TROLLEY TRAIL MASTER PLAN

MILWAUKIE TO GLADSTONE, OREGON

January 2004

NORTH CLACKAMAS PARKS & RECREATION DISTRICT

METRO
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ACKNOWLEDGEMENTS

North Clackamas Parks and Recreation District (NCPRD)

Charles Ciecko, Director
Michelle Healy, Planner
Krista Hornaday, Planning Intern

Metro Regional Parks and Greenspaces Department

Jim Desmond, Director
Jane Hart, Project Manager
Mel Huie, Regional Trails Coordinator
Joel Morton, Senior Assistant Attorney
Heather Nelson Kent, Planning and Education Division Manager
April Olbrich, Senior Legal Assistant

City of Milwaukie

John Gessner, Planning Director
JoAnn Herrigel, Program Administrator

Trolley Trail Working Group

Todd Anslow - Gladstone Vision Group
Margaret Branson - 40-Mile Loop Land Trust
Karen Buehrig - Clackamas County Bike & Pedestrian Coordinator
Wade Byers - Mayor, Gladstone
Jim Edwards - North Clackamas Chamber of Commerce
Peter Gibbs - NCPRD Advisory Board
Thelma Haggenmiller - Friends of the Trolley Trail
Mart Hughes - Milwaukie Parks Advisory Board
Ann Irish - Resident of Rose Villa Retirement Home
Dick Jones - Oak Lodge Community Council
Deputy Sheriff Mark Koberstein - Clackamas County Sheriff's Office
Sylvia Milne - Metro Parks Advisory Committee
Walt Mintkeski - Oak Lodge Sanitary District
Al Sheakley - Business Owner

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Prepared for:

North Clackamas Parks and Recreation District
Metro Regional Parks and Greenspaces Department

Prepared by:

Alta Planning + Design
George Hudson, Principal
Mia Birk, Principal
Arif Khan, Senior Planner
Brian Hannegan, Designer
Daniel Lerch, Assistant Planner
Allison Wildman, Assistant Planner

In Association With:

The JD White Company
Kent Snyder, Natural Resources Manager

Adolphson Associates
Sarah Hartung

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Metro Regional Parks & Greenspaces Department
600 NE Grand Ave.
Portland, Oregon 97232
(503) 797-1700
www.metro-region.org

North Clackamas Parks & Recreation District
11022 SE 37th Avenue
Milwaukie, Oregon 97222
(503) 794-8002
www.co.clackamas.or.us/ncprd

Alta Planning + Design
144 NE 28th Avenue
Portland, Oregon 97232
(503) 230-9862
www.altaplanning.com

For more information or copies of this report, contact:
Jane Hart, Project Manager, (503) 797- 1585, hartj@metro.dst.or.us

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Executive Summary

The proposed Trolley Trail will run along a historic corridor once used by a streetcar line that operated between Portland and Oregon City. When rail service ended in 1968, the idea of turning the corridor into a recreational trail was initiated by a group of local citizens. Through continued efforts by local and regional trail advocates and public agencies, conversion of the rail line to a multi-use recreational trail is moving from a dream to a reality.

In 2001, North Clackamas Parks and Recreation District (NCPRD) and Metro acquired a 6-mile stretch of the historic rail corridor between downtown Milwaukie and Gladstone. The trail connects with existing bike lanes in Milwaukie and Gladstone and will complete an essential link in Metro's Regional Trail System. When completed, the Trolley Trail and connecting trails will create a continuous 20-mile loop connecting Portland, Milwaukie, Gladstone, Oregon City and Gresham.

The Trolley Trail master planning process benefited from the involvement of many citizen, community and agency partners. Over 15 groups and agencies lent their support and services including the Cities of Milwaukie, Gladstone and Oregon City, Clackamas County (Planning, Transportation, and Sheriff's Office), and Oak Lodge Sanitary and Water Districts. Community partners included the citizen-based Friends of the Trolley Trail, and various neighborhood associations and civic clubs.

An independent Trolley Trail Working Group, project stakeholders and the public were involved early and continuously throughout the master planning process and helped shape the Trolley Trail goals, trail alignment and final recommendations for trail design, development and operation.

The master plan analyzes and recommends a trail alignment, environmentally-sensitive trail design features, trail amenities and safety and security measures for the 6-mile trail corridor. The purpose of the master plan is to guide the future development and safe use and operation of the Trolley Trail as a non-motorized recreational and commuter trail. The master plan will also be a useful tool when applying for grants to implement the phased construction of the Trolley Trail.

Trail Alignment and Design Features

- The trail alignment will follow the acquired right-of-way of the historic trolley line.
- A 12-foot-wide (optimum width) trail with an asphalt or concrete surface and soft shoulders will accommodate a wide variety of non-motorized uses including pedestrian, recreational and commuting bicyclists, horses, wheelchairs, in-line skaters and others. In constricted areas, the trail may need to narrow to 10 feet wide.
- Environmentally-sensitive design will respect wetlands, improve drainage, use native plants and enhance degraded natural resources.

- Development of five potential trailheads and 25 pedestrian access points from neighborhood roads will provide good access for local and region-wide trail users.
- The trail will provide connections to community facilities including parks, schools, retirement communities and public transit.
- Intersection improvements will ensure safe trail crossings at existing roads.
- Directional and regulatory signage will help orient trail users and inform them about trail etiquette.
- Interpretive signage will feature the rich cultural and natural history of the Trolley Trail.
- Public art projects will involve the public and area artists.
- Safety and security features include lighting and good definition between the trail and adjacent neighbors (i.e. vegetative buffers).
- Trail amenities will include benches, restrooms and garbage cans.
- Design features will maximize the trail's aesthetic and functional qualities.
- Community involvement in crime prevention will be encouraged through a Trail Watch program.
- Volunteer events and community trail projects will involve citizens in long-term trail maintenance activities.

Project Implementation

Trolley Trail construction is proposed in four phases. NCPRD applied for and has been awarded federal funding to conduct the preliminary engineering work for the entire trail and construction of the first phase (Jefferson Street south to Courtney Road). The funds are expected to be available in 2004/2005 at the earliest.

Successful implementation of the first phase will set the stage for future funding. It is hoped that the majority of the funding for implementation will come from a federal transportation program but there are several state funding sources which should be pursued, as well as the potential for local or regional funding.

NCPRD will work in close coordination with project partners who are planning capital improvement projects in or near the Trolley Trail right-of-way to make the most of any opportunity to reduce or share project implementation costs.

I. Introduction

Project Background

The idea of developing a trail within the Portland Traction Company's historic streetcar line right-of-way has been kept alive for decades by the communities along the rail corridor. In 1969, one year after freight rail service was abandoned, a campaign called "Save the Interurban Right-of-Way" was initiated to convert the rail corridor into a temporary recreational trail. Since that time, portions of the corridor have been used as unimproved footpaths by local residents and children.

Throughout the 1990's the rail corridor was identified as a regional trail route in a number of planning and policy documents including North Clackamas Parks and Recreation District's (NCPRD) Master Plan, The Metropolitan Greenspaces Master Plan, Metro's 2040 Growth Concept, Metro's Regional Transportation Plan, Clackamas County's Pedestrian and Bike Plan and the City of Milwaukie's Comprehensive Plan. A detailed timeline of Trolley Trail planning efforts leading up to the master planning work can be found in Appendix B.

In 2001, NCPRD and Metro acquired a 6-mile stretch of the historic trolley corridor between Milwaukie and Gladstone. The acquisition was made possible with funds from NCPRD's "local share" portion of Metro's Open Spaces Bond Measure, which was approved by the region's voters in May 1995.

WET RUN — Joggers braved heavy rains at times Sunday between Gladstone and Milwaukie to promote conversion of the old Portland Traction Co.'s route into a bike and pedestrian path. The run was sponsored by the Oak Lodge and Jennings Lodge community councils, which hope to obtain state funding for the 6-mile project.

STEVE NEHL/Oregon Journal

Citizens have campaigned for the Trolley Trail for decades in a variety of ways, including this jogging event in the 1970s.

Location

The acquired right-of-way extends from the Jefferson Street Boat Ramp in the City of Milwaukie, through unincorporated Clackamas County, to SE Glen Echo Avenue in Gladstone (see Figure 1, Vicinity Map). The right-of-way is approximately 40 feet wide and 6 miles long The right-of-way is located west of SE McLoughlin Boulevard for the majority of its length, and crosses to the east of SE McLoughlin Boulevard at SE Jennings Avenue. The Portland General Electric Company's power lines are located within the right-of-way for its entire length and provide a visual reference point for the approximate location of the corridor. The right-of-way connects with portions of trails already built in Milwaukie and Gladstone.

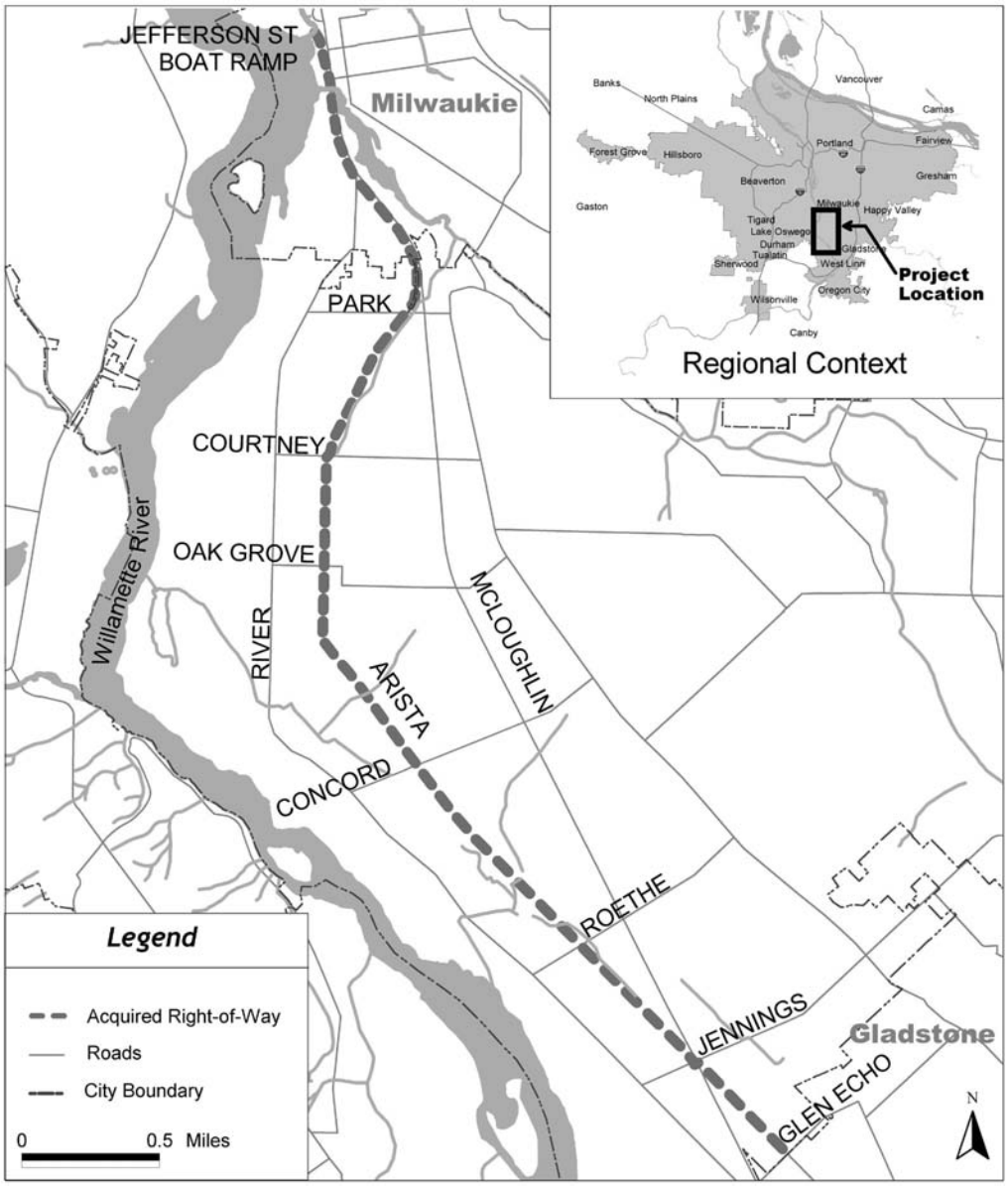


Figure 1. Vicinity Map

Project Significance

The development of this corridor into a multi-use trail has both local and regional significance. The Trolley Trail will renew historic connections between the town centers of Milwaukie and Gladstone and the neighborhoods in-between. The Trolley Trail will also complete a missing link in the regional system of trails and greenways, by connecting the Springwater Corridor trail in the north to the I-205 bicycle and pedestrian pathway to the south (see Figure 2, Regional Trail System). The Trolley Trail and connecting trails, when complete, will create a continuous 20-mile loop connecting Portland, Milwaukie, Gladstone, Oregon City and Gresham.

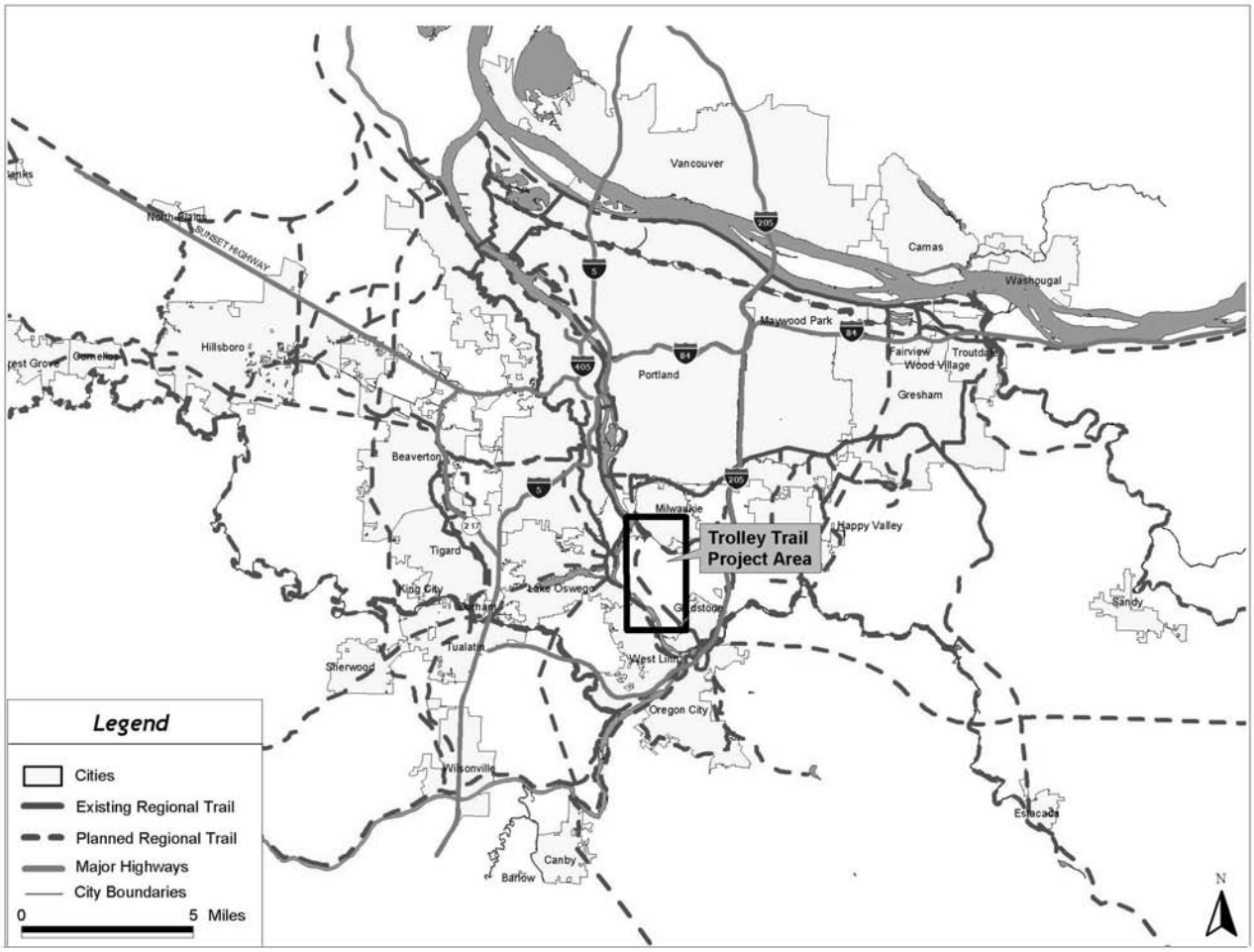


Figure 2. Regional Trails Map

Project Approach

In the summer of 2002, NCPRD in partnership with Metro, retained Alta Planning + Design to prepare the Trolley Trail Master Plan. A cornerstone of the project approach was to promote positive partnerships between all project partners and stakeholders involved during the master planning process. Over 15 groups and agencies lent their support and services to the project.

The master planning work involved the following tasks:

- Establishment of a 19-person Trolley Trail Working Group to provide ongoing independent review during the master planning process
- Stakeholder interviews
- Identification of project goals
- Extensive documentation of existing conditions in the project area
- Opportunities and constraints analysis for the alignment, design, development, operation and maintenance of the proposed Trolley Trail
- Safety and security audit of the Trolley Trail corridor
- Public review of trail alignment options and trail design features. Input was received from the Trolley Trail Working Group, adjacent landowners to the trolley trail, agency stakeholders, community organizations and interested citizens at three public open houses
- Preparation of detailed cost estimates and trail implementation plan
- Preparation of a Federal grant application for implementation funding
- Completion of a Public Review Draft

While the master planning work was underway, a property boundary survey was initiated to delineate the exact location of the acquired right-of-way in relation to the abutting parcels. Boundary maps for the right-of-way were not available during development of the master plan, nor were they deemed necessary, given the conceptual nature of master planning. When the term right-of-way is used in this document or shown in a figure, it refers to an approximate location. As another point of clarification, the term 'corridor' is used synonymously with the term right-of-way throughout the document.

Master Plan Purpose

The master plan is a 'tool box' containing the necessary nuts and bolts for successful trail development and implementation. The 'tools' in the tool box include specific recommendations and guidelines for trail design, the list of required project permits, the cost estimates and potential funding sources. The master plan is also a 'tool' to use when seeking project funding. Funding organizations require the type of information provided in the master plan to determine grant eligibility and project feasibility.

Master Plan Document

- Chapter One describes the project need and goals and provides an overview of the master planning process.
- Chapter Two describes the historical and cultural context of the Trolley Trail.
- Chapter Three describes the natural, cultural and man-made setting of the corridor.
- Chapter Four identifies opportunities and constraints for the trail alignment, design, construction, operation and maintenance.
- Chapter Five describes the recommended trail alignment.
- Chapter Six recommends trail design parameters and trail amenities (e.g., benches, restrooms).
- Chapter Seven identifies project phases, permitting requirements, funding sources and cost estimates.
- Chapter Eight presents long term management and maintenance recommendations.

For planning purposes, the trail alignment was divided into eight segments oriented from the north to the south. Similarly, project information is discussed and shown on maps in a north to south orientation.

Goals

Goals for the future Trolley Trail were developed in consultation with the Trolley Trail Working Group and through public input at the open house meetings. The first goal pertains to the master planning process while the rest of the goals guide trail design and future trail development and operation.

The Trolley Trail project has these goals:

1. Work in partnership with local jurisdictions, citizens, adjacent residential and commercial property owners, Friends of the Trolley Trail and the community as a whole while planning the Trolley Trail.

2. Accommodate a wide variety of non-motorized users including the bicycle commuter and recreational user.

3. Provide a safe and inviting trail.

4. Connect key destinations within the community and the region.

5. Design an environmentally friendly and low maintenance trail.

6. Ensure that trail design, construction and long-term use respect adjacent residential and commercial property owners.

7. Provide an enriching trail user experience through the incorporation of educational, historical and public art opportunities along the trail.

8. Develop a Trail Master Plan that will enable project partners to apply for grants to implement the project.

Public Involvement

The Trolley Trail concept has been in the minds and hearts of citizens and trail providers in the community for many years. Local and regional trail advocates care deeply about the success of this project. The master planning work benefited greatly from the knowledge and expertise provided by a large number of project partners and stakeholders.

Project Partners

During the planning process NCPRD and Metro worked with many project partners (see Table 1).

Table 1. Trolley Trail Project Partners

Cities	Milwaukie Gladstone Portland Oregon City
County	Clackamas County Department of Transportation and Development Clackamas County Sheriff's Office
Districts	Oak Lodge Sanitary District Oak Lodge Water District Clackamas County Service District #1 North Clackamas County School District #12
State	Oregon Department of Transportation
Community-Based Organizations	Friends of the Trolley Trail Island Station Neighborhood Association Oak Lodge Community Council North Clackamas Chamber of Commerce Retirement Communities Milwaukie Lions Club Jennings Lodge CPO
Private Entities	Portland General Electric Burlington Northern Railroad Union Pacific Railroad

Project Stakeholders

One-on-one interviews were held with several residents and business owners along the rail corridor and other special interest groups who expressed concerns with the project. Similar meetings were held as needed with project partners. These meetings were very helpful in addressing concerns of the stakeholders and building mutual trust and respect between the parties.

Trolley Trail Working Group

A 19-person Trolley Trail Working Group met monthly during the master planning process to provide ongoing input and guidance to NCPRD, Metro and the consultant team. The Working Group represented a diverse mix of stakeholders who volunteered their time and expertise at monthly meetings, public open houses and many other planning-related activities. Members included representatives from the cities of Milwaukie and Gladstone; the Oak Lodge Sanitary District, Clackamas County Sheriff's Office and Clackamas County Department of Transportation and Development, NCPRD and Milwaukie Parks Advisory Boards, 40-Mile Loop Land Trust, Metro Regional Parks and Greenspaces Advisory Committee, Friends of the Trolley Trail, the Rose Villa Retirement Community, and residents and business owners along the right-of-way.

Meeting the needs and concerns of the Trolley Trail Working Group, stakeholders, project partners and future trail users were primary objectives of the following public involvement activities:

- Monthly meetings of the Trolley Trail Working Group to review and advise NCPRD and Metro on important project information.
- Project mailings to interested citizens and residents within ½ mile of the public right-of-way.
- Project information and public meeting announcements on Metro's website.
- Stakeholder interviews with affected individuals and agencies.
- Site visits to meet with concerned neighbors along the public right-of-way.
- Three open houses to present project information for public review and comment. Approximately 80 citizens attended each public meeting. Trolley Trail working group members were actively involved in conducting the meetings. Meeting minutes distributed to interested citizens.
- Advertised and informal tours for interested citizens and public officials of the public right-of-way.
- Project presentations to several community organizations.
- Television and print coverage throughout the planning process. Local cable television station produced and aired a project video.
- Following release of the public review draft, two additional meetings of the Trolley Trail Working Group were held to fine-tune their trail design recommendation. Appendix G contains this recommendation and the additional research conducted to inform the group's discussions.

Public involvement information, minutes of Trolley Trail Working Group and public meetings are available as part of an accompanying Technical Notebook.

II. History of the Trolley Trail

The Trolley Trail project is named for the Portland Traction Company interurban trolley that ran along the alignment from 1893 to 1958 (see Figure 3). Before the streetcar line was built, the towns and communities surrounding the corridor were isolated and relatively undeveloped. The area had very few roads, all of which were dirt. Most travel was by foot or horse-drawn wagon, and residents relied on the Willamette River to get to the larger cities of Portland and Oregon City.

The communities of Milwaukie, Oak Grove, and Jennings Lodge are located along what became the streetcar corridor. In 1850, Milwaukie consisted of a sawmill at Johnson Creek and a number of surrounding farms. Oak Grove was platted in 1890, and Jennings Lodge was platted in 1905.

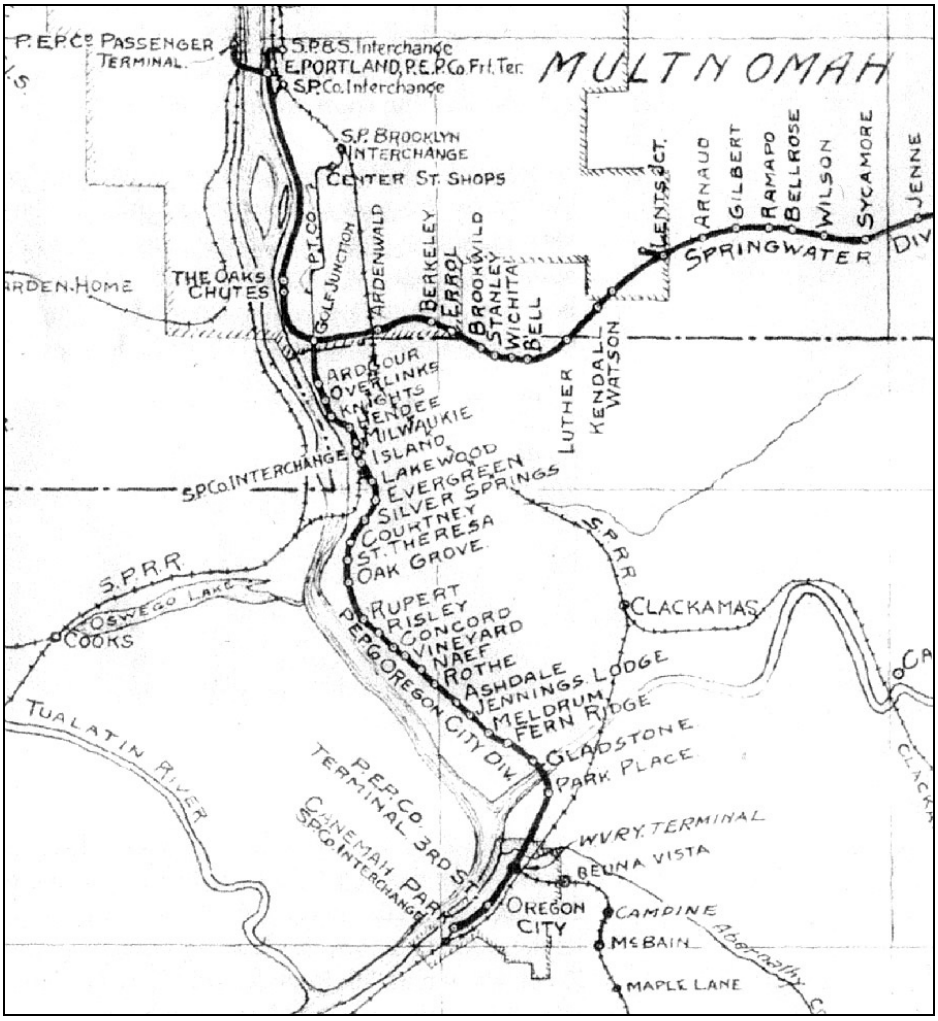


Figure 3. 1938 Map of Historic Rail Lines and Trolley Station Locations (courtesy Oregon Historical Society)

The remote small-town character of the area changed once the streetcar line was built by the Oregon City and Southern Railway. Passenger service began on February 16, 1893, and communities along the corridor rapidly developed and expanded. Oregon City and Southern Railway's parent company was taken over in 1901 by what would eventually become Portland General Electric, which operated the line as Portland Traction Company (PTC) starting in 1930.

Service along this streetcar line, known as the Oregon City Line, peaked in the 1920s and then began to fall. Several factors contributed to this decline, including the Great Depression, the increased use of personal automobiles, the failure of the company to replace aging equipment, and the completion of Highway 99E (McLoughlin Blvd.). Trolley ridership surged again during World War II, as citizens were encouraged to ride public transportation to save gasoline and tires. After the war, ridership declined steadily. Despite this downturn, the Oregon City Line outlasted many other streetcar lines in the region.

Streetcars ran for nearly 65 years on the Trolley Trail corridor, connecting East Portland, Oregon City, and points in between.
(Photo courtesy Oregon Historical Society)

In 1946, PTC became a subsidiary of the newly formed Portland Transit Company. During the next several years, profitability waned and on January 25, 1958, PTC terminated their passenger service. Freight service continued on the line until 1962, when it was sold to the Southern Pacific and Union Pacific Railroads. Rail service was abandoned completely in 1968 with the approval of the Interstate Commerce Commission.

The next year a local high school teacher initiated a campaign with the goal of preserving the corridor as a trail. While a trail was not subsequently built, the vision persisted. In 1971, the Oregon State Highway Division made plans to convert the corridor into a bicycle-pedestrian trail. In 1974, a feasibility study was conducted to explore using the corridor as a demonstration project for the region's first light rail line. Light rail within the Trolley corridor was dropped from consideration due to strong community opposition. Visions for different uses of the corridor continued to resurface over the years until 2001 when Metro and NCPRD purchased the old rail right-of-way for a future trail. Table 2 provides a chronological record of ownership for the rail line.

Table 2. Timeline of Streetcar Ownership: 1891-2001

1891:	Oregon City and Southern Railway, a subsidiary of East Side Railway Company, purchases right-of-way and constructs railroad
1893:	Passenger service begins February 16. Trip time length from East Portland to Oregon City is one hour.
1901:	Portland City and Oregon Railway Company (PCOR Co.) takes over East Side Railway.
1903:	PCOR Co. reorganized to form Oregon Water Power and Railway. Off-street line is built (present Springwater-OMSI corridor), reducing East Portland-Oregon City trip to 35 minutes.
1906:	Rail line transferred to the Portland Railway, Light and Power Company (PRL&P).
1924:	PRL&P changes its name to Portland Electric Power Company (PEPCO).
1930:	Portland General Electric (PGE) formed to take over PEPCO's electric operations, including streetcars. Portland Traction Company (PTC) formed to operate the railways as a subsidiary of PGE.
1946:	Portland Transit Company formed to acquire interurban rail properties of PEPCO, including PTC.
1958:	Passenger service ends on January 25.
1962:	Portland Transit sells the interurban lines to Southern Pacific and Union Pacific Railroads for freight operation.
1968:	Rail service is abandoned completely. Most rails and ties removed from right-of-way.
1969 - present:	Various studies and campaigns are undertaken to convert the right-of-way to a trail or light rail line.
2001:	Metro and North Clackamas Parks & Recreation District purchase the right-of-way for conversion into a multi-use trail.

III. Existing Conditions

Project Setting

Existing conditions adjacent to and in the vicinity of the acquired right-of-way play an important role in the development potential for a future trail within the right-of-way. For this reason, the project study area includes both the right-of-way and lands within one-half mile of the right-of-way. The terms right-of-way and corridor are used interchangeably throughout this document.

To facilitate documentation and mapping of project information, the right-of-way was divided into eight segments along its 6-mile length (see Table 3). In general, existing conditions are presented as they occur from the north to south within the project area. Project information shown in tables and figures is organized by corridor segment when applicable.

Table 3. Trolley Trail Segment Descriptions

Segment 1: Jefferson Street Boat Ramp to SE River Road
This segment links to an existing section of trail in Milwaukie. The right-of-way travels south from the Jefferson Street Boat Ramp along an existing paved sidewalk, across the culverted Kellogg Creek, beneath a railroad trestle near SE 22nd Avenue, and runs parallel to, but set back from, the west side of SE McLoughlin Boulevard to SE River Road.
Segment 2: SE River Road to SE Park Avenue
Segment 2 parallels the west side of SE McLoughlin Boulevard to SE Park Avenue. The right-of-way is separated from the road right-of-way by a wide corridor of trees and grass.
Segment 3: SE Park Avenue to SE Courtney Avenue
This segment begins at SE Park Avenue and travels near residential homes and the Oak Grove Elementary School, and ends at SE Courtney Avenue.
Segment 4: SE Courtney Road to just north of SE Creighton Avenue on SE Arista Drive
This on-street section of the right-of-way begins at SE Courtney Road and follows SE Arista Drive to a point just north of SE Creighton Avenue.
Segment 5: North of Creighton Avenue on SE Arista Drive to SE Concord Road
In this segment the right-of-way leaves SE Arista Drive just north of Creighton Avenue, travels close by several residences, emerges at SE Rupert Drive and continues along an existing grassy median between the two SE Arista Drives (e.g., upper and lower) to Concord Road.
Segment 6: SE Concord Road to SE Roethe Road
Segment 6 resumes the off-street nature of the right-of-way and travels nearby residential homes and wooded areas between SE Concord Road and SE Roethe Road.
Segment 7: SE Roethe Road to SE Jennings Avenue
This segment travels near residences and industrial lands between SE Roethe Road and SE Boardman Avenue. Beginning at Boardman Avenue, the right-of-way runs parallel to the east side of SE Arista Drive along a raised vegetated berm, and crosses SE McLoughlin Boulevard at SE Jennings Avenue.
Segment 8: SE Jennings Avenue to SE Glen Echo Avenue
This segment begins on the east side of SE McLoughlin Boulevard and parallels the west side of SE Abernethy Lane to SE Glen Echo Avenue, linking to an existing sidewalk and bicycle lane in Gladstone.

Land Use

The project area was primarily in agricultural use during the 1930's and 1940's. Some residences and businesses were also present, with pockets of forested areas. In 1970, commercial development began to appear adjacent to and east of the corridor and by the late 1970's, residential development had increased along the corridor's western edge. By the 1980's the project area was almost completely built out.

Today the primary land use along the corridor is single family residential, which accounts for approximately 81 percent of tax lots within the project area. Commercial development is concentrated within the downtown area of Milwaukie and along SE McLoughlin Boulevard. A small commercial area also exists where the corridor crosses Oak Grove Boulevard in the old Oak Grove town center. A few industrial land uses occur along the corridor's eastern boundary between SE Vineyard Road and SE Boardman Avenue.

Community Facilities

A number of community facilities including schools, parks and retirement communities are located in the project area. Table 4 lists these facilities and they are shown on Figure 4.

Schools

There are a total of 11 schools within the project area. Two of the schools, Oak Grove Elementary School and Sojourner Charter School fall, directly along the corridor. Many students already use the right-of-way to walk to and from school and to travel between neighborhoods.

Parks

There are 12 public parks or open spaces within the project area. With one exception, NCPRD manages all of the parks in the project area. The majority of the parks are concentrated on the northern and southern ends of the corridor. The rest of the parks are located at varying distances from the right-of-way.

The Jefferson Street Boat Ramp at the northern end of the corridor has a paved day-use parking area that currently serves recreational boaters parking their cars and boat trailers. Its restrooms are closed in the winter months. The boat ramp site is owned by the City of Milwaukie and maintained by NCPRD. Parking area usage peaks during the fall/spring salmon runs. Milwaukie Waterfront Park and Dogwood Park are located in the vicinity of the boat ramp as well.

The Oak Grove and SE Jennings Lodge neighborhoods between SE Park Avenue and SE Jennings Avenue have two park properties. Risley Park offers active recreational opportunities and a portable restroom facility (in place May - September). NCPRD has acquired the former Stringfield property (located just west of SE Naef Road and the right-of-way) with the intent of developing the site into a park, trailhead and creek restoration demonstration project.

Retirement Communities

People 65 years and older make up the highest percentage (17.1%) of the population living in the project area. The next largest age group in the project is the 50-64 years old group (14.7%). This demographic is most likely due to the fact that there are four retirement complexes and six mobile home communities for people 55 years and older in the project area. The four large retirement complexes are approximately a half mile from the corridor. One mobile home community is located right along the corridor while the other five are at various distances from the corridor.

Table 4. Community Facilities in the Project Area

SCHOOLS	
Portland Waldorf School (former Milwaukie Middle School)	2300 SE Harrison Street, Milwaukie
St. John the Baptist Elementary School	10956 SE 25th Avenue, Milwaukie
Milwaukie Elementary School	11250 SE 27th Avenue, Milwaukie
Milwaukie High School	11300 SE 23rd Avenue, Milwaukie
Rowe Middle School	3606 SE Lake Road, Milwaukie
Oak Grove Elementary School	2150 SE Torbank Road, Milwaukie
Sojourner Charter School	1905 SE Oak Grove Boulevard., Milwaukie
Concord Elementary School	3811 SE Concord Road, Milwaukie
Riverside Elementary School	16303 SE River Road, Milwaukie
Rex Putnam High School	4950 SE Roethe Road
Candy Lane Elementary School	5901 SE Hull Avenue, Milwaukie
Jennings Lodge Elementary School	18521 SE River Rd, Milwaukie
Gladstone High School	18800 Portland Ave, Gladstone
PARKS	
Scott Park	10660 SE 21st Avenue
Spring Creek Park	2566 Harrison Street
Jefferson Street Boat Ramp / Milwaukie Waterfront Park	SE Jefferson Street at Willamette River
Dogwood Park	11299 SE Main Street
Elk Rock Island	in Willamette River at SE 19 & Sparrow
Kellogg Lake Park	between SE McLoughlin Boulevard and Kellogg Lake at SE 22nd Ave.
Spring Park	1881 SE Lark Street, Milwaukie
Bunnell Park	2560 SE Pine Street, Milwaukie
Risley Park	SE Risley 1/8 mi. west of alignment.
Stringfield Family Park	3614 SE Naef, Milwaukie
Willamette Drive Park	Willamette Drive off River Road
Glen Echo Wetlands	SE Glen Echo Avenue at Portland Avenue, Milwaukie
Olson Property	W Kenmore Street at Beatrice Avenue, Gladstone
Diericks Field	W Gloucester Street at Barton Avenue, Gladstone
RETIREMENT COMMUNITIES	
Willamette Valley Assisted Living	13145 SE River Road, Milwaukie
Rose Villa	13505 SE River Road, Milwaukie
Homewood Heights	17999 SE River Road, Milwaukie
Ivy Court Senior Living	18265 SE River Road, Milwaukie

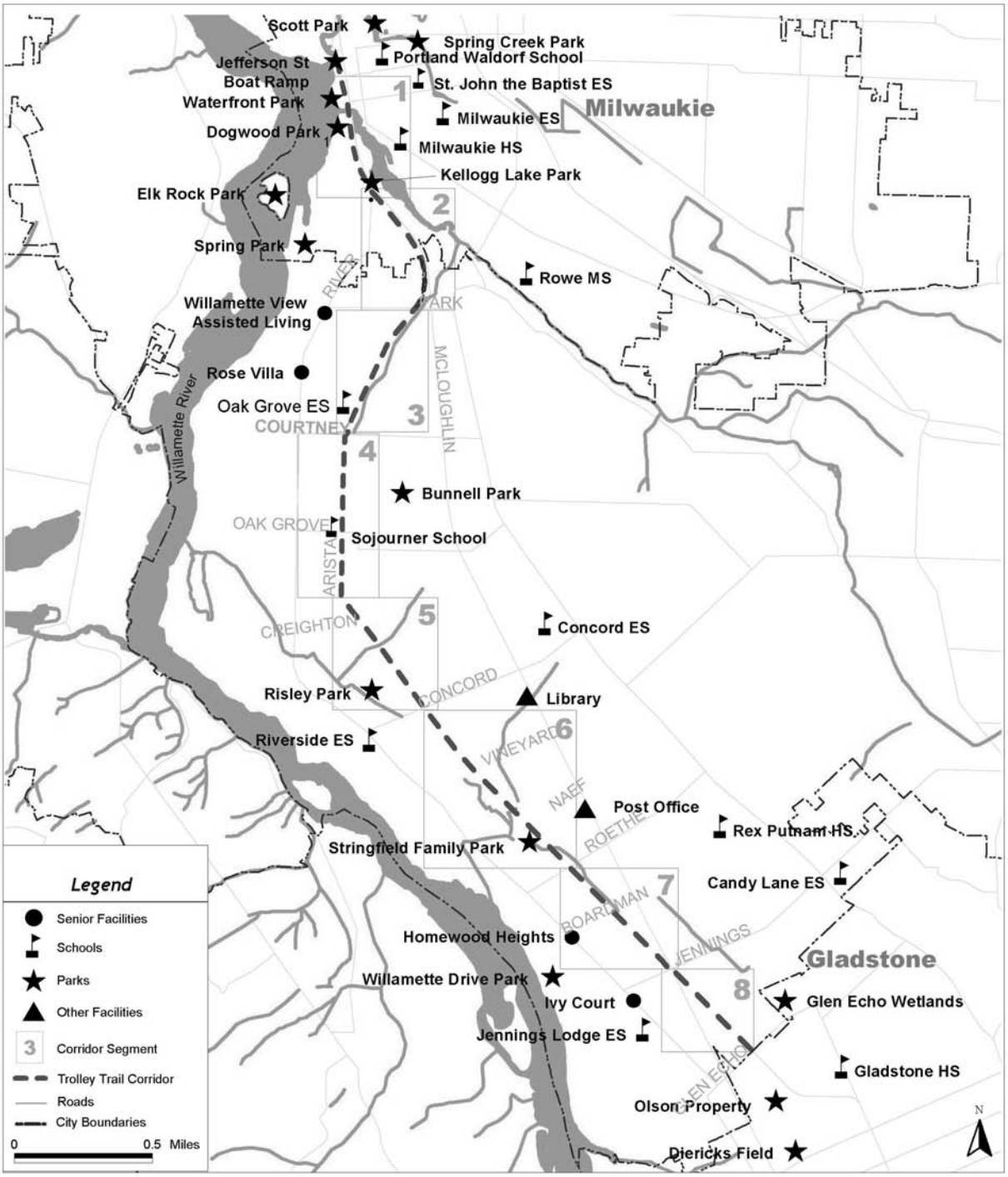


Figure 4. Parks, Schools, Retirement Communities in the Project Area

Utilities

In 2002-2003, Otak Inc. consultants surveyed the utilities within the trail right-of-way for the majority of the 6-mile corridor. The survey was not conducted along trail segments within or adjacent to a public road (segments 1, 4 and 8). Utilities surveyed include, but are not limited to, surface and subsurface electrical, natural gas, water, sanitary sewer and stormdrain. Survey data is available electronically from Metro's Data Resource Center.

