URBANFOOTPRINT ANALYSIS

UrbanFootprint Analysis for the Comprehensive Plan

As part of the Comprehensive Plan process, the City used a growth scenario modeling tool called UrbanFootprint to help estimate the future impacts of our land use and transportation decisions across seven major modules: energy use, water use, fiscal impacts (for both the City and for households), transportation, emissions, health, and land consumption. Growth scenario modeling works by creating a map of existing transportation, land use, employment, development density, and other aspects of urban development. Changes to land use and transportation are then made to existing conditions to create a future scenario. The impacts of future scenarios across the seven metrics are then compared to existing conditions or to other alternate scenarios. UrbanFootprint was customized for use in Madison and Dane County with local data and information from dozens of sources, including the Census, InfoUSA (employment data), Madison Water Utility, Madison Gas and Electric, Wisconsin DNR, the National Household Travel Survey, City Assessor, Capital Area Regional Planning Commission, Dane County, the Madison Area Metropolitan Planning Organization, and many others.

Three citywide scenarios were created for the Imagine Madison process, all of which assumed the addition of approximately 70,000 new residents and 37,000 new employees by 2040. Those scenarios are mapped and summarized on the following pages.

To maintain an "apples to apples" comparison, all three scenarios also assume development occurs according to the Comprehensive Plan's Generalized Future Land Use (GFLU) Map (see page 18 of the Growth Framework chapter). The difference between the scenarios was where growth would occur, not whether the Comprehensive Plan was followed.

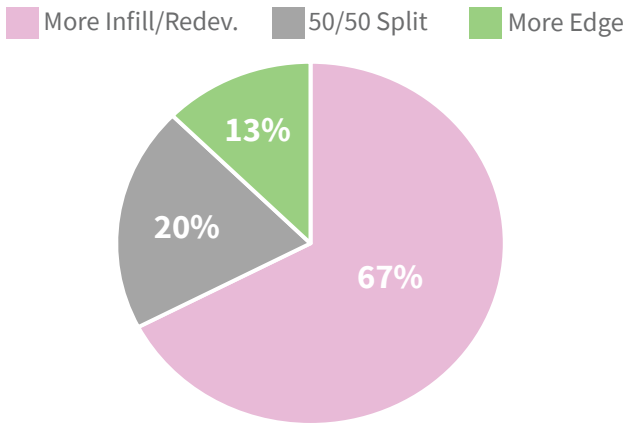
More roadbuilding and less transit were associated with Scenario #1 because edge development tends to be less intense, have a less walkable street network, have less mixing of uses, and be more difficult to serve with transit due to low development intensity and a larger service area.

More transit service was associated with Scenarios #2 and #3 because redevelopment tends to occur in areas that are already walkable and served by transit. Public feedback on Plan goals and strategies in the initial stages of the Imagine Madison process helped inform scenario development.

Public Input Results – Website

UrbanFootprint analysis was used as part of an Imagine Madison website module where visitors had an opportunity to explore outcomes and view maps based on the three citywide scenarios summarized above. Website visitors could explore the anticipated land consumption, household water use, household vehicle miles traveled (VMT), and time spent walking associated with each scenario, alongside maps that depicted geographic variations in these metrics. People could then choose the scenario that most closely matched their vision for the future of the city.

See the maps on the following pages for a comparison of where development of new dwelling units was generally shown for each scenario (green represents edge development and pink represents redevelopment; the darker the color, the more intense the development). Two-thirds chose the scenario with the most infill and redevelopment, 20% chose the scenario with an even mix of edge development and redevelopment, and 13% chose the scenario with the most edge development.



Public Input Results – Community Meetings

Imagine Madison public meetings used UrbanFootprint in a different manner. Background was provided to community meeting attendees in an introductory presentation and via a series of displays that showed existing conditions for the percent of trips taken by non-car modes of transportation, walking minutes per day for adults, and miles driven per household per year (also known as "vehicle miles traveled," or VMT). These maps conveyed the geographic differences between how households travel based on where they live.

Community meeting participants could explore select information from the same three scenarios that were provided on the Imagine Madison website. They were then asked to place dots on a map of the city and surrounding area to show where they felt the city should accommodate the estimated 40,000 housing units that are anticipated. Ninety-one percent of dots were placed in infill and redevelopment areas. A similar growth prioritization exercise was provided to Resident Panels, and 81% of resident panel responses prioritized growth in infill and redevelopment areas.

Implications of Growth Prioritization Results

Implementation of the community's strong general preference for growth to be largely accommodated through infill and redevelopment will be challenging. Redevelopment, when compared to edge development, will always have more residents nearby, some of whom may not agree with a given project. When contrasted with edge development, which tends to have very few (if any) neighbors, attempting to address stakeholder concerns with a proposed redevelopment project creates uncertainty in the development process. When combined with other redevelopment challenges that generally are not present in edge development, such as building demolition, a constrained site, potential environmental contamination, and maintaining transportation circulation, the market demand and the potential financial reward of redevelopment has to be substantial before a redevelopment project can proceed.

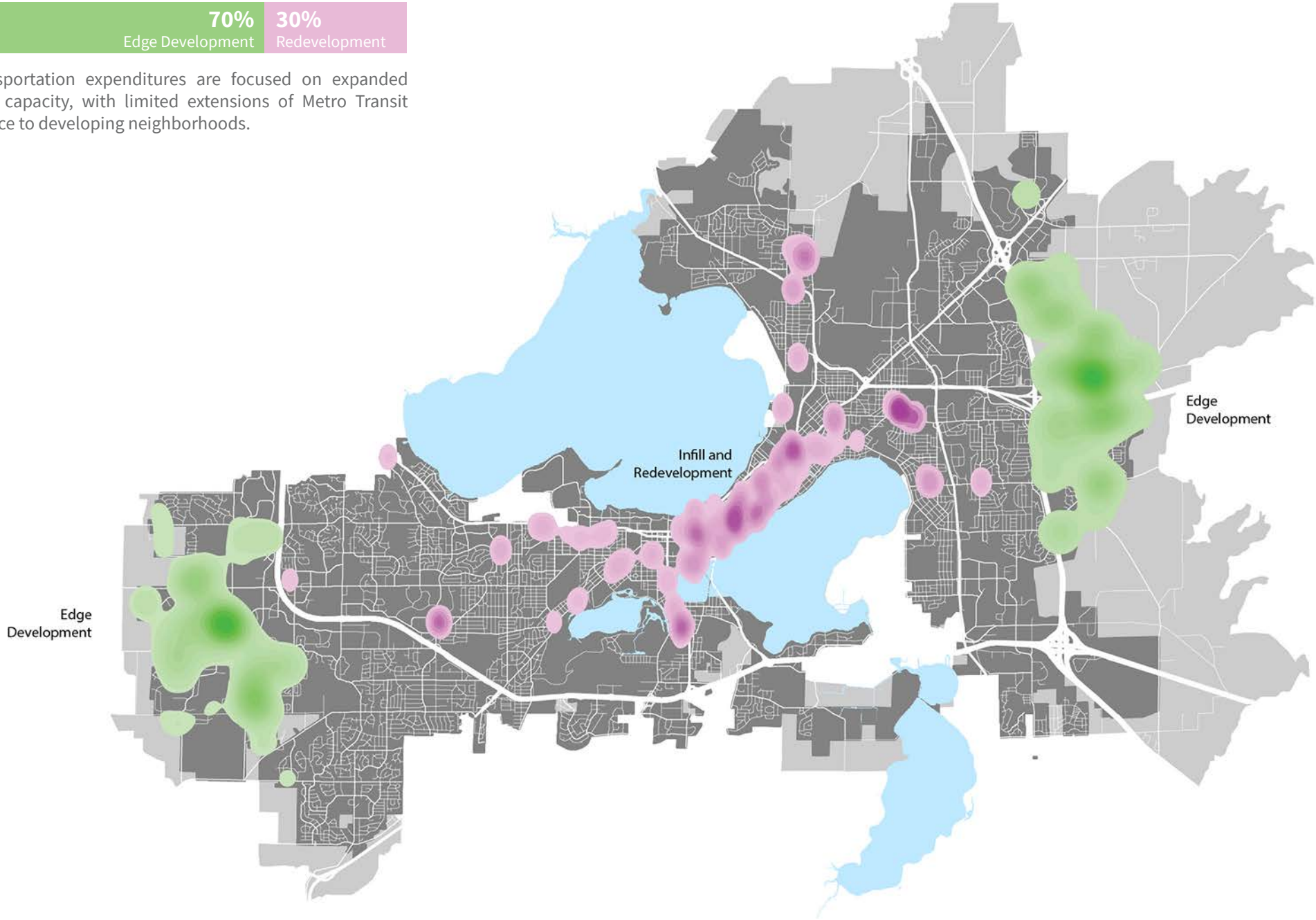
With all of the challenges associated with redevelopment, the benefits can sometimes be overlooked. Redevelopment

