation of potential effect and commitment to mitigation measures would be completed in consultation with the SHPO and interested Tribes. The final analysis of impacts would be documented in the Portland-Milwaukie FEIS. If there are significant effects from the selected alternative that could not be avoided, a MOA would be developed through consultation among the agencies, FTA, SHPO, interested Tribes (if applicable), and other affected parties. The MOA would document the commitments to mitigation. The MOA would be completed prior to publication of the FEIS and would be included within the FEIS.

Selection of the Light Rail Alternative would result in long-term effects from construction of the project in up to eight high probability areas and one moderate probability area with the potential for Native American and historic-period Euroamerican archaeological resources within the APE. Since the location of specific buried archaeological sites cannot be determined prior to selection of the preferred alternative and initiation of construction, it is not possible to design the alternatives to avoid resources that are not yet known. There is the potential for adverse effects to archaeological resources encountered during construction. The effects would result from the long-term (permanent) loss of the archaeological deposits due to displacement. However, there is also the potential for some compensatory benefits if resources are identified because they can be inventoried and recorded, and other preservation actions can be identified.

Areas with a high or moderate probability of archaeological resources have been identified for the various alternatives proposed. Construction activities in these probability areas would be monitored by a professional archaeologist, and, if requested, monitors from appropriate Tribes. The archaeological monitoring would be undertaken within the framework of a Monitoring Protocol to be prepared in consultation with the federal agencies, the SHPO, Metro, TriMet and appropriate interested Tribes, as described under Long-Term Impacts.
3.6 PARKS AND RECREATIONAL RESOURCES

This section identifies park and recreation resources in the project area and discusses potential impacts on these resources. Park and recreation facilities in the project area are owned and managed by several entities, including Portland Parks and Recreation (PP&R), 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 continue to maintain general parks’ goals and policies within their comprehensive plans.

Oregon’s Department of Land Conservation and Development (DLCD) also 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 SDEIS considers both existing parks and plans for future parks.

The analysis also discusses Section 4(f) resources, in response to the requirements of Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966. Section 4(f) applies to the protection and preservation of significant parks, recreation, nature refuges, and cultural resources found to be important to the American public that must be considered during planning and construction of federally funded transportation projects. As stated in the 1983 amended version of the act:

“It is the policy of the United States Government that special effort be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites.”

Additional details on park and recreation resources as they relate to Section 4(f) issues are provided later in this section, in Appendix K, and in the Parks, Recreation and Section 4(f) Results Report (Metro, April 2008).

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 (the area of potential effect, or APE) of the proposed alternative alignments. As summarized in Table 3.6-1, not all of these 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 SDEIS, 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 C, Agency Coordination. Additional details about the individual park and recreation resources are provided in the results report.
### Table 3.6-1
Summary of Potential Parkland and Recreational Resources Evaluated

<table>
<thead>
<tr>
<th>Park Resource</th>
<th>Location</th>
<th>Owner/Custodian</th>
<th>Recreational Use</th>
<th>Within the APE?</th>
<th>Recreational Resource?</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Waterfront Park</td>
<td>North of Marquam Bridge on the west side of the Willamette River</td>
<td>Portland Parks and Recreation</td>
<td>Active and passive recreation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>South Waterfront Greenway</td>
<td>South of the Marquam Bridge on the west side of the Willamette River</td>
<td>Privately owned</td>
<td>Planned recreational trail</td>
<td>Yes</td>
<td>Not yet in place. No date for construction yet determined.</td>
</tr>
<tr>
<td>Vera Katz Eastbank Esplanade</td>
<td>North of the Hawthorne Bridge</td>
<td>Portland Parks and Recreation</td>
<td>Recreational trail</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Eastside Willamette River</td>
<td>South of Hawthorne Bridge and north of SE Caruthers St</td>
<td>Portland Parks and Recreation</td>
<td>Recreational trail</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Brooklyn School</td>
<td>SE 15th Ave and SE Bush St</td>
<td>Portland Public Schools</td>
<td>Educational resource</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Oaks Bottom Wildlife Refuge</td>
<td>SE Sellwood Blvd and SE 7th Ave</td>
<td>Portland Parks and Recreation</td>
<td>Wildlife refuge</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Eastmoreland Golf Course</td>
<td>7605 SE McLoughlin Blvd, Portland</td>
<td>Portland Parks and Recreation</td>
<td>Golf course, active recreation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Westmoreland Park</td>
<td>2425 SE Bybee Blvd, Portland</td>
<td>Portland Parks and Recreation</td>
<td>Active and passive recreation</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Springwater Corridor Trail</td>
<td>Beginning South of SE Ivon St and connecting to several parks and open spaces, including the I-205 Bike Path</td>
<td>Portland Parks and Recreation</td>
<td>Recreational trail</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Roswell Pond Open Space</td>
<td>East of the Tillamook Branch Line alignment and south of the Springwater Corridor</td>
<td>City of Milwaukie, OR</td>
<td>Open drainage space</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Portland Waldorf School</td>
<td>2300 Harrison St, Milwaukie, OR</td>
<td>Privately owned</td>
<td>Private educational resource</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Milwaukee Riverfront Park and</td>
<td>Adjacent to the east side of the Willamette River at Jefferson St</td>
<td>City of Milwaukie, OR</td>
<td>Active recreation</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Jefferson Street Boat Ramp</td>
<td>11300 SE 23rd St</td>
<td>Milwaukee School District</td>
<td>Educational resource</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Milwaukee High School and</td>
<td>Adjacent to Kellogg Lake, on SE Main St, Milwaukie</td>
<td>City of Milwaukee, OR/North Clackamas Parks and Recreation District</td>
<td>Passive recreation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Grounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dogwood Park</td>
<td>Adjacent to Kellogg Lake, on SE Main St, Milwaukie</td>
<td>City of Milwaukee, OR/North Clackamas Parks and Recreation District</td>
<td>Passive recreation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Milwaukee Local Share Parcel</td>
<td>Adjacent to Kellogg Lake, on SE Main St, Milwaukie</td>
<td>City of Milwaukee, OR/North Clackamas Parks and Recreation District</td>
<td>Passive recreation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Robert Kronberg Park (Planned)</td>
<td>Adjacent to Kellogg Lake, south of Lake Road, Milwaukie</td>
<td>City of Milwaukie, OR</td>
<td>Currently an open area. Passive recreation planned</td>
<td>Yes</td>
<td>Not yet developed, but dedicated for future park use</td>
</tr>
<tr>
<td>Trolley Trail (Planned)</td>
<td>Beginning East of SE Jefferson St Boat Ramp in Milwaukie, ending at Glen Echo Rd</td>
<td>North Clackamas Parks and Recreation District</td>
<td>Multimodal recreational trail</td>
<td>Yes</td>
<td>Currently being designed; dedicated for future park use</td>
</tr>
<tr>
<td>Gresham to Fairview Multi-Use</td>
<td>Gresham, adjacent to Ruby Junction</td>
<td>City of Gresham</td>
<td>Multimodal recreational trail</td>
<td>Yes</td>
<td>Planned</td>
</tr>
</tbody>
</table>
3.6.2 Environmental Consequences

This section addresses the direct physical impacts to parks and recreation 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), and parking or access (Chapter 4) impacts.

3.6.2.1 No-Build

With the No Build Alternative, transportation improvements would be limited to those included in the 2000 Regional Transportation Plan (RTP) 2020 financially constrained transit and road network. Under the No Build Alternative, there would be no impacts to any of the recreational resources noted above within the APE.

3.6.2.2 2003 Locally Preferred Alternative

South Waterfront Park

The 2003 LPA would require a small portion of parkland along the southern boundary that would have a minimal effect and would not adversely affect the activities, features, and attributes of the park. The 2003 LPA would also have visual impacts to South Waterfront Park.

Eastside Willamette River Greenway

The 2003 LPA would cross over the Eastside Willamette River Greenway on an elevated structure. Construction of the new bridge could also require detours and a modification of the trail to provide adequate clearance. During further project design, it is anticipated that mitigation measures will be developed to address the visual impacts to the Eastside Willamette River Greenway. While the visual effects of the new bridge are considered high (see Section 3.5, Visual Quality and Aesthetics), the visual effects alone 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 itself, providing connections to greenway trails in place and planned for the South Waterfront Greenway. Design measures may also help to minimize visual impacts on the trail.

Eastmoreland Golf Course

The 2003 LPA would require bus pullouts just east of the proposed Bybee Station, along SE Bybee Street. A narrow strip of land may be needed immediately adjacent to the existing Bybee right-of-way for the development of sidewalks with bus stops and for retaining walls. Because the golf course is adjacent to SE McLoughlin Boulevard, a major arterial, the 2003 LPA and design options are not likely to significantly increase the noise and visual impacts to the resource. There are no alterations to the function of the resource that would affect the recreational viability of the golf course or the club house.

Westmoreland Park

The 2003 LPA will not require direct use of Westmoreland Park property. The park is adjacent to and on the westside of SE McLoughlin Boulevard, a heavy traffic arterial.
**Springwater Corridor Trail**

The 2003 LPA would travel under the Springwater Corridor Trail at the SE McLoughlin Boulevard bridge and the Tillamook Branch Line alignment would travel under the Springwater Corridor Trail UPRR bridge. Both of these bridges were constructed as part of the Springwater Corridor’s Three Bridges Project. The future light rail was planned in coordination with the construction of the Three Bridges Project. There would be no direct long-term impacts. Because both sections of trail already cross over a transportation corridor that has substantial traffic and freight rail traffic, no appreciable noise or visual impacts have been identified, and it is not anticipated that the 2003 LPA would appreciably affect the use of the trail. The nearby stations would also improve access to the trail.

**Dogwood Park**

The 2003 LPA would have no direct effects. There would be no appreciable change to noise levels and visual effects would be few. Activity levels would increase due to the nearby station.

**Milwaukie Local Share Parcel**

The 2003 LPA would have no direct effects. There would be no appreciable change to noise levels and visual effects would be few. Activity levels would increase due to the nearby station.

**3.6.2.3 Willamette River Crossing Options**

**Meade-Sherman and Porter-Sherman River Crossings**

**South Waterfront Greenway (Planned)**

These Willamette River crossing options would intersect the planned South Waterfront Greenway, a future recreational greenway and trail system that the PP&R department has spent considerable effort in planning. The City’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 to South Waterfront Park. At this time, no easements are in place. The Meade alignment would intersect an area that is envisioned for a wider greenspace and potential habitat area, while the Porter alignment would occupy a proposed view corridor in the South Waterfront Plan, and would have a more transverse route across the river, thereby obscuring views. However, the alignments would also provide a new recreational trail crossing over the river, linking with the Eastside Willamette River Greenway and the Springwater Corridor Trail.

**Eastside Willamette River Greenway**

Like the 2003 LPA, river crossing options terminating at SE Sherman Street would cross over the Eastside Willamette River Greenway on an elevated structure.

**Meade-Caruthers and Porter-Caruthers River Crossing Options**

**South Waterfront Greenway**

The impacts of these alignments would be similar to those described above. The Meade-Caruthers alignment would intersect an area that is envisioned for a wider greenspace and potential habitat
area, would require more land, and would have a more transverse route across the river, obscuring views. The Porter-Caruthers alignment, as above, would occupy a proposed view corridor in the South Waterfront Plan.

**Eastside Willamette River Greenway**

The Eastside Willamette River Greenway is within the APE of the Meade-Caruthers and Porter-Caruthers options but these alignments do not actually cross the Eastside Willamette River Greenway. Visual impacts would be less than for the Meade-Sherman or Porter-Sherman crossing options.

**3.6.2.4 Bus/No Bus Options**

Impacts to recreational resources do not differ between the bus/no bus options for the 2003 LPA.

**3.6.2.5 Bridge Type and Elevation Options**

Impacts to recreational resources are not appreciably altered by the bridge types and elevation options. However, there is the potential that the bridge types and options could affect more of the lands envisioned in the South Waterfront Greenway Development Plan for the South Waterfront area.

**3.6.2.6 Tillamook Branch Line Alignment**

The Tillamook Branch Line alignment crosses under the Springwater Corridor Trail in a different location than the 2003 LPA and has both at-grade and elevated design options at the SE McLoughlin Boulevard, SE River Road, and SE 22nd Street crossings. The Tillamook Branch Line alignment has potential impacts to Dogwood Park and Robert Kronberg Park in Milwaukie and to the planned Trolley Trail, which is under the jurisdiction of the NCPRD. Proximity of the light rail and associated stations under the Tillamook Branch Line alignment will increase multimodal access to these park resources and will benefit users.

**Springwater Corridor Trail**

The Springwater Corridor Trail crosses over the UPRR railroad and the proposed light rail alignment. Effects would be similar to those of the 2003 LPA.

**Dogwood Park**

None of the park is needed for right-of-way acquisition. Noise impacts are low, considering existing conditions, and visual impacts are low (see Section 3.10, Noise and Vibration).

**Milwaukie Local Share Parcel**

None of the park is needed for right-of-way acquisition. Noise impacts are low, considering existing conditions, and visual impacts are low (see Section 3.10, Noise and Vibration).
**Robert Kronberg Park (Planned)**

The Tillamook Branch Line alignment would require a minor amount of right-of-way on the southern boundary of the park property, adjacent to the existing railroad trestle. An at-grade option would require more property than an elevated option and could restrict future access between the park and other properties west of the existing trestle, although no formal connections currently exist. The elevated option would provide more opportunities for future connections underneath it. This option would have a higher degree of visual impact (see Section 3.4, Visual and Aesthetics). However, it would occur in areas bordering the park along established transportation rights-of-way.

**Trolley Trail (Planned)**

The planned Trolley Trail would be impacted by the Tillamook Branch Line alignment where it extends to a station at SE Park Avenue. Light rail would require right-of-way within part of the 40-foot corridor purchased for the trail’s construction. FTA, Metro and TriMet are coordinating with the NCPRD during project design to minimize impacts to the development of the trail. NCPRD has indicated its willingness to continue coordination of design and phasing with the light rail project. The most likely option would be to place light rail on the west side of SE McLoughlin Boulevard, between the roadway and the planned Trolley Trail, maintaining the transportation and recreation purpose of the trail. Light rail and the trail also share common treatments to reduce conflicts with side street intersections.

Locating the light rail on the west side of the roadway would require removal of some trees between SE McLoughlin Boulevard and the planned Trolley Trail and construction of a retaining wall in some sections beside the trail. Trees may be perceived to serve as a buffer between the traffic of the roadway and the trail. While light rail would also function as a buffer from roadway traffic, light rail trains would be close to the trail and traveling at relatively high speeds. However, the project would include fencing between the light rail alignment and the trail. Trains would pass twice every 15 minutes, once each way. No noise impacts are projected (see Section 3.10, Noise and Vibration).

**3.6.2.7 2003 LPA Extension to Park**

The 2003 LPA to Park alignment would affect the same parkland resources affected by the 2003 LPA from downtown Portland to downtown Milwaukie. It also includes impacts similar to those described above for the Tillamook Branch Line alignment for the areas south of SE Lake Road, including Robert Kronberg Park, the Milwaukie Local Share Parcel, Dogwood Park, and the Trolley Trail. The Extension to Park does not include the Lake Road Station, so visual impacts to the Milwaukie Local Share Parcel and Dogwood Park would be very low.

**Trolley Trail (Planned)**

The design options and impacts of the 2003 LPA to Park alignment to the planned Trolley Trail are similar to those described in the Tillamook Branch Line alignment, except for the presence of an at-grade or elevated Bluebird Station, which would require more coordination to accommodate the trail and other intersection improvements and modifications along the west side of SE McLoughlin Boulevard.
3.6.2.8 Maintenance Base

The expansion of the TriMet Ruby Junction operations facility in Gresham is not expected to affect any park or recreation resources. The planned Gresham/Fairview Trail through this area would run along the east side of the existing TriMet Ruby Junction operations facility, and therefore would not be impacted by the expansion, as it would occur to the west.

3.6.2.9 Summary of Direct and Secondary Impacts

Two existing recreational resources, South Waterfront Park and Eastmoreland Golf Course, and two planned resources, Robert Kronberg Park and the Trolley Trail, would have direct impacts from any of the alignments through right-of-way acquisition. These impacts are indicated in Table 3.6-2. The Willamette River Crossing options could also intersect future easements for the South Waterfront Greenway, but there are no easements currently in place.

Many impacts to recreational resources are secondary impacts, which can be caused by the proximity of light rail to the resource. These secondary impacts are summarized in Table 3.6-3 and are based on the effects found in other topic areas, including Visual and Aesthetics, Noise and Vibration, and Transportation.

### Table 3.6-2
Summary of Direct Impacts to Park and Recreation Resources

<table>
<thead>
<tr>
<th>Name</th>
<th>Owner/Custodian</th>
<th>Alignment</th>
<th>Estimated Impacted Acres</th>
<th>Total Acreage of Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Waterfront Park</td>
<td>City of Portland</td>
<td>2003 LPA, 2003 LPA to Park and 2003 LPA with Tillamook</td>
<td>0.06</td>
<td>4.27</td>
</tr>
<tr>
<td>Eastmoreland Golf Course</td>
<td>City of Portland</td>
<td>2003 LPA, 2003 LPA to Park and 2003 LPA with Tillamook</td>
<td>&gt;0.02</td>
<td>148</td>
</tr>
<tr>
<td>Robert Kronberg Park (Planned)</td>
<td>City of Milwaukie</td>
<td>2003 LPA to Park and 2003 LPA with Tillamook (range reflects elevated and at-grade options)</td>
<td>0.05 to 0.10</td>
<td>3.50</td>
</tr>
<tr>
<td>Trolley Trail (Planned)</td>
<td>North Clackamas Parks and Recreation District</td>
<td>2003 LPA to Park and 2003 LPA with Tillamook</td>
<td>0.87</td>
<td>17.41</td>
</tr>
</tbody>
</table>
### Table 3.6-3

<table>
<thead>
<tr>
<th>Name</th>
<th>Owner/Custodian</th>
<th>Alignments Impacting Park</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Waterfront Park</td>
<td>City of Portland</td>
<td>2003 LPA, 2003 LPA to Park and 2003 LPA with Tillamook</td>
<td>Visual</td>
</tr>
<tr>
<td>South Waterfront Greenway (Planned)</td>
<td>Currently in private ownership; planned by City of Portland</td>
<td>All Willamette River Crossing Options</td>
<td>Visual</td>
</tr>
<tr>
<td>Eastside Willamette River Greenway</td>
<td>City of Portland</td>
<td>2003 LPA, 2003 LPA to Park, 2003 LPA with Tillamook, and all River Crossing Options</td>
<td>Visual</td>
</tr>
<tr>
<td>Springwater Corridor Trail</td>
<td>City of Portland Parks and Recreation</td>
<td>2003 LPA, 2003 LPA to Park, and 2003 LPA with Tillamook</td>
<td>Visual</td>
</tr>
<tr>
<td>Dogwood Park</td>
<td>City of Milwaukie/North Clackamas Parks and Recreation Department</td>
<td>2003 LPA, 2003 LPA to Park, 2003 LPA with Tillamook</td>
<td>Visual</td>
</tr>
<tr>
<td>Milwaukie Local Share Parcel</td>
<td>City of Milwaukie/North Clackamas Parks and Recreation Department</td>
<td>2003 LPA, 2003 LPA to Park, 2003 LPA with Tillamook</td>
<td>Visual</td>
</tr>
<tr>
<td>Robert Kronberg Park (Planned)</td>
<td>City of Milwaukie</td>
<td>2003 LPA to Park and 2003 LPA with Tillamook</td>
<td>Visual</td>
</tr>
<tr>
<td>Trolley Trail (Planned)</td>
<td>North Clackamas Parks and Recreation District</td>
<td>2003 LPA to Park and 2003 LPA with Tillamook</td>
<td>Visual</td>
</tr>
</tbody>
</table>

#### 3.6.3 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. The location and duration of these effects would differ depending on the project alignments chosen.

Mitigation measures such as signage, alternative traffic routing, and traffic control can mitigate delays and perceptions of decreased access.

Under certain scenarios, construction could temporarily close or limit bicycle or pedestrian access or require detours for the Eastside Willamette River Greenway, the Springwater Corridor, and the planned Trolley Trail, which could affect the connection between multi-use trails that are part of the 40-Mile Loop.

#### 3.6.4 Mitigation

##### 3.6.4.1 Long-Term Mitigation

The design of the light rail project would be coordinated with park owners to minimize the effects of the light rail project. FTA, Metro, and TriMet are coordinating with the City of Milwaukie, the City of Portland, and Clackamas County to define appropriate measures for reducing impacts. Initial designs already incorporate measures designed to minimize impacts and to provide opportunities for benefits. For instance, the light rail route intersects several trails but is grade separated at crossings in all cases and provides stations nearby; the new bridge would also include a trail connecting to both existing and planned trails. Where the use of park property is required, the project will work with the park owner to determine appropriate compensation or other agreements needed to allow use
of the land for the light rail right-of-way. During design, additional design efforts will explore other potential design measures for the Preferred Alternative. Potential mitigation measures could include new or replaced landscaping, park amenities, or modifying project design.

3.6.4.2 Short-Term Mitigation

Depending on the type of resource and the type of project-related impacts, mitigation measures can include a wide range of options, including those defined within individual topic areas such as noise, visual, and transportation. Where direct or proximity impacts are expected, the project will coordinate with park owners to maintain access to park resources where possible and, when restrictions to access or the use of park or recreation resources are unavoidable, the project would work to minimize the duration.

3.6.5 Section 4(f) Resources

Section 4(f) resources include publicly owned parks, recreation areas, wildlife and waterfowl refuges, and historic sites. The analysis of these resources helps FTA determine if there would be any use or taking of Section 4(f) lands or if there would be any impacts that would diminish the qualities that make them 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. The following planned or existing park and recreational resources within the project APE are considered Section 4(f) Resources:

- South Waterfront Park
- Eastside Willamette River Greenway
- Eastmoreland Golf Course
- Springwater Corridor
- Dogwood Park
- Milwaukie Local Share Parcel
- Robert Kronberg Park (Planned)
- Trolley Trail (Planned)

Appendix K contains a draft Section 4(f) evaluation of the project’s effect on 4(f) resources.

3.6.5.1 2003 LPA

The 2003 LPA would require a small portion of parkland from South Waterfront Park, which would not “adversely affect the activities, features, and attributes” of the park. None of the other river crossings would have impacts due to right-of-way acquisition to South Waterfront Park, but they may have visual impacts to the park.

The 2003 LPA could have visual impacts to the Eastside Willamette River Greenway and the Springwater Corridor, but the effects would be minor.

The 2003 LPA would require bus pullouts just east of the proposed Bybee Station, along SE Bybee Street. A narrow strip of land from the Eastmoreland Golf Course may be needed immediately.
adjacent to the existing street right-of-way for the development of sidewalks with bus stops and for retaining walls.

3.6.5.2 Willamette River Crossing Options

The Willamette River Crossing Options would not require a use of land from any Section 4(f) resources. Like the 2003 LPA, two river crossings terminating at SE Sherman Street would cross over the Eastside Willamette River Greenway on an elevated structure, but would not require the use of trail land. There could be a modification of the trail elevation to provide for adequate clearance below the bridge structures, but would not constitute a constructive use of the trail.

3.6.5.3 Tillamook Branch Line Alignment

The Tillamook Branch Line alignment would require use of property along the western boundary of the planned Robert Kronberg Park under the at-grade option, and the elevated option would require a smaller part of the property at the boundary. The at-grade option may require approximately 0.10 acres of the total 3.5 acres of land reserved for the planned park, and the elevated option may require less than 0.05 acres. The Tillamook Branch Line alignment would potentially use land from the planned Trolley Trail. The trail is under the jurisdiction of the NCPRD, which has participated in early efforts to coordinate its design and phasing with the light rail project.

3.6.5.4 2003 LPA Extension to Park

The 2003 Extension to Park alignment would potentially have the same use of Robert Kronberg Park and the planned Trolley Trail as the Tillamook Branch Alignment.

3.6.6 Section 6(f) Resources

Section 6(f) restricts the conversion of uses for properties acquired or developed using monies from Land and Water Conservation Fund (LWCF). The Light Rail Alternative would not impact any resources that were federally funded by the LWCF.

3.7 GEOLOGY AND SOILS

This section addresses geology, soils, and hydrogeologic conditions and impacts for the Portland-Milwaukie Light Rail Project. Complete details on the geology, soils and hydrogeologic conditions analysis are given in the Portland-Milwaukie Light Rail Project Geology and Soils Results Report, Metro, April 2008. This section covers the following information:

- Descriptions of alternatives
- Summaries of methods for data collection and analysis
- Area of potential effect (APE)
- Existing conditions in the affected environment
- Long-term, construction, and cumulative effects to geologic conditions
- Mitigation measures for long-term and construction effects
- Required permits and approvals
3.7.1 Affected Environment

The project team reviewed existing geologic and hydrologic conditions within the project area, using an APE 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 Hydrology

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.

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 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 range in their ability to drain water to the subsurface.

Soil, Aggregate, and Rock Resources

No economic soil, aggregate, and rock resources were identified in the APE. The only aggregate quarries in the proximity of the APE are the Ross Island Sand and Gravel Company, at 4315 SE McLoughlin Boulevard, Portland, Oregon, and an unnamed gravel pit along the east side of the UPRR rail line, just north of SE Harrison Street.

Groundwater Resources

Shallow groundwater may be encountered within the study area. These shallow groundwater areas include those underlain by Quaternary river channel deposits observed in the Mount Scott area and between Milwaukie and Oregon City. There is no area-wide confining unit to retard the advection of surficial contamination to the shallow groundwater table below. Due to the presence of shallow groundwater, potential subgrade construction of rail lines or structures may require dewatering.

Potable groundwater is an important resource in the study area for domestic, municipal, industrial, and irrigation use. However, no wells for potable water appear to be within the APE. Monitoring, irrigation, and industrial wells in and near the APE are of significant value due to ongoing groundwater quality and quantity studies.
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 interpolate folding and faulting of rocks and shallow crustal ruptures in the vicinity of the project area. In addition, volcanic activity associated with the Cascade Range is a source of seismic activity.

Earthquakes

Seismicity in the Portland area has produced earthquakes with magnitudes of M5.3 in 1877, M5.5 in 1962, and M5.6 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 APE 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 APE is within an area 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 APE and are localized along the east and west banks of the Willamette River. Therefore, the high relative earthquake rating is attributed to ground amplification conditions.

Volcanic Hazards

Primary volcanic hazards include ash fall and flooding from Mount Saint Helens and Mount Hood. These hazards are limited within the APE and do not differentiate the alternatives.

Landslides

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. Active and historically active landslides do not appear to be located within the APE.
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 is assigned to category A, 3 is assigned to category B, 2 is assigned to category C, and 1 or 0 is assigned to category D.
Steep Slopes

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 APE are limited to areas along the east and west bank of the Willamette River, north and south of Kellogg Lake, and along the UPRR rail line near Ardenwald. Outside of these identified areas, which are small in aerial extent, no significant steep slopes greater than 25 percent occur in the APE. However, there are localized areas where steep slopes have been observed, including areas adjacent to SE McLoughlin Boulevard, particularly south of downtown Milwaukie.

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 project APE 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 Consequences

A summary of long-term, construction, and cumulative impacts to geologic and hydrologic conditions is presented below.

