CLACKAMAS COUNTY
TRANSIT DEVELOPMENT PLAN

FUTURE SOLUTIONS STRATEGIES

October 13, 2020

CLACKAMAS COUNTY

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TRANSIT DEVELOPMENT PLAN

Date	October 13, 2020
To	Karen Buehrig, Brett Setterfield, Teresa Christopherson, Ellen Rogalin, & Kristina Babcock, Clackamas County Hector Rodriguez-Ruiz, Oregon Department of Transportation
From	Susan Wright, Krista Purser, Paul Ryus, and Russ Doubleday Kittelson & Associates, Inc.
Project	Clackamas County Transit Development Plan
Subject	Draft Future Solutions Strategies Memo (Subtask 4.2)

CLACKAMAS COUNTY

KITTELSON & ASSOCIATES

FUTURE SOLUTIONS STRATEGIES

This memorandum recaps the needs for Clackamas County as identified in the *Needs Identification Memorandum*, describes service types that may address these needs, and begins to identify the service opportunities for each need. These future service opportunities will be evaluated and prioritized based on the evaluation criteria set in the *Goals, Objectives, and Performance Measures Memorandum* and the corridors and recommended transit network identified within this memorandum.

Based on the evaluation criteria and anticipated demands, this memorandum recommends a service model, service span, and service frequency for each opportunity and prioritizes these opportunities for the county. This information will help guide development of the Clackamas County Transit Development Plan (TDP).

Project Purpose

The intent of the Clackamas County Transit Development Plan (TDP) is to guide future transit investments and communicate a connected and coordinated vision for transit service and access to transit within Clackamas County. In particular, the TDP will:

- Guide investments of Statewide Transportation Improvement Fund (STIF) grants by identifying needed and priority connections in portions of the county currently lacking transit service, and
- Identify other actions needed to support transit usage throughout the County.

TDP work will be focused in two areas:

- *Within the Clackamas County portion of the TriMet service area*, the TDP will provide detailed analysis and transit level-of-service information to inform future STIF plans and TriMet service implementation. (Transit planning for areas of the county with other existing service providers [e.g., Wilsonville, Canby, Molalla, Sandy] is addressed in those providers' TDPs, which are reviewed in the *Background Information and Existing Conditions Memorandum*.)
- *In unincorporated areas located between existing service providers and with no current transit service provider*, the TDP will recommend how transit service providers can cover these areas in the future and how existing transit services across the county can be better connected.

Overview

The *Needs Identification Memorandum* identified the new corridors, refinements to existing routes, and service enhancements and efficiency needs for transit in Clackamas County. With this foundation, the *Future Solutions Strategies* memorandum develops future service opportunities to address these needs, along with planning-level capital and operating cost and potential ridership estimates.

This memorandum also reviews the existing and future transit-supportive densities and associated land use policies and code strategies to promote transit use, existing and future travel demand corridors for transit service, and bicycle and pedestrian facilities to access transit. This memorandum prioritizes the service opportunities and establishes a recommended transit network.

Needs Identification

Potential needs were identified primarily through evaluation criteria assessments, considerations of gaps identified in previous regional plans, and gaps identified through public involvement and outreach activities. Potential needs have been grouped by service improvement options and include new transit corridors, refinements to existing routes, and service enhancements and efficiencies.

Needs Related to Existing Transit Performance

This section describes the strengths and limitations of transit service in Clackamas County relative to the goals, objectives, and performance measures established in the *Goals, Objectives, and Performance Measures Memorandum*. Most performance measures were assessed for existing conditions and are summarized here.

- **Intercommunity Connections**: The following corridors/locations lack transit service or connectivity:
  - Highway 212 to Damascus and Boring,
  - Damascus–Gresham,
  - Happy Valley–Gresham,
  - Tualatin–West Linn–Oregon City, and
  - Highway 211 between Estacada–Molalla–Woodburn.
- **Communities without Transit Access**:
  - Damascus, Boring, Estacada, Eagle Creek, and Jennings Lodge–Oak Grove–Oatfield lack local transit service.
  - Happy Valley, which is served by TriMet Lines 155 and 156, has service concentrated primarily around Sunnyside Road, with much of the rest of the city having no transit access.
  - Similarly, the Clackamas Industrial Area is served by TriMet Line 33 along Highway 212 but has no last-mile service to the many employers in the area.
  - Estacada and Eagle Creek are served by TriMet Line 30, but portions remain beyond ¼ mile of service.
- **Walking and Bicycling Access**: Key areas lacking pedestrian and bicycle access are rural highways without formal pedestrian and bicycle facilities, or shoulders that can be used as waiting areas and bus pullouts. Focusing improvements on pedestrian and bicycle facilities along highways that have transit service can help improve access to transit in rural areas.

- **Service to Underrepresented Communities**: The following areas with significant or concentrated underrepresented communities also lack existing transit service: Oregon City outskirts, areas around Canby, Eagle Creek, Jennings Lodge–Oak Grove–Oatfield, Happy Valley, and Damascus. Some of these areas could be better served with more local service. Others, such as Eagle Creek, could use a park-and-ride with sidewalk and bicycle access to existing transit stops on Eagle Creek Road.
- **Access to Jobs**: There are few direct connections from Clackamas County to major employment areas in Gresham and Washington County, and a lack of transit connections to the Clackamas Industrial Area and Wilsonville within Clackamas County. Future land use growth near Wilsonville / Stafford, Oregon City, and Damascus/Boring is anticipated to increase transit demand in these areas.
- **Service on Regional Corridors**: There is a lack of service on several regional corridors, including Highway 212 between the Clackamas Industrial Area and Damascus/Boring, Interstate 205 between West Linn and Tualatin/Wilsonville, and Highway 211 between Molalla and Woodburn.
- **Population Served**: Transit-supportive areas without transit include the Clackamas Industrial Area, western West Linn, southern and western Oregon City, Damascus and the Clackamas to Columbia (C2C) Corridor, and southern Canby.
- **Service Span and Frequency**: Weekday service every 30 minutes or better is provided by 84% of all transit routes in the county, while 63% of all transit routes in the county provide service at least 12 hours a day on weekdays. Not much weekend service is provided on intercommunity routes outside the TriMet district, especially on Sundays.
- **Service Hours per Capita**: Increases to service span, service frequency, or both can help improve transit service levels to residents of rural Clackamas County. Additionally, increased transit service in urban areas can raise Clackamas County service levels closer to those of neighboring Washington and Multnomah counties.
- **System Ease of Use**: There is no common fare system or fare reciprocity across Clackamas County transit providers, and few providers use real-time vehicle arrival technology. Improving the ease of fare payment and providing information such as real-time vehicle arrivals can improve the riding experience for existing riders and can also attract new riders. Technology such as automated passenger counters provides useful information for planning and operating service.

New Corridors

Potential needs for new transit corridors were identified primarily through evaluation criteria focused on intercommunity connections, communities with transit access, service for underrepresented communities, access to jobs, service on regional corridors, and population served. As shown in Table 1, nearly all of these needs were identified based on more than one evaluation criterion as well as other regional planning efforts and public outreach and feedback. Several of these needs could be addressed with one new service. For example, Damascus and Boring lack both local service and intercommunity connections. A new service between these and other communities might address the needs for local travel as well as regional connections. Table 1 also identifies the primary transit district where the corridor is located, or notes N/A where a corridor extends between multiple transit districts.

Addressing these needs will require considering the type of transit service best suited to the need. Many needs can be met through traditional fixed-route local or intercity services. However, other needs have markets, such as commuters/employment and lower-density communities, that may better benefit from other types of services, such as commuter shuttles, last-mile shuttles, or vanpools. These considerations are addressed later in this memorandum in the *Future Service Opportunities and Prioritization* section.

The needs in some new corridors could be met by extending or modifying existing routes. Potential extensions are considered in the *Refinements to Existing Routes* section, below.

Table 1. New Corridor Needs

Service Type	Transit District	Potential Service	Intercommunity Connections	Communities with Transit Access	Underrepresented Communities	Access to Jobs	Service on Regional Corridors	Population Served	Identified in TriMet/Metro Plan	Public Outreach
New Regional Connections	N/A	Damascus and Boring on Highway 212 and/or Sunnyside	X			X	X			X
	N/A	Estacada, Molalla, and Woodburn on Highway 211	X				X			
	N/A	Estacada, Redland, and Oregon City							X	
	TriMet	Tualatin, West Linn, and Oregon City on I-205	X			X	X	X	X	X
	TriMet	West Linn, Lake Oswego, and Washington County							X	X
	TriMet	Enhanced Transit Corridors on Cesar Chavez and 82nd Avenue			X				X	
	TriMet*	Damascus, Happy Valley, and Gresham on the future C2C Corridor	X			X	X	X	X	
New Local Service	TriMet*	Damascus		X	X	X				
	TriMet*	Boring		X		X				
	TriMet	Estacada and Eagle Creek		X	X					
	TriMet	Clackamas Industrial Area		X		X		X	X	
	TriMet	Jennings Lodge–Oak Grove–Oatfield		X	X					
Additional Transit Service	TriMet	Happy Valley		X	X				X	
	TriMet	Oregon City			X	X		X	X	X
	CAT	Canby			X			X		
	SMART	Wilsonville				X				

*Planned to be added to TriMet district in future.

Refinements to Existing Routes

Potential needs for new service areas may be addressed by refinements to existing routes, which could include:

- Extending the Mt. Hood Express from Sandy along Highway 212 to connect Damascus, Boring, and the Clackamas Industrial Area to Clackamas Town Center.
- Extending TriMet Line 87 along the future C2C Corridor on SE 172nd Avenue and SE 190th Avenue, to connect Damascus, Happy Valley, and Gresham.
- Extending TriMet Lines 155 or 156 to Damascus via Sunnyside Road and serving more of Happy Valley north of the existing service area.
  - TriMet's Southeast Service Enhancement Plan identifies extending Line 155 to 172nd Avenue and plans to increase service on Line 156.

- Modifications to TriMet Lines 32, 33, or 99, or SCTD's Molalla to CCC route could serve additional areas in Oregon City. (*Note: the Oregon City First/Last-Mile Shuttle is expected to meet some of these needs and is anticipated to be implemented by the end of 2020.)*
- Generally, route modifications can provide additional connections to/from:
  - Employment areas
  - Food banks, homeless shelters, and other social services
  - Medical facilities
  - Human service agencies
  - Retirement and assisted living centers
  - Affordable housing, such as those funded through the Metro Affordable Housing Bond (Fuller Street Station at 9608 SE Fuller Rd, Happy Valley; Maple Apartments at 14338 S. Maple Lane Ct, Oregon City, and Good Shepard Village at12596 Se 162nd Ave, Happy Valley)

Service Enhancements and Efficiencies

Potential needs for service enhancements were largely identified through the service span and frequency, service hours per capita, walking and bicycling access, and system ease of use evaluation criteria. These include the following:

- Adding weekend service to locations that are not currently served on weekends.
- Increasing route frequencies to locations where there are higher proportions of passenger vehicle trips compared to one-way transit trips.
- Providing bus service earlier in the morning and later in the evening on all transit routes.
- Improving coordination between transit providers, especially in such areas as system integration, fares, timetables, transportation planning efforts, and trip planning applications.
- Increasing schedule reliability and efficiency through coordination between transit providers.
- Making transit easier to access via online tools and public information campaigns.
- Improving access to/from and within transit stops and bus terminals.
  - These improvements can also alleviate the need for local transit service in communities for those able to walk or bike to transit stops.
  - For example, bus stop improvements at the intersection of Eagle Creek Road and Highway 211 and sidewalk and bicycle improvements in this vicinity can make for a safer, more comfortable first- or last-mile to SAM's Sandy–Estacada route and TriMet Line 30.
- Improving bus stops with signage, benches, illumination, and/or shelters.
- Working with local jurisdictions to identify potential developer-funded transit sites (e.g., bus stops and related amenities such as sidewalks), especially those serving residential development, employment sites, commercial properties, and/or educational facilities.
- Considering bus-on-shoulder operations or dedicated transit facilities on congested corridors, improving transit travel time and elevating transit as a competitive alternative to driving.

- Implementing formal and informal park-and-ride and bike-and-ride facilities at major transit stops and along rural highways.
- TriMet's Service Enhancement Plan identifies additional route adjustments and additions:
  - A new route connecting Clackamas Town Center, Milwaukie, and Washington Square Transit Center via the Sellwood Bridge.
  - Rerouted Line 79 that eliminates service to Gladstone.
  - A new route between Clackamas Town Center and Oregon City to the west of I-205 that serves Gladstone.
  - A new route between 172nd Avenue and Oregon City that serves Johnson City and Jennings Lodge.
  - Upgrading Line 35 on Highway 43 to a frequent service route.
  - A new route on Rosemont Road between Lake Oswego and West Linn.

Transportation Demand Corridors and Transit Network

This section describes existing and future transportation demands within Clackamas County, including travel demand on regional corridors, commute demands between communities, and population and employment densities throughout the county. This information helps provide an initial prioritization of the identified needs on a corridor level. The resulting recommended transit network will be used in conjunction with the evaluation criteria to refine and prioritize future service opportunities.

Transit Market Land Use Guidelines

Public transportation service is generally designed to be compatible with the surrounding land use context and development intensity, which are often measured using population and employment densities. Higher residential densities reflect the presence of greater numbers of potential riders, while activity centers are destinations that people need to get to and from on a regular basis. Setting development density guidelines gives transit providers quantifiable benchmarks that they can use to most efficiently target public transportation resources to areas where there is the greatest likelihood that people will choose to use transit.

Transit service can be categorized into the following types:

- **Regional or intercity services** typically connect cities, serving relatively few major stops at key activity or employment centers and connecting to local service within each city. Intercity frequency is based on market size and can be scaled to meet demand. The following two sections, *Travel Demand on Regional Corridors* and *Commute Demands on Regional Corridors*, evaluate priorities for regional and intercity services.
- **Local service** provides connections within communities, generally with relatively short stop spacing. Local services can be designed to achieve productivity or coverage, although in practice most transit systems have a mix of these services and strike a balance between these goals. The *Population and Employment Centers* section describes local service needs.
  - **Productivity-oriented services** are relatively high-frequency routes designed to maximize ridership per hour of service. These routes aim to provide quick, convenient trips with high

convenience and mobility to the busiest activity centers and highest concentrations of residences and jobs.

- **Coverage-oriented services** are lower-frequency services typically designed to serve fewer riders over a relatively large area. Service types in this category may provide reliable mobility options to transit-dependent customers not living near transportation corridors. These services may require reservations and/or less direct travel.

Travel Demand on Regional Corridors

This evaluation criterion measures service by number of runs per day. Figure 1 and Figure 2 show the aggregate number of runs on regional corridors compared to average annual daily traffic (AADT). Regional corridors are those with an estimated AADT of 5,000 vehicles per day or more. Traffic volumes were obtained from ODOT's TransGIS tool. (Note that some corridors have higher levels of freight traffic or long-distance travel compared to regional passenger vehicle traffic, and that travel on a corridor does not directly correlate to transit demand.) This evaluation provides a high-level assessment of transit availability compared to travel demand.

The corridors that do not provide 10 transit trips per 10,000 AADT include:

- I-205 between Oregon City, West Linn, and Tualatin, as well as between Oregon City and Clackamas Town Center
- Highway 211 between Molalla, Estacada, and Woodburn (short segment overlapping Molalla to Canby service)
- Highway 212 between Rock Creek Junction, Damascus, and Boring
- Highway 213 between Molalla and Silverton
- Highway 224 between Milwaukie and I-205
- Clackamas to Columbia Corridor (C2C) from Damascus to Gresham

Detailed breakdowns for transit trips on regional corridors are included in *Appendix A*.

Commute Demands on Regional Corridors

This section evaluates commute demands between major cities in Clackamas County and compares these demands to existing transit service. This information is largely based on Longitudinal Employer–Household Dynamics (LEHD) employment data from the U.S. Census Bureau. This dataset provides valuable information about where workers live and work. This information was assessed in the *Background Information and Existing Conditions Memorandum* and is summarized here. Detailed information about commute demands is provided in Appendix A.

Because this dataset is generated from administrative records, some work locations may be over- or underrepresented. For example, if workers in Portland have their paychecks processed with an address in Salem, their job site may be recorded as Salem instead of Portland, if no local address is given in the administrative data. All data in this section are from 2017, which is the most recent year with complete data.

Several cities were evaluated, including Canby, Estacada, Happy Valley, Molalla, Oregon City, Sandy, West Linn, Lake Oswego, and Wilsonville. Small cities and unincorporated communities, such as Mt. Hood Village, would also contribute to regional commute demand but were not included in this analysis. Additionally, the evaluated data only include the top ten work and home locations for employees and

does not encompass all commutes. As such, this analysis reflects a high-level review of commute demands.

The data were assigned to the regional corridors shown in Table 2. For example, a commute pair between Oregon City and West Linn was assigned to Highway 43, while a Molalla and Wilsonville pair was assigned to Highway 211 and I-5: South of Wilsonville.

Table 2, Figure 3, and Figure 4 display these commute pairs by assigned travel corridor. As shown, there are five corridors with 8,000 or more commute trips from the selected cities. These include sections of I-5 and I-205, Highway 99E, and Highway 43, including portions that extend outside of Clackamas County. All of these sections connect to either Portland or Washington County.

Table 2. Regional Commute Demands

Corridor Extents	Commute Demand Sample
I-5: North of I-205 Interchange	12,040
Highway 99E: Oregon City to Portland (Oregon City, Milwaukie)	9,544
Highway 43: Oregon City to Portland (West Linn, Lake Oswego)	9,473
I-5: I-205 Interchange to Wilsonville	8,507
I-205: Oregon City to Clackamas Town Center	8,708
I-205: North of Clackamas Town Center	8,152
I-5: South of Wilsonville	4,130
I-205: Oregon City to I-5 Interchange	4,677
Highway 99E: Oregon City to Canby	3,961
US 26: West of Sandy	3,638
Highway 213: Oregon City to Molalla	1,652
Highway 224: Highway 212 to Estacada	1,158
Highway 211: West of Molalla	999
Highway 212: I-205 to US 26	854
Highway 213: South of Molalla	307
Highway 99E: South of Canby	163
US 26: East of Sandy	126

Note: While I-5 north of I-205 has high commute demands for Clackamas County residents, the majority of this corridor is beyond the County boundary and not explored in-depth in this memorandum.

Figure 5 and Figure 6 compare transit frequency on regional corridors to the commute demand sample in Table 2. Transit frequency has been normalized to every 1,000 commute trips. As shown, a majority of regional travel corridors have 10 or fewer transit runs for every 1,000 commute trips, including:

- I-205: Clackamas Town Center to I-5 Interchange
- Highway 212: Rock Creek Junction to US 26
- Highway 211: West of Molalla
- Highway 213: South of Molalla and Oregon City to Clackamas Community College
- US 26: West of Sandy
- Highway 43: Oregon City to Portland
- Highway 99E: Portland to Canby

The corridors that do have a larger number of transit trips relative to commute trips are typically intercity routes connecting outlying cities to the metro area and providing access to regional resources beyond commute needs. These include US 26 east of Sandy, Highway 99E south of Canby, Highway 212 through the Clackamas Industrial Area, and Highway 213 north of Molalla.

Population and Employment Centers

This section evaluates where existing and projected population and employment densities are located, along with the recommended service type and frequency for these areas. In comparison to previous sections evaluating regional service, this section emphasizes local services that meet first and last-mile travel needs. Table 3 summarizes appropriate transit service types by land use type and density, including typical service models and service frequencies.

Table 3. Local Transit Service Design Guidance Summary

Land Use			Transit	
Land Use Type	Households per Acre	Jobs per Acre	Appropriate Types of Transit	Frequency of Service
Urban Mixed-Use	15+	15+	BRT Rapid Bus Local Bus	10–15 minutes (64+ trips per day)
Neighborhood & Suburban Mixed-Use	6–15	10–15	Local Bus	15–30 minutes (32+ trips per day)
Mixed Neighborhoods	4–6	5–10	Local Bus On-Demand	30–60 minutes or on-demand (16+ trips per day)
Low Density	1–4	2–5	On-Demand Rideshare Volunteer Driver Program	60+ minutes or on-demand (<16 trips per day)

Source: Synthesis of industry standards, including TCRP Report 165: Transit Capacity and Quality of Service Manual, adapted to local context.

The following sections describe population and employment densities throughout Clackamas County used to identify appropriate transit service types and frequencies. Household and employment data were collected from the 2015 and 2040 Metro RTP model for existing and future conditions. The model includes forecasted population and employment based on county- and city-level forecasts prepared by the State of Oregon and Portland State University's (PSU's) Population Research Center. The forecasts are based on historical data from the State and the U.S. Census Bureau and are updated annually.

Population Density

An important factor for transportation planning is the density of developed residential areas, which helps match bus service to the expected number of riders. Figure 7 and Figure 8 show the population density throughout Clackamas County in the years 2015 and 2040 as well as existing transit service runs per day, a proxy for frequency.

Moderate or higher residential density is an indicator of an adequate concentration of population to support reasonably frequent fixed-route transit service. Some areas of higher residential density not currently served by their recommended service frequency in Clackamas County include:

A. Wilsonville's Villebois neighborhood

B. The area north of Kruse Way near Portland Community College
C. Downtown Lake Oswego
D. Jennings Lodge and North Oak Grove around SE River Road
E. Happy Valley centered around Sunnyside Road and to the south
F. Damascus

These locations with higher residential density not currently served at their recommended service frequency are identified with highlighted lettering in Figure 8 and Figure 9.

Employment Density

Understanding job locations and densities is equally important to informing transit service priorities. Figure 10, Figure 11, and Figure 12 illustrate employment densities in Clackamas County in the years 2015 and 2040 as well as existing transit service runs per day, a proxy for frequency.

Moderate or higher employment density is an indicator of an adequate concentration of population to support reasonably frequent fixed-route transit service. Some areas of moderate employment density not currently served by their recommended service frequency in Clackamas County include:

G. Areas of Wilsonville west of I-5
H. Kruse Way and the north shore of Lake Oswego
I. The Milwaukie Industrial Area
J. The Clackamas Industrial Area
K. Damascus

These locations with higher employment density not currently served by their recommended service frequency are identified with highlighted lettering in Figure 11 and Figure 12.