Continued on page 165

Scenario #1

70% Edge Development | **30%** Redevelopment

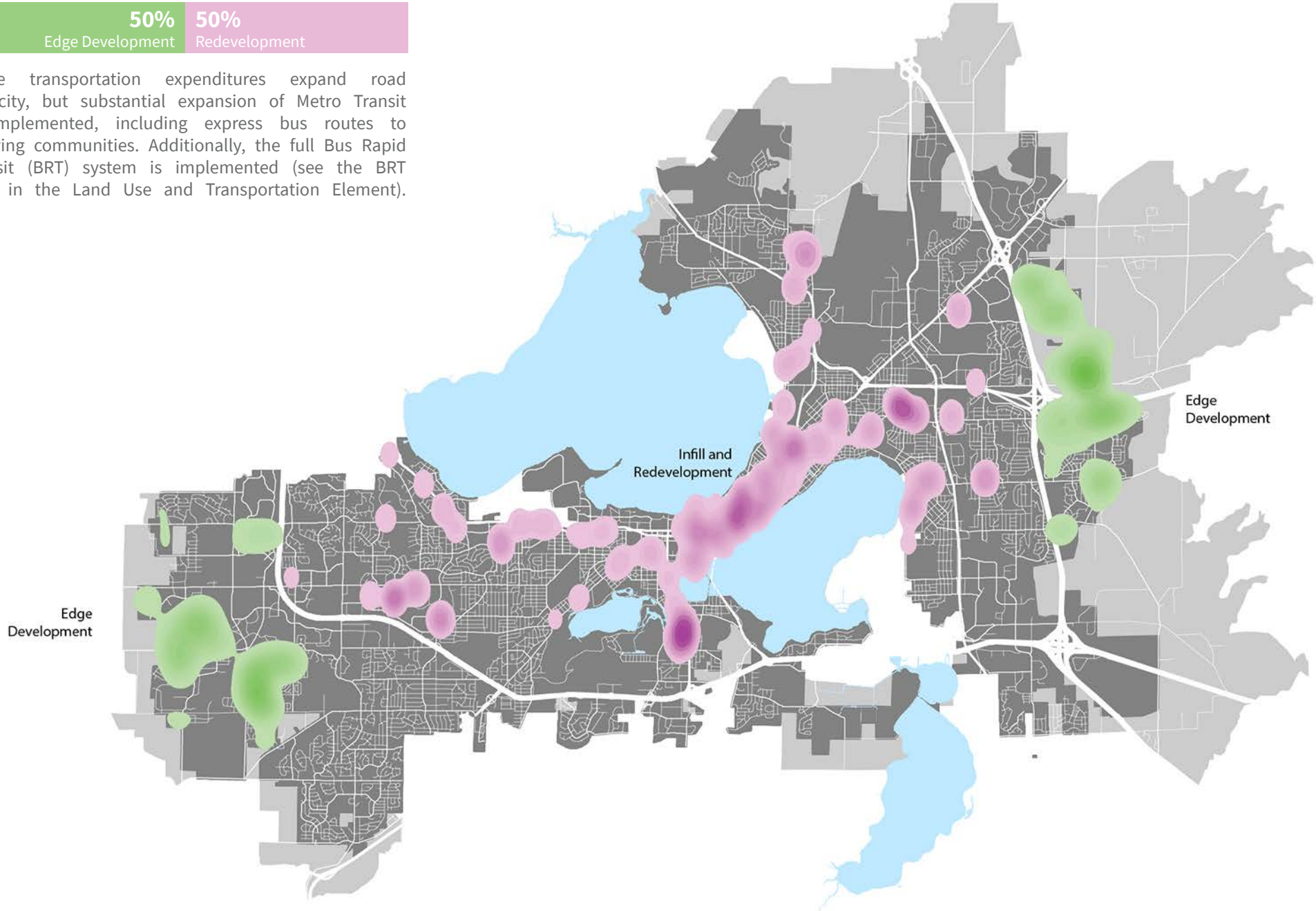
Transportation expenditures are focused on expanded road capacity, with limited extensions of Metro Transit service to developing neighborhoods.



Scenario #2

50% Edge Development	50% Redevelopment

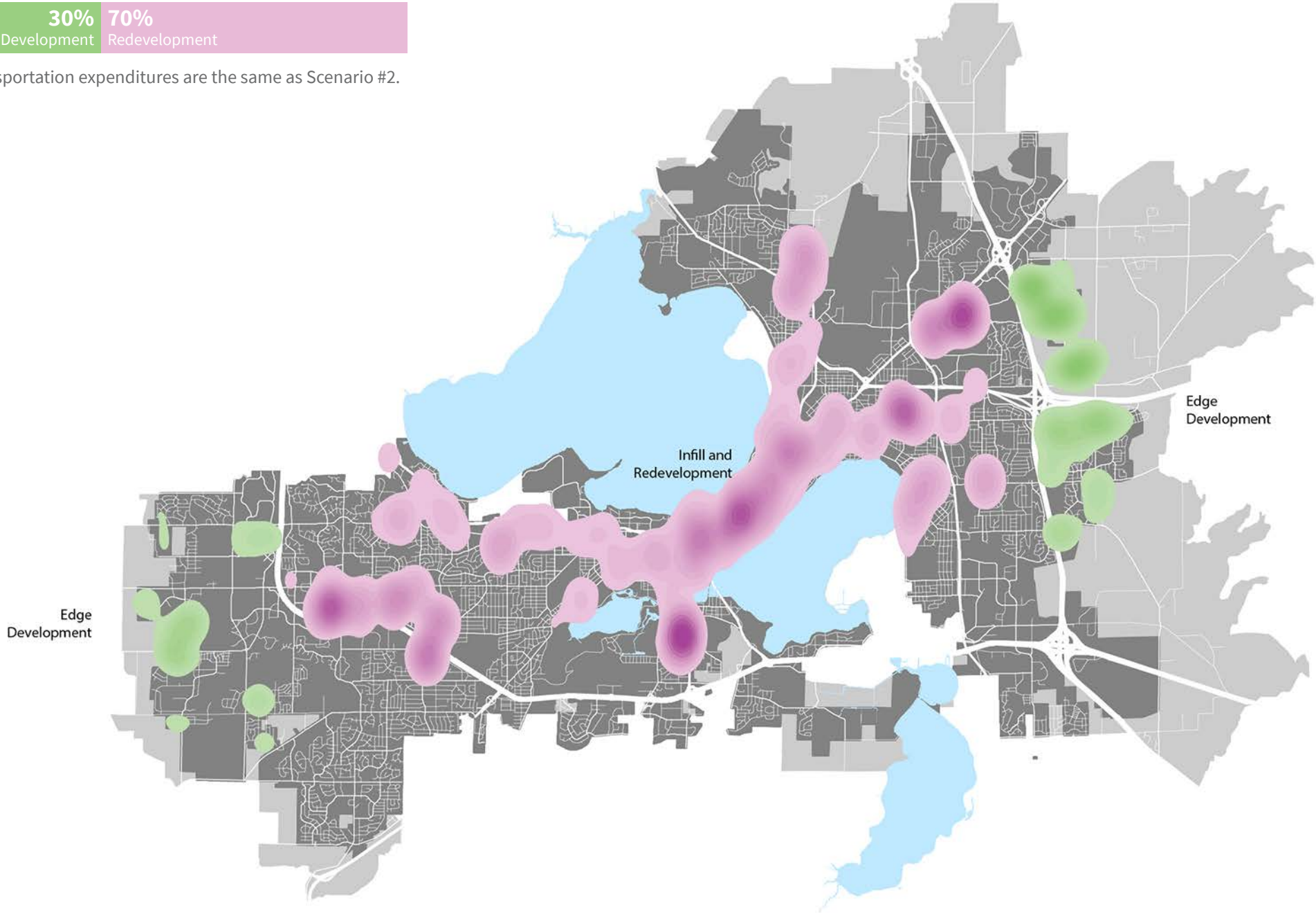
Some transportation expenditures expand road capacity, but substantial expansion of Metro Transit is implemented, including express bus routes to outlying communities. Additionally, the full Bus Rapid Transit (BRT) system is implemented (see the BRT map in the Land Use and Transportation Element).



Scenario #3

30% Edge Development | **70%** Redevelopment

Transportation expenditures are the same as Scenario #2.



projects frequently have access to existing transit service, the road and utility networks have already been constructed, no additional roads need to be maintained to serve redevelopment, the area is already covered by emergency services, and property values (and therefore property tax collections) are substantially higher for most redevelopment projects, among other factors. All this adds up to redevelopment generating more tax revenue for the City while creating fewer costs to be borne by property taxpayers. Not only is that better in the short term, but redevelopment also helps sustain the fiscal health of the City over the long term – fewer maintenance liabilities are generated, and the City doesn't have to depend as much upon revenues from new growth to pay for maintaining existing services and infrastructure.

