KITTELSON & ASSOCIATES
851 SW 6th AVENUE, SUITE 600
PORTLAND, OR 97204
P 503.228.5230 F 503.273.8169

MEMORANDUM

Date:	April 9, 2021	Project #: 23021.19
To:	Project Management Team	
From:	Nick Gross, Amy Griffiths, EIT, Alex Garbier, RSP; Marc Butorac, PE, PTOE, PMP	
Project:	Oregon City-West Linn Pedestrian and Bicycle Bridge Concept Plan	
Subject:	TM #4: Active Transportation Analysis	

PURPOSE

This memorandum summarizes and evaluates opportunities for integrating the five most promising bridge alignments identified as part of *TM#2: Identify Crossing Alignments* into the adjacent active transportation networks of West Linn and Oregon City. "Active transportation" is a term that describes self-propelled, human-powered transportation modes, such as walking, biking, skateboarding, and using a wheelchair (i.e., rolling). The analysis of these alignments includes a level of traffic stress (LTS) analysis for people walking and biking within a quarter mile of bridge alignment landings, an examination of existing walking and biking activity utilizing Strava data, forecast walking and biking trips for each alignment using StreetLight data, and an overview of the potential health benefits of each alignment. The findings will be discussed with the Project Advisory Committee (PAC), Project Leadership Team (PLT), Project Management Team (PMT), stakeholders, and the public to form the basis for recommending a preferred alignment for consideration in amending the local transportation system plans and further developing the project.

MOST PROMISING POTENTIAL BRIDGE ALIGNMENTS

Fifteen alignments for a dedicated active transportation bridge across the Willamette River between Willamette Falls and the I-205 Abernathy Bridge were identified. Based on discussions with the PAC, PLT, PMT, and stakeholders and a feasibility screening conducted in *TM #2: Identify Crossing Alignments*, the following five most promising alignments (shown in Figure 1) were advanced by the PMT for additional consideration:

- Alignment 1c: 4th Street to Mill Street
- Alignment 2b: 5th Street to Mill Street
- Alignment 4a: Main Street to Mill Street
- Alignment 6: 9th Street to Willamette Drive
- Alignment 7b: 10th Street to OR 43

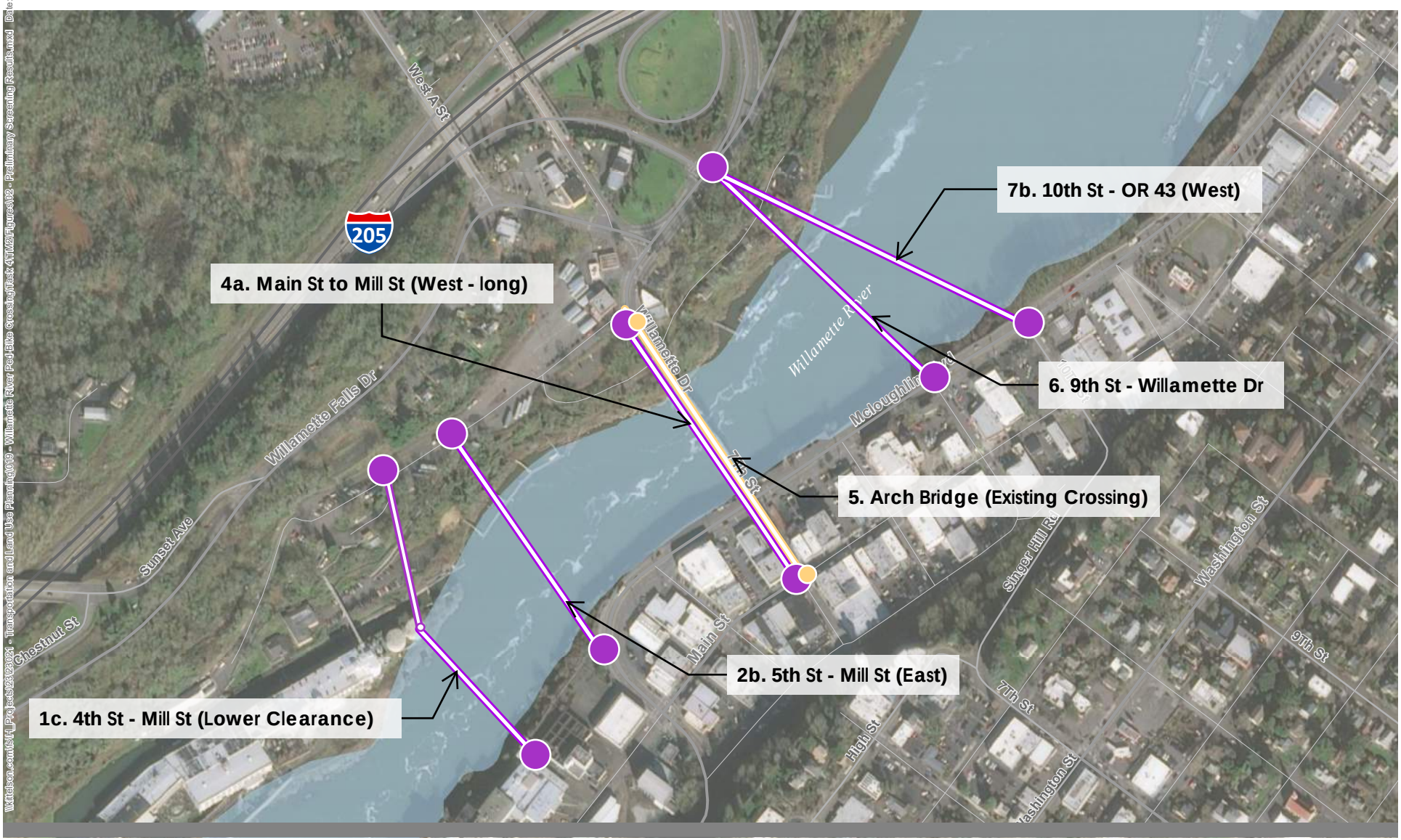


Figure 1

KITTELSON & ASSOCIATES

Potential Bridge Alignments

ACTIVE TRANSPORTATION ANALYSIS OF ALIGNMENTS

The following sections summarize the active transportation analysis of the five most promising bridge alignments. This analysis includes consideration of the following elements:

- Connectivity to essential destinations identified in the local Transportation System Plans (TSPs)
- Connectivity to existing and planned networks for people walking and biking in Oregon City and West Linn
- LTS analysis within a quarter mile of bridge alignment landings
- Walking and biking demand projections for each alignment
- Health benefits associated with demand projections

These elements help to identify which alignments provide users of all ages and abilities connections to the greater active transportation network.

Essential Destinations

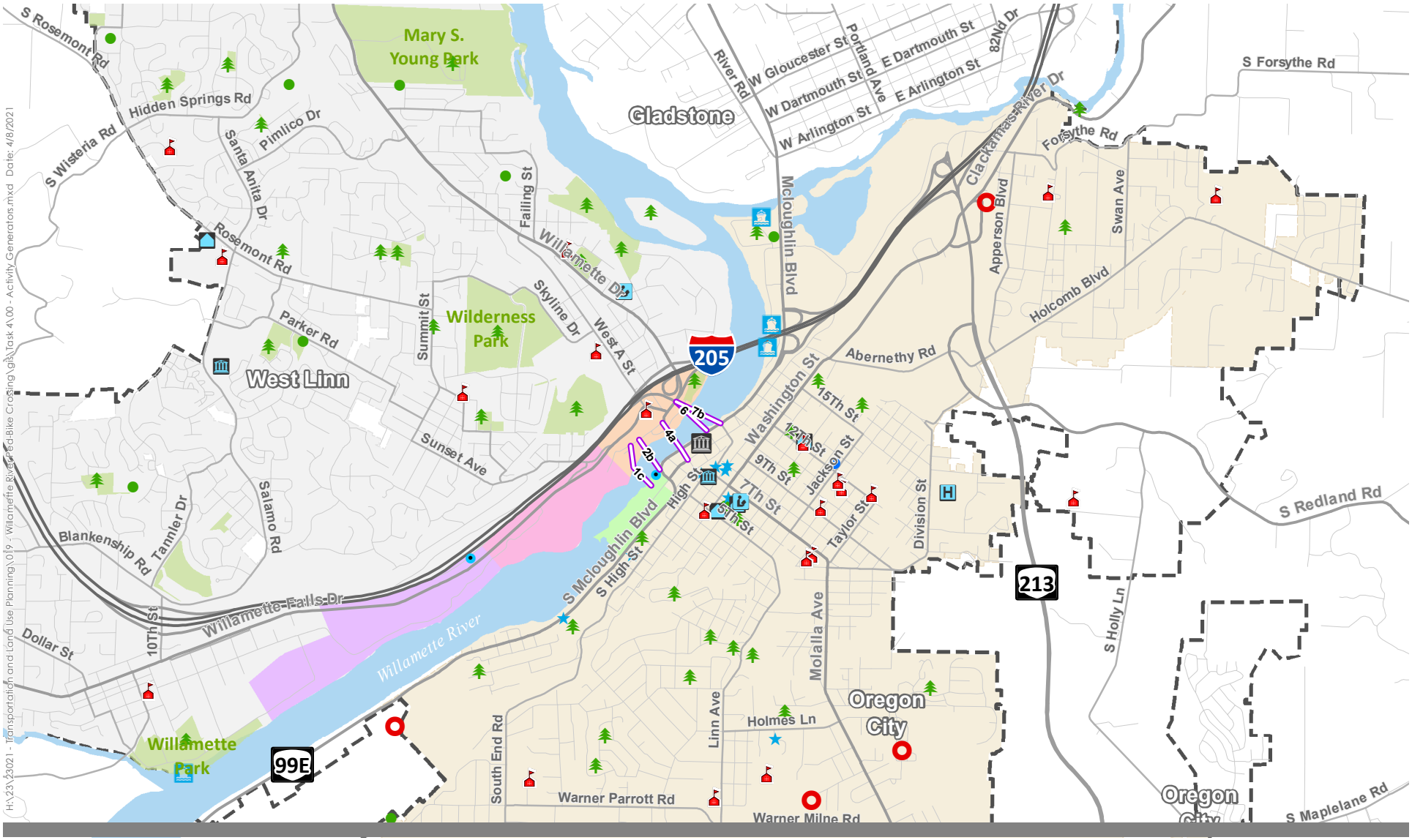
Essential destinations are associated with creating walking, biking, rolling, and transit trips, particularly for people without access to a personal vehicle. Mapping these destinations helps inform the location and priority of investment in walking, biking, and rolling facilities. Locations of essential destinations identified in local TSPs include schools, libraries, landmarks, hospitals, community centers, and green spaces (e.g., parks). As shown in Figure 2, essential destinations are spread throughout the study area, with clusters in downtown Oregon City. Figure 2 also shows how each alignment connects to planned development in the study area. Table 1 summarizes the number of identified essential destinations within a half-mile radius of each alignment.

Table 1: Connection to Essential Destinations

Alignment	Essential Destinations within ½ Mile[1]	Ranking
Alignment 1c: 4th Street to Mill Street	23	4th
Alignment 2b: 5th Street to Mill Street	22	5th
Alignment 4a: Main Street to Mill Street	26	3rd
Alignment 6: 9th Street to Willamette Drive	28	2nd
Alignment 7b: 10th Street to OR 43	29	1st

[1]The count of essential destinations is based on ½ mile radius of each alignment; it does not account for roadway geometry.

The essential destinations within a half mile radius are best served by Alignments 4a, 6, and 7b based on the proximity to the municipal elevator or Singer Hill; however, planned development in the Industrial Heritage District and Willamette Falls Downtown District will be more directly served by Alignment 1c and Alignment 2b.



Legend

- Potential Bridge Alignments
- Industrial Heritage District
- Old City Hall District
- Pond Redevelopment District
- Willamette Falls Downtown District & Riverwalk
- Schools
- Landmark
- Community Center
- Courthouse
- City Hall
- Park
- Open Space
- Boat Landing
- Cemetery
- Library
- Pool
- Willamette Falls View Point
- Oregon City
- West Linn
- Water

0 1 Miles

Figure 2

KITTELSON & ASSOCIATES

Essential Destinations

Existing and Planned Walking, Biking, and Rolling Networks

The following section provides an inventory and assessment of the active transportation facilities in the project study area. The analysis identifies existing, planned, funded, and designed on-street facility information provided by West Linn, Oregon City, Clackamas County, Oregon Department of Transportation (ODOT), and Metro.

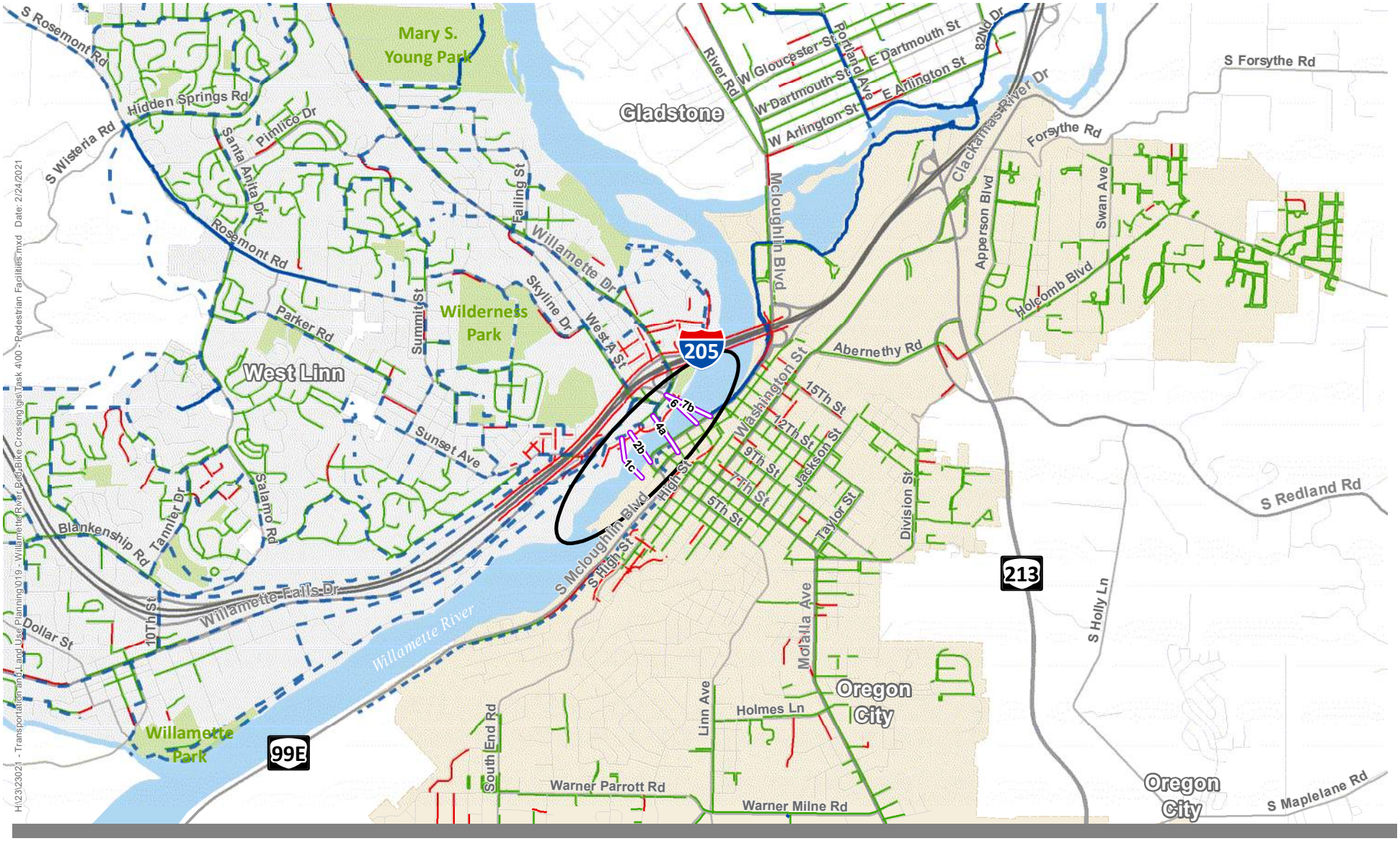
Walking Network

Figure 3 illustrates the existing and planned facilities for people walking in the project study area. The following areas have existing or planned facilities for people walking:

- Sidewalks are widely available and continuous in the downtown Oregon City core.
- Sidewalks are present on major roads in Oregon City connecting to the south (Molalla Avenue, Warner Parrott Road, and Beaver Creek Road).
- A shared-use path along McLoughlin Boulevard extends from Gladstone to 10th Street. The path currently transitions into a sidewalk south of 10th Street, but an extension of this shared-use path is planned.
- Sidewalks are present along West A Street and Willamette Falls Drive in the immediate vicinity of the OR 43 Arch Bridge in West Linn.
- A shared-use path is planned along a future realigned Willamette Falls Drive in West Linn to address the current gap in walking facilities.
- Shared-use paths are planned in West Linn for Sunset Avenue, West A Street, and Willamette Drive. Extensions to current shared-use paths on Rosemont Road and the Willamette River Greenway are planned.
- A shared-use path connection in Gladstone is provided along Abernathy Lane through Portland Avenue and down to the 82nd Street bridge and shared-use path in Oregon City.

