# Shared Transit Parking in Multifamily Developments:

# A Geospatial Analysis for King County Metro Transit

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**Abstract**

Shared Park and Ride Parking in Multifamily Developments:

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Park and rides are an integral part of the Puget Sound region transportation system. During the 4th Quarter of 2014, 20,054 park and ride spaces were used on an average daily basis, resulting in nearly 80% of the system utilized on a given day. Due to rising transit ridership and increased demand for park and ride spaces, transit agencies are pressured to build new parking facilities, which is costly and can be controversial in some neighborhoods. A new solution to this parking problem is to use existing parking in multifamily developments near good transit service as an opportunity to share parking with transit riders. This thesis constitutes a geospatial analysis to support research funded by a federal grant awarded to King County Metro Transit. This thesis employs a proximity analysis of parcels based on King County Assessor data near an Ideal Transit Service Network, created by the researcher. Recommendations of where to locate potential pilot projects are presented in groups and clusters of parcels using two methods through a series of tables and maps, spanning many jurisdictions in King County, WA. Lastly, variables for further research are highlighted that will likely influence a successful potential pilot location.

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# Acknowledgements

Thank you to my committee for their continued support and encouragement: Dr. Qing Shen, Dr. Donald Miller and Daniel Rowe. Dr. Shen and Dr. Miller have been so generous with their time which has resulted in personal and intellectual growth. I can't thank you enough!

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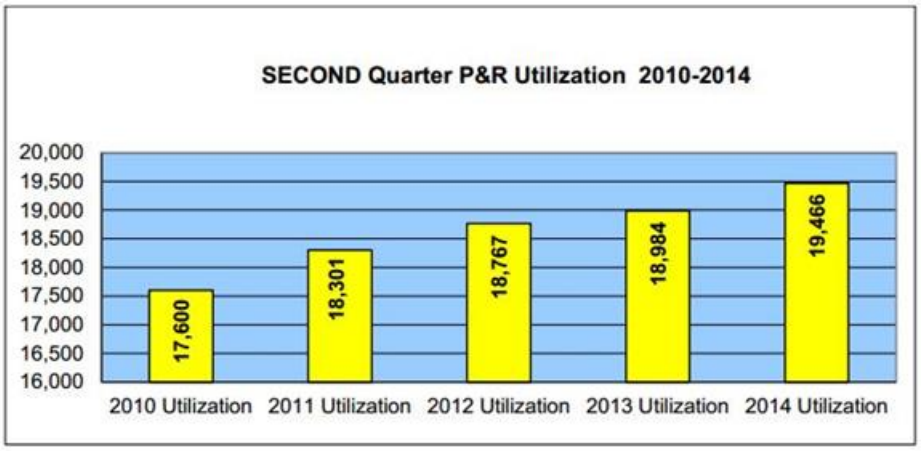
# Chapter 1: Introduction

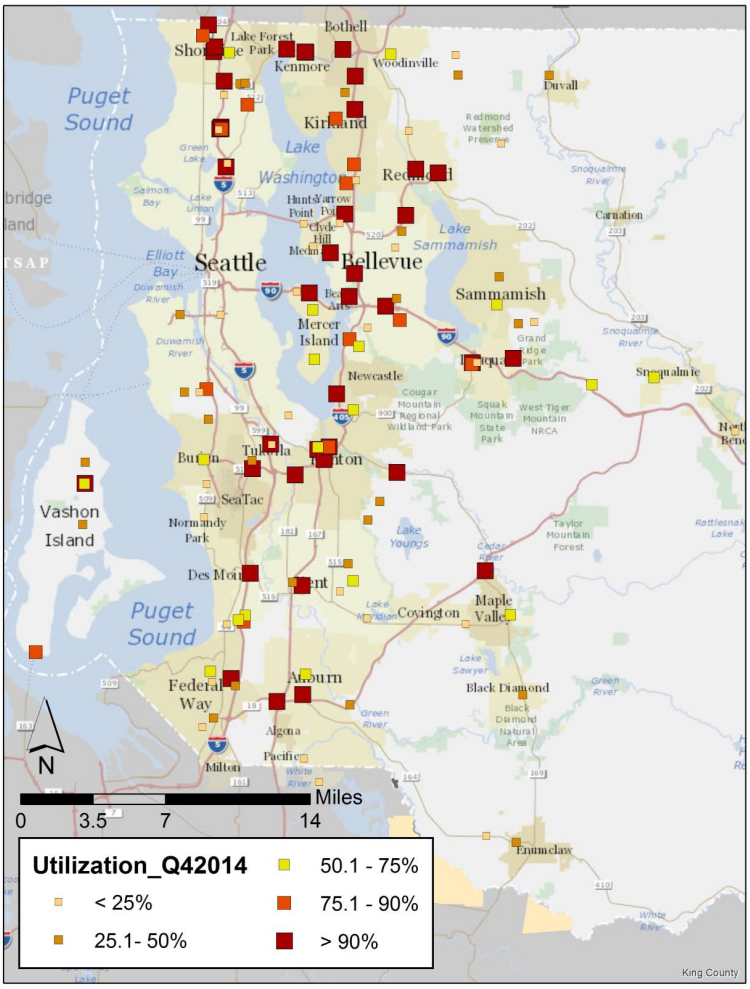
As the Puget Sound region continues to grow in jobs and population, transit ridership is increasing and parking demand has outpaced supply at many park and rides in King County. Parking is one element of land use patterns that influence the transportation system and how people move throughout a region. The utilization of King County Metro Transit's park and ride facilities has risen every year since 2010, with the largest increase in utilization from 2010 to 2011 at 4.0%, resulting in an additional 701 spaces used, see Figure 1.[1] Additionally, in the 4th Quarter of 2014, 45 out of 131 park and rides maintained ≥90% utilization rates, see Figure 2.[2] Many lots are full by 9:00am on weekdays and only allow early travelers to transfer from their cars to transit. As a solution to increasing demand, King County Metro could consider building more park and ride structures. However, building more parking is capital intensive and runs counter to creating compact, walkable communities. Existing parking in multifamily developments near good transit service provides an opportunity to share parking with transit riders. This new model could open up more parking for transit riders and increase the use and efficiency of those spaces, especially during the day when many residents commute to work with their vehicles.

Figure 1. King County Second Quarter Park And Ride Utilization Rates 2010-2014.[3]




[1] Cahan, Steve. *Park-And-Ride Utilization Report Fourth Quarter 2014*. Seattle, WA: King County Metro Transit, January 2015.http://metro.kingcounty.gov/am/reports/2014/2014-par14q4.pdf.
[2] Cahan, Steve. *Park-And-Ride Utilization Report Fourth Quarter 2014*.
[3] Ibid.

Figure 2. Fourth Quarter 2014 Utilization Of Park And Rides In King County, WA.




## Objectives and Audience

### King County Awarded Federal Grant

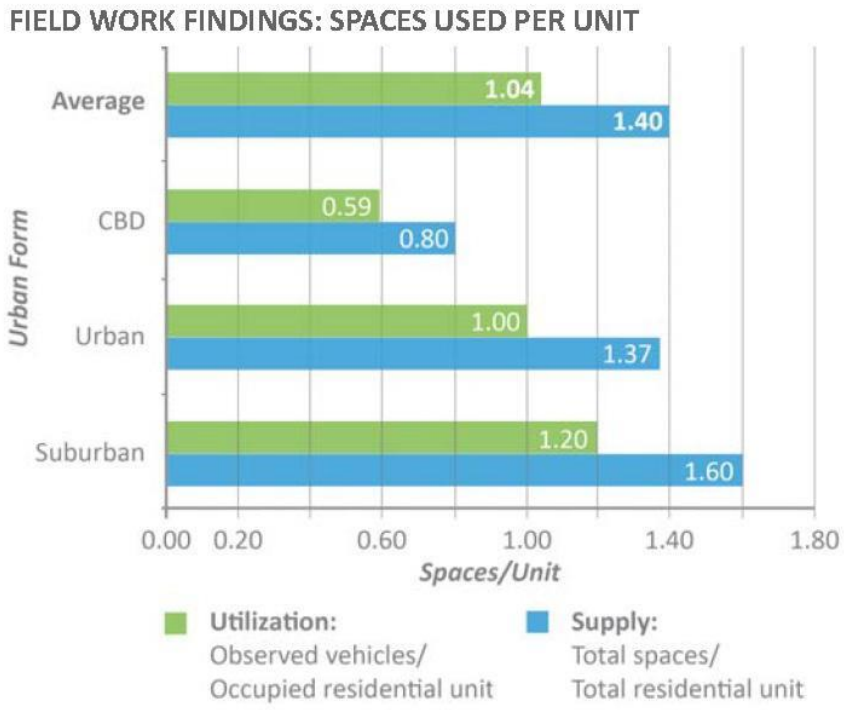
King County Metro was awarded a grant from the Federal Highway Administration (FHWA) Value Pricing Pilot Program to explore opportunities and investigate strategies for market-priced park and ride spaces in multifamily developments near high-capacity transit corridors. The grant effort, Park-and-Ride Pricing in Multifamily Developments, at King County Metro will include geospatial analysis, data collection, business model development, stakeholder interviews, and analysis of potential barriers and opportunities. Based on the conclusions from the grant research, King County Metro will test pilot programs of priced transit pricing. This thesis project completed a geospatial analysis of potential

multifamily developments and delivered recommendations to further narrow locations of potential pilot programs.

The Right Size Parking project (RSP), a project completed by King County Metro in 2014, assembled local information on multifamily residential parking demand to guide parking management policies. The project was funded by an FHWA Value Pricing Pilot Program grant in 2010, and gathered data across multifamily developments in King County. The findings of RSP are presented in a model and tool to "right size" parking by striking a balance between supply and demand.[4] RSP concluded that on average, "parking was found to be oversupplied with 1.4 spaces built per dwelling unit but used at only about 1 space per unit."[5] The rates of supply and use vary based on urban form characteristic: Central Business District (CBD), Urban or Suburban, see Figure 3. The oversupply of parking in multifamily developments could be shared with transit users as available park and ride spaces. Along with excess supply, additional parking in multifamily developments may be open during the day as some residents drive their cars to work.

[4] Rowe, Daniel. *Right Size Parking Project One-Page Description*. King County Metro Transit, February 2–13, 2013.http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/rsp-one-pager-generic-2-20-13.pdf.
[5] Rowe, Daniel. *Right Size Parking: Tools To Balance Supply*. Abstract. Seattle, WA: King County Metro, February 20, 2013. http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/rsp-one-pager-generic-2-20-13.pdf.

Figure 3. Right Size Parking Data Collection: Utilization And Supply.




## Thesis As Part Of Research Funded By Federal Grant

The results of this thesis project were submitted to King County Metro as part of King County's Park-and-Ride Pricing in Multifamily Developments FHWA grant. King County is interested in providing local jurisdictions with tools to encourage transit-supportive land uses. Progressive parking management strategies can help get more commuters out of their cars and into transit.

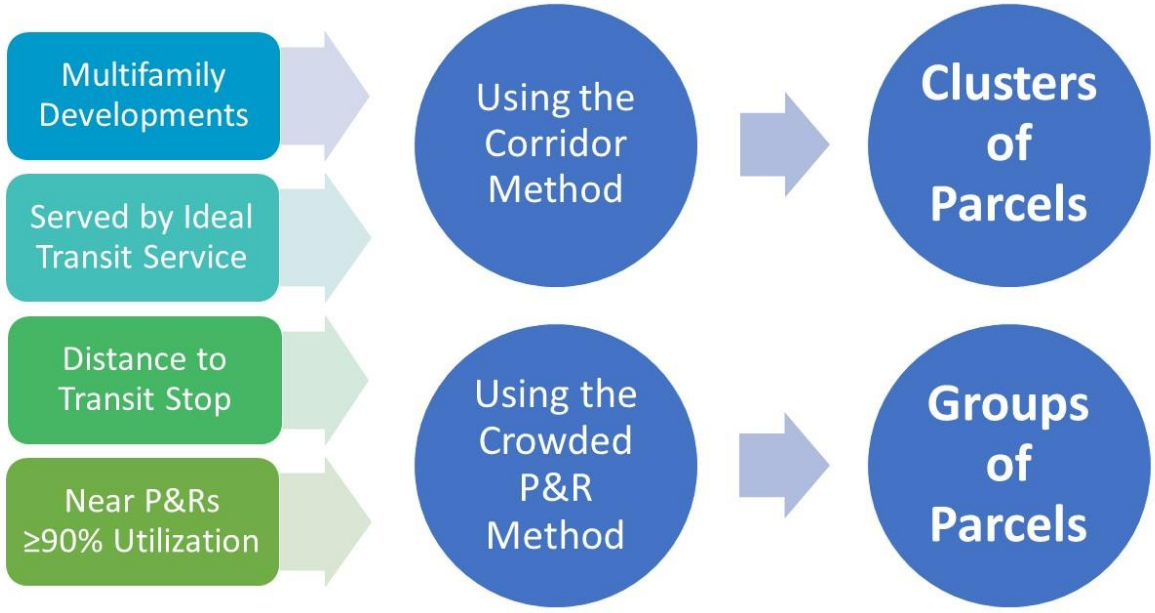
This thesis project completed a geospatial analysis of potential multifamily developments and delivered recommendations to further narrow locations of potential pilot programs. While the grant effort will attempt to identify and capture all relevant variables related to commute behavior, this thesis focused on four criteria:

- Defining Multifamily Developments as Assessor Parcels
- Creation of an Ideal Transit Service Network

- Selecting Parcels near Stops on Ideal Transit Service Network
- Selecting Parcels near Park and Rides at ≥ 90% Utilization Rate

The criteria included in this analysis involved secondary spatial data and included input from planning professionals, academic literature and King County Metro, see Figure 4. From the criteria, two methods, the Corridor Method and the Crowded P&R Method, were employed to select Clusters of Parcels and Groups of Parcels. The selection of parcels are potential areas of opportunity to be further analyzed to select sites for pilot projects. The thesis geospatial analysis was delivered to King County Metro and supports further analysis to identify the locations of pilot programs by undergoing parking supply estimation, on-street parking restrictions, jurisdictional code and other filters.

Figure 4. Conceptual Model For Shared Transit Parking In Multifamily Developments Thesis



## Background of the Park and Ride System in King County

As of July 2014, King County Metro Transit operates 130 park and ride facilities within its service area, totaling 25,512 parking spaces, where users can drive from their home to a parking space and transfer to transit.[6] Of these facilities, 64 are permanent lots owned and operated by King County Metro (see Figure 5) and 66 lots, about 10% of total spaces, are leased from, or donated by, private or other municipal owners, see Figure 6. Due to peak demand on Sundays and low demand during the workdays, the most common example of a leased lot is a church parking lot. Lease lots are a good example of shared transit parking with another use. Quarterly park and ride reports are published on the King County Metro website from the Transit Route Facilities Group with detailed capacity, utilization rates, and current construction projects.[7]

Figure 5. Example Of A Permanent Park And Ride Owned And Operated By King County Metro: South Kirkland Park And Ride.[8]

[6] Cahan, Steve. *Park-And-Ride Utilization Report Second Quarter 2014*. Seattle, WA: King County Metro Transit , July 2014.http://metro.kingcounty.gov/am/reports/2014/2014-par14q4.pdf.
[7] Ibid.
[8] wtblog225. "Sharing Lessons and Successes from SKTOD." *A Breath of Fresh Air - Weber Thompson*, October 23, 2013.http://www.weberthompson.com/blog/2013/10/sharing-lessons-and-successes-from-sktod/.

Figure 6. Example Of A Leased Lot Park And Ride Operated By King County Metro: Aurora Church Of The Nazarene In Shoreline, WA.[9]


Park and ride facilities operated by King County Metro currently do not charge fees for parking. Some lots have electric vehicle spaces. Many permanent lots have bike parking: lockers for rent on-demand or monthly, or first-come-first served bike racks, without any security measures.[10]

Metro has considered pricing some or all parking at its park and ride lots in the past, with the most recent feasibility study report in April 2006. The report, requested by the King County Council, considered the capital and administrative costs of a fee collection system, potential revenue streams to defray maintenance and security costs at the lots, and the potential effect on transit ridership.[11] Two principle reasons for pricing parking stated in the report were to increase revenue and/or manage

[9] "N 175th St., Shoreline, Washington Street View - Aug 2011." Search Engine. *Google Maps*, August 2011. https://www.google.com/maps/@47.7560374,-122.335933,3a,37.5y,62.66h,84.28t/data=!3m4!1e1!3m2!1sys-odOGt-E5Svcf2JFFATA!2e0!6m1!1e1?hl=en-US.
[10] "Park & Ride Information." Government Website. *King County Metro Online*, 2014. http://metro.kingcounty.gov/tops/parknride/.
[11] Sims, Ron to The Honorable Larry Phillips, Chair, King County Council. "Pay to Park Proviso Transmittal," May 1, 2006.

demand.[12] A variety of policy implications and customer impacts are discussed in the feasibility report. The report noted that charging at park and rides in other regions in the nation works best for rail, express bus, or bus rapid transit service.[13] Their analysis was run for four different pricing scenarios: 1) All lots in King County including lease lots; 2) lots that are owned by Metro or included contributions from Metro and others; 3) lots with more than 250 stalls; and 4) lots with more than 250 stalls that are at 80% or more capacity.[14] The recommendations out of Metro's 2006 pricing feasibility report were against a pricing program. Ron Sims, King County Executive in 2006, concluded that increased revenue from a pricing scheme would be at the expense of transit ridership. In addition, Sims stated numerous problems that pricing management would raise with Metro's regional partners: up-front investment, equity and social justice issues between subareas and rider groups, adverse impacts to surrounding neighborhoods, and depressed ridership.[15] In 2006, the time was not right to consider parking management strategies at King County Metro park and rides, but renewed interest in parking management pilots from other transportation agencies in the region signal a shift in current thinking. Discussion of other transportation agencies' recent studies on parking management strategies at their park and rides continues in the Literature Review Chapter.

[12] Sims, Rob to The Honorable Larry Phillips, Chair, King County Council. "Pay to Park Proviso Transmittal."
[13] Desmond, Kevin. Feasibility of Instituting Parking Fees at Metro Park & Ride Lots - April 2006. King County Metro, April 20, 2006, 1.
[14] Sims, Rob to The Honorable Larry Phillips, Chair, King County Council. "Pay to Park Proviso Transmittal."
[15] Ibid.

# Chapter 2: Literature Review

Planning for parking is becoming an increasingly important element of transportation planning. Every vehicle trip results in a parking space and the average personal car spends about 95% of its life parked.[16] Parking management strategies, like other forms of transportation management, can result in more efficient use of parking resources and tactics can take the form of managing supply or managing demand.[17] Parking supply management strategies can include: increasing the supply of parking by building more, Shared Parking or increasing number of people per parked vehicle. Parking demand management strategies can include: market pricing, regulated parking, unbundled parking from rent or lease, commute trip reduction programs, non-motorized improvements or transit improvements. Parking management strategies are evolving with the advent of new technology, and the above list is not exhaustive. In the pages that follow, select strategies of parking management are examined as applicable to this thesis project and King County Metro's Park and Ride in Multifamily Developments Grant.

Public parking at park and rides is in short supply, and privately owned parking near these facilities is available and underutilized. Building more park and rides is expensive and controversial in some neighborhoods. One method of supply management is shared parking, a way to increase the efficiency of a single parking space that can serve more than one land use, effectively increasing the supply of parking without building more.

[16] Shoup, Donald. *The High Cost of Free Parking*. Chicago: Planners Press, 2005: 6.

[17] Litman, Todd. *Parking Management: Strategies, Evaluation and Planning*. Victoria, British Columbia: Victoria Transport Policy Institute, November 5, 2013: 2.http://www.vtpi.org/park_man.pdf.

## Supply Management

### What is shared parking?

Shared parking is not a new idea. Congested downtowns with varied land uses have been sharing parking informally among different uses and times since the advent of the automobile. The Urban Land Institute defines shared parking as a parking space that can serve two or more individual land uses. Shared parking can be achieved when two adjacent or nearby uses have varying peak demand, as a result of different activity patterns.[18] At the time of writing, shared parking between transit park and ride and residential uses is not currently in operation by a U.S. transit agency outside of new building through transit-oriented development. Initial stakeholder interviews with local parking operators, conducted by the King County Project Team, suggest that operators will share residential parking with any use if given the business opportunity by a property manager or developer and if there is revenue potential. This thesis and King County Metro's Park-and-Ride Pricing in Multifamily Developments grant attempt to close this knowledge gap with research and potential pilot projects.

Historically, planning for parking is based on a single-use of the development as outlined in local zoning codes. Many developers recognize the efficiencies of shared parking, but outside of transit oriented development, most zoning codes do not address shared parking explicitly. Instead, many jurisdictions outline parking minimums for single land uses. Parking minimums are an attempt to address peak parking demand for a land use, but are often based on dated, context-general parking surveys with small sample sizes. Sometimes parking minimums are based on neighboring jurisdictions' code. This can leave communities with largely overstated parking requirements, and parking lots that are half empty. An overabundance of parking degrades the pedestrian environment and runs counter to compact, mixed-use development. As Donald Shoup articulates, "off-street parking requirements thus change the way

[18] Shared Parking: A Study Conducted Under The Direction of ULI - The Urban Land Institute by Barton-Aschman Associates. Washington D.C.: Urban Land Institute, 1983: 3.

we build our cities, the way we travel, and how much energy we consume."[19] The emergence of mixed land uses and multi-use developments underscores the need to plan for shared parking.[20] Instead of devoting a parking lot to a single use or building, complementary land uses can optimize parking efficiency and share spaces.[21]

Peak parking demand can vary by hour, by day or seasonally. A classic example of shared parking is between an office and a cinema. Parking demand for office workers peaks during the day on weekdays, while parking demand for a cinema peaks in the evenings and on weekends. By sharing parking between the office and cinema, the gross number of parking stalls required can be reduced. Shared parking is a fundamentally efficient idea; one space can be used more hours per week.[22]

The Urban Land Institute completed a survey in the 1980s to document the effects of shared parking on total number of parking spaces needed. The results indicate a reduced number of parking spaces required to serve peak activity periods. "Estimating the overall parking demand for a mixed-use development simply by adding the peak parking demand for individual land uses produces an estimate that is too high."[23] Shared parking can operate efficiently at a number below the sum of the capacity needed for different uses peak periods.

Many factors can influence the demand for parking in a certain development: land use and intensity, size, security and design of the parking spaces, parking fees, congestion pricing, parking that is surface, underground or structured, surrounding levels of transit service, presence of non-motorized

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[19] Shoup, Donald. *The High Cost of Free Parking*. Chicago: Planners Press, 2005: 3.
[20] Shared Parking: A Study Conducted Under The Direction of ULI - The Urban Land Institute: 4.
[21] Kodransky, Michael. *What Is Shared Parking?* New York: Institute for Transportation & Development Policy, December 12, 2014: 1. https://www.itdp.org/shared-parking/.
[22] Shared Parking: A Study Conducted Under The Direction of ULI - The Urban Land Institute: 59.
[23] Shared Parking: A Study Conducted Under The Direction of ULI - The Urban Land Institute: 40.

infrastructure, income levels and mode-split of population.[24] Understanding the existing conditions of an area for shared parking is important to the success of parking management.

## Shared Parking at a Retail Center

Numerous examples exist of shared park and ride spaces with commercial or non-residential uses (retail centers, recreation centers, churches, theaters), with very few examples of shared transit - residential spaces outside of transit-oriented development.

In the past, transit agencies perceived shared parking in retail centers as a mutual benefit; shared parking brings additional customers to retail and additional riders to transit. However, retail managers worry that commuters are taking parking from potential shoppers during the day, while increasing the risk for property damage and vandalism.[25]

A study by Francis Wambalaba at University of South Florida in 2004 developed a survey to document economic benefits of shared use park and ride facilities located at commercial retail centers. Wambalaba designed the survey to administer to park and ride users at retail center shared park and ride locations, smaller park and ride retail locations and at locations for special event shuttle service to football games/medical center.[26] The survey asked questions to find out user spending habits at businesses located nearby, alternative mode choices the users considered, and how often this location was used. He reported that 83.5% of 249 users who responded rated how beneficial the availability of a park and ride had been as "very beneficial," and that 69% of 68 respondents from the smaller park and rides shopped at the shopping center at least once a week when using the park and ride, along with slightly lower percentages for hospital and football game shuttle park and rides.[27] Wambalaba's results

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[24] Shared Parking: A Study Conducted Under The Direction of ULI - The Urban Land Institute: 6.

[25] Wambalaba, Francis, and Juile Goodwill. *Public Transportation Research Study: Evaluation of Shared Use Park and Ride Impact on Properties*. National Center for Transportation Research, Center for Urban Transportation Research: University of South Florida, April 2004: vi.

[26] Wambalaba, Francis, and Juile Goodwill. *Evaluation of Shared Use Park and Ride Impact on Properties*: vii-x.

[27] Wambalaba, Francis, and Juile Goodwill. *Evaluation of Shared Use Park and Ride Impact on Properties*: ix.

show that the additional people frequenting the site for park and ride increased the shopping centers' customer base and enjoy the convenience of park and ride spaces at a retail center, but that other incentives are needed for private owners of parking to share with transit customers.