There are also a number of environmental benefits to redevelopment. Because redevelopment tends to be more intensive, with smaller lots or larger buildings, there tends to be less energy use per resident or per employee. Water use per household tends to be lower as well. For example, multifamily buildings do not have as much lawn to irrigate, and single family homes, when built as part of a redevelopment or infill project, tend to be on smaller lots with smaller lawns. Redevelopment also reduces the amount of rural farmland and forested lands needed for edge development. Finally, infill and redevelopment are effective at reducing VMT[1] and the accompanying fossil fuel usage and air pollution if projects are planned and implemented with a connected and walkable street network, destinations that are accessible by walking and transit, and a diversity of land uses.

Of course, infill and redevelopment have impacts. While overall VMT is reduced, local traffic may increase. Additionally, demand for low-cost or free on-street parking can increase. While harder to quantify, infill and redevelopment often change the general feel of an area. While it can add exciting new destinations, larger buildings are sometimes seen as out of scale with their surroundings and are not always embraced by some residents who value the current look and feel of a corridor or neighborhood.

Adoption of neighborhood and other sub-area plans which address land use, built form, public infrastructure investments, and other physical, and sometimes social, aspects of a neighborhood can help address concerns in advance of an actual proposal and reduce controversy and conflict for redevelopment, thus lessening one of the barriers to redevelopment.

UrbanFootprint and Madison's Future

While UrbanFootprint helps quantify the impacts of different styles of development, simply using the tool does not guarantee a desirable outcome. Detailed plans that address factors that are unique to a given area or corridor are still needed to ensure that complete neighborhoods – both those on the edge and those experiencing redevelopment – are created. However, UrbanFootprint does help to put numbers to many of the considerations (VMT/traffic, transit use, water use, energy use, emissions, health impacts, land consumption, and fiscal impacts) that are often overlooked when development or redevelopment is proposed.
UrbanFootprint was used to analyze the future of the city in two different ways:

1. Three citywide scenarios were created to analyze the impacts of focusing on redevelopment versus edge development.

2. Scenarios were created for three specific areas of the city that have a high capacity for redevelopment and are planned for future Bus Rapid Transit (BRT) service to analyze the short-term and potential long-term impacts of substantial transit-oriented development around planned BRT routes.

The sections below describe the approach and outcomes of each analysis. It should be noted that none of the scenarios are plans – they simply represent different potential futures for the City, all of which comply with the Comprehensive Plan's Generalized Future Land Use Map.

Citywide UrbanFootprint Scenarios

The table on the next page summarizes citywide UrbanFootprint growth scenarios. All three scenarios assumed 70,000 new residents and 37,000 new employees are added to the city through 2040. The difference between the scenarios is where the new growth is accommodated.

The table on the next page summarizes the results of UrbanFootprint scenarios for selected metrics, with further analysis following the table. Note that UrbanFootprint analyzes conditions for all of Dane County, including both existing development and planned development in future scenarios. This means that new development can only have an incremental change on future outcomes for the entire area because there are already a substantial number of people living in Dane County. The county's 2015 population was 523,643, and the UrbanFootprint scenarios anticipate adding 70,000 residents to the city. With 70,000 new residents representing 13% growth for the county as a whole, the impacts of predicted city growth become diluted. As such, some metrics, such as water consumption, are not shown in the summary table because there is not a substantial difference between scenarios. However, there are still some patterns that emerge that, in aggregate, represent meaningful differences in the outcomes attributable to the city's style of growth through 2040.

Land Consumption

The focus on accommodating growth through redevelopment in Scenario #3 results in an estimated 932 fewer acres of land that would transition from farmland to city development through 2040. As a comparison, the UW-Madison campus is just over 1,000 acres, the UW-Madison Arboretum is about 1,200 acres, and the entire isthmus (Park Street east to the Yahara River) is approximately 1,300 acres.

Energy Use

Scenario #3 results in 128.6 billion fewer British Thermal Units (BTUs) of energy consumed per year, based solely on the style of growth. Scenario #3 assumes more redevelopment, which tends to occur in multifamily buildings. Multifamily buildings are more energy efficient than single-family homes because there is less exterior wall and ceiling space per unit. With the average home in Wisconsin consuming 103 million BTUs of energy per year[2], Scenario #3 results in about 1,250 homes worth of residential energy consumption that is eliminated when compared to Scenario #1. Considering that Scenario #1 only adds 36,400 dwelling units, this is a significant reduction in residential energy use.

Transportation-Related Greenhouse Gas Emissions

Transportation-related Greenhouse Gas (GHG) emissions appear to show a nominal decrease from Scenario #1 to Scenario #3. However, the EPA estimates that the typical passenger vehicle emits 4.6 metric tons of carbon dioxide per year.[3] Scenario #3 is equivalent to removing approximately 11,100 cars from the road, which represents a significant decrease in carbon emissions attributable to the land use pattern alone.

Fuel Costs

Scenario #3, which contains more redevelopment and transit investments than Scenario #1, results in the average Dane County household spending $106 less on gas per year than Scenario #1. With 252,653 households in the scenario, that represents a $26.6 million reduction in spending per year on gasoline. Assuming access to enhanced transit and a steady growth rate, households would save a total of about $577 million on gas between 2018 and 2040.[4] Overall, Scenario #3 anticipates approximately $100 million less in annual passenger vehicle transportation costs per year (about $400 per household) – a total of about $2.15 billion from 2018 through 2040.

Vehicle Miles Traveled

Scenario #3 has about 170 million fewer vehicle miles traveled (VMT) per year than Scenario #1, which is equivalent to removing the vehicles of about 9,100 households from roadways in Scenario #3 when compared to Scenario #1. Note that VMT numbers are analyzed for the entire county, so existing development tends to dilute the gains from new transit service and new transit-oriented development. Each scenarios add, on average, about 35,400 new households. If all the new miles traveled are assigned to new households, each new household drives about 16,600 miles/year in Scenario #1, 14,000 miles/year in Scenario #2, and 11,100 miles/year in Scenario #3. Reducing the average VMT per household is a critical part of mitigating increasing traffic as the region continues to add population and jobs. In the case of these three scenarios, the reduction in VMT between Scenario #1 and #3 was achieved by adding BRT, adding express bus service, adding local bus service, and locating housing, jobs, and destinations in close proximity to each other and to transit.

Citywide UrbanFootprint Scenarios Summary

	Scenario #1: Edge Growth Focus	Scenario #2: Edge/Redevelopment Balance	Scenario #3: Redevelopment Focus
Population Growth: Edge vs. Redevelopment	49,000 edge; 21,000 redev.	35,000 edge; 35,000 redev.	21,000 edge; 49,000 redev.
Jobs Growth: Edge vs. Redevelopment	25,900 edge; 11,100 redev.	18,500 edge; 18,500 redev.	11,100 edge; 25,900 redev.
Roads, Highways, and Auto Infrastructure	Programmed and planned new arterials and collectors; programmed and planned major highway expansions (Interstate 39/90 south of Beltline, US 51- Stoughton Road, US 14 south of STH 138, US 12 West freeway past CTH K, US 12/18 East freeway past CTH N; US 151 - Verona Road); Beltline capacity expansion; additional cross-Beltline connections; North Mendota Parkway.	Programmed and planned new arterials and collectors; some programmed and planned major highway expansions (Interstate 39/90 south of Beltline, US 51 - Stoughton Road, US 151 - Verona Road); limited further Beltline expansion; additional cross-Beltline connections; North Mendota Parkway.	Programmed and planned new arterials and collectors; some programmed and planned major highway expansions (Interstate 39/90 south of Beltline, US 51 - Stoughton Road, US 151 - Verona Road); limited further Beltline expansion; additional cross-Beltline connections; North Mendota Parkway.
Transit	Incremental service improvements to existing system; enhanced service to peripheral Madison neighborhoods; enhanced service to existing Metro communities.	Improvements to existing system (including service to Monona and Sun Prairie); express bus lines to outlying areas (per Figure 15 of Madison Transit Corridor Study); currently planned BRT system (per Madison Transit Corridor Study).	Improvements to existing system (including service to Monona and Sun Prairie); express bus lines to outlying areas (per Figure 15 of Madison Transit Corridor Study); currently planned BRT system (per Madison Transit Corridor Study).

The "UrbanFootprint and Bus Rapid Transit" section at the end of this Appendix has an additional comparison of what it means to locate housing and jobs next to transit.

Transit Trips Per Day

Scenario #1 projects that Metro Transit ridership will increase by about 50% by 2040. While the future population stays constant through all three scenarios, the extension of additional transit service in Scenario #2 increases transit ridership by 38% over Scenario #1 and 108% over current conditions. Scenario #3, which has more growth occurring as redevelopment, increases transit ridership about 3% over Scenario #2 and 114% over current conditions. Expansion of the City's, and region's, transit system helps reduce the growing population's impact on traffic and provides an alternative to driving.