3.7.2.1 Long-Term Impacts

Long-term effects are future effects to resources within the region that may occur after the completion of the Portland-Milwaukie Light Rail Project. Long-term impacts are effects that may be regional as well as local in nature and that may extend from the APE into Clackamas, Multnomah, and Washington Counties of Oregon, and into Clark County in Washington.

No-Build Alternative

The No-Build Alternative would not affect geologic or hydrologic 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.
**Light Rail Alternative**

The 2003 LPA generally crosses lands that are urbanized and is likely to have limited long-term effects on existing geologic and hydrologic conditions. The following effects could occur with the Light Rail Alternative:

- Engineered bridges and structures must be able to withstand a major seismic event.
- Relatively minor changes may be made to topography and drainage patterns.
- Further stabilization of existing slopes, through the use of retaining walls or other design measures, may be required.
- There may be limited settlement of near-surface features.
- Ongoing growth may put a strain on existing groundwater and rock resources, similar to the demands expected under the No-Build Alternative.

None of the options considered for the 2003 LPA would involve an appreciable difference in effects compared to the preferred alternatives.

**Willamette River Crossing Options**

No appreciable differences are thought to exist among Willamette River crossing options in regard to effects on geologic and hydrologic conditions or adverse effects on resources.

**Alignment Options**

No appreciable differences are thought to exist among alignment and terminus options in regard to existing geologic and hydrologic conditions or adverse effects on resources.

**Alignment and Terminus**

No appreciable differences are thought to exist among alignment options in regard to existing geologic and hydrologic conditions or adverse effects on resources.

**Maintenance Base**

The Light Rail Alternative would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. The maintenance base expansion has no meaningful effect on geology and soils.

**3.7.2.2 Short-Term Impacts (Construction)**

Construction impacts are potential short-term impacts to resources within the APE that occur prior to 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 those of other projects that are expected to be developed in the area, even if light rail were not built.
**Light Rail Alternative**

With respect to geologic and hydrogeologic resources, the following beneficial effects could occur due to construction:

- Engineering improvements to areas underlain by historic artificial fill that may be inherently unstable due to the manner in which the fill was placed
- Implementation of advanced or innovative geologic engineering controls

The following potential adverse short-term effects could occur (if not mitigated):

- Induced erosion from construction
- Degraded groundwater quality from construction

**Willamette River Crossing Options**

No appreciable differences are thought to exist among crossing options in regard to effects on geologic and hydrologic conditions or adverse effects on resources. However, the four South Waterfront crossing options would likely encounter artificial fill during construction, which may require special design measures. The 2003 LPA, which appears to have more of its length located on natural soils, may not require special design measures.

**Alignment Options**

No appreciable differences are thought to exist among alignment and terminus options in regard to existing geologic and hydrologic conditions or adverse effects on resources.

**Alignment and Terminus**

No appreciable differences are thought to exist among alignment options in regard to existing geologic and hydrologic conditions or adverse effects on resources.

**Maintenance Base**

The Light Rail Alternative would require expansion of the existing Ruby Junction maintenance facility on NW Eleven Mile Avenue in Gresham. The maintenance base expansion has no meaningful effect on geology and soils.

**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 not expected to materially cause or increase any significant cumulative impacts.

**3.7.3 Mitigation**

**3.7.3.1 Long-Term Mitigation**

Mitigation measures to minimize impacts will be addressed using information obtained during preliminary and final engineering and will utilize standard-of-practice highway/rail construction
methods. Mitigation measures will be identified to meet applicable state and federal design and construction codes that govern transportation projects. 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 mitigation measures are employed.

The following potential mitigation and minimization measures for long-term effects were identified:

- Avoid 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.
- Avoid unstable soils. In areas where unstable soils are limited, they can be excavated and replaced by engineered fill. If this is not feasible, mat foundations, deep foundations, piles, or other forms of mechanical foundations can be used.
- Seismic upgrades to existing or newly proposed structures within the APE that may be susceptible to earthquake hazards could involve introduction of stabilizing soil or supporting structures on non-liquefiable soils or bedrock and more extensive foundation and structural design.
- Identify, characterize, and mitigate unidentified geologic hazards.
- Establish erosion controls during construction through the implementation of erosion and sediment control plans (ESCPs) and grading permits. Mitigation should adhere to Oregon Department of Transportation Construction Project Pollution Control Manual.
- Establish erosion control at river and stream banks through the implementation of ESCP for bridge crossings.
- Protect groundwater resources through stormwater management.

### 3.7.3.2 Construction Mitigation

Site-specific mitigation measures will be considered in subsequent geotechnical evaluations. In cases where avoidance of seismic hazards, steep slopes, known contamination sites, and hazardous soil types is not possible due to the distribution of these conditions throughout the project area, effects of these conditions should be minimized through appropriate geotechnical and engineering controls.

Construction impacts will be addressed by evaluating the results of subsurface investigations that are conducted 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. A separate geotechnical report will be prepared during the engineering design portion of the project. The geotechnical report will quantify the potential short-term construction impacts of the existing geologic and geotechnical conditions on the project. Ground conditions will be evaluated from soil samples collected during drilling activities.
3.8 ECOSYSTEMS

The Ecosystems section discusses the wetlands, vegetation, wildlife, and fisheries species that could be affected by the Portland-Milwaukie Light Rail Project. Additional detail is provided in the *Ecosystems Results Report*, Metro, April 2008. 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. The principal natural resource regulations, ordinances, and permit actions that could apply to the selected alternative are summarized in Table 3.8-1. Additional permits and approvals are listed in Section 6.3.

<table>
<thead>
<tr>
<th>Regulation/Permit</th>
<th>Responsible Agency</th>
<th>Resource Studies</th>
<th>Regulated Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Federal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Environmental Policy Act (NEPA)</td>
<td>Federal Transit Administration (FTA)</td>
<td>NEPA EIS addressing natural resource conditions, impacts and mitigation</td>
<td>All</td>
</tr>
<tr>
<td>Clean Water Act (CWA) Section 404 Individual Permit; Section 10 (Rivers and Harbors Act)</td>
<td>US Army Corps of Engineers (USACE)</td>
<td>Alternatives analysis; wetland delineation study; wetland functional assessment and impact analysis; mitigation plan</td>
<td>Waters of the U.S., including wetlands</td>
</tr>
<tr>
<td>Endangered Species Act (ESA)</td>
<td>National Marine Fisheries Service (NMFS); US Fish and Wildlife Service (USFWS)</td>
<td>Biological Assessment addressing project impacts to listed species, species proposed for listing and candidate species, and their habitats</td>
<td>Vegetation, wildlife, fisheries, habitats</td>
</tr>
<tr>
<td>Fish and Wildlife Coordination Act</td>
<td>USFWS; NMFS; Oregon Department of Fish and Wildlife (ODFW)</td>
<td>Agency consultation; identify impacts to fish and wildlife resources; recommend mitigation</td>
<td>Vegetation, wildlife, fisheries, habitats</td>
</tr>
<tr>
<td>Magnuson-Stevens Fishery Conservation Management Act</td>
<td>NMFS</td>
<td>Identify potential impacts to Essential Fish Habitat (EFH)</td>
<td>Habitat for commercially significant fish</td>
</tr>
<tr>
<td>Migratory Bird Treaty Act</td>
<td>USFWS</td>
<td>Identify impacts to migratory birds</td>
<td>Wildlife</td>
</tr>
<tr>
<td><strong>State</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oregon Removal – Fill Permit</td>
<td>OR Department of State Lands (DSL)</td>
<td>Alternatives analysis; wetland delineation study; wetland functional assessment and impact analysis; mitigation plan</td>
<td>Waters of the state, including wetlands</td>
</tr>
<tr>
<td>Oregon State ESA</td>
<td>ODFW; OR Department of Agriculture (ODA)</td>
<td>Identify project impact to state-listed and candidate species</td>
<td>Vegetation, wildlife, fisheries</td>
</tr>
<tr>
<td>CWA Section 401 Water Quality Certification</td>
<td>OR Department of Environmental Quality (DEQ); US Environmental Protection Agency (EPA)</td>
<td>Assess project compliance with state water quality standards; implement mitigation measures; stormwater management plan</td>
<td>Rivers, streams, other bodies of water</td>
</tr>
<tr>
<td>Oregon Fish Passage Statute</td>
<td>ODFW</td>
<td>Identify stream crossing and impacts to ability for fish to pass upstream and downstream</td>
<td>Native fish, streams and culverts</td>
</tr>
<tr>
<td><strong>Local</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portland Greenway Review</td>
<td>City of Portland</td>
<td>Evaluation of impacts to native vegetation; mitigation or preservation of native vegetation</td>
<td>Greenway Setback, vegetation, wildlife, fisheries</td>
</tr>
<tr>
<td>Environment Overlay Zone</td>
<td>City of Portland</td>
<td>Identification of adverse impacts; mitigation plan</td>
<td>Streams, wetlands, wildlife habitat</td>
</tr>
<tr>
<td>City of Milwaukee Natural Resource Overlay Zone Setback Requirements</td>
<td>City of Milwaukee</td>
<td>Protection of natural resources and areas of public value</td>
<td>All</td>
</tr>
<tr>
<td>Clackamas County</td>
<td>Protection of river and stream corridors</td>
<td>Rivers and streams</td>
<td></td>
</tr>
</tbody>
</table>
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. Agencies must avoid undertaking or providing assistance for new construction located in wetlands unless the agency finds that 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. In making this finding, the head of the agency may take into account economic, environmental and other pertinent factors. Executive Order 11988 – Floodplain Management provides similar protection for floodplains.

### 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. Discussions of the affected environment, focused primarily on resources within an area of potential effect (APE) of 150 feet in each direction from the proposed project alignment (creating a 300-foot wide study area), are provided below. However, the analysis also considers information from field observations and from local, state and federal agencies to help characterize ecosystem resources.

#### 3.8.1.1 Wetlands

Five wetlands sites were identified within the light rail project corridor study area. The Ruby Junction Operations Facility is situated partially on hydric soils, and wetlands or waters are present in the vicinity. However, no wetlands or waters are present within the facility’s boundaries.

<table>
<thead>
<tr>
<th>Site/Wetland</th>
<th>Waterway</th>
<th>Wetland Class</th>
<th>Wetland Determination</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM1/A</td>
<td>Crystal Springs Creek</td>
<td>RFT</td>
<td>Wetland</td>
<td>Perennial stream bounded by emergent and scrub-shrub wetland.</td>
</tr>
<tr>
<td>PM2/B</td>
<td>NA</td>
<td>S/F</td>
<td>Wetland</td>
<td>Union Pacific Railroad (UPRR) Brooklyn Yard wetland mitigation site.</td>
</tr>
<tr>
<td>PM6/C</td>
<td>NA</td>
<td>DEP</td>
<td>Wetland</td>
<td>City of Milwaukie Roswell retention facility supporting emergent, scrub-shrub, and forested wetland.</td>
</tr>
<tr>
<td>PM7/D</td>
<td>Crystal Creek and tributary</td>
<td>RFT</td>
<td>Wetland</td>
<td>Perennial stream and intermittent tributary supporting emergent, scrub-shrub, and forested wetland.</td>
</tr>
<tr>
<td>PM10/O</td>
<td>Unnamed ephemeral drainage</td>
<td>DEP</td>
<td>Wetland</td>
<td>Small wetland with no outlet due to roadway fill at downslope end, receives hydrology from small ephemeral drainage.</td>
</tr>
</tbody>
</table>


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

Depending on the alignment option selected, transit improvements proposed as part of the Light Rail Alternative would cross the Willamette River and Kellogg Lake 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. Additionally, the proposed expansion of the existing Ruby Junction Operations Facility in Gresham would occur in proximity to Fairview Creek and would occur in a portion of its floodplain. 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 near the corridor are also considered an integral part of the waterways ecological function, although within the project area, most of the floodplains involve cleared areas. The exceptions include Crystal Springs Creek and Johnson Creek, where active restoration and preservation activities have helped maintain and improve functional values.

Figure 3.8-1 provides mapping of the rivers and streams in the analysis area. Table 3.8-3 identifies the project area streams affected by the Light Rail Alternative and its alignment options. Table 3.8-4 summarizes existing conditions in 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 Resources.

<table>
<thead>
<tr>
<th>Table 3.8-3 Project Area Streams</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stream</strong></td>
</tr>
<tr>
<td>Willamette River</td>
</tr>
<tr>
<td>Crystal Springs Creek</td>
</tr>
<tr>
<td>Johnson Creek</td>
</tr>
<tr>
<td>Crystal Creek</td>
</tr>
<tr>
<td>Spring Creek</td>
</tr>
<tr>
<td>Kellogg Lake/Creek</td>
</tr>
<tr>
<td>Courtney Springs Creek</td>
</tr>
<tr>
<td>Fairview Creek</td>
</tr>
</tbody>
</table>

1 Streams are presented in order moving south along the alignment.
2 Fairview Creek is proximate to the existing Ruby Junction Operations Facility, which would be expanded as part of the Light Rail Alternative. It is not listed in this table because it is not crossed by any of the alignment options but could be indirectly affected by the proposed expansion of the facility.
3 There are four Willamette River crossing options located south of the 2003 LPA crossing. They would not affect any streams other than the Willamette River and can be applied to any of the corridor’s alignment options.

2 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.
*Wetland determinations were conducted by URS, Inc., during April and May 2002, for the South Corridor Project SDEIS, and were updated in October 2007 (Table 3.8-2) by David Evans and Associates.
Table 3.8-4
Summary of Existing Conditions in Project Area Streams

<table>
<thead>
<tr>
<th>Stream</th>
<th>Crossed by Alignment Options</th>
<th>Supports TES Fish Species (Species)</th>
<th>Approx. Basin Size (sq mi)</th>
<th>Approx. Wetted Width at Crossing (ft)</th>
<th>Water Quality Limited Waterbodies for Following Parameters ³ ⁴</th>
<th>TMDL(s) Approved for Following Parameters ³ ⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willamette River</td>
<td>All</td>
<td>Yes (Chinook, coho, cutthroat, steelhead, pacific lamprey, green sturgeon)</td>
<td>11,500</td>
<td>1,200</td>
<td>Aldrin, biological criteria, DDT, DDE, dieldrin, E. coli, fecal coliform, iron, manganese, mercury, PCBs, PAHs, pentachlorophenol</td>
<td>Dioxin; temperature; DDT; dieldrin</td>
</tr>
<tr>
<td>Crystal Springs Creek</td>
<td>All</td>
<td>Yes (Chinook, coho, cutthroat, steelhead, pacific lamprey)</td>
<td>2</td>
<td>15</td>
<td>None</td>
<td>Bacteria; temperature; DDT; dieldrin</td>
</tr>
<tr>
<td>Johnson Creek</td>
<td>All</td>
<td>Yes (Chinook, coho, cutthroat, steelhead)</td>
<td>54</td>
<td>35</td>
<td>DDT, temperature, dieldrin, E. coli, fecal coliform, PCBs, PAHs</td>
<td>Bacteria; temperature; DDT; dieldrin</td>
</tr>
<tr>
<td>Crystal Creek</td>
<td>All</td>
<td>No</td>
<td>&lt;1</td>
<td>&lt;5</td>
<td>Not Listed; Tributary of Johnson Creek</td>
<td>None; see Johnson Creek</td>
</tr>
<tr>
<td>Spring Creek</td>
<td>All</td>
<td>No</td>
<td>&lt;1</td>
<td>&lt;5</td>
<td>Not Listed; Tributary of Johnson Creek</td>
<td>None; see Johnson Creek</td>
</tr>
<tr>
<td>Kellogg Lake/Creek</td>
<td>2 of 3</td>
<td>Yes (Chinook, coho, pacific lamprey, cutthroat, steelhead)</td>
<td>15</td>
<td>400</td>
<td>E. coli</td>
<td>None</td>
</tr>
<tr>
<td>Courtney Springs Creek</td>
<td>2 of 3</td>
<td>Yes (cutthroat)</td>
<td>&lt;1</td>
<td>&lt;5</td>
<td>Not Listed; Tributary of Kellogg Lake/Creek</td>
<td>None; see Kellogg Lake/Creek</td>
</tr>
<tr>
<td>Fairview Creek</td>
<td>None</td>
<td>No</td>
<td>7</td>
<td>NA</td>
<td>E. coli, fecal coliform</td>
<td>Bacteria; temperature</td>
</tr>
</tbody>
</table>

¹ Sources: PNW Ecosystem Research Consortium (2002); StreamNet (2007a); City of Portland (2007).
² Wetted width is the distance between water’s edge on each side of the stream as measured perpendicular to streamflow.
⁴ 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.
⁵ 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.

The proposed alignment options would cross project area streams in the following locations:

- Willamette River – the 2003 LPA and four crossing options, all located between the Marquam and Ross Island Bridges.
- Crystal Springs Creek – immediately west of UPRR, 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 – immediately east of the existing UPRR crossing.
• Courtney Springs Creek – immediately to the west of SE McLoughlin Boulevard; approximately 100 feet north of SE Park Avenue.

Kellogg Lake and Courtney Springs Creek would be crossed only if either the Tillamook Branch Line or 2003 LPA to Park alignment option is selected. All streams are proposed to be crossed on new bridge structures or using existing culverts. With the exception of the Willamette River and Kellogg Lake (if it remains in its current dammed condition), all crossing structures and project elements would be located above the ordinary high water (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. Five vegetation cover types were noted within the alignment including grassland, scrub-shrub, riparian scrub-shrub, upland forest, and riparian forest. These vegetation cover types include the broader habitat types identified in the 2006 Oregon Conservation Strategy, but the corridor encounters primarily wetland and riparian habitat types identified in the strategy.

Table 3.8-5 lists the acreage of each plant community within the corridor. 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) and includes all alignment options. A vegetation cover map is also provided in Figure 3.8-2.

<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>Acres in Study Area¹</th>
<th>Percent of Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassland</td>
<td>12.58</td>
<td>3%</td>
</tr>
<tr>
<td>Riparian Scrub-Shrub</td>
<td>8.87</td>
<td>2%</td>
</tr>
<tr>
<td>Scrub-Shrub</td>
<td>23.37</td>
<td>6%</td>
</tr>
<tr>
<td>Riparian Forest</td>
<td>3.16</td>
<td>1%</td>
</tr>
<tr>
<td>Upland Forest</td>
<td>17.08</td>
<td>5%</td>
</tr>
<tr>
<td>Open Water</td>
<td>32.13</td>
<td>8%</td>
</tr>
<tr>
<td>Developed</td>
<td>283.28</td>
<td>75%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>380.47</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

¹ Acreage data from GIS mapping based on revisions to data from South Corridor SDEIS (2002) Cover types at the Ruby Junction Operations Facility consists of developed, with small portions of residential lawn and mature trees.
Portland-Milwaukie Light Rail Project

Vegetative Cover in Area of Potential Effect

Figure 3.8-2

- Grass Land
- Riparian Scrub-Shrub
- Scrub-Shrub
- Riparian Forest
- Upland Forest
- Open Water

Area of Potential Effect
3.8.1.4 Wildlife

Wildlife species that occur within the project 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 study corridor, 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. The reptiles within the study corridor would be expected to occur in moist areas of riparian and wetland habitats.

Bird species are the largest group of animals that occur in urban areas, including the study corridor. 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 study corridor, nor is there likely suitable habitat for nesting, but peregrine falcons could use some of the corridor areas 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. Information on bald eagles is discussed in the 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 study corridor include Virginia opossum, Eastern cottontail, raccoon, coyote, fox squirrel, native mice and vole species, several bat species, house mice, and Norway rat. Occasionally, black-tailed deer would be expected to occur in the larger woodland areas. Also, muskrat, non-native nutria, beaver, and river otter occur in the Willamette River and its tributaries.

Urban areas, which are usually characterized by fragmented non-contiguous habitats, generally limit movement of ambulatory wildlife (species that walk or run). The alignment is primarily located along existing streets and railroads and would not create new barriers to wildlife movement. 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 Operations Facility, which is within an urbanized area, are similar to those in the Portland - Milwaukie corridor.

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 Light Rail Alternative are documented as supporting populations of resident and anadromous fish species. The remaining streams are much smaller but likely support resident and anadromous species during certain portions of the year.

3.8.1.6 Threatened, Endangered, and Sensitive Species

Threatened and endangered species (TES), including those species proposed for listing or candidates for listing, are categorized as such under the federal and Oregon ESAs. Sensitive species are categorized as such by federal agencies as species of concern and by Oregon Department of Fish and
Wildlife (ODFW) and Oregon Department of Agriculture (ODA) through the Oregon sensitive species lists. In addition, other entities may denote the special status of species including the City of Portland and the Oregon Natural Heritage Information Center (ORNHIC).

Seven of the native fisheries species documented in project area streams are listed as threatened under the ESA, and several more are species of concern. As listed in Table 3.8-6, 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, 2007; 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, April 2008.

**Table 3.8-6**

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Federal Status</th>
<th>State Status</th>
<th>Crystal Springs Creek</th>
<th>Johnson Creek</th>
<th>Kellogg Lake/Creek</th>
<th>Willamette River</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Native Species</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Columbia River Coho Salmon ESU&lt;sup&gt;1&lt;/sup&gt;</td>
<td><em>Oncorhynchus kisutch</em></td>
<td>LT</td>
<td>LE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Lower Columbia River Steelhead DPS&lt;sup&gt;2&lt;/sup&gt;</td>
<td><em>O. mykiss</em></td>
<td>LT</td>
<td>SC</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Upper Willamette River Steelhead DPS&lt;sup&gt;2&lt;/sup&gt;</td>
<td><em>O. mykiss</em></td>
<td>LT</td>
<td>SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Columbia River Chinook Salmon ESU&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td><em>O. tshawytscha</em></td>
<td>LT</td>
<td>SC</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Upper Willamette River Chinook Salmon ESU&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td><em>O. tshawytscha</em></td>
<td>LT</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Bull trout&lt;sup&gt;3&lt;/sup&gt;</td>
<td><em>Salvelinus confluentus</em></td>
<td>LT</td>
<td>SC</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Green sturgeon (southern DPS)&lt;sup&gt;3&lt;/sup&gt;</td>
<td><em>Acipenser medirostris</em></td>
<td>LT</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Green sturgeon (northern DPS)&lt;sup&gt;3&lt;/sup&gt;</td>
<td><em>Acipenser medirostris</em></td>
<td>SOC</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Pacific lamprey</td>
<td><em>Lampetra tridentatus</em></td>
<td>SOC</td>
<td>SV</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cutthroat trout (Lower Columbia River ESU)&lt;sup&gt;4&lt;/sup&gt;</td>
<td><em>O. clarki</em></td>
<td>SOC</td>
<td>SC</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

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.


<sup>1</sup> Essential Fish Habitat, as designated under the Magnuson-Stevens Fishery Conservation Management Act, exists for these species in the project area.

<sup>2</sup> Critical Habitat, as designated under the Endangered Species Act, exists for these salmon and steelhead species within the project area.

<sup>3</sup> Although bull trout typically are found in cold, clear streams at relatively high elevations, they may use portions of the Columbia River, and perhaps Willamette River, seasonally. Consequently, although their presence in the project area is unlikely and is not documented, they could occur in the project area during winter and spring months.

<sup>4</sup> Cutthroat trout also are reported in Courtney Springs Creek.

The U.S. Fish and Wildlife Service (USFWS) identified 20 federal TES wildlife species and 11 federal TES plant species with potential to occur within the vicinity of the project corridor. The ORNHIC database provided 13 records of 11 state and federal TES wildlife and plant species within the two-mile search area, but all are outside of the 300-foot wide study corridor (Table 3.8-7). Several of these records are historic and represent species that are likely extirpated from the project area. No TES species wildlife or plant species were recorded by ORNHIC within one mile of the Ruby Junction Operations Facility.
No TES wildlife or plant species were identified within the 300-foot-wide study corridor and, 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 was observed. Bald eagles are likely to use the Willamette River within the stretch of the proposed crossing for foraging and movement to some extent. Known nests are located within one mile of the northern and southern termini of the proposed alignments, but not within one-quarter mile. 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 operations facility.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>USFWS/NMFS Status</th>
<th>ODFW/ODA Status</th>
<th>Year Last Recorded by ORNHIC</th>
<th>Documented in Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amphibians and Reptiles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oregon spotted frog</td>
<td><em>Rana pretiosa</em></td>
<td>C</td>
<td>SC</td>
<td>1931</td>
<td>No</td>
</tr>
<tr>
<td>Western painted turtle</td>
<td><em>Chrysemys picta</em></td>
<td>--</td>
<td>SC</td>
<td>1965</td>
<td>No</td>
</tr>
<tr>
<td><strong>Birds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bald eagle</td>
<td><em>Haliaeetus leucocephalus</em></td>
<td>DL</td>
<td>T</td>
<td>2006</td>
<td>No</td>
</tr>
<tr>
<td>American peregrine falcon</td>
<td><em>Falco peregrinus anatum</em></td>
<td>DL</td>
<td>DL</td>
<td>2003</td>
<td>No</td>
</tr>
<tr>
<td>Purple martin</td>
<td><em>Progne subis</em></td>
<td>SOC</td>
<td>SC</td>
<td>1998</td>
<td>No</td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific western big-eared bat</td>
<td><em>Corynorhinus townsendii</em></td>
<td>SOC</td>
<td>SC</td>
<td>1928</td>
<td>No</td>
</tr>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oregon megomphix (snail)</td>
<td><em>Megomphix hemphilli</em></td>
<td>--</td>
<td>--</td>
<td>1996</td>
<td>No</td>
</tr>
<tr>
<td>Shortface lanx</td>
<td><em>Fisherola nuttalli</em></td>
<td>--</td>
<td>--</td>
<td>1985</td>
<td>No</td>
</tr>
<tr>
<td><strong>Plants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tall bugbane</td>
<td><em>Cimicifuga elata</em></td>
<td>--</td>
<td>C</td>
<td>1993</td>
<td>No</td>
</tr>
<tr>
<td>Pale larkspur</td>
<td><em>Delphinium leucophaeum</em></td>
<td>SOC</td>
<td>E</td>
<td>1991</td>
<td>No</td>
</tr>
<tr>
<td>Oregon sullivantia</td>
<td><em>Sullivantia oregana</em></td>
<td>SOC</td>
<td>C</td>
<td>1976</td>
<td>No</td>
</tr>
</tbody>
</table>

Source: ORNHIC 2007

1 Status Codes: E = Endangered; T = Threatened; DL = Delisted; C = Candidate for listing as Threatened or Endangered; SOC = Species of Concern; SC = Sensitive Critical.

2 These species likely utilize portions of the project corridor currently for movement and foraging.

### 3.8.2 Environmental Consequences

The environmental consequences that could result from the Portland-Milwaukie Light Rail Project include 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 alternative within the alternative’s physical footprint. Indirect impacts are those impacts that take place later in time or outside of the physical footprint of an alternative. 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” (CEQ regulation, 40 CFR 1508.7; CEQ, 1978).

Analyses of impacts for ecosystem resources are based on the conceptual designs as described Chapter 2. This level of design is adequate for analyzing general impacts and comparing alternatives. Analyzing specific impacts, such as precise volumes for removal/fill activities, precise areas of vegetation removal, and hydraulic impacts on streams, will be analyzed during further design and in concert with natural resource permitting processes.

