Mapping the Western Minnehaha Creek Watershed District

GIS and Community Partnerships
Macalester College Geography Department
Fall 2014

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Class Instructors: Holly Barcus and Ashley Nepp
Students: Catherine Bretheim, Matthew Creasy, Jessica Del Fiacco, Rachel Fehr, Luciano Guzman, Elizabeth Isaac-Herzog, Joseph Klein, Shelby Maidl, Anoushka Millear, Caitlin Toner
Report Design: Jessica Del Fiacco and Elizabeth Isaac-Herzog
Cover Design: Catherine Bretheim

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Introduction

Introduction to Project

During the Fall 2014 semester, the *GIS and Community Partnerships*[1] class in the Geography Department at Macalester College joined with the Minnehaha Creek Watershed District and The Freshwater Society to continue the work of a three-year-long partnership between the organizations and Macalester College's Geography Department. This is the second year of the project, and this report builds on the work of two previous collaborations involving students from the *Qualitative Research Methods*[2] class and *Urban GIS*[3] class.

The Minnehaha Creek Watershed District and the Freshwater Society created the Master Water Stewards Program in 2013 to protect and improve water quality in Minnesota (masterwaterstewards.org). The program certifies community volunteers to act as leaders and implement pollution prevention projects with the aim of increasing ground absorption and reducing runoff. These projects ensure that pollution is filtered through the ground soil rather than transported to water bodies. They include rain gardens, permeable pavers, and rain gutters.

Brief Geography of Watershed

The Minnehaha Creek Watershed is a sub-watershed of the Upper Mississippi River Basin. It comprises 181 square miles in Minneapolis and its western suburbs and includes Minnehaha Creek, Lake Minnetonka, the Minneapolis Chain of Lakes, and Minnehaha Falls (See **Reference Map, Map 0.0**). It is a water-rich region with eight major creeks, 129 lakes, and thousands of wetlands (Minnehaha Creek Watershed District 2014). All water that falls within the Watershed's domain drains first to Minnehaha Creek before ending up in the Mississippi River.

Background and Broader Context for this Collaborative Project

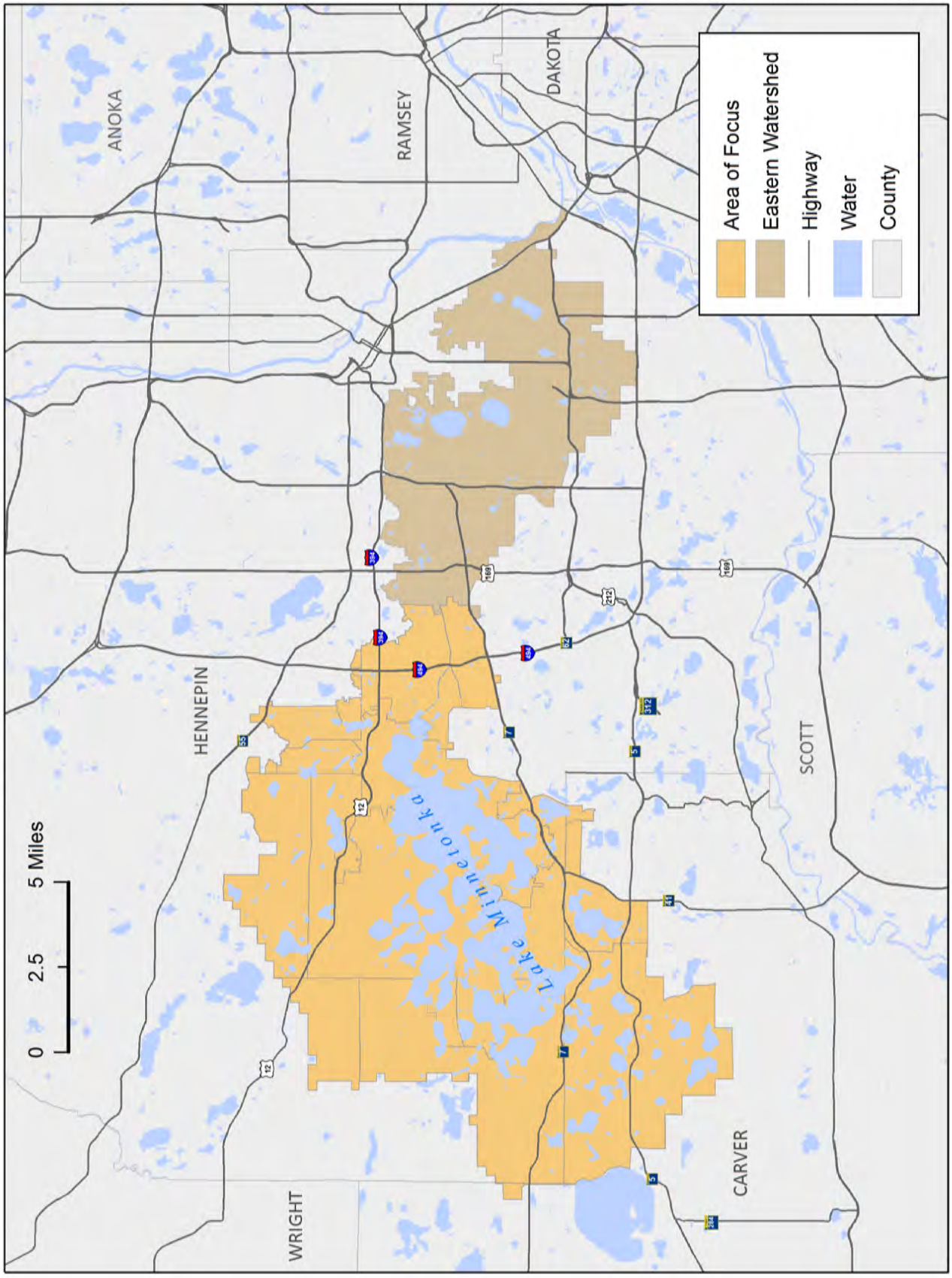
In its first year (2013-2014), this collaborative project between Macalester College geography students and the Watershed District provided interesting insights into the atmosphere of the Watershed surrounding questions of water quality. The students of the *Qualitative Research Methods* class examined the yard and lawn maintenance practices of residents in order to identify the receptiveness of residents to the implementation of water improvement projects. They determined that the people in the Watershed have widely varying assumptions, values, and levels of understanding regarding their lawn care practices and the impacts of these practices on water quality. Overall, they suggest that the residents are open to changing their lawn care practices in order to improve water quality, though they may be unaware of how or why their practices should change (Macalester College Qualitative Research Methods, 2013). The students of the *Urban GIS* class began the mapping process for the Watershed District and focused on three broad categories: physical, social, and behavioral. Their maps of the eastern, urban portion of the watershed provide baseline data intended to set the stage for further, more nuanced research (Macalester College Urban GIS, 2013).

Objectives and Goals

This report expands on the previous research and focuses on the western section of the watershed. The primary objective, identified by The Freshwater Society, was to answer the following questions: 1) Who lives here?; 2) What do they do?; 3) How can the Master Water Stewards Program most effectively involve and influence these residents?; and 4) What are the most critical risks to water quality, and where are those risk-areas located? To answer these questions, the students of the *GIS and Community Partnerships* course decided to address three dimensions of these questions. These dimensions include Physical Environment, Community and Built Environment, and Lifestyles. Each of these dimensions comprises a full chapter in this report.

[1]Taught by Holly Barcus, Associate Professor of Geography
[2]Taught by Dan Trudeau, Associate Professor of Geography
[3]Taught by Laura Smith, Associate Professor of Geography

Reference Map



Executive Summary

Introduction

The prompt from the Fresh Water Society (FWS) was very open-ended, so the first task was to brainstorm all of the possible maps that might be beneficial for FWS's clean and sustainable water mission. After covering a whiteboard full of ideas of what to map, the class grouped these ideas into three categories: environmental land use/land cover, community, and lifestyle. These three categories then became our teams, and three to four students focused on making maps for each respective category. The three teams often collaborated with one another, exchanging and synthesizing data in order to create informative maps. By the end of the semester, the class produced an abundant amount of maps with the intent of being informative and useful for the Fresh Water Society. This section will briefly explain some of the important findings from each of the major sections of the report.

Physical Environment

Looking at the environmental landscape and its land use helps provides information on water issues in the western part of the watershed. Keeping in mind the goals of the FWS, this chapter focuses on water quality and water infiltration. To find sources that impact water quality, maps were created to find the impervious regions within the watershed. Impervious areas lead to flooding and polluted waters. Along with water quality, water infiltration also impacts the health of the watershed. Maps that display soil type, erodibility, and slope were examined and synthesized to find regions that contained highest risk for water quality and infiltration.

The synthesis of variables highlights regions that are at high risk of water runoff or of poor water quality. The southwest portion of the watershed is at high risk of soil erosion. This area also has many agricultural lands, so pesticides and animal waste may flow into the water streams. Apart from the farmland, the shoreline of Lake Minnetonka also has high risk of erosion. The shoreline communities, particularly Spring Park, contain many impermeable surfaces such as asphalt and concrete. This leads to a high risk of flooding, and also increases the risk of pollution flowing into the lake. In regards to the physical features of the landscape, this group recommend agricultural lands and shoreline areas as locations with a high risk for water quality and water infiltration.

Community and Built Environment

Throughout the past several decades, the western part of the watershed has transformed from natural and agricultural areas to suburban developed area. This shift influences how the land is used and how it impacts water quality. This chapter examines the communities and the types of features constructed in the western part of the watershed. The maps show various ways in which the land is utilized, including the presence of such entities such as educational institutions, agricultural land, and vacant land. A strong focus was put on residential land use. While a variety in age of houses exists, there has been an increase in new homes over the past decade,

and these homes are often larger and more expensive than many of the older homes. Rapid and geographically extensive residential development over the past two decades has increased the risk of local flooding, as is evidenced by the spring 2014 floods (Bosman 2014). Also included in this dimension are maps of such entities as storm ponds and septic tanks to help better understand the land use and whether or not it impacts water quality.

The maps show that residential areas are commonly found along the shoreline. Developed areas such as these contain a higher likelihood of creating impervious surfaces such as asphalt or concrete, when traditional building methods are used. These neighbourhoods' close vicinity to the lake also increases the risk of polluting natural bodies of water such as Lake Minnetonka. In addition to existing homes, it is also important to examine the vacant lots. Focusing on Edina, vacant lots often lead to tear-downs, the process for which can cause non-point source pollution if conducted poorly. Additionally, vacant lots have the potential to be purchased by the FWS in order to better control the water quality in the district. Examining these developed lands identifies both the impact of water quality and its potential to improve water quality.

Lifestyles

Understanding the characteristics of the population that resides in the region is key for many of the FWS's campaigns and community based projects. Characteristics such race, age, education levels, and political party preference can all highlight residents' behaviour and their relationship with water. This chapter utilized "Tapestry" data, which is a market-based summary of lifestyles and livelihoods for small geographic areas of the United States. These data allow for in-depth analysis of the specific demographics and livelihood trends within this region. Apart from Tapestry, creating maps of race, education, and political views provides clearer understanding of the people that choose to live in this region. All this information is intended to help the FWS find effective ways to collaborate with the community in the western watershed.

The collection of maps suggests that the people living in the western watershed are white, highly educated, conservative, and relatively older. As one moves from east to west throughout the watershed district, the demographic becomes older, more conservative, and has generally had less formal education. Understanding the demographics of the region helps the FWS find an effective strategy to promote its mission to residents of the watershed. More liberal residents in the eastern part of the watershed may become water stewards because of their strong concerns for global climate change. For more conservative residents, the importance of clean water may be more of an economic asset that can raise property values.

Conclusion

Throughout the entire process, from brainstorming to map design, the class made a conscious effort to uphold the mission of FWS. Within the collection of maps, a plethora of variables were analyzed and synthesized in order to examine the factors affecting water quality in the district. This executive summary highlights some of the major findings from each group. This paper explains goals, process, limitations, results, analysis, and suggestions of each map created. Additionally, the report is intended to be clear enough so that someone at FWS could replicate the process. The class hopes that the maps and written analysis can be used as a tool for the FWS and aid in future plans and strategies to fulfil the organization's mission.