Electrical

Portland General Electric (PGE) provides electrical service in the vicinity of the right-of-way and maintains an easement across the entire length and width of the right-of-way. All 42 pole-mounted transformers observed along the right-of-way appear to belong to PGE.

Natural Gas, Water and Sewer

Oak Lodge Water District (OLWD) provides water service in the project area. The City of Milwaukie provides sanitary sewer service within its city limits and Oak Lodge Sanitary District (OLSD) provides sewer service to the rest of the area. NW Natural provides gas service.

Stormwater

OLSD is the responsible agency for stormwater management in the project area and has identified and inventoried existing drainage conveyance facilities adjacent to the right-of-way. Many of these facilities rely on former track side ditching and have been minimally maintained over the years. Property owners adjacent to the ditches own the seeps and creeks in the OLSD, including those that cross the right-of-way. OLSD does not have drainage easements along the ditches and streams and must request residents' permission for access in order to clear debris and make necessary improvements. Structures and features of the stormwater conveyance facilities that have been inventoried in the vicinity of the right-of-way are described below:

1. SE 26th Place, south of SE Park Avenue – An existing 12" pipe inlet structure picks up water from the south and connects to an underground box culvert draining to Kellogg Lake.

2. South of SE Evergreen Street (halfway to SE Silver Springs Street) – Stormwater from private property flows east to the right-of-way and then north along the west side of the right-of-way to a 12" inlet near SE 26th Place.

3. SE Waldron Drive and Waldron Meadows Subdivision – A detention pond holds water from the subdivision on the west side of the right-of-way. The detention pond drains north through a ditch paralleling the west side of the right-of-way ultimately tying into the 12" pipe inlet structure at SE Silver Springs Road.

4. SE Naef Road to SE Roethe Road – An undersized and heavily sedimented culvert crosses perpendicular to the right-of-way, and carries Boardman Creek beneath the trail right-of-way.

Railroad

The right-of-way just north of SE 22nd Avenue travels beneath an overhead railroad trestle. This is an active rail line owned by Union Pacific (UP) and Burlington Northern Santa Fe (BNSF).

Existing Uses in the Corridor

During the 34 years since rail service was abandoned, portions of the right-of-way have been used by local residents as informal paths for walking, biking and horseback riding. Portions of the right-of-way have also been encroached upon by adjacent residents and businesses for gardens, fences, driveway access and parking.

Residential Use

- At the end of SE Evergreen Street vehicles must cross the right-of-way to access a residence located just to the east of the right-of-way.
- Some residents living between SE Silver Springs Road and SE Torbank Road use the right-of-way for vehicular access their homes.
- Small sheds and other structures appear to be in the right-of-way in the vicinity of SE Park Avenue.
- Gardens and fences appear to be within the right-of-way between SE Torbank Road and SE Courtney Avenue.
- Gardens have been planted in the grassy median area between the double SE Arista Drives between SE Rupert Road and SE Concord Road.
- Yard debris has been placed in the right-of-way on the other side of some residents' fences.

Commercial Use

- It appears that commercial establishments located near the intersection of SE McLoughlin Boulevard and SE Park Avenue and SE Roethe Road have been using the right-of-way for employee and customer parking.
- A car dealership located on the east side of the intersection of SE McLoughlin Boulevard and SE Jennings Avenue has an existing lease with Metro to use part of the right-of-way for their business.

Parking

- A gravel parking area has been created within the right-of-way directly across from the Amazing Grace Church near SE Concord Road. The area is used for overflow parking by the church.
- Cars park within the right-of-way near the southern end of the corridor just north of SE Glen Echo Avenue.

Off-Road Vehicles

- 4-wheel drive activity has been observed just north of SE Park Avenue
- Until recently, 4-wheel drive vehicles used the right of way between SE Silver Springs Road and SE Torbank Road. Barriers have been placed in this area to prevent access.
- 4-wheel activity occurs in the grassy median between the double SE Arista Drives between SE Rupert Drive and SE Concord Road. The vehicles access the right-of-way at a number of points between SE Rupert Drive and SE Concord Road.

Equestrian Use

A few local residents use the right-of-way between SE Concord Road and SE Boardman Avenue for horseback riding. The area adjacent to the right-of-way through this stretch is generally less developed and more wooded and natural. These residents stable their horses nearby.

Planned Future Developments

There are several planned projects in the vicinity of the project that will potentially impact the right-of-way. These projects include:

- **City of Milwaukie, Jefferson Street Boat Ramp:** The City of Milwaukie's adopted Downtown Plan proposes a riverfront park in place of the existing boat ramp and parking area. The City is also considering upgrading the existing boat ramp to fit better into a park setting, which would reduce the parking area.
- **ODOT Sidewalk Improvement:** At the north end of the right-of-way, a sidewalk begins at SE Jefferson Street and heads south paralleling SE McLoughlin Boulevard. This sidewalk comes to an abrupt end in the vicinity of the Kellogg Creek wastewater treatment plant. ODOT has developed plans to extend the sidewalk southward from this terminus point to River Road. ODOT's Rail Division is working with the Union Pacific (UP) and Burlington Northern Santa Fe (BNSF) railroads on the trestle undercrossing design.
- **SE McLoughlin Boulevard Improvements, City of Milwaukie**: The City of Milwaukie is in the planning stages of expanding the width of SE McLoughlin Boulevard in the downtown Milwaukie area. Expansion of the street right-of-way will occur to the west/riverside by approximately 8 to 12 feet. A major goal of the design is to gain full access to Kellogg Plant and the Boat Ramp from SE Washington Street.
- **Kellogg Creek Restoration Project:** The City of Milwaukie has plans to remove an existing dam and fish ladder on Kellogg Creek, and restore approximately 14 acres of associated riparian and wetland habitats in the lower portion of the creek.

- **OLSD Stormwater and Sanitary Sewer Improvements:**
  - **SE Lark Street and SE 27th Avenue:** A future storm sewer connection is planned from SE 27th Avenue to SE McLoughlin Boulevard. This would include a ditch and pipe system.
  - **SE Park Avenue:** Possible connection of Pump Station #3 to Clackamas County Service District No. 1 sanitary sewer.
- **SE Park Avenue:** Clackamas County and OLSD have applied for community block grant funding to construct storm sewer improvements, sidewalks, a bike lane, and an asphalt overlay on Park Avenue from River Road to McLoughlin Blvd.
- **Oak Grove Elementary School Bus Project:** Oak Grove Elementary School, located directly west of the right-way between SE Courtney and SE Torbank, has purchased property off of SE Courtney with the intent of paving a bus access road connection to the east side of the school grounds. OLSD is aware of the project and would like to see stormwater improvements as part of the bus access project.
- **Boardman Creek Culvert:** Between SE Naef Road and SE Roethe, OLSD has plans to replace a heavily sedimented and undersized culvert which conveys Boardman Creek across the right-of-way at this location.

Zoning

Lands within the project area are controlled by the Comprehensive Land Use Plans and Zoning Codes for the City of Milwaukie and Clackamas County (see Figure 5 and Figure 6).

For portions of the corridor in Milwaukie, the Milwaukie Planning Department administers code compliance and development permits. Development within the Willamette River Greenway, and Natural Resource Overlay Zones are subject to conditional use and community service approvals granted by the Milwaukie Planning Department. For portions of the corridor in Clackamas County, the Clackamas County Department of Transportation and Development administers code compliance and development permits.

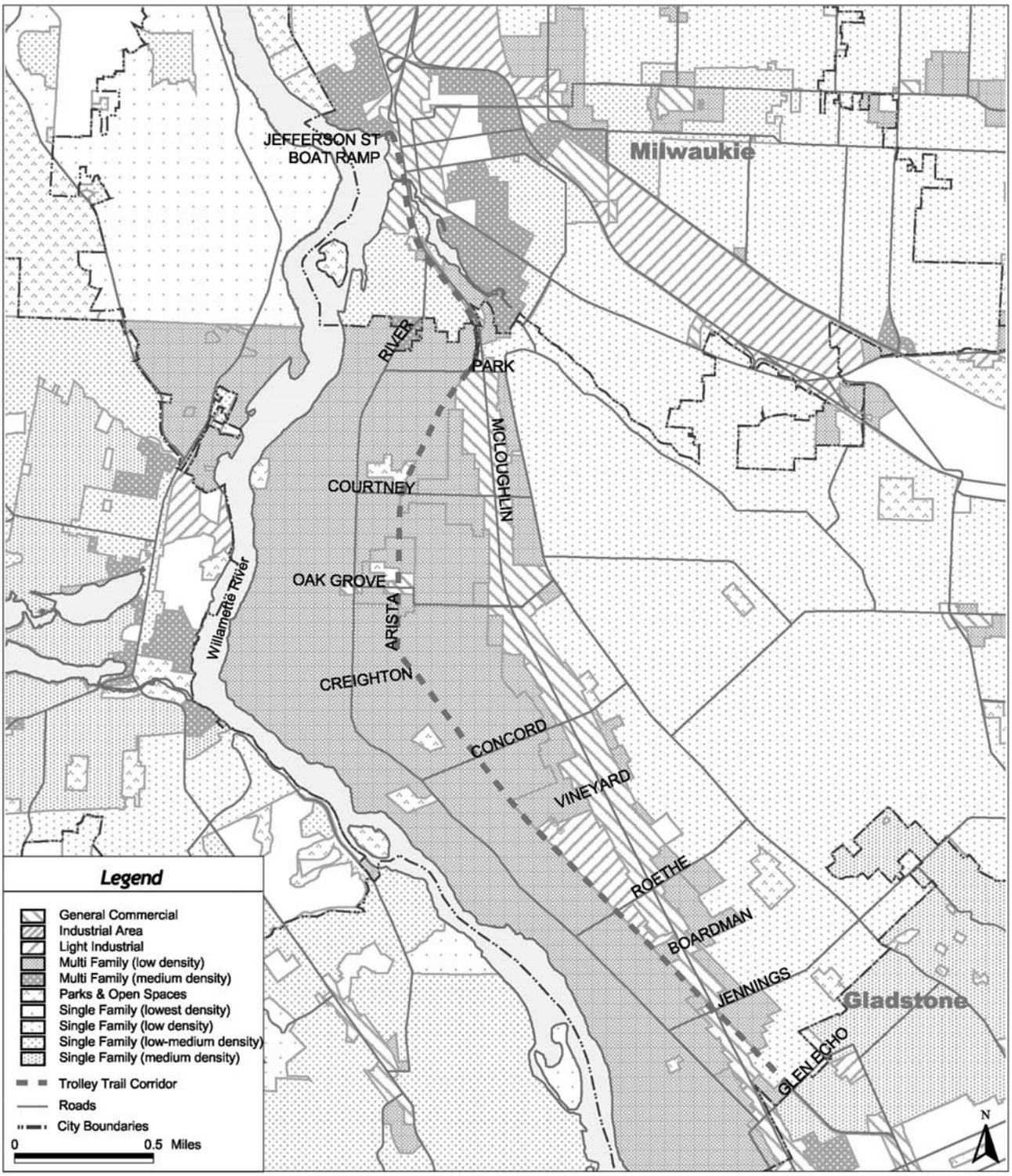


Figure 5. Comprehensive Plan Designations

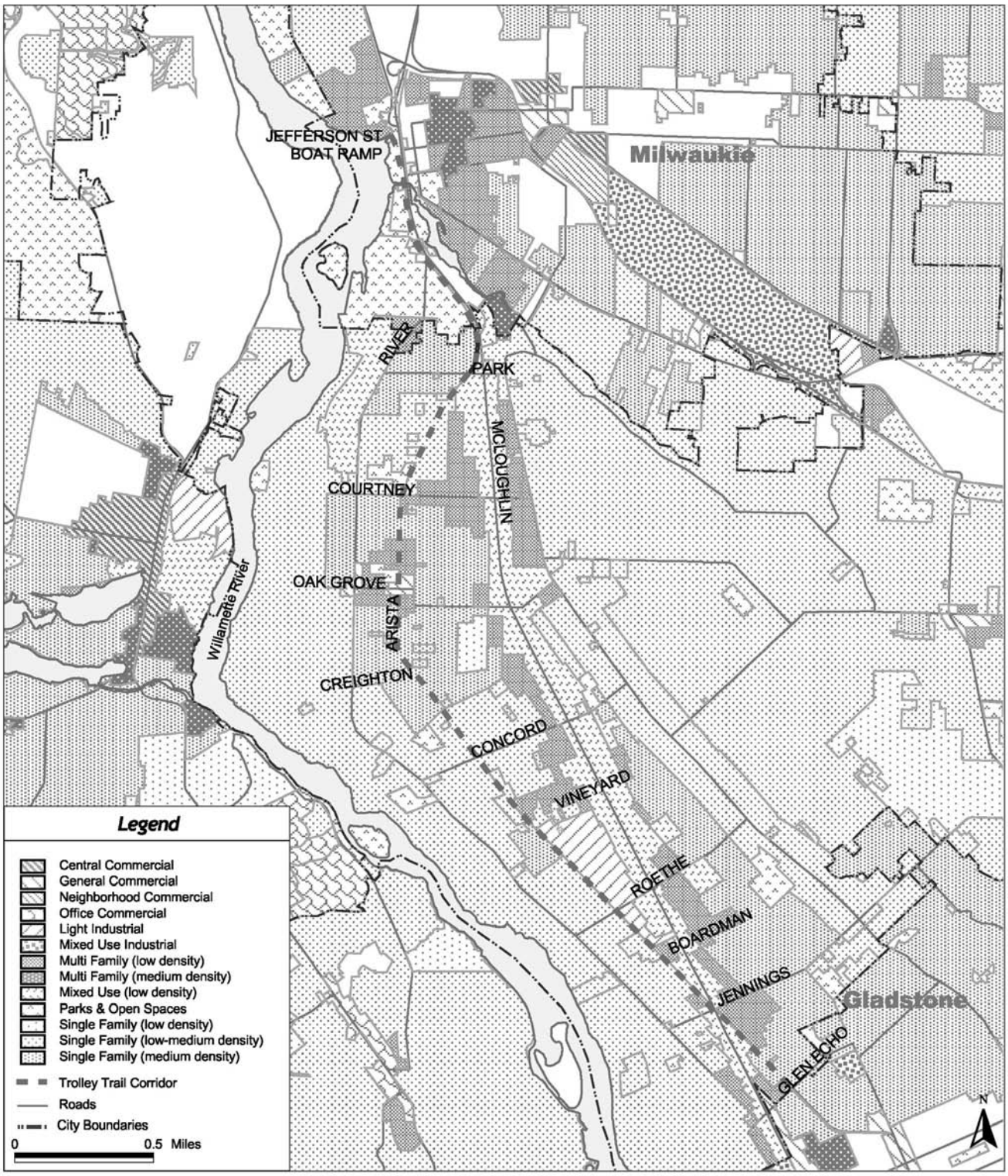


Figure 6. Zoning Designations in the Project Area

Cultural Resources

Clackamas County has inventories historic properties and their associated donation land claims in the project area (Clackamas County Cultural Resource Inventory, 1992). Historical buildings that pre-date trolley operations and buildings developed as a result of the trolley still exist along the corridor, providing examples of Western Farmhouse and Craftsman-Bungalow architectural styles. The Jacob Risley and Charles Risley Houses (both designated historic landmarks) are located in the project area near SE Risley Avenue and are excellent examples of Italianate and Queen Anne style houses.

The old trolley itself was serviced by as many as 21 trolley stations, the names of which changed throughout the years. Historical photographs, residents' interviews, memorabilia and other artifacts have been archived by the Milwaukie Historical Society (MHS) and other efforts. A more detailed description of these historic trolley stations is contained in Appendix C. The trolley stations located in the project area are shown in Figure 3 (Chapter 2) and listed in Table 5 below:

Table 5. Historical Trolley Station Locations

Station	Location	Station	Location
Milwaukie Station	SE McLoughlin Boulevard downtown	Concord Station	SE Arista / SE Concord Road
Island Station	SE McLoughlin Boulevard / SE 22nd Avenue	Vineyard Station	Right-of-way / ~SE Vineyard Road
Lakewood Station	SE McLoughlin Boulevard / SE 26th Avenue	Naef Station	Right-of-way / ~SE Naef Road
Evergreen Station	Right-of-way / SE Park Avenue	Roethe Station	Right-of-way / ~SE Roethe Road
Silver Springs Station	Right-of-way / SE Silver Springs Road	Ashdale Station	Right-of-way / SE Boardman Avenue
Torbank Station	Right-of-way / SE Torbank Road	Jennings Lodge Station	Right-of-way / SE McLoughlin Boulevard (& SE Jennings Avenue)
Courtney Station	SE Arista Drive / SE Courtney Road	Hull Station	Right-of-way / SE Hull Avenue
Saint Theresa Station	SE Arista Drive / ~SE Pinelane Street	Meldrum Station	SE Abernethy / ~SE Meldrum Avenue
Oak Grove Station	SE Arista Drive / SE Oak Grove Boulevard.	Fern Ridge	SE Abernethy / ~Beatrice Avenue, Gladstone
Rupert Station	Right-of-way / ~SE Creighton Avenue	Glen Echo Station	SE Abernethy / SE Glen Echo Avenue
Risley Station	Right-of-way / SE Swain Avenue		

Geology and Soils

Three bedrock formations underlie the corridor. From oldest to youngest, these include the Columbia River Basalt in the northeast, lacustrine deposits in the southwest and the Troutdale Formation throughout – consisting of primarily interbedded alluvial deposits of cemented gravels, mudstones, sandstones and siltstones.

The right-of-way is relatively flat with a gentle upward slope from north to south. Exposed surface soils in the vicinity of the right-of-way would likely be classified as 'Urban Land Complex' – soils that have been cut, graded, or otherwise disturbed. These surface soils often contain coarse gravel and fine sands and silts. Between 1 to 3 feet beneath these surface soils, the primary types of soils are silt loams, clay loams, sandy loams, loam and river wash (OLSD, 1997). These soils are generally characterized by high runoff and low infiltration potential.

Hydric soils (wetland soils) occur between SE Torbank Road and SE Oak Grove Boulevard and SE Naef Road and SE Jennings Avenue. Soils with hydric inclusions (that is, soils with pockets of wetland soils) occur between SE Evergreen Road and SE Torbank Road.

Flood-prone areas of the corridor are discussed in more detail in the following Hydrology section.

Hydrology

Annual precipitation in the project area ranges from 45 to 50 inches (98% rain and 2% snow). Most (88%) of this rain falls between October to May, with half the annual total falling in November, December and January.

The corridor passes through five drainage basins: Kellogg, River Forest, North Boardman, South Boardman and Gladstone. The North Fork of River Forest Creek is piped under SE Arista Drive south of Ada Lane and ultimately flows into River Forest Lake. The lake outlet to the Willamette River is a fixed weir structure 6-8 feet in height that serves as a complete fish barrier (Walt Mintkeski, personal communication, 2003). Between SE Park Avenue and just south of SE Courtney Avenue, the corridor runs along a small, unnamed creek feeding from Elkhorn Springs to Kellogg Lake.

Groundwater in the vicinity of the right-of-way is expected to flow towards the Willamette River, located 0.2 to 1.0 miles to the west. The anticipated depth to groundwater in the right-of-way vicinity ranges from 10 to 30 feet below ground surface. A number of natural springs are in the project area, including two directly adjacent to the trail corridor both north and south of SE Courtney and east of SE Arista Drive.

Hydrological features in the project area are shown on Figure 7.

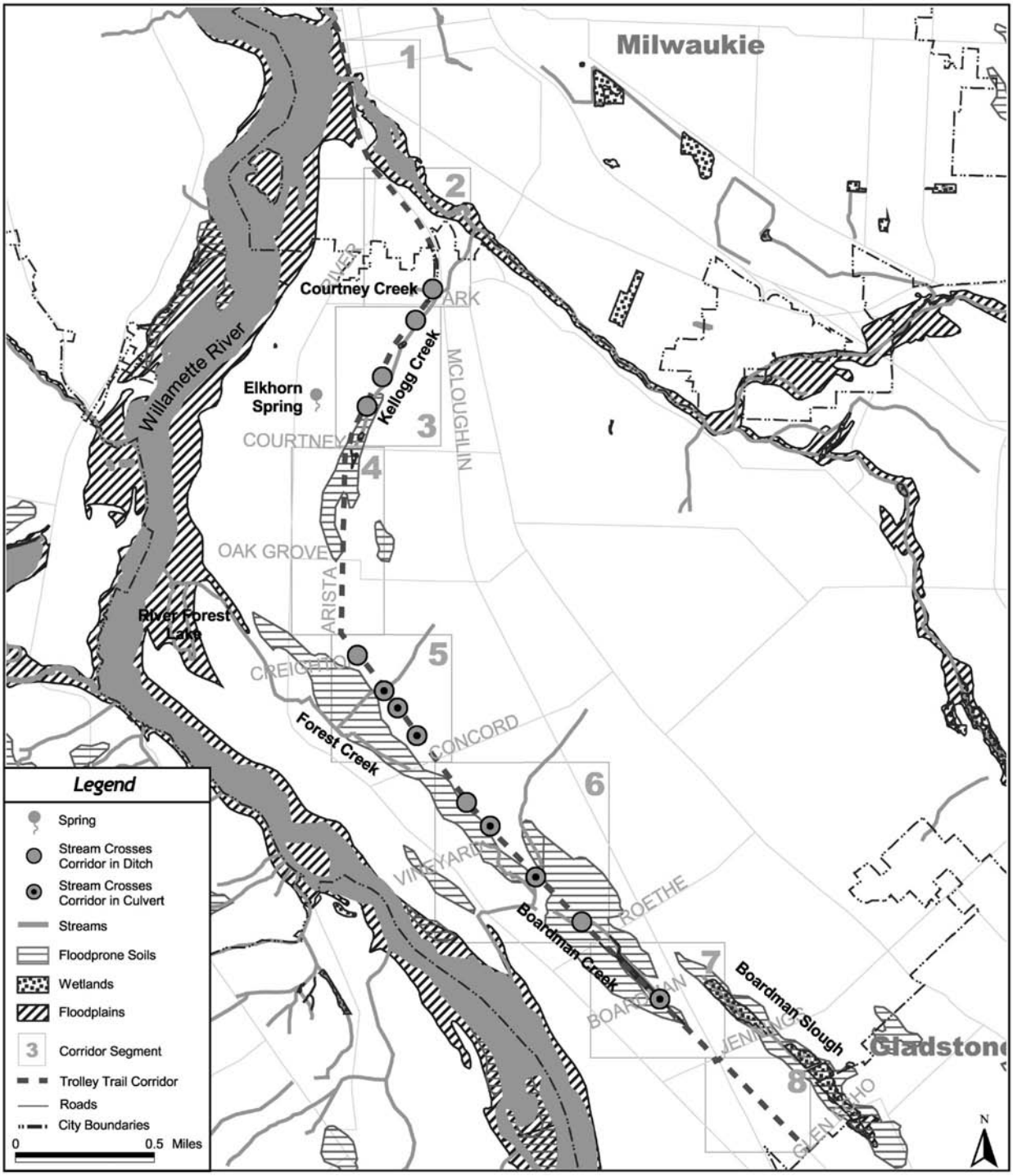


Figure 7. Hydrological Features in the Project Area

Stormwater Drainage System in the Project Area

All stormwater in the right-of-way eventually drains to the Willamette River. Stormwater management in the project area is achieved by a system of open drainage ditches and culverts adjacent to the right-of-way. Maps available from the Oak Lodge Sanitary District show this system in detail.

Oatfield Ridge, a heavily urbanized area east of the corridor, is the highest ground in the vicinity. Significant storm water runoff flows from the ridge westward, towards SE McLoughlin Boulevard at which point it is combined with runoff from the highway and transported through open ditches and culverts, eventually draining to the Willamette River.

Wetlands

Identification of potential wetland areas along the right-or-way was based on a review of National Wetland Inventory (NWI) maps (1981) and field reconnaissance conducted on August 20, 2002. No wetland delineations have been performed to date.

Based on the NWI data, palustrine emergent wetlands occur in two locations near the corridor. Palustrine refers to inland, freshwater wetlands, such as marshes or bogs, that lack flowing water. The Boardman Slough is a substantial wetland system located less than a quarter mile east of the corridor between Boardman Road and SE Glen Echo Avenue. The other wetland area, Boardman Creek is hydrologically connected to the Boardman Slough and located adjacent to the right-of-way for about 1,000 feet between SE Roethe Road and SE Boardman Avenue. No other wetland areas are mapped along the corridor, although portions of the corridor between SE Torbank Road and SE Courtney Avenue and SE Roethe Road and SE Boardman Avenue (west side) appear to have wetland characteristics including hydrology, soil and vegetation.

This wet area of the right-of-way near SE Torbank is adjacent to Elkhorn Springs.

<u>Flood-Prone Areas of the Corridor</u>

Portions of the right-of-way prone to flooding are described below and shown in Figure 7. A more complete description of the erosion and flooding potential of soils in these flood-prone areas is contained in Appendix D.

SE Park Avenue to SE Silver Springs Road – Cut banks along this portion of the right-of-way may result in drainage seeping on to the trail corridor.

SE Silver Springs Road to SE Torbank Road – Poor drainage conditions in this area can be attributed to the flat grade, and low percolation rate of the clay soils.

SE Torbank Road to SE Courtney Road – Storm water flow from the Oak Grove Elementary School combined with stormwater flow from Courtney Road, and the presence of underground springs (Elkhorn Springs) and hydric soils causes surface water flow over the right-of-way.

SE Naef Road to SE Roethe Road – Properties adjacent to the right-of-way area are prone to flooding due to the presence of an undersized and heavily sedimented culvert carrying stormwater on Boardman Creek.

SE Roethe Road to SE Boardman Avenue – During major storm events, Boardman Creek, adjacent to the right-of-way to the east, overflows its banks and the storm water flows westward across the right-of-way into a drainage swale that conveys storm water from the residential development on SE Paradise Drive. Residential properties on the west side of the right-of-way flood in these occasions.

SE Boardman Avenue, south for 300' on SE Arista Drive – Flooding is frequent in this area on local streets.

Vegetation

During a field reconnaissance visit in August 2002, common native and non-native plants were observed in the vicinity of the corridor (see Table 6). Native species observed include Oregon ash black cottonwood, red-osier dogwood, willow, Douglas spirea and swordfern. Non-native plants observed included Himalayan blackberry, morning glory, English ivy, Japanese knotweed, *Clematis* and *Vinca*.

Clematis

Blackberry

Plants observed in the corridor.

Based on a review of the Oregon Natural Heritage Program (ONHP) database, no state or federal listed plant species have been documented along the corridor or in the vicinity (OHNP, 2002). This is not unexpected because of the current and past use of the corridor. The nearest documented occurrence of a listed or sensitive plant species is on Elk Rock Island, approximately 0.5 miles west of the trail alignment.

Table 6. Common Plant Species in the Vicinity of the Corridor

Native	Douglas fir (*Pseudotsuga menziesii*) Big leaf maple (*Acer macro phyllum*) Oregon grape (*Berberis nervosa*) Oregon ash (*Fraxinus latifolia*) Black hawthorne (*Crateagus suuksdorfii*) Western red cedar (*Thuja plicata*) Black cottonwood *(Populus balsamifera ssp. trichocarpa*) Red-osier dogwood (*Cornus sericea ssp. sericea*) Douglas spirea (*Spiraea douglasii*) Oak *(Quercus)*	Red alder (*Alnus rubra*) Sword fern (*Polystichum munitum*) Indian plum (*Oemleria cerasiformis*) Snowberry (*Symphoricarpos albus)* Red elderberry (*Sambucus racemosa*) Willow (*Salix ssp.*) Salmonberry (*Rubus spectabilis*) Timbleberry (*Rubus parvifloruss*) Hazelnut *(Corylus)*
Non-native / Invasive	Himalayan blackberry (*Rubus discolor*) English ivy (*Hedera helix*) *Clematis* Periwinkle (*Vinca spp.*) Japanese knotweed (*Polygonum cuspidatum*)	Poison oak (*Rhus diversiloba*) Yellow iris (*Iris pseudacros*) Western horsetail (*Equisetum arvense*) Reed canary grass (*Phalaris arundicnacea*)
Non-native / Ornamental	Apple *(Malus* Crab apple *(Malus))* Laurel (*Kalmia ssp.*)	Wild rose *(Rosa woodsii)* Wisteria *(Wisteria floribunda)*

Fish and Wildlife

The information in this section is based on field observations, personal communication with resource agency staff and a search of the Oregon Natural Heritage Program database.

Wildlife inhabiting the corridor and vicinity are common species adapted to human activity. Examples of wildlife observed, or expected to occur, include the western screech owl, American robin, great blue heron, green heron, spotted towhee, raccoon, opossum, beaver, nutria and Pacific treefrog. With the exception of listed salmonids in Kellogg Creek, no federal threatened or endangered species occur within the right-of-way (ONHP 2002). The nearest occurrence of a terrestrial listed species (bald eagle) is over 1 mile to the west along the shore of Lake Oswego (ONHP 2002).

Based on correspondence with the Oregon Department of Fish and Wildlife (Caldwell 2002), the following federally listed fish species may occur in Kellogg Creek located in the northern portion of the project corridor: Lower Willamette steelhead (federally threatened; see Table 7) and fall chinook (state threatened). Fall chinook and coho (state threatened) have been verified in Johnson Creek (within 0.25 miles), but not in Kellogg Creek.

The fish ladder at the confluence of Kellogg Creek and the Willamette River acts as a barrier during low summer flows (Caldwell 2002). During normal flows, fish are able to access the creek via the ladder. An existing paved sidewalk and SE McLoughlin Boulevard span Kellogg Creek via a wide, concrete over-pass. Run-off from the existing sidewalk infiltrates into surrounding turf grass on the over-pass.

Table 7. Observed and Expected Fish and Wildlife in the Vicinity of the Corridor

Fish	Fall chinook salmon (Oncorhynchus tshawytscha) - state threatened Coho salmon (Oncorhynchus kisutch) - state threatened	Lower Willamette steelhead (*Oncorhynchus mykiss)* - federally threatened	Steelhead trout (Salmo gairdneri)
Birds	Red-breasted nuthatch (*Sitta canadensis*) Black-capped chickadee (*Parus atricappillus*) Chestnut-backed chickadee (*Parus rufescens*) House finch (*Carpodacus mexicanus*) Mallard (*Anas platyrhyncos*) Common Merganzer (*Mergus merganser*)	Pine siskin (*Carduelis pinus*) Song sparrow (*Melospiza melodia*) Fox sparrow (*Passerella iliaca*) Dark-eyed junco (*Junco hyemalis*) House wren (*Troglodytes aedon*) Great blue heron (*Ardea herodias*) Green-back heron (*Butorides striatus*)	Spotted towhee (*Pipilo erythrophthalmus*) American robin (*Turdus migratorius*) Hermit thrush (*Catharus guttatus*) Belted kingfisher (*Ceryle alcyon*) Red-winged blackbird *(Agelaius phoeniceus)*
Amphibians & Reptiles	Long-toed salamander (*Ambystoma macrodactylum*)	Pacific treefrog (*Hyla regilla*) Bullfrog (*Rana catesbeiana*)	Rough-skinned newt (*Taricha granulosa*)
Mammals	Raccoon (*Procyon lotor*) Opossum (Didelphis marsupialis)	Eastern gray squirrel (Sciuridae)	American Beaver (*Castor Canadensis*) Nutria (*Myocastor coypus*)

IV. Opportunities and Constraints Analysis

Goals

In order to set the context for the opportunities and constraints discussion, it is helpful to review the goals of the Trolley Trail. Goals that pertain to trail design, development, operation and maintenance include:

1. Accommodate a wide variety of non-motorized uses including bicycling for both recreation and commuting.
2. Provide a safe and inviting trail.
3. Connect key destinations within the community and the region.
4. Design an environmentally friendly and low maintenance trail.
5. Ensure the trail design, construction and long-term use respect adjacent residential and commercial property owners.
6. Provide an enriching trail user experience through the incorporation of educational, historical and public art opportunities along the trail.

Evaluation Criteria

Using the goals as a framework, evaluation criteria were developed as a means of determining the opportunities and constraints associated with a particular trail segment. Opportunities and constraints were considered for the trail alignment, design and development features and operation and maintenance practices within a given segment. Opportunities enhance project success while constraints detract from the project's success.

For some segments, the possibility of using an alternative alignment to the acquired right-of-way was considered. A ranking system was developed as a means of comparing the alignment options within a given segment. The higher the score, the better an alignment satisfied the multiple goals of the Trolley Trail. The rankings can be seen in Table 12. The ranking system is not applicable to other aspects of the opportunities and constraints analysis (i.e. trail design, development, operation, maintenance).

The evaluation criteria include:

On-route Safety and Security

- Conforms with state and federal standards and guidelines.
- Reflects input from planners, engineers, and the Clackamas County Sheriff's office.
- Reflects traffic accident data.
- Separation of trail from vehicular traffic.

- Line of sight and "eyes on the route" that exist along a given alignment (this refers to the visual proximity and access to and from occupied homes, businesses, and other people near the route).

Connectivity

Provides the most direct and convenient access to other trails or bikeways, schools, parks, commercial or employment areas and senior centers.

Environmental Sensitivity

This criterion reflects degree to which segment avoids or minimizes any negative impacts to the natural environment.

Aesthetics

Segments will be evaluated according to surrounding views and existing or potential visual access to features in the natural and built environment.

Cost Efficiency

Estimated cost of implementation/maintenance, especially where crossing improvements, fencing or other expensive infrastructure improvements are required. Includes estimated cost of land use approvals and permitting requirements.

Roadway and Driveway Crossings

Typically, the fewer driveway and roadway crossings, the safer the segment. The safety of each crossing also depends on traffic speed, visibility, roadway width and traffic volume.

Potential for Multiple Users/Accessibility

Projected segment use. Typically, off-street routes will receive higher levels of use, but use is also a function of adjacent land uses, population density and trail access. Segment provides access to multiple types of users, i.e., recreational and commuter users.

Public Support

Public support for the alignment option and segment overall. This criterion is based on comments received from the public at the Trolley Trail Open Houses (June 2002, October 2002 and Spring 2003) and the Trolley Trail Working Group.

Right-of-way

Utilizes as much of the historic Trolley Trail right-of-way as possible.

Opportunities and Constraints

Opportunities and constraints for each trail segment are summarized in Table 8 through Table 11 and shown in Figure 8 through Figure 11. Each table includes information for two segments; the corresponding map for those two segments is on the opposite page. The acquired alignment is shown as a dotted line on the maps.