### 3.8.2.1 No-Build Alternative

**Long-Term Direct and Indirect Impacts**

Existing conditions characterize the No-Build Alternative, which would not include any of the proposed changes to 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. While traffic and congestion would increase over time with all project alternatives, the No-Build Alternative would be associated with worse congestion than the Light Rail Alternative. For further detail, see Section 3.9, Water Quality and Hydrology.

Furthermore, stormwater runoff from impervious surfaces would continue to flow untreated or undertreated to project area streams until redevelopment occurs. Most of the area’s transportation facilities and adjacent developments were built before current stormwater management practices were in place.

**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 encouraging growth in a manner that is consistent with regional density goals.
3.8.2.2 Light Rail Alternative

**Wetlands**

**Long-Term Direct Impacts**

In accordance with relevant state and federal regulations and Executive Order 11990, impacts to wetlands and jurisdictional waters were avoided and minimized to the extent practicable. This includes efforts to identify and narrow potential alignments as discussed in Chapter 2 and Appendix L, which focused the alignment on existing rights-of-way. Estimated wetland impacts associated with the project are shown in Table 3.8-8. Wetland locations are shown in Figure 3.8-1. The wetland impacts from the 2003 LPA alignment would be 0.57 acres. Impacts would occur to approximately 0.02 acres of wetlands classified as Riverine Flow-through (Site PM1/A and Site PM7/D). Impacts would occur to approximately 0.55 acres of Site PM2/B, which is classified as a Slope/Flat wetland. Site PM2/B 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 Department of State Lands (DSL), negotiated when a mitigation site was developed in the same area identified as a likely location for the light rail project. The alignment would cross along the east edge of Wetland B, and due to site constraints related to the existing railway, roadway, and Crystal Springs Creek there is no practicable opportunity to fully avoid this feature.

<table>
<thead>
<tr>
<th>Wetland Impacts</th>
<th>2003 LPA Alignment Acreage</th>
<th>2003 LPA-Park</th>
<th>2003 LPA with Tillamook Branch Line Alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM1/A</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>PM2/B</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
</tr>
<tr>
<td>PM6/C</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>PM7/D</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>PM10/O</td>
<td>None</td>
<td>None¹</td>
<td>None¹</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.57</strong></td>
<td><strong>0.57</strong></td>
<td><strong>0.57</strong></td>
</tr>
</tbody>
</table>

Source: David Evans and Associates 2008

¹ Light rail may require realigning a planned trail, when could encroach on the wetland.

No additional wetlands impacts are anticipated as part of the Willamette River crossing options because no wetlands are present in this area of the project corridor.

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

**Long-Term Indirect Impacts**

Long-term indirect impacts to project area wetlands primarily would be associated with increases in impervious area and associated impacts to hydrology and water quality, which are detailed in the Waterways section below.
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, and if severe enough could be permanent, resulting 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 temporary removal of tree and shrub vegetation would likely result in decreased shading of project area wetlands and potential habitat loss. For the Light Rail Alternative and its options, no appreciable temporary effects are anticipated outside of the likely construction area due primarily to implementation of impact minimization measures, sediment and erosion 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. Removal of the Kellogg Lake dam would likely help to increase overall ecosystem functions in the area. In addition, the area will likely continue to develop pursuant to land and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources.

Waterways

Long-Term Direct Impacts

Transit improvements under consideration would cross or intersect major and minor watercourses and floodplains within the lower portion of the Willamette River basin. The build alternative would cross the Willamette River, Kellogg Lake, and, depending on the alignment option selected, as many as five additional streams: Crystal Springs, Johnson, Crystal, Spring, and Courtney Springs Creeks. The proposed maintenance facility expansion is located adjacent to Fairview Creek’s floodplain. Figure 3.8-3 shows the project area streams affected by the Light Rail Alternative and its alignment options. 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\(^{1,2}\)

<table>
<thead>
<tr>
<th>Willamette River</th>
<th>Crystal Springs Creek</th>
<th>Johnson Creek</th>
<th>Crystal Creek</th>
<th>Kellogg Lake</th>
<th>Courtney Springs Creek</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate Wetted Width(^2) (ft)</td>
<td>1,200</td>
<td>15</td>
<td>35</td>
<td>&lt;5</td>
<td>400</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Estimated Bridge Width (Linear Feet of Stream)</td>
<td>66</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>2003 LPA Footprint (ft(^2))</td>
<td>82,700</td>
<td>450</td>
<td>1,050</td>
<td>&lt;150</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Impacts from Alternate Willamette River Crossing Alignment Options (ft\(^2\))**

<table>
<thead>
<tr>
<th>Location</th>
<th>Willamette River</th>
<th>Crystal Springs Creek</th>
<th>Johnson Creek</th>
<th>Crystal Creek</th>
<th>Kellogg Lake</th>
<th>Courtney Springs Creek</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meade-Caruthers</td>
<td>85,100</td>
<td>450</td>
<td>1,050</td>
<td>&lt;150</td>
<td>0</td>
<td>0</td>
<td>86,750</td>
</tr>
<tr>
<td>Meade-Sherman</td>
<td>91,800</td>
<td>450</td>
<td>1,050</td>
<td>&lt;150</td>
<td>0</td>
<td>0</td>
<td>91,800</td>
</tr>
<tr>
<td>Porter-Caruthers</td>
<td>89,900</td>
<td>450</td>
<td>1,050</td>
<td>&lt;150</td>
<td>0</td>
<td>0</td>
<td>91,550</td>
</tr>
<tr>
<td>Porter-Sherman</td>
<td>100,300</td>
<td>450</td>
<td>1,050</td>
<td>&lt;150</td>
<td>0</td>
<td>0</td>
<td>101,950</td>
</tr>
</tbody>
</table>

**Impacts from Alternate Alignment Options (ft\(^2\))**

<table>
<thead>
<tr>
<th>Location</th>
<th>Willamette River</th>
<th>Crystal Springs Creek</th>
<th>Johnson Creek</th>
<th>Crystal Creek</th>
<th>Kellogg Lake</th>
<th>Courtney Springs Creek</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 LPA-Park</td>
<td>82,700</td>
<td>450</td>
<td>1,050</td>
<td>&lt;150</td>
<td>12,000</td>
<td>&lt;150</td>
<td>96,500</td>
</tr>
<tr>
<td>2003 LPA w/Tillamook Branch Line Alignment</td>
<td>82,700</td>
<td>450</td>
<td>1,050</td>
<td>&lt;150</td>
<td>12,000</td>
<td>&lt;150</td>
<td>96,500</td>
</tr>
</tbody>
</table>

\(^1\) A crossing/bridge’s footprint is the total area (square feet) of the bridge located above the stream/river. It approximates the shade produced by the structure. For all streams except the Willamette River, the crossing structure’s footprint is calculated by multiplying the width of the bridge (row 1) by the stream’s wetted width (row 2). For the five potential Willamette River crossings, the anticipated bridge span was measured to inform the calculation of each crossing option’s footprint.

\(^2\) In all cases, Spring Creek would be crossed on an existing structure, therefore, the project would not include added footprint over that stream.

\(^3\) Wetted width is the distance between water’s edge on each side of the stream as measured perpendicular to streamflow.

Although the Light Rail Alternative would cross up to seven waterways, five of these crossing structures would be located above their respective OHW elevation. In other words, because only the Willamette River and Kellogg Lake bridges would include structures below the OHW elevation, only those waterbodies would be subject to direct impacts to hydrology, fish habitat, etc. Impacts to floodplains are discussed in more detail in Section 3.9, Water Quality and Hydrology.

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

### Willamette River

- Preliminary bridge designs suggest that bridge pier(s) 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. The likelihood of piers in water less than 20 feet deep increases with concrete segmental options, which also feature four sets of piers rather than the one to two in-water towers that would be needed for the cable-stayed or cable-stayed through truss bridge options.

- Regardless of the type of bridge constructed, the total volume of the piers within the Willamette River are similar relative to the size of the river channel. The total area and volume of the piers would likely be less than 10 percent of the water column. When further design information on shape, height, width, and material is available, an analysis of hydraulic effect from piers would allow design and mitigation measure to help provide unimpeded flow under most river conditions reducing pier related effects.
Portland-Milwaukie Light Rail Project

Stream Crossing Locations and Threatened, Endangered, and Sensitive Fish Species

Figure 3.8-3

Stream Name
TES Fish Presence

△ Stream Crossing

Streams

Light Rail alternative

Existing Streetcar

Light Rail: Under Construction

Willamette River
Fall Chinook, Spring Chinook, Coho, Winter Steelhead, Cutthroat Trout, Green Sturgeon, Pacific Lamprey

Kellogg Lake
Winter Steelhead, Coho, Fall Chinook, Cutthroat Trout, Pacific Lamprey

Spring Creek
Winter Steelhead, Coho, Fall Chinook, Cutthroat Trout, Pacific Lamprey

Johnson Creek
Winter Steelhead, Coho, Fall Chinook, Cutthroat Trout, Pacific Lamprey

Crystal Creek
Winter Steelhead, Coho, Fall Chinook, Cutthroat Trout, Pacific Lamprey

Crystal Springs Creek
Winter Steelhead, Coho, Fall Chinook, Cutthroat Trout, Pacific Lamprey

Courtney Springs Creek
Cutthroat Trout

Willamette River
Fall Chinook, Spring Chinook, Coho, Winter Steelhead, Cutthroat Trout, Green Sturgeon, Pacific Lamprey
Kellogg Lake

- Throughout 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 ability of the bridge to impact (primarily by scouring) existing habitat and channel integrity is minimal.
- The pier(s) would likely be small relative to the size of Kellogg Lake. Depending on the final design of the bridge pier(s), total area and volume of the river 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 river conditions.
- The bridge will be designed such that, if Kellogg Lake’s dam is removed and the stream is returned to a free-flowing system, the bridge’s piers will be located above the OHW elevation of Kellogg Creek’s restored channel.

Fairview Creek

- At the Ruby Junction maintenance facility, no buildings are proposed to be built within Fairview Creek or its floodplain. Necessary stormwater treatment from any new construction would result in minimal impacts to surface water or ground water resources.

Crossings of the other streams would occur with the use of bridges or bottomless culverts that would not place structures below the ordinary high water level. At all crossings, the project would adhere to applicable regulations and policies, including use of approved in-water work windows and stormwater collection. For all waterbodies crossed, any unavoidable fill located in the channel or floodplain also would be mitigated by a balanced cut, offsetting impacts to floodplain function and stream hydrology.

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 three reasons:

- It provides a surface for collecting pollutants and retaining heat.
- Because it prevents infiltration, it increases runoff and, therefore, can provide a mechanism for efficiently transporting accumulated pollutants to project area streams.
- 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. Increased runoff may increase peak flows, decrease base flows, increase erosion, and degrade instream habitat.

Table 3.8-10 shows the amount of impervious surface that would be created by the Light Rail Alternative and alignment options. These quantities represent a small overall increase in total impervious surface area in each basin, with less than a 0.09-percent increase over all the basins combined. Additionally, approximately 50 percent of the total impervious surface areas of the Light Rail Alternative and alignment options would be redeveloped, i.e., constructed on existing impervious surface areas. Due to updated stormwater treatment that would be required under the City of Portland, City of Milwaukie, and the Oregon Department of Environmental Quality (DEQ) permitting processes, these redeveloped areas would likely experience an improvement in stormwater runoff water quality conditions over the No-Build Alternative.
Table 3.8-10
Total Impervious Surface Area Increase (acres) by Basin and Alternative

<table>
<thead>
<tr>
<th>Basin</th>
<th>Existing Impervious Surface Area in the Basin</th>
<th>No-Build Alternative</th>
<th>Light Rail Alternative Alignment Options²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2003 LPA</td>
<td>2003 LPA River Crossing Options⁵</td>
</tr>
<tr>
<td>Lower Willamette River</td>
<td>27,517</td>
<td>0</td>
<td>13.3</td>
</tr>
<tr>
<td>Crystal Springs Creek</td>
<td>409</td>
<td>0</td>
<td>1.1</td>
</tr>
<tr>
<td>Johnson Creek³</td>
<td>9,979</td>
<td>0</td>
<td>6.4</td>
</tr>
<tr>
<td>Kellogg Lake/Creek⁴</td>
<td>1,157</td>
<td>0</td>
<td>1.6</td>
</tr>
<tr>
<td>Fairview Creek</td>
<td>1,338</td>
<td>0</td>
<td>3.7</td>
</tr>
<tr>
<td>Total</td>
<td>39,062</td>
<td>0</td>
<td>26.1</td>
</tr>
</tbody>
</table>

1 Source: URS (2003).
² Impervious surface area estimates do not include LRT track on ballast, which is considered pervious.
³ The Johnson Creek basin includes two small project area streams, Spring Creek and Crystal Creek.
⁴ The Kellogg Lake/Creek basin includes one small project area stream, Courtney Springs Creek.
⁵ The Porter-Sherman alignment option would result in the greatest amount of additional impervious surface of all Willamette River crossing alignment options. Consequently, it is used in the analysis to represent a worst-case scenario for the crossing alignment options. The other crossing options would result in approximately 13.5 to 13.7 acres of impervious surface in the Willamette River basin. The values for the other basins are the same as for the 2003 LPA and Porter-Sherman crossing option.

Because the amount of new impervious surface added is relatively low compared to the overall size of the basin in which it is located and the Light Rail Alternative and alignment options 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; therefore, it would have the potential to cause the following concerns:

- Construction of bridge piers in the Willamette River and Kellogg Lake could affect stream flow, re-suspend bed sediments, increase turbidity, and perhaps release contaminated sediments into the water column.³ These issues could affect general fish species as well as endangered species. Intensive construction activities such as pile driving, augering of piles, the construction of coffer dams and dewatering, could also impact fish species, particularly if the most intensive in-water activities occur when endangered salmon or steelhead are migrating through the corridor.

³ Additional information regarding sediment contamination in the Willamette River and the potential for resuspension into the water column can be found in Chapter 3.9 (Water Quality and Hydrology) and Chapter 3.13 (Hazardous Materials) of this document as well as in their respective results reports. Additional analysis regarding the potential effects of resuspended contaminants on listed fish species will be included in the project’s Biological Assessment, pending further information provided during advanced and final designs of the Zidell cleanup site in Fall 2008.
• 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 presence of work barges in the Willamette River and Kellogg Lake during construction also would elevate the potential for contaminant leaks and spills.

• Construction activities may remove riparian vegetation.

For the Light Rail Alternative and its options, temporary effects would be largely confined to the immediate project area, and would be managed through the implementation of impact minimization measures, sediment and erosions 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 Company and DEQ are working on plans to conduct an environmental cleanup and containment on and near the Zidell property on the west side of the Willamette River, starting south of the Marquam Bridge and continuing south of the Ross Island Bridge. Sediment is proposed to be removed in several locations in this stretch of river, extending up to 200 feet from the riverbank. Capping of the remaining sediments is proposed to occur over the majority of this stretch. These potential activities are subject to approval by the State as well as by Federal agencies, including the National Marine Fisheries Service. However, some of these activities may occur as early as Summer 2008.

In addition, upland sources of contamination have not been fully controlled, but are proposed to be contained as part of this project. Disturbance of the upland or in-water sites could result in degradation of water quality in the Willamette River. The extent of disturbance would depend on ongoing clean-up activities by others. Measures to avoid or minimize disturbance of contaminated sediment or the weakening of the proposed cap will need to be further defined during Preliminary Engineering for the new Locally Preferred Alternative. The 2003 LPA passes north of the cleanup site boundaries, whereas the other four crossing options pass over the site and land within the upland site boundary. Further information on this cleanup site is located in Section 3.13, Hazardous Materials.

In addition, the Willamette River Greenway Plan includes plans for shallow water habitat along the west bank of the river within and adjacent to the Zidell site. Based on a preliminary review, it appears that all of the proposed Willamette River crossing alignments may be able to avoid direct impacts if in-water and upland piers are located carefully. Shading and potential hydrologic/hydraulic impacts may be possible with any of the alignments.
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.

**Vegetation**

### Long-Term Direct Impacts

Total vegetation impacts excluding areas of open water (i.e., Willamette River) for the 2003 LPA would be approximately 6.71 acres.

The various bridge type and elevation options generally would produce the same level of direct impacts to project area vegetation. Very minor differences in impacts to the highly degraded riparian corridor adjacent to the Willamette River could occur among the options if bridge type and elevation differences affect the size of support structures (i.e., footings/abutments) along the riverbanks. The size and placement of these bridge abutments ultimately would determine the level of impact.

The 2003 LPA to Park and the Tillamook Branch Line alignment would result in 7.87 and 7.03 acres of vegetation impacts, respectively. These additional impacts would primarily occur to grassland and upland forest cover types. These additional areas are relatively degraded as a result of the urban setting and high presence of invasive and non-native species. Most of the upland forest cover that would be impacted consists of large, scattered conifer trees with extensive canopy cover and with lawns and paved walking paths underneath.

### Table 3.8-11

<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>2003 LPA (243.4-acre Study Area)</th>
<th>% of LPA Study Area</th>
<th>2003 LPA-Park (277.5-acre Study Area)</th>
<th>% of 2003 LPA-Park Study Area</th>
<th>Tillamook Branch Line Alignment (274.6-acre Study Area)</th>
<th>% of Tillamook Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassland</td>
<td>2.17</td>
<td>0.9%</td>
<td>2.17</td>
<td>0.8%</td>
<td>1.30</td>
<td>0.5%</td>
</tr>
<tr>
<td>Riparian Scrub-Shrub</td>
<td>1.10</td>
<td>0.5%</td>
<td>1.13</td>
<td>0.4%</td>
<td>1.13</td>
<td>0.4%</td>
</tr>
<tr>
<td>Scrub-Shrub</td>
<td>2.53</td>
<td>1.0%</td>
<td>2.53</td>
<td>0.9%</td>
<td>2.66</td>
<td>1.0%</td>
</tr>
<tr>
<td>Riparian Forest</td>
<td>0.27</td>
<td>0.1%</td>
<td>0.37</td>
<td>0.1%</td>
<td>0.37</td>
<td>0.1%</td>
</tr>
<tr>
<td>Upland Forest</td>
<td>0.63</td>
<td>0.3%</td>
<td>1.58</td>
<td>0.6%</td>
<td>1.58</td>
<td>0.6%</td>
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<tr>
<td>Open Water</td>
<td>1.90</td>
<td>0.8%</td>
<td>2.05</td>
<td>0.7%</td>
<td>2.05</td>
<td>0.7%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>8.61</strong></td>
<td><strong>3.5%</strong></td>
<td><strong>9.83</strong></td>
<td><strong>3.5%</strong></td>
<td><strong>9.08</strong></td>
<td><strong>3.3%</strong></td>
</tr>
<tr>
<td><strong>Total without Open Water</strong></td>
<td><strong>6.71</strong></td>
<td><strong>2.8%</strong></td>
<td><strong>7.78</strong></td>
<td><strong>2.8%</strong></td>
<td><strong>7.03</strong></td>
<td><strong>2.6%</strong></td>
</tr>
</tbody>
</table>

Source: David Evans and Associates 2008

Totals may not add up due to rounding.

The Tillamook Branch Line alignment results in 0.75 fewer acres of vegetation impacts than the 2003 LPA to Park and 0.32 more acres of impacts than the 2003 LPA. Impacts specific to the Tillamook Branch Line segment only would occur in scrub-shrub cover. Nearly all of this cover
consists of invasive non-native Himalayan blackberry thickets growing in a highly disturbed railway corridor.

Expansion of the Ruby Junction Operations Facility would result in the removal of approximately 30 broadleaf and conifer trees scattered throughout the proposed 8.7 acre expansion area, which is mostly developed land with existing streets and buildings.

**Long-Term Indirect Impacts**

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

**Short-Term Impacts (Construction)**

Temporary disturbance to vegetation would occur during construction as a result 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 already disturbed areas where possible. All temporarily disturbed areas would be revegetated with native plant species and restored to pre-project conditions or better. Silt fencing and other erosion control methods would be utilized to minimize the potential short-term impacts to adjacent vegetation.

**Cumulative Impacts**

Potential cumulative impacts to vegetation 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 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.

Past projects developed the area from natural habitats to its current condition. Planned future projects include residential and commercial development. In addition, the City of Portland has proposed and adopted a plan for the South Waterfront Greenway Trail that proposes to place recreational trails along the western riverfront between the Marquam Bridge and Hamilton Court near the Ross Island Bridge. 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 this area. The Greenway Trail is located on and adjacent to the proposed Zidell cleanup site that will also be providing removal of invasive species and stabilizing ground cover, however the Zidell site does not yet have a final planting plan approved. Across the Willamette River, the Eastside Willamette Greenway Trail provides a strip of native trees and shrubs along the top of the east bank of the Willamette River.

The 2003 LPA and the four Willamette River crossing options pass over these greenway trails, the Zidell site, and their associated vegetation. Impacts to the vegetation in these areas would include potential direct effects from placement of bridge piers and indirect impacts from shading of...
Vegetation. The 2003 LPA may result in the least impact to vegetation because shading and piers associated with the Marquam Bridge already decreases potential vegetative productivity in this area. Additional information on these sites is located in Section 3.6, Parks and Recreational Resources and Section 3.13, Hazardous Materials. Section 3.13 also contains a mapping of the hazardous materials areas in relation to the South Waterfront developments, including the proposed habitat enhancement area.

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.

**Wildlife**

**Long-Term Direct Impacts**

Potential long-term direct impacts include disturbance of foraging, resting, nesting/denning, and movement activities along the Willamette River banks and the area between Milwaukie and Johnson Creek. The 2003 LPA to Park and Tillamook Branch Line alignments 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). 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 Operations 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 Light Rail Alternative and alignment options could include disturbance to existing nesting/denning and movement activities as a result of operation of the Light Rail Alternative. Light rail operations for the 2003 LPA to Park and the Tillamook Branch Alignment could also disturb habitat east of SE McLoughlin Boulevard and south of Lake Road.

**Short-Term Impacts (Construction)**

Short-term impacts may include visual and auditory disturbance and removal of vegetation during construction. Short-term impacts are likely to occur within an additional 25 feet on both sides of the proposed project footprint. Any birds protected by the Migratory Bird Treaty Act that are nesting in areas cleared or graded during construction could be adversely affected. These impacts could be avoided by several methods, including scheduling the clearing activity for the non-nesting season.

**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 Light Rail Alternative would be habitat related. The Light Rail Alternative and alignment options would create new in-water structures (piers) in the Willamette River and Kellogg Lake that could serve as refugia habitat for native and non-native piscivorous (predator) species. Shading from the bridge deck also could provide cover for piscivorous fish species and encourage their use of the mainstem river, which could contribute to increased predation rates on salmonids and other native species. Existing hydrology and river bottom topography would also be impacted through introduction of bridge footings in a waterway. In addition, filling of wetlands and development of fill in floodplains (particularly at Johnson and Crystal Springs Creeks) could alter waterway and off-channel habitat used by fish as refugia during flood events. Table 3.8-10 summarizes the permanent footprint of the Light Rail Alternative at each of its stream and river crossings. No direct impacts to fisheries are expected from the expansion of the Ruby Junction Operations Facility.

**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 build alternative 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, reduced congestion, and reduced growth in personal vehicle use. Enhanced stormwater treatment in redeveloped areas and mitigation for floodplain fill would help offset hydrologic impacts.

**Short-Term Impacts (Construction)**

Depending on the alignment option selected, it is estimated that the Light Rail Alternative construction activities would temporarily impact a total of approximately 200 lineal feet of potentially fish bearing streams in the following locations:

- 58–66 lineal feet at the Willamette River
- 34 lineal feet at Crystal Springs Creek
- 34 lineal feet at Johnson Creek
- 34 lineal feet at Crystal Creek
- 34 lineal feet at Kellogg Lake

The extension options would impact Kellogg Lake, whereas the 2003 LPA would not. In addition, although Spring Creek and Courtney Springs Creek will be crossed by at least one alignment alternative, they would be crossed on existing structures and no short-term impacts are anticipated.
Potential short-term impacts to project area fisheries resulting from the Light Rail Alternative are similar to those outlined above for project area waterways. Turbidity from project activities could affect fish by silting spawning beds, reducing the 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 (potentially using coffer dams), 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 other impact minimization measures, sediment and erosions control, and stormwater management.

**Cumulative Impacts**

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.

Past projects have developed the area from natural habitats to its current condition. As discussed in the Waterways section above, the Zidell cleanup site is located on the west side of the Willamette River. The 2003 LPA alignment crossing appears to impact this site less than the other four crossing options. Disturbance of contaminated sediments or disturbance of the in-water or upland caps could release contaminants into the Willamette River where they could harm fish and other aquatic life.

In addition, the South Waterfront Willamette Greenway Trail proposed for the west side of the Willamette River would likely include the integration of native trees and shrubs. Any 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, create passage impediments for salmonids, and 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.
TES Species

Although designs for this alternative are currently conceptual and Section 7 ESA consultation is expected to occur in 2009, based on coordination with NMFS and USFWS, it is anticipated that the Light Rail Alternative would likely adversely affect listed anadromous salmonids, bull trout\(^4\), and the southern distinct population segment (DPS) of green sturgeon. Furthermore, it is anticipated that this alternative may affect but is not likely to destroy or adversely modify designated critical habitat. This Light Rail Alternative may adversely affect Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSFCMA), primarily because the development of the bridge itself would be considered a modification to the habitat as defined under the 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 is below.

Long-Term Direct 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 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 alignment option selected, the Light Rail Alternative would permanently impact a total of 126 to 156 lineal feet of TES fish-bearing streams, place bridge piers within the Willamette River and Kellogg Lake, and create shadowing of the stream crossings. In-water structures and stream shadowing could directly affect juvenile salmonids and other native species through increased predation risk.

The new structure in the Willamette River and Kellogg Lake would affect usage of benthic habitats by lamprey, sturgeon, salmonids, and their prey. Shadowing caused by the Willamette River bridge is less of 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. The in-water structures related to the bridge types would vary the level of impacts, but given the proposed pier sizes relative to the size of the channel, impacts are more related to pier placement than the number or the size of piers. Piers placed outside of shallow water habitat can help minimize long-term effects on fish. However, the cable-stayed bridge type, with the higher clearance and fewer in-water structures, would have comparatively lower potential for impacts than the concrete segmental bridge types.

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.

\(^4\) As stated previously, bull trout are not documented in the project area and are unlikely to occur there. However, until further consultation with USFWS and ODFW occurs, a conservative determination of likely to affect is proposed.
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-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, reduced congestion, and reduced growth in personal vehicle use. 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 may occur where the alignment crosses potential habitats such as wetlands and native, forested habitats, and include visual and auditory disturbance and removal of vegetation during construction.

Depending on the alignment option selected, it is estimated that the Light Rail Alternative would temporarily impact a total of approximately 200 lineal feet of TES fish bearing waterbodies, including the Willamette River, Crystal Springs Creek, Johnson Creek, and Kellogg Lake. The extension options would impact Kellogg Lake, while the 2003 LPA would not.

These four waterbodies support as many as seven TES species. Impacts to these species are similar to those outlined above for Waterways and Fisheries. Migrating adult salmon, 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 salmon 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 salmon during rearing could include harassment, direct injury (including lethal effects), and avoidance of the work area.

If they are present in the project area, effects to bull trout would be similar to these outlined above for salmon. Effects to green sturgeon would be similar to those outlined under Waterways and Fisheries; however, because they are a benthic species, green sturgeon would be particularly impacted by disturbances to river sediments.