Citywide UrbanFootprint Maps

UrbanFootprint's strength is in its ability to not only provide numeric comparisons of future scenarios, but also to provide maps of existing and future conditions for the variety of modules that are available. The maps on the following pages show existing and future conditions across a variety of metrics:

1. Percent of Trips by Non-Car Modes of Transportation, 2015
2. Walking Minutes Per Day for Adults, 2015
3. Vehicle Miles Traveled Per Household, 2015 map
4. Vehicle Miles Traveled Per Household, Scenario #1
5. Passenger Vehicle Greenhouse Gas Emissions Per Household, Scenario #2
6. Percent Change in Transit Use, Scenario #3

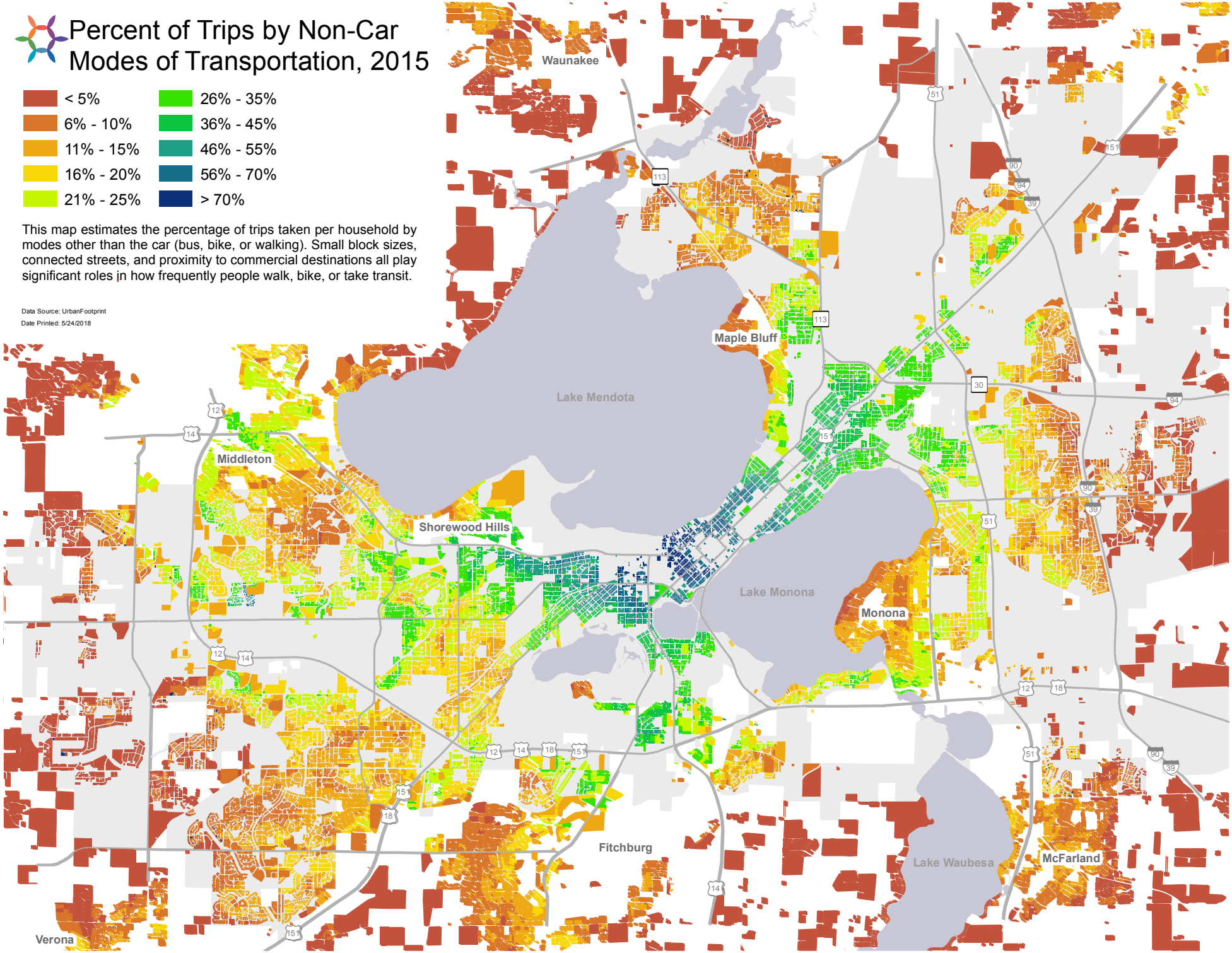
Percent of Trips by Non-Car Modes of Transportation, 2015

< 5%	26% - 35%
6% - 10%	36% - 45%
11% - 15%	46% - 55%
16% - 20%	56% - 70%
21% - 25%	> 70%

This map estimates the percentage of trips taken per household by modes other than the car (bus, bike, or walking). Small block sizes, connected streets, and proximity to commercial destinations all play significant roles in how frequently people walk, bike, or take transit.

Data Source: UrbanFootprint

Date Printed: 5/24/2018



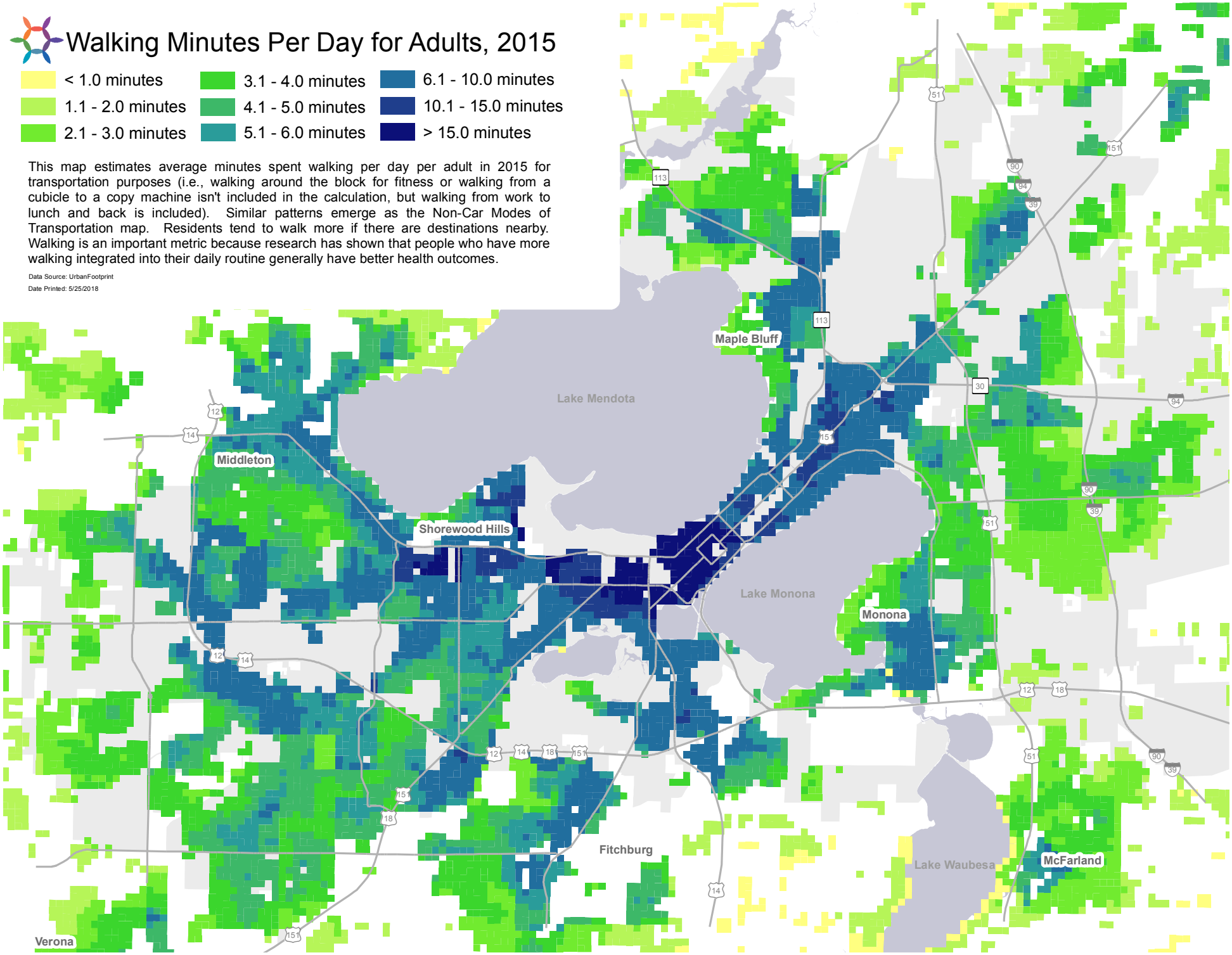
Walking Minutes Per Day for Adults, 2015

- < 1.0 minutes
- 1.1 - 2.0 minutes
- 2.1 - 3.0 minutes
- 3.1 - 4.0 minutes
- 4.1 - 5.0 minutes
- 5.1 - 6.0 minutes
- 6.1 - 10.0 minutes
- 10.1 - 15.0 minutes
- > 15.0 minutes

This map estimates average minutes spent walking per day per adult in 2015 for transportation purposes (i.e., walking around the block for fitness or walking from a cubicle to a copy machine isn't included in the calculation, but walking from work to lunch and back is included). Similar patterns emerge as the Non-Car Modes of Transportation map. Residents tend to walk more if there are destinations nearby. Walking is an important metric because research has shown that people who have more walking integrated into their daily routine generally have better health outcomes.