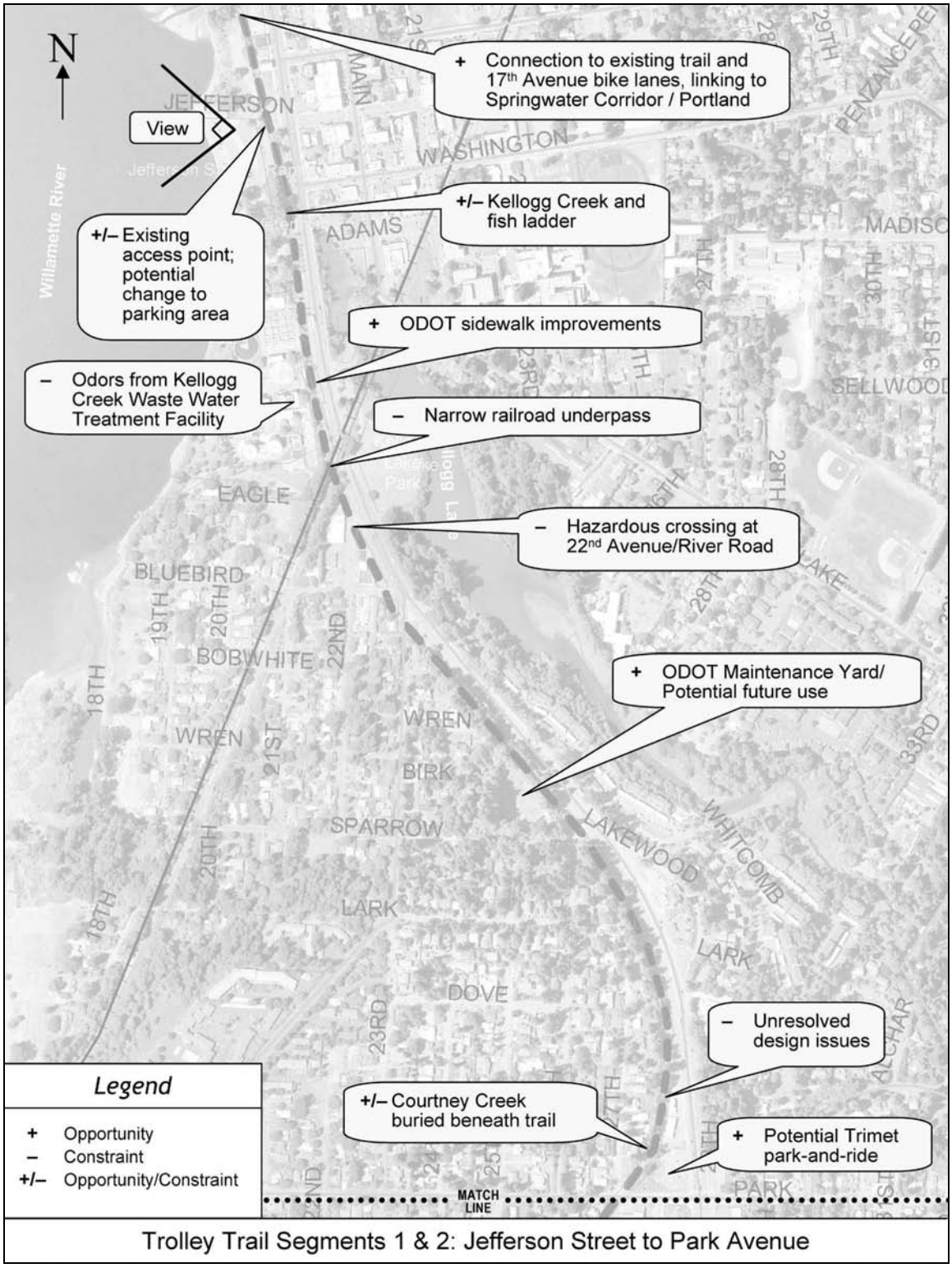
Table 8. Opportunities, Constraints, and Alignment Options – Segments 1 and 2

Segment 1: SE Jefferson Street to SE River Road

Opportunities	Constraints
• Link to SE 17th Avenue bike lane and Springwater Corridor • Views of Willamette River • Presence of boat ramp parking area with restroom • Kellogg Creek interpretive opportunity • Planned "Green Street" improvements for SE McLoughlin Boulevard • Linkage to existing waterfront trail • Connection to downtown Milwaukie • Linkages to bus stops and bike routes • ODOT sidewalk project	• Challenging street crossings at 22nd and River Road • Alternative alignment near odors from the waste water treatment plant • Proximity to fast-moving traffic on SE McLoughlin Boulevard • Right-of-way alignment is narrow beneath railroad trestle • Right-of-way alignment is isolated from neighborhoods • Dark • Environmental permitting may be costly for Kellogg Creek crossing at fish ladder
Alignment Options	
Existing Right-of-Way Alignment This alignment begins at the terminus of the existing trail north of the Jefferson Street Boat Ramp. The alignment travels adjacent to SE McLoughlin Boulevard and crosses over Kellogg Creek, under the railroad trestle, and across SE 22nd to SE River Road *Alternative Alignment*: The alternative alignment begins at the terminus of an existing trail north of the Jefferson Street Boat Ramp. The alignment runs through the park, crosses Kellogg Creek, and links to an existing trail located to the west of the Kellogg Creek Treatment Plant, along the Willamette River. The existing trail ends at 19th Ave. where the alternative alignment will continue to SE Bluebird. The alternative alignment will travel up a steep slope east on SE Bluebird and connect to the Existing Right-of-Way Alignment at OR99E. *Alternative Crossing*: The alternative crossing begins at the trail's intersection with SE 22nd. At this junction, the alignment will continue south on SE 22nd to SE bluebird, then travel east to connect to the Existing Right-of-Way Alignment at OR99E.	

Segment 2: SE River Road to SE Park Avenue

Opportunities	Constraints
• Presence of mature trees • ODOT maintenance yard may serve future maintenance needs • Few street crossings (only 1) present • Trimet considering a Park-and-Ride lot near Park Avenue. Potential partner for trailhead	• Challenging street crossings at 26th • Alternative alignment is in close proximity to SE McLoughlin Boulevard • Encroachment issues in vicinity of Park Avenue • Isolated from neighborhoods • Courtney Creek buried beneath trail • Dark • Sewer manholes present
Alignment Options	
Existing Right-of-Way Alignment The existing right-of-way alignment continues to travel adjacently to SE McLoughlin Boulevard until approximately 152 meters (500 ft) before the intersection with SE Park Avenue, at which point the trail veers westward following the interurban right-of-way. The existing right-of-way alignment crosses SE Park Avenue at the intersection of SE 27th Street. *Alternative Alignment* The alternative alignment follows the existing right-of-way alignment until the point the trail veers westward. The alternative alignment continues to travel adjacently to SE McLoughlin Boulevard to the intersection with SE Park Avenue. The alternative alignment then travels west along SE Park Avenue to the existing right-of-way alignment crossing at SE 27th Street. There are currently no facilities for bicyclists and pedestrians on SE Park Avenue.	



Trolley Trail Segments 1 & 2: Jefferson Street to Park Avenue

Figure 8. Opportunities and Constraints, Segments 1 and 2

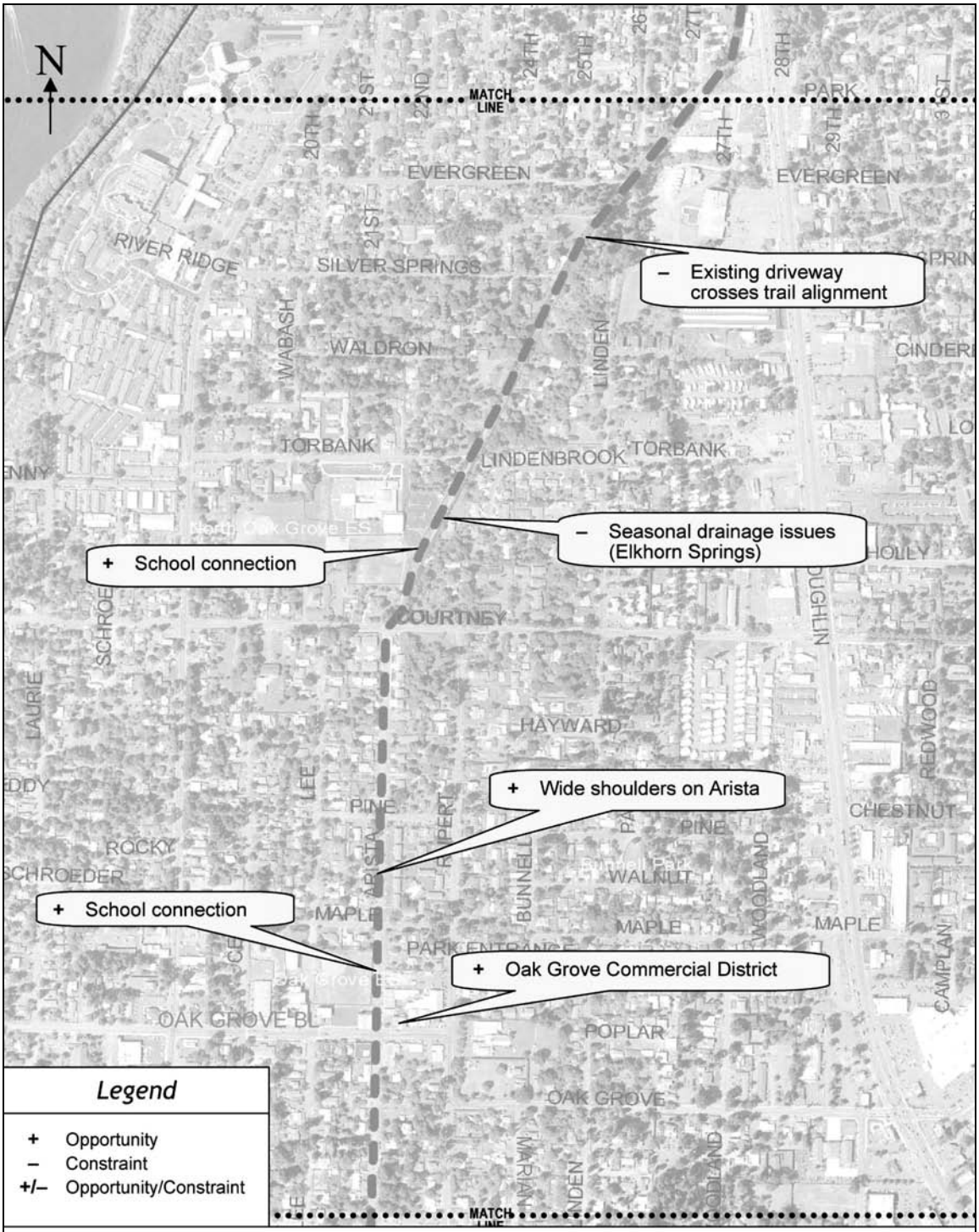
Table 9. Opportunities, Constraints, and Alignment Options – Segments 3 and 4

Segment 3: SE Park Avenue to SE Courtney Road

Opportunities	Constraints
• Connection to Oak Grove Elementary School • Partnership with OLSD for drainage improvements • Excellent neighborhood access • Possible partner with Elks Club • Few street crossings (only 1) present	• Seasonal drainage issues • Drainage issues • Shared driveway use • Encroachment issues just south of Park • History of 4WD vehicle activity
Alignment Options	
Existing Right-of-Way Alignment This alignment follows the right-of-way along SE Arista Drive to SE Courtney. The existing right-of-way alignment is adjacent to the Oak Grove Elementary School. *Alternative Alignment* There is no alternative alignment in this segment.	

Segment 4: SE Courtney Road to just north of Creighton Avenue on SE Arista Drive

Opportunities	Constraints
• 60' wide street right-of-way on SE Arista, with 5-6' wide shoulders in all sections • Linkages to existing bike lanes on Courtney Road and Oak Grove Boulevard • Connects to Oak Grove commercial district • Connection to Sojourner Charter School / community center • Innovative trail / green street design potential • Moderately low traffic volumes on SE Arista • Improvements to existing right-of-way in 90's to accommodate future trail connections	• Proximity to traffic of on-street section • Numerous encroachments present in street right-of-way, including parking lots • Numerous driveway crossings • Loss of existing parking • Recognized need for on street parking • Segment just north of Oak Grove Boulevard is isolated from neighborhood view and may be security issue • Alternative alignment is narrow, in poor condition and has many driveway crossings
Alignment Options	
Existing Right-of-Way Alignment The existing right-of-way alignment is an on-street section that follows SE Arista Drive in the right-of-way to a mid-block crossing just north of Creighton Avenue. This alignment is adjacent to the Sojourner Charter School and travels through the Oak Grove business district. *Alternative Alignment* The alternative alignment leaves the existing right-of-way alignment at the junction of SE Courtney and continues to travel east on SE Courtney to SE Rupert. The alternative alignment then runs south on SE Rupert, to intersection with SE Arista Drive.	



Trolley Trail Segments 3 & 4: Park Avenue to just north of Creighton Avenue at Arista Drive

Figure 9. Opportunities and Constraints, Segments 3 and 4

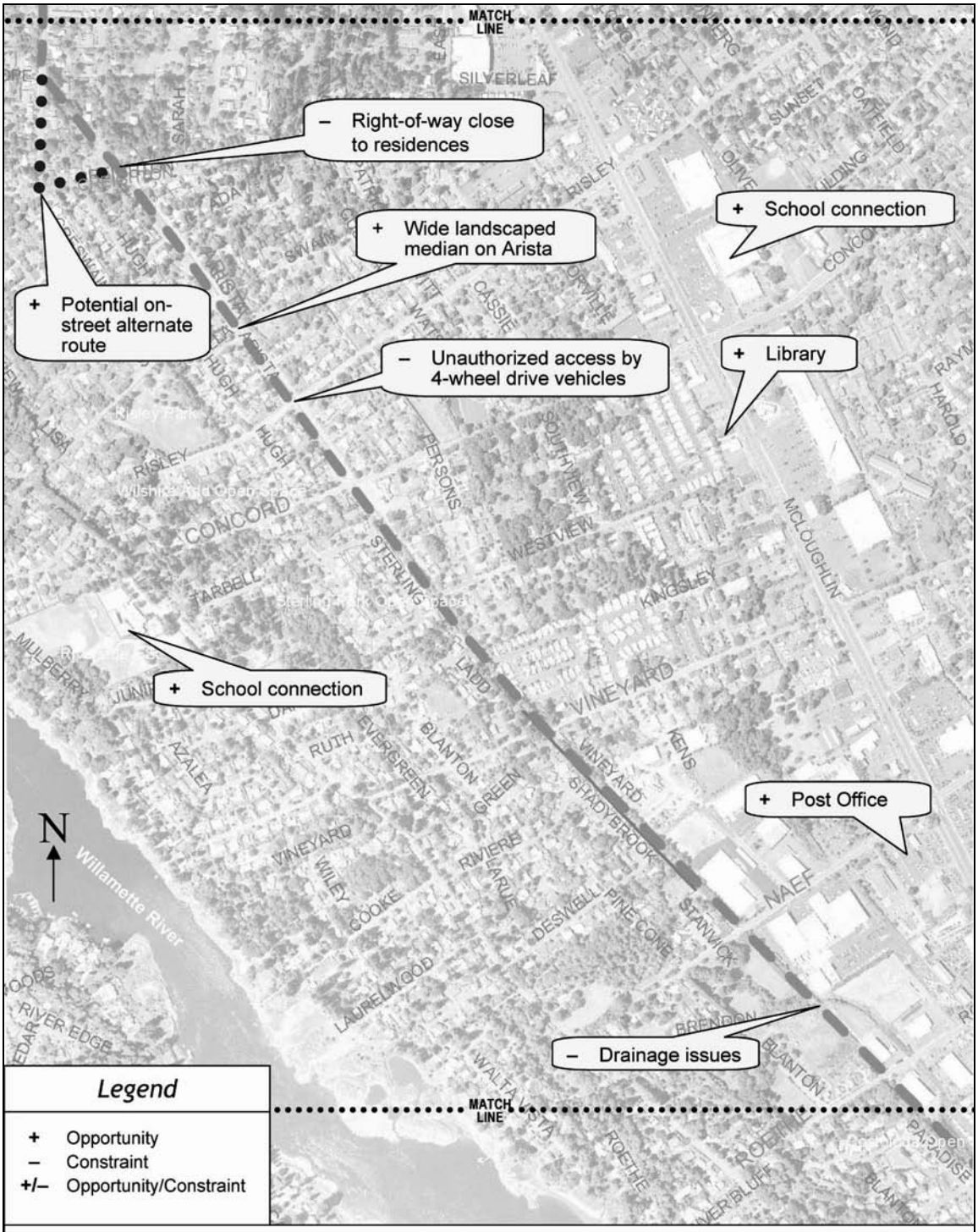
Table 10. Opportunities, Constraints, and Alignment Options – Segments 5 and 6

Segment 5: SE Arista Drive to SE Concord Road

Opportunities	Constraints
• Good neighborhood access • Connection to Risley Park • Potential parking area just south of Concord • Wide median present through the double SE Arista segment • Proximity to Riverside Elementary School • Proximity to Concord Elementary School	• Safety/security concerns with adjacent neighbors • Isolated northern section from SE Creighton Avenue to SE Arista Drive • History of illegal vehicle access from SE Risley Avenue • Unauthorized 4-wheel drive activity in right-of-way • Moderate to low traffic volumes on three street crossings • Presence of creek (underground) at Risley • Alternative Alignment 1 is narrow, in poor condition and has many driveway crossings • Alternative Alignment 2 has steep grades, and is on-street and less direct for commuting cyclists.
Alignment Options	
Existing Right-of-Way Alignment The existing right-of-way alignment uses a mid-block crossing on SE Arista Drive and cuts diagonally to the southeast close to residences. The right-of-way travels in a median strip down the center of SE Arista Drive where it crosses SE Concord. *Alternative Alignment 1* This alternative alignment continues from Segment 4 on SE Rupert until it intersects the Trolley Trail right-of-way at SE Arista Drive. This alternative alignment then joins the existing right-of-way alignment to continue on SE Arista Drive to SE Concord. *Alternative Alignment 2* This alternative alignment continues past the mid-block crossing on SE Arista to the intersection of SE Creighton. This alternative alignment then heads east up an incline along SE Creighton to the intersection of SE Arista Drive and the Trolley Trail right-of-way.	

Segment 6: SE Concord Avenue to SE Roethe Road

Opportunities	Constraints
• Good neighborhood access from SE Westview Avenue • Future trailhead at Stringfield Family Park property at southwest corner of SE Naef Road • Proximity to Library • Proximity to Post Office	• Moderate traffic volumes on two street crossings (Roethe & Naef). • Bridge needed and drainage issues south of Naef
Alignment Options	
Existing Right-of-Way Alignment The existing right-of-way alignment in this section continues to follow the Trolley right-of-way to the end of SE Arista Road. The Trolley right-of-way then continues at the same southeast diagonal to SE Roethe, paralleling SE River Road. *Alternative Alignment* There is no Alternative Alignment in this section.	



Trolley Trail Segments 5 & 6: Just north of Creighton Avenue at Arista Drive to Roethe Road

Figure 10. Opportunities and Constraints, Segments 5 and 6

Table 11. Opportunities, Constraints, and Alignment Options – Segments 7 and 8

Segment 7: SE Roethe Road to SE Jennings Avenue

Opportunities	Constraints
• Few street crossings (2) • Proximity to Boardman Creek presents interpretive/educational opportunity • Innovative design options on SE Arista Drive • Proximity to Rex Putnam High School	• Moderate traffic volumes on 2 street crossings. Note: Roethe and Boardman provide direct connections to Rex Putnam high school to the east. • Design issues between SE Arista Drive and SE McLoughlin Boulevard, including encroachments to east; 4-6' elevation difference • Flooding/drainage issues • Approach to SE McLoughlin Boulevard requires sidewalk widening and other improvements
Alignment Options	
Existing Right-of-Way Alignment The existing right-of-way alignment continues to follow the right-of-way, crossing SE Roethe and SE Boardman. Here the trail is proposed as a cantilevered trail on the east side of SE Arista Drive, separating the trail from the roadway. This alignment would join SE Arista Drive right before it intersects SE McLoughlin Boulevard. It would then follow SE McLoughlin Boulevard to the intersection with SE Jennings. *Alternative Alignment 1* The alternative alignment continues to follow the existing right-of-way alignment to SE Arista Drive. The alternative alignment is within the roadway along SE Arista Drive to SE McLoughlin Boulevard and SE Jennings Avenue. *Other Alternatives*: Three potential treatments for the Trolley Trail on SE Arista Drive include: •Designating SE Arista Drive as a one-way street; •Making SE Arista Drive a dead-end street; •Moving utility poles to use more of the street right-of-way to preserve vegetation and slope stability.	

Segment 8: SE Jennings Avenue to SE Glen Echo Avenue

Opportunities	Constraints
• Linkage to existing bike route in Gladstone along SE Abernethy Lane, and to I-205 bike/ped path and Oregon City over SE 82nd Avenue bridge • SE Hull Street links Candy Lane Elementary School to the east • Trail right-of-way is flat and open, easily accommodating the trail • Trimet considering upgrading transit service and amenities on SE McLoughlin Boulevard, which would improve access to trail • Few cross streets and low volumes and speeds • Good neighborhood access and visibility • Connection to City of Gladstone trail to the south	• Challenging crossing at SE McLoughlin Boulevard • Parking use present on right-of-way at Hull and Glen Echo • Some proposed transit improvements could increase crossing distance at SE McLoughlin Boulevard
Alignment Options	
Existing Right-of-Way Alignment The existing right-of-way alignment crosses OR99E at SE Jennings and continues to follow the right-of-way west of SE Abernethy Lane at the same southeastern diagonal. The existing right-of-way alignment terminates and connects to an existing trail at SE Glen Echo Avenue on the northern edge of Gladstone. This alignment will require using right-of-way that is currently being used for parking. *Alternative Alignment* The Alternative Alignment in this section is to use the Abernethy roadway.	

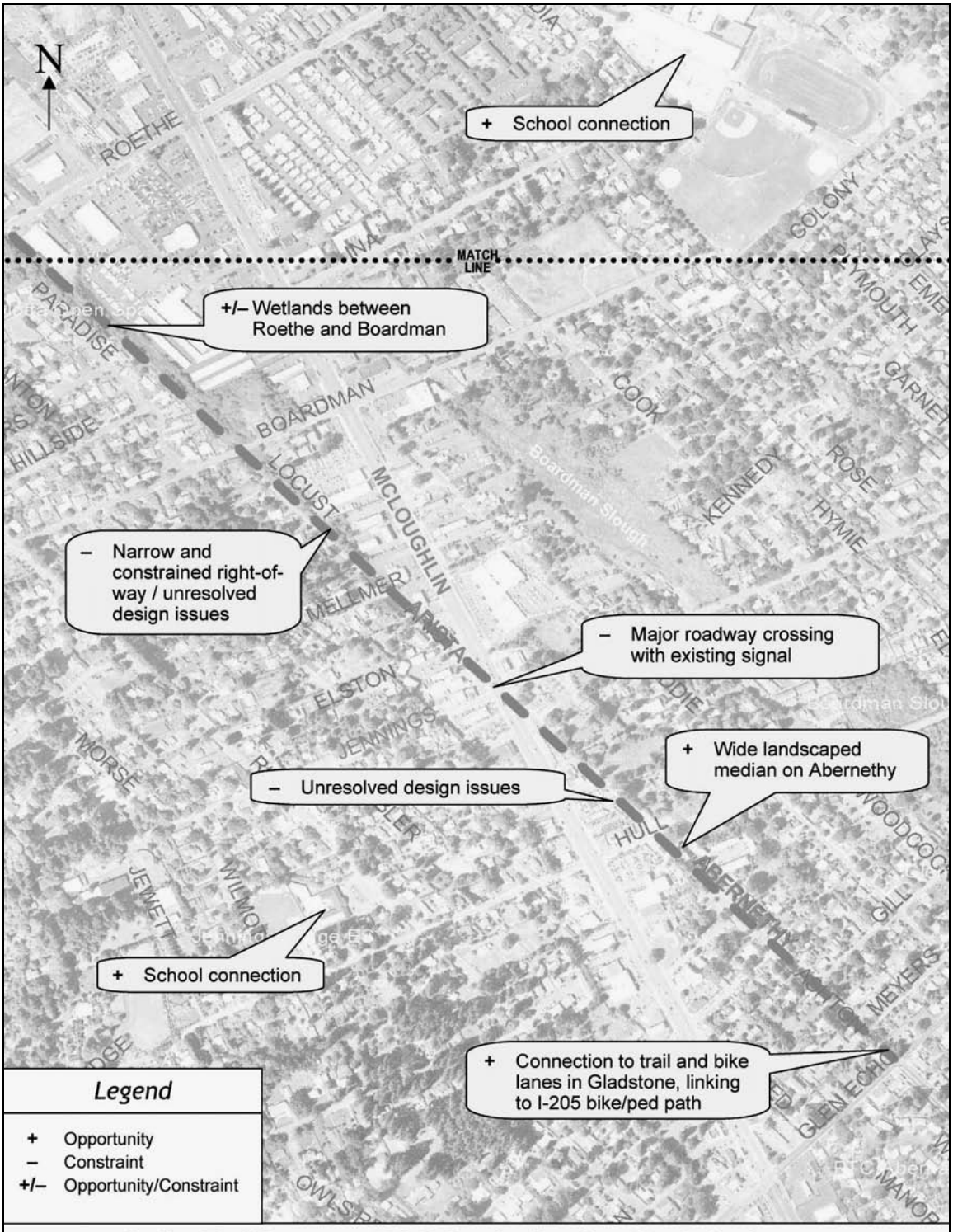


Figure 11. Opportunities and Constraints, Segments 7 and 8

Alternative Alignment Analysis

"Alternative alignment" refers to any trail alignment that utilizes property other than the right-of-way purchased for the project.

A decision matrix was used to score alternative alignments (see Table 12). In the decision matrix, a score was assigned to each alternative alignment to reflect how well it met each criterion. The higher the score, the better suited the alignment to meet the multiple goals of the Trolley Trail. In some cases certain criteria were not relevant to the alignment evaluation, and these were listed as not applicable ("NA") in the matrix. Each criterion was given equal importance in the decision-making process.

Based on the scoring, the acquired right-of-way ranked higher than any alternative alignment, except for one instance when there was a tie. The tie was with an alternative alignment for Segment 1. This alternative uses an existing paved river-side path that provides excellent views of the Willamette River and Portland. However, it does not follow the acquired right-of-way and therefore does not meet one of the project's goals. This alternative is already an existing trail and will be identified as an alternate signed route when the Trolley Trail is constructed.

For the other seven segments, the existing right-of-way alignment outscored the other alignment options because it typically provides protected off-street routes that were more attractive and had fewer roadway conflicts.

Population growth in the area was also recognized as putting increasing demands on the existing roadway system. Participants at the public open houses as well as the working group strongly endorsed utilization of the existing right-of-way alignment because they saw a trail separated from roadway as inherently safer than utilizing the roadways.

Recommended Trail Alignment

The acquired right-of-way is the recommended alignment for the Trolley Trail. The final placement of the alignment may be influenced by design considerations. For example, some sections of the Trolley Trail may be difficult to construct within the acquired right-of-way due to topographical conditions or some other physical impediment. In these areas, the cost of trail construction may outweigh the benefit realized by staying within the acquired right-of-way, and the alignment may need to be reconsidered.

Table 12. Trail Alignment Decision Matrix

Segment	Scoring Factors									
Alignment	Safety	Connectivity	Environmental Sensitivity	Aesthetics	Cost Efficiency	Roadway Crossings	Potential for Multiple Users/ Accessibility	Public Support	On TT ROW	OVERALL SCORE
1: Jefferson Street Boat Ramp to SE River Road										
Trolley Trail Route: McLoughlin	3	NA	2	2	2	2	3	3	3	20
Alt: Island Station	2	NA	3	3	3	2	3	3	1	20
2: SE River Road to SE Park Avenue										
Trolley Trail Route	2	3	2	3	3	2	3	3	3	24
Alt: McLoughlin/ Park	3	3	3	2	2	1	2	1	1	18
3: SE Park Avenue to SE Courtney Road										
Trolley Trail Route										
4: SE Courtney Road to just north of SE Creighton Avenue on SE Arista Drive										
Trolley Trail Route: Arista	3	3	3	3	3	2	3	2	3	25
Alt: Rupert Street	2	3	3	3	1	2	2	1	1	18
5: Just north of SE Creighton Avenue on SE Arista Drive to SE Concord Road										
Trolley Trail Route	3	3	2	3	2	3	3	3	3	25
Alt: Creighton Road	2	2	3	2	2	2	1	2	1	17
6: SE Concord Road to SE Roethe Road										
Trolley Trail Route										
7: SE Roethe Road to SE Jennings Avenue										
Trolley Trail Route: E. of Arista Drive	3	3	2	3	1	3	3	3	3	24
Alt: On Arista Drive	1	3	3	3	3	3	2	2	1	21
8: SEJennings Avenue to SE Glen Echo Avenue										
Trolley Trail Route	3	3	2	2	2	3	3	3	3	24
Alt: On Abernethy	2	3	3	2	2	3	2	2	1	20

Scoring:
3- Good (Meets criteria, achieves goals)
2- Fair (Meets some criteria, does not meet goals)
1- Poor (Fails to meet criteria)

V. Trail Design Elements

Design Concept

Today, as a linear open space winding its way through urban development, the Trolley Trail provides an opportunity to recapture its historic roots as a transportation corridor, to enhance the natural environment and interpret its rich cultural and natural history.

The character of the Trolley Trail will be influenced by the surrounding land uses and landscapes, as well as the design attributes of the recommended trail improvements (i.e. width, materials, color, texture, landscaping). The trail will be designed to blend aesthetically with its surroundings. Significant natural features in the vicinity of the Trolley Trail include the Willamette River, Kellogg Lake and the Boardman Slough. Examples of trail improvements include benches, public art and a paved, wheelchair accessible, trail surface.

The name Trolley Trail clearly evokes the image of the historic use of this corridor as a trolley line. Those that remember the trolley line speak fondly of that era. Many of the older neighborhoods were platted with frontage onto the trolley line since it was once a primary means of transportation for the local residents to travel between neighborhoods and to town centers. The communities and neighborhoods we see today were shaped and designed by the construction of the trolley line.

Wood and metal were the key materials used to build the trolley line and streetcars, and were used in simple but rather elegant ways. This came in the form of tracks, steel trolley wheels and wooden trestles. Wood was utilized in heavy timbers (with the intent of structurally supporting the train) with a semi-rustic character to it. Metal, in the form of steel, had a raw quality to it but was polished over time by use.

Equal to the cultural significance, the corridor provides an opportunity for environmental enhancement and interpretation. The surrounding native landscape played a key part in the place names of many of the former trolley stations. These include names such as Lakewood, Island, Evergreen, Silver Springs and Oak Grove. This reference to the surrounding landscape should be emphasized with the development of the trail through the use of native plant material and native stone like the basalt found on nearby Elk Rock Island.

Trail Access

The Trolley Trail is a multi-use, non-motorized trail that will be used by pedestrians, bicyclists (both recreational and commuters), equestrians, in-line skaters and others. The trail will be accessible to people in wheelchairs and senior citizens with walking aides who require a smooth surface for navigating.

Good access to the trail for all users is a key element to its future success. Simply put, if people cannot get to a trail easily, they will not use it. Neighborhood access

will be achieved from all local streets crossing the trail. Each street crossing will be identified and directional signage will be placed at street intersections identifying destinations and distances along the trail and within the surrounding community. Trail users who live in the neighborhoods along the Trolley Trail can access the trail at the locations shown in Table 13 and shown on Figure 12.

Table 13. Trail Access Points

- SE Jefferson Street Boat Ramp
- SE 22nd Avenue
- SE Bluebird Street
- SE River Road
- SE Sparrow Street/26th Avenue
- SE Park Avenue
- SE Evergreen Street
- SE Silver Springs Road
- SE Torbank Road
- SE Arista Drive (on-street route)
- SE Courtney Road
- SE Oak Grove Boulevard
- Crossing SE Arista Drive
- SE Creighton Avenue
- SE Swain Avenue
- SE Risley Avenue
- SE Concord Road
- SE Vineyard Road
- SE Naef Road
- SE Roethe Road
- SE Boardman Avenue
- SE McLoughlin Boulevard at SE Jennings Avenue
- SE Hull Avenue
- SE Meldrum Avenue
- SE Glen Echo Avenue
- SE 26th Avenue
- SE Westview Avenue
- Mobile home park between SE Vineyard & SE Westview Avenue

Potential Trailheads

Trailheads (formalized parking areas) serve the regional population arriving to the trail by car. Trailhead locations should ideally be located every two to three miles along the trail. Five areas along the trail are recommended as new trailhead access points (see Figure 12). Use of these sites as public trailheads will require discussions with both the managing agency of the site and neighbors living in the vicinity of the trailheads. Final approval will rest exclusively with the managing agency.

The Jefferson Street Boat Ramp: This parking area is immediately adjacent to the trail and will function well as a trailhead. Given that the McLoughlin Boulevard improvements call for relocating the entrance to the boat ramp from Jefferson Street to Washington Street, and given ongoing discussion about potential changes to the boat ramp area, close coordination with city staff will be important.

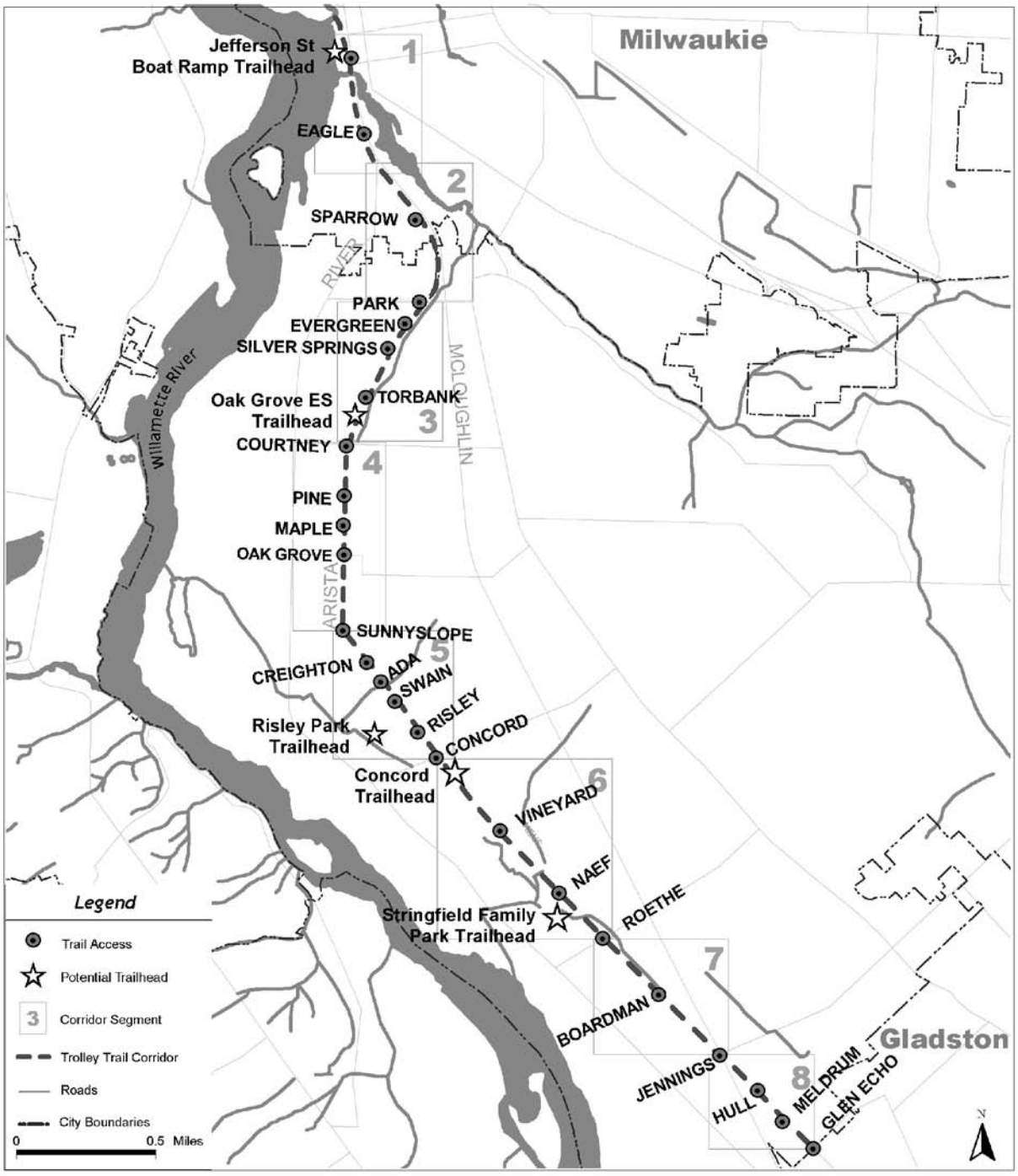


Figure 12. Trolley Trail Access Points and Potential Trailheads

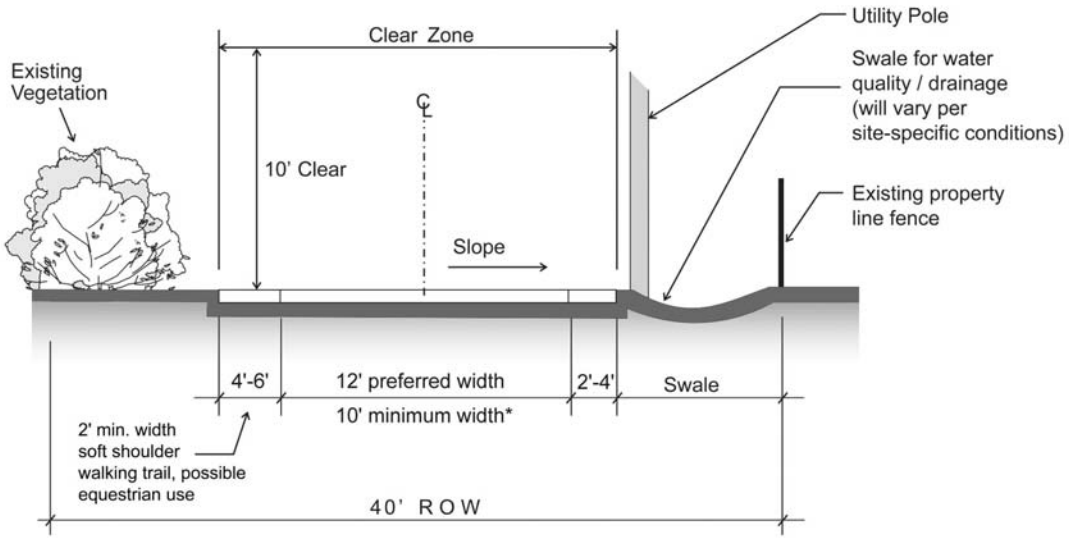
Oak Grove Elementary School: It is recommended that the existing school parking lot be explored as a potential site for trail access during non-school hours. Non-school hour access is important because the early evening weekday hours will likely be some of the most popular times for trail use (statistics from the nearby Springwater Corridor bear this out). Peak trail use and need for parking therefore should not conflict with peak parking times for the school. Use of this site will require approval from the school district.

Just south of the intersection of SE Arista Drive and SE Concord Road: This parking area will be formalized to allow for trail user parking of 8-10 cars and still have sufficient width to accommodate the trail. Discussions will need to be held with the local church regarding formalizing this use.

Stringfield Family Park on SE Naef Road: NCPRD acquired this property in 2003 to provide a trailhead for the Trolley Trail and a neighborhood park for the Oak Lodge neighborhood. The park may include passive recreational amenities such as benches, environmental interpretation, a community garden and picnic facilities. Other facilities may include a small playground, parking for 6 to 10 cars and restrooms. NCPRD will also work with OLSD on a wetland restoration/interpretation project on the property.