Figure 1. Regional Corridor Service – County Extent

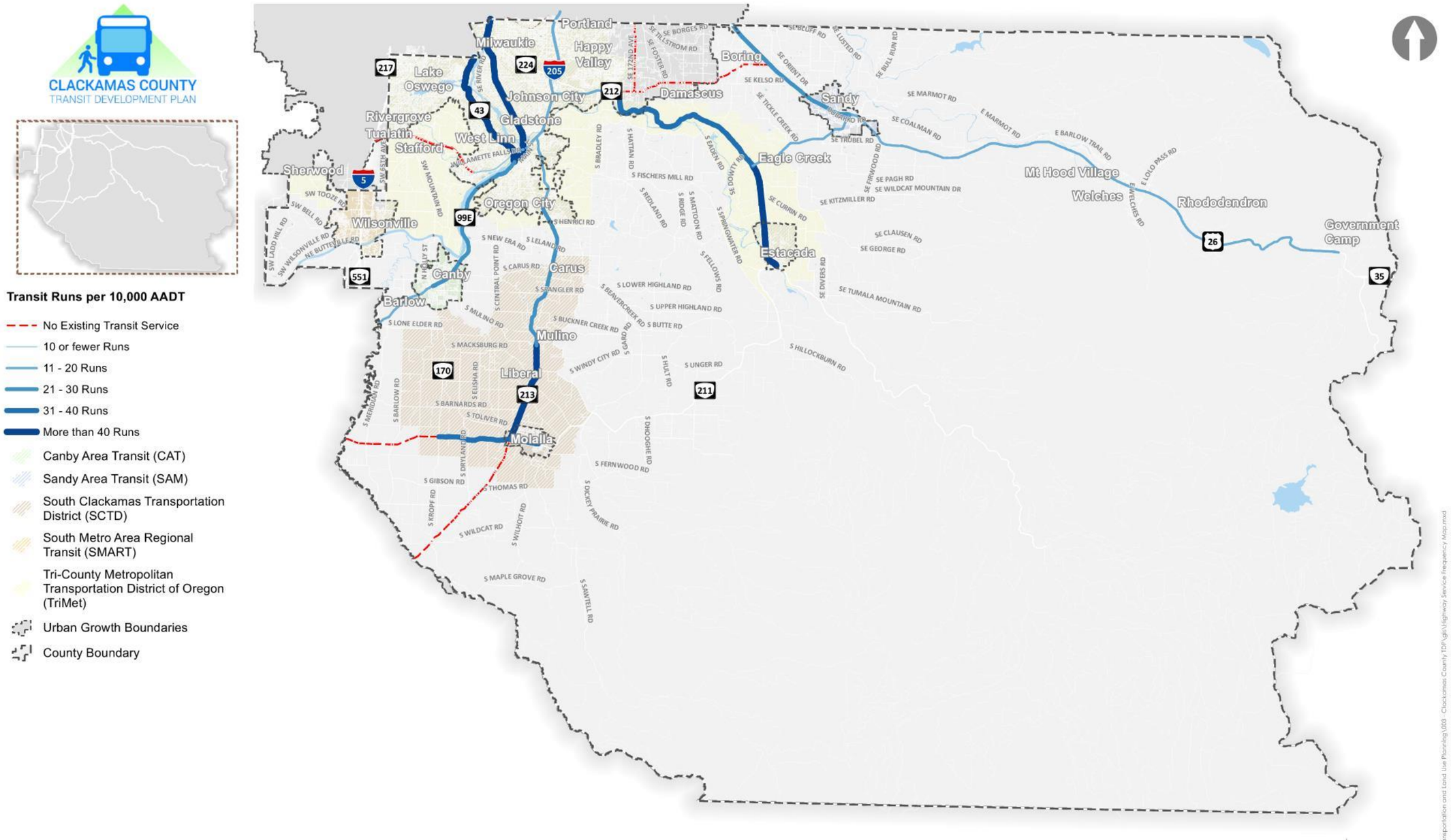


Figure 2. Regional Corridor Service – TriMet Extent

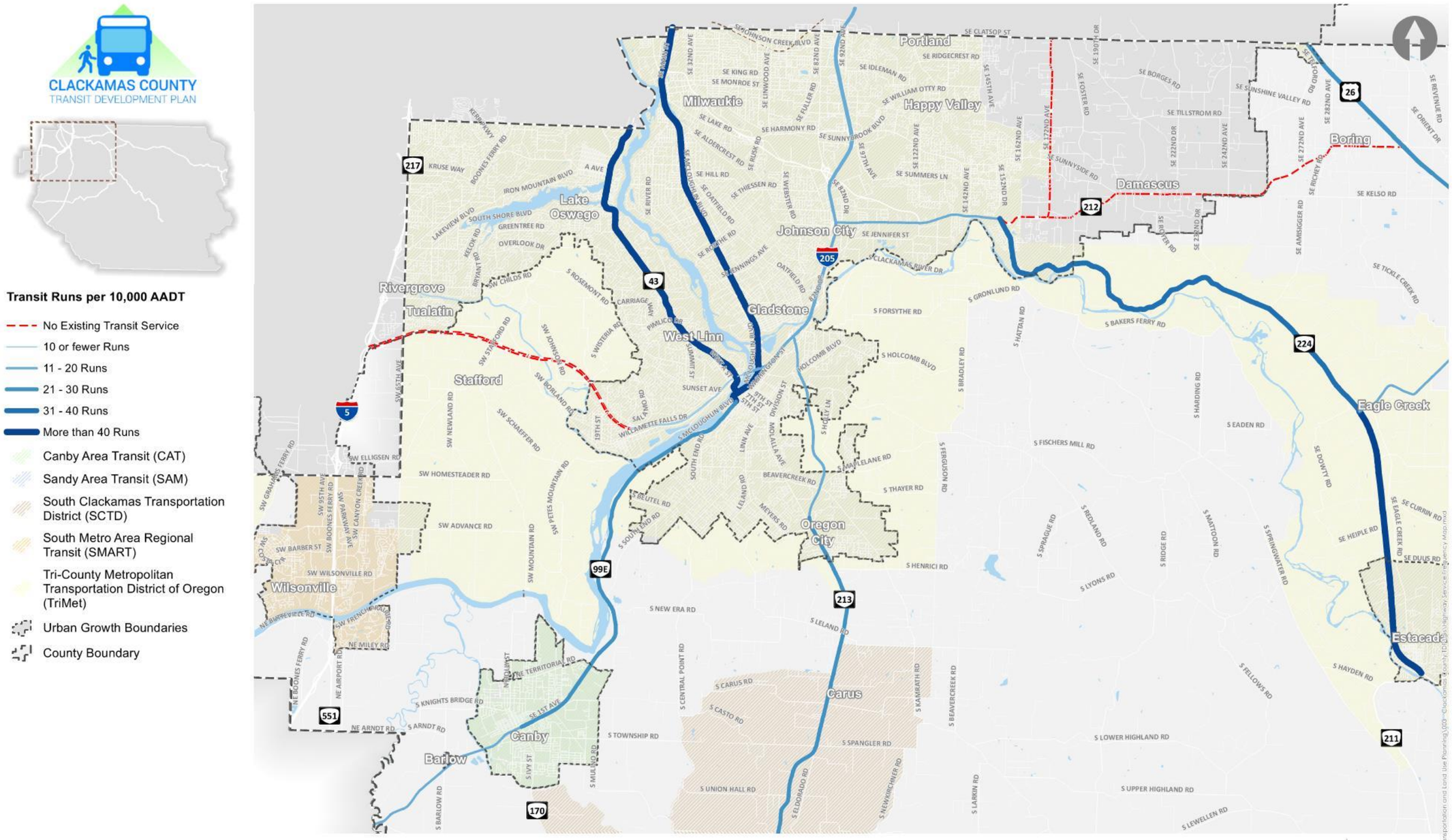


Figure 3. Highway Commute Demand – County Extents

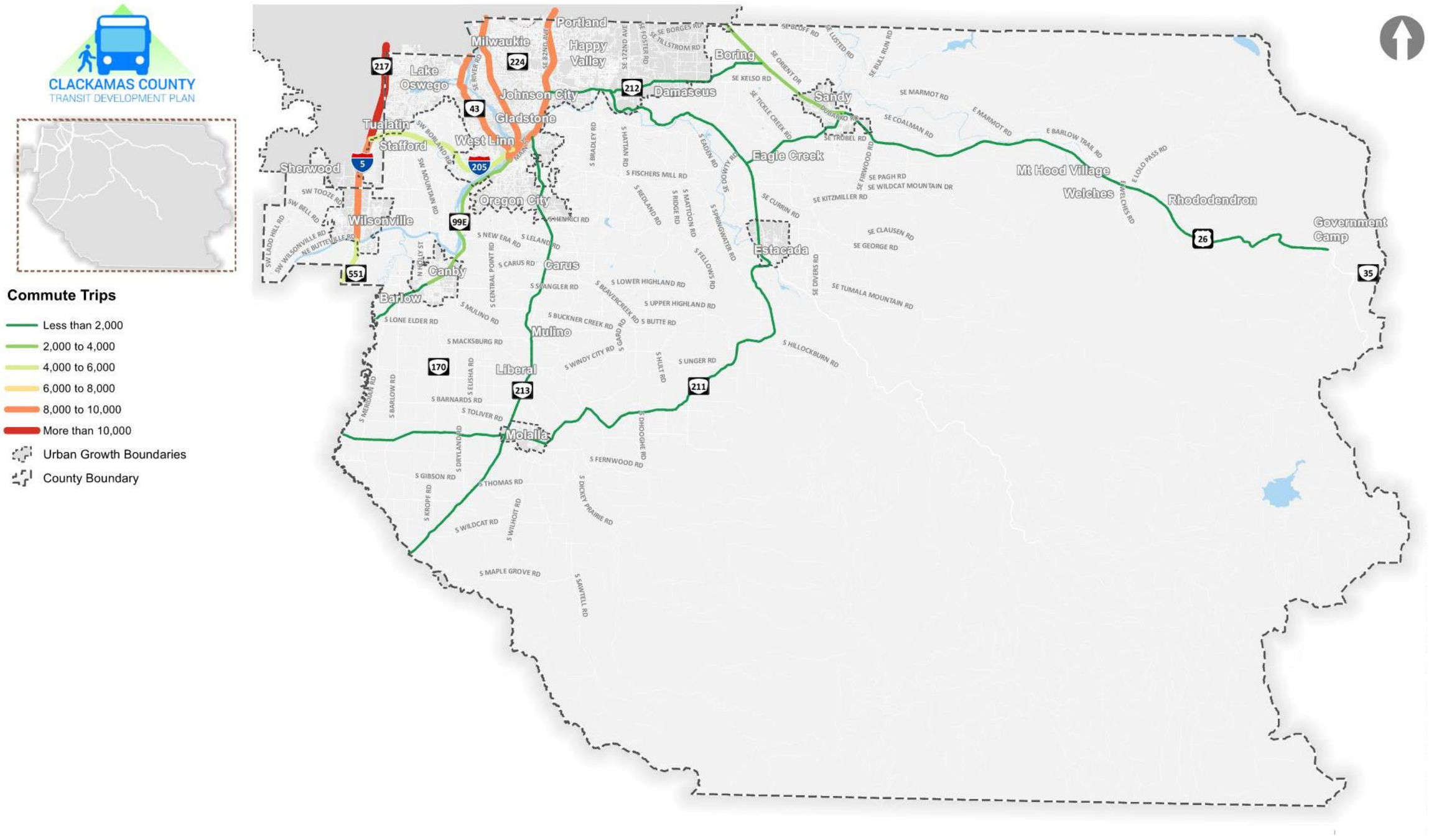


Figure 4. Highway Commute Demand – TriMet Extents

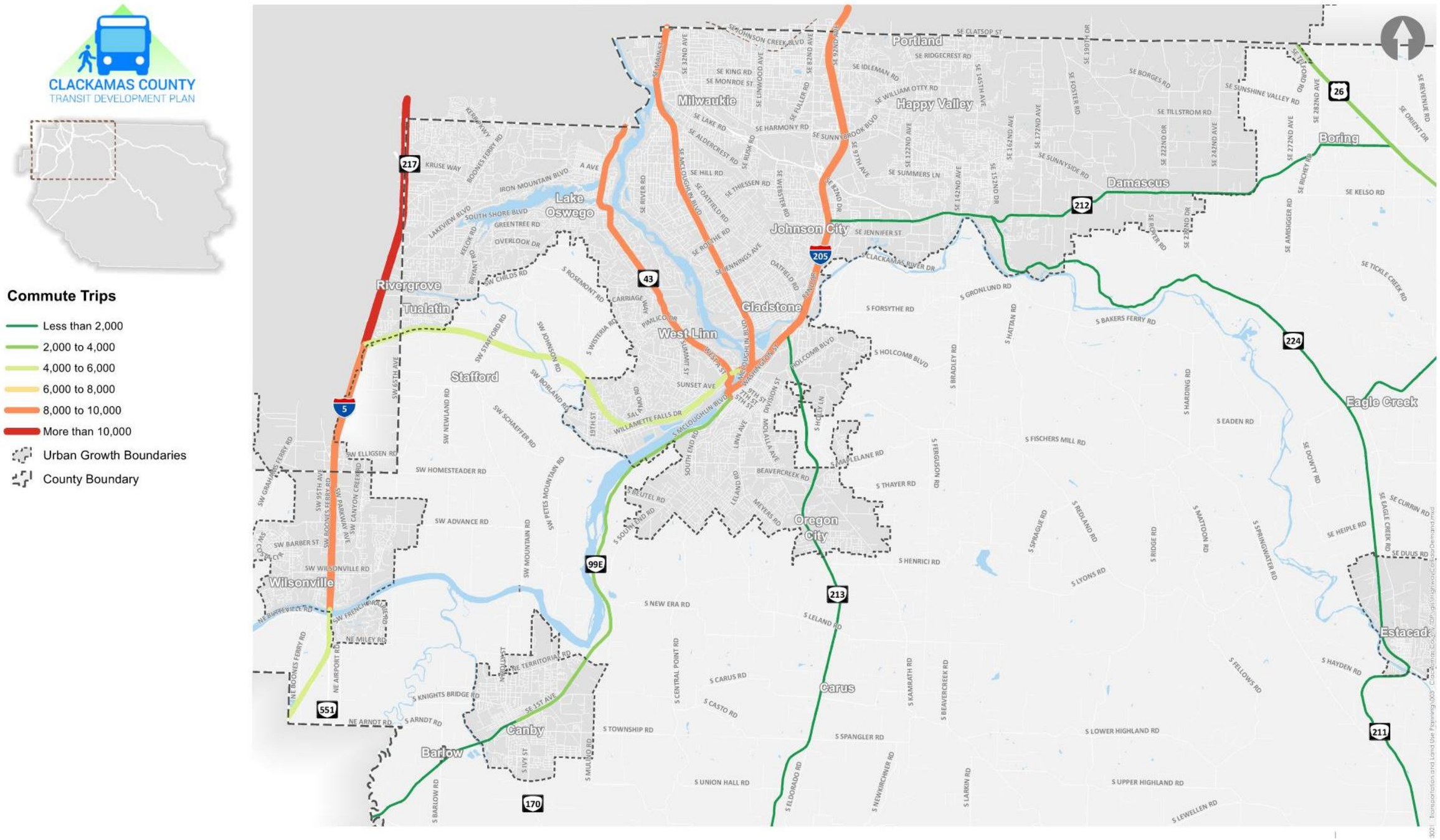


Figure 5. Commute Demand Compared to Transit Frequency – County Extents

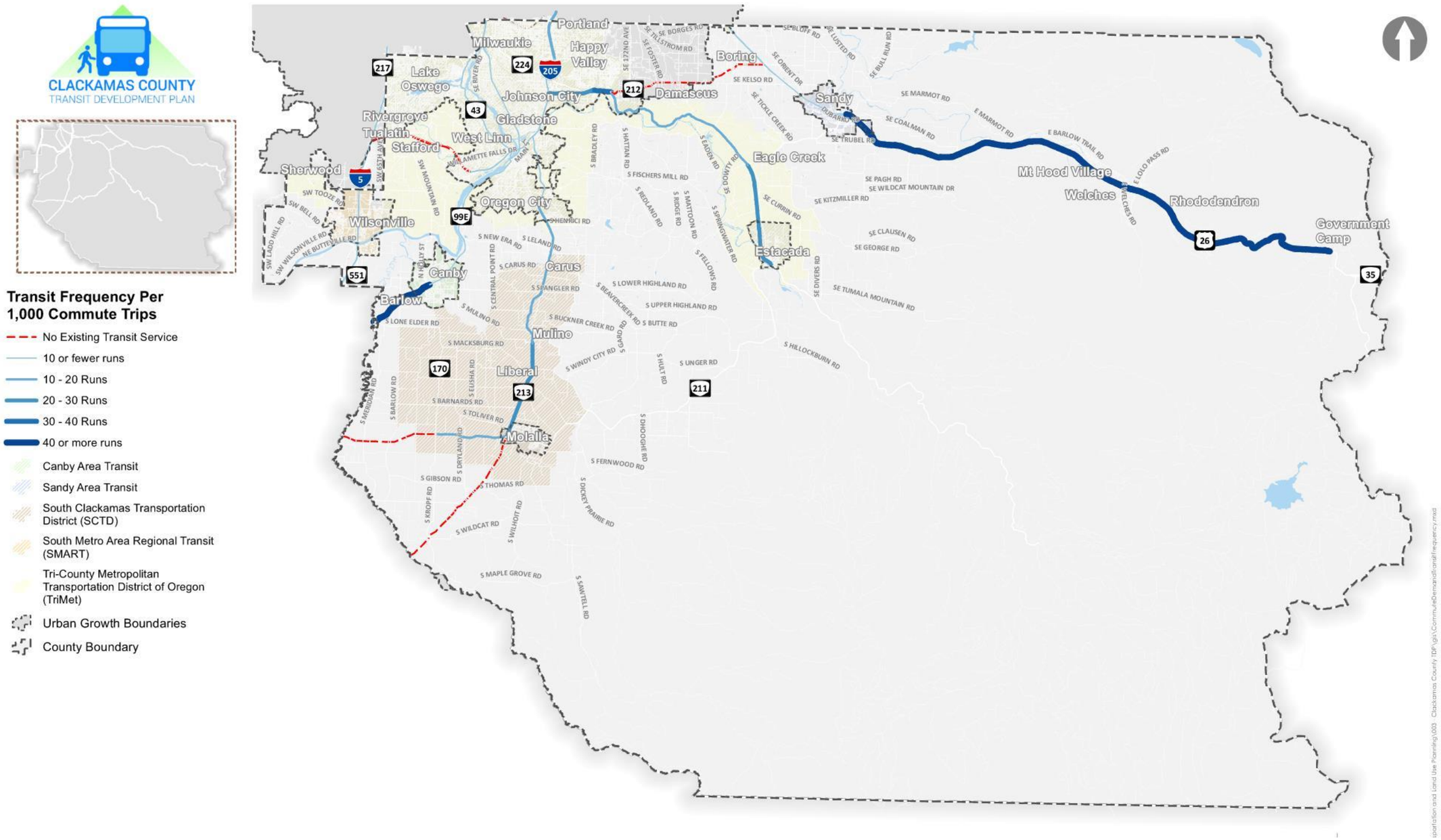


Figure 6. Commute Demand Compared to Transit Frequency – TriMet Extents

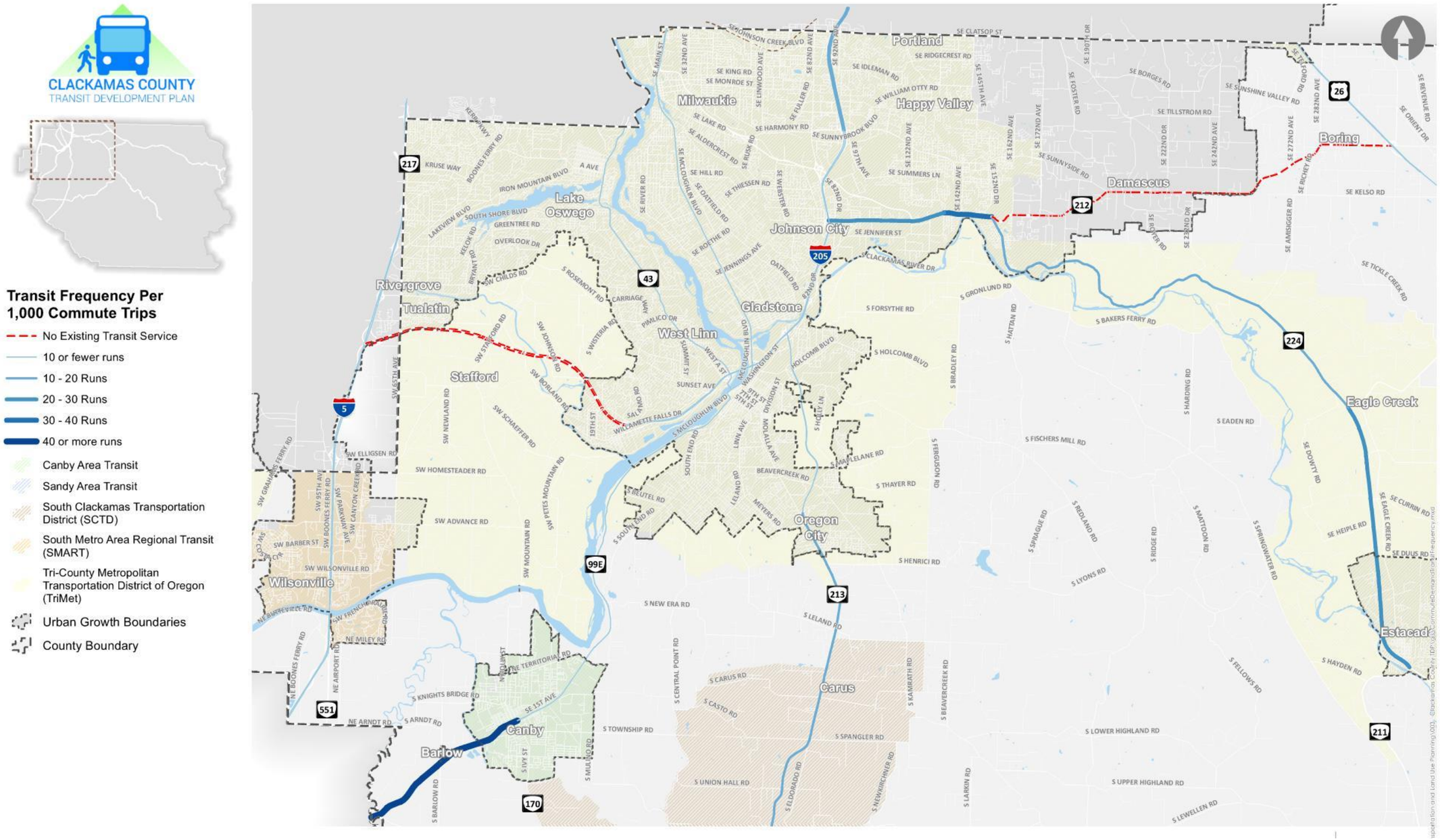


Figure 7. Population Density, 2015 and 2040 – County Extents

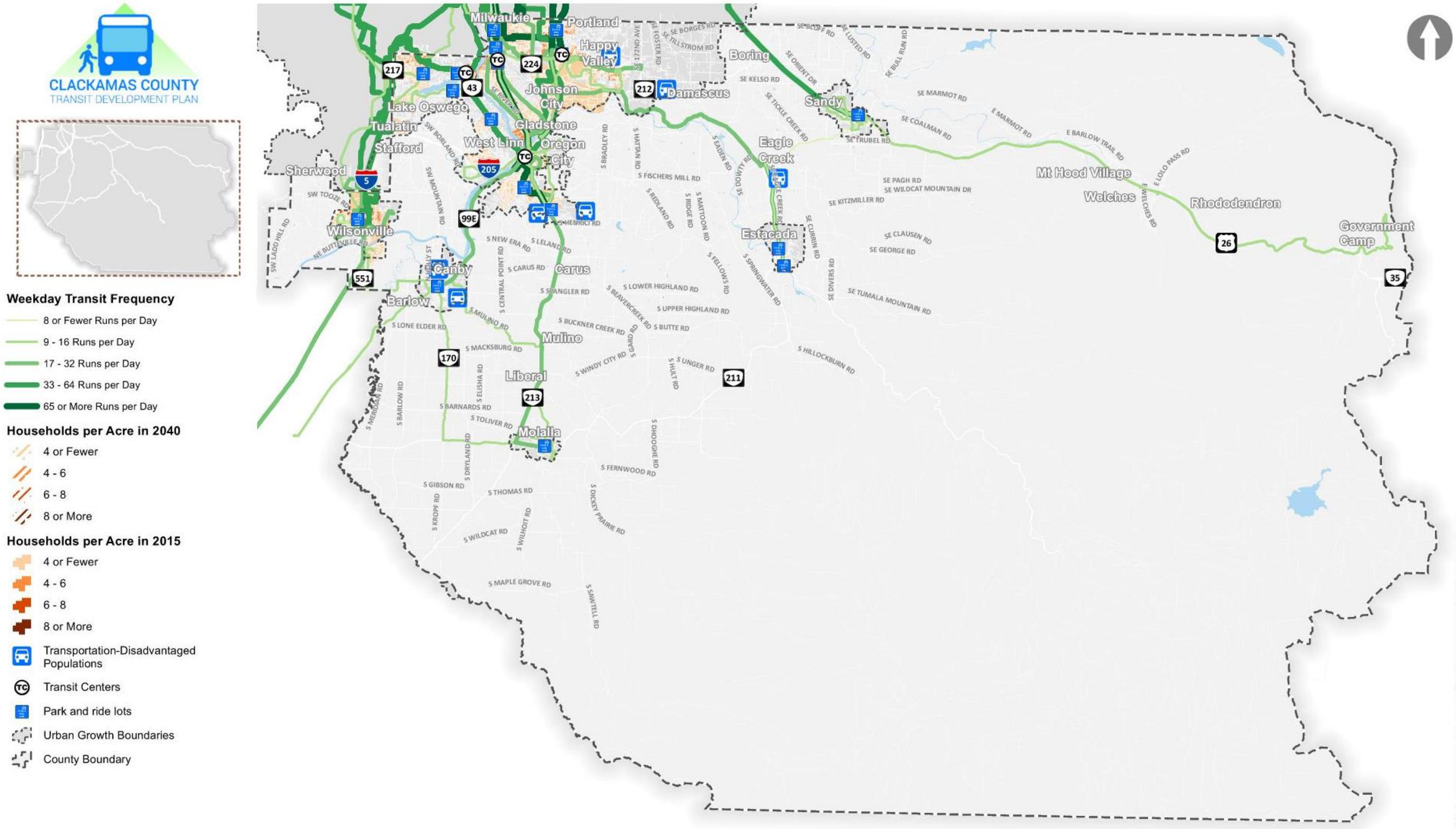


Figure 8. Population Density, 2015 and 2040 – TriMet Extents

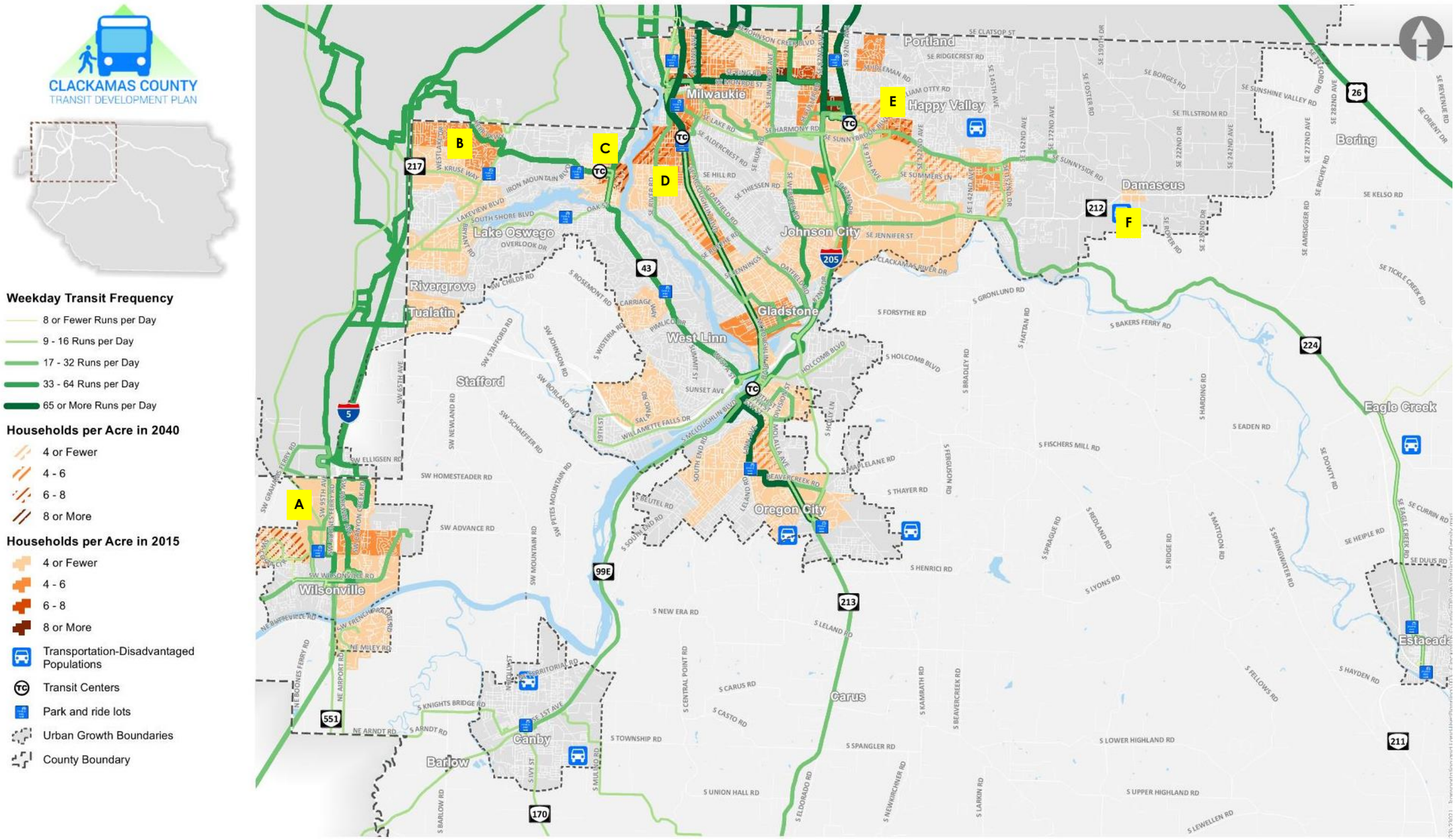


Figure 9. Population Density, 2015 and 2040 – Northwest County Extents

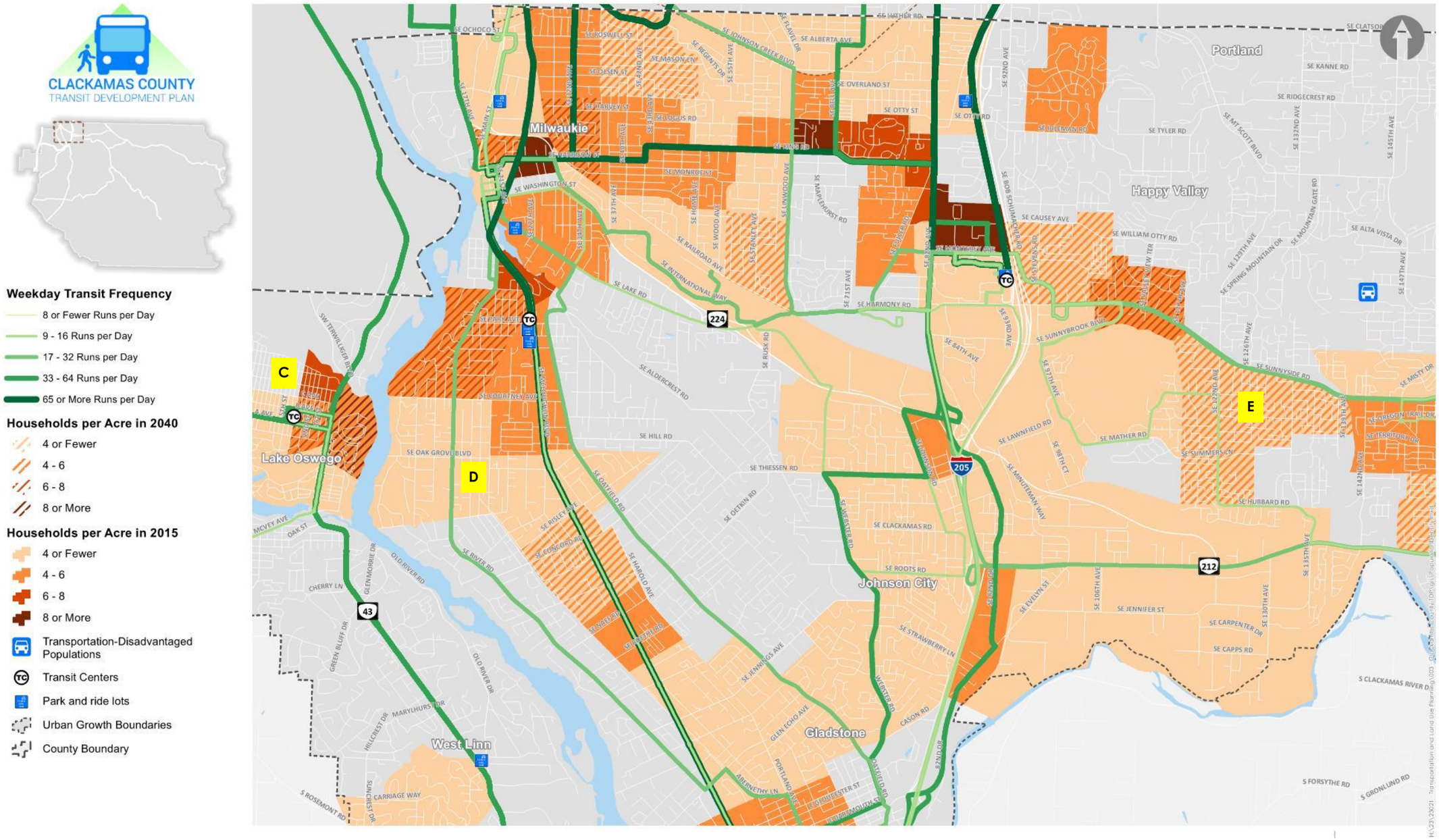


Figure 10. Employment Density, 2015 and 2040 – County Extents

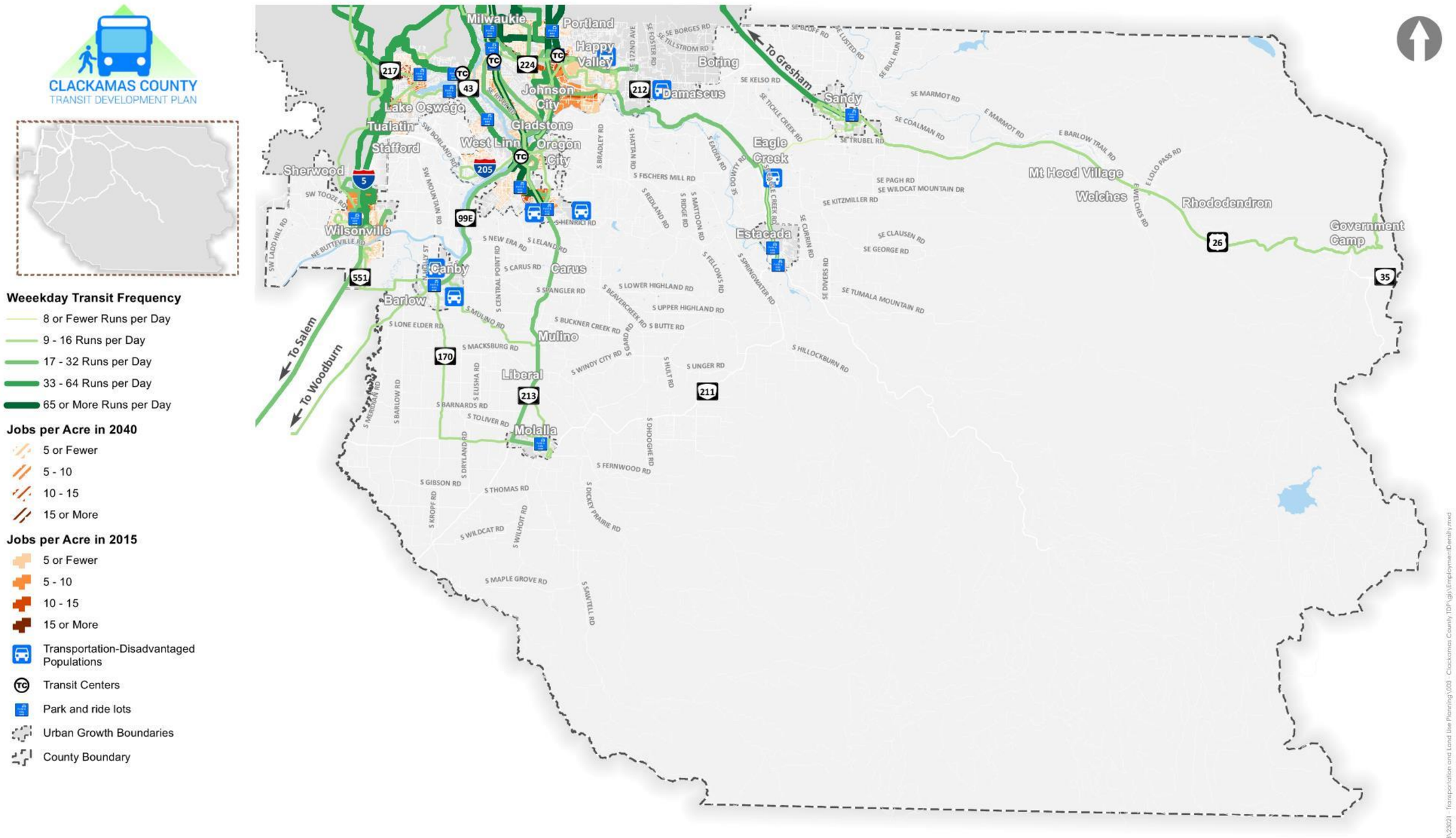


Figure 11. Employment Density, 2015 and 2040 – TriMet Extents

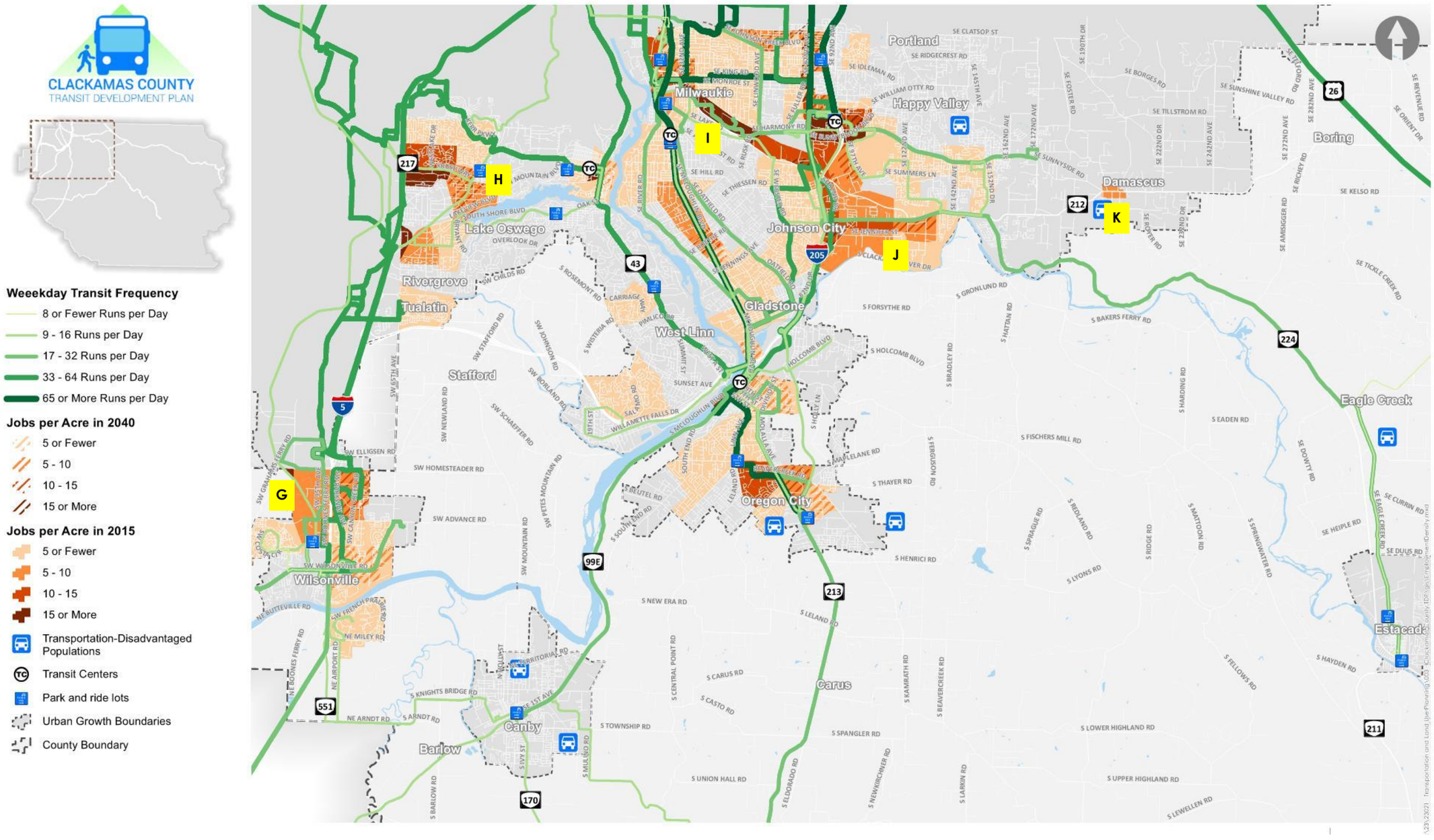
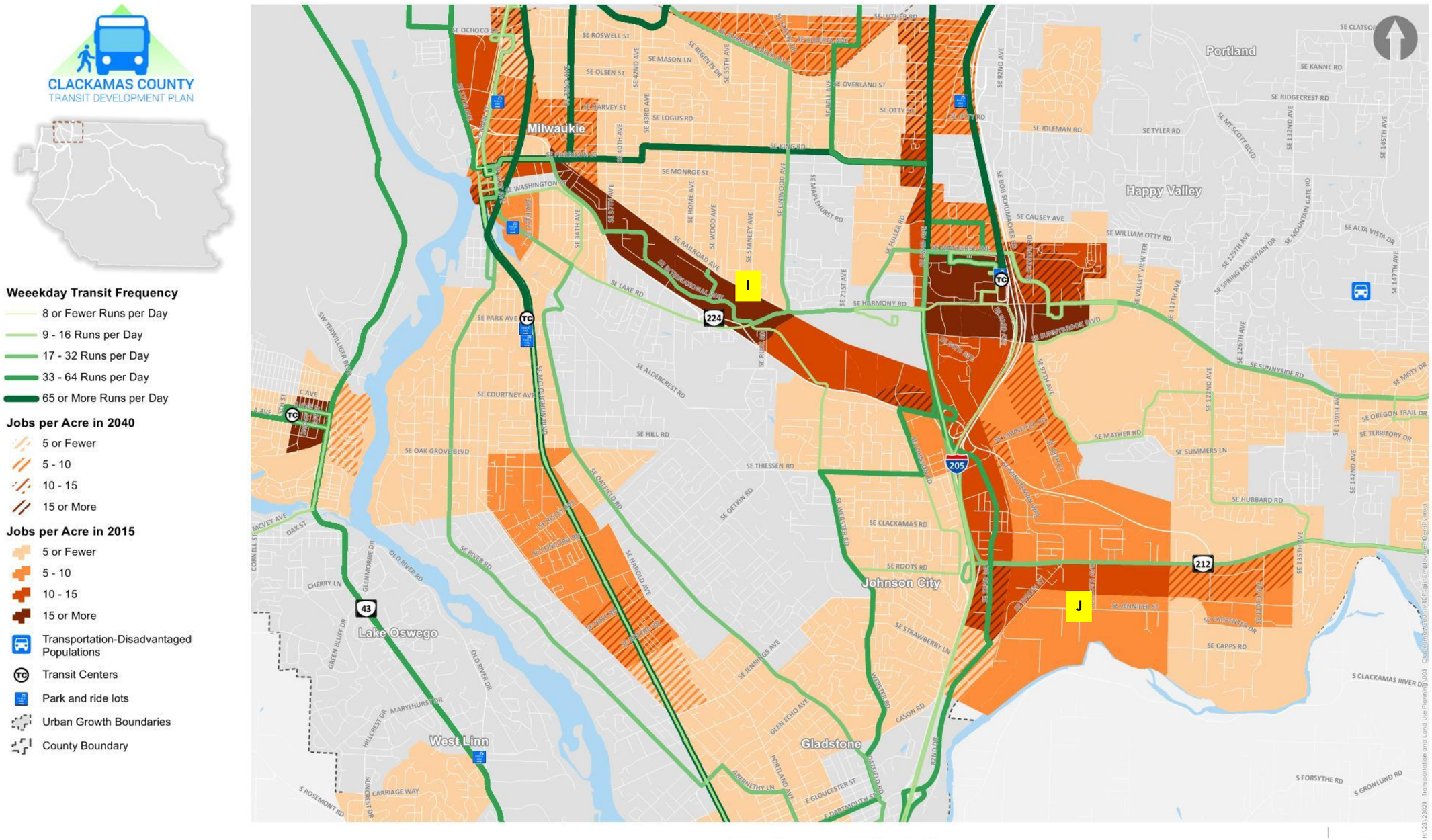


Figure 12. Employment Density, 2015 and 2040 – Northwest County Extents



Transit-Underserved Corridors and Areas

Clackamas County transit providers serve many parts of Clackamas County, offering important mobility to major population and employment centers. However, there remain population and employment centers and regional corridors that are underserved. Table 4 and Table 5 summarize the corridors and areas that do not meet the recommended service frequency compared to the regional and local estimated demand. The largest value is **bolded** to indicate the driving criteria for corridor-level service improvement. Table 5 also notes the areas where underrepresented communities had been identified as being underserved in the *Needs Identification Memorandum*.

Table 4. Transit Demand Corridors

Corridor	Existing Runs per Day	Travel Demand (Additional transit runs to 10 transit runs/10,000 AADT)	Commute Demands (Additional transit runs to 10 transit runs/1,000 commuters)	Land Use Along Corridor	
				Land Use Type	Runs to Meet Land Use Frequency Recommendation
US 26: West of Sandy	33	0	**3**	2015 and 2040: Low Density	0
US 26: East of Sandy	15	0	0	2015 and 2040: Low Density	2015: 0 2040: 0
Highway 43: Oregon City to Portland (West Linn, Lake Oswego)	47	0	**48**	2015 and 2040: Low Density	0
Highway 99E: Oregon City to Portland (Oregon City, Milwaukie)	84	0	**11**	2015: Mixed Neighborhood 2040: Neighborhood & Suburban Mixed-Use	0
Highway 99E: Oregon City to Canby	26	0	**14**	2015 and 2040: Low Density	0
Highway 99E: South of Canby	14	0	0	2015 and 2040: Low Density	2015: 0 2040: 0
I-205: Oregon City to Clackamas Town Center	69	0	**18**	2015: Neighborhood & Suburban Mixed-Use 2040: Urban Mixed-Use	2015: 0 2040: 0
I-205: Clackamas Town Center toward Portland	85	0	0	2015: Neighborhood & Suburban Mixed-Use 2040: Urban Mixed-Use	2015: 0 2040: 0
I-205: Oregon City to I-5 Interchange	0	**47**	41	2015 and 2040: Low Density	2015: 16 2040: 16
Highway 211: West of Molalla	0	3	**10**	2015 and 2040: Low Density	2015: 8 2040: 8
Highway 212: I-205 to US 26	0	14	3	2015: Mixed Neighborhoods 2040: Neighborhood & Suburban Mixed-Use	**2015: 0** **2040: 10**
Highway 213: Oregon City to Molalla	24	0	0	2015 and 2040: Low Density	0
Highway 213: South of Molalla	0	3	3	2015 and 2040: Low Density	**2015: 8** **2040: 8**
Highway 224: Highway 212 to Estacada	27	0	0	2015 and 2040: Low Density	0
C2C Corridor	0	**10**	0	2015 and 2040: Low Density	2015: 8 2040: 8
Jennings Lodge and Oak Grove East–West	0	N/A	N/A	2015 and 2040: Mixed Neighborhoods	**2015: 16** **2040: 16**

Table 5. Transit Demand Areas

Area	Land Use Type	Frequency to Meet Recommendation	Additional Runs Needed	Underrepresented Communities
Happy Valley	2015: Mixed Neighborhoods 2040: Neighborhood & Suburban Mixed-Use	2015: 16 runs per day 2040: 32 runs per day	2015: 0 2040: **16 (South of Sunnyside)**	East Happy Valley/ C2C Corridor
Oregon City	2015 and 2040: Neighborhood & Suburban Mixed-Use	32 runs per day	**32**	South Oregon City
Canby	2015 and 2040: Neighborhood & Suburban Mixed-Use	32 runs per day	**16**	North Canby/ South Canby
Wilsonville	2015: Mixed Neighborhoods 2040: Neighborhood & Suburban Mixed-Use	2015: 16 runs per day 2040: 32 runs per day	2040: **8–16 (West Wilsonville)**	
Damascus	2015: Low Density 2040: Mixed Neighborhoods	2015: 8 runs per day 2040: 16 runs per day	2015: **8** 2040: **16**	Damascus
Boring	2015 & 2040: Low Density	8 runs per day	**8**	
Estacada–Redland–Oregon City	2015 & 2040: Low Density	8 runs per day	**8**	Eagle Creek
Estacada and Eagle Creek	2015 & 2040: Low Density	8 runs per day	0	Eagle Creek
Clackamas Industrial Area	2015 and 2040: Urban Mixed Use	64 runs per day	**42**	
Milwaukie Industrial Area	2015 & 2040: Urban Mixed Use	64 runs per day	**31**	
West Lake Oswego/ Kruse Way	2015: Mixed Neighborhoods 2040: Neighbor & Suburban Mixed-Use	2015: 16 runs per day 2040: 32 runs per day	2015: **4** 2040: **20**	
East Tualatin	2015 and 2040: Low Density	8 runs per day	**8**	

Table 6, Figure 13, and Figure 14 show the transit demand corridors and areas by the recommended service level threshold, an estimated prioritization for additional transit service in Clackamas County. For example, Highway 43 between Oregon City and Portland has the highest additional demand at 48 more transit runs to meet recommended thresholds. Conversely, I-205 from Clackamas Town Center toward Portland already has frequent service via the MAX Green Line and is not recommended for increased transit service.

Table 6 also shows the total number of recommended transit runs for each corridor and area, which factors in existing transit service. These values will serve as the basis for the recommended transit network in the next section.