Physical Environment

Matthew Creasy - Shelby Maidl - Anoushka Millear - Caitlin Toner

INTRODUCTION

The focus of this chapter is the environmental and physical features and characteristics of the land within the western region of the Minnehaha Creek Watershed District. These maps address two main concerns of value to the Freshwater Society: infiltration and runoff, and water quality. When mapped, these issues serve to illustrate both the natural condition of the Minnehaha Creek Watershed District and the influence of human activity on the landscape, as well as the factors that most directly impact water quality and place certain areas of the watershed at higher risk of runoff, decreased infiltration, and compromised water quality. By addressing these concerns, this chapter aims to highlight areas that are at greater risk of compromised water quality. The following discussion provides an overview of the factors deemed most important in assessing the environmental and physical features of the area. These include infiltration rates, imperviousness and specific human activities.

Infiltration rate refers to the velocity at which water enters soil. When soil takes on water (either from rainfall or irrigation) that exceeds the soil's infiltration capacity, the water moving across the downward sloping land is considered runoff (NRCS 2008). Water quality and infiltration are closely linked, as higher rates of infiltration positively correlate to better water quality. Infiltration provides soils with nutrients while the soil particles act as a filter, removing pollutants before the water reaches the groundwater table. Runoff results in poor water quality, as it carries pollutants, chemicals, and bacteria to standing bodies of water (EPA 1999). Using these factors, we created several maps including **Landcover** (agricultural, wetland, forest, turfgrass, water, and non-impervious urban landscapes; **Map 1.1**), **Imperviousness** (**Map 1.2**), **Land Change Over Time** (**Map 1.3)**, **Consumer Expenditures on Lawn Care and Supplies and Pest Control** (**Map 1.4**), **Soil Type** (**Map 1.5**), **Soil Erodibility** (**Map 1.6**), and **Infiltration Rates** (**Map 1.7**).

Infiltration rates can be influenced by a variety of factors, including the imperviousness of the soil, which refers to the inability of water to pass through the earth. The opposite of impervious is permeable. In general, "natural" land cover allows for greater permeability. Permeable land might include prairie, marsh, or other natural land cover, while impermeable land cover includes concrete and asphalt. Traditional green lawns are also highly impervious because soils with smaller particle size allow for less water infiltration and increased rates of runoff. Built environments, like urban areas (concrete, asphalt) and residential, suburban areas (built structures, green lawn) tend to experience higher rates of imperviousness, as the built environment prevents water from infiltrating into the ground. As water moves across impermeable surfaces, it can accumulate pollutants (sediment, nutrients, bacteria, pesticides, metals, and oil) and discharge these non-point-source pollutants into water bodies (USGS 2014). Most urban surfaces, such as cement, pavement, and even short green grass in residential front lawns fail to absorb water. These impervious surfaces may lead to flooding and poor water quality (USGS 2014). This chapter includes maps that display factors which directly influence imperviousness, including soil type/particle size; changes in land cover from vegetation to residential, agricultural, or urban land; and slope.

Water quality can be indirectly linked to infiltration rates and imperviousness, as the runoff produced in areas of low infiltration rates and high imperviousness can carry pollutants, sediment and other contaminants into the surrounding water bodies. Stormwater runoff is water that does not get absorbed, or infiltrated, into the ground and instead must be diverted by street curbs, sewer systems, and ditches in order to reach water bodies (USGS 2014). Another factor that impacts water quality is erodibility, a measure of soil's resistance to the impact of water on the surface of the soil and water runoff (Roose 1996). Erodibility contributes to the amount of sediment in a water

body, which results in higher turbidity, changes to freshwater ecosystems, and the spread of pollutants (DNR 2014). Maps of erodibility and soil type show the areas at higher risk of compromised water quality.

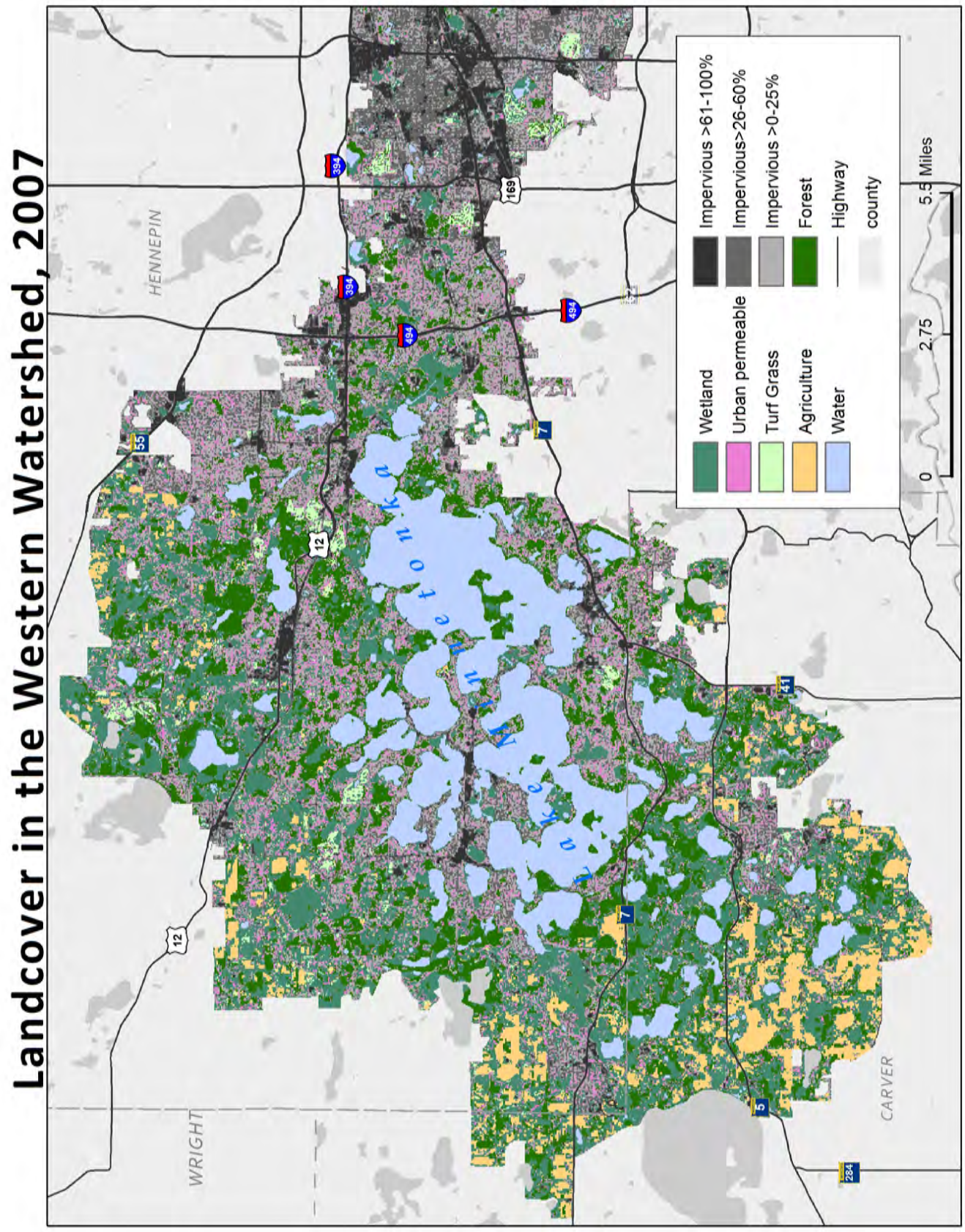
The presence of humans and human activities also impact water quality; for example, various agricultural and environmental inputs (pesticides, fertilizers) can decrease water quality, while physically manipulating natural material (land, waterways, vegetation) can impact erodibility and soil quality, leading to an increase in sediments in water bodies and decreased water quality. Agricultural nonpoint source pollution is the leading cause of poor water quality in the United States and the second leading cause in damaging natural wetland areas. When poorly managed, farming practices such as overgrazing, plowing too often, and use of pesticides may lead to long term damage to the environment and less crop yield in the future (United States Environmental Protection Agency 2014).

1.1 Landcover in the Western Wastershed, 2007

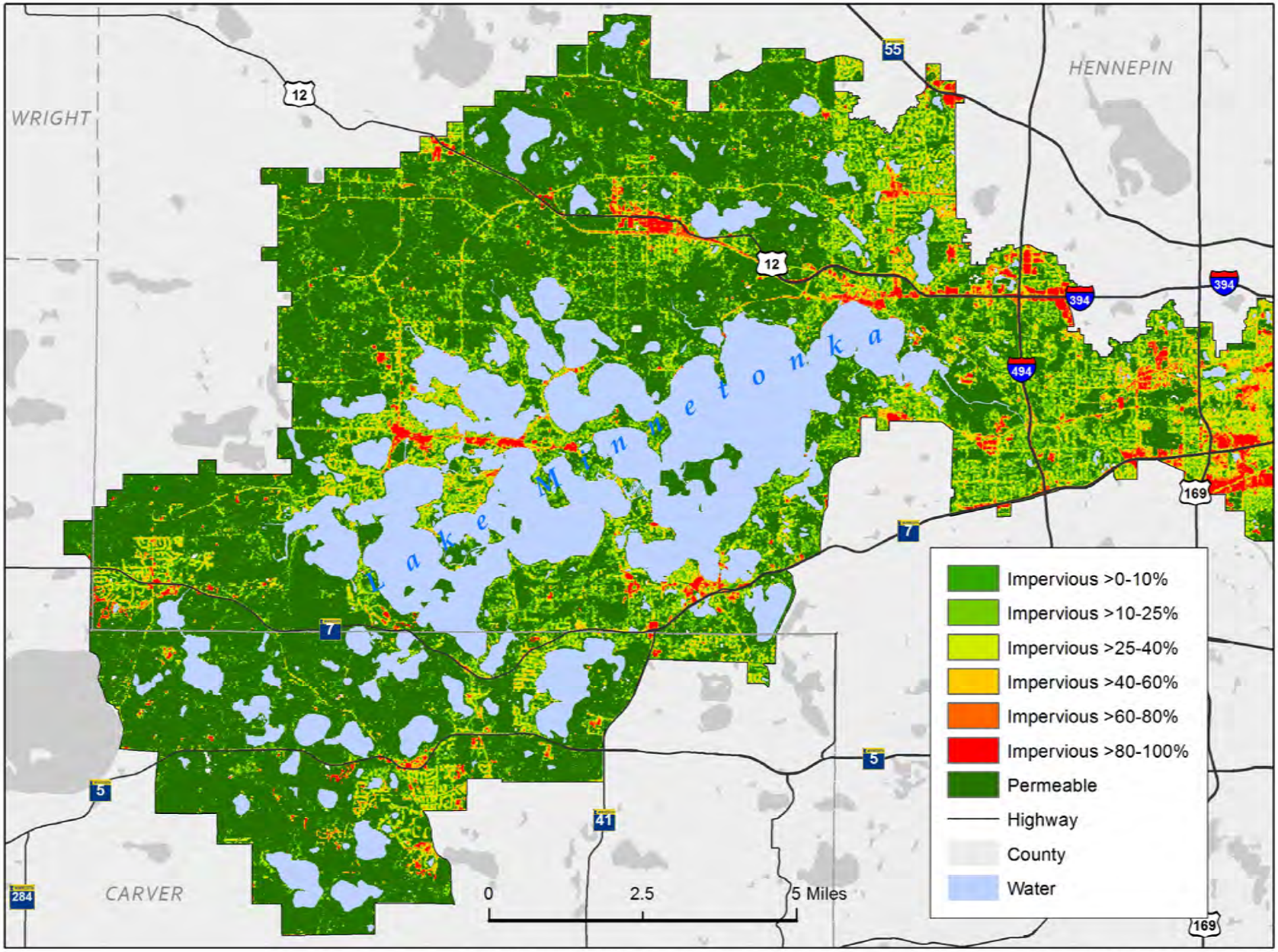
How people use the land strongly affects water runoff. Urban and residential land use are usually more impervious, while natural areas such as forest and wetlands are able to absorb more water. The places with high imperviousness are more prone to flooding, runoff, and pollutants draining into the water system. In order to diminish quantity of impervious land within the watershed, two pieces of information are considered valuable: 1) how much land in the watershed is impervious; and 2) where the impervious land is located. In the map Landcover in the Western Watershed 2007 (**Map 1.1**), the high resolution data (30 by 30 meters) provides precise information of land use type, and is even more accurate than examining land use by census blocks. With this fine detail, the map identifies regions that have a variety of land use types, while other regions are strongly homogeneous.