The gaps were identified in the following areas, as shown in Figure 3:

- Linn Avenue, a minor arterial, has sidewalk gaps in Oregon City.
- Many neighborhood streets southwest of the downtown core in Oregon City are missing sidewalks.
- Many neighborhood streets in West Linn are missing sidewalks, particularly along Sunset Avenue.
- I-205, the river, limited access points, and indirect routes are barriers for people walking from West Linn to the waterfront.



Legend

- Existing Sidewalk
- Existing Multi-Use Trail
- Proposed Multi-Use Trail
- Sidewalk Gaps
- Potential Bridge Alignments
- Oregon City
- West Linn
- Water
- Focus Study Area

0 1 Miles

Figure 3

KITTELSON & ASSOCIATES

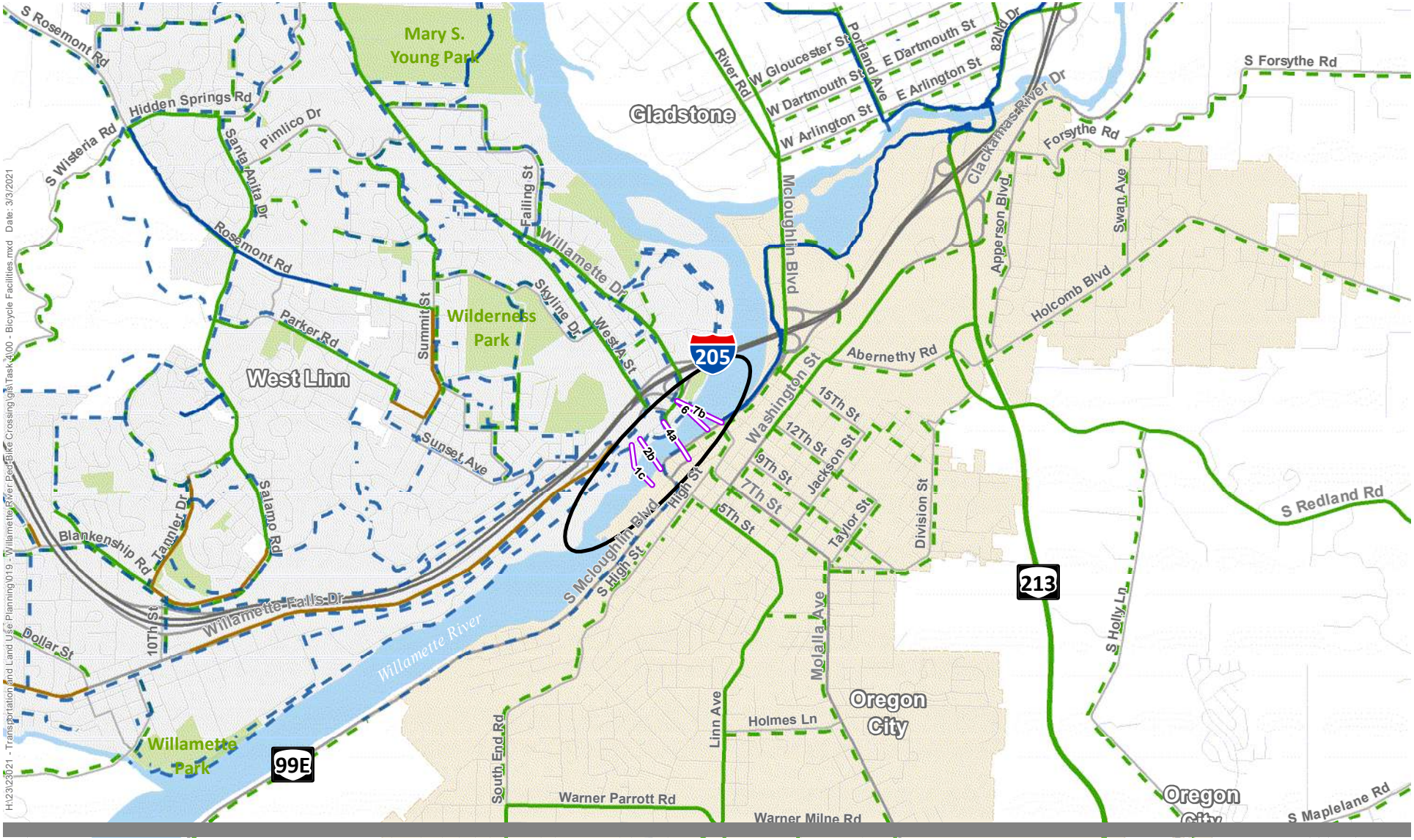
Existing and Planned Pedestrian Facilities

Biking Network

Figure 4 illustrates existing and planned facilities for people biking in the project study area. The following areas have existing or planned biking facilities:

- There are existing bike lanes along segments of Washington Street and 5th Street in Oregon City; the TSP proposes several bike lanes to connect to complete the network.
- Bike lanes are present in Oregon City on Highway 213 east of downtown and on Linn Avenue south of downtown.
- Bicycle facilities are planned on downtown streets and arterials in Oregon City, such as Molalla Avenue, Holcomb Avenue, and South End Road.
- Bike lanes are provided in West Linn on West A Street, Willamette Drive, and Salamo Road.

Dedicated bike lanes are currently missing on Sunset Avenue and Willamette Falls Drive, key roads that connect to the potential bridge alignments in West Linn. The planned improvement projects described below will help connect people biking to the potential bridge alignments.



H:\23\2021 - Transportation and Land Use Planning\019 - Willamette River Ped/Bike Crossing\gis\Task 4\00 - Bicycle Facilities.mxd Date: 3/3/2021

Legend

- Existing Shoulder Bike Lane
- Existing Bike Lane
- Existing Multi-Use Trail
- Proposed Bike Lane
- Proposed Multi-Use Trail
- Potential Bridge Alignments
- Oregon City
- West Linn
- Water
- Focus Study Area

Figure 4

KITTELSON & ASSOCIATES

Existing and Planned Bicycle Facilities

Planned Improvement Projects

Three planned improvement projects are expected to substantially improve access for people walking, biking, and rolling within the project study area increasing connectivity and access to the potential bridge alignments:

- Willamette Falls Downtown District & Riverwalk
- Highway 43 Improvements
- Willamette Falls Drive Project – West Linn Arterial Roadways

These projects are still in the design phase. Timing for implementation is based on private development or funding availability. The latest project information is provided below.

Willamette Falls Downtown District & Riverwalk

The Willamette Falls Downtown District & Riverwalk ("Riverwalk") project is a planned shared-use path and public space enhancement that will connect downtown Oregon City to Willamette Falls[1]. The *Willamette Falls Riverwalk Master Plan* includes a Transportation Demand Management Plan[2] that provides recommendations for improving walking and biking facilities in the area. Figure 5 shows a current aerial of the project concept.

Figure 5: Willamette Falls Downtown District & Riverwalk

Source: Willamette Falls Downtown District & Riverwalk, https://www.willamettefallslegacy.org/willamette-falls-downtown-district/

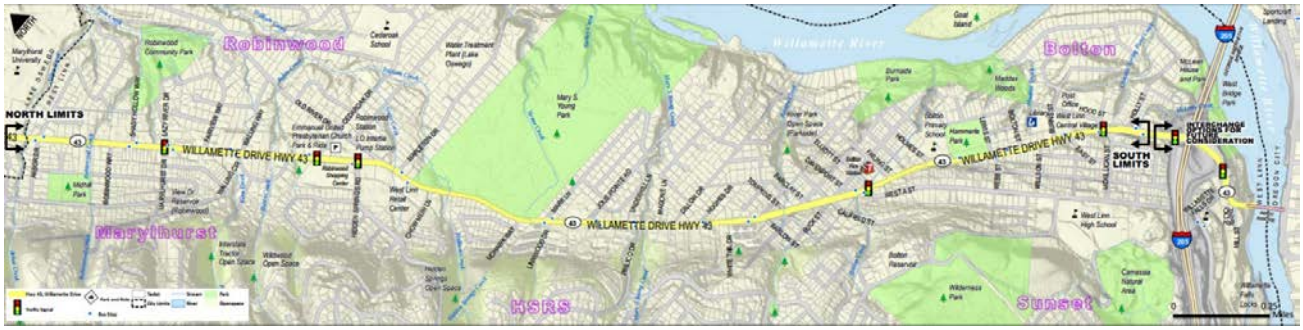
[1] For more information about the Willamette Falls Downtown District & Riverwalk, visit the project website: https://www.willamettefallslegacy.org/

[2] Transportation demand management is a term for strategies that redistribute demand in space (e.g. creating mode shift from single-occupancy vehicles to carpools and active transportation) or time (e.g. reducing peak-hour vehicle trips) as a way to increase capacity.

Highway 43 Improvements

The West Linn OR 43 Conceptual Design Plan includes improvements for people walking and biking, intersection upgrades, improved signal timing, and transit access from Lake Oswego city limits to the Historic Arch Bridge[3]. This project upgrades the existing narrow sidewalks and on-street bike lanes to wide sidewalks and a separated bike lane, creating a comfortable route along the entire section of OR 43. Figure 6 shows the extent of the *West Linn OR 43 Conceptual Design Plan*.

Figure 6: West Linn OR 43 Conceptual Design Plan



Source: West Linn OR 43 Conceptual Design Plan, https://westlinnoregon.gov/sites/default/files/fileattachments/planning/project/10880/proposed_2016_hwy_43_concept_plan_to_pc_5-18-16.pdf

Willamette Falls Drive Project -- West Linn Arterial Roadways

The Willamette Falls Drive Project includes sidewalks, separated bike facilities, and enhanced landscaping and decorative street lighting along Willamette Falls Drive[4]. This project includes a shared-use path connecting Willamette Falls Drive and Sunset Avenue to West A Street and a shared-use path connecting the Historic Arch Bridge to planned improvements along OR 43. This will create a comfortable route from western West Linn neighborhoods to the bridge.

Figure 7 illustrates the two alignment alternatives for the Willamette Falls Drive Project.

[3] For more information about the West Linn OR 43 Conceptual Design Plan, visit the project website: https://westlinnoregon.gov/planning/2016-west-linn-or-43-conceptual-design-plan

[4] For more information about Willamette Falls Drive -- West Linn Arterial Roadways, visit the project website: https://willamette-falls-drive-project-page-westlinnoregon.hub.arcgis.com/

Alternative A

OR43

I-205

W A Street

Sunset Ave

Sunset Ave

Willamette Falls Dr

7th Street

N

SCALE

0 200 400

Alternative B

W A Street

OR43

I-205

Sunset Ave

Sunset Ave

Willamette Falls Dr

7th Street

N

SCALE

0 200 400

I-205 Improvements Stafford Road to OR 213 Project

The I-205 Improvements Stafford Road to OR 213 Project includes widening I-205 and the Abernethy Bridge to add a third vehicle lane in each direction from Stafford Road to the east side of the Abernethy Bridge[5]. This includes construction of roundabouts that tie into the Highway 43 Improvements and Willamette Falls Drive Project. Adding walking, biking, and rolling facilities to the Abernethy Bridge is not feasible for the following reasons[6]:

- Cantilevering off the side of the I-205 Abernethy Bridge structure adds complexity to the design and construction of I-205 and can be more expensive than a stand-alone dedicated walking and biking bridge with shorter spans.
- Attaching walking, biking, and rolling facilities under the bride would infringe upon US Coast Guard navigation channel clearance requirements on the Willamette River.
- The alignment would support regional trips; however, it would create out of the way trips for people travelling between West Linn and Oregon City.
- Walking, biking, and rolling along I-205 would subject users to substantial noise and greater discomfort due to the proximity of fast-moving adjacent vehicles.

Figure 8 illustrates the extents of this project.

Figure 8: I-205 Abernethy Project

Source: I-205 Improvements Stafford Road to OR 213 Project, https://www.i205corridor.org/

[5] For more information about I-205 Improvements Stafford Road to OR 213 Project, visit the project website: https://www.i205corridor.org/

[6] Appendix A of *TM #2: Identify Crossing* Alignments provides additional detail for why ODOT determined that adding walking and biking facilities to the Abernethy Bridge is not a feasible alternative.

Existing and Planned Facility Connectivity to Potential Bridge Alignments

Table 2 summarizes the existing and planned walking, biking, and rolling networks at proposed alignment bridgeheads in Oregon City and West Linn. Today, the existing walking, biking, and rolling networks do not provide comfortable or complete connections to any of the five alignment bridgeheads. Planned projects substantially improve these connections and are considered acceptable by all users for most alignments based on level of traffic stress.

Table 2: Alignment Connectivity to Existing and Planned Active Transportation Networks

Alignment	Existing Connections	Planned Connections
Alignment 1c: 4th Street to Mill Street	• Unacceptable for most users[1] • Absence of walking, biking, and rolling facilities on Willamette Falls Drive • Absence of walking, biking, and rolling facilities in the Willamette Falls Downtown District & Riverwalk area.	• Acceptable for most users • Willamette Falls Drive Project includes separated walking, biking, and rolling facilities. • Willamette Falls Downtown District & Riverwalk includes walking, biking, and rolling facilities to connect to downtown Oregon City
Alignment 2b: 5th Street to Mill Street	• Unacceptable for most users • Absence of walking, biking, and rolling facilities on Willamette Falls Drive • Facilities for people walking are available on OR 99E (McLoughlin Boulevard); no facilities for people biking are provided	• Acceptable for most users • West Linn Arterial Roadways Project includes walking, biking, and rolling facilities along Willamette Falls Drive • Shared-use path extension planned along McLoughlin Boulevard
Alignment 4a: Main Street to Mill Street	• Unacceptable for most users • Absence of walking, biking, and rolling facilities on Willamette Falls Drive • Curb-tight sidewalks and narrow bike lanes provided on Willamette Drive (OR 43) • Main Street has sidewalks but no bike lanes	• Unacceptable for most users • Willamette Falls Drive Project includes separated walking, biking, and rolling facilities. • Comfortable walking, biking, and rolling facilities planned along Willamette Drive (OR 43) as part of the Highway 43 Improvements Project • No improvements planned on Main Street
Alignment 6: 9th Street to Willamette Drive	• Unacceptable for most users • Curb-tight sidewalks and narrow bike lanes provided on Willamette Drive (OR 43) • Wide sidewalks available on McLoughlin Boulevard, no dedicated facilities for people biking south of 10th Street	• Acceptable for most users • Comfortable walking, biking, and rolling facilities planned along Willamette Drive (OR 43) as part of the Highway 43 Improvements Project • Shared-use path extension planned along McLoughlin Boulevard
Alignment 7b: 10th Street to OR 43	• Unacceptable for most users • Curb-tight sidewalks and narrow bike lanes provided on Willamette Drive (OR 43) • Wide sidewalks available on McLoughlin Boulevard, no dedicated biking facilities south of 10th Street	• Acceptable for most users • Comfortable walking and biking facilities planned along Willamette Drive (OR 43) as part of the Highway 43 Improvements Project • Shared-use path extension planned along McLoughlin Boulevard

[1]Most users includes more vulnerable users who may be less-confident walking, biking, and/or rolling such as children, elderly, and people using a wheeled mobility device.