Table 6. Additional Transit Runs to Meet Recommended Service Level Threshold

Corridor or Area	Existing Runs per Day	Additional Transit Run Demand	Total Recommended Transit Runs	Recommended Service Span and Frequency Changes
Highway 43: Oregon City to Portland	47	48	95	Improve headways from 30 minutes to 15 minutes
I-205: Oregon City to I-5 Interchange	0	47	47	Implement service at 20–30 minute headways
Clackamas Industrial Area	22	42	64	Implement local service at 15–30 minute headways
Oregon City (South and West)	0	32	32	Implement local service at 30-minute headways
Milwaukie Industrial Area	33	31	64	Implement local service at 30-minute headways
West Lake Oswego/Kruse Way	12	20	32	Increase service beyond peak periods
I-205: Oregon City to Clackamas Town Center	69	18	87	Improve headways to 15-20 minutes
Wilsonville (West Wilsonville)	16	16	32	Increase service beyond peak periods
Happy Valley (South)	16	16	32	Implement hourly or better service
Canby (North and South)	16	16	32	Implement hourly or better service
Jennings Lodge and Oak Grove East-West	0	16	16	Implement hourly or better service
Damascus	0	16	16	Implement hourly or better service
Highway 99E: Oregon City to Canby	26	14	40	Increase frequency and/or expand operating hours
Highway 212: I-205 to US 26	0	14	14	Implement hourly or better service
Highway 99E: Oregon City to Portland	84	11	95	Increase frequency and/or expand operating hours
Highway 211: Molalla to Woodburn	0	10	10	Implement hourly service
C2C Corridor	0	10	10	Implement hourly service
Highway 213: South of Molalla	0	8	8	Implement hourly service
Boring	0	8	8	Cover with Damascus service
East Tualatin	0	8	8	Cover with I-205 Oregon City to I-5 service
Estacada–Redland–Oregon City	0	8	8	Consider demand-response service
US 26: West of Sandy	33	3	36	Extend service hours
Estacada and Eagle Creek	27	0	27	Cover with Estacada–Redland–Oregon City demand-response
I-205: Clackamas Town Center toward Portland	85	0	85	Monitor needs for potential increases to transit demand
Highway 224: Highway 212 to Estacada	27	0	27	
Highway 213: Oregon City to Molalla	24	0	24	
Highway 99E: South of Canby	14	0	14	
US 26: East of Sandy	15	0	15	

Figure 13. Additional Transit Demand to Meet Recommended Service Level Threshold – County Extents

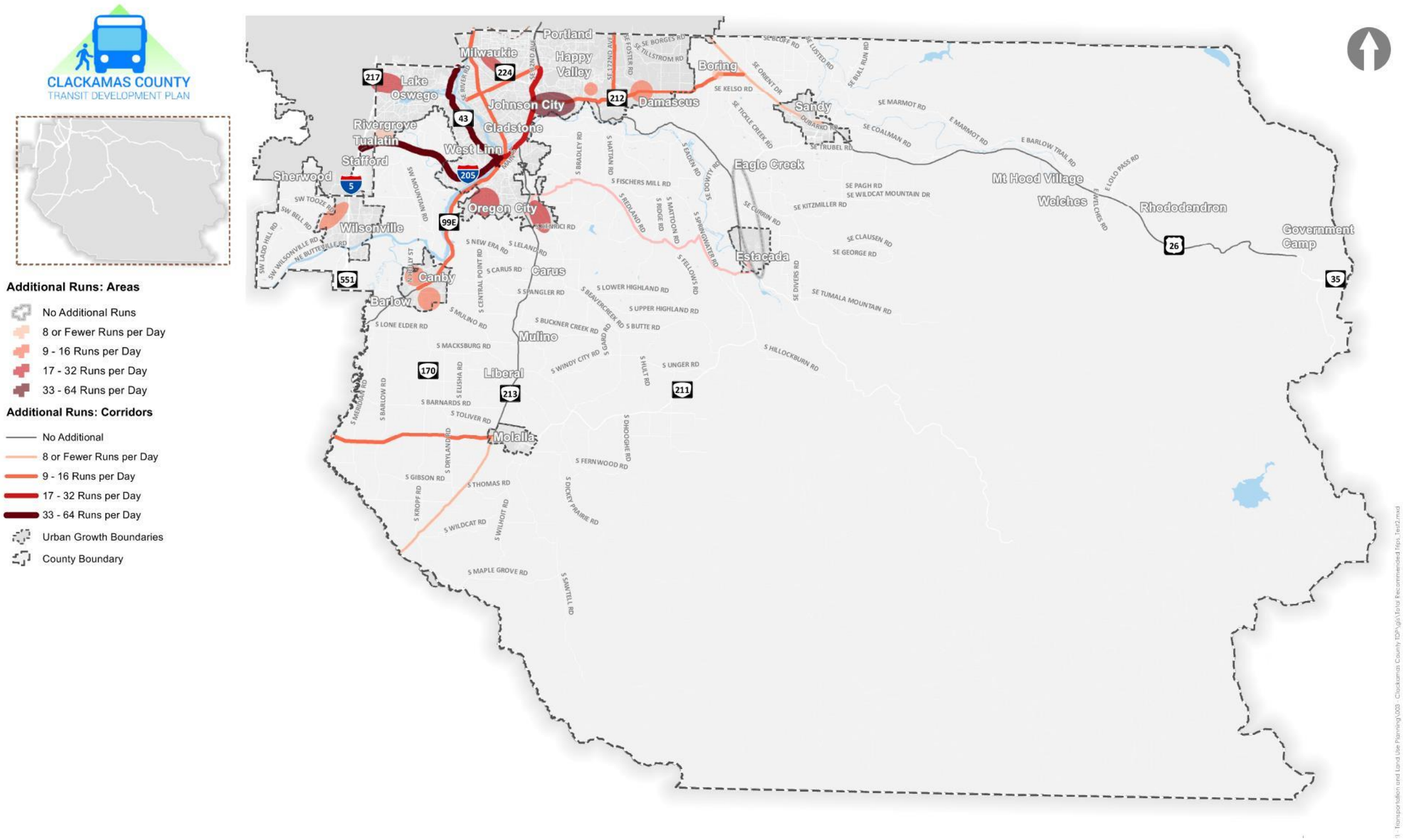
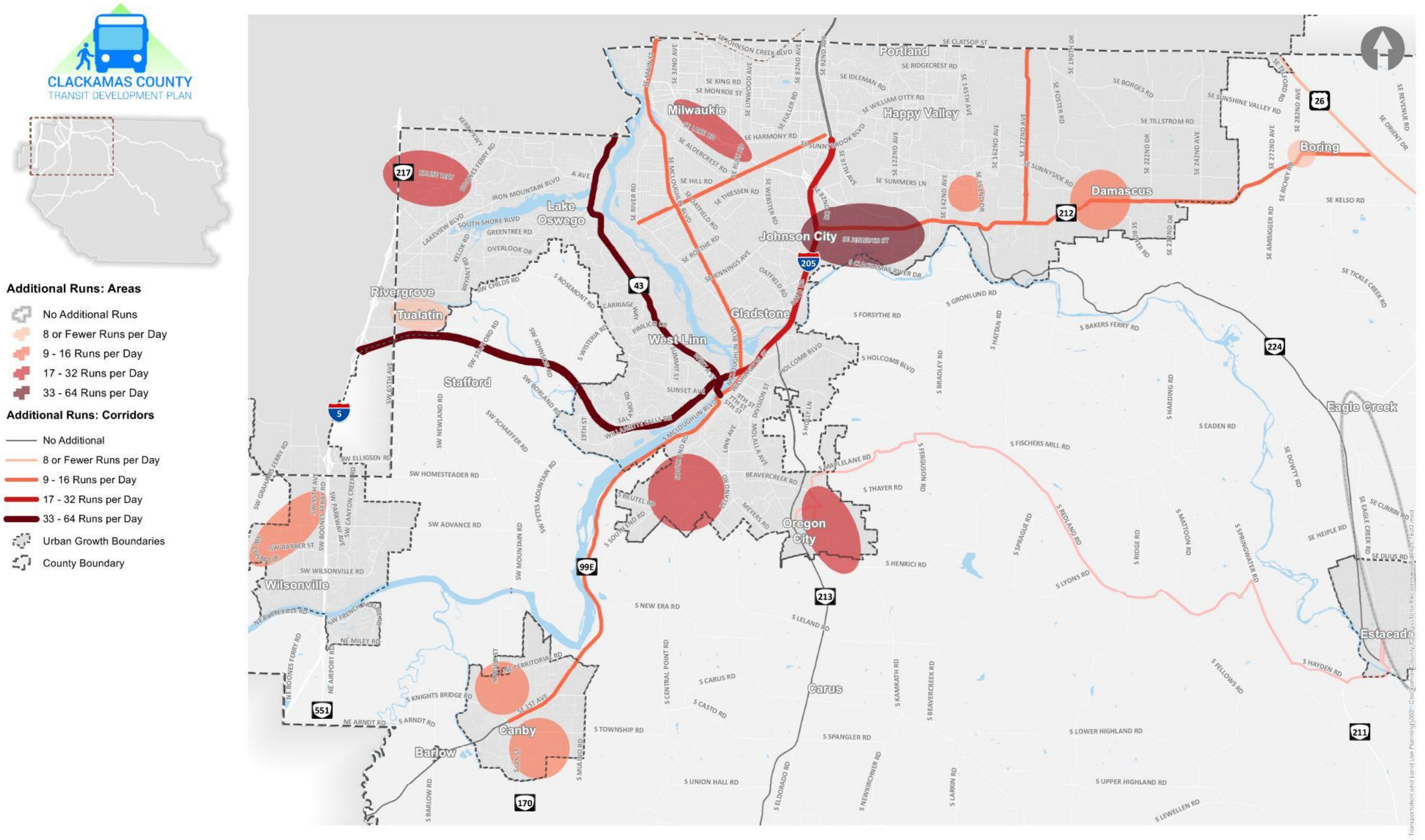


Figure 14. Additional Transit Demand to Meet Recommended Service Level Threshold – TriMet Extents



Recommended Transit Network

Drawing from the transit-underserved corridor and area findings presented above, this section recommends transit network corridor and area designations for Clackamas County. This network reflects existing and projected transit demand and regional travel needs. In addition to already planned high-density land uses, the County and its jurisdictions can focus and encourage higher-density land use and affordable housing along these corridors and within these areas to further promote transit use.

Figure 16 and Figure 17 illustrate the draft recommended Primary Transit Network corridor designations, as well as system considerations for the transit network in Clackamas County. Corridor segments are classified as follows:

- **Definite corridors** with the highest land use density and ridership potential can support relatively frequent service based on current or near-term conditions. These include the following corridors and areas:
    - Existing Definite Corridors (current service matches demand)
        - I-205: Clackamas Town Center toward Portland
    - Enhanced Definite Corridors (demand exists to increase current service)
        - US 26: West of Sandy
        - OR 43: Oregon City to Portland
        - Highway 99E: Oregon City to Portland
        - Highway 99E: Oregon City to Canby
        - I-205: Oregon City to Clackamas Town Center
        - Highway 212: I-205 to US 26/Sandy
    - New Definite Corridors (no current service, but demand exists)
        - I-205: Oregon City to I-5 Interchange
        - C2C Corridor
- **Candidate corridors** with more moderate land use density and current or future potential for moderately frequent service (possibly only in the peak periods). In some areas and corridors, the ability to support more frequent transit service depends on how land use and urban form actually develop in the near to longer term. These include corridors with:
    - Existing fixed-route service
        - US 26: East of Sandy
        - Highway 99E: South of Canby
        - Highway 213: Oregon City to Molalla
        - Highway 224: Highway 212 to Estacada
    - Potential for new fixed-route service
        - Highway 211: Molalla to Woodburn
        - Highway 213: Molalla to Silverton
- **Future service areas** may be considered for either fixed-route or other service models.
    - Fixed-route or deviated fixed-route service areas
        - Clackamas Industrial Area
        - Milwaukie Industrial Area
        - Oregon City

    - Canby
    - Happy Valley
    - West Lake Oswego/Kruse Way
    - West Wilsonville
    - Jennings Lodge–Oak Grove
- Demand-response service areas
    - Estacada–Redland–Oregon City
    - Estacada and Eagle Creek
    - Damascus and Boring
    - East Tualatin

Figure 16 also illustrates existing transit centers and potential mobility hub locations in Clackamas County. Mobility hubs are places (typically, but not necessarily, public spaces) where multimodal mobility services such as public transportation are designed to facilitate convenient, safe, and accessible travel options and transfers between modes. The following types of mobility hubs are included:

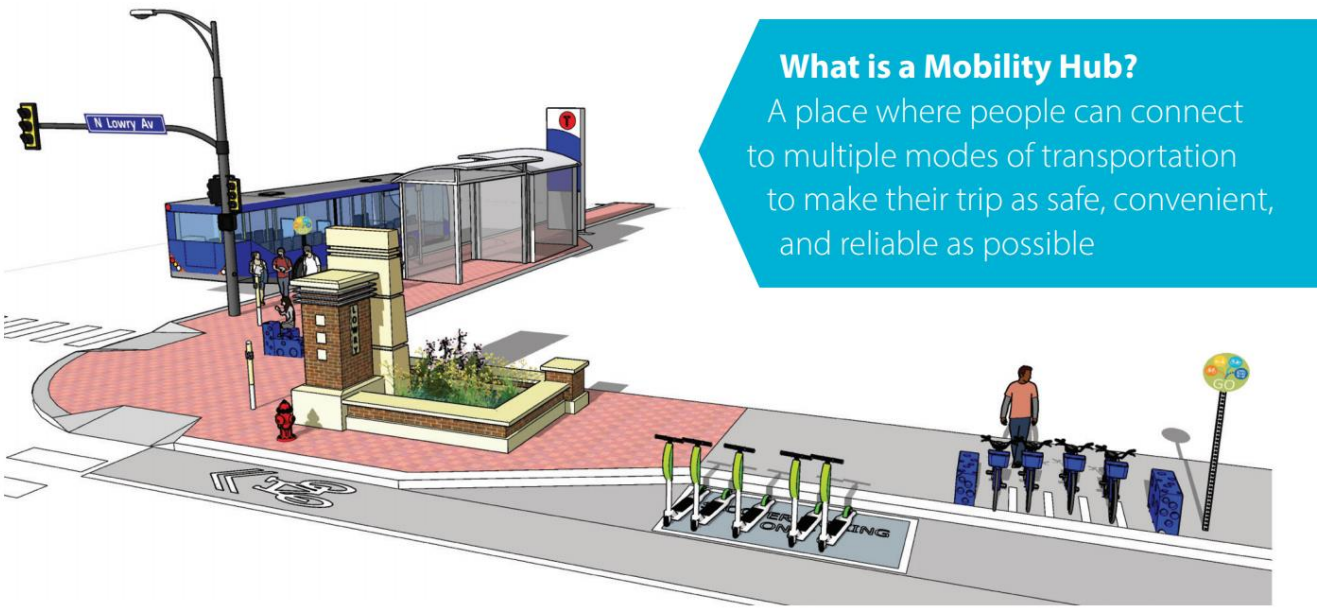
- **Transit Centers** are the primary locations where bus routes converge and buses can layover between transit runs. In Clackamas County, major transit centers include Clackamas Town Center, Oregon City Transit Center, and many others. Major transit centers typically provide large sheltered areas, restrooms, or other amenities. They facilitate transfers to/from local routes as well as longer-distance intercity services.
- **Mobility Hubs** may function as secondary transit centers/transit hubs that provide additional transfer and layover locations outside of the main transit center, or improve amenities to full transit centers as service increases. Mobility hubs provide an integrated number of mobility services, which could include transit, bikeshare, scooters, shuttles, and TNCs (see Figure 15).
- **Park-and-ride facilities,** which may be co-located with transit centers and secondary hubs, allow passengers to access transit by motor vehicle, by being dropped off, or to access shared rides (carpools or vanpools) to local or regional worksites. Park and rides may be located at public facilities or may be established through a cooperative agreement with a private landowner. Though not shown on the map, park-and-ride areas can also be established on a smaller scale. Additional park-and-ride areas would benefit Clackamas County transit riders, especially along rural highways.

Mobility hubs can include a variety of infrastructure and mobility service elements and are adaptable to a range of existing or planned transit facilities. Proposed mobility hub locations include:

- West Linn's Willamette neighborhood, connecting I-205 corridor services with TriMet Line 154
- Highway 212 and 82nd Drive in the Clackamas Industrial Area, connecting the shuttle services with TriMet Lines 79, 30, and the Oregon City–Happy Valley connection
- Sunnyside Road and 152nd Avenue (C2C Corridor), connecting the future TriMet Line 155 extension, future C2C service, the Oregon City–Happy Valley connection, and Sandy–Clackamas Town Center service
- Boring, connecting Sandy–Clackamas Town Center service with Sandy–Gresham service
- Eagle Creek, connecting Sandy–Estacada, TriMet Line 30, and potential demand-response service

These locations are conceptual and are not intended to be precise locations. The services identified above are described in the next section.

Figure 15. Mobility Hub Concept for Minneapolis



Note: This concept for Minneapolis showcases the multimodal nature of mobility hubs. In more suburban or rural locations in Clackamas County, ridesharing or carsharing options may be utilized instead of scooters or bikeshare. Source: [Mobility Hubs – Minneapolis Public Works]

Figure 16. Total Recommended Transit Runs – County Extents

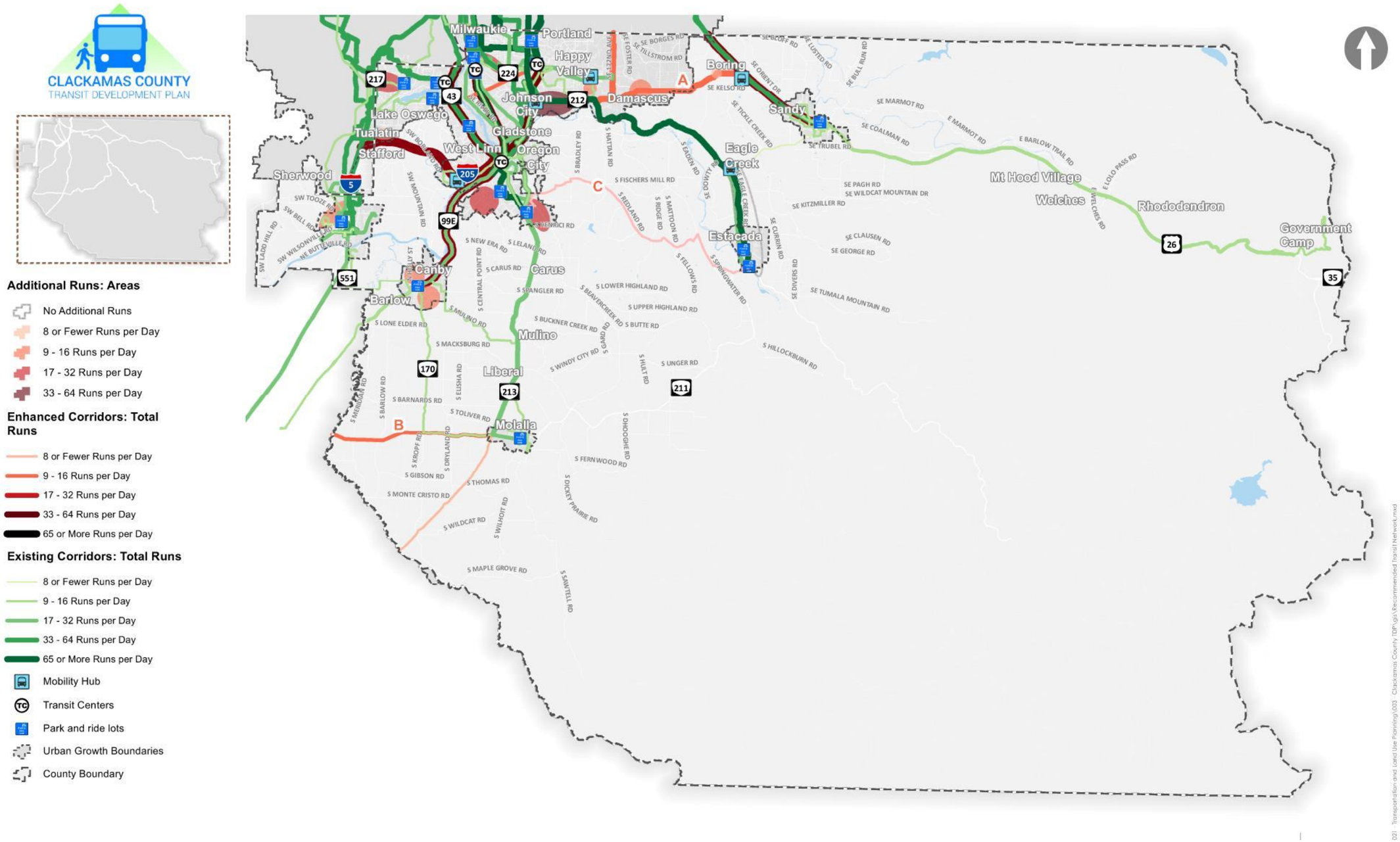


Figure 17. Total Recommended Transit Runs – TriMet Extents

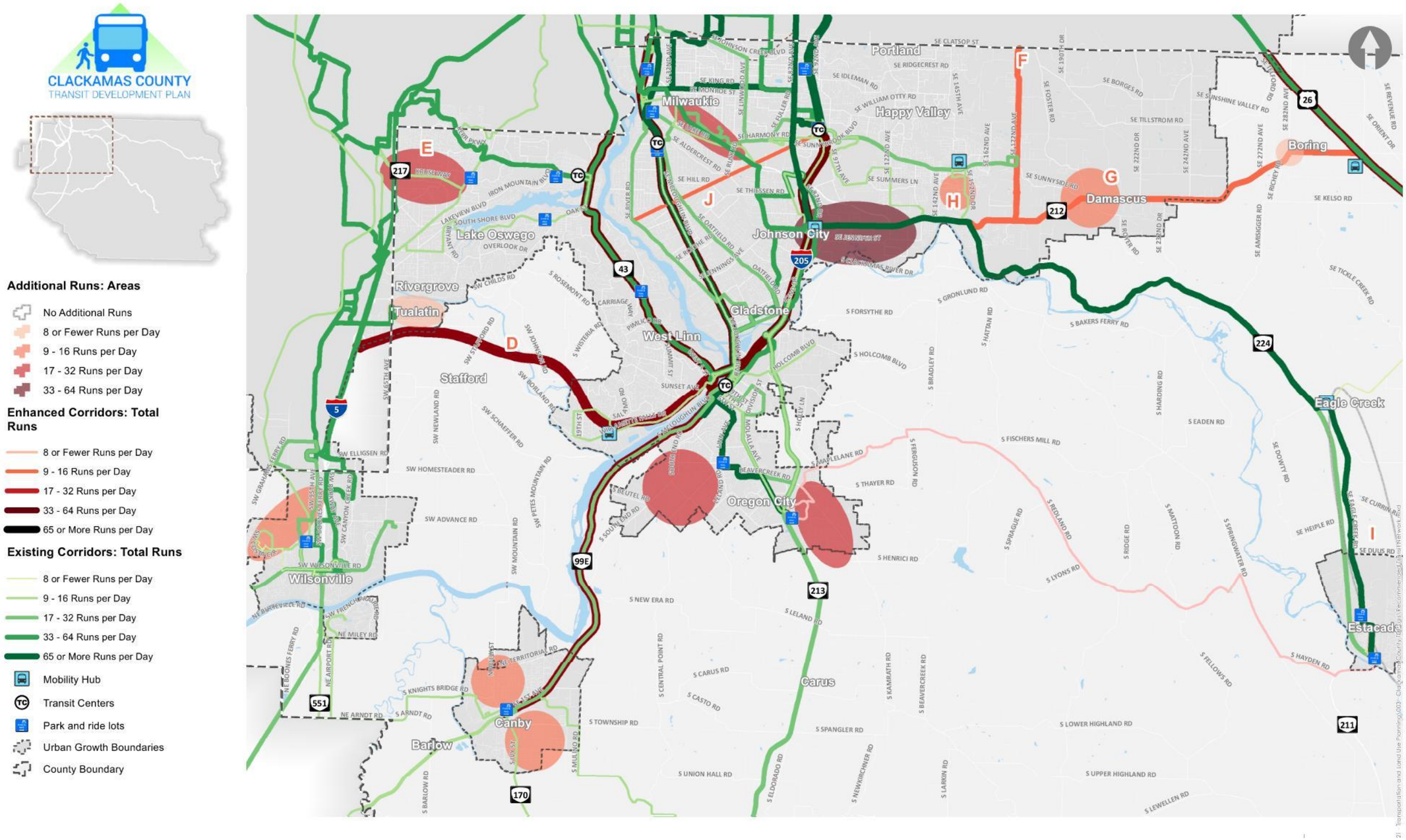
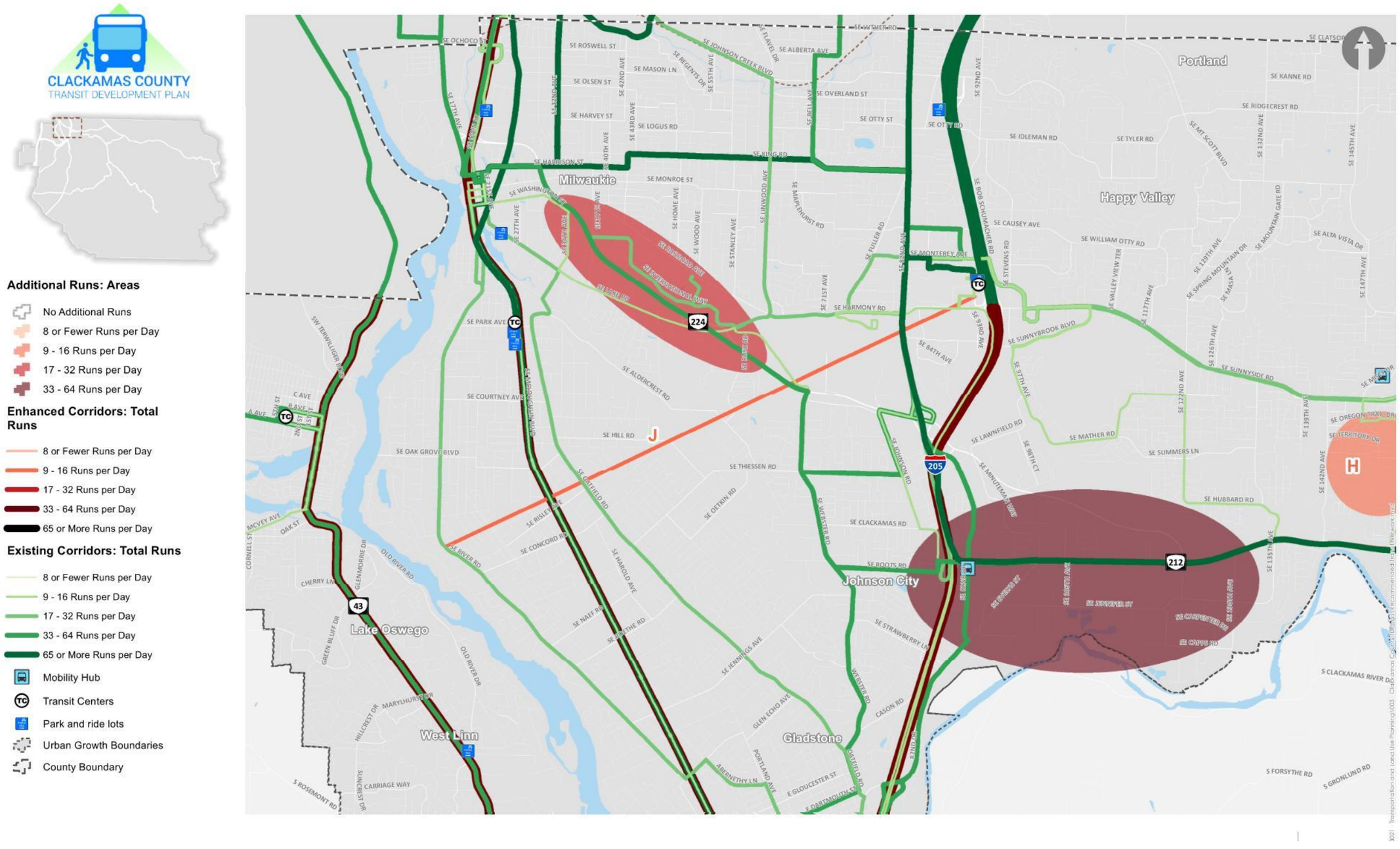


Figure 18. Total Recommended Transit Runs – Northwest County Extents



Future Service Opportunities and Prioritization

Service Types

Public transportation service is generally designed with several factors in mind. These include:

- The characteristics and travel needs of potential riders (e.g., key origins and destinations within the service area),
- The trade-offs the community wants to make in providing service (e.g., balancing geographic coverage and frequency),
- The surrounding land use context and intensity of development (e.g., population and employment densities), and
- The readiness of the jurisdiction (Clackamas County) and its transit providers and partners to make the commitments necessary to start up and maintain services under a particular model.

The service model may focus on one or several types of services, including:

- **Local fixed-route services**: These services tend to be the most visible and are increasingly cost-efficient as ridership increases. Local service provides connections within communities, generally with relatively closely spaced stops. Local service is suitable in areas with higher population and/or employment densities, such as those identified in the transit-supportive area analysis in the *Needs Identification Memorandum*. The Americans with Disabilities Act (ADA) requires complementary paratransit service, usually provided as demand-response service, which entails extra costs.
- **Deviated fixed-route services**: These services combine elements of fixed-route and demand-responsive service (e.g., a route serves specific stops at specific times), but is allowed to deviate from the route to pick up and drop off passengers. Deviated services can be used to provide local access as part of an intercity route. Some small-city systems with relatively low ridership use flexible routes to eliminate the need for ADA paratransit service (as the ability to deviate serves some needs of people with limited mobility), with the trade-off that additional time must be provided in the schedule to accommodate these deviations.
- **Demand-responsive services**: These services provide curb-to-curb service between any origin and destination and do not follow fixed routes or serve fixed stops. Passengers request rides (often through a smartphone app or over the phone), and the provider optimizes vehicle routing to serve passengers most efficiently. Transit accessibility is maximized, but per-trip costs can be significantly higher than other service types, as there are typically only one or two people traveling between any given origin and destination. In order to better match trips, non-ADA passengers may not be able to travel at their desired time.
- **Shuttles**: This service is designed to provide regular trips to key local or regional activity centers such as commercial districts, grocery stores, and medical facilities. These routes may be the only regular or fixed-route service available within the area or times that they operate. Service models for shuttles are typically deviated fixed-route or demand-responsive.
- **Vanpools**: Vanpools are well-suited to commute trips between clustered residences or park-and-rides and job locations. Vanpool fares can cover much of the expense of operating the program.
- **Microtransit**: This middle ground between taxis and public transit is generally heavily reliant on smartphone ownership for drivers and passengers. Microtransit services vary, and may include demand-responsive service within a defined area, deviated fixed routes with dynamic scheduling for deviations, or service that feeds into existing fixed-route transit at scheduled connection points.

- **Transportation network companies (TNCs)** (Uber, Lyft, etc.): TNCs provide demand-responsive curb-to-curb service between any origin and destination within a TNC provider's service area. Passengers request rides through a smartphone app and are paired with a nearby driver who is available or is close to completing a previous request. TNCs also provide carpooling services (branded as UberPool for Uber and Shared rides for Lyft), which give passengers the option for a reduced fare if their trip is linked with another passenger's trip whose origin and/or destination is along the way.
- **Rural intercity or commuter service**: This longer-distance fixed-route service typically connects cities, serves relatively few major stops at key activity or employment centers and connects to local service with each city. Intercity frequency is based on market size and can be scaled to meet demand; some may operate every day, while others are "Lifeline" routes that operate once a week. They are not required to provide ADA paratransit service, which lowers the overall cost of providing service.
- **Express service**: This fixed-route service is similar to rural intercity or commuter service in that it serves longer trips. This service only stops within the two major destinations on the route, skipping locations that may fall in between. This type of service also includes limited-stop intra-city routes; for example, serving stops every mile as compared to non-express services serving stops every ¼ mile. This service type is most appropriate where there is considerable demand or commute patterns between two fixed locations.
- **Park-and-ride/Bike-and-ride facilities**: These facilities offer a place for commuters and travelers to park their car or bike at a central location and connect to local transit service, commuter transit service, shuttle service, and other transportation options. They can be located at transit centers, which typically offer information that makes accessing and using these services seamless and easy-to-navigate. They are also commonly used with rural intercity or long-distance express service.

Each of these services requires coordination with other transit providers, counties, cities, ODOT, and/or other organizations. For example, new transit services need to develop and provide their route information to adjacent providers and to trip planning applications such as Google Transit. New services also need to use stops -- existing transit centers, new stops, or improvements to existing stops -- that would then have more activity. Lastly, services need to consider the likely transfers to adjacent providers and may consider similar fare payment systems or fare reciprocity programs.

Table 7 provides the typical coverage area, route flexibility, vehicle size/capital cost, operating cost per hour, and rides per hour for each of the service types listed above.

Table 7. Service Type Specifications

Services	Typical Coverage Area		Flexibility			Vehicle Size and Capital Cost		Typical Operating Cost	Rides per Hour
	Regional	Local	Fixed-Route	Deviated Fixed-Route	Demand-Response	Lower	Higher		
Fixed-Route Rural[1]	X	X	X				X	$75/hour	6–10
Fixed-Route Urban[1]	X	X	X				X	$105/hour	15–30
Deviated Fixed-Route		X		X			X	$75/hour	7–9
Demand-Response		X			X	X		$65/hour	2–4
Shuttles		X	X	X	X	X		$65/hour	6–8
Vanpools	X		X	X	X	X		$65/hour	4–6
Microtransit		X		X	X	X		$65/hour	3–5
TNCs	X	X			X	X		$65/hour	1–3
Rural Intercity Service	X		X	X		X	X	$75/hour	8–10
Express Service	X	X	X			X	X	$75/hour	15–30
Park-and ride; Bike-and-ride	X		X	X		*	**	N/A	N/A

[1]ADA complementary paratransit service (usually demand-response) is required during the same service hours.
*Example: Existing formal agreement with nearby business or church
**Example: New parking garage

Table 8 summarizes existing, planned, and potential future service types for the *Needs Identification Memorandum* findings. This section does not include corridors such as Highway 99E where no changes to service type or routing are recommended, but where increased frequency may be warranted.

- *Existing* includes services present today;
- *Planned* includes those needs and service types identified in other planning efforts and their general timeframes of short-term (under 10 years) or long-term (10 or more years), and
- *Potential* includes additional or alternative services that may address those needs.

The planned and potential services are described further below in the *Service Opportunities* section.

Table 8. Local Service Types by Time Frame – Existing, Planned, and Potential Services.

Service Area	Local Fixed-Route	Shuttle/ Deviated Fixed-Route	Intercity/ Express	Vanpool	Demand-Response / Micro-transit	TNCs
New Regional Connections						
Damascus and Boring on Highway 212 and/or Sunnyside	Potential	Potential	Planned (long-term)	—	Potential	Potential
Estacada, Molalla, and Woodburn on Highway 211	Potential	Potential	Potential	—	—	—
Estacada, Redland, and Oregon City	—	Potential	Potential	—	Potential	—
Tualatin, West Linn, and Oregon City on I-205	Potential	Potential	Planned (long-term)	Potential	Potential	Existing
Clackamas Town Center, Gladstone, and Oregon City	Existing and Additional Planned	Potential	—	—	Potential	Existing
West Linn, Lake Oswego, and Washington County	Existing	—	Potential	Potential	Potential	Existing
Enhanced Transit Corridors on Cesar Chavez and 82nd Avenue	Existing	—	Existing	—	Potential	Existing
Damascus, Happy Valley, and Gresham on the future C2C Corridor	Planned (long-term)	Potential	Planned (long-term)	—	Potential	Existing
New Local Service						
Damascus	—	Potential	—	—	Potential	Existing
Boring	—	Potential	—	—	Potential	Existing
Estacada and Eagle Creek	Existing	Potential	—	—	Potential	-
Clackamas Industrial Area	Existing	Planned (short-term)	—	—	Potential	Existing
Jennings Lodge–Oak Grove–Oatfield	Planned (long-term)	Potential	—	—	Potential	Existing
Additional Transit Service						
Happy Valley	Existing	Potential	—	Potential	Potential	Existing
Oregon City	Existing	Planned (short-term)	Existing	Potential	Potential	Existing
Canby	Existing	Potential	Existing	Potential	Potential	Potential
Wilsonville	Existing	Existing	Existing	Potential	Potential	Existing

Service Opportunities

This section reviews opportunities for fulfilling the needs based on Table 3, *Local Transit Service Design Guidance Summary*, above. Many needs can be met with multiple service types.

For example, the Damascus and Boring gaps on Highway 212 have planned intercity/express service and potential for shuttle and TNC service. Given the high commute and travel demand on the corridor, a larger vehicle may be needed. Additionally, the long-distance connection may need to be fixed-route and rely on local services within each community to provide first/last-mile connections, rather than a

curb-to-curb service. As each area grows, the need may also increase for curb-to-curb services, such as vanpools or commuter shuttles to major employment centers.

This section describes the most relevant service opportunity based on existing and projected patterns, though the potential remains for other services, as described above. Further, this section focuses on service opportunities for areas not currently within a transit district or within the TriMet service area.

- Opportunities are described at a planning level.
- All routes were assumed to operate from 6 a.m. to 7 p.m. on weekdays and 8 a.m. to 6 p.m. on weekends, with runs per day dependent on the route length, for a total of about 4,415 annual service hours per route operated. This is referred to in each route description as one full-time bus.
- Recommended service spans and frequencies will be refined based on population and employment densities as well as regional travel demand in the *Prioritization* section of this memo.

The operating cost per hour and rides per hour for each service opportunity were adapted from Table 7, and the cost per ride divides the operating cost per hour by the number of rides per hour.

Table 9 summarizes the service opportunities, route length in miles and time, capital needs, operating cost per hour, cost per ride, and cost per vehicle. The operating cost per hour and rides per hour for each service opportunity were adapted from Table 7, and the cost per ride divides the operating cost per hour by the number of rides per hour.

Table 9. Service Opportunity Summary

Service Need	Service Type	Round-Trip Length (Miles/ Time)	Weekday Runs per Day	Capital Needs	Operating Cost per Hour	Rides per Hour	Cost per Ride	Pop Coverage	Job Coverage
Damascus and Boring on Highway 212 and/or Sunnyside	Option A1. New Intercity Service on Hwy 212 (Figure 19)	38 miles / 113 minutes	5	Larger Vehicle	$75	8–10	$7.50–$9.38	12,969	10,402
	Option A2. New Intercity Service on Sunnyside (Figure 20)	35 miles / 104 minutes	6	Larger Vehicle	$75	8–10	$7.50–$9.38	13,884	11,239
	Option A3. Mt. Hood Express Extension (Figure 21)	78 miles / 230 minutes	5	Smaller Vehicle	$65	8–10	$6,50–$8.13	10,730	9,199
Estacada, Molalla, and Woodburn on Highway 211	Option B1. New Intercity Service Woodburn - Molalla (Figure 22)	30 miles / 91 minutes	9	Larger Vehicle	$75	8–10	$7.50–$9.38	6,749	1,867
	Option B2. New Intercity Service Woodburn – Estacada (Figure 23)	72 miles / 217 minutes	4	Larger Vehicle	$75	8–10	$7.50–$9.38	6,552	1,996
Estacada, Redland, and Oregon City	Option C1. New Deviated Intercity Service (Figure 24)	36 miles / 143 minutes	5	Smaller Vehicle	$65	7–9	$7.22–$9.29	4,178	1,719
	Option C2. New Demand-Response	N/A	N/A	Smaller Vehicle	$65	3	$21.67	4,178	1,719
Tualatin, West Linn, and Oregon City on I-205	Option D1. New Express Service (Figure 25)	22 miles / 67 minutes	12	Larger Vehicle	$105	15–30	$3.50–$7.00	3,015	4,666
	Option D2. New Local Service; Deviated Fixed-Route (Figure 26)	22 miles / 87 minutes	9	Smaller Vehicle	$65	7–9	$7.22–$9.29	11,054	12,621
West Linn, Lake Oswego, and Washington County	Option E1. TriMet Line 36 Extension (Figure 27)	29 miles / 118 minutes	7	Larger Vehicle	$105	15–30	$3.50–$7.00	38,400	78,588
	Option E2. TriMet Line 37 Extension (Figure 28)	40 miles / 159 minutes	5	Larger Vehicle	$105	15–30	$3.50–$7.00	33,208	21,498
	Option E3. New Local Service; Fixed-Route (Figure 29)	31 miles / 125 minutes	6	Larger Vehicle	$105	15–30	$3.50–$7.00	21,787	17,854
Enhanced Transit Corridors on Cesar Chavez and 82nd Avenue	Summary information provided here; See Metro's Regional Transit Strategy for further detail.								
Damascus, Happy Valley, and Gresham on the future C2C Corridor	Option F1. New Intercity Service to Rockwood MAX (Figure 30)	17.1 miles / 69 minutes	11	Larger Vehicle	$105	15–30	$3.50–$7.00	16,421	2,591
	Option F2. New Intercity Service to Powell (Figure 31)	13 miles / 52 minutes	15	Larger Vehicle	$105	15–30	$3.50–$7.00	8,297	941

Service Need	Service Type	Round-Trip Length (Miles/ Time)	Weekday Runs per Day	Capital Needs	Operating Cost per Hour	Rides per Hour	Cost per Ride	Pop Coverage	Job Coverage
Damascus	Option G1. New Local Fixed-Route Loop (Figure 32)	7.8 miles / 30 minutes	26	Larger Vehicle	$105	15–30	$3.50–$7.00	6,024	637
	Option G2. New Local Fixed-Route Line (Figure 33)	8.3 miles / 33 minutes	23	Larger Vehicle	$105	15–30	$3.50–$7.00	4,496	437
Damascus and Boring	Option G3. New Intercity Service Deviated Fixed-Route (Figure 34)	16.2 miles / 65 minutes	12	Smaller Vehicle	$65	7–9	$7.22–$9.29	5,375	616
Happy Valley	Option H1. New North Line Fixed-Route (Figure 35)	12.9 miles / 52 minutes	15	Larger Vehicle	$105	15–30	$3.50–$7.00	9,905	5,410
	Option H2. New Local Fixed Route Line (Figure 36)	21.7 miles / 87 minutes	9	Larger Vehicle	$105	15–30	$3.50–$7.00	11,872	10,175
Estacada and Eagle Creek	Option I1. New Deviated Local Fixed-Route (Figure 37)	11 miles / 44 minutes	18	Smaller Vehicle	$65	7–9	$7.22–$9.29	1,321	551
	Option I2. New Demand-Response	N/A	N/A	Smaller Vehicle	$65	3	$21.67	3,270 **	631
Jennings Lodge and Oak Grove	Option J1. New Local Fixed-Route Line (Figure 38)	13 miles / 50 minutes	16	Larger Vehicle	$105	15–30	$3.50–$7.00	10,521	7,912
	Option J2. New Local Fixed Route Line (Figure 39)	16 miles / 64 minutes	12	Larger Vehicle	$105	15–30	$3.50–$7.00	14,539	9,334
	Option J3. New Local Fixed-Route Line (Figure 40)	21 miles / 86 minutes	9	Larger Vehicle	$105	15–30	$3.50–$7.00	17,011	6,630
Clackamas Industrial Area	See the *Clackamas Industrial Area Shuttle* Plan								
Oregon City	See the *Oregon City Shuttle* Plan								
Canby	See CAT Master Plan								
Wilsonville	See SMART Transit Master Plan								

*Estimated from the 2010 U.S. Census
**Estimated from the 2014-2018 American Community Survey 5-Year Estimate

Regional Connections Between Service Districts

This section identifies high-level routing alternatives for connections between multiple service districts where the appropriate provider of the service may be unclear.

