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MEMORANDUM

June 2, 2023

To: Scott Hoelscher, Brett Setterfield, Clackamas County
From: Talia Jacobson, Kerry Aszklar, AICP, and Jacob Nigro, Toole Design
Jeri Stroupe, Drusilla van Hengel, and Layne Wyse, Nelson\Nygaard
Project: Walk Bike Clackamas

Re: Technical Memorandum 8: Gaps and Deficiencies

Summary

This memorandum describes the spatial distribution and the methodology of identifying gaps and deficiencies of walking and bicycling facilities throughout Clackamas County, structured by Walk Bike planning areas,[1] for the Walk Bike Clackamas Plan ("Plan"). Identifying gaps and deficiencies aligns with Goal 3, Connectivity, of the Plan. This goal guides the plan effort to: "Develop and maintain walking and biking routes that provide convenient and clear connections to important community destinations in Clackamas County." Input criteria in this analysis overlap slightly with Technical Memorandum 7: Shared Streets. [2]

Three data-driven analyses enable Clackamas County and the project team to identify existing gaps and deficiencies in the walking and bicycling transportation network on county-maintained facilities in unincorporated Clackamas County, which will help to inform project recommendations and prioritization. The methodology of each of these analyses is located in the appendices.

The three main analyses as part of this task are:

- **Bicycle Level of Traffic Stress (BLTS):** the likely amount of stress a bicyclist faces due to roadway and traffic conditions.
- **Bicycle Network Analysis (BNA):** an analysis that measures the connectivity of the bicycle network to destinations on the Census block level.
- **Pedestrian Level of Crossing Stress (PxLTS):** the likely amount of stress when pedestrians cross at roadway intersections and where trails and multi-use paths intersect road segments.[3]

[1] These areas align with the Transportation System Plan planning areas.

[2] Overlapping inputs included but are not limited to: posted speed, motor vehicle functional classification, and traffic volumes.

[3] The sidewalk network examined is the urban area and unincorporated communities as defined in the Clackamas County Comprehensive Plan, Chapter 5: Transportation System Plan.

While this methodology describes the Geographic Information System (GIS) analysis for each of these, additional data informed this methodology, including Replica (a data clearing house for transportation and built environment data)[4] as well as activity areas that generate pedestrian activity (defined as land use areas from Metro's analysis areas[5] located in unincorporated Clackamas County and unincorporated Rural Communities as geographically defined by Clackamas County).

This methodology does not include a crash analysis but instead defers to Clackamas County's software, Vision Zero Suite, which enables Clackamas County to conduct its own crash analysis.

Defining Gaps and Deficiencies

The three analyses of BLTS, BNA, and PxLTS are tools to identify gaps and deficiencies. In these analyses, gaps are defined as a break in continuity. A deficiency speaks to the level of quality of the facility. The following table breakdown the connection between the analyses and how they reveal gaps and deficiencies.

Table 1. Analyses to inform gaps and deficiencies.

	Output Scores	Gap	Deficiency
Bicycle Level of Traffic Stress	BLTS 1-4; 4 is higher stress	BLTS 4 conditions reveals high-stress bicycling conditions with no bicycle facility, or a poor-quality facility.	BLTS 3 or 4 reveals high stress bicycling conditions due to poor quality bikeway facilities
Bicycle Network Analysis	0-100; lower scores mean poorer connectivity	Lower BNA scores reveal a geographic area with insufficient low-stress bikeway connections. Since the output of this analysis is based on Census tracts, it informs both gaps and deficiencies at a different scale of detail compared to BLTS and PxLTS.	
Pedestrian Level of Crossing Stress	PxLTS 1-4; 4 is higher stress	PxLTS 4 reveals high stress crossing conditions due to the lack of crossing infrastructure or the roadway conditions	PxLTS 3 or 4 reveals poor quality crossing conditions due to the lack of crossing infrastructure

Criteria that contribute to whether there are gaps or deficiencies are also dependent on each other. For example, a 25mph street with one lane in each direction that has under 750 vehicles per day creates the conditions for a BLTS 1 facility. However, if the posted speed increases to 30 mph while all other conditions remain the same, that facility is identified as a BLTS 2 facility.

[4] Replica uses big data sources to create large-scale models of multimodal travel activity. It leverages a variety of data sources, including demographic and locational data (such as from smart phones), to produce models with granular, privacy-safe data on mobility and people. Replica's models are calibrated and validated by comparing modeled outputs with observed travel metrics, which are sourced by Replica directly and optionally provided by Replica's customers.

[5] https://rlisdiscovery.oregonmetro.gov/datasets/drcMetro::analysis-centers-5/explore?location=45.360398%2C-122.575653%2C9.73

More detailed, qualitative information about the conditions of roadways for BLTS, BNA, and PxLTS can be found in Appendices A, B, and C, respectively.

Data Sources

The data used for these analyses came from several sources. The geometry and base attribute for the on-street network was the County's street network, which was topologically valid and routable. The geometry and base attributes for the off-street came from the county's trail dataset. This dataset was not topologically valid and routable, and due to budgetary constraints, it was not possible to either perform the necessary work to make the off-street network routable, nor integrate it with the on-street network. This means that the on-street and off-street networks are not able to register as networks that connect to each other, even though these networks intersect at certain locations. This affected BNA accuracy near some off-street facilities. For this work, all relevant roadway network and intersections data was combined into a single, unified dataset.

Additional data sources, including the on-street bicycle facilities, trails, vehicular roadway data,[6] destinations, population, and jobs, were all sourced from Clackamas County, Open Street Map, the Census, or the Longitudinal Employer-Household Dynamics[7] program. Land use data to identify activity centers was sourced from Clackamas County and Oregon Metro.

To inform analysis of locations where multimodal and vehicular trips are currently happening, Toole Design used Replica, an online data platform that uses big data sources to create large-scale models of multimodal travel activity. Replica provided insights on travel activity and patterns to inform the evaluation of existing travel habits and to guide recommendations. It leverages a variety of data sources, including demographic and locational data (such as from smart phones), to produce models with granular, privacy-safe data on mobility and people. Data units are by the number of trips per day.

For this memo, data regarding the locations of current walking, bicycling, and short vehicle trips was examined. Short vehicle trips were included to understand where trips under 3 miles were occurring, given that these trips could be shifted to walking or bicycling trips. While this data is informative, it did not directly impact the BLTS, BNA, or the PxLTS.

This memo also considered previous project work, such as the existing conditions and public input from Engagement Milestone #2 in February 2023. The project team reviewed these materials to inform opportunities and constraints of the existing gaps and deficiencies identified via the BLTS, the BNA, and the PxLTS.

See Appendix A: Data Sources for more information on each source and which analyses it was used for. See Appendices F-H for maps representing bicycling, walking, and short vehicle trips.

Building Upon Other County Plans

This gaps and deficiencies analysis builds upon the gaps and deficiencies identified in Clackamas County's current Transportation System Plan[8], as well as the Clackamas Regional Center Pedestrian and Bicycle Connection Project[9] and the Villages at Mt. Hood Pedestrian and Bikeway Implementation Plan[10].

[6] These include posted speed limits, number of lanes, annual average daily traffic centerline presence, parking, and traffic control.
[7] https://lehd.ces.census.gov/
[8] https://www.clackamas.us/transportation/tsp
[9] https://www.clackamas.us/engineering/connect.html
[10] https://www.clackamas.us/engineering/walkbikevillages.html

Project Next Steps

Based on these three analyses of Bicycle Level of Traffic Stress, Bicycle Network Analysis, and Pedestrian Level of Crossing Stress, the project team will identify projects addressing gaps and deficiencies and will develop a methodology for prioritizing projects based on the goals and objectives of Walk Bike Clackamas. This work will be documented in subsequent technical memoranda.

Analyses by Areas

Below are summaries and maps of the three analyses – BLTS, BNA, and PxLTS – based on the entire county and the five Walk Bike planning areas. The three analyses were conducted for the entire county, including incorporated areas, to understand how Clackamas County-maintained facilities connect to other jurisdictions' facilities. Including both the unincorporated and the incorporated areas of the County also acknowledges that most people who walk or bike will not differentiate between facility ownership. Understanding gaps and deficiencies across the transportation system regardless of facility ownership informs project development for the unincorporated area that is the focus of this plan.

Countywide

Bicycle Level of Traffic Stress

Generally, roads throughout Clackamas County were identified as either BLTS 1 or BLTS 4; very few were BLTS 2-3. Most higher classification and higher volume roads are BLTS 4. Rural roads outside of incorporated areas that connect incorporated cities or activity areas were majority BLTS 4, leaving few convenient and direct BLTS 1 connections across the County.

Bicycle Network Analysis

Much of Clackamas County is not well connected via low-stress routes, and relies on high stress routes to connect between destinations. Higher density low-stress connections are present on the outskirts of incorporated areas in the Northwest, McLoughlin, and Clackamas Town Center Areas. In the Southwest Area, there is a higher concentration of low-stress connections southeast and south of Molalla. More information is available for each Walk Bike planning area below.

Pedestrian Level of Crossing Stress

Crossing stress scores are generally high on higher classification and higher volume roads throughout the county. Even where adjacent lower classification streets may offer lower-stress alternatives, the high stress crossings on the county's major corridors represents a barrier to encouraging walking and active travel.

Figure 1. Bicycle Level of Traffic Stress

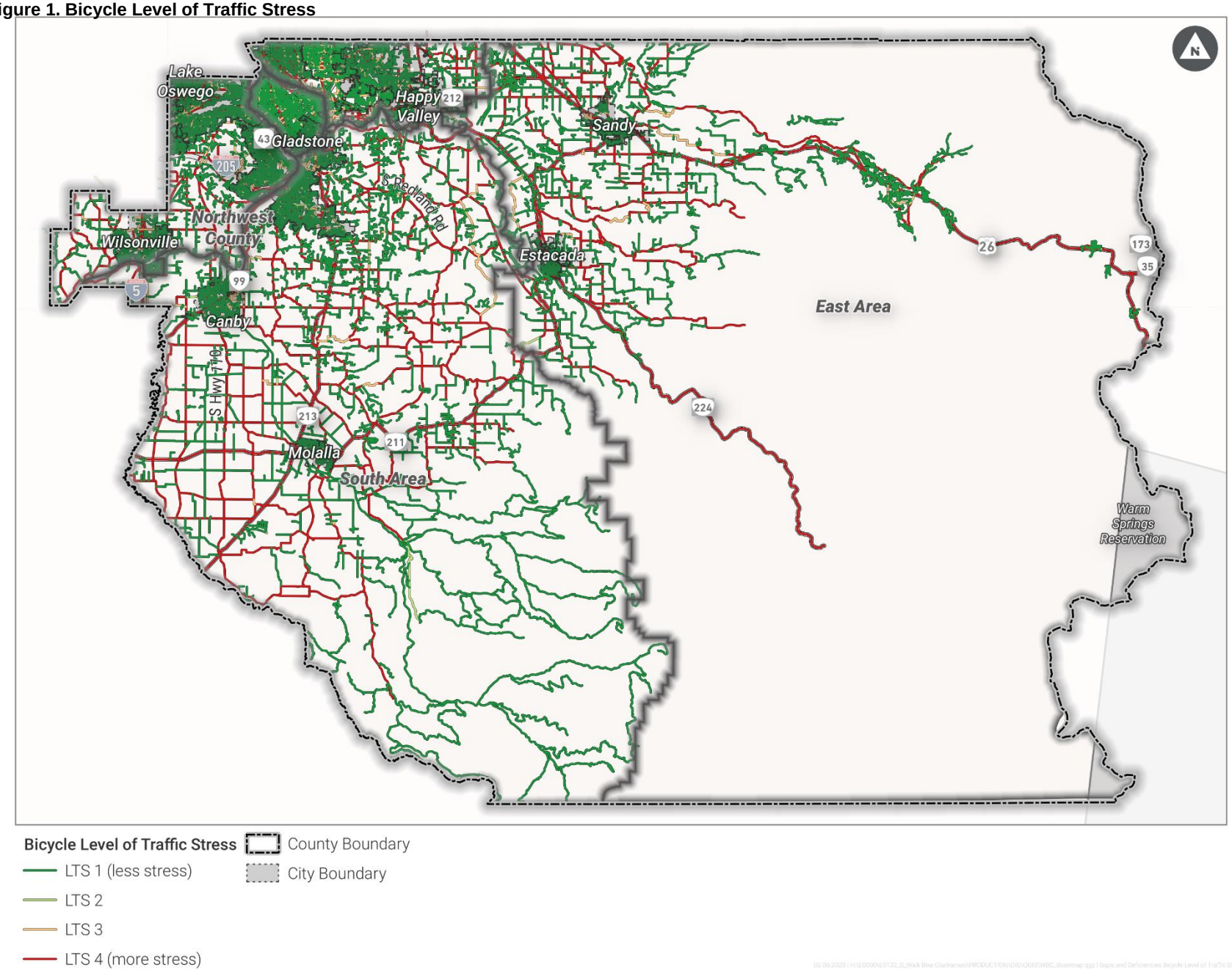


Figure 2. Bicycle Network Analysis

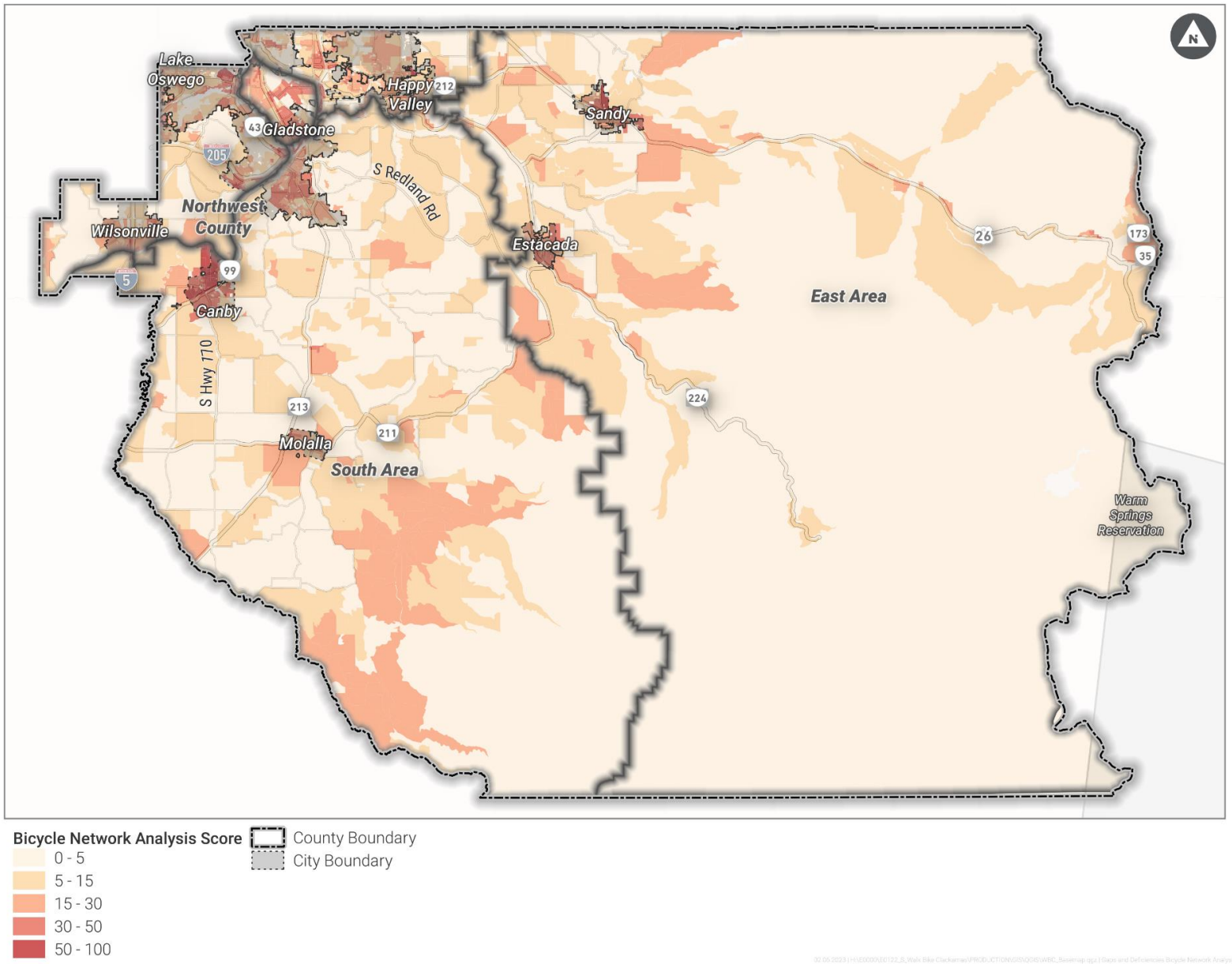
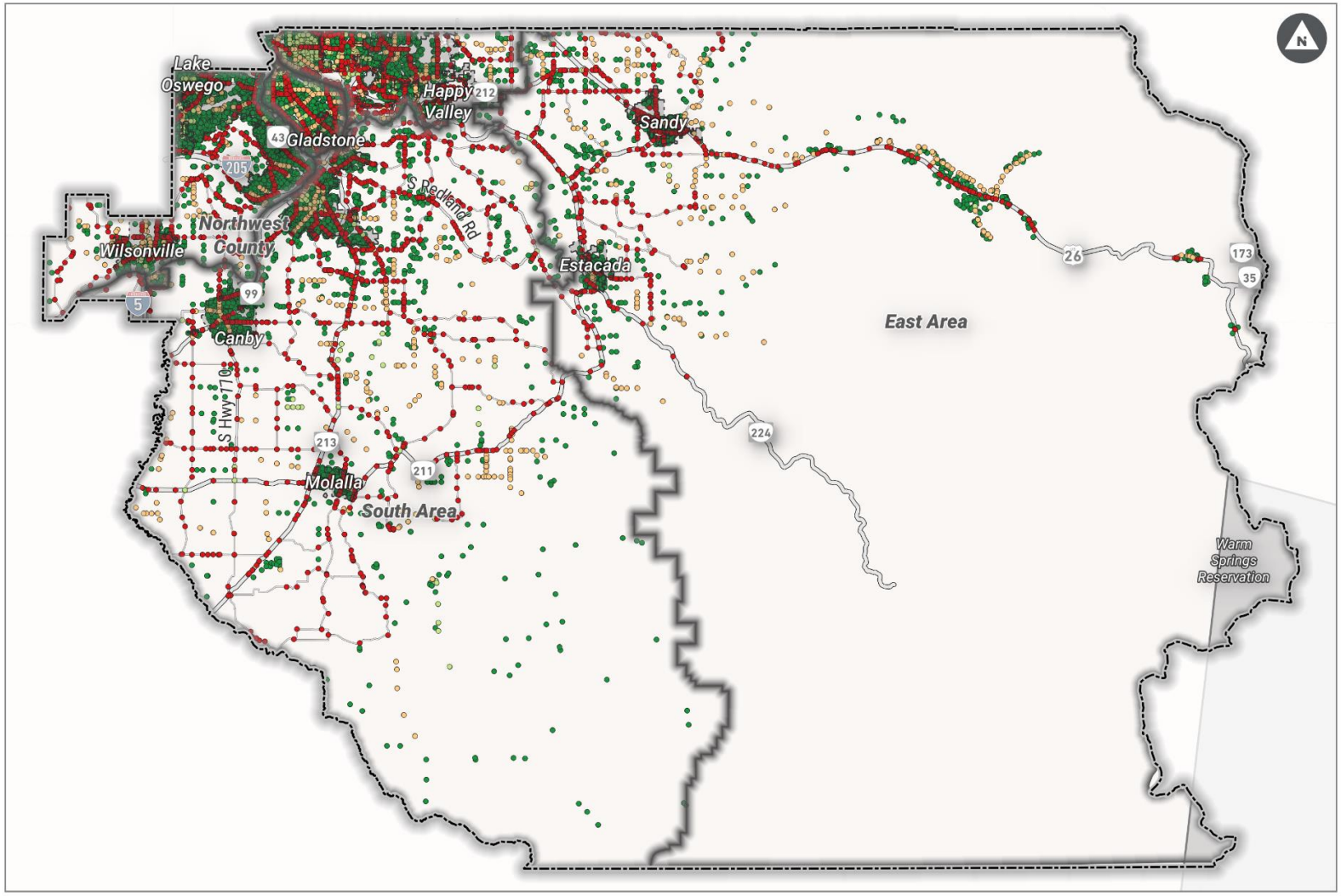


Figure 3. Pedestrian Level of Crossing Stress



Walk Bike Planning Area: Greater Clackamas Town Center/Industrial Area

Bicycle Level of Traffic Stress

In the Clackamas Town Center Area, most LTS 4 roads are along key through routes. Also high stress are roads owned by the Oregon Department of Transportation, namely Route 224, Route 99, and SE 82nd Avenue/Route 213. Route 212 is also a noted high-stress route.

Long stretches of SE Sunnyside Road are slightly less stressful as an LTS 3.

Bicycle Network Analysis

High-scoring (better connected) locations for the bicycle network in the Clackamas Town Center are in the southwest corner adjacent to Route 213, and both north and south of Route 212. Other areas that score highly are north of SE Sunnyside Road, between SE 172nd Avenue and SE Foster Road. Lastly, the area between SE 82nd Avenue and Interstate 205, including the Clackamas Town Center up to SE King Road, also scored highly.

Areas of poor connectivity are mainly located in the east part of the area, and in the area adjacent to Milwaukie.

Pedestrian Level of Crossing Stress

High levels of pedestrian crossing stress in the Clackamas Town Center Area are concentrated on SE 82nd Avenue, SE King Road, SE Johnson Creek Boulevard, and along Route 212. Other streets where high crossing stress suggests deficiencies include SE 242nd Avenue and SE Tillstrom Road.

Network Opportunities And Constraints

Based on these analyses and trip data from Replica, gaps and deficiencies could be addressed by improving the bicycle and pedestrian network along and across arterial roads east of Milwaukie, as well as providing better connections across state owned roads, along and across SE 82nd Avenue, and across SE Sunnyside Road. Interstate 205, the Clackamas River, and state-owned roads all represent physical and infrastructure network barriers.

Figure 4. Bicycle Level of Traffic Stress

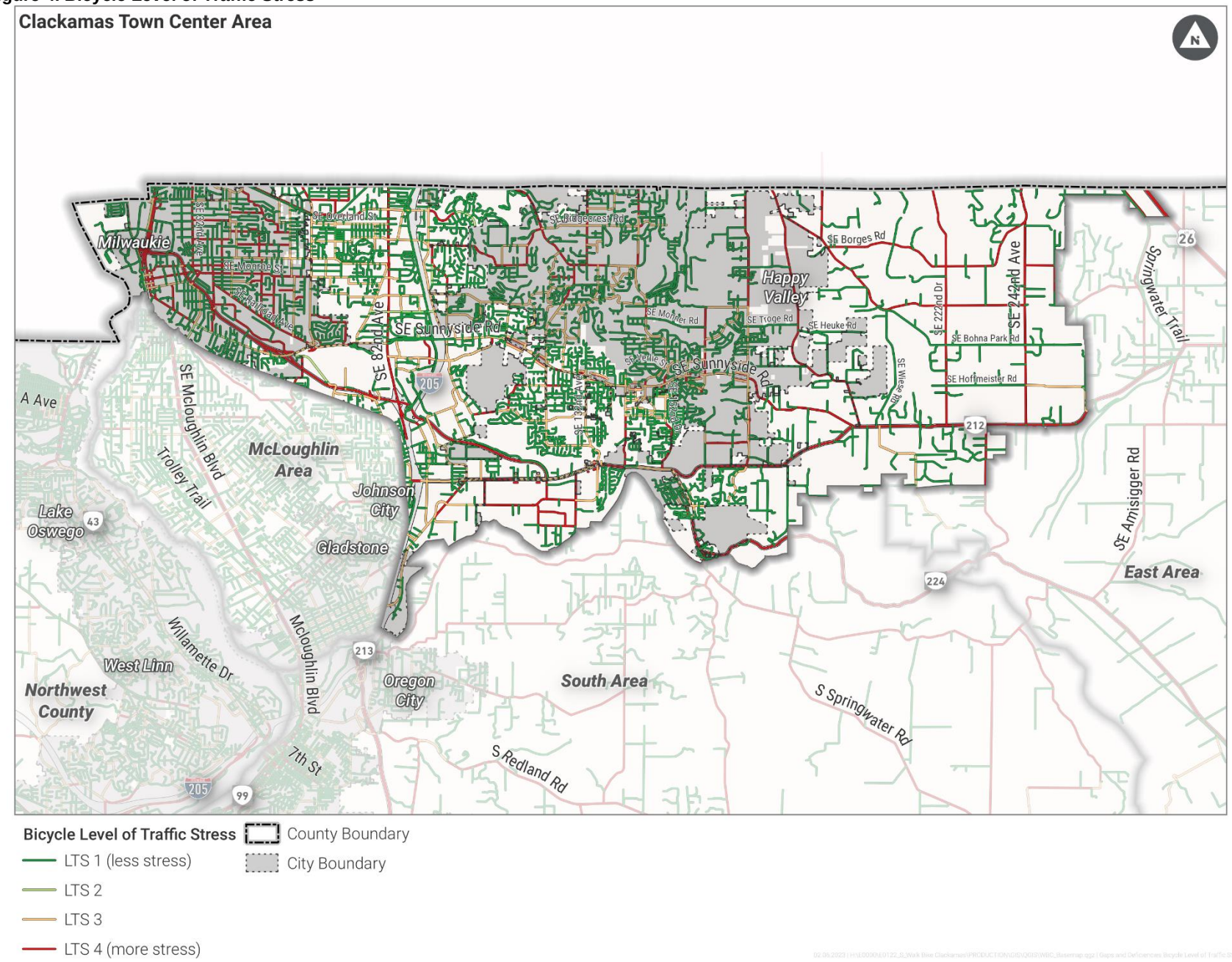


Figure 5. Bicycle Network Analysis

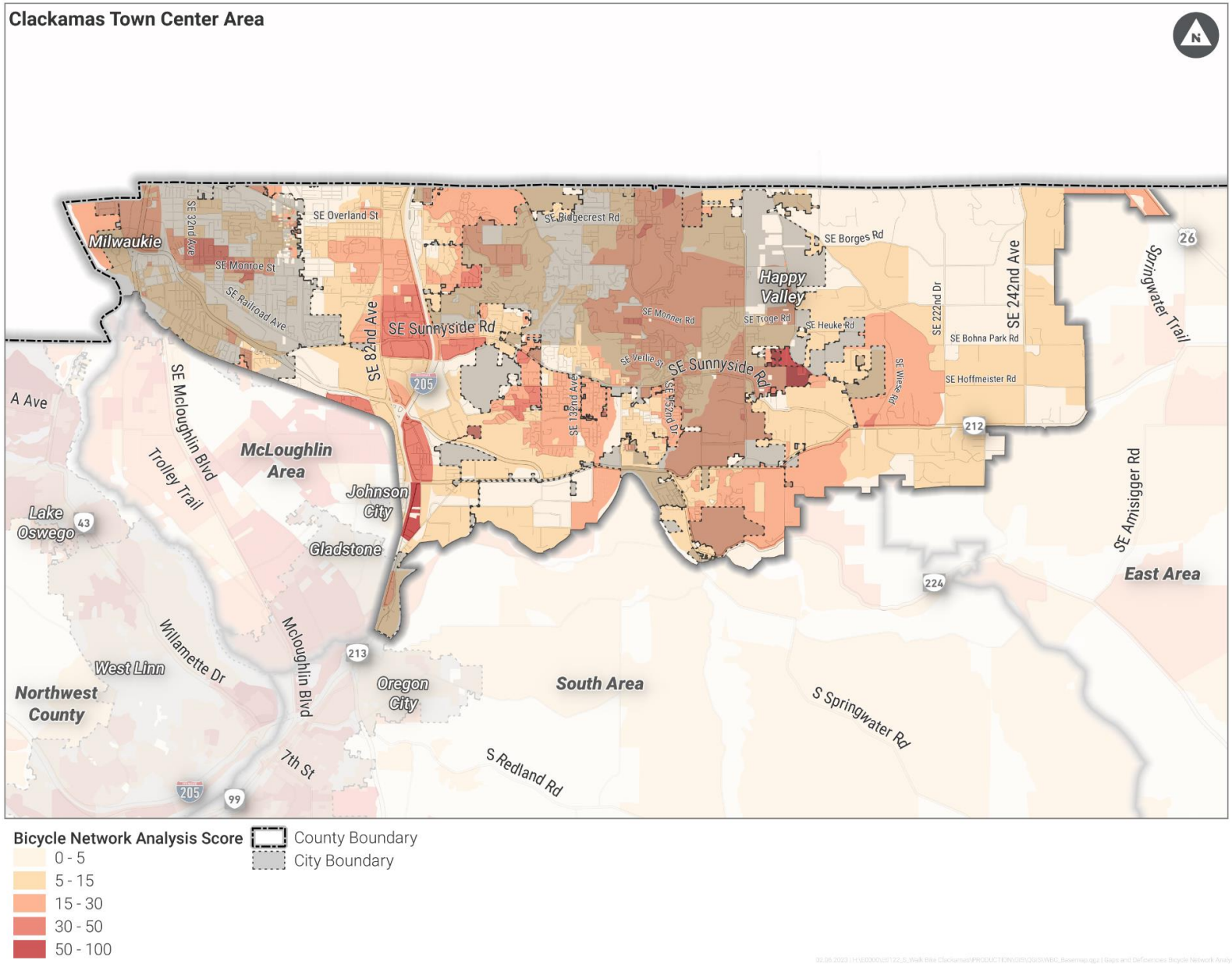
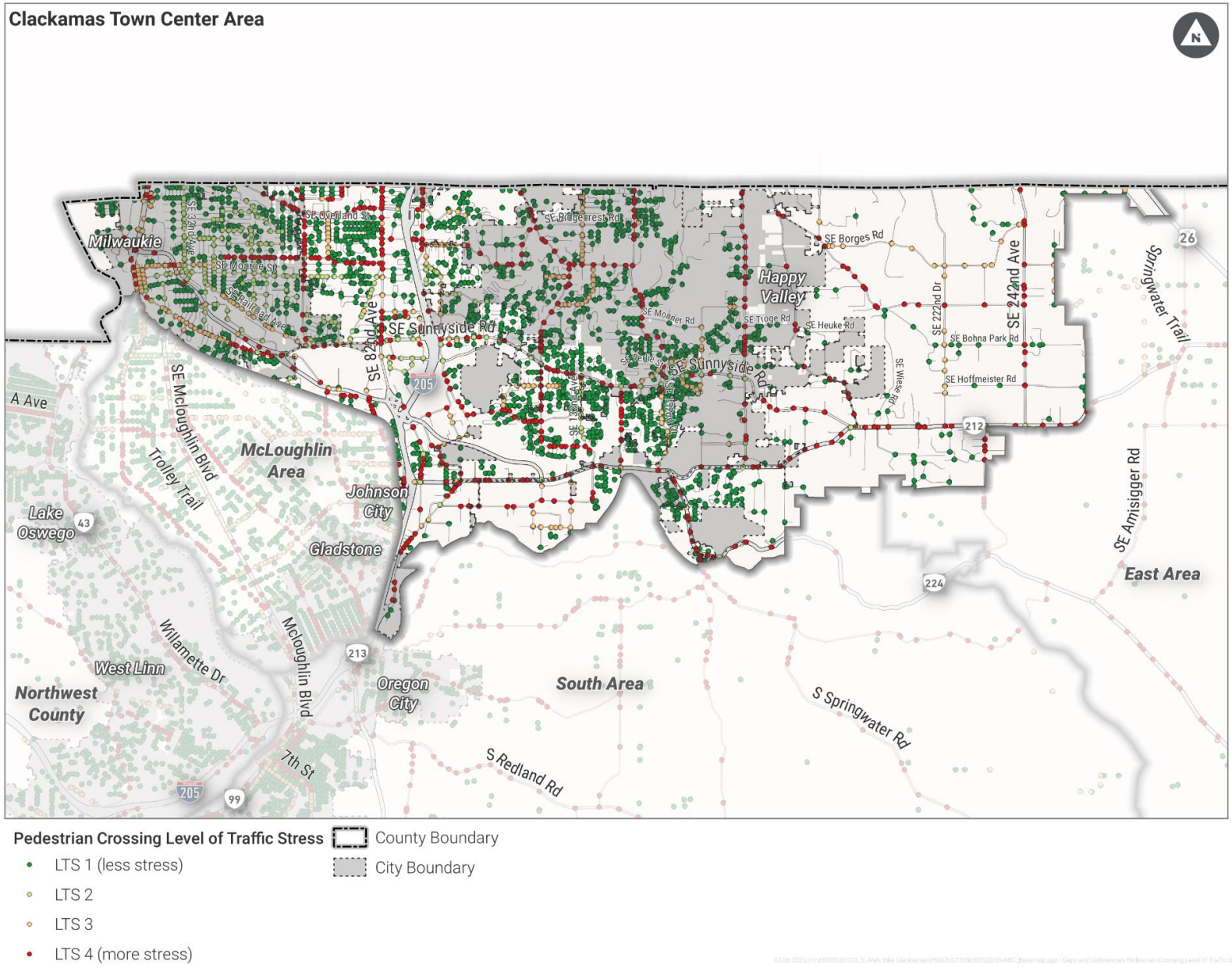


Figure 6. Pedestrian Level of Crossing Stress



Walk Bike Planning Area: East Area

Bicycle Level of Traffic Stress

Streets with high levels of bicycle traffic stress include Route 224 from the Happy Valley area all the way to Ripplebrook. Route 26 throughout Clackamas County all the way to Government Camp and beyond was also identified as a high stress facility for bicycling. Route 211 from Estacada and spilling across the East Area boundary, going into the Southwest Area, is also a high stress facility. Additional streets measured as BLTS 4 include a number of rural roads in and around the towns of Tracy, George, Dover, and Cottrell.