## Demand Management

### Locations Where Demand is High

Nationally, parking demand is high at airports, employment centers, and transit park and ride facilities due to several factors: record level air travel, large interest in attending downtown events, and the desire for commuters to avoid delays by switching to transit at opportune points along their route during the trip.[28] At park and ride lots specifically, the problem involves:

- Commuters searching for a parking spot under the pressure of making a commuter bus or train departure
- Commuters who are intermittently unsuccessful in finding a spot, and end up on the freeway or arterial and drive all the way to work
- Commuters who consistently cannot find parking and ultimately give up on using transit, resulting in additional congestion[29]

Better management of the current parking supply near good transit service is one potential solution. Additionally, access to good parking system information must be a part of any solution.

### Priced Parking

The logical end of every driving trip is a parking spot and Americans do not pay for parking in 99% of all trips.[30] Instead of motorists paying directly for parking, often the cost of residential parking is bundled into other costs, concealing the true cost in rent, mortgage or other fees. The costs are paid by the

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[28] Paniati, Jeffrey. *Advanced Parking Management Systems: A Cross-Cutting Study*. Washington, DC: Federal Highway Administration, January 2007: 3-1. http://ntl.bts.gov/lib/jpodocs/repts_te/14318_files/14318.pdf.
[29] Paniati, Jeffrey. *Advanced Parking Management Systems: A Cross-Cutting Study*. 3-2.
[30] Shoup, Donald. "Instead of Free Parking." *Access Magazine: University of California*, November 15, 1999: 8.

consumer in a variety of ways, but often it is not clear how much parking costs. In a sense, everyone pays for parking, whether driving or not. "Building the cost of parking into higher prices for everything else skews travel choices toward cars and away from public transit, cycling and walking."[31]

Over the years, planners have diagnosed the parking problem as a shortage of supply, instead of a solution to manage demand. By charging too low a price for on-street parking, drivers are rewarded for wasting time and fuel circling the block when they eventually find an open on-street space. While searching for an open curb space, drivers are also contributing to local congestion.[32] Donald Shoup has brought attention to this phenomenon known as "cruising for parking," in his 2005 book, *The High Cost of Free Parking*. Many cities do not see the parking supply as a market that can be managed by pricing, and instead impose a distorted market by requiring amounts of off-street parking in excess of demand, which drives the price lower. "Rather than charge market prices for on-street parking, cities insist on ample off-street parking for every land use. As a result, most of us drive almost everywhere we go."[33] In addition, on-street parking often offers the most convenient spaces for urban retail shoppers, and this resource could be priced accordingly to increase turnover and utilize many shoppers in a given day. "Improved technology will increase fuel efficiency and reduce pollution emissions, but technology alone is unlikely to solve the parking problem."[34]

## Recent Local Transit Parking Management Studies

### WSDOT Report on Maximizing Efficiency and Increasing Occupancy

In June of 2014, the Washington State Department of Transportation (WSDOT) published a report completed by The Pennsylvania State University Transportation Institute to provide King County Metro Transit and Sound Transit "with more detailed information on the use of the 17 busiest park and ride

[31] Shoup, Donald. *The High Cost of Free Parking*. Chicago: Planners Press, 2005: 3.
[32] Shoup, Donald. *The High Cost of Free Parking*. Chicago: Planners Press, 2005: 7.
[33] Shoup, Donald. *The High Cost of Free Parking*. Chicago: Planners Press, 2005: 8-9.
[34] Shoup, Donald. *The High Cost of Free Parking*. Chicago: Planners Press, 2005: 6.

facilities in the Central Puget Sound Region."[35] The study gathered park and ride utilization information and customer intercept surveys on trip purpose, origin-destination pairs, mode used to arrive at the park and ride, reasons for using park and rides, and reactions to potential parking management strategies. WSDOT acknowledged that many park and rides in the Central Puget Sound Region are crowded and operating at or near capacity, which may require parking management strategies to serve high demand for parking with a limited number of stalls.[36]

The primary data collection yielded findings that could be used to inform and evaluate potential parking management strategies at park and rides. Findings from the on-site audit of 10 facilities included the average occupancy of parked vehicles tended to be very close to 1 person per vehicle, "the values ranged between 1.02 and 1.10 persons per vehicle on average across the 10 lots audited."[37] This means that most people who drive to park and rides drive alone and there is an opportunity for increasing the ratio of people per car by offering incentives to carpool.

About one-half of survey respondents are willing to pay a fee to park at park and rides if guaranteed spaces could be provided, and about one-fourth of respondents are willing to pay for a guaranteed space 10-15 minute walk away, see Table 1.[38] Of those users willing to pay, they are willing to pay the same amount for a non-guaranteed space at the park and ride as for a guaranteed space located 10-15 minute walk away, see Table 2.[39] This indicates that some users are willing to pay for the certainty of a guaranteed space, even if it is not immediately next to the transit stop. Setting the price appropriately would likely also be important.

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[35] Gayah, Vikash, Krae Stieffenhofer, Venky Shankar, and Michael Flood. *How Can We Maximize Efficiency and Increase Person Occupancy at Overcrowded Park and Rides?* Final Research Report. Washington State Department of Transportation, June 2014: vi.
[36] Ibid.
[37] Ibid.
[38] Gayah, Vikash, et. all. *How Can We Maximize Efficiency and Increase Person Occupancy at Overcrowded Park and Rides?*: viii.
[39] Ibid.

Interestingly, a stated interest survey completed in 1998 at King County park and rides found that 35% of survey respondents said they would pay $2 per day for increased capacity and security at the most crowded lots.[40] Although capacity and security was deemed the most important, the survey also found that park and ride users would like to see other amenities close by to the park and ride, which included coffee shops, dry cleaning and car services.[41] Other data from an FHWA report highlight park and ride customer preferences. As stated in the report, "people in a hurry want to know the answers to three main questions: 'Where are parking facilities close to my destination?', 'Is there an open spot in the facility I choose?', and 'How much is this going to cost me in time and parking fees?'"[42] In some scenarios park and ride users reported that they are willing to pay for a spot if it included certain amenities and transit to their final destination. Testing out new parking management strategies as pilot projects can provide transit agencies with information on what works and what does not.

Table 1. Fraction Of Survey Respondents Willing To Pay For Parking, WSDOT 2014 Study.

| *Fraction willing to pay for…* | *Train* | *Bus* | *Both* | *All* |
|---|---|---|---|---|
| **Parking space** | 27.9% | 28.4% | 25.1% | 28.0% |
| **Guaranteed space at lot** | 43.4% | 46.8% | 43.4% | 45.7% |
| **Guaranteed space 10-15 min. walk away** | 29.9% | 27.5% | 21.4% | 27.6% |

[40] Gayah, Vikash, et. all. *How Can We Maximize Efficiency and Increase Person Occupancy at Overcrowded Park and Rides?*: 9.
[41] Ibid.
[42] Paniati, Jeffrey. *Advanced Parking Management Systems: A Cross-Cutting Study*. 3-1.

Table 2. Of Those Willing To Pay, Summary Statistics For Maximum Amount, WSDOT 2014 Study.

| *Willingness to pay for…* | *Train* | *Bus* | *Both* | *All mean (st. dev)* |
|---|---|---|---|---|
| **Parking space** | $1.497 | $1.487 | $1.659 | $1.501 ($0.960) |
| **Guaranteed space at lot** | $1.886 | $1.810 | $1.788 | $1.825 ($1.264) |
| **Guaranteed space 10-15 min. walk away** | $1.518 | $1.527 | $1.611 | $1.530 ($1.011) |

## Sound Transit Parking Management Pilots

In 2014-2015, Sound Transit began three parking management pilot projects, in response to crowded conditions at park and rides. The purpose of the pilot projects is to "increase the number of transit riders per parking stall, improve efficiency in use of transit facilities and services, and improve customer satisfaction."[43] The pilots are implementing parking permits, rideshare incentives and real-time parking availability monitoring.[44]

The Permit Parking Pilot was completed in 2014 at four different sites, see Table 3. The Permit Parking Pilot dedicated 25% of available park and ride spaces for permit at selected sites. On weekdays only, permits were offered to carpools at $5/quarter and single-occupancy drivers at $33/quarter for two quarters in 2012. The remaining 75% of spaces at the locations continued unmanaged as a first-come first-served basis, with unpermitted drivers able to park in managed stalls after 10 am. Over 500 people were selected to participate from 1,400 submitted permit applications, indicating a strong interest in managed spaces at crowded park and rides.[45]

Sound Transit considers the 2014 parking permit project a success in gathering valuable information from park and ride customers. The Rideshare Collaboration Pilot and Real-time Parking Availability

[43] Office of Planning and Development. *Parking Management Pilot Project: Draft Evaluation Report*. Seattle: Sound Transit, April 1, 2015: i.
[44] Ibid.
[45] Ibid.

Information Pilot remain ongoing at the time of writing. After the completion of the other pilots, Sound Transit aims to implement system-wide parking management in 2016, which may include a combination of permit pricing, rideshare incentives and real-time information. A number of questions regarding enforcement, scope, price level, privacy and coordination with other regional agencies remain unanswered, which the Sound Transit Board will need to consider.[46] Other park and ride owners in the region, King County Metro, WSDOT and perhaps operators in Snohomish and Pierce counties, will need to consider parking management strategies at their park and rides and how best to coordinate across the region.

Table 3. Locations And Transit Service Of Sound Transit Parking Permit Pilot.[47]

| Location | Parking Spaces | Lot Type | Transit Service |
|---|---|---|---|
| **Issaquah Transit Center** | 819 | Structure | ST Express bus, Metro bus |
| **Mukilteo Station** | 63 | Surface | Sounder commuter rail |
| **Sumner Station** | 343 | Surface | Sounder commuter rail, ST Express bus |
| **Tukwila Int'l Blvd Station** | 600 | Surface | Link light rail, Metro bus |

[46] Office of Planning and Development. *Parking Management Pilot Project: Draft Evaluation Report*: ii.
[47] Office of Planning and Development. *Parking Management Pilot Project: Draft Evaluation Report*: i.

# Chapter 3: Methodology

## Proximity Geospatial Analysis: Locating Areas of Opportunity

To recommend locations of parcels to the King County Metro project team for further analysis, critical criteria were applied to existing conditions data to map potential areas of opportunity. Multifamily Developments were defined by selected present use codes from King County Assessor Data, an Ideal Transit Service Network was constructed from select routes that deliver express or frequent transit service, distance to transit stops was calculated as potential distance to walk from parking space to transit stop, and the distance to crowded park and ride was calculated to find nearby multifamily developments.

A suite of ArcGIS feature tools were employed to highlight areas of opportunity to discover proximity relationships.[48] Buffer, Select by Attribute and Select by Location were used to answer the research question: Which multifamily parcels are near ideal transit stops or crowded park and rides?

## Criterion 1: Definition of Parcels as Multifamily Developments

At the county-level, spatial and assessor data for multifamily developments is maintained in a tax parcel layer by the King County GIS Data Portal with current information maintained by the King County Assessor's Office. The parcel layer, a vector feature class, was used as a base layer to join other attribute tables based on the Parcel Identification Number (PIN), which is a ten character unique identifier.[49] The parcel layer used in this analysis was last updated by King County in 2014. Through the use of the parcel layer, the Assessor's Office provided relevant spatial, present-use, and building characteristics for the mapping analysis.

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[48] "ArcGIS Help 10.1: Proximity Analysis." *ESRI: ArcGIS Resources*, October 29, 2012.http://resources.arcgis.com/en/help/main/10.1/index.html#//018p00000007000000.
[49] Most, Christine. "GIS MetaData Parcel." King County GIS Data Portal. *KCGIS Center*, April 3, 2015.http://www5.kingcounty.gov/gisdataportal/Default.aspx.

Applying the assumption that multifamily developments can be identified through corresponding parcels, criteria for multifamily present use codes were applied to the entire King County Parcel layer to select a total of 10,956 parcels. The parcel layer, *parcel.address*, was joined with the Accessory Record Description table, *EXTR_LookUp.csv*, or any available parking formation.[50] Through the King County Department of Assessments, complete parking information is usually available and up to date for condominium developments. Parking information tends to be incomplete for multifamily rental developments, and usually tenants are not allowed to sell their parking space if it is bundled with their dwelling unit. Owners of a condominium parking stall are able to sell or rent their space as the owner. The present use categories selected for locating areas of opportunity are found in Table 4. Apartment and condominiums are at the core of the term "multifamily." The researcher elected to include retirement facilities and nursing homes as these buildings tend to build excess parking for visitors and mobility-impaired patients. According to *Parking Generation* by the Institute of Transportation Engineers, Land Use 255: Continuing Care Retirement Community supply an average parking ratio of 1.3 spaces per dwelling unit, with average peak period parking demand of 1.0 vehicles per dwelling unit.[51] The oversupply of parking in *Parking Generation*'*s* Land Use 255 is consistent with Right Size Parking findings; that on average, King County multifamily developments tended to be oversupplied with parking providing 1.4 spaces per unit while utilization averaged 1.0 spaces per unit.[52] A rooming house, as defined by a Sightline Daily article, is similar to living in a residential hotel, with small private bedrooms and shared bathrooms down the hall.[53] Present use codes not included in this project, but may be still considered multifamily developments in some contexts, are listed in Table 5.

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[50] Ibid.
[51] Institute of Transportation Engineers. *Parking Generation*. 4th Edition. Washington D.C., 2010: 70-72.
[52] Rowe, Daniel. *Right Size Parking: Tools To Balance Supply*. Abstract. Seattle, WA: King County Metro, February 20, 2013.http://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/rsp-one-pager-generic-2-20-13.pdf.
[53] Durning, Alan. "Rooming Houses: History's Affordable Quarters."*Sightline Daily*, November 14, 2012. http://daily.sightline.org/2012/11/14/rooming-houses-historys-affordable-quarters/.

Next, from the parcel layer of multifamily developments a selection was made of developments with ≥20 units. The researcher noted that there could be a certain size development where a pilot project would work best. Twenty units was selected based on input from the King County Project Team and stakeholder interviews. During the interviews with property managers, developers and parking operators, the team heard that there must be a revenue-generating incentive to take on extra management and liability to share parking with transit riders. While a twenty unit minimum estimation lacks precedent in the literature, this thesis and completion of the grant effort will shed light on minimum number of units for this program to be successful. The MF Base Layer contains 10,956 parcels and the MF >20 Layer contains 2,477 parcels, see Table 6. This 77% decrease in the number of parcels based on a selection of Total Units in the attribute table is not entirely due to the true number of units. In the MF Bayer Layer, 4,016 parcels contained null values in the Total Units attribute, and 406 parcels listed 0 in the Total Units attribute. A total of 4,422 parcels contained null or 0 values in the Total Units attribute. This is likely due to multifamily developments straddling more than one parcel, but could also be due to data error in gathering or recording by the King County Department of Assessments. Spot checks of the parcels containing null or 0 values in the Total Units attribute revealed that many share a property line with a parcel that contains a value of ≥1 in the Total Units attribute, crediting the first suspicion. See Figures 7 and 8, at the end of this chapter for reference.

Table 4. Present Use Codes Selected For Parcel Analysis As Multifamily Developments.

| Present Use, CODE_NUMBE | Description | # of Parcels |
|---|---|---|
| 11 | Apt | 6114 |
| 16 | Apt (Mixed Use) | 1146 |
| 17 | Apt (Co-op) | 44 |

| | | |
|---|---|---|
| 18 | Apt (Subsidized) | 128 |
| 20 | Condo (Residential) | 2791 |
| 25 | Condo (Mixed Use) | 296 |
| 49 | Retirement Facility | 166 |
| 59 | Nursing Home | 59 |
| 341 | Rooming House | 212 |
| Total Number of Parcels: | | 10,956 |

Table 5. Present Use Codes Not Included In The Analysis.

| Present Use, CODE_NUMBE | Description |
|---|---|
| 3 | Duplex |
| 4 | Triplex |
| 5 | 4-Plex |
| 29 | Townhouse Plat |
| 38 | Mobile Home Park |
| 48 | Condominium |
| 51 | Hotel / Motel |
| 56 | Residence Hall / Dorm |
| 57 | Group Home |
| 58 | Resort / Lodge / Retreat |

| | |
|---|---|
| 272 | Historic Property (Residence) |
| 301 | Vacant |
| 340 | Bed & Breakfast |
| 342 | Fraternity / Sorority House |

Table 6. Number of Parcels in Base Layer And ≥20 Units Layer.

| Name Of Layer | Description of Layer | # of Parcels |
|---|---|---|
| MF Base Layer: Pres_Use_MF_6 | Base Layer of the present use code selection, see Table 5. | 10,956 |
| MF Base Layer Null | Base Layer with null or 0 values in Total Units. | 4,422 |
| MF Base Layer Not Null | The Base Layer less all null and 0 values in Total Units. | 6,534 |
| MF ≥20 Layer: Pres_Use_MF6_20 | A selection from the Base Layer of parcels with value ≥20 in Total Units. | 2,477 |

## Criterion 2: Ideal Transit Service Network

Before parcels can be considered as a good a location for commuters to switch modes to transit, a transit service network must be spatially constructed. The Ideal Transit Service Network (Ideal Network) is based on the assumption that potential and current park and ride users would generally prefer to utilize routes that operate express service to major employment centers during peak travel periods. Many of the routes selected for the Ideal Network are competitive with driving due to peak period congestion and the use of High-Occupancy Vehicle lanes on highways. The Ideal Network is composed of

select routes serving King County which includes buses, light rail, commuter rail, and streetcar. Routes included in the Ideal Network are all routes not-local or not-hourly and spend the vast majority of the route in King County. Because King County Metro classifies corridors by service family, and does not classify individual routes, the same criteria for corridor service family was applied to individual routes to arrive at the Ideal Network. King County Metro lists corridor service families in the 2014 Service Guidelines Report as Very Frequent, Frequent, Local, Hourly and Peak based on frequency, days of service and hours of service, see Table 7. In addition, King County Metro Online maintains an online trip planning tool to search routes by number and lists route frequency, which was used to classify routes, by the researcher.[54] If a route could not be clearly classified, it was included to err on the side of including more routes for a larger transit network. Included in the Ideal Network are 176 routes, see Table 8. For a spatial distribution of the Ideal Transit Service Network, see Figure 9 at the end of this chapter.

[54] "Schedules & Maps: Routes by Number." Transit Agency Trip Planning.*King County Metro Online*, 2015.http://metro.kingcounty.gov/schedules/index.html.

Table 7. Corridor Service Family Guidelines As Applied To Individual Routes.

Table Published in King County Metro's 2014 Service Guidelines Report.[55]

**Service Families**

| Service family | Frequency (minutes) | | | Days of service | Hours of service |
|---|---|---|---|---|---|
| | Peak[1] | Off-peak | Night | | |
| Very frequent | 15 or better | 15 or better | 30 or better | 7 days | 16-20 hours |
| Frequent | 15 or better | 30 | 30 | 7 days | 16-20 hours |
| Local | 30 | 30 - 60 | * | 5-7 days | 12-16 hours |
| Hourly | 60 or worse | 60 or worse | -- | 5 days | 8-12 hours |
| Peak | 8 trips/day minimum | -- | -- | 5 days | Peak |
| | | | | | |
| Alternative services | Determined by demand and community collaboration process | | | | |

1 Peak periods are 5-9 a.m. and 3-7 p.m. weekdays; off-peak are 9 a.m. to 3 p.m. weekdays and 5 a.m. to 7 p.m. weekends; night is 7 p.m. to 5 a.m. all days.

* Night service on local corridors is determined by ridership and connections.

Table 8. Routes Included On The Ideal Transit Service Network.

Key: RR = RapidRide, CT = Community Transit operated routes in King County, PT = Pierce Transit operated routes in King County, LINK = Link Light Rail, Sounder = Sounder Train.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 49 | 76 | 121 | 167 | 210 | 245 | 308 | 522 | 577 PT | 675 RR E Line |
| 2 | 18 | 50 | 77 | 122 | 173 | 211 | 250 | 309 | 532 CT | 578 PT | 676 RR F Line |
| 3 | 19 | 55 | 98 | 123 | 177 | 212 | 252 | 311 | 535 CT | 586 PT | 773 |
| 4 | 21 | 56 | 99 | 124 | 178 | 214 | 255 | 312 | 540 | 590 PT | 775 |
| 5 | 26 | 57 | 101 | 140 | 179 | 215 | 257 | 316 | 542 | 592 PT | 795 |
| 7 | 28 | 60 | 102 | 143 | 186 | 216 | 260 | 342 | 545 | 594 PT | 952 |

[55] *King County Metro Transit 2014 Service Guidelines Report*. Strategic Plan. 201 S. Jackson St. Seattle WA 98104: King County Metro Transit, October 2014: 11. http://metro.kingcounty.gov/planning/pdf/2011-21/2014/service-guidelines-full-report.pdf.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 29 | 62 | 106 | 150 | 190 | 217 | 265 | 355 | 550 | 595 PT | 981 |
| 9 | 36 | 64 | 107 | 152 | 192 | 218 | 268 | 358 | 554 | 596 PT | 984 |
| 10 | 37 | 65 | 110 | 153 | 193 | 219 | 269 | 372 | 555 | 599 LINK | 994 |
| 11 | 40 | 67 | 111 | 154 | 197 | 232 | 277 | 373 | 556 | 601 | Sounder |
| 12 | 41 | 68 | 113 | 157 | 201 | 237 | 301 | 510 CT | 560 PT | 671 RR A Line | |
| 13 | 43 | 70 | 114 | 158 | 202 | 242 | 303 | 511 CT | 566 PT | 672 RR B Line | |
| 14 | 44 | 74 | 116 | 159 | 205 | 243 | 304 | 512 CT | 567 PT | 673 RR C Line | |
| 15 | 48 | 75 | 120 | 161 | 209 | 244 | 306 | 513 CT | 574 PT | 674 RR D Line | |

## Criterion 3: Distance to Transit Stop

The Ideal Transit Service Network was created from a merge of point files of transit stops that are associated with the selected 176 routes representing the Ideal Network. Each of the points represents a transit stop on one or more of the selected routes. Next, buffers were created around each of the transit stops on the Ideal Network at different scales: .5 mile, .25 mile and .1 mile, to represent different thresholds a potential park and ride user would have to walk from the multifamily development to the transit stop.

Three new parcel layers of multifamily developments layer with ≥20 units, MF ≥20 Layer (Pres_Use_MF6_20), were created by running the select by location tool using the 'intersect the source layer feature' spatial method at each buffer scale. The new parcel layer created from an intersection

with the .5 mile buffer contains the most parcels, while the new parcel layer created from an intersection with the .1 mile buffer contains the fewest parcels, see Table 9. Most multifamily parcels with ≥20 units are within the .5 buffer of the Ideal Transit Service Network: 95%, or 2,344 of 2,477, parcels. Additionally, 71%, or 1,746 of 2,477, of multifamily parcels with ≥20 dwelling units are within .1 buffer. Most of the large multifamily developments in King County are close to transit. For reference of parcels at three different buffer distances to transit stops on Ideal Network, see Figures 10 and 11 at the end of this chapter.

Table 9. Number Of Multifamily Parcels Within Three Buffer Scales Of The Ideal Transit Service Network.

| Ideal Transit Service Network Buffer Scale | # of >20 Units MF Parcels |
|---|---|
| Within .1 Mile Buffer | 1,746 |
| Within .25 Mile Buffer | 2,201 |
| Within .5 Mile Buffer | 2,344 |

One important note is that as parcels are irregularly shaped and vary in size, the walking distance will vary depending on which edge of a parcel the exit of a building is located will impact the distance a pedestrian must walk to the transit stop. Site-level analysis of walking distance presents an opportunity for finer-grained analysis later in the grant effort. To account for this discrepancy, all of the multifamily parcels, with ≥20 units and within .1 mile buffer scale were selected. An American Public Transportation Association best practices report states that the "majority of activity will be generated within ⅛ to ¼ mile of [a transit] stop."[56] Given the discrepancies in measuring site-level distances to the Ideal Network

[56] *Recommended Practice: Design of On-Street Transit Stops and Access from Surrounding Areas*. APTA Standards Development Program. Washington D.C.: American Public Transportation Association, March 2012: 20#. http://www.apta.com/resources/standards/Documents/APTA-SUDS-UD-RP-005-12.pdf.

transit stop from irregular parcel shapes, a .1 mile buffer is a conservative estimate to stay under .25 mile of actual walking distance.

## Criterion 4: Near Crowded Park And Rides

King County publishes quarterly reports on utilization rates for park and rides within the County. Not all of these facilities are owned by King County Metro, but all are used by Metro customers and many facilities are served by Metro routes.[57] In the 3rd Quarter of 2014, 37 out of 131 park and rides maintained ≥90% utilization rates. Additionally, in the 4th Quarter of 2014, 45 out of 131 park and ride maintained ≥90% utilization rates.[58] One way to open up more parking supply near crowded park and rides would be to locate multifamily developments near park and rides with ≥90% utilization. Using three buffer scales drawn around park and rides with ≥90% utilization in the 4th Quarter of 2014, multifamily parcels with ≥20 units were selected using the intersect the source layer feature spatial method. The buffer scales were .1 mile, .25 mile and .5 mile, see Table 10. Nearly all of the park and rides with ≥90% utilization are also served by a route in the Ideal Transit Service Network, with the exception of: Grace Lutheran Church in Bellevue, Kennydale United Methodist Church in Renton, Peasley Canyon Park and Ride in Auburn and Ober Park and Ride on Vashon Island.