Damascus and Boring on Highway 212 or Sunnyside Road

There are multiple ways to address the Highway 212 transit service gap. This section shows three ways:

- Option A1. New fixed-route service from Sandy to Clackamas Town Center via Highway 212 (Figure 19)
  - 38 miles and 113 minutes
  - Would allow for 5 round-trips per day operated by one full-time bus.
  - Within a ¼ mile of the proposed route, would serve 12,969 residents and 10,402 jobs.
  - Cost per ride estimated to be $7.50 to $9.38.
- Option A2. New fixed-route service from Sandy to Clackamas Town Center via Sunnyside Road (Figure 20)
  - 35 miles and 104 minutes
  - Would allow for 6 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 13,884 residents and 11,239 jobs.
  - Cost per ride estimated to be $7.50 to $9.38.
  - This alternative was identified in Sandy Area Metro's Transit Master Plan.
- Option A3. An extension of the Mt. Hood Express to Clackamas Town Center (Figure 21).
  - Adds 33 miles and 96 minutes to the route, bringing the total route to 78 miles and 230 minutes.
  - Would allow for 5 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 10,730 residents and 9,199 jobs.
  - Estimated cost per ride is $8.13 to $10.83.
  - Considerations include reliability issues for long transit routes (such as scheduling concerns and mechanical breakdown far from maintenance and storage facilities), which would make this challenging. Providing the extension (rather than the new service) would reduce the number of transfers from Sandy to Clackamas Town Center.

Recommendation: Based on public outreach and the above analysis, the ***Option A2. Sunnyside Road Alternative*** is recommended to address this corridor need. The Sunnyside Road alternative provides service coverage on multiple corridors that currently lack any service and has fewer reliability concerns compared to extending the Mt. Hood Express. This option also provides an opportunity for a mobility hub at Sunnyside and 152nd.

Figure 19. New Service on Highway 212 Serving Damascus and Boring (Option A1)

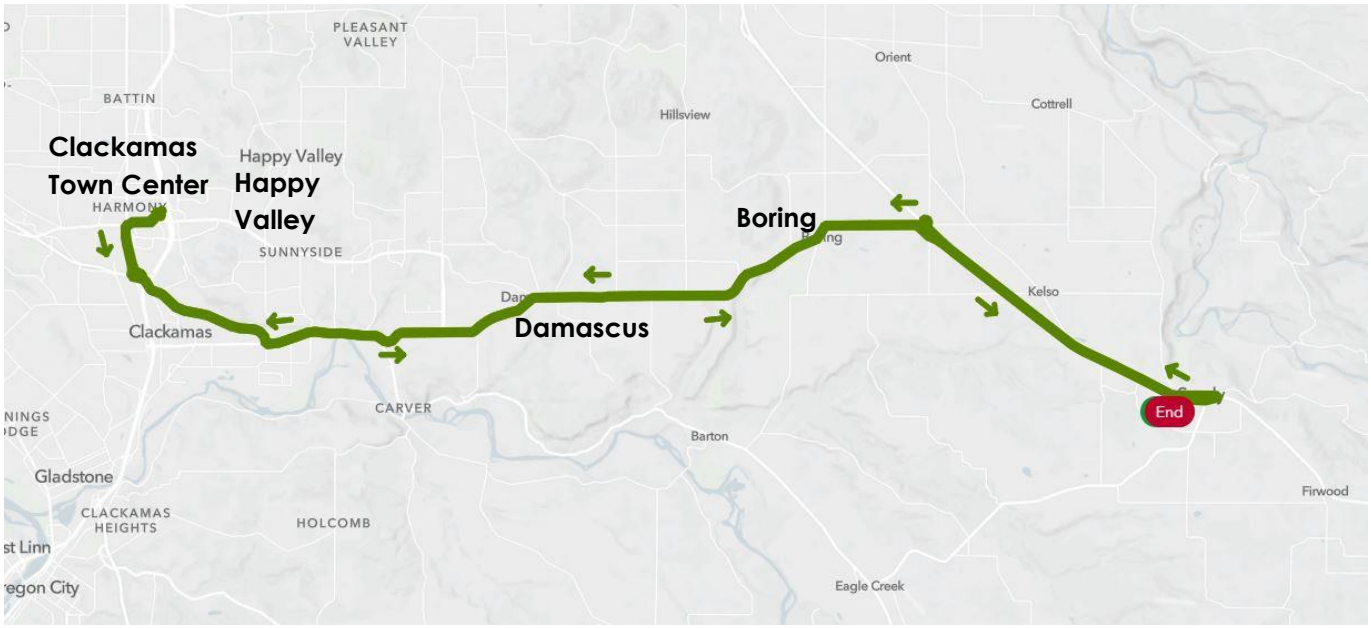
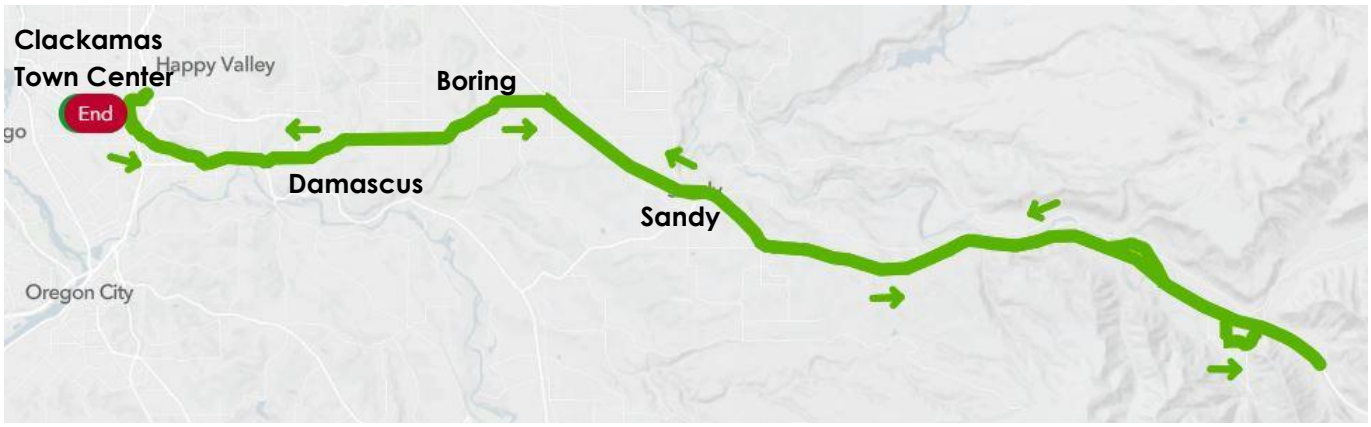


Figure 20. New Service on Sunnyside Road Serving Damascus and Boring (Option A2)

Figure 21. Extending Mt. Hood Express to Serve Damascus and Boring on Highway 212 (Option A3)



Estacada, Molalla, and Woodburn on Highway 211

There are several ways to address a gap in service on Highway 211, two of which are shown here:

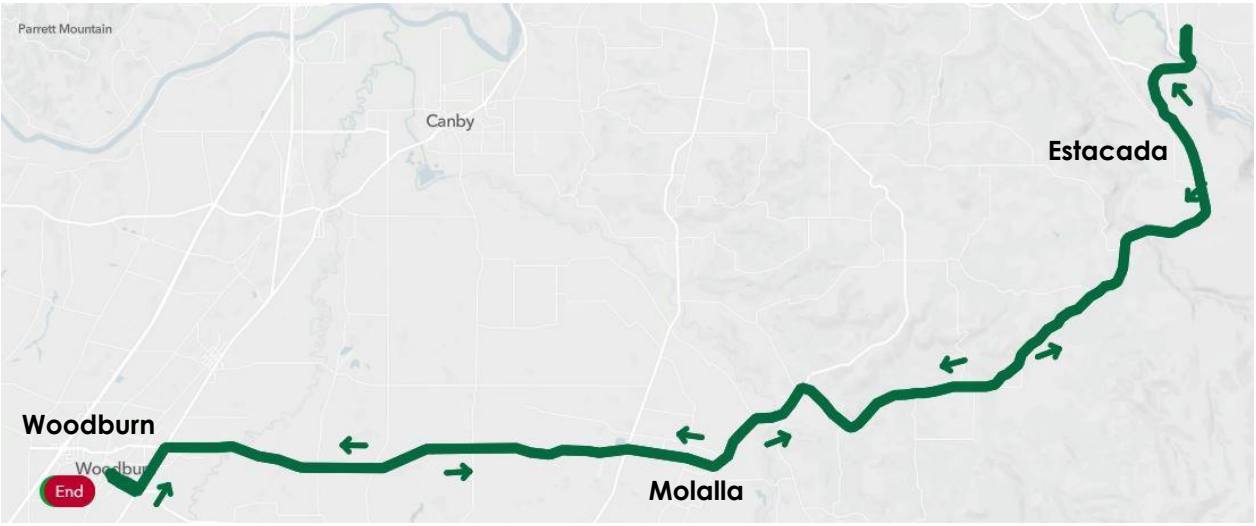
- Option B1. New fixed-route service between Woodburn and Molalla (Figure 22)
  - 30 miles and 91 minutes
  - Would allow for 9 round-trips per day operated by one full-time bus
  - Within ¼ mile of the proposed route, would serve 6,749 residents and 1,867 jobs
  - Cost per ride estimated to be $7.50 to $9.38
- Option B2. New fixed-route service between Woodburn, Molalla, and Estacada (Figure 23)
  - 72 miles and 217 minutes.
  - Would allow for 4 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 6,552 residents and 1,996 jobs.
  - Cost per ride estimated to be $7.50 to $9.38.

Although an Estacada-Woodburn route provides a one-seat ride, there may be reliability issues for long transit routes (such as scheduling concerns and mechanical breakdown far from maintenance and storage facilities).

Recommendation: Based on public outreach and the above analysis, the ***Option B1. Woodburn–Molalla Alternative*** is recommended to address this corridor need. Molalla–Estacada does not have high travel demand and results in more potential reliability issues and costs.

Figure 22. New Commuter Service between Woodburn and Molalla (Option B1)

Figure 23. New Commuter Service between Woodburn, Molalla, and Estacada (Option B2)



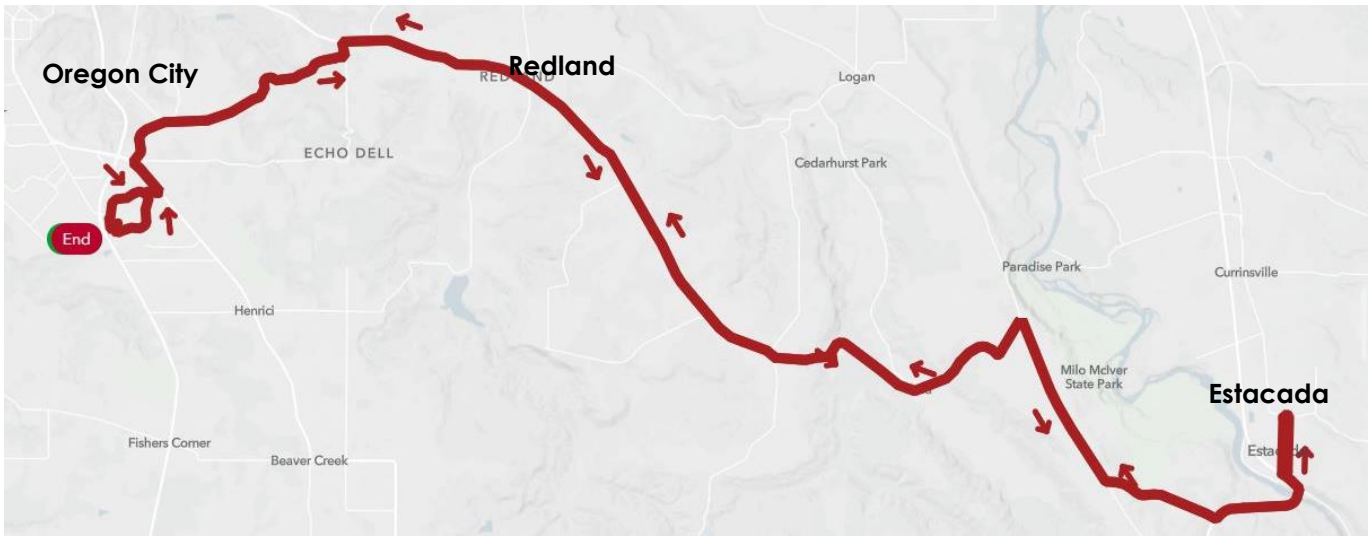
Estacada, Redland, and Oregon City

There are several ways to address a gap in service between Estacada, Redland, and Oregon City (specifically, Clackamas Community College), two of which are shown here:

- Option C1. New deviated fixed-route service between Estacada and Clackamas Community College (Figure 24)
  - 36 miles and 143 minutes
  - Would allow for 5 round-trips per day operated by one full-time bus
  - Within ¼ mile of the proposed route, would serve 4,178 residents and 1,719 jobs; and could be modified to cover a larger demand-response area on both ends of the route.
  - Cost per ride estimated to be $7.22 to $9.29
- Option C2. New demand-response service for Estacada and South Oregon City centered around Clackamas Community College.
  - Demand-response service is proposed to serve all of Estacada and south Oregon City, especially the Maplelane neighborhoods which were identified through Clackamas County Shuttles outreach for their topographic challenges and lack of pedestrian facilities.
  - Service could provide three passenger trips per hour at a cost of $21.67 per ride.
  - Within ¼ mile of the proposed route, would serve 4,178 residents and 1,719 jobs; and could be modified to cover a larger demand-response area on both ends of the route.

Recommendation: Based on public outreach, the above analysis, and the need for expanded transit service in south Oregon City the ***Option C1. Deviated Fixed-Route Alternative*** is recommended to address this need.

Figure 24. New Intercity Service between Estacada and Clackamas Community College (Option C1)



Regional Connections Within or Near TriMet Service Area

This section identifies high-level routing alternatives for connections primarily within the TriMet Service Area, where service may be provided by TriMet or via pass-through funds.

Tualatin, West Linn, and Oregon City on I-205

A shuttle service is being explored to operate between Oregon City, West Linn's Willamette neighborhood and the Tualatin Transit Center. There are two primary ways to address this service gap:

- Option D1. New express fixed-route service on I-205 (Figure 25)
  - 22 miles and 67 minutes
  - Would allow for 12 round-trips per day operated by one full-time bus
  - Within ¼ mile of the route, would serve 3,015 residents and 4,666 jobs
  - Cost per ride estimated to be $3.50 to $7.00
  - Faster than Borland option
  - Currently being evaluated and potentially being provided by SMART
- Option D2. New local fixed-route service along Borland Road (Figure 26)
  - 22 miles and 87 minutes
  - Would allow for 9 round-trips per day operated by one full-time bus
  - Within ¼ mile of the route, would serve 11,054 residents and 12,621 jobs
  - Cost per ride estimated to be $7.22 to $9.29
  - Provides more area coverage than I-205 option
  - Will be further explored as part of Clackamas County's ongoing Shuttle Planning Project.

Recommendation: Based on public outreach and multiple needs for both alternatives, SMART's ***Option D1. Express Route on I-205*** and ***Option D2. Local Route on Borland*** are recommended to address this corridor need.

Figure 25. New Express Service on I-205 between Oregon City and Tualatin (Option D1)

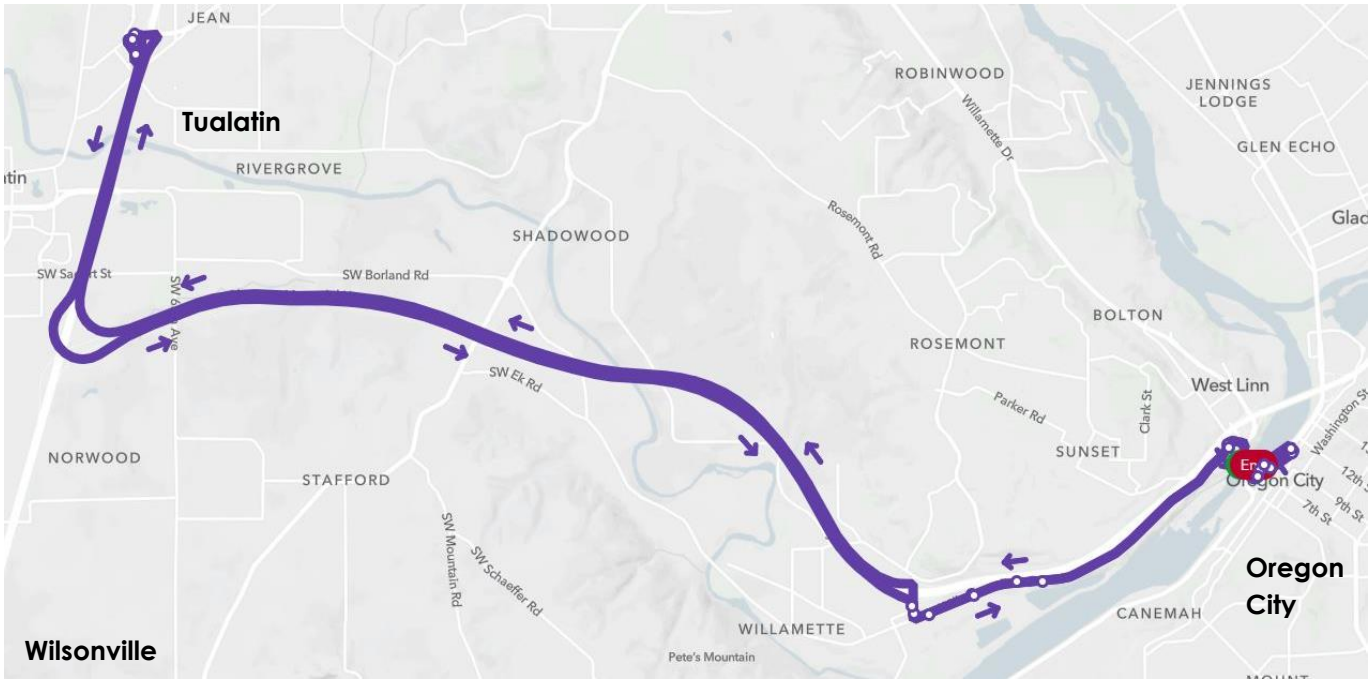
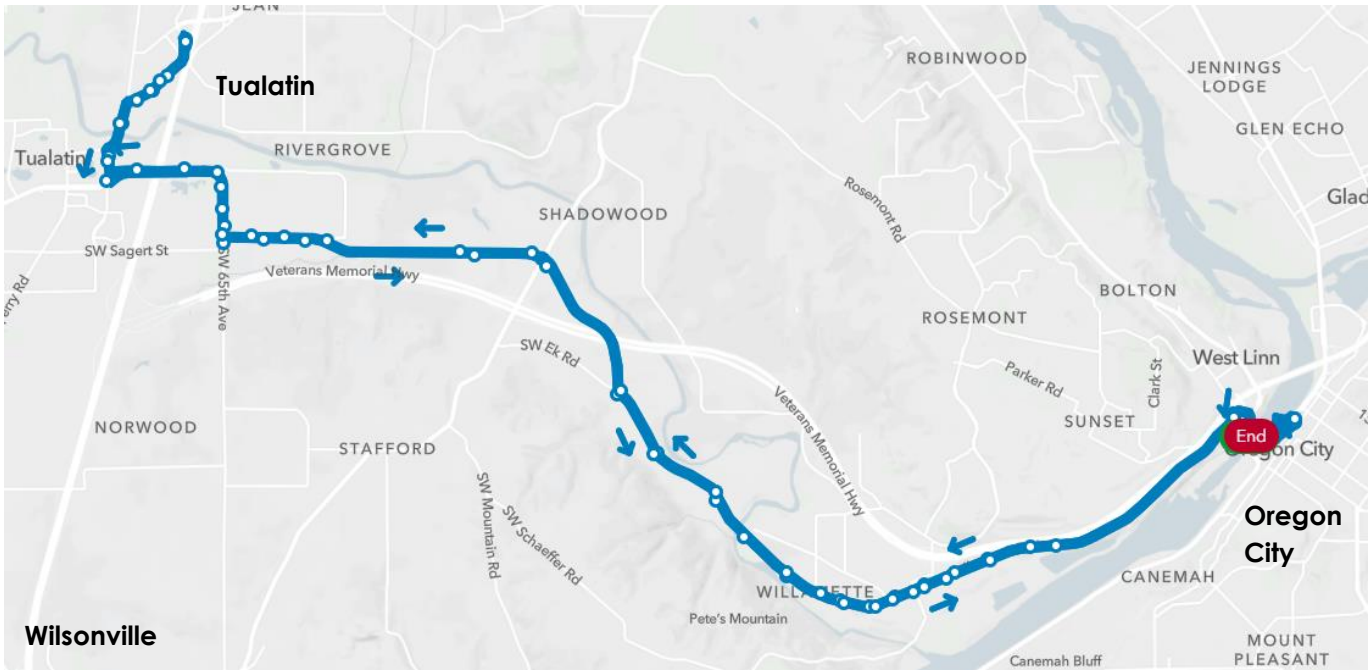


Figure 26. New Local Service between Oregon City and Tualatin (Option D2)



West Linn, Lake Oswego, and Washington County

There are several ways to connect West Linn and Lake Oswego with Washington County.

- Option E1. Extending TriMet Line 36, which currently operates between Tualatin and Lake Oswego, to West Linn's Willamette neighborhood via Highway 43 (Figure 27)
    - Would add 72 minutes and 17 miles over existing service.
    - Would allow for 7 round-trips per day operated by one full-time bus.
    - Within ¼ mile of the proposed route, would serve 38,400 residents and 78,588 jobs.
    - Cost per ride estimated between $3.50 to $7.00.
    - Would provide a future connection to the Southwest Corridor Light Rail Bridgeport Transit Center Station
- Option E2. Extending TriMet Line 37 to West Linn's Willamette neighborhood via Highway 43, and incorporating TriMet's proposed changes to Line 37 (as outlined in the Southwest Service Enhancement Plan) to reroute west from Lake Oswego to Tigard and Murrayhill (Figure 28)
    - Would add 120 minutes and 40 miles to proposed TriMet Line 37.
    - Would allow for 5 round-trips per day operated by one full-time bus.
    - Within ¼ mile of the proposed route, would serve 32,694 residents and 21,238 jobs.
    - Cost per ride estimated between $3.50 to $7.00.
    - Would provide an existing connection to WES Commuter Rail and future connection to the Southwest Corridor Light Rail Bonita Station
- Option E3. New fixed-route service between West Linn, Lake Oswego, and Tigard along Rosemont Road to the west of Highway 43 (Figure 29)
    - 31 miles and 125 minutes
    - Would allow for 6 round-trips per day operated by one full-time bus.
    - Within ¼ mile of the proposed route, would serve 21,787 residents and 17,854 jobs.
    - Cost per ride estimated between $3.50 to $7.00.
    - The portion of the route between West Linn and Lake Oswego is identified in TriMet's Southwest Service Enhancement Plan.

Other considerations for all alternatives include reliability issues for long transit routes (such as scheduling concerns and mechanical breakdown far from maintenance and storage facilities) and non-linear travel routes, where Lake Oswego is a considerable out-of-direction destination for travel between West Linn and Tualatin. A transit center or mobility hub could be added to complement each of these service alternatives, and a potential transit route along Borland Road.

Recommendation: Based on TriMet's Service Enhancement Plan and the above analysis, the ***Option E2. TriMet Line 37*** Extension and ***Option E3. New Service Along Rosemont Road to Lake Oswego*** is recommended to meet this corridor need. A new route does not negatively impact riders using existing routes that may be modified, and a connection to Tigard provides a more direct connection to Portland and across Washington County.

Figure 27. Rerouted TriMet Line 36 with Extension to West Linn (Option E1)

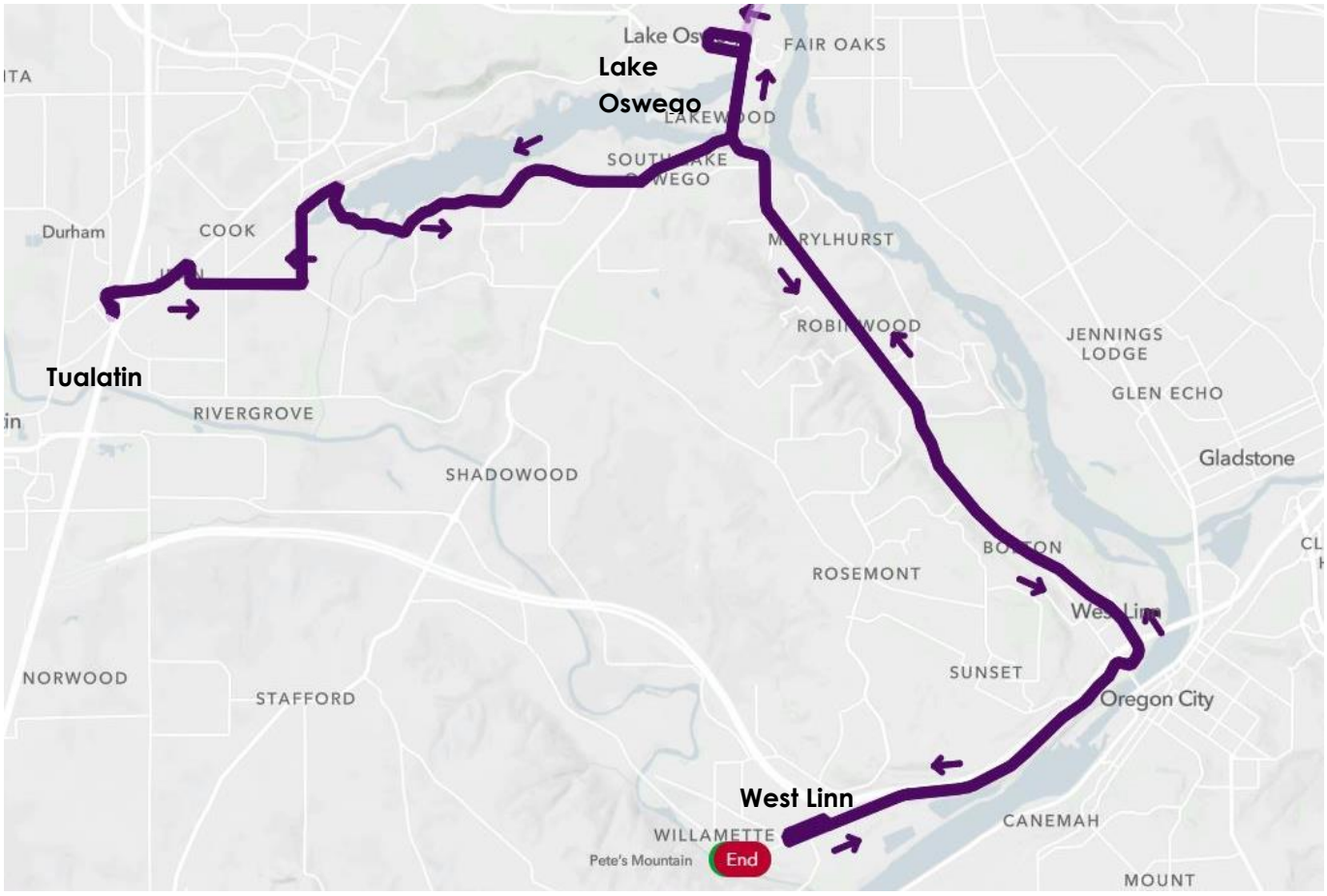


Figure 28. Rerouted TriMet Line 37 with Extension to West Linn (Option E2)

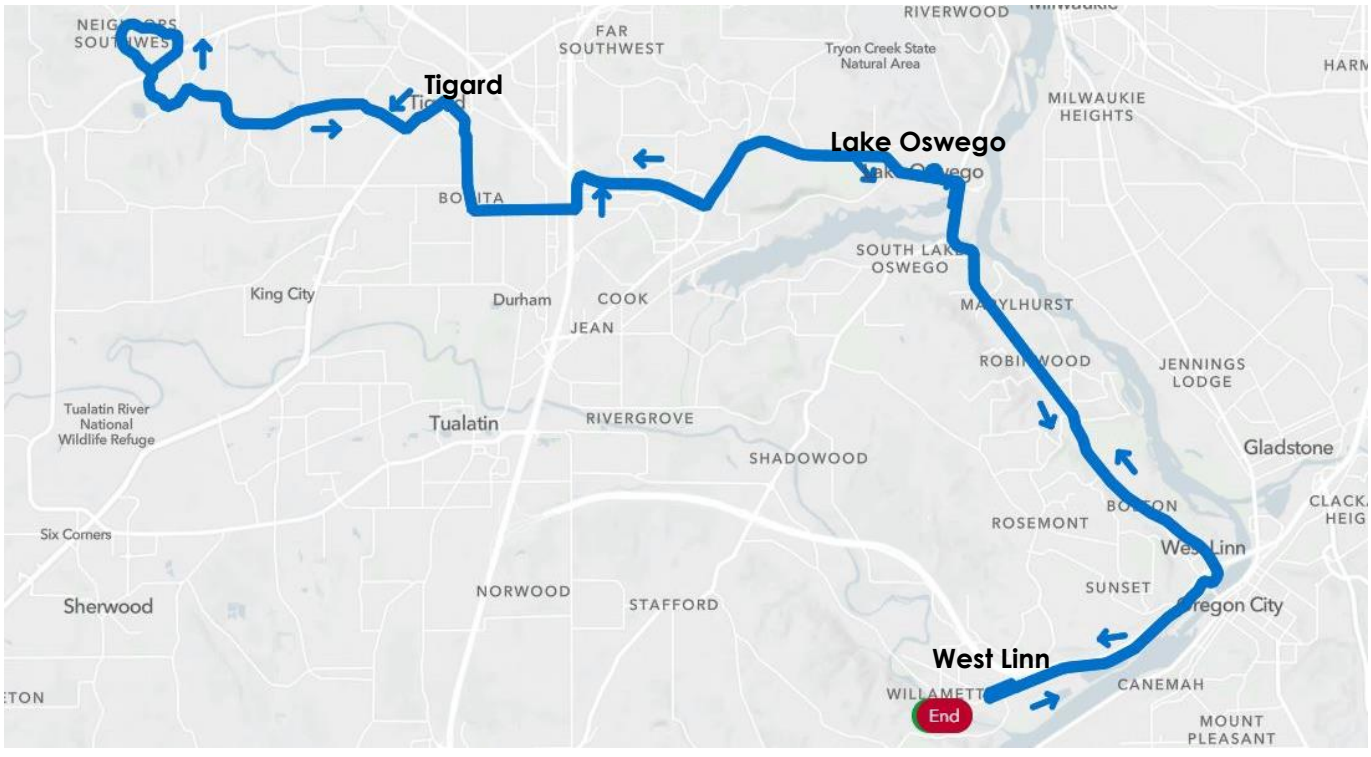
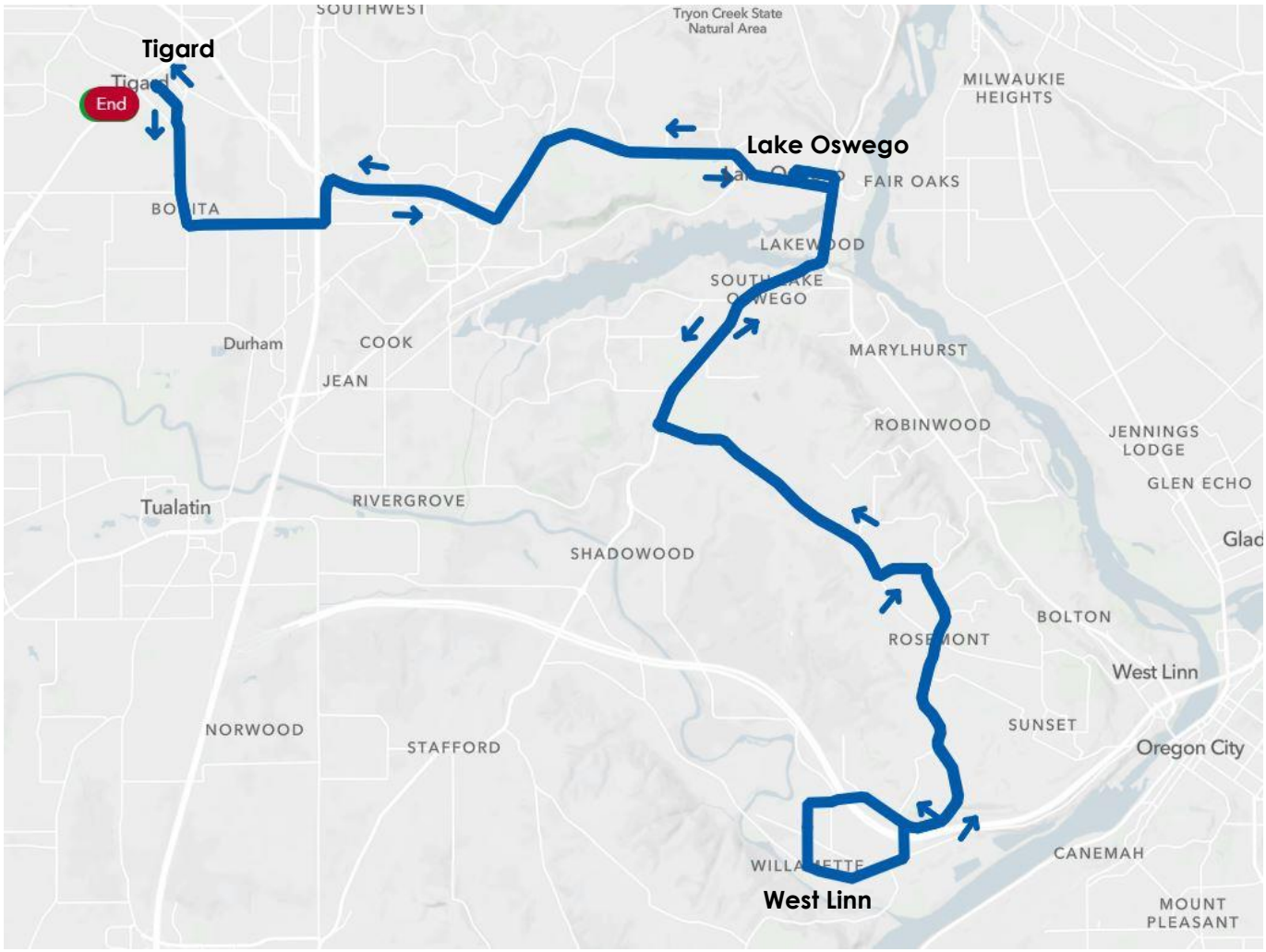


Figure 29. New Service Along Rosemont Road between West Linn, Lake Oswego, and Washington County (Option E3)



Enhanced Transit Corridors on Cesar Chavez and 82nd Avenue

Metro's Regional Transit Strategy defines Enhanced Transit Corridors (ETCs) as places suitable for frequent bus service, streetcar, or corridor-based Bus Rapid Transit (BRT) where transit speed and reliability should be improved. Two corridors in Clackamas County are identified as ETCs: 82nd Avenue from Clackamas Town Center north into Portland, and Lombard/Cesar Chavez Boulevard from downtown Milwaukie north into Portland.

Table 10 shows that only the ETC on 82nd Avenue from Clackamas Town Center is on Metro's financially constrained project list. Other high-capacity transit projects, including on I-205 and McLoughlin Boulevard, both with service to Oregon City, are included here but do not have 2018-2027 project funding.

Table 10. Metro RTP Transit Projects Related to Enhanced Transit Corridors or High-Capacity Transit

Project Name	Description	Estimated Cost (2016 Dollars)	Time Period	Financially Constrained Project List?
ETC: 82nd Ave/ Killingsworth Enhanced Transit Project	Capital construction of regional enhanced transit project. Project will coordinate with ODOT to identify locations and design treatments.	$30,000,000	2018-2027	Yes
ETC: Lombard/Cesar Chavez Enhanced Transit Project	Capital construction of regional enhanced transit project. Project will coordinate with ODOT to identify locations and design treatments.	$30,000,000	2028-2040	No
HCT: I-205 Capital Construction	High-capacity transit (HCT) on I-205, as envisioned in regional HCT System Plan.	$150,000,000	2028-2040	No
HCT: McLoughlin Blvd High-Capacity Transit extension	Improve safety in the McLoughlin Blvd corridor by extending HCT (light rail or bus rapid-transit) from the current end of the MAX Orange Line at Park Avenue to downtown Oregon City with implementation of bicyclist and pedestrian safety countermeasures at stop locations. Interim ETC improvements should be considered.	$23,300,000	2028-2040	No

Additional corridors that could be categorized as ETCs in Clackamas County include:

- Highway 43 between Oregon City and Portland. As identified earlier in this memorandum, there is a need to increase service to 15 minutes or better, which is TriMet's definition of a frequent service line. Additionally, TriMet's Southwest Service Enhancement Plan identifies Line 35 (which runs on Highway 43 between Oregon City and Portland) as a future frequent service route.
- I-205 between Oregon City and Clackamas Town Center. There are two lines – TriMet Line 31 on the west side of I-205 and TriMet Line 79 on the east side of I-205 – that offer service between Oregon City and Clackamas Town Center. (The Clackamas Community College Xpress Shuttle also provides service but is not operating as this is being written due to the COVID-19 pandemic.) Identifying this high-volume corridor as an ETC would improve transit operations ahead of a planned high-capacity transit capital construction project.