Note: the Cazadero Trail, an off-street path from Barton to Eagle Creek, is only partially improved.

Bicycle Network Analysis

Bicycle connectivity in the East Area is limited. The highest concentrations of connectivity, which are medium tier (between 30 to 50 out of 100), are located south and east of Estacada, east of Sandy, and small pockets west of Sandy. The connectivity south of Estacada is likely due to Milo McIver State Park, and east of Estacada are rural roads in an area with destinations. Connectivity east and west of Sandy are more rural roads.

Pedestrian Level of Crossing Stress

Locations of high pedestrian crossing stress are highly concentrated on Route 211 north and south of Estacada, as well as on rural streets around Estacada, such as SE Coupland Road and SE Divers Road. Other areas with high pedestrian crossing stress were located in and around Sandy. Specifically on Route 26, intersections around Cherryville, at the Mt Hood Village area, Rhododendron, Government Camp, and at intersection of SE Alder Creek Rd all showed high levels of crossing stress. Intersections in and around Eagle Creek were also identified as high stress.

Network Opportunities and Constraints

Based on these analyses, gaps and deficiencies could be addressed in the bicycle and pedestrian network adjacent to and between Sandy and Estacada, and the network westward to Happy Valley. There are also opportunities to improve pedestrian crossings in particular along Route 26 given the number of destinations. Network constraints include natural barriers such as waterways and topography.

Figure 7. Bicycle Level of Traffic Stress

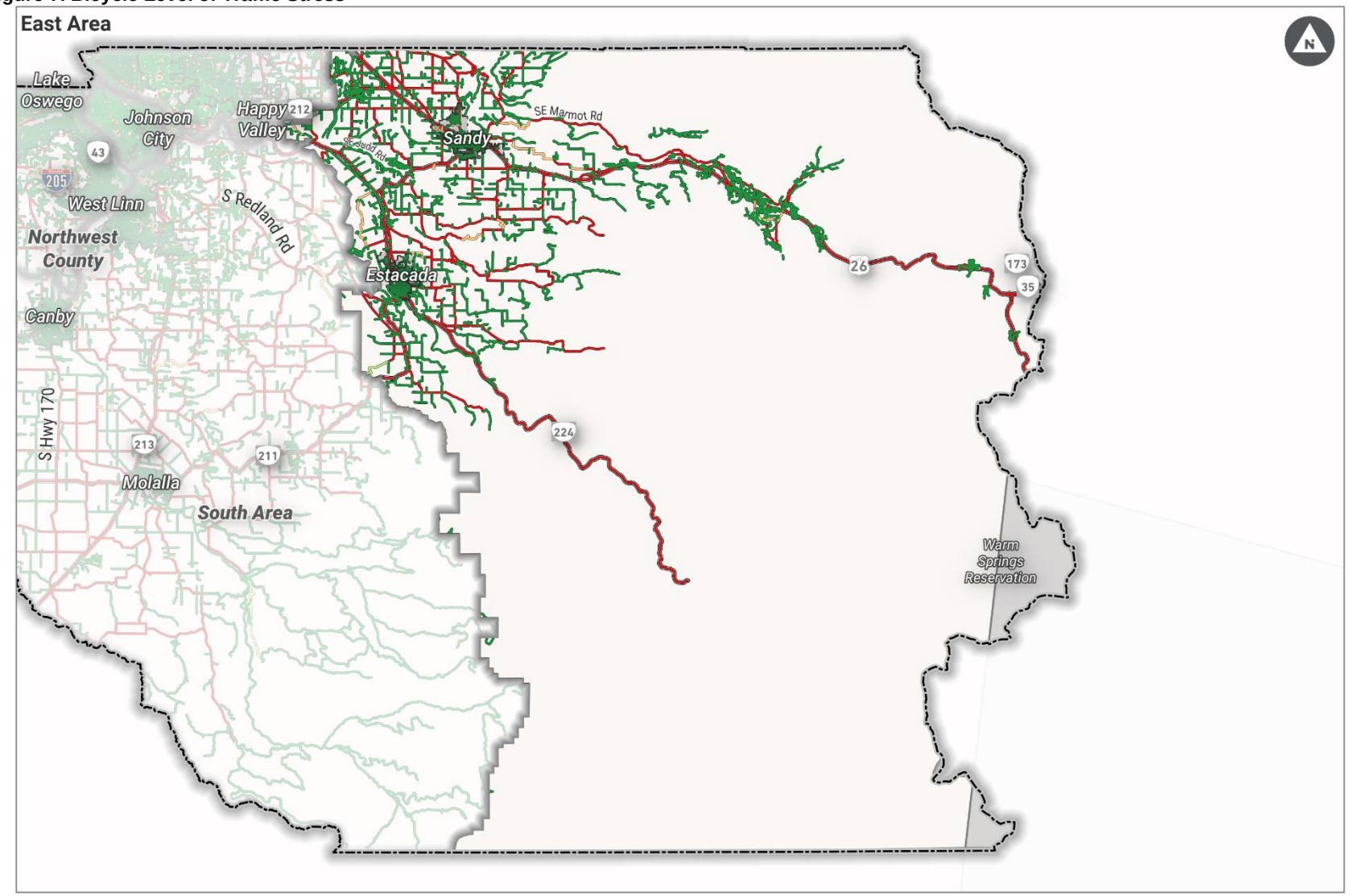


Figure 8. Bicycle Network Analysis

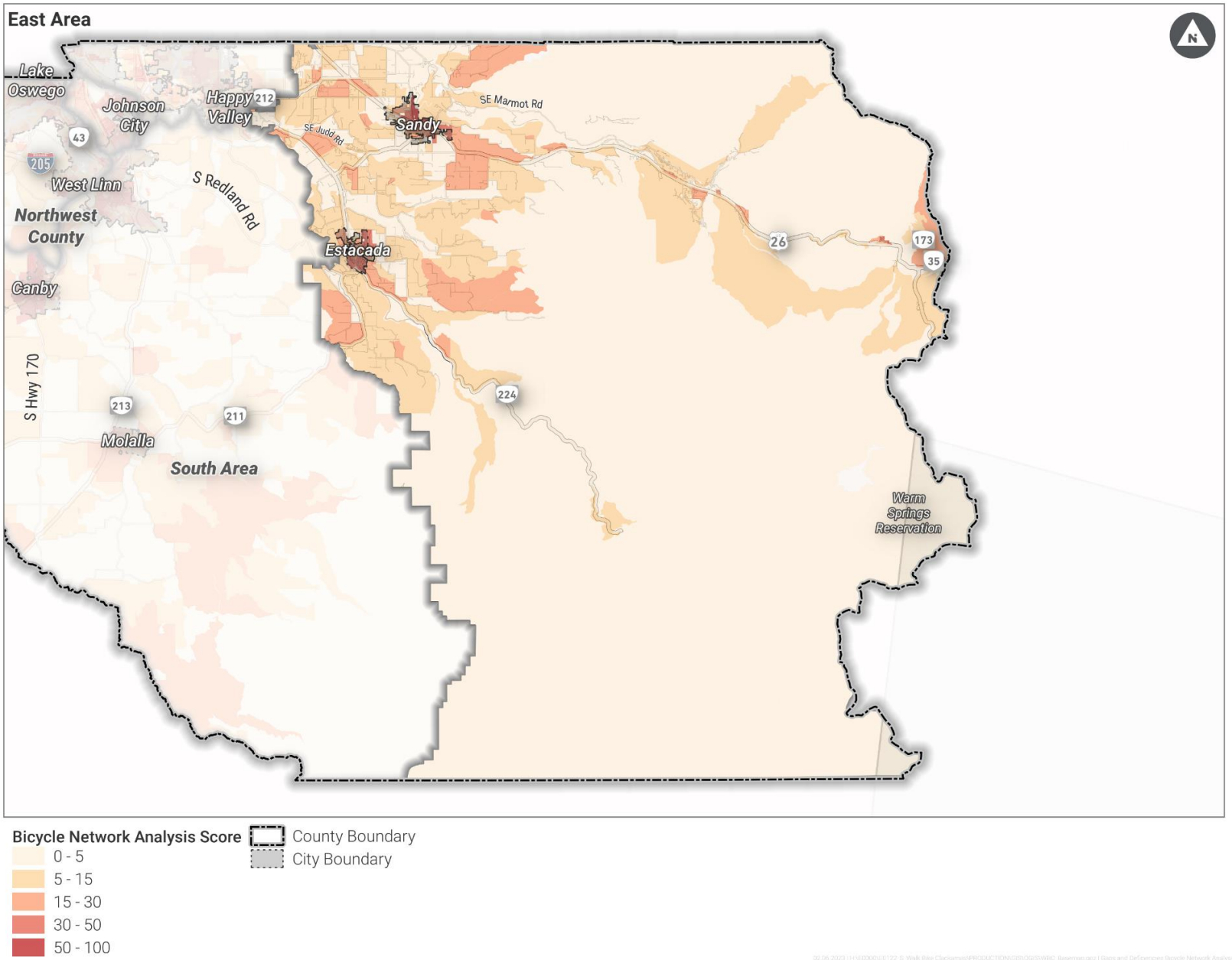
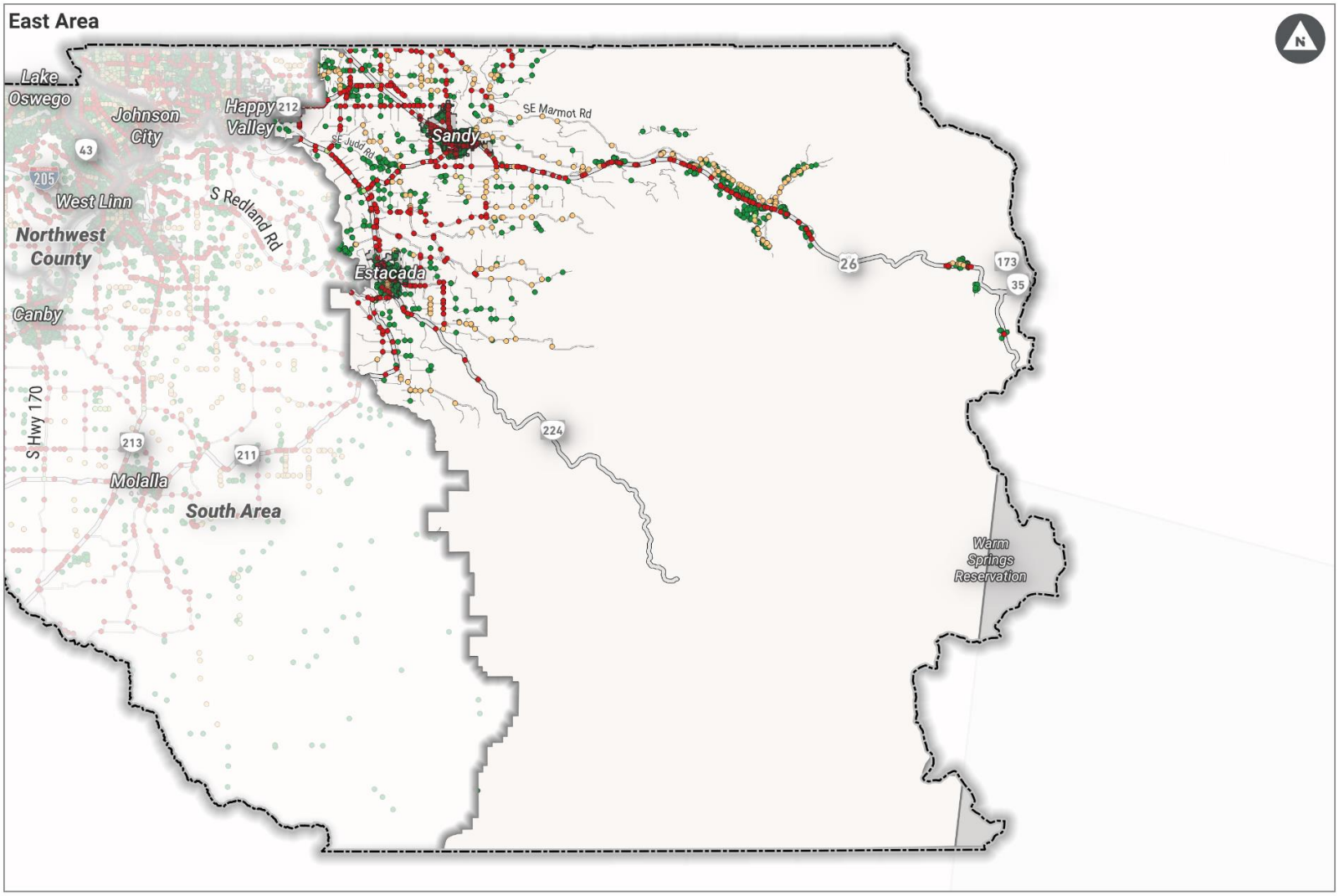


Figure 9. Pedestrian Level of Crossing Stress



Walk Bike Planning Area: Greater McLoughlin Area

Bicycle Level of Traffic Stress

Streets with high levels of bicycle traffic stress are predominately state-owned Route 99, as well as SE McLoughlin Boulevard, SE Aldercrest Road, and SE Hill Road. A number of east-west streets were identified as BLTS 3.

Bicycle Network Analysis

The Greater McLoughlin Area is well connected, scoring high on the east side of McLoughlin Boulevard. One area of high connectivity generally aligns with SE Thiessen Road; another high connectivity area is between SE Roeth Road to the boarder of Gladstone. Areas west of SE McLoughlin Boulevard also generally scored high regarding connectivity. These increased connectivity scores are likely due to the concentration of low-stress neighborhood streets and high density of destinations.

Pedestrian Level of Crossing Stress

Streets with high pedestrian crossing stress include the length of SE River Road and Oatfield Road. SE Webster Road and SE Roots Road also had a high concentration of stressful pedestrian crossings. This is likely due to the concentration of motor vehicle traffic on the few north-south streets in the area, which increases crossing stress.

Network Opportunities and Constraints

Based on these analyses, gaps and deficiencies could be addressed in the bicycle and pedestrian network on east-west crossings over Route 99 and throughout the area, and improve pedestrian crossings along River Road. Network constraints include few east-west through streets across topographic challenges in the eastern part of the area.

Figure 10. Bicycle Level of Traffic Stress

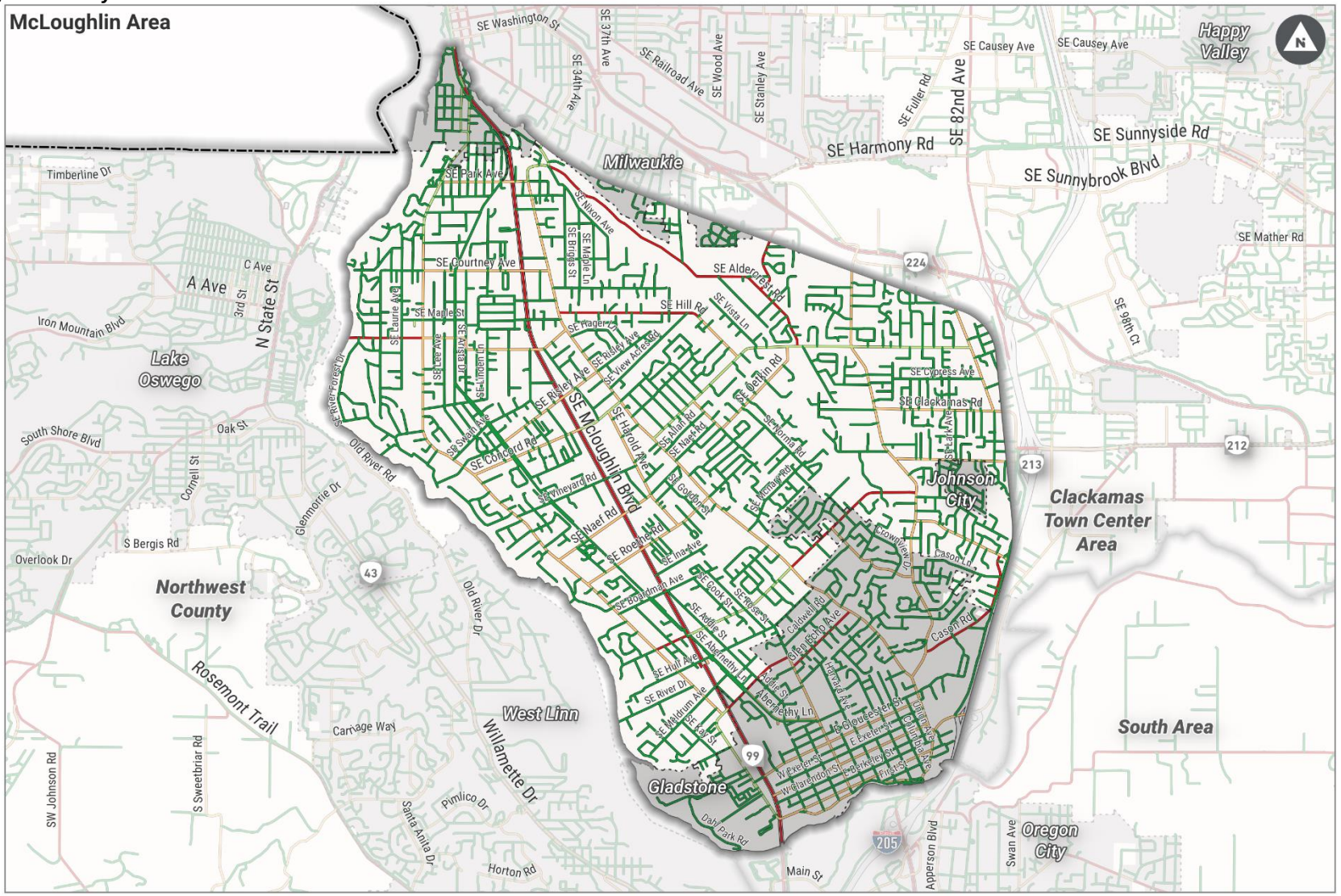


Figure 11. Bicycle Network Analysis

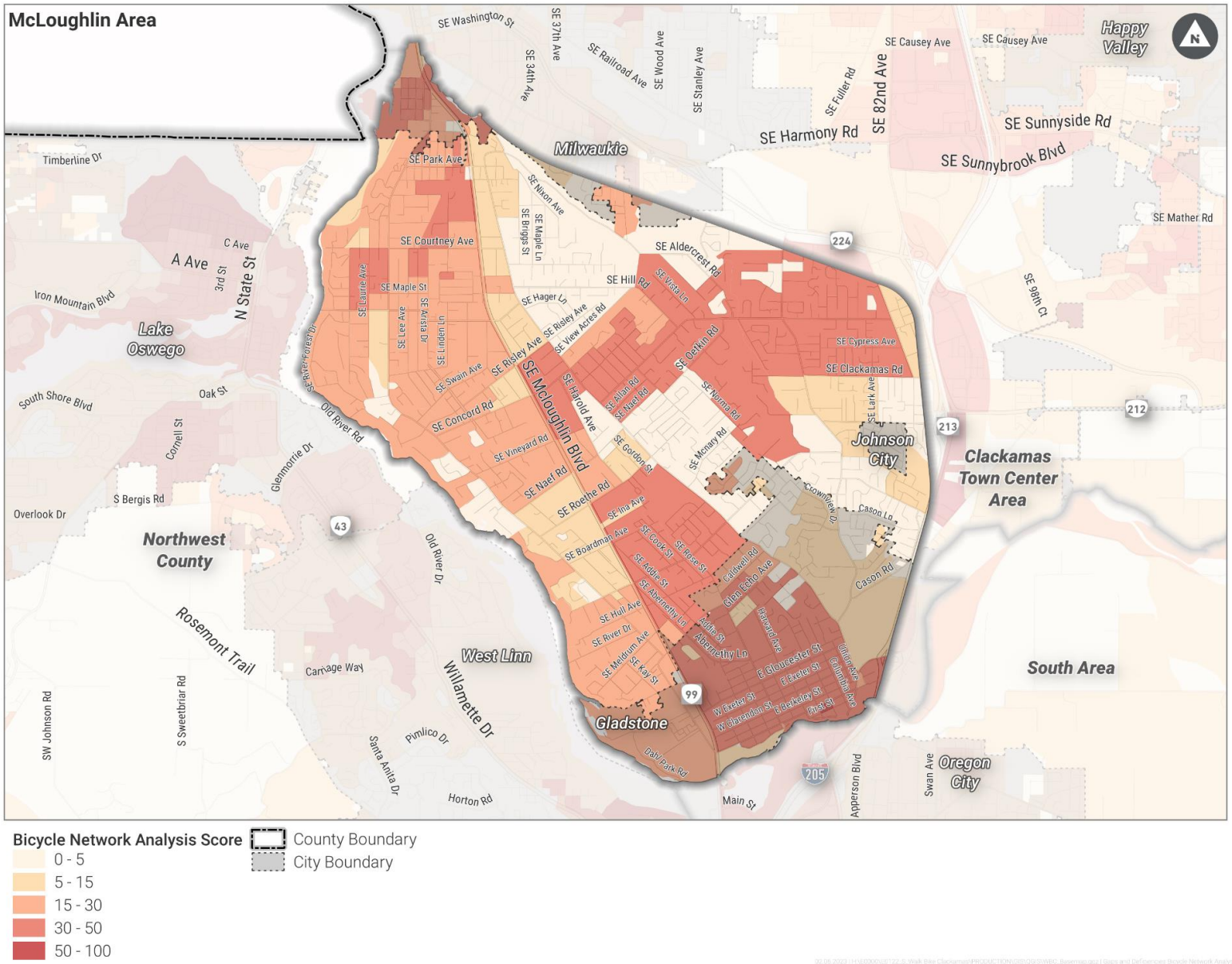
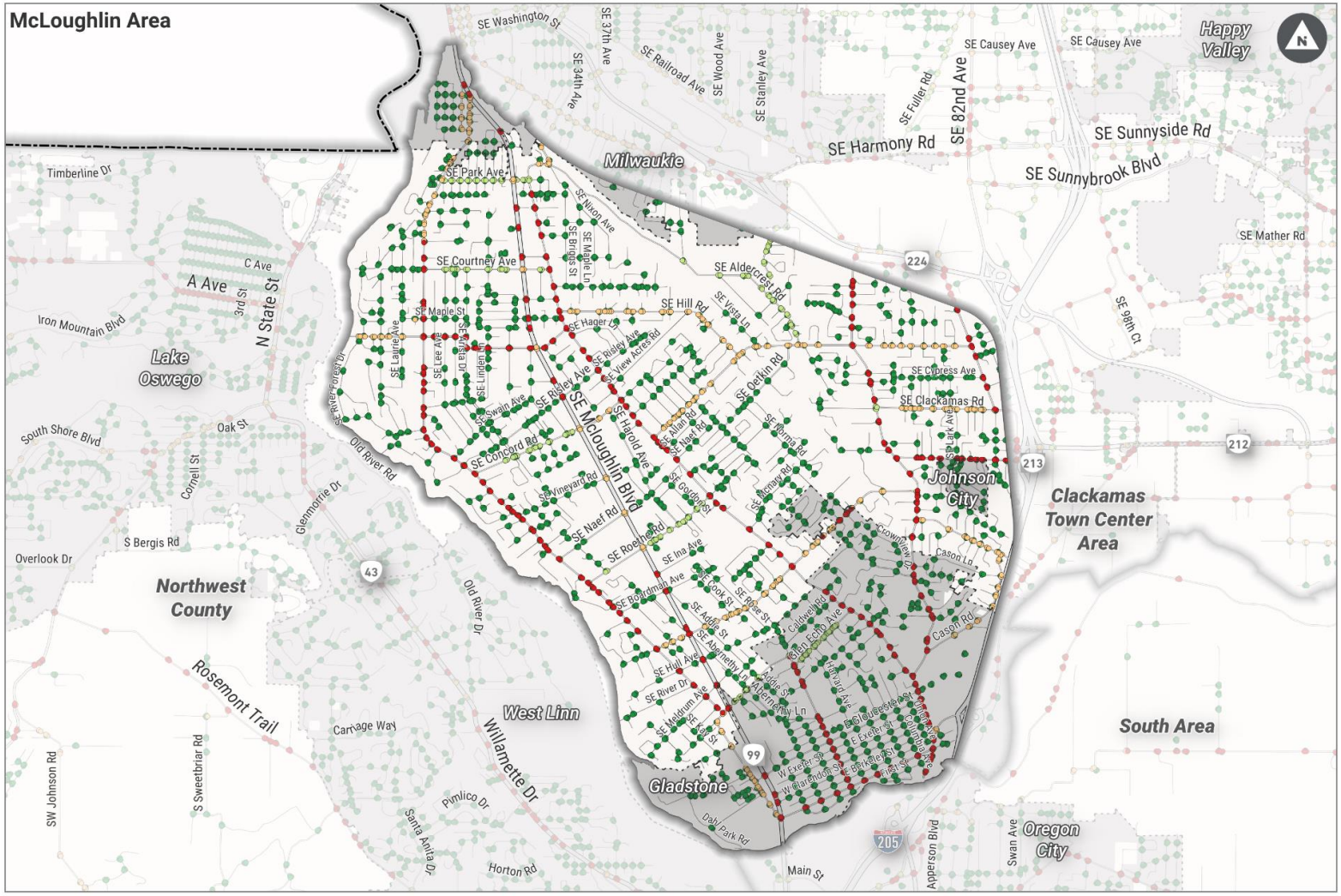


Figure 12. Pedestrian Level of Crossing Stress



Walk Bike Planning Area: Northwest County

Bicycle Level of Traffic Stress

Streets with high levels of bicycle traffic stress are scattered throughout the Northwest County area. Given the topography of the area, there are a limited number of streets that connect to destinations, which increases the concentration of vehicle traffic on those streets. High stress streets (BLTS 4) for bicycling include essentially any street that connects to activity centers.

Bicycle Network Analysis

Bicycle connectivity in the Northwest Area is poor, given major barriers such as the Willamette River, Interstate 205, and Interstate 5. Two pockets of high connectivity are located west and southwest of Lake Oswego, while large swaths of medium tier connectivity are located in between Wilsonville, West Linn, and Tualatin.

Pedestrian Level of Crossing Stress

High stress pedestrian crossings in the Northwest County area are concentrated along key connecting streets between Wilsonville and West Linn. There are fewer high stress crossings compared to other planning areas, which is due to fewer streets and therefore fewer intersections.

Network Opportunities and Constraints

Based on these analyses, there is opportunity to improve gaps and deficiencies in the bicycle and pedestrian network between Wilsonville and West Linn, and across Interstate 205. Other opportunities include improving pedestrian crossings along streets that funnel into the few crossings over or under Interstate 205. Constraints in the network include topography, few direct routes, and connections across Interstate 205.