Two significant patterns of imperviousness can be seen in this map. The first pattern is the eastern part of the watershed contains a high density of impervious land use. This makes sense because the eastern part is closer to the Minneapolis, and urban areas consist of more impervious land. The western part of the watershed contains more variety in non-impervious land, such as forests and wetlands. The western portion of the watershed contains fewer residential areas and instead has more agricultural and natural places. The pattern of becoming less impervious from east to west provides some reassurance that there is still land within the watershed that can be maintained for water absorption and hopefully good water quality.

While the extensive natural lands in the western part of the watershed are reassuring, there are still highly impervious regions that need attention. The second pattern on the map is that many of the impervious regions in the western part of the watershed are along the shoreline of Lake Minnetonka. An example of this is Spring Park, a town that is only .5 square miles but has four miles worth of shoreline (US Census 2010). The town predominantly consists of residential area, and people choose to live there because of the appeal of Lake Minnetonka as an amenity (US Census 2007; Spring Park 2014). According to the map, Spring Park has developed areas that are highly impervious, such as asphalt and concrete surfaces. These surfaces have the potential to damage the water quality of Lake Minnetonka. While the town seems to be aware of water


Landcover in the Western Watershed, 2007
HENNEPIN
WRIGHT
CARVER
Minnetonka
Lake Minnetonka
Impervious >61-100%
Impervious>26-60%
Impervious >0-25%
Forest
Highway
county
Wetland
Urban permeable
Turf Grass
Agriculture
Water
0
2.75
5.5 Miles
Caitlin Toner, October 28, 2014, Sources:University of Minnesota Remote Sensing and Geospatial Analysis, ESRI, Fresh Water Society Projection: NAD 1983 Zone UTM 15N

Imperviousness of Minnehaha Creek Watershed District, 2007



Anoushka Millear, October 30, 2014, ESRI, MNDOT, Remote Sensing and Geospatial Analysis Laboratory, Projection: NAD 1983 Zone UTM 15N

regulation, not addressing the issue of impervious land use will exacerbate the issue water quality.

1.2 Imperviousness of Minnehaha Creek Watershed District, 2007

A surface is impervious if water cannot easily pass through the earth, while a surface is permeable if water can easily infiltrate the earth. Impervious surfaces prevent water from infiltrating into the ground, which can lead to high runoff rates and polluted water bodies. This map shows varying levels of imperviousness, from 0% (permeable) to 100% (completely impervious). The map is made with raster data that shows the level of imperviousness of each cell in the grid. All the cells are 30 meters by 30 meters, and each cell has a specific value for the measure of imperviousness (for example, 5% impervious or 60% impervious). To make this map, those values were sorted into eight different categories, assigning each grid cell a value that corresponds to the categories listed in the map legend. When viewed alongside other watershed features like Lake Minnetonka and highways, the highest levels of imperviousness can be found in developments alongside the highway (e.g., along Route 7 in the western watershed) and in the eastern suburbs. An East-West oriented strip of high levels of imperviousness can be found in the western half of Lake Minnetonka. In these areas of high imperviousness, water is unable to pass through the earth; this leads to water runoff, which can contaminate water and decrease water quality.

1.3 Soil Infiltration Rates

The ability of soil to allow water to pass through is measured by an infiltration rate. Soil has a maximum capacity when taking on water, either from rainfall or irrigation, and if this capacity is reached the excess water becomes runoff, as it moves across the landscape rather than into the soil (NRCS 2008). This map highlights areas that will have low infiltration and high runoff and can therefore give insight into the water quality. Higher rates of infiltration lead to better water quality. As water moves through soil, the soil particles act as a filter for pollutants while maintaining nutrients. Runoff results in poorer water quality because it moves pollutants, chemicals, and bacteria to water bodies (EPA 1999).

Most of the watershed has moderate infiltration. Areas of concern, those with low infiltration and high runoff, can be found in a north-south oriented strip in the western part of the watershed, across Highway 12, and along the southeastern corner. These are represented by shades of red. Some sections of the watershed show both high and low rates, meaning the soil consists of large and small particle sizes. These areas are displayed in green. The water stewards should give attention to red areas, as these are places at greater risk of poor water quality due to higher rates of runoff and movement of pollutants.

1.4a-b Soil Erodibility (Full Extent and Zoom)

There is a direct correlation between soil erodibility and water quality. Sediments are a common water pollutant, and a higher level of erodibility leads to greater amounts of sediment being transported to streams, rivers, and lakes. High sediment levels are associated with increased turbidity, making waters murky and less transparent (DNR 2014). Eroded land can also impact water quality when floating particles bind to pollutants and move these pollutants through the water system (National Estuarine Research Reserve System, Accessed on: Nov. 13 2014).

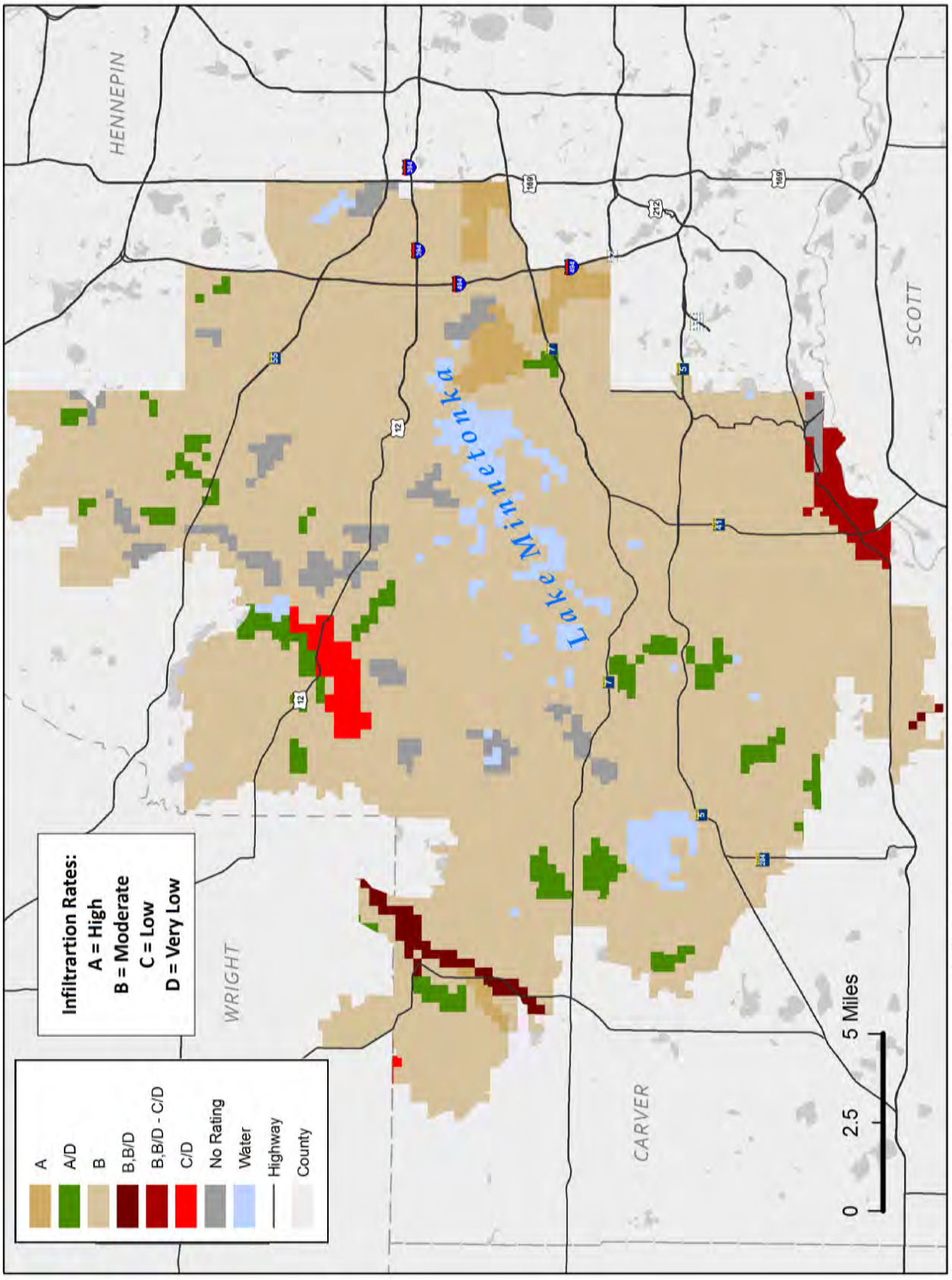
As these maps show, soil erodibility levels are severe throughout the watershed. An area of particular interest, however, is around Lake Minnetonka, particularly along the upward-slanting southern edge. Beyond the K-factor, it is important to consider anthropogenic causes of erodibility. Here, boat wakes on Lake Minnetonka and other surrounding lakes may be contributing to increased erodibility (National Estuarine Research Reserve System, Accessed on: Nov. 13 2014). The severe erodibility of soil within the watershed is a significant problem that will require attention from the Water Stewards as it has negative implications for water quality.

Note: Soil erodibility is described by the K-factor, a quantitative description of the susceptibility of soil particles to detach and their likelihood to move location due to rainfall, runoff, and wind. Texture of soil, soil structure, amount of organic matter, and permeability combine to determine the K-factor of any given soil (Streile et al. 1996).

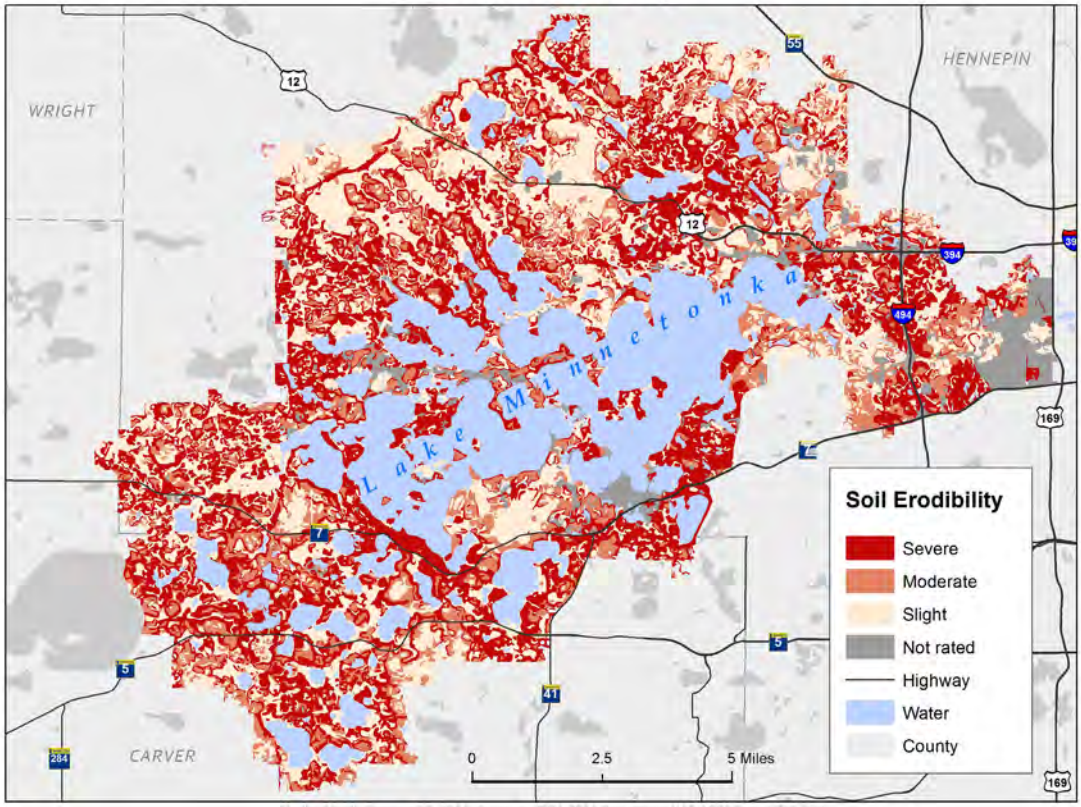
1.5 Soil Type Based on Particle Size

Soil type is linked to water quality because it impacts the infiltration rate and capacity of soil. Soil is classified into three primary categories based on particle size – sand, silt, and clay. Sand has a relatively large particle size and allows for high water infiltration. Clay consists of very small particles that are easily compacted, producing soil that does not allow for much infiltration. Silt has a particle size and infiltration rate that falls in between sand and