Damascus, Happy Valley, and Gresham on the future C2C Corridor

There are multiple ways to incorporate transit service on the future Clackamas to Columbia Corridor (C2C) linking Damascus and Happy Valley with Gresham and East Portland. This section shows two ways:

- Option F1. New fixed-route service to the Rockwood MAX station (Figure 30)
  - 17.1 miles and 69 minutes.
  - Would allow for 11 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 16,421 residents and 2,591 jobs.
  - Cost per ride estimated between $3.50 to $7.00.
- Option F2. New fixed-route service to Powell Boulevard (Figure 31)
  - 13 miles and 52 minutes.
  - Would allow for 15 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 8,297 residents and 941 jobs.
  - Cost per ride estimated between $3.50 to $7.00.

Both routes assume construction of the new 172nd–190th Connector, completing the C2C mainline. The northern ends of both proposed routes connect with frequent service TriMet routes, with potential park-and-ride locations at the 181st MAX station one stop west of Rockwood, and bus turnaround abilities via 185th and Stark or at Rockwood Station. Building a mobility hub at the transfer point would help people better connect between north–south transit service on the C2C, and east–west service on Powell or MAX service, helping people in the C2C corridor connect to points across east Multnomah County, including Gresham and Sandy.

Recommendation: Based on the analysis above and the ability to decrease transfers, the ***Option F1. Service to the Rockwood MAX Station*** is recommended to address this corridor need. While not located in Clackamas County, a mobility hub at the Rockwood MAX station would benefit riders going to or coming from Clackamas County.

Figure 30. New Service on C2C Corridor with Service to Rockwood MAX (Option F1)

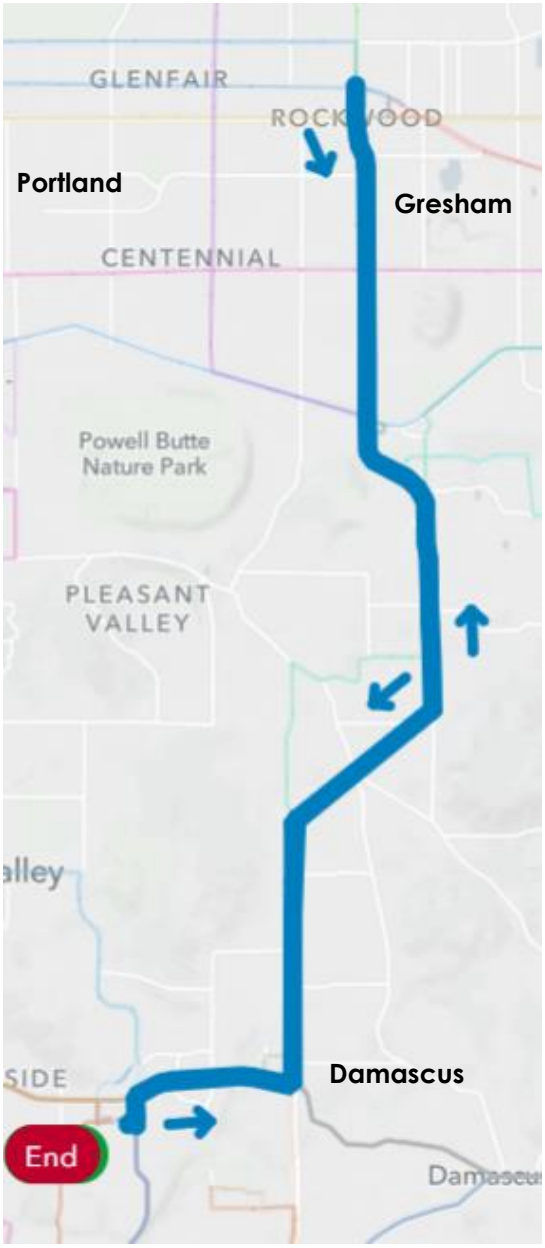
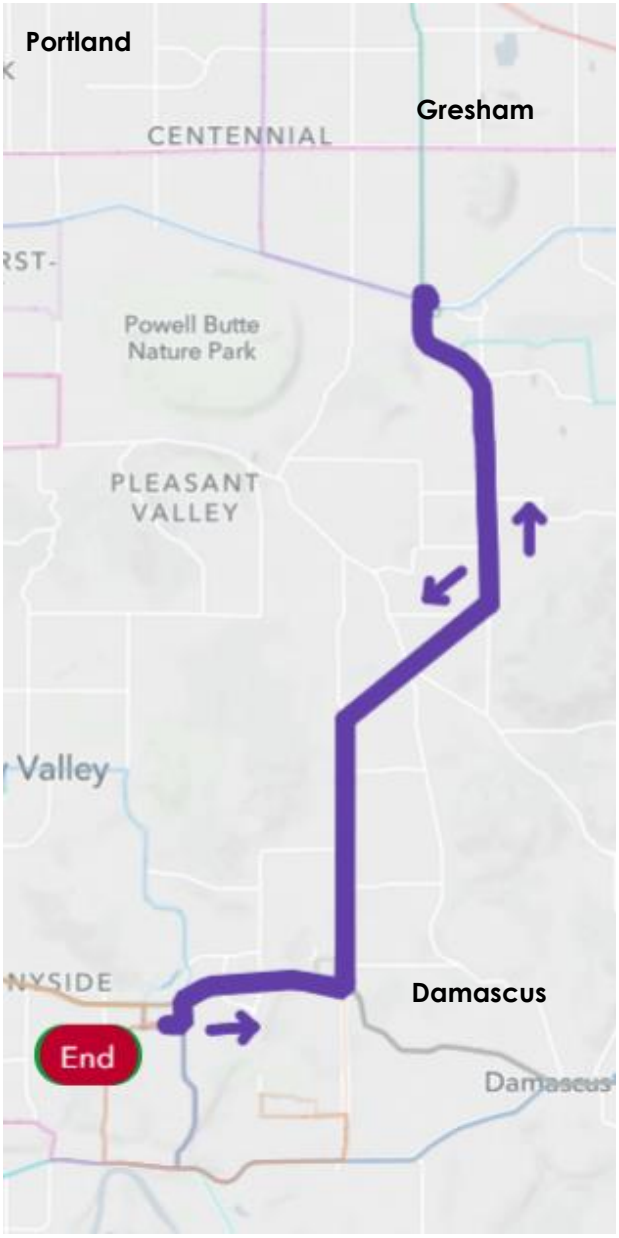


Figure 31. New Service on C2C Corridor with Service to Powell Boulevard (Option F2)



Damascus

There are multiple ways to add service to the Damascus area. This section includes three alternatives:

- Option G1. New fixed-route loop service in Damascus (Figure 32)
  - 7.8 miles and 30 minutes
  - Would allow for 26 round-trips per day operated by one full-time bus
  - Within ¼ mile of the proposed route, would serve 6,024 residents and 637 jobs
  - Cost per ride estimated to be $8.13 to $10.83
- Option G2. New fixed-route line service (Figure 33)
  - 8.3 miles and 33 minutes
  - Would allow for 23 round-trips per day operated by one full-time bus
  - Within ¼ mile of the proposed route, would serve 4,496 residents and 437 jobs
  - Cost per ride estimated to be $8.13 to $10.83
- Option G3. New deviated fixed-route service between Damascus and Boring (Figure 34)
  - 16.2 miles and 65 minutes
  - Would allow for 12 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 5,375 residents and 616 jobs.
  - Cost per ride estimated to be $7.22 to $9.29.
  - With low population density along this proposed route, service deviation could expand ridership.

Considerations include bus turnaround locations for each alternative. The proposed Sandy to Clackamas Town Center route would run through Damascus and along the Highway 212 corridor, providing an opportunity for transfers between local and regional transit service.

Recommendation: Based on the analysis above, low density in Damascus and Boring, and connectivity between other proposed routes in this plan, the ***Option G3. New Deviated Intercity Service*** is recommended to meet this area need.

Figure 32. New Loop Service in Damascus (Option G1)

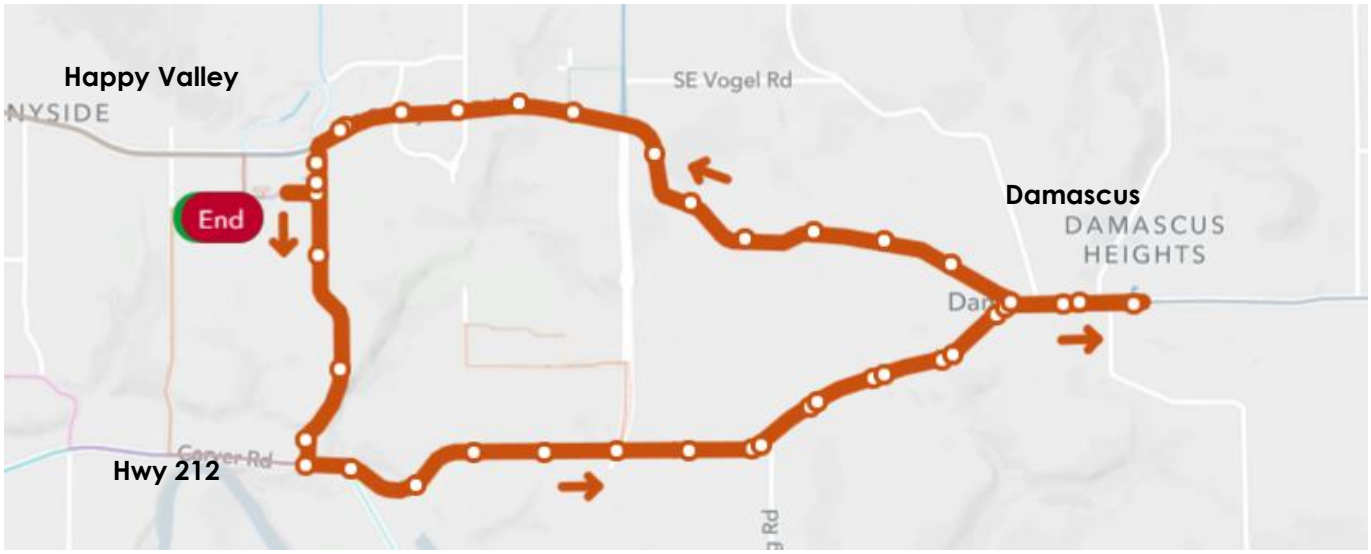


Figure 33. New Line Service in Damascus (Option G2)

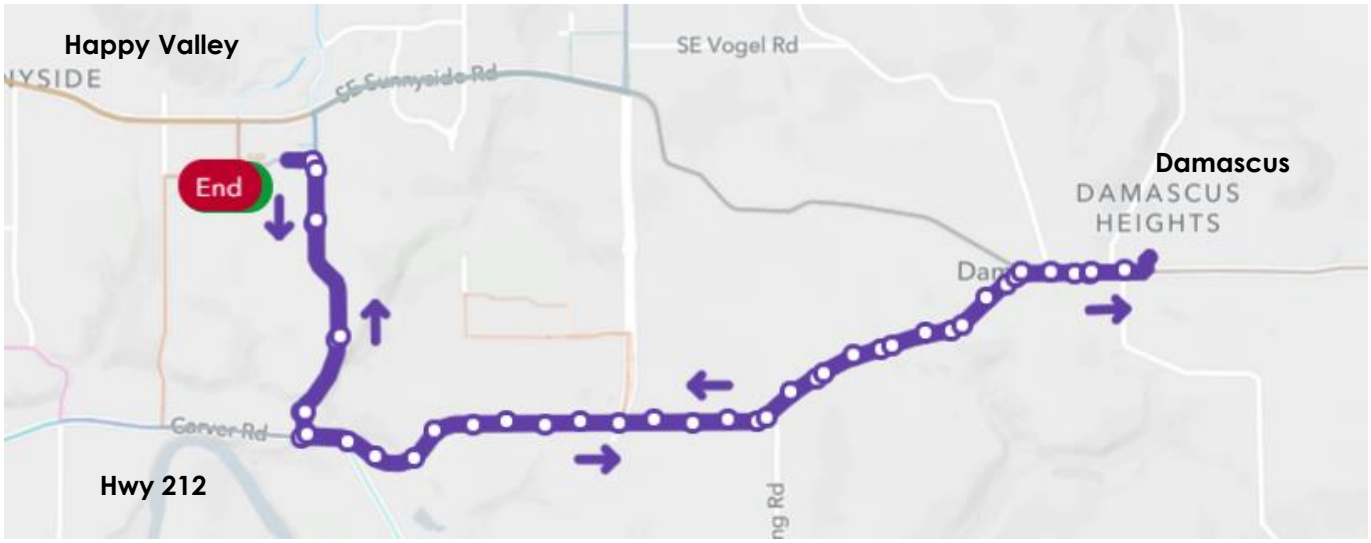


Figure 34. New Deviated-Route Service between Damascus and Boring (Option G3)

Boring

Outside of its urban core on Highway 212, Boring Road, and Richey Road, the community of Boring is a sparsely populated area with few connecting roads. According to the 2010 U.S. Census, there are 7,762 people living in the unincorporated area known as Boring, and there are 886 jobs. Deviated fixed-route service as shown in the intercity service between Damascus and Boring is recommended to provide first/last-mile connections to the Sandy – Clackamas Town Center. There are few sidewalks outside of the urban core, so the curb-to-curb service that deviation provides could suit this community well.

Happy Valley

There are multiple ways to improve transit service in Happy Valley. This section highlights two alternatives:

- Option H1. New fixed-route service north of Sunnyside connecting residential and commercial areas (Figure 35)
  - 12.9 miles and 52 minutes
  - Would allow for 15 round-trips per day operated by one full-time bus
  - Within ¼ mile of the proposed route, would serve 9,905 residents and 5,410 jobs
  - Cost per ride estimated between $10.50 to $13.13.
- Option H2. New fixed-route service along Sunnyside Road and Highway 212 (Figure 36)
  - 21.7 miles and 87 minutes
  - Would allow for 9 round-trips per day operated by one full-time bus
  - Within ¼ mile of the proposed route, would serve 11,872 residents and 10,175 jobs
  - Cost per ride estimated between $3.50 to $7.00

Additionally, a route providing service between Happy Valley, Jennings Lodge, and Oregon City is discussed below. A route connecting Sandy to Clackamas Transit Center via Sunnyside Road was discussed previously.

Considerations for these alternatives include duplicating existing TriMet service on Sunnyside Road for the loop and line alternatives, roadway width for transit vehicles on the loop and line alternatives, and a suitable turnaround point in Damascus for the Line 155 extension.

Recommendation: Based on the above analysis and on connectivity between other proposed routes in this plan, the ***Option H1. Line North of Sunnyside Road*** is recommended to meet this area need. In addition, TriMet has implemented an extension of Line 155 to connect to 172nd Avenue and the future C2C Corridor. The Line 155 schedule is recommended to be coordinated with that of the recommended Sandy–Clackamas Town Center route to provide better effective frequencies on Sunnyside Road out to 172nd Avenue.

Figure 35. New Line Service in North Happy Valley (Option H1)

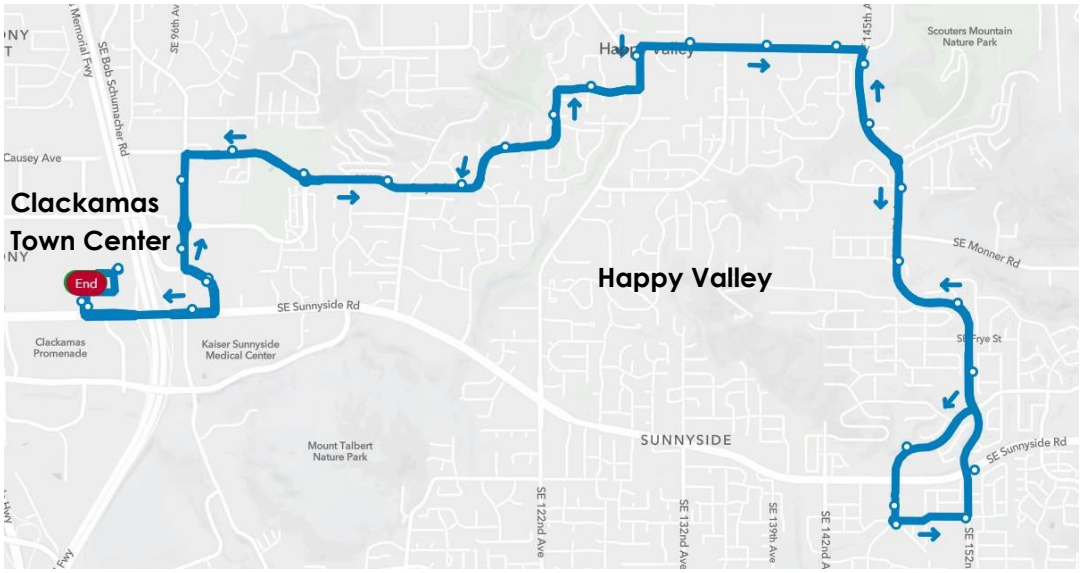
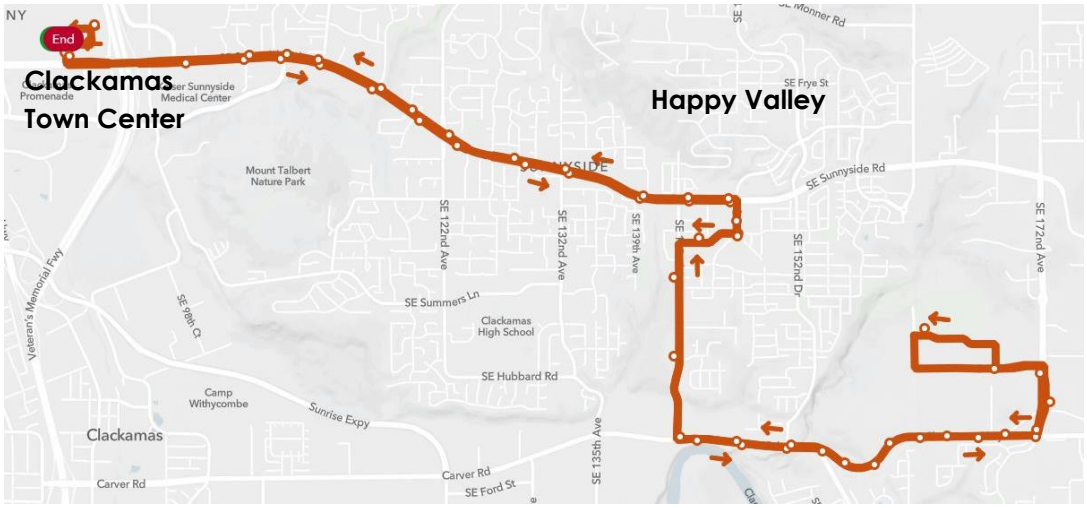


Figure 36. New Line Service in Happy Valley (Option H2)



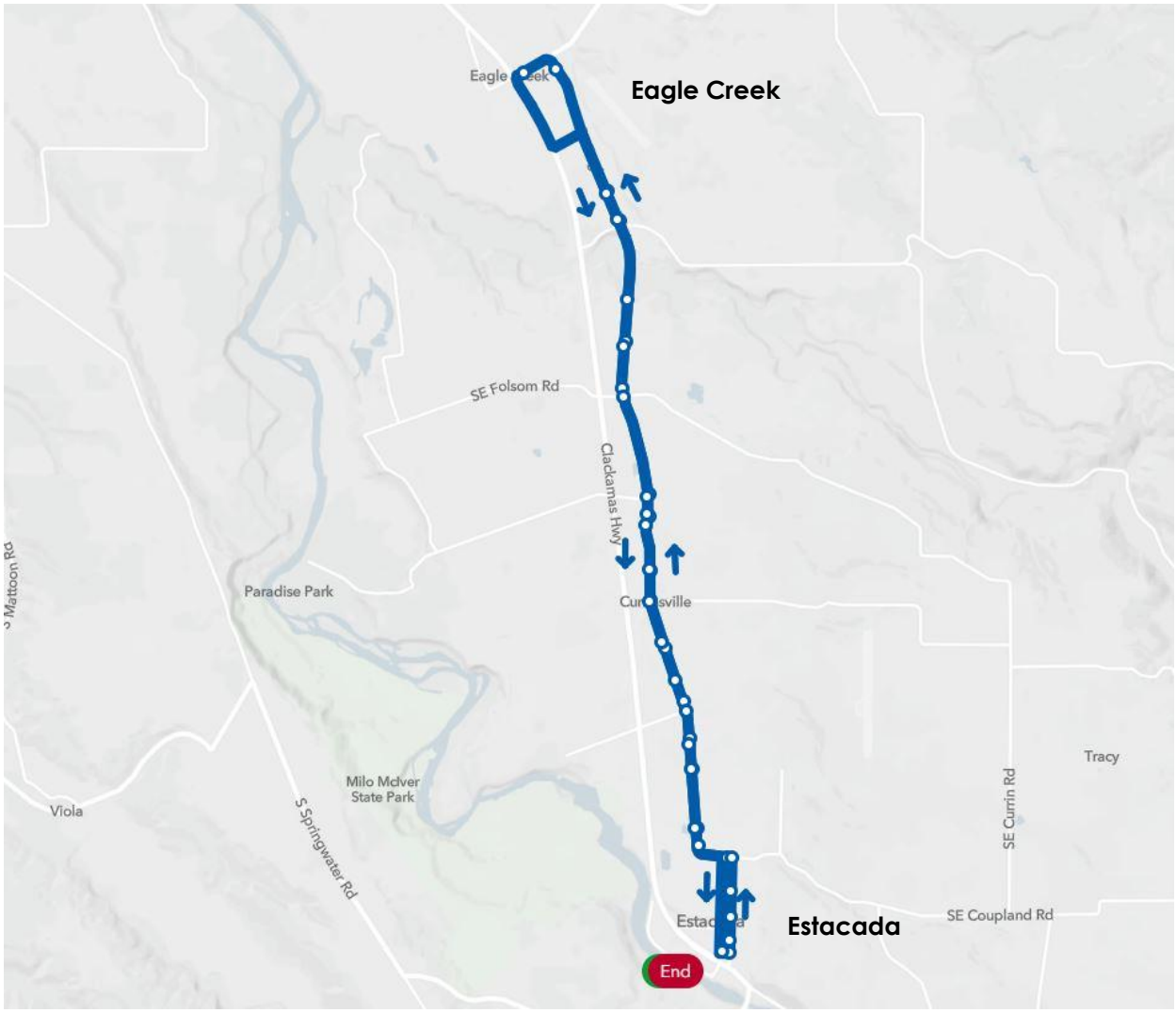
Estacada and Eagle Creek

Although TriMet Line 30 provides hourly service to Eagle Creek and Estacada, there is no first/last-mile option to access the route from locations beyond walking distance from the route. There are multiple ways to address local service needs in Estacada and Eagle Creek. The two ways shown here include:

- Option I1: New fixed-route service between Estacada and Eagle Creek (Figure 37)
  - 11 miles and 44 minutes
  - Would allow for 18 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 1,321 residents and 551 jobs.
  - Cost per ride estimated to be $7.22 to $9.29.
- Option I2: New demand-response service

For many of the same reasons as in Boring, a demand-response service is an alternative. Considerations for a new line compared to demand-response service include low population densities, where demand-response service could provide more coverage with timed connections to Line 30. However, this could be covered via the Estacada-Redland-Oregon City deviated fixed-route service. As such, **no additional service** is recommended.

Figure 37. New Local Service between Estacada and Eagle Creek



Jennings Lodge, Oak Grove, and Oatfield

There are multiple ways to address an east-west service deficiency for Jennings Lodge–Oak Grove–Oatfield. This section highlights three alternatives:

- Option J1. New fixed-route service between Oak Grove and Clackamas Town Center (Figure 38)
  - 13 miles and 50 minutes
  - Would allow for 16 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 10,521 residents and 7,912 jobs.
  - Cost per ride estimated between $3.50 to $7.00
- Option J2. New fixed-route service between Oak Grove, the Clackamas Industrial Area, and Clackamas Town Center (Figure 39)
  - 16 miles and 64 minutes
  - Would allow for 12 round-trips per day operated by one full-time bus.
  - Within ¼ mile of the proposed route, would serve 14,539 residents and 9.334 jobs.
  - Cost per ride estimated between $3.50 to $7.00
- Option J3. New fixed-route service between Oregon City, Jennings Lodge, the Clackamas Industrial Area, and Happy Valley (Figure 40)
  - 21 miles and 86 minutes
  - Would allow for 9 round-trips per day operated by one full-time bus
  - Within ¼ mile of the proposed routed, would serve 17,011 residents and 6,630 jobs.
  - Cost per ride estimated between $3.50 to $7.00

Recommendation: Based on public feedback and the above analysis, the ***Option J2. Oak Grove to Clackamas Town Center via Clackamas Industrial Area*** route is recommended to address this corridor need. In addition, TriMet is planning the implement ***Option J3. Oregon City to Happy Valley route***.

Figure 38. New Local Service Route between Oak Grove and Clackamas Town Center (Option J1)

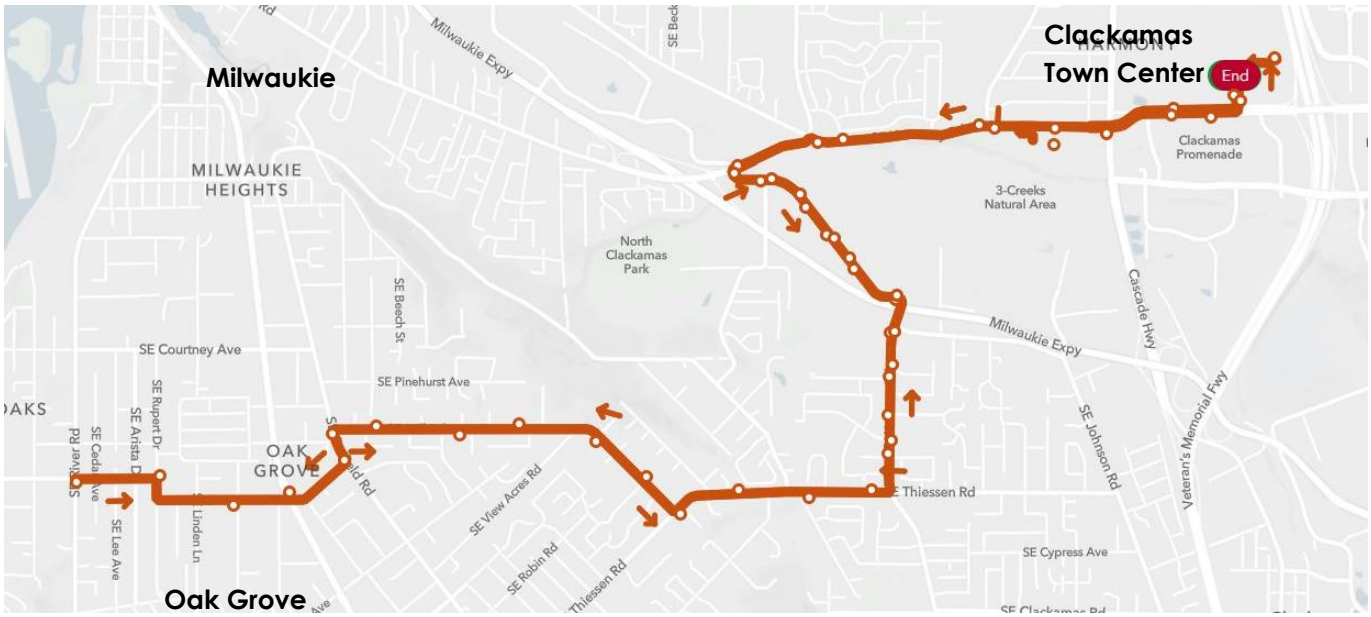


Figure 39. New Local Service Route between Oak Grove, Clackamas Industrial Area, and Clackamas Town Center (Option J2)

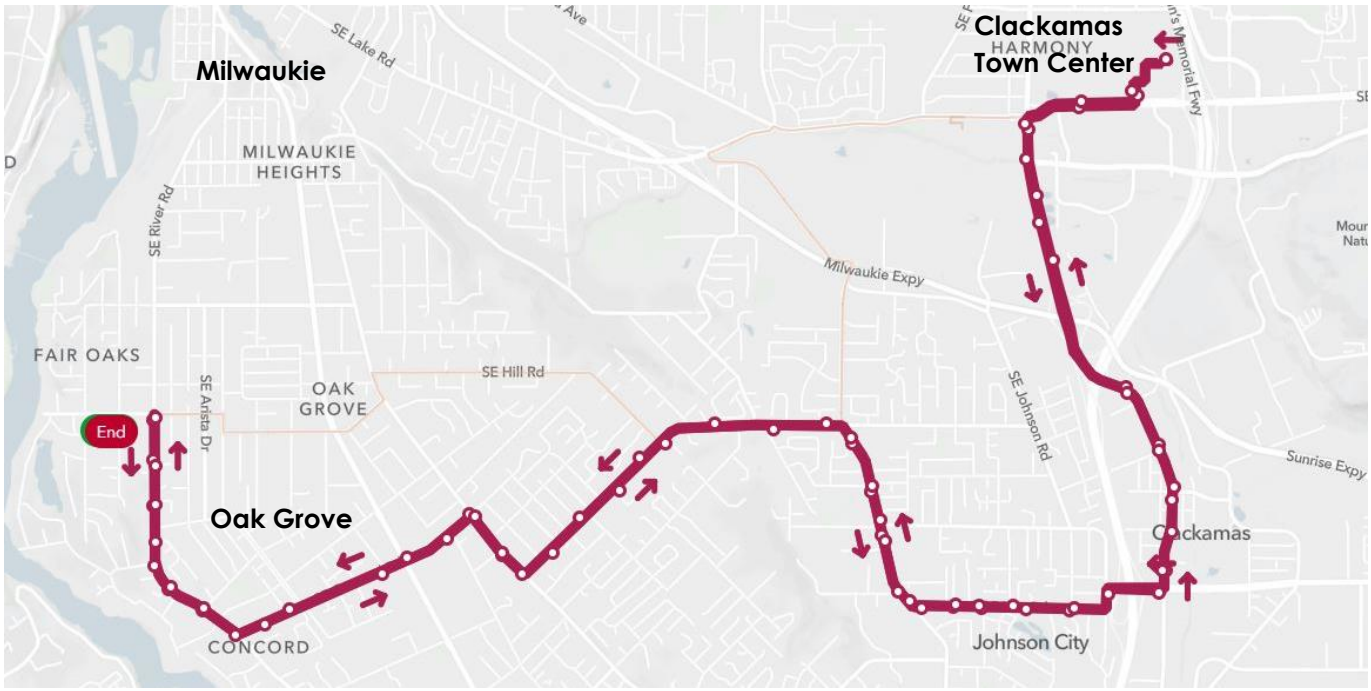
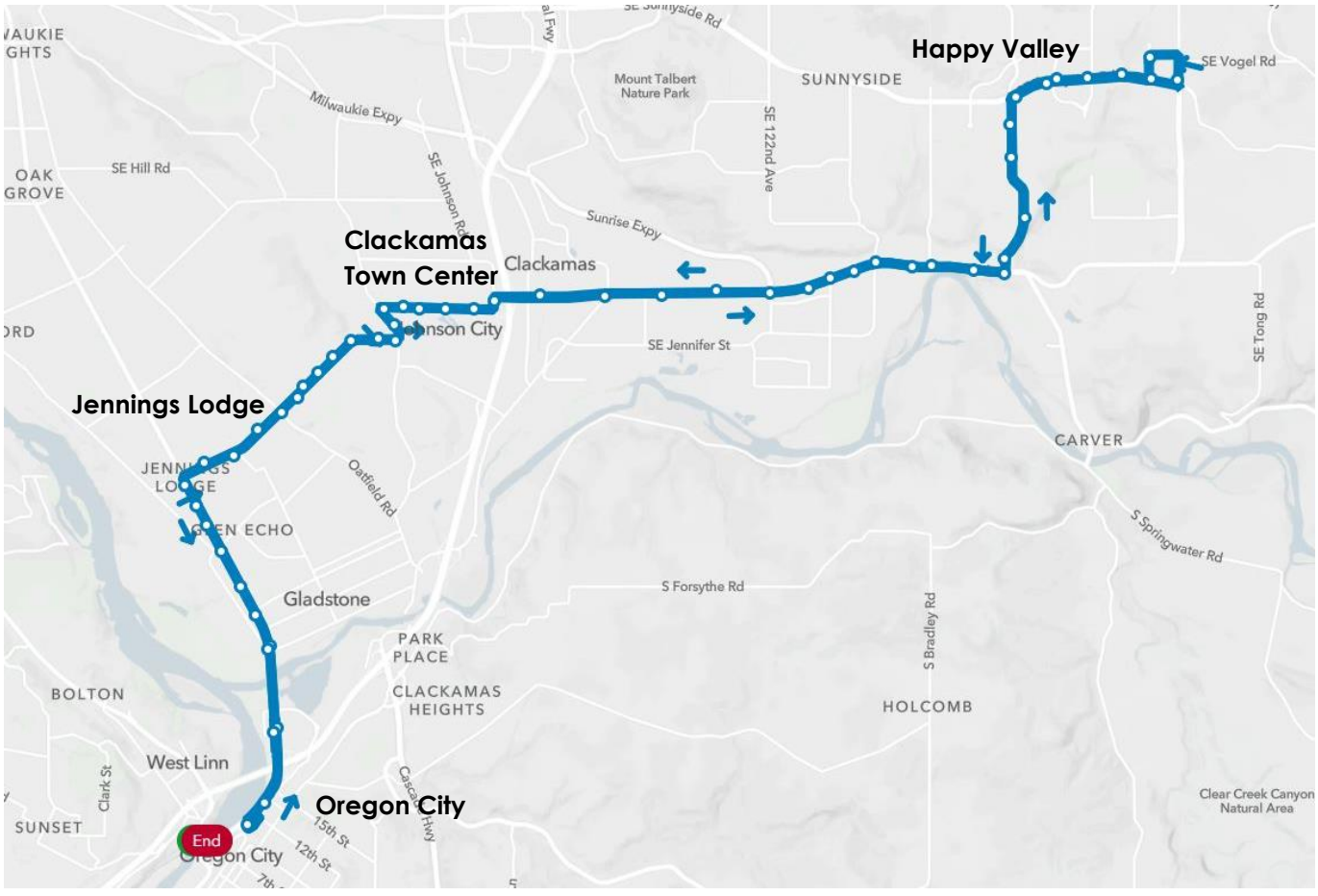


Figure 40. New Local Service Route Between Jennings Lodge, Clackamas Industrial Area, and Happy Valley (Option J3)



Prioritization

This section describes the prioritization of the recommended service opportunities based on the recommended transit network and demand information.

Table 11 shows recommendations for short-term, mid-term, and long-term implementation of the recommended service opportunities and whether these opportunities are already partially or fully recommended in other plans.

- Short-term recommendations consist of those opportunities with demands exceeding 20 additional runs per day and are estimated to be completed in the next 10 years.
- Mid-term recommendations are those opportunities with demand for 11–20 additional transit runs per day and are estimated to be completed in 5-15 years.
- Long-term recommendations consist of the remaining additional transit trip demands and are estimated to be completed in 10-20 years.

Improvements are incremental; for example, while 47 additional transit runs are recommended for I-205 between Oregon City and the I-5 interchange, the short-term recommendation is to add hourly service on the I-205 route and a separate hourly service on the Borland Road route, a total of approximately 28 daily runs. After the service is established, the County can evaluate ridership patterns and unmet needs in the mid- and long-term and determine whether expanding service hours, adding frequency, or leaving service as-is is appropriate.

Table 11. Recommended Service Opportunity Prioritization

Corridor or Area	Existing Runs per Day	Additional Transit Run Demand	Recommendation			Already Planned?
			Short-Term	Mid-Term	Long-Term	
Highway 43: Oregon City to Portland[1]	47	48	Implement 15-minute service on Line 35, new service on Rosemont Road	—	—	Yes; TriMet Plan
I-205: Oregon City to I-5 Interchange[1]	0	47	Implement hourly local service on Borland Road (Option D2) and hourly express service on I-205 (Option D1) (about 28 runs per day total)	Evaluate service; consider increased service span and frequency to add 10 runs per day.	Evaluate service; Consider increased service span and frequency to add 10 runs per day.	Yes; TriMet Plan for Pass-Through Funds on Borland, SMART for I-205
Clackamas Industrial Area[1]	22	42	Implement hourly shuttle service, new hourly Happy Valley–Oregon City service (Option J3) (about 28 runs per day)			Yes; TriMet Plan for Pass-Through Funds
I-205: Oregon City to Clackamas Town Center[1]	50	37	Implement 15-minute service on Line 79 (about 34 runs per day)			Yes; TriMet Plan
Oregon City (South and West) [1]	0	32	Implement hourly shuttle service (about 12 runs per day)			Yes; TriMet Plan for Pass-Through Funds
Milwaukie Industrial Area[1]	33	31	Implement hourly shuttle service, expand service hours on Line 152 (about 12 runs per day)			
West Lake Oswego/ Kruse Way[1]	12	20	—	Expand service hours beyond peak periods and improve headways to 30 minutes during AM peak hour (Option E2 and/or Option E3)		
Wilsonville (West Wilsonville)[2]	16	16	—	Expand service hours beyond peak periods		
Happy Valley[1]	16	16	—	Establish hourly service in North Happy Valley (Option H1)		
Canby (North and South)[3]	16	16	—	Implement local service as established in CAT's Master Plan		Yes; CAT Master Plan

Corridor or Area	Existing Runs per Day	Additional Transit Run Demand	Recommendation			Already Planned?
			Short-Term	Mid-Term	Long-Term	
Jennings Lodge–Oak Grove–Oatfield[1]	0	16	Clackamas Industrial Area (Happy Valley–Oregon City, Option J3) provides service to Jennings Lodge	Establish hourly service from Oak Grove (Option J2) (8 runs per day)		Yes; TriMet Plan
Damascus[1]	0	16	—	Establish hourly service (Option G3)		
Highway 99E: Oregon City to Canby[2]	26	14	—	Establish 30-minute headways during the entire day		Yes; CAT Master Plan
Highway 212: I-205 to US 26[2]	0	14	—	Establish hourly service (Option A2)		
Highway 99E: Oregon City to Portland[1]	84	11	—	—	Add 11 runs per day	Yes; TriMet Plan
Highway 211: Molalla to Woodburn[2]	0	10	—	—	Establish hourly service (Option B1)	
C2C Corridor[1]	0	10	—	—	Establish hourly service (Option F1)	
Highway 213: South of Molalla[2]	0	8	—	—	Establish hourly service	
Boring[1]	0	8	—	—	Establish demand-response service	
East Tualatin[1]	0	8	Hourly service provided by Borland Road route	—	—	
US 26: West of Sandy[2]	33	3	—	—	Add 3 runs per day	
Estacada–Redland–Oregon City	0	8	Consider deviated fixed-route service (Option C1)			
Estacada and Eagle Creek[1]	27	0	Additional service could be covered by Estacada–Redland–Oregon City deviated fixed-route (Option C1)			
I-205: North of Clackamas Town Center[1]	85	-	Monitor potential increases to transit demand			
Highway 224: Highway 212 to Estacada[1]	27	-				
Highway 213: Oregon City to Molalla[2]	24	-				
Highway 99E: South of Canby[2]	14	-				Yes; CAT Master Plan
US 26: East of Sandy[2]	15	-				

[1]Within existing or future TriMet district

[2]Outside TriMet service area

Short-Term Recommendations

Short-term recommendations include adding service along Highway 43 and between Oregon City and Clackamas Town Center, and establishing service along the I-205 corridor from Oregon City to Tualatin, in the Clackamas Industrial Area, in Oregon City, and in the Milwaukie Industrial Area.