Data Source: UrbanFootprint

Date Printed: 5/25/2018



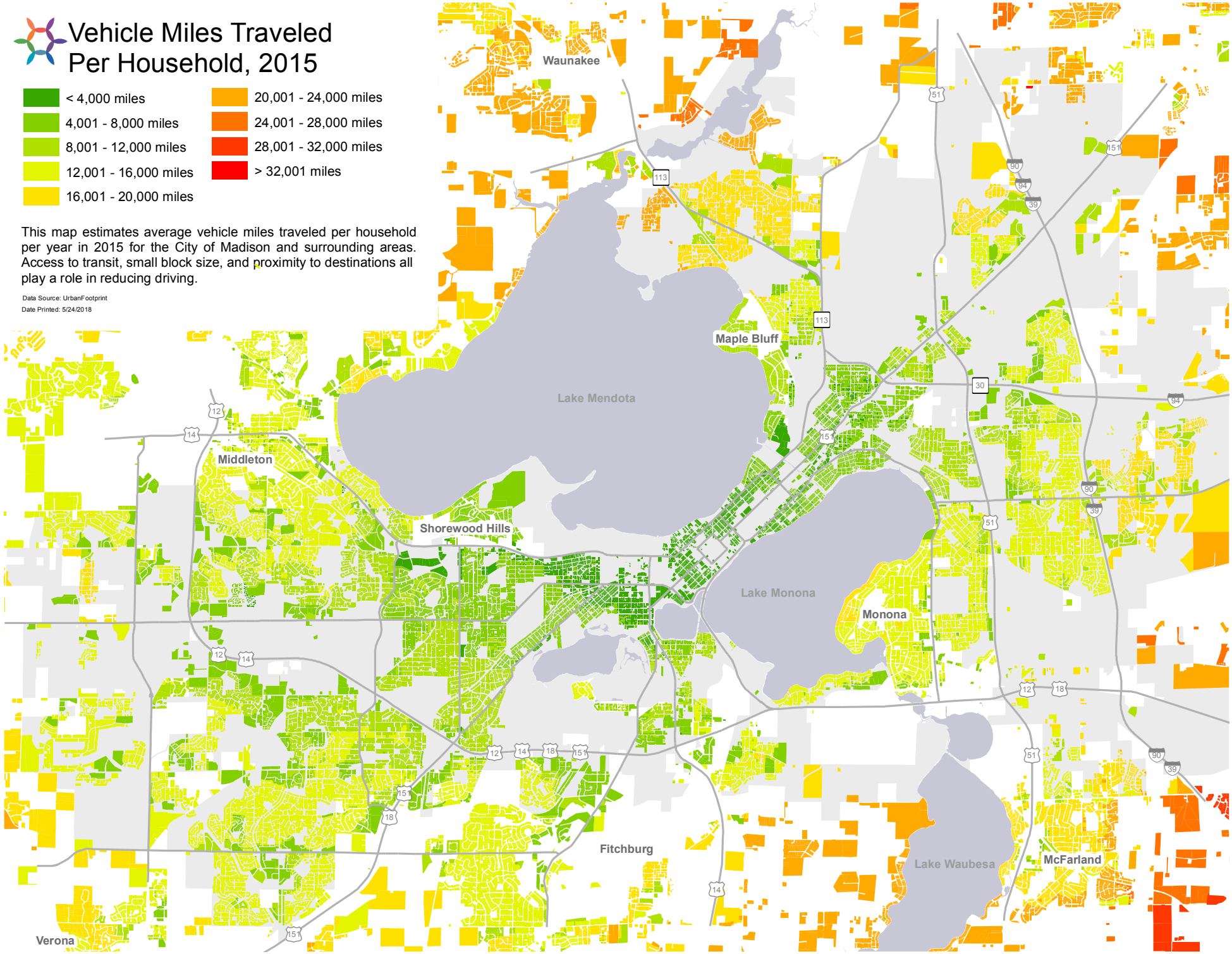
Vehicle Miles Traveled Per Household, 2015

- < 4,000 miles
- 4,001 - 8,000 miles
- 8,001 - 12,000 miles
- 12,001 - 16,000 miles
- 16,001 - 20,000 miles
- 20,001 - 24,000 miles
- 24,001 - 28,000 miles
- 28,001 - 32,000 miles
- > 32,001 miles

This map estimates average vehicle miles traveled per household per year in 2015 for the City of Madison and surrounding areas. Access to transit, small block size, and proximity to destinations all play a role in reducing driving.

Data Source: UrbanFootprint

Date Printed: 5/24/2018



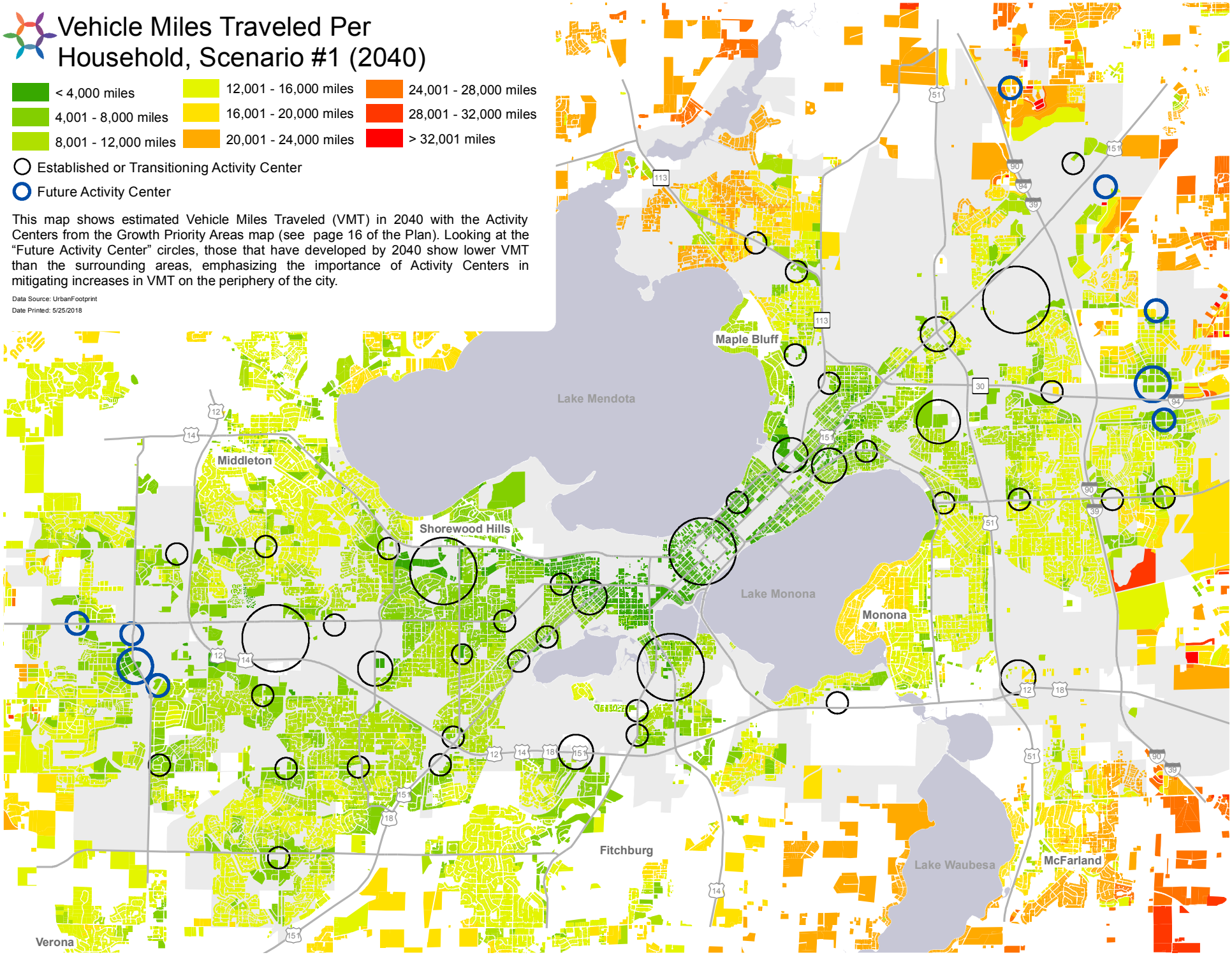
Vehicle Miles Traveled Per Household, Scenario #1 (2040)

- < 4,000 miles
- 4,001 - 8,000 miles
- 8,001 - 12,000 miles
- 12,001 - 16,000 miles
- 16,001 - 20,000 miles
- 20,001 - 24,000 miles
- 24,001 - 28,000 miles
- 28,001 - 32,000 miles
- > 32,001 miles
- Established or Transitioning Activity Center
- Future Activity Center

This map shows estimated Vehicle Miles Traveled (VMT) in 2040 with the Activity Centers from the Growth Priority Areas map (see page 16 of the Plan). Looking at the "Future Activity Center" circles, those that have developed by 2040 show lower VMT than the surrounding areas, emphasizing the importance of Activity Centers in mitigating increases in VMT on the periphery of the city.