This model uses park and ride utilization as a proxy for park and ride demand. Quantifying demand with utilization rates may be an imperfect proxy variable because there are places in the county with multiple lots near the same location, that do not share the same utilization rate. For instance three facilities in Renton, WA, are within 1 mile of each other, but do not have similar utilization rates. Metropolitan Place has a 97% utilization rate, South Renton has a 100% utilization rate, and City View Church lease lot has a

[57] Cahan, Steve. "Accountability Center: Park & Ride Usage."*King County: Metro Online*, 2015. http://metro.kingcounty.gov/am/accountability/park-ride-usage.html.
[58] Ibid.

52% utilization rate.[59] The differences in use among these three facilities may be due to transit service provision or pedestrian environment. For reference of park and rides in King County and the 4th Quarter 2014 utilization rates, see Figure 12 at the end of the this chapter.

Table 10. Number Of Multifamily Parcels Within Three Buffer Scales Of Park And Rides With ≥90% Utilization, Quarter 4, 2014.

| Park and Ride Buffer Scale | # of >20 Units MF Parcels |
|---|---|
| Within .1 Mile Buffer | 24 |
| Within .25 Mile Buffer | 97 |
| Within .5 Mile Buffer | 255 |

[59] Ibid.

Figure 7. Multifamily Parcels With ≥20 Units: Kirkland, Redmond And Bellevue.

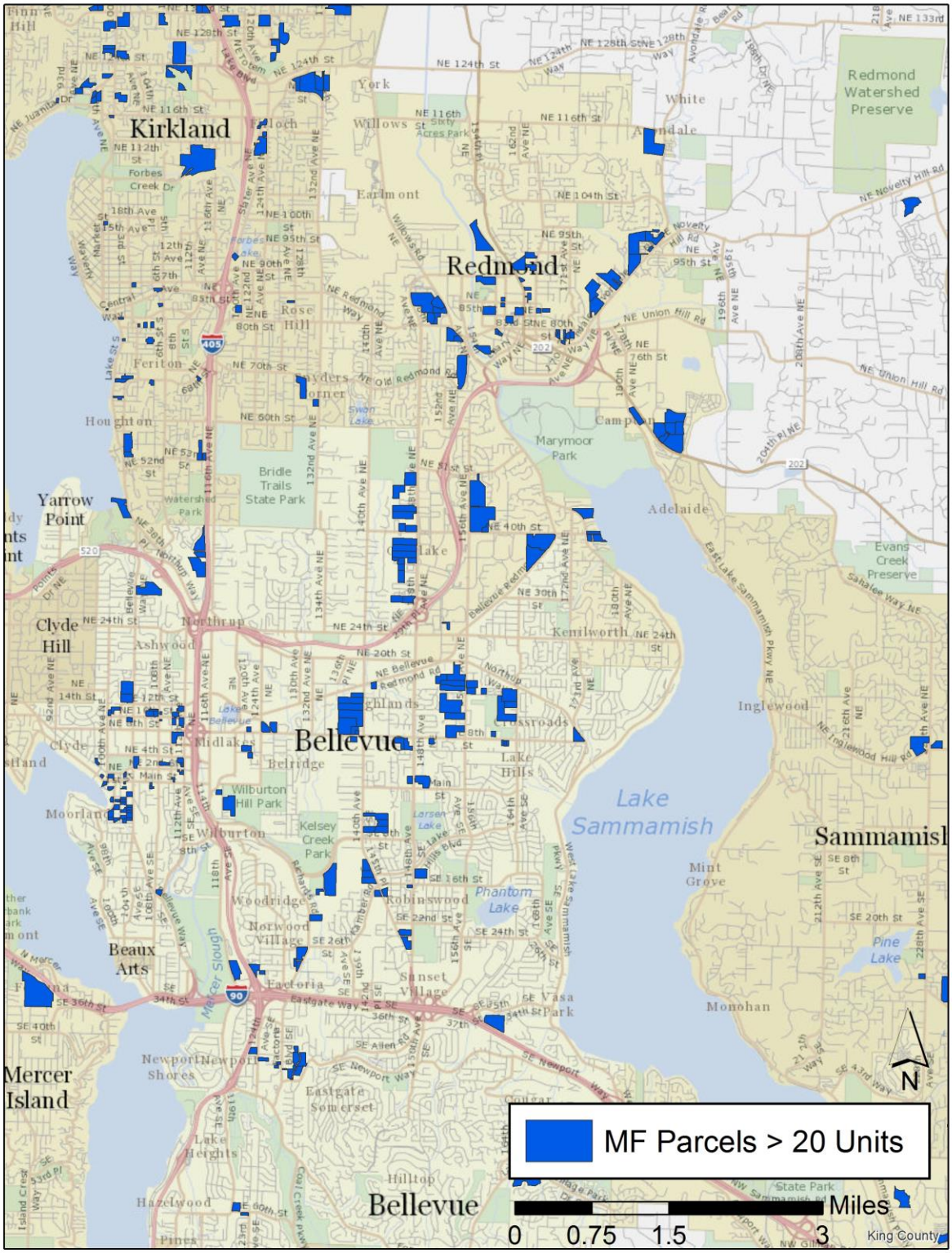


Figure 8. Multifamily Parcels With ≥20 Units: SeaTac, Tukwila, Renton, Kent And Des Moines.

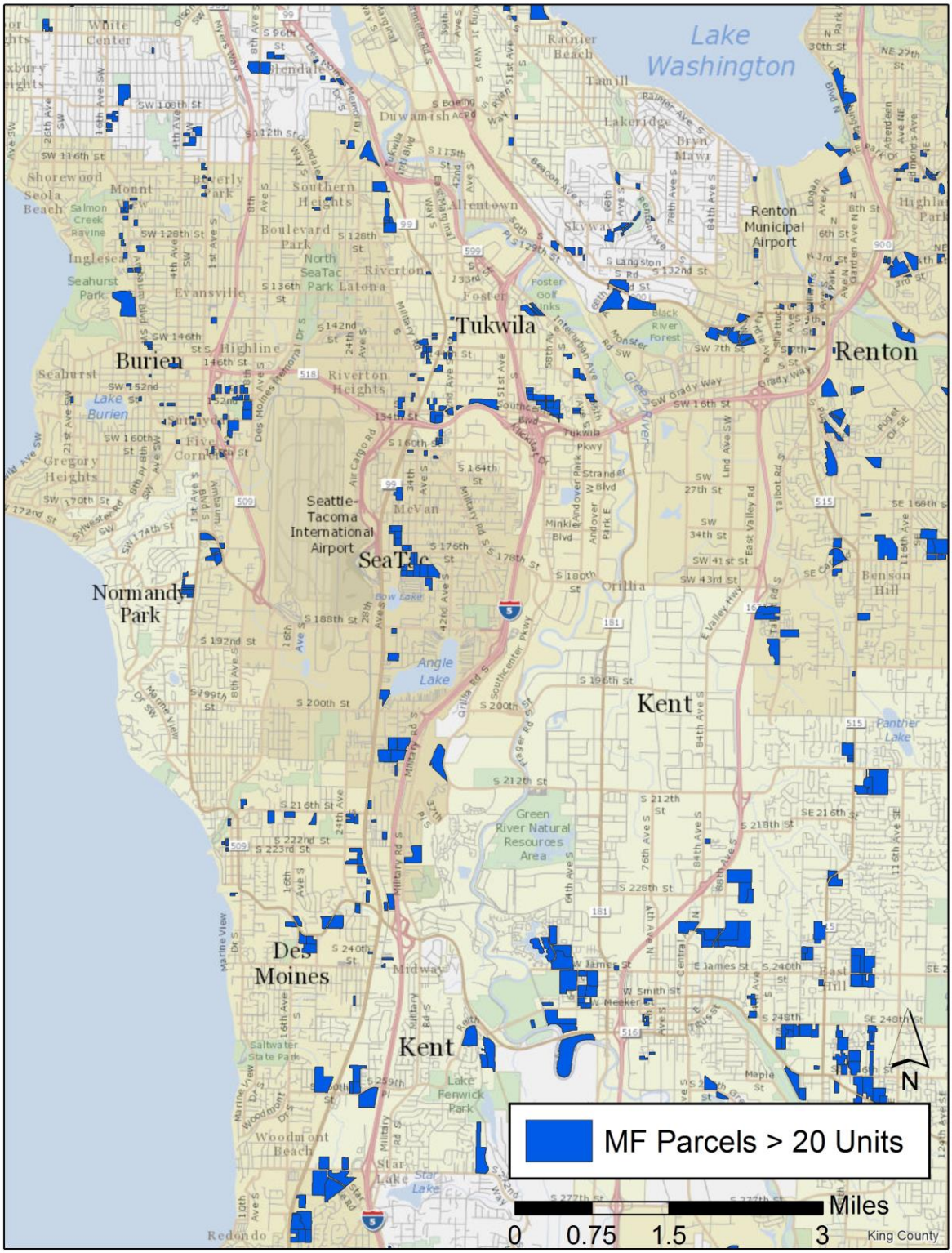


Figure 9. Transit Stops On The Ideal Transit Service Network In King County, WA.

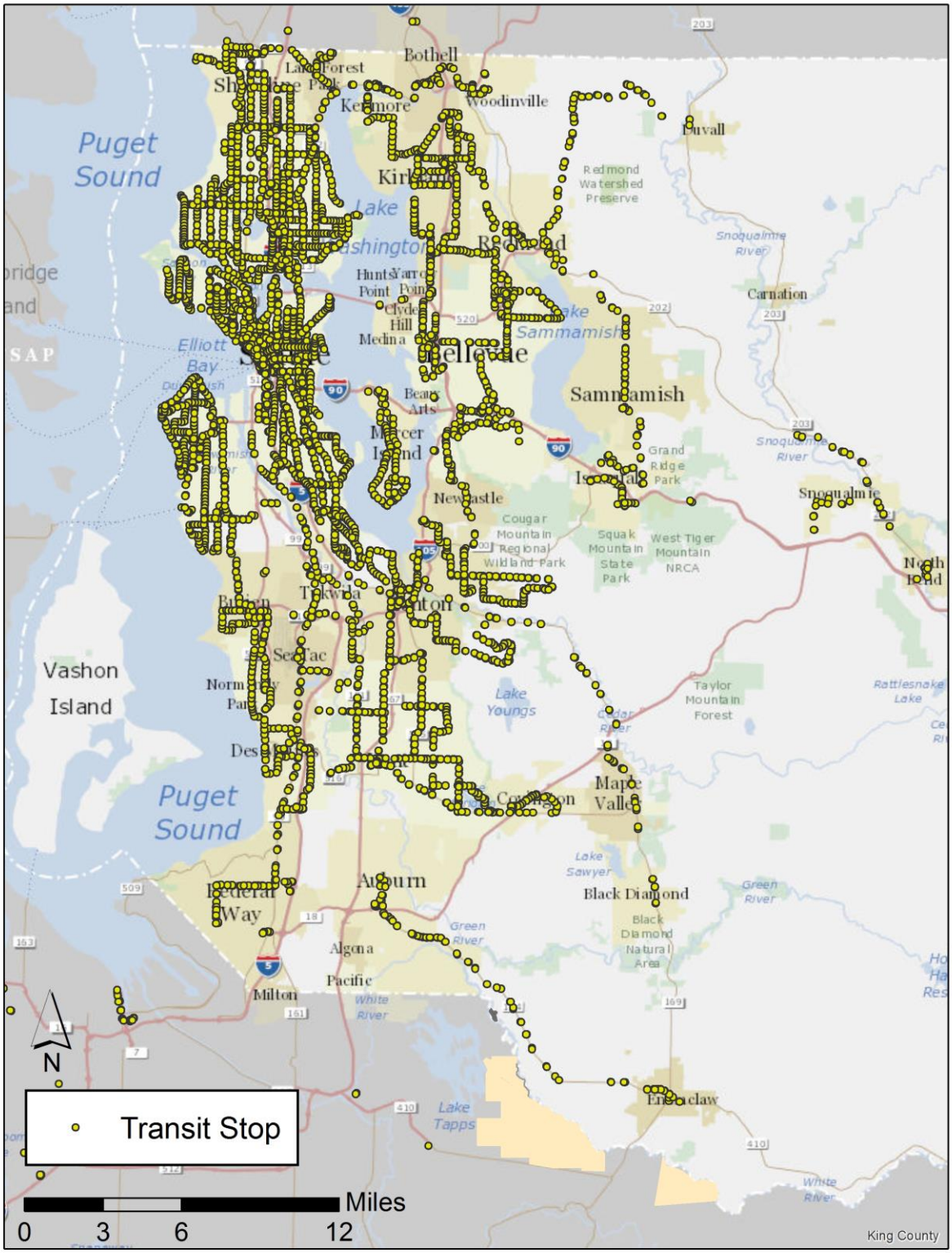


Figure 10. Multifamily Parcels At Three Buffer Distances To Transit Stops On Ideal Transit Service Network: Kirkland, Redmond And Bellevue.

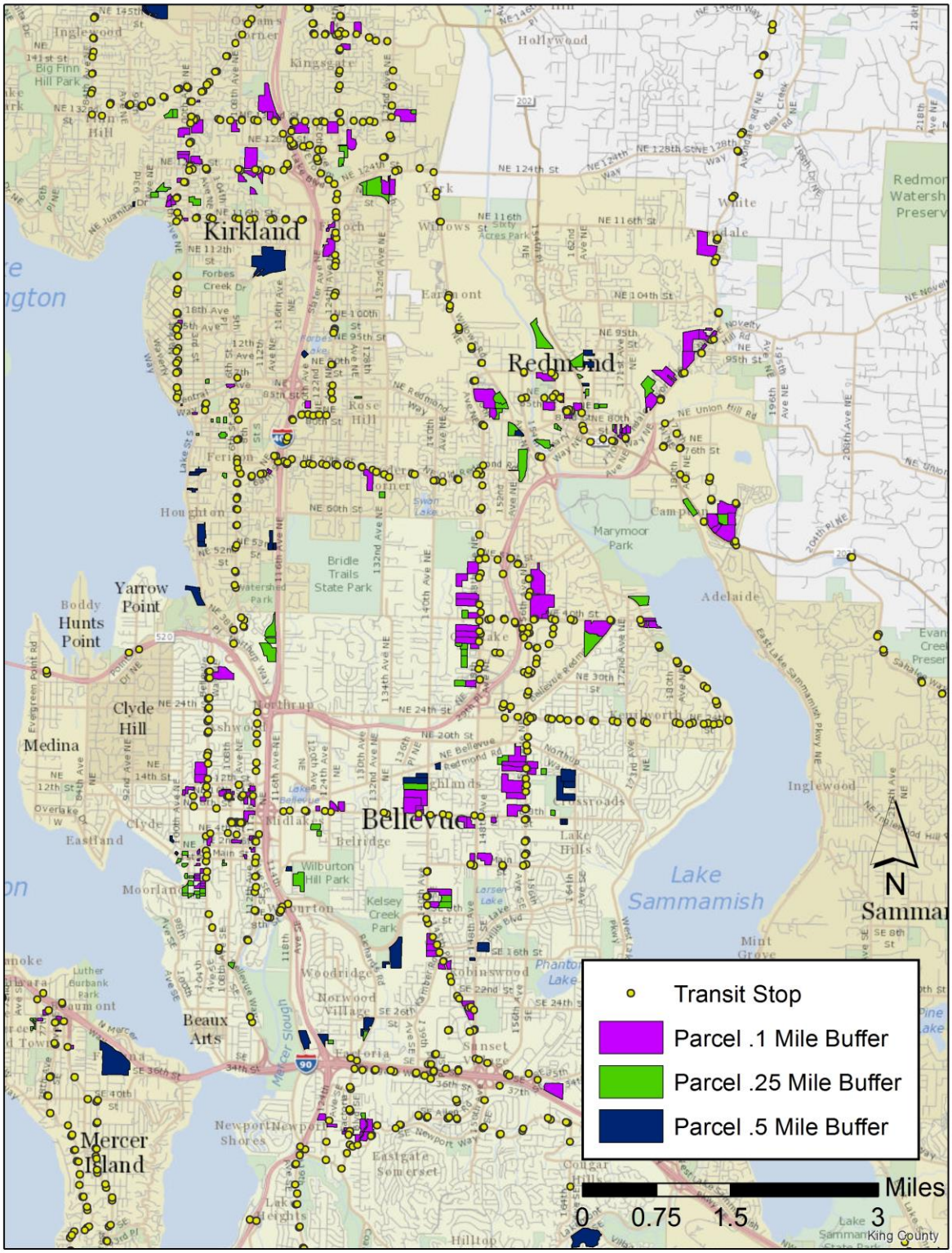


Figure 11. Multifamily Parcels At Three Buffer Distances To Transit Stops On Ideal Transit Service Network: SeaTac, Tukwila, Renton, Kent And Des Moines.

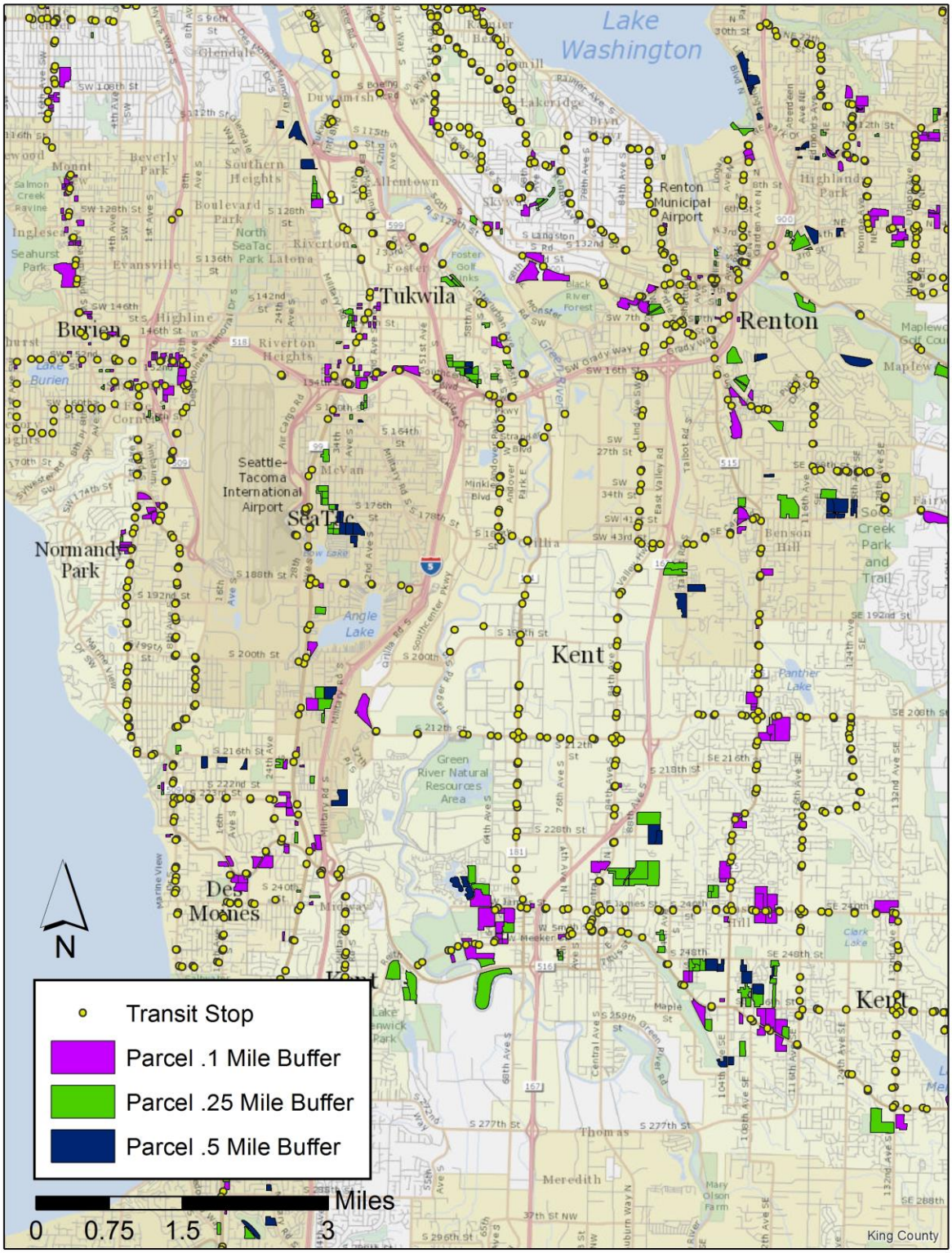
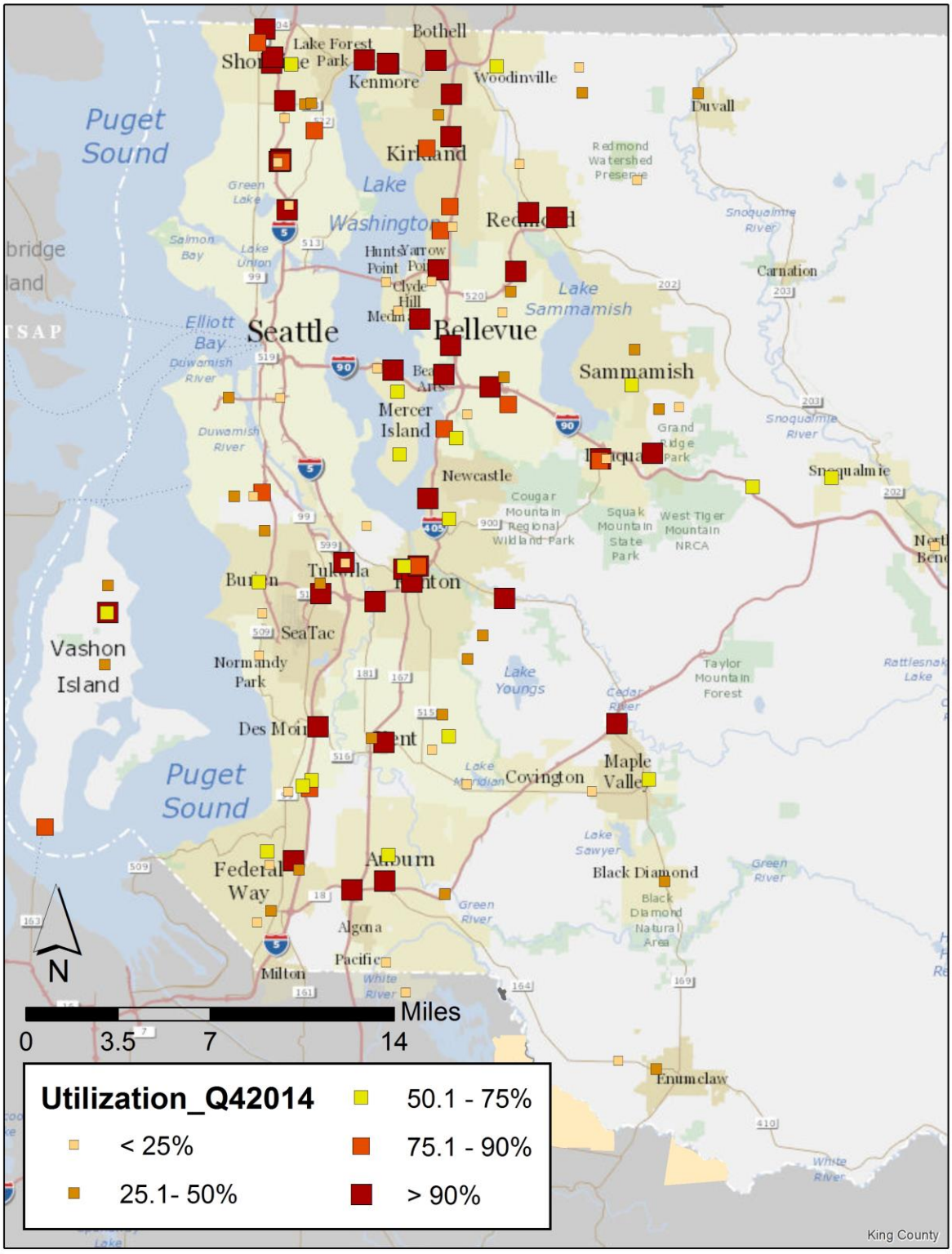


Figure 12. Park And Rides In King County, WA With Utilization Quarter 4, 2014.