Typical Trail Cross Section Design

The optimum recommended trail width is 12'-0". However, due to constriction in the right-of-way, the trail may narrow to 10' in some areas. Vertical clearance along the trail should be a minimum of 10'-0" and horizontal clearance should extend 2'-0" beyond the trail shoulders (see Figure 13). Asphalt is a logical and economical surface choice, although concrete should be considered if funding is available. Concrete is more expensive to install, but requires less maintenance in the long term.



* In some areas the trail may need to be narrower than 10' due to site constraints.

Figure 13. Trolley Trail Cross Section (looking south)

Soft shoulders should be provided on both sides of the trail. Shoulders provide a setback or "shy distance" from fixed objects along the trail edge and serve as tactile warning devices for anyone inadvertently swaying off of the trail. Soft shoulders can also accommodate walkers, runners and horses.

Table 14. Trolley Trail Design Recommendations

Width	12'-0" (optimum), 10' minimum
Surface	Asphalt or concrete
Soft Shoulder	Crusher fines or gravel
Vertical Clearance	10'-0"
Horizontal Clearance	2'-0"
Maximum Slope	5%
Cross Slope	2%

Between Jefferson Street and Park Avenue where the right-of-way parallels McLoughlin Boulevard, 2' wide gravel shoulders are recommended. South of Park Avenue, where the right-of-way passes through residential areas, one shoulder should be 4' to 6' wide of crusher fines and the other shoulder 2' to 4' wide of crusher fines or gravel (depending upon funding availability). Pavers should be considered for the wider shoulder if funding is available and if recommended by a trail design professional. Pavers are used to bring stability and strength to a surface, are composed of either concrete or plastic, and have a lattice-like structure filled with crusher fines.

When constrictions occur in the right of way, the hard surface trail will be reduced to not less than 10' wide before reducing the shoulder widths to a minimum of 2'. In some areas the trail may need to be narrower than 10' due to site constraints. Every effort should be made to enhance the aesthetic appearance and feel of the trail throughout the corridor. Examples include meandering the trail, tinting the surface with a natural color and landscaping.

Structural Section and Surface

Trail construction will be conducted in a similar manner as roadway construction. Sub-base thickness will be determined by soil conditions. Expansive soil types require special structural sections. Use of geotextiles should be encouraged (depending on subsurface soil type and drainage) to provide stability and aid drainage to subsurface soils). Ideal asphalt thickness should be 3 inches of Type A or Type B ODOT Asphalt Mix, with 3/4" minus crushed aggregate-base, 4" depth.

Although there have been trails constructed recently in the Portland Metropolitan area using an ODOT standard Class F asphalt mix to achieve permeability, use of this mix is not recommended due to serious drainage issues throughout the trail corridor.

In lieu of use of a permeable pavement, the trail should be cross-sloped at least 2% to direct water to a subdrainage or swale which then directs the water to the nearest water body ("cross-sloping" means the center of the trail is slightly higher than the edge of the trail, causing water to flow off the trail). This will provide a pretreatment opportunity for stormwater.

Design Speed

The maximum design speed for bike paths is 20 miles per hour. Speed bumps or other surface irregularities should never be used to slow bicycles.

Horizontal Alignment

A 2% cross slope is recommended for drainage, and should generally not be exceeded. The Trolley Trail runs along a linear corridor, and sharp curves are not anticipated along the trail, except at trail entrance/exit points and at transitions at the north and south ends of the alignment. At trail entrances, the trail connecting to the main trail should meet the main trail at a 90 degree angle and consideration given to maintaining good visibility around the trail intersection.

Grades

The recommended maximum gradient is 5%. Steeper grades can be tolerated for short distances (up to about 500 feet). The Trolley Trail corridor is nearly flat for most of the alignment.

Trail in Median

There are two areas along the right-of-way where the trail will be located in a wide street median area: from SE Creighton Avenue to SE Concord Road between the double Arista Drives, and on the west side of Abernethy Lane between SE Jennings Avenue and SE Glen Echo Avenue (see Figure 14 and Figure 15).

In some areas within the northern median between SE Creighton Avenue and SE Concord Road, adjacent property owners have introduced plants and garden areas in the median. Sufficient width is available within this median area to facilitate alignment of the trail and retain the majority of the introduced plants.

Figure 14. Trail in Median Between Double SE Arista Drives
Looking South between SE Creighton Avenue and SE Concord Road

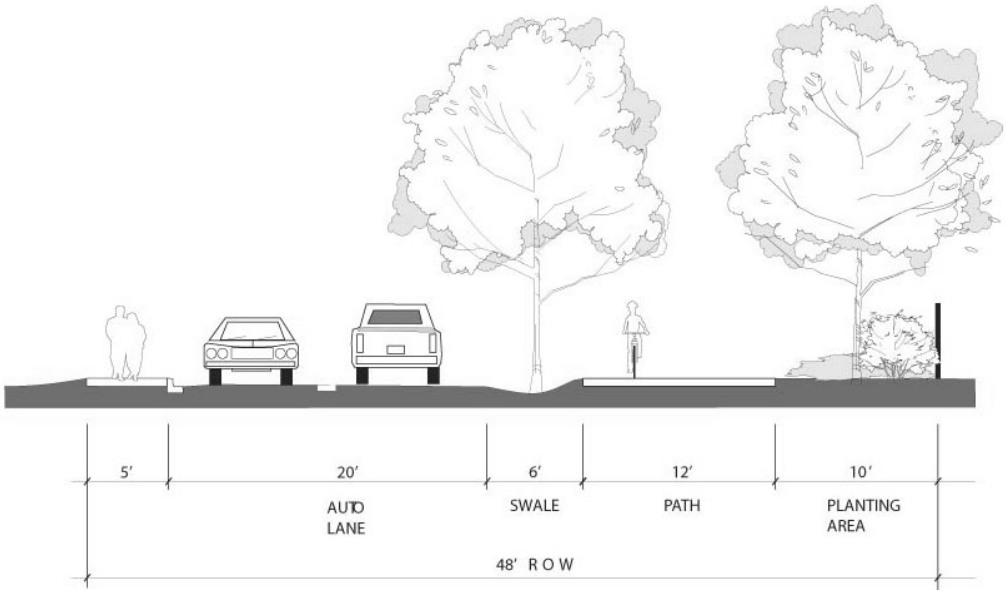


Figure 15. Abernethy Lane Treatment
Looking South between SE Jennings Avenue and SE Glen Echo Avenue

Cantilevered Trail

Continuation of the trail within the trolley right-of-way becomes a challenge on SE Arista Drive between SE Boardman Avenue and SE McLoughlin Boulevard. Grades become steep and adjacent commercial businesses along SE McLoughlin Boulevard abut the eastern edge of the right-of-way. Nonetheless, there appears to be adequate width to place a retaining wall to support the trail along this stretch (see Figure 16).

Given the development constraints of using the trail right-of-way, three alternative designs were considered using the existing Arista Drive for the trail.

1. Relocation of PGE power poles: This would provide sufficient room for the trail on the east of SE Arista Drive.

2. SE Arista Drive becomes a one-way route: This will allow sufficient room for the trail on the east side of SE Arista Drive.

3. SE Arista Drive becomes a dead-end street: This would reduce traffic on Arista Drive, make it more conducive to accommodating trail use on the east side and eliminate a difficult turn on to McLoughlin Boulevard.

The general consensus from discussions with Clackamas County staff and the Trolley Trail Working Group is to maximize the use of the Trolley Trail right-of-way for the trail and minimize the use of SE Arista Drive. Arista Drive's narrow travel lane and sub-standard right-of-way would create conflicts between trail users and automobiles, and there is concern that the Trolley Trail right-of-way would be transferred to a non-recreational use. Implementation of the trail in this area will require further analysis and discussion between the managing agency, Clackamas County and nearby residents.

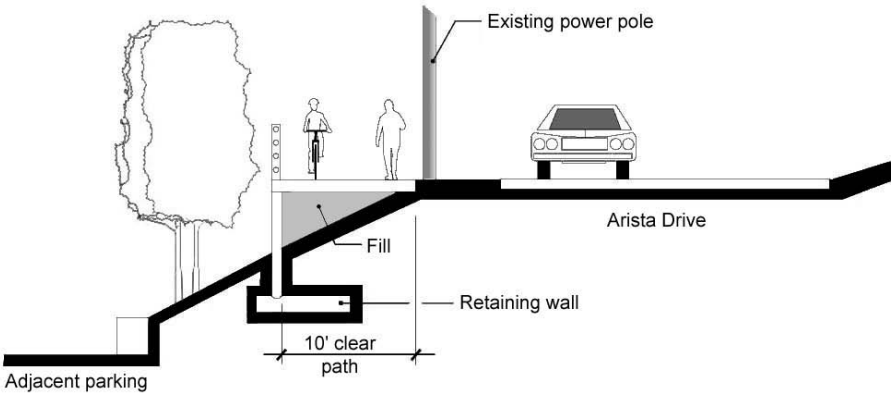


Figure 16. Trail Option with Retaining Wall
Looking South on Arista Drive between SE Boardman Avenue and SE McLoughlin Boulevard

Equestrian Use of Trail

During the master planning process a petition with approximately 50 signatures was received from citizens urging NCPRD and Metro to consider equestrian use on the Trolley Trail. A 2-mile section of the Trolley Trail will be built to accommodate equestrian use by residents who stable their horses in the vicinity of the Trolley Trail. The equestrian portion of the Trolley Trail begins at SE Creighton Avenue (the northern extent of the double Arista drives) and extends south to SE Boardman Avenue. This is the section of the unimproved right-of-way that has historically been used by local residents for horseback riding. The other sections of the Trolley Trail are either unsafe, undesirable or infeasible for equestrian use given their close proximity to roads and fast moving traffic, or their physical isolation in-between on-street sections of the trail. Given the equestrian portion of the trail is approximately 2 miles long, it is of a scale to meet local equestrian needs but does not have the capability to serve as a regional equestrian trail. Providing access such as horse trailer parking would easily overwhelm the 2-mile section of trail designed to accommodate local equestrian use.

Between SE Creighton Avenue and SE Boardman Avenue, the equestrian trail should be a maximum width of 6 feet and a minimum width of 4 feet along one side of the paved path, with a vertical clearance of 10 feet. Horizontal separation with vegetative buffer between the paved trail and multi-use trail should be pursued; however, local equestrians have indicated that use of a 6'-wide soft shoulder along the paved path was acceptable. A crusher fines shoulder surface will be provided. Whether to use pavers for this shoulder will be determined during the design phase.

Potential safety concerns regarding the presence of equestrians come primarily from trail user conflicts. An inexperienced horse and rider could become spooked by an unannounced cyclist. Measures to minimize user conflicts between equestrians and other trail users include:

- Post regulations to educate users about trail etiquette (e.g., pedestrians and bicyclists yield to horses, equestrians clean up after their horses).
- Require trail users to give an audible warning as they approach an equestrian.

Shared Use of the Trail Corridor

As a general policy, vehicle access to the trail should be prohibited with the exception of emergency and maintenance vehicles. However, there is one area where private automobile access is required within the Trolley Trail right-of-way.

Between SE Silver Spring Road and SE Torbank Road, the right-of-way must facilitate both the trail and automobile access to certain residential properties. The recommended treatment in this area is to separate vehicle use from trail use within the right-of-way. Separation of car use from trail use is inherently safer than a shared use approach, and there is sufficient right-of-way width available for both the trail and driveway access to coexist. A vegetative buffer that maintains sight lines (no

higher than 3') should be created between the trail and driveway. In a few cases, driveway entrances cross perpendicular to the trail. At these driveway crossings the trail user will have the right-of-way and vehicles will be required to stop (Type I roadway crossing; see Table 15 on page 57). Special signing and/or pavement markings may also be appropriate.

On-Street Trail Design

As stated previously, the preferred alignment for the Trolley Trail is along the old trolley right-of-way, as it provides a route that existing roadways do not offer. Generally, a multi-use path is not recommended directly parallel to roadways, as most bicyclists will find such a trail less usable than the street itself (assuming there is adequate roadway width).

However, in some sections, the Trolley Trail does parallel roadways. In these areas the trail should be located no closer than five feet from the edge of the roadway, unless a physical barrier is provided. Based upon field reconnaissance work, it appears the minimum setback of 5' can be achieved.

SE Arista Drive between SE Courtney Road and just north of SE Creighton Avenue

This segment of the Trolley Trail right-of-way is within an existing street right-of-way, SE Arista Drive. The roadway is paved with 12'-6" wide travel lanes and limited available shoulder width. The presence of numerous driveways on both sides of the street make potential conflicts with trail users and vehicles high. The street right-of-way is 60' wide and intermittent sidewalks exist on both sides of the road. There has been significant private development within the right-of-way, ranging from landscaping and mailboxes to off-street parking.

Design treatments considered for this area include three options shown in Figure 17, Figure 18 and Figure 19:

- Option 1: Trail in Median
- Option 2: Bike Lanes and Sidewalks on both sides
- Option 3: Bike and Pedestrian Trail on East side of SE Arista right-of-way

Clackamas County traffic engineers and the Statewide Bicycle and Pedestrian Coordinator reviewed the three on-road trail options for Arista Drive and concluded that Option 2 (Bike Lanes and Sidewalks on both sides of the road) was their preferred option. The general consensus was that Option 1 (Trail in Median) was less safe and that Option 3 (Bike and Pedestrian trail on East Side of Arista right-of-way) was undesirable due to conflicts associated with the number of driveway crossings. A letter from the County (1/15/03) providing detailed review of the Arista options can be found in Appendix E, Trail Design Elements.

Implementation of any treatment of SE Arista Drive would require a substantial public process, as well as an additional funding source, and for this reason the master plan does not recommend a particular option.

When the time comes to select an option, the following criteria should be considered in the trail design:

- Maintaining continuity of the trail
- Enhancing safety
- Providing on street parking
- Incorporating traffic calming measures
- Applying "Green Street" concepts
- Minimizing impacts to private property
- Costs

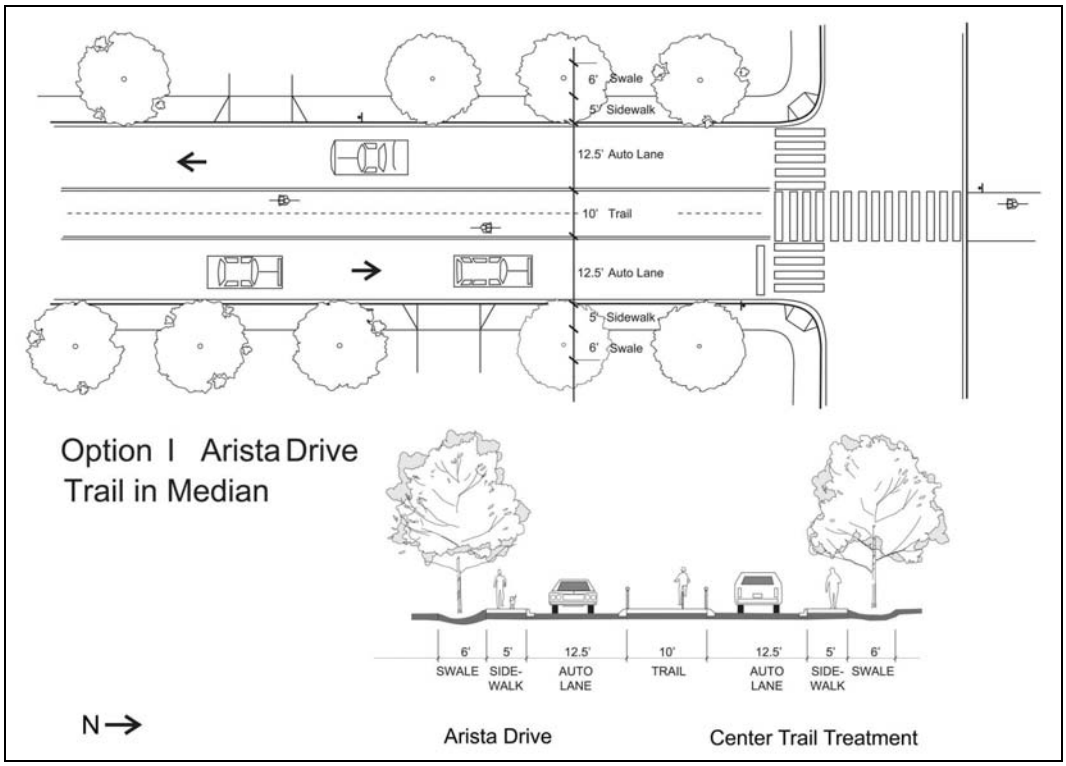


Figure 17. Option 1 for SE Arista Drive

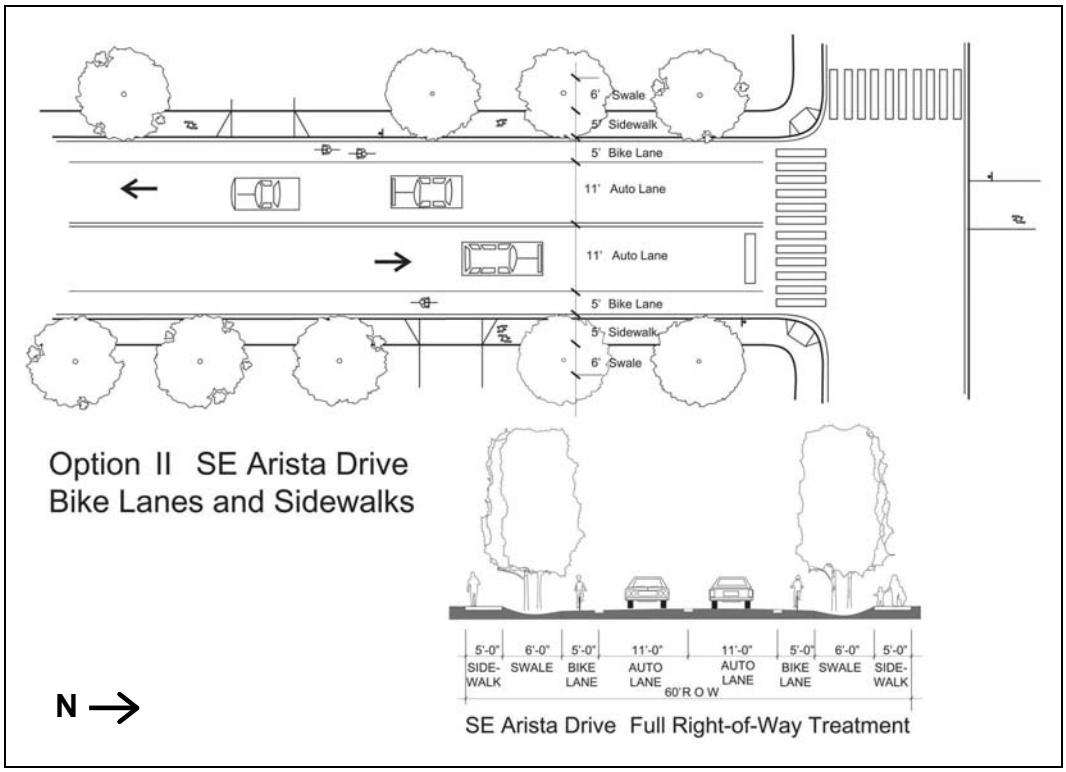


Figure 18. Option 2 for SE Arista Drive

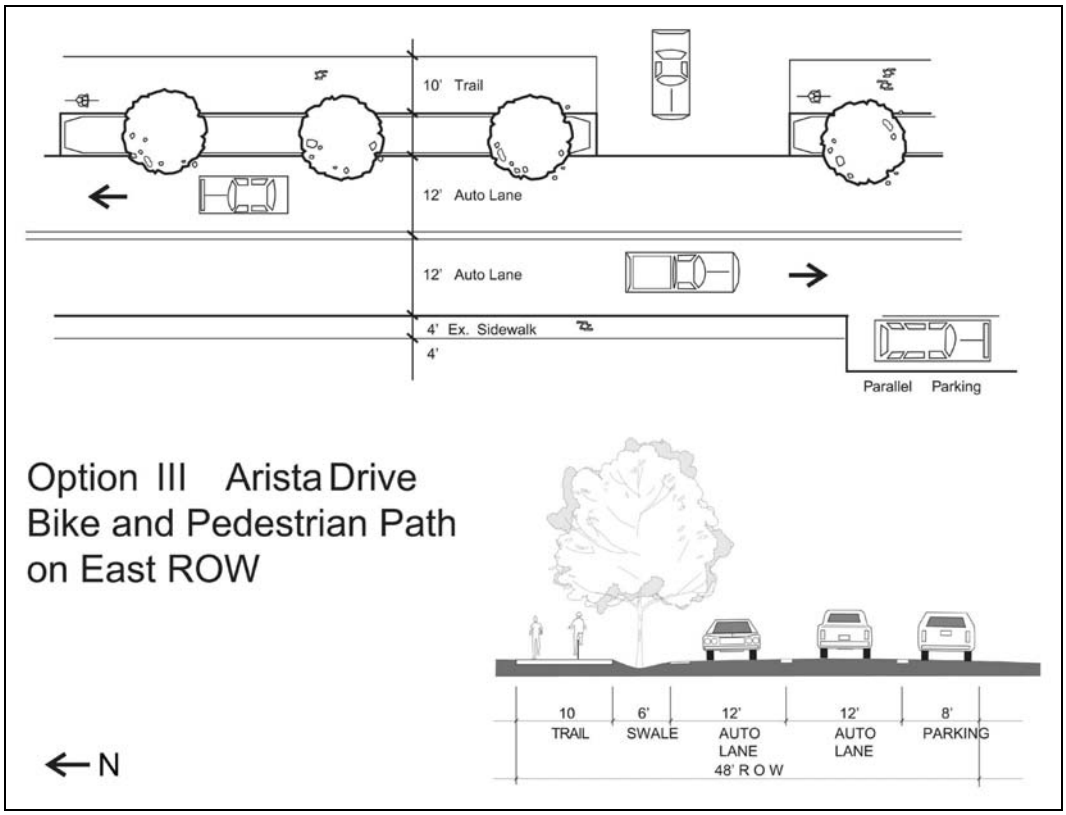


Figure 19. Option 3 for SE Arista Drive

Roadway Crossings

The Trolley Trail crosses about 25 roads and driveways. Fortunately, most of these roadways are low-volume, neighborhood streets that do not require extensive treatment to accommodate users safely.

Roadway crossings represent one of the key challenges to trail implementation. Motorists often do not expect to see bicyclists and pedestrians at unprotected locations at trail crossings. However, intersection treatments on the Trolley Trail do not pose a large challenge. The crossings typically have low to moderate traffic volumes, have excellent visibility on the approaches, both from the trail user's point of view as well as the automobile driver. In addition, the vast majority of the trail/roadway intersections meet at a simple 90 degree angle, minimizing crossing distances and making the appropriate design treatments simple to implement. The few exceptions to this include the crossings of SE McLoughlin Boulevard at SE Jennings Avenue, and the crossing at SE River Road and 22nd Avenue.

Design of crossings of the Trolley Trail will involve analysis of traffic patterns of vehicles as well as trail users. This includes traffic speeds, street width, traffic volumes (average daily traffic, and peak hour), line of sight and trail user profile (age distribution, destinations).

A Traffic Safety study will need to be completed as part of the actual civil engineering design of the proposed crossings to determine the most appropriate design features. This will identify the most appropriate crossing options given available information, which must be verified and/or refined through the actual engineering and construction document stage.

The proposed crossing treatments in this report are based on established standards, preliminary evaluation of the available data and the experiences on similar existing facilities. Virtually all the possible crossing treatments fit into one of four basic categories, described in Table 15.

Table 15. Basic Crossing Prototypes

Crossing Type	Description
I. Unprotected	Unprotected but marked crossings include mid-block crossings of residential, collector, and sometimes major arterial streets.
II. Routed to Existing Intersection	Trails which emerge near existing intersections may be routed to these locations.
III. Signalized/Controlled	Trail crossings which require signals or other control measures due to traffic volumes, speeds, and trail usage.
IV. Grade Separated	Bridges or undercrossings provide the maximum level of safety but also generally are the most expensive and have right-of-way, maintenance and other public safety considerations.

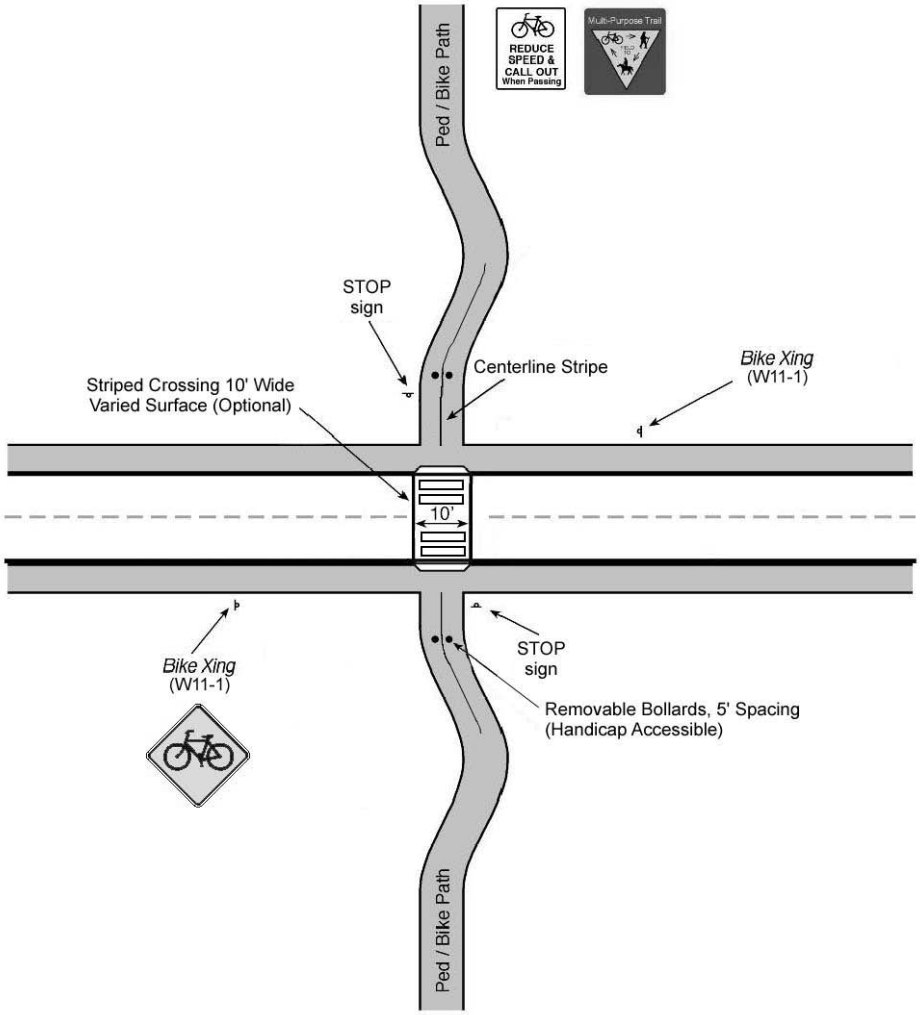


Figure 20. Non-signalized, Type I Crossing Treatment

For the Trolley Trail, only Type I and II trail crossings are recommended. This is due to the low volume (under 5,000) of existing automobile traffic on the intersecting roadways. The only intersecting roadway with an Average Daily Traffic (ADT) volume over 10,000 cars is SE McLoughlin Boulevard (with 38,000), which already has an existing traffic signal where the Trolley Trail needs to cross the road.

Type I or uncontrolled crossings (unsignalized, but with other traffic control devices; see Figure 20) are recommended for streets where a significant number of vehicles ("85th percentile", which is 85% or more) travel at speeds of less than 45 mph, and are used by less than 10,000 vehicles per day.

Type II crossings are recommended where the trail intersection crossing is within 250 feet of an existing signalized intersection. In order for this option to be effective, signing would be needed to direct trail users to the signalized crossings.

Table 35 in Appendix E presents a summary of recommended roadway crossing treatments for the Trolley Trail.

Standard Crossing Features

Signing

Crossing features for all roadways should include warning signs both for vehicles and trail users. Signing for trail users must include a standard "STOP" or "YIELD" sign and pavement marking, combined with other features such as bollards or a curve in the Trolley Trail to slow bicyclists as they approach the intersection. The type, location and other criteria are identified in the Manual for Uniform Traffic Control Devices (MUTCD).

Consideration must be given for adequate warning distance based on vehicle speeds and line of sight, with visibility of any signing absolutely critical. Catching the attention of motorists desensitized to roadway signs may require additional alerting devices such as roadway striping. Care must be taken not to place too many signs at crossings or they will result in sign clutter and will negate their impact.

Directional signing may be useful for trail users and motorists alike. For motorists, a sign reading "Trolley Trail Xing" along with a trail emblem or logo helps both warn and promote use of the trail itself. For trail users, directional signs and street names at crossings help direct people to their destinations. Table 36 in Appendix E lists regulatory signs to be used.

Striping

Standard striping patterns used nationwide to delineate trail crossings will be implemented on the Trolley Trail. A centerline stripe on the trail approach to the intersection will help to organize and warn trail users. The actual crosswalk striping may be accompanied by pavement treatments to help warn and slow motorists. In areas where motorists do not typically defer to pedestrians in crosswalks, additional measures may be required. While some engineers prefer not to mark unprotected crossings, the proposed marked trail/roadway crossings serve a valuable function by warning motorists and trail users.

Existing Intersections

When the trail emerges closer than 250 feet from a signalized intersection, such as on SE McLoughlin Boulevard and SE Jennings Avenue, it should go to that crossing and not make its own crossing. Motorists are not expecting to see pedestrians and bicyclists crossing so close to an intersection, and such a close crossing may unnecessarily impact traffic capacity on a corridor.

Where the Trolley Trail does not emerge at an existing intersection, a barrier and directional signing will be required to keep bicyclists and others from crossing at the unmarked location. At the existing intersection crosswalk, all trail users will technically become pedestrians. Motorists are required to yield to pedestrians in a crosswalk. For areas where significant pedestrian conflicts exist, or are projected to exist, local agency review is recommended to identify the safest solution.

One of the key problems with using existing intersections is that it requires bicyclists to transition from a separated two-way facility to sidewalks and crosswalks normally reserved for pedestrians. Widening and striping the sidewalk between the trail and intersection is recommended to alleviate some of these concerns.

SE River Road Area

This segment of trail parallels SE McLoughlin Boulevard and requires grade crossings at SE 22nd Avenue, SE Bluebird Street and SE River Road. The trail alignment through this area was developed jointly with the ODOT and the City of Milwaukie engineering staff. ODOT has current plans of extending a sidewalk through this area and negotiations are currently underway between Metro and ODOT to allow the sidewalk to be improved to a bikeway standard and be constructed on the trolley right-of-way as opposed to the SE McLoughlin Boulevard right-of-way.

A key challenge in this area is safe crossings of the roadways. The proposed design recommends creation of a right turn lane on SE McLoughlin Boulevard and realignment of SE 22nd Avenue to a tighter turning radius (see Figure 21). This will require vehicles turning onto SE 22nd Avenue to slow down on their approach thereby improving safety conditions at the trail crossing.

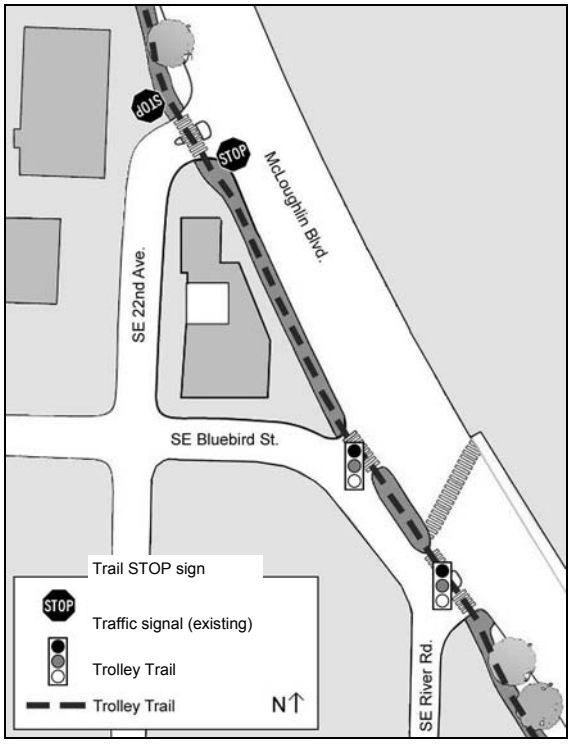


Figure 21. Proposed Intersection Treatments,
SE 22nd Avenue to River Road

Drainage Treatments

It is critical to maintain the existing established drainage pattern along the Trolley Trail right-of-way and enhance the system where feasible. A description of the key drainage improvement recommendations follows:

SE Park Avenue to SE Courtney Road

1. SE 26th Place south of SE Park Avenue: OLSD needs periodic access to the nearby 12" inlet structure for maintenance purposes.

2. SE Park Avenue: Trolley Trail design/development needs to be coordinated with Clackamas County's and OLSD's plans for improvements along SE Park Avenue.

3. South of SE Evergreen Street (half way to SE Silver Springs Street): The existing ditches on the west side of the trail right-of-way will need to remain and be maintained in conjunction with the Sanitary District. Maintenance includes vegetation and sediment removal.

4. SE Waldron Drive and Waldron Meadows Subdivision: The ditch that receives drainage from the nearby detention pond will need to remain and be maintained.

5. SE Silver Springs Road to SE Torbank Road: Recommend negotiation and acquisition of drainage easement through property to the east that would tie into the Kellogg Creek tributary. This would allow piping of water from the west side of the trail, through the drainage easement and creek.

6. SE Torbank Road to SE Courtney Road: Catch basins could tie into the proposed extension of the school district's storm drain line and provide drainage for this area. Note: Even without the storm drain extension, there is an existing storm drain line through the area that would allow installation of catch basins in the northern half of this area.

7. SE Creighton Avenue to SE Concord Road: Recommend maintaining existing swales on the west side of the median between the double Arista Drives. This will provide needed drainage and a physical barrier to unauthorized access by 4-wheel drive vehicles.

8. SE Westview Avenue to SE Vineyard Road: Trolley Trail development will not impede maintenance access to the following pipes:

    - 36" storm sewer at NW corner of Royal Terrace Mobile Home Park
    - 60" storm sewer outfall and 72" storm pipe at south end of Vineyard Ave..
    - 12" storm sewer crossing trail north of Vineyard Road at entrance to mobile home park.

9. SE Naef Road to SE Roethe Road: Recommend that the undersized culvert be replaced with a bridge where Boardman Creek crosses the trail midway between SE Naef Road and SE Roethe Road (see Figure 22). The likelihood is good that OLSD would be a project partner to help with the cost of this improvement. Maintain the ditch swale on the west side of the trail from the bridge to Roethe Road.

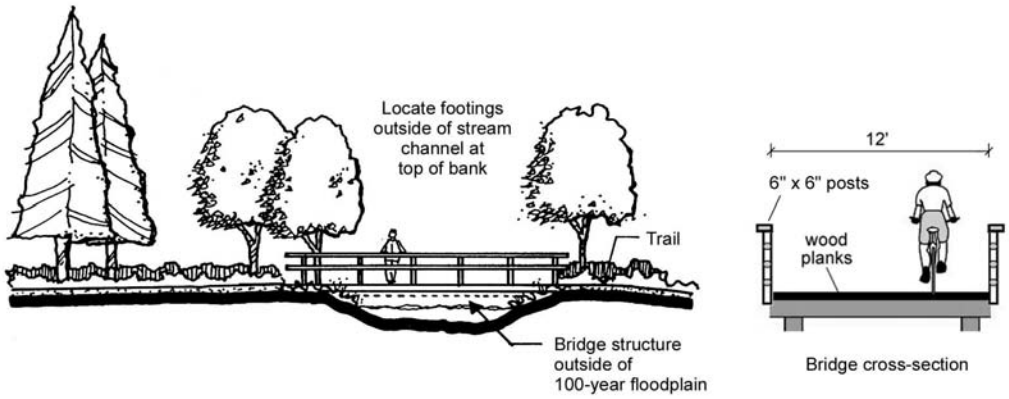


Figure 22. Crossing of Boardman Creek

10. SE Roethe Road to SE Boardman Road: Maintain the ditch swale on the west side of the trail from SE Roethe Road to the north end of SE Paradise Drive. OLSD recommends elevating the trail in this area above existing grade by approximately 1 to 2 feet to keep Boardman Creek from flooding across the trail into the Paradise Drive drainage swale. While this option may alleviate flooding across the trail, it is not clear what effect the contained floodwaters would have on the adjacent Boardman Creek wetlands. Another option would be to pave the trail at grade with a trail base and surface designed to be underwater for periods of time. A wetland delineation will be necessary prior to determining the best design of the trail in this area.

11. SE Arista Drive from SE Boardman Avenue to SE Jennings Avenue/SE McLoughlin Boulevard: Roadway flooding is frequent on SE Arista Drive from the Boardman intersection and heading south on SE Arista Drive about 300 feet. Though SE Arista Drive at this location is not in the Trolley Trail right-of-way, OLSD has recommended raising the grade on SE Arista Drive through this area by approximately 12 inches.

12. Other Drainage Considerations: The equestrian trail should be sloped for positive drainage as per the multi-use trail. Drainage should be sloped away from natural resource areas and placement of the equestrian trail should be on the opposite side of the multiuse trail from the resource.

    In areas along the corridor with cut banks above the trail surface, it is recommended to install rock lined trenches (french drain) between the cut bank and the trail. These trenches should be lined with geotextile to prevent water from infiltrating the subgrade of the trail.

In areas where flood-prone soils have been mapped, construction methods (excavation, grading and importing gravel for the trail base) may eliminate the potential for those soils to erode or seep. Field verification and examination of flood-prone soils by a soil scientist or geologist may be prudent to determine if any soils will severely impact trail construction. This being said, it is not likely that the soils in the project area will affect trail construction since the trail corridor has been disturbed and compacted from past construction of the trolley line.

It is recommended that field work be conducted to delineate potential wetlands between SE Torbank Road and SE Courtney Road and SE Roethe Road and SE Boardman Avenue (east side). These areas appear to have wetland characteristics including hydrology, soil and vegetation.

Trail Amenities

A key project goal is to have the trail appeal to a wide variety of users. To achieve this, the Trolley Trail should be designed to provide a high level of user conveniences. The demographics of the surrounding community includes a high percentage of both elderly and young. These groups will use the trail more often if amenities are provided. The trail can easily be designed within Americans With Disabilities Act (ADA) standards of slopes not exceeding five percent.