Cumulative Impacts

Direct cumulative impacts for TES are similar to those listed above for fisheries and wildlife. In addition, due to the range of many of the TES species, particularly salmon species that migrate, long term changes to the water quality and hydrologic conditions in the Columbia River system (including the 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 Potential Mitigation Measures

Mitigation measures for the Portland-Milwaukie Light Rail Project are designed to first avoid and then minimize and compensate for all unavoidable impacts. Impact avoidance and minimization
largely are addressed through project design, including alternatives and alignment options that were considered but not advanced due to impacts to ecosystem and other resources (see Chapter 2 and Appendix L). Certain alignment options and design specifics also have been modified to reduce impacts to resources. These avoidance and minimization efforts would be continued (with ongoing agency input) through final design and construction.

The Light Rail Alternative 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 after the alignment and design options are selected. Discussions with federal, state, and local agencies to determine appropriate mitigation measures have been initiated and will continue during the preliminary design stage, which is expected to coincide with drafting of the FEIS and Section 7 ESA consultation, and through other permitting processes during final design. Consequently, mitigation measures presented in this section are preliminary and are described in conceptual terms.

3.8.3.1 Wetlands

Unavoidable impacts to wetlands must be mitigated through compensatory wetland mitigation (CWM). Direct CWM, including restoration, creation, or enhancement measures, is the preferred approach to replace the functions and values lost through a permitted wetland alteration. Restoration, the preferred direct method, reestablishes wetland conditions (i.e., wetland hydrology) in areas that were historically wetland. With creation, a wetland is constructed in an area that did not historically support wetlands. Enhancement improves an existing but degraded wetland by correcting the degrading conditions. Minimum ratios of direct CWM, as established by DSL, are as follows:

- Restoration ratio is 1:1 (1 acre restored for every 1 acre lost)
- Creation ratio is 1.5:1 (1.5 acres created for every 1 acre lost)
- Enhancement ratio is 3:1 (3 acres enhanced for every 1 acre lost)

Direct CWM must be conducted on site unless the DSL determines that on-site mitigation would be impracticable, on-site mitigation would not adequately replace lost functions or values, or off-site mitigation would be environmentally preferable considering the type of wetland to be impacted and the historic loss of wetland types and functions in the watershed (OAR 141-085-0120; DSL, 1995).

Although direct CWM is preferred, indirect methods may also be proposed. Indirect CWM may be provided through a mitigation bank or payment to provide mitigation. Mitigation bank credits may be purchased from an appropriate and approved mitigation bank only if on-site mitigation has been examined and found to be impracticable or use of off-site mitigation is environmentally preferable.

Potential wetland mitigation opportunities exist in areas adjacent to and nearby the proposed light rail corridor. Potential opportunities include wetland creation or restoration in the vegetated area between SE McLoughlin Boulevard and the UPRR railway, wetland enhancement opportunities adjacent to Crystal Springs Creek, and wetland creation adjacent to the south side of Kellogg Lake. Other opportunities are likely present within the project area watersheds.

3.8.3.2 Waterways

Without adequate mitigation, additional impervious surface area created by the Light Rail Alternative would negatively affect stream hydrology and water quality. Long-term water quality
and hydrologic mitigation measures implemented as part of the Light Rail Alternative are described in Section 3.9, Water Quality and Hydrology.

### 3.8.3.3 Vegetation

Potential vegetation mitigation opportunities exist in areas adjacent to and nearby the proposed light rail corridor. Such opportunities occur in similar locations described for wetland mitigation. Coordination with the City of Portland and other stakeholders in the areas adjacent to the Willamette River, Johnson Creek, Crystal Creek, and Kellogg Lake/Creek will also occur to ensure planned restoration and enhancement activities at these sites are supported by the Light Rail Alternative. Upland bridge piers for a Willamette River crossing would likely need to be placed a minimum of 50 feet from the top of the bank to allow for implementation of the planting plan associated with the South Waterfront Willamette Greenway trail. Planting and maintenance of vegetation that prefers shading would help offset productivity losses. Additionally, vegetation mitigation could also include removal of invasive non-native species and replacement with native desirable species. The City of Portland also requires preservation or replacement of trees over six inches in diameter with similar sized trees.

### 3.8.3.4 Wildlife

The following mitigation measures may be implemented to avoid or reduce potentially adverse impacts to wildlife within Portland-Milwaukie corridor:

- Avoid removal of native vegetation
- Where native vegetation removal is unavoidable, remove potential bird nest trees outside of nesting season, and leave cut trees and large shrubs onsite to provide cover for small mammals, ground-nesting birds and herpetofauna
- Retain snags and downed woody material
- Provide for nesting and roosting habitats where practicable for native birds and bats

### 3.8.3.5 Fisheries

While impacts to fish are not specifically identified as requiring compensation, detrimental effects to their habitats, in both quality and quantity, are generally mitigated for under federal, state, and local regulations. Appropriate regulatory agencies would be consulted throughout the design and permitting phases of the project, which will help to define mitigation commitments required for permit approvals, which can include compensation.

Further definition of avoidance and minimization measures to address fisheries impacts would continue to occur during the preliminary design of the Preferred Alternative and in consultation with regulatory agencies, and mitigation commitments will be documented in the Final EIS. Measures to reduce impacts will also continue through Final Design and permitting, as well as during all phases of construction. Passage for native fish must be allowed or restored if stream crossings impact streams where native fish reside. Impact avoidance and minimization would be addressed by timing in-water work to occur outside of critical fish migration seasons (i.e., during the specified in-water work window), using coffer dams around in-water work sites, using confined bubble curtains and bubble trees around pile driving and other noise-generating activities, and other impact minimization methods. Monitoring likely would be required to assess impacts to fish from in-water work.

The potential impacts of bridge pier(s) on the Willamette River could be mitigated by minimizing the number of piers required and designing piers such that they do not impact near-shore habitats,
the Zidell cleanup site, or encourage predator use. Compensation measures such as enhancement of shallow water habitat and riparian areas within or in proximity to the project area could be proposed to offset the negative impacts to fish habitat along the corridor.

### 3.8.3.6 TES Species

Impacts to threatened and endangered plants and wildlife are not anticipated. Impacts to sensitive wildlife may occur, but avoidance or minimization of impacts to riparian areas, waterways, and native, treed habitats would be proposed.

The primary impact to TES fish species and habitat would be from the proposed Willamette River bridge. However, Crystal Springs Creek, Johnson Creek, and Kellogg Lake/Creek support TES species; therefore, impacts to these streams (as well as other impacts to the Willamette River) also may require offsetting negative impacts. In general, impacts to TES species and appropriate minimization and enhancement measures are similar to those outlined above for Waterways and Fisheries. Additional short- and long-term mitigation measures will likely be developed with regulatory agencies and project sponsors during Section 7 consultation. Through the consultation process, the team would mitigate impacts by:

- Developing alignment refinements and final designs that avoid and minimize impacts to TES species.
- Developing construction practices that minimize unavoidable impacts, such as in-water work timing, isolation of in-water work areas when practical, and erosion and sediment control.
- Identifying elements of the project that could enhance habitat and fish production to compensate for unavoidable impacts, such as:
  - restoration of shallow-water habitat in the lower Willamette River,
  - upgrading culverts and other passage constraints on smaller streams,
  - removal of invasive vegetation,
  - planting of large, native trees in riparian areas for shading and large woody debris recruitment,
  - replacement or restoration of off-channel riparian and floodplain habitat,
  - integration of pervious pavement where practical,
  - designing infrastructure elements within floodplains to reduce stranding of fish during flood events, and
  - implementation of enhanced treatment for stormwater.
- Reviewing listed species recovery plans to determine if conservation measures could be implemented to support management recommendations and recovery efforts.
- Coordinating planned restoration and enhancement efforts and locations with the plans and proposals of other parties active in the watershed.
3.9 WATER QUALITY AND HYDROLOGY

This section discusses the results of the analysis of hydrology and water quality issues expected for the Portland-Milwaukie Light Rail Project. Additional detail is provided in the *Water Quality and Hydrology Results Report*, Metro, April 2008.

3.9.1 Affected Environment

The Portland-Milwaukie Corridor is located in the lower portion of the Willamette River basin. 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., multi-family 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 and local agencies also have natural resource management regulations that protect water quality, hydrologic and floodplain functions.

Over one-third of the project area 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. Floodplains are also shown for the Ruby Junction Operations Facility in Appendix H.
Portland-Milwaukie Light Rail Project

Figure 3.9-1

- Watershed
- 100 FEMA FIRM & 1996 Floodplain
- Streams
- Light Rail alternative
- Station location
- Existing Streetcar
- Portland Aerial Tram
- Light Rail: Under Construction
- Portland Streetcar Loop Project
- Railroad
- County line

Note: FEMA = Federal Emergency Management Agency
FIRM = Flood Insurance Rate Maps

River, Stream, and Floodplain Crossings

Willamette River Watershed
Johnson Creek Watershed
Stephens Creek Watershed
Tryon Creek Watershed
Kellogg Creek Watershed

Figure 3.9-1

Portland-Milwaukie Light Rail Project

November 2007

0 0.5 1 Miles

Note: FEMA = Federal Emergency Management Agency
FIRM = Flood Insurance Rate Maps

Portland – Milwaukie
LIGHT RAIL PROJECT

Metcro
Waterbodies that could be affected by the proposed alternatives include the Willamette River, Crystal Springs Creek, Johnson Creek, Crystal Creek, Spring Creek, Kellogg Lake, Courtney Springs Creek, and Fairview Creek. All of these streams have hydrology and water quality issues typical of urban streams. For example, three streams are listed on the Oregon Department of Environmental Quality (DEQ) 303(d) list (City of Portland 2008; DEQ 2007). 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 20th century.

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 and Kellogg Lake is provided in the sections below.

### Table 3.9-1
Summary of Existing Conditions in Project Area Streams

<table>
<thead>
<tr>
<th>Stream</th>
<th>Crossed by Alignment Options</th>
<th>Approx. Basin Size (sq mi)</th>
<th>Average/100-Year Flows (cfs)</th>
<th>Approx. Wetted Width at Crossing (ft)</th>
<th>303(d) Listed for Following Parameters</th>
<th>TMDLs Approved for Following Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willamette River</td>
<td>All</td>
<td>11,500</td>
<td>32,000/400,000</td>
<td>1,200</td>
<td>Aldrin, biological criteria, DDT, DDE, dieldrin, E. coli, fecal coliform, iron, manganese, mercury, PCBs, PAHs, and pentachlorophenol</td>
<td>Dioxin, temperature, bacteria</td>
</tr>
<tr>
<td>Crystal Springs Creek</td>
<td>All</td>
<td>2</td>
<td>17/NA</td>
<td>15</td>
<td>None</td>
<td>Bacteria, temperature, DDT, dieldrin</td>
</tr>
<tr>
<td>Johnson Creek</td>
<td>All</td>
<td>54</td>
<td>76/2,780</td>
<td>35</td>
<td>E. coli, fecal coliform, PCBs, and PAHs</td>
<td>Bacteria, temperature, DDT, dieldrin</td>
</tr>
<tr>
<td>Crystal Creek</td>
<td>All</td>
<td>&lt;1</td>
<td>NA/NA</td>
<td>&lt;5</td>
<td>Not listed; tributary of Johnson Creek</td>
<td>Not listed; tributary of Johnson Creek</td>
</tr>
<tr>
<td>Spring Creek</td>
<td>All</td>
<td>&lt;1</td>
<td>NA/NA</td>
<td>&lt;5</td>
<td>Not listed; tributary of Johnson Creek</td>
<td>Not listed; tributary of Johnson Creek</td>
</tr>
<tr>
<td>Kellogg Creek/Lake</td>
<td>2 of 3</td>
<td>15</td>
<td>NA/1,990</td>
<td>400</td>
<td>E. coli</td>
<td>None; tributary of Willamette River</td>
</tr>
<tr>
<td>Courtney Springs Creek</td>
<td>2 of 3</td>
<td>&lt;1</td>
<td>NA/NA</td>
<td>&lt;5</td>
<td>Not listed; tributary of Kellogg Creek</td>
<td>None; tributary of Kellogg Creek</td>
</tr>
<tr>
<td>Fairview Creek</td>
<td>None</td>
<td>7</td>
<td>NA/NA</td>
<td>NA</td>
<td>E. coli, fecal coliform</td>
<td>Bacteria, temperature</td>
</tr>
</tbody>
</table>

1 Sources: PNW Ecosystem Research Consortium (2002); StreamNet (2007a); City of Portland (2007); City of Portland 2008; DEQ 2007.
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 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 amongst the pollutant's sources (both point and nonpoint). TMDLs largely determine the regulatory environment under which municipalities manage their stormwater discharges.

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.

6 Fairview Creek would be impacted by expansion of the existing Ruby Junction Maintenance Facility.
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 U.S. Army Corps of Engineers (USACE). These facilities have substantially altered the hydrology of the river compared to its original state. Table 3.9-2 summarizes average 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

<table>
<thead>
<tr>
<th>Average Flow(^1)</th>
<th>Peak 1996 Flood Flow(^1)</th>
<th>100 yr Flood Flow (FEMA estimate)(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32,000 cfs</td>
<td>460,000</td>
<td>400,000 cfs</td>
</tr>
</tbody>
</table>

\(^1\) Source: USGS 2002, as reported in URS 2003.

\(^2\) Source: FEMA 1986, as reported in URS 2003.

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. The South Waterfront area is exempt from Title 3 regulations, whose floodplain is defined by the extents of the FEMA 100-year floodplain and February 1996 flood inundation area combined.

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, PAHs, E. coli, aldrin, biological criteria, fecal coliform, PCBs, manganese, mercury, iron, and pentachlorophenol (City of Portland 2008; DEQ 2007). In addition to these 303(d) listings, DEQ also has set Total Maximum Daily Load (TMDL) for the Willamette River for dioxin (2,3,7,8-TCDD), bacteria, and temperature and established a pollutant reduction target for mercury (City of Portland 2008; DEQ 2007).

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 (Water Environment Services 2001). 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).

### 3.9.2 Water Quality and Hydrologic 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 conceptual designs as described in Chapter 2. This level of design is adequate for analyzing general impacts and comparing alternatives. More
specific definition of impacts, such as precise volumes for removal/fill activities and hydraulic impacts on streams, will be confirmed during further design with additional mitigation details provided in the Final EIS and through natural resource permitting processes.

3.9.3 Long-Term Impacts

3.9.3.1 No-Build Alternative

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. Potential adverse effects associated with the No-Build Alternative could include:

- Stormwater runoff from impervious surfaces would continue to flow untreated to project area streams and typically would not be improved unless areas are redeveloped to current standards.

- 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 the Light Rail Alternative, and so pollutant transport is expected to be higher with No-Build.

3.9.3.2 Light Rail Alternative

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 primarily would be caused by creation of impervious surfaces and encroachment upon floodplains and stream channels.

Depending on the alignment option selected, transit improvements proposed as part of the Portland-Milwaukie Light Rail Project would cross the Willamette River as well as up to five streams and one
lake, all of which are located within the lower portion of the Willamette River basin. These affected waterbodies include Crystal Springs Creek, Johnson Creek, Crystal Creek, Spring Creek, Kellogg Lake, and Courtney Springs Creek (Figure 3.9-1 and Table 3.9-3). Expansion of the existing Ruby Junction Maintenance Facility also could indirectly impact Fairview Creek.

Table 3.9-3
Project Area Streams Crossed by the Light Rail Alternative

<table>
<thead>
<tr>
<th>Stream1,2</th>
<th>2003 LPA w/Extension to Park</th>
<th>2003 LPA w/Tillamook Branch Alignment</th>
<th>Location of Crossing and Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willamette River</td>
<td>X</td>
<td>X</td>
<td>Between the Marquam and Ross Island Bridges. Up to four piers in the Willamette River channel.</td>
</tr>
<tr>
<td>Crystal Springs Creek</td>
<td>X</td>
<td>X</td>
<td>Spans creek approximately one-quarter mile north of the SE Bybee Boulevard bridge. New structures, but none below OHW.</td>
</tr>
<tr>
<td>Johnson Creek</td>
<td>X</td>
<td>X</td>
<td>Spans creek immediately east of SE McLoughlin Boulevard, approximately 100 feet south of the SE Tacoma Street bridge. New structures, but none below OHW.</td>
</tr>
<tr>
<td>Crystal Creek</td>
<td>X</td>
<td>X</td>
<td>Spans stream between Highway 224 and SE Harrison Street. New structures, but none below OHW.</td>
</tr>
<tr>
<td>Spring Creek</td>
<td>X</td>
<td>X</td>
<td>Spans stream adjacent to the Tillamook Branch Line at its SE Harrison Street crossing. Would cross on existing structure.</td>
</tr>
<tr>
<td>Kellogg Creek/Lake</td>
<td>X</td>
<td>X</td>
<td>Immediately south of Lake Road and east of the existing Tillamook Branch trestle crossing. Up to three piers could be located in Kellogg Lake. If Kellogg Creek has been returned to a free-flowing stream, the bridge would clear-span its channel.</td>
</tr>
<tr>
<td>Courtney Springs Creek</td>
<td>X</td>
<td>X</td>
<td>West of SE McLoughlin Boulevard, approximately 100 feet north of SE Park Avenue. Would cross on existing structure.</td>
</tr>
</tbody>
</table>

1 Fairview Creek is proximate to the proposed Ruby Junction Operations and Maintenance (O&M) Facility, which would be expanded as part of the Light Rail Alternative. It is not crossed by any of the alignment options but could be indirectly affected by the proposed expansion of the O&M facility.

2 There are four alternate Willamette River crossing options located south of the 2003 LPA crossing. They would not affect any streams other than the Willamette River and can be applied to any of the corridor's alignment options.

Depending on the alignment option selected, the Light Rail Alternative also would involve the construction or redevelopment of between 31.1 and 34.2 acres of impervious surfaces, approximately half of which would be redeveloped. These impervious areas consist of stations, bridges, park and ride lots, maintenance facilities, and segments of track embedded in concrete pavement. Between 1.9 and 2.7 acres of this impervious area would be located in project area floodplains. Tie and ballast track is considered pervious and therefore is not factored into the impervious area estimates.
Impacts Associated with Impervious Surfaces

Table 3.9-4 shows the total amount of impervious surface that would be created by the Light Rail Alternative. Impervious surfaces can have an adverse impact on hydrology and water quality because they collect pollutants and prevent stormwater from entering the ground, therefore increasing runoff and transporting accumulated pollutants to project-area streams.

The new impervious surfaces related to the Light Rail Alternative represent a small overall increase in total impervious surface area in each basin. Approximately 50 percent of the Light Rail Alternative’s total impervious area would be constructed on existing impervious areas. Most of these areas were developed prior to current stormwater controls, and therefore have little, if any, stormwater treatment. Because current regulations require that stormwater from redeveloped areas be treated, 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, if the Willamette River crossing structure that includes bus lanes is selected, buses would be rerouted from existing bridges with antiquated (if any) stormwater treatment to a structure that complies with current regulations.

Table 3.9-4
Total Impervious Surface Area (acres) by Basin and Alternative

<table>
<thead>
<tr>
<th>Basin</th>
<th>Existing Impervious Area in the Basin¹</th>
<th>No-Build Alternative</th>
<th>2003 LPA²</th>
<th>2003 LPA w/ Porter-Sherman Willamette River Crossing⁶</th>
<th>2003 LPA w/Extension to Park</th>
<th>2003 LPA w/Tillamook Branch Alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willamette River</td>
<td>27,517</td>
<td>0</td>
<td>13.3</td>
<td>13.7</td>
<td>13.3</td>
<td>13.3</td>
</tr>
<tr>
<td>Crystal Springs Creek</td>
<td>409</td>
<td>0</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Johnson Creek³</td>
<td>9,977</td>
<td>0</td>
<td>6.4</td>
<td>6.4</td>
<td>6.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Kellogg Creek/Lake⁴</td>
<td>1,157</td>
<td>0</td>
<td>1.6</td>
<td>1.6</td>
<td>4.7</td>
<td>4.7</td>
</tr>
<tr>
<td>Fairview Creek⁵</td>
<td>1,338</td>
<td>0</td>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40,398</td>
<td>0</td>
<td>26.1</td>
<td>26.5</td>
<td>29.2</td>
<td>26.6</td>
</tr>
</tbody>
</table>

² Impervious areas do not include LRT track on ballast, which is considered pervious.
³ The Johnson Creek basin includes two small project-area streams, Spring Creek and Crystal Creek.
⁴ The Kellogg Creek basin includes one small project-area stream, Courtney Springs Creek.
⁵ Only the Ruby Junction Operations and Maintenance Facility would affect Fairview Creek. All of the LRT alternatives include this facility.
⁶ The Porter-Sherman alignment option contains the greatest amount of added impervious surface of all Willamette River crossing alignment options. Consequently, it is used in the analysis to represent a worst-case scenario for the crossing alignment options.

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 Alternative would adhere to all applicable stormwater management regulations, adverse hydrologic impacts resulting from impervious surfaces are unlikely to occur. Should impacts occur, they would be detectable only at the local scale. Additionally, although operation of LRT facilities has the capacity to release small

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¹ For detail regarding applicable stormwater regulations, refer to Section 2 of the Water Quality and Hydrology Results Report.
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 LRT 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.

**Channel/Floodplain Impacts at Stream Crossings**

Of the waterways crossed by the project, only the Willamette River and Kellogg Lake bridges would include structures located below the ordinary high water (OHW) elevation. Due to the lack of impacts and proposed floodplain mitigation, none of the other streams that would be crossed would have capacity or hydrology impacts. Due to varying inwater structure requirements, the potential impacts to the Willamette River and Kellogg Lake would vary depending on the bridge type selected. However, regardless of the structure selected, potential impacts are not anticipated to be an appreciable change in existing conditions within these segments for the following reasons:

- The size of the piers relative to size of the channel (total area and volume of the river impacted by the piers likely would be less than 10 percent).
- The “hardened” and homogenous nature of the Willamette River channel.
- 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 bridge piers to impact (primarily by scouring) channel integrity is very low.
- Kellogg Lake’s bridge will be designed such that if the dam is removed and the stream is returned to a free flowing condition all piers will be located above the OHW elevation of the restored channel.
- Adherence to applicable regulations and fluvial performance standards negotiated with regulatory agencies prior to project construction.

However, the presence of piers does alter localized hydraulic characteristics which can result in impacts to project area fisheries, habitat, and aquatic ecosystems as discussed in Section 3.8.

The Light Rail Alternative would encroach upon the FEMA-designated floodplains of Crystal Springs Creek, Johnson Creek, and the Willamette River. Similarly, it also would encroach on the Kellogg Lake floodplain if the Light Rail Alternative were to be extended to SE Park Avenue. The acreage of LRT facilities located in a floodplain was used to provide rough estimates of floodplain impacts. These acreages are reported for each alignment option in areas where the Light Rail Alternative encroached upon a floodplain (Table 3.9-5). In summary, the Light Rail Alternative would place between 1.9 and 2.7 acres of LRT facilities in floodplains.
Table 3.9-5
Combined Acreage of Track, Park and Ride Lots, and Stations in Mapped Project-Area Floodplains

<table>
<thead>
<tr>
<th>Floodplain/Stream</th>
<th>No Build Alternative</th>
<th>2003 LPA</th>
<th>2003 LPA w/ Porter-Sherman Willamette River Crossing</th>
<th>2003 LPA w/ Extension to Park</th>
<th>2003 LPA w/Tillamook Branch Alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willamette River</td>
<td>0.0</td>
<td>0.6</td>
<td>1.2</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Crystal Springs Creek</td>
<td>0.0</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Johnson Creek</td>
<td>0.0</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Kellogg Lake</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Fairview Creek</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.0</strong></td>
<td><strong>1.9</strong></td>
<td><strong>2.5</strong></td>
<td><strong>2.0</strong></td>
<td><strong>2.7</strong></td>
</tr>
</tbody>
</table>

1 FEMA has not mapped floodplains for Crystal, Spring, and Courtney Springs Creeks. Consequently, they are not included in this analysis.

Impacts to 100-year floodplains would be analyzed in accordance with local regulations and Executive Order 11988, Floodplain Management. As required by these regulations, all lost storage would be mitigated by creating additional volume elsewhere in the floodplain. Furthermore, where appropriate, culverts would be placed under the proposed track to allow floodwaters to flow unimpeded around, under and/or through the elevated track to provide access to adjacent floodplain storage areas and preserve its functionality. These two mitigation measures would combine to substantially minimize, perhaps eliminate, any potential rise in flood elevation.

**Impacts from Other Project Elements**

The Ruby Junction Operations Facility in Gresham, Oregon, is the location proposed for an expanded transit maintenance facility. The facility would be expanded by approximately 10.5 acres. Proposed facility improvements (new roads, parking, and buildings) would contribute 3.6 acres of new impervious area to the watershed.

Three of the 10 parcels that would be added to the maintenance facility are located within Fairview Creek’s 100-year floodplain. These three parcels presently contain several buildings and paved surfaces; however, no new buildings would be constructed within them. Therefore, no new floodplain encroachments are anticipated. If the floodplain were encroached upon, the project would avoid impacts by balancing cut and fill earthwork within the floodplain as outlined above.

The three parcels in the 100-year floodplain would be used for outside storage of non-hazardous materials. Operational activities such as equipment cleaning and repairs could result in accidental spills or polluted stormwater runoff to Fairview Creek. Mitigation measures would be required to prevent accidents and to store and treat runoff prior to it leaving the site.

**Summary of Long-Term Impacts**

The No-Build Alternative would not include any long-term impacts to water resources other than continued non-treatment of project-area runoff. Once minimization and mitigation measures are implemented, impacts to water quality and hydrology resulting from the Light Rail Alternative are expected to be detectable only at the local scale. Potential effects include limited addition of new
impervious surfaces and floodplain fill, limited 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 each alternative. 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 each alignment option.

<table>
<thead>
<tr>
<th>Impact Level</th>
<th>Local Impacts</th>
<th>Basin-Wide Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not Detectable</td>
<td>Not Detectable</td>
</tr>
<tr>
<td>2</td>
<td>Detectable</td>
<td>Not Detectable</td>
</tr>
<tr>
<td>3</td>
<td>Detectable and Significant</td>
<td>Not Detectable</td>
</tr>
<tr>
<td>4</td>
<td>Detectable and Significant</td>
<td>Detectable</td>
</tr>
<tr>
<td>5</td>
<td>Detectable and Significant</td>
<td>Detectable and Significant</td>
</tr>
</tbody>
</table>

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 were to 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 water body, 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 water body, 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.

3.9.3.3 Short-Term Impacts (Construction)

Short-term impacts include increased rates and volumes of sediment-laden runoff, 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. The likelihood of spills affecting surface waterbodies also would be greatest in these areas. Although other larger areas of construction 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.