Figure 13. Bicycle Level of Traffic Stress

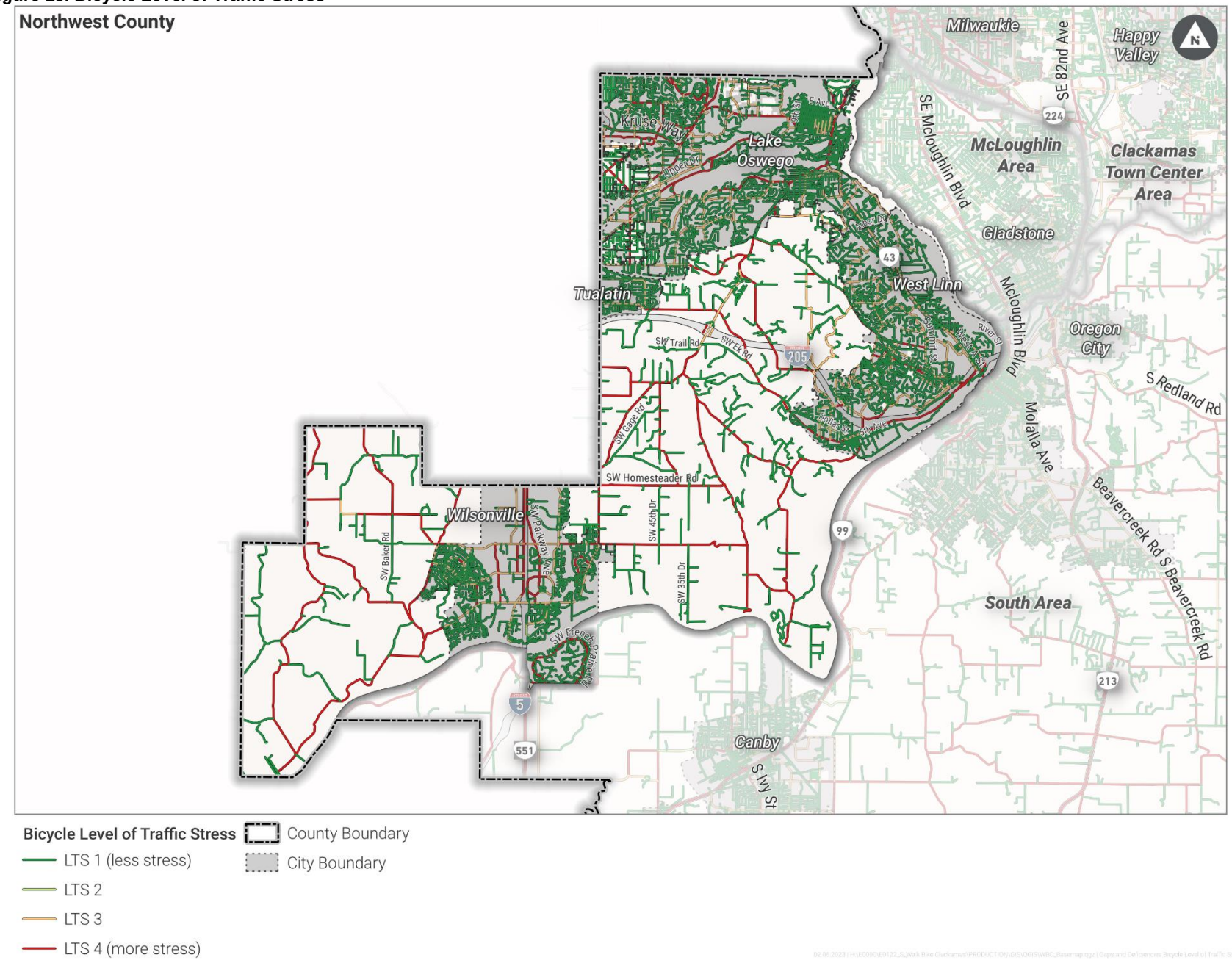


Figure 14. Bicycle Network Analysis

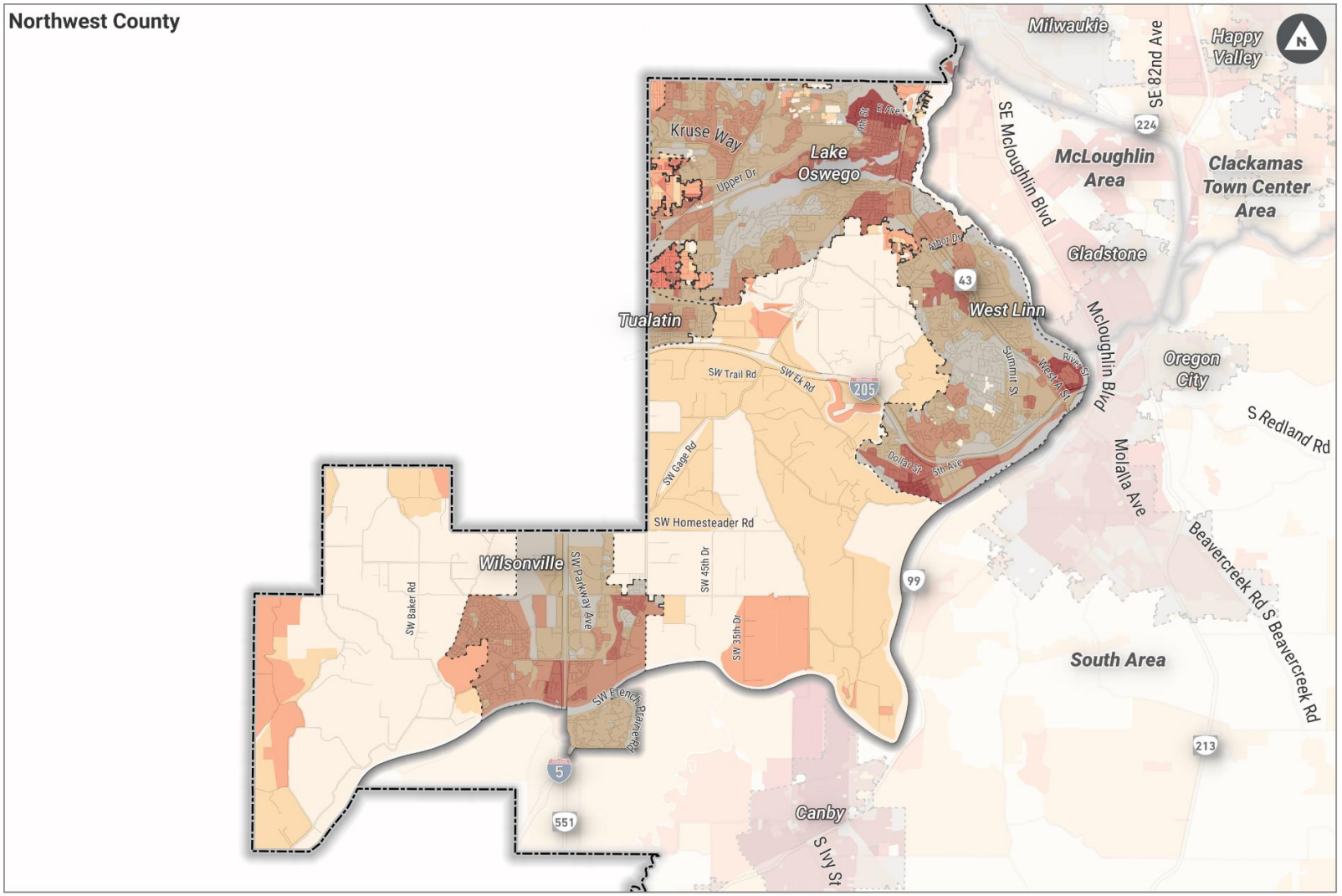
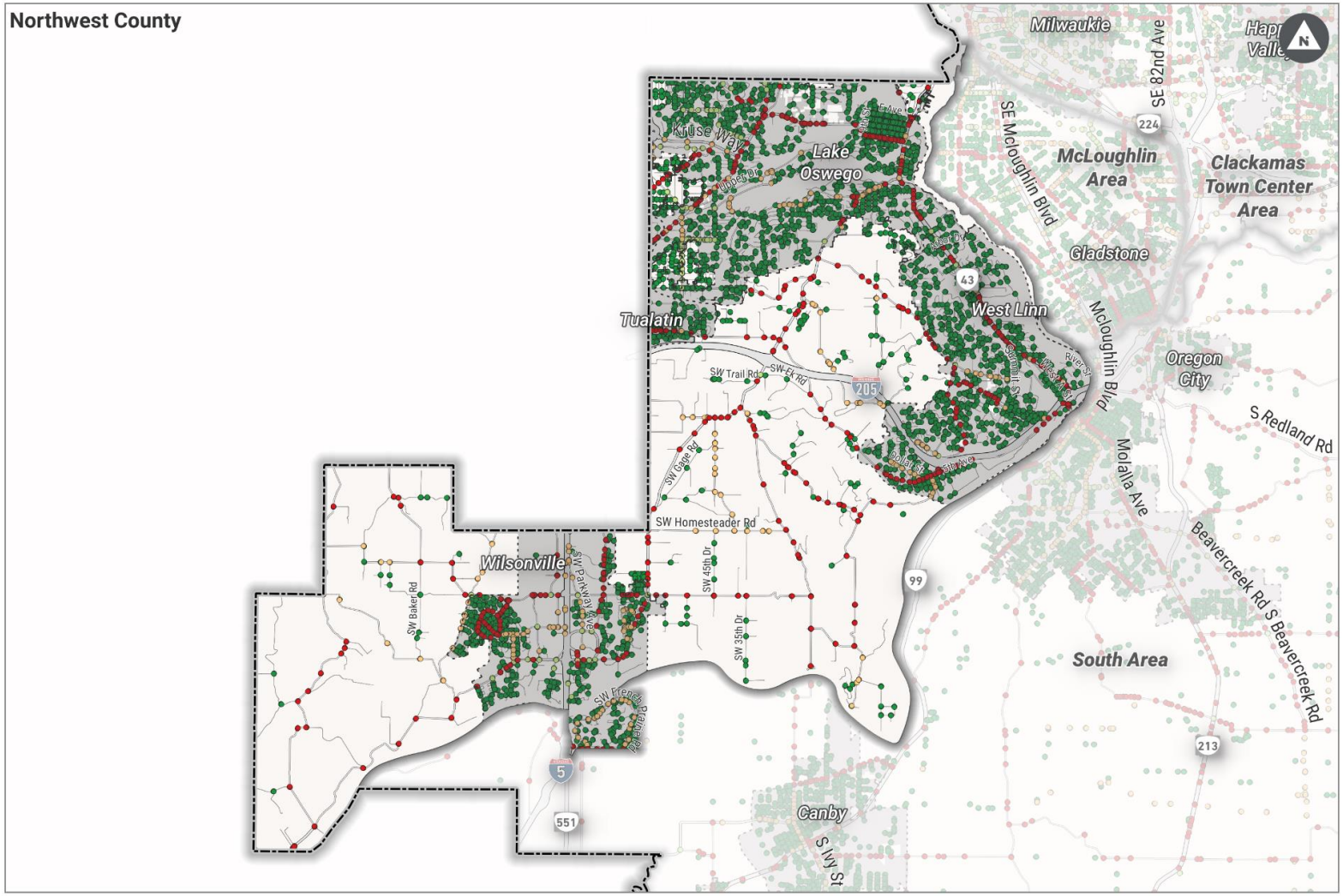


Figure 15. Pedestrian Level of Crossing Stress



Walk Bike Planning Area: Southwest Area

Bicycle Level of Traffic Stress

A high proportion of streets in the Southwest Area are identified as BLTS 4, the highest measure of bicycle traffic stress. Most of these high-stress streets are the only through routes that connect to incorporated areas or activity areas; the majority of low-stress streets do not connect.

Bicycle Network Analysis

Large swaths of the Southwest Area have poor connectivity. Most of the bicycle network connectivity is concentrated in the forests south of Molalla and south of Route 211 in general. Areas with low tier connectivity (5-15 out of 100) are concentrated along state-owned routes, such as Routes 213 and 211, likely due to the concentration of destinations along these routes. Areas with poor connectivity are dotted across the area in between the incorporated cities and activity areas.

Pedestrian Level of Crossing Stress

Streets with high pedestrian crossing stress are located throughout the area, similar to the geographic distribution of streets with high levels of bicycle traffic stress. High-stress pedestrian crossing streets are located on Routes 213 and 211, S Beavercreek Road, SE Redland Road, and S Springwater Road

Network Opportunities and Constraints

Based on these analyses, gaps and deficiencies could be addressed by improving the bicycle and pedestrian network north and northwest of Molalla to connect to Canby, Oregon City, and Estacada. Network constraints include natural barriers, such as waterways, and large swaths of agricultural land.

Figure 16. Bicycle Level of Traffic Stress

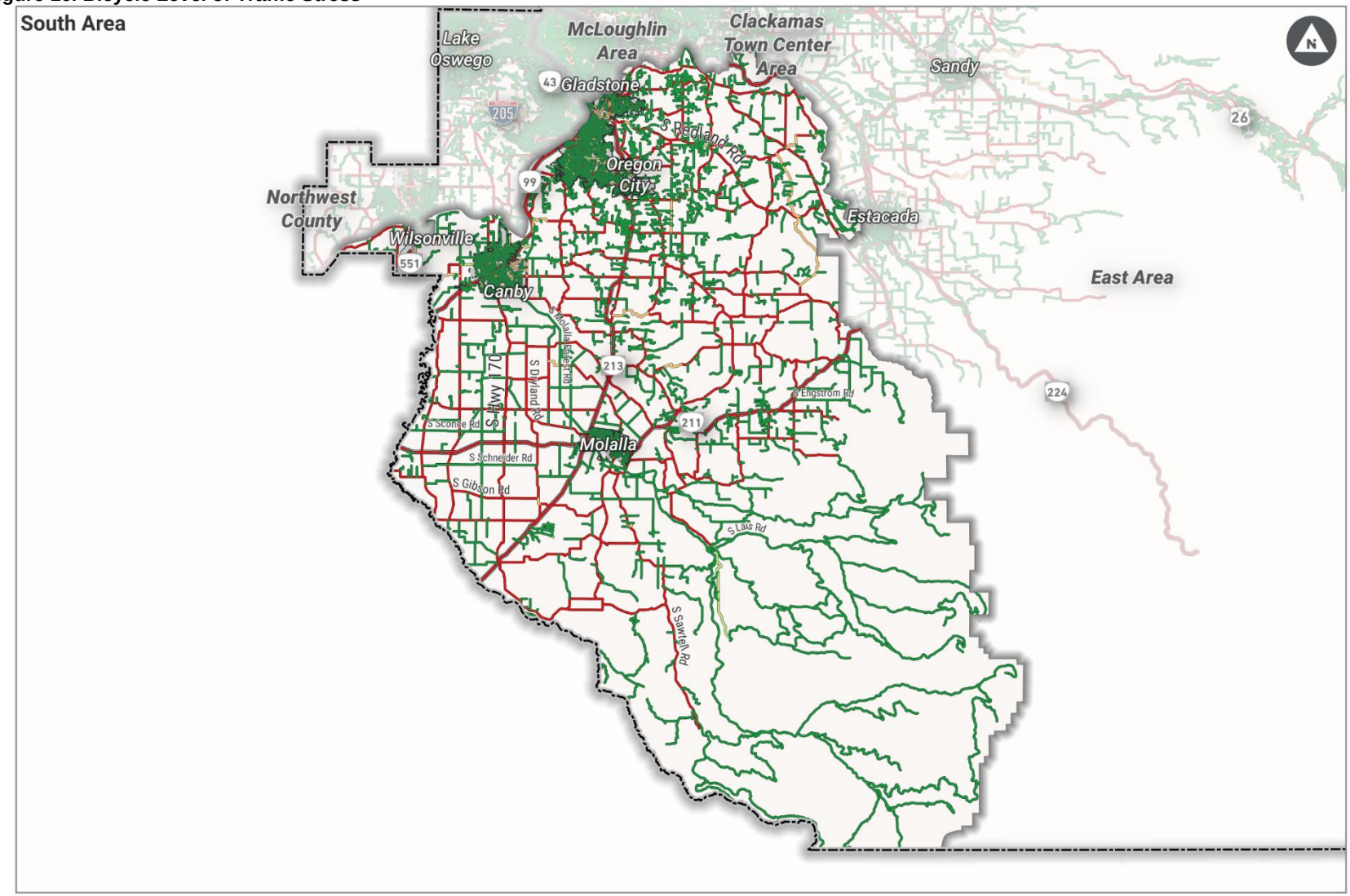


Figure 17. Bicycle Network Analysis

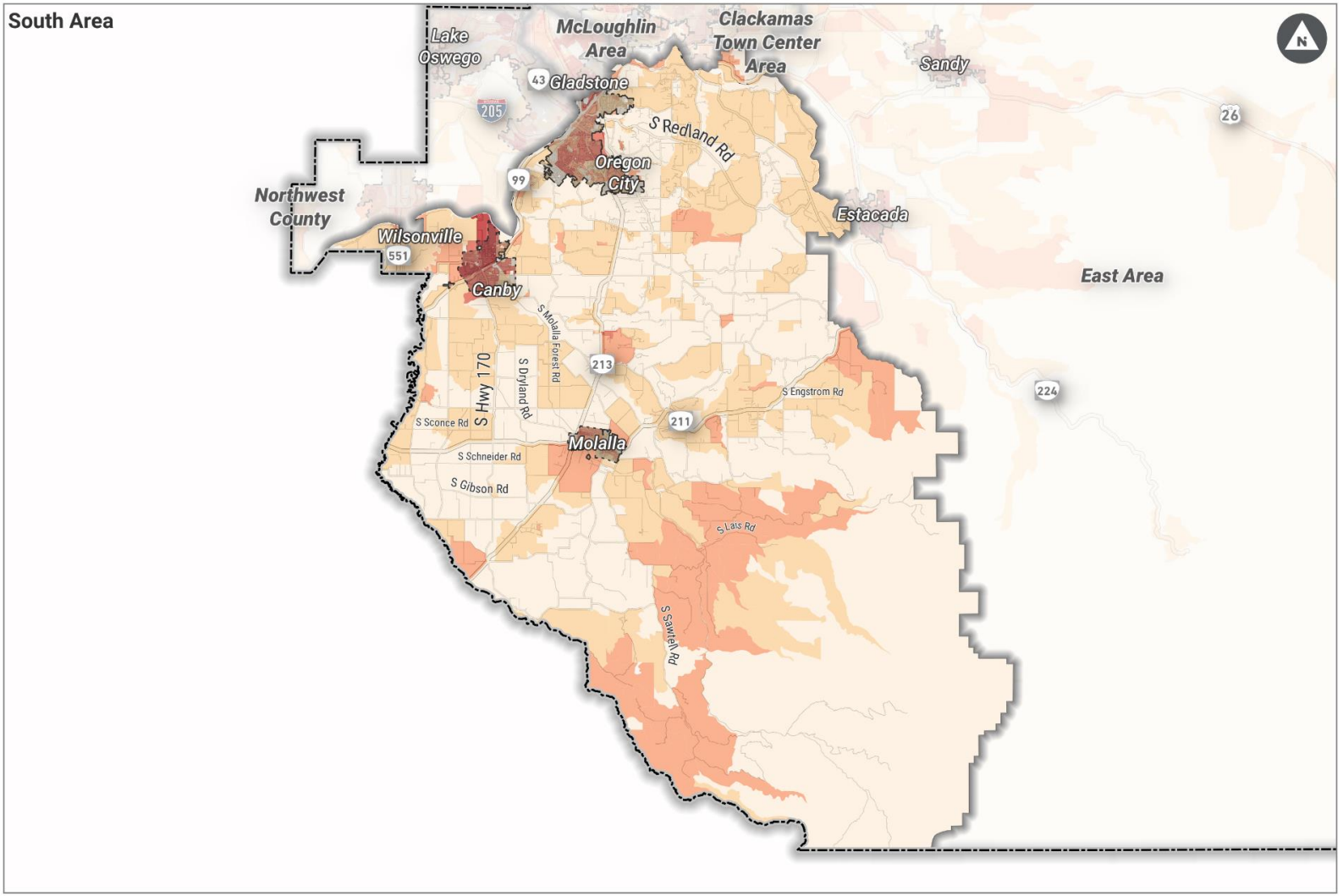
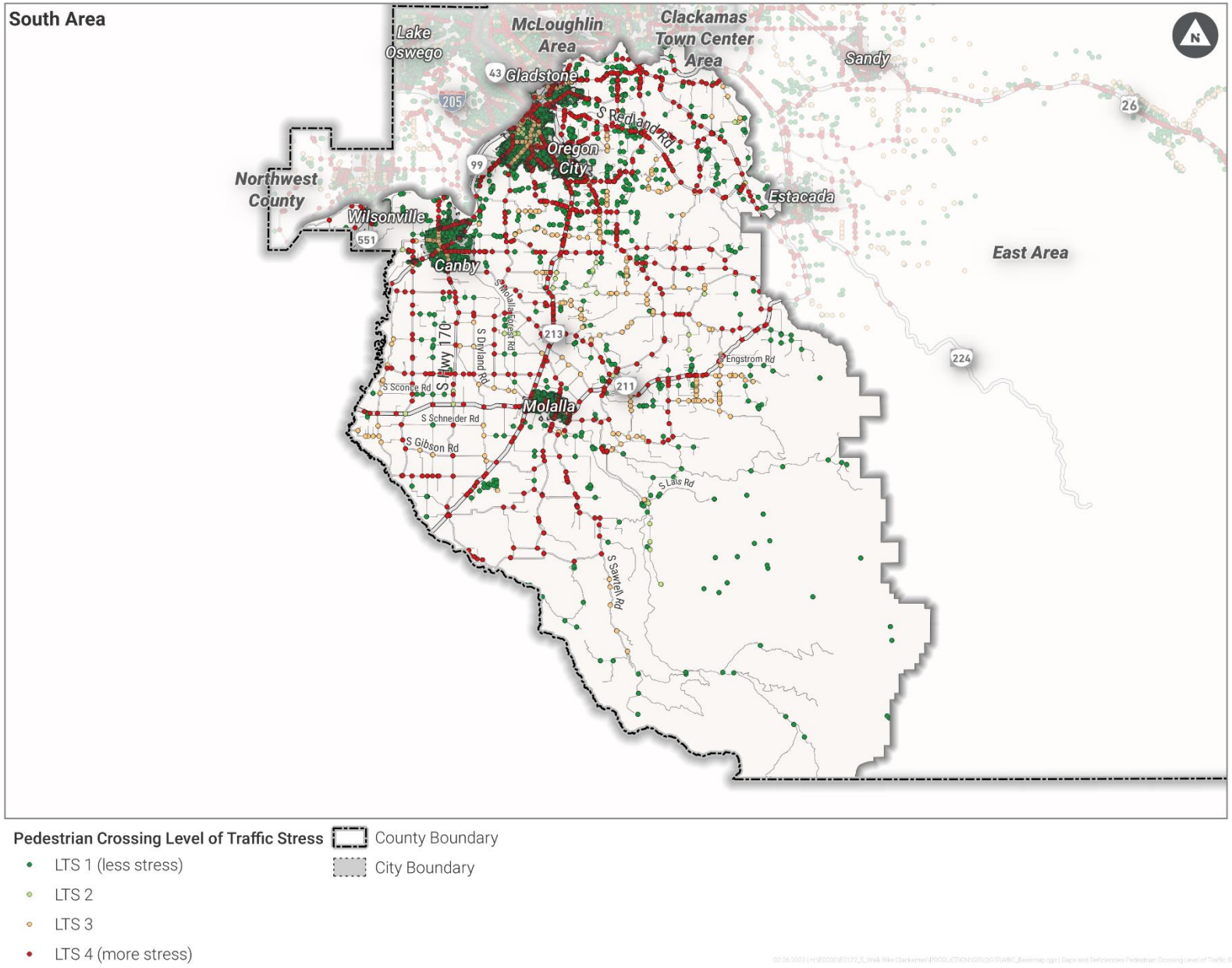


Figure 18. Pedestrian Level of Crossing Stress



APPENDIX A: Data Sources

Table 2. Data sources

Category	Source	Notes	BLTS	PxLTS	BNA
On-street bicycle facilities	• County bike lanes • County existing and planned bike facilities • Manual updates from county staff	Clarifying note: The bicycle system analyzed for Gaps and Deficiencies analysis is the bikeway network from the Comprehensive Plan (Maps 5-2a, urban bikeways and 5-2b, rural bikeways) and from the countywide Active Transportation Plan (Maps 5-12a and 5-12b from the Comprehensive Plan).	Yes	No	Yes*
Off-street bicycle and pedestrian facilities	County trails		Yes	No	Yes*
Functional classification	County planning functional classes	Not used for analysis, but used for assumptions	N/A	N/A	N/A
Speed limit	• County • Open Street Map	Missing values filled based on known values, and on functional classification	Yes	Yes	Yes*
Lanes	OSM	Missing values filled based on known values, and on functional classification	Yes	Yes	Yes*
AADT	N/A	Assumed based on functional classification	Yes	Yes	Yes*
Centerline presence	N/A	Assumed based on functional classification	Yes	No	Yes*
Parking	N/A	Assumed based on functional classification	Yes	No	Yes*

Traffic Control	• Signals
	  ○ County
	  ○ OSM
	• Stop signs
	  ○ OSM
			Yes	Yes	Yes*

Destinations	OSM		No	No	Yes
Population	Census	2020 decennial census	No	No	Yes
Jobs	Longitudinal Employer-Household Dynamics (LEHD)	LODES 2020	No	No	Yes
Land use	Clackamas County, Oregon Metro		Yes	Yes	Yes

**** The BNA uses the BLTS outputs, so anything that was used for the BLTS would also affect BNA***

Replica Data

Replica uses big data sources to create large-scale models of multimodal travel activity. It leverages a variety of data sources, including demographic and locational data (such as from smart phones), to produce models with granular, privacy-safe data on mobility and people. Replica's models are calibrated and validated by comparing modeled outputs with observed travel metrics, which are sourced by Replica directly and optionally provided by Replica's customers.

The unit of measurement for vehicle, bicycle, and walking trips is the number of trips per day. Vehicle trips are considered "short" were 3 miles or less. In general, vehicular trips throughout Clackamas County averaged 9.2 miles, with the median distance of 5.9.

APPENDIX B: BLTS

Bicycle Level of Traffic Stress

Bicycle Level of Traffic Stress (BLTS) is the likely amount of stress a bicyclist faces due to roadway and traffic conditions.[11,12] LTS values can range from 1 to 4, with LTS 1 being the lowest stress and LTS 4 being the highest stress. LTS 1 and LTS 2 are generally considered low-stress, which is acceptable to the majority of the adult population. A segment's LTS value depends on factors such as number of lanes, traffic volume, speed, presence of bike facility, parking lane, width of bike lanes, etc.

The LTS criteria used in this analysis are based on industry best practices. These LTS criteria are shown in APPENDIX A: Data Sources

Table 2. Data sources

Category	Source	Notes	BLTS	PxLTS	BNA
On-street bicycle facilities	• County bike lanes • County existing and planned bike facilities • Manual updates from county staff	Clarifying note: The bicycle system analyzed for Gaps and Deficiencies analysis is the bikeway network from the Comprehensive Plan (Maps 5-2a, urban bikeways and 5-2b, rural bikeways) and from the countywide Active Transportation Plan (Maps 5-12a and 5-12b from the Comprehensive Plan).	Yes	No	Yes*
Off-street bicycle and pedestrian facilities	County trails		Yes	No	Yes*

[11] Furth, P., Mekuria, M., and Nixon, H. (2012). Low-Stress Bicycling and Network Connectivity. Mineta Transportation Institute. https://transweb.sjsu.edu/sites/default/files/1005-low-stress-bicycling-network-connectivity.pdf

[12] Furth, P. (2017). Level of Traffic Stress Criteria for Road Segments, version 2.0. https://cpb-us-w2.wpmucdn.com/sites.northeastern.edu/dist/e/618/files/2014/05/LTS-Tables-v2-June-1.pdf

Category	Source	Notes	BLTS	PxLTS	BNA
Functional classification	County planning functional classes	Not used for analysis, but used for assumptions	N/A	N/A	N/A
Speed limit	• County • Open Street Map	Missing values filled based on known values, and on functional classification	Yes	Yes	Yes*
Lanes	OSM	Missing values filled based on known values, and on functional classification	Yes	Yes	Yes*
AADT	N/A	Assumed based on functional classification	Yes	Yes	Yes*
Centerline presence	N/A	Assumed based on functional classification	Yes	No	Yes*
Parking	N/A	Assumed based on functional classification	Yes	No	Yes*

Traffic Control	• Signals
	  ○ County
	  ○ OSM
	• Stop signs
	  ○ OSM
			Yes	Yes	Yes*

Destinations	OSM		No	No	Yes
Population	Census	2020 decennial census	No	No	Yes
Jobs	Longitudinal Employer-Household Dynamics (LEHD)	LODES 2020	No	No	Yes
Land use	Clackamas County, Oregon Metro		Yes	Yes	Yes
**** The BNA uses the BLTS outputs, so anything that was used for the BLTS would also affect BNA***					

Replica Data

Replica uses big data sources to create large-scale models of multimodal travel activity. It leverages a variety of data sources, including demographic and locational data (such as from smart phones), to produce models with granular, privacy-safe data on mobility and people. Replica's models are calibrated and validated by comparing modeled outputs with observed travel metrics, which are sourced by Replica directly and optionally provided by Replica's customers.

The unit of measurement for vehicle, bicycle, and walking trips is the number of trips per day. Vehicle trips are considered "short" were 3 miles or less. In general, vehicular trips throughout Clackamas County averaged 9.2 miles, with the median distance of 5.9.

APPENDIX . Toole Design's BLTS approach is similar to Design Bulletin 2022-1 from the Washington Department of Transportation, using similar inputs and structuring outputs using values ranging from 1 to 4. Using the LTS

criteria, every non-bicycle-prohibited segment (or every segment where bicycling is allowed)[13] is assigned a stress level. In addition to the segment stress, bicycle crossing stress values are also assigned where data was available. Generally speaking, higher crossing stress applies to lower functional class streets when they cross a higher functional class street without any intersection control devices like signals or median crossing islands.

Mixed traffic criteria

Number of lanes	ADT	Posted Speed Limit						
		≤ 20 mph	25 mph	30 mph	35 mph	40 mph	45 mph	50+mph
Unmarked 2-way street (no centerline)	0-750	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	751-1500	LTS 1	LTS 1	LTS 2	LTS 3	LTS 3	LTS 4	LTS 4
	1501-3000	LTS 2	LTS 2	LTS 2	LTS 3	LTS 4	LTS 4	LTS 4
	3000+	LTS 2	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
1 thru lane per direction (1-way, 1-lane street or 2-way street with centerline)	0-750	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	751-1500	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4	LTS 4
	1501+	LTS 2	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4	LTS 4
2 thru lanes per direction	0-8000	LTS 3	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
	8001+	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4	LTS 4	LTS 4
3+ thru lanes per direction	any ADT	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4	LTS 4	LTS 4

Bike lanes not adjacent to a parking lane

Number of lanes	Bike lane width from curb (include marked buffers)	Posted Speed Limit					
		≤ 25 mph	30 mph	35 mph	40 mph	45 mph	50+ mph
1 thru lane per direction, or unlaned (no centerline)	6+ ft	LTS 1	LTS 1	LTS 2	LTS 3	LTS 3	LTS 3
	4 or 5 ft	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4
2 thru lanes per direction	6+ ft	LTS 2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 3
	4 or 5 ft	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4	LTS 4
3+ lanes per direction	any width	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4

Bike lanes alongside a parking lane

Number of Lanes		Posted Speed Limit

[13] A non-bicycling segment describes roads where bicycling is outright prohibited, such as federal highways in Oregon.

	Bike lane reach = Bike lane width + Parking lane width from curb	≤ 25 mph	30 mph	35 mph
1 lane per direction	15+ ft	LTS 1	LTS 2	LTS 3
	12-14 ft	LTS 2	LTS 2	LTS 3
2 lanes per direction (2-way)	15+ ft	LTS 2	LTS 3	LTS 3
2-3 lanes per direction (1-way)		LTS 2	LTS 3	LTS 3
other multilane		LTS 3	LTS 3	LTS 3

Crossings

Control	Island	Lanes	Posted Speed Limit			
			≤ 25 mph	30 mph	35 mph	40+ mph
Uncontrolled	No	3	LTS 1	LTS 1	LTS 2	LTS 3
		5	LTS 2	LTS 2	LTS 3	LTS 4
		6+	LTS 4	LTS 4	LTS 4	LTS 4
	Yes	5	LTS 1	LTS 2	LTS 3	LTS 4
		6+	LTS 2	LTS 3	LTS 4	LTS 4
RRFB	No	3	LTS 1	LTS 1	LTS 2	LTS 3
		5	LTS 2	LTS 2	LTS 2	LTS 3
		6+	LTS 4	LTS 4	LTS 4	LTS 4
	Yes	5	LTS 1	LTS 2	LTS 2	LTS 3
		6+	LTS 2	LTS 3	LTS 4	LTS 4
HAWK	Any	Any	LTS 1	LTS 1	LTS 1	LTS 1
Signal	Any	Any	LTS 1	LTS 1	LTS 1	LTS 1
4 way stop	Any	Any	LTS 1	LTS 1	LTS 1	LTS 1

APPENDIX C: BNA

Bicycle Network Analysis

The bicycle network analysis (BNA) relies on data analysis from the BLTS analysis. This BNA analysis is the same method developed by Toole Design for the non-profit, PeopleForBikes, to use as part of their Places for Bikes program. BNA performs a connectivity analysis at a census block-to-block level. For each census block, a shortest path to destinations is calculated both along the low-stress network (LTS 1-2) and overall network (LTS 1-4) within three miles of destinations. Travel along the low-stress network often requires longer distances than the overall network, which can be a barrier when the low-stress distance far exceeds the overall network distance. This forces bicyclists to travel farther in order to follow more comfortable routes. To account for this, a maximum detour of 0.25 miles is applied to low-stress routes when compared to overall network distance. BNA's routing algorithm takes into account both segment stress and crossing stress – a low-stress route is possible only if it does not require travel along any high-stress links or across any high-stress crossings. The output of this analysis is a list of census block pairs that are connected using either the low-stress links or all links.

BNA Scores

The final step of BNA is to assign a score to each block on a scale of zero to 100 based on the destinations listed in the table on the following page that can be reached using both low-stress and high-stress networks, with higher scores suggesting greater accessibility to destinations by the low-stress network. Destinations The destinations used in the analysis include different categories based on the type of destinations. Each census block is assigned a score for each individual type of destination and scores are aggregated based on weights assigned to that destination type. APPENDIX lists all destinations and their weights.

A location's BNA score depends on two factors:

1) Whether there are destinations nearby, and
2) Whether the low-stress network connects to those destinations.

In other words, the low-stress network is only one aspect of accessibility to destinations. If the low-stress network does not connect to any destinations, the value of the bicycling network transitions from a valuable way to connecting to destinations to valuable from the perspective of creating opportunities for health and wellness.

In this analysis, we calculated a measure of BNA that highlights the difference between high-stress and low-stress (Measure 1) networks while also incorporating destination density (Measure 2). The BNA analysis for the Walk Bike Clackamas Plan uses Measure 2.

Measure 1

This measure first looks at the total number of destinations of each type that are connected to each block using the high-stress network. It then looks at how many of those destinations are also accessible using only the low-stress network. The magnitude of this measure depends on the difference between the destinations accessible using the two networks. If a block does not have access to a certain type of destination using the high-stress network, that destination sub score is not included in the final measure. This step ensures that only the destination types that are reachable on the network within a three-mile distance are considered in the overall measure. This measure is useful in identifying locations that have a large difference in connectivity between the low-stress and high-stress networks. The result is that some outlying areas with fewer destinations show high connectivity if those destinations are accessible by both low-stress and high-stress networks.

Measure 2

Like Measure 1, this measure starts by looking at the number of destinations reachable using high-stress and low-stress networks from each block. However, any block without overall network access (including high-stress routes) to a given destination type automatically gets a score of zero for that destination type. This means that blocks with higher scores have more destinations nearby and those destinations are accessible by the low-stress network, whereas in Measure 1, blocks can get higher scores even if there are not many destinations nearby. This measure is a useful way to combine the effect of both the low-stress network and proximity to destinations. As a result, destination-rich areas get higher scores than the outlying areas if those destinations are accessible using the low-stress network.

Caveats

BNA scores for large census blocks should be treated with caution and some skepticism. Block sizes in rural areas are large, and if a rural census block has access from one part of the block to the low-stress network, it may score highly. Conversely, large census blocks with few routing options may have especially low scores if those routes do not provide any access to destinations.

BNA Destinations

Category	Category Weight	Category Destinations	Subcategory Weight
People	15	Population	N/A
Opportunity	20	Jobs	35
		Schools	35
		Colleges	10
		Universities	20
Core Services	20	Doctors	20
		Dentists	10
		Hospitals	20
		Pharmacies	10
		Supermarkets	25
		Social Services	15
Recreation	15	Parks	60
		Community Centers	40
Retail	15	Retail locations	N/A
Transit	15	Bus stops and stations	N/A

Source: Open Street Map, Census data, and Longitudinal Employer-Household Dynamics.

APPENDIX D: PxLTS

Pedestrian Level of Crossing Stress

The Pedestrian Level of Crossing Stress (PxLTS) analysis is the likely amount of stress when pedestrians cross at roadway intersections. As noted previously, since the trail and shared use path network is not routable, it is not feasible to integrate into the network, and therefore these facilities were not included in the PxLTS. The Oregon Department of Transportation (ODOT) has developed a framework for evaluating pedestrian traffic stress—that is, how comfortable or safe it feels to walk along or cross a street as a pedestrian. The framework applies the simple logic of the Bicycle Level of Traffic Stress (BLTS) to pedestrian crossings. The methodology considers basic details including the speed of cross traffic, distance to cross, and mitigating features like signals and refuge islands. The thresholds identified by ODOT result in a Pedestrian Level of Traffic Stress score from 1 through 4 representing the following conditions, as described in ODOT's Analysis Procedures Manual[14] (PxLTS descriptions are quoted from the manual with minor edits for clarity):

- PxLTS 1 – Represents little to no traffic stress and requires little attention [by the pedestrian] to the traffic situation.
- PxLTS 2 – Represents little traffic stress for most adults, but requires more attention to the traffic situation than young children [defined as ages 10 and younger] may be capable of.
- PxLTS 3 – Represents moderate stress; a higher level of attention to traffic is needed, and adults may feel some discomfort using this facility
- PxLTS 4 – Represents high traffic stress. Only pedestrians with limited route choices would use this facility.

ODOT's manual identifies PxLTS 2 as a reasonable target for most situations. PxLTS 2 conditions are considered appropriate for people of all ages and abilities. Note that this analysis does not include an assessment of accessibility for people with disabilities. Lack of ADA-compliant curb ramps, poor pavement in the crossing, and other factors impact accessibility and therefore the real-world comfort of crossings.