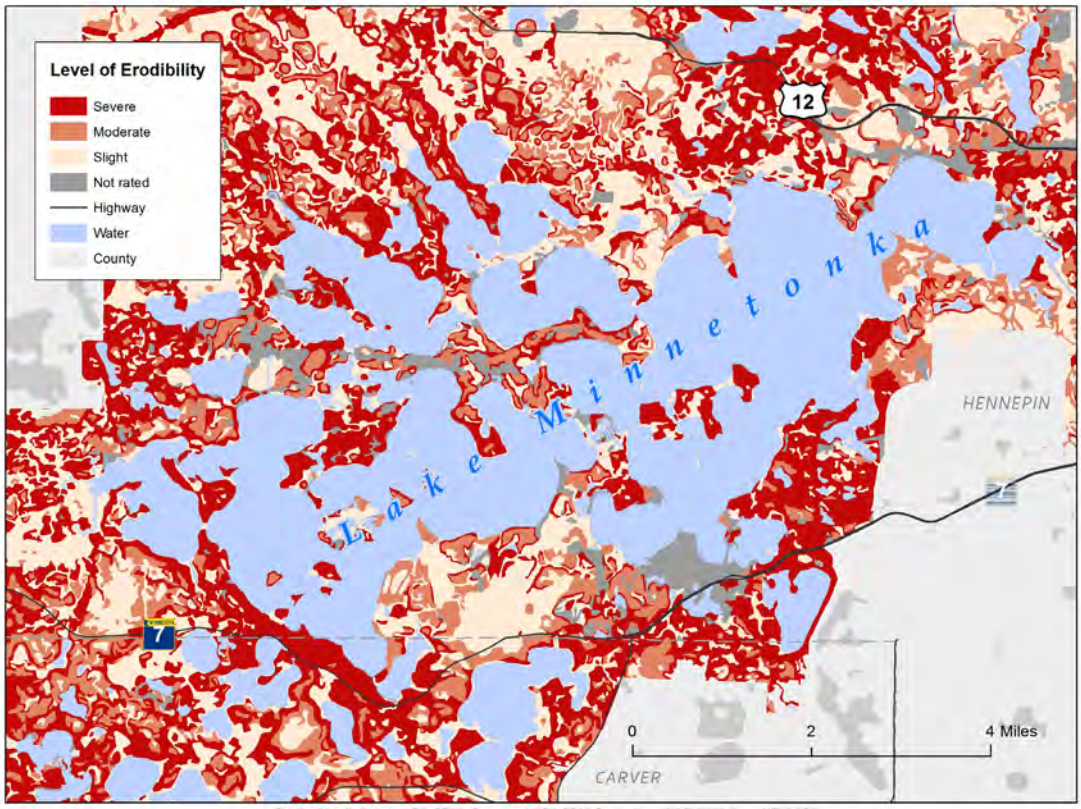
Soil Infiltration Rates

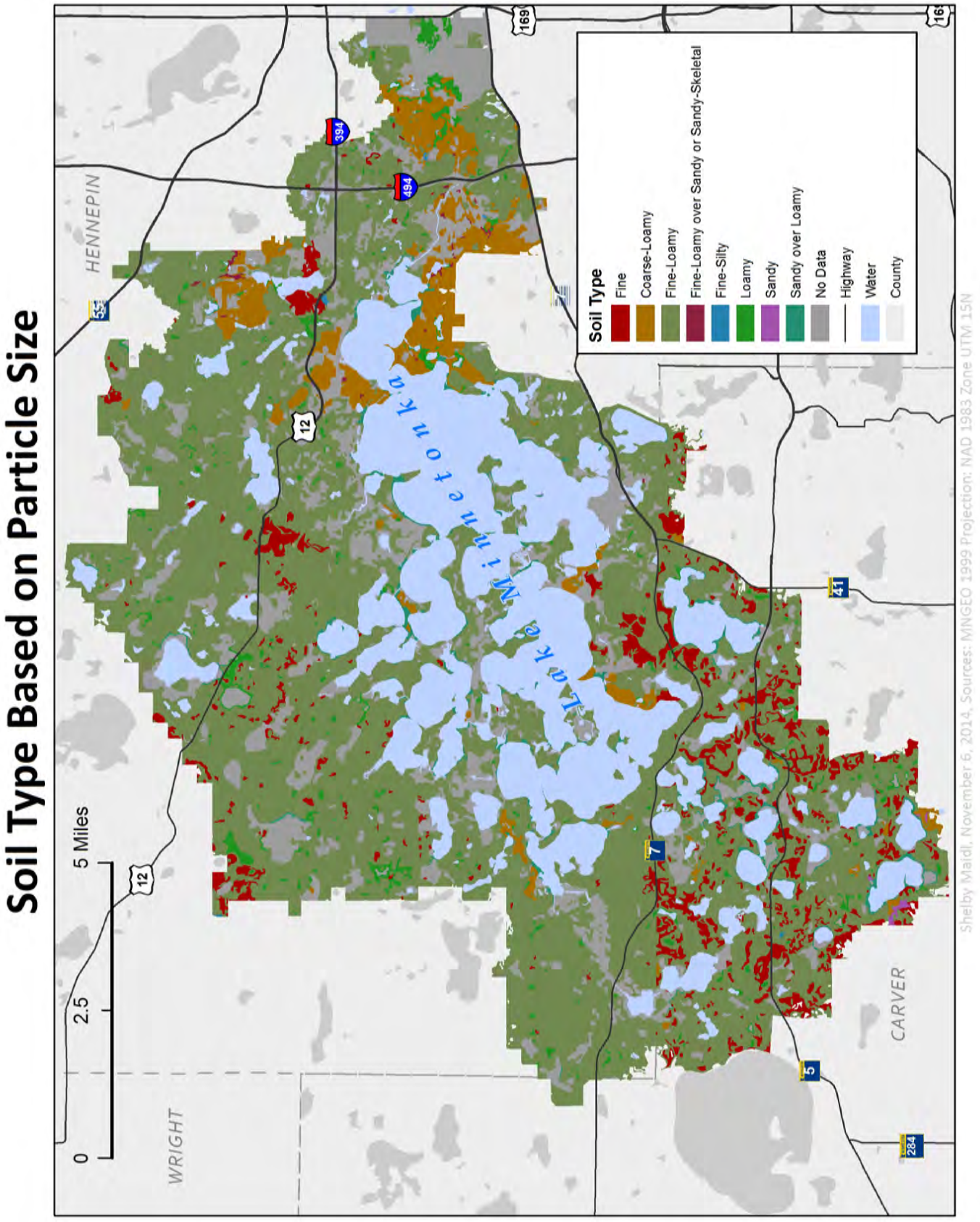


Soil Erodibility



Soil Erodibility: Severe Around the Lakes




Soil Type Based on Particle Size
Soil Type
Fine
Coarse-Loamy
Fine-Loamy
Fine-Loamy over Sandy or Sandy-Skeletal
Fine-Silty
Loamy
Sandy
Sandy over Loamy
No Data
Highway
Water
County
Lake Minnetonka
HENNEPIN
WRIGHT
CARVER
0
2.5
5 Miles
Shelby Maidl, November 6, 2014, Sources: MNGEO 1999 Projection: NAD 1983 Zone UTM 15N

clay (Purdue University 2006). Loamy describes soil that combines roughly equal amounts of sand, silt, and clay. This kind of soil is ideal for planting, as it holds moisture but avoids inundation (Purdue University 2006). Most of the Minnehaha Creek Watershed District consists of fine loamy soil, meaning it contains moderate particle sizes and allows for moderate infiltration of water. However, some areas contain fine soil, represented by the color red on the map. These red areas are of concern because the small particle sizes allow for less infiltration of water and a higher rate of runoff. They should receive more attention from the Water Stewards.

1.6 Risk of Erosion and Erodibility - 2014

Various aspects of the natural environment can lend themselves more to erosion and erodibility than others. Of all of them, the most important factors were established to be soil factors, including soil type, and slope. This map combines those factors to find areas that are most susceptible to erosion. It consists of two data sets, the first being a set of soil factors, the second being slope data. Both datasets were broken down into three categories – slight, moderate, and severe. They were then combined to find places where the areas of 'severe' threat overlapped.

1.7 Urban Runoff Potential - 2014

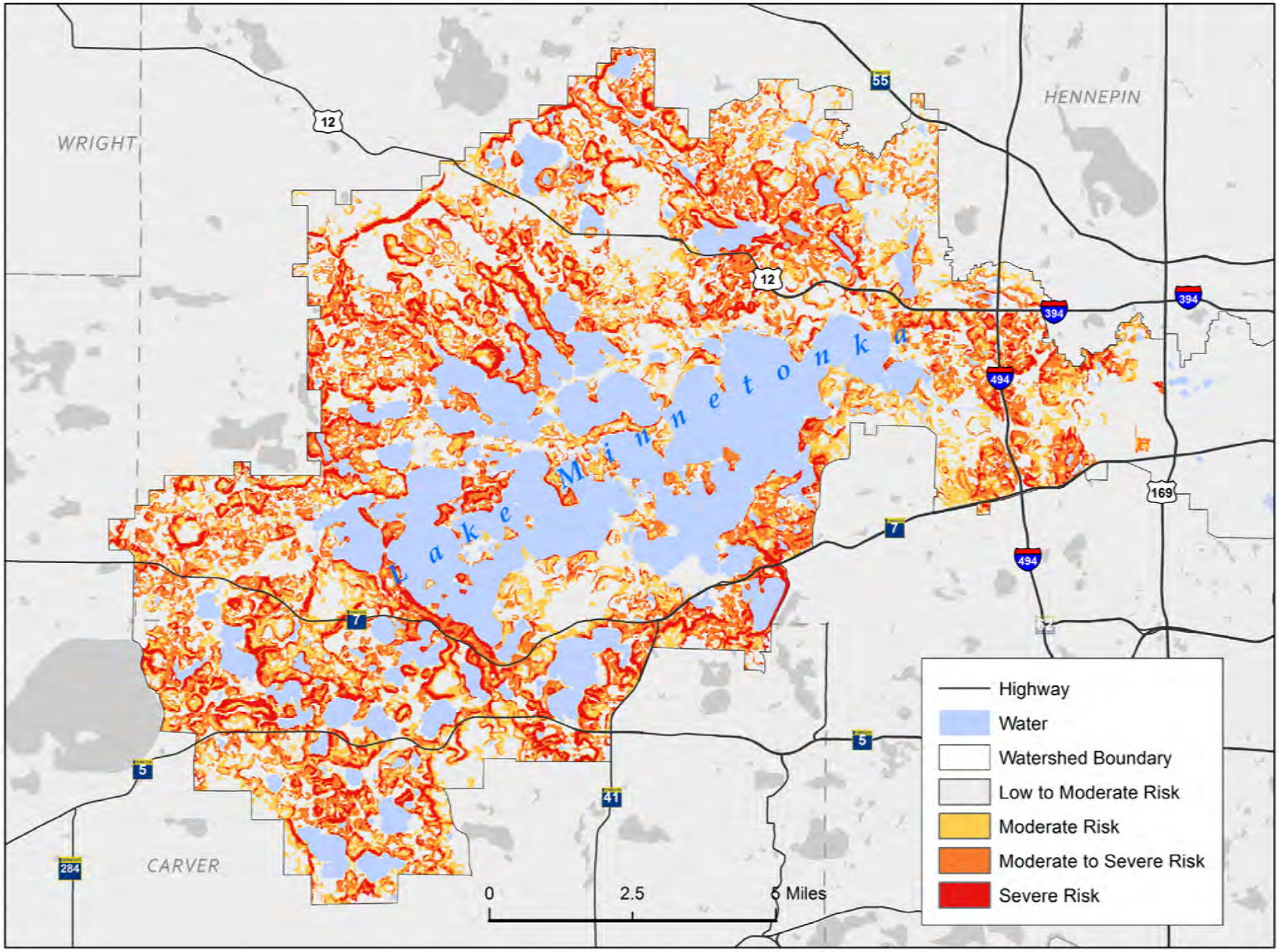
Runoff is very important and linked to water quality, especially in an urban context. This map shows two datasets, slope and urban impervious land cover such as paved areas, industrial parks, and areas not susceptible to water infiltration. Slope was broken down into three categories – slight, moderate, and severe. The impervious land cover was classified in the same way, depending on percentage imperviousness present. For example, an acre could be 30% impervious due to the presence of a road. Areas with more than 60% were categorized as severe, from 40% to 60% moderate, and from 0% to 40% slight. This map shows the areas where both datasets were classified as moderate or above. These areas are important because they show the intersection of both datasets, wherein the probability of water runoff, which may carry harmful pollutants, is high.