Level of Traffic Stress Analysis

The existing walking, biking, and rolling networks in the project study area were analyzed using level of traffic stress (LTS) to determine which potential alignments would provide safe and comfortable facilities accessible for people of all ages and abilities. The analyses were conducted within a quarter mile of the potential alignment bridgeheads in accordance with the procedures outlined in the ODOT *Analysis Procedures Manual (APM)*.[7]

Figure 9 illustrates the acceptable stress tolerance for four types of cyclists; including the highly confident, somewhat confident, interested but concerned, and non-bicycle. The interested but concerned make up the majority of the general population and include vulnerable users i.e., elderly and youth. The interested but concerned population has low stress tolerance, requiring LTS 1 or LTS 2 facilities (i.e., wide sidewalks, separated paths, buffered bike lanes) to feel comfortable. Somewhat confident and highly confident are willing to accept higher stress facilities (i.e., curb-tight sidewalks, on-street bike lanes).

For the purposes of the Oregon City-West Linn Pedestrian and Bicycle Bridge Concept Plan, the LTS analysis relies of the perspective of the interested but concerned, requiring low stress (LTS 1 and LTS 2) connections to the potential bridgeheads from a network connectivity standpoint.

Figure 9: Stress Tolerance for People Biking

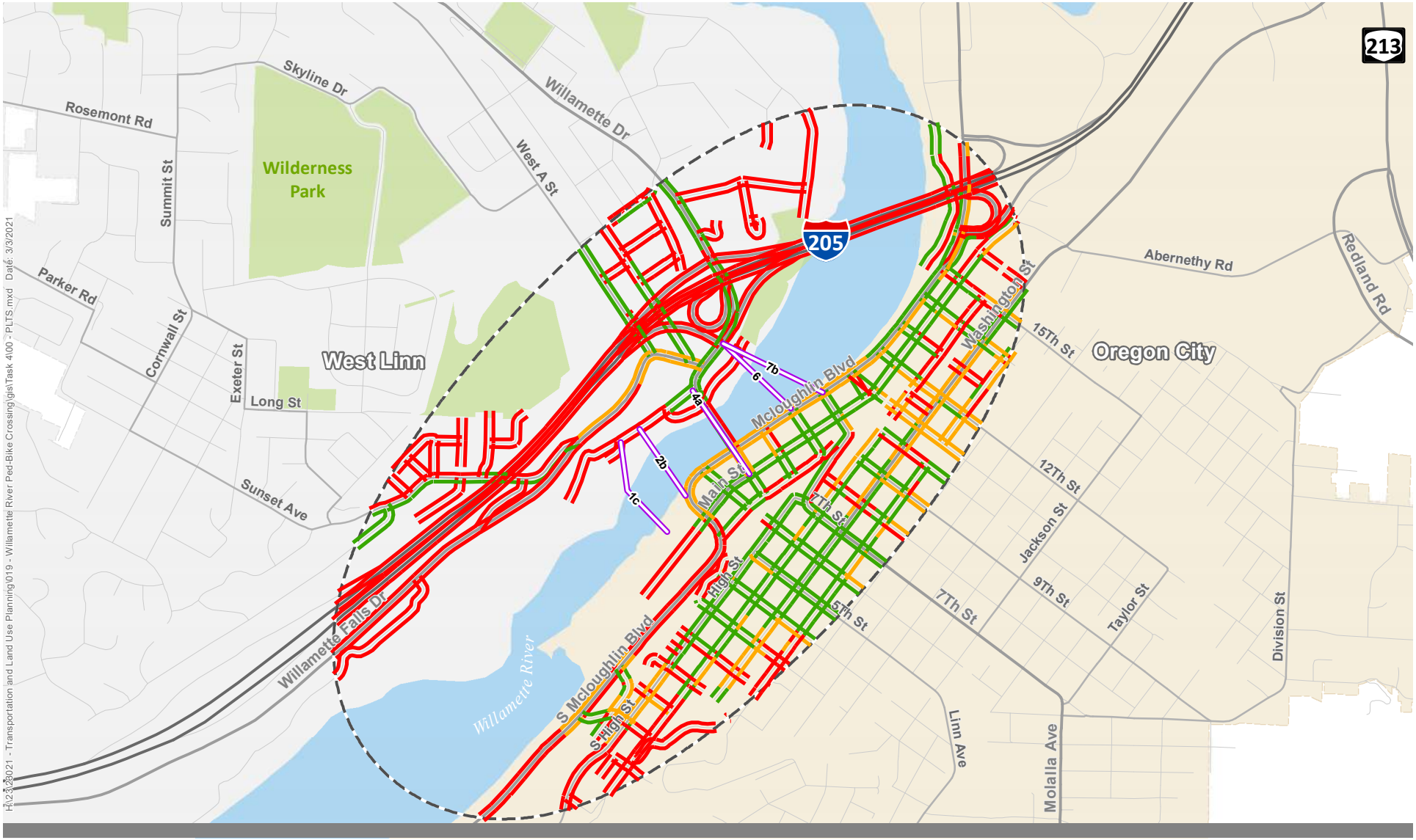
[7] Data was provided by Metro, West Linn, Oregon City, ODOT, and Clackamas County. Where data was not available, the consultant team provides estimates based on Google Earth information. The PLTS score did not include sidewalk condition, as this data was not readily available and can be subjective. Where information was not provided, 5-foot sidewalks, 5.5-foot bicycle lanes, 4-foot shoulders, and 8-foot parking widths were assumed. Functional classification of the roadway was taken from the Oregon City and West Linn TSP's.

Pedestrian Level of Traffic Stress

The pedestrian level of traffic stress (PLTS) segment score is determined based on the speed of the roadway; number of travel lanes per direction; presence, condition, and width of sidewalks; presence and type of buffer space; and several other factors such as lighting. Figure 10 illustrates the results of the PLTS analysis within a quarter mile of the potential bridge landings.

Many streets south of 7th Street in downtown Oregon City are low-stress (PLTS 2) due to lower speeds, presence of buffers, and continuous sidewalks. However, portions of some streets north of 7th Street, such as 8th and 10th streets, are high-stress (LTS 4) due to a lack of sidewalks. In addition, a number of segments were calculated as high-stress (LTS 3) due to narrow sidewalks. Therefore, there are direct low-stress (PLTS 2) connections for people walking to access the Historic Arch Bridge or a potential future alignment from southeast Oregon City to 7th Street. However, missing sidewalks and higher traffic create gaps in the low-stress network (PLTS 3 and 4) on 11th, 12th, Washington, and High Streets north of 7th Street.

In West Linn, West A Street and Willamette Drive provide low-stress (LTS 2) facilities that connect to neighborhoods. East-west connections, including Willamette Falls Drive and parts of Sunset Drive, are high-stress (LTS 4) due to lack of sidewalk facilities. In addition, many local roads were found to be high-stress (LTS 4) due to a lack of sidewalk facilities. Therefore, there are currently few acceptable routes to the bridge alignments that meet the PLTS criteria.



Legend

- PLTS 2
- PLTS 3
- PLTS 4
- Potential Bridge Alignments
- Quarter-Mile Buffer
- Oregon City
- West Linn
- Water

0 0.5 Miles

Figure 10

KITTELSON & ASSOCIATES

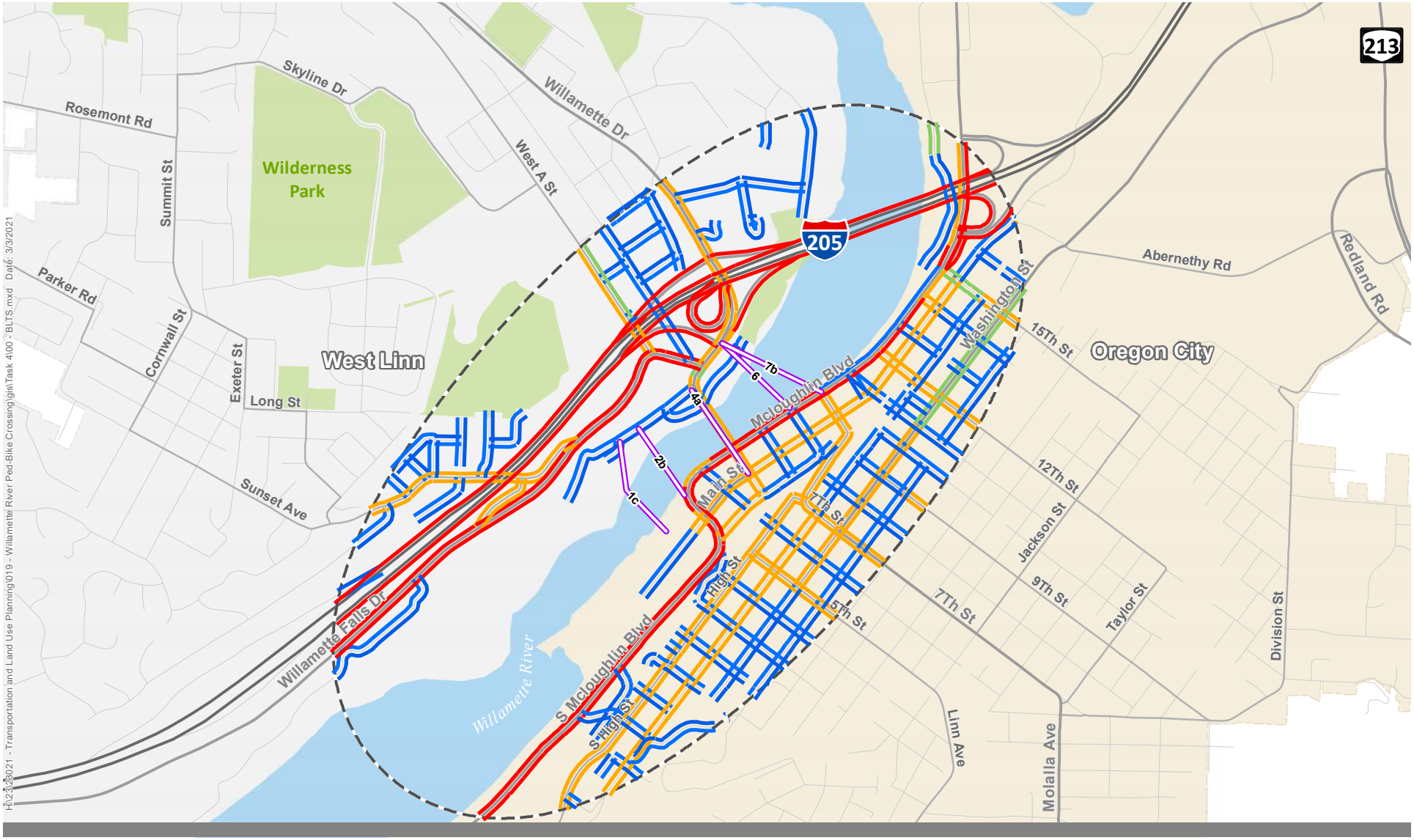
Pedestrian Level of Traffic Stress

Bicycle Level of Traffic Stress

ODOT provided the results of a segment bicycle level of traffic stress (BLTS) analysis conducted along state facilities in Oregon City and West Linn. Data provided by Oregon City and West Linn was analyzed to determine the BLTS along segments within a quarter mile of the potential bridge landings. The BLTS segment score is determined based on the speed of the roadway, number of travel lanes per direction, presence, and width of an on-street bike lane and/or adjacent parking lane, and several other factors such as the presence of a centerline. Figure 11 illustrates the results of the BLTS analysis.

In Oregon City, many of the north–south streets – such as 3rd Street, 4th Street, 6th Street, 8th Street, 9th Street, 10th Street, and 14th Street – are low-stress (BLTS 1) due to their low speeds and "local street" classification. 7th Street, a key route that people biking could use to access several potential bridge alignments, is high-stress (BLTS 3) due to high traffic volumes associated with arterial roadways. BLTS along segments of Center Street and Washington Street vary between 1 and 3, depending on available biking facility traffic volumes. For example, John Adams Street, a local road, is low-stress (BLTS 1), while High Street, an arterial, is high-stress (BLTS 3). The shared-use path on McLoughlin Boulevard running north from 10th Street provides a low-stress (BLTS 1) north–south connection. This connection stops at 10th Street.

In West Linn, neighborhood streets are low-stress (BLTS 1), with shared, low-volume streets. West A and Willamette Drive are also low-stress (BLTS) due to bike lanes and moderate traffic volumes. Willamette Falls Drive, a high-volume east-west connector road with no bicycle facilities, is high-stress (BLTS 4). Sunset Avenue, a connector to neighborhoods southwest of the bridge alignments, is high-stress (BLTS 3) due to traffic conditions and no dedicated biking facilities.