# Chapter 4: Results and Recommendations

Areas of opportunity are identified in clusters and groups of parcels using either the Corridor or Crowded Park and Ride Method. Some parcels may have been selected by both methods. These results were submitted to King County Metro as part of the Park-and-Ride Pricing in Multifamily Developments grant and used to support further analysis to identify potential pilot program locations. The criteria could also be weighted for variables that are more important than others for successful pilot projects. Weighted criteria could involve certain jurisdictions or property managers that are enthusiastic and willing to pilot progressive parking management strategies. Other criteria could include the number of parking spaces modeled for each development using the Right Size Parking model, regulated and time-limited on-street parking surrounding the development, and site-specific design characteristics.

## Using The Corridor Method

The Corridor Method was developed by the researcher to identify areas of opportunity that can be used to target a corridor or transit route to provide more park and ride spaces. Clusters of parcels were highlighted by jurisdiction in Table 11 and Figures 13 – 26, at the end of this chapter. The recommendations below reflect the broad nature of this analysis for areas of opportunity for pilot programs, without eliminating areas too early in the feasibility and selection process. Clusters of parcels were identified by being within .1 mile buffer of an Ideal Transit Service Network stop and occurring in proximity of at least 5 parcels.

The Corridor Method can be used to target specific transit routes that are not currently overcrowded and by providing additional park and ride spaces along the stops, which could increase ridership during peak trips. The Corridor Method can also be used to spread out transit ridership along stops, avoiding crush loads that occur at popular park and ride facilities. Crush loads cause delay through increased dwell time at the most popular stop where majority of passengers board. Pilot projects identified by The

Corridor Method with multiple locations of parking may also minimize local traffic impacts by spreading out parking trips among multiple transit stops.

Table 11. Clusters Of Parcels On Corridors Of Ideal Transit Service Network By Jurisdiction.

| Jurisdiction | Corridor | # of Parcels |
|---|---|---|
| Seattle (North) | Greenwood Ave N., from N 105th St. to Bitter Lake / N 137th St. | 18 |
| Seattle (North) | SR 99 / Aurora Ave N., from NE 130th St. to NE 145th St. | 9 |
| Seattle (North) | 15th Ave. NE, from NE 115th St to NE 145th St. | 20 |
| Seattle (North) | SR 522 / Lake City Way, from NE 120th St. to NE 145th St. | 37 |
| Seattle (West) | California Ave SW, from Alaska St. to N Morgan St. | 20 |
| Seattle (South) | Rainier Ave S, from S Orcas St. to S Fletcher St. | 24 |
| Shoreline | SR 99 / Aurora Ave N., from N 170th St. to N 205th St. | 18 |
| Kenmore | SR 522 / Bothell Way NE, from 73rd Ave NE to 91st Ave NE in Bothell | 8 |
| Kirkland | 100th Ave. NE from NE 116th St. to Juanita-Woodinville Way NE | 10 |
| Kirkland | NE 132nd St., from 105 Ave. NE to 127th Dr. NE | 7 |
| Redmond | NE 85th St., from Sammamish River to SR 202 / 164 Ave. NE | 5 |
| Redmond | Avondale Way NE, from NE 70th St. to NE | 11 |

| | | |
|---|---|---|
| | 104th St. | |
| Bellevue | Downtown Bellevue along Bellevue Way NE, from SE 6th St. to NE 17th ST. | 20 |
| Bellevue | Downtown Bellevue along 112th Ave NE, from Main St. to NE 12th St. | 15 |
| Bellevue | 148th Ave NE., from NE 29th Pl. to NE 51st Pl. | 8 |
| Bellevue | 156th Ave NE., from NE 8th St. to NE 20th St. | 8 |
| Renton | NE 4th St, from Monroe Ave NE. to Duvall Ave NE. | 6 |
| Renton | Kirkland Ave. NE, from Harrington Ave NE to NE 9th St. | 8 |
| Renton | SR 900 / Sunset Blvd, from Thomas Ave. SW to Main Ave. S | 9 |
| Kent | W James St. / S 240th St., from 62nd Way S. to SR 181 / Washington Ave N. | 8 |
| Kent | SR 516 / Canyon Dr., from 94th Ave. S to 116th Ave. SE | 10 |
| Des Moines | 516 / S Kent-Des Moines Rd, from 16 Ave. S to I-5 | 11 |
| Des Moines | Pacific Hwy S, from S 216th St. to 516 / S Kent-Des Moines Rd | 7 |
| Tukwila | Tukwila International Blvd, from S 139th St. to SR 518 | 17 |
| Tukwila | SR 518 from Tukwila International Blvd to I-5 | 6 |

| | | |
|---|---|---|
| Federal Way | SR 99 / Pacific Hwy S, from S 272nd St. to S 296th St. | 11 |
| Burien | Ambaum Blvd SW, from SW 120th St. to SW 146th St. | 19 |
| Burien | SW 152nd St., 8th Ave. S and SW 156th St. | 17 |

## Using The Crowded P&R Method

The Crowded P&R Method was developed by the researcher to identify areas of opportunity that can be used to target an existing park and ride that is at or near 90% utilization to provide more park and ride spaces. Groups of parcels are highlighted by jurisdiction in Table 12 and Figures 27 – 37, at the end of this chapter. These recommendations reflect the broad nature of this analysis for areas of opportunity for pilot programs, without eliminating areas too early in the feasibility and selection process.

Groups of parcels are identified near crowded park and rides. These multifamily locations have the potential to increase the supply of parking spaces without building more parking and could mitigate problems with parking spillover or long-term infrastructure construction. Jurisdictions or transit agencies may also be interested in the results as a transportation demand management program. Additional trips to parcels near a crowded park and ride or along a corridor could add to local traffic impacts, and may impact political feasibility. Additionally, the Crowded P&R Method may also contribute to crush loads at already popular park and ride facilities, which presents challenges to transit service planning and can contribute to delays.

A crowded park and ride is defined as a location with ≥90% utilization in the 4th Quarter of 2014. Recommended parcels are those that are within a .25 mile buffer of the park and ride lot. The .25 mile buffer was used for recommendations over the .1 mile buffer due to too few parcels identified by the .1

mile buffer: a mere 24 parcels. The .25 mile buffer identified 97 parcels, see Table 10 in the Methodology chapter. Table 12 outlines park and rides that have at least 1 parcel in proximity and lists the park and rides by jurisdiction. Figures 27 - 37 display the locations of the groups of parcels.

Table 12. Groups of Parcels Within .25 Mile Buffer Of Crowded Park And Rides By Jurisdiction.

| Jurisdiction | Park and Ride Lot(s) | # of Parcels |
|---|---|---|
| Seattle | Greenlake / I-5 P&R | 16 |
| Seattle | Multiple Northgate P&R | 7 |
| Shoreline | Aurora Village TC | 5 |
| Kenmore | Kenmore P&R and Kenmore Community Church | 4 |
| Bothell | Bothell P&R | 2 |
| Bothell | Brickyard P&R | 1 |
| Kirkland | Holy Spirit Lutheran Church | 3 |
| Kirkland | Kingsgate | 3 |
| Redmond | Redmond P&R | 9 |
| Redmond | Overlake TC | 2 |
| Bellevue | Grace Lutheran Church Lease Lot | 2 |
| Mercer Island | Mercer Island P&R | 2 |
| Issaquah | Issaquah Highlands P&R | 1 |
| Renton | New Life Church at Renton Lease Lot | 1 |
| Renton | Renton TC P&R Garage* | 10 |

| | | |
|---|---|---|
| Renton | Renton Fred Meyer Lease Lot | 3 |
| Renton | South Renton P&R | 1 |
| Kent | Kent Surface Lot at Kent Station | 1 |
| Tukwila | Tukwila P&R | 3 |
| Tukwila | Tukwila International Blvd Station | 12 |
| Federal Way | Federal Way TC | 4 |
| Auburn | Auburn Garage and Surface Lot at Auburn Station | 3 |
| Vashon | Ober P&R | 2 |

*Of the 10 parcels identified by the analysis, 1 parcel identified is Metropolitan Place Apts, which was part of a Transit Oriented Development agreement with King County Metro and supplies 150 spaces for park and ride since 2001.[60]

[60] "Metropolitan Place, Renton TOD." *King County Transportation*, January 12, 2010.http://www.kingcounty.gov/transportation/kcdot/PlanningAndPolicy/RegionalTransportationPlanning/TransitOrientedDevelopment/Projects/Renton.aspx.

Figure 13. Clusters Of Parcels By Corridor Method: North Seattle.

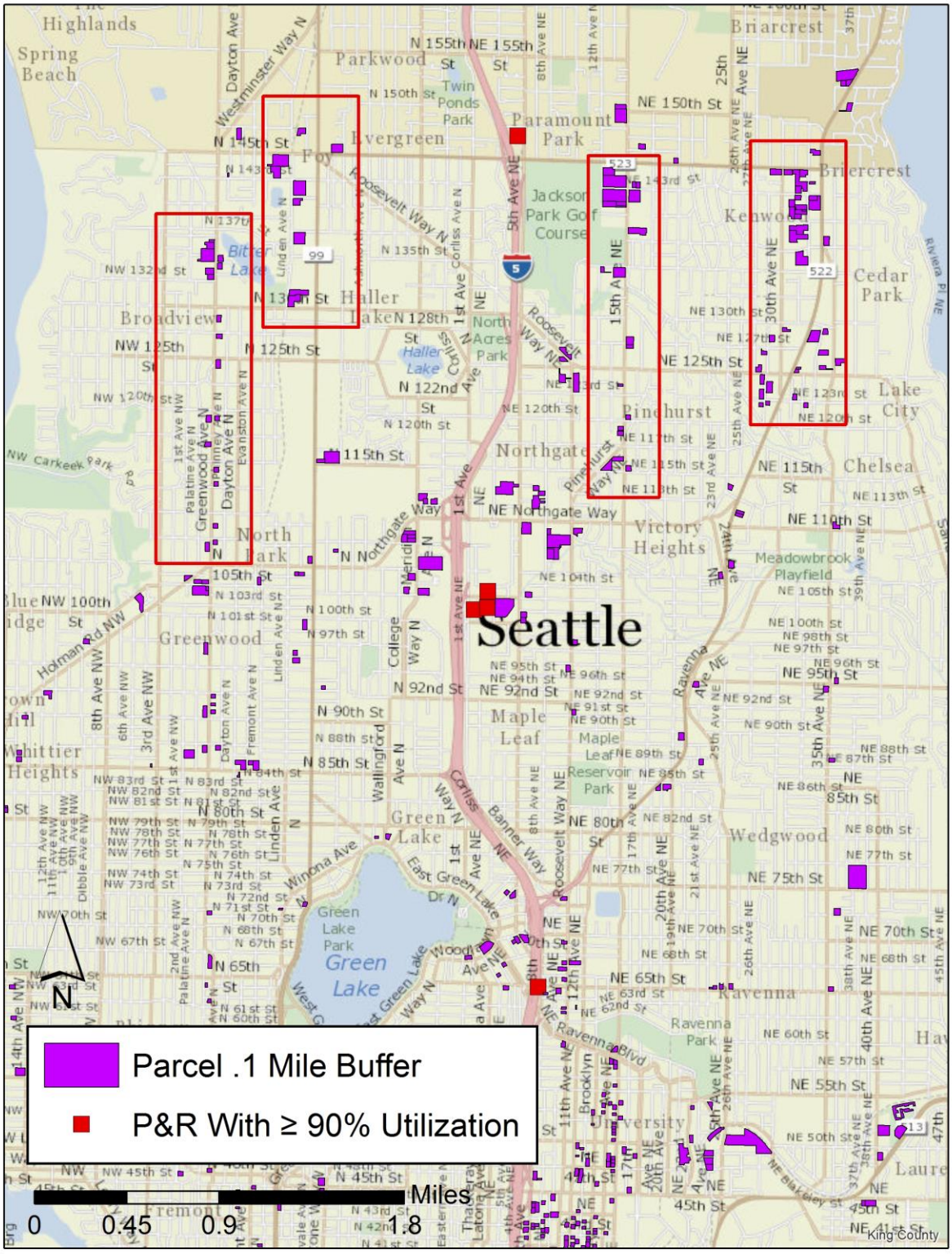


Figure 14. Clusters Of Parcels By Corridor Method: West Seattle.

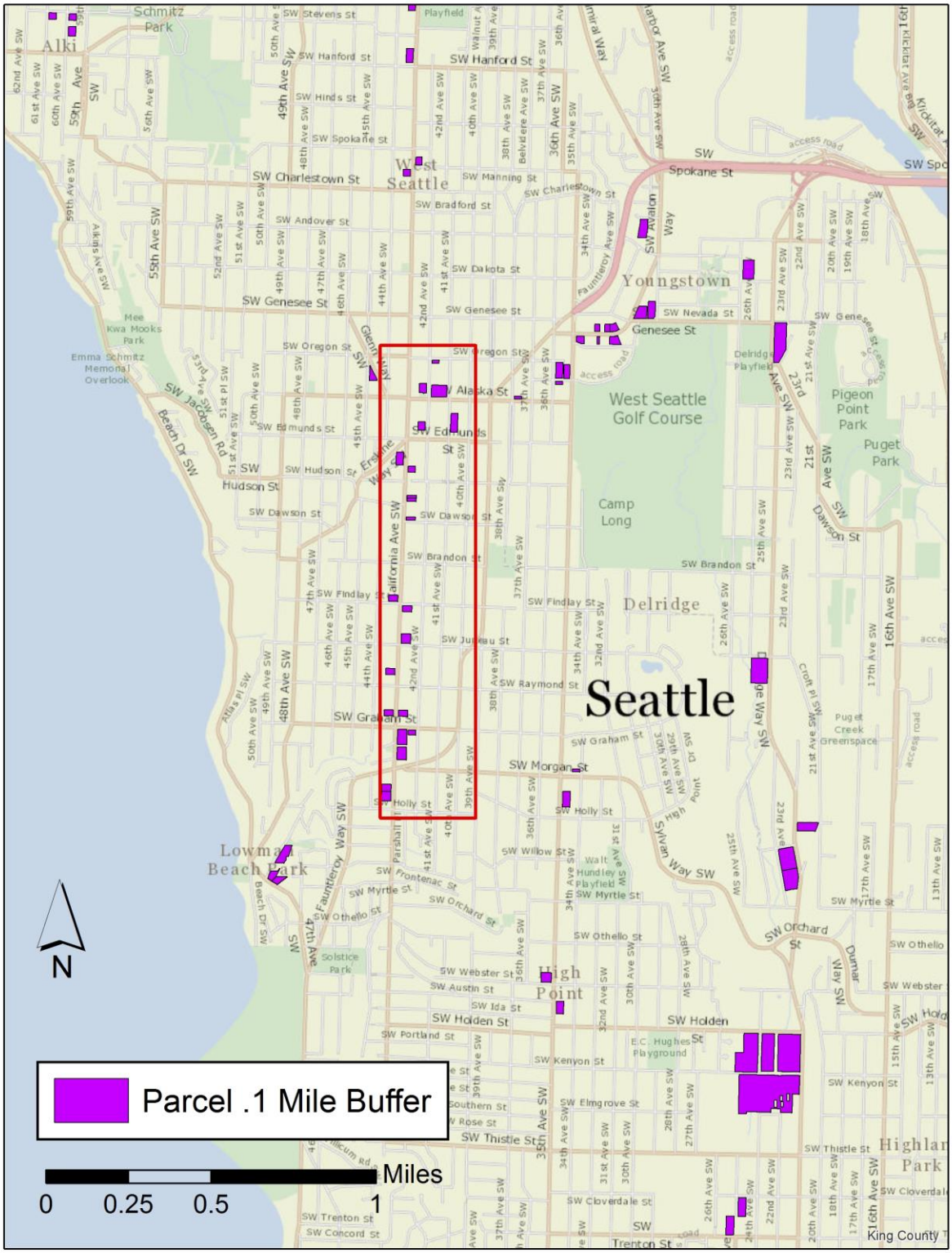


Figure 15. Clusters Of Parcels By Corridor Method: South Seattle.

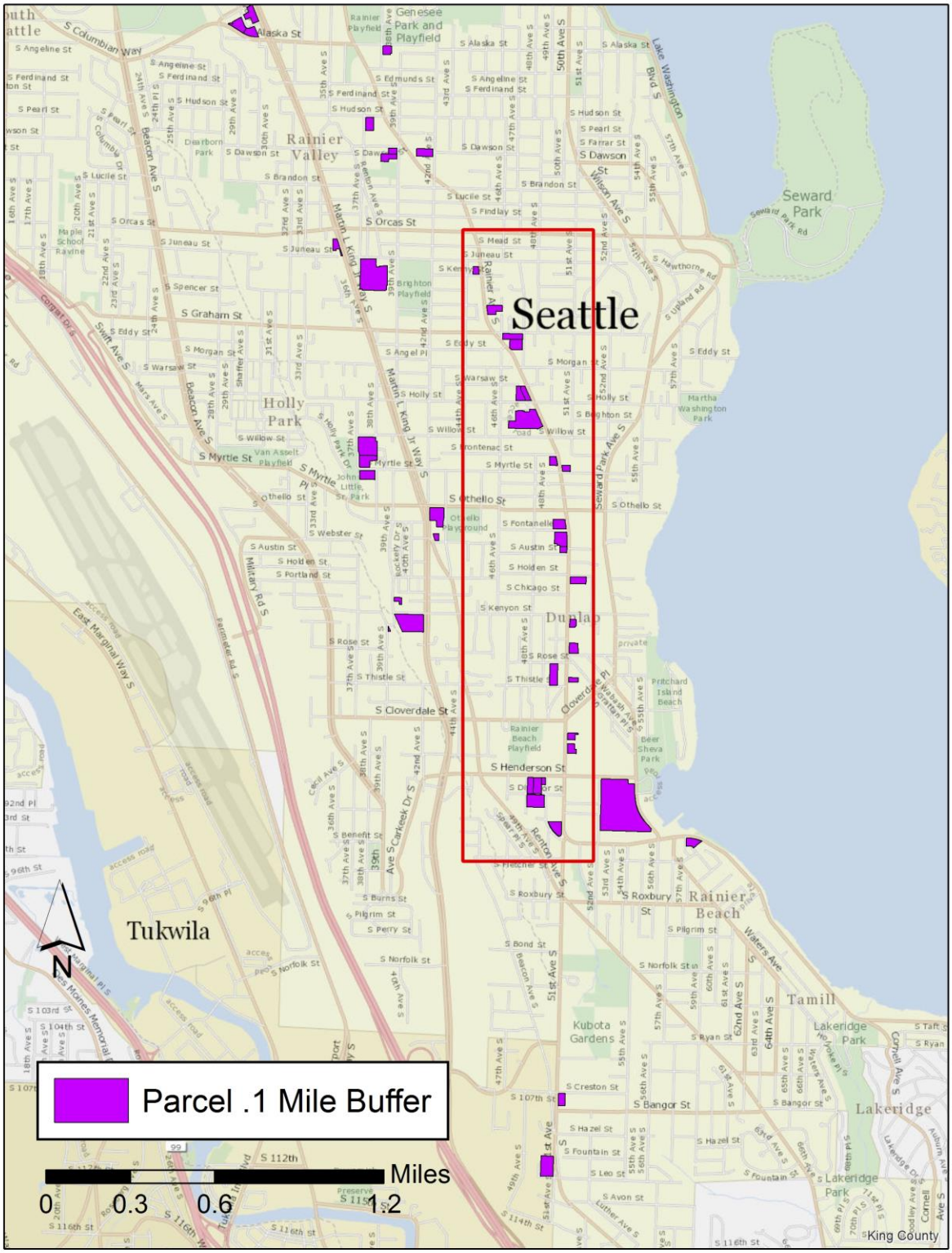


Figure 16. Clusters Of Parcels By Corridor Method: Shoreline, WA.

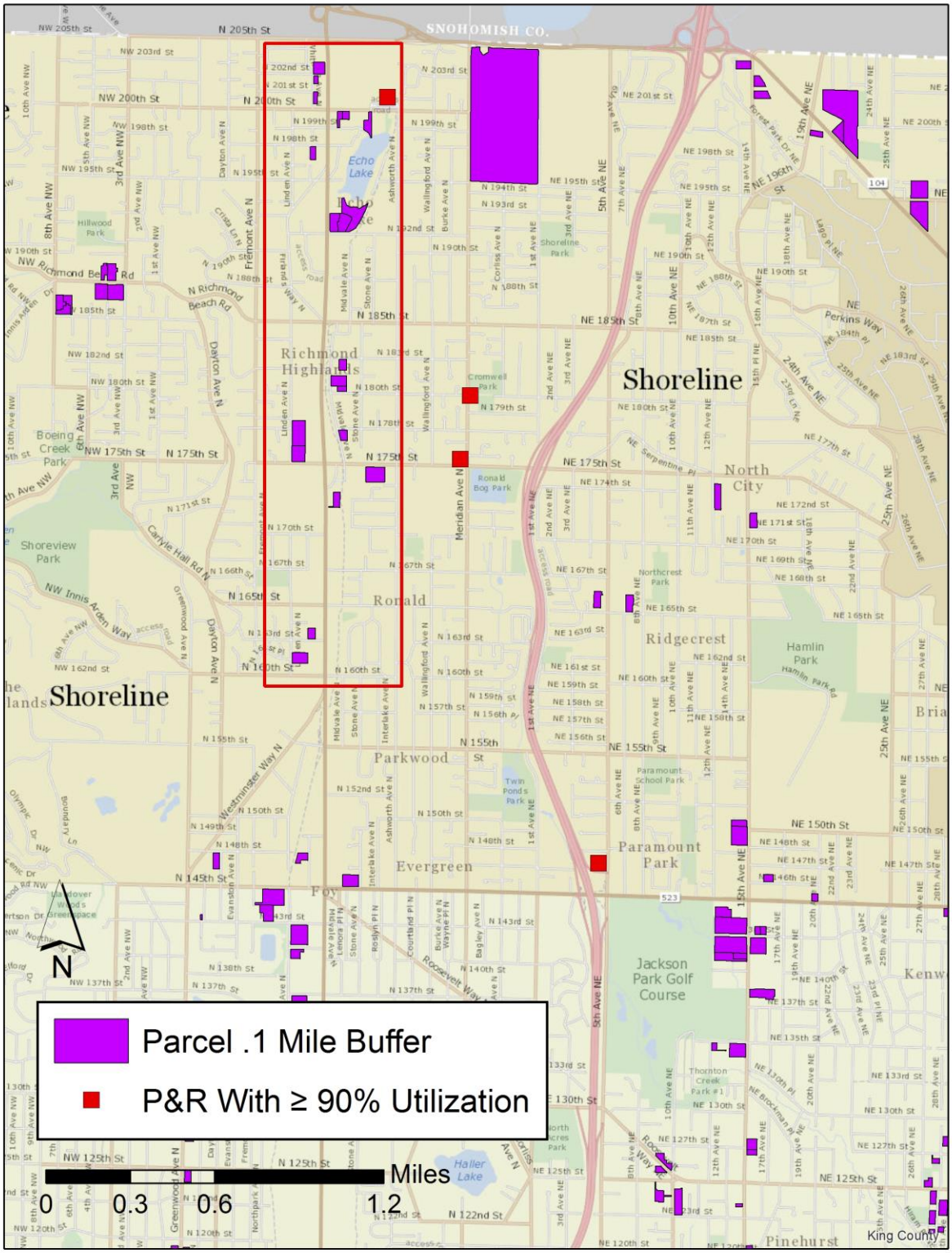


Figure 17. Clusters Of Parcels By Corridor Method: Kenmore, WA.