1.8-9 Agricultural Land and Feedlot Sites / Number of Livestock Operations by Zip Code

Apart from impervious land use, other types of land use can affect the water quality within the watershed. While the western part of the watershed is less impervious than the eastern part, this region has more agricultural land. **Agricultural Land and Feedlot Sites 2007** (**Map 1.8**) locates crop agriculture and additionally locates feedlot sites that are deemed as contaminant sites by the Minnesota Pollution Control Agency. The map first indicates that most farms are found at the edges of the watershed, and more farms are located right outside the watershed. Being on the border makes it difficult to isolate the agricultural industry in the region and whether the agricultural practices affect the Minnehaha Creek watershed or a different watershed. Nonetheless, this map illuminates

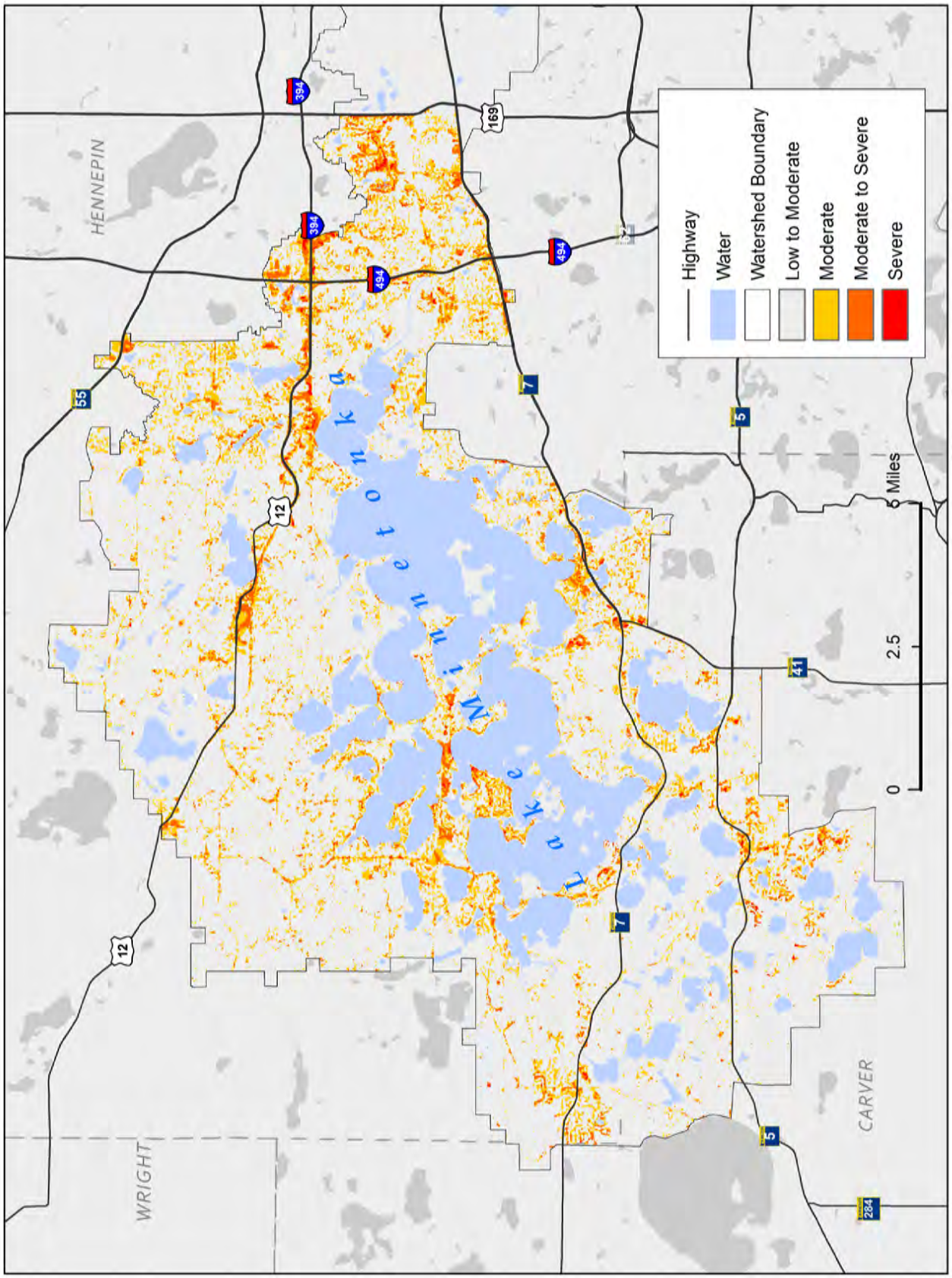
The Gray's Bay Dam Controls Water Coming Out of Lake Minnetonka (Holly Barcus, 2014)