Recommended trail amenities include:

- Benches: utilize wood composites with metal detailing.
- Covered bench areas: metal and wood composites should be encouraged. Design of cover structure will be reflective of the former trolley station and include a metal sign identifying the former station name.
- Bike racks
- Mile post markers: Mileposts greatly increase use of the trail by joggers and cyclists looking for set work out distances. Recommend incorporation of milepost markers onto fixed wood composite bollards. Markers should be consistent with other trail signage.
- Restrooms: Utilize existing restrooms at the Jefferson Street Boat Ramp and at Risley Park. Restrooms are planned as part of the new Stringfield Farm

Fixed and removable bollards

Sheltered bench area

Park Trailhead near SE Naef Road. Signage should be provided to indicate these facilities. Porta-potties could be placed at the proposed SE Concord Road Trailhead.

- Garbage cans: The trail should establish the National Park Service ethic of "pack it in, pack it out". However, garbage cans are already provided at the Risley Park and Jennings Boat Ramp sites and should be provided at the new trailheads.
- Dog waste pickup stations: Dog waste pickup bag dispensers will be placed at trailheads and key neighborhood access points along the route. Signs should be placed along the trail notifying dog owners of the County ordinance requiring dog owners to pick up after their dogs.

Materials used for amenities should receive approval from the future trail managing authority, the North Clackamas Parks & Recreation District (NCPRD). For recycling and maintenance purposes, NCPRD will use wood composite materials for amenities where wood is specified; wood composites have the aesthetic qualities of wood, but are better for park amenities.

Bollards

Posts or bollards at roadway/trail intersections and trail entrances will be necessary to keep vehicles from entering the Trolley Trail. Posts will be designed to be visible to bicyclists and others, especially at nighttime, with reflective materials and appropriate striping. Posts will be designed to be removable by emergency vehicles.

Bollards slow cyclists and prevent vehicles from entering the trail.

- Fixed bollards: Should be used at roadway/trail intersections. Bollards should be heavy timber structures, or local columnar basalt stone and spaced at 5'-0" on center.
- Removable bollards: Install center removable bollards at intersections that can be keyed and locked to allow maintenance and emergency service vehicle access to the trail. Recommend use of metal.
- Between SE Park Avenue and SE Courtney Avenue, install permanent barriers that prohibit vehicles from utilizing the right-of-way as a throughway and 4-wheel drive route. Where necessary, place removable bollards for maintenance vehicle access.

Landscaping

Since the rails were removed from the corridor decades ago, many trees, shrubs and plants have grown or been planted in the right-of-way. As a general rule, these plantings should be preserved when they add to the aesthetic of the trail, do not inhibit PGE maintenance activities and are not a safety or security concern.

Vegetative Buffers

When possible, landscaping is the first choice for creating separation between the trail and adjacent properties. Vegetative buffers have the dual purpose of creating a natural privacy screen and providing habitat for some of the wildlife that live near the trail (i.e. birds, small mammals). Landscaping can also be an effective barrier to unwanted access where needed (see Figure 23).

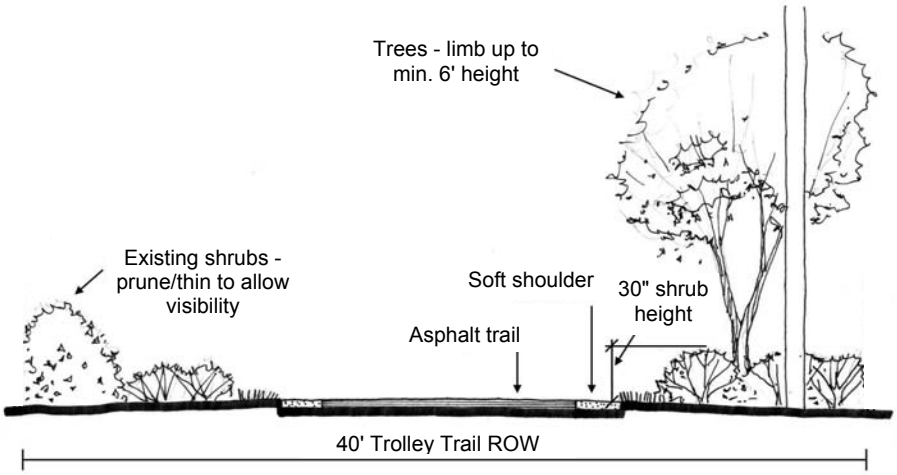


Figure 23. Cross Section with Vegetative Buffer

Recommended Plants

Use of native plant materials that can establish in one or two growing seasons should be encouraged. Irrigation along the trail is not anticipated so truck watering will most likely be needed during the establishment period.

Areas cleared of invasive/non-native vegetation should be planted with native shrubs and groundcover. Examples may include Oregon grape (*Mahonia [Berberis]* species), common and/or creeping snowberry, and salal (*Gaultheria shallon*).

Because the right-of-way contains overhead PGE electrical lines, large trees should not be planted in the right-of-way without the approval of PGE. Placement of large trees should have a minimum clearance from overhead lines of 25 feet at mature height. A lower growing scrub type plant community is already established on the corridor. New plants should fit this theme. Existing vegetation that should be preserved in the corridor is shown in Table 16. A list of recommended plants appropriate for the corridor is shown in Table 37 in Appendix E.

Table 16. Vegetation to Preserve Within the Trolley Trail Corridor

Project Segment	Trees & Plants to Preserve
1: Jefferson Street Boat Ramp to SE River Road	Apple, laurel, oak
2: SE River Road to SE Park Avenue	Douglas fir, laurel bush, maple, alder, cedar, sword fern
3: SE Park Avenue to SE Courtney Road	Douglas fir, laurel bush, maple, alder, cedar, willow, bracken fern, vinca
4: On-street section of SE Arista Drive	not applicable
5: Just north of SE Creighton Avenue on SE Arista Drive to SE Concord Road	some plantings in corridor
6: SE Concord Road to SE Roethe Road	Hazelnut, cedar, Douglas fir, hawthorn, dogwood, cherry, willow, maple, crabapple
7: SE Roethe Road to SE Jennings Avenue	Hawthorn, oak, fir
8: SE Jennings Avenue to SE Glen Echo Avenue	Maple, Douglas fir, cottonwood, laurel, wisteria

Invasive Plant Removal

Implementation of the proposed trail project will likely require the removal of some non-native and native vegetation along the existing corridor (see Table 17). The majority of vegetation will likely be non-native and invasive species. Japanese knotweed should be eradicated. Metro should be consulted on the best eradication methods for Japanese knotweed. Himalayan blackberry and English ivy removal has become a common volunteer activity along the trail corridor. This should be followed up with planting efforts (possibly through volunteer effort) that will ultimately shade out the nuisance plants. In selected areas, some blackberry plants will be left for trail users to pick and eat. Manual removal is a relatively low impact method of controlling invasive plants, but some species may require spot application of a state-approved herbicide. Metro's Integrated Pest Management Policies should be followed when using herbicides.

Table 17. Vegetation to Remove Within the Trolley Trail Corridor

Project Segment	Plants to Remove
1: Jefferson Street Boat Ramp to SE River Road	Himalayan blackberry, scotch broom, English ivy
2: SE River Road to SE Park Avenue	Himalayan blackberry, clematis, English ivy
3: SE Park Avenue to SE Courtney Road	Himalayan blackberry, clematis, English ivy, canary grass, poison oak
4: On-street section of SE Arista Drive	not applicable
4: SE Courtney Road to 15200 SE Arista Drive	-
5: Just north of SE Creighton Avenue on SE Arista Drive to SE Concord Road	Himalayan blackberry, English ivy, poison oak
6: SE Concord Road to SE Roethe Road	Himalayan blackberry, English ivy, goutweed, poison oak
7: SE Roethe Road to SE Jennings Avenue	Himalayan blackberry, scotch broom, English ivy, canary grass
8: SE Jennings Avenue to SE Glen Echo Avenue	Himalayan blackberry, bamboo

Fencing

In general, fencing is not recommended along the Trolley Trail corridor. Although the public often perceives fencing as a means of assuring safety by prevention of unwanted access, too much fencing can have the opposite effect by impairing informal trail surveillance. Inappropriate fencing can also degrade the experience of trail users, obscuring views and creating a "tunnel" effect that make users feel trapped.

As a general policy, fencing will be the responsibility of the adjacent resident. If credible evidence exists that trespassing and crime issues on a specific property results from the development of the trail, then installation of fencing by NCPRD should be considered.

Should adjacent property owners choose to build fences, a variety of fencing applications can be considered (Figure 24). Solid fencing that does not allow any visual access to the trail should be discouraged. Fencing that allows a balance between adjacent residents' privacy and allowing for informal surveillance of the trail should be encouraged. If fencing is desired purely for privacy reasons, vegetative buffers are recommended. Bare chain link fencing provides no privacy, is not aesthetically pleasing and is not recommended along the Trolley Trail.

A fencing height of 6' is typically sufficient to provide security. Lower fencing of approximately 4' can also provide a barrier sufficient to denote private property or deter most access.

Natural Barriers

Recommendations for using natural barriers include:

- Utilize landscaping, earthberms, and boulders to minimize access where roads parallel the trail right-of-way.
- Between SE Creighton Avenue and SE Concord Road, where unwanted vehicle access has been prevalent, curve the trail in a manner that allows bike access, but is uncomfortably tight for vehicle access. Accentuate this through strategic boulder placement and landscaping.

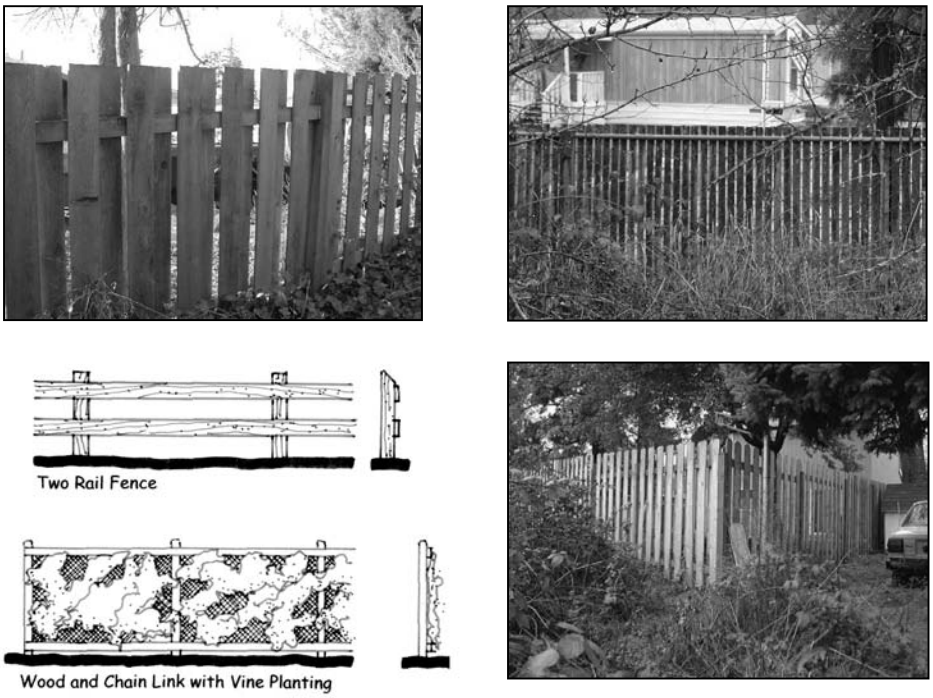


Figure 24. Various Fence Designs

Lighting

Installation of lighting along the Trolley Trail has been strongly encouraged by local law enforcement as a means of deterring crime.

Very few trail providers in the region provide trail lighting due to the high expense of installing and maintaining lighting. It is recommended that the Trolley Trail be constructed without lighting, and that lighting be added on an 'as needed' basis. If and when safety and security issues develop, NCPRD will revisit the lighting recommendations (see Table 26, Trail Safety Recommendations, in Chapter VI and the cost estimate tables in Appendix F).

Trail lighting can be artistic, utilitarian, or both.

In general, lighting is recommended at trail access points and mid points between blocks to help facilitate security surveillance of the trail from police vehicles. Light cut-offs are recommended to minimize unwanted light onto private property.

Signage

The Trolley Trail should use a comprehensive signage system that includes three types of signs: directional, regulatory and interpretive. Signage style and imagery should be consistent throughout the trail to provide the trail user with a sense of continuity, orientation, and safety. As a general rule, caution should be exercised to not "over sign" the trail. Incorporation of signage into planned trailside vertical elements such as bollards should be encouraged. This will avoid "visual pollution" of too many signs along the trail and an excessive number of sign poles.

Mileage markers should be placed at quarter-mile increments along the Trolley Trail.

Regulatory Signage

The Manual of Uniform Traffic Control Devices clearly spells out how regulatory signage should be incorporated into the trail. Table 36 lists the appropriate regulatory signage needed on the Trolley Trail.

Trailhead Access Signage

Since trailheads will serve as access points to people that may not be as familiar with the trail, information signage should be provided that includes a "You Are Here" map and trail etiquette signs. These should be placed on an information kiosk (see Figure 25), designed to be reflective of the former trolley station design. The kiosk must be ADA compliant.

Trail Etiquette Sign: Utilize at Key Access Points

The trail etiquette sign will clearly spell out proper rules and customs for trail users. This will be based on national standards and accepted trail practices. A sample sign is shown in Figure 26.

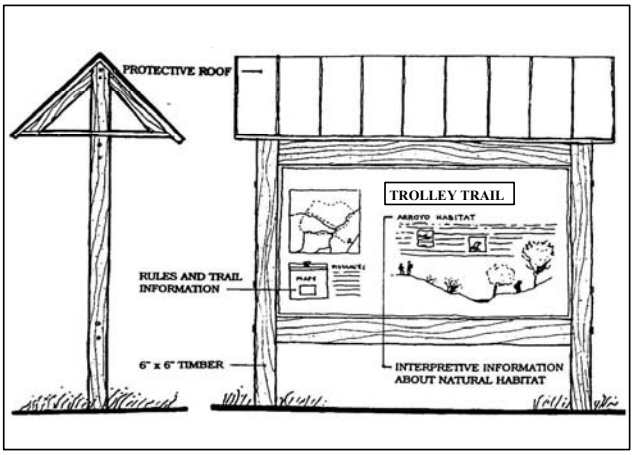


Figure 25. Information Kiosk

Figure 26. Trail Etiquette Sign

Directional Signage

Directional signage provides orientation to the trail user and emphasizes the continuity of the trail. Street names, mileage markers and place names are key elements that should be called out along the trail. Street names should be called out at all trail intersections with roadways. Mileage markers should be based on the historic railroad mileposts, with mileage call outs at quarter-mile increments. In addition to providing a distance reference, mileage markers are an attraction to joggers and walkers that target exercise for set distances. Directional signage should be used to call out key destinations along the trail route and include the following:

- Schools
- Parks
- City of Milwaukie
- City of Gladstone
- Oak Grove Commercial District
- Other trails (Kellogg Creek Waste Water Treatment Facility Waterfront Trail)
- to SE River Road
- to Springwater Corridor Trail
- to Gladstone and Oregon City
- 20-mile loop trail map for Clackamas County

Interpretive Signage

Interpretive signage provides enrichment to the trail user experience, focuses attention on the unique attributes of the local community, and provides educational opportunities. The natural and cultural resources in the vicinity of the trolley corridor provide many opportunities for interpretation. Key opportunities include:

- Trolley Trail historic signs and photos at old station locations
- Willamette River: Recommended location at the Jefferson Street Boat Ramp
- Salmonid species/Fish Ladder at Kellogg Creek
- The former trolley line: SE Arista Drive (median area)
- Historic neighborhood development: SE Arista Drive (median area)
- Boardman Slough wildlife habitat
- Water quality: Recommend location: Oak Grove Elementary School
- Land settlement patterns/place name history: Recommended location at SE Risley Road
- "Green Streets" concept: SE Arista Drive

Community members may want to consider forming an historic district along the trolley corridor as well.

Historical trolley station sites are just part of the rich area history that can be used for interpretive installations.

Much like these mile markers, trolley tokens could be embedded in the trail.

Public Art

Public art along a trail provides an opportunity to add interest to the trail experience and depending on the scale and form, can become an "event" unto itself and serve as a public draw as something to see and experience. Opportunities for public art along the trail should be sought. Incorporation of public art in areas of high visibility such as trailhead access points, or areas adjacent to SE McLoughlin Boulevard should be encouraged. Public art can also be combined with interpretive opportunities. An artist should be included on the consultant team selected to implement the project and public involvement should be a strong element of the public art selected.

The following is a menu of ideas that can be used as a starting point for art concepts:

- Identification of former trolley station locations
- Pavement inlays of metal trolley token / transfer castings at intersection locations
- Interactive transportation sculpture

Public art on the trail can take many forms.

Unresolved Design Issues

Many of the design recommendations contained in this master will need to be further explored and fleshed out prior to the preliminary and final design and construction phases. For example, the master plan recommends a 12' wide trail (optimum), with one 4' to 6' wide soft shoulder and one 2' to 4' wide soft shoulder. However, the trail and shoulder widths may vary slightly depending on the

topography and existing man-made features (i.e. electrical poles, manholes) within the right-of-way.

Many of the master plan recommendations direct NCPRD and Metro to continue to coordinate with various entities on planned development in the vicinity of the Trolley Trail that has not yet happened, but may impact the trail. As underground lines will likely be added and/or removed in the time leading up to trail construction, it is recommended that underground utilities are located via the Oregon Utility Notification Center (the "One Call Center") immediately prior to project implementation.

The very nature of master planning includes identifying unresolved issues and the steps to take towards resolving them in order to successfully implement the project. Some of the unresolved design issues relate to existing encroachments within the right-of-way. NCPRD and Metro will meet individually with neighboring property owners who are using portions of the right-of-way with the goal of coming to a mutually-agreeable solution for the trail design in those areas. The Trolley Trail boundary survey (completed Spring 2003) will be very helpful with these discussions.

Recommended Improvements

Major trail design recommendations discussed throughout this chapter are listed in Table 18 through Table 25 and shown on Figure 28 through Figure 35 on the following pages. The tables and maps correspond to the eight Trolley Trail segments discussed throughout the Master Plan (see Figure 27). The segments of the Trolley Trail are each about 0.7 mile in length. Within each segment, individual trail sections and trail-roadway intersections are notated from north to south. Trail section start and stop nodes are noted with letters (i.e. A-B). The roadway intersections have been noted by a lowercase 'i' and a corresponding number (i.e. i-2). The trail-roadway crossings are also differentiated through the use of *italics* (i.e. '*i-1*').

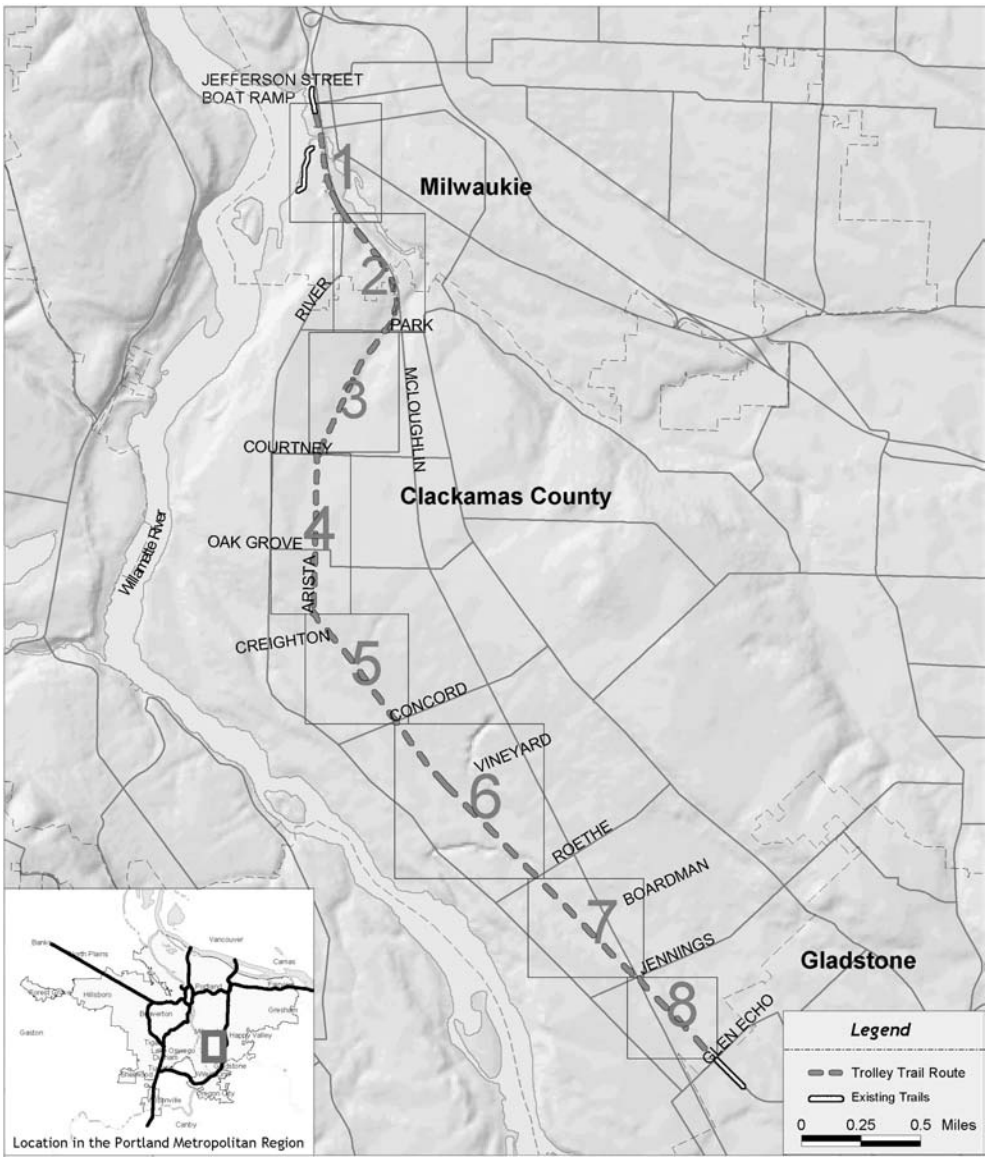
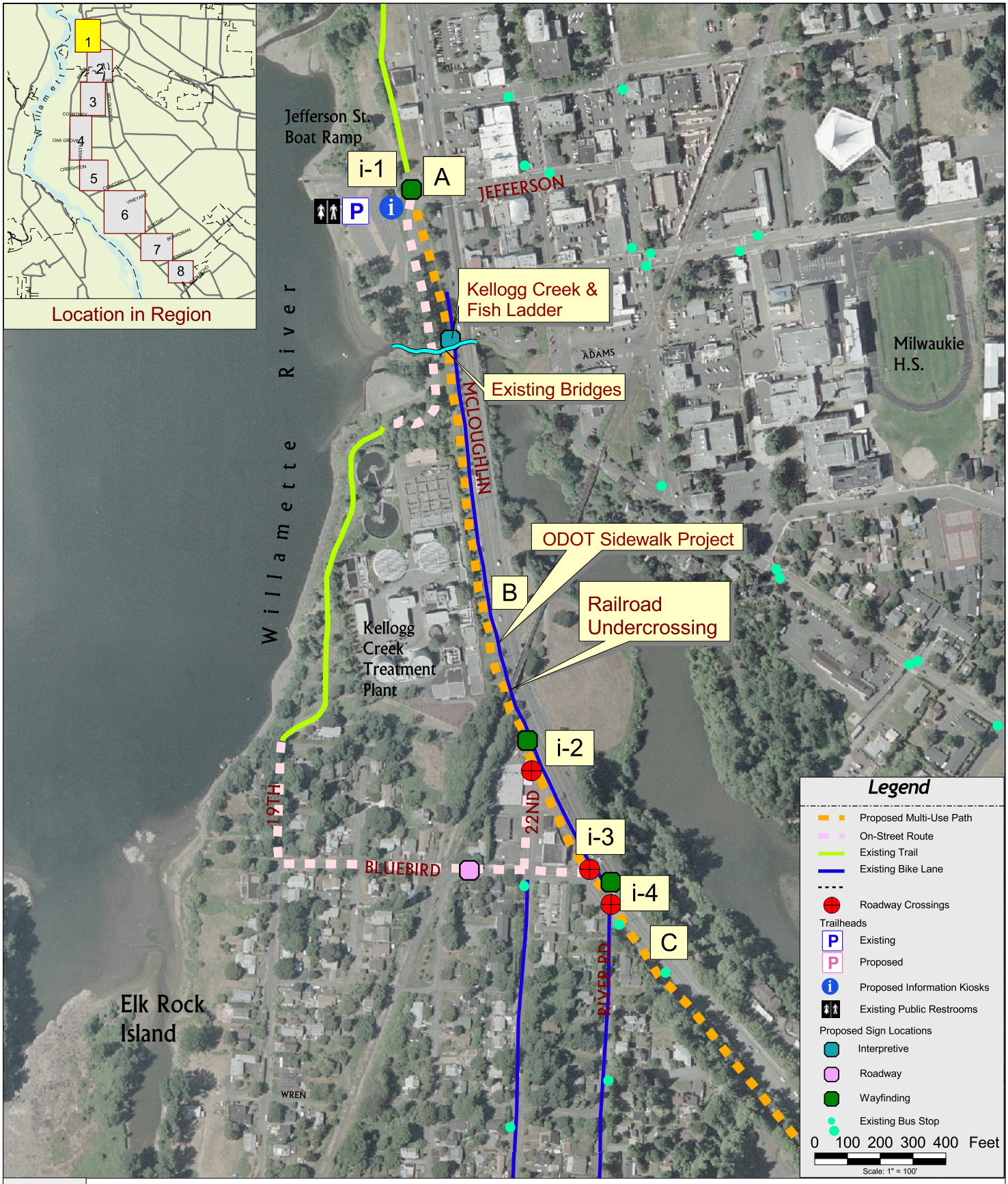


Figure 27. Trolley Trail Segments

Table 18. Trolley Trail Improvements, Segment 1

Segment #	Section/ Intersection	Recommended Improvement	Length (mi.)	Issues / Notes
Segment 1: Jefferson Street Boat Ramp to River Road				
1	Entire segment	Install lighting.		
1	*i-1: Jefferson Street Boat Ramp Driveway*	*Improve crossing by providing a clearly marked or textured crosswalk across the signalized intersection. (Type II treatment).*	*x*	*This entrance to the boat ramp is roughly 100' wide at the signalized intersection.*
1	A-B: Jefferson Street to Kellogg Creek Wastewater Treatment Plant (WWTP)	Widen the existing sidewalk beginning at the terminus of an existing trail north of the Jefferson Street Boat Ramp. The alignment travels adjacent to OR99E (SE McLoughlin Boulevard), crossing over Kellogg Creek.	0.25	City of Milwaukie may reconfigure the Jefferson Street Boat Ramp area. Potential for interpretive signage at Kellogg Creek fish ladder.
1	*i-2: 22nd Ave.*	*Provide a marked crosswalk and pedestrian refuge islands to cross the 50' wide intersection. Provide appropriate signage. (Type I treatment; see Figure 21, page 60).*	*x*	*Poor sight distance with vehicles entering 22nd from SE McLoughlin Boulevard at 30-40 mph.*
1	*i-3: Bluebird Street*	*Use existing signalized crossing. Provide appropriate signage. (Type I treatment).*	*x*	*25' wide crossing. Good sight distance.*
1	B-C: Kellogg Creek WWTP to River Road	A new 12' wide shared use path should be constructed as part of the ODOT Improvement Project. The path will go under the railroad trestle, and across SE 22nd to SE River Road.	0.25	Will need permits from Union Pacific and BNSF Railroads for undercrossing. Includes the three intersections.

Next page: Figure 28. Segment 1 Map



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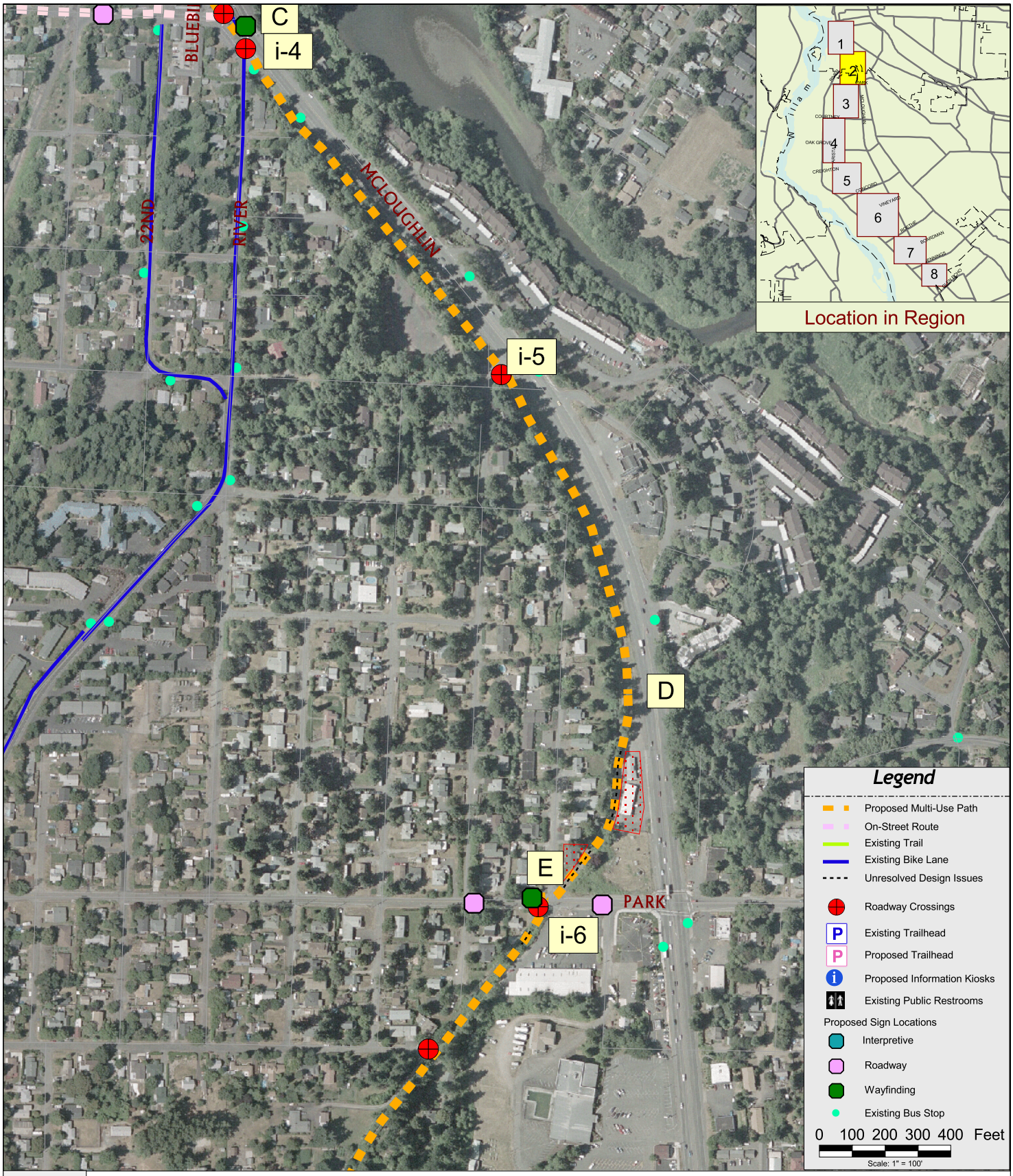
Jefferson Street to River Road

Table 19. Trolley Trail Improvements, Segment 2

Segment #	Section/ Intersection	Recommended Improvement	Length (mi.)	Issues / Notes
Segment 2: River Road to Park Avenue				
2	Entire segment	Install lighting.		Location of manholes should be considered.
2	C-D: River Road to DaVinci's Restaurant	A new 12' wide shared use path should parallel SE McLoughlin Boulevard and would cross Sparrow Road to DaVinci's Restaurant about 500' before SE Park.	0.5	Will generally follow "demand path." May need to relocate guy wires of utility poles.
2	*i-4: River Road*	*Use existing signalized crossing. Provide appropriate signage. (Type II treatment).*	*x*	*Existing signal. 45' wide. Poor sight distance.*
2	*i-5: Sparrow/26th*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. Narrow pavement area. (Type I treatment).*	*x*	*Existing stop-controlled crossing 35' wide. Poor sight distance.*
2	D-E: DaVinci's Restaurant to Park	A new 12' wide shared use path should veer westward following the trail right-of-way to SE Park at the intersection of SE 27th. Use earthberm to elevate the trail and landscaping to clearly distinguish the trail from the restaurant service/parking area.	0.15	Will require negotiation with DaVinci's property owner.
2	*i-6: Park Ave.*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Medium-volume road crossing, 25' wide. Good sight distance.*

Next page: Figure 29. Segment 2 Map



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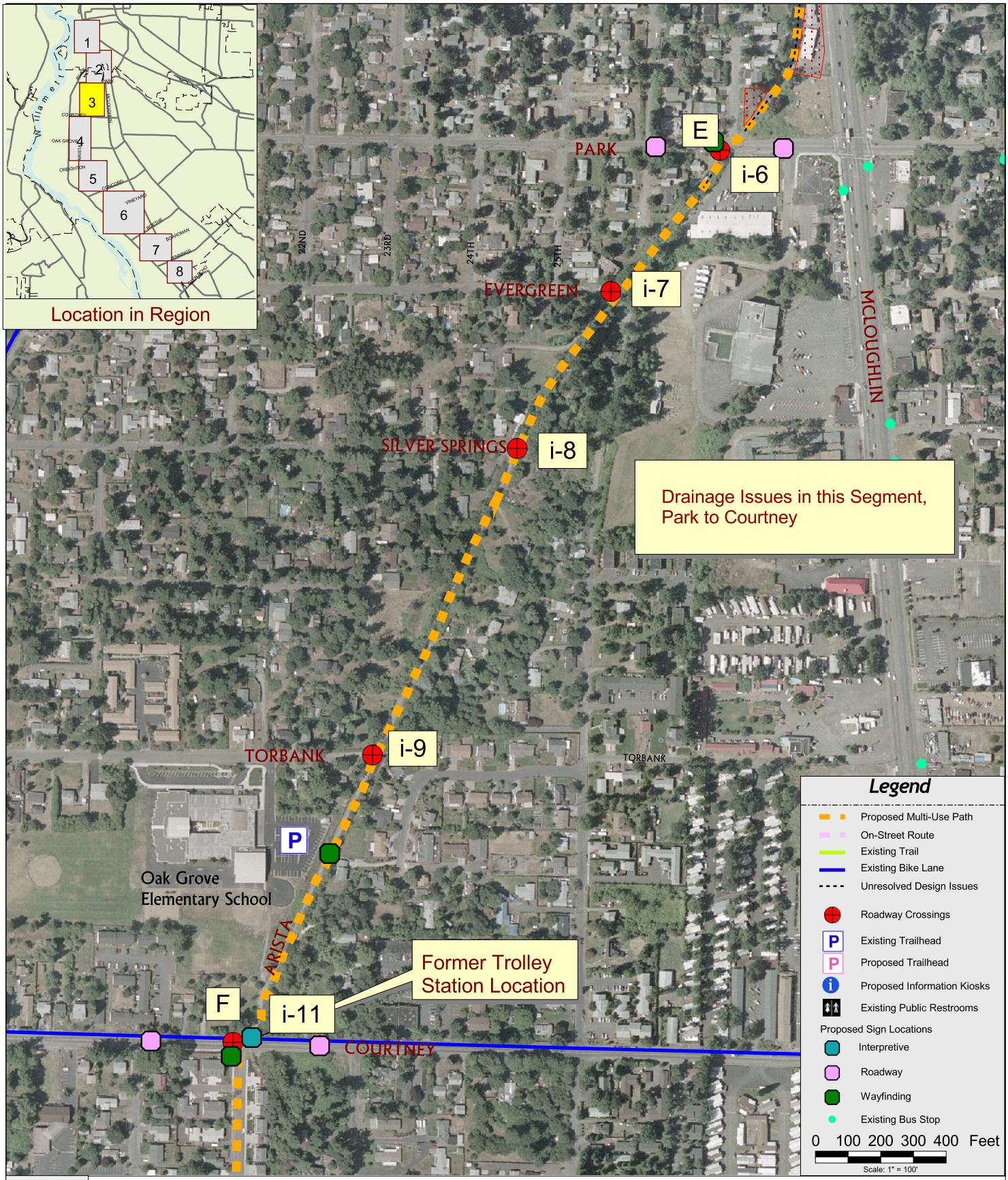
River Road to Park Avenue

Table 20. Trolley Trail Improvements, Segment 3

Segment #	Section/ Intersection	Recommended Improvement	Length (mi.)	Issues / Notes
Segment 3: Park Avenue to Courtney Road				
3	E-F: Park to Courtney	A new 12' wide shared use path should follow the trail right-of-way at a diagonal to a junction with SE Courtney. The route passes the Oak Grove Elementary School.	0.6	Joint usage of Oak Grove Elementary School parking lot as a trailhead should be explored. Drainage issues exist in this section.
3	*i-7: Evergreen Driveway*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic (Type I treatment).*	*x*	*Driveway crossing, 25' wide. Driveway crosses perpendicular to the trail.*
3	*i-8: Silver Springs Crossing*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic (Type I treatment).*	*x*	*Crosses adjacent to trail, 28' wide*
3	*i-8 - i-9 (driveways)*	*Signage to warn trail users. Separate driveway parallel to trail with vegetative buffer.*	*x*	*Multiple driveway entrances cross the trail right-of-way between Silver Springs and Torbank. Provide permanent barricade and landscaping to separate driveway access from trail.*
3	*i-9: Torbank Crossing*	*Clearly demarcate crossing and provide appropriate warning signs.*	*x*	*Low-volume road crossing, 20' wide.*
3	*(i-10 On-Street SE Arista)*	*-*	*x*	*-*
3	*i-11: Courtney*	*Direct trail users to existing marked crosswalk. Provide appropriate signage. (Existing Type I treatment).*	*x*	*Existing marked crosswalk on 32' wide street with centerline striping. Good sight distance.*
3	i-8 - i-9: Silver Springs to Torbank Road	Acquire drainage easement to the east of the right-of-way to tie drainage into the Kellogg Creek Tributary.	0.2	Requires negotiations with private property owners.