3.9.3.4 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.
## Table 3.9-7
Summary of Long-Term Impacts

<table>
<thead>
<tr>
<th>Option</th>
<th>Basin</th>
<th>Water Quality</th>
<th>Ordinal Value</th>
<th>Hydrology</th>
<th>Ordinal Value</th>
<th>Floodplain</th>
<th>Ordinal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-Build</td>
<td>All</td>
<td>None</td>
<td>1</td>
<td>None</td>
<td>1</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>Light Rail Alternative&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Willamette</td>
<td>Although unlikely, discharge to the Willamette River could have a detectable impact locally.</td>
<td>2</td>
<td>Direct impacts to the Willamette River channel would have a local impact. Detectable impacts from increased runoff are not anticipated.</td>
<td>2</td>
<td>Up to ~1.2 acres of LRT facilities would be located in the Willamette River floodplain. All fill would be mitigated; therefore, if they occur, impacts would be detectable only locally.</td>
<td>2</td>
</tr>
<tr>
<td>Crystal Springs</td>
<td>Discharge to Crystal Springs Creek could have a detectable impact locally.</td>
<td>2</td>
<td>Although unlikely, increased runoff could be detected locally. Direct impacts to the stream channel are not anticipated.</td>
<td>2</td>
<td>Up to ~1.1 acres in floodplain; all fill would be mitigated.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Johnson</td>
<td>As described for Crystal Springs.</td>
<td>2</td>
<td>As described for Crystal Springs.</td>
<td>2</td>
<td>Up to ~0.9 acres in floodplain; all fill would be mitigated.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Kellogg</td>
<td>As described for Crystal Springs.</td>
<td>2</td>
<td>As described for the Willamette River.</td>
<td>2</td>
<td>Up to ~0.2 acres in floodplain all fill would be mitigated.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Light Rail Alternative&lt;sup&gt;2&lt;/sup&gt; and O&amp;M Facility</td>
<td>Fairview</td>
<td>As described for Crystal Springs.</td>
<td>2</td>
<td>As described for Crystal Springs.</td>
<td>2</td>
<td>Three parcels in 100-year floodplain will be acquired; however, no structures will be built within floodplain.</td>
<td>1</td>
</tr>
</tbody>
</table>

<sup>1</sup> 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.

<sup>2</sup> 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. There are no impacts assumed for Spring Creek which is in a culvert.

### 3.9.3.5 Light Rail Alternative

Short-term impacts to water resources from construction of the Light Rail Alternative could occur at stream crossings. Short-term impacts also could occur during construction of stations and park and ride facilities, particularly the Bybee, Tacoma, Lake, and Bluebird Stations and the Tacoma Park and Ride, which are located in proximity to stream crossings and/or within floodplains. Impacts likely would not occur at the Spring Creek and Courtney Springs Creek crossings because they would be crossed on existing structures.

Bridge construction at these crossings would involve work within and/or above the streams; 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 resuspension. The 2003 LPA would have the least potential to disturb contaminated sediments as it avoids contaminated areas and the proposed in-water sediment cap.

Similar impacts could occur during construction of Kellogg Lake bridge piers although less sediment contamination exists at that site and flows are less erosive in the lake. 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 would comply with all applicable stormwater regulations, including those required to alleviate short-term impacts during project construction. Additionally, all in-water work would be conducted during agency coordinated and approved in-water work windows. Details regarding construction equipment, methods, timing, and sequencing would be developed in conjunction with the appropriate regulatory agencies at a later date.

3.9.3.6 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 Alternative likely would have some level of effect on the water quality and hydrology of each basin in which it is located. Table 3.9-8 summarizes the assessment of impacts for each alignment option using the ordinal scale presented in Table 3.9-6.

### Table 3.9-8

**Summary of Short-Term Impacts**

<table>
<thead>
<tr>
<th>Option</th>
<th>Basin(s)</th>
<th>Water Quality</th>
<th>Ordinal Value</th>
<th>Hydrology</th>
<th>Ordinal Value</th>
<th>Floodplain</th>
<th>Ordinal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-Build</td>
<td>All</td>
<td>None</td>
<td>1</td>
<td>None</td>
<td>1</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>Light Rail Alternative&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Willamette</td>
<td>Potential</td>
<td>3</td>
<td>Potential impacts include increased runoff from vegetation clearing, soil compaction and dewatering portions of the channel during in-water construction.</td>
<td>3</td>
<td>None</td>
<td>2</td>
</tr>
<tr>
<td>Crystal Springs</td>
<td>Potential impacts include sediment-laden runoff, accidental spills, leaks from construction equipment, and removal of riparian vegetation.</td>
<td>3</td>
<td>Potential impacts include increased runoff from vegetation clearing and soil compaction.</td>
<td>2</td>
<td>None</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Johnson</td>
<td>Same as Crystal Springs above.</td>
<td>3</td>
<td>Same as Willamette River above</td>
<td>3</td>
<td>Same as Crystal Springs above</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Kellogg</td>
<td>Same as Crystal Springs above.</td>
<td>3</td>
<td>Same as Crystal Springs above</td>
<td>2</td>
<td>Same as Crystal Springs above</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Light Rail Alternative&lt;sup&gt;2&lt;/sup&gt; and O&amp;M Facility</td>
<td>Fairview</td>
<td>Potential impacts include sediment-laden runoff, accidental spills, and leaks from construction equipment.</td>
<td>2</td>
<td>Potential impacts include increased runoff from vegetation clearing and soil compaction.</td>
<td>2</td>
<td>None</td>
<td>1</td>
</tr>
</tbody>
</table>

1 The ordinal scale of impacts is described in Table 3.9-3 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 implementation of typical permit requirements.
3.9.3.7 Cumulative Impacts

Past and future development within the watershed, including transportation but also other urbanization projects that have occurred in this region, have cumulatively affected the health of the watershed by removing natural cover, creating impervious surfaces, channelizing streams, altering flow regimes, and discharging contaminants into waterbodies.

With or without the implementation of the Light Rail Alternative, continued development and redevelopment activities are expected along the project corridor and throughout the Portland 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 Alternative 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 proposed project alternatives would worsen conditions in the project corridor’s receiving waterbodies.

3.9.4 Potential 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 occur during preliminary and final design stages and through project permitting.

3.9.4.1 Mitigation for Long-Term Effects

Mitigation for Impacts from New and Redeveloped Impervious Surfaces

Hydrologic and water quality impacts are minimized by 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.

Non-structural BMPs also can be used to minimize water quality impacts. Non-structural BMPs are source control activities related to maintenance, pollution prevention or other housekeeping activities.
that help prevent stormwater from coming in contact with pollutants. They could include activities such as street sweeping, properly maintaining vehicles, and routine litter removal.

Water quality and hydrologic measures implemented as part of the Light Rail Alternative would include minimizing impervious surface area (especially new impervious surfaces) and implementation of structural and non-structural BMPs (especially on-site infiltration facilities). All measures implemented for the Light Rail Alternative would not only meet applicable regulations (including treatment of TMDL-specified parameters), they also would consider treatment of constituents of particular concern, such as copper, zinc, and 303(d)-listed parameters. See Section 2 of the Water Quality and Hydrology Results Report for further detail on recommended and required stormwater treatment BMPs.

3.9.4.2 Mitigation for Direct Impacts at Stream Crossings

Of the seven potential 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.

3.9.4.3 Mitigation for Channel/Floodplain Impacts

The Light Rail Alternative would 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 and fill 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 which 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.

3.9.4.4 Mitigation for Short-Term Effects

The Light Rail Alternative would mitigate its potential short-term impacts through full compliance with applicable regulations. 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 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.

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 noise and vibration analysis are
given in the Portland-Milwaukie Light Rail Project Noise and Vibration Results Report, Metro,
April 2008.

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 weighing system that filters out higher and lower
frequencies in a manner similar to the human ear was developed. Measurements made with this
weighing system are termed “A-weighted” and are specified as “dBA” readings.

The equivalent sound level (Leq) 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 (Ldn) is an Leq 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 Ldn is the primary noise level descriptor for
light rail noise at residential land uses. The peak-hour Leq 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 Ldn noise levels and residential land use compatibility.

![Figure 3.10-1](Figure 3.10-1)

<table>
<thead>
<tr>
<th>Ldn (dBA)</th>
<th>Land Use Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Rural area with no major roads nearby</td>
</tr>
<tr>
<td>50</td>
<td>Typical quiet suburban residential area</td>
</tr>
<tr>
<td>60</td>
<td>Relatively noisy residential area. Usually a major road or airport is nearby. Considered in compatible with residential land use.</td>
</tr>
<tr>
<td>70</td>
<td>Generally considered unacceptable for residential use. Strongly affected by major transportation source.</td>
</tr>
<tr>
<td>80</td>
<td>Very noisy area. Unusual except in rare circumstances</td>
</tr>
</tbody>
</table>

Source: FTA 1995

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.

![Figure 3.10-2](image_url)

**Figure 3.10-2**

**Typical Vibration Levels**

<table>
<thead>
<tr>
<th>RMS Vibration Velocity Level (VdB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

- **Approximate threshold of human perception**
- **Perceptible to most people, but rarely considered unacceptable**
- **Generally acceptable for residential land uses**
- **Very noticeable, generally not intrusive for office or institutional land uses. Only acceptable for residential land uses if vibration occurs a limited number of times per day.**
- **Sufficient to cause difficulty with tasks such as reading video display terminal.**
- **Approximate threshold for damage to fragile historic buildings.**
- **Sufficient to cause cosmetic damage to some buildings.**

Source: FTA, April 1995

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**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, January 2008. Noise impacts include additional noise caused by light rail, traffic related to the project, and by ground-borne noise, which is a result of vibration causing structures to “rumble.”

**3.10.3.1 FTA Noise and Vibration Criteria**

The impact criteria given in the Transit Noise and Vibration Guidance Manual, FTA, revised May 2007, 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 groups 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, churches, and office buildings and other commercial and industrial land use.
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 (Categories 3). The Portland-Milwaukie Light Rail Project corridor was examined extensively, and no Category 1 land uses were identified in the corridor. 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 $L_{dn}$.

**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

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.
- 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.

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.

3.10.3.3 Analysis Methods

The light rail noise and vibration analysis was performed in accordance with the Transit Noise and Vibration Guidance Manual, FTA revised May 2007. Models were developed to predict noise and vibration using the methods given in the FTA Manual. Input to the models includes the track type (elevated, at-grade and embedded), distance from LRT tracks to sensitive properties, train speed, number of trains per hour per day, and special track work such as switches. Light rail noise impacts were evaluated using measured noise levels from TriMet’s newer fleet of light rail vehicles. 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. The corrected vibration levels were compared to the appropriate vibration criteria and vibration impacts identified.

3.10.4 Affected Environment

The project corridor was examined to identify noise- and vibration-sensitive locations and to select locations for supplemental noise monitoring. Noise and vibration measurement locations used in the analysis are shown on Figure 3.10-4.

Land use along the Portland-Milwaukie Light Rail Project corridor includes single and multi-family residential, office and commercial, industrial, institutional, educational, and recreational. Land use on the west side of the Willamette River includes residential, including the Residence Inn at RiverPlace, and commercial.

Sensitive land uses on the east side of the Willamette River includes OMSI, the Portland Opera Eastbank Esplanade and the Willamette River Greenway. South of SE Powell Boulevard, land use is predominantly commercial and industrial; however, there are residential land uses along SE 16th Avenue that may have increased noise from the proposed light rail alignment and traffic along SE 17th Avenue. Project corridor land use South of SE Holgate Boulevard is primarily commercial and industrial to Highway 224. South of Highway 224, land use includes single- and multi-family residential, the Portland Waldorf School and Milwaukie High School, parks, library, and commercial and retail.
Existing noise levels along the project corridor range from 52 dBA $L_{eq}$ to 76 dBA $L_{eq}$. Major existing noise sources include Amtrak, 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 3.10-1, with the locations shown on Figure 3.10-4.

Ambient vibration levels along the project corridor ranged from 30 to 55 VdB, excluding Amtrak and freight trains. Vibration propagation information from the initial South/North Corridor Project Draft Environmental Impact Statement (Metro, 1998) was used for this analysis. In addition, ambient vibration levels from the South Corridor Noise and Vibration Results Report (Metro 2002) are cited for reference. The vibration test and measurement locations shown on Figure 3.10-1 are denoted V1 through V5. As defined in the FTA manual, a conservative human perception threshold of ground vibration is 65 VdB.

### Table 3.10-1
Existing Conditions Noise Levels*

<table>
<thead>
<tr>
<th>M#</th>
<th>Location</th>
<th>$L_{eq}$</th>
<th>$L_{dn}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>SE Clay St at SE Water Ave</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>M2</td>
<td>SE Caruthers St at SE 8th Ave</td>
<td>70</td>
<td>71</td>
</tr>
<tr>
<td>M3</td>
<td>SE Clinton St at SE 12th Ave</td>
<td>66</td>
<td>68</td>
</tr>
<tr>
<td>M4</td>
<td>1264 SE Gideon St</td>
<td>62</td>
<td>64</td>
</tr>
<tr>
<td>M5</td>
<td>3626 SE 16th Ave</td>
<td>56</td>
<td>57</td>
</tr>
<tr>
<td>M6</td>
<td>1635 SE Rhone St</td>
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<td>64</td>
</tr>
<tr>
<td>M7</td>
<td>3704 SE 16th Ave</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>M8</td>
<td>1716 SE Center St</td>
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<td>M9</td>
<td>4806 SE 16th Ave</td>
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</tr>
<tr>
<td>M10</td>
<td>5147 SE 18th Ave</td>
<td>67</td>
<td>69</td>
</tr>
<tr>
<td>M11</td>
<td>5411 SE McLoughlin Blvd</td>
<td>76</td>
<td>74</td>
</tr>
<tr>
<td>M12</td>
<td>5912 SE 23rd Ave</td>
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<td>6106 SE 23rd Ave</td>
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<td>M14</td>
<td>Westmorland Golf Course</td>
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<td>Westmorland Park</td>
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<td>2516 SE Nehalem St</td>
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<td>66</td>
</tr>
<tr>
<td>M17</td>
<td>2700 SE Boyd St</td>
<td>66</td>
<td>74</td>
</tr>
<tr>
<td>M18</td>
<td>10506 SE 24th Ave</td>
<td>52</td>
<td>54</td>
</tr>
<tr>
<td>M19</td>
<td>10500 SE 26th Ave</td>
<td>58</td>
<td>60</td>
</tr>
<tr>
<td>M20</td>
<td>2171 SE Monroe St</td>
<td>60</td>
<td>62</td>
</tr>
<tr>
<td>M21</td>
<td>Milwaukie High School</td>
<td>58</td>
<td>60</td>
</tr>
<tr>
<td>M22</td>
<td>2046 SE Lake Road</td>
<td>58</td>
<td>60</td>
</tr>
<tr>
<td>M23</td>
<td>SE McLoughlin Blvd at SE River Rd</td>
<td>72</td>
<td>72</td>
</tr>
</tbody>
</table>

* Noise data from on-site monitoring between October 24 and October 30, 2007 and updated data from the South Corridor Noise and Vibration Results Report, Metro, 2002.

1 Monitoring locations shown on Figure 3.10-4.

2 Address nearest monitoring site.

3 Peak hour daytime $L_{eq}$ in dBA.

4 24-hour $L_{eq}$ noise level in dBA.
Figure 3.10-4

Portland-Milwaukie Light Rail Project

Noise and Vibration Monitoring Sites

- **Noise Monitor Site**
- **Vibration Monitor Site**

- **Light Rail alternative**
- **Station location**
- **Existing Streetcar**
- **Portland Aerial Tram**
- **Light Rail: Under Construction**
- **Portland Streetcar Loop Project**
- **Railroad**
- **County line**
3.10.5 Environmental Consequences

The number and severity of noise and vibration impacts vary with alignment, station, and terminus options. Future noise levels with the project could increase by as much as 2-3 dBA L_{dn}, although most residences would increase by only 1 to 2 dBA L_{dn}. No severe noise impacts were identified at any residential land use. Figure 3.10-5 identifies the locations of properties with noise and vibration impacts for all alternatives. Table 3.10-2 is a summary of impacted properties by alternative.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Noise Impacts</th>
<th>Severe Noise Impacts</th>
<th>Vibration Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 LPA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003 LPA with Stations at Tacoma/Milwaukie/Harrison/Lake Rd</td>
<td>23</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>River Crossing Options with Stations at South Waterfront and Tacoma/Milwaukie/Harrison/Lake Rd</td>
<td>3</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>2003 LPA to Park Avenue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At-grade south of SE Lake Rd</td>
<td>25</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>Tacoma/Milwaukie/Washington/Bluebird/Park</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevated south of SE Lake Rd</td>
<td>25</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Tacoma/Milwaukie/Washington/Bluebird/Park</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003 LPA with Tillamook Branch Alignment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At-grade south of SE Lake Rd</td>
<td>25</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Elevated south of SE Lake Rd</td>
<td>25</td>
<td>0</td>
<td>34</td>
</tr>
</tbody>
</table>

* Impacts identified in the Portland-Milwaukie Light Rail Project Noise and Vibration Results Report, April 2008.

3.10.5.1 Noise Impacts

For the 2003 LPA, potential noise impacts were identified at 20 residential units at RiverPlace that exceed the FTA criteria by up to 2 dBA. No noise impacts are projected at OMSI, the Portland Opera, or between SE Water Avenue and Highway 224. There are three noise impacts at single-family residences just north of SE Harrison Street, where future noise levels are projected to increase by 2 dBA L_{dn} over the existing levels. The total number of noise impact under the 2003 LPA is 23.

Under the River Crossing Options, the noise impacts at the RiverPlace Apartments would not occur, and the project would result in 20 fewer noise impacts, reducing the total number of noise impacts under the LPA with the South Waterfront alignment to three.

The 2003 LPA to Park alignment option would have additional noise impacts at two single-family residences north of the Park Avenue Station along SE 27th Avenue. This increases the total number of noise impacts from 23 to 25 when compared to the 2003 LPA. Either option that includes and extension to Park (2003 LPA to Park or Tillamook Branch to Park) would add noise impacts to at two residences on SE 27th Avenue. Noise impacts at those residences would occur with either the at-grade or grade-separated design alternative and would exceed the criteria by 3 dBA.
Figure 3.10-5

Noise and Vibration Impacts

- **Noise and Vibration Impact**
- **Vibration Impact**

- Light Rail alternative
  - Station
  - Station option
- Park and Ride
  - Park and Ride option

- Existing Streetcar
- Portland Aerial Tram
- Light Rail: Under Construction
- Portland Streetcar Loop Project
- Railroad
- County line

Impact at Waldorf School only with Washington or Monroe Station
Impact only with At-Grade Design Option
Impact only with LPA

Portland–Milwaukie LIGHT RAIL PROJECT

Metro
Under the Tillamook Branch Line alignment option, noise impacts are the same as given for the 2003 LPA. The total number of noise impacts under the Tillamook Branch Line alignment option is 25 (20 units at RiverPlace Apartments, 3 single family residences in Milwaukie and 2 single family residences south to Park), but would be reduced to five with the South Waterfront alignment option. Table 3.10-3 is a summary of the projected noise levels for properties identified with noise impacts. The table includes the existing and projected L_{dn} along with the projected future L_{dn} and project impact criteria.

The Waldorf School qualifies as Category 3 under the FTA criteria, and with an existing peak-hour L_{eq} of 62 dBA, the impact criteria is 64 for a moderate impact, or 69 for a severe impact. Light rail noise levels at the Portland Waldorf buildings range from 54 to 55 dBA L_{eq} with the Harrison St station or 56 to 57 dBA L_{eq} with the Washington or Monroe St Stations. The higher predicted noise levels are at the high school, while lower noise levels are for the main building. The varying noise levels are due to different maximum speeds under different station options. No noise impacts from the light rail operations were identified at either of the Portland Waldorf School buildings because all predicted noise levels are below the 64 dBA criteria for Category 3 Land Uses.

Under the 2003 LPA to Park alignment option, the light rail would increase noise levels along the Trolley Trail. However, the dominant noise source would continue to be heavy trucks and vehicle traffic on SE McLoughlin Boulevard. The FTA criterion for trails is 70 dBA L_{eq}, and the peak-hour L_{eq} from light rail operations is projected at 68 dBA L_{eq}, which is below the FTA impact criteria.

### 3.10.5.2 Noise at Park and Rides and Maintenance Base

Noise related to the operation of the Tacoma Street Station and Milwaukie-area stations are not expected to change the existing noise environment more than 1 to 2 dBA. 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 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. Finally, the additional light rail traffic to and from the maintenance base is not projected to result in any additional noise impacts.
3.10.5.3 Noise Related to Crossing Bells and Warning Horns

Crossing gate bells are required at all gated crossings, and there is potential for increased noise levels at noise-sensitive properties in the immediate area. Typical noise level associated with warning bells range from 75 to 105 dBA at 10 feet. The actual noise level required would depend on the existing noise level in the area and would be set as low as safety allows.

The SE Washington Street crossing is shielded from Milwaukie High School and not projected to result in a noise impact. The Spring Creek Apartments (located south and east of the SE Harrison Street crossing) were updated with new double-pane windows that are expected to be sufficient to mitigate interior noise levels at these buildings. More testing would occur in later design phases to verify that windows are adequate to address noise in excess of allowable levels. If the existing windows are not adequate, additional noise mitigation would be required and provided.

Noise from crossing bells is not projected to result in noise impacts inside the classrooms at the Portland Waldorf School. Typically, warning bells sound for approximately 15 seconds prior to the train’s arrival and for 5 seconds after the train while the gates are lowered. Un-mitigated bells could produce peak-hour noise levels of up to 69 dBA $L_{eq}$ at the nearest window at the Waldorf High School building. The newer brick Portland Waldorf School building near the SE Harrison Street crossing has a few small, double-pane windows and doors facing toward the tracks. Therefore, noise levels in these classrooms are projected to remain within interior noise standards for institutional land use. More testing would occur in later design phases to verify that windows are adequate to address noise in excess of allowable levels. If the existing windows are not adequate, additional noise mitigation would be required and provided.

3.10.5.4 Vibration Impacts

Vibration impacts are projected at 20 residential units at the RiverPlace Apartments under the 2003 LPA. OMSI and Portland Opera buildings were evaluated under the FTA criteria for a Concert Hall, TV/Recording Studio and neither was identified with vibration impacts, regardless of the alignment alternative. Between the Tacoma Street Station and Highway 224, the only vibration impact is at the historic ODOT building on SE McLoughlin Boulevard.

Five vibration impacts were identified north of SE Harrison Street due to the efficient propagation in this area. There are also seven projected vibration impacts between SE Harrison Street and the 2003 LPA terminus at SE Lake Road. The total number of vibration impacts for the 2003 LPA is 33.

Under the 2003 LPA to Park alignment option, vibration impacts north of SE Harrison Street are the same as the 2003 LPA. Higher light rail speeds under the Washington Station option result in an additional vibration impact at the Portland Waldorf High School building, where predicted vibration levels just meet the 75 VdB criteria for an institutional land use. South of downtown Milwaukie there are 4 additional vibration impacts to single- and multi-family residences with an at-grade alternative. Two impacts are expected South of downtown Milwaukie with the elevated alternative. This brings the total number of vibration impacts under the 2003 LPA to Park to 38 with the at-grade alignment and 36 under the elevated alignment.

The number of vibration impacts under the Tillamook Branch Line alignment option is two less than the 2003 LPA to Park due to an alignment that does not impact the ODOT building, and reduced speeds in downtown Milwaukie, for a total of 36 with the at-grade alignment and 34 with an elevated alignment. The vibration projections in Milwaukie are due to efficient propagation characteristics and switches near SE Lake Road and SE Park Avenue. Table 3.10-4 summarizes the project vibration impacts.
<table>
<thead>
<tr>
<th>Area Description</th>
<th>Land Use</th>
<th>Vibration Criteria</th>
<th>Vibration Level</th>
<th>Exceeds Criteria</th>
<th>Number of Impacts</th>
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</thead>
<tbody>
<tr>
<td>2003 LPA Vibration Impacts</td>
<td></td>
<td></td>
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<tr>
<td>RiverPlace (MFR)</td>
<td>2</td>
<td>72</td>
<td>72</td>
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<td>8</td>
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<td>RiverPlace (MFR)</td>
<td>2</td>
<td>72</td>
<td>74</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>ODOT Building</td>
<td>3</td>
<td>75</td>
<td>86</td>
<td>11</td>
<td>1</td>
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<td>North of SE Harrison St (SFR west)</td>
<td>2</td>
<td>72</td>
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<tr>
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<td>72</td>
<td>0</td>
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<td>RiverPlace (MFR)</td>
<td>2</td>
<td>72</td>
<td>74</td>
<td>2</td>
<td>12</td>
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<td>2</td>
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<td>76</td>
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<td>Building at SE Washington St</td>
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<td>0</td>
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<td>RiverPlace (MFR)</td>
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<td>72</td>
<td>74</td>
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<tr>
<td>North of SE Harrison St (SFR west)</td>
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<tr>
<td>Portland Waldorf School – rear bldg</td>
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<td>South of SE Harrison St (MFR east)</td>
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<td>4</td>
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<tr>
<td>Building at SE Washington St</td>
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<td>75</td>
<td>86</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>SE Adams St</td>
<td>3</td>
<td>75</td>
<td>90</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>LPA to Park and Tillamook Branch Alignment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFR off SE River Rd (At-grade alternative only)</td>
<td>2</td>
<td>72.0</td>
<td>74</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>SFR south of SE Sparrow St</td>
<td>2</td>
<td>72.0</td>
<td>72</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

1 General description of sensitive receiver location: SFR = single family residence / MFR = multi-family residence / Comm = commercial
2 Land use by FTA criteria.
3 FTA Vibration criteria.
4 Predicted maximum vibration level during train pass-by – **Bold** 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.
The high vibration levels in downtown Milwaukie are due to the high propagation measurements taken during the initial DEIS for the South/North Light Rail Project (Metro, 1998). After the identification of a Preferred Alternative, additional testing will be performed during preliminary design stages to verify the vibration levels and further refine mitigation measures.

For a reference, a pass-by measurement of a freight train was performed on April 17, 2008. During this test, vibration measurement transducers were placed at 70 feet from the near track, and just inside the door of the nearest location at the high school, approximately 75 feet from the tracks. Figure 3.10-6 is a time record of the maximum vibration levels inside and outside the school. The maximum level outside the school was measured at 85 VdB, while the maximum interior level was 80 VdB. In addition, the 6 loudest seconds were energy summed to provide interior and exterior 6-second $L_{eq}$ levels of 79 VdB and 84 VdB, respectively.

**Figure 3.10-6**

Typical Freight Train Pass-By at the Portland Waldorf School

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### 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 noise and the contractor would be required to adhere to these regulations. Construction outside normal weekday, daytime hours may require a noise variance from the city or county where the work is being performed.

Major noise-producing equipment used during construction preparation could include saw cutters, concrete pumps, cranes, excavators, haul trucks, loaders, tractor trailers, 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.
Maximum noise levels for construction of bridges and other structures would range from 82 to 94 dBA at the closest receiver locations. Following heavy construction, general construction such as 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.

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 100 feet of sensitive receivers.

Pile driving could be required for the river crossing and for elevated structures. 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 *Portland-Milwaukie Light Rail Project Noise and Vibration Results Report*, Metro, April 2008.

Noise from pile driving also has the potential to affect fish and wildlife. Pile driving has the potential to produce noise levels of 190 dB at 150 feet from the source in deep water. However, noise attenuates more quickly in shallow water where most piles would be driven as is the case in the proposed bridge crossing locations. Studies have shown that waterborne noise levels of 180 dB or more can injure fish and potentially cause mortality. Similar type project have used bubble curtains surrounding the in-water pile driving has mitigated this impact by using high pressure air in the water to minimize the affect of water borne vibration.