Legend

- BLTS 1
- BLTS 2
- BLTS 3
- BLTS 4
- Potential Bridge Alignments
- Quarter-Mile Buffer
- Oregon City
- West Linn
- Water

0 0.5 Miles

Figure 11

KITTELSON & ASSOCIATES

Bicycle Level of Traffic Stress

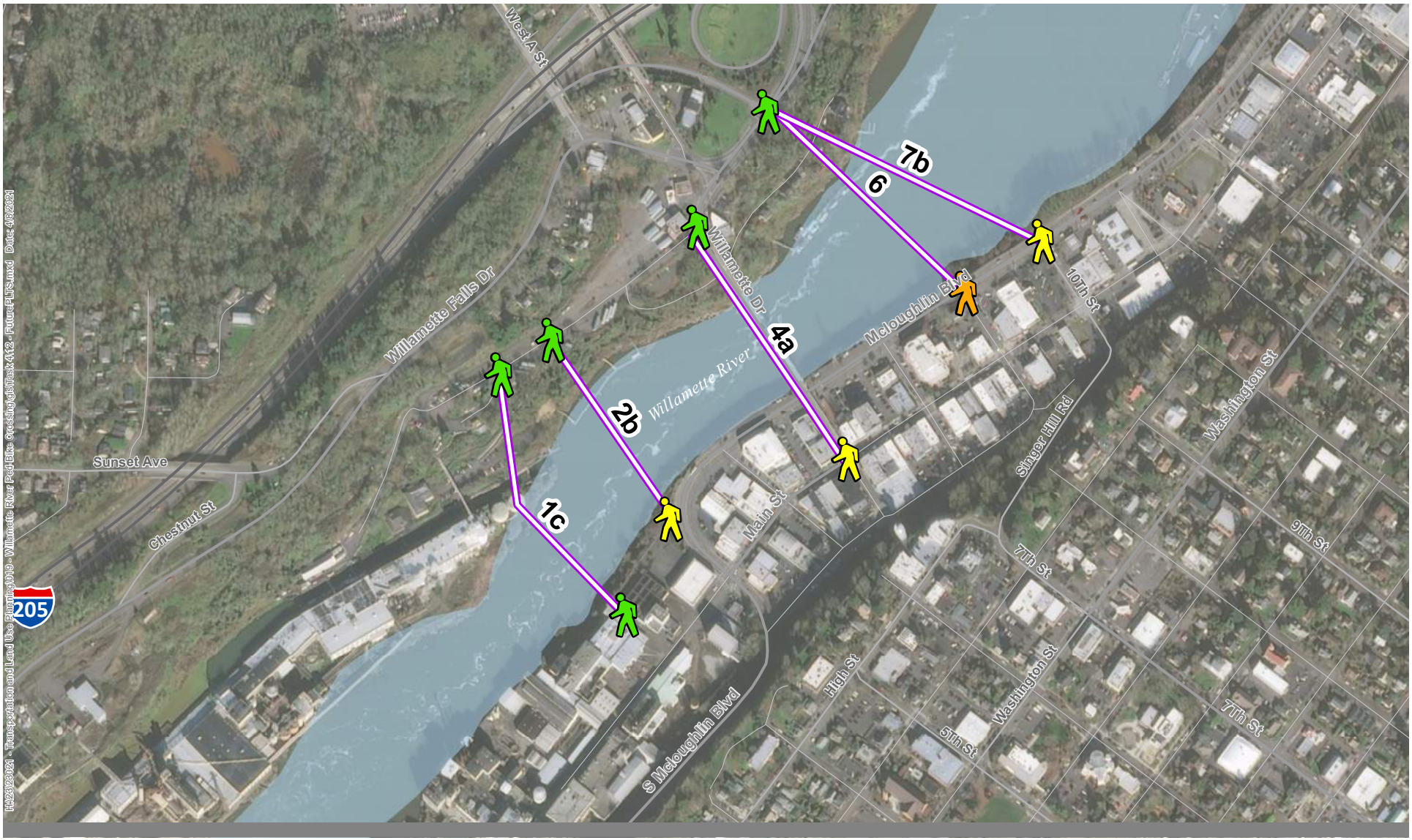
Access to Potential Bridge Alignments

In Oregon City, narrow sidewalk widths and high speeds along OR 99E are barriers for people walking between all potential bridge alignments and the downtown core. While some streets have the speeds and volumes needed for comfortable shared roadway environments, the lack of dedicated bike lanes along higher speed and volume roads makes the most direct routes to all the alignments – such as 10th Street/Singer Hill and segments of OR 99E – uncomfortable for most users. A planned future shared-use path along OR 99E will support access for people walking and biking to all five potential alignments.

In West Linn, people walking and biking from the south are able to access all alignments via the proposed realigned Willamette Falls Drive, which is currently a high-stress facility (due to an absence of walking and biking facilities). The realigned Willamette Falls Drive would provide direct access to Alignments 1c and 2b. Planned improvements along Willamette Falls Drive will provide comfortable facilities for people walking and biking in the future. From the north, people walking and biking can access all alignments via West A Street or Willamette Drive, which currently has both bike lanes and sidewalks. These streets provide direct access to Alignments 6 and 7b. Planned improvements along Willamette Falls Drive will provide additional separation for people walking and biking from vehicular traffic, making a comfortable connection to the potential alignments.

Table 3 summarizes the connection between low-stress walking, biking, and rolling networks and the potential bridge alignments. Figure 12 and Figure 13 illustrate the access to low-stress facilities at each bridgehead for people walking/rolling and biking, respectively[8]. These networks provide access for people walking and with a wide range of ages and ability levels. Today, low-stress networks are limited in extents: no alignments provide low-stress connectivity between Oregon City and West Linn. Planned projects will improve access in the future to all alignments.

[8] These graphs illustrate the *access* to low-stress facilities each bridgehead has based on future planned facilities. It is assumed that all bridges would be designed to provide comfortable facilities for users of all ages and abilities.



Legend

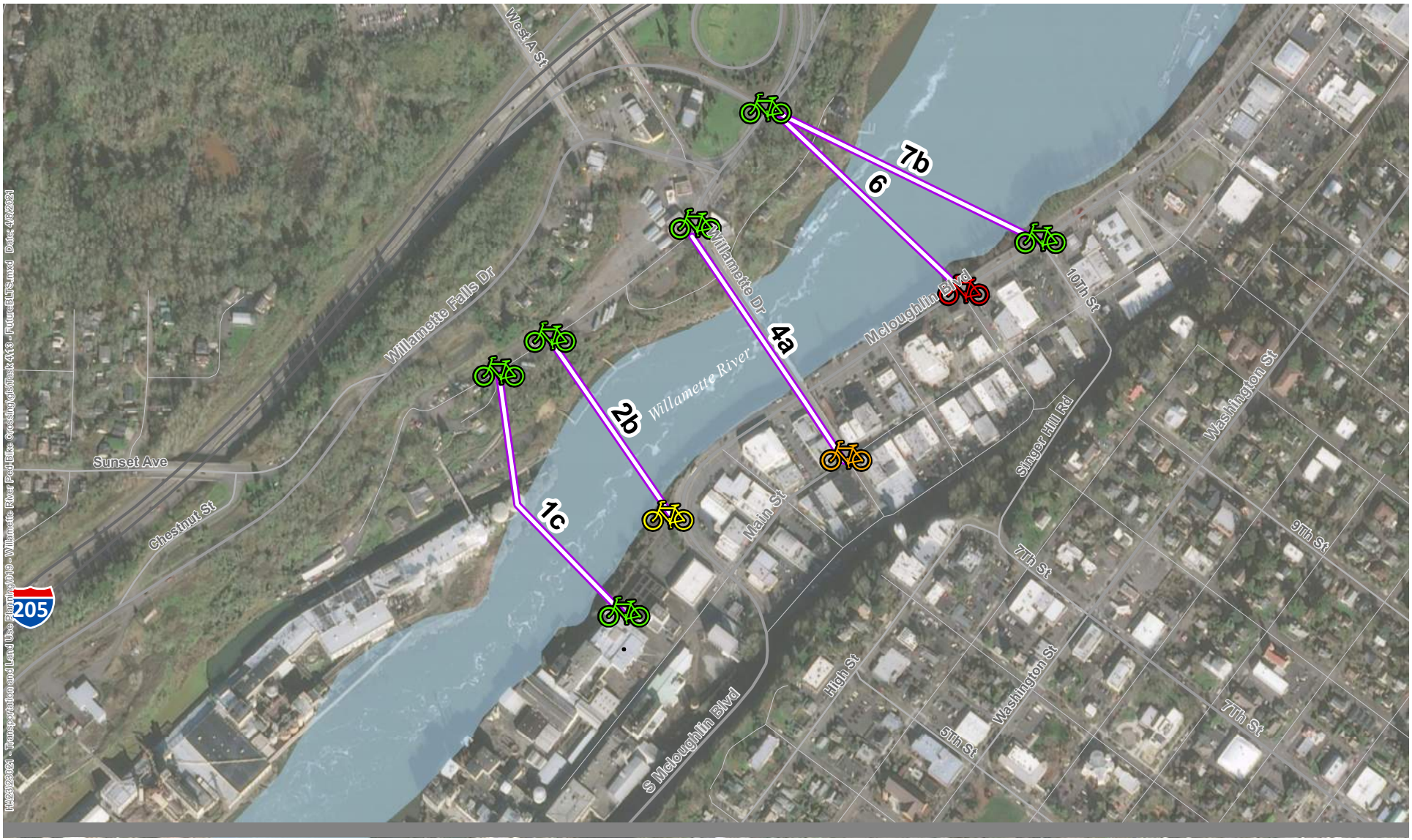
- Potential Alignments
- PLTS 1
- PLTS 2
- PLTS 3

0 0.05 0.1 0.2 Miles

Figure 12

KITTELSON & ASSOCIATES

Pedestrian Level of Traffic Stress Access at Bridgeheads (Assumes Future Development)



Legend

Potential Alignments

BLTS 1 BLTS 2 BLTS 3 BLTS 4

0 0.05 0.1 0.2 Miles

Figure 13

KITTELSON & ASSOCIATES

Bicycle Level of Traffic Stress Access at Bridgeheads (Assumes Future Development)

Table 3: Connection to Existing Low-Stress Networks

Alignment	Existing Walking Connections to Bridgeheads	Existing Biking and Rolling Connections to Bridgeheads
Alignment 1c: 4th Street to Mill Street	• No immediate access via low-stress facilities: the bridgeheads connect to PLTS 4 facilities. • Connections to greater area via facilities on Main Street, 7th Street, and 5th Street are low-stress. • Connections to the greater area via facilities on Mill Street, McLoughlin Boulevard, and Willamette Falls Drive are high-stress.	• In the immediate area, limited access via low-stress facilities: the bridgeheads connect to BLTS 1 facilities. • Connections to the greater area via facilities on Main Street, McLoughlin Boulevard, 7th Street, 5th Street, and Willamette Falls Drive are high-stress.
Alignment 2b: 5th Street to Mill Street	• No immediate access via low-stress facilities: the bridgehead in West Linn connects to PLTS 4 facilities and the bridgehead in Oregon City connects to PLTS 3 facilities. • Connections to the greater area via facilities on Main Street, 7th Street, and 5th Street are low-stress. • Connections to the greater area via facilities on Mill Street, McLoughlin Boulevard, and Willamette Falls Drive are high-stress.	• In the immediate area, incomplete access via low-stress facilities: the bridgehead in West Linn connects to BLTS 1 facilities but the bridgehead in Oregon City connects to BLTS 4 facilities. • Connections to the greater area via facilities on Main Street, McLoughlin Boulevard, 7th Street, 5th Street, and Willamette Falls Drive are high-stress.
Alignment 4a: Main Street to Mill Street	• In the immediate area, access to low-stress facilities: the bridgeheads connect to PLTS 2 facilities. • Connections to the greater area via facilities on Main Street, 7th Street, and 5th Street are low-stress. • Connections to the greater area via facilities on Mill Street, McLoughlin Boulevard, and Willamette Falls Drive are high-stress.	• In the immediate area, incomplete access via low-stress facilities: the bridgehead in West Linn Connects to BLTS 1 facilities but the bridgehead in Oregon City connects to BLTS 3 facilities. • Connections to the greater area via facilities on Main Street, McLoughlin Boulevard, 7th Street, 5th Street, and Willamette Falls Drive are high-stress.
Alignment 6: 9th Street to Willamette Drive	• In the immediate area, partial access to low-stress facilities: PLTS 2 facilities are present at both bridge landings. • Connections to the greater area via facilities on Main Street, 7th Street, and 5th Street are low-stress. • Connections to the greater area via facilities on Mill Street, McLoughlin Boulevard, and Willamette Falls Drive are high-stress.	• In the immediate area, incomplete access via low-stress facilities: the bridgehead in Oregon City connects to BLTS 1 facilities but the bridgehead in West Linn connects to BLTS 3 facilities. • Connections to the greater area via facilities on Main Street, Mcloughlin Boulevard, 7th Street, 5th Street, and Willamette Falls Drive are high-stress.
Alignment 7b: 10th Street to OR 43	• In the immediate area, partial access to low-stress facilities: PLTS 2 facilities are present at both bridge landings. • Connections to the greater area via facilities on Main Street, 7th Street, and 5th Street are low-stress. • Connections to the greater area via facilities on Mill Street, McLoughlin Boulevard, and Willamette Falls Drive are high-stress.	• In the immediate area, incomplete access to low stress facilities: the bridgehead in Oregon City connects to BLTS 1 facilities but the bridgehead in West Linn connects to BLTS 3 facilities. • Facilities on 10th Street, Willamette Drive, and McLoughlin Boulevard south of 10th Street are high-stress. • Connections to the greater area via facilities on Main Street, McLoughlin Boulevard, 7th Street, 5th Street, and Willamette Falls Drive are high-stress.

Demand

Existing and forecast transportation data from Strava, StreetLight, and Metro's Travel Demand Model were reviewed to understand relative demand generated by the alternative bridge alignments. The sections below focus on demand estimates; and details on the demand model are provided in Appendix A.

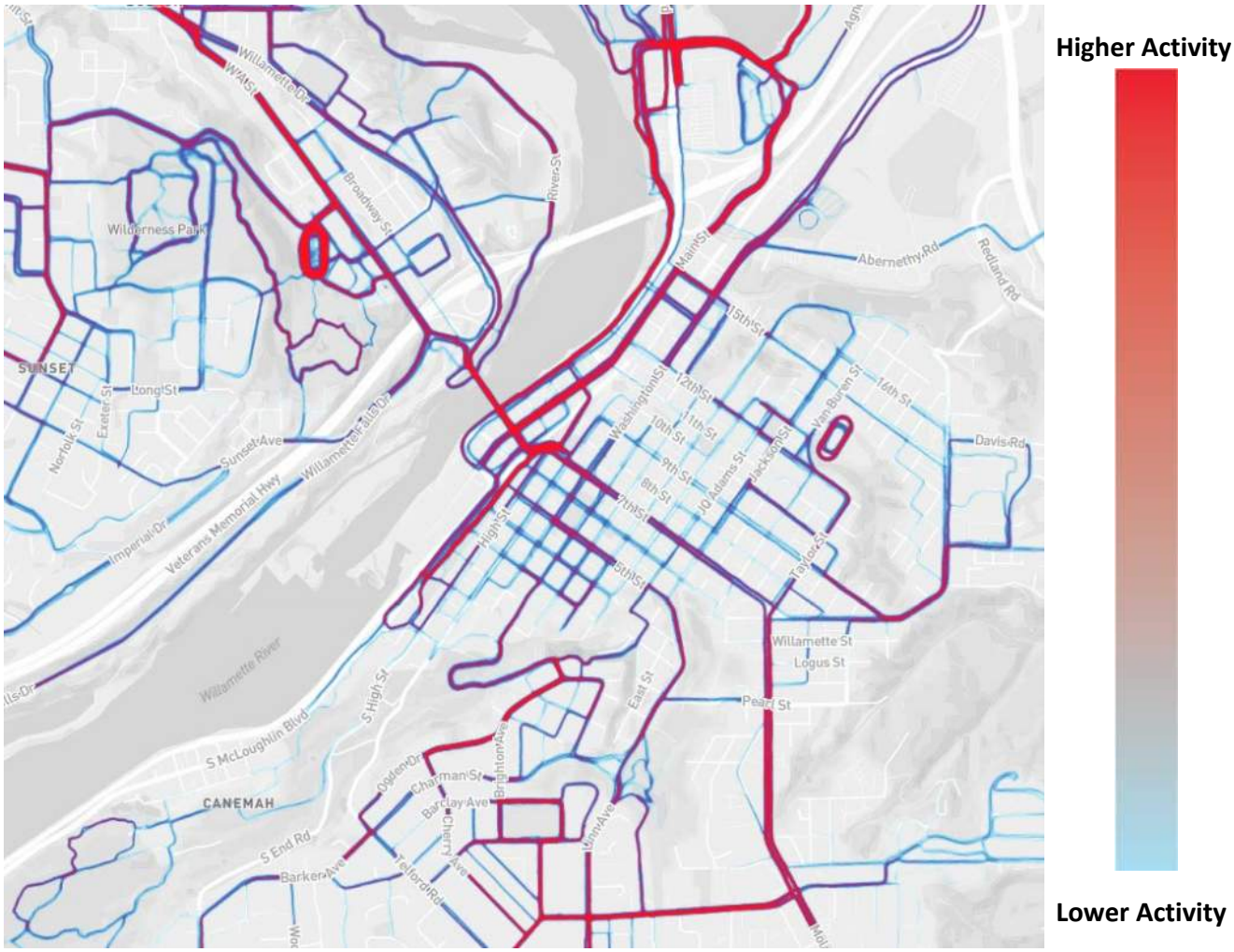
Existing Activity

To understand relative walking, biking, and rolling activity in the study area, heatmaps illustrating areas of greater walking, biking, and rolling, activity were developed using data from Strava. Strava collects data through a mobile app that allows users to record their physical exercise through mobile devices. The data is potentially biased towards higher income individuals and is less likely to capture non-recreational activity. It provides value by identifying where people of walk, bike and roll to destinations via most commonly travel routes.