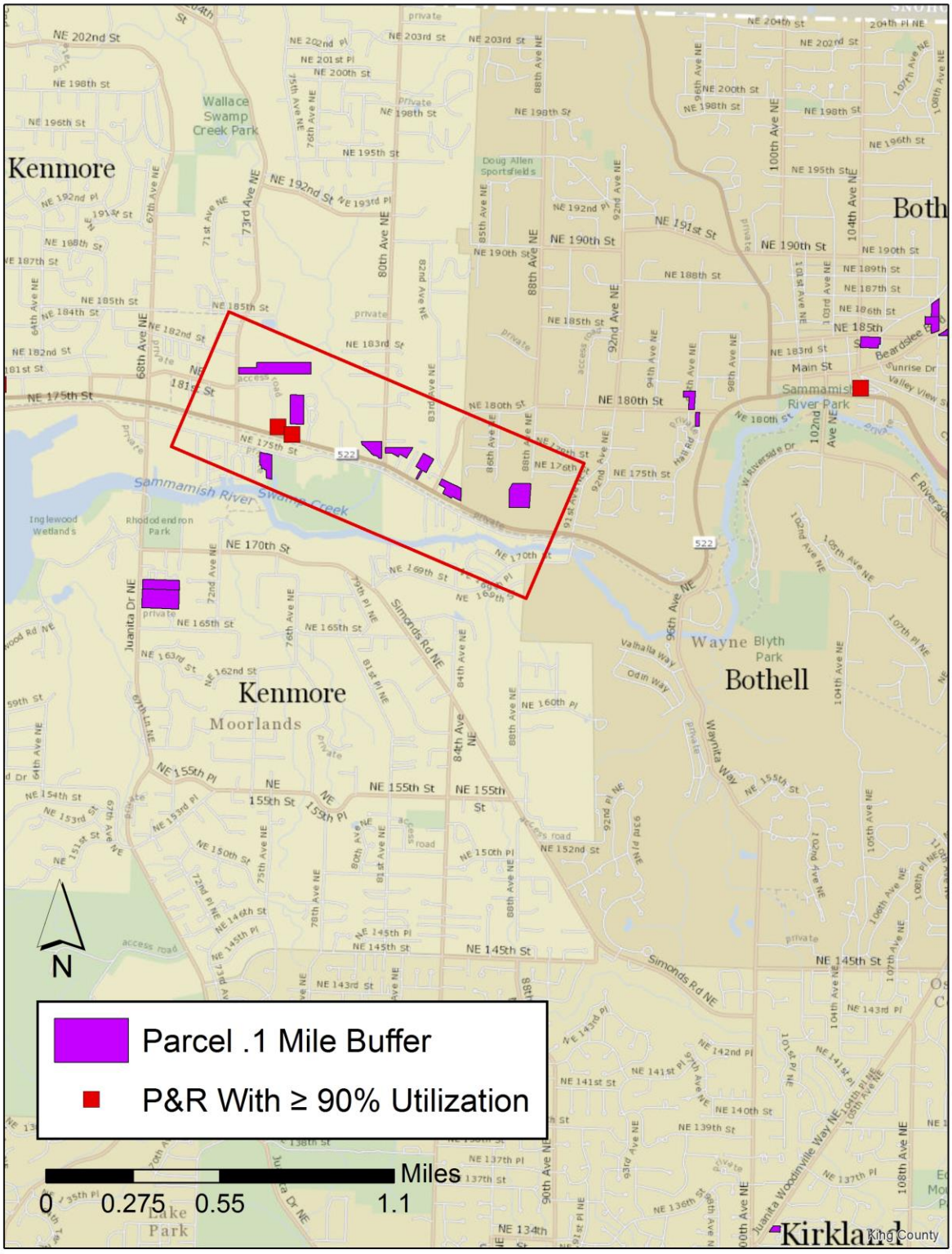


Figure 18. Clusters Of Parcels By Corridor Method: Kirkland, WA.

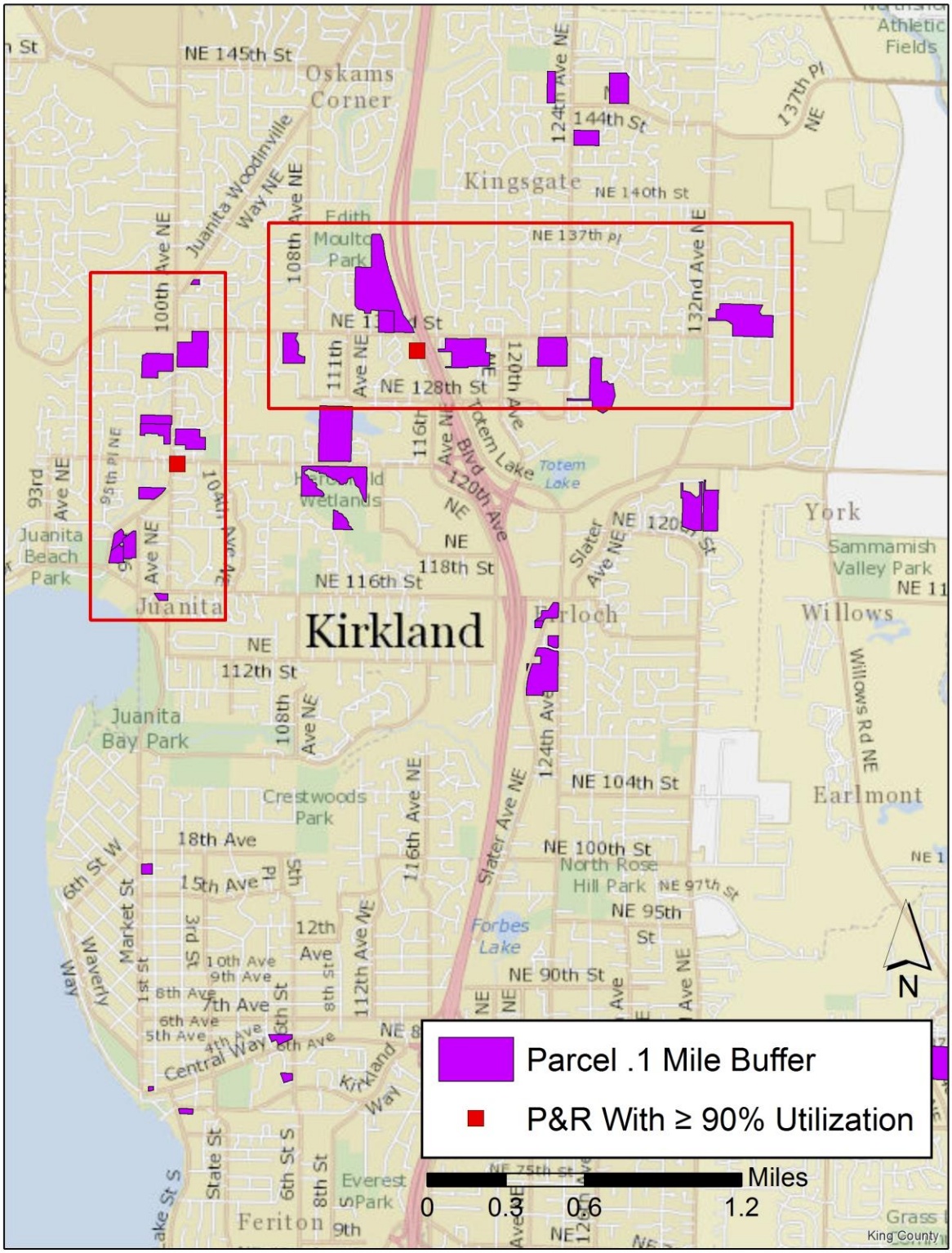


Figure 19. Clusters Of Parcels By Corridor Method: Redmond, WA.

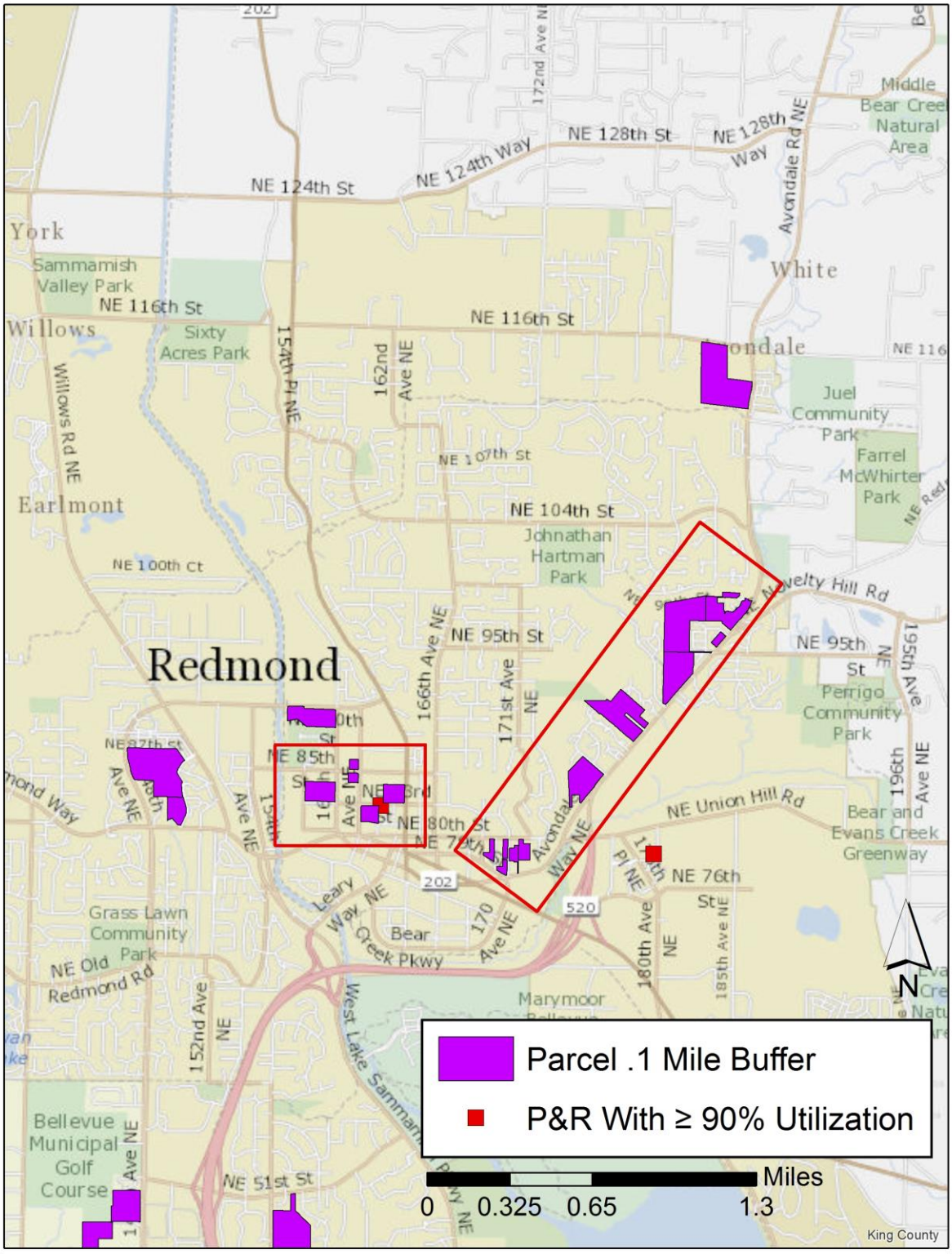


Figure 20. Clusters Of Parcels By Corridor Method: Bellevue, WA.

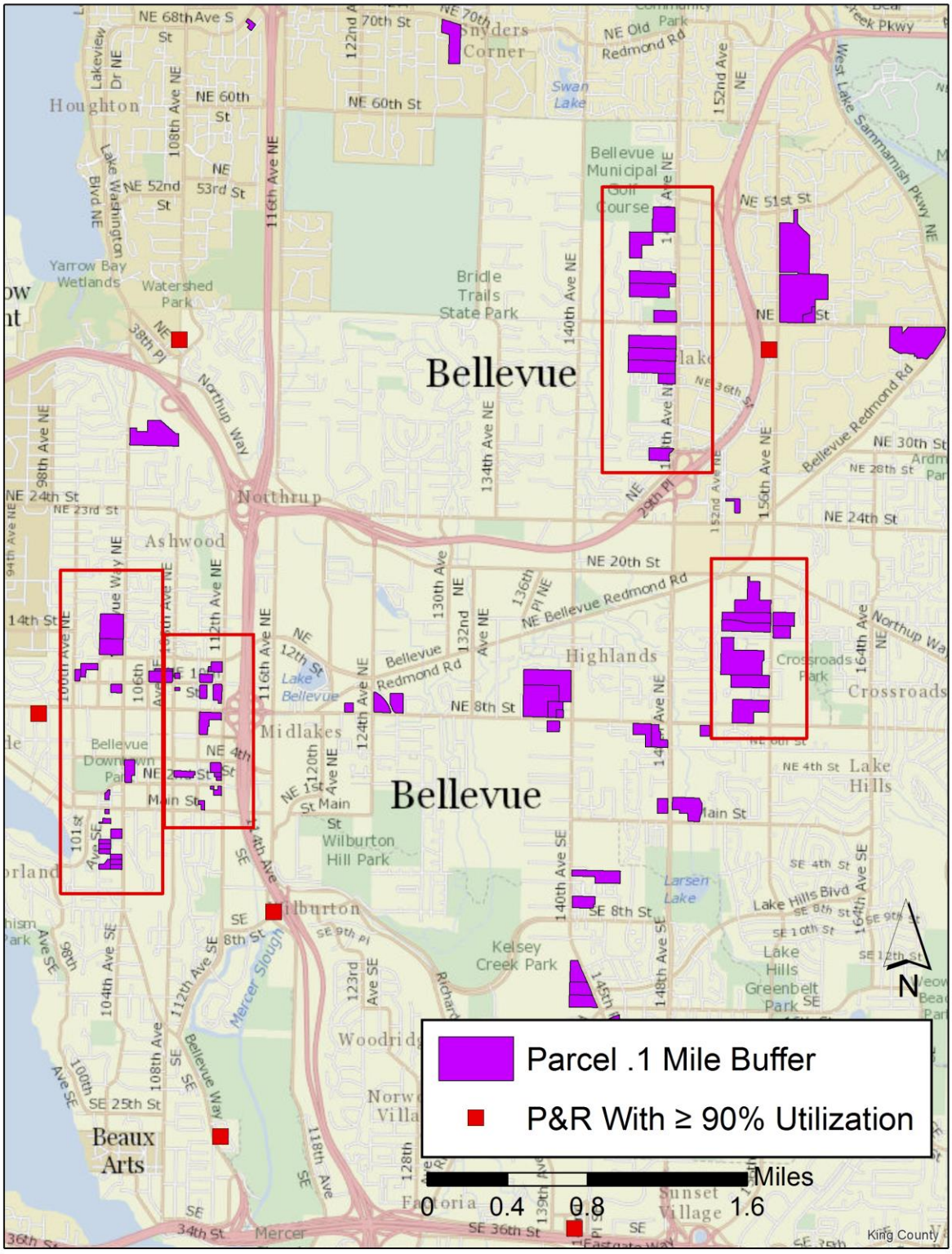


Figure 21. Clusters Of Parcels By Corridor Method: Renton, WA.

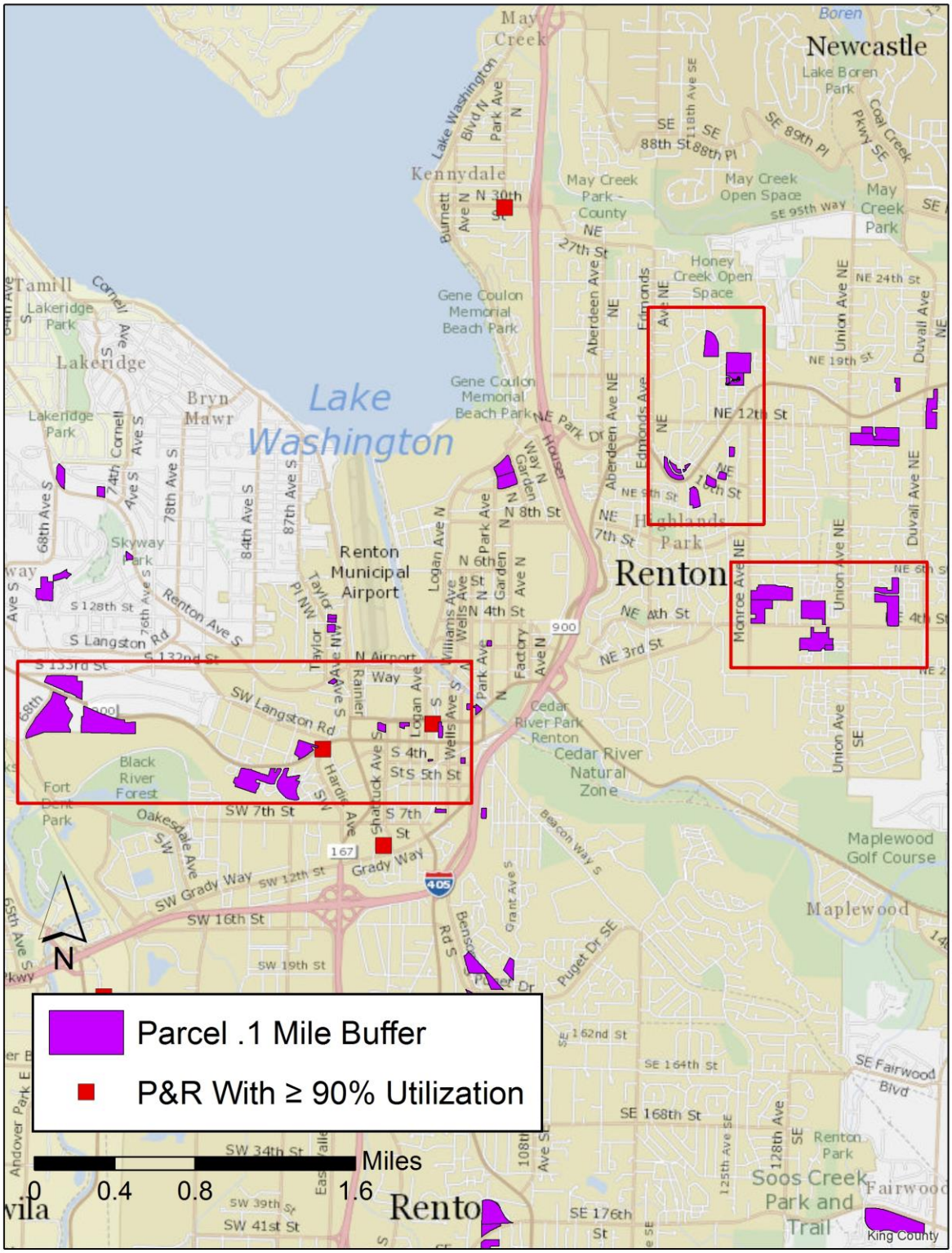


Figure 22. Clusters Of Parcels By Corridor Method: Kent, WA.

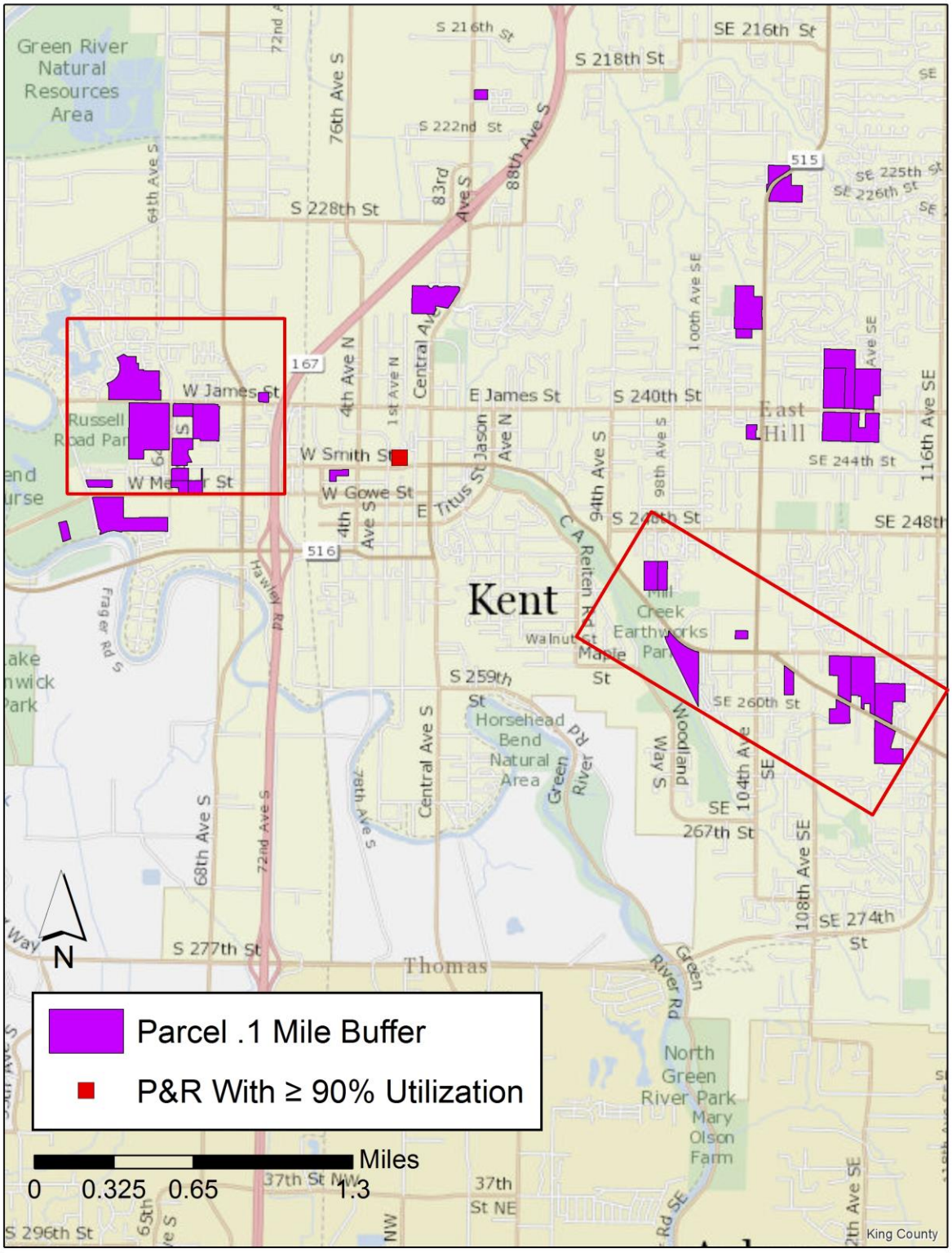


Figure 23. Clusters Of Parcels By Corridor Method: Des Moines, WA.

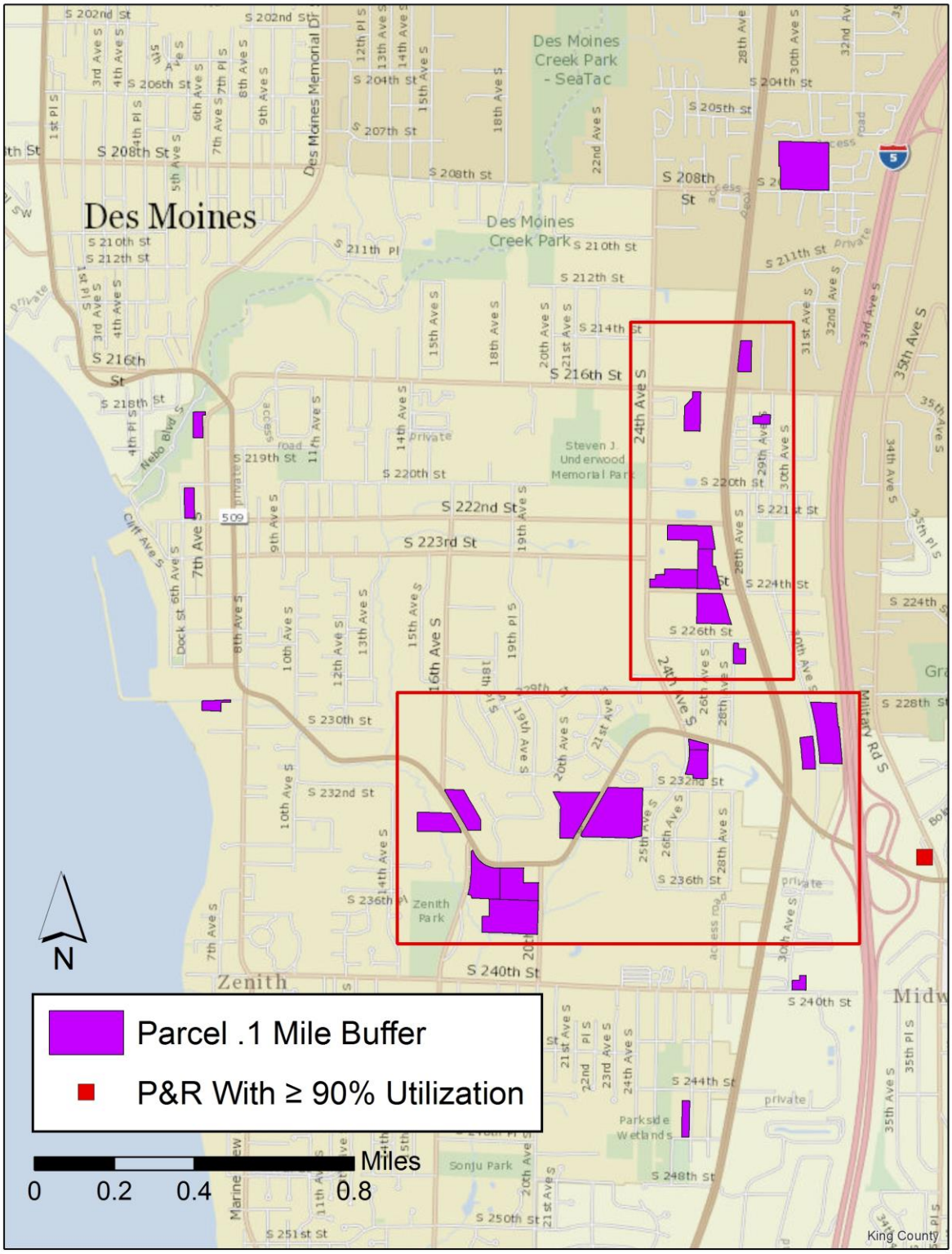


Figure 24. Clusters Of Parcels By Corridor Method: Tukwila, WA.