### 3.10.7 Potential Abatement and Mitigation Measures

As required by the FTA, noise and vibration impacts associated with the project will be considered for mitigation. This section provides details on potential noise and vibration mitigation measures that could be used to resolve project impacts. As project design continues and when a final alignment is selected, slight deviations in track locations or speeds can vary the number and location of noise and vibration impacts. Therefore, during final design, the noise and vibration levels will be reevaluated and mitigation measures revised to meet the final build design. The following general noise and vibration mitigation could be used to reduce or eliminate project impacts.

#### 3.10.7.1 Light Rail Noise Mitigation

Possible mitigation measures for reducing noise impacts from light rail are described below:

- **Sound Barriers.** Construction of noise barriers between the trackway and the affected receivers would reduce noise levels by physically blocking the transmission of noise. Depending on the proximity of the tracks to the barrier, location of the noise sensitive properties, and track elevation, barriers for LRT range from 4 to 8 feet tall.

- **Track Lubrication at Curves.** Trackside lubrications can be effective at reducing wheel squeal that sometimes occurs on tight-radius curves. Currently, most of the corridor does not involve tight curves and the few locations where they do occur are not near sensitive receptors.

- **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.

- **Special Trackwork at Crossovers and Turnouts.** The impacts of LRT wheels over rail gaps at some special trackwork increases LRT noise by about 6 dBA. The use of spring-rail, flange-
bearing or moveable-point frogs in place of standard rigid frogs allow the gap to remain closed reducing noise levels. Potential locations for these treatments could include the crossover locations near the Lake Road and Park Avenue stations.

- **Reduced Train Speed.** Reducing train speeds from that assumed in the noise and vibration analysis can reduce noise generated by the project. This can be used in combination with other mitigation measures.

For the RiverPlace Apartments, mitigation could include sound insulation or a noise barrier on the light rail structure. Noise impacts under the Tillamook Branch Line alignment could be mitigated with a sound wall along the elevated structure. Finally, the two single-family homes on SE 27th Avenue could also be mitigated with sound walls or sound insulation.

### 3.10.7.2 Light Rail Train Horns

The noise analysis has assumed that light rail trains will not be required to sound their horns at the decibel level required for freight trains. The project will utilize a process and provide measures to qualify the project for an exemption to the Freight horn decibel requirement in downtown Milwaukie. The requirements that allow an exemption to high train horn decibel levels are flexible and involve a process that weighs accident data, traffic levels, rail crossing characteristics and proposed supplemental safety measures to determine whether loud train horns are needed to provide an appropriate level of safety at the light rail crossing.

### 3.10.7.3 Mitigation for Crossing Gate Warning Bells

Warning bells would be required for the gated crossings. There are several types of crossing bells that could be used for the project. If, during final design it is determined that crossing bells could result in impacts, adjustable bells, bell shrouds, or a combination of both could be used to reduce noise at sensitive properties. A description of the different bell mitigation measures is provided below

- **Adjustable Crossing Bells.** Adjustable crossing bells are electronic versions of the standard crossing bells used at crossing for freight trains. The adjustable bells typically have variable outputs ranging from 105 dBA to 75 dBA at 10 feet and are approved for the types of crossing in the downtown Milwaukie. By using a lower bell level, noise from the bells are reduced for nearby noise sensitive properties.

- **Bell Shrouds.** Bell shrouds are metal plates installed inside an 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. Shrouds have been shown to reduce noise from crossing bells by 3 to 5 dBA.

### 3.10.7.4 Light Rail Vibration Mitigation

Vibration impacts are considered to be significant and warrant consideration of reasonable and feasible mitigation. The following vibration mitigation measures could be potentially used 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.

• **Tire Derived Aggregate (TDA).** TDA is simply shredded tires. This is a relatively new method of vibration mitigation and normally consists of 12 inches of shredded tires under the standard ballast.

• **Special Trackwork at Crossovers and Turnouts.** The FTA sites that LRT wheels over rail gaps of special trackwork can increases LRT vibration by about 10 VdB. The use of spring-rail, flange-bearing or moveable-point frogs in place of standard rigid frogs allow the gap to remain closed reducing vibration levels.

• **Reduced Train Speed.** Reducing train speeds from that assumed in the noise and vibration analysis could reduce vibration generated by the project. This can be used in combination with other mitigation measures.

The majority of vibration impacts identified in this analysis could be mitigated with ballast mats, resilient fasteners, TDA, reduced speeds or a combination of mitigation measures. The selected vibration mitigation method would depend on the track type and level of vibration impact. More detailed analysis will be carried out during the preliminary design of the project’s preferred alternative to refine the vibration estimates and to determine the vibration mitigation commitments to be identified in the FEIS and FTA’s Record of Decision, unless further evaluation during final design indicates that the expected vibration impact will not occur.

**3.10.7.5 Construction Noise and Vibration Mitigation**

Several construction noise abatement methods can be implemented to limit the impacts. Operation of construction equipment can 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 can be required to have mufflers installed according to the manufacturer's specifications, and all equipment can 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 his own expense, may 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.
- Near schools some construction activities could be restricted to summer months, when school is not in session.
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, April 2008) 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>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Time</th>
<th>Federal</th>
<th>Oregon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>8-hour</td>
<td>9 ppm</td>
<td>9 ppm</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>35 ppm</td>
<td>35 ppm</td>
</tr>
<tr>
<td>Lead</td>
<td>Calendar Quarter</td>
<td>1.5 μg/m³</td>
<td>1.5 μg/m³</td>
</tr>
<tr>
<td>Ozone</td>
<td>1-hour</td>
<td>0.12 ppm</td>
<td>0.12 ppm</td>
</tr>
<tr>
<td></td>
<td>8-hour</td>
<td>0.08 ppm</td>
<td>-</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>Annual Arithmetic Mean</td>
<td>0.053 ppm</td>
<td>0.053 ppm</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>Annual Arithmetic Mean</td>
<td>0.03 ppm</td>
<td>0.02 ppm</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>0.14 ppm</td>
<td>0.10 ppm</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>N/A</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>24-hour Average</td>
<td>150 μg/m³</td>
<td>150 μg/m³</td>
</tr>
<tr>
<td>PM₂·₅</td>
<td>3-year Average Annual Arithmetic Mean*</td>
<td>15 μg/m³</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>3-year Average, 98th Percentile</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>24-hour Average</td>
<td>35 μg/m³</td>
<td>-</td>
</tr>
</tbody>
</table>

Sources: EPA Office of Air Quality Planning and Standards (OAQPS) and DEQ, 2006.
Notes: ppm = parts per million; μg/m³ = micrograms per cubic meter; PM₁₀ = particulates with an aerodynamic diameter of less than or equal to 10 micrometers; PM₂·₅ = 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 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 area is a carbon monoxide (CO) maintenance area. DEQ has identified measures to ensure compliance and maintain healthy air quality in the Portland area.

As a result of the 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 mobile sources by plans approved for the region by the Oregon Environmental Quality Commission and the EPA. The second part requires that vehicle emissions from individual projects (e.g., a hot spot) does not cause or contribute a violation of the NAAQS.

A light rail line connecting Portland to Milwaukie is included in the 2004 Regional Transportation Plan (RTP) Financially Constrained network and in the 2005 Portland area Metropolitan Transportation Improvement Program (MTIP). Both the RTP Financially Constrained network and the MTIP have been determined to conform to the SIP. The conformity determinations for these plans have been reviewed and approved by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA). Recently, Metro prepared the 2007 Air Quality Conformity Determination for the 2008-11 MTIP as required by state and federal law. The Metro Council held a public hearing in August 2007 to deliberate on the air quality conformity report, consider public comments received during the comment period, and act on a resolution to adopt the 2008-11 MTIP with the air quality conformity determination report. The conformity determination is now being reviewed by federal authorities.

In the 1980s, the Portland/Vancouver area was also designated as nonattainment 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, 1-hour values would no longer be evaluated for attainment purposes. Future compliance will 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 8-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 (AQMA). The Ozone Maintenance Plan indicates DEQ and Metro will informally track volatile organic compounds (VOC) and nitrous oxides (NOx) (along with air toxics and greenhouse gas emissions) when Metro assesses conformity. Thus, emission estimates of VOC, NOx, and carbon dioxide (CO2) have been included for informational purposes only and not for conformity purposes.

### 3.11.2 Environmental Consequences

Because the primary pollutant of concern for transportation-related projects is CO, and the Portland area is a maintenance area for this pollutant, regional air quality impacts are measured through forecasting changes in transportation-related emissions of CO. This allows a comparison between existing conditions and future conditions with and without the Light Rail Alternative. Estimated regional average weekday emissions of CO from vehicles (auto, truck, and transit) are shown in Table 3.11-1. Vehicle miles traveled (VMT) are projected to increase for the 25-year period between the existing (2005) and future (2030) scenarios due to growth in the region. The No-Build Alternative VMT is based on conditions if the light rail is not built. The 2003 Locally Preferred Alternative (2003 LPA) VMT reflects the changes in driving patterns if the light rail is built and also includes vehicle trips related to LRT (e.g., driving to park-and-rides) (see Table 3.11-2). The table also shows that the 2030 LPA VMT is lower than conditions 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 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 the projected emission estimates for NO\textsubscript{x}, VOC, and CO\textsubscript{2} for each alternative for informational purposes. Like CO, the regional vehicle-related emissions of VOC and NO\textsubscript{x} are projected to decrease between 2005 and 2030 due to improvements in vehicle emissions technology. Only the 2003 LPA was analyzed in this section. Estimated environmental consequences between the alignment options are similar.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>CO</th>
<th>VOC</th>
<th>NO\textsubscript{x}</th>
<th>CO\textsubscript{2}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions (2005)</td>
<td>905.4</td>
<td>53.8</td>
<td>90.9</td>
<td>24,476</td>
</tr>
<tr>
<td>No-Build (2030)</td>
<td>606.3</td>
<td>19.1</td>
<td>16.2</td>
<td>36,328</td>
</tr>
<tr>
<td>2003 LPA (2030)</td>
<td>605.8</td>
<td>19.1</td>
<td>16.1</td>
<td>36,299</td>
</tr>
</tbody>
</table>

Notes: Emission factors are based on peak daily speed.

Unlike the other pollutants, Table 3.11-2 shows an increase in CO\textsubscript{2} emissions from 2005 to 2030. This is because the current CO\textsubscript{2} emission factor is only a function of the type and amount of fuel consumed and does not change between 2005 and 2030. Because the emission factor depends on fuel usage, the CO\textsubscript{2} emissions increase as the VMT increase. However, CO\textsubscript{2} emissions would be slightly lower with the 2003 LPA than the No-Build, which would mean lower greenhouse gas emissions.

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 3.11-3. Both 1-hour and 8-hour CO concentrations were forecast.

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 Light Rail Alternative and No-Build conditions 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 Alternative has the potential to increase localized traffic volumes, delay, and queuing when compared to No-Build conditions. However, because future individual vehicle emission rates would be reduced and conditions are already congested at most intersections under the No-Build condition, very little change in CO concentrations are predicted.
Maintenance of light rail transit vehicles would occur at the TriMet Ruby Junction maintenance base in Gresham. Stationary sources such as maintenance facilities are subject to the permitting regulations of either DEQ or the Southwest Clean Air Agency (SWCAA), and no impacts are expected as a result of maintenance base operations.

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Existing Conditions 1-Hour</th>
<th>Existing Conditions 8-Hour</th>
<th>No-Build 1-Hour</th>
<th>No-Build 8-Hour</th>
<th>2003 LPA 1-Hour</th>
<th>2003 LPA 8-Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>99E McLoughlin/Harrison (Milwaukie)</td>
<td>6.6</td>
<td>5.5</td>
<td>4.6</td>
<td>4.0</td>
<td>4.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Naito Parkway/Harrison (Portland)</td>
<td>4.9</td>
<td>4.2</td>
<td>3.7</td>
<td>3.3</td>
<td>3.7</td>
<td>3.3</td>
</tr>
<tr>
<td>SE Powell/SE Milwaukie (Portland)</td>
<td>6.5</td>
<td>5.2</td>
<td>4.4</td>
<td>3.7</td>
<td>4.4</td>
<td>3.7</td>
</tr>
</tbody>
</table>

1 ppm = parts per million; forecasts assume ambient background concentrations of 2 ppm.

Note: Federal Standards (NAAQS) are 35 ppm at 1 hr and 9 ppm at 8 hrs.

3.11.2.1 Short-Term Impacts (Construction)

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. 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, and the 2003 LPA to Park, which includes an extending light rail with an additional two stations and a park and ride, would have the highest impact.

3.11.2.2 Indirect and Cumulative Impacts

The forecast traffic volumes used to analyze air quality impacts of the LRT project include traffic from all sources. Background concentrations representing the cumulative emissions of other sources in the area are added into the predicted local concentrations for CO at intersections. Because of these inclusive analysis methodologies, the impacts shown throughout this report section represent indirect and cumulative air quality impacts.

3.11.2.3 Compliance with State Implementation Plans

The Light Rail Alternative is included in the 2004 RTP’s Financially Constrained network and in the 2005 Portland area MTIP. Both the RTP Financially Constrained network and the MTIP have been determined to conform with the SIP. The conformity determinations for these plans have been reviewed and approved by FHWA and FTA. The long-term impacts analysis conducted for the SDEIS also shows that the LRT project would not cause or contribute to a violation of the NAAQS; the project would therefore meet 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 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 hotspots analysis 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 Mitigation

Construction contractors are required to comply with state regulations (OAR 340-208-0210) requiring that reasonable precautions be taken to avoid dust emissions. Mitigation measures normally 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.

3.12 ENERGY ANALYSIS

This section summarizes transportation energy consumption in the Portland metropolitan area for the No-Build and Light Rail Alternatives, considering consumption impacts during construction and operation. For more detailed information and analysis results, consult the Energy Results Report (Metro and DEA, 2007).

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 353.473 x 10^9 Btu^8.

---

^8 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 = 139,000 Btu and 1 gallon of gasoline = 125,000 Btu. Also, 1 US barrel of crude oil = 42 gallons of gasoline.
Table 3.12-1
Transportation Operations Energy Consumption in Base Year (2005) Portland Metropolitan Area

<table>
<thead>
<tr>
<th>Vehicle and Facility Operations</th>
<th>Daily VMT(^1)</th>
<th>Daily Fuel Consumption(^2) (Gallons)</th>
<th>Daily Energy Consumption(^3) (Billions of Btu*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Vehicle Operations Totals</td>
<td>41,611,841</td>
<td>2,528,804</td>
<td>321.990</td>
</tr>
<tr>
<td>Motor Vehicle Maintenance(^4)</td>
<td></td>
<td></td>
<td>28.894</td>
</tr>
<tr>
<td><strong>Total Motor Vehicle Energy Usage</strong></td>
<td></td>
<td></td>
<td><strong>350.884</strong></td>
</tr>
<tr>
<td>Transit Bus Vehicles</td>
<td>85,908</td>
<td>13,636</td>
<td>1.891</td>
</tr>
<tr>
<td>Non-Fuel Source Transit System(^4)</td>
<td>13,127</td>
<td></td>
<td>0.367</td>
</tr>
<tr>
<td>LRT Maintenance Facility Operation(^5)</td>
<td></td>
<td></td>
<td>0.029</td>
</tr>
<tr>
<td>Bus Vehicle Maintenance(^5)</td>
<td></td>
<td></td>
<td>0.147</td>
</tr>
<tr>
<td>Bus Maintenance Facility Operation(^5)</td>
<td></td>
<td></td>
<td>0.147</td>
</tr>
<tr>
<td>Park and Ride Operation(^5)</td>
<td></td>
<td></td>
<td>0.008</td>
</tr>
<tr>
<td><strong>Total Transit Energy Usage</strong></td>
<td></td>
<td></td>
<td><strong>2.589</strong></td>
</tr>
<tr>
<td><strong>Combined Energy Usage</strong></td>
<td></td>
<td></td>
<td><strong>353.473</strong></td>
</tr>
</tbody>
</table>

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 \((8.2 \text{ kWH/car mile}) \times (13,127 \text{ car miles}) \times (3,412 \text{ Btu/kWH})\)
\(^5\) TriMet 2007

3.12.2 Impacts

This section summarizes the energy analysis for the Portland-Milwaukie Light Rail Project for:

- Energy that would be consumed during operation of the Light Rail Alternative and options (long-term or direct impacts), compared to the No-Build Alternative.
- Energy that would be consumed during construction of the Light Rail Alternative and options (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 Alternative and options, compared to the No-Build Alternative.

The variations in design options (i.e., variations of an alignment within an alternative) would result in only minor differences in energy use (less than one percent) on a system-wide level. In general, long-term energy use would increase slightly with those design options that increase transit travel times and distances, and short-term energy use would increase slightly with those design options that have higher capital costs.

3.12.2.1 Summary of Long-Term Energy Impacts

Direct (long-term) energy impacts would consist of energy consumed for operation of the vehicle transportation system and includes light rail and vehicles traveling the roadways. 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 used for light rail transit. Table 3.12-2 summarizes the predicted operational energy use for the Portland-Milwaukie Light Rail Project alternatives in the year 2030. The comparisons assume that the price of gasoline would
continue to be elastic. It is further assumed that gasoline prices would have to increase significantly to trigger a significant change in gasoline consumption.

Compared to the No-Build Alternative, the 2003 Locally Preferred Alternative (LPA) and all alignment options would reduce operational energy use. For example, the No-Build Alternative would consume the most energy, with use peaking at $495.173 \times 10^9$ Btu/day. The 2003 LPA-Park would consume the least energy, at $494.632 \times 10^9$ Btu/day. The difference in energy consumption between these alternatives is approximately 541,000 x $10^9$ (Billion) Btu/day, the equivalent of 4,184 gallons of gasoline per day.

### Table 3.12-2
Summary of Daily Corridor Transportation Operations Energy Consumption in 2030 (Billions of Btu)$^1$
Portland-Milwaukie Light Rail Project Alternatives

<table>
<thead>
<tr>
<th>Energy Use</th>
<th>No-Build</th>
<th>2003 LPA</th>
<th>2003 LPA-Park</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Vehicle Maintenance</td>
<td>40.545</td>
<td>40.515</td>
<td>40.498</td>
</tr>
<tr>
<td><strong>Total Motor Vehicle Energy Usage</strong></td>
<td><strong>492.454</strong></td>
<td><strong>492.089</strong></td>
<td><strong>491.893</strong></td>
</tr>
<tr>
<td>Transit Bus Vehicles</td>
<td>2.053</td>
<td>2.033</td>
<td>2.034</td>
</tr>
<tr>
<td>Commuter Rail Vehicles</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
</tr>
<tr>
<td>Non-Fuel Source Transit System</td>
<td>0.307</td>
<td>0.337</td>
<td>0.342</td>
</tr>
<tr>
<td>LRT Maintenance Facility Operation</td>
<td>0.036</td>
<td>0.039</td>
<td>0.039</td>
</tr>
<tr>
<td>Bus Vehicle Maintenance</td>
<td>0.160</td>
<td>0.158</td>
<td>0.158</td>
</tr>
<tr>
<td>Rail Vehicle Maintenance</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Bus Maintenance Facility Operation</td>
<td>0.147</td>
<td>0.147</td>
<td>0.147</td>
</tr>
<tr>
<td>Park-and-ride Operation</td>
<td>0.011</td>
<td>0.012</td>
<td>0.012</td>
</tr>
<tr>
<td><strong>Total Transit Energy Usage</strong></td>
<td><strong>2.719</strong></td>
<td><strong>2.731</strong></td>
<td><strong>2.737</strong></td>
</tr>
<tr>
<td><strong>Combined Energy Usage</strong></td>
<td><strong>495.173</strong></td>
<td><strong>494.819</strong></td>
<td><strong>494.632</strong></td>
</tr>
</tbody>
</table>


$^1$ Btu = British Thermal Unit. One gallon of gasoline = 125,000 Btu.

### 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 highest impact alternative (2003 LPA-Park). As shown in Table 3.12-3, construction energy usage would be 2,763.2 billion Btu.

### Table 3.12-3
Summary of Construction Energy Consumption (Billions of Btu)$^1$
Portland-Milwaukie Light Rail Project Alternatives

<table>
<thead>
<tr>
<th>No-Build</th>
<th>Highest Impact Build Alternative (2003 LPA-Park)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2,763.2</td>
</tr>
</tbody>
</table>


$^1$ 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 combined annual energy use for operation and construction (direct and indirect impacts) of all the Portland-Milwaukie Light Rail Project alternatives.

Table 3.12-4
Summary of Annual\(^1\) Energy Consumption by Alternatives (Billions of Btu\(^2\))

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Motor Vehicle(^3) Annual Energy Use</th>
<th>Bus Annual Energy Use</th>
<th>LRT Annual Energy Use</th>
<th>Total Annual Operations Energy</th>
<th>Annual Operational Energy Savings(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-Build</td>
<td>167,434.36</td>
<td>802.40</td>
<td>122.06</td>
<td>168,358.82</td>
<td>0.0</td>
</tr>
<tr>
<td>2003 LPA</td>
<td>167,310.26</td>
<td>794.92</td>
<td>133.62</td>
<td>168,238.80</td>
<td>120.02</td>
</tr>
<tr>
<td>2003 LPA-Park</td>
<td>167,243.62</td>
<td>795.26</td>
<td>135.32</td>
<td>168,174.20</td>
<td>184.62</td>
</tr>
</tbody>
</table>

\(^1\) 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.
\(^5\) Analysis was conducted for the Highest Impact Build Alternative (2003 LPA-Park) only

3.12.2.4 Cumulative Energy Impacts

The project alternatives are not expected to have a significant effect upon 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 any of the project alternatives 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 any of the Light Rail Alternative and its options would cumulatively reduce overall vehicle miles traveled (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 the Light Rail Alternative or its options would not affect regional power supply and would reduce overall energy consumption for the total transportation system compared to the No-Build Alternative. In addition, TriMet will comply with applicable FTA regulations regarding energy-efficient studies before construction of buildings.
3.13 HAZARDOUS MATERIALS

This section identifies hazardous materials sites within the area of potential effect (APE) for the Portland-Milwaukie Light Rail Project. A hazardous materials site is a location or facility that has reportedly contained a hazardous substance or has released a hazardous substance into the environment (soil, water and/or air). The APE is defined as the area within a 500-foot buffer around project alternatives and design options. This distance has been found to encompass nearby parcels of a range of sizes, reasonably reflect the potential for migration of contaminants from other nearby sites, and allow for engineering refinements in alternative alignments as project designs continue. This section also evaluates potential long-term, short-term, and cumulative impacts related to exposure and mobilization of hazardous material for the Light Rail Alternative and its design options. Such impacts could affect worker safety, property value, sensitive environmental resources (e.g., streams, wetlands), and project costs and completion schedule.

3.13.1 Affected Environment

3.13.1.1 Federal and State Database Review

The affected environment within the APE was assessed by reviewing reasonably ascertainable government database records from federal and state sources. Information for the database review is based, in part, on a report provided by Environmental Data Resources (EDR) that compiled database records through October 22, 2007. The database search found 306 potential hazardous materials sites within the APE. This is not unusual for an established urban area that includes waterfront, rail corridors, major highways, and a number of industrial areas.

3.13.1.2 Other Data Sources

Industrial properties were identified in the South Waterfront Area with known environmental issues that will likely have short-term and long-term affects to the project. These properties are the Zidell Marine Corporation (ESCI No. 689) and the former Schnitzer Steel Corporation (ESCI No. 875) (now owned by Oregon Health and Science [OHSU]). At the request of Metro and TriMet, a file review of these industrial properties was conducted at the Oregon Department of Environmental Quality (DEQ) in January 2008. The objective of the file review was to gain further understanding of environmental impacts at these properties and remedial actions (RAs) that have occurred or are proposed for cleanup.

3.13.2 Environmental Consequences

Environmental consequences are long-term, short-term, and cumulative impacts that would be expected from the Portland-Milwaukie Light Rail Project alternative and design options.

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3.13.2.1 Long-Term Impacts

Long-term impacts are future effects to resources within the region that may occur after the completion of the Portland-Milwaukie Light Rail Project.

No-Build Alternative

Under the No-Build Alternative, ground disturbances associated with the Light Rail Alternative would not occur or would be diminished. The absence of these disturbances would create both potentially adverse as well as beneficial long-term effects associated with the No-Build Alternative. Adverse long-term effects include hazardous materials sites that may not be investigated or subsequently remediated. Such sites would likely continue to pose long-term risk to human health and/or the environment. In addition, adverse effects may be associated with the long-term operation and maintenance of the No-Build Alternative due to increased traffic demands. These adverse effects include but are not limited to bridge, roadway and transit upkeep, incidental spills or releases from vehicles or transit, and stormwater management and treatment. Beneficial long-term effects of the No-Build Alternative include limiting the potential of exacerbating contamination in soil, sediment, or groundwater because identified and unidentified hazardous materials sites would not be disturbed. However, No-Build would not contribute to efforts to address contaminated sites or provide support for their redevelopment.

Light Rail Alternative

Long-term impacts to hazardous materials sites from the Light Rail Alternative may include adverse effects on remedial actions proceeding at hazardous materials sites. Remedial actions could include active cleanup, long-term monitoring and maintenance, enforcement, institutional controls (i.e., deed restrictions, restrictive covenants), and/or engineering controls (i.e., soil cap, groundwater pump and treat). Long-term operation of these remedial actions may conflict with operation of the Light Rail Alternative or its options. No current remedial activities or operation of remedial systems were identified in the APE. A number of remedial actions are anticipated in the South Waterfront area. However, these actions are still in the planning stages and have not yet been fully defined; more information is anticipated to be available by the end of 2008. Long-term impacts associated with remedial actions are thought to be minor in comparison to short-term impacts associated with construction.

Long-term impacts associated with the Light Rail Alternative also include direct and indirect exposure or mobilization of contaminated materials as a result of roadway and transit operation and maintenance. In most locations, it is not anticipated that operation and maintenance associated with the Light Rail Alternative would cause an appreciable increase in the potential for incidental spills or releases of hazardous materials from vehicles or transit. However, the 2003 Locally Preferred Alternative (LPA) does include an option for running buses along a new bridge to be constructed over the Willamette River, as do all of the Willamette River crossing options. Buses, as well as maintenance vehicles, would be expected to carry petroleum products and would be a potential source for accidental contamination.

Maintenance Base

Long-term impacts from the operation and maintenance of train cars at maintenance bases may include generation, storage, and proper disposal of hazardous materials. These wastes would be regulated by the Fire Marshall and/or State of Oregon hazardous waste regulations. Consequently,
long-term impacts would include management of hazardous materials and the potential future risk of a release of hazardous materials

3.13.2.2 Short-Term Impacts (Construction)

Construction impacts are evaluated for both the No-Build and Light Rail Alternatives. Construction impacts are potential direct short-term impacts to resources within the APE, which may occur prior to or during construction of the Light Rail Alternative.

No-Build Alternative

Under the No-Build Alternative, no right-of-way, property acquisition and construction activities will occur. Therefore, the No-Build Alternative is not anticipated to result in appreciable construction impacts.

Light Rail Alternative

Impacts Common to All Design Options

The Light Rail Alternative requires construction activities in all project segments. Hazardous materials impacts may occur due to a variety of construction activities. Construction-related equipment relies heavily on petroleum products. Improper fuel transfers may result in spills to the ground, potentially leading to soil and groundwater contamination. Other potentially hazardous chemicals are also used during construction activities. Chemical pollutants such as paints, acids for cleaning masonry surfaces, cleaning solvents, asphalt products, concrete-curing compounds, and fertilizers may be used at construction sites and may be carried in stormwater runoff.