Walking and Running Activity

Figure 14 shows the Strava heatmap for walking and running activity in Oregon City and West Linn. Thicker, red lines indicate more activity, and thinner, blue lines indicate lesser activity. As shown in Figure 14, there is a relatively high amount of walking and running activity along West A Street in West Linn; the Historic Arch Bridge; and along McLoughlin Boulevard, Main Street, and near the municipal elevator in Oregon City. Existing walking and running activity is higher on the east side of the river than the west side. The roads with greater activity generally provide access to specific destinations, such as West A and West Linn High School, and provides a comfortable experience, such as the trail along McLoughlin Boulevard. Note that while activity is higher east of the Historic Arch Bridge than to the west, planned developments and infrastructure projects west of the Historic Arch Bridge may change these patterns.

Figure 14: Strava Heatmap – Walking and Running Activity

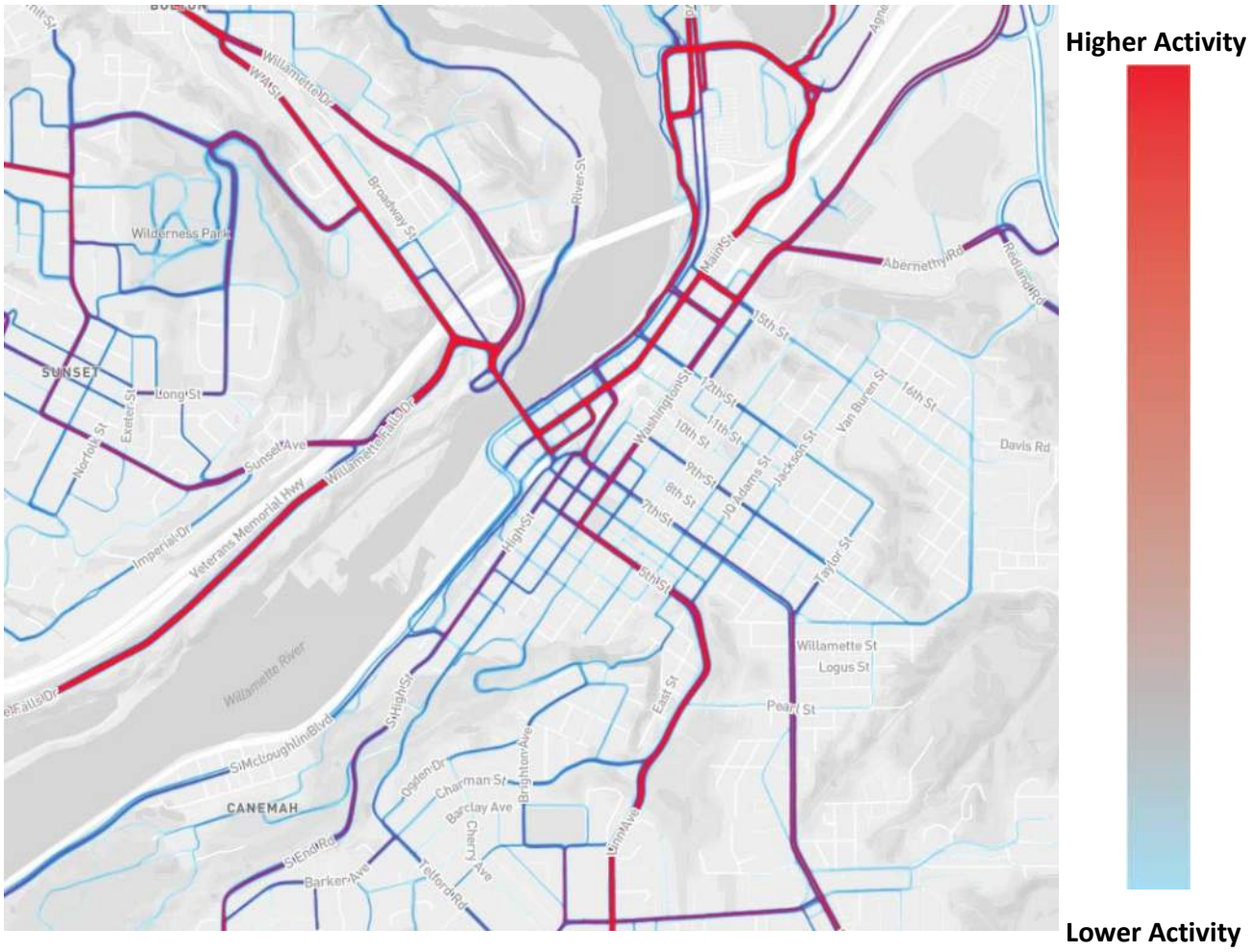


Biking Activity

Figure 15 shows the Strava heatmap for people biking in Oregon City and West Linn. There is a relatively high amount of biking activity along Willamette Falls Drive, 5th Street, Washington Street, Main Street, and McLoughlin Boulevard. Today, there is limited activity of people biking in Oregon City southwest of the Historic Arch Bridge; however, planned development in the Willamette Falls Downtown District is anticipated to increase activity. Note that the activity patterns reflect existing activity for people biking and are drawn from a resource used for recording physical exercise. As a result, the people reflected in this map are potentially more comfortable using higher stress facilities such as Willamette Falls Drive and the Historic Arch Bridge than more vulnerable users (e.g., elderly and youth).

The proposed alignments do not have a clear relative benefit in providing better or worse connections. Alignments 6 and 7b would more directly connect to existing bike patterns in Oregon City via Singer Hill and along the trail parallel to McLoughlin Boulevard, whereas Alignments 1c and 2b would connect more directly to the existing bike pattern on Willamette Falls Drive and the planned redevelopment of the Historic Old City Hall District (West Linn) and the Willamette Falls Downtown District.

Figure 15: Strava Heatmap – Biking Activity



Estimated Walking, Biking, and Rolling Demand for Potential Bridge Alignments

A demand tool was developed to estimate the potential attractiveness or "demand" for each of the five potential bridge alignments. The tool estimates weekday walking and biking trips for Year 2027. The tool considers existing travel patterns, walking and biking infrastructure, and, design characteristics of the alignments, proximity of alignments to different areas of each city, and planned housing growth. For Year 2027, Kittelson used Metro Model land use development patterns as well as known development in the study area to factor for population growth. The scenario includes new roadways constructed as part of the *Willamette Falls Drive -- West Linn Arterial Roadways* project and *Willamette Falls Downtown District & Riverwalk*.

Results from the demand tool are provided below, with a more detailed description of the tool provided in Appendix A. At a high level, the tool estimates potential walking, biking, and rolling trips by evaluating the likelihood of walking or biking for different trips between Oregon City and West Linn. The probability is estimated based on the length and quality of the route – shorter, more comfortable trips are more likely to be completed by active modes than long trips.

Estimated Demand and Projected Mode Shift

Table 4 shows the estimated daily number of walking, biking, and rolling trips for each alignment and the baseline condition. The baseline condition is to maintain use of the existing Historic Arch Bridge without constructing a new bridge. This baseline is used to estimate the net mode shift for each alignment. The table also identifies the number of active trips (walking, biking, running, etc.) that may continue along the Historic Arch Bridge if it provides a shorter route. These estimates do not include purely recreational trips where an individual starts and ends a trip from a single location (recreational trips are described in "Projected Recreational Activity"). The estimates for mode shift trips are provided separately to clearly show the expected change of trips from personal motor vehicles to active transportation. Maps showing travel zones where trips are generated for each alignment are provided in Appendix A. These maps show how locations are served by each alignment.

Table 4: Projected Active Mode Shift from Vehicular Travel[1]

Projected Daily Active Trips	Alignment 1c	Alignment 2b	Alignment 4a	Alignment 6	Alignment 7b	Baseline[2]
New Alignment – Walking Trips	240	285	615	665	680	NA
Historic Arch Bridge – Walking Trips	160	200	-	30	25	200
New Alignment – Biking Trips	55	55	75	85	80	NA
Historic Arch Bridge – Biking Trips	20	20	-	-	-	50
Total Active Trips	**475**	**560**	**690**	**780**	**785**	**250**
New Active Trips (Shift from Motor Vehicles)	**225**	**310**	**440**	**530**	**535**	**NA**

[1] Trips are rounded to the nearest 5.
[2] Existing Historic Arch Bridge

The estimates indicate that all five potential bridge alignments would increase total active transportation trips. Alignments 6 and 7b generate the greatest number of new active transportation trips, while Alignment 4a would generate slightly fewer new active transportation trips than the eastern two crossings. Alignments 1c and 2b generate the smallest increase in active transportation trips; the tool assumes a substantial share of active transportation trips would continue on the Historic Arch Bridge under the Alignments 1c and 2b scenarios.

The difference in the projections is generally driven by two factors:

- In Oregon City, the transportation network connects trips between the river to the bluff either through the public elevator or along Singer Hill. Alignments 4a, 6, and 7b provide more direct access than Alignments 1c and 2b to both routes.
- While planned development from the Willamette River Legacy Project increases the projected demand for Alignments 1c and 2b, land use activity and population are still projected to be greater north of the Historic Arch Bridge in both West Linn and Oregon City.

Walking trips are impacted to a greater degree by the choice of alignment. There is a minimal difference in the number of expected bike trips across the alignments, whereas walking trips are substantially higher for Alignments 6 and 7b than the other alignments. This difference is projected for two major reasons:

- There is a greater decline in the propensity to walk than in the propensity to bike as trips get longer. As a result, the alignments with bridgeheads closer to population and commercial centers will have higher projected walking trips.
- The choice to bike is determined by the full context of the full travel route; therefore, hills and roadway conditions beyond the bridge that are similar across the alignments have a similar and large influence on expected trip numbers. Walking is also impacted by the full context of the trip; however, since walking trips are generally shorter, the immediate connection to the bridge alignment has a larger impact on whether a person chooses to walk.

Projected Recreational Activity

In addition to mode shift, the tool estimates recreational demand for each potential bridge alignment. The expected activity is generated based on stated activity levels collected from a survey of Clackamas County[9] and study area residents' proximity to the proposed crossings. Alignments 4a, 6, and 7b are projected to get more trips than 1c and 2b; however, the difference is smaller than for the non-recreation trips. Table 5 provides the projected recreational trips for each alignment.

[9] Clackamas County Active Transportation Plan (June 2013).

Table 5: Projected Recreational Trips

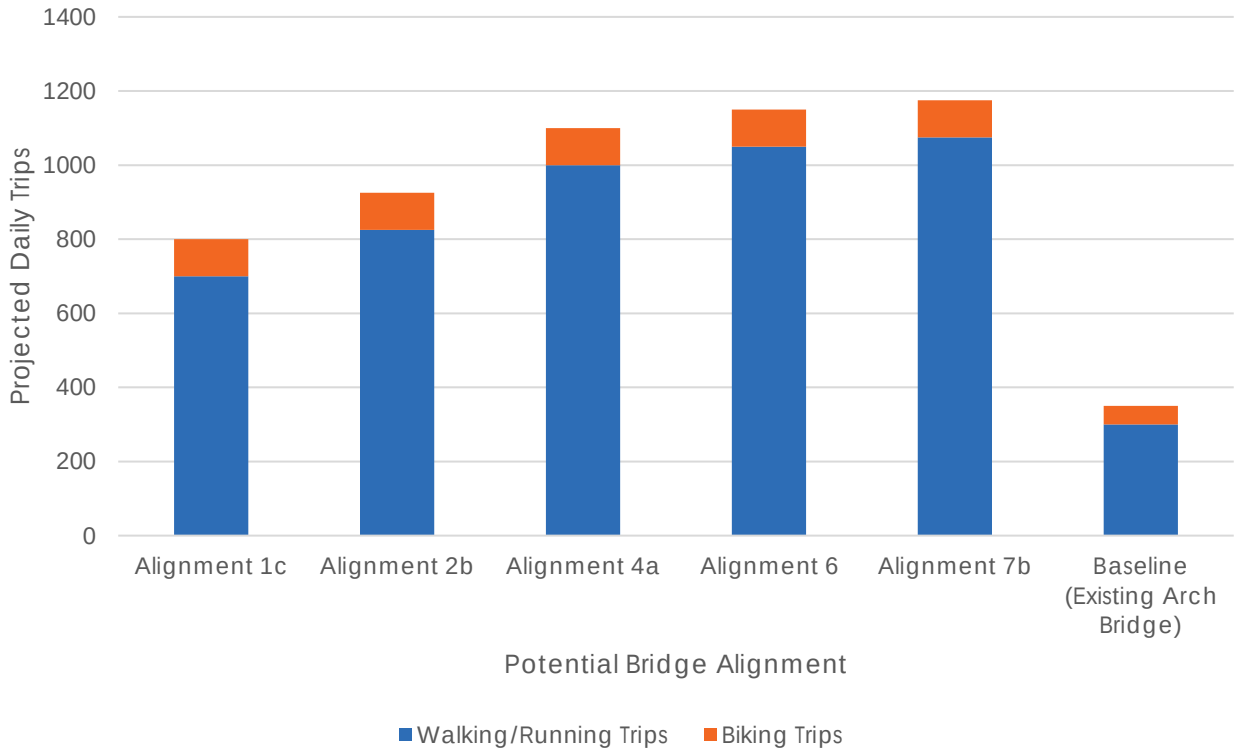
Projected Daily Recreational Trips[1]	Alignment 1c	Alignment 2b	Alignment 4a	Alignment 6	Alignment 7b	Baseline[2]
Recreational walking/running trips	290	340	365	355	365	100
Recreational biking trips	30	25	25	25	25	10
Total recreational trips	**320**	**365**	**390**	**380**	**390**	**110**

[1] Trips are rounded to the nearest 5.
[2] Existing Historic Arch Bridge

Total Activity Estimates

Chart 1 illustrates the total projected walking, running, rolling, and biking trips associated with each potential bridge alignment.[10] These trip estimates include recreational trips and trips that are expected to continue using the Historic Arch Bridge. All potential bridge alignments are projected to double to triple active travel along the Historic Arch Bridge.

Chart 1: Total Projected Active Trips



[10] Total trip estimates include trips modeled to be maintained along the Historic Arch Bridge.

Equity

The preferred alignment is intended to support active transportation access across the river for people of all ages and abilities. In the *Purpose and Needs Statement*, 2018 American Community Survey (ACS) data at the block group level was analyzed to identify areas with a high number of residents who historically face transportation barriers and environmental justice communities that have been traditionally underserved. This analysis included people of color, Hispanic populations, elderly (over the age of 64) youth (under the age of 18), individuals experiencing low-income situations, and crowded households. Community profile maps were provided in the *Purpose and Needs Statement*.