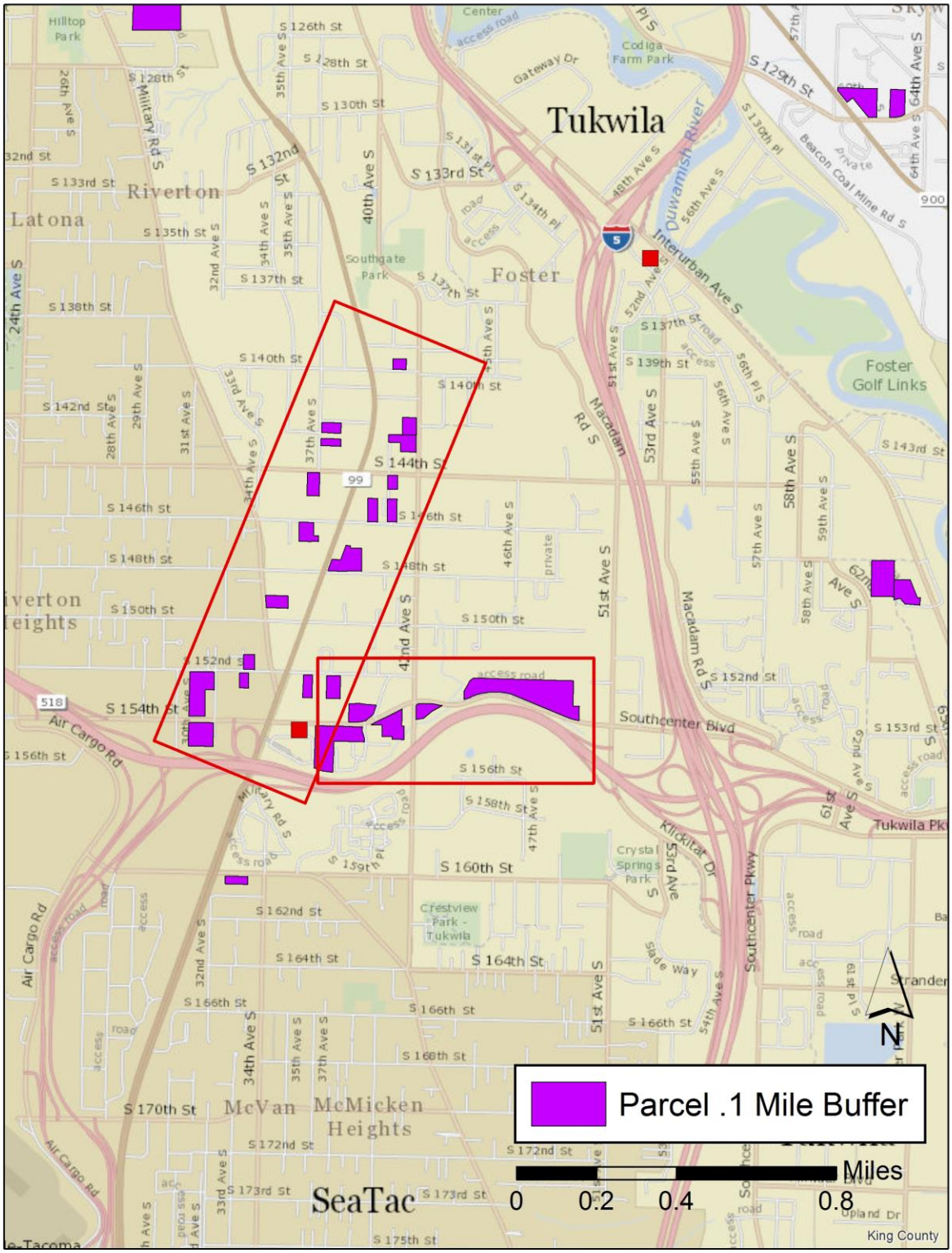


Figure 25. Clusters Of Parcels By Corridor Method: Federal Way, WA.

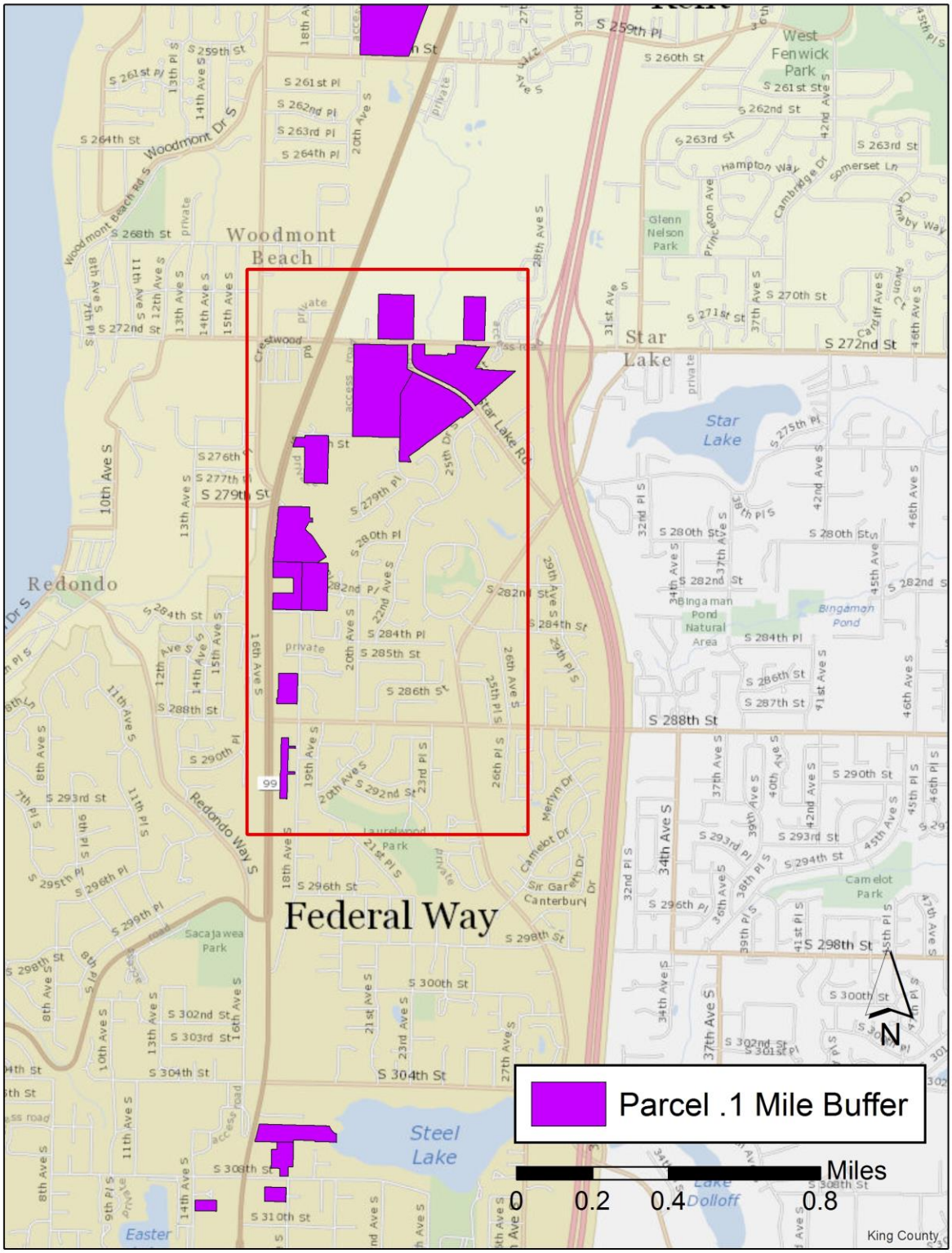


Figure 26. Clusters Of Parcels By Corridor Method: Burien, WA.

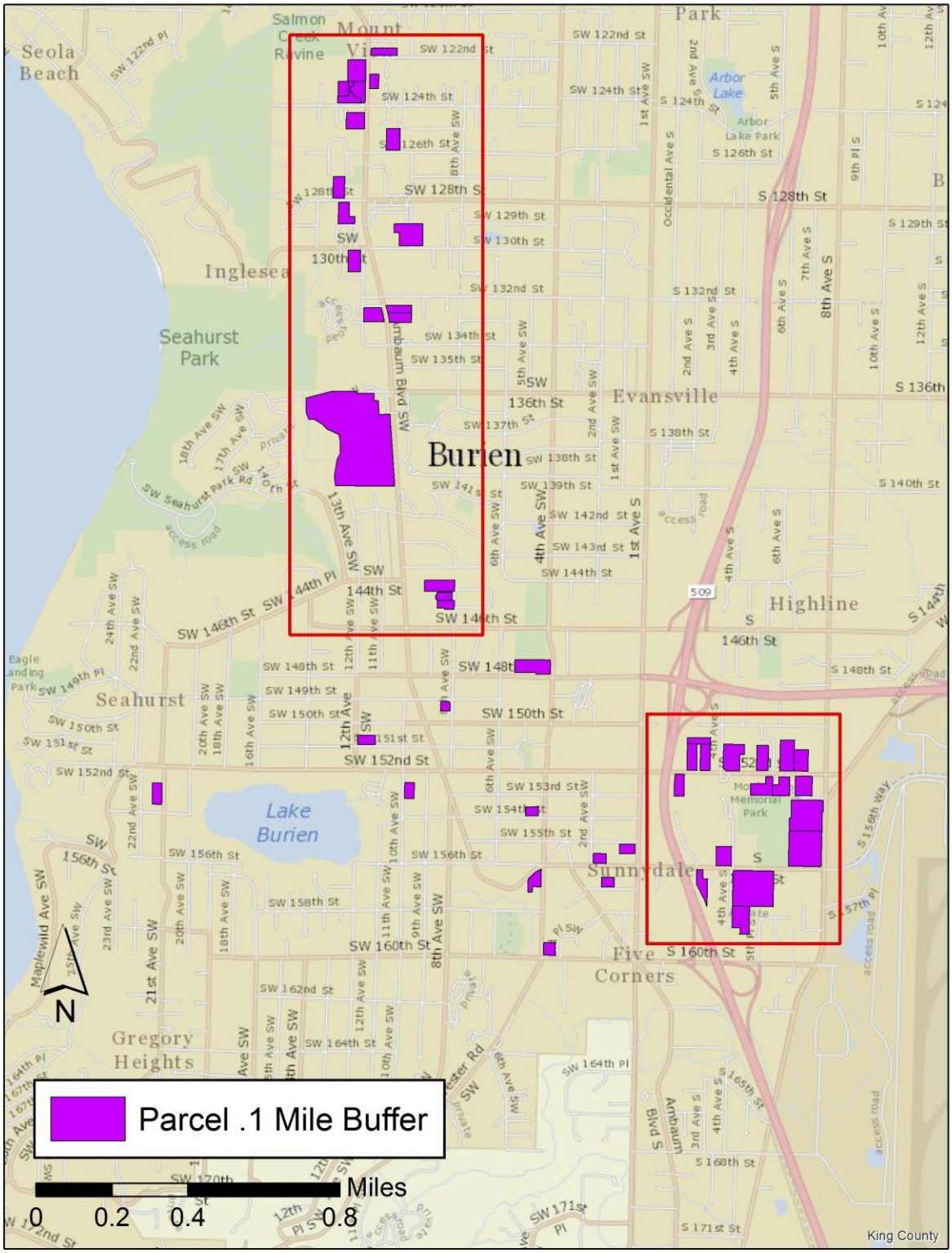


Figure 27. Groups Of Parcels By Crowded P&R Method: Northgate and Greenlake P&Rs, Seattle.

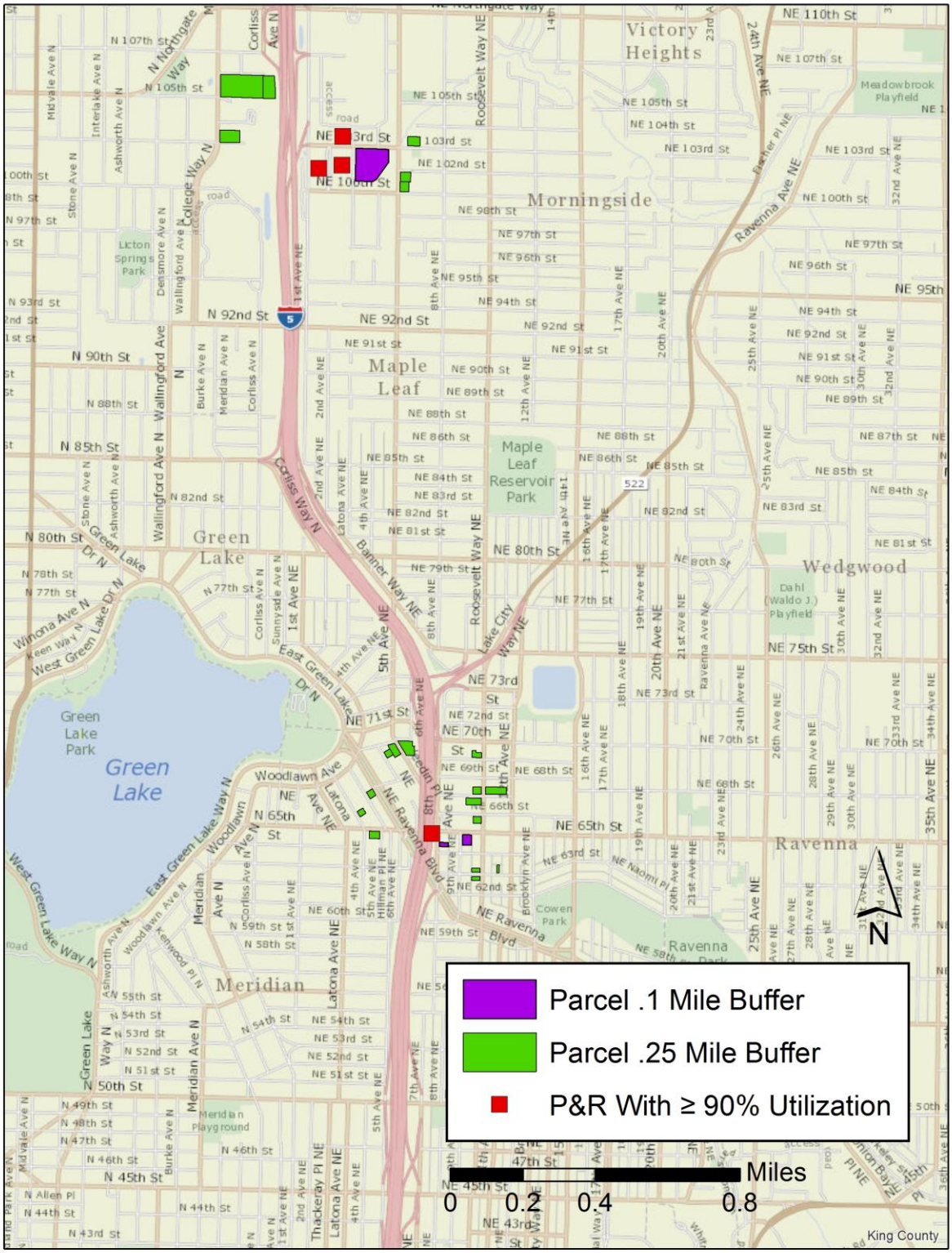


Figure 28. Groups Of Parcels By Crowded P&R Method: Aurora Village Transit Center, Shoreline, WA.

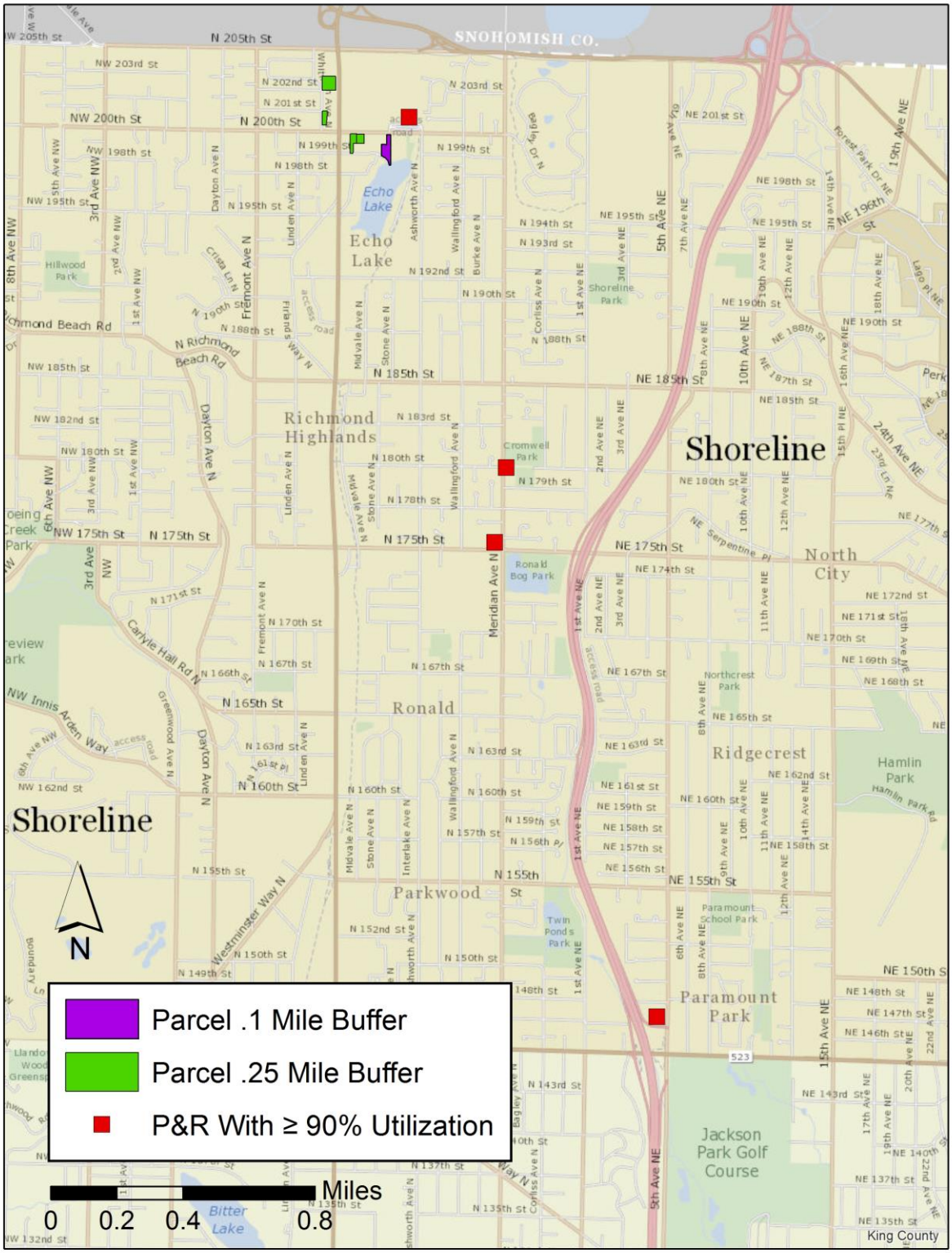


Figure 29. Groups Of Parcels By Crowded P&R Method: Kenmore, Bothell, Brickyard, and Kingsgate P&Rs, Kenmore Community Church and Holy Spirit Lutheran Church Lease Lots, Bothell, WA.

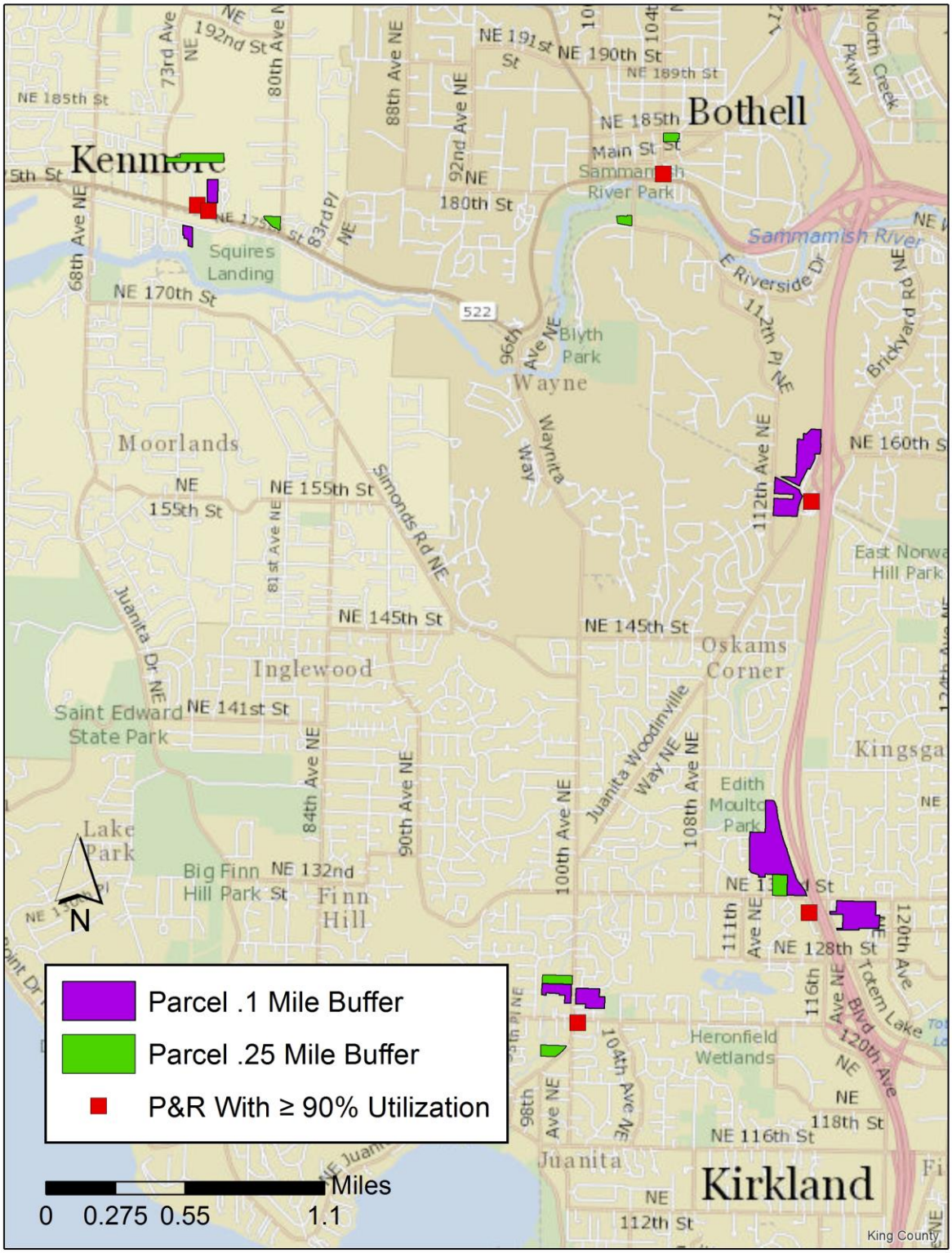


Figure 30. Groups Of Parcels By Crowded P&R Method: Redmond and Overlake Transit Center P&Rs, Redmond, WA.

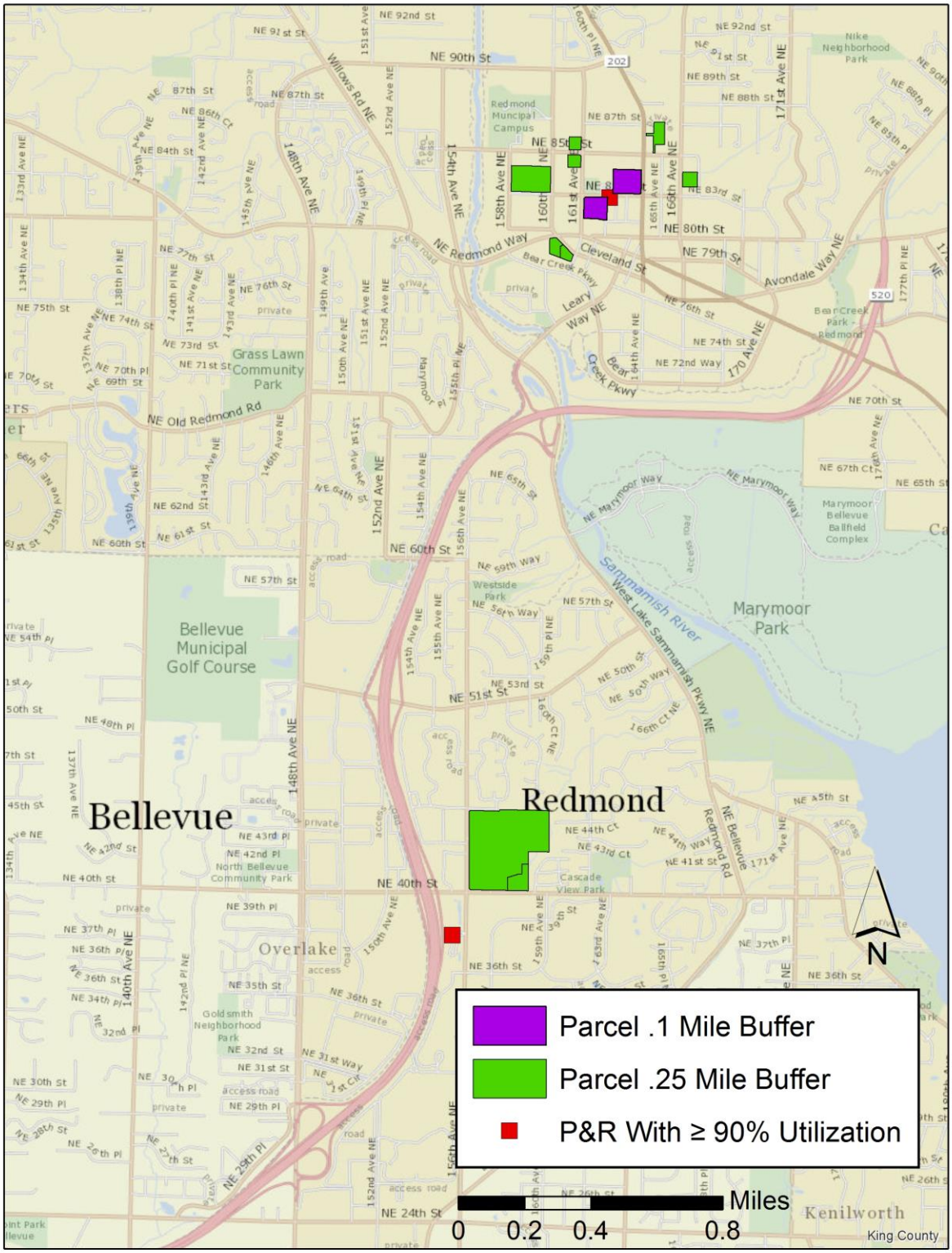


Figure 31. Groups Of Parcels By Crowded P&R Method: Mercer Island P&R and Grace Lutheran Church Lease Lot, Mercer Island and Bellevue, WA.