Table 12 lists the transit corridor or area with the short-term recommendation and additional considerations. Figure 41 and Figure 42 show the full county transit network with the short-term recommendations.

Table 12. Short-Term Recommendations

ID	Corridor or Area	Existing Runs per Day	Additional Transit Run Demand	Recommendation
ST-1	Highway 43: Oregon City to Portland[1]	47	48	Implement 15-minute service on Line 35, new service on Rosemont Road
ST-2	I-205: Oregon City to I-5 Interchange[1]	0	47	Implement hourly local service on Borland Road and hourly express service on I-205 (about 28 runs per day); Triggers Mobility Hub in West Linn
ST-3	East Tualatin[1]	0	8	Hourly service provided by Borland Road route
ST-4	Clackamas Industrial Area[1]	22	42	Implement hourly shuttle service; new hourly Happy Valley–Oregon City Service (about 28 runs per day); Triggers Mobility Hub in Clackamas Industrial Area
ST-5	Jennings Lodge-Oak Grove-Oatfield[1]	0	16	Jennings Lodge served by new hourly Happy Valley–Oregon City service; triggers Mobility Hub in Happy Valley
ST-6	Oregon City (South and West) [1]	0	32	Implement hourly shuttle service (about 12 runs per day)
ST-7	Milwaukie Industrial Area[1]	33	31	Implement hourly shuttle service; expand Line 152 service hours (about 12 runs per day)

[1]Within existing or future TriMet district

[2]Outside TriMet service area

Mid-Term Recommendations

The mid-term recommendations continue to expand service along the I-205 corridor, in the Clackamas Industrial Area and Milwaukie Industrial Area, and in the southern and western areas of Oregon City. In addition, mid-term recommendations include expanding service along Kruse Way, in West Wilsonville, Happy Valley, Canby, and Highway 99E between Oregon City and Canby; providing east–west service for Oak Grove and Oatfield; and establishing service in Damascus and along the Highway 212 corridor.

Table 13 lists the transit corridor or area with the mid-term recommendation and additional considerations. Figure 44, Figure 45, and Figure 46 show the full county transit network with the mid-term recommendations.

Table 13. Mid-Term Recommendations

ID	Corridor or Area	Runs per Day Prior to Mid-Term	Additional Transit Run Demand	Recommendation
MT-1	I-205: Oregon City to I-5 Interchange[1]	28	19	Evaluate service; consider increased service span and frequency to add runs to service
MT-2	Clackamas Industrial Area[1]	50	14	
MT-3	Oregon City (South and West) [1]	12	20	
MT-4	Milwaukie Industrial Area[1]	45	19	
MT-5	I-205: Oregon City to Clackamas Town Center[1]	69	18	Implement 20-minute headways on Line 79 (about 50 runs per day)
MT-6	West Lake Oswego/ Kruse Way[1]	12	20	Increase frequency to 30 minutes during AM peak hour (about 10 runs per day)
MT-7	Wilsonville (West Wilsonville)[2]	16	16	Expand service hours beyond peak periods (about 8 runs per day)
MT-8	Happy Valley[1]	16	16	Establish hourly service (about 8 runs per day)
MT-9	Canby (North and South)[3]	16	16	Implement local service as established in CAT's Master Plan (about 8 runs per day)
MT-10	Jennings Lodge-Oak Grove-Oatfield[1]	8	8	Establish hourly service from Oak Grove (about 8 runs per day)
MT-11	Damascus[1]	0	16	Establish hourly service (about 8 runs per day)
MT-11	Boring[1]	0	8	Hourly service provided by Damascus deviated fixed-route
MT-12	Highway 99E: Oregon City to Canby[2]	26	14	Establish 30-minute headways during the entire day (about 8 runs per day)
MT-13	Highway 212: I-205 to US 26[2]	0	14	Establish hourly service (about 8 runs per day); triggers Mobility Hub in Boring

[1]Within existing or future TriMet district
[2]Outside TriMet service area

Long-Term Recommendations

The long-term recommendations continue to expand service in corridors and areas highlighted in the short- and mid-term recommendations. In addition, the long-term recommendations include expanding service on Highway 99E between Oregon City and Portland and on US 26 west of Sandy, and establishing new service in Boring, East Tualatin, along the Clackamas to Columbia Corridor, on Highway 211 between Molalla and Woodburn, and on Highway 213 south of Molalla.

Table 14 lists the transit corridor or area with the long-term recommendation and additional considerations. Figure 47, Figure 48, and Figure 49 show the full county transit network with the long-term recommendations.

Table 14. Long-Term Recommendations

ID	Corridor or Area	Runs per Day Prior to Long-Term	Additional Transit Runs Demand	Recommendation
LT-1	I-205: Oregon City to I-5 Interchange[1]	38	9	Evaluate service; consider increased service span and frequency to add about 10 runs per day.
LT-2	Oregon City (South and West) [1]	22	10	
LT-3	Milwaukie Industrial Area[1]	55	9	
LT-4	I-205: Oregon City to Clackamas Town Center[1]	84	3	
LT-5	West Lake Oswego/ Kruse Way[1]	22	10	
LT-6	Wilsonville (West Wilsonville)[2]	24	8	
LT-7	Happy Valley[1]	24	8	
LT-8	Canby (North and South)[3]	24	8	
LT-9	Damascus[1]	8	8	
LT-10	Highway 99E: Oregon City to Canby[2]	34	6	
LT-11	Highway 212: I-205 to US 26[2]	8	6	
LT-12	Highway 99E: Oregon City to Portland[1]	84	11	Add 11 runs per day on Line 99, maintain existing 20-minute headways with extended service hours
LT-13	Highway 211: Molalla to Woodburn[2]	0	10	Establish hourly service
LT-14	C2C Corridor[1]	0	10	Establish hourly service
LT-15	Highway 213: South of Molalla[2]	0	8	Establish hourly service
LT-16	Estacada-Redland-Oregon City[2]	0	8	Consider deviated fixed-route service
LT-17	US 26: West of Sandy[2]	33	3	Add 3 runs per day, maintain 30-minute headways with extended service hours
N/A	Estacada and Eagle Creek[1]	Covered by Estacada–Redland–Oregon City route; consider mobility hub in Eagle Creek		
	I-205: North of Clackamas Town Center[1]	Monitor potential Increases to transit demand		
	Highway 224: Highway 212 to Estacada[1]			
	Highway 213: Oregon City to Molalla[2]			
	Highway 99E: South of Canby[2]			
	US 26: East of Sandy[2]			
	Boring[1]			

[1]Within existing or future TriMet district

[2]Outside TriMet service area

Figure 41. Short-Term Recommendations – County Extents

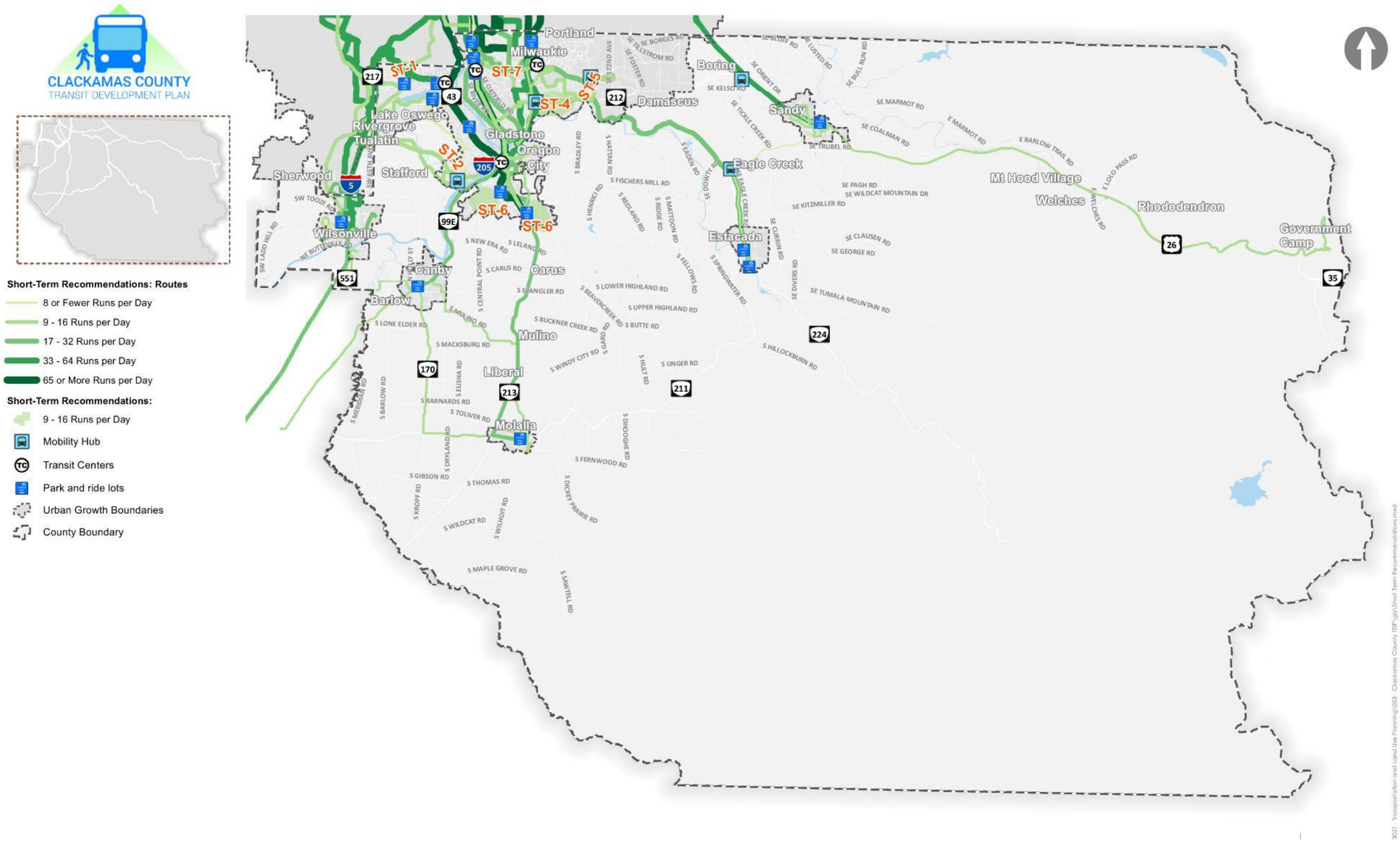


Figure 42. Short-Term Recommendations – TriMet Extents

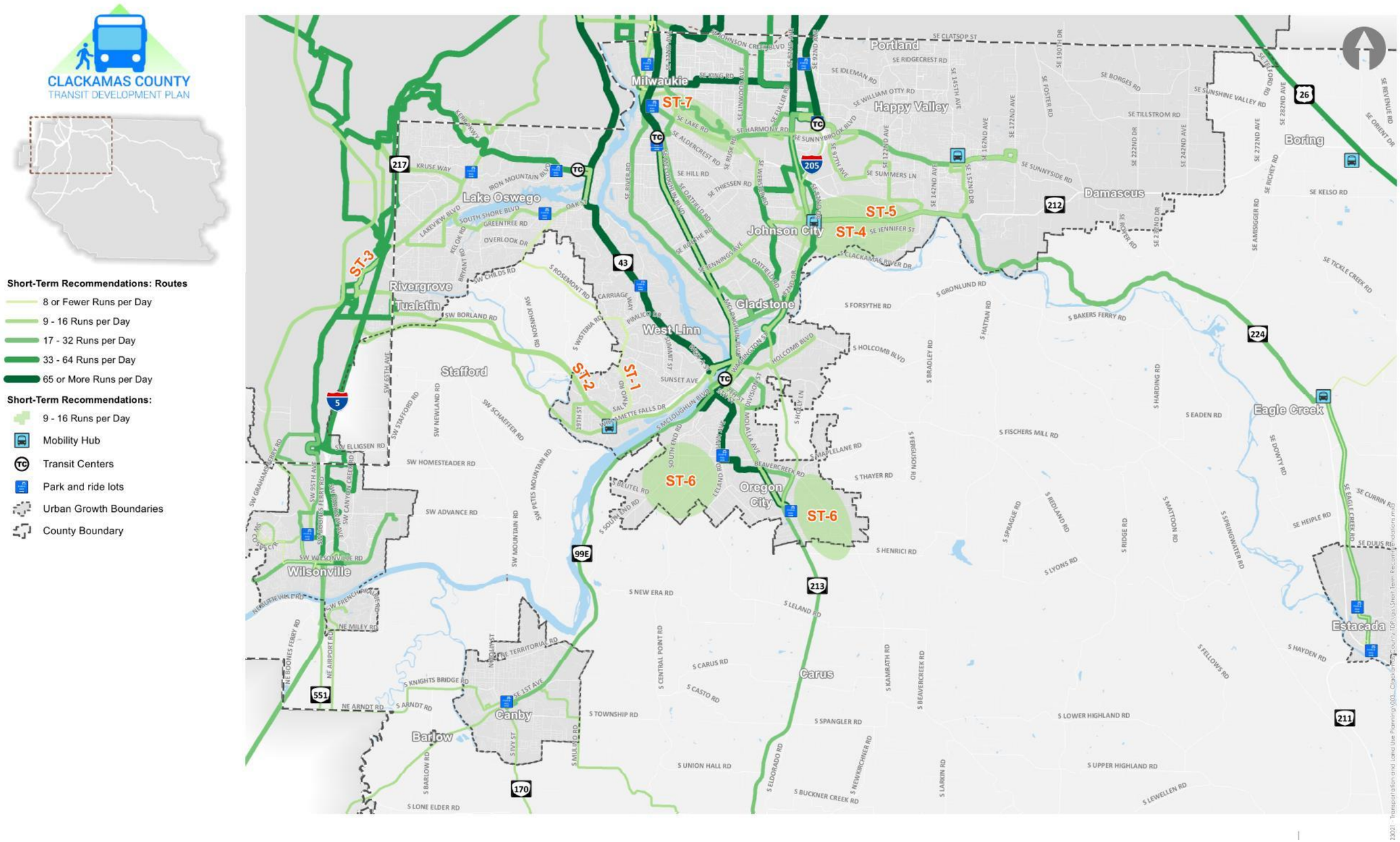


Figure 43. Short-Term Recommendations – Northwest County Extents

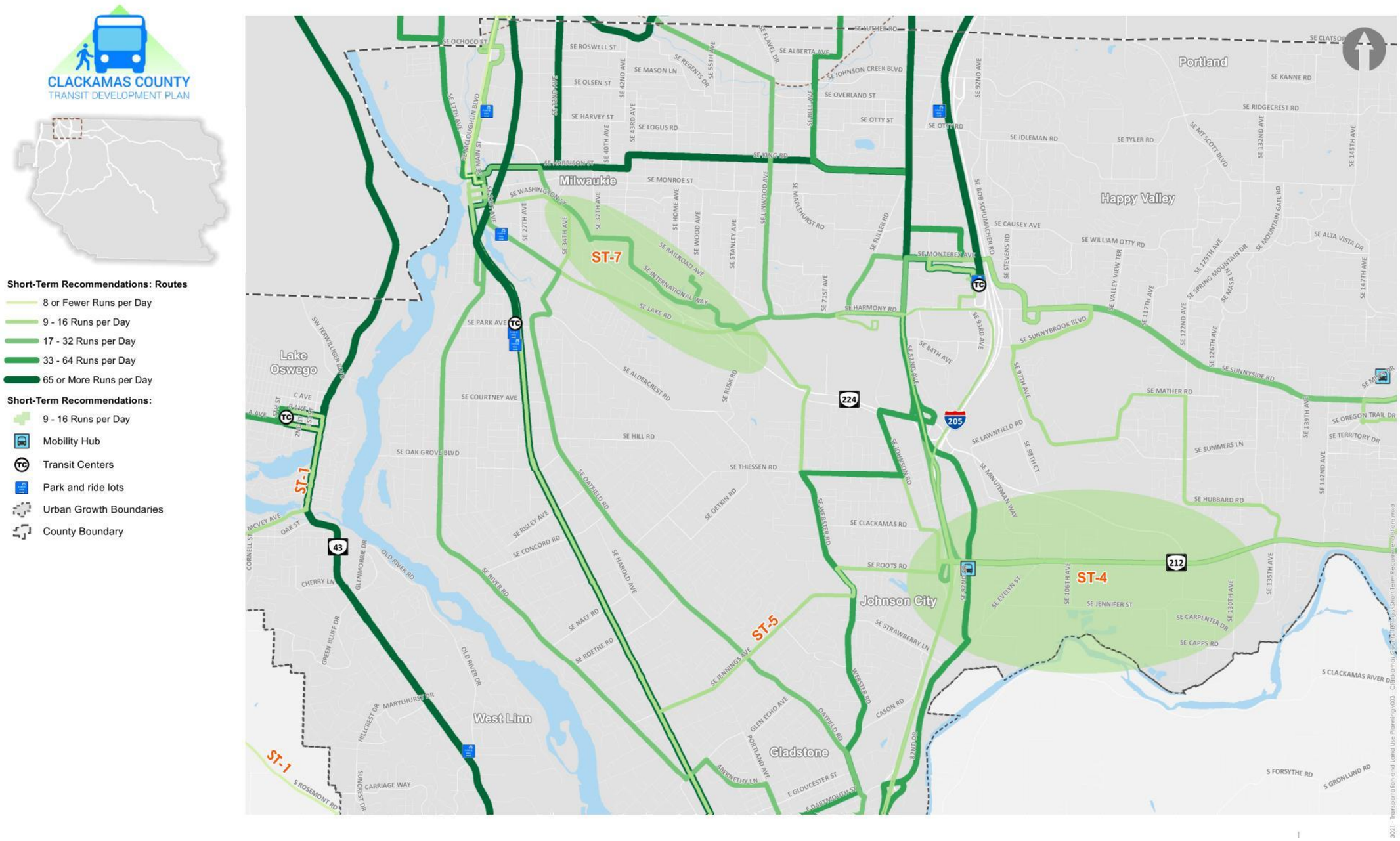


Figure 44. Medium-Term Recommendations – County Extents

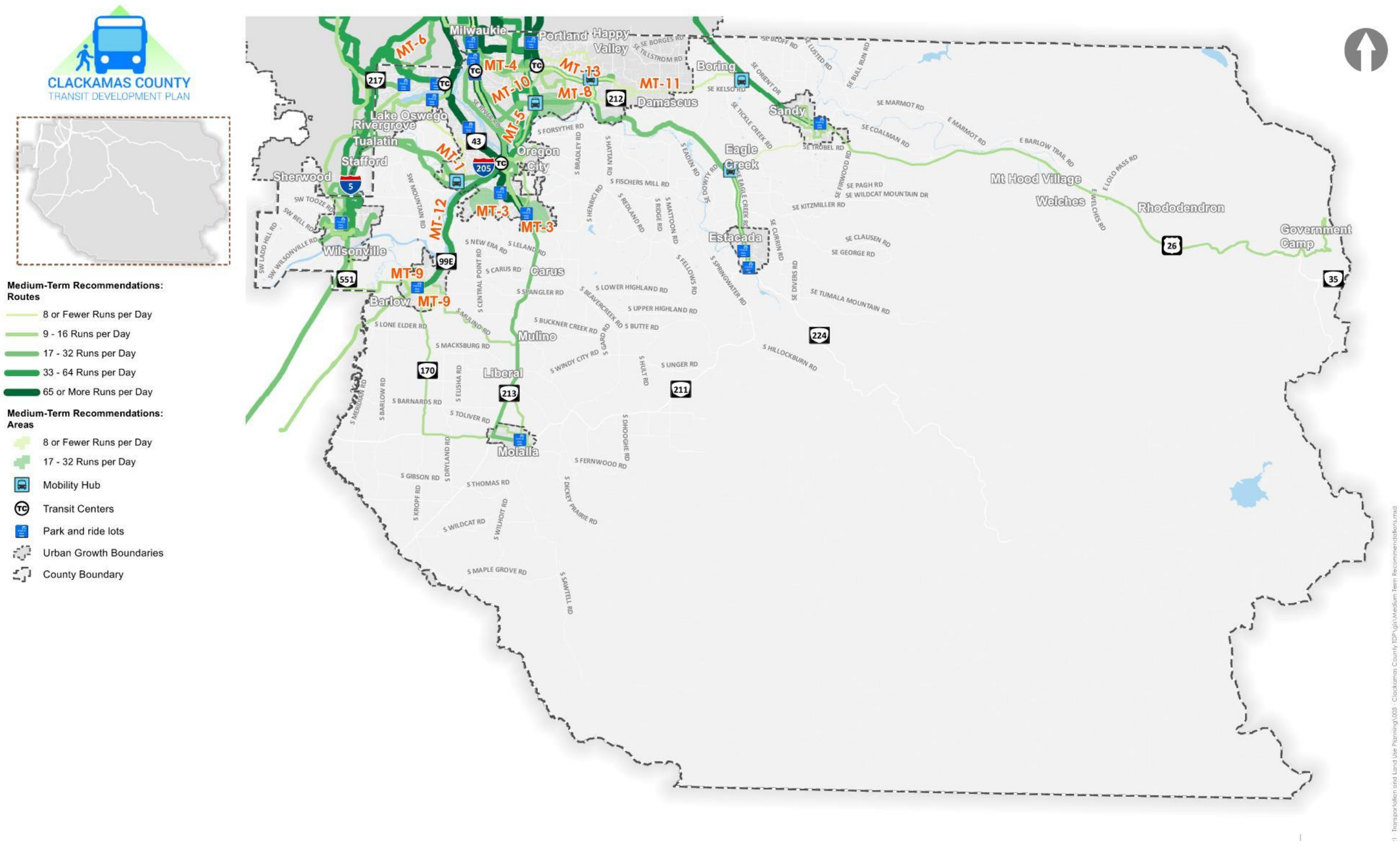


Figure 45. Medium-Term Recommendations – TriMet Extents

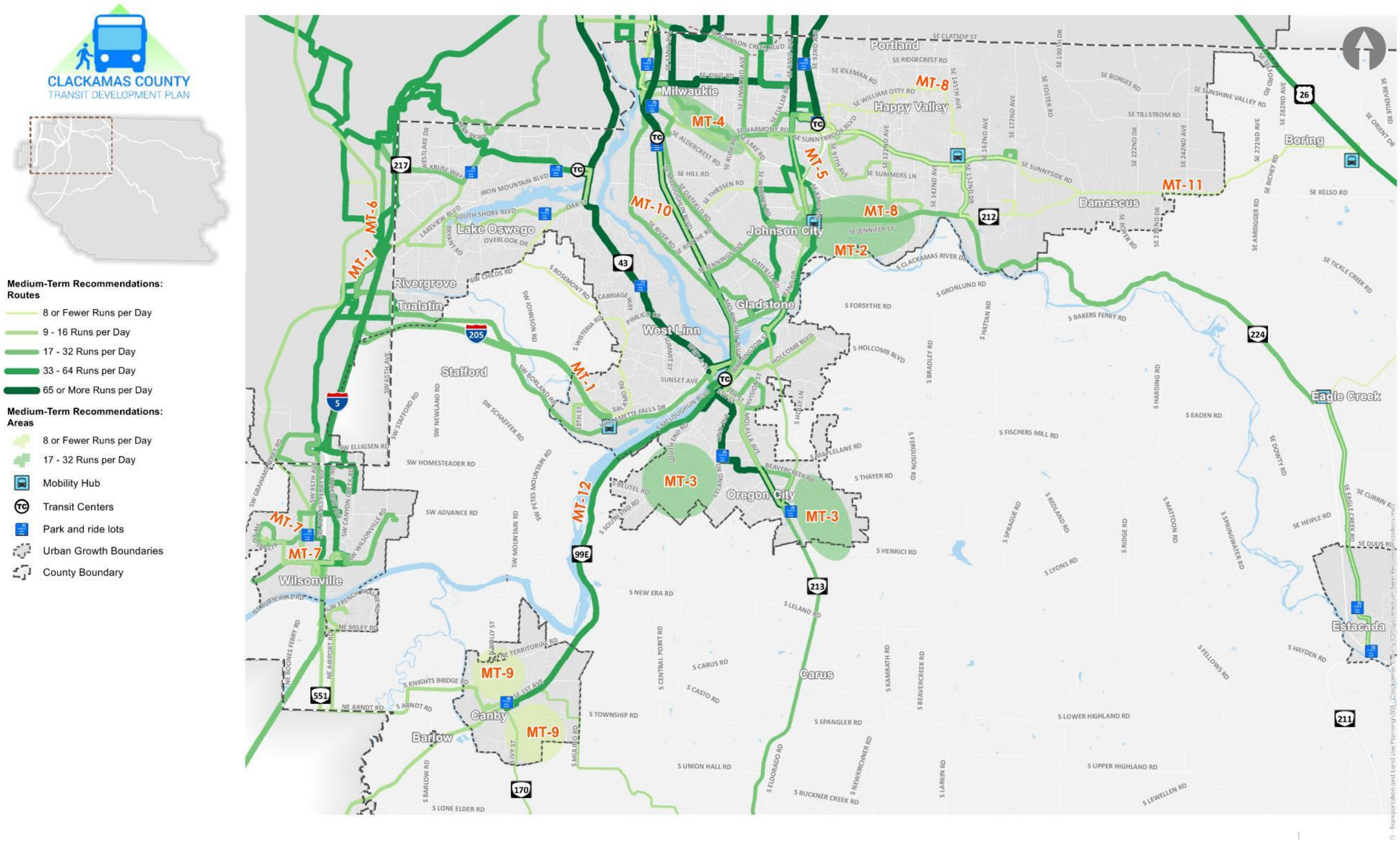


Figure 46. Medium-Term Recommendations – Northwest County Extents

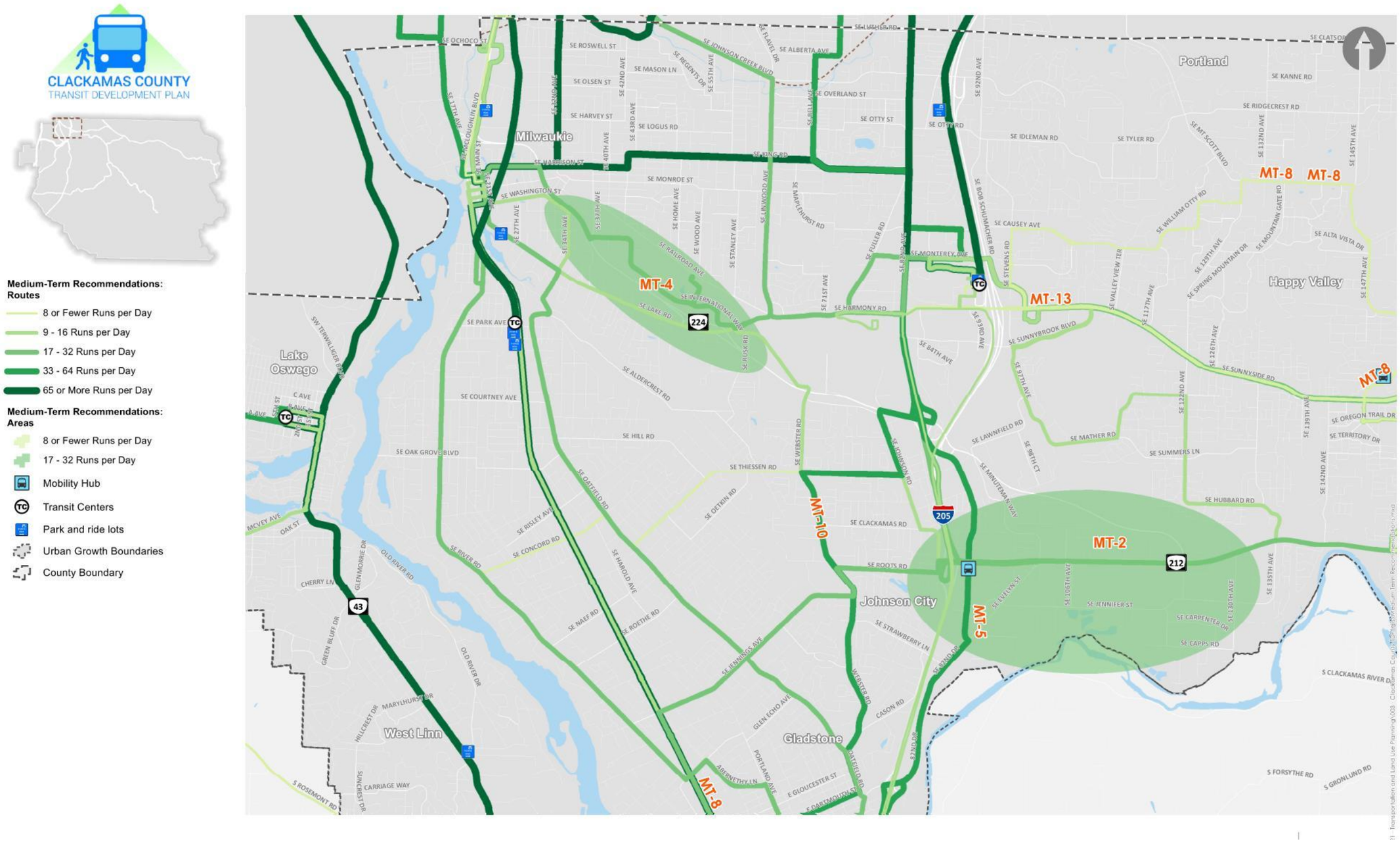


Figure 47. Long-Term Recommendations – County Extents

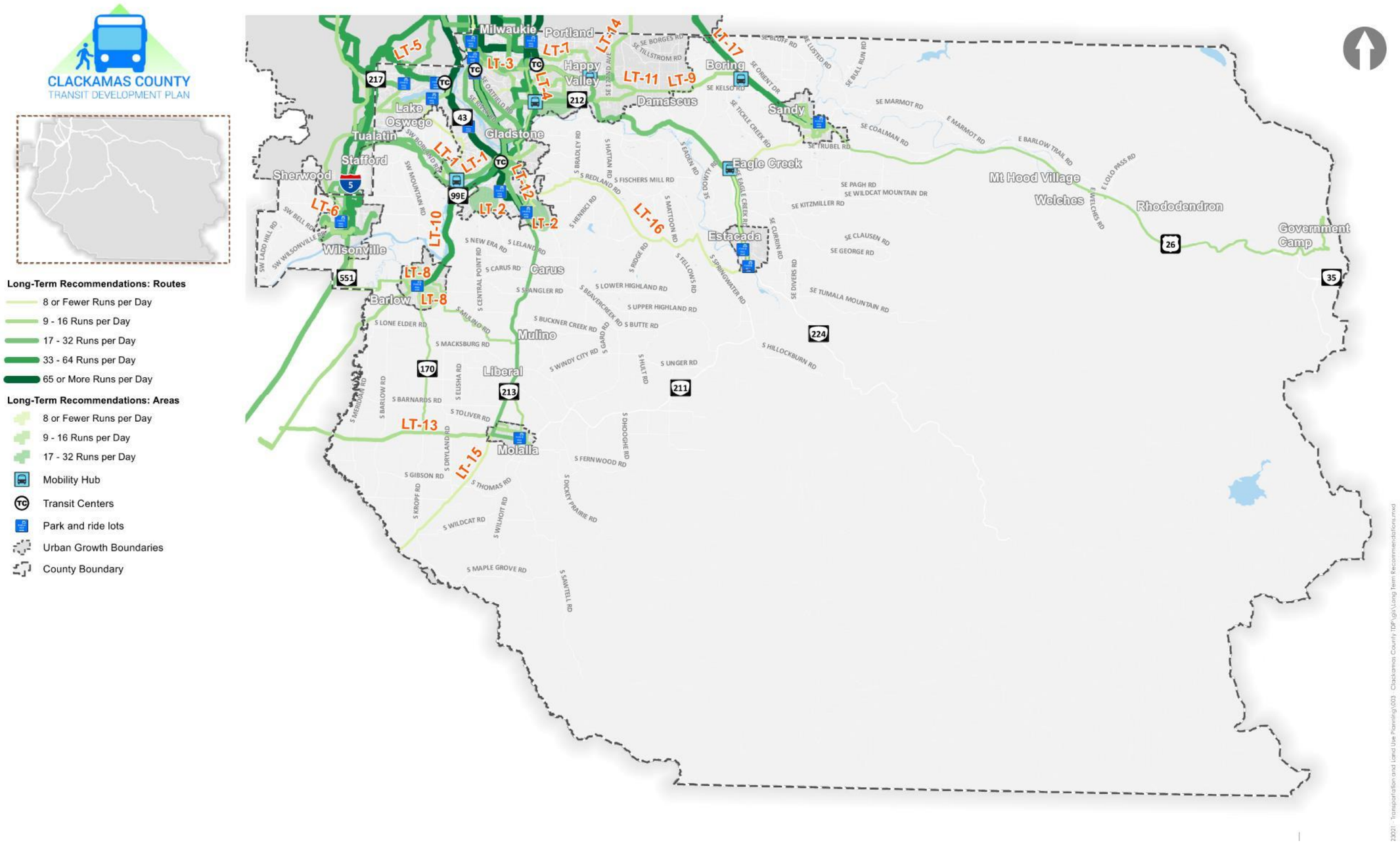


Figure 48. Long-Term Recommendations – TriMet Extents

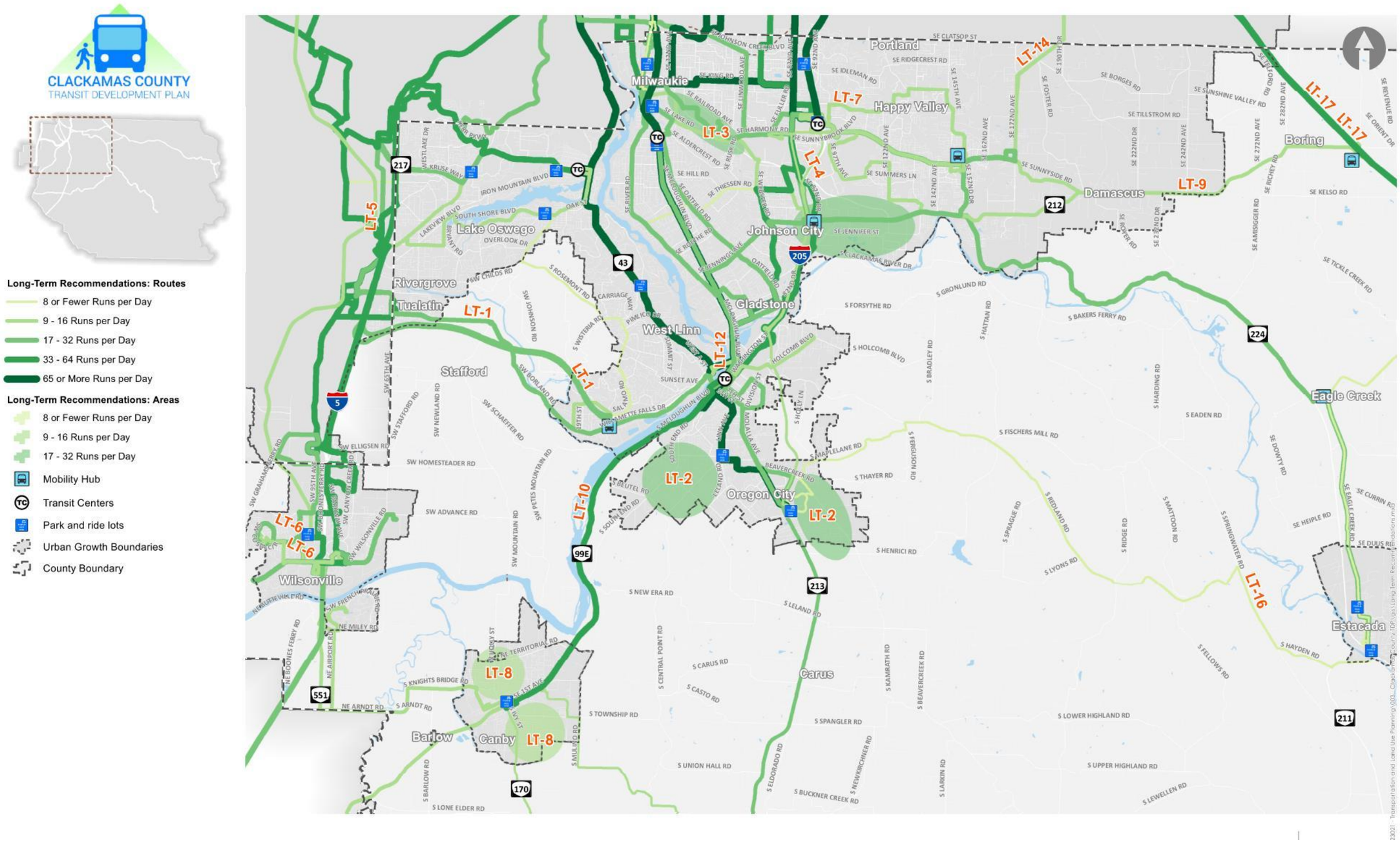
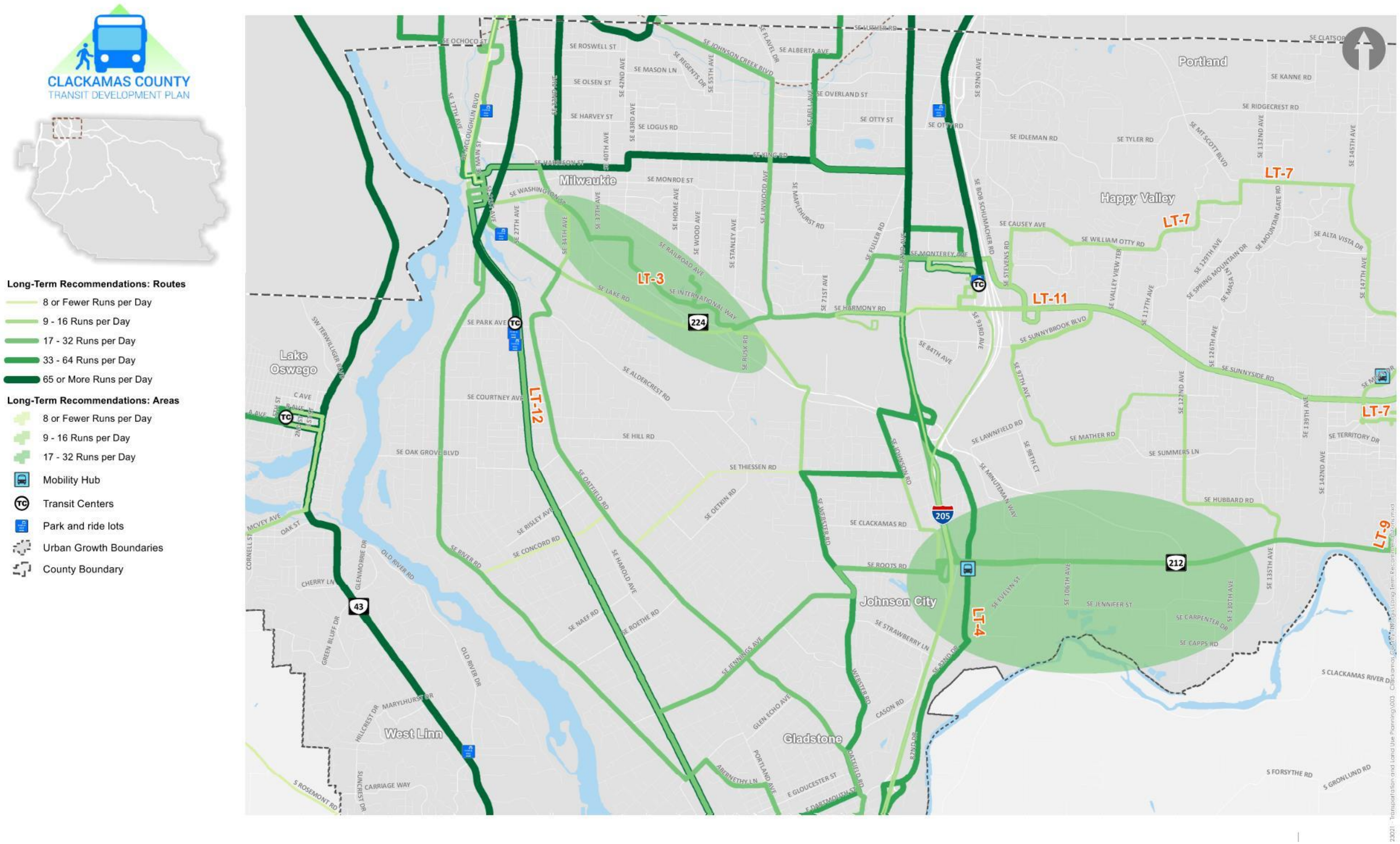


Figure 49. Long-Term Recommendations – Northwest County Extents



Transit-Supportive Improvements and Strategies

This section describes transit center and stop improvements, bicycle and pedestrian facility connectivity, land use policies, and information and technology improvements the County could undertake to promote transit.