Based on this analysis, there is a high portion of elderly and youth in the study area. These populations rely on separated, low-stress infrastructure to feel comfortable walking, biking, and/or rolling. By providing a facility that is low-stress and compliant with the Americans with Disabilities Act of 1990, all five potential bridge alignments improve access for elderly and youth.

As shown in travel zone maps provided in Appendix A, much of the study area is expected to generate the same number of projected active trips for all five alignments. The following differences are observed:

- Alignments 1c, 2b, and 4a serve more trips in the area of that will be redeveloped as part of the Willamette Falls Downtown District & Riverwalk than Alignments 6 and 7b. This area serves individuals who are consistent with the community profile of the overall study area. The area will be redeveloped in the near future.
- Alignments 6 and 7b serve more projected active trips south and west of downtown Oregon City than Alignments 1c, 2b, and 4a. Block groups in this area have slightly higher portions of people of color, Hispanic populations, people experiencing low-income situations, and crowded households relative to the community profile of the overall study area.

Based on the review, Alignments 6 and 7b may serve slightly more people who are historically disadvantaged with respect to population. However, all five alignments are projected to serve vulnerable populations throughout the study area.

Health

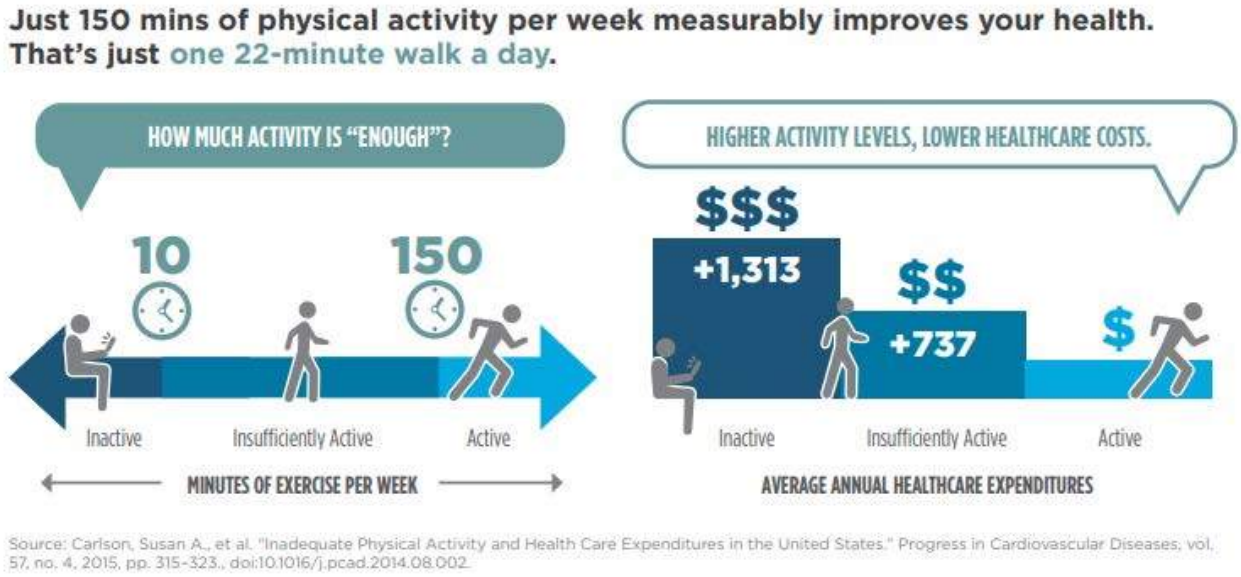
The health impacts of various bridge alignments were considered with respect to a mode shift to active transport. Cardiovascular exercise from walking and biking improves physical and mental health. People who walk and bike regularly are less likely to suffer from depression, anxiety, and other mental health issues than those leading inactive lifestyles.[11]

A Centers for Disease Control and Prevention (CDC)-associated study found that healthcare costs for people who exercise regularly are substantially lower than for people leading inactive lifestyles. As shown

[11] Sharma, Ashish et al. "Exercise for Mental Health," *Primary Care Companion to the Journal of Clinical Psychiatry,* Vol. 8,2, 2006, 106. doi:10.4088/pcc.v08n0208a.

in Figure 16, average annual healthcare costs for people who get at least 150 minutes of exercise are $737 lower than for people who exercise between 10 to 150 minutes per week and $1,313 less than for people who exercise less than 10 minutes per week.[12]

Figure 16: Health Benefits of Physical Activity



Source: Carlson, Susan A., et al. "Inadequate Physical Activity and Health Care Expenditures in the United States." Progress in Cardiovascular Diseases, vol. 57, no. 4, 2015, pp. 315-323., doi:10.1016/j.pcad.2014.08.002.

In particular, active commuting (by walking and biking) is linked to positive public health outcomes, likely because activity is incorporated into daily routines and more likely to be maintained over time than other exercise. Increased use of walking and biking for transport is directly related to improved health in older adults,[13] and active commuting has been found to be positively correlated with aerobic fitness and inversely correlated with body mass index, obesity, triglyceride levels, resting blood pressure, and fasting insulin.[14] In addition, growing evidence indicates a correlation between adult obesity and travel behavior, with countries with the highest active transportation mode share also having the lowest rates of

[12] Carlson, Susan A. et al. "Inadequate Physical Activity and Health Care Expenditures in the United States," *Progress in Cardiovascular Diseases,* Vol. 57, No. 4, pp. 315–323, doi: 10.1016/j.pcad.2014.08.00.

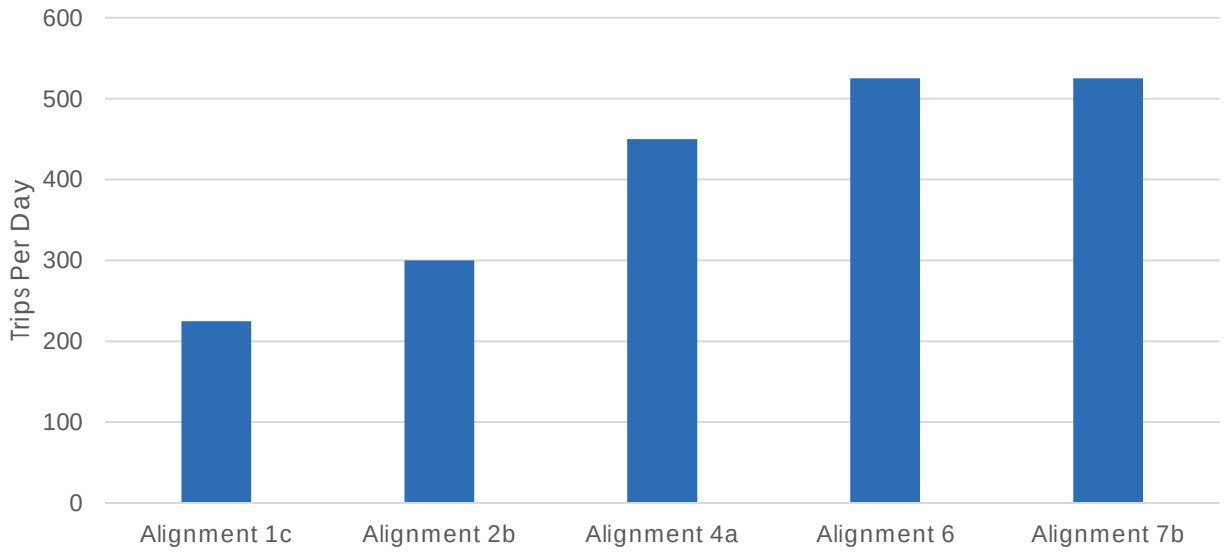
[13] Huy, C., Becker, S., Gomolinsky, U., Klein, T., and Thiel, A. "Health, Medical Risk Factors, and Bicycle Use in Everyday Life in the Over-50 Population," *J Aging Phys Act.,* 2008, 16(4):454–464. Crossref, Medline, Google Scholar.

[14] Gordon-Larsen, P., Boone-Heinonen, J., Sidney, S., Sternfeld, B., Jacobs, D.R., and Lewis, C.E. "Active Commuting and Cardiovascular Disease Risk: The CARDIA Study." *Arch Intern Med.,* 2009, 169(13):1216–1223. Crossref, Medline, Google Scholar.

obesity.[15] Another study showed that in multi-ethnic, low socioeconomic status populations, biking for travel reduced the odds for diabetes and lowered risk factors for cardiovascular disease.[16]

As outlined in the Demand section above, the potential bridge alignments are projected to double to triple active travel along the Historic Arch Bridge. Chart 2 illustrates the mode shift associated with each alignment and does not account for the potential of a new bridge to increase recreational activity in the area. This mode shift, and associated health benefits, is projected to be greatest for Alignments 6 and 7b.

Chart 2: Mode Shift from Vehicular Trips to Walking and Biking Trips



[15] Bassett, D.R., Pucher, J., Buehler, R., Thompson, D.L., and Crouter, S.E. "Walking, Cycling, and Obesity Rates in Europe, North America, and Australia," *J Phys Act Health,* 2008, 5(6):795–814. Crossref, Medline, Google Scholar.

[16] Armund Riiser, Ane Solbraa, Anne Karen Jenum, Kåre I. Birkeland, and Lars Bo Andersen. "Cycling and Walking for Transport and Their Associations with Diabetes and Risk Factors for Cardiovascular Disease," *Journal of Transport & Health,* Vol. 11, 2018, pp. 193–201, ISSN 2214-1405, doi.org/10.1016/j.jth.2018.09.002.

CONCLUSION

Based on consideration of essential destinations, potential integration into the existing and planned networks for people walking, biking and rolling, LTS analysis, and forecasted walking, biking, and rolling trips, Alignments 7b is a strong candidate for bridge alignment. A list of primary benefits is as follows:

- Alignment 7b has the most essential destinations (29) within a half-mile radius.
- Alignment 7b directly connects to 10th Street/Singer Hill, which is one of the main routes that people walking and biking would use to access destinations throughout Oregon City.
- Alignment 7b connects to Oregon City at the signalized intersection of 10th Street/McLoughlin Boulevard. Alignment 6 connects at 9th Street/McLoughlin Boulevard; traffic currently flows freely at McLoughlin Boulevard at this intersection, which would be a barrier for people walking and biking.
- Alignment 7b directly connects to the planned shared-use paths along McLoughlin Boulevard and Willamette Drive.
- Alignment 7b is expected to generate the most walking and biking trips.

Alignment 7b does not provide as direct a connection to planned development in the Willamette Falls Downtown District as Alignments 1c and 2b provide; this is a distinct disadvantage for alignments north of the Historic Arch Bridge.

An additional analysis of equity, environmental impact, cost, design feasibility, and public input will be considered before making a final recommendation for the preferred crossing alignment.

NEXT STEPS

This Active Transportation Analysis has been reviewed by the PMT and updated to produce the final *TM #4: Active Transportation Analysis*.

The findings presented in this memorandum, *TM #3A: Preliminary Bridge Concept Plans*, and *TM #3B: Benefits and Impact Analysis* have been incorporated into *TM #5: Executive Summary and Recommendations* to evaluate and identify a preliminary preferred crossing alignment to be reviewed with the PAC, PLT, and the public to form the basis of recommendations for the preferred crossing alignment.

Appendix A Demand Modeling

DEMAND MODELING WITH STREETLIGHT DATA

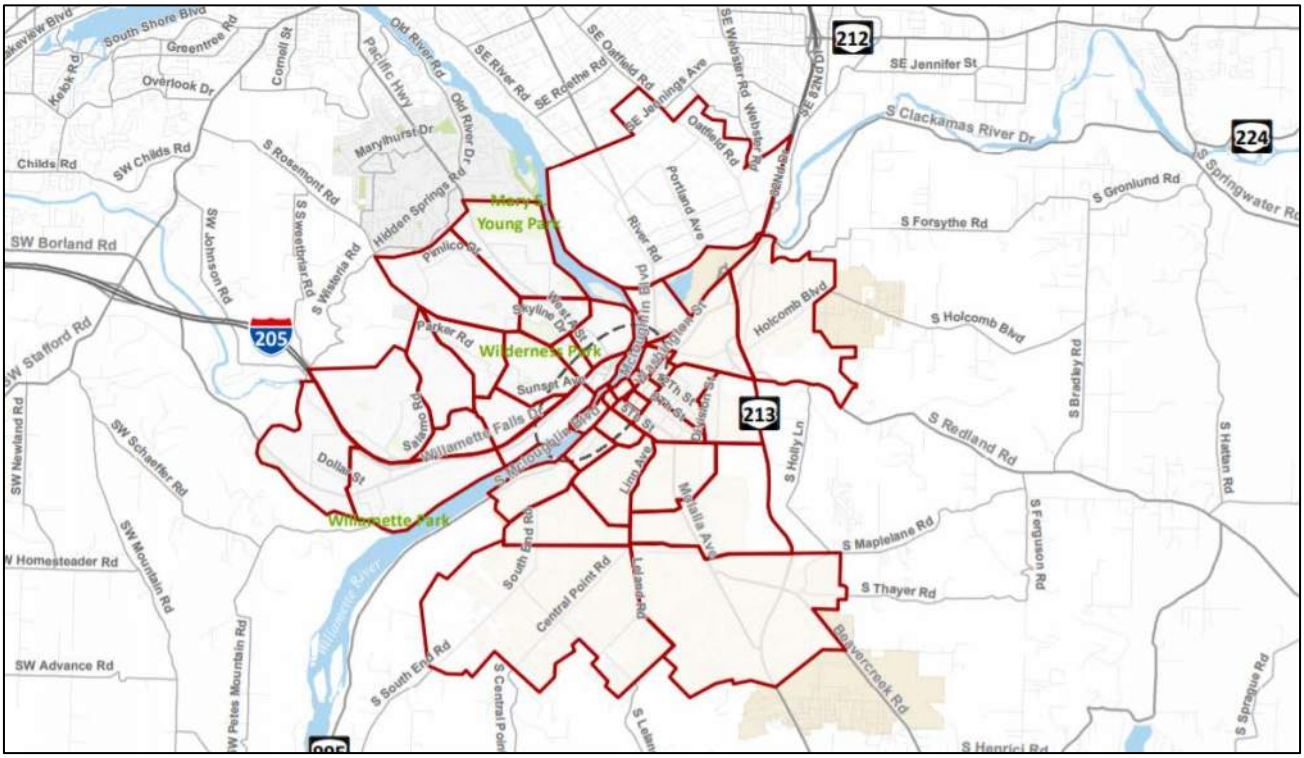
A tool was developed to estimate the potential demand for each of the five potential bridge alignments. The tool estimates weekday walking and biking trips for Year 2027. The tool considers existing travel patterns, sidewalk and road conditions, design characteristics of the alignments, proximity of alignments to different areas of each city, and planned housing growth. Information about this tool and the assumptions used is provided below.

Travel Patterns

Travel patterns were developed using data from the company StreetLight Data. StreetLight is a company that generates transportation data using cell phone application records. StreetLight creates the travel pattern data by processing the cell phone records to identify unique trips. The trips are aggregated based on trips between travel zones.

Kittelson developed origin-destination patterns using StreetLight data for 40 distinct zones in Oregon City and West Linn. The data identifies current vehicular travel volumes between different zones on either side of the river and the average length of those trips. Next, based on assumptions outlined below, the tool identifies the number of trips that could be shifted to active modes by each potential bridge alignment. The zones considered are shown with red outlines in Figure A-1. Trips starting or ending outside of the area are not expected to significantly impact the daily demand based on their distance from the crossing.