Construction may require the removal of structures that contain hazardous materials, including lead, asbestos, and polychlorinated biphenyls (PCBs)—known carcinogens. Removal and disturbance of lead, asbestos, and PCBs may cause mobilization of these compounds and can create unacceptable exposure to the public and the environment.

- Lead-based paint was widely used until 1978, when it was phased out of residential and commercial structures. Such structures constructed prior to 1978 may be coated with lead-based paint and may have contaminated soil surrounding the structure. Some industrial and municipal uses continue to be permitted to use lead-based paint, so industrial structures of historic or recent origin may be coated with paint containing lead.

- Laws regulating the use and disposal of asbestos were established in 1977. Building materials consisting of or containing asbestos may include siding, roofing shingles, floor tiles, insulation, ceiling tiles, heating systems, gaskets, pipe wrapping, and duct lining.

- PCBs typically occur in transformers manufactured between 1929 and 1977. Transformers containing PCBs can be found in residential, commercial, and industrial buildings constructed before 1978.

Construction of river crossings may directly and indirectly affect aquatic organisms through the mobilization or exacerbation of contaminated sediments within the Willamette River. Construction activities include placement of piers or other supporting bridge structures that would require disturbance of in-water sediments and river embankment soils. Contaminants include, but are not limited to, metals (antimony, arsenic, cadmium, chromium, lead, mercury, copper, nickel, and zinc), tributyltin, polycyclic aromatic hydrocarbons (PAHs), and PCBs.
Construction of the Light Rail Alternative may be directly and indirectly affected by hazardous materials sites. Short-term effects may include increased costs and delays in the project schedule resulting from:

- Notification to regulatory agencies of a potential hazardous exposure
- Work stoppage due to potential exposure of construction workers or ecological receptors to hazardous materials
- Identification of and negotiation with potentially responsible parties and regulatory agencies
- Focused investigation and characterization of affected media
- Implementation of remedial actions
- Management and disposal of affected media

Construction activities that disturb hazardous materials sites with Recognized Environmental Conditions (RECs) can adversely affect nearby residents, business occupants, and worker safety, raise project costs, and create project delays.

Any design option that requires additional acquisition of right-of-way or excavation would increase the probability of encountering hazardous materials. However, the extent, cost and the timeframe of remediation or mitigation required is dependent on site conditions that may be unique to a design option.

**Design Option Impacts**

The potential of a hazardous materials site to cause construction impacts to the proposed project was evaluated using the following criteria:

- The identified site is to be acquired for the proposed project.
- The identified site is adjacent to the proposed project and near enough to potentially result in contamination within the project construction area.
- The site has a known or suspected release of a hazardous substance(s).
- The current cleanup status of the site indicates hazardous materials may still be present.
- The site appears on one or more database listings for hazardous materials releases.
- The land use type involves the past or present use of hazardous materials.

A ranking of the potential for hazardous materials impact was then determined based upon the estimated severity of the hazardous materials contamination and the potential for disturbance of hazardous materials by project construction activities.

Identified databases were compared relative to one another for their potential to cause construction impacts. Identified hazardous materials sites were ranked on a scale from 0 (very low probable effect) to 5 (high probable effect) of causing a direct environmental consequence to roadway or transit options. Sites with a ranking of 4 and 5 pose the greatest potential to have appreciable adverse construction impacts to the project. The difference between rankings is based on the type of impact (i.e., leaking heating oil tank vs. state environmental cleanup site), the status of the site (i.e., no further action vs. ongoing cleanup), and site location (acquired vs. nearby). Ranking is based on best
available data and professional judgment. Figure 3.13-1 maps the sites considered to have the potential to cause construction impacts.

2003 Locally Preferred Alternative

Eighty ranked sites are identified in the APE of the 2003 LPA. Of these sites, 35 are ranked 4 or greater. These sites have the greatest potential for contamination to be encountered and are described from north to south along the 2003 LPA alignment.

Of these 35 sites, five may cause significant adverse impacts during construction due to the nature and extent of contamination in the subsurface. Focused environmental investigation should be conducted at the following sites to evaluate how these impacts may affect the proposed project and provide mitigation options. These sites are:

- No. 67 Portland Gas & Coke
- No. 69 Central Service Center/NW Natural Gas #71, Portland Gas & Coke Gas Holder Tanks (Former)
- No. 80 OHSU Supplemental & Growth Parking, Former Schnitzer Investment Corp.
- No. 180 Peco Manufacturing Co., Inc.
- No. 185 Columbia Battery Mfg. Co.

Appreciable environmental consequences are likely to affect the 2003 LPA river crossing due to the potential disturbance of existing contaminated river sediments, river embankment soils, and upland soils. Figure 3.13-2 displays potential remedial actions for the Zidell property and the former Schnitzer property. Remedial actions (RAs) are being employed at both of these properties to clean up contamination or mitigate impacts. The footprint of the 2003 LPA crosses the former Schnitzer property but does not intersect the Zidell property.

Cleanup actions for the former Schnitzer property include, but are not limited to placement of a soil cap in upland areas and institutional controls that may restrict land use. Implementation of RAs will be dependent on the development of the property. Cleanup actions implemented by Zidell may adversely affect the 2003 LPA, but to a lesser degree than the Willamette River Crossings since the alignment avoids the Zidell property.

Willamette River Crossing Design Options

Willamette River crossing options include four bridge alignments: Meade-Sherman, Meade-Caruthers, Porter-Sherman, and Porter-Caruthers. In general, these bridge design options extend from SW Naito Parkway to SE Division Street and SE 10th Avenue. These design options offer a different alignment to the 2003 LPA Willamette River crossing.
Construction impacts were evaluated by using a “multiple lines of evidence” approach. Identified hazardous material sites are ranked on a scale from 1 (a low probability) to 5 (a high probability) of causing a direct environmental consequence to the project.
The Zidell Remedial Action/Remedial Design Work Plan, dated April 10, 2007, was the source document for noted environmental impacts at Zidell. The Work Plan and subsequent remediation plan have not yet received agency approval. The Record of Decision (Unit C in September 1991, Unit A in April 1995) was the source document for noted environmental impacts at the OHSU/former Schnitzer property.

The size and locations of the features shown are approximate.
Up to 15 ranked sites were identified within the APE of these design options. Of these sites, the following three sites ranked 4 or greater are common to each design option:

- No. 11 South Waterfront Redevelopment Area 3
- No. 80 OHSU Supplemental & Growth Parking, Schnitzer Investment Corp.
- No. 118 Zidell Marine Corporation

In addition, the Meade-Caruthers and Porter-Caruthers options include one ranked site:

- No. 41 Columbia Corrugated Box

The Porter-Sherman option includes one ranked site:

- No. 104 Westwood Swinerton Construction

Appreciable environmental consequences are likely to affect all Willamette River crossing options in the South Waterfront area due to contamination of river sediments, river embankment, and upland soils and associated remedial actions (RAs). Figure 3.13-2 displays potential remedial actions for the Zidell property and former Schnitzer property. The footprint of the Willamette River crossings intersects both the Zidell property and the former Schnitzer property. RAs are being employed at both of these properties to clean up contamination or mitigate impacts.

RAs for the Zidell property include, but are not limited to: 1) removal, management and disposal of hot spot soil and sediment material; 2) placement of an uplands soil cap; 3) placement of an in-water sediment cap; 4) remedial enhancements of the river embankment, which may include grading and bank armament; and 5) institutional controls that may restrict land use. Implementation of RAs for in-water sediment and the river embankment will be conducted over the next five years; implementation of RAs for Zidell’s upland will be conducted over the next 10 years.

RAs for the former Schnitzer property include, but are not limited to placement of a soil cap in upland areas and institutional controls that may restrict land use. Implementation of RAs will be dependent on the development of the property.

Environmental consequences may be different in type and magnitude for each design option and would likely affect construction design and implementation, including cost. Because the cleanup plans for some of these sites including the Zidell property, are still in relatively early stages, these effects are difficult to compare and evaluate until the DEQ releases a more detailed description of the RAs’ design. However, compared to the 2003 LPA, the development of any of the Willamette River crossing options would have a greater potential for being affected by contaminated sites and their cleanup. Coordinated planning and project development would be needed to minimize effects.

Tillamook Branch Alignment

The Tillamook Branch Line alignment is an alternative to the 2003 LPA’s alignment in the Milwaukie Industrial District. The design option turns southeast at the proposed Tacoma Street

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10 Pursuant to the Consent Order between Oregon District Court and Zidell Marine Corporation, the Final Remedial Design Report for the Sediment Cap and River Embankment is to be submitted to DEQ by September 2008.
Station, crosses over the Tillamook Branch of the rail line, and runs along the east side of the rail line to North Milwaukie (Highway 224).

Ten ranked sites were identified within the APE of the Tillamook Branch Line alignment. Of these 10 sites, the seven sites below were ranked 4 or greater. Only one site, No. 229, is proposed to be partially acquired. These sites are:

- No. 229 Old Shell Station/Oregon Worsted Co.
- No. 230 Tacoma Street Overpass-Edwards Mfg.
- No. 233 East Side Plating Inc., Amcoat Enameling Inc.
- No. 260 Holman Transfer Co. Milwaukie, Z Pro International Inc, PPG Industries
- No. 266 Former Mail-Well Facility, Mail-Well Envelope Co., Mackay Envelope Company LLC
- No. 274 Cornell Pump Mfg. Corp.
- No. 276 Chevron Chemical Company, Heiberg Garbage & Recycling

In addition, hazardous materials impacts are expected to be encountered during LRT construction where the alignment is along existing railway lines. The presence of contaminants is expected due to potential releases or spills from long-established rail use, as well as historical uses along the corridor. No specific details about locations or extent of releases, if any, were available through regulatory sources examined in late 2007. The light rail project would likely seek an easement from the railway rather than acquiring the property to be used for light rail. This action could limit the liability for cleanup but would still require compliance with hazardous materials handling regulations to protect against exposure to humans and prevent the further release or transfer of contaminants in the environment.

**2003 LPA to Park**

The 2003 LPA to Park design option extends transit from SE Lake Road to SE Park Avenue. There were four ranked sites identified for the 2003 LPA to Park. Of these, no sites were ranked 4 or greater. The at-grade crossing and elevated crossing options did not affect the level of impacts.

**Maintenance Base**

Operation and maintenance needs for light rail would require an expansion of the existing TriMet Ruby Junction operations facility. The expansion would require approximately 10.4 acres that are not currently in the public right-of-way, including 14 tax lots with 10 separate owners. DEQ reports that as sections of the present Ruby Junction site were acquired, TriMet completed cleanup activities in 1994 and 1998 for previously-existing leaking underground fuel tanks. The maintenance base uses and stores potentially hazardous materials that are typically used for upkeep and repair of the vehicles. Past spills or leaks have been reported at or near this site.

Several adjoining parcels used for manufacturing and auto maintenance have also had reported hazardous materials spills in the past, although DEQ reports that cleanup or remediation activities at all adjoining sites have been completed. The Ruby Junction site also has a permitted small-quantity hazardous waste generator, with wastes including solvents, battery waste, paint, and paint thinner.
Comparison of Impacts

A comparison of construction impacts was conducted to evaluate relative differences among the various alignment and design options.

LPA and Willamette River Crossings

For the 2003 LPA and the four Willamette River crossing options, a comparative review of the differences in impacts indicates that:

- The 2003 LPA alignment for the river crossing has one site ranked 5 and four sites ranked 4
- The Willamette River crossing options have two sites ranked 5 and up to three sites ranked 4

The two sites ranked 5 in the South Waterfront area would likely have appreciable long-term construction impacts to the Willamette River crossing options. These impacts would be avoided or lessened with the 2003 LPA.

During bridge construction, both the LPA and Willamette River crossings would likely encounter in-water sediments that are contaminated with polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and metals. Sediment contamination within this area of the Willamette River is from, but not limited to, upland sources, stormwater runoff, historic ship building/demolition activities, and deposition. The degree of sediment contamination is likely to be higher in the vicinity of the South Waterfront area due to past industrial activities. Consequently, adverse construction impacts are thought to be greater with the four Willamette River crossing options than with the 2003 LPA. Similarly, the concrete segmental bridge types are likely to have greater impacts than the cable-stayed type because it would have more piers and more potential to disturb sediments.

In addition, contaminated sediment and river embankment soils associated with No. 118 (Zidell Marine Corporation) will be capped along the shoreline in the South Waterfront area. Figure 3.13-2 shows site features and potential remedial actions in this area. This cleanup is as part of upcoming RAs agreed upon with the State of Oregon. RAs are plans for cleanup and containment of hazardous material sites. Although details of the RAs are not fully known, the South Waterfront crossings could conflict with the RAs or require new or modified measures compared to the 2003 LPA.

2003 LPA and Tillamook Branch Line Alignment

A comparison of the 2003 LPA to the Tillamook Branch Line alignment indicates that:

- The 2003 LPA in the area connecting Southeast Portland to Milwaukie has two sites ranked 5 and ten sites ranked 4
- The Tillamook Branch Line alignment has two sites ranked 5 and five sites ranked 4 for a comparable section

The two sites ranked 5 are common to both design options. Five additional sites ranked 4 are found with the 2003 LPA that will not be encountered by the Tillamook Branch Line alignment.

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\[11\] Personal communications with Chris Kaufman, Department of Environmental Quality Project Manager and Eric Roth, Parametrix Project Geologist. December 3, 2007.
3.13.2.3 Cumulative Impacts

The Light Rail Alternative or options are not expected to add to the number of hazardous materials sites along the corridor. Existing sites as well as currently unidentified sites, if any, would otherwise be subject to further measures to clean up or contain contaminated sites.

3.13.2.4 Mitigation

Long-Term Mitigation

Potential releases of hazardous substances and petroleum products occurring from an accident involving roadway transit would be mitigated by the applicable federal, state, or local response agency. Responses by the State of Oregon Fire Marshal would be under directive A-206, Issued April 15, 1994; Revised September 14, 2000. This directive is known as “Hazardous Waste Operations and Emergency Response: Responding to Hazardous Substance Releases.” Introducing buses in a new bridge over the Willamette River would have the potential to release hazardous substances. Maintenance vehicles in use on the bridge could also release hazardous substances. However, the new bridge would mitigate these potential releases through proper stormwater collection, management, and treatment. As such the new bridge would provide a benefit to water quality since a portion of transit would be shifted to the new bridge from existing bridges that have limited stormwater management.

Mitigation of stormwater impacts through upgrades or enhancements to the stormwater conveyance system would reduce or control stormwater runoff and infiltration. Therefore, these mitigation measures would reduce long-term effects of contamination migration from shallow soils to groundwater and/or surface water.

Construction Mitigation

Mitigation Before Construction

Mitigation plans for short-term impacts will be prepared prior to construction activities. The acquisition of properties containing hazardous materials or petroleum products results in legal and financial liability for the purchaser. To reduce the risk of liability, an Environmental Site Assessment would be completed at each site proposed for acquisition. This assessment, typically completed prior to property or easement acquisition, is part of the due diligence process and usually includes review of agency files and permits, site inspection, historic land use review, and interviews with tenants and owners.

If contamination is not discovered during Environmental Site Assessment activities but is discovered at a later date, the property owner may be afforded legal protection under the “innocent landowner defense” of the Comprehensive Environmental Response and Liability Information System (CERCLA). However, due diligence must be demonstrated. Impacts would be reduced by conducting due diligence activities prior to any property acquisition where liability for contamination is possible. For example, Federal Transit Administration (FTA) requires due diligence to reduce project costs and liabilities and to ensure that property appraisals are fully informed during the acquisition process (see FTA Circular 5010.1C, Chapter II. 2, October 1, 1998).

A survey for asbestos containing materials (ACMs) is required for all structures (buildings, bridges, etc.) to be demolished or modified. The survey must be conducted by a certified asbestos inspector. An asbestos abatement plan is required prior to asbestos removal and must be prepared by a licensed
abatement contractor. The abatement must be conducted by a licensed abatement contractor using workers trained in handling and disposal of asbestos.

A lead-based paint survey is required for all structures (bridges, houses, etc.) that will be leased as residences, burned, or demolished unless air quality monitoring is provided during construction and demolition activities. The project team would review structures proposed for removal to evaluate whether contamination is likely to be present. If contamination exists, the risk of release could be minimized through adherence to environmental performance standards like those developed by ODOT for the Oregon Transportation Improvement Act (OTIA) III Bridge program.

**Mitigation During Construction**

Direct impacts would be mitigated during construction activities. Mitigation actions will vary depending on site conditions, the nature and extent of contamination, the affected media, and potential receptors. A contaminated soil management plan will be developed as a mitigation tool to minimize exposure to construction and excavation workers and reduce the risk to human health and the environment. Due to the nature of contaminated sediments in the South Waterfront area of the Willamette River, an in-water management plan will be developed to minimize potential exposure to relevant receptors while setting piers or other structures.

The plans will be developed in conjunction with the appropriate regulatory agencies. The plans will provide emergency contact information and describe practices for safe working conditions, such as using personal protective equipment and monitoring for vapors in the breathing zone and for explosive conditions.

Site-specific plans will address management, storage, and disposal of hazardous substances and petroleum products. A supplemental management plan for groundwater will be developed if dewatering activities occur as part of below-grade construction.

In addition, certain hazardous materials will likely be used during construction, such as asphalt, fuel, raw concrete, striping paint, solvents, spray paint, landscaping chemicals, etc. The safe storage, use, and disposal of these products will be addressed in the contractor's pollution control plan, and BMPs will be followed to reduce the risk of spills or leaks of potentially hazardous materials.

**3.14 UTILITIES**

This section provides a review of potential long-term as well as short-term, temporary construction effects on utilities.

**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 and PacifiCorp. Communication providers in the project area include Qwest, Sprint, T-Mobile, Verizon, 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 area include City of Portland water; City of Portland 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; Northwest Natural Gas; and can include the electrical and communication providers listed above.

3.14.2 Environmental Consequences

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. This is 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 facilities and infrastructure impacts identified for this SDEIS 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 longitudinal or crossing. 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, as 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

No-Build Alternative

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.

Light Rail Alternative

The Light Rail Alternative 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) and the existing regional providers have adequate long-term capacity to meet regional needs with the addition of the light rail project.

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 above or below ground 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 above and below-ground facilities as anticipated for the Light Rail Alternative.

Light Rail Alternative

The various options being considered for the Light Rail Alternative would involve construction of an alignment that could conflict with existing utilities. The design for the Light Rail Alternative alignments and design options is still at a conceptual stage, and a detailed inventory of utilities would occur with preliminary engineering, after a Preferred Alternative is identified. 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. The 2003 LPA could potentially have longitudinal impacts to Portland sanitary and storm gravity mains located within SW Lincoln Street. The Porter-Caruthers and Meade-Caruthers options could have longitudinal impacts to Portland sanitary and storm gravity mains located within SE Caruthers Street. A sanitary gravity main runs along the UPRR between SE Division Place and SE 11th Avenue. Combined gravity mains cross the alignment at SE 11th, 12th, 14th, and 15th Avenues. A storm line crosses at SE 16th Avenue and SE Tibbetts Street. A combined sanitary and storm main that is located within SE 17th Avenue could have both a longitudinal impact and a crossing impact. There is a combined gravity main along SE McLoughlin Boulevard from SE 17th Avenue to SE Harold Street that could have a longitudinal impact. Crossing impacts are expected at the proposed Harold Station. There are combined sanitary storm mains crossing SE McLoughlin Boulevard between SE Insley and SE Ellis Streets. There are combined sanitary storm lines with potential longitudinal and crossing impacts at the proposed Bybee Station. There is a combined sanitary storm main crossing at the proposed Tacoma Station.

The Eastside Combined Sewer Overflow Tunnel (Big Pipe) project is currently under construction on the east side of Portland. A 22-foot-diameter tunnel is being constructed 120 to 150 feet underground. A general project location map available on the City of Portland website indicates that the rail alignment is in the vicinity of the Big Pipe where the OMSI Station is proposed for the Porter-Caruthers and Meade-Caruthers options and at SE 17th Avenue and SE McLoughlin Boulevard. The light rail project would attempt to avoid direct conflicts with the Big Pipe.

Aerial Electrical Utilities. There is an aerial electric distribution crossing at SW Harbor Drive. The available engineering drawings identify a high-tension electric transmission line that would be affected by the 2003 LPA, which would be grade-separated east of SE Water Avenue. There is an electric distribution line crossing near the SE Martin Luther King Jr. Boulevard viaduct that would affect the Light Rail Alternative and its options. Additionally, an electric distribution line is located along SE 17th Avenue that is a potential longitudinal impact for the 2003 LPA. An electric distribution line is located along SE Bybee Boulevard at the location of the Bybee Station.

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.

Underground Communication Facilities. Underground fiber optic cable located within the UPRR right-of-way may also be affected by the 2003 LPA.
**Portland Water.** There are Portland water lines located in SW Lincoln Street that affect the 2003 LPA. The available engineering drawings identify a 36-inch water line crossing on the Porter-Caruthers and Meade-Caruthers options. The City of Portland also has a water line located in SE 17th Avenue that is a potential longitudinal impact for the 2003 LPA; water pipes that are steel and in close proximity to the light rail alignment will require catholic protection.

**NW Natural Gas.** The available engineering drawings have identified NW Natural Gas crossings at SE 9th Avenue and at SE Clinton Street. At the current engineering stage, it is indicated that the gas line is to be protected at these locations. Additionally, a 12-⅜-inch and 20-inch crossing is identified on the Porter-Caruthers and Meade-Caruthers options; gas pipes that are steel and in close proximity to the light rail alignment will require catholic protection.

**City of Milwaukie**

**Sanitary and Storm Facilities.** There is potential for crossing impacts to the City of Milwaukie’s sanitary and storm system by all options. However, because the 2003 LPA and other alignments are mostly along an existing rail corridor that also crosses the city’s utilities; the impacts are expected to be minor. The 2003 LPA’s alignment does include sections along city streets south of the Tacoma Street station, and this section is more likely to involve conflicts with city utilities. The Tillamook Branch Line alignment would avoid more of these impacts because more of its length is within the UPRR right-of-way.

**Aerial Electrical Utilities.** There are aerial electric crossings at the Springwater Corridor and at SE Hanna-Harvester Drive that may be affected by the 2003 LPA. There are aerial electric distribution crossings at SE Harrison and SE Monroe Streets that have the potential of being affected by all options. A main electric transmission line is located along the west side of SE McLoughlin Boulevard and would be a longitudinal impact.

**Aerial Communication Facilities.** There is a potential conflict with one or more communication companies on any of the electrical distribution and transmission lines, both crossings and longitudinal, discussed above.

**Milwaukie Water.** There is a potential for crossing impacts to the City of Milwaukie’s water system by all options. The effects would be similar to those described above for sewer and stormwater utilities. Water pipes that are steel and located in close proximity to the light rail alignment will require catholic protection.

**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 2003 LPA to Park and Tillamook Branch Line alignment with extension to Park would construct the SE Park Avenue station and park and ride nearby. It is not anticipated that the pump station would be affected by either extension option, but the proximity of construction as well as potential conflicts with the pipe would require close coordination with the Oak Lodge Sanitary District.

**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.

For the 2003 LPA near SE 17th Avenue and for either of the two Willamette River crossing options with an OMSI station at SE Caruthers Street, TriMet would coordinate with the City of Portland to identify design measures to avoid conflicts with the Eastside Combined Sewer Overflow Project.

### 3.15 PUBLIC SERVICES

This section describes existing conditions and potential impacts 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 some areas outside of the city limits. PPB headquarters is located in downtown Portland with five precincts, which include Central, North, Northeast, Southeast and East. The 2003 LPA would travel within the Central and Southeast precincts. The Central precinct is at 1111 SW 2nd Avenue, approximately one-half mile north of the project corridor. The Southeast precinct is at 4735 E Burnside Street, approximately 3.5 miles east from the project corridor. The bureau’s Patrol District Map identifies SE 17th Avenue as a critical patrol and response route.

**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 30 stations within the City of Portland. Three stations serve areas near the proposed project:

- 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

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12 For information on TriMet security provided by local police bureaus, refer to the Safety and Security Results Report.
Figure 3.15-1

Public Services Locations in Project Area

- City Hall
- Police Department
- Fire Station
- Hospital
- Public School
- Post Office

- Project Area
- Light Rail alternative

Portland-Milwaukie Light Rail Project

Portland

Cleveland High

Hosford Middle

Grout Elementary

Duniway Elementary

Oak Grove Elementary

Llewellyn Elementary

Southeast Precinct

Winterhaven

Milwaukie High

Sellwood Middle

Milwaukie Elementary

Ardenwald Elementary

Abernethy Elementary/Environmental Middle

Central Precinct

Milwaukie Police Department

Clackamas Co. Fire Department

OHSU

Shriner's

Veterans Affairs

Doernbecher Children's Hospital

Multnomah Co. Offices

Clackamas Co. Offices

Lake Oswego
• 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

SE Martin Luther King Jr. Boulevard, SE Division, and SE 11th and 12th Avenues are major emergency response routes for Station 23. Within and near the project corridor, SE 17th 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. Station 10, as located on the west side of the Willamette River, uses SE Tacoma Street, and the Sellwood Bridge emergency routes.

**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 13 patrol districts that provide patrol, incarceration, civil process, and search and rescue services for approximately 1,893 square miles within Clackamas County. The Highway 99E patrol district, which covers the most southern 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 Clackamas County Sheriff’s Office include 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 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 16 fire stations strategically located throughout Clackamas County to cover a total service area of 193.14 square miles. All non-residential 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 west of the project corridor.
3.15.1.2 School Transportation

**Portland**

Portland Public Schools provides bus transportation for middle school students living 1.5 miles or more from the school and for elementary students living one mile or more from the school. 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 McLoughlin Boulevard, SE 17th Avenue, SE Milwaukie Avenue, SE Holgate Boulevard, and SE Tacoma Street. Portland Public Schools in the project area are listed in Table 3.15-1.