Next page: Figure 30. Segment 3 Map



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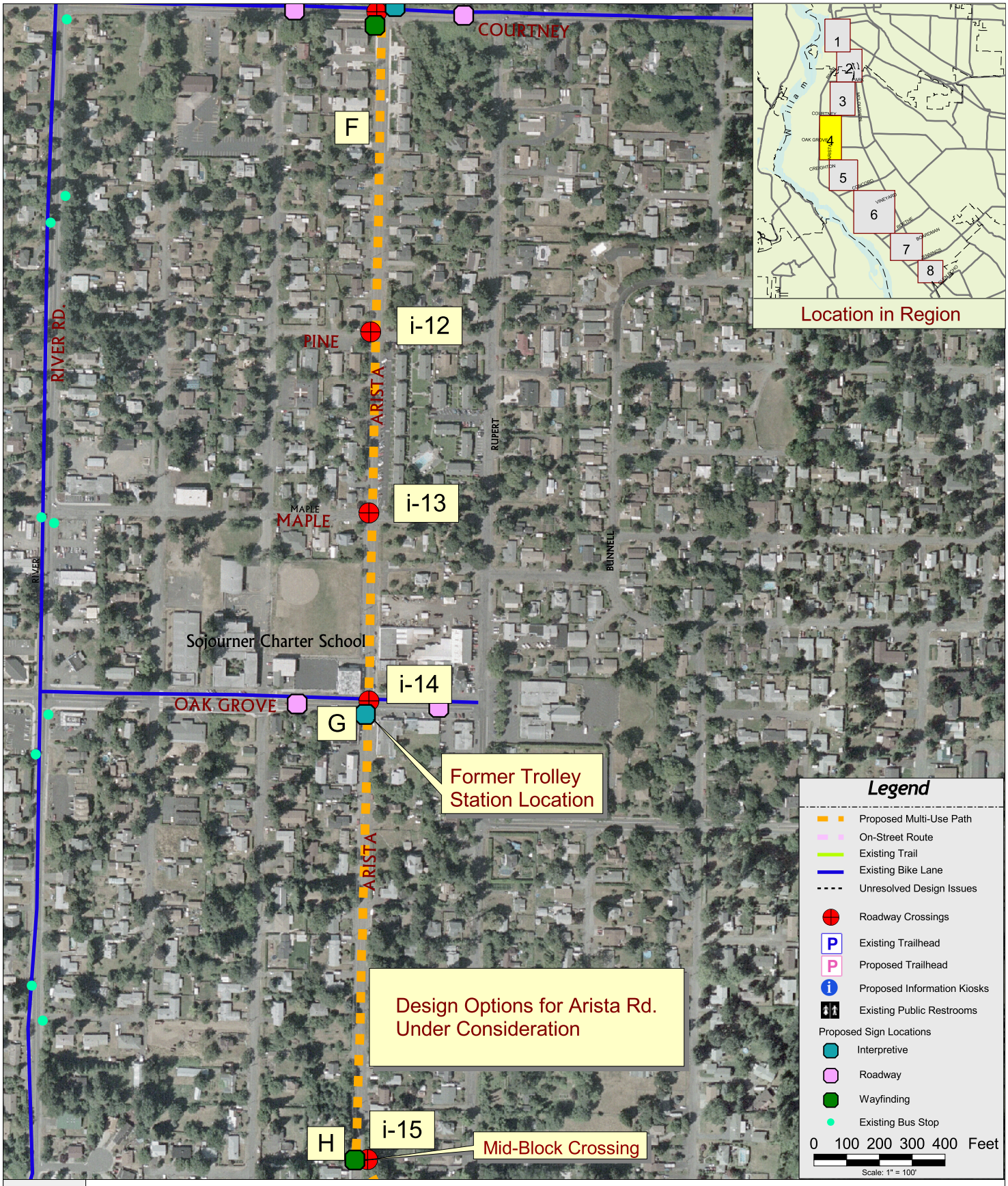
Park Avenue to Courtney Road

Table 21. Trolley Trail Improvements, Segment 4

Segment #	Section/ Intersection	Recommended Improvement	Length (mi.)	Issues / Notes
Segment 4: Courtney Avenue to just north of Creighton Avenue on Arista Drive				
4	F-G: Courtney to Oak Grove Boulevard	The design of the path through this section has not been determined and will require additional study.	0.3	This section follows SE Arista Ave. in the Trolley Trail right-of-way to a mid-block crossing. This section passes Sojourner Charter School to the Oak Grove business district. Parking may need to be removed near Oak Grove Boulevard.
4	*i-12: Pine Lane*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Road crossing, 33' wide. Good sight distance.*
4	*i-13: Maple Road*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Stop-controlled crossing 33' wide. Good sight distance.*
4	*i-14: Oak Grove Boulevard*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic (Type I treatment).*	*x*	*Stop controlled crossing, 36' wide. Good sight distance.*
4	G-H: Oak Grove Boulevard to just north of Creighton Avenue on SE Arista Road	The design of this section has not been determined. Three major options exist (see Figure 17 through Figure 19 in Chapter V).	0.25	Parking may need to be removed near Oak Grove Boulevard.
4	*i-15: Crossing SE Arista*	*Provide mid-block crossing to cross SE Arista Drive. (Type I treatment).*	*x*	*Road is 26' wide. Good sight distance.*

Next page: Figure 31. Segment 4 Map



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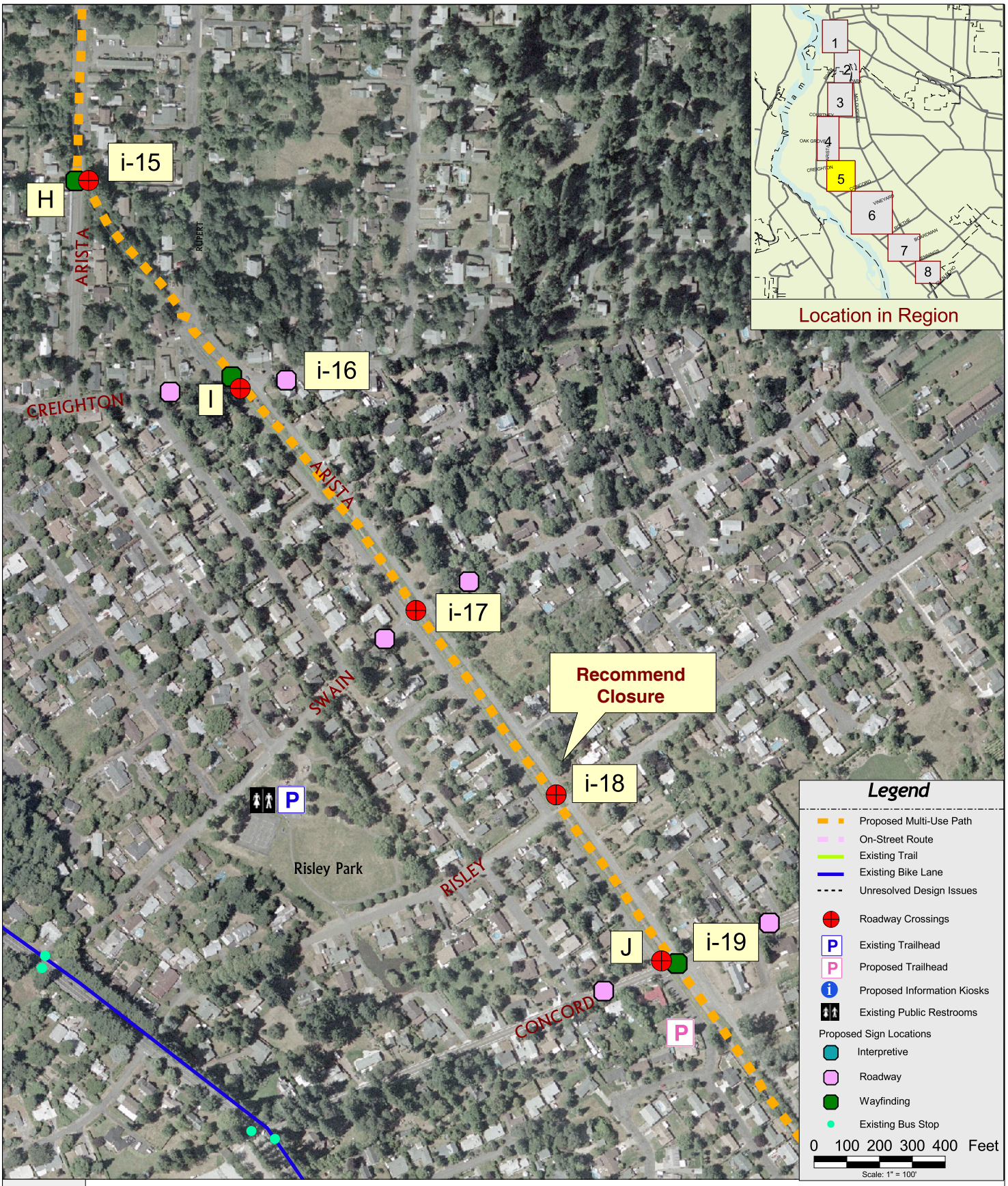
N

Courtney Road to just north of Creighton Avenue on Arista Drive

Table 22. Trolley Trail Improvements, Segment 5

Segment #	Section/ Intersection	Recommended Improvement	Length (mi.)	Issues / Notes
Segment 5: Just north of Creighton Avenue on Arista Drive to Concord Road				
5	H-I: SE Arista to Creighton	A new 12' wide shared use path should cross SE Arista Road and veer southeast to follow the trail right-of-way to Creighton Avenue.	0.15	Construction should be coordinated with neighbors. Fencing may be needed.
5	*i-16: Creighton Avenue*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Low-volume road crossing, 26' wide. Good sight distance. Provide landscaping north of intersection to distinguish private property/Trolley Trail right-of-way.*
5	*i-17: Swain Road*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Stop-controlled crossing at median, 32' wide. Good sight distance.*
5	*i-18: Risley Road (illegal crossing)*	*Close off to cut-through traffic.*	*x*	*Some drivers have been illegally crossing over the unpaved median.*
5	I-J: Creighton Avenue to Concord Road	A new 12' wide shared use path should use the existing median on SE Arista Drive from Creighton Avenue to Concord Road.	0.4	Trailhead could be sited at Concord Ave. Risley intersection with path should be barriered. Earth berms, landscaping and basalt stone should be used to prevent automobile access.
5	*i-19: Concord Road*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Medium-volume road crossing, 32' wide, has bike lanes and centerline striping. Good sight distance.*

Next page: Figure 32. Segment 5 Map



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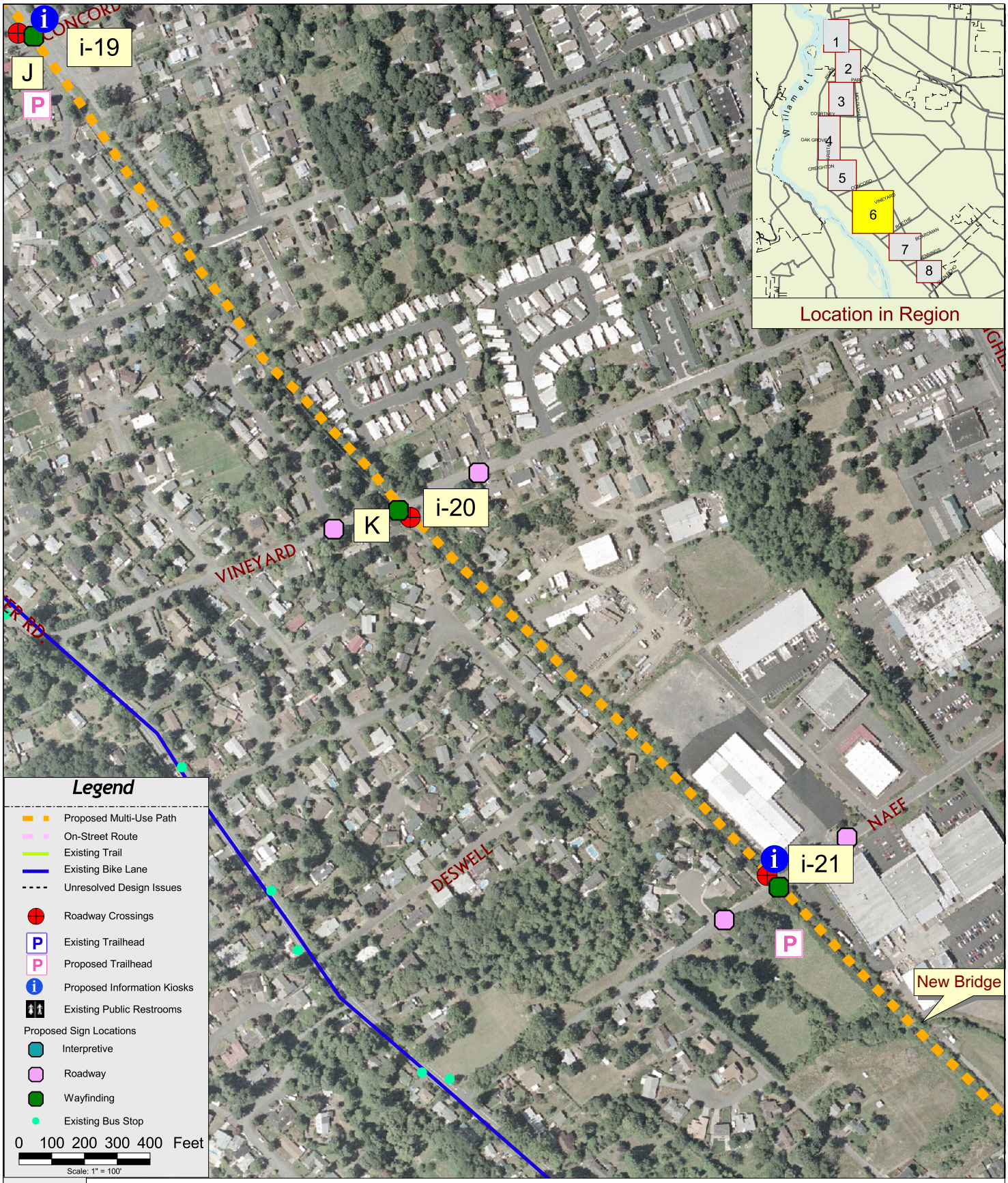
N

Just north of Creighton Avenue on Arista Drive to Concord Road

Table 23. Trolley Trail Improvements, Segment 6

Segment #	Section/ Intersection	Recommended Improvement	Length (mi.)	Issues / Notes
Segment 6: Concord Road to Roethe Road				
6	J-K: Concord to Vineyard	A new 12' wide shared use path will follow the forested section of trail right-of-way to Vineyard. Add trailhead just south of Concord.	0.3	
6	K-L: Vineyard to Roethe	A new 12' wide shared use path should parallel the private road to Vineyard Lane to the south. New trailhead at Stringfield Family Park near Naef. Bridge will replace culvert just south of Naef.	0.3	
6	*i-20: Vineyard*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Low-volume road crossing, 32' wide. Good sight distance.*
6	*i-21: Naef*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. Develop trailhead/interpretive kiosk at Stringfield property just south of Naef. (Type I treatment).*	*x*	*Low-volume road crossing, 26' wide. Good sight distance. Recommend flashing yellow warning lights.*

Next page: Figure 33. Segment 6 Map



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N

Concord Road to Roethe Road

Table 24. Trolley Trail Improvements, Segment 7

Segment #	Section/ Intersection	Recommended Improvement	Length (mi.)	Issues / Notes
Segment 7: Roethe Road to Jennings Avenue				
7	*i-22: Roethe*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Low-volume road crossing, 26' wide. Good sight distance. Recommend flashing yellow warning lights.*
7	L-M: Roethe to Boardman	A new 12' wide shared use path should follow Boardman Creek.	0.3	Wetland delineation needs to be conducted for Boardman Creek wetlands prior to determining best trail design in this area.
7	*i-23: Boardman*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Low-volume road crossing, 26' wide. Good sight distance.*
7	M-N: Arista Drive	A new 12' wide shared use path should follow the trail right-of-way to the east of Arista Drive. The trail will need to be cantilevered off of the roadway bed.	0.3	A retaining wall will be necessary.
7	N-O: Arista Drive to Jennings	A new 12' wide shared use path should cross Arista Drive and use the sidewalk on McLoughlin Boulevard to the intersection at Jennings.	0.05 (250')	
7	*i-24: McLoughlin Boulevard and Jennings*	*Use existing signalized intersection. Provide appropriate warning signs for trail users and vehicles on roadway. (Type II treatment).*	*x*	*Existing signalized, high-volume roadway crossing. Good sight distance. Widen sidewalks to 10' to intersection approach.*

Next page: Figure 34. Segment 7 Map

7

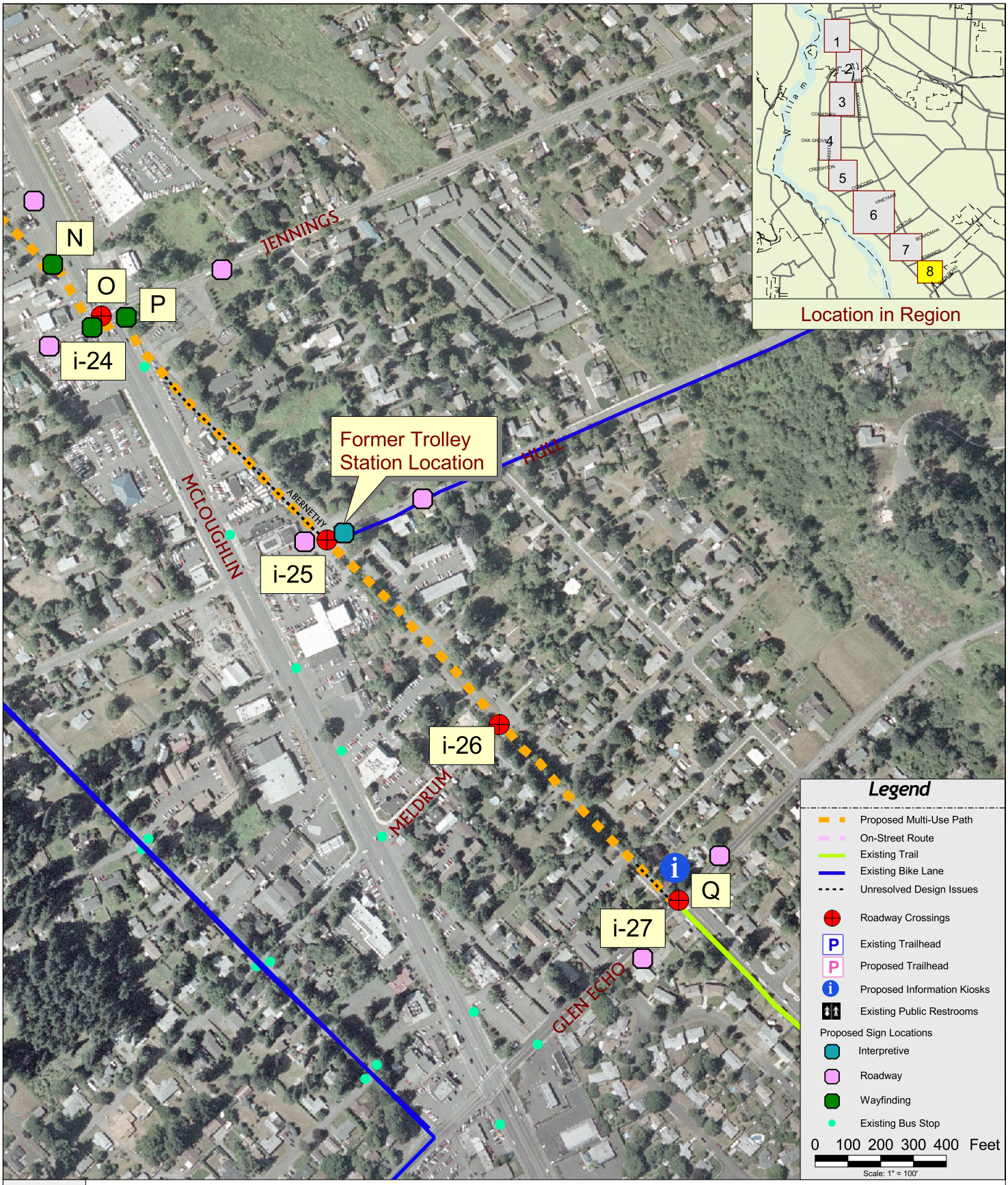
N

Roethe Road to Jennings Avenue

Table 25. Trolley Trail Improvements, Segment 8

Segment #	Section/ Intersection	Recommended Improvement	Length (mi.)	Issues / Notes
Segment 8: SE Jennings Ave. to Glen Echo Ave.				
8	O-P:	The crossing of SE Jennings will occur on the southeast side of the intersection.	0.05 (250')	Widen sidewalks to 10' on southeast side of SE McLoughlin Boulevard.
8	P-Q:	A new 12' wide shared use path should follow the trail right-of-way parallel to Abernethy to the beginning of the bike lanes at Glen Echo. Kiosk at Glen Echo.	0.5	Provide 10' min. width landscape buffer between trail and RW fence.
8	*i-25: Hull*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Stop-controlled, low-volume crossing, 25' wide. Good sight distance. Remove parking area and restore with native plantings.*
8	*i-26: Meldrum*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Stop-controlled, low-volume crossing, 25' wide. Good sight distance.*
8	*i-27: Glen Echo*	*Clearly demarcate crossing and provide appropriate warning signs for cross-traffic. (Type I treatment).*	*x*	*Stop-controlled, low-volume crossing, 25' wide. Good sight distance. Remove parking area.*

Next page: Figure 35. Segment 8 Map



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N

Jennings Avenue to Glen Echo Avenue

VI. Trail Safety Recommendations

Public Safety Audit

As part of this planning effort, the consultant team preformed a Safety Audit of the Trolley Trail right-of-way in conjunction with a Clackamas County law enforcement officer. The intent of this audit was to review field conditions from law enforcement's prospective and apply recommended crime prevention methods through environmental design. The corridor was walked the majority of its length, conditions noted and photographed.

Table 26 summarizes key safety issues, location(s) of concern and recommended improvements.

Table 26. Safety Recommendations

Safety Issue	Recommended Improvements	Location on Trail
Unwanted vehicle access on the trail The use of the right-of-way by 4-wheel drive activity was noted at three locations along the trail. Area one is from Silver Springs to Torbank. Area two is in the double SE Arista section from SE Creighton to SE Concord Road. Area three is just north of SE Park Avenue.	1. Utilize landscaping to define the corridor edge and trail, including earth berms and large boulders.	All, with emphasis on Segment 5, Creighton to Concord, and segment 2 just north of Park.
	2. Use bollards at intersections.	All
	3. Pass a motorized vehicle prohibited ordinance and sign the trail.	All
	4. Where autos share access along the Trolley Trail for private property access, separate the auto use from the trail use and provide a vegetative buffer between the trail and the driveway.	Segment 3, Park to Torbank.
	5. Close off opportunity for driving through between Silver Springs & Torbank with a physical barrier and "no outlet" signage.	Segment 3, Park to Torbank.
	6. Create a Trail Watch program and encourage citizens to photograph report illegal vehicle use of the corridor.	All
	7. Lay the trail out with curves that allow bike/ped passage, but are uncomfortably tight for automobile passage.	Segment 5, Creighton to Concord.
Privacy of adjacent property owners This was one of the biggest concerns expressed by neighbors in the Creighton area. Concern is that the trail will bring people into areas that have for decades been quasi-private. Trail users will be able to peer into people's backyards and homes.	1. Encourage the use of neighborhood friendly fencing and also planting of landscape buffers.	All
	2. Clearly mark trail access points.	All
	3. Post trail rules that encourage respect for private property.	All
	4. Strategically placed lighting.	All

Safety Issue	Recommended Improvements	Location on Trail
Litter and dumping Incidental dumping was noted throughout the right-of-way, the majority of which was yard debris that appears to be dumped over property line fences.	1. Post trail rules encouraging pack it in pack it out etiquette.	All, post rules at access points.
	2. Place garbage receptacles at trailheads.	All
	3. Provide good visual access to the trail.	All
	4. Strategically-placed lighting, utilizing light shields to minimize unwanted light in adjacent homes.	All
	5. Manage vegetation within the right-of-way to allow good visual surveillance of the trail from adjacent properties and from roadway/trail intersections.	All
	6. Encourage local residents to report incidents as soon as they occur.	All
	7. Remove dumpsites as soon as possible.	All
	8. Encourage use of yard debris recycling service.	All
Trespassing Trespassing through people's backyards was a concern expressed by some members of the public.	1. Clearly distinguish public trail right-of-way from private property through the use of vegetative buffers and the use of good neighbor type fencing.	All; Special emphasis on Creighton area in segment 5.
	2. Post trail rules that encourage respect for private property.	All
	3. Place good neighbor fencing between trail and residence immediately north of Park.	Segment 2, single resident just north of Park.
Crime Creighton area neighbors expressed concern about potential loitering, burglary, muggings, kidnapping, etc. Neighbors stated there were issues several years ago that went away once the right-of-way became impassable due to dense vegetation. Undesirable transient activity should be handled following these recommendations as well.	1. Manage vegetation so that corridor can be visually surveyed from adjacent streets and residences.	All, special noted emphasis on segments 1, 2, and 6.
	2. Select shrubs that grow below 3' in height and trees that branch out greater than 6' in height.	All
	3. Place lights strategically and as necessary.	Light all of segments 1 and 2 (where necessary). Add lights at intersections and where necessary between intersections for segments 3-8.
	4. Place benches and other trail amenities at locations with good visual surveillance and high activity.	All, two sites were identified one at 28th as an access point, second at just south of Concord. Both are suitable bench locations.
	5. Provide mileage markers at quarter-mile increments and clear directional signage for orientation.	All
	6. Create a "Trail Watch Program" involving local residents.	All
	7. Proactive law enforcement. Utilize the corridor for mounted patrol training.	All
Private use of corridor Private use of the corridor includes parking, vehicle access to private property, landscaping, and placement of small buildings on the right-of-way.	1. Attempt to negotiate win/win solution with property owners.	All Parking noted at Concord, Hull, and Glen Echo. Encroachment activity in segment 2, 3, 7, and 8.
	2. Eliminate where detrimental impact to trail cannot be reasonably ameliorated.	All

Safety Issue	Recommended Improvements	Location on Trail
Intersection safety Roadway and trail crossings present a potential safety concern between trail users and cars. Naef and Roethe were both noted as higher level safety concerns due to local high school traffic.	1. Require all trail users to stop at public roadway intersections through posting of stop signs.	All
	2. Provide cross walk striping and trail crossing warning signs for vehicle drivers. Put Trolley Trail logo on warning signs.	All
	3. Install flashing yellow lights at Naef, Roethe, and Concord.	Segment 6 and 7
	4. Utilize existing signal at SE Jennings and SE McLoughlin Boulevard crossing. Widen sidewalk at west and east side of SE McLoughlin Boulevard.	Segment 7
	5. Manage vegetation at intersections to allow visual access at crossings.	All
	6. Redesign 22nd to force vehicles to slow down as they exit SE McLoughlin Boulevard.	Segment 1
	7. Redesign 26th & Sparrow to narrow pavement area and slow vehicles down as they exit SE McLoughlin Boulevard	Segment 2
Local on-street parking A concern in the Evergreen, Silver Springs and Torbank area.	1. Post local residential streets as parking for local residents only to discourage trail user parking. Place "no outlet" and "no parking" signs prior to trail access points.	All
Trailhead safety	1. Clearly identify trailhead access areas.	All trailheads.
SE McLoughlin Boulevard impacts The proximity of the trail to SE McLoughlin Boulevard in segments 1 and 2 was identified as a concern. Though adequate setback is present, greater separation should be encouraged.	1. Deepen and widen the drainage ditch at the roadway shoulder while still allowing surveillance through and across ditch. 2. Place a small earth berm between trail and road.	Segment 1 and 2
Vandalism	1. Select benches, bollards, signage and other site amenities that are durable, low maintenance and vandal resistant.	All
	2. Respond through removal or replacement in rapid manner.	All
	3. Keep a photo record of all vandalism and turn over to local law enforcement.	All
	4. Encourage local residents to report vandalism.	All
	5. Create a trail watch program; maintain good surveillance of the corridor.	All
	6. Involve neighbors in trail projects to build a sense of ownership.	All
	7. Place amenities (benches, etc.) in well used and highly visible areas.	All

Community Involvement with Safety on the Trail

Creating a safe trail environment goes beyond design and law enforcement and should involve the entire community. The most effective and most visible deterrent to illegal activity on the Trolley Trail will be the presence of legitimate trail users. Getting as many "eyes on the corridor" as possible is a key deterrent to undesirable activity on the Trolley Trail. There are several components to accomplishing this as outlined below:

Provide good access to the trail

Access ranges from providing conveniently located trailheads along the trail, to encouraging the construction of sidewalks to accommodate access from private developments adjacent to the trail. Access points should be inviting and signed so as to welcome the public onto the trail.

Good visibility from adjacent neighbors

Neighbors adjacent to the trail can potentially provide 24-hour surveillance of the trail and can become NCPRD's biggest ally. Though some screening and setback of the trail is needed for privacy of adjacent neighbors, complete blocking out of the trail from neighborhood view should be discouraged. This eliminates the potential of neighbors' "eyes on the trail," and could result in a "tunnel effect" on the trail.

High level of maintenance

A well maintained trail sends a message that the community cares about the public space. This message alone will discourage undesirable activity along the trail.

Programmed events

Community events along the Trolley Trail will help increase public awareness and thereby attract more people to use the trail. The Friends of the Trolley Trail can help organize numerous public events along the trail which will increase support for the trail. Events might include a day-long trail clean up or a series of short interpretive walks led by long time residents or a park naturalist. The Friends of the Trolley Trail can also generate public support for future funding applications.

Community projects

The support generated by the Friends of the Trolley Trail could be further capitalized by involving neighbors and friends of the trail in a community project. Ideas for community projects include volunteer planting events, art projects, interpretive research projects, or even bridge building events. These community projects are the strongest means of creating a sense of ownership along the trail that is perhaps the strongest single deterrent to undesirable activity along the trail.

Adopt-a-Trail Program

Nearby businesses, community institutions, and residential neighbors often see the benefit of their involvement in the trail development and maintenance. Businesses and developers may view the trail as an integral piece of their site planning and be willing to take on some level of responsibility for the trail. The Elks Club may provide an excellent opportunity to make contact with local business leaders. Creation of an adopt-a-trail program should be explored to capitalize on this opportunity and build civic pride.

Trail Watch Program

The Clackamas County's Sheriff's office is pursing the development of a "Trail Watch" program along the Trolley Trail. This program would provide an opportunity for local residents to become actively involved in crime prevention along the trail. Similar to Neighborhood Watch programs, residents are brought together to get to know their neighbors, and are educated on how to recognize and report suspicious activity.

VII. Project Implementation

Project Phasing

The primary purpose for a trail phasing plan is to ensure a logical sequence of implementation that provides a high degree of success as each phase is built, thereby building momentum for each future phase of the project. Success is directly correlated with a substantial level of use, strong public and political support, and proven effective management of the trail as each phase is implemented.

Success of the first built phase is critical to securing of future funding. The first phase must be well received by the public and become a model for all other future phases.

Phase I: Jefferson Street Boat Ramp to SE Courtney Road

Phase I includes design and construction of the northern portion of the trail, extending from SE Jefferson Street to SE Courtney Road. This represents 1.8 miles of trail. An application for federal transportation dollars was submitted for this portion of the trail in the winter of 2002, with the intent of conducting preliminary engineering work for the entire Trolley Trail project, followed with implementation of this first phase. This phase links residential neighborhoods to the town center of downtown Milwaukie. Additionally, this section provides connection to Oak Grove Elementary School. It supports pedestrian and bicycle travel and provides access to the riverfront, one of Milwaukie's greatest assets. The trail connects to the north with the SE 17th Avenue bike lanes, which connect to the Springwater Corridor, which ultimately links with downtown Portland.

Phase II: SE Courtney Road to just north of SE Creighton Avenue on SE Arista Drive

This phase of improvements will tackle the most challenging and expensive segment of the trail. This phase will involve the redesign of SE Arista Drive. It is anticipated that approvals for any redesign on SE Arista Drive will require a public process before a final design consensus is reached.

Given that the trail is recommended to be built within the existing street right-of-way, it is unlikely that the improvements will be eligible for the same MTIP funding as the Phase I improvements. Additional funding sources will be needed to address the planning, design and implementation of this segment of trail. Funding could be acquired from a variety of sources including the ODOT Bicycle and Pedestrian Program, the MTIP Green Streets or Main Streets categories, or the Clackamas County Capital Improvement Program (CIP). If funding does not materialize in a timely manner, additional phases of work should proceed while the effort to secure funds for this segment continues.

Phase III: Just north of SE Creighton Avenue on SE Arista Drive to SE McLoughlin Boulevard at SE Jennings Avenue

This phase represents 2.1 miles and is the greatest length of trail within a single phase of implementation.

Phase IV: SE McLoughlin Boulevard at SE Jennings Avenue to SE Glen Echo Avenue

This phase logically extends Phase III to the southern terminus of the project at SE Glen Echo Avenue. This will provide a direct link to the existing bike lanes that travel along SE Glen Echo Avenue and to the City of Gladstone. The total length of this segment of trail is 0.5 mile.

Trail Design and Development Guidelines/Requirements

Agency Standards, Guidelines and Reviews

The design and alignment for the Trolley Trail will generally follow national, state, and regional standards and guidelines for multi-use trails. A list of the relevant documents and guidelines are included in Table 27.

Table 27. Trail Design and Development Relevant Standards and Guidelines

TYPE	AGENCY (& contacts)	CONTACT/DOCUMENT	RELEVANT STANDARDS & GUIDELINES
region	Metro Regional Services Parks and Greenspaces	Jennifer Buddhabatti, 503-797-1700	Guidelines: In 2004, Metro will issue guidelines that pertain to urban trails adjacent to natural resources. These best management practices will influence the design and alignment of future regional trails.
state	Oregon Department of Transportation	Michael Ronkin, 503-986-3555 *Oregon Bicycle and Pedestrian Plan*	Standards Widths and Clearances: 8 ft. minimum width, 2' minimum lateral clear distance, 8' minimum overhead clearance, 5' separation from edge of roadway or fence separation. Many of the standards and guidelines are based on AASHTO recommendations.
federal	American Association of State Highway and Transportation Officials (AASHTO)	*Guide for the Development of Bicycle Facilities*	Guidelines: This book provides guidelines for trails including widths, grades, intersection treatments, pavement surfaces, lighting, and signing.
federal	Americans with Disabilities Act-US Department of Justice	*ADA Standards for Accessible Design*	These standards apply to public facility designs and require that urban trails meet accessibility requirements regarding slope, clearance, height of facilities (i.e. drinking fountains),
federal	Federal Highway Administration	*Manual on Uniform Traffic Control Devices (MUTCD)*	The MUTCD provides both standards and guidelines regarding trail and roadway traffic control devices. The standards primarily include signing recommendations.

Permitting Requirements

Trail design and development will require certain land use approvals and permits. These are listed in Table 28.

Table 28. Land Use Approvals/Permit Requirements

RELEVANT ZONES	DESCRIPTION	TRAIL ALLOWED?
MILWAUKIE		
DO - Downtown Office	"Parks, plazas and open space" are specifically permitted. Trails are not specifically mentioned.	YES
DOS - Downtown Open Space	"Parks, plazas and open space" permitted. Trails are not specifically mentioned.	YES
R3 - Residential Zone	No mention of trails, parks or other recreational infrastructure.	May need CSO
R5 - Residential Zone	No mention of trails, parks or other recreational infrastructure.	May need CSO
CSO - Community Service Overlay zone	Can be applied to permit trail use. These zones are not mapped, just applied..	YES
Willamette Greenway Overlay zone	To maintain Title 3 standards; Covers portions of the Trolley Trail alignment; Trail would require a Conditional Use Permit, acquired through Milwaukie Planning Department.	Conditional Use Permit req'd
Natural Resource Overlay zone	Generally follows 100-yr floodplain; Covers portions of the Trolley Trail alignment; Trail would require a Conditional Use Permit, acquired through Milwaukie Planning Department.	Conditional Use Permit req'd
CLACKAMAS		
C2 - Community Commercial	Primary Uses: Commercial; Trails not mentioned. Accessory Uses: Bike racks, street furniture, drinking fountains, and other pedestrian and transit amenities.	trails are treated as sidewalks
C3 -General Commercial	Primary Uses: Commercial; Trails not mentioned. Accessory Uses: Bike racks, street furniture, drinking fountains, and other pedestrian and transit amenities.	trails are treated as sidewalks
HDR - High Density Residential	Accessory Uses: includes "Indoor and outdoor recreational facilities, such as ...bike and walking trails..."	YES
R7 R8.5 R10 Urban Low-Density Residential	(R-5 through R-30:) Primary Uses: includes "Public parks, recreational and community buildings and grounds... and similar recreational uses..." Conditional Uses: "Service and recreational uses... subject to Section 813."	YES
MR1 Medium Density Residential	Primary Uses: includes "Public parks, recreational and community buildings and grounds... and similar recreational uses..." Accessory Uses: "...outdoor recreational facilities, such as... bike and walking trails."	YES
OSM Open Space Management	Primary Uses: includes public and private outdoor recreation facilities, and parks...Nature trails, bird sanctuaries, nature conservancies... Accessory Uses: Restroom and locker room facilities; Information and interpretive centers; Maintenance buildings associated with a primary use; Parking and maneuvering areas incidental to a primary or conditional use, subject to subsections 1007.07 and 1009.04; Security facilities, such as lights, gates and fences.	YES

Reviewing Agencies

A number of agencies will need to review the plans and designs for the Trolley Trail. These are listed in Table 29.

Table 29. Reviewing Agencies

TYPE	AGENCY	CONTACT	RELEVANT PERMITS, REGS, REVIEWS
Local	City of Milwaukie Planning Commission (503) 786-7600	Kenneth Kent, 503-786-7653	Local zoning codes; Planning Commission review required for application of overlay zones
County	Clackamas County Dept. of Transp. & Development 503-353-4500	Karen Buehrig (Ped/Bike Coordinator) 503-353-4500	Zoning codes outside City of Milwaukie
State	ODOT		Review and approve a biological assessment (BA) for trail development. SE Jennings Ave. crossing of SE McLoughlin Boulevard, N end of trail next to Hwy. 99E.
Federal	US Fish and Wildlife Service		Review and approve a biological assessment for trail development if the BA determination is "may affect."
Federal	National Marine Fisheries Service		Review and approve a biological assessment for trail development if the BA determination is "may affect.".
Federal	US Army Corps of Engineers		Review and approve a biological assessment for trail development if wetland fill is required.

Implications for Development of the Trolley Trail

Trail between Jefferson Street Boat Ramp and Washington Street

It is recommended that NCPRD and Metro continue ongoing coordination with the City of Milwaukie, US Army Corps of Engineers, the Oregon Marine Board and Clackamas County Water Environment Services regarding the proposed Kellogg Creek Dam Removal Project and SE McLoughlin Boulevard improvements project. It would be very cost effective if the trail permitting/development work could be dovetailed into the permitting and design/development of the dam removal project, the expansion of SE McLoughlin Boulevard right-of-way by approximately 8 to 12 feet to the west (towards the river) and the proposed relocation of the entrance of the boat ramp from Jefferson Street to Washington Street.