Figure A-1: Travel Zones Included in Demand Modeling Tool



Relative Access

The tool estimates the number of people walking and biking based on the distance of the trip – shorter trips are more likely to be completed by walking or biking whereas longer trips are more likely to be completed by car. To evaluate the alternative crossings, the tool adjusts the travel distance for different origin-destination pairs based on the characteristics of walking and biking trips. It increases or decreases the relative length of trips based on the presence of high- or low-stress facilities and uphill travel.

- **Distance** – Calculated using network distance based on review of shortest route in Google Maps and consultation of Strava data.
- **Comfort** – Adjustments made to distance based on the presence of higher or lower level of traffic stress (LTS) facilities for people walking, biking, and rolling.
- **Grade –** Change in elevation identified using Google Earth elevation data. Trip distance for each pair of zones was adjusted based on the direction of travel with greater elevation gain.

Kittelson developed estimates for what percent of trips of different length are conducted by different modes using travel survey data collected in California. This data was used because it provided detailed survey results categorized by location type. This allowed Kittelson to select for suburban locations similar to those in the study area. Table A-1 provides a summary of the estimated mode by trip distance.

Table A-1: Estimated Mode by Distance

Distance (mi)	% Walk	% Bike
0.25	78%	1%
0.50	52%	3%
1.00	24%	6%
1.50	11%	2%
2.00	6%	2%
2.50	4%	2%
3.00	3%	2%
3.50	2%	2%
4.00	1%	1%
4.50	0%	1%
5.00	0%	1%
6.00	0%	1%
7.00	0%	1%
8.00	0%	1%
9.00	0%	1%
10 or greater	0%	<1%

Alternative Crossing Characteristics

For each alignment, the tool modifies travel distance between the origin-destination pairs to account for the comfort and grade of the proposed crossing as well as its proximity to individual zones. For example, alignments that require greater use of ramping at 5 percent grade are less appealing to active transportation and generate fewer trips compared to a similar alignment that is flatter. The tool applies the same assumptions when considering the approaches to the alignment. The tool also identifies if a portion of trips would continue to use the Historic Arch Bridge. The rules applied to identify these trips are:

- **Walking** – Individuals will use the Historic Arch Bridge if the Historic Arch Bridge provides a shorter path for the trip than the proposed alignment.
- **Biking** – Individuals will use the Historic Arch Bridge if the trip is shorter and/or if it the trip is traveling downhill across the Historic Arch Bridge (West Linn to Oregon City). No use of the Historic Arch Bridge is predicted in the uphill direction since the difference in motor vehicle speed is greater, increasing stress.
- **Recreation** – All recreational activity will use the new alignment.

Future Conditions

The tool is calibrated for Year 2027 using data from the Portland Metro Transportation model. The tool identifies the population growth forecast in different areas of West Linn and Oregon City and adjusts the existing travel estimates from StreetLight Data based on the average population growth expected across each origin-destination pair. A review of the model estimates found that the projected population was not in line with the planned growth in the Industrial Heritage District, so the tool was adjusted based on a projection of 350 residential units being added to the site.

Recreational Activity

The tool estimates recreational activity based on residential population and survey data collected in Clackamas County. The tool uses the two numbers to identify the expected level of recreation based on population and stated recreational patterns. It then estimates the proportion of that activity that would use each proposed crossing-based proximity. These estimates are provided separately as expected percent changes. This is done in part to reflect the absence of detailed recreational data to calibrate estimates.

- **Walking/Running** – 0.25 trips per day per resident
- **Biking** – 0.05 trips per day per resident

DEMAND MAPS

Figure A-2 through Figure A-14 show daily weekday active trip generation for baseline and proposed alignment alternatives. Walking and biking trips are shown in separate maps.