Toole Design made minor modifications to ODOT's analysis based on information from the Federal Highway Administration's (FHWA) Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations[15] and FHWA's Crash Modification Factors (CMF) Clearinghouse[16]. Unless otherwise stated, the tables in this document refer to the configuration, speeds, and traffic volumes of the street that is being crossed.

For more information about the scoring criteria used, see Appendix C.

Unsignalized crossings

Lanes Crossed	ADT	Island	Posted Speed Limit			
			≤ 25 mph	30 mph	35 mph	40+ mph
1	Any	No	LTS 1	LTS 1	LTS 2	LTS 3

[14] Oregon Department of Transportation Analysis Procedures Manual, Chapter 14: Multimodal Analysis, Section 5: https://www.oregon.gov/odot/Planning/Documents/APMv2_Ch14.pdf

[15] https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/docs/STEP-guide-improving-ped-safety.pdf

[16] https://www.cmfclearinghouse.org/

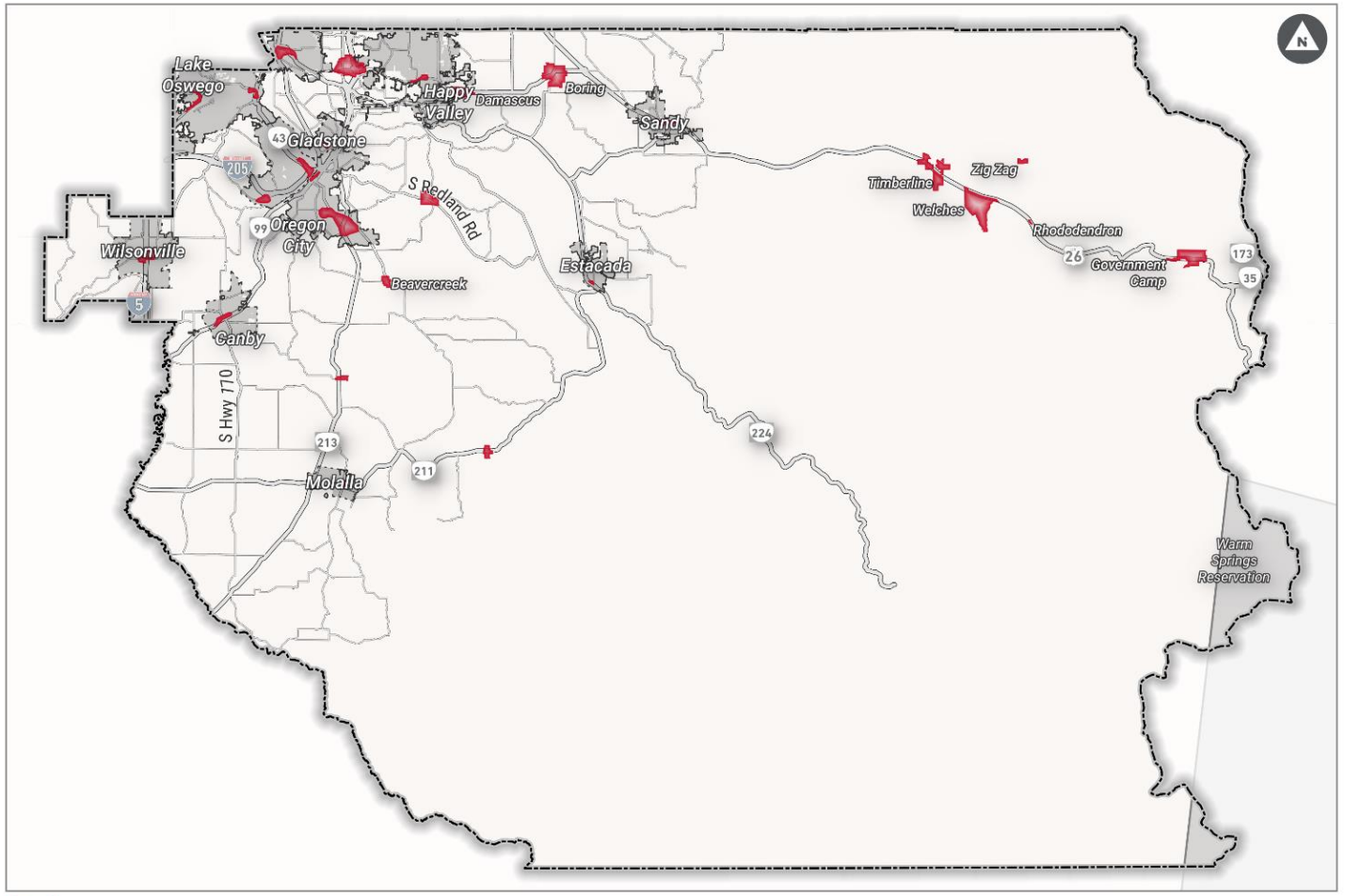
Lanes Crossed	ADT	Island	Posted Speed Limit			
			≦ 25 mph	30 mph	35 mph	40+ mph
		Yes	LTS 1	LTS 2	LTS 2	LTS 3
2	0-5000	No	LTS 1	LTS 2	LTS 3	LTS 3
	5001-9000		LTS 2	LTS 3	LTS 3	LTS 4
	9001 +		LTS 3	LTS 3	LTS 4	LTS 4
	0-5000	Yes	LTS 1	LTS 2	LTS 2	LTS 3
	5001-9000		LTS 2	LTS 2	LTS 2	LTS 3
	9001 +		LTS 2	LTS 2	LTS 3	LTS 4
3	0-8000	No	LTS 3	LTS 3	LTS 4	LTS 4
	8001-12000		LTS 3	LTS 3	LTS 4	LTS 4
	12001 +		LTS 4	LTS 4	LTS 4	LTS 4
	0-8000	Yes	LTS 2	LTS 2	LTS 3	LTS 4
	8001-12000		LTS 2	LTS 3	LTS 4	LTS 4
	12001 +		LTS 3	LTS 3	LTS 4	LTS 4
4+	Any	Any	LTS 4	LTS 4	LTS 4	LTS 4

Signalized crossings

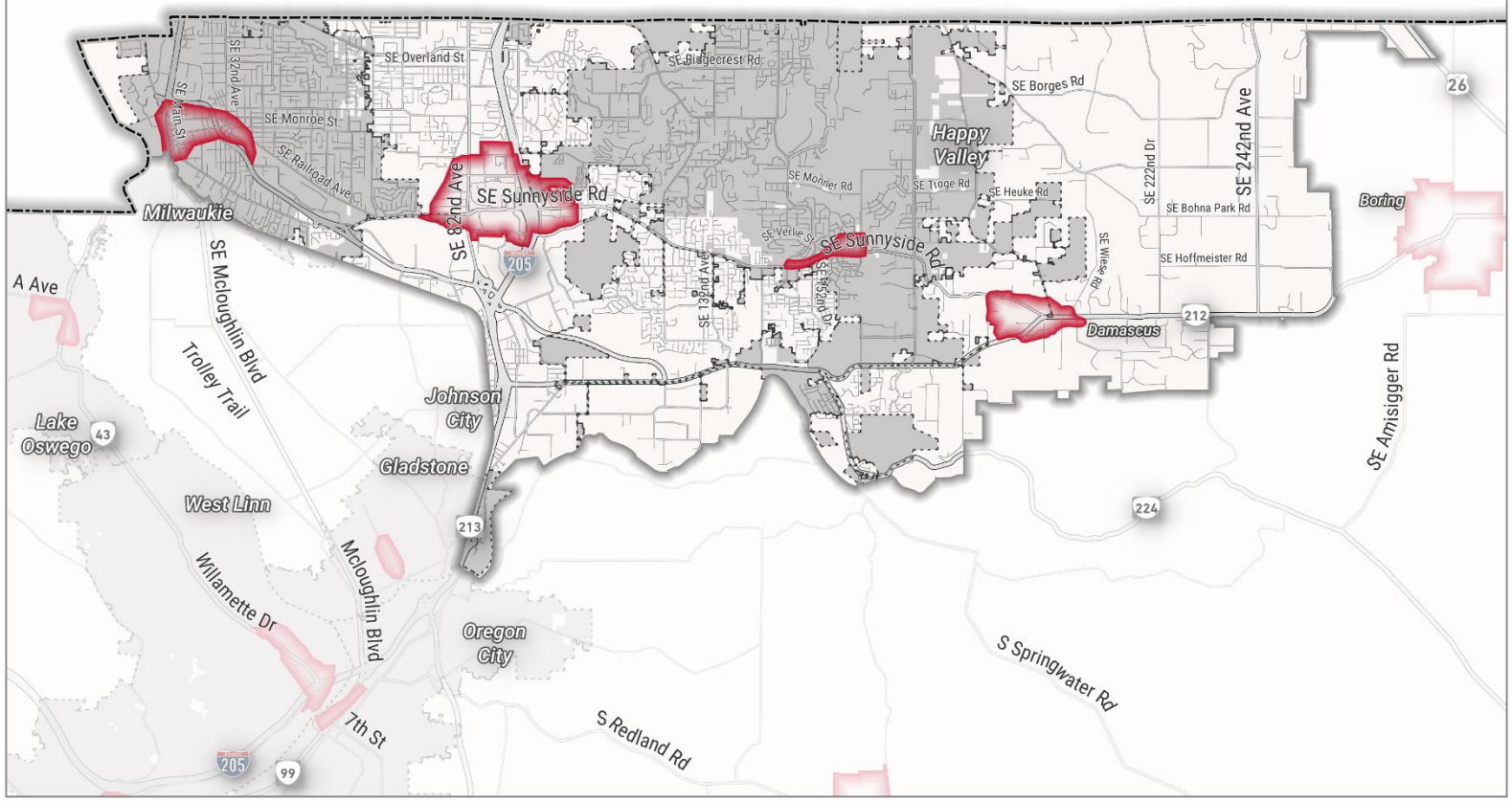
Midblock	Lanes Adjacent	Lanes Crossed				
		1-2	3	4	5	6+
Yes	Any	LTS 1	LTS 2	LTS 3	LTS 3	LTS 3
No	1-2	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4
	3	LTS 2	LTS 3	LTS 3	LTS 4	LTS 4
	4	LTS 2	LTS 3	LTS 3	LTS 4	LTS 4
	5	LTS 3	LTS 3	LTS 4	LTS 4	LTS 4
	6+	LTS 3	LTS 4	LTS 4	LTS 4	LTS 4

APPENDIX E: Activity Centers Maps

For these analyses, activity centers were defined as Rural Communities (which included Rural Service Areas, Urban Unincorporated Communities, and Resort Communities), activity center cities defined by Clackamas County, and Metro analysis centers that were located within Unincorporated Clackamas County.



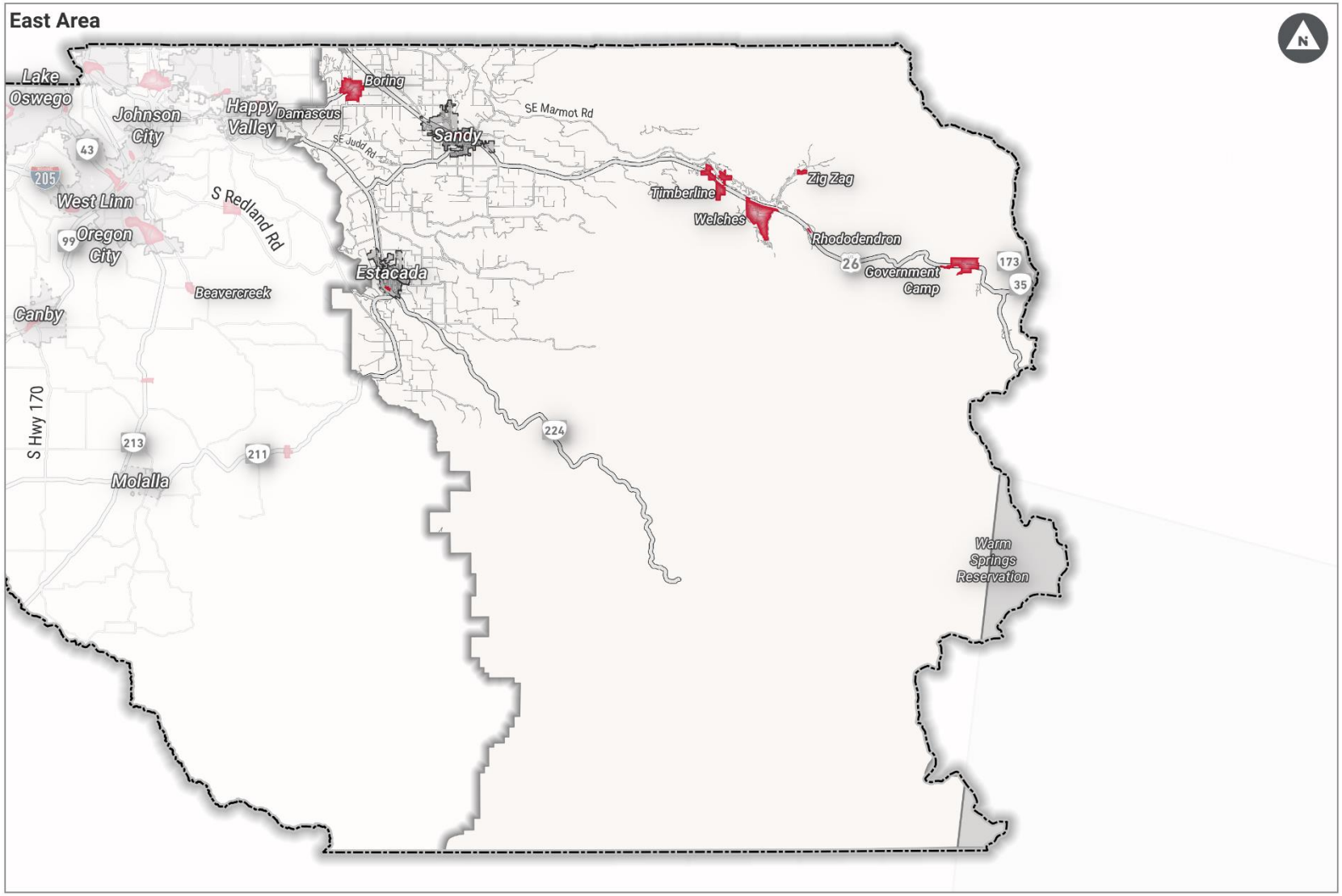
Clackamas Town Center Area

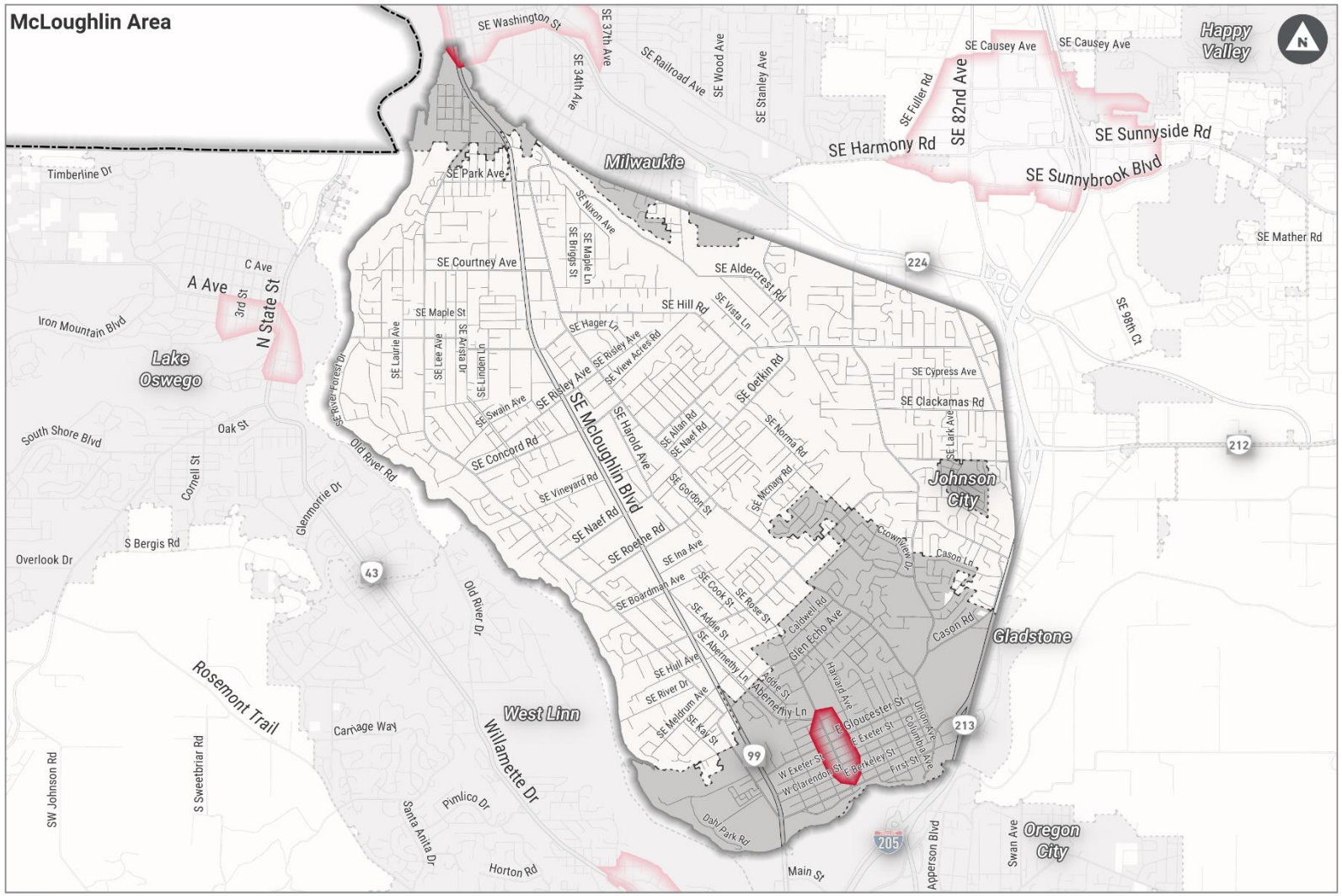


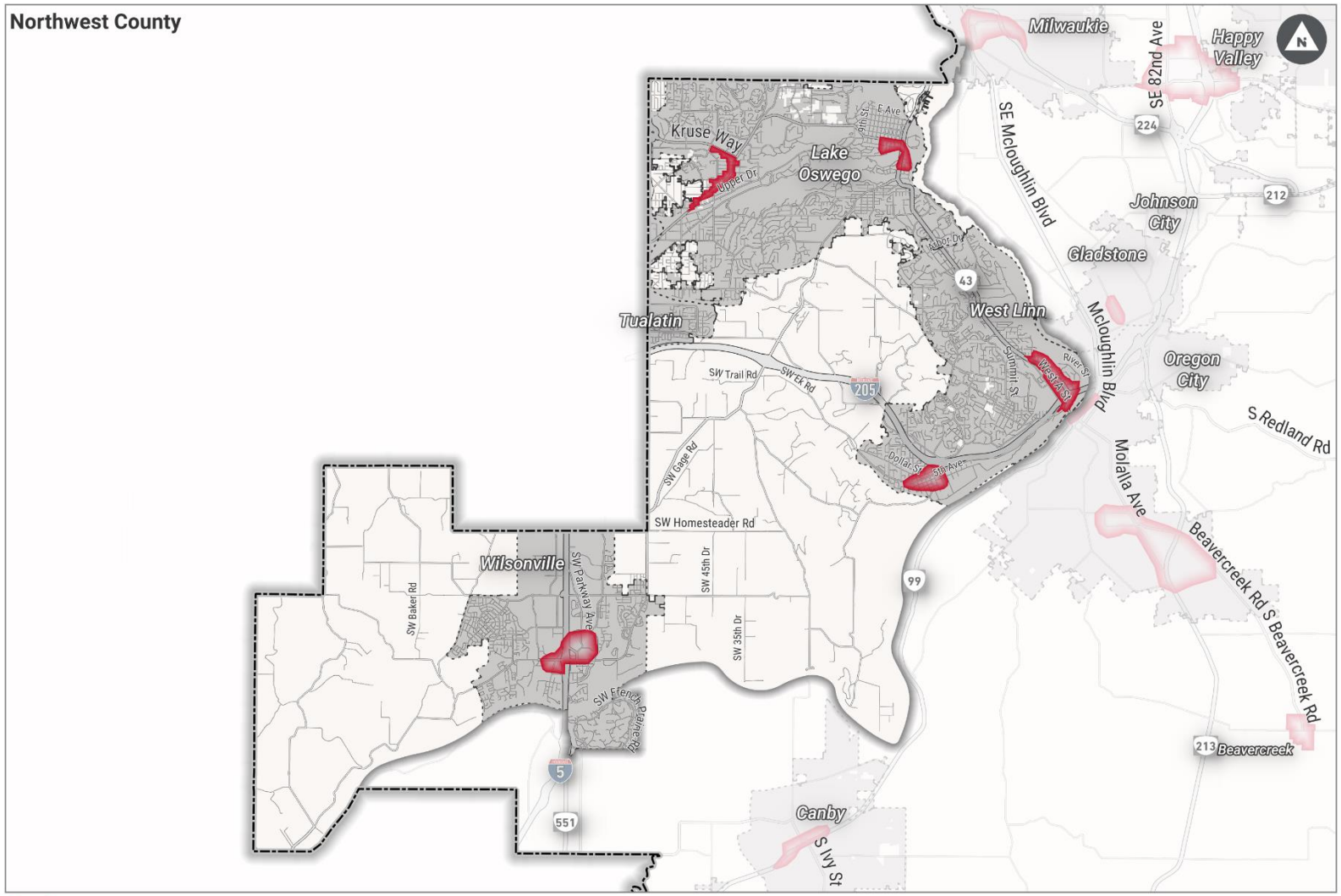
Activity Centers

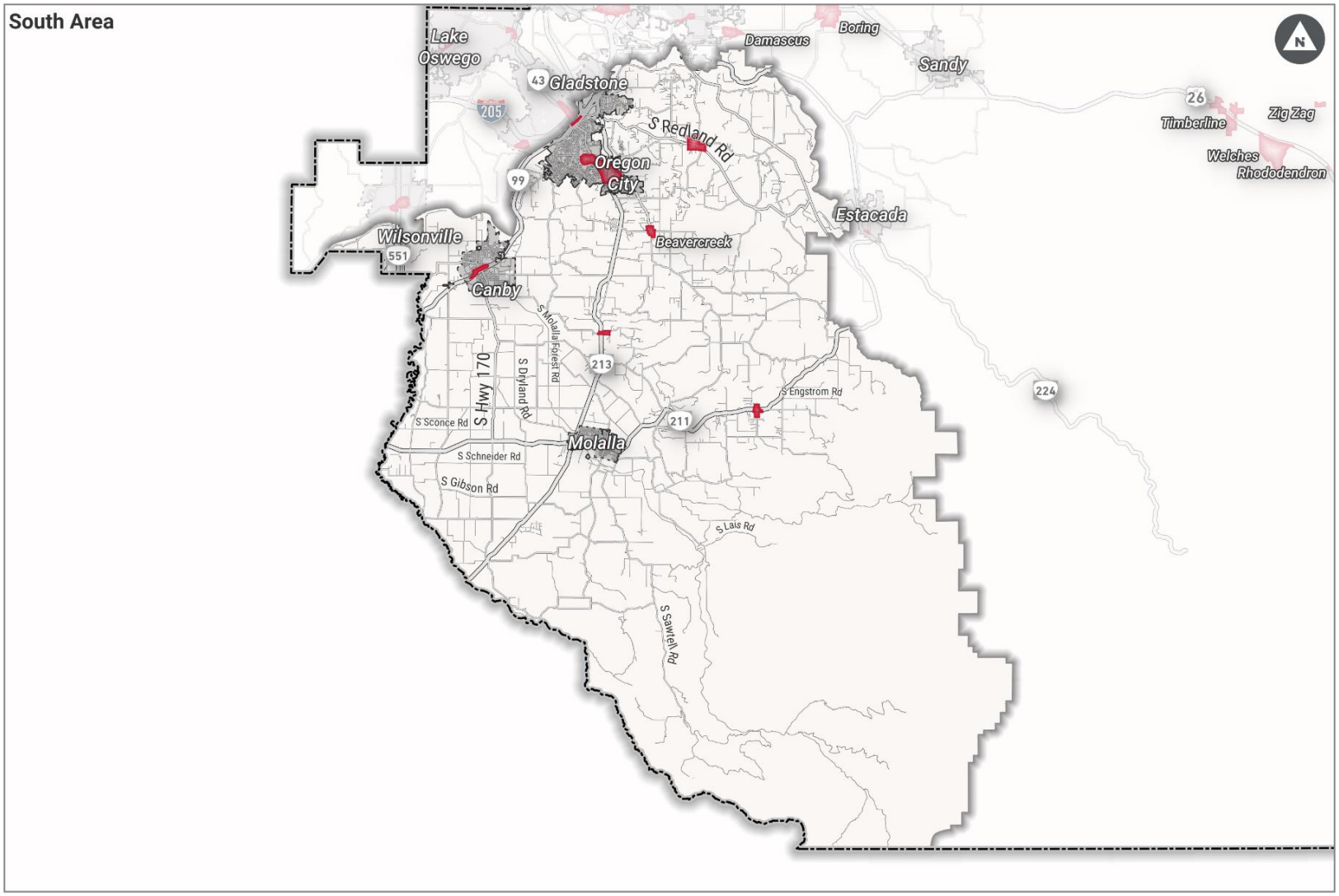
County Boundary

City Boundary

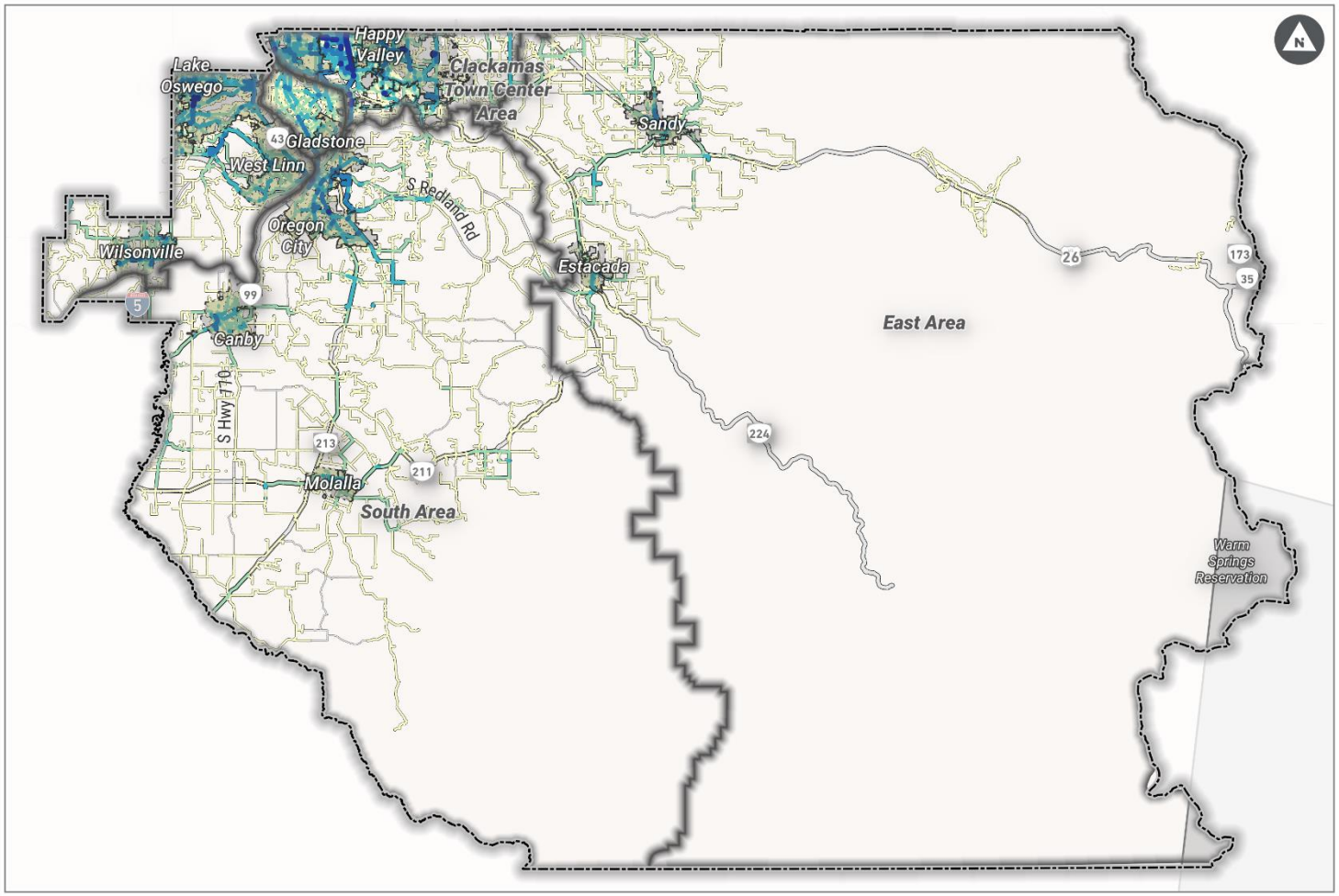

East Area
Lake Oswego
Johnson City
Happy Valley
Damascus
Boring
Sandy
SE Marmot Rd
SE Judd Rd
43
205
West Linn
S Redland Rd
99
Oregon City
Beavercreek
Canby
Estacada
Timberline
Zig Zag
Welches
Rhododendron
26
Government Camp
173
35
224
S Hwy 170
213
211
Molalla
Warm Springs Reservation
N
Activity Centers
County Boundary
City Boundary


McLoughlin Area
SE Washington St
SE 37th Ave
SE 34th Ave
SE Railroad Ave
SE Wood Ave
SE Stanley Ave
SE Causey Ave
SE Causey Ave
Happy Valley
SE Fuller Rd
SE 82nd Ave
SE Harmony Rd
SE Sunnyside Rd
SE Sunnybrook Blvd
SE Mather Rd
Timberline Dr
SE Park Ave
Milwaukie
SE Nixon Ave
SE Briggs St
SE Maple Ln
SE Courtney Ave
SE Aldercrest Rd
224
C Ave
A Ave
3rd St
N State St
Iron Mountain Blvd
SE Maple St
SE Hill Rd
SE Vista Ln
SE Hager Ln
SE Risley Ave
SE View Acres Rd
SE 98th Ct
SE River Forest Dr
SE Laurie Ave
SE Lee Ave
SE Linden Ln
Lake Oswego
SE Swain Ave
SE Risley Ave
SE McLoughlin Blvd
SE Detkin Rd
SE Cypress Ave
SE Clackamas Rd
SE Lark Ave
South Shore Blvd
Oak St
Old River Rd
SE Concord Rd
SE Harold Ave
SE Allan Rd
SE Naef Rd
SE Norma Rd
212
Cornell St
SE Vineyard Rd
SE Gordon St
SE Menaro Rd
Johnson City
Glenmorrie Dr
SE Naef Rd
SE Roethe Rd
SE Ina Ave
Crownview Ct
Cason Ln
Overlook Dr
S Bergis Rd
43
SE Boardman Ave
SE Cook St
SE Rose St
Caldwell Rd
Old River Dr
SE Addie St
Glen Echo Ave
Cason Rd
Gladstone
SE Hull Ave
SE Abernethy Ln
Addie St
Harvard Ave
Rosemont Trail
SE River Dr
E Gloucester St
E Exeter St
Columbia Ave
Union Ave
213
Carriage Way
West Linn
SE Meldrum Ave
SE Kay St
99
W Exeter St
W Clarendon St
E Berkeley St
First St
Willamette Dr
SW Johnson Rd
S Sweetbriar Rd
Pimlico Dr
Santa Anita Dr
Dahl Park Rd
205
Apperson Blvd
Swan Ave
Oregon City
Horton Rd
Main St
Activity Centers
County Boundary
City Boundary


Northwest County
Milwaukie
Happy Valley
SE 82nd Ave
224
212
Johnson City
Gladstone
SE Mcloughlin Blvd
Kruse Way
Lake Oswego
Upper Dr
9th St
E Ave
43
West Linn
Tualatin
SW Trail Rd
SW Ek Rd
205
Summit St
River St
Mcloughlin Blvd
Oregon City
S Redland Rd
Molalla Ave
SW Gage Rd
SW Homesteader Rd
Wilsonville
SW Parkway Ave
SW Baker Rd
SW 45th Dr
SW 35th Dr
SW French Prairie Rd
99
Beavercreek Rd
S Beavercreek Rd
213 Beavercreek
5
551
Canby
S Ivy St
Activity Centers
County Boundary
City Boundary