<table>
<thead>
<tr>
<th>Elementary Schools</th>
<th>Location</th>
<th>2006 Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abernethy Elementary School</td>
<td>2421 SE Orange Avenue, Portland</td>
<td>357</td>
</tr>
<tr>
<td>Winterhaven School (K-8)</td>
<td>3830 SE 14th Avenue, Portland</td>
<td>344</td>
</tr>
<tr>
<td>Grout Elementary School</td>
<td>3119 SE Holgate Boulevard, Portland</td>
<td>333</td>
</tr>
<tr>
<td>Llewellyn Elementary School</td>
<td>6301 SE 14th Avenue, Portland</td>
<td>309</td>
</tr>
<tr>
<td>Duniway Elementary School</td>
<td>7700 SE Reed College Place, Portland</td>
<td>446</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Middle Schools</th>
<th>Location</th>
<th>2006 Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosford Middle School</td>
<td>2303 SE 28th Place, Portland</td>
<td>476</td>
</tr>
<tr>
<td>Sellwood Middle School</td>
<td>8300 SE 15th Avenue, Portland</td>
<td>515</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Schools</th>
<th>Location</th>
<th>2006 Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleveland High School</td>
<td>3400 SE 26th Avenue, Portland</td>
<td>1472</td>
</tr>
</tbody>
</table>

**Milwaukie – North Clackamas County School District**

Milwaukie Public Schools provides bus transportation for high school and middle school age students living 1.5 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. Critical transportation time for the bus routes are between 7:00 and 8:00 A.M. in the morning and between 2:00 and 5:00 P.M. in the evening. Milwaukie public schools in the project area are listed in Table 3.15-2.
Table 3.15-2
Milwaukie Public Schools within the Portland-Milwaukie Project Area*

<table>
<thead>
<tr>
<th>Location</th>
<th>2006 Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ardenwald Elementary School 3606 SE Lake Road, Milwaukie</td>
<td>273</td>
</tr>
<tr>
<td>Milwaukie Elementary School 11250 SE 27th Avenue, Milwaukie</td>
<td>365</td>
</tr>
<tr>
<td>Oak Grove Elementary School 2150 SE Torbank Road, Milwaukie</td>
<td>580</td>
</tr>
<tr>
<td>Milwaukie High School 11300 SE 23rd Avenue, Milwaukie</td>
<td>1206</td>
</tr>
</tbody>
</table>

* 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. Johns 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

Three U.S. Postal Service (USPS) offices lie within the 2003 LPA. 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.

3.15.1.4 Solid Waste

Metro operates two recycling and garbage stations/transfer stations in the Portland metropolitan area. They are located at 616 NW 61st Avenue in northwest Portland and 2001 Washington Street in Oregon City. The recycling and garbage stations/transfer stations accept trash and recyclables from private citizens, businesses and commercial waste haulers.

3.15.1.5 Other Public Facilities

No other major public facilities were identified near the 2003 LPA alignment or that could otherwise be affected by the project.

3.15.2 Impact Assessment

3.15.2.1 Long-Term Impacts

No-Build Alternative

Population and employment growth are projected to increase through the year 2030. 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.
2003 Locally Preferred Alternative

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. TriMet’s Fire, Life, Safety committee is a systemwide program that resolve issues related to emergency response on MAX and includes member agencies in jurisdictions where TriMet operates. The committee also helps develop terms of agreements between TriMet and its partner agencies to address unique training, equipment, and other emergency response needs within the system.

Fire and Emergency Medical Services and Law Enforcement

City of Portland Police Bureau, Fire and Rescue

No Portland Police Bureau or Portland Fire and Rescue (PF&R) facilities would be relocated by construction of the 2003 LPA. Light rail would still allow movements along SE 17th Avenue, a critical response route, but there may be access restrictions placed on sidestreets and increased potential for delays. Southeast 11th and 12th Avenues have been identified as major emergency response routes for PF&R’s Station 23. Delays from gated crossings at the SE 11th and 12th Avenues and SE Milwaukie Avenue intersection could increase response times. The construction of a new bridge across the Willamette River will require a specific emergency response plan and routing and training for emergency services staff. Response plans would also be needed for sections of the 2003 LPA alignment that are along the UPRR right-of-way.

City of Milwaukie Police Department

No City of Milwaukie Police facilities would be relocated by the 2003 LPA and, after the project is complete, no facilities would be detrimentally affected. The 2003 LPA does not involve major modifications to police response routes, and response times are not expected to be affected.

Clackamas County Fire District #1

No Clackamas County Fire District #1 facilities would be relocated for the 2003 LPA and, after the project is complete, none would be detrimentally affected. The 2003 LPA does not involve major modifications to the fire district response routes, and response times are not expected to be appreciably affected compared to No-Build Alternative. However, traffic congestion with both the No-Build Alternative and 2003 LPA would increase, which could slow response times. The 2003 LPA includes additional controls that affect grade crossings at several streets including SE Harrison, SE Monroe and SE Washington Streets, although these streets are currently crossed by the existing railroad.

School Transportation

The 2003 LPA 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 routes 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 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.

**Willamette River Crossing Options**

The Willamette River Crossing options do not affect fire and emergency services, school
transportation providers, USPS, solid waste disposal, or other public facilities and is no different
from the 2003 LPA.

**Tillamook Branch Line Alignment**

The Tillamook Branch Line alignment would avoid the 2003 LPA’s at-grade street crossings and
other circulation and congestion effects in the Milwaukie Industrial Area. As it extends to SE Park
Avenue, One secondary access road would be closed to all vehicles, and access from SE 26th Avenue
and SE Sparrow Street would be closed to SE McLoughlin Boulevard, with traffic rerouted to signal-
controlled intersections. These changes are not expected to appreciably alter public service access
routes or response times. The development of a terminus and park and ride at SE Park Avenue could
increase activity levels in the area, and could increase the need for public services or emergency
response in that location.

**2003 LPA with Extension to SE Park Avenue**

The effects of the 2003 LPA to Park would be similar to the 2003 LPA, except that the corridor
would extend farther south. One secondary access road would be closed to all vehicles, and access
from SE 26th Avenue and SE Sparrow Street would be closed to SE McLoughlin Boulevard, with traffic rerouted to signal-controlled intersections. These improvements are not expected to appreciably alter public service access routes or response times. The 2003 LPA to Park would not require the removal or relocation of public service buildings or related facilities.

There is an option for an at-grade crossing of SE McLoughlin Boulevard at the Bluebird Station,
which would add a signalized intersection and increase travel times on SE McLoughlin Boulevard.
This could increase emergency response times compared to the No-Build Alternative or an elevated
option.

SE Park Avenue is a major bus route for Oak Grove Elementary School. Buses cross
SE McLoughlin Boulevard in the morning to pick up students and in the afternoon to take students
home. The addition of a station and park and ride would increase traffic in this location, but the
project would also improve signalized intersections in the area to accommodate traffic to and from
the park and ride and station. The development of a terminus and park and ride at SE Park Avenue
could also increase activity levels in the area, and could increase the need for public services or
emergency response in that location.
**Maintenance Base**

The expansion of the TriMet Ruby Junction Operations Facility in Gresham is not expected to affect the provision of any public services or utilities.

**3.15.2.2 Short-Term Impacts (Construction)**

**No-Build Alternative**

There would be no construction impacts with the No-Build Alternative.

**2003 Locally Preferred Alternative**

**Fire and Emergency Medical Services and Law Enforcement**

**City of Portland Police Bureau, Fire and Rescue**

During construction of the 2003 LPA and options, 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 alternate 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 2003 LPA, the Tillamook Branch Line, and the 2003 LPA to Park, there would be construction-related street or lane closures that could affect patrol and response routes. However, 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 and SE Main Streets. Closures and delays may require alternate 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.

**Willamette River Crossing Options**

These options would have similar effects to the 2003 LPA.

**Tillamook Branch Line Alignment**

The Tillamook Branch Line alignment would avoid construction on streets in the North Milwaukie Industrial Area, compared to the 2003 LPA. Effects in downtown Milwaukie would be similar to the 2003 LPA, up to the Lake Road Station. The extension to SE Park Avenue would involve construction of an at-grade or elevated crossing on SE McLoughlin Boulevard and at SE Park Avenue, primary routes for many public service providers. Several side streets to SE McLoughlin Boulevard would also be restricted or modified.

**2003 LPA Extension to Park**

The 2003 LPA to Park would have the same effects as the 2003 LPA through downtown Milwaukie. From SE Lake Road to SE Park Avenue, the effects would be the same as the Tillamook Branch Alignment.

**3.15.2.3 Cumulative Impacts**

Cumulative impacts to fire and emergency services, school transportation providers, USPS, solid waste disposal, or other public facilities would consist of the effects of the Light Rail Alternative with the general increases in demand caused by continued growth in population and employment in the region.

**3.15.3 Mitigation Measures**

Assuming coordination with public service providers during design, no long-term impacts to public services are anticipated and no mitigation is anticipated.

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 should work closely with the police departments, fire and rescue, schools, USPS, and solid waste management companies to identify the construction practices that would best minimize those impacts. For example, by partnering with the USPS, TriMet could ensure access to mailboxes either by temporarily relocating boxes and/or providing safe pedestrian access.
3.16 SAFETY AND SECURITY

This section describes the safety and security conditions in the project area and evaluates potential effects of the Portland-Milwaukie Light Rail Alternative. The SDEIS also has a related section, 3.14 Public Services, which evaluates effects on a variety of service providers and facilities, including fire, police, emergency medical services, and hospitals. Section 3.14 focuses on potential impacts to the provision of services, including possible impacts to emergency response routes. This section focuses on public safety considerations for the communities to be served by the light rail project and also discusses safety and security factors for the light rail facilities.

3.16.1 Affected Environment

Figure 3.14-1 in the Public Services section shows fire, emergency services, law enforcement, and other public service providers found in the project area.

3.16.1.1 Law Enforcement, Fire and Emergency Medical Services

City of Portland Police Bureau

Portland Police Bureau (PPB) provides law enforcement services from police headquarters in downtown Portland in five precincts: Central, North, Northeast, Southeast, and East. The Portland-Milwaukie Light Rail Project will be located within the Central and Southeast Precincts. Central Precinct covers 32.4 square miles with an estimated residential population of 99,174 as of 2000. The Southeast Precinct covers 22.3 square miles with an estimated residential population of 145,436 as of 2000.

City of Portland Fire and Rescue

Portland Fire and Rescue (PF&R) is Oregon’s largest fire and emergency provider. PF&R has 30 stations, three of which serve areas adjacent to the proposed light rail alignment: Station 4 (Portland State University) serves downtown Portland and the South Portland (formerly Corbett-Terwilliger-Lair Hill and Homestead neighborhoods); Station 23 (Lower Eastside) serves the Hosford-Abernethy and Brooklyn neighborhoods; and Station 20 (Sellwood/Moreland) serves Sellwood-Moreland, Ardenwald and Eastmoreland neighborhoods. 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, back-up 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 is in the Milwaukie Public Safety Building at 3200 SE Harrison Street, approximately one-third mile west of the project corridor.

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 and emergency back-up for city police officers and specialized units. The 99E patrol district covers the most southern end of the project area and 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. Areas within the project area that are within the 99E patrol district include the Oak Grove and Oak Lodge neighborhoods. Patrol deputies are dispatched out of the North Station (12800 SE 82nd Avenue in Clackamas) and also use the Oak Lodge substation (2930 SE Oak Grove Road in Milwaukie), which serves the areas adjacent to the proposed terminus of the light rail alignment. Clackamas County Sheriff’s Office is currently operating with the same number of sworn deputies that it had in 1991.

**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 area. Milwaukie Fire Station is in the Milwaukie Public Safety Building at 3200 SE Harrison Street, approximately one-third mile west of the project corridor.

**3.16.1.2 Safety Statistics by Neighborhood**

TriMet’s service district covers 575 square miles in the urban portions of the Tri-County area. TriMet's 44-mile light rail system and 93 bus lines provide about 310,000 rides each weekday. On average about three incidents are reported per day for the entire transit system. Generally, these are non-weapon and non-violent incidents. During fiscal years 2006 and 2007, approximately 30 crimes were reported for the Interstate MAX Yellow Line.

**City of Portland and City of Milwaukie**

Table 3.16-1 shows City of Portland, City of Milwaukie and Clackamas County crime statistics for the neighborhoods affected by the proposed Light Rail Alternative. For comparison purposes, the multiple crime categories were collapsed into three categories: serious crimes, property crimes, and misdemeanors.

<table>
<thead>
<tr>
<th>Table 3.16-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Crimes in Portland and Milwaukie, January–June 2007</td>
</tr>
<tr>
<td>Serious Crimes</td>
</tr>
<tr>
<td>Portland</td>
</tr>
<tr>
<td>Downtown</td>
</tr>
<tr>
<td>Hosford-Abernethy</td>
</tr>
<tr>
<td>Brooklyn</td>
</tr>
<tr>
<td>Sellwood-Moreland</td>
</tr>
</tbody>
</table>

13 For the City of Portland, serious crimes include murder, sexual assault, molestation, robbery, and aggravated assault. Property crimes include residential burglary, non-residential burglary, arson, 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, weapons laws, drug laws, liquor laws, disorderly conduct, trespass/threats, curfew and runaway. Forgery/counterfeit and fraud were not included in the analysis.
<table>
<thead>
<tr>
<th></th>
<th>Serious Crimes</th>
<th>Property Crimes</th>
<th>Misdemeanors</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastmoreland</td>
<td>6</td>
<td>237</td>
<td>71</td>
<td>314</td>
</tr>
<tr>
<td>Ardenwald</td>
<td>5</td>
<td>37</td>
<td>4</td>
<td>46</td>
</tr>
<tr>
<td>Milwaukie</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ardenwald¹</td>
<td>4</td>
<td>57</td>
<td>36</td>
<td>97</td>
</tr>
<tr>
<td>McLoughlin Industrial</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Historic Milwaukie</td>
<td>1</td>
<td>12</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Island Station</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Clackamas County</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99E Patrol District (larger area including Oak Grove and Oak Lodge)</td>
<td>332</td>
<td>1,491</td>
<td>232</td>
<td>2,055</td>
</tr>
</tbody>
</table>


¹A portion of the Ardenwald neighborhood is within the City of Portland and 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. Other than downtown Portland, few serious crimes are reported for all neighborhoods. However, somewhat higher levels of property crimes and misdemeanors are shown in the Hosford-Abernethy and Sellwood-Moreland neighborhoods, compared to other neighborhoods along the project corridor, although these are not reported per capita. Property crimes and misdemeanors reported near the Ardenwald neighborhood make up the majority of total crimes within the City of Milwaukie. There are relatively few property crimes in the Historic Milwaukie neighborhood and a minimal number of crimes reported in the Island Station neighborhood.

Clackamas County crime statistics are reported at the patrol district level and are not available at the neighborhood level, so comparisons to other neighborhood crime levels along the corridor are not appropriate. Property crimes make up over 70 percent of the total crime for the three categories of reported crime in the 99E Side patrol district. The most frequently occurring crime types in the 99E patrol district which includes the Oak Grove and Oak Lodge neighborhoods are (in order of frequency): theft, criminal mischief, burglary, stolen vehicle, identify theft, and assault.

### 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, including:

- Isolation of transit stations and passengers on light rail trains
- Crime along the light rail corridor, including increased incidence of crime
- Livability concerns with drunkenness, loud verbal assaults, nuisance behavior
- Unavailability of local jurisdictions to respond to 9-1-1 calls for assistance because of inadequate staffing caused by the increased population density
- Lighting at transit stations and at park and ride lots
- Vehicular, pedestrian and bike crossings of the light rail alignment
• School children interaction with light rail trains and light rail alignment
• Gated crossings along light rail alignment
• Light rail transit station placement and access
• Vandalism and graffiti of property, especially at proposed light rail stations
• Homeless individuals’ presence and the public’s perception of safety near parks, trails, and segments of Johnson Creek within vicinity of a proposed station
• Car and bike prowls or theft near transit station locations

3.16.2.1 Long-Term Impacts

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\textsuperscript{14}. Light rail stations are places that attract people and can be a place where incidents occur. Similarly, vehicles at a park and ride can be a potential target for vandalism and theft.

TriMet considers safety and security management as 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 Portland Police Bureau and is made up of contracted law enforcement officers from other police agencies in the region. To provide more focused deployment and presence, Eastside and Westside precincts have just been established with offices in Hillsboro and Gresham. The TPD is currently being increased from 36 to 41 sworn officers and will increase by another 10 percent with the opening of the I-205/Portland Mall MAX Light Rail Project. 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

\textsuperscript{14} Numerous reports have been written and studies conducted across the U.S. 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 al 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, Loukaitou-Sideris, A, and Isek, H 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).
issues and collaborate on solutions. With the proposed opening of two light rail lines in Clackamas County in upcoming years, a south police precinct is also likely.

Security improvements and crime reduction can be greatly affected by system design and maintenance, technology, community outreach, and enforcement. While enforcement is critical, a 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.** A concept that keeps 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, the presence of passersby, transit personnel, and other riders waiting for transit or on transit all contribute to “the number of eyes,” helping to reduce the potential for safety concerns.

- **Territorial Reinforcement.** A concept that promotes a sense of ownership among users and 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.** A concept that 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.** Concerns features that manage entry and access, and includes closed circuit television (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.
No-Build Alternative

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 byproduct of growth and is likely to increase congestion on roadways, which has the potential to slow emergency response times, as discussed in more detail in Section 3.14. 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.

2003 Locally Preferred Alternative

As stated above, households and employment growth are forecast to be the same under both the Light Rail and No-Build Alternatives. As with No-Build, 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 No-Build, which is likely to increase congestion on roadways and slow emergency response times, as discussed in more detail in Chapter 4, Transportation, and Section 3.14, Public Services.

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 systems development and operation.

In general, the majority of crimes that occurred during in 2006 to 2007 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. There were somewhat higher numbers of crimes committed in the statistical areas that encompass the proposed sites for the Lincoln, RiverPlace, OMSI, Clinton and Rhine Stations. The proposed Holgate, Harold and Bybee Stations, as well as the Tacoma Station and Park and Ride, are located in or adjacent to neighborhoods with relatively few crimes committed.

The Lincoln and RiverPlace stations would be street-oriented stations in areas that currently have dense mixed-use environments, with residential and commercial uses nearby and high levels of activity. No unique concerns are anticipated.

A new bridge crossing of the Willamette River, with or without buses, would also have a pedestrian and bike trail. The bridge would be designed to allow for effective emergency detection and response. To respond to safety and/or security emergencies on the bridge, TriMet will work cooperatively with the City of Portland to develop and conduct emergency response plans.

The OMSI Station would be at street level, with streetcars and bus stops nearby. There would also be a new trail connection to the existing Willamette River Greenway Trail and the Springwater Trail. Overall activity levels would be higher than today, which is expected to improve visibility and reduce the potential for crime during evening off-peak hours, when the area currently is less active.
The Clinton, Rhine and Holgate Stations are located on currently active transit routes and would all be street-oriented stations. The lighting and amenities at stations, taken with the higher activity levels that accompany light rail, would be an improvement over existing transit stops in these areas, and no unique concerns are anticipated.

The optional Harold Station and the Bybee Station are surrounded by neighborhoods that currently have lower incidents of crime. Each of the station sites is somewhat removed from adjacent neighborhoods, which reduces natural surveillance opportunities from surrounding uses. The Harold Station would be more visible to travelers on SE McLoughlin Boulevard, compared to the Bybee Station, but design and operating measures are available for either station to provide patrons with well-lit and visible station areas and accessways.

The Tacoma Street Station and Park and Ride and the Milwaukie Station and Park and Ride would be located in areas that currently are largely industrial, although residential areas are located to the east. While SE McLoughlin Boulevard and SE Tacoma Street are active roadways, activity levels in the surrounding area for the Tacoma Station are relatively low outside of daytime hours. The Milwaukie Station is more central to the industrial area, with higher activity levels during the daytime, but lower levels at night. As with other park and ride stations in the MAX system, the stations and park and rides would be designed to maximize visibility, provide for safe and convenient access for patrons, and reduce potential property loss or damage to parked vehicles. Other potential measures could include access controls, the use of CCTV, and frequent security patrols.

The proposed Harrison Station and the Lake Station and Park and Ride would be located in a downtown Milwaukie neighborhood with a relatively low incidence of crime. Both of the stations would be located adjacent to existing streets and are in areas that afford good visibility from SE Harrison Street. Both stations would be sited along an existing and active rail corridor with nearby schools, and both would feature gated crossings of existing streets and sidewalks. The stations and the gated crossings for light rail would incorporate a combination of design, education and operating measures to minimize potential safety concerns to students and others who may access light rail or cross the corridor. This includes outreach and education programs targeted directly to students and community members to help them better understand light rail operations and safety issues.

While somewhat higher levels of transit use are anticipated in downtown Milwaukie relative to existing or future No-Build conditions, the populations served would be similar. The presence of light rail stations would increase overall activity levels on streets and public areas leading to the proposed light rail stations at SE Harrison Street and SE Lake Road. Potential for trespass would be discouraged with signage, landscaping or other measures at access points to or from the light rail station. Station access would be oriented to existing streets and sidewalks and all grade crossings will be gated and clearly designated. The station and the light rail alignment would also feature physical barriers to prevent patrons from crossing directly across the tracks from the station or onto school grounds, and these barriers would also prevent children from crossing onto the tracks from the school grounds.

The Lake Road Station and Park and Ride would be in area that is highly visible and is accessible by existing streets. No unique public safety considerations are anticipated.
For downtown Milwaukie overall, the more frequent service levels provided by light rail are also expected to reduce waiting times for patrons, compared to the existing transit center, which has the potential to reduce real or perceived opportunities for loitering or nuisance behavior.

**Willamette River Crossing Options**

The Willamette River crossing options would not likely have appreciably different effects on safety and security compared to the 2003 LPA bridge crossing. However, the South Waterfront station options would be sited in an area that is not yet developed, and it is assumed that planning for surrounding developments and infrastructure would be coordinated to maximize opportunities to provide for safe, visible and accessible stations and for safe light rail crossings of future streets.

**2003 Locally Preferred Alternative (LPA) with Extension to Park**

The 2003 LPA to Park would provide a Washington Street Station instead of the 2003 LPA’s Harrison Street and Lake Road Stations. This would result in lower ridership levels overall in downtown Milwaukie. Other considerations, including gated crossings for pedestrians, vehicles and bicyclists, similar to those provided with the 2003 LPA.

The proposed Bluebird Station would be located along SE McLoughlin Boulevard while the Park Avenue Station and Park and Ride would be located near the Oak Lodge neighborhood in unincorporated Clackamas County, south of downtown Milwaukie. The stations would be sited in areas visible from nearby streets and surrounding businesses and/or residences. However, an elevated Bluebird Station would be less visible to passersby on SE McLoughlin Boulevard than an at-grade station. Final design would address access and emergency response. The Park Avenue Station and Park and Ride would be designed similar to other park and ride stations in the MAX system, incorporating TriMet’s best practice measures to maximize visibility, provide safe and convenient access for patrons, and reduce potential property loss or damage to parked vehicles.

**Tillamook Branch Line Alignment**

The Tillamook Branch Line Alignment would have a Tacoma Station with a different site layout and higher park and ride capacity than the 2003 LPA Tacoma Station, but overall safety and security conditions would be similar. The Tacoma Station platform for the Tillamook Branch Line Alignment would be located farther from existing streets, particularly SE McLoughlin Boulevard, making it less visible to passersby. Although less visible, the larger park and ride would increase overall activity levels in the parking areas and on the platform and the higher numbers of people would support natural surveillance. The station would employ the same design and security measures as the 2003 LPA.

The Tillamook Branch Alignment would not feature a Milwaukie Station or park and ride, and it would feature a Monroe Street Station rather than a Harrison Street Station. The Monroe Station would be similar to the Harrison Station but would be more central to the commercial core of downtown Milwaukie. As with the Harrison Station, the station and the light rail alignment would feature physical barriers to prevent patrons from crossing directly across the tracks from the station or onto school grounds, and station access would be oriented to existing streets and sidewalks.

The Tillamook Branch Line alignment would have a Lake Road Station and Park and Ride, the same as the 2003 LPA. As it extends south, it would differ from the 2003 LPA to Park because it would
not have a Bluebird Station, but it would have a Park Avenue Station with the same safety and security considerations as discussed for the 2003 LPA to Park.

**Maintenance Base**

The Light Rail Alternative would require expansion of the existing Ruby Junction maintenance 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.

**3.16.2.2 Short-Term Impacts (Construction)**

**No-Build Alternative**

There would be no construction impacts with the No-Build Alternative.

**2003 Locally Preferred Alternative**

Short-term construction impacts related to the Portland-Milwaukie Light Rail Project will be addressed by TriMet’s Safety Engineer and Risk Manager using construction, contractor, and safety management plans written specifically for this project. Fences and barriers will secure construction areas from public access and signage will redirect vehicles, bicycles, and pedestrians as needed. Persons with disabilities will be provided for as well.

**3.16.2.3 Secondary and Cumulative Impacts**

Secondary impacts are reasonably foreseeable effects that occur as a result of an action or not doing an action, but which are removed from the direct impacts of a project in place or time.

Cumulative impacts are the sum of effects from past, current and other expected improvements or public actions. Light rail projects typically encourage nearby development. The current light rail alignments have generated more than $6 billion of investment with more than $1.5 billion in public and private funds occurring in developments along the Downtown Transit Mall. If station areas experience redevelopment, the uses would typically be denser and involve higher levels of activity, but no major changes in crime rates would be expected.

**3.16.3 Mitigation Measures**

The potential mitigation measures are based on TriMet’s existing programs and its responses to ongoing safety and security issues throughout the MAX system. These measures also reflect public concerns and questions regarding safety issues related to specific conditions affecting the Portland-Milwaukie Light Rail Project Alternative and options. The public involvement program for the project has featured a Safety and Security Task Force, which met regularly during the development of the SDEIS and provided feedback on:

- Design principles to enhance safety and security at station areas.
- A report documenting community input about stations in each segment, and overall alignment issues and operations as they relate to safety and security.
- Elements for outreach and education strategy for safety and security.
The task force developed suggestions for the project, which are attached as Appendix J and recommended actions for addressing specific safety issues during the development of the light rail project:

- Use CPTED principles, which are the industry’s accepted strategies to promote safety and security, throughout the design process.
- Work with the Union Pacific Railroad to ensure that standards for safe operations in shared corridors are met.
- Include a multidisciplinary review of safety and security practices and design during SDEIS.
- Install CCTV cameras at all stations.
- Use quad gates to prevent vehicles from “running” the gates.
- Include better way-finding at platforms to help pedestrians find bus connections and other destinations.
- Place ticket machines away from platforms, so anyone on the platform will already have purchased a ticket.
- If stations are not access-restricted, clearly delineate platform area and communicate that only paying customers are allowed in the platform area.

Except for the use of quad gates at crossings, the Task Force mitigation suggestions for consideration in the SDEIS are addressed in TriMet’s current practices and policies for security along the existing system. TriMet is committed to making continued improvements to help maintain a safe and effective transit system. Other suggestions will be considered during the FEIS and design and construction or as a systemwide change.

Mitigation measures were also shaped by comments and suggestions from the other jurisdictions and by the project’s Citizen and Technical Advisory Committees and the Steering Committee.

The project team also held two community workshops in Southeast Portland focused on station area attributes and characteristics. Residents and stakeholders suggested the following mitigation measures to address safety and security:

- Provide good lighting in station areas and at park and rides.
- Consider using an underpass to route bikes and pedestrians under railroad tracks.
- Add lighting on SE Powell Boulevard pedestrian bridges, along the trail beside the Willamette River Bridge, and at the street level on SE 17th Avenue.
- Attract businesses such as coffee shops and news stands on the platforms to enhance security by providing “eyes” on station activities.

Station area meetings in Milwaukie and Oak Grove in March 2008 have also garnered similar information for the south end of the alignment.

As the project continues through a Final EIS and into final design, TriMet will continue 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 Final EIS and preliminary engineering efforts, TriMet will form a Project Safety and Security Committee comprising internal operations staff, staff from local jurisdictions, project design staff, and maintenance staff. The committee will be charged with ensuring that CPTED principles and lessons from past projects are being applied to the project. The committee will help to further refine the mitigation commitments for the Preferred Alternative in the Final EIS.

• 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 comprised of police, firemen, 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 otherwise. The staffing levels, hours, routes and locations for security personnel are continuously monitored by TriMet and its partners to help address emerging concerns throughout the light rail system.
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