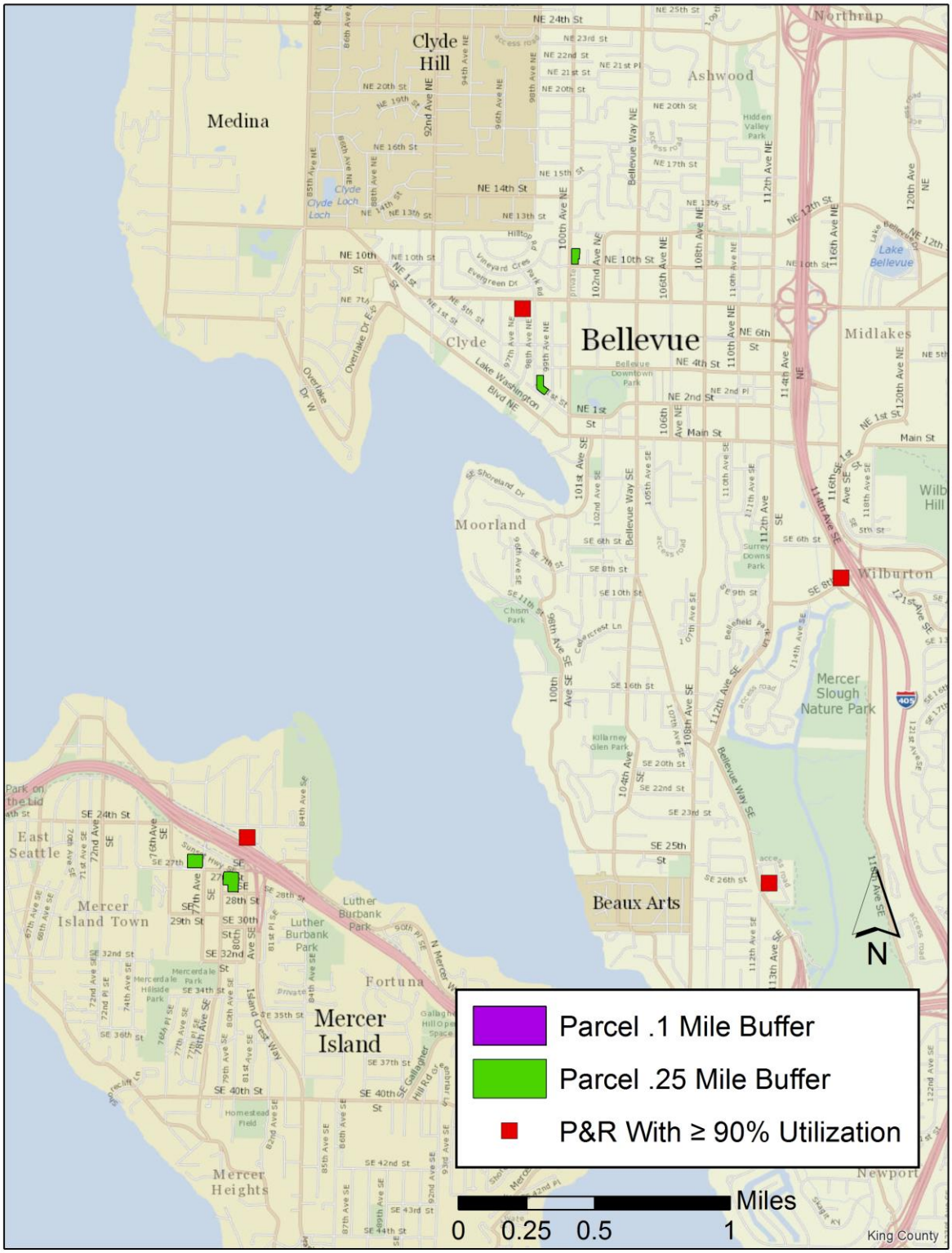


Figure 32. Groups Of Parcels By Crowded P&R Method: Issaquah Highlands P&R, Issaquah, WA.

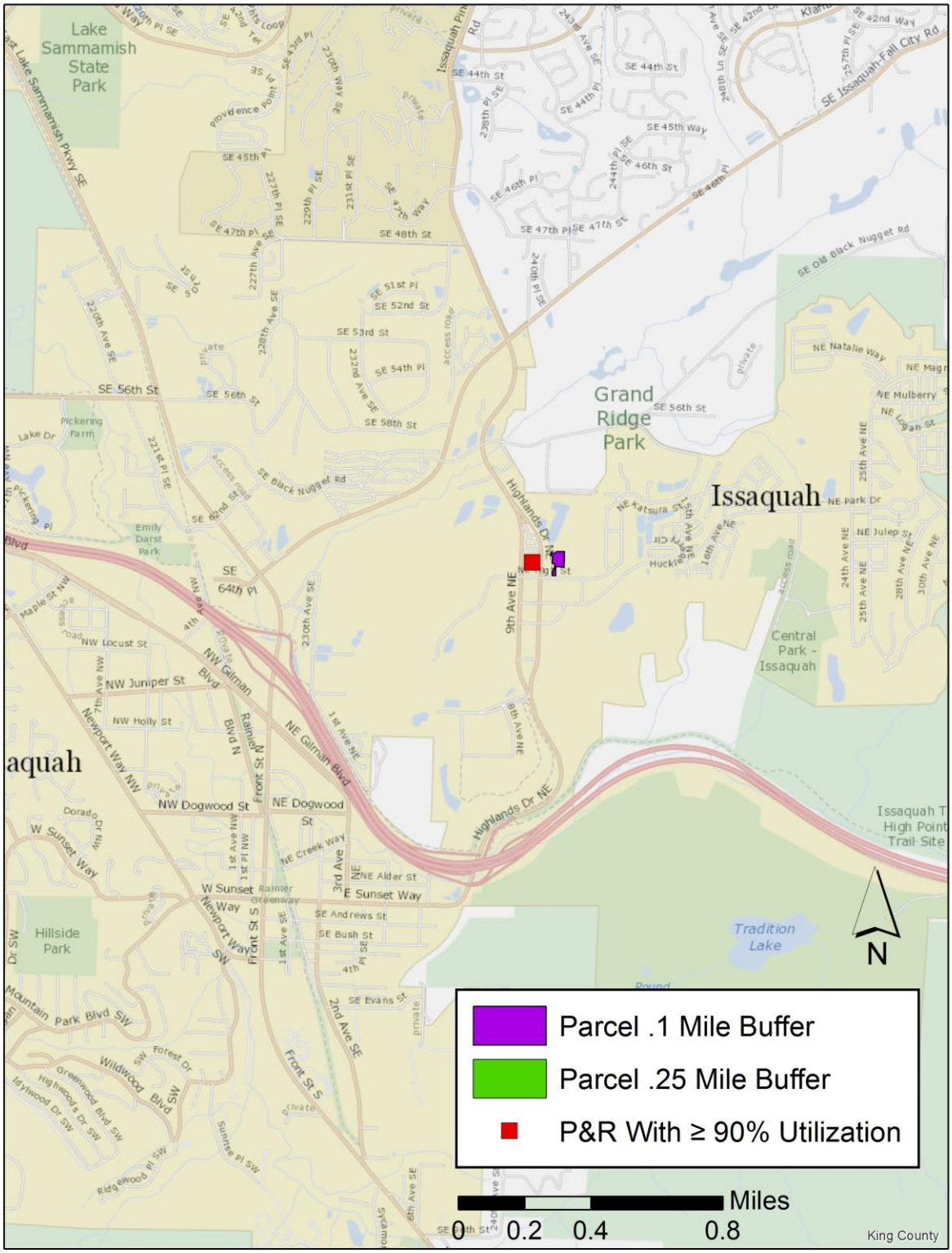


Figure 33. Groups Of Parcels By Crowded P&R Method: Renton Transit Center and South Renton P&Rs, Fred Meyer and New Life Church Lease Lots, Renton, WA.

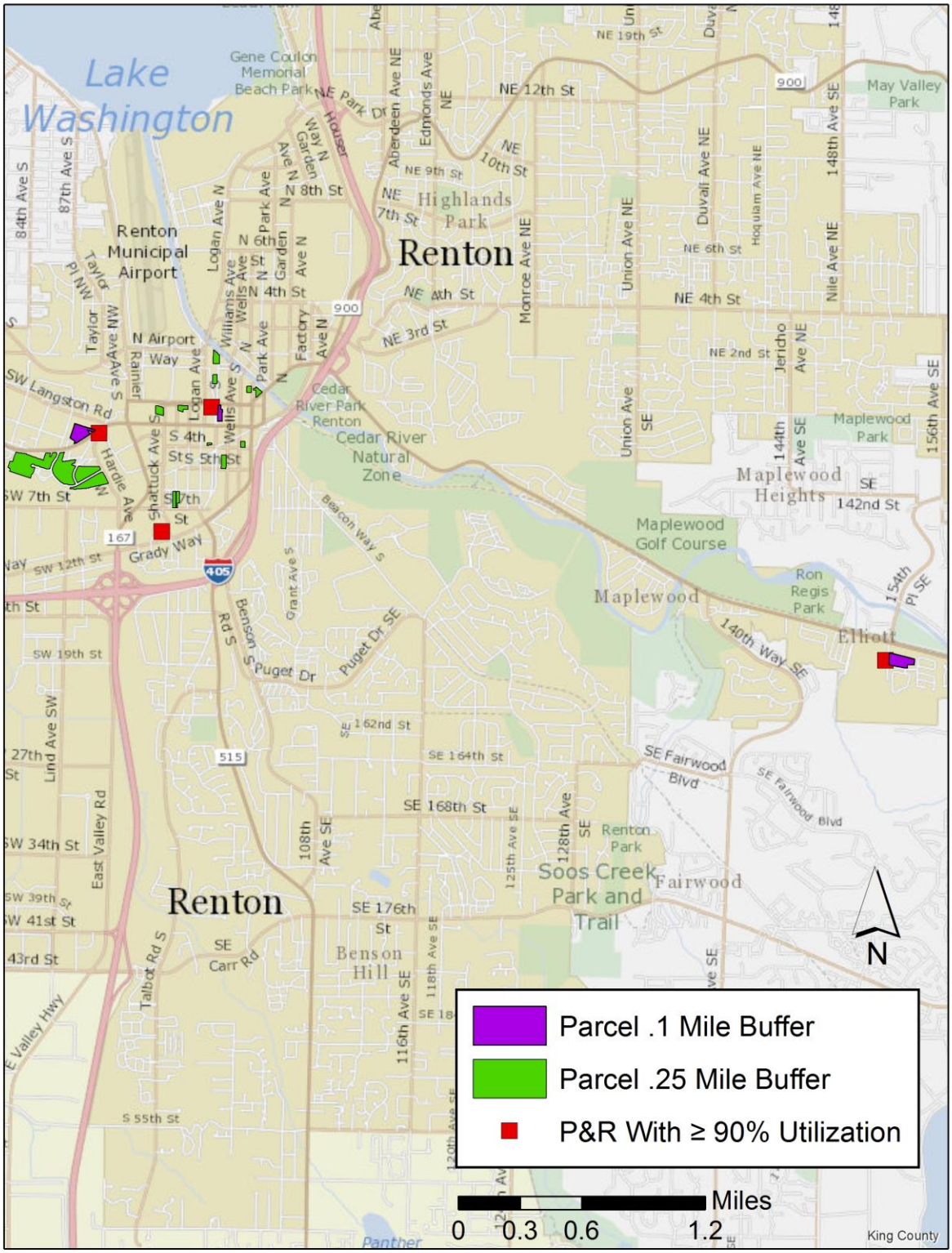


Figure 34. Groups Of Parcels By Crowded P&R Method: Kent Surface Lot at Kent Station P&R, Kent, WA.

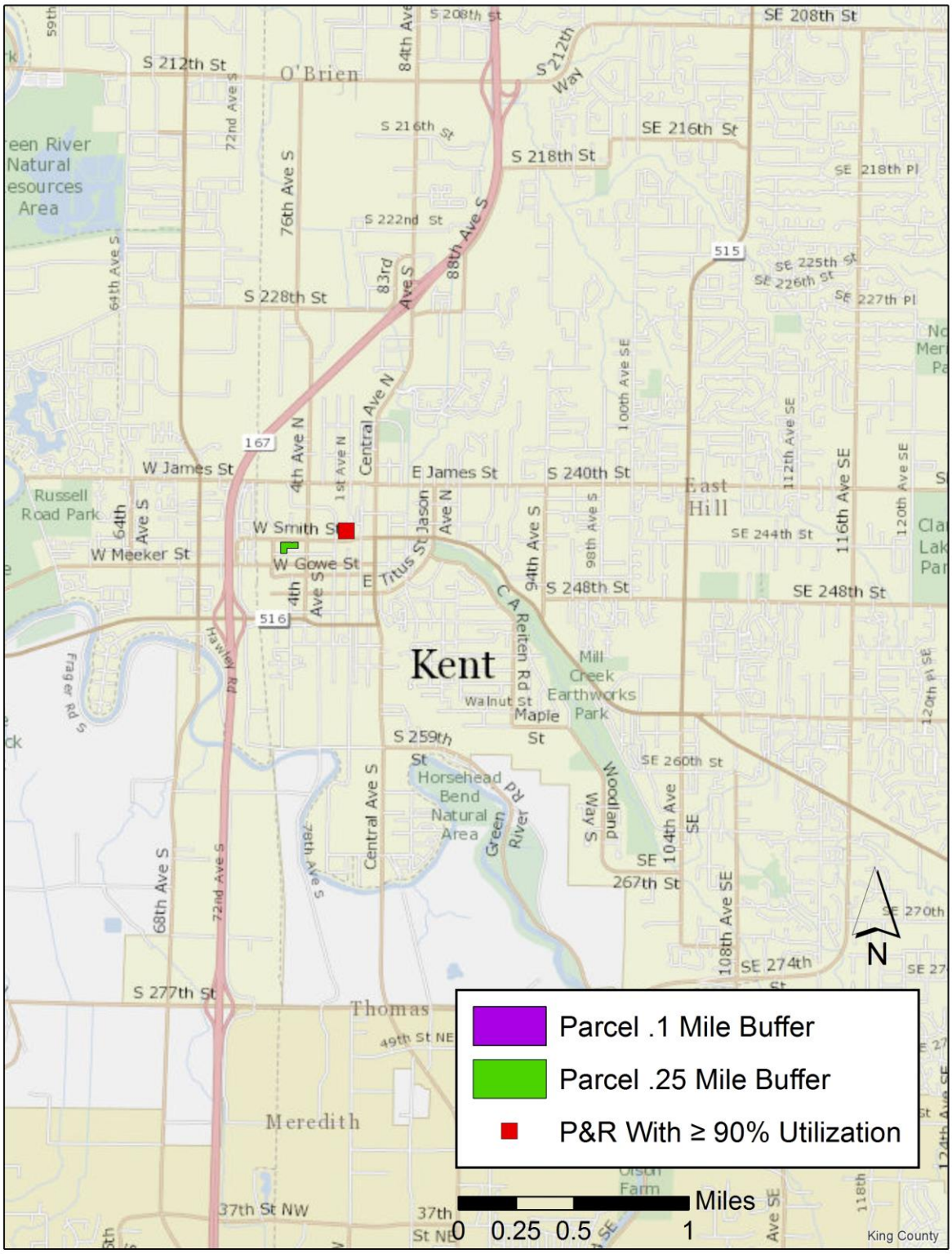


Figure 35. Groups Of Parcels By Crowded P&R Method: Tukwila International Blvd Station and Tukwila P&R, Tukwila, WA.

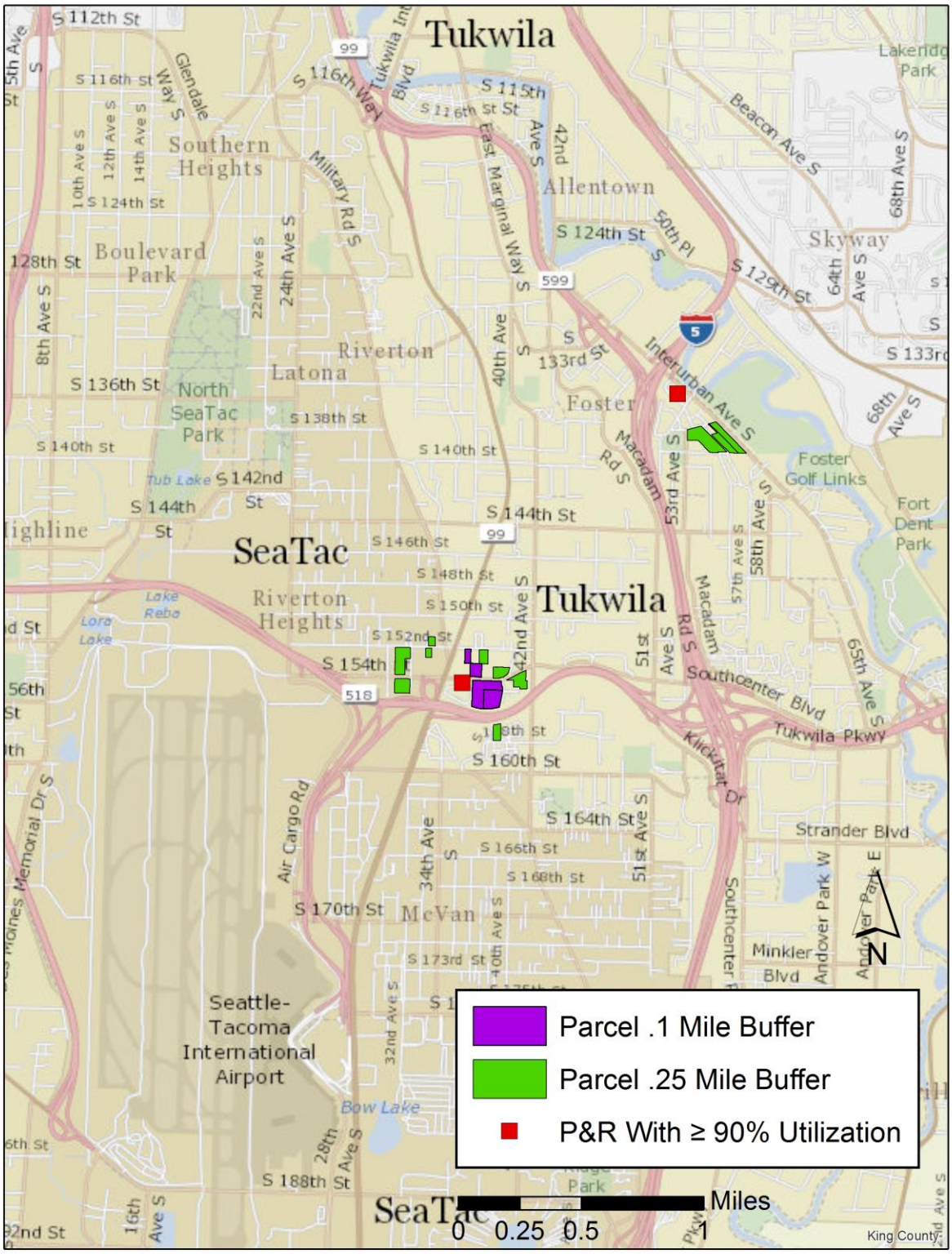


Figure 36. Groups Of Parcels By Crowded P&R Method: Federal Way Transit Center, Auburn Garage and Surface Lot at Auburn Station P&R, Federal Way and Auburn, WA.

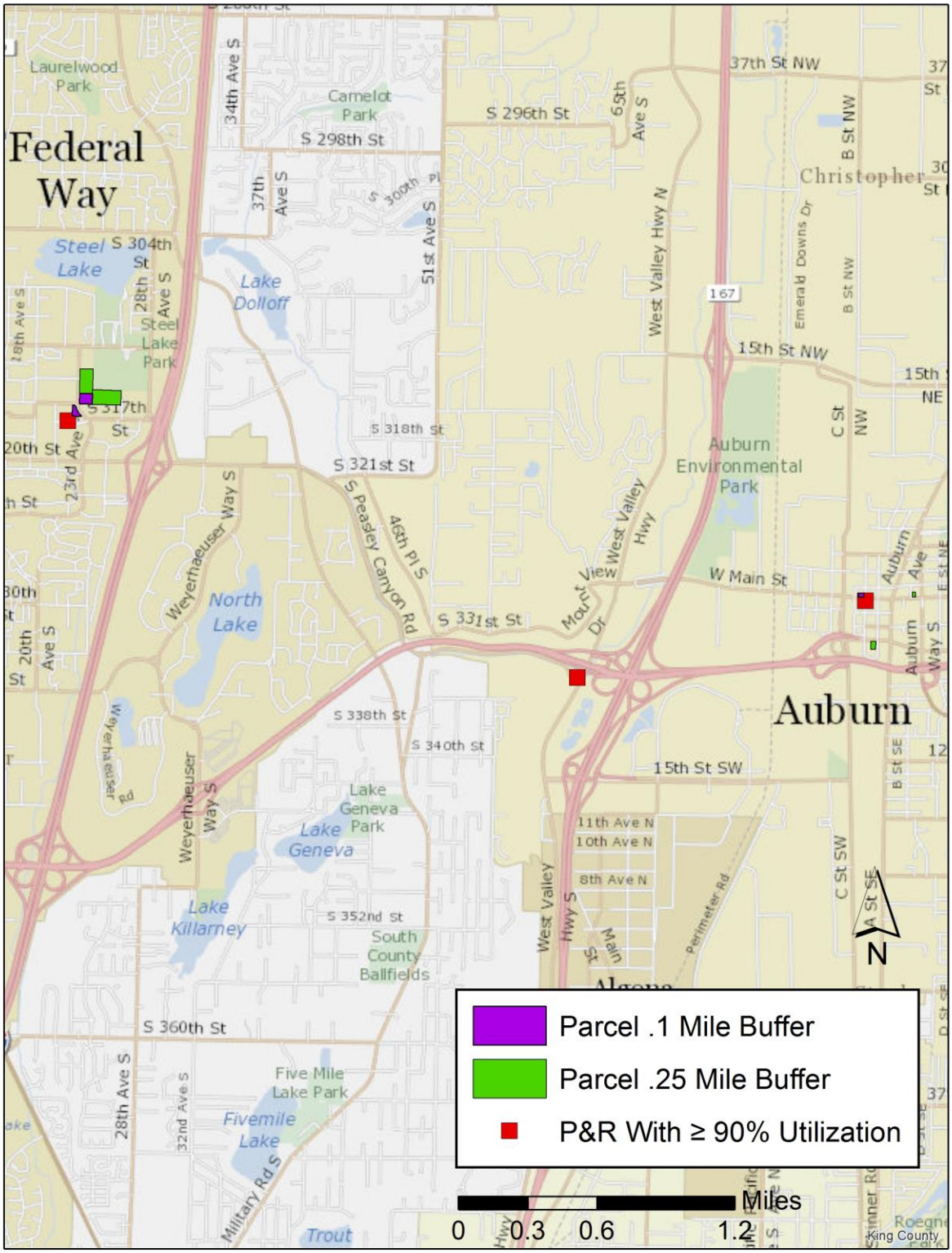
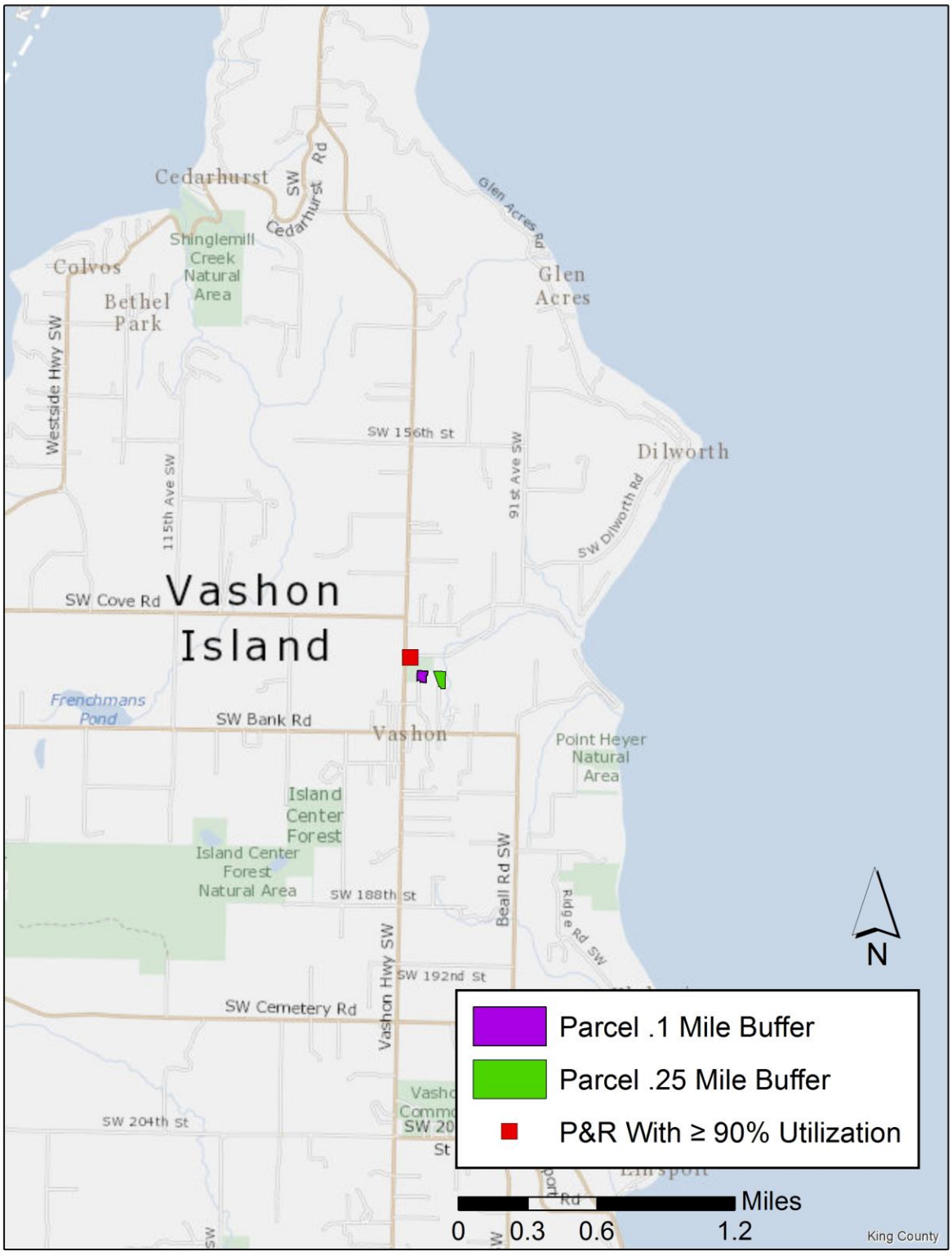


Figure 37. Groups Of Parcels By Crowded P&R Method: Ober P&R, Vashon Island, WA.