Data Source: UrbanFootprint

Date Printed: 5/25/2018

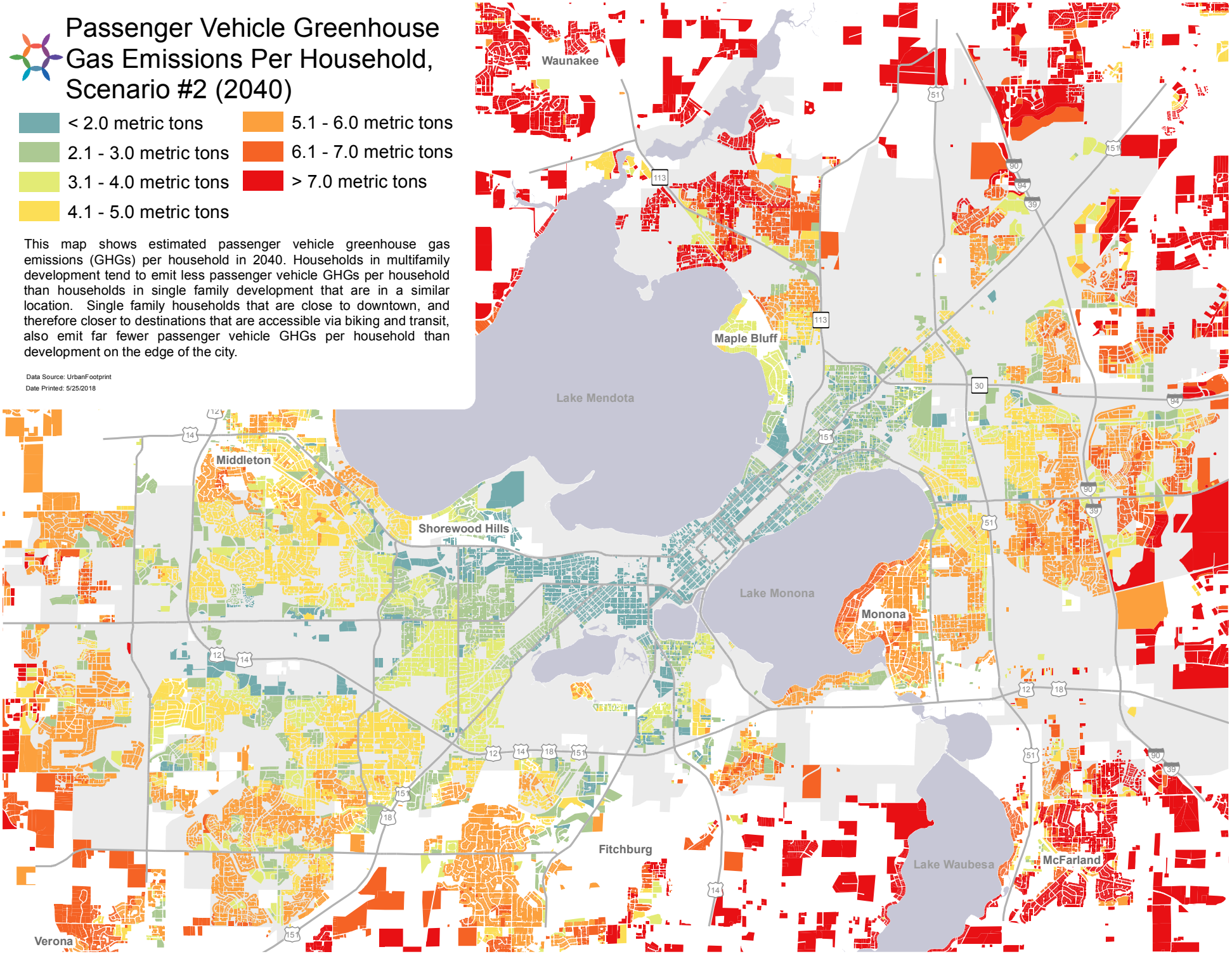


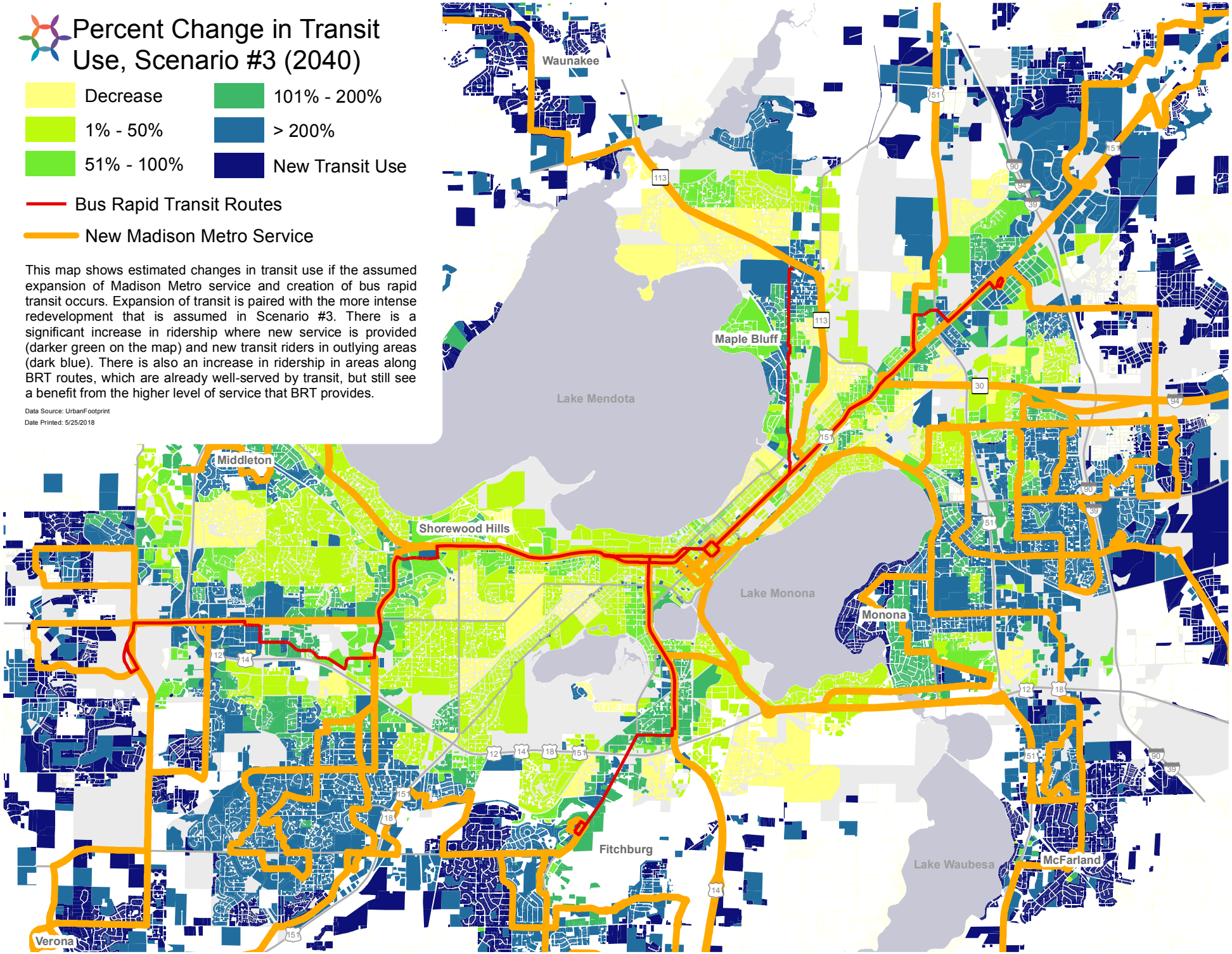
Passenger Vehicle Greenhouse Gas Emissions Per Household, Scenario #2 (2040)

- < 2.0 metric tons
- 2.1 - 3.0 metric tons
- 3.1 - 4.0 metric tons
- 4.1 - 5.0 metric tons
- 5.1 - 6.0 metric tons
- 6.1 - 7.0 metric tons
- > 7.0 metric tons

This map shows estimated passenger vehicle greenhouse gas emissions (GHGs) per household in 2040. Households in multifamily development tend to emit less passenger vehicle GHGs per household than households in single family development that are in a similar location. Single family households that are close to downtown, and therefore closer to destinations that are accessible via biking and transit, also emit far fewer passenger vehicle GHGs per household than development on the edge of the city.