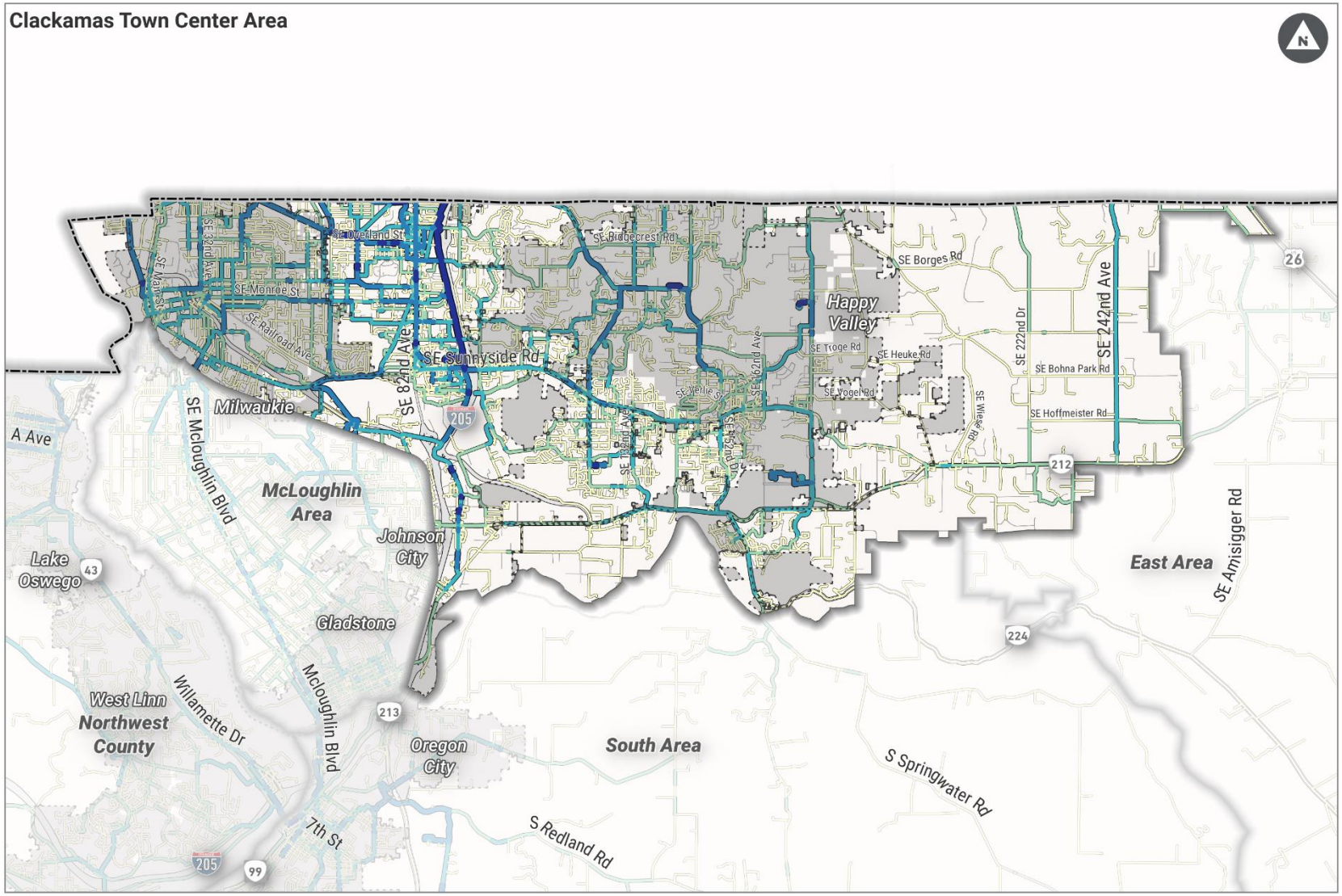

South Area
Lake Oswego
Damascus
Boring
Sandy
43
Gladstone
205
S Redland Rd
26
Timberline
Zig Zag
Welches
Rhododendron
Oregon City
99
Estacada
Wilsonville
Beavercreek
551
Canby
S Molalla Forest Rd
213
S Dryland Rd
S Hwy 170
S Engstrom Rd
224
S Sconce Rd
211
Molalla
S Schneider Rd
S Gibson Rd
S Lals Rd
S Sawtell Rd
Activity Centers
County Boundary
City Boundary

APPENDIX F: Replica Bicycle Trips and Trip Density Maps



Source: Replica, Northwest 2021 Q4
Thursday Trips, Biking Mode Trips

Clackamas Town Center Area



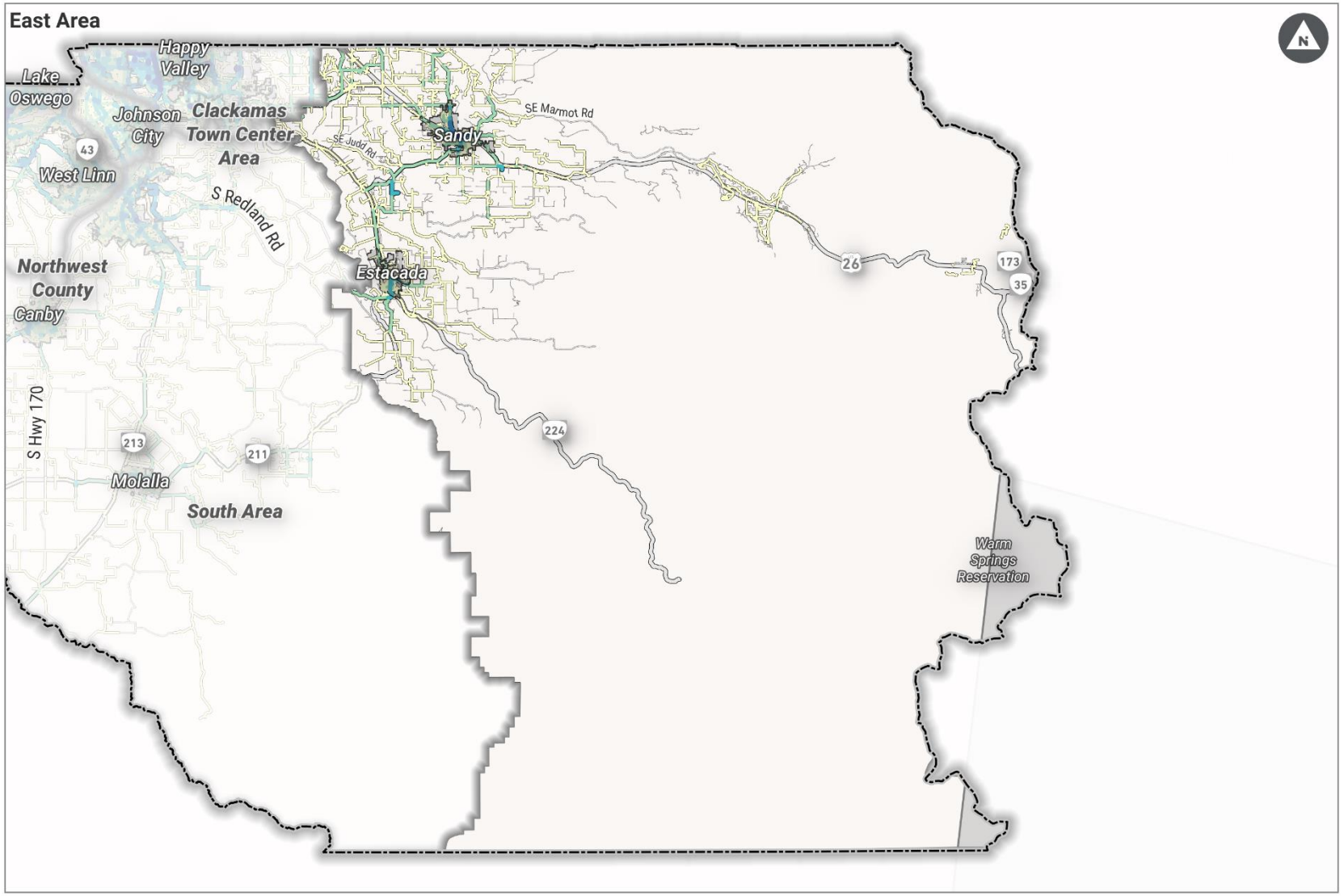
Bicycle Trips

- 1 - 25
- 25 - 78
- 78 - 169
- 169 - 383
- 383 - 755

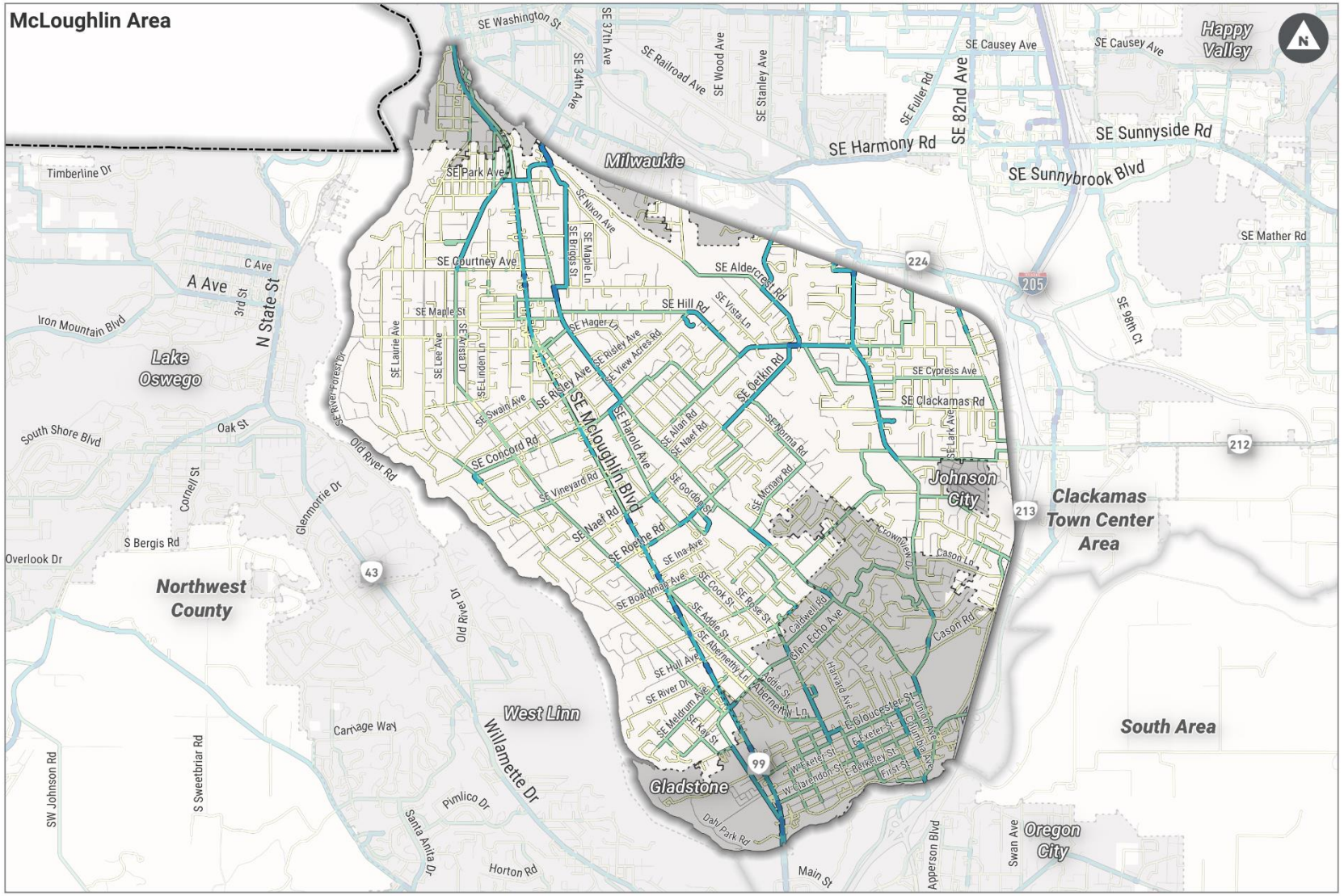
County Boundary

City Boundary

Source: Replica, Northwest 2021 Q4
Thursday Trips, Biking Mode Trips



Source: Replica, Northwest 2021 Q4
Thursday Trips, Biking Mode Trips



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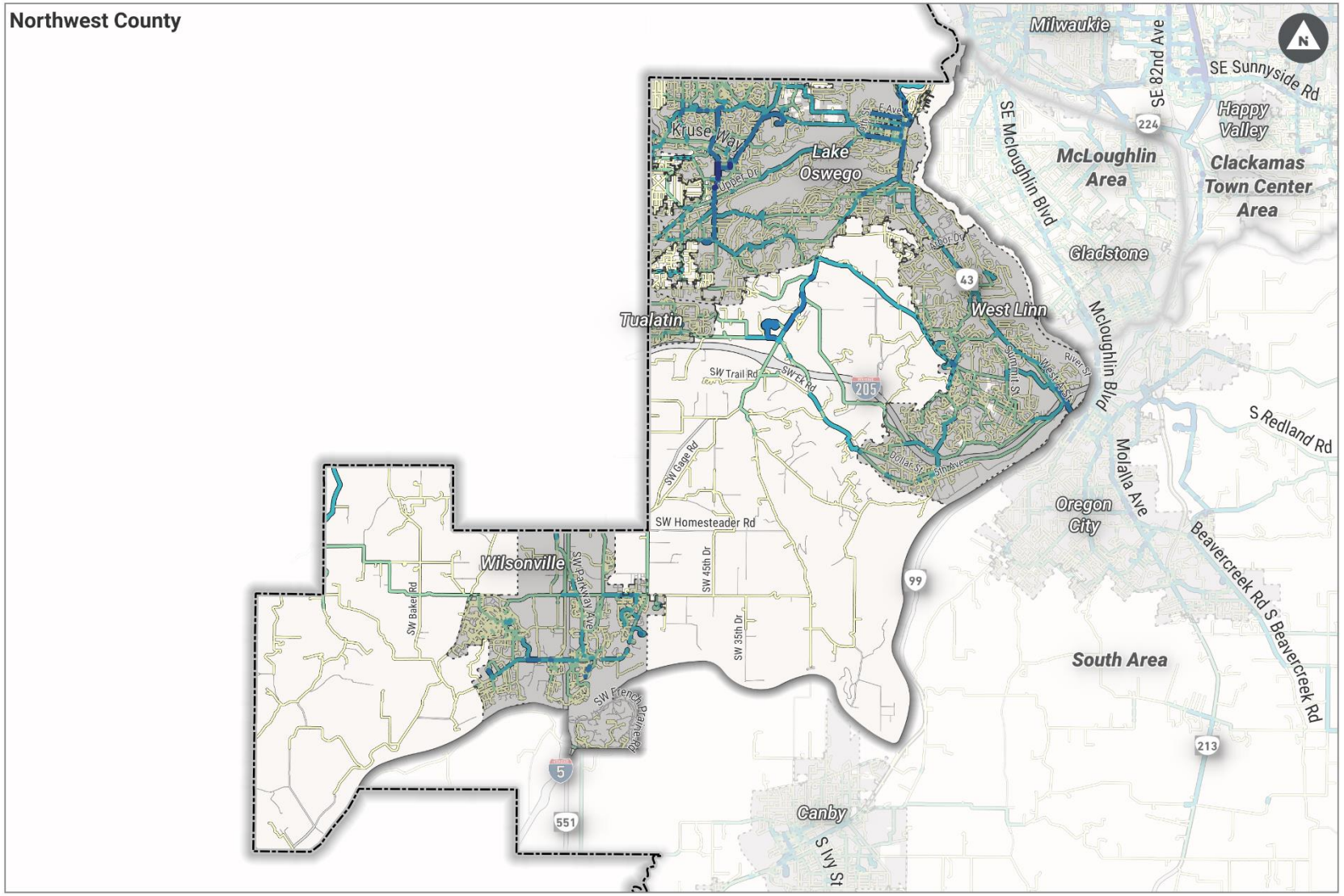
Thursday Trips, Biking Mode Trips



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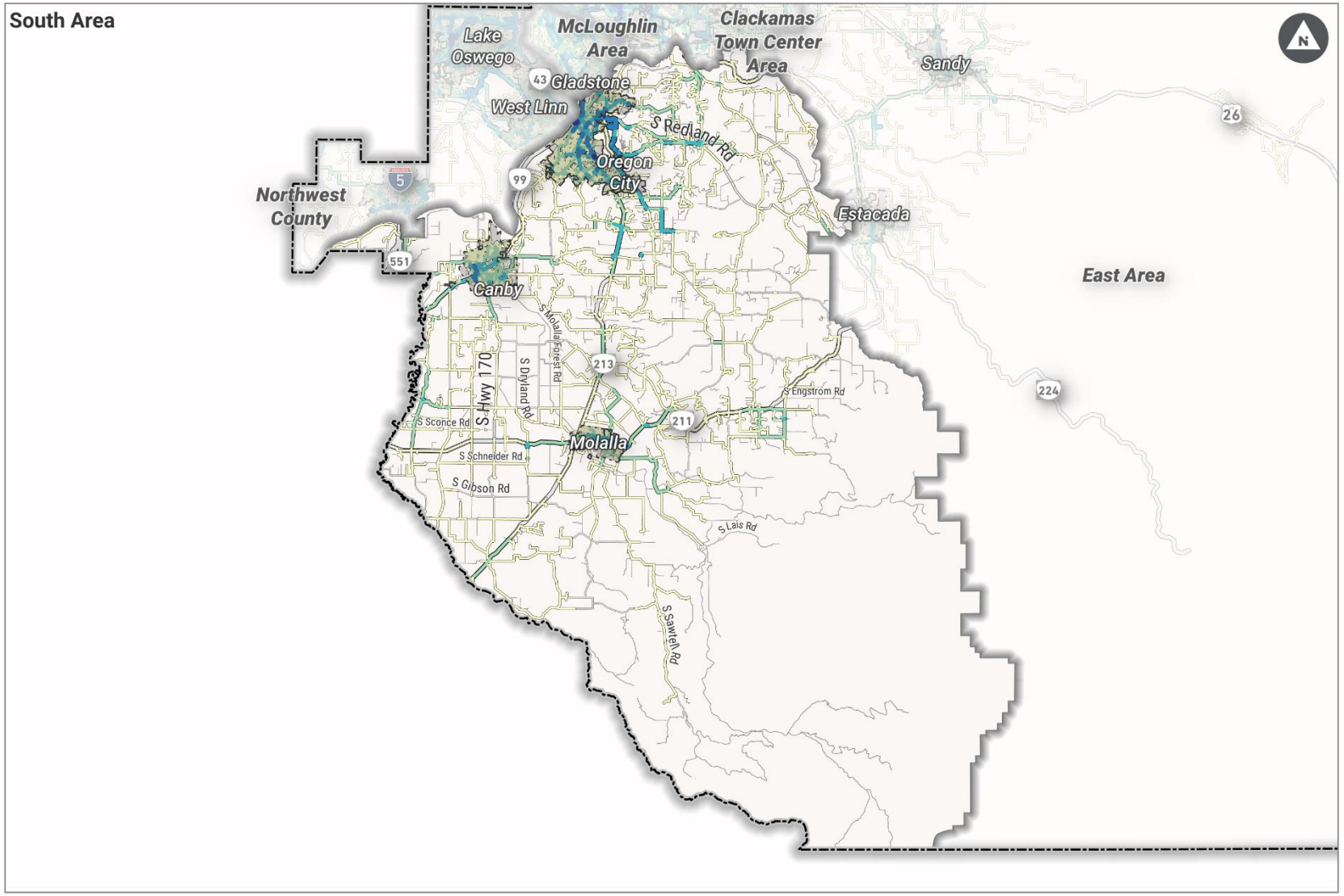
Thursday Trips, Biking Mode Trips



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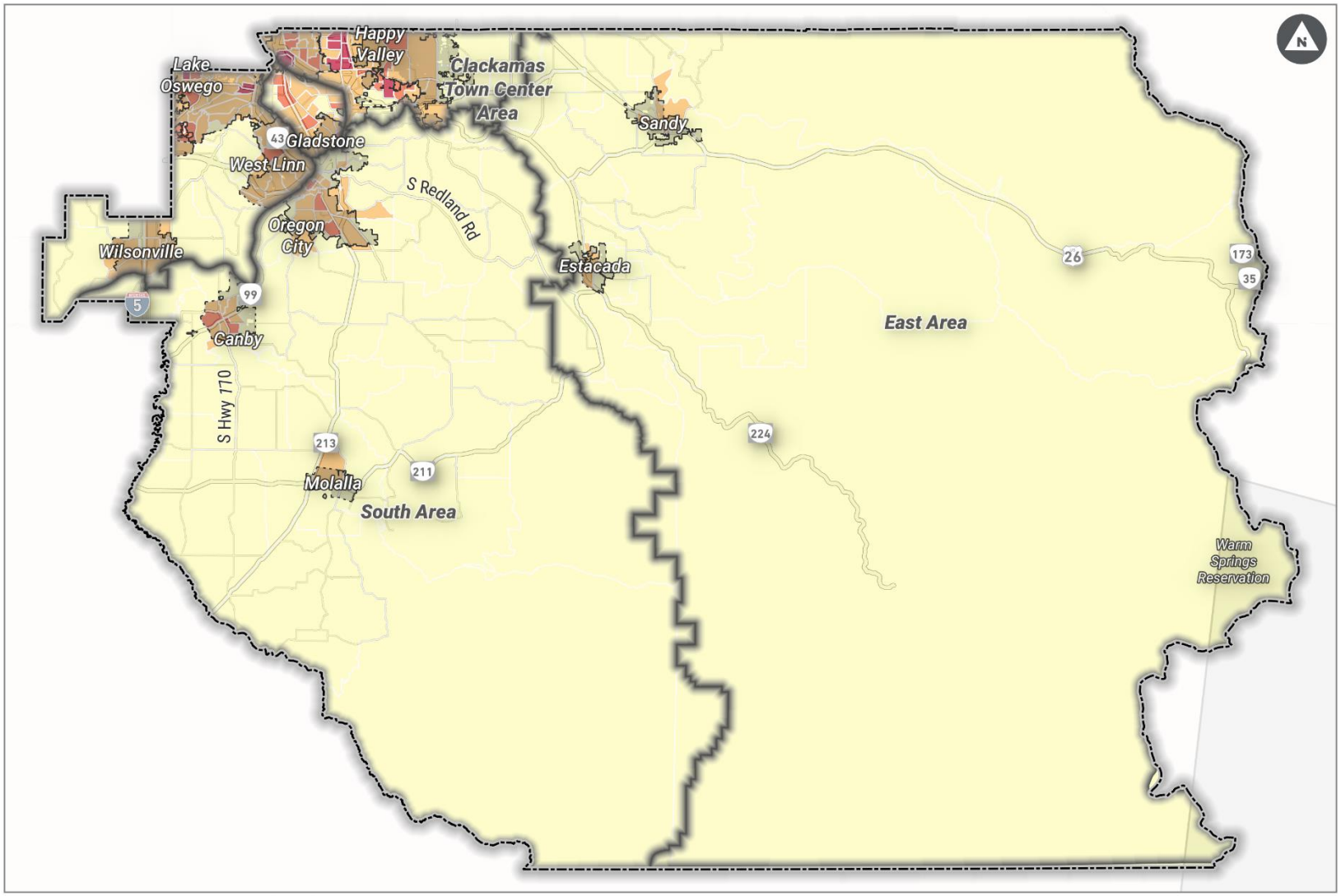
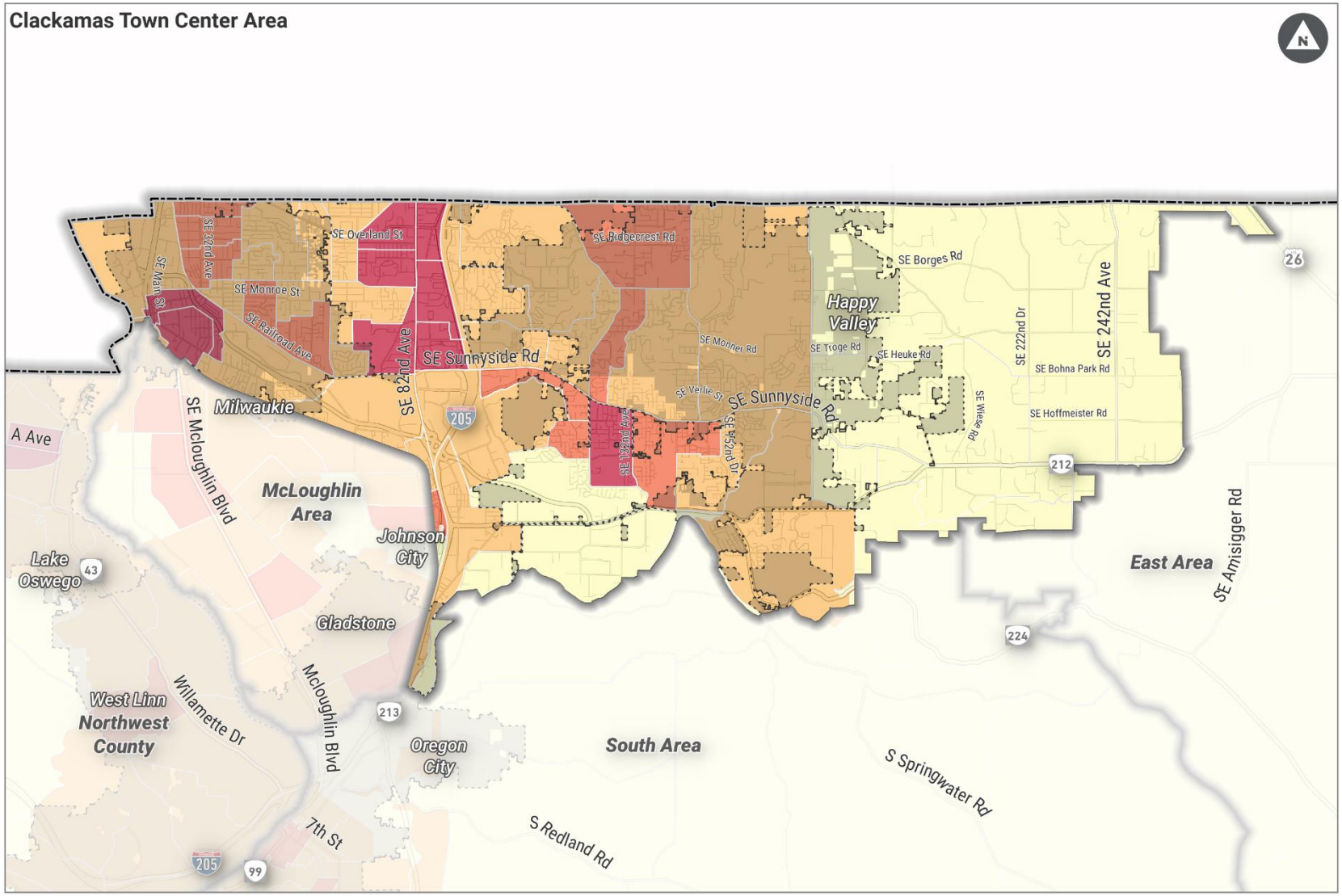
Thursday Trips, Biking Mode Trips



Source: Replica, Northwest 2021 Q4
Thursday Trips, Biking Mode Trips

Clackamas Town Center Area

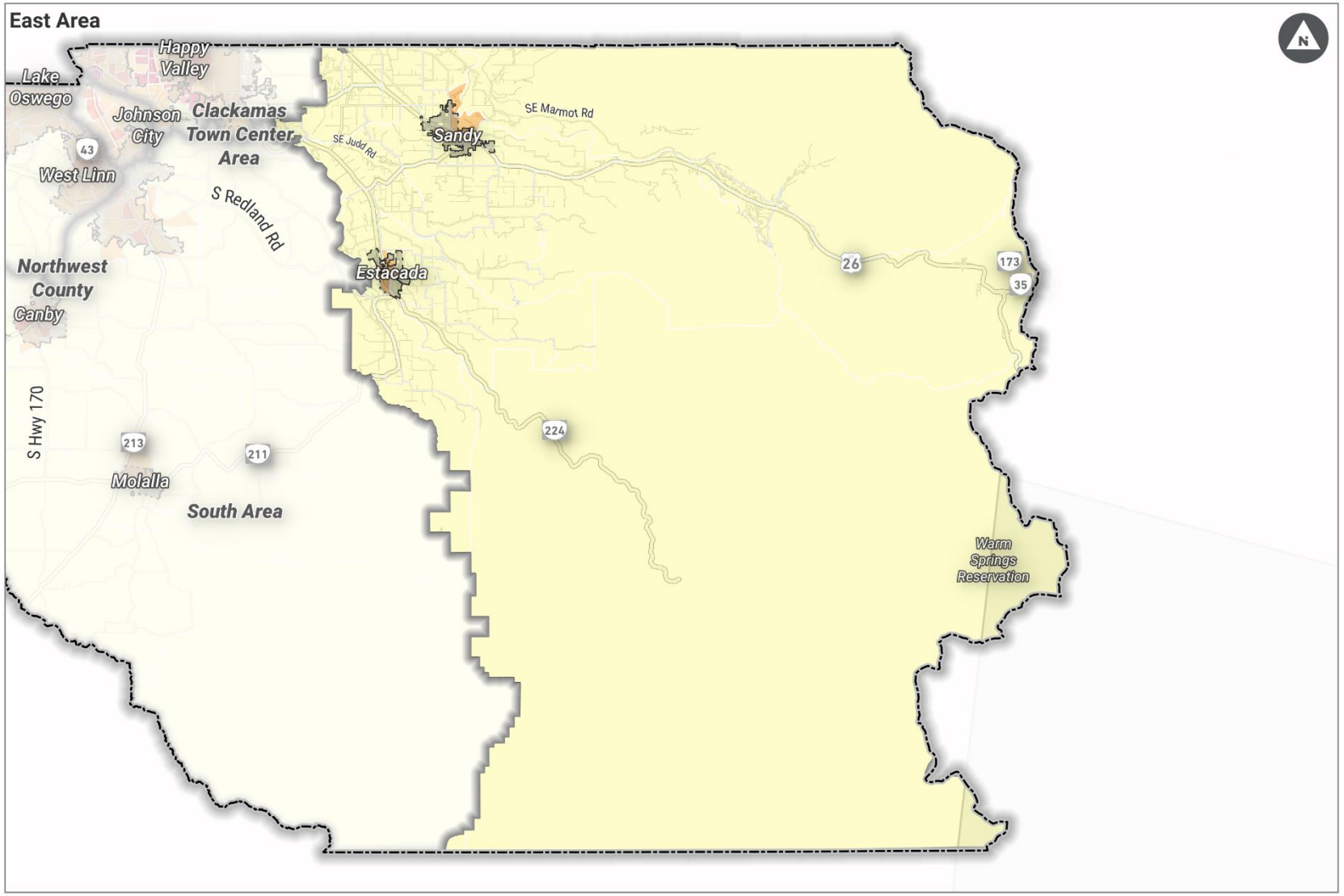


Bicycle Trip Density

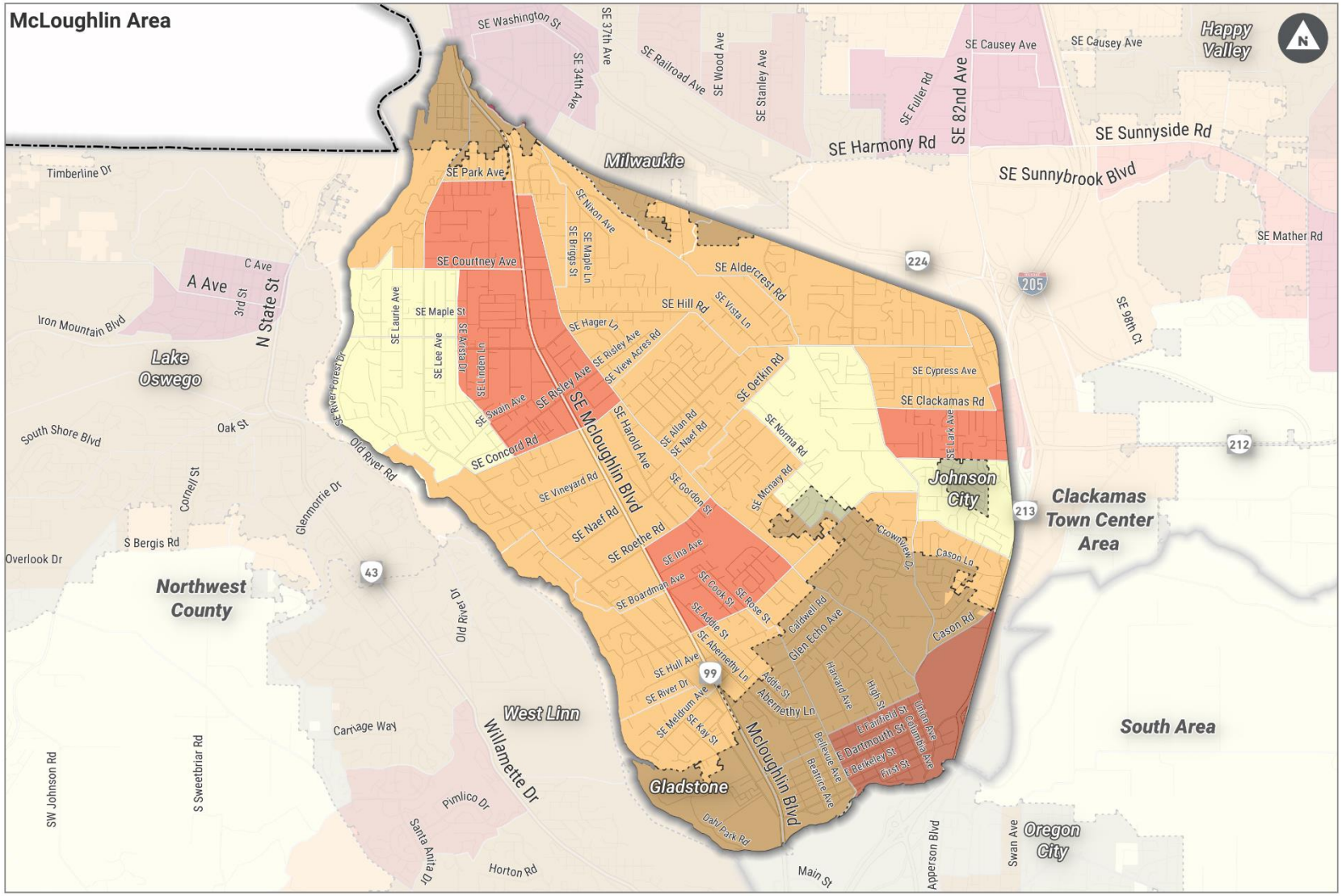
- Below county average
- County average
- Above county average
- Well above county average