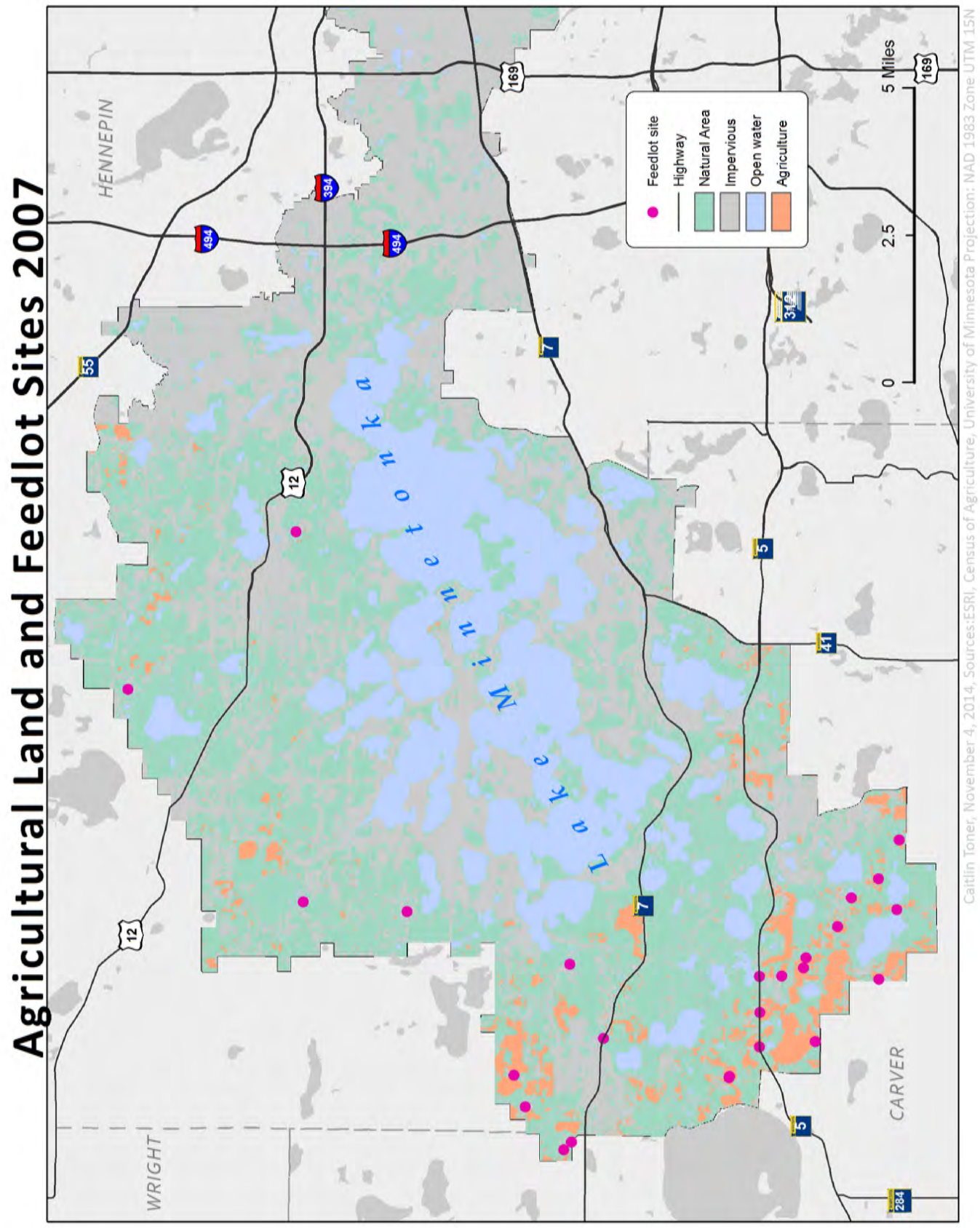
Risk of Erosion and Erodibility - 2014

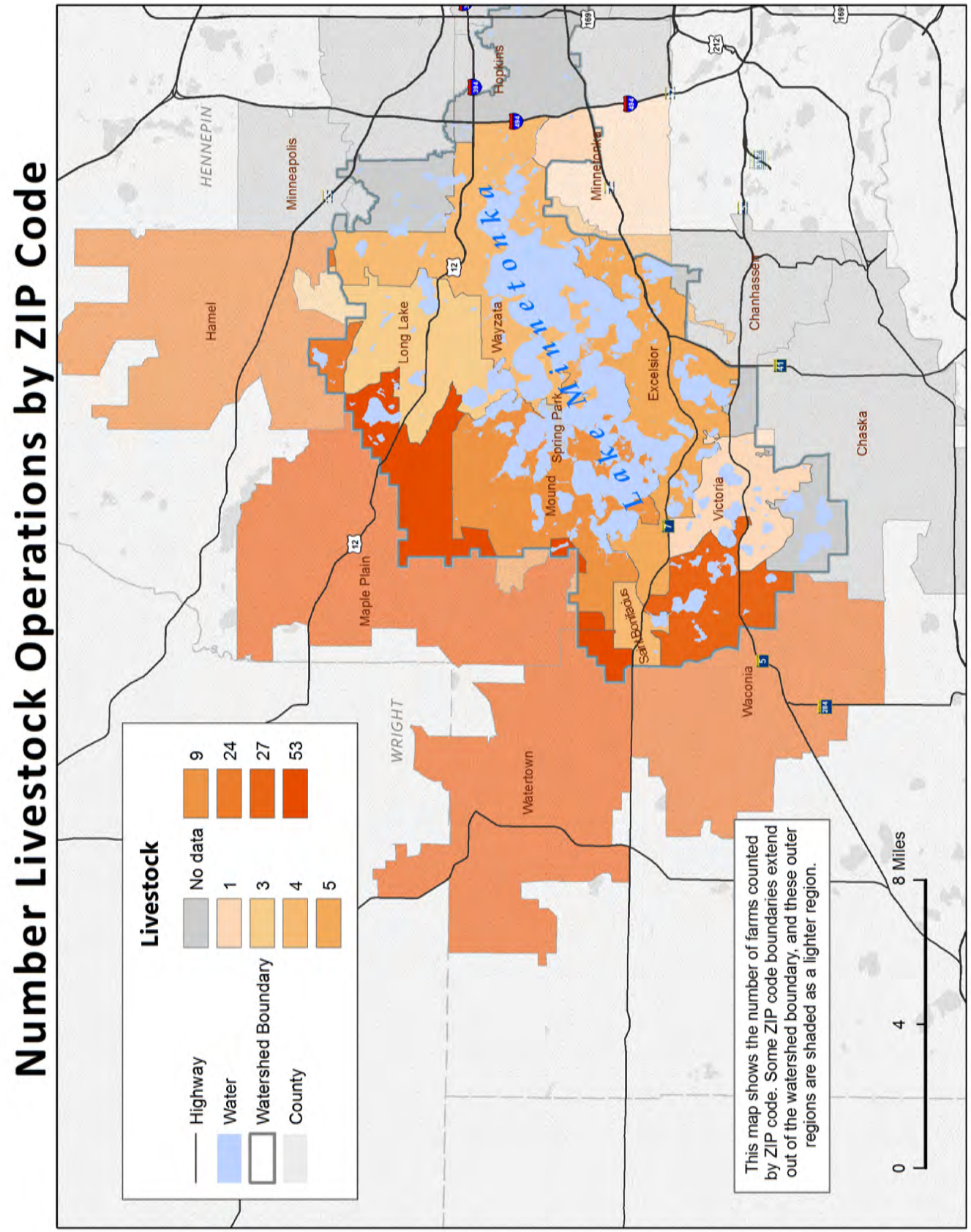


Matthew Creasy, November 20, 2014, Sources: USGS, SSURGO/USDA/ESRI Projection: NAD 1983 Zone UTM 15N

Urban Runoff Potential - 2014




Agricultural Land and Feedlot Sites 2007
HENNEPIN
WRIGHT
CARVER
Minnetonka
Lake
Feedlot site
Highway
Natural Area
Impervious
Open water
Agriculture
0
2.5
5 Miles
Caitlin Toner, November 4, 2014, Sources:ESRI, Census of Agriculture, University of Minnesota Projection: NAD 1983 Zone UTM 15N


Number Livestock Operations by ZIP Code
Livestock
No data
1
3
4
5
9
24
27
53
Highway
Water
Watershed Boundary
County
HENNEPIN
WRIGHT
Minneapolis
Hopkins
Minnetonka
Hamel
Long Lake
Wayzata
Minnetonka
Lake
Spring Park
Mound
Excelsior
Chanhassen
Victoria
Chaska
Maple Plain
Watertown
Waconia
This map shows the number of farms counted by ZIP code. Some ZIP code boundaries extend out of the watershed boundary, and these outer regions are shaded as a lighter region.
0
4
8 Miles
Caitlin Toner, October 28, 2014, Sources: Census of Agriculture, MNDOT, ESRI, Projection: NAD 1983 Zone UTM 15N

ferent watershed. Nonetheless, this map illuminates the broad spectrum of land use within the watershed, from urban to suburban to natural wetlands and to agriculture. Therefore, different locations will require different strategies for water quality solutions.

The second part of the map shows the relationship between the agricultural sites and feedlot sites. Similar to the agricultural lands, this map shows many feedlot sites in the south west portion of the watershed. This suggests a correlation between agricultural land and feedlot sites. No data with the exact size and location of livestock farms could be found, so the map **Number of Livestock Farms by Zip Code** (**Map 1.9**) illuminates the quantity of farms in the region. Similar to the Agricultural Land and Feedlot Sites map, this map also shows that more farms exist on the western edges and outside of the watershed. Both livestock and crop farms contain a high possibility of creating contaminant sites, and should be further examined when trying to resolve water quality issues.

1.10 Change to Residential Land Cover from 1992 to 2013

Over the past twenty years, the Twin Cities metro region has seen a boom in housing development. This map attempts to show where new houses have been placed within the watershed from 1992 up until 2013, to give an idea of where infiltration rates have changed. In order to determine where these new houses were placed, satellite imagery from both of the years was examined and areas with houses were identified. Besides residential areas, natural areas were also identified. Natural areas were defined as places with no or minimal built environment or human structures. Agricultural areas were also identified and were defined as row crops and pasture. The final product shows the areas that were identified to either be agricultural or natural in 1992 that changed to residential by the year 2013. Purple areas on the map indicate areas that were natural and changed to residential, while yellow areas indicate agricultural areas that changed to residential. This shows us where development is occurring and thusly where permeable land cover is transitioning to impervious, as well as areas that may be more prone a detriment in water quality through various urban pollutants.

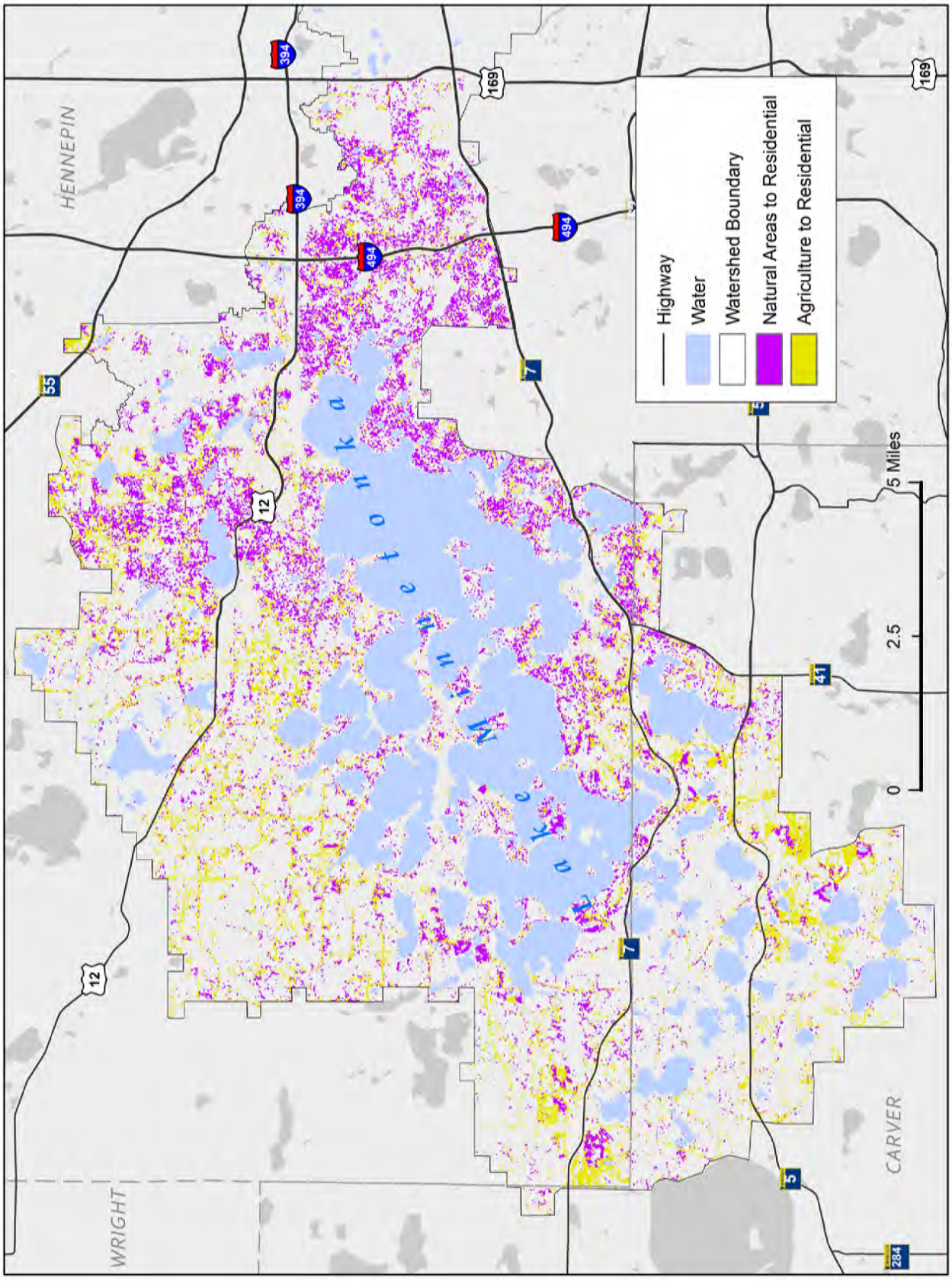
1.11a-b - 1.12 Average Household Expenditure on Lawn Care Supplies, 2010 / Average Household Expenditure on Lawn Care Service, 2010 / Household Expenditure on Termite/ Pest Control, 2010

These maps explore the average levels of consumer spending per household on lawn supplies, lawn services, and termite and pest control. The maps are built from data from Consumer Expenditure Surveys to estimate consumer spending patterns. Two types of consumer expenditure surveys, interview surveys and diary surveys, are administered by the United States Department of Labor Bureau of Labor Statistics to estimate consumer spending on specific goods (Bureau of Labor Statistics, n.d.). These maps show average household expenditure during the year 2011, organized by block group (the smallest unit at which the Census publishes data, approximately 600 to 3,000 population) (United States Census Bureau, 2012). These maps assume that the purchase of lawn care supplies means that those supplies are being applied to the lawns of the survey respondents, and that the services being consumed (lawn, pest control) are being used to manipulate the natural environment in some way, and consequently contribute to decreased water quality. Artificial inputs can pollute water, while manipulating the physical environment can increase runoff. All three maps show generally higher expenditures towards the northeast portion of the map, although Expenditure on Lawn Care Supplies and Expenditure on Termite/ Pest Control show higher spending towards the southwest border of Lake Minnetonka. Although these maps cannot show the specific purchase and application of goods by consumers, they can show generally the areas where these purchases are the highest, and subsequently, the areas that might have greater water quality issues as a result of that expenditure.