Data Source: UrbanFootprint
Date Printed: 5/25/2018



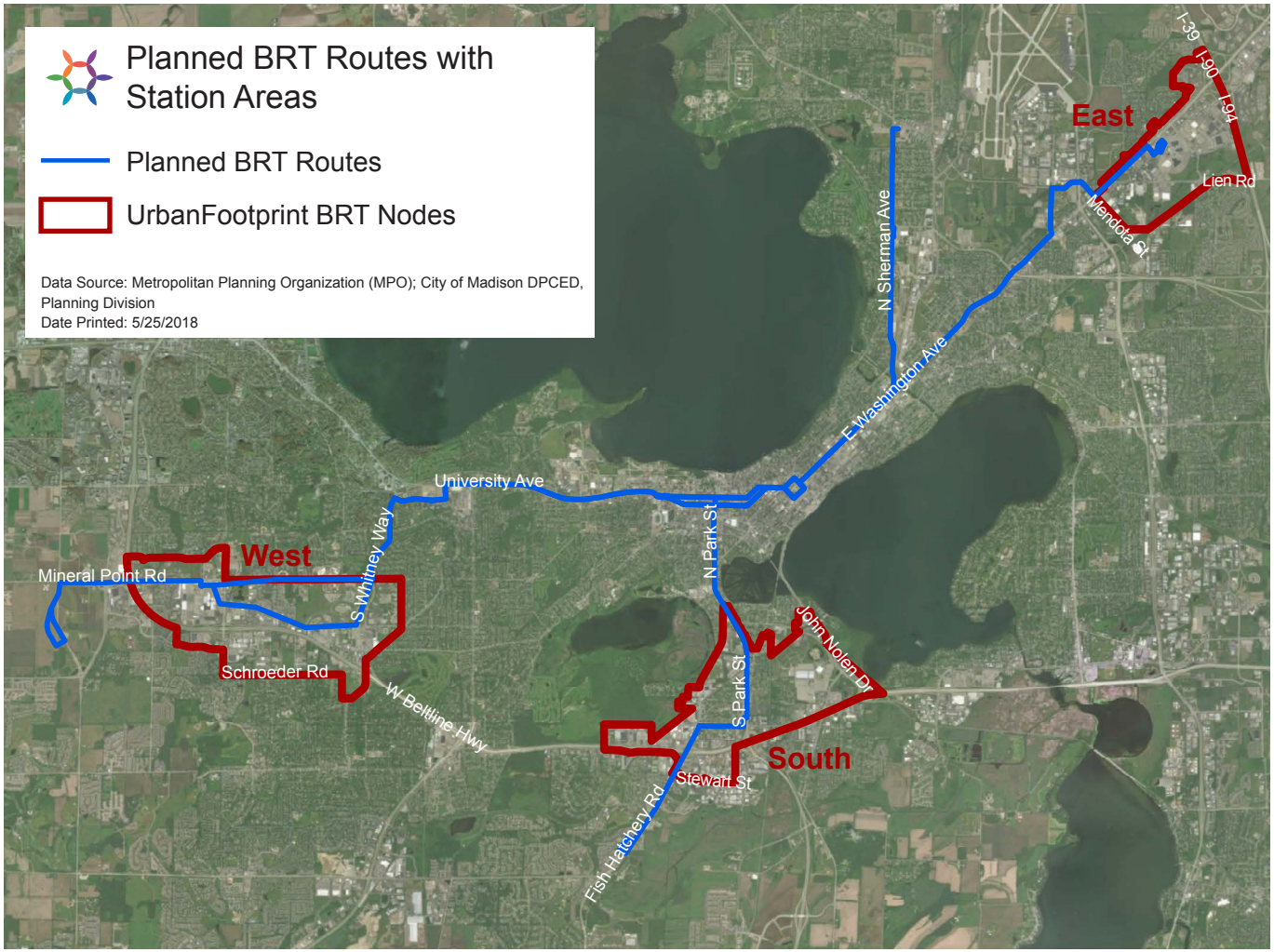

Percent Change in Transit Use, Scenario #3 (2040)
Decrease
1% - 50%
51% - 100%
101% - 200%
> 200%
New Transit Use
Bus Rapid Transit Routes
New Madison Metro Service
This map shows estimated changes in transit use if the assumed expansion of Madison Metro service and creation of bus rapid transit occurs. Expansion of transit is paired with the more intense redevelopment that is assumed in Scenario #3. There is a significant increase in ridership where new service is provided (darker green on the map) and new transit riders in outlying areas (dark blue). There is also an increase in ridership in areas along BRT routes, which are already well-served by transit, but still see a benefit from the higher level of service that BRT provides.
Data Source: UrbanFootprint
Date Printed: 5/25/2018
Waunakee
Maple Bluff
Lake Mendota
Middleton
Shorewood Hills
Lake Monona
Monona
Fitchburg
Lake Waubesa
McFarland
Verona

UrbanFootprint Bus Rapid Transit Nodes Analysis

In addition to the three citywide scenarios, UrbanFootprint scenarios were developed to compare development within three areas that have significant capacity for infill and redevelopment and are planned for Bus Rapid Transit service. These three areas are shown on the map on the next page.

There are opportunities for both near-term infill and redevelopment in all three areas, as well as long-term infill at a scale that could lead to redevelopment similar to what the Hilldale area has begun to experience. While there are no detailed plans in place to guide such a substantial change to these areas, an UrbanFootprint analysis was run as an exercise to see what the potential impacts of such development would be when compared with accommodating the same number of people and employees within edge development areas (see the peripheral growth areas on the Growth Priority Areas map on page 16).

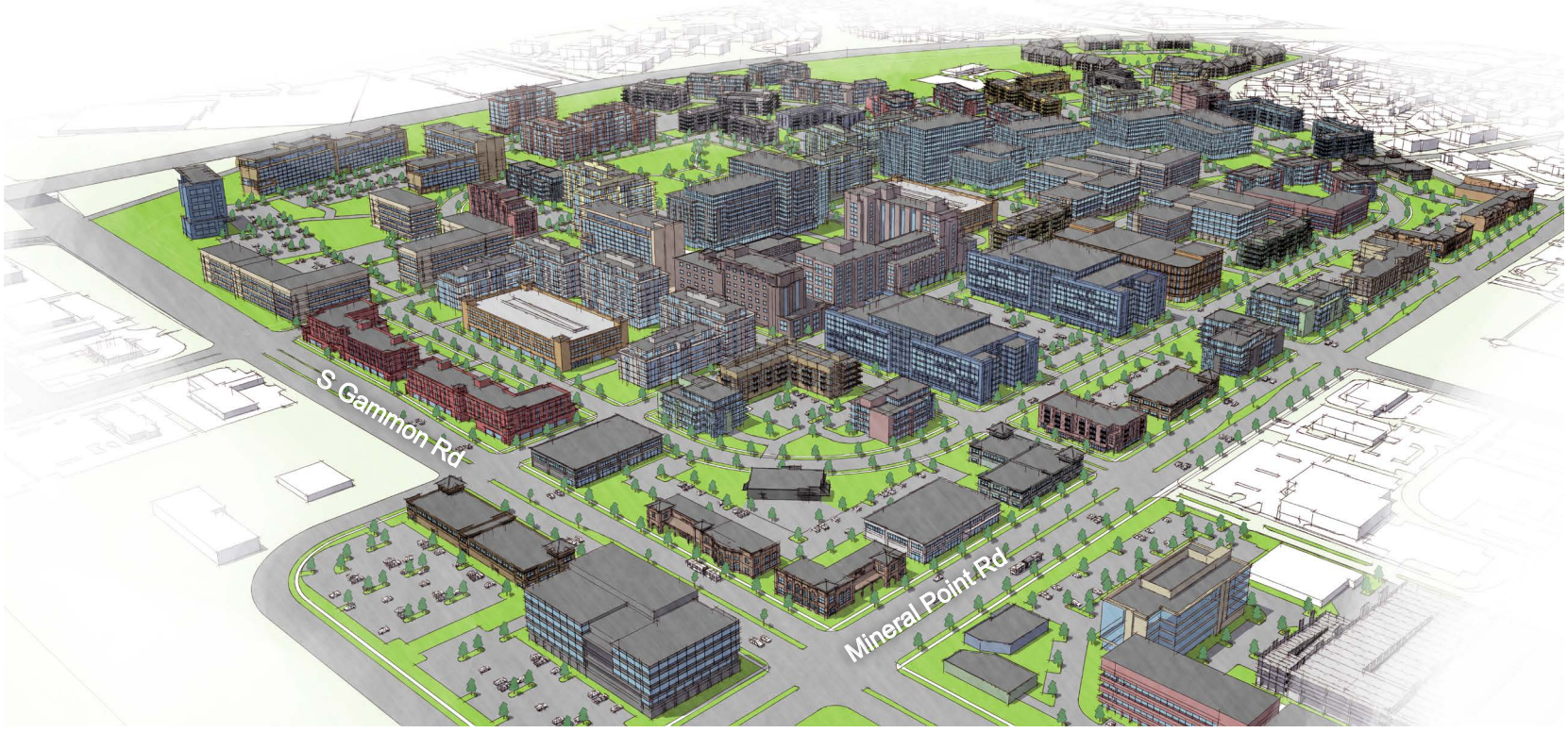
The following table summarizes the current population and jobs within the BRT nodes (according to the US Census Bureau and InfoUSA), along with potential near-term (over the next 10-20 years) additions in population and jobs through redevelopment and long-term (20+ years) infill and redevelopment. As a comparison, the isthmus (Park Street to the Yahara River) contained about 40,000 residents and 39,000 jobs on 1,336 acres in 2015. The combined BRT nodes are about three times larger than the isthmus, encompassing 3,914 acres. It should be noted that, even in the Long Term scenario, not all land in the BRT areas is assumed to be redeveloped/infilled – about 850 acres is assumed for redevelopment/infill. Overall, the 850 acres of infill can accommodate about the same amount of development as approximately 2,900 acres (4.5 square miles) of edge development, if areas on the periphery of the city developed consistent with the Generalized Future Land Use Map and Neighborhood Development Plans. With additional rights-of-way, the peripheral acreage would be even larger. The conceptual renderings on the following pages illustrate what the near-term and potential long-term development could be within certain parts of the three BRT areas.