Trail Crossing of Kellogg Creek

If for some reason the Kellogg Creek trail crossing is constructed before the Kellogg Creek dam removal project, the following design and development recommendations will be useful. Consider widening the trail by 3 to 4 feet over Kellogg Creek. This will slightly increase the amount of impervious surface (less than 200 square feet) and thus the amount of run-off that may reach the creek. Only occasional maintenance vehicles are expected to use the proposed recreational trail, therefore run-off would be relatively free of pollutants. Temporary construction impacts can be mitigated by installing silt fencing and straw bales between the construction site and the creek. The slight increase in impervious surface adjacent to Kellogg Creek is not likely to generate significant concern; however, coordination with local and federal agencies prior to construction will be required. In general, minimize the

amount of new impervious surface, especially adjacent to waterbodies. Design considerations may include semi-porous trail material or sloping the trail away from the creek, at least in certain sections, to reduce run-off. If necessary, run-off would be treated through Best Management Practices (BMPs) such as bioswales.

Due to the proximity to the Willamette River and Kellogg Creek, the proposed trail alignment within the City of Milwaukie's jurisdiction will require review for consistency with the Natural Resource Overlay Zone, the Willamette Greenway Zone, and the Community Service Overlay Zone. This would involve preparing a narrative that demonstrates how the proposal meets the criterion of the three zones.

Assuming federal money is granted for the project, a biological assessment (BA) will be required to comply with Section 7 of the Endangered Species Act of 1973, as amended. The Section 7 process is initiated by contacting the US Fish and Wildlife Service (USFWS) and the NOAA Fisheries to determine which species to evaluate in the BA. The USFWS issues a list of species that may occur within one section of the project area based on OHNP data. For example, because a portion of the trail passes through Section 11 of T2S, R1E, a bald eagle (*Haliaeetus leucocephalus*) nest documented in Section 10 will trigger its inclusion on the USFWS list. The NOAA Fisheries does not issue a formal list of species to evaluate, but will confirm a list generated by the preparer of the BA. The following species would likely require evaluation in the BA: steelhead, chinook, coho, chum (*O. keta*), bull trout (*Salvelinus confluentus*), bald eagle and possibly a few listed plant species. Fish species with only a state listing would not require inclusion in the BA. If federal funding is passed through the transportation department, then ODOT would be the lead agency. ODOT would review and approve the BA, then submit it to the USFWS and the NOAA Fisheries for concurrence, if the effect determination of the BA is "may affect, not likely to adversely affect." Favorable review by the agencies is expected due to the low-impact nature of the proposal. If the project is determined to have "no effect" on listed species, then concurrence from USFWS and NOAA Fisheries is not required.

Due to expected minimal impacts along the existing rail corridor, no local, state or federal mitigation requirements are foreseen at this time. If mitigation is required as part of the BA to compensate for impacts to vegetation / potential wildlife habitat, it will most likely involve controlling non-native / invasive plant species and establishing native vegetation along the project corridor. The proponent may also offer to plant native vegetation on-site whether or not mitigation is required.

If it is determined that the trail is near essential habitat for salmon species (per ESA), and federal review/funding is involved, the following design restrictions will apply:

- Trails with hard surfaces must be 100 feet from the water body.
- Permeable hard surface trails are allowed within 100 feet of water body.
- Trail crossings of water bodies should be where previous disturbances exist (pipelines, roads, bridges).

Trail Crossing Beneath Union Pacific and BNSF Railroad Trestle

Formalizing a trail under the trestle near SE 22nd Avenue and McLoughlin Boulevard will require railroad concurrence and issuance of a Public Utilities Commission permit through ODOT.

Potential Wetland Areas

The Division of State Lands (DSL) and the US Army Corps of Engineers (Corps) should be consulted in determining whether wetlands having marginal characteristics, such as those between SE Courtney Avenue and SE Torbank Road, and SE Roethe Road and SE Boardman Road (east side), are considered jurisdictional wetlands. The Corps and DSL may be able to conduct a brief site visit to provide such a determination.

Any disturbance to a creek bank (e.g. Boardman Creek) or any action involving the removal or fill of material from a wetland is likely to require permitting from local agencies (e.g. Clackamas County), the DSL and the Corps.

Division of State Lands and Army Corps of Engineers

Fill of more than 50 cubic yards along Boardman Creek would require a Joint Permit Application to be submitted to the DSL and Corps for review.

Under state permitting conditions in place on February 2003, any fill or removal greater than 50 cubic cards along Boardman Creek would require review by the DSL and associated permit. Likewise, the Corps regulates area of fill with regard to wetlands and linear length for streambed impact. Depending on the extent of impact either a Nationwide Permit (NWP) or Individual Permit (IP) will be required by the Corps. In general, depending on the appropriate permit, a NWP will be applicable for impacts of less than 0.5 acre to non-tidal wetland or 300-linear feet of streambed, and a IP will be required for impacts greater than these. Mitigation is normally required for any level of impact. A Section 401 Water Quality Certification and a ESA consultation may also be required, depending on the degree of impact and permit.

Clackamas County

Metro's Title 3 establishes specific performance standard and practices for local jurisdictions for the protection of flood plain areas, water quality and fish and wildlife habitat areas. Depending on the results of a wetland delineation, trail development in the vicinity of Boardman Creek may be subject to Clackamas County's implementing ordinance for Title 3.

Clackamas County regulates certain activities proposed in wetlands or wetland buffers under the Conservation Wetland District (Section 709). The County generally recognizes buffer areas of 25 feet around conservation wetlands, defined as jurisdictional wetlands verified by DSL or the Corps.

Proposed trail construction over River Forest Creek (buried beneath the trail) may be subject to development standards of the County's Section 704: River and Stream Conservation Areas. Coordination with DSL, Oregon Department of Fish and Wildlife (ODFW), and the County may be required as part of the design process for this section of the trail.

OLSD

According to information provided by Walt Mintkeski (OLSD), trail construction plans, in addition to storm drainage and erosion control plans, must be submitted to the OLSD for review. The plans must show a 25-foot undisturbed corridor adjacent to sensitive areas or an equivalent mitigation plan. Sensitive areas include existing or created wetlands, rivers, streams, and creeks carrying flows from 100 acres or more. The purpose of a buffer, according to the OLSD, is to reduce the input of total suspended solids, nutrients, and stormwater runoff to nearby streams and wetlands. A report submitted to OLSD for approval must describe how the undisturbed corridor will be delineated (with fencing, signage, or equivalent methods) and how it will be maintained to protect the water quality function of the adjacent sensitive area. If a mitigation plan alternative to the 25-foot wide buffer corridor is proposed, the report must include a description of how this plan will function equivalent to the 25-foot undisturbed buffer. Trail planners are recommended to meet with OLSD staff to discuss design issues and potential mitigation prior to submission of detailed plans and specifications for review by the OLSD.

Mitigation

Mitigation measures to offset possible impacts could include, but are not limited to, the following:

- sloping the trail to drain surface water away from the sensitive areas,
- swales to treat Trolley Trail surface runoff,
- limiting user access to sensitive areas through fencing and/or signage,
- enhancing vegetation in the undisturbed corridor to provide additional shading,
- pollutant uptake, and surface water absorption, and
- detention and/or treatment of surface water entering sensitive areas from upstream of the Trolley Trail development.

Additional features to mitigate impacts to adjacent sensitive areas include using porous trail material or opting to not widen the existing corridor. Methods to alleviate seepage or drainage on to the trail may include removing the adjacent soil, excavating a ditch between the cut bank and the trail to convey water away from the trail, and/or elevating the trail surface.

A mitigation plan may not be required if the development application demonstrates that the trail will not impact water quality.

Funding Sources

It is assumed that the majority of funding for implementation will be acquired through the Federal Highway Administration's Transportation Efficiency Act for the 21st Century (TEA-21) program. Grant amounts are unknown, but for multi-use trail projects similar to the Trolley Trail in the Portland metropolitan area grants have typically been in the $1 million to $3 million range. Phasing recommendations target levels of funding within this range.

Other funding sources that should be explored for Trolley Trail implementation include:

- Recreational Trails Grants – Coordinated by Oregon State Parks. Funds can be used for construction. Annual funding cycle.
- Land and Water Conservation Fund (LWCF) – Federal funds coordinated by Oregon State Parks. Funds can be used for construction. Biannual funding cycle.
- Measure 66 Funds – Funds from Oregon State Lottery coordinated by Oregon State Parks. Funds can be used for construction. Biannual funding cycle.
- Enhancement Projects – Funded by federal transportation dollars and administered by Oregon Department of Transportation (ODOT). No funding cycle, when funds are available.
- Oregon Pedestrian/Bicycle Grants – Administered by ODOT's Pedestrian/Bicycle Program. Project must be in a public right-of-way.
- Community Development Block Grants – Federal funds administered by the counties for areas with low and moderate income households. Parks projects are eligible.
- NCPRD's System Development Charges – Funded by fees from new development and administered by NCPRD. Funds can be used for acquisition and development, not operations and maintenance.
- Clackamas County Capital Improvement Program (CIP) – Local General Fund dollars intended for capital improvements (repair, reconstruction or new construction) of facilities within Clackamas County. County has discretion as to how dollars are spent.

Cost Estimates

The construction costs for the Trolley Trail will depend on a number of factors, most specifically, the final alignment and design of the trail segments. Preliminary estimates for construction are included in Table 30. Table 38 in Appendix F contains a detailed cost estimate (by trail segment) based on unit costs for all recommended improvements and trail amenities. The total estimated cost for the Trolley Trail is $3.69 million.

Table 30. Preliminary Trail Construction Costs Summary

Estimated Cost of Construction Summary by Segment	
Segment	**Cost**
Segment 1	$ 224,019
Segment 2	272,752
Segment 3	366,375
Segment 4	598,980
Segment 5	346,382
Segment 6	441,407
Segment 7	576,980
Segment 8	288,605
Subtotal Cost, All Segments	3,115,501
Architectural & Engineering (A&E) Estimated Costs	573,087
Grand Total Costs	$ 3,688,588

Cost Qualifications:
1. Cost estimates include labor.
2. Cost estimates for segments 1 and 2 assume 2' gravel shoulders.
3. Easements or right-of-way acquisition are not included in these costs.
4. Permit fees are not included in these costs.
5. Full design/public process fees for SE Arista Drive are excluded for Segment 4.
6. Cost sharing arrangements are not reflective in these costs (ODOT or OLSD).
7. Maintenance and utility costs are not included in these costs.
8. Using concrete for the trail surface instead of asphalt would add $587,716 to the overall construction costs.

VIII. Management and Maintenance

Management Responsibilities

NCPRD will manage the Trolley Trail. NCPRD is a full service park district and experienced in managing public parks and facilities. NCPRD has established management policies and practices that will apply to the Trolley Trail.

NCPRD and Metro Regional Parks and Greenspaces Department have successfully partnered on several projects including acquisition and master planning of the Trolley Trail. Their continued partnership on this project will be beneficial to successful project implementation.

The following recommendations pertain to an asphalt trail surface with crusher fine shoulders. As mentioned previously, concrete is another option to consider for the trail surface and should be further explored during the design phase.

Trail Maintenance

Effective trail maintenance is critical to the overall success and safety of the Trolley Trail. Maintenance activities typically include pavement stabilization, landscape maintenance, facility upkeep, sign replacement, mowing, litter removal and painting. A successful maintenance program requires continuity and often involves a high level of citizen participation. Routine maintenance on a year-round basis will not only improve trail safety, but will also prolong the life of the trail. The benefits of a good maintenance program are far-reaching, including:

- A high standard of maintenance is an effective advertisement to promote the trail as a regional and state recreational resource.
- Good maintenance can be an effective deterrent to vandalism, litter, and encroachments.
- Good maintenance is necessary to preserve positive public relations between the adjacent land owners and managing agency.
- Good maintenance can make enforcement of regulations on the trail more efficient. Local clubs and interest groups will take pride in "their" trail and will be more apt to assist in protection of the trail.
- A proactive maintenance policy will help improve safety along the trail.

Ongoing trail maintenance likely includes some, if not all, of the following activities:

Vegetation

In general, visibility between plantings at trailside should be maintained so as to avoid creating the feeling of an enclosed space. This will also give trail users good, clear views of their surroundings, which enhances the aesthetic experience of trail users. Under-story vegetation within the trail right-of-way should not be allowed to

grow higher than 36 inches. Trees species selection and placement should be made that minimizes vegetative litter on the trail and root uplifting of pavement. Vertical clearance along the trail should be periodically checked, and any overhanging branches over the trail should be pruned to a minimum vertical clearance of 10 feet.

Surfacing

Asphalt is the recommended surface material for the Trolley Trail. Cracks, ruts and water damage will need to repair periodically.

Where drainage problems exist along the trail, ditches and drainage structures will need to be kept clear of debris to prevent wash outs along the trail and maintain positive drainage flow. Checks for erosion along the trail should be made during the wet season, and immediately after any storm that brings flooding to the local area.

The trail surface should be kept free of debris, especially broken glass and other sharp objects, loose gravel, leaves and stray branches. Trail surfaces should be swept periodically. Soft shoulders should be well maintained to maximize their usability.

Pest and Vegetation Management

Some basic measures should be taken to protect the trail investment. This includes a bi-annual mowing along both sides of the trail to prevent invasion of plants into the pavement area. The recommended time of year for mowing is fall and spring.

Wherever possible, vegetation control should be accomplished by mechanical means or hand labor. Some species may require spot application of state-approved herbicide. Metro's Integrated Pest Management Policies should be followed when using herbicides. Efforts should be made to eradicate two invasive species found along the Trolley Trail right-of-way: Japanese knotweed (consult with Metro) and English ivy.

Litter and Illegal Dumping

Staff or volunteers should remove litter along the trail. Litter receptacles should be placed at access points such as trailheads.

Illegal dumping should be controlled by vehicle barriers, regulatory signage and fines as much as possible. When it does occur, it should be removed as soon as possible in order to prevent further dumping. Neighborhood volunteers, friends groups, alternative community service crews and inmate labor should be considered in addition to maintenance staff.

Signage

Signage should be replaced along the trail on an as-needed basis.

Flooding

Portions of the trail at Boardman and just south of Roethe are subject to flooding. Debris accumulated on the trail surface should be removed after each recession of water. In addition, one bridge is anticipated on the trail between Naef and Roethe. Debris should be periodically removed from the waterway under the bridge structure.

Table 31 summarizes maintenance recommendations for the Trolley Trail:

Table 31. Maintenance Recommendations

Item	Suggested Frequency
Sign replacement/repair	1-3 years
Pavement marking replacement	1-3 years
Planted Tree, Shrub, trimming/fertilization	5 months- 1 year
Pavement sealing/potholes	5-15 years
Clean drainage system	Annual
Pavement sweeping	Monthly
Shoulder mowing*	Bi-Annual – Fall/Spring
Trash disposal	As needed, twice a week
Graffiti removal	Weekly/or as reported
Maintain benches, site amenities	1 year
Pruning to maintain vertical clearance	1-4 years
Remove fallen trees	As needed
Weed control	Monthly
Water plants	As needed

* Additional maintenance may be required.

Typical maintenance vehicles for the trail will be light pick up trucks and occasionally heavy dump trucks and tractors. A mechanical sweeper is recommended to keep the trail clear of loose gravel and other debris. Care should be taken when operating heavier equipment on the trail to warn trail users and to avoid breaking the edge of the trail surface.

Maintenance Costs

The total estimated annual maintenance for the Trolley Trail is about $38,500 based on the estimated length of 5.5 miles. This length excludes the half-mile on-street segment of trail on SE Arista Drive, with the assumption that maintenance of this segment will be through the Clackamas County Road Department. This maintenance cost is based on an industry standard of $7,000 per mile of asphalt bike path annually, which is the approximate cost per mile for maintenance on the built portions of the Springwater Corridor. These costs can be greatly reduced if volunteer crews are used or if the groups assume some of the responsibilities.

Maintenance costs cover labor, supplies, and amortized equipment costs for trash removal, sweeping, resurfacing and re-striping the asphalt path, repairs to crossings, cleaning drainage systems, landscaping, underbrush and weed abatement.

In addition to these maintenance costs, electrical costs will be associated with any lighting improvements along the trail. Based upon full implementation of the recommended lighting improvements (see Table 38, Appendix F), the estimated annual electrical cost would be approximately $15,250. In reality, annual electrical costs will be based on the amount of lighting actually installed. This estimate is based upon electrical costs incurred by other local park providers.

APPENDIX A. Bibliography

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APPENDIX B. Project Timeline

Plans for the Trolley Trail have been proposed and developed for over 30 years:

Table 32. Timeline of Trolley Trail Planning: 1968-2003

1968:	Freight service on Trolley Trail alignment discontinued. Local residents and children use right-of-way as an informal trail.
1969:	"Save the Interurban Right-of-Way" committee campaigns for conversion of the right-of-way into a temporary bicycle and pedestrian trail.
1971:	Oregon State Highway Division plans for conversion of the corridor into a trail.
1972:	Columbia Region Association of Governments (CRAG) "Urban Outdoors Report: A New Proposal for Metropolitan Area Parks and Open Spaces."
1974:	First feasibility study exploring light rail service in corridor.
late 1980s:	Tri-Met, ODOT, and other agencies study use of corridor as potential light-rail route.
1990:	North Clackamas Parks and Recreation District (NCPRD) Master Plan identifies abandoned Portland Traction Line as a potential trail corridor.
1992:	Metropolitan Greenspaces Master Plan / Regional Trails & Greenway Map designate Trolley Trail as a regional trail.
1995:	Metro Regional Urban Growth Goals and Objectives / 2040 Concept Map: Trolley Trail included.
	Metro's Regional Open Space Bond Measure passes: includes NCPRD "local share" portion to fund acquisition of old Portland Traction Co. right-of-way for a future trail.
1996:	Clackamas County Bicycle Master Plan proposes Trolley Trail.
2000:	Metro Regional Transportation Plan (RTP) Update, includes Trolley Trail.
2001:	Friends of the Trolley Trail forms to advocate for Trolley Trail.
	Metro Green Ribbon Committee recommends Trolley Trail receive priority funding for development.
	Purchase of Trail Right-of-Way by Metro and NCPRD.
2002:	Friends of Trolley Trail partner with Metro and NCPRD to conduct volunteer activities along trail corridor.
	Clackamas County Comprehensive Plan calls for implementing the Trolley Trail.
	NCPRD draft Master Plan update lists Trolley Trail corridor as a priority trail project.
	Portland State University graduate students publish "Trolley Trail: An Assessment of Opportunities and Constraints."
	Trolley Trail Master Plan study begins; Trolley Trail Citizen Working Group established, public involvement processes underway.
2004:	Trolley Trail Master Plan completed.

Appendix C. Historic Trolley Stations

This section is excerpted from Bell, et. al. (2002).

The number of stations and their names underwent minor changes throughout the operating years of the streetcar. The original stations got their names in one of two ways. The names were either descriptive of the natural surroundings or they were provided by the owners of the land surrounding the corridor (Witter, n.d.). Figure 3 (page 9) shows the stations as they existed in 1938. Below, each of the stations are described from north to south.

Milwaukie Station was located near what is now Vic's Tavern on the west side of McLoughlin Boulevard. This station took the name of the city it served, and in 1915, the station consisted of a covered waiting platform with benches. The station was in front of an American Express Company office and an ice cream and soda shop.

Island Station, the next stop, was located just north of what is now the "Yes! I Do Bridal" store at the intersection of 22nd Avenue and McLoughlin Boulevard. This station took its name from the nearby Rock Island in the Willamette River, known as Elk Rock Island today (Witter, n.d.). In 1933, the station consisted of a small freestanding wooden shelter.

Earlier photos of Island Station show it next to a muddy road, possibly an early River Road, with a sign for an Open Air Sanitarium.

Lakewood Station was located near Kellogg Lake. From Island Station, the streetcar traveled up a hill, past the lake, and through a deep stand of firs (Witter, n.d.). The station was appropriately named after these natural features. A 1915 picture shows trolley cars within the vicinity of the station.

Evergreen Station was the next stop on the line. It was also named for its surroundings (Witter, n.d.). This station was located at the northwest corner of the intersection of the streetcar line with Park Avenue. It is fondly remembered by local residents who used to buy pieces of penny candy at the small store adjacent to the station. Others remember that to get to the station from the east one had to cross a wooden bridge over a small gully. The gully was filled in during the construction of the "Super Highway," known today as McLoughlin Boulevard.

Silver Springs Station is the next station continuing south. It was named for a spring in the area (Witter, n.d.). Residents who used to ride the trolley remember that the station was located at the intersection of the corridor and what is now Silver Springs Road.

Torbank Station was located approximately where Torbank Road currently meets the trail right-of-way. The station was named by the wife of Joseph J. Price. Her husband gave land for the station.

Courtney Station was located at the southwest corner of the intersection of Arista Drive with North Avenue. North Avenue is now called Courtney Road. Courtney Station was named for an Irish chicken farmer, although the land previously belonged to the Broetje family and was used as a nursery.

Saint Theresa was located on the east side of Arista Drive about halfway between Courtney Road and Oak Grove Boulevard. It was named for Sister Theresa who established "The Little Flower" sanitarium at this location. A large evergreen hedge near the intersection of Arista Drive and Pine Avenue reportedly marks the location of the sanitarium and the station (Witter, n.d.).

Oak Grove Station was located in the community of Oak Grove at the corner of Oak Grove Boulevard and Arista Drive. Oak Grove offered stores, a post office, and gathering places clustered along Oak Grove Boulevard (called Central Avenue until around 1913). The station's stop and ticket office were once located in the general store, which now houses the Oak Grove Bar and Grill.

Rupert Station was on more sparsely developed land and was reportedly located just after the corridor turns to the east, near present day Third Avenue.

Risley Station was the next stop and its name recognizes one of the more prominent families in the area. The station was a small shelter located at the northwest corner of the intersection of the corridor with Swain Avenue. Today, members of the Risley family continue to live in the area around the corridor.

Concord and Vineyard Stations were the next two stops. It is unclear how either station received its name. Both stations were on land that once belonged to the Andrew's family (Witter, n.d.). Concord Station was reportedly located at the northwest corner of where Concord Road now intersects with Arista Drive. The station may have been named after Concord, Massachusetts or for Concord grapes that early pioneers tried to grow in the area.

Naef Station was also named after a prominent family. Similar to the Risley family, members of the Naef family still live in the area.

Roethe Station, the next stop, was located approximately at the intersection of the corridor and Roethe Road. Just past Roethe Road was **Ashdale Station.** The station was located approximately at the intersection of current Boardman Avenue with the trolley corridor.

Jennings Lodge Station was named for the Jennings family. The station was located near the present day intersection of the trolley corridor and McLoughlin Boulevard. This stop offered commercial stores, a post office and meeting places. It was also a very popular destination for youth and teenagers. Long-time residents recall getting off the trolley at this stop and walking north to Roake's Hot Dogs.

Meldrum Station was named for the family that previously owned the land. The station was located along Abernethy Lane.

Fern Ridge was the last station in the study area and was located just north of present day Glen Echo Avenue.

Appendix D. County Soil Information

Table 33. Runoff, Erosion Hazard, Drainage Class of Soils Mapped Along the Trolley Trail Corridor

Soil Map Unit	Description of Runoff	Water Erosion Hazard	Soil Drainage Class
Aloha silt loam	Slow	Slight	Somewhat poorly drained
Cove silty clay loam	Slow to ponded	Slight	Poorly drained
Huberly silt	Slow to ponded	Slight	Poorly drained
Humaquepts, ponded	Slow to ponded	Slight	Poorly drained
Saum silt loam	Medium	Moderate	Well drained
Urban land	NA	NA	NA
Woodburn silt loam	Slow	Slight	Moderately well drained
Woodburn silt loam	Medium	Moderate	Moderately well drained
Xerochrepts and Haploxerolls	Rapid	Severe	Well drained

Source: Soil Survey of Clackamas County Area, Oregon, 1985

Table 34. Potential Flooding Characteristics of Soils Mapped Along the Trolley Trail Corridor

Soil Map Unit	Flooding Potential			High Water Table		
	Frequency[1]	Duration[2]	Months	Depth (ft)	Kind	Months
(1A) Aloha silt loam[3], 0 to 3 % slopes	None	NA	NA	1.5-2.0	Perched	Dec-Apr
(1B) Aloha silt loam[3], 3 to 6 % slopes	None	NA	NA	1.5-2.0	Perched	Dec-Apr
(25) Cove silty clay loam[4], 0 to 2 % slopes	Occasional	Brief	Dec-Apr	0-1.0	Perched	Dec-Apr
(41) Huberly silt loam[4], 0 to 3 % slopes	None	NA	NA	0-1.5	Perched	Dec-Apr
(42) Humaquepts[4], ponded, 0 to 2 % slopes	Frequent	Brief	Dec-Apr	0	Perched	Dec-Apr
(78C) Saum silt loam, 8 to 15 % slopes	None	NA	NA	NA	NA	NA
(82) Urban land, 0 to 30 % slopes	NA	NA	NA	NA	NA	NA
(91B) Woodburn silt loam[3], 3 to 8 % slopes	None	NA	NA	2.0-3.0	Perched	Dec-Apr
(91C) Woodburn silt loam[3], 8 to 15 % slopes	None	NA	NA	2.0-3.0	Perched	Dec-Apr
(92F) Xerochrepts and Haploxerolls, very steep	None	NA	NA	3.0-6.0	Perched	Dec-Apr

Source: Soil Survey of Clackamas County Area, Oregon, 1985

Notes: 1- "None" = not probable; "Occasional" = 5-50% chance of flooding; "Frequent" = >50% chance of flooding
2- "Brief" = 2-7 days
3- May contain hydric soils as inclusions
4- Hydric soils dominate these map units

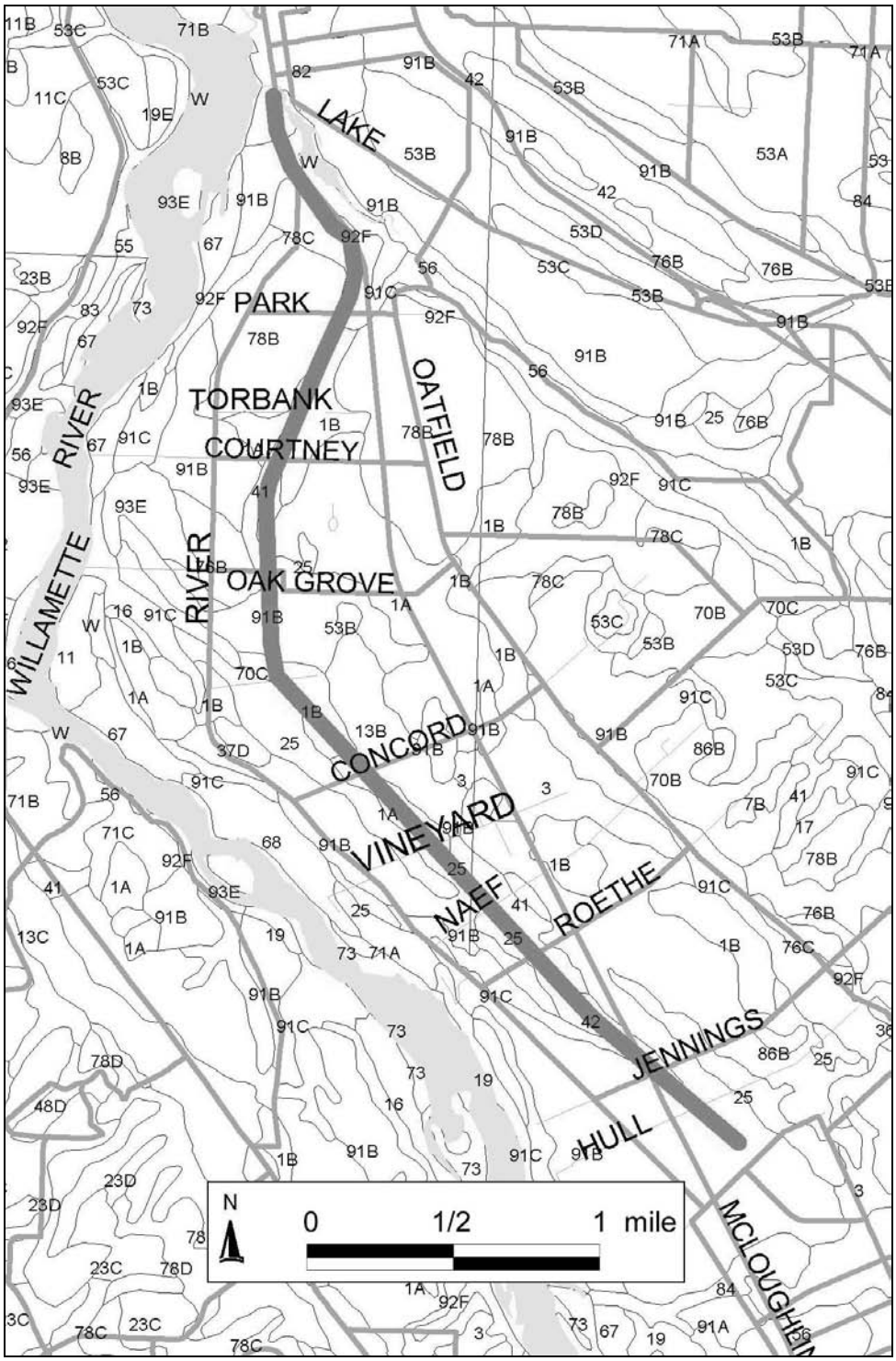

Figure 36. Soil Map of Trolley Trail Vicinity
(refer to Table 34, page 117 for soil key)

APPENDIX E. Trail Design Elements

Figure 37. Letter from Clackamas County regarding options for Arista Drive

January 15, 2003

Jane Hart
Project Manager, Trolley Trail Master Plan
Metro
600 NE Grand Ave
Portland, OR 97232

Dear Jane:

Over the past few months I have had an opportunity to get comments from the Statewide Pedestrian and Bikeway Coordinators and from the County's traffic engineer regarding the different concepts for the on-road sections of the Trolley Trail Arista Road and Arista Drive. Below are the comments, summarized by option.

Option 1: Bike lane down the middle of Arista (between Courtney and Creighton Dr.)

The general consensus was that this was very unsafe.

- There were too many obstacles to overcome (existing use of the ROW, limitation of crossing, creating the one-way streets)
- There would be problems with pedestrians squeezing the trail.
  - There is not enough space in the middle of the road. The trail would need to be between 12' and 14' wide.
  - If cyclist fell, because they hit the curb, they could fall directly into the travel lane.
- Too many existing driveways and crossings
  - Access issues would be very challenging
  - Create substantial access and out of direction travel issues for existing residents.
  - Intersection control would be difficult, especially at Oak Grove Blvd

Option 2: Trail on one side of the road (wide sidewalk)

The number of driveways accessing Arista makes this option less desirable.

- Increased conflicts with the driveways
- There will be many grading issues with the driveways and yards
- The issue with the existing apartment parking in the right-of-way will be challenging
- Have to deal with crossing cyclists and peds to the facility on one side.
- Need minimum separation from the roadway for a two-way facility to function safely.

Option 3: Bike lanes and sidewalks on both sides of the road

Bike Lanes and sidewalks on both sides is the preferred option

- Drainage will still be an issue along the northeastern side
- There will be more flexibility with design (sidewalk width, bike lane and travel lane width) which will give the ability to work with unique situations, like the apartment complex parking.

Arista Lane - Boardman to Jennings

For this section, keeping the Trolley Trail within the Metro right-of-way is the best option. While there will be a need for retaining walls, the construction of that segment is feasible and there appears to be adequate width within the corridor right-of-way. Arista Lane has a narrow travel lane and substandard right-of-way. Directing bicycle and pedestrian traffic onto this road would cause too many conflicts with the automobile traffic.

There would not necessarily be a need to create a one way street or reduce automobile access at Jennings if the Trolley Trail was constructed with in the Metro right-of-way. The traffic engineers did not support changing the access to Arista Lane at this time.

Arista Lane - Jennings to Glen Echo

The best place for the Trolley Trail in this segment is within the Metro right-of-way. The existing road right-of-way is substandard. Metro should work with the property owners that are currently using the Trolley Trail right-of-way to complete the trail outside of the road right-of-way.

Other comments

No matter the option recommended, removing on-street parking will be a political and sensitive issue. The design should try to focus on using the most narrow cross-section possible. At the time that the segment is constructed, there will be a need to work to accommodate the people who live in the area. Public involvement will be extremely important to work through the many design challenges.

While the “green streets” concept is a nice idea, it would require the entire ROW. There would be a substantial number of tough design issues with regards to drainage.

As the recommendation is developed, hopefully there will be over arching goals that can be applied at the time the actual street segment is developed. There may be design tools, such as using a different color pavement to distinguish bike lanes from street or raising the bike lanes that may help facilitate the continuity of the Trolley Trail.

Thank you for the opportunity to comment.