- County Boundary
- City Boundary

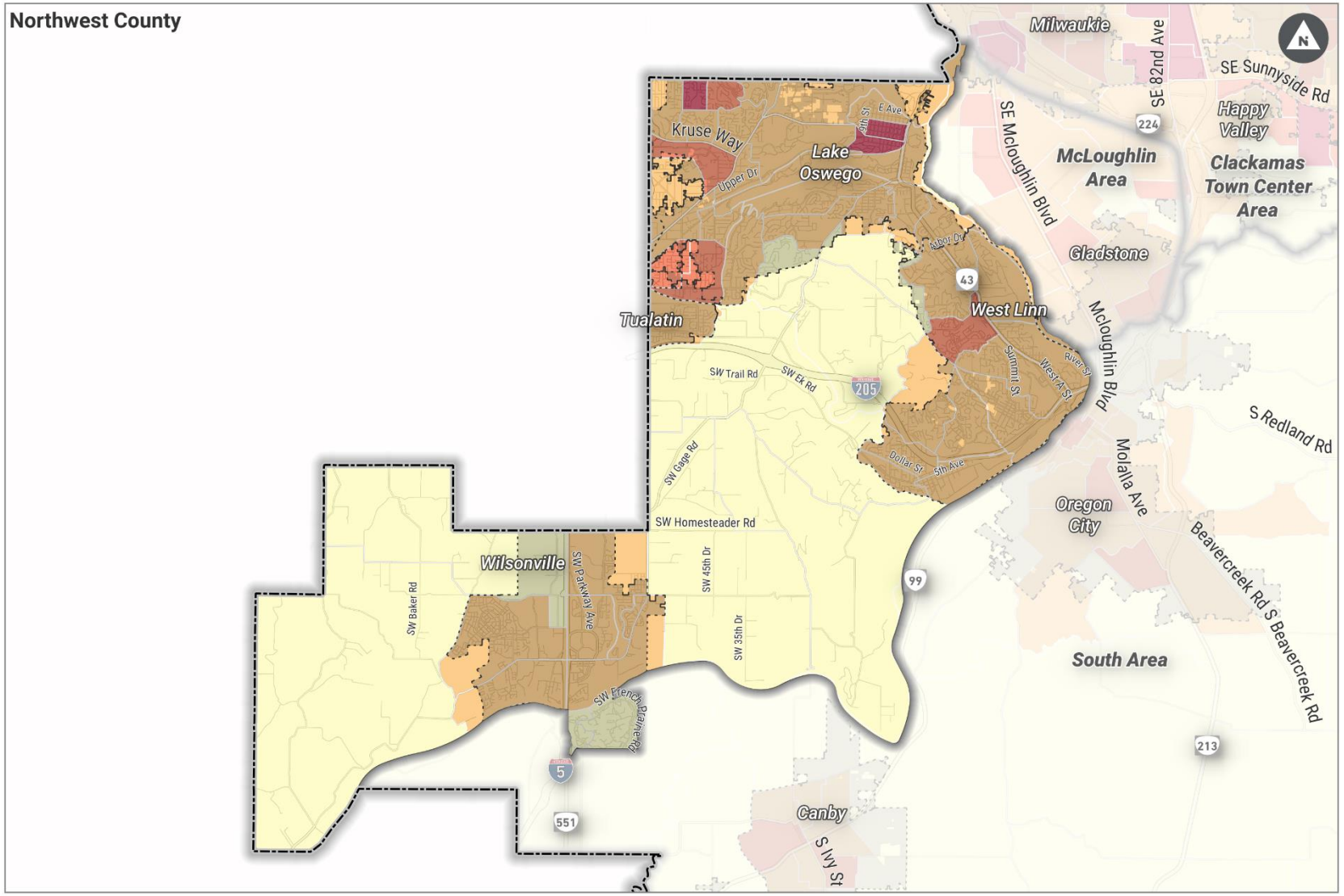
Source: Replica, Northwest 2021 Q4
Thursday Trips, Biking Mode Trips



Source: Replica, Northwest 2021 Q4
Thursday Trips, Biking Mode Trips



Source: Replica, Northwest 2021 Q4
Thursday Trips, Biking Mode Trips



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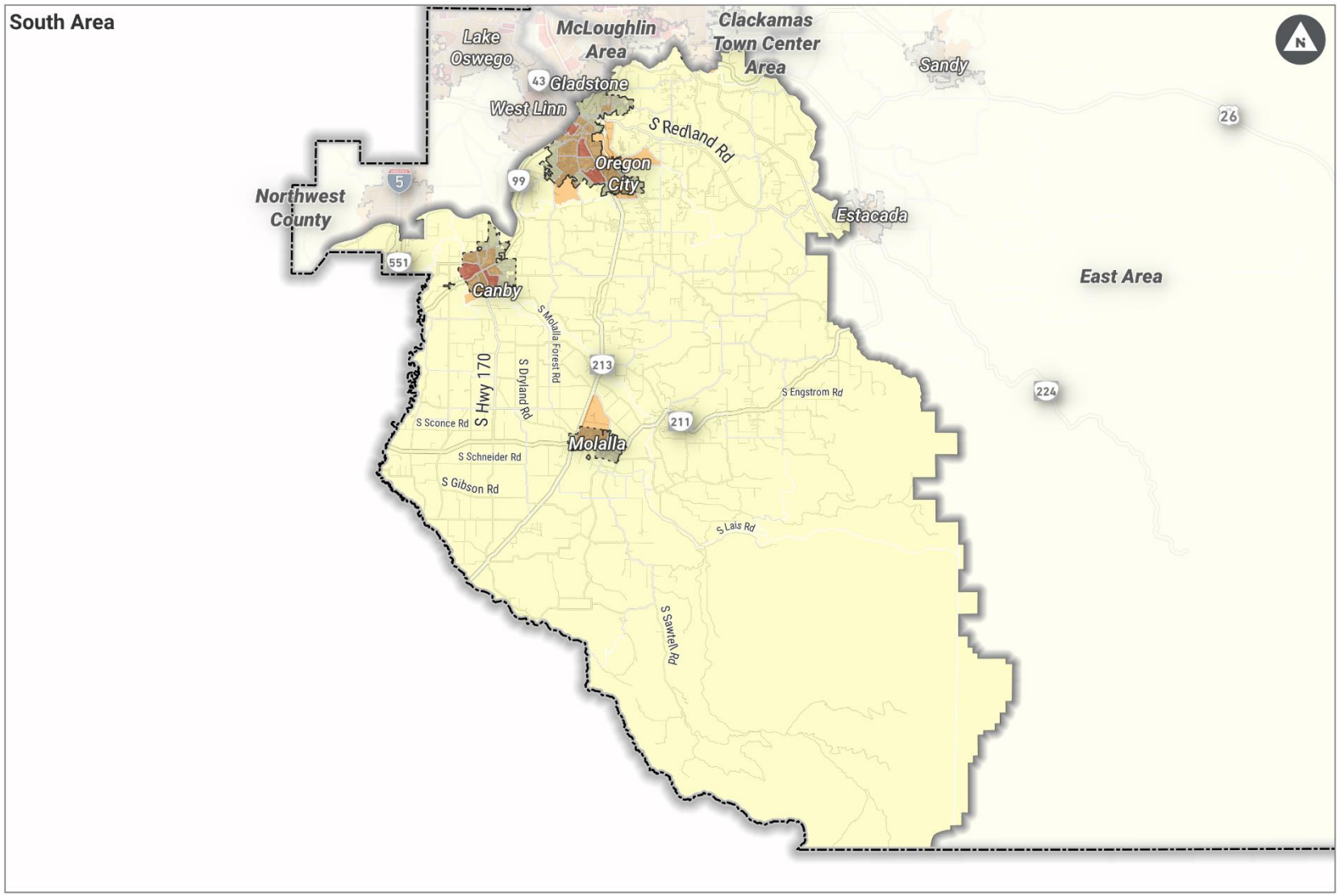
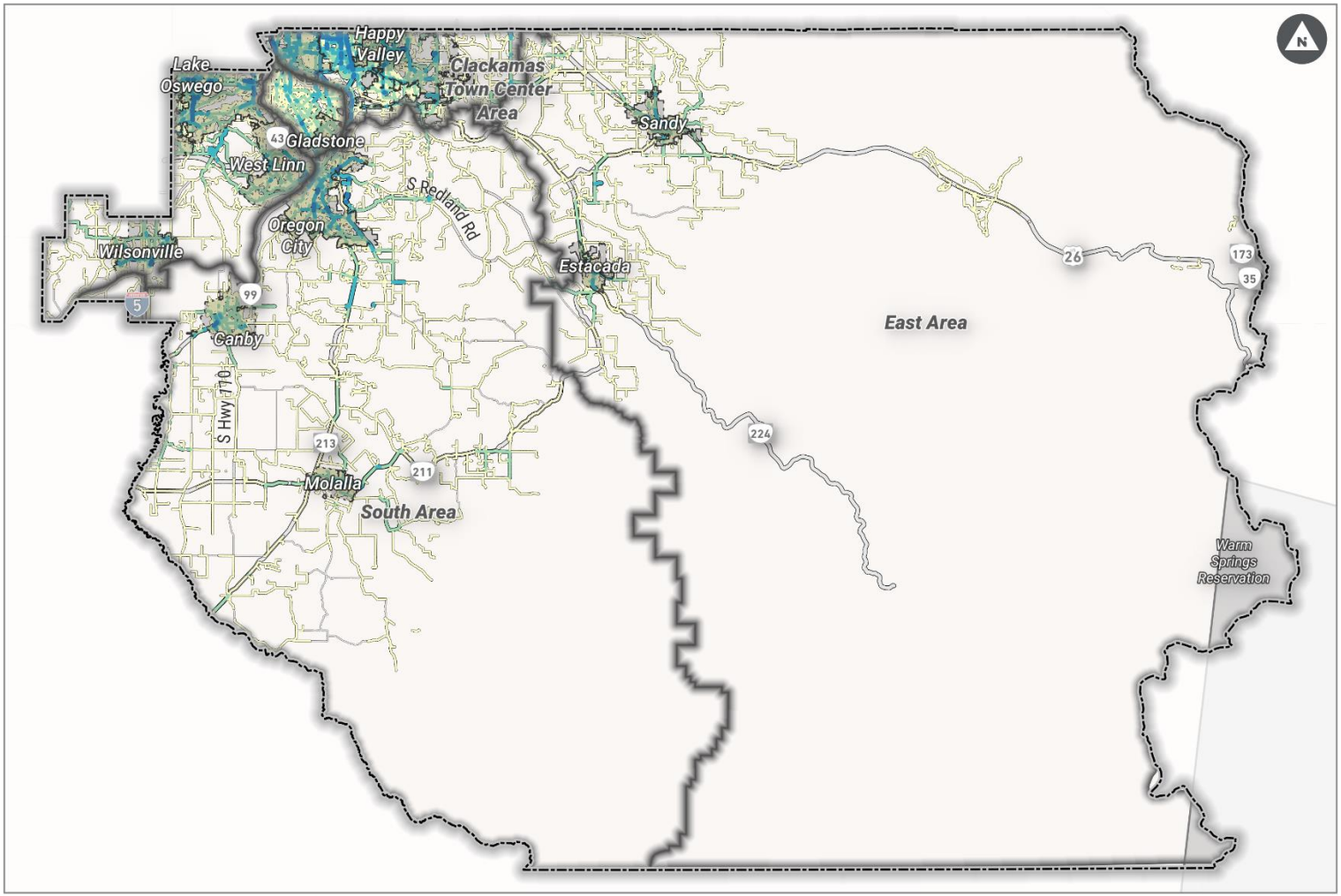
Thursday Trips, Biking Mode Trips

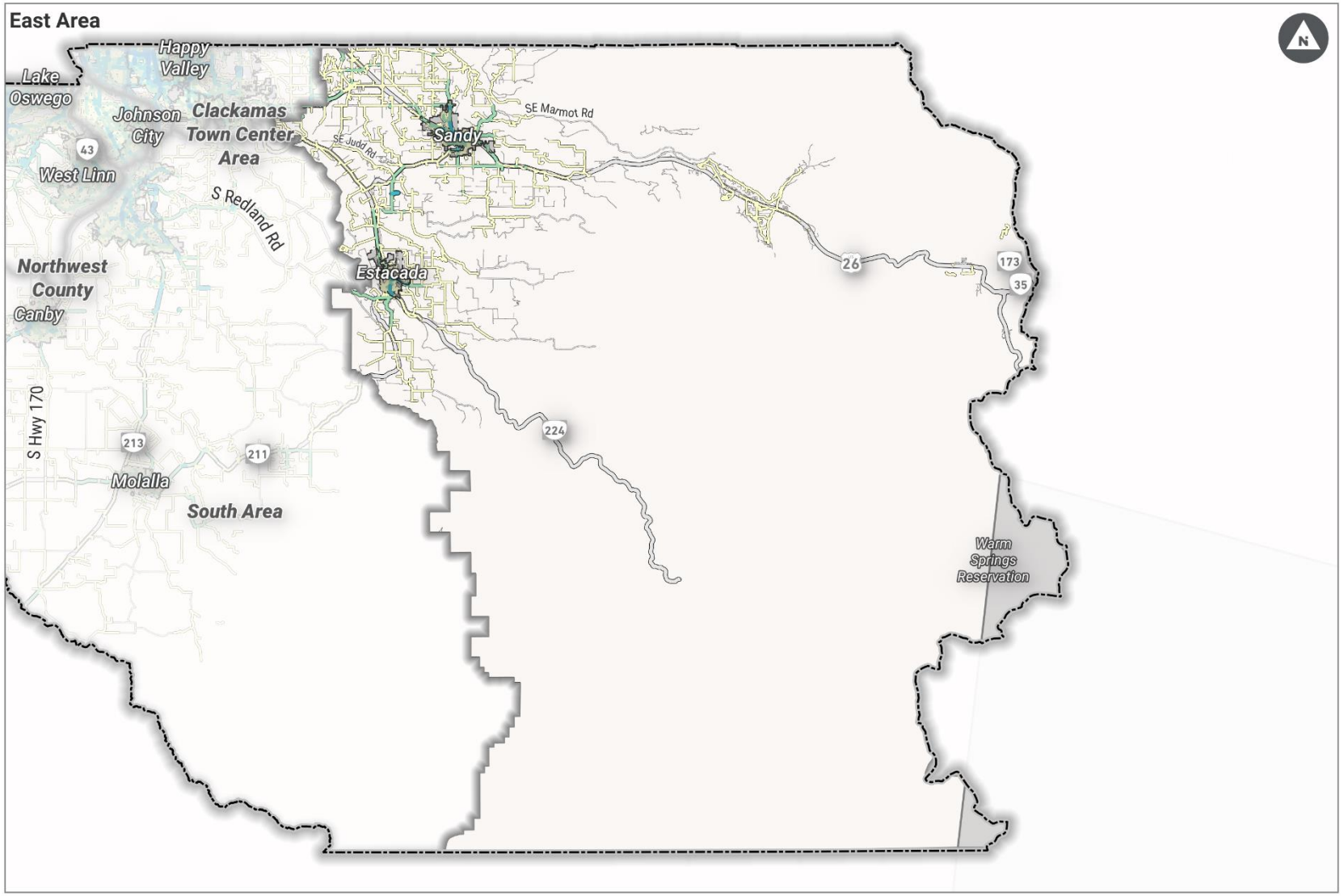


Source: Replica, Northwest 2021 Q4 Thursday Trips, Biking Mode Trips

APPENDIX G: Replica Walking Trip Density Maps

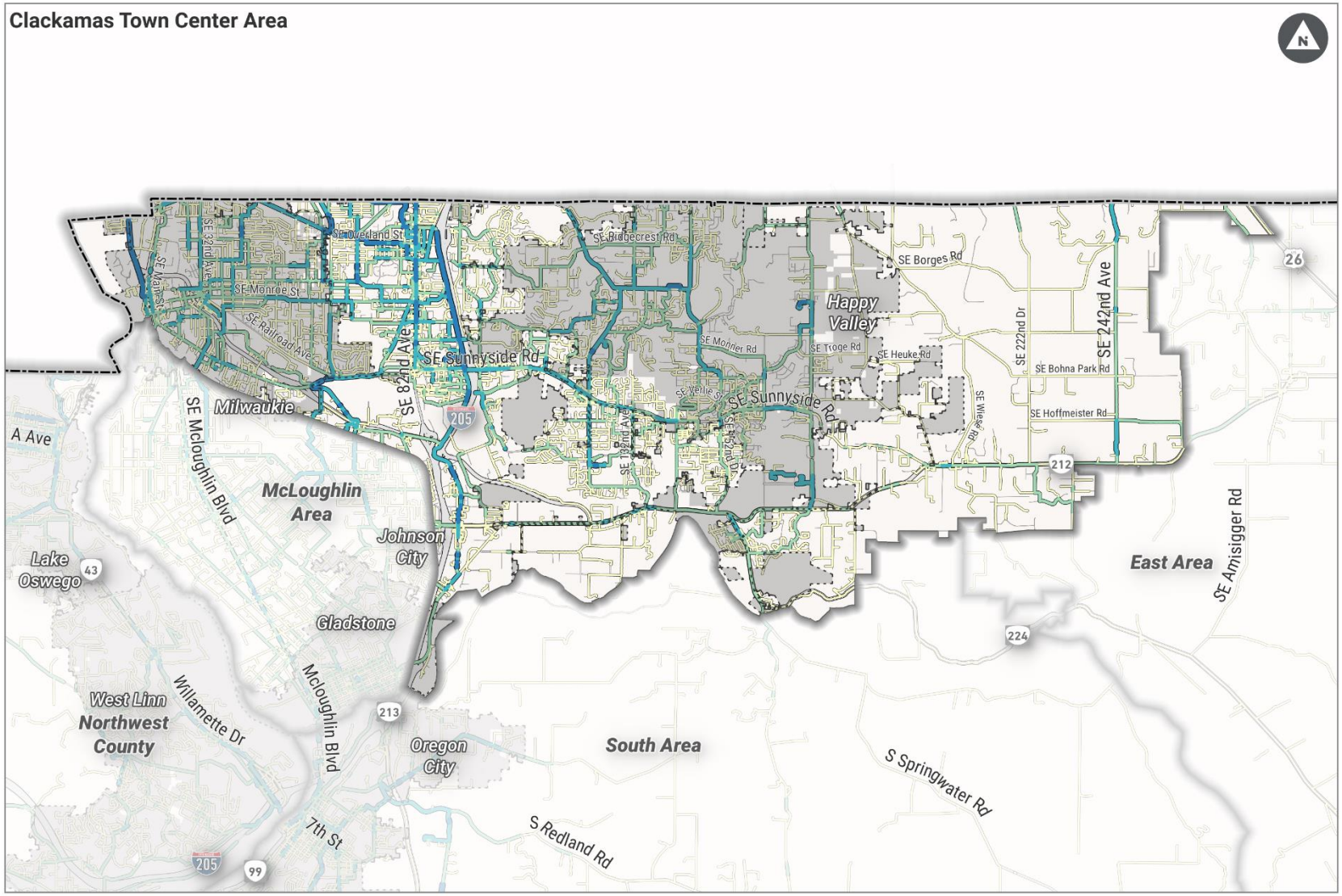


Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips



Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips

Clackamas Town Center Area



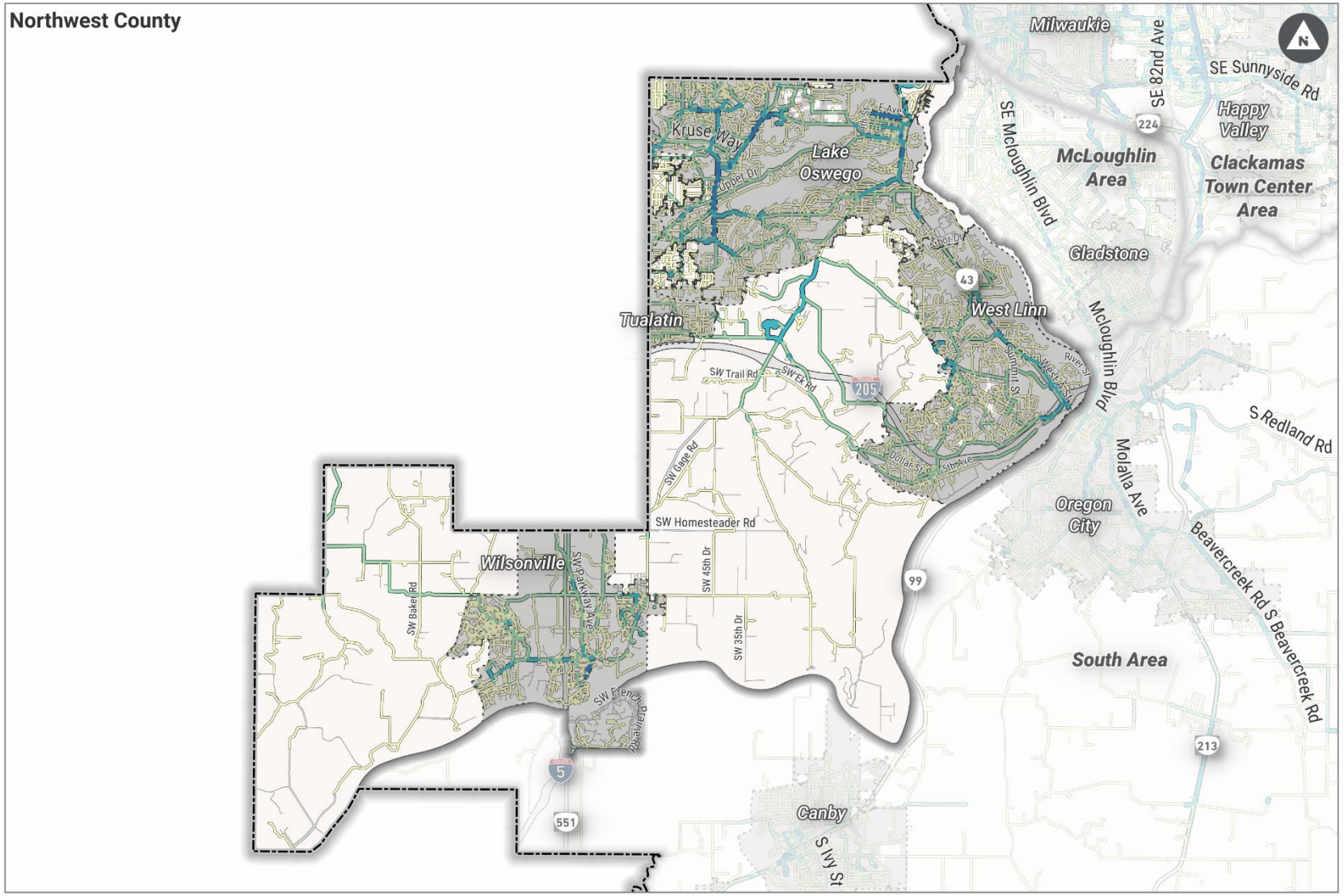
Walk Trips

- 1 - 32
- 32 - 113
- 113 - 276
- 276 - 869
- 869 - 1869

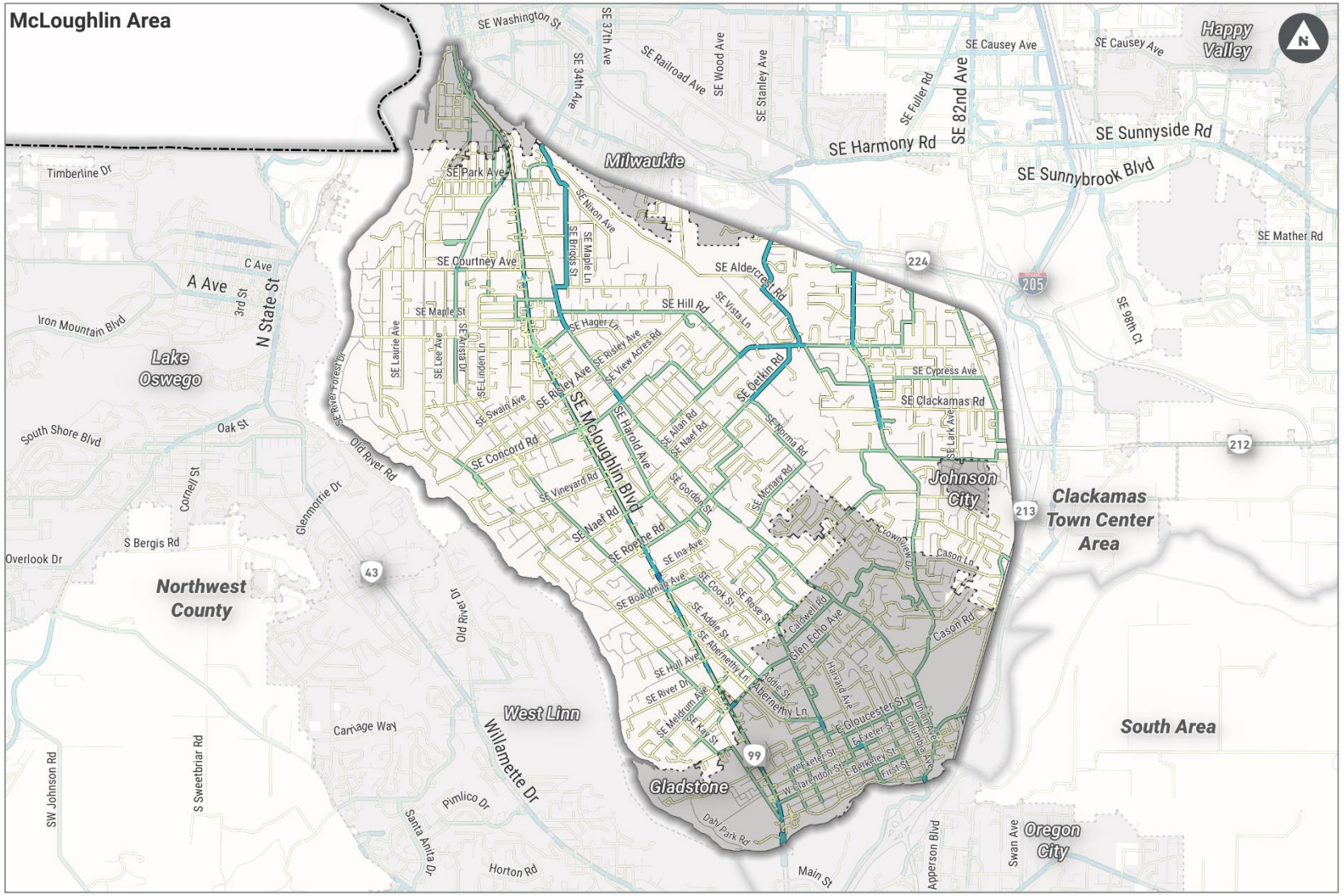
County Boundary

City Boundary

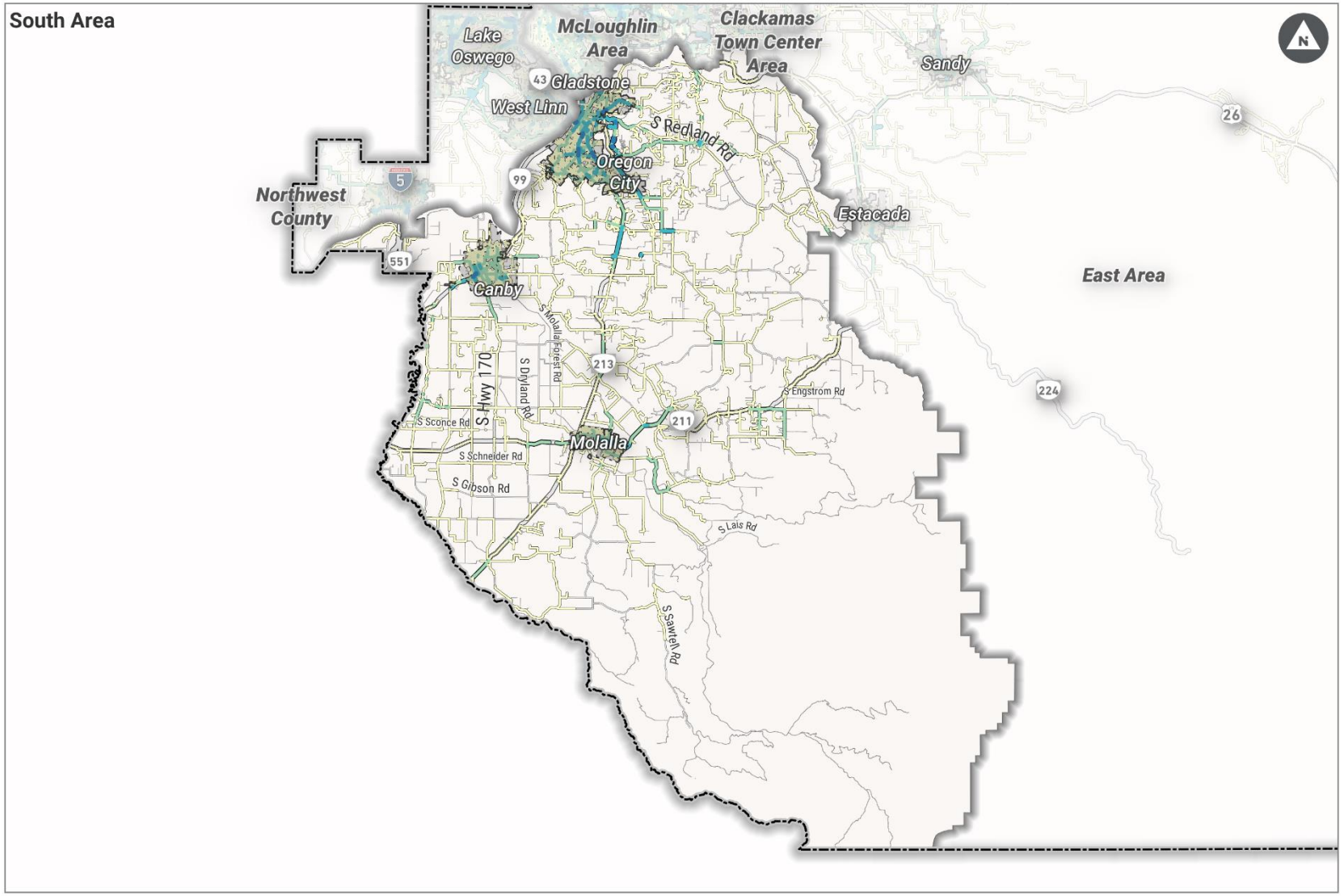
Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips