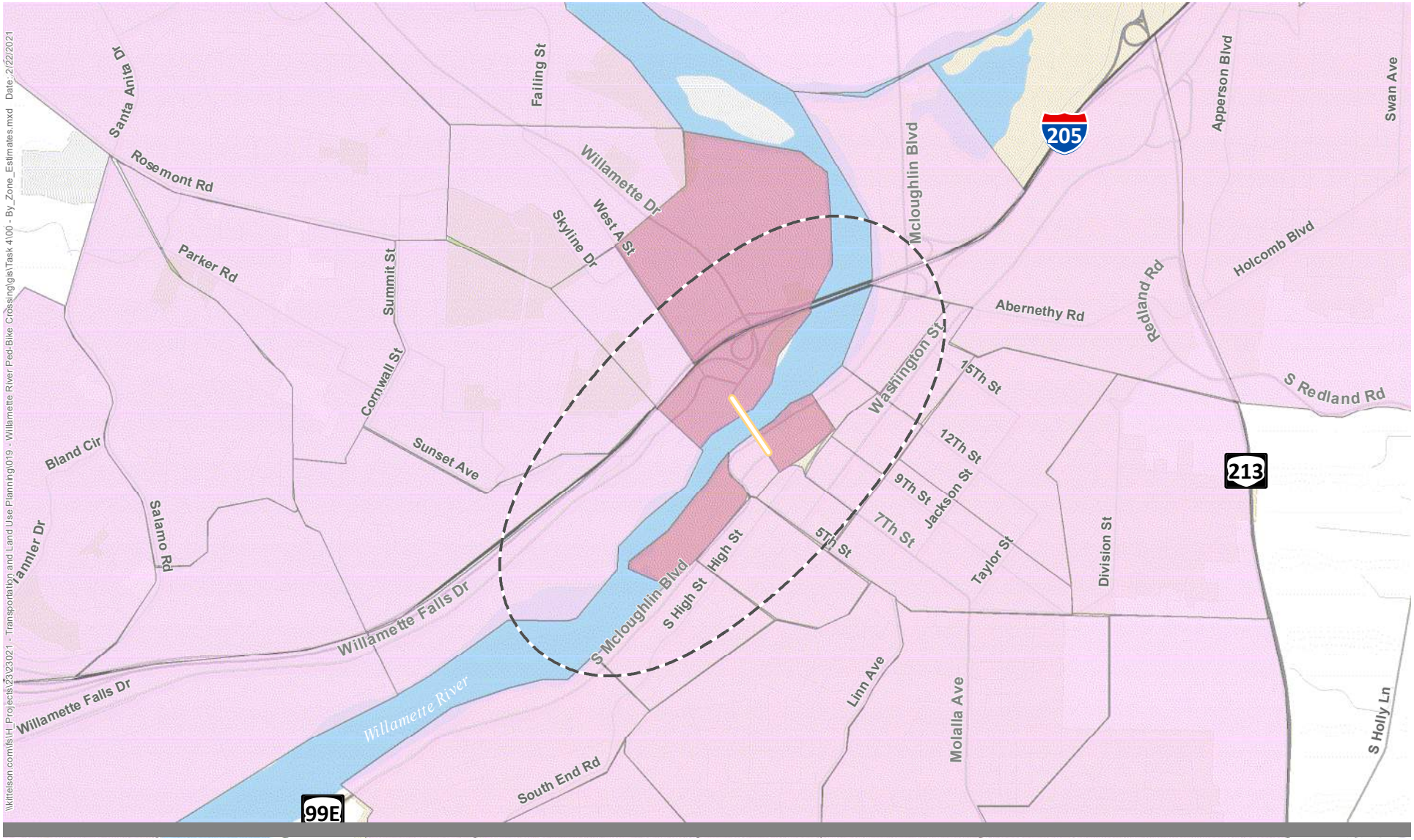


Figure A-2

KITTELSON & ASSOCIATES

Pedestrian Trips by Zone - Baseline

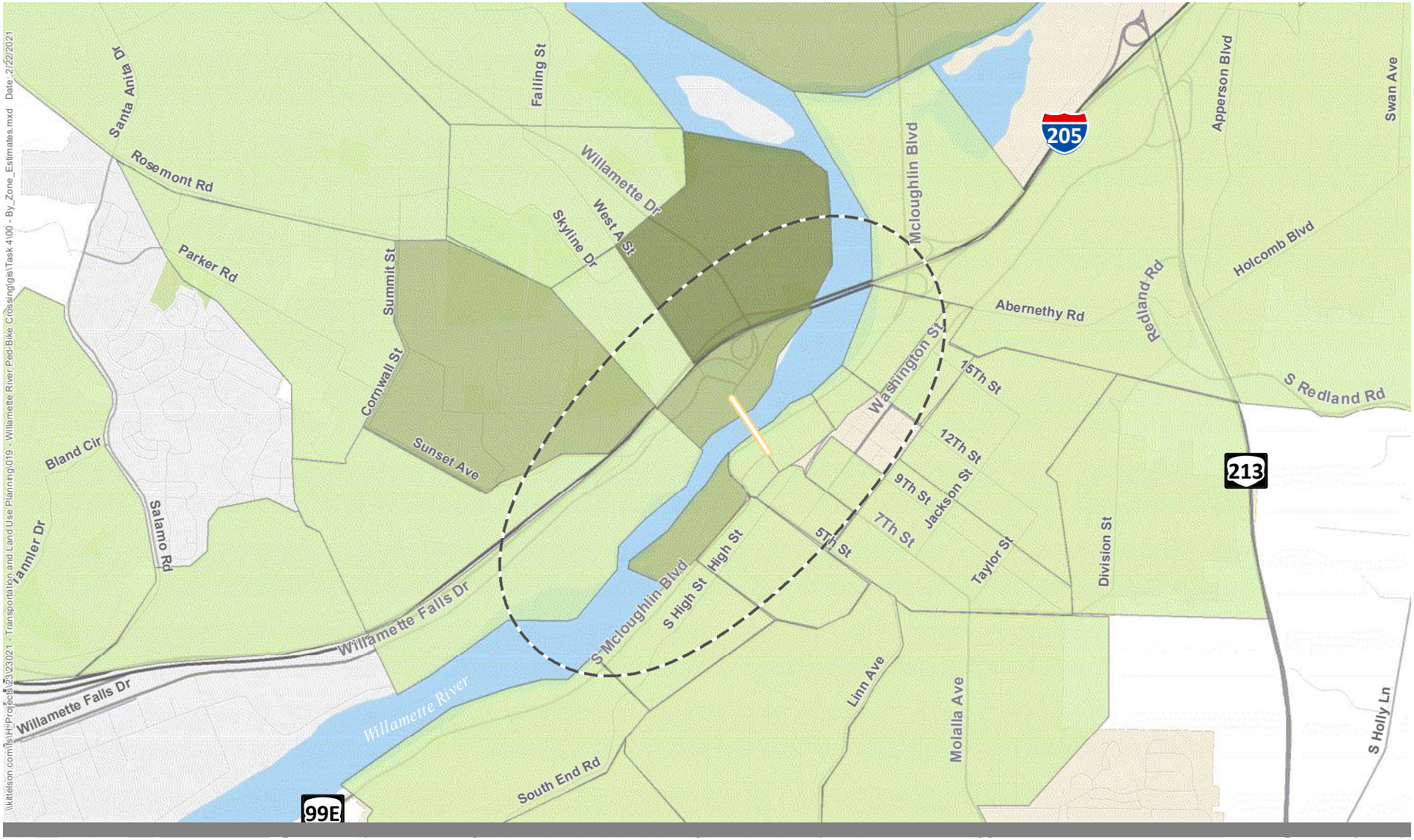


Figure A-3

KITTELSON & ASSOCIATES

Bicycle Trips by Zone - Baseline

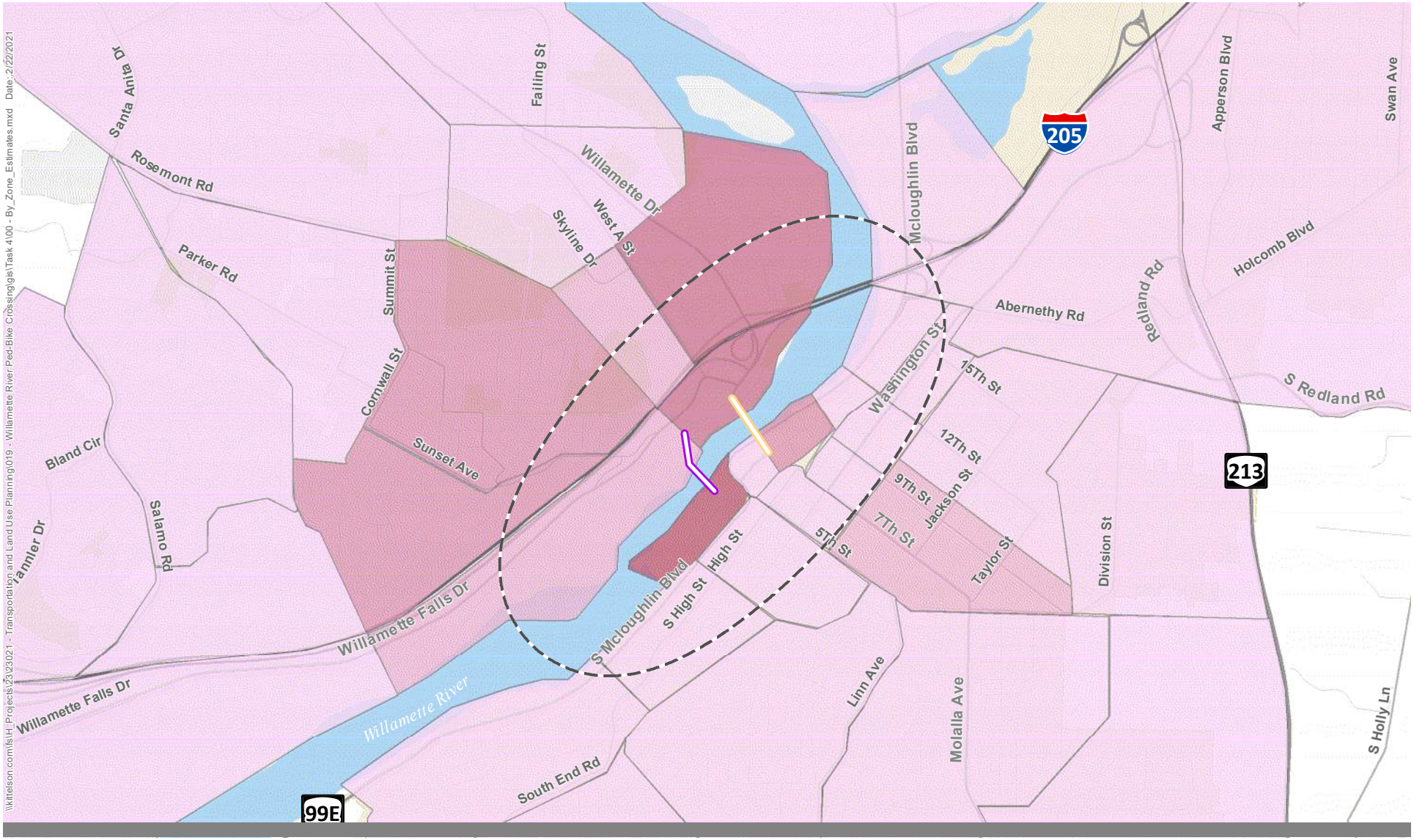


Figure A-4

KITTELSON & ASSOCIATES

Pedestrian Trips by Zone - Alignment 1c

Figure A-5

KITTELSON & ASSOCIATES

Bicycle Trips by Zone - Alignment 1c

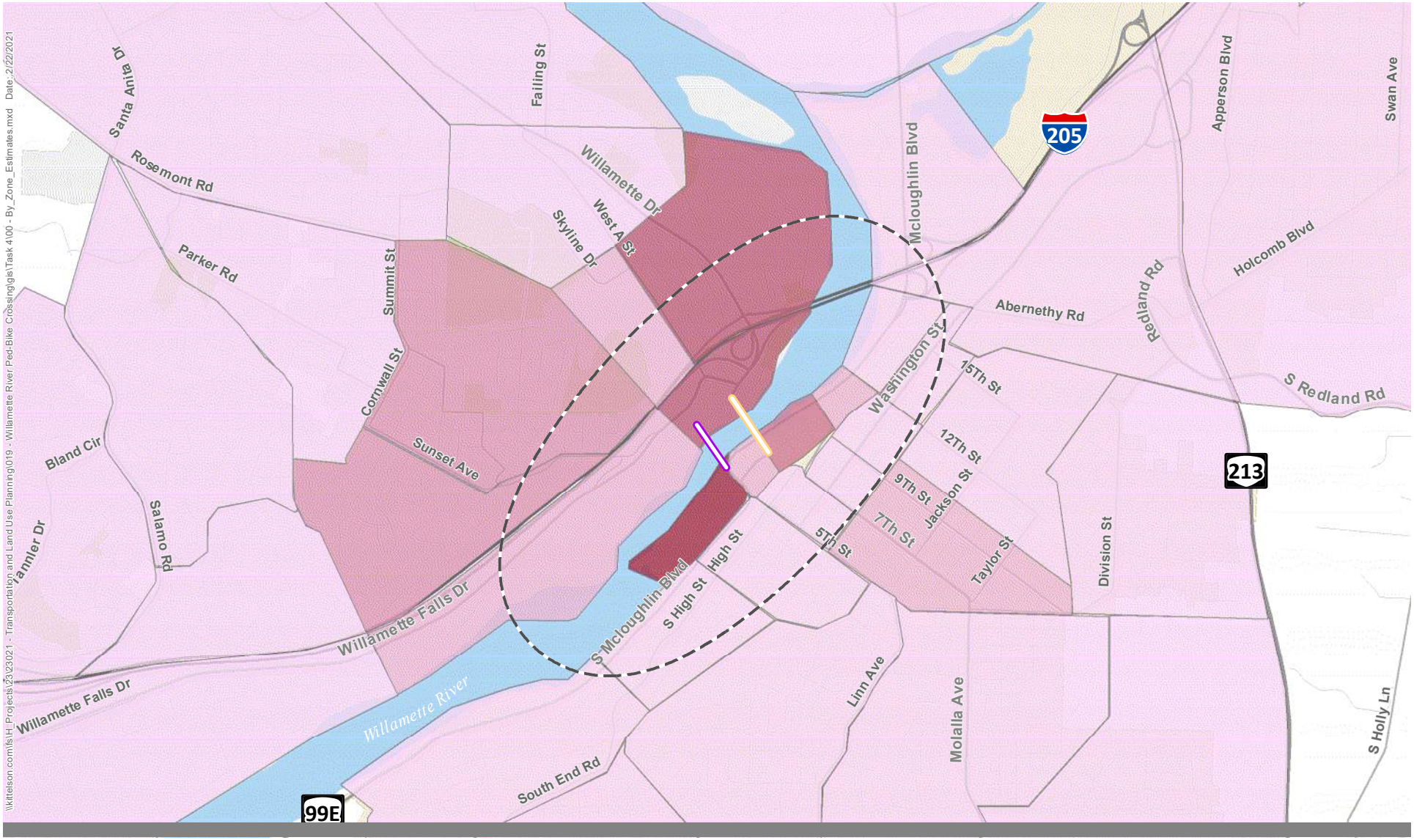


Figure A-6

KITTELSON & ASSOCIATES

Pedestrian Trips by Zone - Alignment 2b

1 - 5
6 - 10
11 - 20
21 - 40
Alignment
Arch Bridge

0 0.5 Miles

Figure A-7

KITTELSON & ASSOCIATES

Bicycle Trips by Zone - Alignment 2b

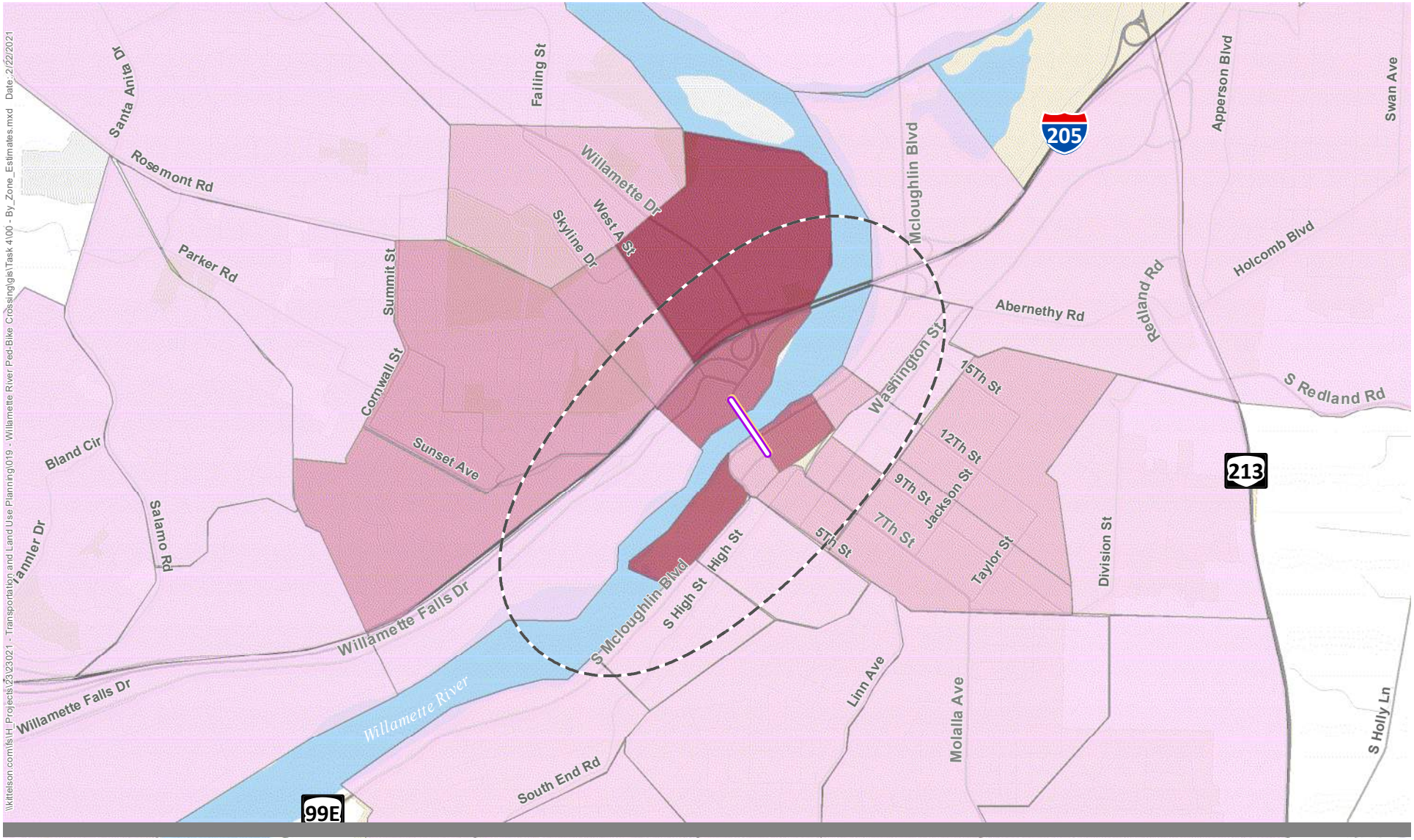


Figure A-8

KITTELSON & ASSOCIATES

Pedestrian Trips by Zone - Alignment 4a

Figure A-9

KITTELSON & ASSOCIATES

Bicycle Trips by Zone - Alignment 4a

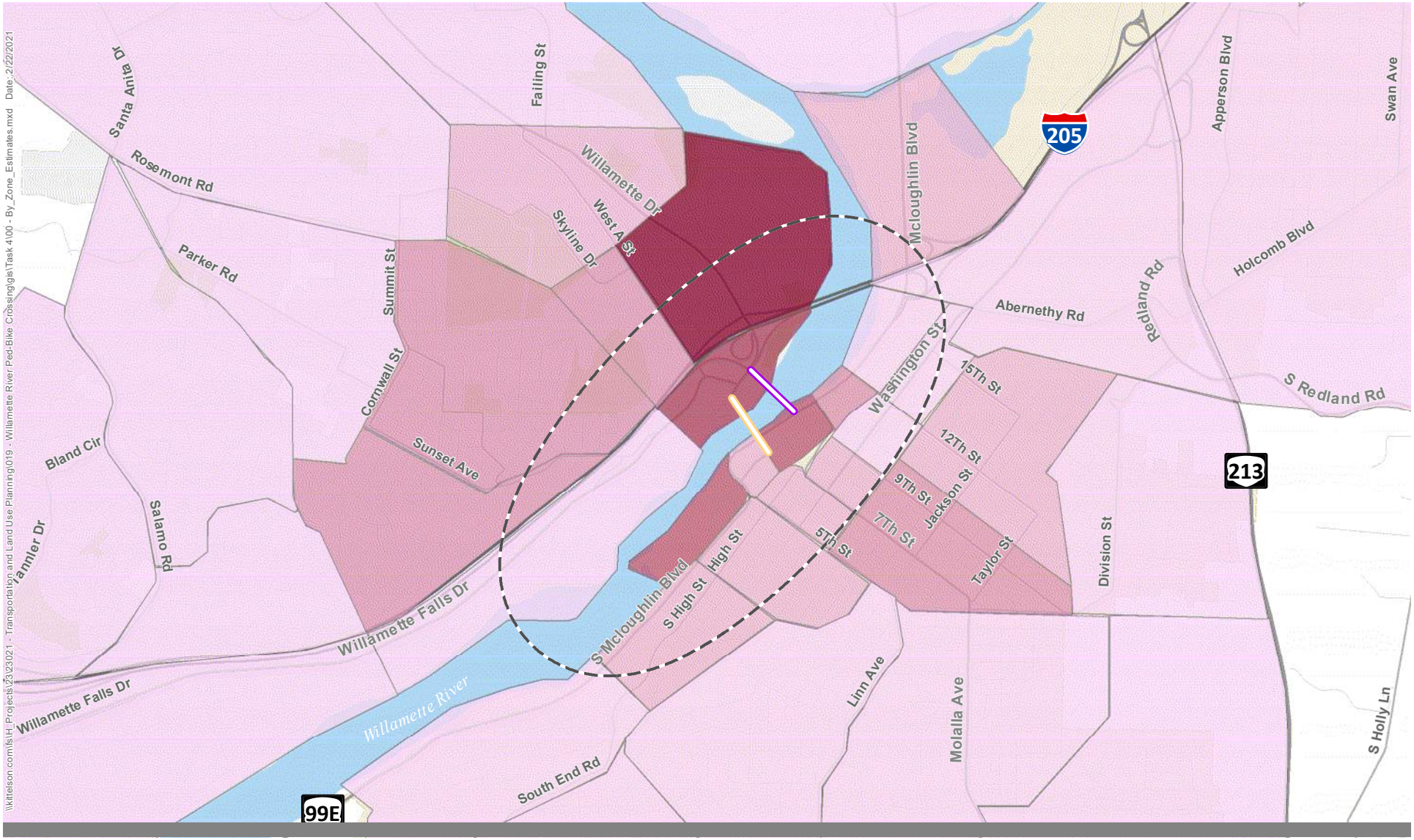


Figure A-10

KITTELSON & ASSOCIATES

Pedestrian Trips by Zone - Alignment 6

Figure A-11

KITTELSON & ASSOCIATES

Bicycle Trips by Zone - Alignment 6

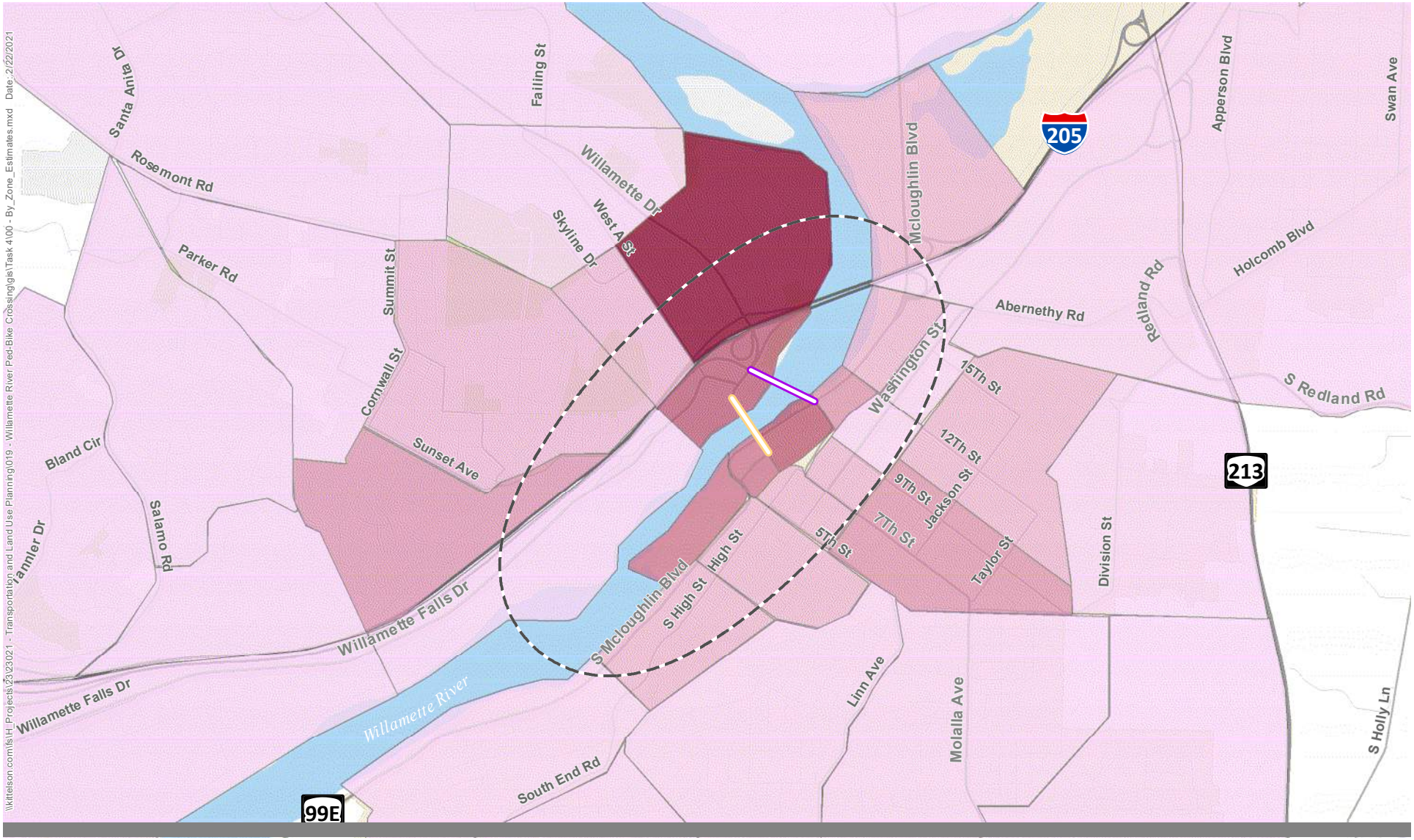


Figure A-12

KITTELSON & ASSOCIATES

Pedestrian Trips by Zone - Alignment 7b

Figure A-13

KITTELSON & ASSOCIATES

Bicycle Trips by Zone - Alignment 7b