Sincerely,

Karen Buehrig
Land Use Planner

Table 35. Roadway Crossings Matrix

	Roadway	Current Crossing Treatment	Sight Distance	Crossing Width	Avg./ Posted Speed	Traffic Volume (Daily Avg.)	Sidewalks	Bike Lns	Recommended Crossing Treatment
MILWAUKIE									
I-1	Jefferson Boat Ramp	signal about 30' to east	good	100'	n/a	low	yes		Existing Type II
I-2	22nd Avenue	none	poor	50'	40	med			Type I; redesign as shown
I-3	Bluebird Street	signal	good	25'	n/a	low			Existing Signal
I-4	River Road	signal, stop sign	poor	45'	n/a	med (5,000)			Existing
I-5	Sparrow Street / 26th Avenue	stop sign 30' to east	poor	35'	n/a	low			Type I; narrow pavement to 26th
CLACKAMAS COUNTY									
I-6	Park Ave.	none	good	25'	30	med (4000)	intermittent		Type I
I-7	Evergreen (Driveway)	none	n/a	25'	n/a	low			None
I-8	Silver Springs Road	none	n/a	28'	n/a	low			None
I-9	Torbank Road	none	good	20'	n/a	low			None
I-10	SE Arista Drive (on-street route)		good	25'	25	med		yes	
I-11	Courtney Road	crosswalk	good	32'	35/20	low (3000)	yes (s. side)	yes	Existing Type I
I-12	Pinelane Street	none	good	33'	20	low			Type I
I-13	Maple Street	stop sign on SE Arista	good	33'	20	low			Type I
I-14	Oak Grove Boulevard.	stop sign on SE Arista	good	36'	35	low (3000)	yes	yes	Type I
I-15	Crossing SE Arista Drive	none	good	26'	30	med		wide shoulder	Type I
I-16	Creighton Avenue (on-street alternate)	stop sign	good	26'	25	low			Type I
I-17	Swain Avenue	stop sign in median	good	32'	25	low			Type I
I-18	Risley Avenue (illegal crossing)	none	good	n/a	n/a	low			Close off current illegal crossing to thru-traffic
I-19	Concord Road	none	good	32'	25	med (3700)		yes	Type I, flashing warning light
I-20	Vineyard Road	none	good	32'	25	low			Type I
I-21	Naef Road	none	good	26'	25	low (1900)			Type I; flashing warning light
I-22	Roethe Road	none	good	26'	25	low (1300)			Type I; flashing warning light
I-23	Boardman Avenue	none	good	26'	25	low (1000)			Type I
I-24	SE McLoughlin Boulevard @ SE Jennings Avenue	signal	good	65'	40	high (38,000)	yes		Type II
I-25	Hull Avenue	stop sign	good	25'	25	low			Type I
I-26	Meldrum Avenue	stop sign	good	25'	25	low			Type I
I-27	SE Glen Echo Avenue	stop sign	good	32'	30	med	yes		Type I

Table 36. Regulatory Signage

Item	Location	Color	AASHTO Designation	MUTCD Designation
No Motor Vehicles	Entrances to trail	B on W	R44A	R5-3
Use Ped Signal/Yield to Peds	At crosswalks; where sidewalks are being used (SE McLoughlin Boulevard)	B on W	N/A	R9-5 , R9-6
Bike Lane Ahead: Right Lane Bikes Only	At beginning of bike lanes	B on W	N/A	R3-16, R3-17
STOP, YIELD	At trail intersections with roads	W on R	R1-2	R1-1, R1-2
Bicycle Crossing	For motorists at trail crossings	B on Y	W79	W11-1
Bike Lane	At the far side of all arterial intersections	B on W	R81	D11-1
Turns and Curves	At turns and curves which exceed 20 mph design specifications	B on Y	W1,2,3; W4,5,6,14 W56,57	W1-1,2 W1-4,5 W1-6
Trail Intersections	At trail intersections where no STOP or YIELD required, or sight lines limited	B on Y	W7,8,9	W2-1, W2-2 W2-3, W2-3 W2-4, W2-5
STOP Ahead	Where STOP sign is obscured	B,R on Y	W17	W3-1
Signal Ahead	Where signal is obscured	B,R,G	YW41	W3-3
Pedestrian Crossing	Where pedestrian walkway crosses trail	B on Y	W54	W11A-2
Directional Signs	At intersections where access to major destinations is available	W on G	G7, G8	D1-1b(r/l), D1-1c
Trail Regulations / Bikes Reduce Speed & Call Out Before Passing	All trail entrances	B on W	n/a	n/a
Multi-purpose Trail: Bikes Yield to Pedestrians	All trail entrances	n/a	n/a	n/a
Please Stay On Trail	In environmentally-sensitive areas near Boardman Slough	n/a	n/a	n/a
Trail Closed: No Entry Until Made Accessible & Safe for Public Use	Where trail or access points closed due to hazardous conditions	n/a	n/a	n/a

Table 37. Recommended Plant List

Woodland Upland Areas (Segments 1, 2, 3, 5, 8)		
Trees:	Douglas fir (*Pseudotsuga menziesii*)	Western red cedar (*Thuja plicata*)
	Western hemlock (*Tsuga heterophylla*)	Big leaf maple (*Acer macro phyllum*)
	Grand fir (*Abies grandis*)	Red alder (*Alnus rubra*)
	Oak *(Quercus)*	
Small Trees and Shrubs:	Vine maple (*Acer circinatum*)	Common chokecherry (*Prunus virginiana*)
	Cascara (*Rhamnus purshiana*)	Bitter cherry (*Prunus emarginata*)
	Serviceberry (*Amelanchier alnifolia*)	Tall Oregon grape (*Mahonia aquifolium*)
	Pacific yew (*Taxus brevifolia*)	Dull Oregon grape (*Mahonia nervosa*)
	Chinkapin (*Castanopsis chrysophylla*)	Red huckleberry (*Vaccinium parvifolium*)
	California hazel (*Corylus cornuta*)	Evergreen huckleberry (*Vaccinium ovatum*)
	Pacific dogwood (*Cornus nurrallii*)	Salal (*Gaultheria shallon*)
	Oceanspray (*Holodiscus discolor*)	Red flowering currant (*Ribes sanguineum*)
	Western rhododendron (*Rhododendron macrophyllum*)	Thimbleberry (*Rubus parviflorus*)
	Indian plum (*Osmaronia cerasiformis*)	Snowberry (*Symphoricarpus albus*)
	Red elderberry (*Sambucus racemosa*)	Woods rose (*Rosa woodsii*)
	Blue elderberry (*Sambucus cerulea*)	Nootka rose (*Rosa nutkana*)
	Western mock-orange (*Philadelphia lewisii*)	Oval-leaf viburnum (*Virburnum ellipticum*)
Herbaceous plants and wildflowers:	Vanilla leaf (*Achylis triphylla*)	Foamflower (*Tiarella trifoliata*)
	Wild ginger (*Asarum caudatum*)	Starflower (*Trientalis latifolia*)
	Ladyfern (*Athyrium filix-femina*)	Piggyback plant (*Tolmiea menziesii*)
	Deerfern (*Blechnum spicant*)	Inside-out flower (*Vancouveria hexandra*)
	Swordfern (*Polystichum munitum*)	Trillium (*Trillium ovatum*)
	Bunchberry dogwood (*Cornus stolonifera*)	Wood violet (*Viola glabella*)
	Twinflower (*Linnaea borealis*)	Snow queen (*Synthris reniformis*)
	Miners lettus (*Montia siberica*)	Red columbine (*Aquilegia formosa*)
	Oxalis (*Oxalis oregona*)	Western buttercup (*Ranunculus occidentalis*)
	False solomonseal (*Smilacena racemosa*)	Pacific bleedingheart (*Dicentra formosa*)
	Starry solomonseal (*Smilacena stellata*)	Camas *(Camassia quamash)*
Prairie/Grasslands (all segments)		
Grasses and Herbaceous Plants:	California brome-grass (*Bromus carinatus*)	Barestem lomatium (*Lomatium nudicaule*)
	Blue wildrye (*Elymus glaucus*)	Nine-leaf lomatium (*Lomatium triternatum*)
	California fescue (*Festuca californica*)	Common lomatium (*Lomatium utriculatum*)
	Idaho fescue (*Festuca idahohensis romeri*)	Sickle-keel lupine (*Lupinus albicaulis*)
	Lemmon's needlegrass (*Stipa lemmoni*)	Slender cinquefoil (*Potentilla gracilis*)
	White yarrow (*Achillea millefolium*)	Heal-all (*Prunella vulgaris*)
	Western columbine (*Aquilegia formosa*)	Rose checker-mallow (*Sidalcea virgata*)
	Menzies' larkspur (*Delphinium menziesii*)	Canadian goldenrod (*Solidago canandensis*)
	Leichtlin's camas (*Camassia leichtlinii*)	Yellow violet (*Viola nuttallii*)
	Globe gillia (*Gillia capitata*)	Mule's ears (*Wyethia angustifolia*)
	Shooting star (*Dodecatheon hendersonii*)	Northern saitis (*Brodiaea congesta*)
	Broadleaf strawberry (*Fragaria virginiana platypetala*	Harvest brodiaea (*Brodiaea coronaria*)
	Oregon iris (*Iris tenax*)	Spanish clover (*Lotus purshianus*)
	Smallflower prariestar (*Lithophragma parviflora*)	

Riparian/Wetland Areas (Segments 3, 6, 7)		
Trees:	Oregon ash (*Fraxinus oregona*) Black cottonwood (*Populus trichocarpa*) Western red cedar (*Thuja plicata*) Cascara (*Rhamnus purshiana*) Columbia willow (*Salix fluviatilis*) Pacific willow (*Salix lasiandra*)	Piper's willow (*Salix piperi*) Rigid willow (*Salix rigida*) Scouler willow (*Salix scouleriana*) Soft-leaved willow (*Salix sessiliflora*) Sitka willow (*Salix sitchensis*)
Shrubs:	Red-osier dogwood (*Cornus stolonifera*) Black twinberry (*Lonicera involucrata*) Indian plum (*Oemlaria cerasiformis*) Pacific ninebark (*Physocarpis capitatus*) Swamp rose (*Rosa pisocarpa*)	Salmonberry (*Rubus spectabilis*) Blue elderberry (*Sambucus cerluea*) Red elderberry (*Sambucus racemosa*) Douglas spirea (*Spirea douglasii*) Nootka rose (*Rosa nootkana*)
Herbaceous plants and wildflowers:	Maidenhair fern (*Adiantum pedatum*) Douglas aster (*Aster Douglasii*) Lady fern (*Athyrium fliex-femina*) Big-leaf sedge (*Carex amplifolia*) Columbia sedge (*Carex aperta*) Dewey's sedge (*Carex deweyana*) Henderson's wood sedge (*Carex hendersonii*) Western corydalis (*Corydalis scouleri*) Elegant rein-orchid (*Habenaria elegans*) Soft rush (*Juncus effusus*) Skunk cabbage (*Lysichitum americanum*)	Yellow monkey-flower (*Mimlulus quttatus*) Streambank springbeauty (*Montia parviflora*) Candyflower (*Montia siberica*) Forget-me-not (*Myostis laxa*) Water parsley (*Oenanthe sarmentosa*) Sweet coltsfoot (*Petasites frigidus*) False solomon-seal (*Smilacena racemosa*) Laceflower (*Tiarella trifoliata*) Piggyback (*Tolmiea menziesii*) Stream violet (*Viola glabella*)

APPENDIX F. Implementation

Table 38. Preliminary Trail Construction Costs, by Segment

Segment 1: Jefferson Street Boat Ramp to River Road (0.6 mile)							
	ENGLISH			METRIC			
Item	Quantity	Unit Cost	Unit	Quantity	Unit Cost	Unit	Total
Clearing/Grubbing & Brush Removal	3,168	$ 1.00	LF	966	$ 3.28	LM	$ 3,168.00
Asphalt Pathway with Sub-base (12' wide)	26,016	2.75	SF	7,930	9.02	SM	71,544.00
Concrete Sidewalk Extension (4' width)	4,000	3.25	SF	1,219	10.66	SM	13,000.00
Trail Shoulder (2' wide gravel)	-	1.25	SF	-	4.10	SM	-
Hydroseed Trail Shoulder Disturbed Areas	12,672	0.24	SF	3,862	0.79	SM	3,041.28
Silt Fencing	400	1.95	LF	122	6.40	LM	780.00
Trail Information Kiosk	1	3,000.00	EA	1	3,000.00	EA	3,000.00
Lighting (entire length)	18	2,200.00	EA	18	2,200.00	EA	39,600.00
Curb Extension (22nd Xing)	300	16.75	LF	91	54.95	LM	5,025.00
Bench	2	2,500.00	EA	2	2,500.00	EA	5,000.00
Stop Sign	6	150.00	EA	6	150.00	EA	900.00
Trail Xing Ahead Sign (Vehicle warning)	6	150.00	EA	6	150.00	EA	900.00
Directional Signage	6	150.00	EA	6	150.00	EA	900.00
Striping (8" thermal plastic cross walk)	480	2.04	LF	146	6.69	LM	979.20
Pavement Inlays (Interpretive)	1	800.00	EA	1	800.00	EA	800.00
Fixed Wooden Bollard	10	500.00	EA	10	500.00	EA	5,000.00
Removable Bollard	5	700.00	EA	5	700.00	EA	3,500.00
Wood Bollard 1/4 Mile Post Marker	3	550.00	EA	3	550.00	EA	1,650.00
Landscape Area (unirrigated)	10,000	1.25	SF	3,048	4.10	SM	12,500.00
Litter Receptacle	1	400.00	EA	1	400.00	EA	400.00
ADA Ramp	1	800.00	EA	1	800.00	EA	800.00
Bike Rack	1	500.00	EA	1	500.00	EA	500.00
Fencing (Wooden)	-	12.00	LF	-	39.37	LM	-
Flashing Yellow Warning Lights	-	1,200.00	EA	-	1,200.00	EA	-
Columnar Basalt Stone Bollards	-	600.00	EA	-	600.00	EA	-
Prefabricated Wooden Bridge	-	75.00	SF	-	246.06	SM	-
Subtotal							**172,987.48**
Mobilization		8.00%	EA		8.00%	EA	13,839.00
Temporary Protection & Direction of Traffic		1.50%	EA		1.50%	EA	2,594.81
Contingency		20%			20%		34,597.50
Grand Total Segment 1							**$ 224,018.79**

Segment 2: River Road to Park Avenue (0.6 mile)							
	ENGLISH			METRIC			
Item	Quantity	Unit Cost	Unit	Quantity	Unit Cost	Unit	Total
Clearing/Grubbing & Brush Removal	3,168	$ 1.00	LF	966	$ 3.28	LM	$ 3,168.00
Asphalt Pathway with Sub-base (12' wide)	37,728	2.75	SF	11,499	9.02	SM	103,752.00
Concrete Sidewalk Extension	-	3.25	SF	-	10.66	SM	-
Trail Shoulder (2' wide gravel)	12,576	1.25	SF	3,833	4.10	SM	15,720.00
Hydroseed Trail Shoulder Disturbed Areas	47,376	0.24	SF	14,440	0.79	SM	11,370.24
Silt Fencing	3,168	1.95	LF	966	6.40	LM	6,177.60
Trail Information Kiosk	-	3,000.00	EA	-	3,000.00	EA	-
Lighting (entire length)	18	2,200.00	EA	18	2,200.00	EA	39,600.00
Curb Extension	140	16.75	LF	43	54.95	LM	2,345.00
Bench	1	2,500.00	EA	1	2,500.00	EA	2,500.00
Stop Sign	3	150.00	EA	3	150.00	EA	450.00
Trail Xing Ahead Sign (Vehicle warning)	2	150.00	EA	2	150.00	EA	300.00
Directional Signage	1	150.00	EA	1	150.00	EA	150.00
Striping (8" thermal plastic cross walk)	160	2.04	LF	49	6.69	LM	326.40
Pavement Inlays (Interpretive)	-	800.00	EA	-	800.00	EA	-
Fixed Wooden Bollard	6	500.00	EA	6	500.00	EA	3,000.00
Removable Bollard	3	700.00	EA	3	700.00	EA	2,100.00
Wood Bollard 1/4 Mile Post Marker	3	550.00	EA	3	550.00	EA	1,650.00
Landscape Area (unirrigated)	800	1.25	SF	244	4.10	SM	1,000.00
Litter Receptacle	-	400.00	EA	-	400.00	EA	-
ADA Ramp	-	800.00	EA	-	800.00	EA	-
Bike Rack	-	500.00	EA	-	500.00	EA	-
Fencing (Wooden)	80	12.00	LF	24	39.37	LM	960.00
Drainage Culvert	50	9.00	LF	15	29.53	LM	450.00
Columnar Basalt Stone Bollards	12	600.00	EA	4	1,968.50	EA	7,200.00
Earthwork/Excavation (SE McLoughlin Boulevard separation)	210	40.00	CY	192	43.74	CM	8,400.00
Subtotal							**210,619.24**
Mobilization		8.00%	EA		8.00%	EA	16,849.54
Temporary Protection & Direction of Traffic		1.50%	EA		1.50%	EA	3,159.29
Contingency		20%			20%		42,123.85
Grand Total Segment 2							**$ 272,751.92**

Segment 3: Park Avenue to Courtney Road (0.6 mile)							
	ENGLISH			METRIC			
Item	Quantity	Unit Cost	Unit	Quantity	Unit Cost	Unit	Total
Clearing/Grubbing & Brush Removal	3,168	$ 1.00	LF	966	$ 3.28	LM	$ 3,168.00
Asphalt Pathway with Sub-base (12' wide)	38,016	2.75	SF	11,587	9.02	SM	104,544.00
Concrete Sidewalk Extension	-	3.25	SF	-	10.66	SM	-
Trail Shoulder (2' wide, gravel)	6,336	1.25	SF	1,931	4.10	SM	7,920.00
Trail Shoulder (6' wide, crusher fines)	19,008	2.50	SF	5,794	8.20	SM	47,520.00
Hydroseed Trail Shoulder Disturbed Areas	19,008	0.24	SF	5,794	0.79	SM	4,561.92
Silt Fencing	6,236	1.95	LF	1,901	6.40	LM	12,160.20
Trail Information Kiosk	-	3,000.00	EA	-	3,000.00	EA	-
Lighting (select points)	7	2,200.00	EA	7	2,200.00	EA	15,400.00
Curb Extension	-	16.75	LF	-	54.95	LM	-
Bench	3	2,500.00	EA	3	2,500.00	EA	7,500.00
Stop Sign	8	150.00	EA	8	150.00	EA	1,200.00
Trail Xing Ahead Sign (Vehicle warning)	7	150.00	EA	7	150.00	EA	1,050.00
Directional Signage	1	150.00	EA	1	150.00	EA	150.00
Striping (8" thermal plastic cross walk)	640	2.04	LF	195	6.69	LM	1,305.60
Pavement Inlays (Interpretive)	1	800.00	EA	1	800.00	EA	800.00
Fixed Wooden Bollard	16	500.00	EA	16	500.00	EA	8,000.00
Removable Bollard	8	700.00	EA	8	700.00	EA	5,600.00
Wood Bollard 1/4 Mile Post Marker	3	550.00	EA	3	550.00	EA	1,650.00
Landscape Area (unirrigated)	15,000	1.25	SF	4,572	4.10	SM	18,750.00
Litter Receptacle	1	400.00	EA	1	400.00	EA	400.00
ADA Ramp	-	800.00	EA	-	800.00	EA	-
Bike Rack	-	500.00	EA	-	500.00	EA	-
Fencing (Wooden)	-	12.00	LF	-	39.37	LM	-
Catch Basin and Drainage	2	1,800.00	EA	2	1,800.00	EA	3,600.00
Columnar Basalt Stone Bollards	16	600.00	EA	16	600.00	EA	9,600.00
2" Crushed Drain Rock/Trail Sub-base 6" Depth	623	45.00	CY	570	49.21	CM	28,035.00
Subtotal							**282,914.72**
Mobilization		8.00%	EA		8.00%	EA	22,633.18
Temporary Protection & Direction of Traffic		1.50%	EA		1.50%	EA	4,243.72
Contingency		20%			20%		56,582.94
Grand Total Segment 3							**$ 366,374.56**

Segment 4: Courtney Road to Just north of SE Creighton Avenue on SE Arista Drive (0.6 mile)							
	ENGLISH			METRIC			
Item	Quantity	Unit Cost	Unit	Quantity	Unit Cost	Unit	Total
Clearing/Grubbing & Brush Removal	3,168	$ 1.00	LF	966	$ 3.28	LM	$ 3,168.00
Asphalt Pathway with Sub-base (12' wide)	38,016	2.75	SF	11,587	9.02	SM	104,544.00
Concrete Sidewalk Extension	38,016	3.25	SF	11,587	10.66	SM	123,552.00
Trail Shoulder (2' wide gravel)		1.25	SF	-	4.10	SM	-
Hydroseed Trail Shoulder Disturbed Areas	31,680	0.24	SF	9,656	0.79	SM	7,603.20
Silt Fencing	1,600	1.95	LF	488	6.40	LM	3,120.00
Trail Information Kiosk		3,000.00	EA		3,000.00	EA	-
Lighting (entire length)	18	2,200.00	EA	18	2,200.00	EA	39,600.00
Curb Extension	6,336	16.75	LF	1,931	54.95	LM	106,128.00
Bench		2,500.00	EA		2,500.00	EA	-
Stop Sign	10	150.00	EA	10	150.00	EA	1,500.00
Trail Xing Ahead Sign (Vehicle warning)	6	150.00	EA	6	150.00	EA	900.00
Directional Signage	2	150.00	EA	2	150.00	EA	300.00
Striping (8" thermal plastic cross walk)	1,200	2.04	LF	366	6.69	LM	2,448.00
Pavement Inlays (Interpretive)	1	800.00	EA	1	800.00	EA	800.00
Fixed Wooden Bollard	2	500.00	EA	2	500.00	EA	1,000.00
Removable Bollard	1	700.00	EA	1	700.00	EA	700.00
Wood Bollard 1/4 Mile Post Marker	3	550.00	EA	3	550.00	EA	1,650.00
Landscape Area (unirrigated)	38,016	1.25	SF	11,587	4.10	SM	47,520.00
Litter Receptacle		400.00	EA		400.00	EA	-
ADA Ramp	18	800.00	EA	18	800.00	EA	14,400.00
Bike Rack		500.00	EA		500.00	EA	-
Fencing (Wooden)		12.00	LF	-	39.37	LM	-
Flashing Yellow Warning Lights / Courtney	1	1,200.00	EA	1	1,200.00	EA	1,200.00
Columnar Basalt Stone Bollards	4	600.00	EA	4	600.00	EA	2,400.00
Prefabricated Wooden Bridge		75.00	SF	-	246.06	SM	-
Subtotal							**462,533.20**
Mobilization		8.00%	EA		8.00%	EA	37,002.66
Temporary Protection & Direction of Traffic		1.50%	EA		1.50%	EA	6,938.00
Contingency		20%			20%		92,506.64
Grand Total Segment 4							**$ 598.980.49**

Segment 5: Just north of SE Creighton Avenue on SE Arista Drive to Concord Road (0.6 mile)							
	ENGLISH			METRIC			
Item	Quantity	Unit Cost	Unit	Quantity	Unit Cost	Unit	Total
Clearing/Grubbing & Brush Removal	3,168	$ 1.00	LF	966	$ 3.28	LM	$ 3,168.00
Asphalt Pathway with Sub-base (12' wide)	37,440	2.75	SF	11,412	9.02	SM	102,960.00
Concrete Sidewalk Extension	-	3.25	SF	-	10.66	SM	-
Trail Shoulder (2' wide gravel)	6,240	1.25	SF	3,804	4.10	SM	7800.00
Trail Shoulder (6' wide, crusher fines)	18,720	2.50	SF	5,794	8.20	SM	46,800.00
Hydroseed Trail Shoulder Disturbed Areas	18,774	0.24	SF	5,722	0.79	SM	4,505.76
Silt Fencing	200	1.95	LF	61	6.40	LM	390.00
Trail Information Kiosk	-	3,000.00	EA	-	3,000.00	EA	-
Lighting (Select Points)	6	2,200.00	EA	6	2,200.00	EA	13,200.00
Curb Extension	-	16.75	LF	-	54.95	LM	-
Bench	3	2,500.00	EA	3	2,500.00	EA	7,500.00
Stop Sign	6	150.00	EA	6	150.00	EA	900.00
Trail Xing Ahead Sign (Vehicle warning)	4	150.00	EA	4	150.00	EA	600.00
Directional Signage	3	150.00	EA	3	150.00	EA	450.00
Striping (8" thermal plastic cross walk)	320	2.04	LF	98	6.69	LM	652.80
Pavement Inlays (Interpretive)	-	800.00	EA	-	800.00	EA	-
Fixed Wooden Bollard	14	500.00	EA	14	500.00	EA	7,000.00
Removable Bollard	6	700.00	EA	6	700.00	EA	4,200.00
Wood Bollard 1/4 Mile Post Marker	3	550.00	EA	3	550.00	EA	1,650.00
Landscape Area (unirrigated)	23,760	1.25	SF	7,242	4.10	SM	29,700.00
Litter Receptacle	-	400.00	EA	-	400.00	EA	-
ADA Ramp	-	800.00	EA	-	800.00	EA	-
Bike Rack	-	500.00	EA	-	500.00	EA	-
Fencing (Wooden)	-	12.00	LF	-	39.37	LM	-
Flashing Yellow Warning Lights	-	1,200.00	EA	-	1,200.00	EA	-
Columnar Basalt Stone Bollards	60	600.00	EA	60	600.00	EA	36,000.00
Prefabricated Wooden Bridge	-	75.00	SF	-	246.06	SM	-
Subtotal							**267,476.56**
Mobilization		8.00%	EA		8.00%	EA	21,398.12
Temporary Protection & Direction of Traffic		1.50%	EA		1.50%	EA	4,012.15
Contingency		20%			20%		53,495.31
Grand Total Segment 5							**$ 346,382.15**

Segment 6: Concord Road to Roethe Road (0.9 mile)							
	ENGLISH			METRIC			
Item	Quantity	Unit Cost	Unit	Quantity	Unit Cost	Unit	Total
Clearing/Grubbing & Brush Removal	4,752	$ 1.00	LF	1,448	$ 3.28	LM	$ 4,752.00
Asphalt Pathway with Sub-base (12' wide)	57,024	2.75	SF	17,381	9.02	SM	156,816.00
Concrete Sidewalk Extension	-	3.25	SF	-	10.66	SM	-
Trail Shoulder (2' wide gravel)	9,504	1.25	SF	5,794	4.10	SM	11,880.00
Trail Shoulder (6' wide, crusher fines)	28,512	2.50	SF	8,693	8.20	SM	71,280.00
Hydroseed Trail Shoulder Disturbed Areas	28,512	0.24	SF	8,693	0.79	SM	6,842.88
Silt Fencing	800	1.95	LF	244	6.40	LM	1,560.00
Trail Information Kiosk	2	3,000.00	EA	2	3,000.00	EA	6,000.00
Lighting (Select Points)	9	2,200.00	EA	9	2,200.00	EA	19,800.00
Curb Extension	-	16.75	LF	-	54.95	LM	-
Bench	4	2,500.00	EA	4	2,500.00	EA	10,000.00
Stop Sign	6	150.00	EA	6	150.00	EA	900.00
Trail Xing Ahead Sign (Vehicle warning)	6	150.00	EA	6	150.00	EA	900.00
Directional Signage	3	150.00	EA	3	150.00	EA	450.00
Striping (8" thermal plastic cross walk)	600	2.04	LF	183	6.69	LM	1,224.00
Pavement Inlays (Interpretive)	1	800.00	EA	1	800.00	EA	800.00
Fixed Wooden Bollard	12	500.00	EA	12	500.00	EA	6,000.00
Removable Bollard	6	700.00	EA	6	700.00	EA	4,200.00
Wood Bollard 1/4 Mile Post Marker	4	550.00	EA	4	550.00	EA	2,200.00
Landscape Area (unirrigated)	5,000	1.25	SF	1,524	4.10	SM	6,250.00
Litter Receptacle	1	400.00	EA	1	400.00	EA	400.00
ADA Ramp	-	800.00	EA	-	800.00	EA	-
Bike Rack	1	500.00	EA	1	500.00	EA	500.00
Creek Bank Stabilization	1	5,000.00	LF	0	16,404.20	LM	5,000.00
Flashing Yellow Warning Lights / Concord, Naef	2	1,200.00	EA	2	1,200.00	EA	2,400.00
Columnar Basalt Stone Bollards	12	600.00	EA	12	600.00	EA	7,200.00
Prefabricated Wooden Bridge	180	75.00	SF	55	246.06	SM	13,500.00
Subtotal							**340,854.88**
Mobilization		8.00%	EA		8.00%	EA	27,268.39
Temporary Protection & Direction of Traffic		1.50%	EA		1.50%	EA	5,112.82
Contingency		20%			20%		68,170.98
Grand Total Segment 6							**$ 441,407.07**

Segment 7: Roethe Road to SE Jennings Avenue (0.6 mile)							
	ENGLISH			METRIC			
Item	Quantity	Unit Cost	Unit	Quantity	Unit Cost	Unit	Total
Clearing/Grubbing & Brush Removal	3,168	$ 1.00	LF	966	$ 3.28	LM	$ 3,168.00
Asphalt Pathway with Sub-base (12' wide)	28,512	2.75	SF	8,690	9.02	SM	78,408.00
Cantilevered Concrete Walkway	4,800	50.00	SF	1,463	164.04	SM	240,000.00
Trail Shoulder (2' wide gravel)	4,752	1.25	SF	2,897	4.10	SM	5,940.00
Trail Shoulder (6' wide, crusher fines)	14,256	2.50	SF	4,346	8.20	SM	35,640.00
Hydroseed Trail Shoulder Disturbed Areas	19,008	0.24	SF	5,794	0.79	SM	4,561.92
Silt Fencing	4,768	1.95	LF	1,453	6.40	LM	9,297.60
Sidewalk Extension (at SE McLoughlin Boulevard, 4' width)	1,200	6.00	SF	366	19.69	SM	7,200.00
Lighting (entire length)	2	2,200.00	EA	2	2,200.00	EA	4,400.00
Curb Extension	-	16.75	LF	-	54.95	LM	-
Bench	-	2,500.00	EA	-	2,500.00	EA	-
Stop Sign	5	150.00	EA	5	150.00	EA	750.00
Trail Xing Ahead Sign (Vehicle warning)	6	150.00	EA	6	150.00	EA	900.00
Directional Signage	5	150.00	EA	5	150.00	EA	750.00
Striping (8" thermal plastic cross walk)	480	2.04	LF	146	6.69	LM	979.20
Pavement Inlays (Interpretive)	1	800.00	EA	1	800.00	EA	800.00
Fixed Wooden Bollard	12	500.00	EA	12	500.00	EA	6,000.00
Removable Bollard	6	700.00	EA	6	700.00	EA	4,200.00
Wood Bollard 1/4 Mile Post Marker	3	550.00	EA	3	550.00	EA	1,650.00
Landscape Area (unirrigated)	18,000	1.25	SF	5,486	4.10	SM	22,500.00
Litter Receptacle	-	400.00	EA	-	400.00	EA	-
ADA Ramp	2	800.00	EA	2	800.00	EA	1,600.00
Bike Rack	-	500.00	EA	-	500.00	EA	-
Fencing (Wooden)	-	12.00	LF	-	39.37	LM	-
Flashing Yellow Warning Lights	2	1,200.00	EA	2	1,200.00	EA	2,400.00
Columnar Basalt Stone Bollards	24	600.00	EA	24	600.00	EA	14,400.00
Prefabricated Wooden Bridge	-	75.00	SF	-	$246.06	SM	-
Subtotal							**445,544.72**
Mobilization		8.00%	EA		8.00%	EA	35,643.58
Temporary Protection & Direction of Traffic		1.50%	EA		1.50%	EA	6,683.17
Contingency		20%			20%		89,108.94
Grand Total Segment 7							**$ 576,980.41**

Segment 8: (SE Jennings Avenue to SE Glen Echo Avenue (0.5 mile)							
	ENGLISH			METRIC			
Item	Quantity	Unit Cost	Unit	Quantity	Unit Cost	Unit	Total
Clearing/Grubbing & Brush Removal	2,640	$ 1.00	LF	805	$ 3.28	LM	$ 2,640.00
Asphalt Pathway with Sub-base (12' wide)	31,104	2.75	SF	9,480	9.02	SM	85,536.00
Concrete Sidewalk Extension	1,200	6.00	SF	366	19.69	SM	7,200.00
Trail Shoulder (2' wide gravel)	5,184	1.25	SF	3,160	4.10	SM	6,480.00
Trail Shoulder (6' wide, crusher fines)	15,552	2.50	SF	4,741	8.20	SM	38,880.00
Hydroseed Trail Shoulder Disturbed Areas	15,552	0.24	SF	4,741	0.79	SM	3,732.48
Silt Fencing	200	1.95	LF	61	6.40	LM	390.00
Trail Information Kiosk	1	3,000.00	EA	1	3,000.00	EA	3,000.00
Lighting (select points)	4	2,200.00	EA	4	2,200.00	EA	8,800.00
Curb Extension	400	16.75	LF	122	54.95	LM	6,700.00
Bench	2	2,500.00	EA	2	2,500.00	EA	5,000.00
Stop Sign	6	150.00	EA	6	150.00	EA	900.00
Trail Xing Ahead Sign (Vehicle warning)	6	150.00	EA	6	150.00	EA	900.00
Directional Signage	2	150.00	EA	2	150.00	EA	300.00
Striping (8" thermal plastic cross walk)	320	2.04	LF	98	6.69	LM	652.80
Pavement Inlays (Interpretive)	1	800.00	EA	1	800.00	EA	800.00
Fixed Wooden Bollard	12	500.00	EA	12	500.00	EA	6,000.00
Removable Bollard	6	700.00	EA	6	700.00	EA	4,200.00
Wood Bollard 1/4 Mile Post Marker	2	550.00	EA	2	550.00	EA	1,100.00
Landscape Area (unirrigated)	25,000	1.25	SF	7,620	4.10	SM	31,250.00
Litter Receptacle	1	400.00	EA	1	400.00	EA	400.00
ADA Ramp	1	800.00	EA	1	800.00	EA	800.00
Bike Rack	-	500.00	EA	-	500.00	EA	-
Fencing (Wooden)	-	12.00	LF	-	39.37	LM	-
Flashing Yellow Warning Lights	-	1,200.00	EA	-	1,200.00	EA	-
Columnar Basalt Stone Bollards	12	600.00	EA	12	600.00	EA	7,200.00
Prefabricated Wooden Bridge	-	75.00	SF	-	246.06	SM	-
Subtotal							**222,861.28**
Mobilization		8.00%	EA		8.00%	EA	17,828.90
Temporary Protection & Direction of Traffic		1.50%	EA		1.50%	EA	3,342.92
Contingency		20%			20%		44,572.26
Grand Total Segment 8							**$288,605.36**

APPENDIX G. Supplemental Research

MEMORANDUM

TO:	Trolley Trail Working Group
CC:	Jim Desmond, Heather Nelson Kent, Jane Hart – Metro George Hudson, Mia Birk – Alta Planning + Design Michelle Healy, Krista Hornaday – NCPRD
FROM:	Charles Ciecko, NCPRD
DATE:	January 28, 2004
SUBJECT:	Final Recommendation on Trail Cross-Section for Trolley Trail Master Plan

This memo provides an important update to the December 12, 2003 memo that accompanied the November 19, 2003 Trolley Trail Working Group meeting minutes. As you may recall, the 12/12/03 memo provided a summary of the Working Group's final recommendation on the trail cross section. This memo contains the same summary bullets as the December 12 memo, with the addition of two more bullets (in Italics). We believe this addition reflects an important aspect of the final recommendation that was included in the minutes but not reflected in the 12/12/03 memo.

- In general, the Trolley Trail will be a hard surface trail, 10'- 12' wide, with 2'-6' soft shoulders on both sides.
- Ideally, the hard surface will be 12' wide and surfaced with concrete, however due to the constrictions in the right of way and financial constraints, the trail may be narrowed to 10' at points and an asphalt surface may be used throughout.
- On one side of the trail there will be a 4'-6' wide soft shoulder composed of "fines" (with or without pavers, depending on budget and the engineering recommendation).
- On the other side, there will be a 2' to 4' wide gravel or fines shoulder.
- At constriction points, the hard surface portion of the trail will be reduced to not less than 10' in width before reducing the width of the shoulders (to a minimum of 2').
- *The aesthetic appearance and feel of the trail will be enhanced by using design features such as meandering the trail, adding an earth-tone tint to the trail material, providing landscaping, benches and artwork.*
- *Trail shoulder materials will be cost effective and aesthetically pleasing and will be maintained to maximize their usability and function.*

As I expressed in the December 12 memo, I am very pleased to be able to let the policy makers know that this Master Plan is the outcome of a consensus based, collaborative process. This outcome would not have been possible were it not for your extra effort and open minds. Thank you again for your hard work and dedication; we have a better Master Plan and will have a better trail because of it.

Table 39. Trail Surfacing Matrix

Key				
Functionality		**Availability**	**Vandalism Susceptible**	
B=Bicycle P=Pedestrian S=In-line skate	W=Wheelchair V=Emergency Vehicle	H=High M=Moderate L=Low	G=Graffiti C=Cutting A=Arson	M=Moved D = Deformation

Product	Description/ Installation Method	Durability	Maintenance Description	Permeable	Functionality	ADA	MTIP Fundable	Availability	Vandalism Susceptible	Cost Per SF	2'-12'-2' section cost*
Hard Surface Trail											
Nike Grind – Atlas Tracks (Familian Product)	Prepare subbase, place geotextile, 6" aggregate base, apply Nike grind atlas track rubberized surface over base.	8-10 years	Reapply binding agent every 5-6 years. Keep surface clean, dirt and sand wear surface down, Full replacement needed after 10 years	Yes	Pedestrian only. Avoid heavy loads including equestrians, bicyclists, and vehicles	Yes	No	L – locally based but few installers	C, A, G	$12.50	$3,198,000
Nike Grind – Field Turf	Prepare subbase, place geotextile, 6" aggregate base, apply field turf surface over base, similar to laying a carpet.	8-10 years	Sweep regularly; keep free of organic materials as they will rot the surface. Replace surface after 10 years	Yes	Pedestrians only, too soft for bikes and wheels	No	No	L	C, A, G	$11.75	$3,006,120
Nike Grind – Rebound Ace	Prepare subbase, place geotextile, 6" aggregate base, pour concrete or asphalt base, apply rebound Ace surface directly over hard surface.	8-12 years	Replace topcoat after 10 years	No	B, P, W, S, but not tested, intended application is sport surfaces	Yes	Yes	L	C, A, G	$10.50	$2,686,320
Permeable Concrete	Prepared subbase, place geotextile, 12" depth aggregate base, Portland cement, coarse aggregate, water, 5" depth section	15 years	Vacuum sweep and pressure wash 4 times a year	Yes	B, P, W, V	Yes	Yes	M	G	$6.00	$1,535,040

Product	Description/ Installation Method	Durability	Maintenance Description	Permeable	Functionality	ADA	MTIP Fundable	Availability	Vandalism Susceptible	Cost Per SF	2'-12'-2' section cost*
Concrete	Prepared subbase, place geotextile, 6" agg. base, Portland cement, aggregate, sand, water 4" depth section	25 years	Periodic inspection for uplift and settlement, repair as needed	No	B, P, S, W, V	Yes	Yes	H	G	$4.75	$1,215,240
Permeable Asphalt	Prepared subbase, place geotextile, 12" depth aggregate base, emulsion and coarse aggregate 2" depth section	8 years	Vacuum sweep and pressure wash 4 times a year, patch any pot holes as needed	Yes	B, P, S, W, V	Yes	Yes	M	G	$3.50	$895,440
Glassphalt	Prepared subbase, place geotextile, 6" agg. base, asphalt with aggregate/glass, 2" depth section	7-10 years	Pothole patching	No	B, P, S, W, V	Yes	Yes	M	G	$2.75	$703,560
Reground Asphalt	Prepared subbase, place geotextile 6" aggregate base, emulsion recycled asphalt chips 2" depth section	7-10 years	Pothole patching	No	B, P, S, W, V	Yes	Yes	M	G	$2.75	$703,560
Asphalt	Prepared subbase, place geotextile, 6" aggregate base, emulsion, aggregate	10 years	Pothole patching	No	B, P, S, W, V	Yes	Yes	H	G	$2.75	**$703,560**
Poly Pave	Prepared subbase, place geotextile, 6" aggregate base, grade and shape, mix poly pave in top 2" of base, spray on two top coats of poly pave 2" depth section	5-10 years	Reapply Poly pave solidifier every 1-2 years depending on level of use. Make spot repairs as needed.	No	B, P, W, S, V	Yes	Unknown	L	G	$2.50	$639,600

Product	Description/ Installation Method	Durability	Maintenance Description	Permeable	Functionality	ADA	MTIP Fundable	Availability	Vandalism Susceptible	Cost Per SF	2'-12'-2' section cost*
Chip Seal	Prepared subbase, place geotextile, 6" aggregate base, emulsion, ½" – ¼" aggregate, two coat process	7-10 years	Pothole patching	No	B, P, W, V	Yes	Yes	M	G	$2.00	$511,680
Soft Surface Trail											
Nike Grind – tlas Tracks (Familian Product)	Prepare subbase, place geotextile, 6" aggregate base, apply Nike grind atlas track rubberized surface over base.	8-10 years	Reapply binding agent every 5-6 years. Keep surface clean, dirt and sand wear surface down. Full replacement needed after 10 years	Yes	Pedestrian only. Avoid heavy loads including equestrians, bicyclists, and vehicles	Yes	Not as primary trail, ok as shoulder	L – locally based but few installers	C, A, G	$12.50	$1,200,600
Nike Grind – Field Turf	Prepare subbase, place geotextile, 6" aggregate base, apply field turf surface over base, similar to laying a carpet.	8-10 years	Sweep regularly; keep free of organic materials as they will rot the surface. Replace surface after 10 years	Yes	Pedestrians only, too soft for bikes and wheels	No	Not as primary trail, ok as shoulder	L	C, A, G	$11.75	$1,128,564
Nike Grind – Rebound Ace	Prepare subbase, place geotextile, 6" aggregate base, pour concrete or asphalt base, apply rebound Ace surface directly over hard surface.	8-12 years	Replace topcoat after 10 years	No	B, P, W, S, but not tested, intended application is sport surfaces	Yes	Yes	L	C, A, G	$10.50	$1,008,504
Pavers with Fines	Prepare subbase, place geotextile, 6" aggregate base, place plastic pavers over base, fill cells with 3/16" minus crushed rock.	15 years	Keep weeded, refill cells with gravel as needed	Yes	B, P, W, S, E, V	Yes	Yes	M	M	$4.50	$432,216
Wood Planner Shavings	Prepare subbase, place geotextile, 4" aggregate base, place 3" layer of wood planners shavings, add additional 3" layer after initial compaction	2-3 years	Add 2"-3" of new material annually	Yes	P, E	No	Not as primary trail, ok as shoulder	H	M, D, A	$2.60	$249,725

Product	Description/ Installation Method	Durability	Maintenance Description	Permeable	Functionality	ADA	MTIP Fundable	Availability	Vandalism Susceptible	Cost Per SF	2'-12'-2' section cost*
Crusher Fines/Gravel	Prepare subbase, place geotextile, 6" aggregate base, place 2" depth ½" minus over base, roll and compact	2-5 years, depending on maintenance	Sweep to fill voids from dislodged fines	Yes	P, B, V	No	Not as primary trail, ok as shoulder	H	M, D	$2.50	$240,120
Filbert Shells	Prepare subbase, place geotextile fabric, 4" aggregate base, then 3" layer of filbert shells	7-10 years	Keep shells in place by regular raking. Re-top every 5 years	Yes	P, E	No	Not as primary trail, ok as shoulder	M	M	$2.25	$216,108
Wood Mulch	Prepare subbase, place geotextile, 4" aggregate base, place 3" layer of wood mulch, rake and shape, apply second 3" layer after initial compaction and settlement	1-3 years	Top dress annually	Yes	P, E	No	Not as primary trail, ok as shoulder	H	M, D, A	$2.10	$201,700

*The cost for all hard surface options includes using 2' wide shoulders of ¾" minus gravel for a 6 mile trail..
* 6' width is used as an example and cost estimating purposes only. Other widths can be considered.