Transit Centers and Stop Improvements

Facilities improvements include transit centers and major stops, bus stops, and other bus and administrative facilities. Safe and comfortable passenger facilities can improve the riding experience and increase ridership by improving stop visibility, providing protection from poor weather, and improving access to transit. The following sections describe potential implications of and high-level cost estimates for facility improvements. Ridership estimates are not provided as these vary significantly by provider and community. Many cost estimates are based on *Transit in Small Cities: A Primer for Planning, Siting, and Designing Transit Facilities in Oregon.*[1] This information is provided for reference and does not include recommendations for stop locations beyond the mobility hubs identified previously; stop-level decisions are made by the respective transit provider and the roadway owner (cities, Clackamas County, ODOT).

Transit Centers and Major Transit Stops

Transit centers provide a transfer point for bus routes and other transit services, while major transit stops are typically provided at major activity centers. In addition to providing greater passenger amenities that improve rider comfort, transit centers and major transit stops provide visibility for the transit service, reminding residents and visitors of the availability of the service within their community. The following key concepts should be considered when constructing transit centers or major transit stops:

- The location should consider pedestrian access to nearby destinations, ease of access by bus that reduces out-of-direction travel and allows for safe bus operations, and a location that is highly visible, both to publicize the service and to enhance rider safety and security.
- The stop or transit center should be sized to accommodate planned 20-year growth, both in terms of the number of buses accommodated and the size of rider amenities, such as a passenger shelter.
- Materials used should consider life-cycle costing, which usually points toward high quality, long-lasting materials that have lower on-going maintenance costs.
- The design should use Crime Prevention Through Environmental Design (CPTED) principles to improve rider security. CPTED principles include maintaining clear sight lines into and across the station, eliminating "hiding" spots, and providing adequate lighting.
- Public art should be considered for transit centers. Art has been shown to discourage vandalism and can also be used to involve the local art community in the transit center project. Regulations now require that public art funded through FTA be "functional." Art associated with railings, benches, pavement, windscreens, or any other element of the shelter would meet the FTA requirement. Free-standing art, such as a sculpture, would not.

[1] http://www.oregon.gov/LCD/TGM/docs/fulltransitprimer4-4-13.pdf

- Information displays should be located at transit centers and at some major stops to provide system-wide data, transfer times between routes, and general schedule and overall system information.

Current bus stops that have more than ten boardings a day should be considered major stops, and merit consideration for a higher level of improvement (relative to the base level amenities found at all bus stops), such as a shelter or information case.

Bus Stops

Waiting at a bus stop is generally a rider's first direct interaction with the transit system on a given trip; therefore, providing comfortable and safe stops helps enhance the transit system. Designated bus stops have the following advantages:

- They provide awareness of the service, improving the visibility of transit in the community.
- They can be located to assure safe bus and passenger access.
- They can be improved with a paved landing pad, for example, to facilitate access by riders needing to use the bus lift or ramp.
- They can consolidate access, reducing the number of stops a bus makes along its route and thereby speeding up the overall trip.
- They can help communicate service if information such as route numbers are included on the signs.

The cost for a new bus stop signage and pole, installed, can range from $300 to $1,000, depending on the material and the installation conditions. It is recommended that route names be placed on the signs to assist riders in identifying the service. Bus stop displays with specific route, schedule, and fare information can also be very helpful, though they require updating when there are services or fare changes, which adds to operating cost. If service and fare changes are relatively infrequent, providing detailed rider information at highly used bus stops is recommended. This option is especially important in areas where visitors may use a transit provider's service, because they are less likely to be familiar with the fares, routes and schedules.

Bus stops should be located to allow for safe bus and passenger access. Where possible, bus stops would be located near existing or planned sidewalks or other pedestrian connections that allow for safe pedestrian crossing of the street. On major roadways, such as state highways, bus stops should allow for the bus to stop out of the traffic lane to avoid rear end collisions and discourage unsafe passing of the bus by motorists. Major bus stops should have lighting and accommodations for bicycle parking such as racks.

Shelters

Passenger shelters add to the comfort of waiting for a bus and are generally very popular with riders. An "off the shelf" passenger shelter typically costs approximately $6,000 plus installation. In addition to initial capital costs, passenger shelters will incur maintenance costs, both for routine on-going cleaning and repair and replacement as needed. The primary maintenance issues for shelters, apart from the routine cleaning, are vandalism and fading/clouding of the windscreen. For routine cleaning, trash receptacles, if included, would dictate the frequency that the shelter should be serviced. If trash receptacles are not provided, the regular cleaning and servicing of shelters can be as low as once per month.

Passenger shelters must be designed to meet the requirements of the Americans with Disabilities Act (ADA) and should be located so as to provide safe and convenient pedestrian connections with nearby

destinations. Coordination of shelter placement with sidewalk and other pedestrian improvement projects planned by Oregon Department of Transportation (ODOT) or local agencies is encouraged. In addition to the overhead protection (roof), shelter amenities can include:

- Windscreens
- Benches
- Trash receptacles
- Passenger information

Passenger shelters are recommended at high-use stops and all transit centers. All major stops should have shelters; all transit centers currently do have shelters, but shelters also should be installed at major stops moving forward. The condition of existing shelters at these locations should be reviewed and additional amenities considered, although final prioritization depends on the future service plan.

There is a maintenance cost tradeoff between the level of wind/weather protection provided through the use of windscreens and an open shelter design without a windscreen. If vandalism is not a major problem for providers, windscreens are recommended for shelters both to address winds and because infrequent service can lead to longer wait times which suggests the need for a higher level of protection from the weather. Glass in lieu of acrylic should be considered to address weathering and fading issues.

Benches

An alternative to a shelter for a stop that has less ridership is a bench. Benches should be considered for stops with at least three boardings per day, although other factors, such as the proximity to senior housing and nearby businesses willing to contribute to the costs, should be factored into the decision as well. Benches that attach to the bus stop pole, such as the Simmi-Seat (see Figure 50) take up very little space, have low maintenance, and are relatively inexpensive. Installed benches vary in price from $500 to $1,500, depending on materials, the quality of the product, and the installation conditions.

Figure 50. Simmi Seat

Bicycle and Pedestrian Facilities

This section identifies bicycle and pedestrian infrastructure gaps relative to accessing transit and jobs, primarily considering existing and proposed transit centers and park-and-ride facilities. Virtually every bus rider is also a pedestrian, and bicycles provide an important first/last-mile option for transit. Improvements such as continuous sidewalks, low-stress bicycle facilities, street lighting, and enhanced pedestrian and bicycle crossings can improve transit ridership by facilitating walking and biking access.

The following review of bicycle and pedestrian facilities is based on high-level model data, which may not be complete or entirely up-to-date. As such, this review highlights areas of focus, but relies on county and local jurisdiction transportation system plans (TSPs) to identify specific facility improvements near transit lines. Since model data were mostly constrained to the Metro boundary (TriMet and SMART service areas), this analysis focuses on these areas. At a high level, rural highways in Clackamas County lack both sidewalk and bicycle facilities, and often lack shoulders as well.

Bicycle Facilities

Figure 51 shows bicycle facilities within the Clackamas County portion of the Metro service area, including whether those facilities are off-street paths, on-street facilities, or shared roadways, and the location of transit centers and park-and-rides. Some transit centers – such as Clackamas Town Center and the SE Park Avenue MAX Station – have bicycle connections in all directions, while others – such as the Milwaukie and Estacada park-and-rides – have few if any connections. Providing low-stress bicycle facilities to these key transit stops, as well as bike lockers or other secure bicycle storage, can enhance transit ridership and make first/last-mile connections. Data is provided by Metro's Regional Land Information System (RLIS) database.

Pedestrian Facilities

Figure 52 shows sidewalk availability within the Clackamas County portion of the Metro service area, including whether sidewalks are on both sides or one side of the street. The figure also shows the location of transit centers and park-and-rides. This particular dataset did not cover every road in the County and thus, while the figure shows streets with no sidewalks, any unmarked streets were not included. In addition to sidewalk availability, topography can also be a challenge for transit riders in Clackamas County, especially for the elderly and people with disabilities. The dataset does not include information about crossing roadway facilities, which can also be a barrier for transit riders.

As shown, transit centers in downtown cores such as Oregon City and Lake Oswego generally have good sidewalk connectivity. However, several park-and-rides, such as SE Fuller Road and West Linn, lack connections. While park-and-rides primarily serve vehicular access, their associated stops tend to have higher ridership and therefore a higher level of transit amenities. Therefore, providing bicycle and pedestrian connections to these facilities can improve the rider experience.

Providing access to transit facilities is of particular importance as well as being a legal requirement. Transit centers, shelters, and new or relocated bus stops should be designed to meet the requirements of the Americans with Disabilities Act (ADA). It is recommended that cities, the County, and Oregon Department of Transportation (ODOT) prioritize street corners near transit centers and shelters for ADA ramps. Data is provided by Metro's RLIS database.

Figure 51. Bicycle Network in the Clackamas County Portion of the Metro Service Area

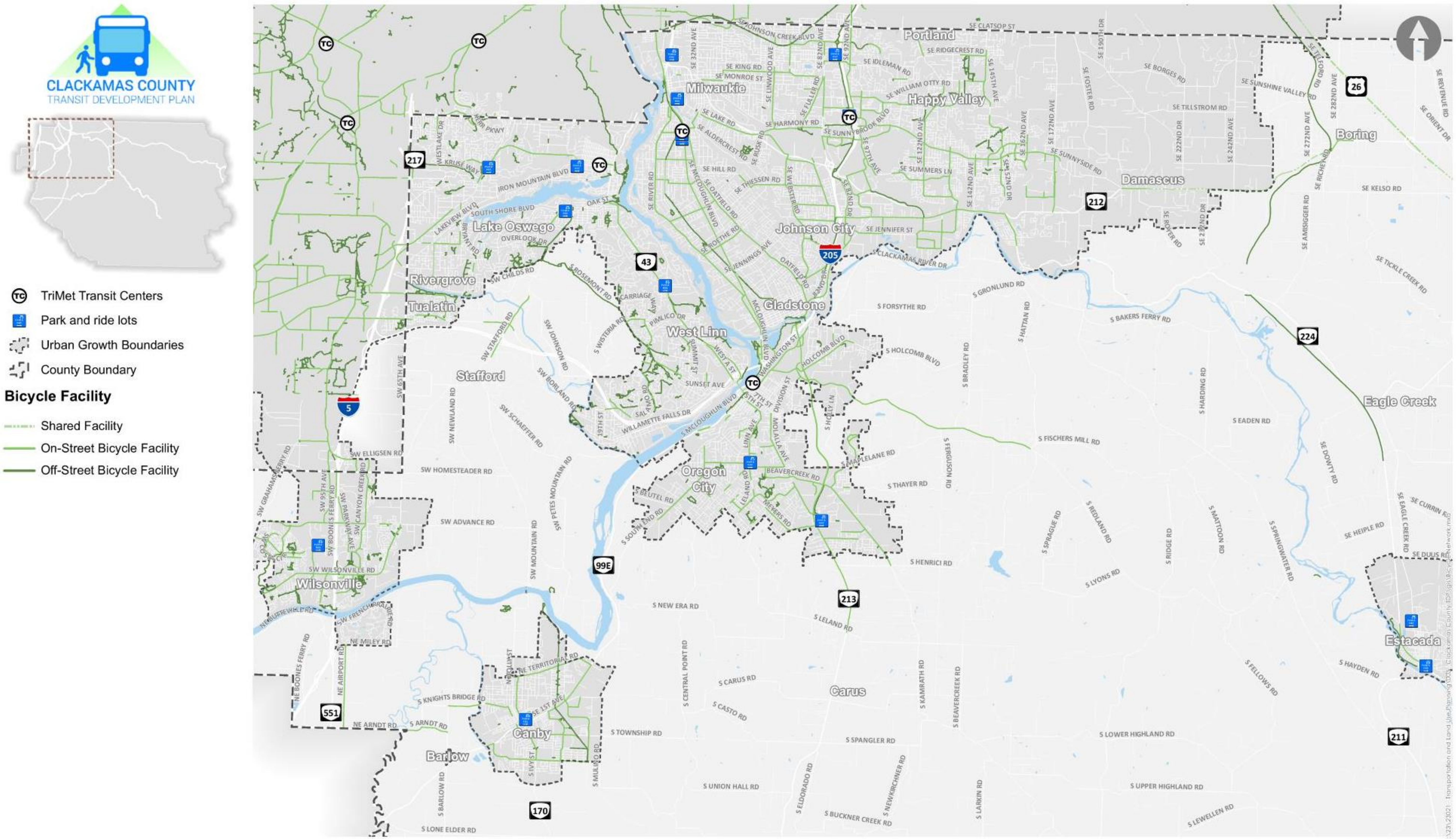
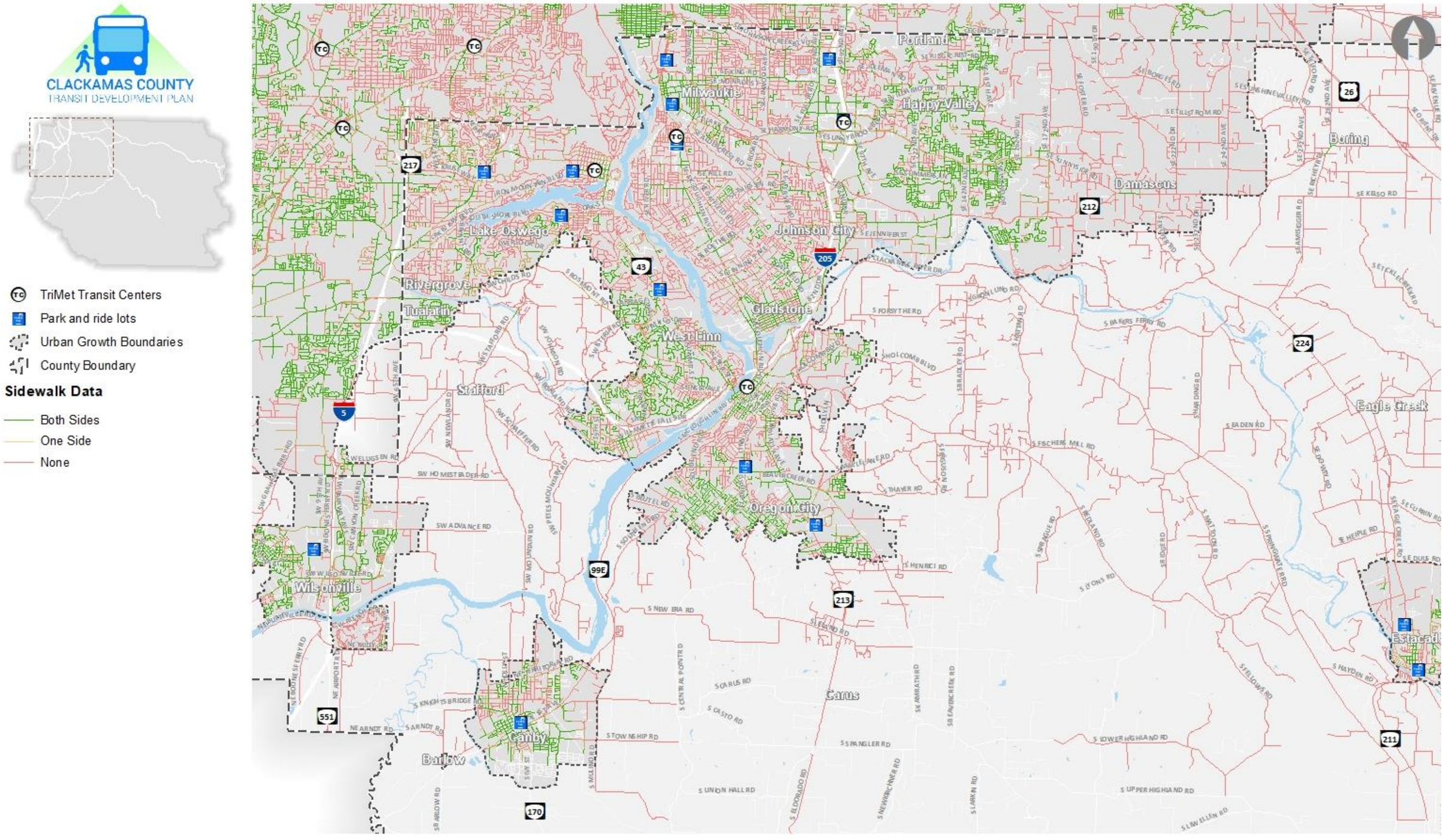


Figure 52. Pedestrian Network in the Clackamas County Portion of the Metro Service Area



Land Use and Code Strategies

This section identifies potential transit-supportive land use implementation strategies for jurisdictions in Clackamas County. The preliminary transit-supportive strategies recommended in this memorandum build on land use strategies identified in previous planning documents, providing what can be regarded as "best practices". Land uses, development density, transportation system connectivity and access, parking requirements, and urban form (e.g., building setbacks) are all regulatory elements and code strategies related to development that impact how supportive an area is for transit service. The resulting set of transit-supportive code strategies is presented in Table 15. These strategies are generally geared toward urban environments, but can also be applied in a rural setting. The categories under which these strategies are organized are listed below with general descriptions on how they benefit and support transit. They should be reviewed with local jurisdictions to determine land use and code policy changes.

- **Coordination** – Coordination between jurisdictions and transit service providers regarding proposed development is critical to ensuring transit-supportive development occurs. The periods during which an applicant is preparing a development application and when that application is under review by the jurisdiction present key opportunities for this coordination.
- **Uses** – The general idea behind use-related transit-supportive strategies is: (a) to encourage uses that support a high number and density of potential transit riders; and (b) to discourage uses that do not provide many riders or that do not promote a pedestrian-oriented environment that supports safe, convenient, and attractive transit access. Therefore, use regulations proposed in Table 15 promote a variety of uses and high trip generation as well as limit auto-oriented uses that detract from a pedestrian-oriented environment.
- **Development Standards** – Development standards address the intensity and form that development takes. Like use regulations, development standards can be used to promote higher densities of riders near transit, establish a pedestrian-friendly environment, and support transit. Particular transit-supportive development standards that are recommended in Table 15 include those that: require minimum levels of residential and employment density; bring buildings closer to transit streets and connect them to transit stops; and create visual interest and pedestrian amenities along transit street-facing building fronts.
- **Access** – Providing safe and convenient access to transit is critical to its robust use. In addition to requiring access directly from buildings on a site to an existing or planned transit stop, transit-supportive access ensures that transportation network connectivity is high enough to easily reach transit stops by walking and rolling (e.g., biking, scooting, mobility devices). Strategies proposed in Table 15 promote this connectivity through maximum block length standards and required non-motorized access through long blocks.[2]
- **Parking** – Parking affects the transit orientation of development in several ways. Capping the amount of vehicle parking permitted can help make alternatives to driving more attractive. Providing sufficient and well-designed bicycle parking supports bike connections from transit to destinations. The location and design of parking lots – e.g., restricting parking between buildings and the street and requiring landscaping and walkways – play a significant role in making

[2] Projects that improve pedestrian and bicycling infrastructure and connections to transit streets are also vital to supporting transit. These types of projects fall within the purview of transportation system planning. Jurisdictions within Clackamas County vary as to how recently their transportation system plans have been updated and when they next expect to conduct an update.

pedestrian access to transit attractive and convenient. Parking areas also provide potential locations for transit stops, park-and-rides, and ridesharing.

Table 15. Transit-Supportive Land Use Strategies

Transit-Supportive Code Strategy	Notes
Coordination	
Coordination with Transit Provider	Require involvement of transit provider in pre-application conference and/or application review for development applications. Require notice of development application hearings be sent to transit provider
Transit Stop Improvements/Amenities	Work with transit provider to provide seating, lighting, etc. consistent with their development and master plans
Uses	
Accessory Dwelling Units	Allow a minimum of one accessory dwelling unit (ADU)
Mixed Use	Allow or require mixed uses
Major Trip Generator	Allow uses that offer goods or services that attract large numbers of employees or members of the public, such as: • Institutional Uses for the Public • Neighborhood Commercial Uses • Major Employment Generating Uses • Major User-Generating Uses
Non-Transit-Supportive: Auto-Oriented and Auto-Dependent Uses	Prohibit or restrict auto-oriented and auto-dependent uses, including uses that provide goods and services for vehicles and uses (e.g., distribution facilities) where vehicles are a primary and integral part of operations
Non-Transit-Supportive: Drive-Throughs	Restrict or prohibit drive-throughs
Development Standards	
Residential Density	Establish minimum density consistent with local transit service guidelines identified in this memo
Minimum Floor Area Ration (FAR) or Lot Coverage	Establish, e.g., a FAR of 1:1 to 2:1 or no maximum lot coverage
Max. Front Yard Setbacks	Establish, e.g., no minimum setback and maximum 10-foot setback
Pedestrian Amenities in Front Setback	Allow for greater front setback when pedestrian space (seating, etc.) provided, e.g., up to 20 feet of setback for up to 50% of building face
Pedestrian Orientation (Basic)	Require primary entrance oriented to street and pedestrian connection from building(s) to street (transit stop) Encourage pedestrian amenities (in front setback)
Pedestrian Orientation (Enhanced)	Require building articulation, minimum ground floor windows, and weather protection (e.g., awnings), e.g., windows for minimum 50% of length and minimum 60% of area of street-facing wall; weather protection for minimum 50% of length of street-facing wall and over street-facing entries Require integration of two or more other pedestrian-oriented design features including human-scale building lighting, signs, and horizontal/vertical elements (e.g., cornice, columns, transoms)
Additional Height for Housing	Allow for additional building height (up to an alternative maximum) when housing provided, possibly with design requirements such as stepbacks

Transit-Supportive Code Strategy	Notes
Access	
Block Length	Establish maximum block length standards consistent with State of Oregon Transportation & Growth Management Model Development Code for Small Cities, 3rd Edition ("Model Code")[3]
Accessways Through Long Blocks	Require non-motorized accessways consistent with the Oregon Transportation Planning Rule
Parking	
No Vehicle Parking/ Circulation in Front Setback	Prohibit parking and circulation in front setback Related to maximum front setback
Parking Maximums	Potential reduction of existing maximums
Parking Reductions for Transit	Establish reductions (including maximum % reduction) for locations within specified distance of transit
Parking Management Strategy	Consider developing a Parking Management Strategy to evaluate parking needs and manage supply (for integration into future code requirements and/or policy adopted related to the Clackamas County Transit Development Plan)
Landscaping and Walkways in Parking Lots	Set minimum standards for perimeter landscaping, landscaping islands, and walkways through parking lots
Transit-Related Uses in Parking Lots	Allow for redevelopment of existing parking lots to accommodate transit-related uses (e.g., stops, park-and-rides, transit-oriented buildings), provided that other minimum parking standards can be met and the location of the use is appropriate and safe
Preferential Parking for Ridesharing	Require location of rideshare (carpool) parking required to be closest to primary entrance, aside from Americans with Disabilities Act (ADA)-accessible parking
Bicycle Parking	Establish minimum bicycle parking space and design requirements consistent with the Oregon Transportation Planning Rule

Information and Technology

Information and technology services can improve the ridership experience and increase ridership by improving ease of transit use by providing information. The following sections describe potential implications of and high-level cost estimates for information and technology improvements, including real-time vehicle arrival information, fare payment options, and online/mobile trip planning tools. Since the impacts to transit ridership vary strongly by provider when implementing these services, changes in ridership are not explored for these improvements.

In addition to improving existing service, data gathered from technologies such as real-time vehicle arrival information and automatic vehicle location (AVL) equipment can help transit providers and planners analyze the performance of existing and future services. For example, AVL data could be assessed to adjust schedules based on delay points and improve transfer connections.

Online/Mobile Trip Planning Tool

Trip planning tools can help the public get travel information at any day or time. While some providers create proprietary trip planning tools, free and readily available trip planning tools are available and

[3] https://www.oregon.gov/LCD/TGM/Pages/Model-Code.aspx

more fitting to a small transit provider's size and needs. These tools include Google Maps, OneBusAway, Moovit, and Transit. All of these tools depend on the open data format for GTFS-Realtime.

Real-Time Vehicle Arrival Information

Several Clackamas County transit providers post schedules for all routes, but do not provide real-time vehicle arrival information. Real-time information helps improve the ridership experience by reducing passenger wait times (passengers can choose to show up shortly before the bus arrives), providing passengers with confidence that they haven't missed a bus that is running late, and generally creating a more informed and comfortable rider. This information can be made accessible via website, smartphones, and through "push" technologies such as text messages.

TCRP Synthesis 48 reports costs for AVL system implementation at smaller systems (10–25 AVL-equipped vehicles). Total capital costs ranged between $60,000 and $171,000, while per-vehicle costs ranged between $3,000 and $8,101. Note that these cost data were collected when the technology was newer and improved system efficiencies have led to decreased costs. These costs should be explored further with vendors. ODOT encourages providers to buy systems that support GTFS-Realtime (GTFS-RT).

Fare Payment Options

Fare payment options include smart card-based electronic fare collection systems, mobile ticketing, and more. Offering additional fare payment options may increase ridership and improve the customer experience. In addition, transitioning to mobile systems reduces the effort of collecting and processing paper tickets and cash fares. Implementation costs vary; large systems range from $35,000 to $50,000 per vehicle to upgrade, while smaller systems have implemented as low as $21,000 per vehicle.[4]

Additionally, there exists the potential for administration savings as well as an improved ability to make minor adjustments to fares over time, as the coinage barrier is lowered. However, non-cash fare payment systems can be a barrier for low-income riders, and a cash option should be maintained. Currently, small transit providers in Clackamas County and the County itself are participating in a regional effort to study the feasibility of an integrated, regional fare collection system to provide seamless transfers across different transit providers. ODOT encourages providers to buy systems that support GTFS-ride data format for fare collection systems and/or automated passenger counters.

Next Steps

This memorandum will be reviewed with the Project Management Team (PMT), Technical Advisory Committee (TAC), and Project Advisory Committee (PAC) and used to inform the Transit Development Plan. Future work in this planning process will include refining recommended service opportunities and strategies through public feedback to support and implement the Clackamas County TDP and transit-supportive development.

Appendix

A. Regional Travel Demand and Commute Demands

[4] https://www.itsknowledgeresources.its.dot.gov/ITS/benecost.nsf/ID/3960B2C6B48F4EE785257F0F004DDAE0?OpenDocument&Query=CApp

Appendix A. Regional Travel Demand and Commute Demands

Travel Demand on Regional Corridors

Findings are as follows:

- Interstate 205:
  - 50 daily transit runs between Clackamas Town Center and Oregon City on a route adjacent to Interstate 205 (TriMet Route 79 and the Clackamas Community College Xpress Shuttle),
  - 16 daily transit runs between Oregon City and West Linn's Willamette neighborhood on a route adjacent to Interstate 205 (TriMet Route 154).
  - Otherwise, there is no transit service on or adjacent to Interstate 205 between West Linn and Tualatin or Wilsonville.
  - Interstate 205 has the lowest transit trips compared to vehicle trips, as shown in Figure 1.
- US 26:
  - 33 daily transit runs between Gresham and Sandy,
  - 15 daily transit runs between Sandy and Mt. Hood Village, and
  - 12 daily transit runs between Mt. Hood Village and Government Camp/Timberline Lodge.
- OR 99E:
  - 84 daily transit runs between Milwaukie and Oregon City (TriMet Routes 33 and 99),
  - 48 daily transit runs on routes adjacent to OR 99E (TriMet Routes 32 and 34).
  - 26 daily transit runs between Oregon City and Canby,
  - 14 transit runs between Canby and Woodburn.
- OR 43:
  - 47 daily transit runs between Portland and Oregon City, which also stop in Lake Oswego and West Linn.
- OR 211:
  - 5 daily transit runs between Sandy and Eagle Creek,
  - 27 daily transit runs between Eagle Creek and Estacada, and
  - 10 daily transit runs between Molalla and Hamricks Corner.
  - No transit service on the remaining portions of OR 211 in Clackamas County, including between Estacada and Molalla and between Molalla and Woodburn.
- OR 212:
  - 22 daily transit runs between Clackamas Town Center and Rock Creek Junction.
  - No service east of Rock Creek Junction, including to Damascus and Boring.
- OR 213:
  - 24 daily transit runs between Clackamas Community College and Mulino,
  - 34 daily transit runs between Mulino and Molalla.
  - No transit service in Clackamas County south of Molalla toward Silverton and Salem.
- OR 224:
  - 22 daily transit runs between Clackamas Town Center and Estacada.
  - No service south of Estacada.

- Clackamas to Columbia Corridor (C2C): C2C is a planned north-south corridor connecting Happy Valley to Gresham along SE 172nd Avenue. No north-south transit service currently operates along SE 172nd Avenue given that the complete C2C Corridor has not yet been constructed.

Commuter Information Details

Oregon City

In 2017, approximately 15,820 employed persons lived in Oregon City. Just over one in every four (28.8%) worked in Portland, the most common work destination, while one in every eight employees (12.8%) who lived in Oregon City also worked in Oregon City. Additionally, 4 of the top 10 work destinations for employees living in Oregon City were Washington County jurisdictions.

In 2017, approximately 14,100 employees worked in Oregon City. Employees who worked in Oregon City were most likely to live in Portland (15%) and Oregon City (14.4%) – no other jurisdiction accounted for more than 4% of all employees who work in Oregon City. While employed persons who lived in Oregon City work across the Portland metropolitan region, the top 10 locations for employees who worked in Oregon City are much closer: 7 of the top 10 home locations for employees in Oregon City were located in Clackamas County.

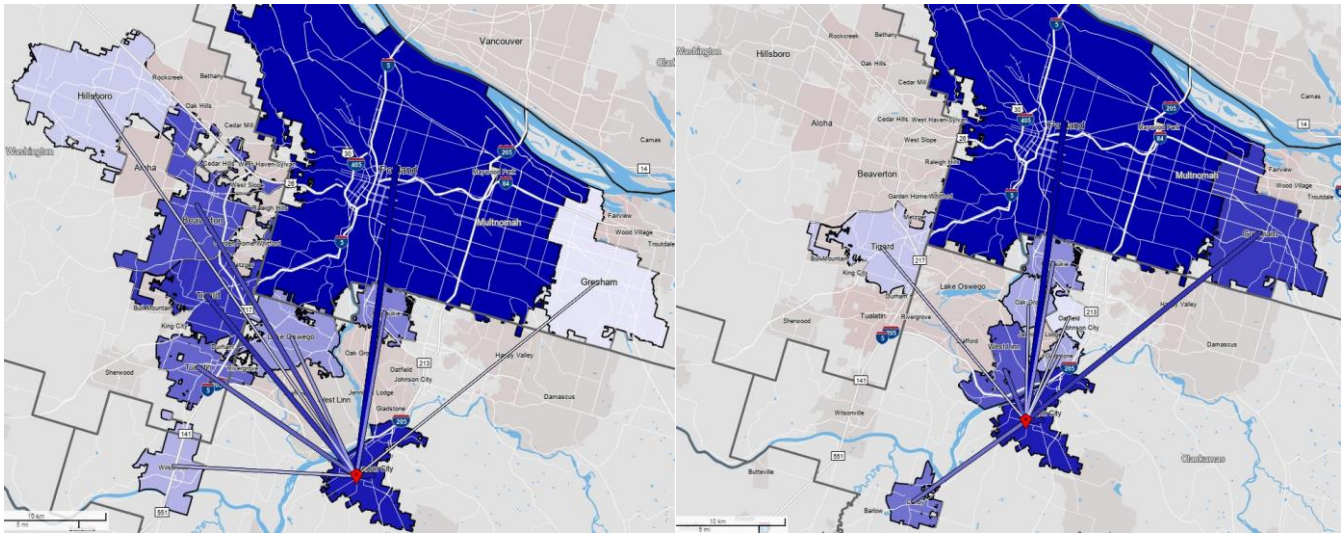
Table C-1 and Figure C-1 show the primary home locations for employees in Oregon City and work locations for employees living in Oregon City in 2017.

Table C-1. Employees Coming To and Going From Oregon City

Oregon City Resident Work Locations	Count	Share
Portland	4,557	28.8%
Oregon City	2,026	12.8%
Tigard	699	4.4%
Beaverton	580	3.7%
Tualatin	476	3.0%
Milwaukie	473	3.0%
Lake Oswego	451	2.9%
Wilsonville	408	2.6%
Hillsboro	347	2.2%
Gresham	292	1.8%
All Other Locations	5,511	34.8%

Oregon City Employee Home Locations	Count	Share
Portland	2,121	15.0%
Oregon City	2,026	14.4%
Gresham	439	3.1%
West Linn	389	2.8%
Canby	310	2.2%
Milwaukie	283	2.0%
Gladstone	263	1.9%
Oak Grove (Census Designated Place, CDP)	263	1.9%
Tigard	231	1.6%
Oatfield (CDP)	216	1.5%
All Other Locations	7,559	53.6%

Figure C-1. Map of Employees Leaving Oregon City (Left) and Employees Entering Oregon City (Right)



Note: Darker spokes and shading reflect which cities have the most commutes to and from these cities. The darkest city is the top commute location, while the lightest city is the tenth largest commute location.

Of the 10 most common commute origin and destination cities for Oregon City, five are accessible by transit on a direct route, and four are accessible with a single transfer. Travel to and from Gresham is the only route in Table C-2 that requires two transfers. TriMet Route 35 provides direct service between Oregon City and Portland, the most common commute origin–destination pair with Oregon City.

Table C-2. Most Common Commute Pairs for Oregon City with Transit Connections

Commutes to/from Oregon City	Count (Both Directions)	Number of Transfers	Service Frequency
Portland	6,678	-	15 minutes (peak), 30 minutes (off-peak)
Oregon City	2,026	-	<15 minutes
Tigard	930	1	30 minutes
Beaverton	789	1	30 minutes
Milwaukie	756	-	<15 minutes
Gresham	731	2	30 minutes
Lake Oswego	643	-	15 minutes (peak), 30 minutes (off-peak)
Tualatin	642	1	60 minutes
West Linn	625	-	15 minutes (peak), 30 minutes (off-peak)
Wilsonville	566	1	60 minutes

Wilsonville

In 2017, approximately 9.832 employed persons lived in Wilsonville. Portland (22.3%) and Wilsonville (15.2%) were the top two work destinations for employed persons living in Wilsonville. Two cities within the top 10 work destinations, Salem and Woodburn, were outside the Portland metropolitan area.

In 2017, approximately 19,137 employees worked in Wilsonville, more than double the number of employees who live in Wilsonville. The top home locations for employees working in Wilsonville are Portland (10.8%) and Wilsonville (7.8%). Salem is the fourth-largest home location for employees in Wilsonville; more than three times as many employees commute from Salem to Wilsonville as do from Wilsonville to Salem.