UrbanFootprint BRT Areas Summary

	Population	Jobs
BRT Areas – Current	13,000	35,600
BRT Areas – Near Term (redevelopment in scattered areas; includes current population and jobs)	20,600	43,400
BRT Areas – Long Term (substantial build out of potential infill/ redevelopment areas; includes current and Near Term population and jobs)	68,000	93,300

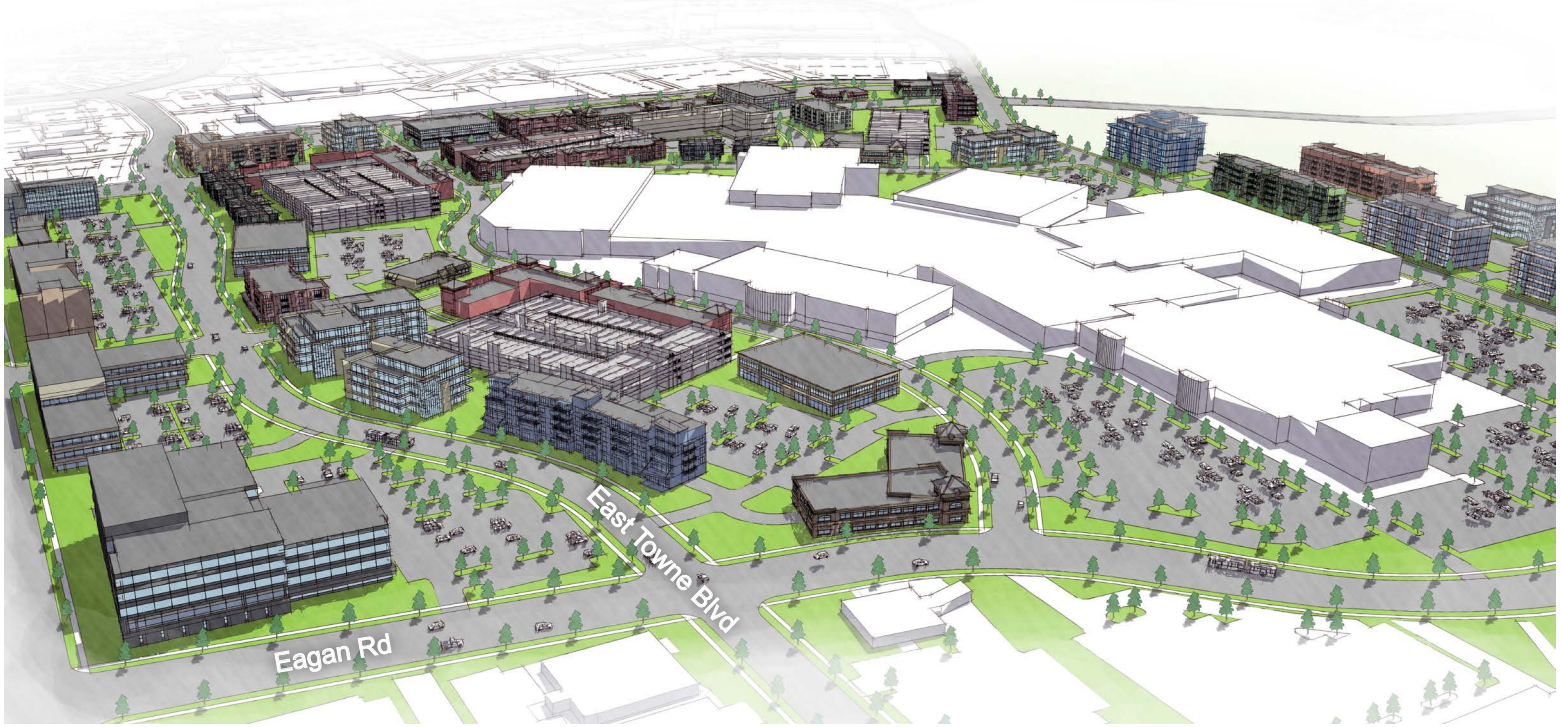
West Towne Mall Area – Near-Term Concept



West Towne Mall Area – Long-Term Concept

**South Area –
Near-Term Concept**

**South Area –
Long-Term Concept**



East Towne Area – Near-Term Concept

East Towne Area – Long-Term Concept

The table to the right summarizes metrics that compare redevelopment within the BRT areas (the large purple dots on the Growth Priority Areas map on page 16 of this Plan) to accommodate the same number of residents and employees in edge development (the yellow areas on the Growth Priority Areas map). Some additional metrics are also provided to show the estimated impact of transit-oriented development on metrics like walk minutes per day.

As would be expected, accommodating growth via redevelopment virtually eliminates the consumption of agricultural and wooded lands. Residential energy use is also reduced, as most redevelopment tends to occur as multifamily development, which is more energy efficient because there is less exterior wall and roof area per unit. Greenhouse gas emissions attributable to passenger vehicles remains virtually the same because of the larger amount of commercial space within the BRT areas, which attracts more passenger vehicles from outside of the area than the Edge Development scenario.

Vehicle miles traveled per household is cut by more than half – a substantial change that can be attributed to placing more intense development in close proximity to high-capacity, frequent transit service. This reduction also obviously means a reduction in the GHG emissions attributable to driving. Residents take about 65% more trips via transit when development is focused around newly provided BRT service. Walk minutes per day increase by 83% - with more intense, mixed-use development, there are more destinations within easy walking distance and also more frequent transit service to walk to. Finally, outdoor residential water use is decreased by two-thirds in the BRT scenario, as there is less lawn to water for residential infill/redevelopment.

Summary

The above scenarios are meant to provide a numerical comparison, based on the UrbanFootprint modeling software, of how the city is impacted by different approaches to growth. While the city will not grow precisely as envisioned in any given scenario, knowing the potential outcomes of different styles of growth across a variety of metrics can help inform decisions on transportation expenditures and land use planning.

UrbanFootprint BRT Area Infill/Redevelopment Comparison With Edge Development

	Scenario A: Edge Development	Scenario B: BRT Areas	Percent Change
Agriculture/Woodland/Rural Land Consumed (acres)	2,900	16*	-99.4%
Annual Energy Use – Residential (BTUs/year, in trillions)	2.04	1.81	-11.3%
Transportation-Related Greenhouse Gas Emissions for Passenger Vehicles (metric tons/year)	289,000**	290,000**	+0.3%**
Vehicle Miles Traveled (household/year)~	8,100	3,890	-51.0%
Transit Trips/day	16,789	27,754	+65.3%
Adult Walk Minutes/day	3.32	6.09	+83.4%
Residential Outdoor Water Use (millions of gallons/year)	207	69	-66.7%

Note: All numbers assume that the only changes from 2015 are to land use and transportation to isolate the impacts of different styles of development. Annual gasoline costs per household are not available for smaller project areas.

* Some portions of University Research Park, which is included in the west BRT area, are currently undeveloped.

** There is no substantial difference because the BRT areas contain a much larger amount of total commercial space and employment, which attracts more passenger vehicles. With the BRT Areas scenario having 22% more total jobs and the same population as the Edge Development scenario, having GHG emissions be virtually the same is an indication of the impact of providing a high level of transit service – the BRT Areas scenario supports 16,800 more jobs than the Edge Development scenario without generating more passenger vehicle emissions.

~ Because so much of the total VMT is attributable to people driving to the scenario areas from outside the boundaries, VMT/HH/year is used instead of total VMT to illustrate the impact of households being located in close proximity to high-frequency transit.

Citations:

[1] Reid Ewing & Robert Cervero (2010) Travel and the Built Environment, Journal of the American Planning Association, 76:3, 265-294, DOI: 10.1080/01944361003766766

[2] See https://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/wi.pdf, accessed 4/16/18.

[3] See https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle, accessed 4/16/18.

[4] According to www.gasbuddy.com, gas prices have fluctuated widely for the Madison area from 2008 through 2018, varying from about $4.10 per gallon to about $1.50 per gallon. These calculations assume a price of $3.62 per gallon.