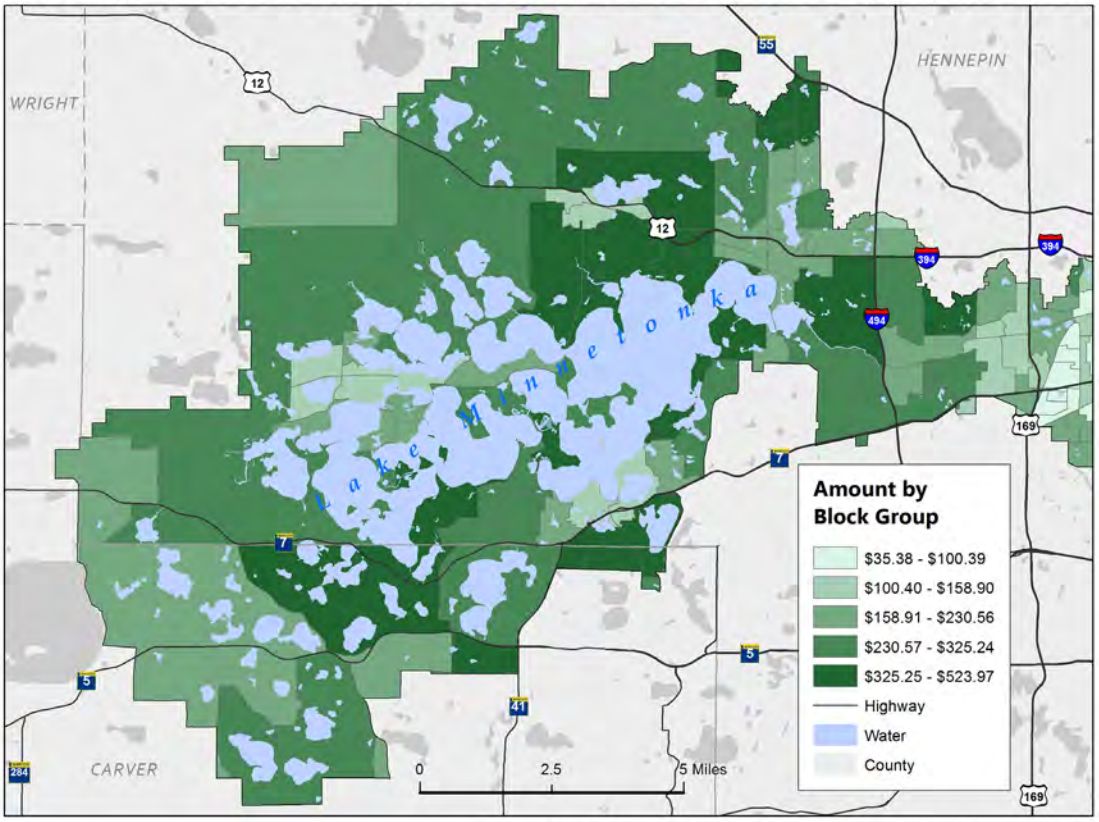
CONCLUSION

This chapter focuses on the environmental features of the landscape and seeks to present the factors that impact water quality and water infiltration in the western part of the watershed. Water quality is more explicitly linked with land use and human behavior on the land, while water infiltration focuses more on the topography of the watershed. These maps are intended to give an environmental context to the watershed in order to help the Freshwater Society make informed decisions on

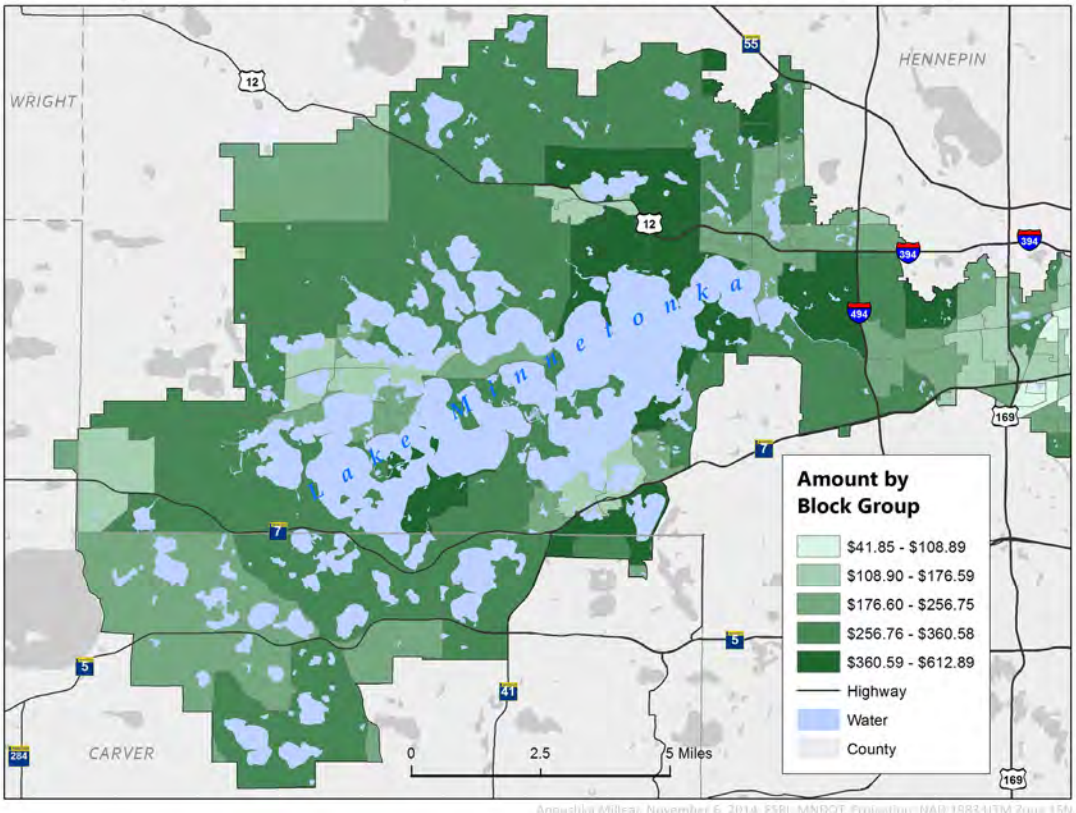
Change to Residential Land Cover from 1992 to 2013

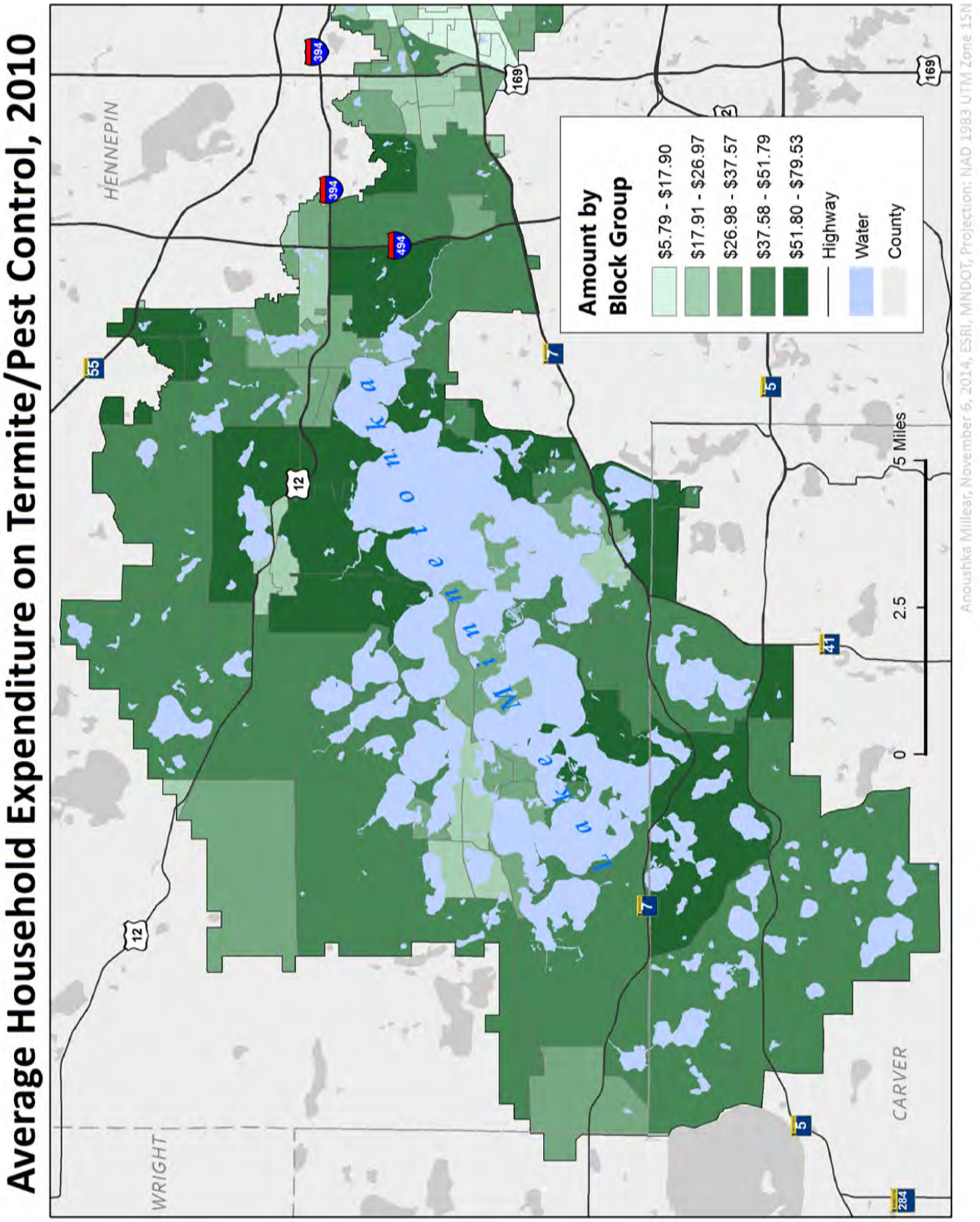


Average Household Expenditure on Lawn Care Supplies, 2010



Average Household Expenditure on Lawn Care Service, 2010




Average Household Expenditure on Termite/Pest Control, 2010
Amount by Block Group
$5.79 - $17.90
$17.91 - $26.97
$26.98 - $37.57
$37.58 - $51.79
$51.80 - $79.53
Highway
Water
County
HENNEPIN
WRIGHT
CARVER
Minnetonka
0
2.5
5 Miles
Anoushka Millear, November 6, 2014, ESRI, MNDOT, Projection: NAD 1983 UTM Zone 15N

projects in the future.

In the western part of the watershed, agriculture, residential development, and human behavior impact the water quality. Agricultural land use practices are often unhealthy and pollute the water, as evidenced by the contaminated feedlot sites in the region (see **Map 1.8**). Additionally, many agricultural lands have transitioned into residential areas over the past twenty years, but this does not diminish the land's influence on water quality. Residential development leads to more impervious surfaces like asphalt and concrete, as well as large built-structure-to-natural environment ratios, which disrupt natural water flows. These changes on the landscape lead to higher rates of runoff and therefore contribute to water pollution. Many of the people who move into these residential areas also have some unsustainable practices, such as paying for lawn services that use pesticides. Residents in the watershed can help to mitigate water runoff by reducing their properties' asphalt and concrete coverage and installing rain gardens.

How water travels dictates how water can transport harmful pollutants that affect water quality. Pollutants such as pesticides, wastewater, animal waste, and even normal soil, can all enter various bodies of water through different methods of travelling across the physical landscape. Infiltration is one way that water travels, by travelling through it. Soils have a direct impact on how easily water will seep downwards and join the water table, potentially joining with an aboveground body in the future. Impervious land cover means that water will not infiltrate the soil; therefore, water will either run off or simply collect and stay idle. Areas that contain any kind of slope allow for the water to run off and collect at the lowest points in the area. Think, for instance, of a river embankment with large steep slopes and little vegetation; a heavy thunderstorm could easily erode the sides nearest to the river because of the rate of water flow and steepness of the slope. Steep paved areas will just deposit the water to the lowest point without potential loss of soil.

Looking at the intersection of water quality and water infiltration, this chapter suggests focusing on the area near and around St. Bonifacius. The farms in this area contain feedlot sites, implying the agricultural practices that might negatively impact the water quality. Because this area has seen a lot of recent residential development, there has been a change in rate of infiltration as land cover becomes more and more impervious. This, alongside the high-grade slope and erodibility of some parts of the area, allows contaminated water to runoff, erode, and pollute various sources of water. Considering the information provided in the other chapters of this book, which cover who lives here and what do they do, the Minnehaha Creek Watershed District and the Master Water Stewards Program would do well to target high-risk water quality areas that overlap with populations that would be likely to engage in water improvement projects.