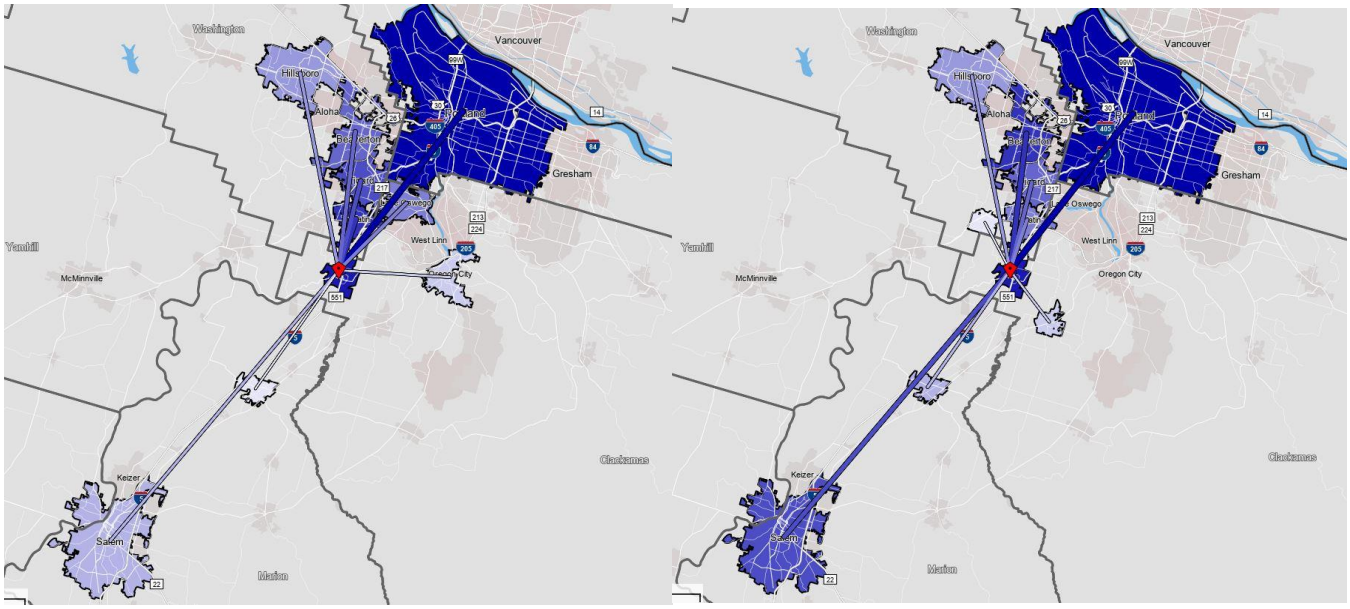
Table C-3 and Figure C-2 show the primary home locations for employees in Wilsonville and work locations for employees living in Wilsonville. While some of the Wilsonville–Salem employees may be an anomaly due to the way the data treat employers with multiple worksites, Wilsonville's proximity to Salem indicates many of these employees are likely employed in Salem.

Table C-3. Employees Coming To and Going From Wilsonville

Wilsonville Resident Work Locations	Count	Share
Portland	2,189	22.3%
Wilsonville	1,499	15.2%
Tualatin	665	6.8%
Tigard	653	6.6%
Beaverton	547	5.6%
Lake Oswego	432	4.4%
Hillsboro	395	4.0%
Salem	253	2.6%
Oregon City	158	1.6%
Woodburn	137	1.4%
All Other Locations	2,904	29.5%

Wilsonville Employee Home Locations	Count	Share
Portland	2,069	10.8%
Wilsonville	1,499	7.8%
Beaverton	782	4.1%
Salem	768	4.0%
Tigard	672	3.5%
Tualatin	615	3.2%
Hillsboro	504	2.6%
Woodburn	493	2.6%
Canby	490	2.6%
Sherwood	410	2.1%
All Other Locations	10,835	56.6%

Figure C-2. Map of Employees Leaving Wilsonville (Left) and Employees Entering Wilsonville (Right)



Note: Darker spokes and shading reflect which cities have the most commutes to and from these cities. The darkest city is the top commute location, while the lightest city is the tenth largest commute location.

There are six cities in Table C-4 that are accessible by transit to or from Wilsonville with no transfers during peak commute hours. Portland is the most common origin and destination for employees traveling to or from Wilsonville, and there is no direct transit service between the two cities. Service is available via WES and MAX during peak periods and via SMART line 2X and TriMet line 96 during off-peak periods.

Table C-4. Most Common Commute Pairs for Wilsonville with Transit Connections

Commutes to/from Wilsonville	Count (Both Directions)	Number of Transfers	Service Frequency
Portland	4,258	1	30 minutes (peak); 60 minutes (off-peak)
Wilsonville	1,499	-	30 minutes
Beaverton	1,329	- (peak); 1 (off-peak)	30 minutes
Tigard	1,325	- (peak); 1 (off-peak)	30 minutes
Tualatin	1,280	-	30 minutes (peak); 60 minutes (off-peak)
Salem	1,021	-	30-60 minutes
Hillsboro	899	1 (peak); 2(off-peak)	30 minutes
Lake Oswego	841	1	60-90 minutes
Woodburn	630	1	60 minutes
Canby	619	-	60 minutes

Happy Valley

In 2017, approximately 8,301 employed persons lived in Happy Valley. Portland (41.3%) was the most common work destination, while no other city had more than 5% of employees living in Happy Valley. Happy Valley was the sixth most common work destination for employed persons who lived in Happy Valley.

In 2017, approximately 3,664 employees worked in Happy Valley, less than half the number of employed persons who live in Happy Valley. Portland residents account for 22.7% of Happy Valley employees.

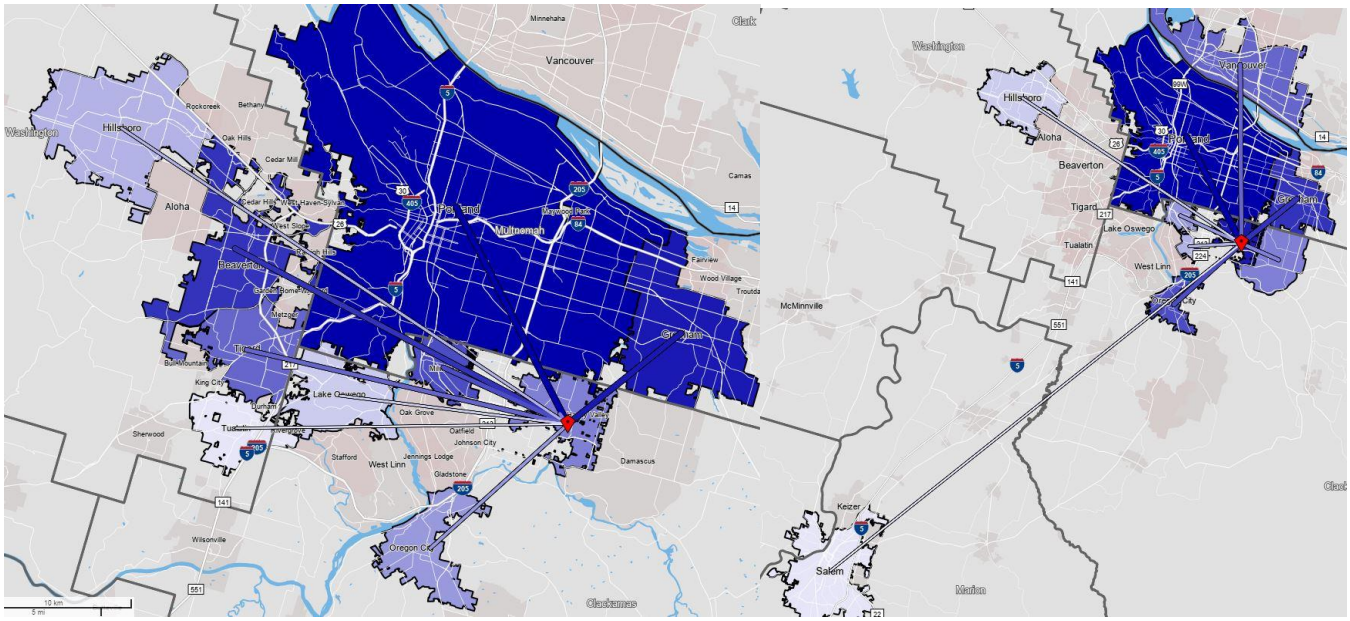
Table C-5 and Figure C-3 show the primary home locations for employees in Happy Valley and work locations for employees living in Happy Valley. The high Salem employment may be due to the data anomaly noted previously.

Table C-5. Employees Coming To and Going From Happy Valley

Happy Valley Resident Work Locations	Count	Share
Portland	3,430	41.3%
Gresham	413	5.0%
Beaverton	305	3.7%
Milwaukie	294	3.5%
Tigard	279	3.4%
Happy Valley	226	2.7%
Oregon City	210	2.5%
Hillsboro	158	1.9%
Lake Oswego	156	1.9%
Tualatin	149	1.8%
All Other Locations	2,681	32.3%

Happy Valley Employee Home Locations	Count	Share
Portland	830	22.7%
Happy Valley	226	6.2%
Gresham	225	6.1%
Oregon City	117	3.2%
Vancouver	85	2.3%
Damascus (CDP)	78	2.1%
Milwaukie	74	2.0%
Oatfield (CDP)	66	1.8%
Hillsboro	62	1.7%
Salem	59	1.6%
All Other Locations	1.842	50.3%

Figure C-3. Map of Employees Leaving Happy Valley (Left) and Employees Entering Happy Valley (Right)



Note: Darker spokes and shading reflect which cities have the most commutes to and from these cities. The darkest city is the top commute location, while the lightest city is the tenth largest commute location.

Persons traveling to or from Happy Valley for work by transit must transfer at least once (at Clackamas Town Center). As Table C-6 shows, three cities require one transfer (including Portland, the most common origin or destination for people traveling to or from Happy Valley for work), while six cities require two transfers.

Table C-6. Most Common Commute Pairs for Happy Valley with Transit Connections

Commutes to/from Happy Valley	Count (Both Directions)	Number of Transfers	Service Frequency
Portland	4,260	1	30 minutes
Gresham	638	2	30 minutes
Milwaukie	368	1	40 minutes
Beaverton	358	2	30 minutes
Oregon City	327	1	30 minutes
Tigard	320	2	30 minutes
Happy Valley	226	-	30 minutes
Hillsboro	220	2	30 minutes
Lake Oswego	194	2	30 minutes
Tualatin	183	2	30 minutes

Molalla

In 2017, approximately 4,073 employed persons lived in Molalla. Molalla, which is about equidistant from both downtown Portland and downtown Salem, has 780 persons working in Portland (19.2%) and 137 persons working in Salem (3.4%). All of the other top 10 locations for where employees living in Molalla work are north of Molalla headed toward Portland.

In 2017, approximately 2,568 employees worked in Molalla. Of these employees, 472 also work in Molalla (18.4%). Woodburn (6.1%), Salem (4.4%), and Portland (3.5%) are second, third, and fourth, respectively, for home locations for employees who work in Molalla.

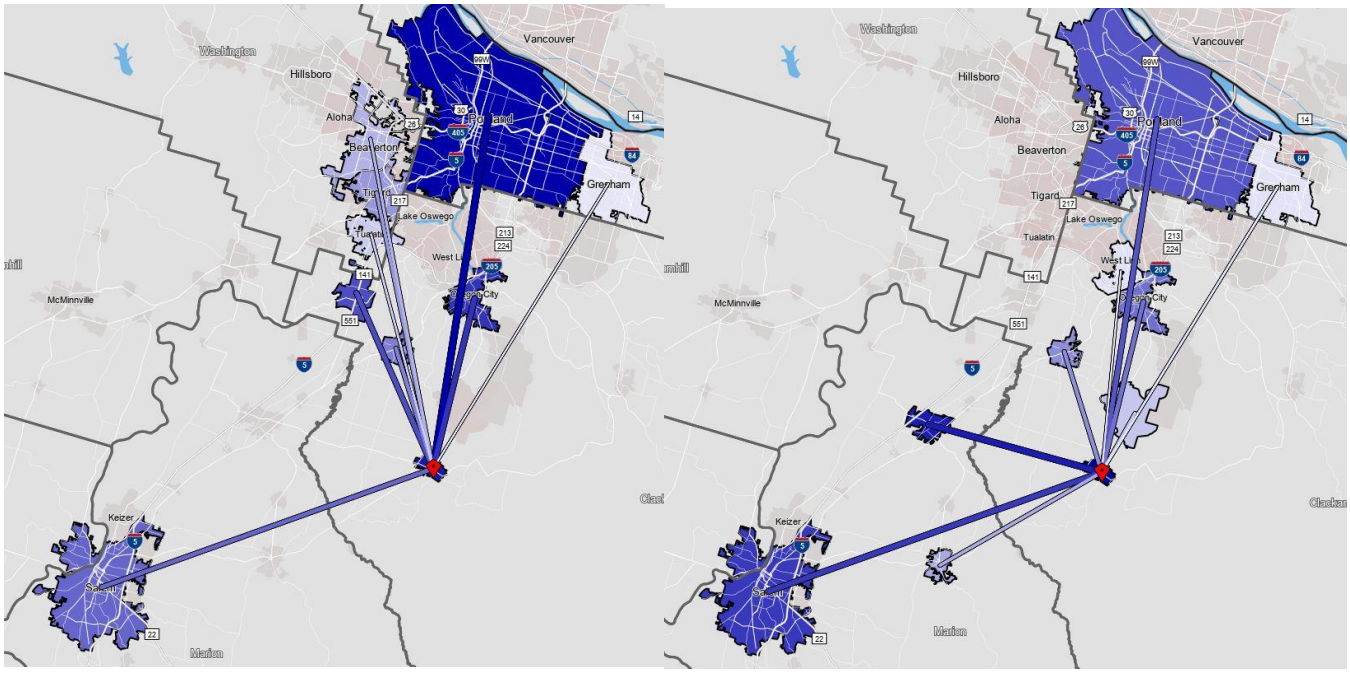
Table C-7 and Figure C-4 show the primary home locations for employees in Molalla and work locations for employees living in Molalla. As before, the high Salem employment may be due to the data anomaly noted in the introduction.

Table C-7. Employees Coming To and Going From Molalla

Molalla Resident Work Locations	Count	Share
Portland	780	19.2%
Molalla	472	11.6%
Oregon City	202	5.0%
Wilsonville	150	3.7%
Salem	137	3.4%
Canby	136	3.3%
Tigard	120	2.9%
Beaverton	108	2.7%
Tualatin	104	2.6%
Gresham	95	2.3%
All Other Locations	1,769	43.4%

Molalla Employee Home Locations	Count	Share
Molalla	472	18.4%
Woodburn	156	6.1%
Salem	112	4.4%
Portland	89	3.5%
Oregon City	81	3.2%
Canby	61	2.4%
Silverton	58	2.3%
Mulino (CDP)	46	1.8%
Gresham	26	1.0%
West Linn	26	1.0%
All Other Locations	1,441	56.1%

Figure C-4. Map of Employees Leaving Molalla (Left) and Employees Entering Molalla (Right)



Note: Darker spokes and shading reflect which cities have the most commutes to and from these cities. The darkest city is the top commute location, while the lightest city is the tenth largest commute location.

As Table C-8 shows, three cities – Molalla, Oregon City, and Canby – are accessible by transit to Molalla without a transfer. Portland is the most common origin or destination for people traveling to or from Molalla for work, and this trip requires two transfers during off-peak periods.

Table C-8. Most Common Commute Pairs for Molalla with Transit Connections

Commutes to/from Molalla	Count (Both Directions)	Number of Transfers	Service Frequency
Portland	869	1 (peak); 2 (off-peak)	30 minutes
Molalla	472	-	60 minutes
Oregon City	283	-	30-45 minutes
Salem	249	2	60-90 minutes
Woodburn	228	1	60-90 minutes
Canby	197	-	60-90 minutes
Wilsonville	163	1	60-90 minutes
Tigard	138	2	60-90 minutes
Gresham	121	2 (peak); 3 (off-peak)	30 minutes
Beaverton	116	2	60-90 minutes
Tualatin	116	2	60-90 minutes

Sandy

In 2017, approximately 5,321 employees lived in Sandy. The top three work destinations for employees living in Sandy were Portland (28.4%), Sandy (12.2%), and Gresham (10.2%), accounting for more than 50% of all employees who live in Sandy. Both Gresham and Sandy are served by Sandy Area Metro (SAM), while a transfer from SAM to the TriMet MAX Blue Line in Gresham provides access to Portland.

In 2017, approximately 3,255 employed persons worked in Sandy. One in five (19.9%) employees in Sandy also lived in Sandy, while Gresham was home to the second-highest number of employees who work in Sandy (12.3%). Within the top 10 home locations for employees in Sandy, there were jurisdictions in all directions from Sandy, including Vancouver, Estacada, and Mount Hood Village.

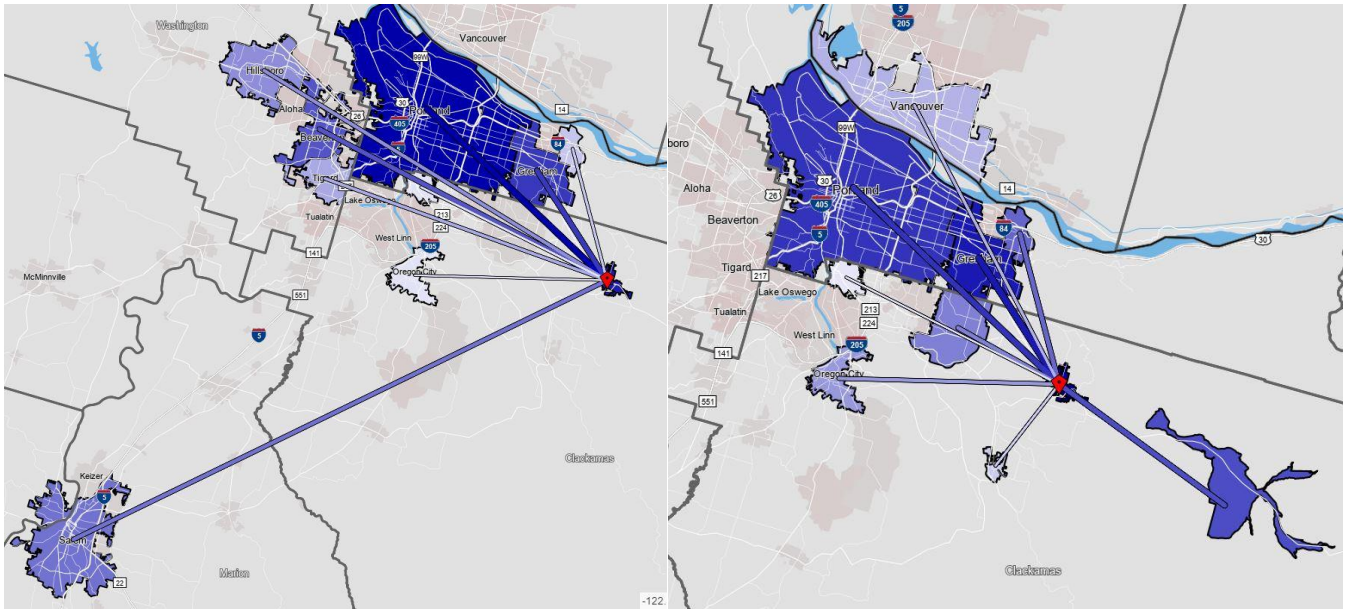
Table C-9 and Figure C-5 show the primary home locations for employees in Sandy and work locations for employees living in Sandy. The high Salem employment may be due to the data anomaly noted in the introduction.

Table C-9. Employees Coming To and Going From Sandy

Sandy Resident Work Locations	Count	Share
Portland	1,509	28.4%
Sandy	649	12.2%
Gresham	542	10.2%
Beaverton	121	2.3%
Salem	118	2.2%
Hillsboro	104	2.0%
Tigard	102	1.9%
Troutdale	88	1.7%
Milwaukie	84	1.6%
Oregon City	84	1.6%
All Other Locations	1,920	36.1%

Sandy Employee Home Locations	Count	Share
Sandy	649	19.9%
Gresham	399	12.3%
Portland	271	8.3%
Mount Hood Village (CDP)	113	3.5%
Troutdale	66	2.0%
Damascus (CDP)	54	1.7%
Oregon City	38	1.2%
Vancouver	32	1.0%
Estacada	28	0.9%
Milwaukie	26	0.8%
All Other Locations	1,579	48.5%

Figure C-5. Map of Employees Leaving Sandy (Left) and Employees Entering Sandy (Right)



Note: Darker spokes and shading reflect which cities have the most commutes to and from these cities. The darkest city is the top commute location, while the lightest city is the tenth largest commute location.

Sandy, Gresham, and Mount Hood Village are all accessible by transit to or from Sandy without a transfer (see Table C-10). Any city that is on the MAX Blue Line, including Portland (the most common origin or destination for people traveling to or from Sandy for work) and cities on the west site, is accessible with one transfer.

Table C-10. Most Common Commute Pairs for Sandy with Transit Connections

Commutes to/from Sandy	Count (Both Directions)	Number of Transfers	Service Frequency
Portland	1,780	1	30 minutes
Gresham	941	-	30 minutes
Sandy	649	-	30 minutes
Mount Hood Village (CDP)	164	-	120 minutes
Troutdale	154	1	30 minutes
Salem	144	3	60 minutes (peak hour only)
Beaverton	132	1	30 minutes
Oregon City	122	2	30 minutes
Tigard	117	2	30 minutes
Hillsboro	115	1	30 minutes

West Linn

In 2017, approximately 10,954 employees lived in West Linn. The top four work destinations for employees living in West Linn were Portland (31.7%), West Linn (6.5%), Lake Oswego (6.1%), and Beaverton (5.4%), accounting for just under 50% of all employees who live in West Linn. Portland, West Linn (along Highway 43 only), and Lake Oswego are served by TriMet Line 35.

In 2017, approximately 4,737 employed persons worked in West Linn. Approximately one in six employees lived in Portland (16.5%), with a similar number of employees also living in West Linn (15%). Of the top 10

home locations for employees in West Linn, five were from Clackamas County, three were from Washington County, and two were from Multnomah County.

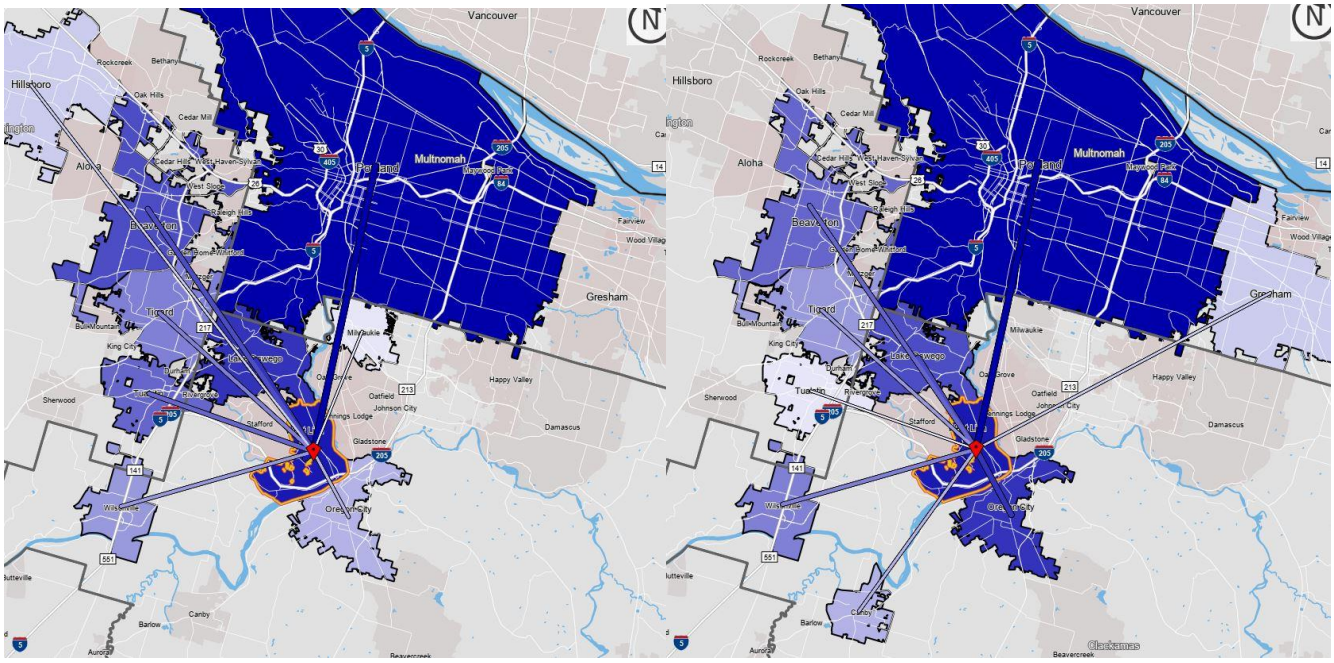
Table C-11 and Figure C-6 show the primary home locations for employees in West Linn and work locations for employees living in West Linn.

Table C-11. Employees Coming To and Going From West Linn

West Linn Resident Work Locations	Count	Share
Portland	3,447	31.7%
West Linn	710	6.5%
Lake Oswego	669	6.1%
Beaverton	587	5.4%
Tualatin	516	4.7%
Tigard	515	4.7%
Wilsonville	391	3.6%
Oregon City	389	3.6%
Hillsboro	289	2.6%
Milwaukie	218	2.0%
All Other Locations	3,193	29.1%

West Linn Employee Home Locations	Count	Share
Portland	782	16.5%
West Linn	710	15.0%
Oregon City	236	5.0%
Lake Oswego	185	3.9%
Beaverton	130	2.7%
Wilsonville	118	2.5%
Tigard	110	2.3%
Canby	103	2.2%
Gresham	96	2.0%
Tualatin	93	2.0%
All Other Locations	2,173	45.9%

Figure C-6. Map of Employees Leaving West Linn (Left) and Employees Entering West Linn (Right)



Note: Darker spokes and shading reflect which cities have the most commutes to and from these cities. The darkest city is the top commute location, while the lightest city is the tenth largest commute location.

Portland, Lake Oswego, Oregon City, and West Linn are all accessible by transit to or from West Linn without a transfer (see Table C-12). The Lake Oswego Transit Center provides connections to Tigard, Tualatin, and Wilsonville (with a further connection at Tualatin Park & Ride)

Table C-12. Most Common Commute Pairs for West Linn with Transit Connections

Commutes to/from West Linn	Count (Both Directions)	Number of Transfers	Service Frequency
Portland	4,259	-	15 minutes (peak hour), 30 minutes (weekday non-peak)
Lake Oswego	854	-	15 minutes (peak hour), 30 minutes (weekday non-peak)
Beaverton	717	1	15 minutes (peak hour), 30 minutes (weekday non-peak)
West Linn	710	-	15 minutes (peak hour), 30 minutes (weekday non-peak)
Tigard	625	1	30 minutes
Oregon City	625	-	15 minutes (peak hour), 30 minutes (weekday non-peak)
Tualatin	609	1	30 minutes
Wilsonville	509	2	30 minutes
Hillsboro	360	1	15 minutes (peak hour), 30 minutes (weekday non-peak)
Milwaukie	285	1	15 minutes (peak hour), 30 minutes (weekday non-peak)

Canby

In 2017, approximately 7,813 employees lived in Canby. The top three work destinations for employees living in Canby were Portland (19.6%), Canby (13.7%), and Wilsonville (6.3%). No other destination pulled more than 5% of employees living in Canby. Wilsonville is accessible by transit with no transfers.

In 2017, approximately 5,302 employed persons worked in Canby. Approximately one in five employees lived in Canby (20.2%), while 5.9% of employees lived in Portland. No other home location had more than 4% of employees who worked in Canby. There were four counties within the top 10 home locations for employees in Canby: Clackamas County, Multnomah County, Marion County, and Washington County.

Table C-13 and Figure C-7 show the primary home locations for employees in West Linn and work locations for employees living in Canby.

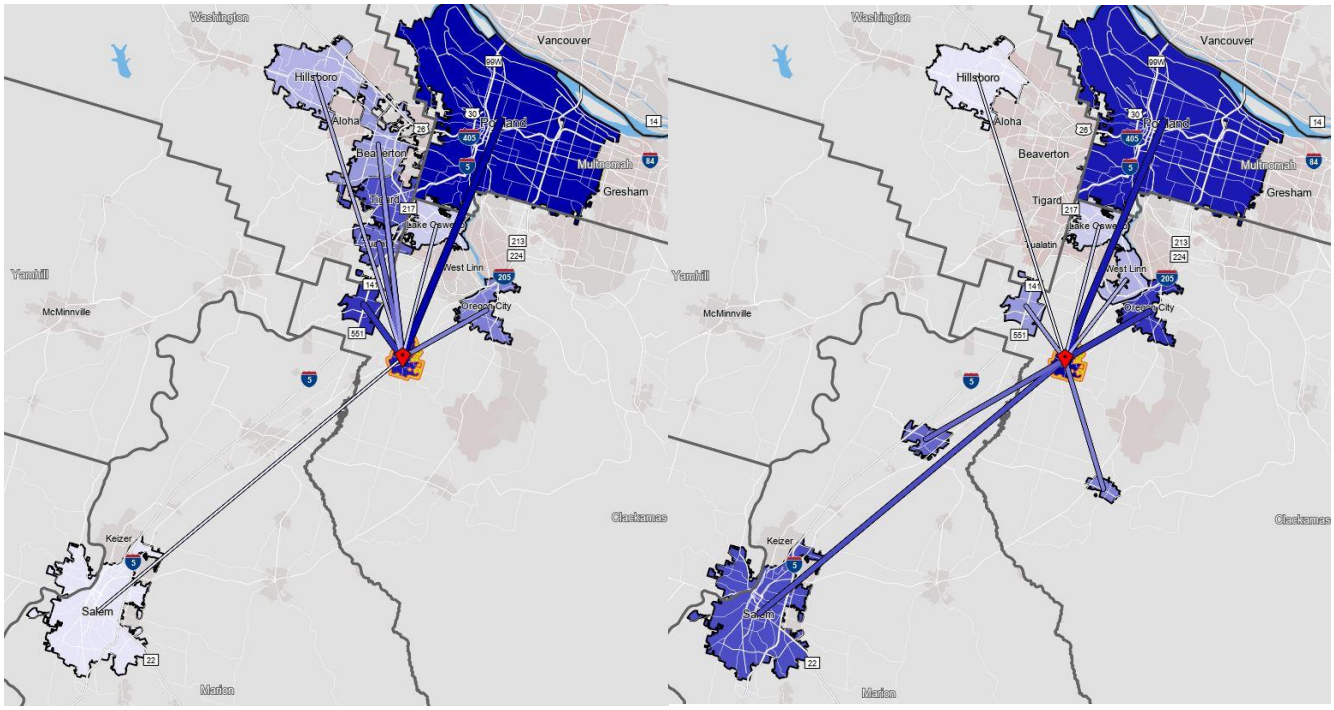
Table C-13. Employees Coming To and Going From Canby

Canby Resident Work Locations	Count	Share
Portland	1,535	19.6%
Canby	1,069	13.7%
Wilsonville	490	6.3%
Tigard	346	4.4%
Tualatin	317	4.1%
Oregon City	310	4.0%
Beaverton	281	3.6%
Hillsboro	215	2.8%
Lake Oswego	153	2.0%
Salem	132	1.7%

Canby Employee Home Locations	Count	Share
Canby	1,069	20.2%
Portland	312	5.9%
Oregon City	206	3.9%
Salem	174	3.3%
Woodburn	163	3.1%
Molalla	136	2.6%
Wilsonville	129	2.4%
West Linn	74	1.4%
Lake Oswego	69	1.3%
Hillsboro	68	1.3%

All Other Locations	2,965	37.9%	**All Other Locations**	2,902	54.7%

Figure C-7. Map of Employees Leaving Canby (Left) and Employees Entering Canby (Right)



Note: Darker spokes and shading reflect which cities have the most commutes to and from these cities. The darkest city is the top commute location, while the lightest city is the tenth largest commute location.

Wilsonville, Oregon City, Woodburn, and Canby are all accessible by transit to or from Canby without a transfer (see Table C-14). The Wilsonville Transit Center provides connections to Tigard, Tualatin, Beaverton and Hillsboro on TriMet's WES commuter train during peak hours only and to Salem on SMART's 1X express bus. During non-peak times, service to destinations in Washington County would need to go through downtown Portland instead.

Table C-14. Most Common Commute Pairs for Canby with Transit Connections

Commutes to/from Canby	Count (Both Directions)	Number of Transfers	Service Frequency
Portland	1,847	1 (2 during non-peak periods)	30 minutes
Canby	1,069	-	30 minutes
Wilsonville	619	-	60 minutes
Oregon City	516	-	30 minutes
Tigard	410	1 (peak periods only)	60 minutes
Tualatin	383	1	60 minutes
Beaverton	330	1 (peak periods only)	60 minutes
Salem	306	1	60 minutes
Hillsboro	283	2 (peak periods only)	60 minutes
Woodburn	276	-	60 minutes

Estacada

In 2017, approximately 1,287 employees lived in Estacada. Portland (23%) and Estacada (11.8%) were the top work destinations for employees living in Estacada. No other destination pulled more than 5% of

employees living in Estacada. Four of the top ten work destinations for employees are in Clackamas County.

In 2017, approximately 1,160 employed persons worked in Estacada. More than twice as many employees lived and worked in Estacada than lived in any other jurisdiction commuting into Estacada. Seven of the top ten home locations for employees working in Estacada were in Clackamas County.

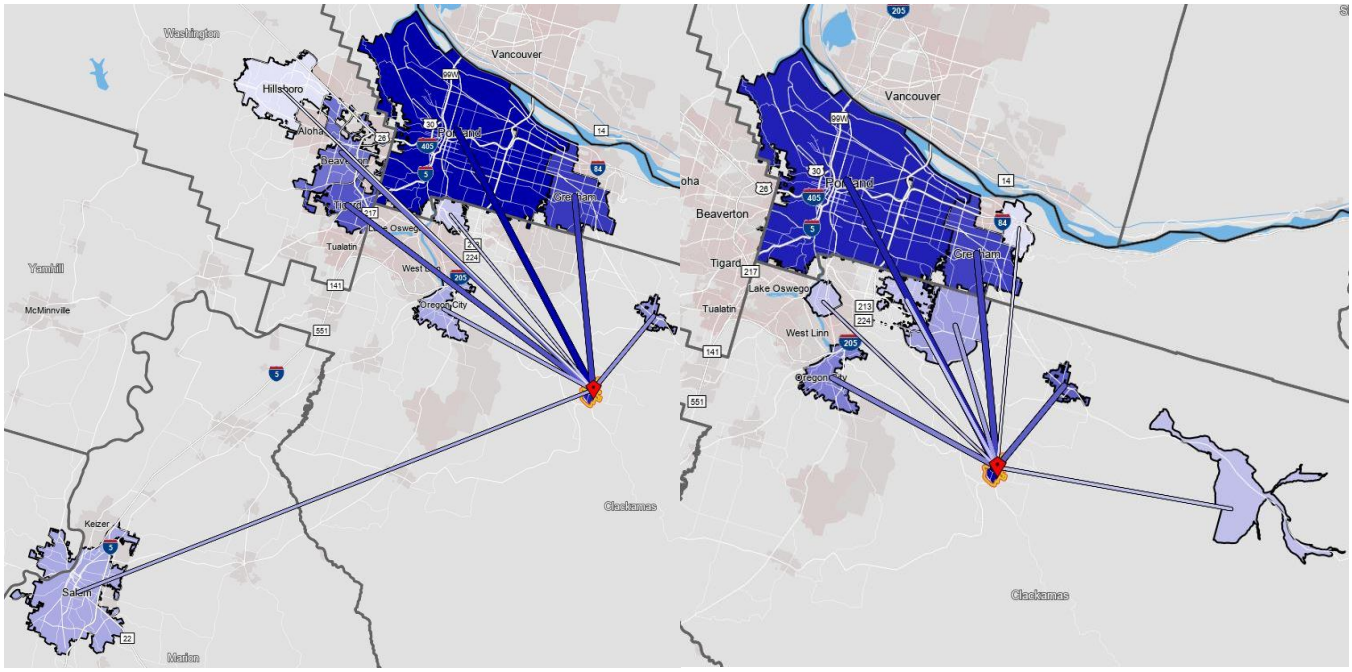
Table C-15 and Figure C-8 show the primary home locations for employees in West Linn and work locations for employees living in Estacada.

Table C-15. Employees Coming To and Going From Estacada

Estacada Resident Work Locations	Count	Share
Portland	296	23.0%
Estacada	152	11.8%
Gresham	61	4.7%
Tigard	41	3.2%
Beaverton	31	2.4%
Sandy	28	2.2%
Oregon City	27	2.1%
Salem	27	2.1%
Milwaukie	22	1.7%
Hillsboro	18	1.4%
All Other Locations	584	45.4%

Estacada Employee Home Locations	Count	Share
Estacada	152	13.1%
Portland	70	6.0%
Gresham	65	5.6%
Sandy	43	3.7%
Oregon City	21	1.8%
Damascus CDP	17	1.5%
Happy Valley	13	1.1%
Mount Hood Village CDP	13	1.1%
Oak Grove CDP	13	1.1%
Troutdale	11	0.9%
All Other Locations	743	64.0%

Figure C-8. Map of Employees Leaving Estacada (Left) and Employees Entering Estacada (Right)



Note: Darker spokes and shading reflect which cities have the most commutes to and from these cities. The darkest city is the top commute location, while the lightest city is the tenth largest commute location.

Estacada and Sandy are all accessible by transit to or from Estacada without a transfer (see Table C-16). Clackamas Town Center provides connections to Portland, Oregon City, Milwaukie, and Gladstone.

Access to Gresham and destinations in Washington County would need to take the MAX Green Line from Clackamas Town Center.

Table C-16. Most Common Commute Pairs for Estacada with Transit Connections

Commutes to/from Estacada	Count (Both Directions)	Number of Transfers	Service Frequency
Portland	366	1	30 minutes
Estacada	152	-	30 minutes
Gresham	126	2	30 minutes
Sandy	71	-	5 times daily
Oregon City	48	1	30 minutes
Tigard	45	2	30 minutes
Salem	37	4	60 minutes (peak periods only)
Beaverton	35	2	30 minutes
Milwaukie	29	1	40 minutes
Gladstone	25	1	30 minutes