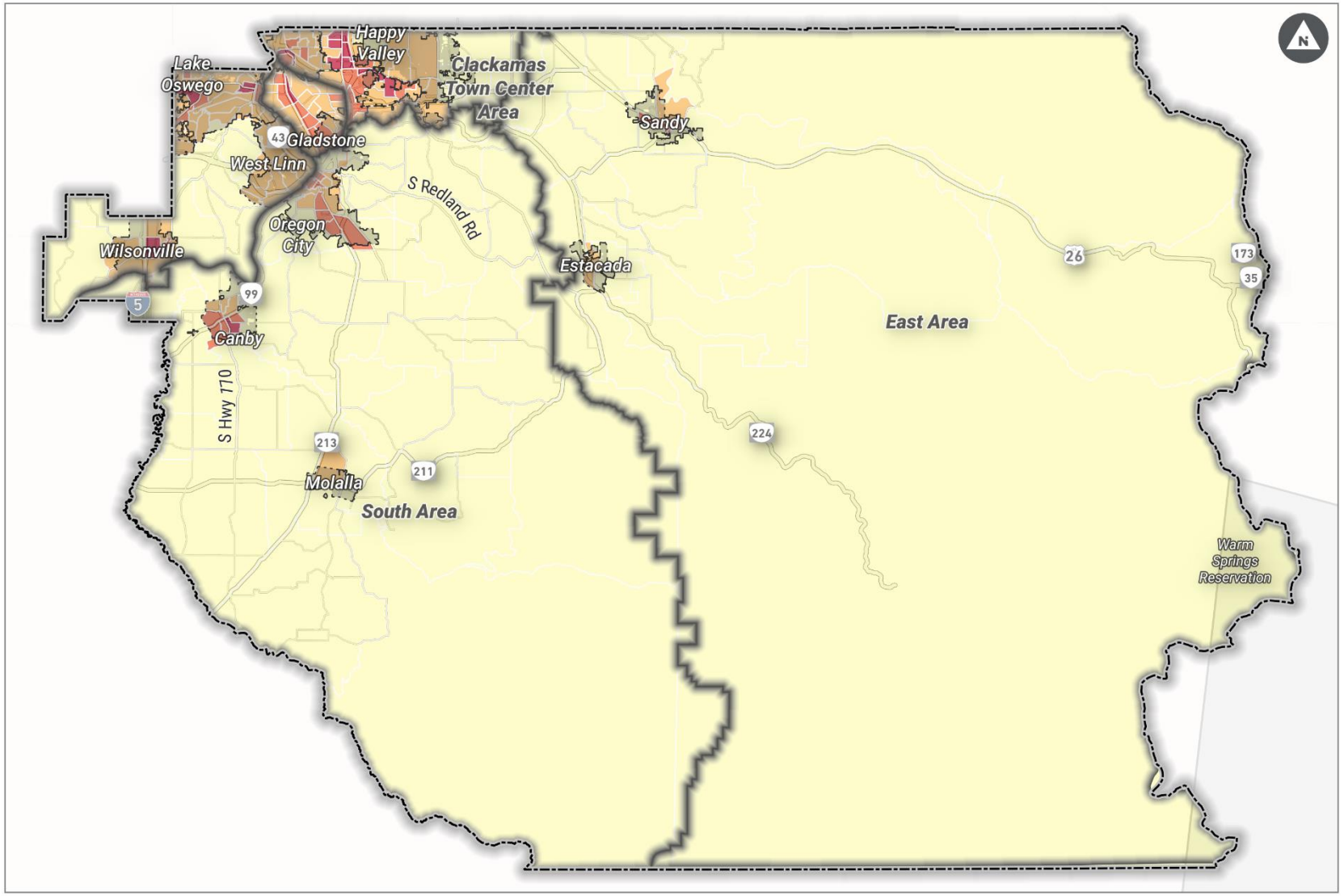
Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips



Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips

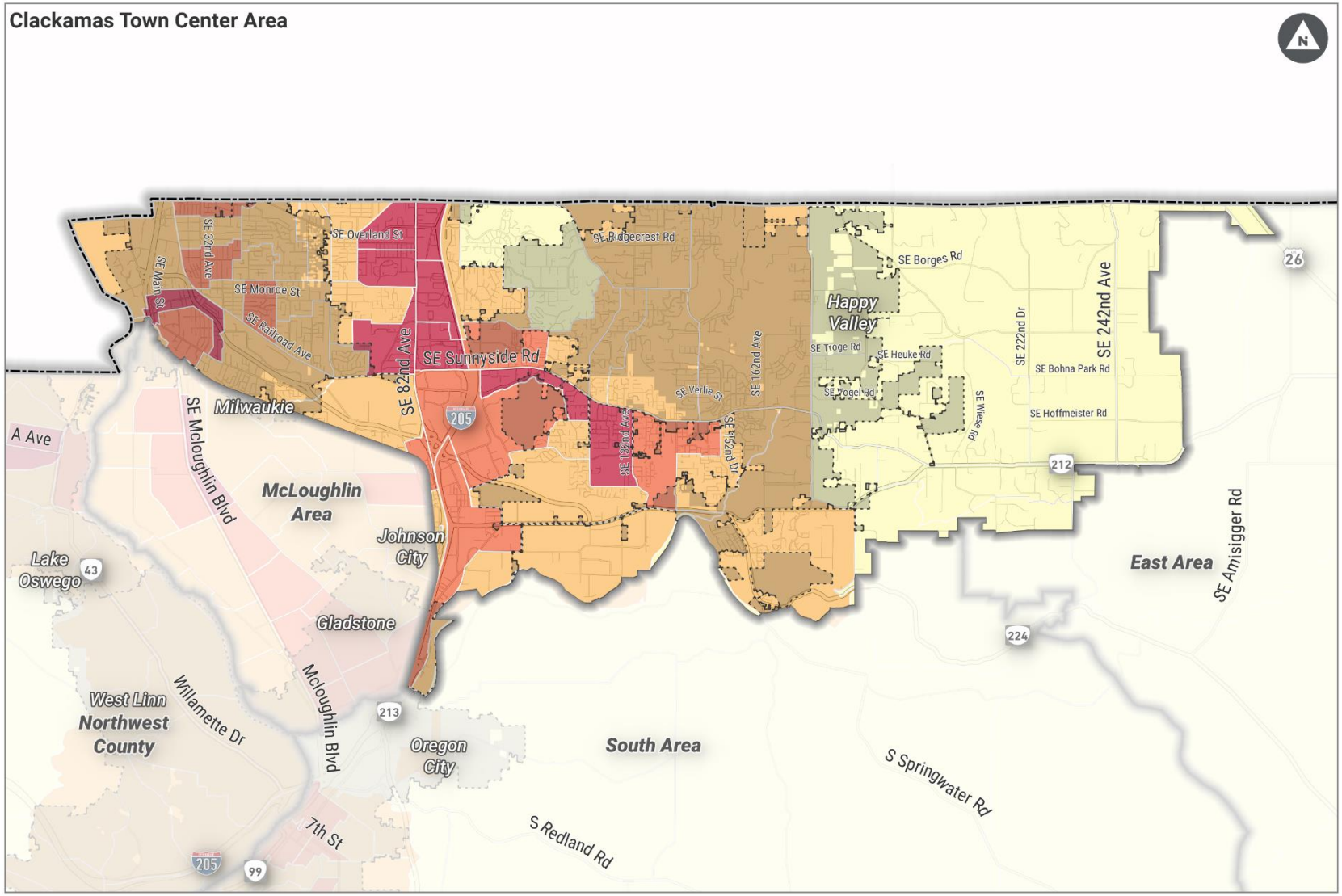


Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips



Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips

Clackamas Town Center Area

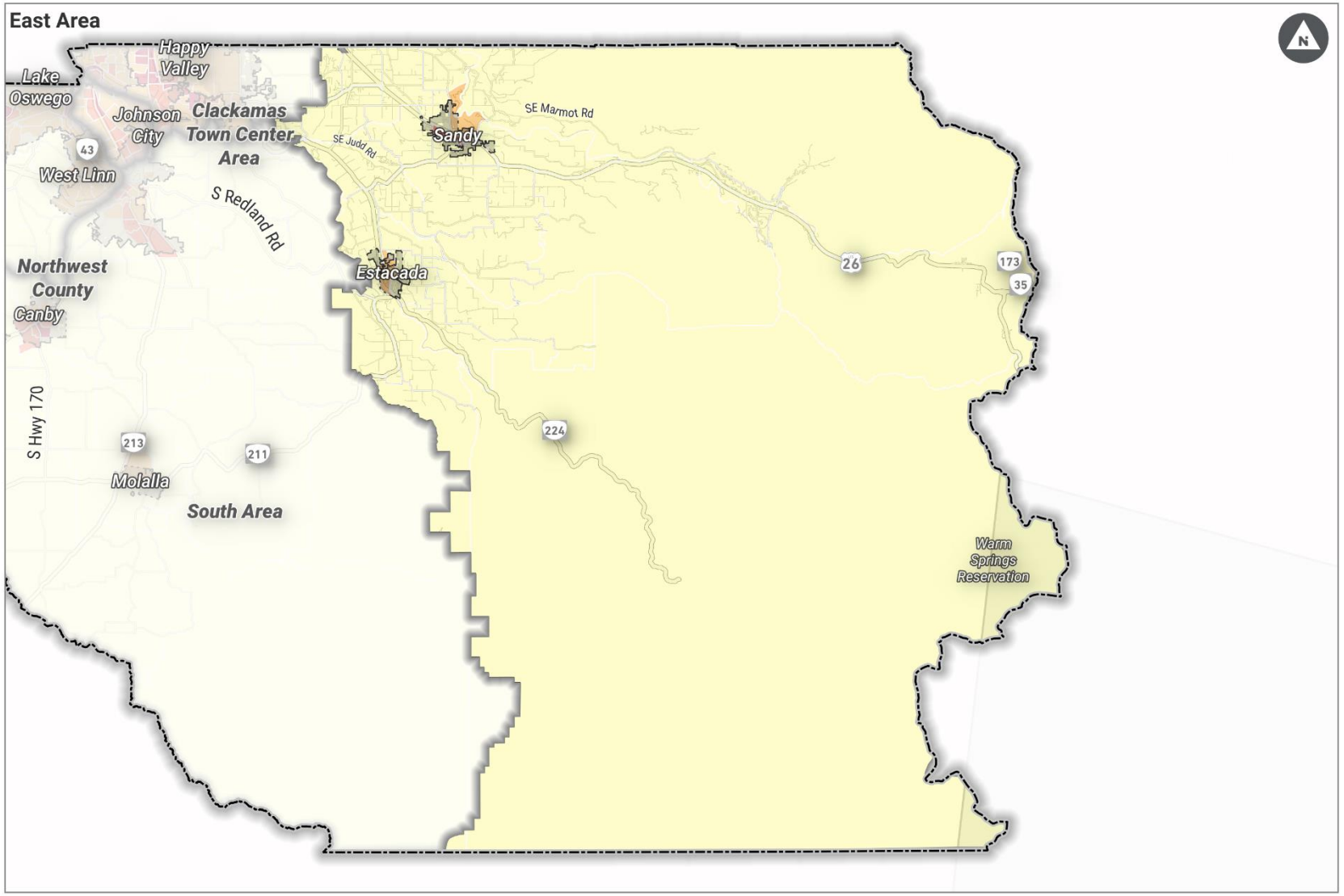


Walk Trip Density

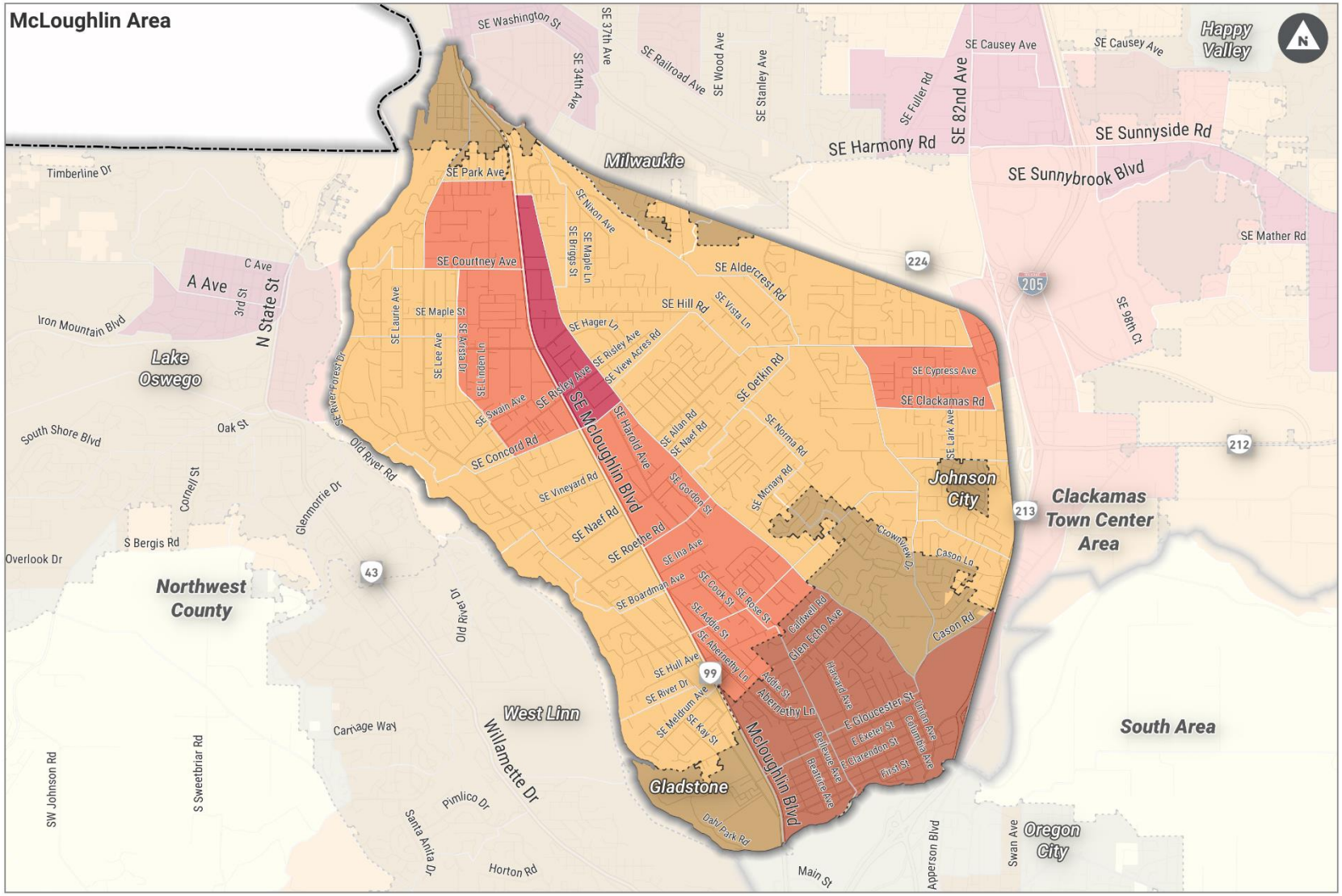
- Below county average
- County average
- Above county average
- Well above county average

- County Boundary
- City Boundary

Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips



Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips

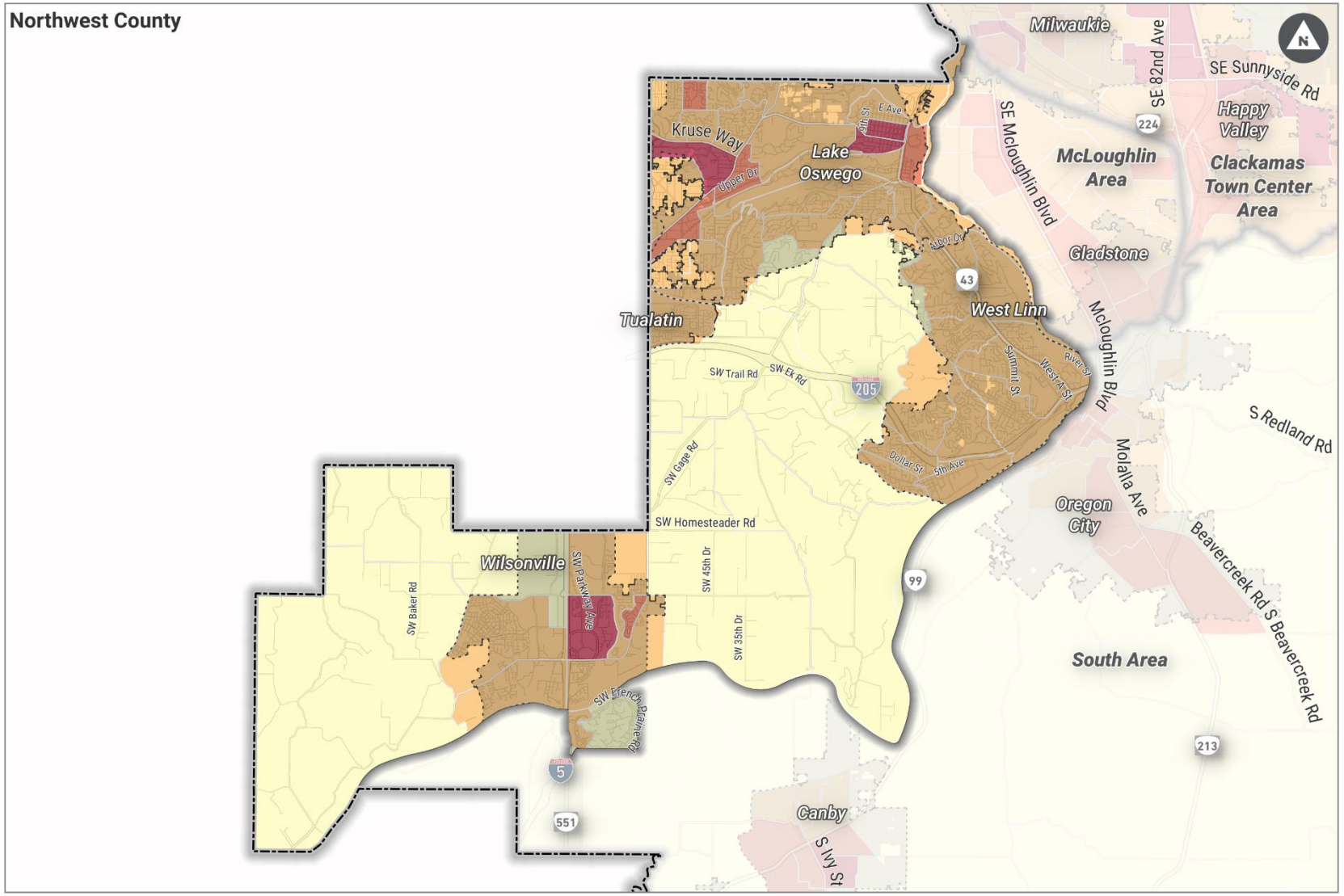


Walk Trip Density

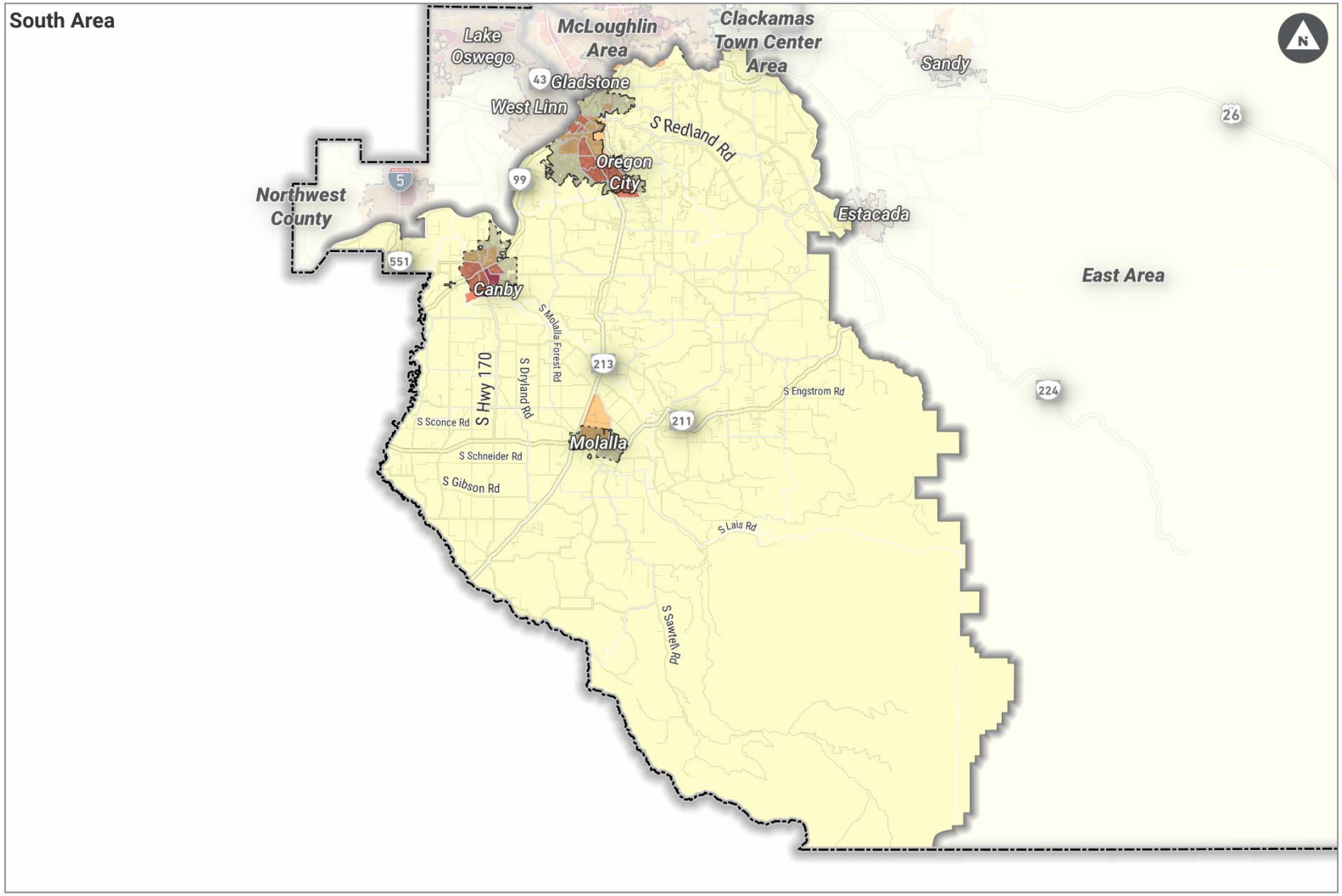
- Below county average
- County average
- Above county average
- Well above county average

- County Boundary
- City Boundary

Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips

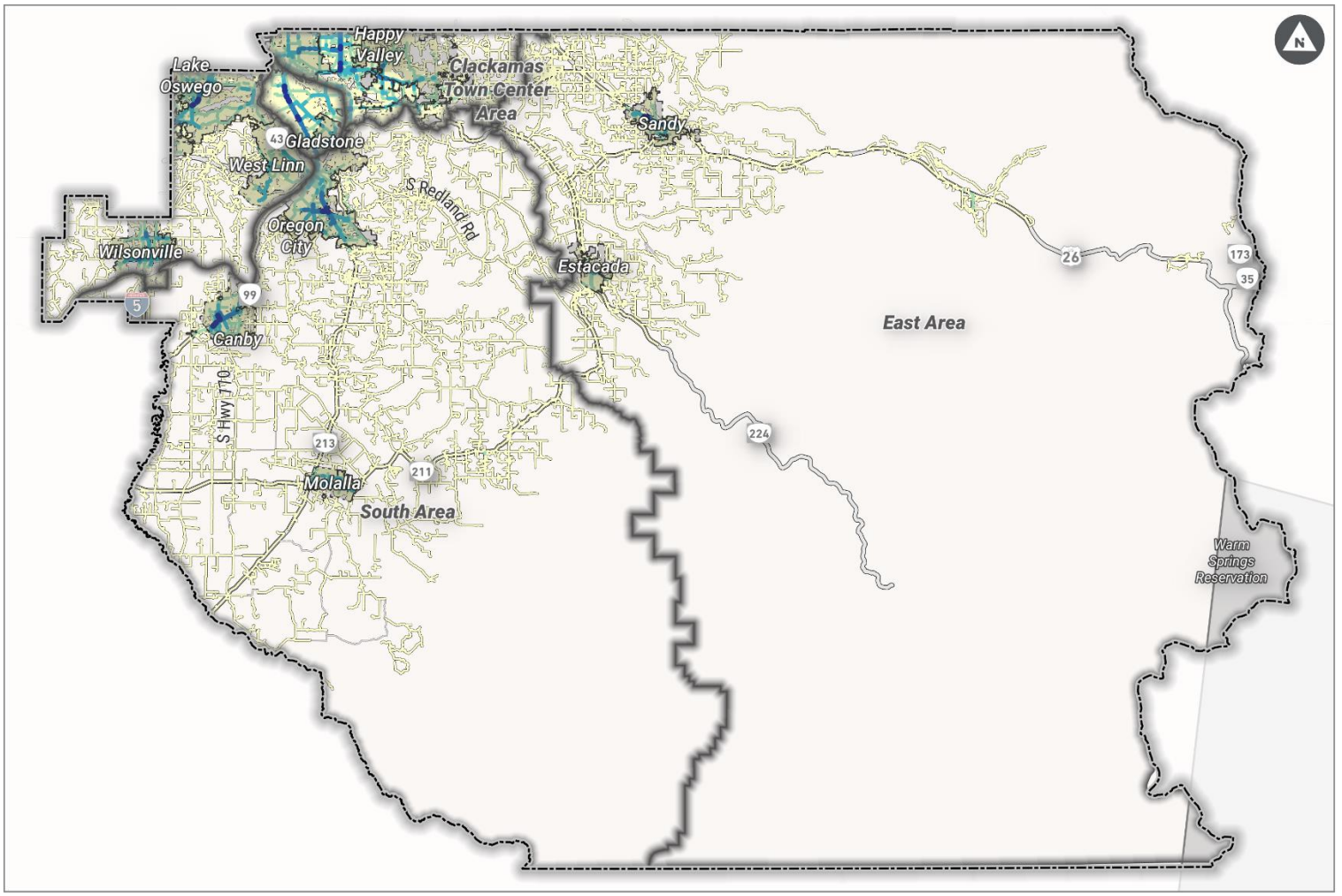


Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips



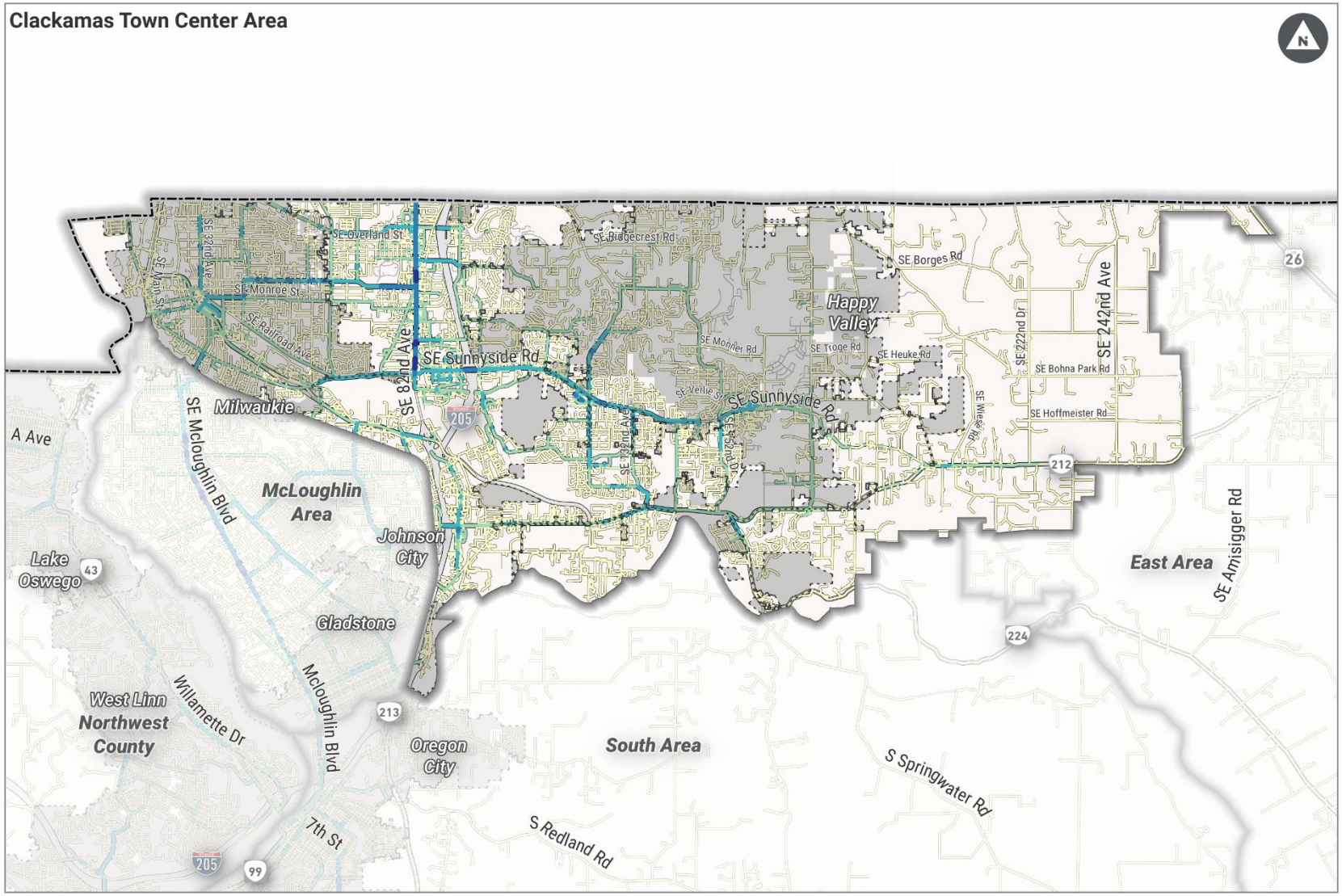
Source: Replica, Northwest 2021 Q4
Thursday Trips, Walking Mode Trips