# Chapter 5: Summary and Further Research

## Summary

Park and rides are an integral part of the transportation system in the Puget Sound region. During the 4th Quarter of 2014, 20,054 park and ride spaces were used on an average daily basis, resulting in a system-wide average utilization rate of 79% of available parking capacity.[61] Park and ride demand is rising along with transit ridership, putting pressure on transit agencies to supply more transit parking. Additionally, many lots are full by 9:00am putting those that commute later at a disadvantage. Existing vacant or underutilized parking in multifamily developments near good transit service provides an opportunity to share parking with transit riders. Shared parking as a solution to this problem will increase the efficiency of each existing parking space and can, in a sense, increase the supply without building new parking.

This thesis is situated in other research funded by a federal grant awarded to King County Metro Transit. A completed geospatial analysis was delivered to the King County project team based on four criteria: defining multifamily developments from King County Assessor parcels, creation of an Ideal Transit Service Network, distance to transit stop on the Network, and proximity to crowded park and rides. Next, parcels were selected based on the Corridor or Crowded Park and Ride Methods. Parcels selected by both methods are detailed in a series of tables and maps in the Recommendations Chapter. The research completed by this thesis will support further research in locating potential pilot projects in King County.

Broad recommendations of parcels highlighted by the Corridor and Crowded Park and Ride Methods span many jurisdictions in King County, and reflect an early stage of research. Other variables will influence the success of a pilot project in further research completed by the project team.

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[61] Cahan, Steve. *Park-And-Ride Utilization Report Second Quarter 2014*. Seattle, WA: King County Metro Transit , July 2014. http://metro.kingcounty.gov/am/reports/2014/2014-par14q4.pdf.

## Illustration

An example route traveled can help illustrate the shared transit parking model. For instance, a commuter lives in a cul-de-sac neighborhood in Lake Forest Park, WA and commutes to a job in downtown Seattle. Driving from home to work for this commuter may be unpredictable, expensive, and may be stressful. Google maps with traffic modeling guesses that this commute would take anywhere from 22 to 40 minutes driving using Interstate-5 on a Monday morning, leaving at 7am.[62] On the other hand, Google models taking transit from door-to-door at 1 hour 2 minutes via route 77 and leaving at 7am on a Monday morning.[63] Using the shared transit parking model, the commuter could drive to the Cambridge Apts in North Seattle, a multifamily parcel recommended by the Corridor Method, park their vehicle and board the RapidRide E Line at N 130th St. and Aurora Ave N, finally arriving in downtown Seattle. Google maps with traffic modeling guesses that the trip from Lake Forest Park, WA to The Cambridge Apartments takes between 14 and 16 minutes using NE 155th St, see Figure 38.[64] After parking their vehicle in a shared space at The Cambridge Apartments, the commuter walks to N 130th St. and Aurora Ave. N and takes the RapidRide E Line to downtown Seattle, see Figure 39. Google maps estimates this trip on the RapidRide E Line would take 39 minutes.[65] By employing the shared transit parking model, the commuter is able to maintain a speedy commute, save money on parking and maintenance of a personal vehicle, and be able read or relax on the majority of their commute.

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[62] "Trip Planner." *Google Maps*, 2015. https://www.google.com/maps/dir/2746-2798+NE+184th+Pl,+Lake+Forest+Park,+WA+98155/Benaroya+Hall,+University+Street,+Seattle,+WA/@47.6866941,122.3856069,23823m/data=!3m2!1e3!4b1!4m17!4m16!1m5!1m1!1s0x5490104efdca1809:0xb45dd98bc81d8cde!2m2!1d-122.3051049!2d47.7619786!1m5!1m1!1s0x54906ab3cb8fb7e1:0xf3a61c0c5726c496!2m2!1d-122.33697!2d47.608084!2m2!7e2!8j1433746800!3e0.

[63] Ibid.

[64] Ibid.

[65] Ibid.

## Further Research

The geospatial analysis detailed in this thesis project, could become a powerful tool through automation of steps, perhaps using ArcMap ModelBuilder. This would allow for flexible inputs and would allow the project team to test out different scenarios through different methodologies. For instance, the project team could decide to raise or lower the number of dwelling units, above or below 20 total units, in a multifamily development, which would affect the number of parcels available as potential pilot projects in King County. Another potential change would be to increase or decrease the level of service required on the Ideal Transit Service Network. For instance, the project team could decide to use only express bus routes to employment centers where paid parking is above $5 / day. Selecting only express routes to certain centers will decrease the number of routes on the Network, and also decrease the number of parcels available as potential pilot projects. If the methodology were to be developed as an ArcMap toolbox, it could be shared with other regions looking to pilot a similar parking management program.

Further research is needed to fully develop locations for potential pilot projects. Beyond defining multifamily parcels from King County Assessor data, creation of an Ideal Transit Service Network, and selecting parcels through the Corridor or Crowded Park and Ride Methods, other variables should be considered, see Figure 40 for a Future Research Conceptual Model. Estimated parking supply in each multifamily development, regulated and time-limited on-street parking restrictions, local traffic impacts and political and legal feasibility are likely to be the most important variables. Additionally, the project team must decide how to measure or model each variable and how to weigh the variables as a whole. Quarterly reports on King County Metro's Park and Ride Pricing in Multifamily Developments can be found on the U.S. Department of Transportation Federal Highway Administration's website under the Value Pricing Pilot Programs.

Figure 38. Illustration Route Traveled: From Home To Shared Transit Parking Space.

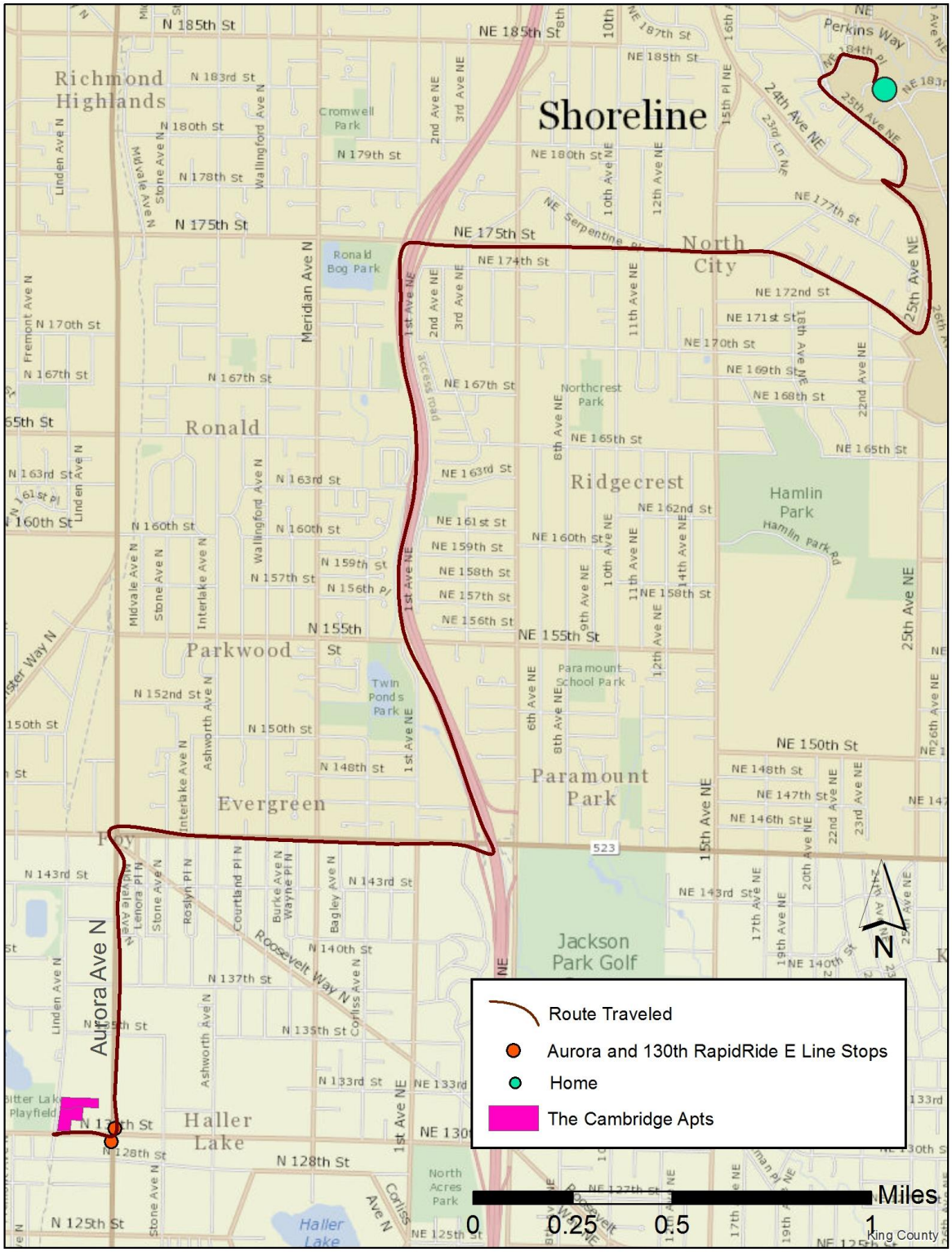
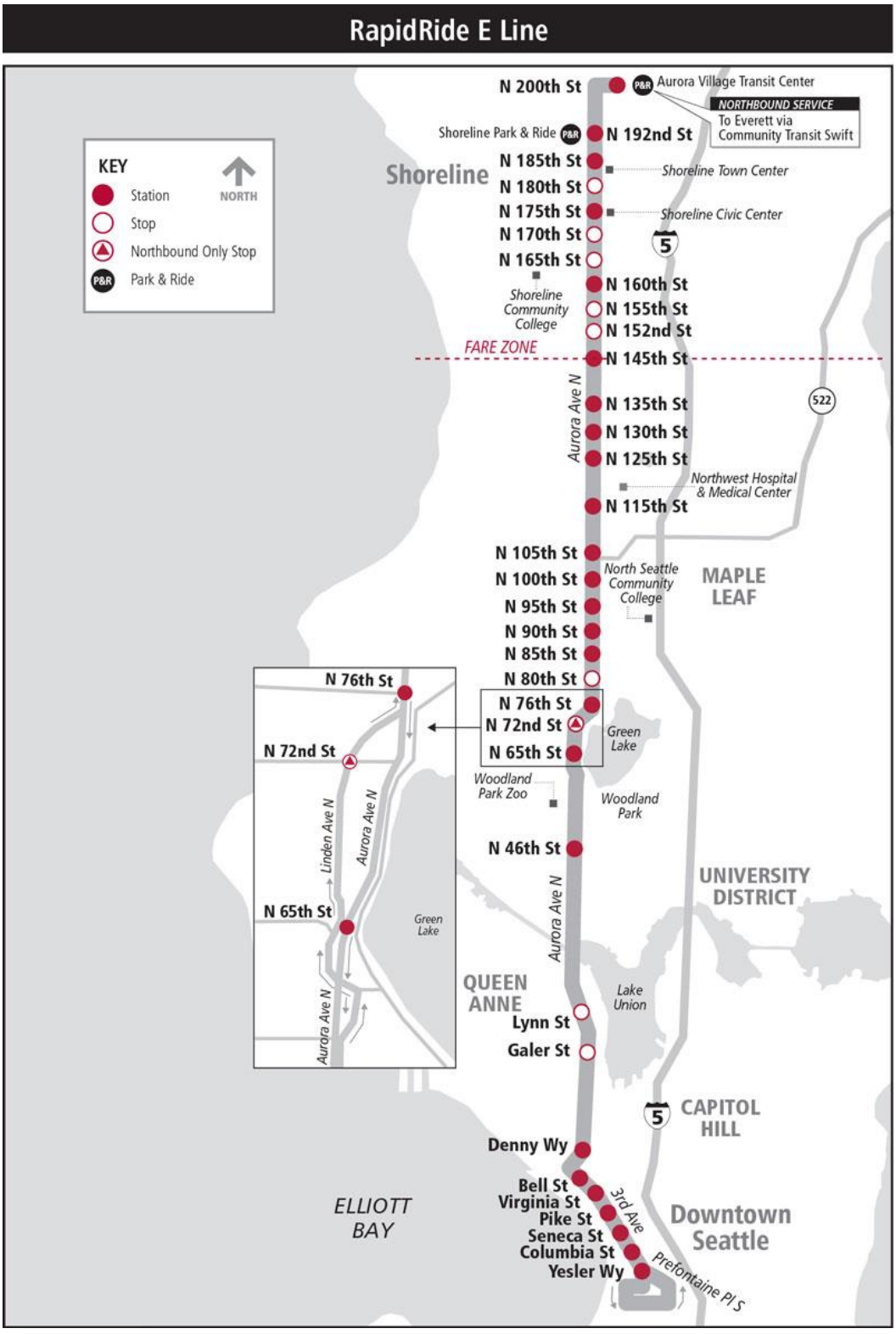
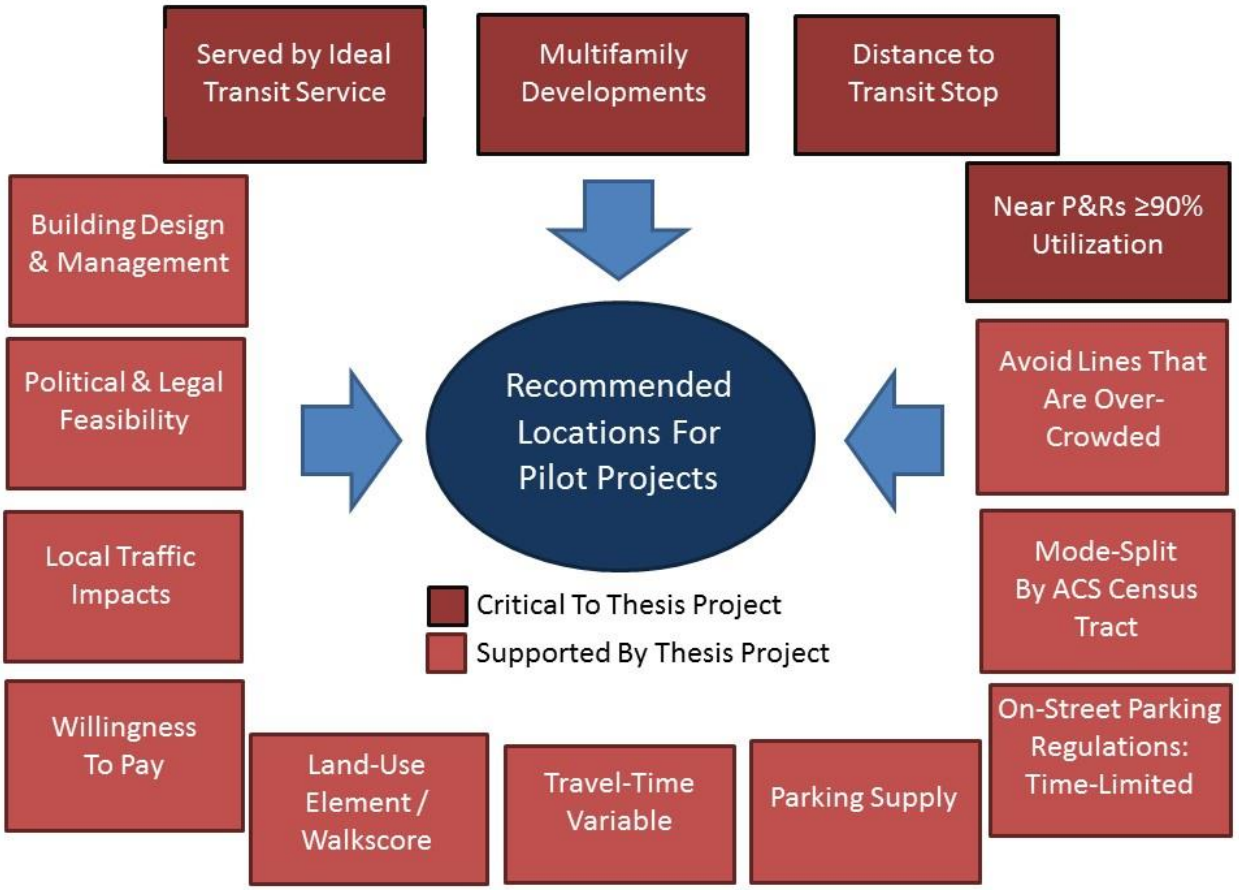


Figure 39. Illustration Route Traveled: From N 130th St to Downtown Via RapidRide E Line.[66]




[66] "RapidRide E Line." Route Map. *King County Metro Online*, 2015. http://metro.kingcounty.gov/schedules/675/map.html.

Figure 40. Future Research Conceptual Model.



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"ArcGIS Help 10.1: Proximity Analysis." *ESRI: ArcGIS Resources*, October 29, 2012. http://resources.arcgis.com/en/help/main/10.1/index.html#//018p00000007000000.

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## Appendix: Metadata Dictionary For GIS Source Layers

| Variable | Layer / Sheet Name | Description | Source | Revision Date |
|---|---|---|---|---|
| Distance to transit stop / Ideal Transit Service Network | busstops_Metro_MetroOper | Busstops (Zonekeys) for all KCM and Metro-operated (ST) on routes according to the table of selected Frequent Transit Service. Ultimately, all not-Local or not-Hourly routes. | King County GIS Center, Transportation | December 23, 2014 |
| Distance to transit stop / Ideal Transit Service Network | Busstop_Metro_Freq | Busstops (Zonekeys) for all KCM and KCM-operated routes classified as Frequent Transit Service by the researcher. Zonekey_Passes.csv sheet joined to busstops layer based on ZONEKEY. 1 assigned to a zonekey if the stop serves a frequent route. 0 assigned if it does not. | Excel File: N/A | Excel File: N/A |
| Ideal Transit Service Network | routes | KCM and Metro-operated ST routes. May not be useful for analysis but for visual presentation. | King County GIS Center, Transportation | December 21, 2014 |
| Ideal Transit Service Network | LinkLightRail | Line file of the Link light rail. May not be useful for analysis but for visual presentation. | Sound Transit Data Downloads | June 8, 2014 |
| Ideal Transit Service Network | LinkStations | Point file of Link light rail stations added to Metro and STExpress stops. | Sound Transit Data Downloads | June 8, 2014 |
| Ideal Transit Service Network | Sounder | Line file of Sounder rail line. May not be useful for analysis but for visual presentation. | Sound Transit Data Downloads | June 8, 2014 |
| Ideal Transit Service Network | SounderStations | Point file of Link light rail stations added to Metro and STExpress stops. | Sound Transit Data Downloads | June 8, 2014 |

| | | | | |
|---|---|---|---|---|
| Ideal Transit Service Network | STExpress_CTPTOper | Line file of STExpress bus lines operated by Community Transit and Pierce Transit. May not be useful for analysis but for visual presentation. | Sound Transit Data Downloads | June 8, 2014 |
| Ideal Transit Service Network | STExpressStops | Point file of STExpress bus lines operated by Community Transit and Pierce Transit. | Sound Transit Data Downloads | June 8, 2014 |
| Ideal Transit Service Network | FreqTran_ALL4_Merge | Point file merge of 4 point files: Busstop_Metro_Freq, STExpress stops, LinkStations, Sounder stops. Attribute table is difficult to sort out (a combination of all attributes). | N/A | N/A |
| Ideal Transit Service Network | FreqTran_Merge_*XX*_ buffers | Buffer tool used around Freq_Trans_ALL4_Merge point layer to create various distance buffers at 1/10 mile, ¼ mile, and ½ mile. | N/A | N/A |
| Multifamily Developments | Pres_Use_MF_6 | A selection of MF categories from the *PRESENTUSE* attribute from the KC parcel_address.shp layer, joined with Accessory Record Description, *EXTR_LookUp.csv* for parking info (if avail). | King Count<br>y GIS Center, Property, Assessor's Office | 2014 |
| Multifamily Developments with ≥20 units | Pres_Use_MF6_20 | A selection of parcels from Pres_Use_MF_6 where TotUnits >= 20 | N/A | N/A |
| Near P&Rs | P_Rs_KC | A selection of PRs (only in KC) from ParkandRides.gdb | Washington State Department of Transportation, Mark Eldridge | Apr. 9, 2013 |
| Near P&Rs | P_Rs_KC_Utilization | P&Rs in King County with | King County | 2013 & 2014 |

| | | | | |
|---|---|---|---|---|
| | | updated Q32014 and Q42014 utilization data. | Metro, Steve Cahan | respectively |
| Near P&Rs | PR_Q32014_90Util | A selection of P&Rs in KC with ≥90% utilization from Quarter 3, 2014 data. | N/A | N/A |
| Near P&Rs | PR_Q42014_90Util | A selection of P&Rs in KC with ≥90% utilization from Quarter 4, 2014 data. | N/A | N/A |
| Near P&Rs | PR_Q32014_90Util_buffer | A ½ mile buffer around KC P&Rs with ≥90% utilization from Q32014. | N/A | N/A |
| Near P&Rs | PRQ4201490Util_*XX*_buffer | Buffer tool used around PR_Q42014_90Util point layer to create various distance buffers at 1/10 mile, ¼ mile, and ½ mile. | N/A | N/A |
| Ideal Transit Service Network / Multifamily Developments with ≥20 units | PUMF620_*XX*_sel2 | A selection of multifamily parcels, with ≥20 units, selected by location of various Ideal Transit Service Network buffer scales. | N/A | N/A |
| Near P&Rs / Multifamily Developments with ≥20 units | PUMF620_PR90Util_*XX*_sel2 | A selection of multifamily parcels, with ≥20 units, selected by location of various P&R with ≥90% utilization buffer scales. | N/A | N/A |