APPENDIX H: Replica Short Vehicle Trips and Short Vehicle Trip Density Maps



Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips

Clackamas Town Center Area



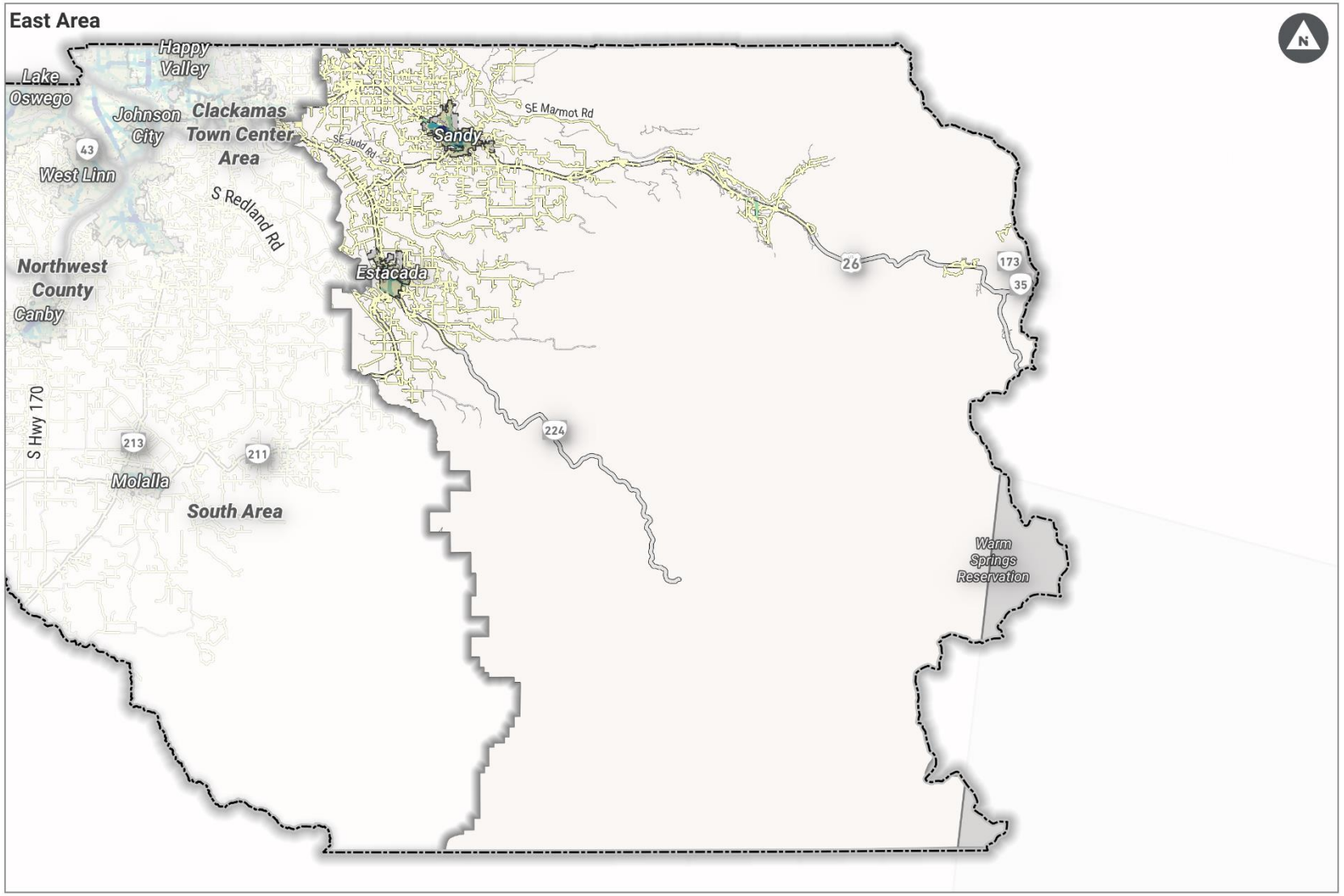
Short Vehicle Trips

- 1 - 633
- 633 - 2182
- 2182 - 5048
- 5048 - 10373
- 10373 - 22092

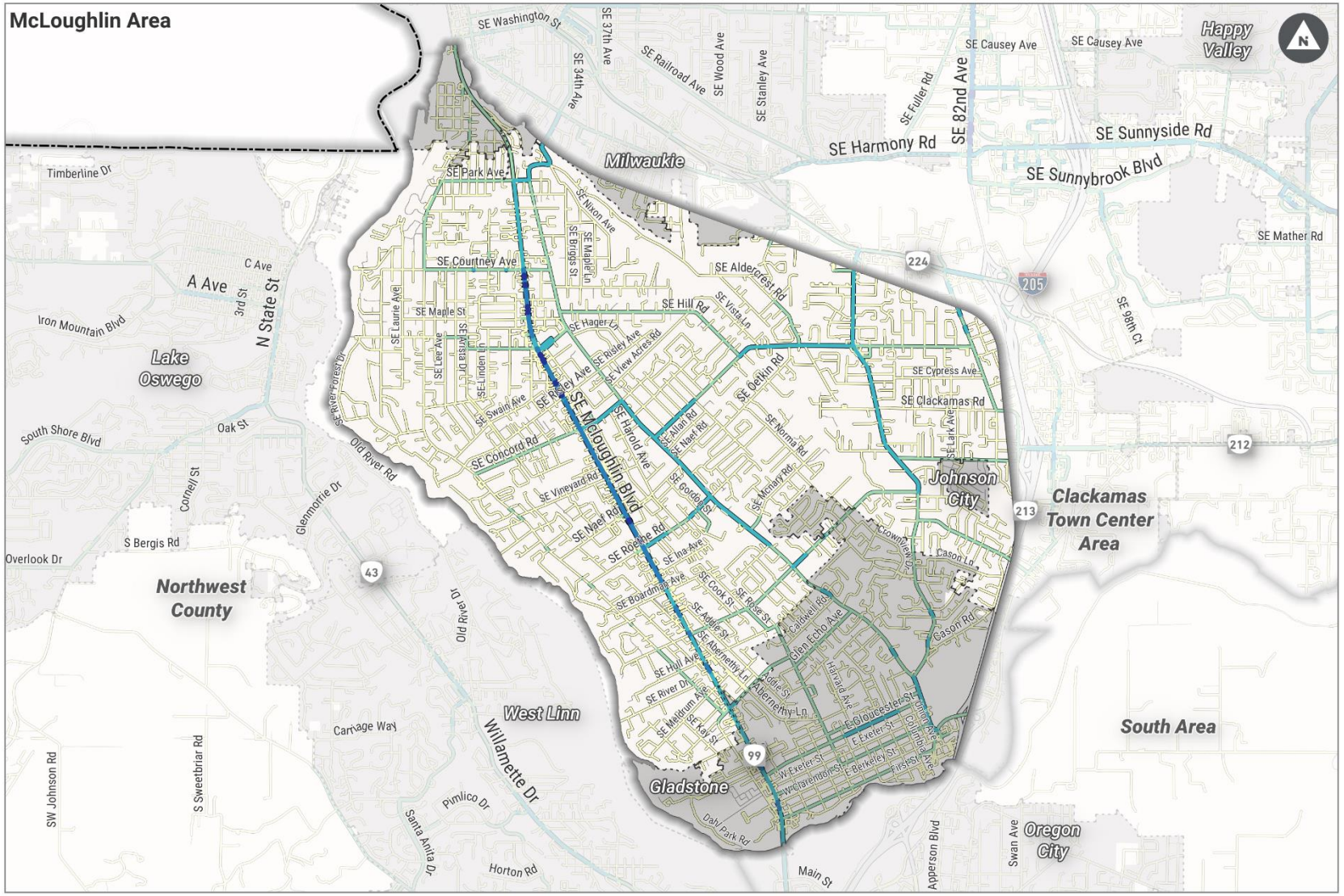
County Boundary

City Boundary

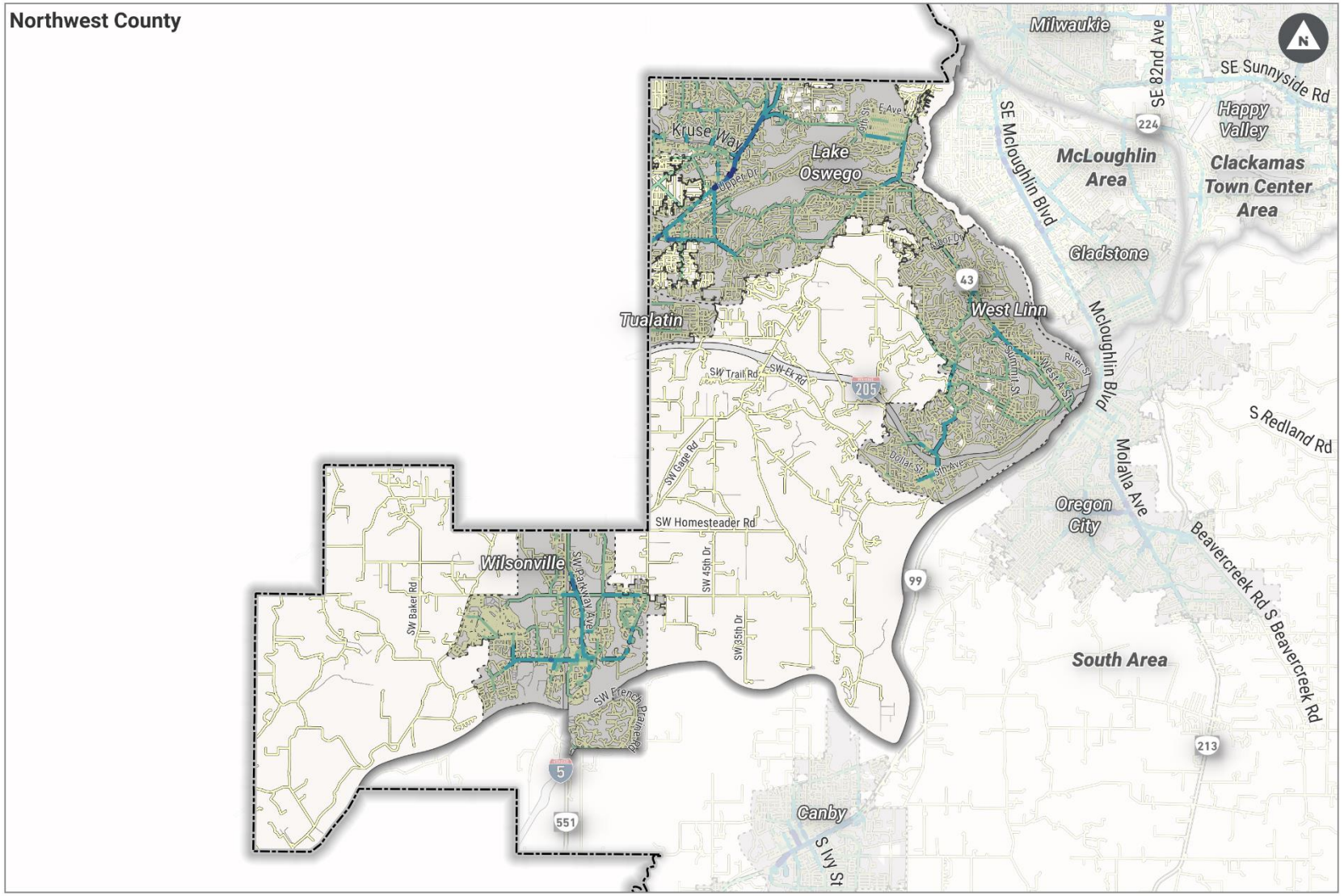
Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips



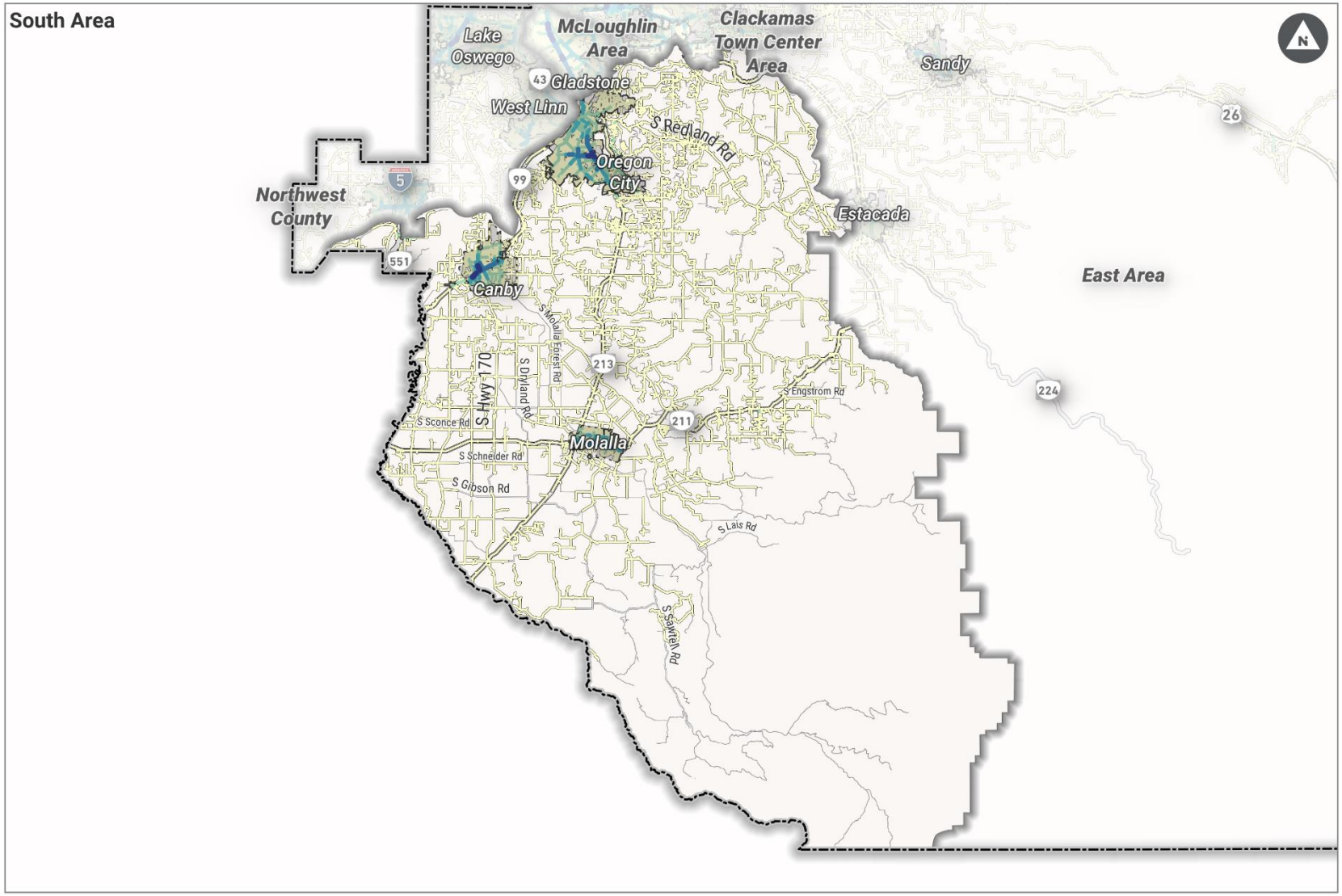
Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips



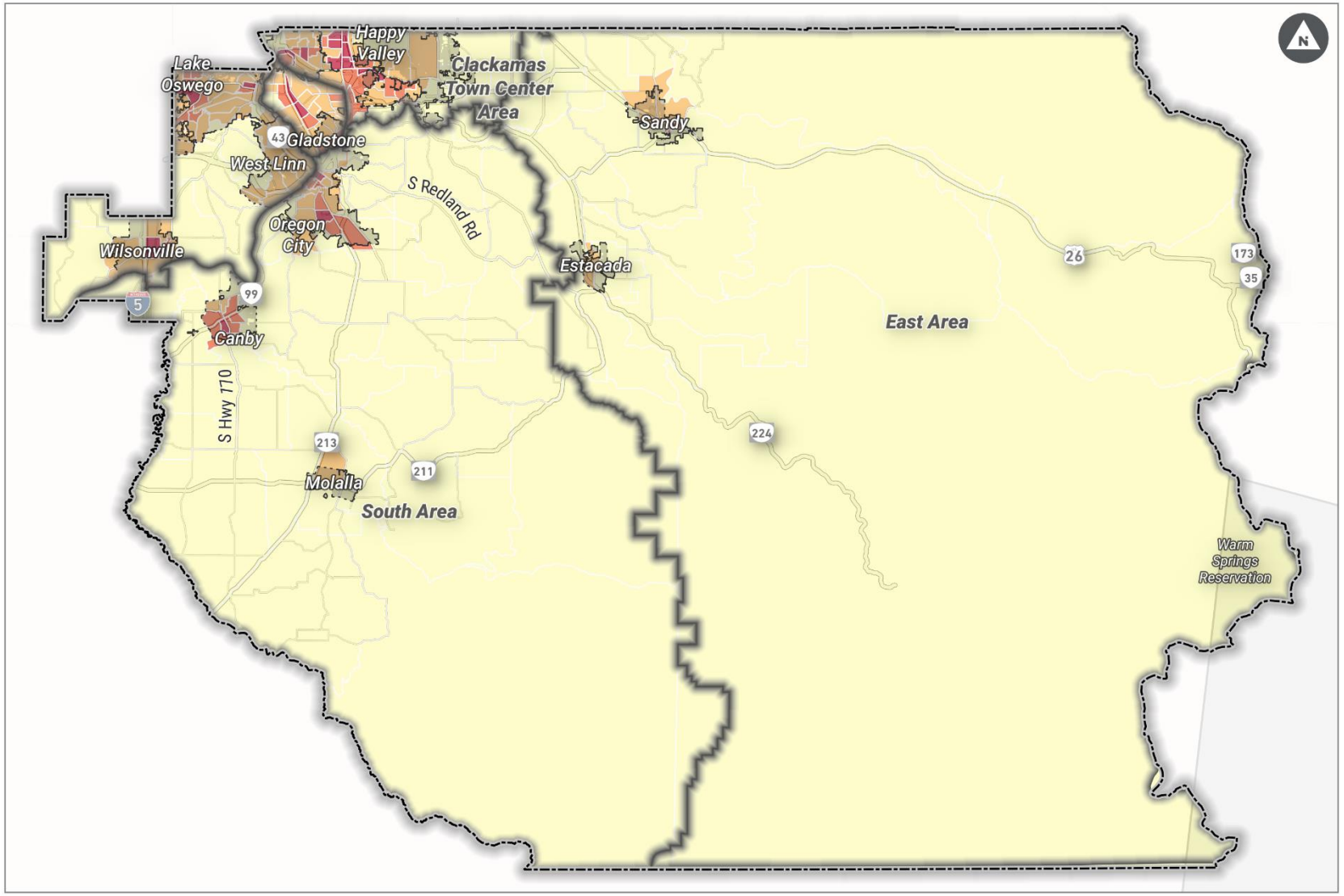
Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips



Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips



Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips



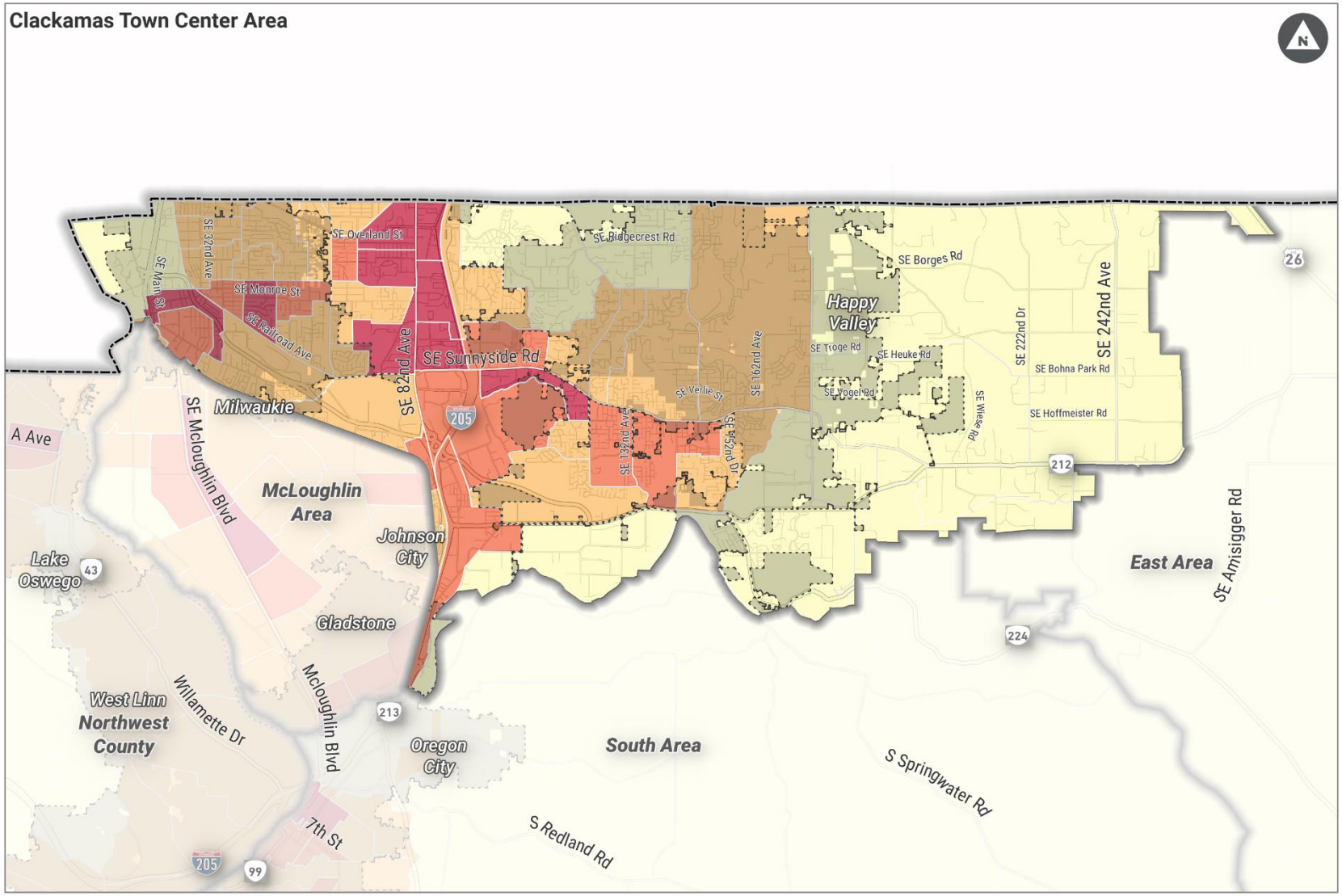
Short Vehicle Trip Density

- Below county average
- County average
- Above county average
- Well above county average

- County Boundary
- City Boundary

Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips

Clackamas Town Center Area



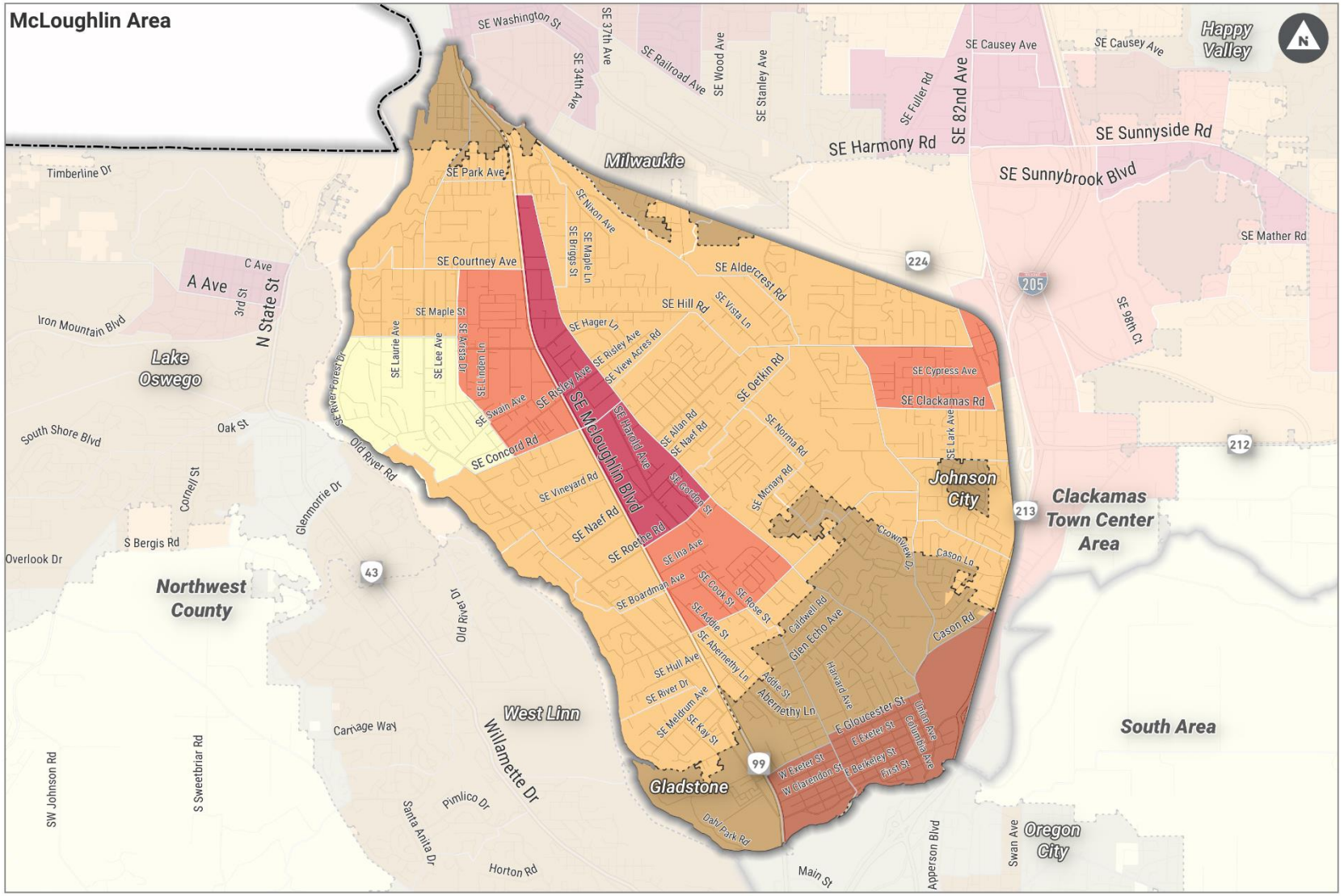
Short Vehicle Trip Density

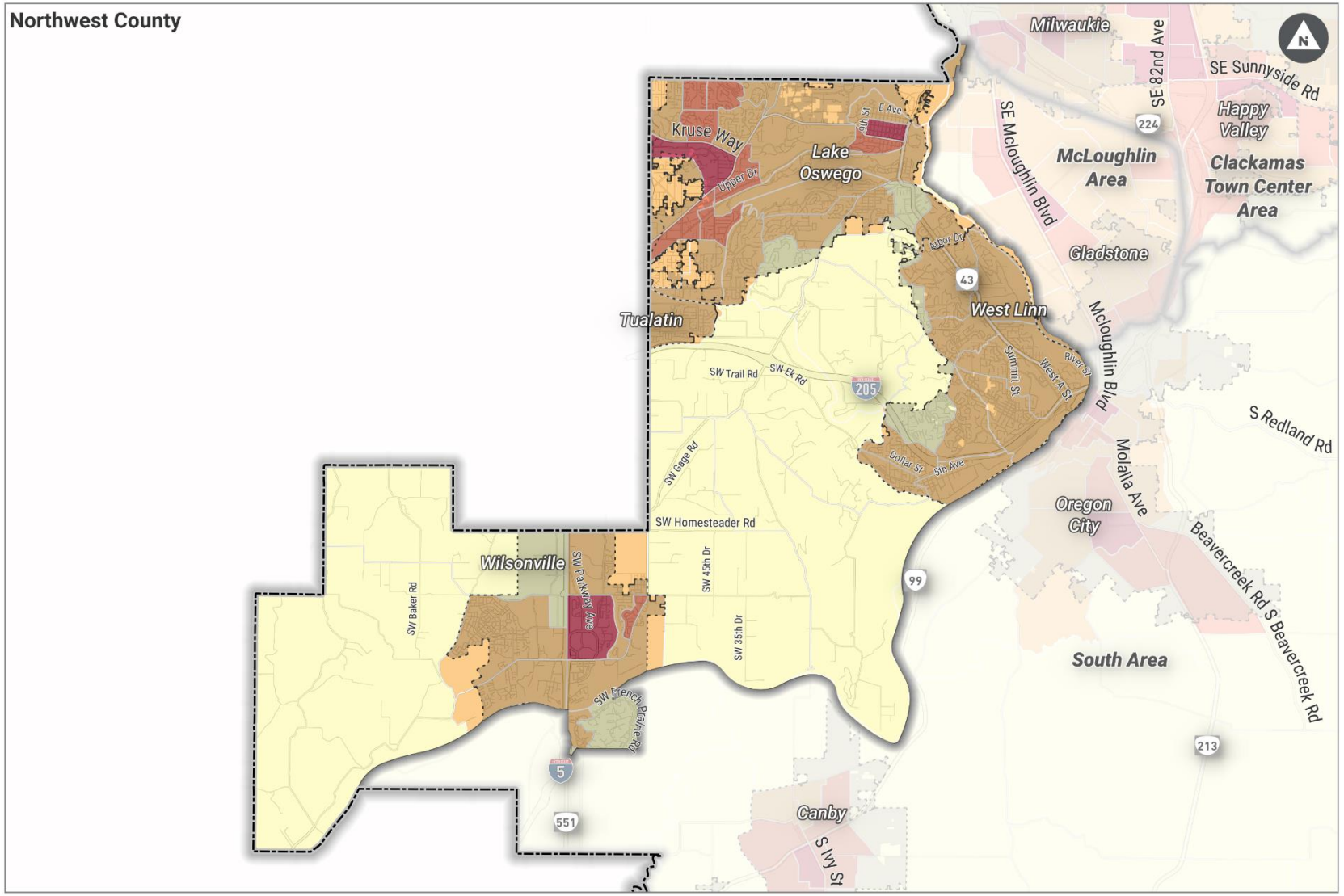
- Below county average
- County average
- Above county average
- Well above county average

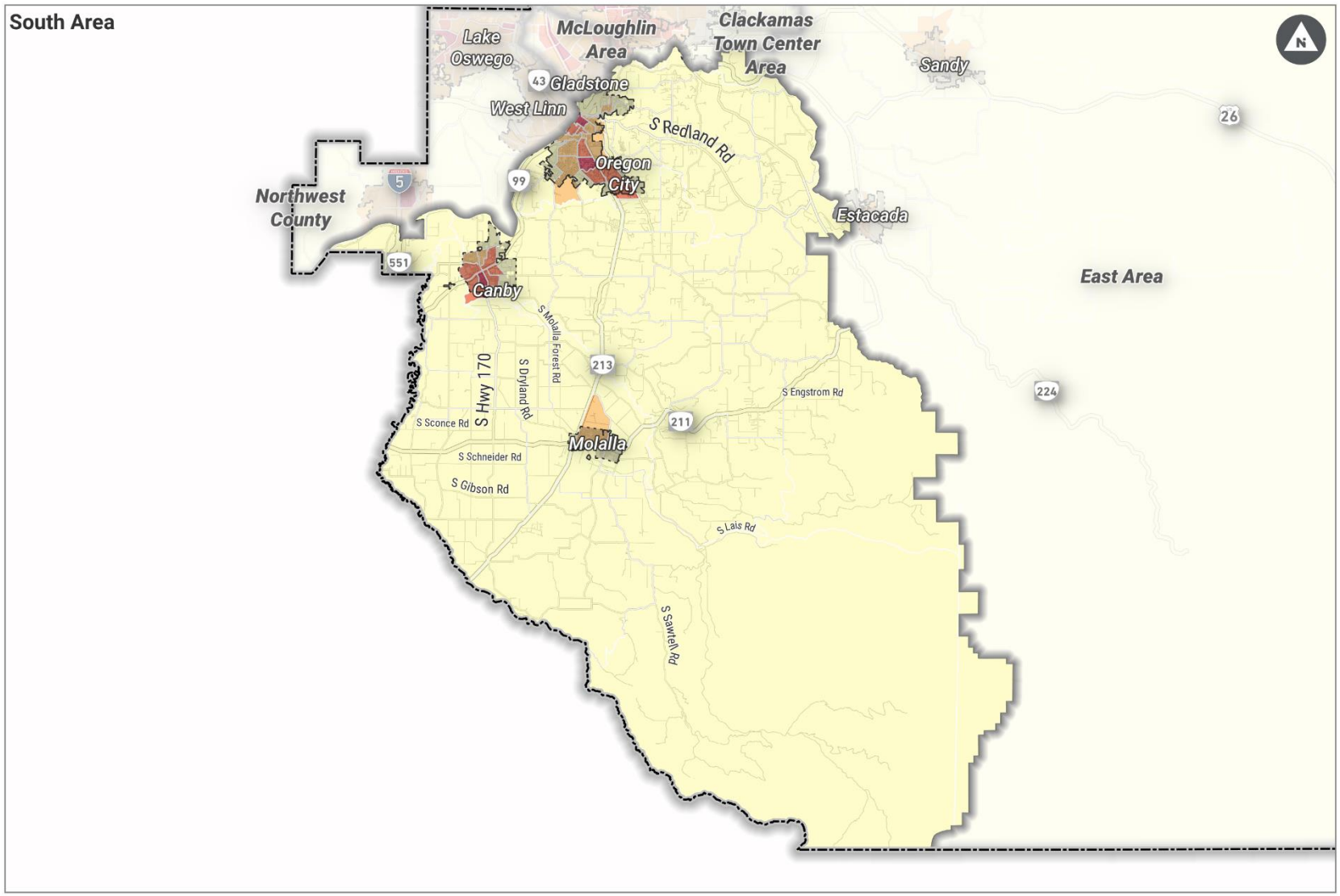
- County Boundary
- City Boundary

Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips

Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips


McLoughlin Area
Milwaukie
Happy Valley
Lake Oswego
Johnson City
Clackamas Town Center Area
Northwest County
West Linn
South Area
Gladstone
Oregon City
SE McLoughlin Blvd
SE Washington St
SE 37th Ave
SE 34th Ave
SE Railroad Ave
SE Wood Ave
SE Stanley Ave
SE Causey Ave
SE 82nd Ave
SE Fuller Rd
SE Harmony Rd
SE Sunnyside Rd
SE Sunnybrook Blvd
SE Mather Rd
SE 98th Ct
SE Park Ave
SE Nixon Ave
SE Briggs St
SE Maple Ln
SE Courtney Ave
SE Aldercrest Rd
SE Hill Rd
SE Vista Ln
SE Hager Ln
SE Risley Ave
SE View Acres Rd
SE Maple St
SE Linden Ln
SE Laurie Ave
SE Lee Ave
SE Swain Ave
SE Oetkin Rd
SE Cypress Ave
SE Clackamas Rd
SE Lark Ave
SE Norma Rd
SE Allan Rd
SE Naef Rd
SE Harold Ave
SE Concord Rd
SE Vineyard Rd
SE Gordon St
SE Mcnary Rd
SE Roethe Rd
SE Ina Ave
SE Boardman Ave
SE Cook St
SE Rose St
SE Addie St
SE Abernethy Ln
SE Hull Ave
SE River Dr
SE Meldrum Ave
SE Kay St
Crownview Dr
Cason Ln
Cason Rd
Caldwell Rd
Glen Echo Ave
Harvard Ave
E Gloucester St
E Exeter St
E Berkeley St
First St
Clinton Ave
Columbia Ave
W Exeter St
W Clarendon St
Timberline Dr
C Ave
A Ave
3rd St
N State St
Iron Mountain Blvd
South Shore Blvd
Oak St
Cornell St
Glenmorrie Dr
Old River Rd
SE River Forest Dr
S Bergis Rd
Overlook Dr
Old River Dr
Carriage Way
Willamette Dr
Pimlico Dr
Santa Anita Dr
Horton Rd
Dahl Park Rd
Main St
Apperson Blvd
Swan Ave
SW Johnson Rd
S Sweetbriar Rd
224
205
212
213
43
99
Short Vehicle Trip Density
Below county average
County average
Above county average
Well above county average
County Boundary
City Boundary
Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips


Northwest County
Milwaukie
SE Sunnyside Rd
SE 82nd Ave
Happy Valley
Clackamas Town Center Area
McLoughlin Area
SE Mcloughlin Blvd
Gladstone
Kruse Way
Lake Oswego
Upper Dr
4th St
E Ave
Alder Dr
West Linn
Tualatin
Mcloughlin Blvd
River St
Summit St
West A St
SW Trail Rd
SW Ek Rd
205
S Redland Rd
Dollar St
5th Ave
SW Gage Rd
Molalla Ave
Oregon City
SW Homesteader Rd
Wilsonville
SW Parkway Ave
SW 45th Dr
SW 35th Dr
SW Baker Rd
99
Beavercreek Rd
S Beavercreek Rd
South Area
SW French Prairie Rd
213
5
551
Canby
S Ivy St
Short Vehicle Trip Density
Below county average
County average
Above county average
Well above county average
County Boundary
City Boundary
Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips



Source: Replica, Northwest 2021 Q4 Thursday Trips, Private Auto, Carpool Mode, ≤ 3 mi Distance Trips