Many Lake Minnetonka Lawns Reach All the Way to the Water's Edge (Holly Barcus, 2014)

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Community and Built Environment

Catherine Bretheim - Jessica Del Fiacco - Joe Klein

INTRODUCTION

This section reflects the work of the second student group, which focused on community and built spaces within the western MCWD in an attempt to find overarching patterns of how people's relationships to both their community and their local environment are influencing the status of the watershed. Ideally, these findings are meant to be useful for the expansion of the Master Water Steward Program and other MCWD outreach efforts by offering insights into the different structures and types of communities present. Three sub-themes were chosen to try to reach this goal: 1) housing development; 2) potential sources of pollution; and 3) community institutions. All are different aspects of land use and its impacts on the environment, and each focus group helped to create a more cohesive pattern from specific examples of historical, current, and changing communities and environments within the region.

For instance, **Map 2.3** (**Age of Housing Stock and Recent Home Sales in Edina**) and **Map 2.7** (**Average Year of Home Construction**) broadly examine the housing make up in the region and **Map 2.10** (**Out-of-State and Second-Home Owners**) offers a different view of the same pattern—together they begin to tell a story about the people who live in the watershed and what the landscape looks like. **Map 2.3** specifically investigates the "tear down" trend in the watershed, or the problematic construction of large homes on relatively small lots. From overall trends to individual sales, this series of housing development maps tries to make sense of various neighborhood patterns and highlight areas of concern or importance.

Others maps are made up of recreational areas, such as boat launches and regional parks, community spaces like schools and churches, and planned infrastructure such as sewer systems and roads. **Map 2.1** and **Map 2.2** (**Government and Educational Institutions**, and **Parks and Community Spaces**, respectively) display many institutions that foster community in different ways, and may hold potential for educating and motivating people to be proactive about protecting their environment. These two maps contain examples of community assets (things present within communities that improve quality of life and interpersonal connections), which are an important window into the health of the local community.[1] They can also instruct how best to approach and work with the people who live here by reflecting values, skills, and interests of different areas.

The patterns found among all of the maps help to explain what life looks like in the western part of the watershed, and most identify areas that pose either potential problems for water conservation or areas that provide a good potential starting point when reaching out to local communities. The following maps indicate that the Minnehaha Creek Watershed is undergoing rapid change in many sectors, most visibly in housing and development trends. The expansion of urban space and diversifying demographics is occurring alongside long-standing agricultural and natural land tracts—this results in a complicated physical and social landscape that can have a range of impacts on the environment. These maps represent the use of GIS tools to try and make sense of, or predict, how and where the watershed will be affected, as well as how local residents can best be reached to prevent negative consequences.

2.1 Presence of Government / Educational Institutions

The western half of the watershed contains many different community and civic institutions (such as schools, libraries or government offices) that could be used as central gathering points for the FWS's educational efforts, or bases from which the Master Water Stewards program can expand in the future. These institutions include colleges, municipal libraries, city halls, and schools. In addition, this map also includes the Minnesota Landscape Arboretum, as it still might bring together like-minded community members and produce educational material, despite its different focus than these civic institutions. All these institutions are likely to have high levels of community interaction and high traffic, as they are fairly universal sites that can bring together many individuals.

Schools classified on this map include both public and private elementary, middle and high schools, as well as child care centers, to reflect the wide range of school types that exist in the watershed. Most of these institutions are located in the eastern half of the watershed, in more established suburbs such as Hopkins, Edina and St. Louis Park. In other areas of the watershed, these institutions tend to cluster near one another (such as in Victoria and Excelsior), reflecting where people are concentrated in those areas of the watershed. Areas near and north of Lake Minnetonka have a relatively high presence of these institutions, while the southern and western parts of the watershed have fewer institutions. These areas have experienced the most recent home construction in the watershed (see **Average Year of Home Construction by Block Group**, **Map 2.7**), yet civic institutions to serve those areas have not developed at the same pace. Therefore, the ties individuals have to those institutions are likely weaker than in more established areas of the watershed. Any usage of these institutions as community gathering points could face some difficulties in the western and southern areas of the watershed, because the relative lack of institutions and low-density, sprawling nature of those developments make it less likely individuals will interact with these institutions on a regular basis. However, that shortage will make the presence of those few institutions all the more important in those areas.

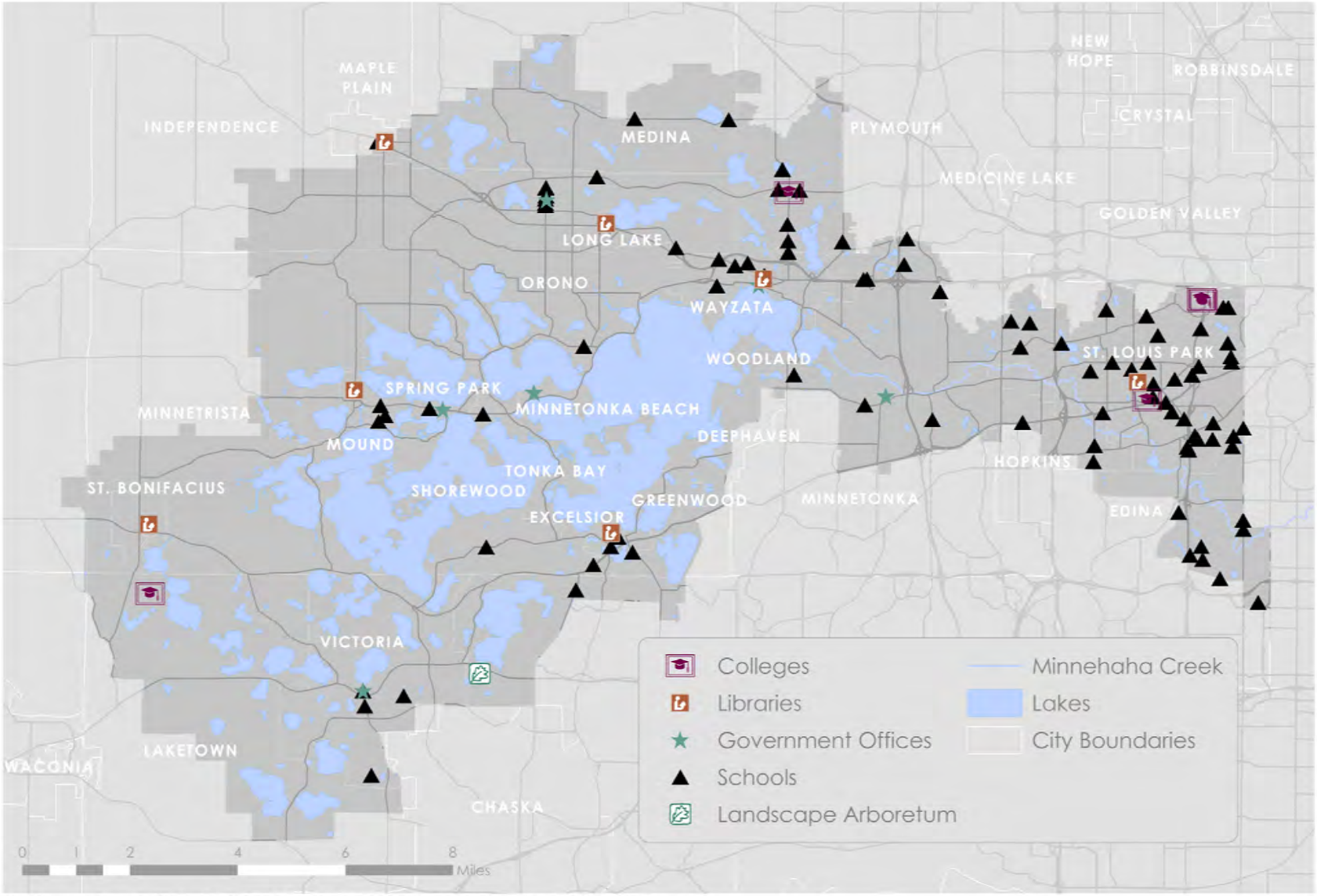
2.2 Recreation and Community Spaces

If the water stewards or the MCWD want to reach out to people who live in this part of the watershed, it will be important to know the best places to do that. Given that the Minnehaha Creek Watershed is home to many people who are enthusiastic about some aspect of the environment and/or what they do in it, such as boating, hiking, fishing, swimming, hunting, camping, biking and other activities, it would follow that the message of the importance of maintaining the watershed will be most successful when tied in with outdoor recreation. Religious centers and community spaces are also included, to give a more rounded idea of places people are interacting with other people in their local community—even if not located outside, these may still be spaces where important discussion and education could occur. For the most part, these points are evenly distributed throughout the watershed, especially the religious centers, but there are slightly fewer towards the western edge, as there is a lower population density. Overall, there are plenty of spaces and opportunities for the FWS to gather with and communicate to a variety of different segments of the population.

2.3 Age of Housing Stock and Recent Home Sales in Edina

Mapping the age of housing stock and recent home sales in a neighborhood can help in understanding how long individuals have lived in a neighborhood and the potential strength of their community ties. Edina is a slightly older, more established suburb with much of its residential construction occurring mid-century (see **Average Year of Home Construction by Block Group**, **Map 2.7**) The section of Edina located within the MCWD (which is displayed on this map) is consistent with those features. However, the neighborhood of Morningside—located in the far northeastern corner of the city—is distinguished from the rest of the neighborhood by an even older housing stock and a "distinct and independent" community feel that could assist in any outreach or educational efforts in this neighborhood.[2] Edina's desirable location and high property values have led to an increase in housing teardowns over the past few years, where houses originally built on lots were demolished and replaced with new, often larger homes on the same lot.[3] The construction of these houses may disrupt water quality in the region, as houses with larger footprints have greater levels of impermeable land on the property. That increased impermeability may contribute to runoff and flooding in Edina. The teardowns accompanied a rapid pace of home sales that occurred after 2005. When combined, these two variables demonstrate that the population of Edina has trended toward living in the city for a shorter period of time and living in recently-constructed houses. Such a household might not have developed the

PRESENCE OF GOVERNMENT AND EDUCATIONAL INSTITUTIONS



Cartographer: J. Klein. 11/21/2014. NAD 1983 UTM 15N. Source: ESRI, MetCouncil.

same ties to the community and their neighborhood as residents who have lived there longer. That being said, new residents to Edina, especially those who may want to stay here for an extended time, may have high expectations and feel more compelled to invest in the neighborhood around them.

Residents near these teardowns might be concerned with this trend, as the existing housing stock around them is torn down and replaced with newer houses that often do not match the character of the surrounding neighborhood. However, they may also be implicitly concerned with changing water quality of their neighborhood as these new properties will affect runoff and flooding. Residents near these housing teardowns could potentially be strong candidates for Master Water Stewards, and may benefit from increased educational efforts from the FWS.

2.4 Vacancies and Recent Housing Teardowns in Edina

Edina's housing market has changed rapidly over the past ten years, as many houses have recently changed ownership and new houses have been built throughout the city. Edina has experienced a fair amount of housing teardowns in the past few years, where a developer or owner will demolish the existing house on a lot and build a new, often larger house in its place. These teardowns change the character of the neighborhood and are a result of the strengthening housing market in the Twin Cities.[4] This map presents a few factors that highlight the rapidly changing housing stock in Edina, which has contributed to the presence of teardowns. Properties colored in orange are houses that have been sold to new owners in the past ten years. Many of these properties appear to cluster close to one another, so in many cases the majority of a block is occupied by new residents to the neighborhood. However, these properties are fairly well-distributed throughout Edina, so there are few areas, if any, that have not experienced this high turnover in ownership of their houses.

Housing teardowns also exist fairly evenly throughout the study area, yet they tend to cluster around other teardowns when they occur. The newest residential properties in Edina — those built since 2000 — are represented with yellow dots. Many of these newly-built houses are in the middle of well-established, older neighborhoods, so these housing teardowns often change the character of the neighborhood and stand out from other surrounding houses.

In addition, a fair number of residential properties in Edina are currently vacant. Some of these properties are located near recently-built houses, and were sold to new owners in the past few years. Those two variables, when combined, suggest these houses are prime candidates for teardowns. The housing stock of Edina will continue changing in the future, and once again residents near existing or potential teardowns could be recruited into the Master Water Stewards program to raise awareness of the environmental implications of housing teardowns in Edina.

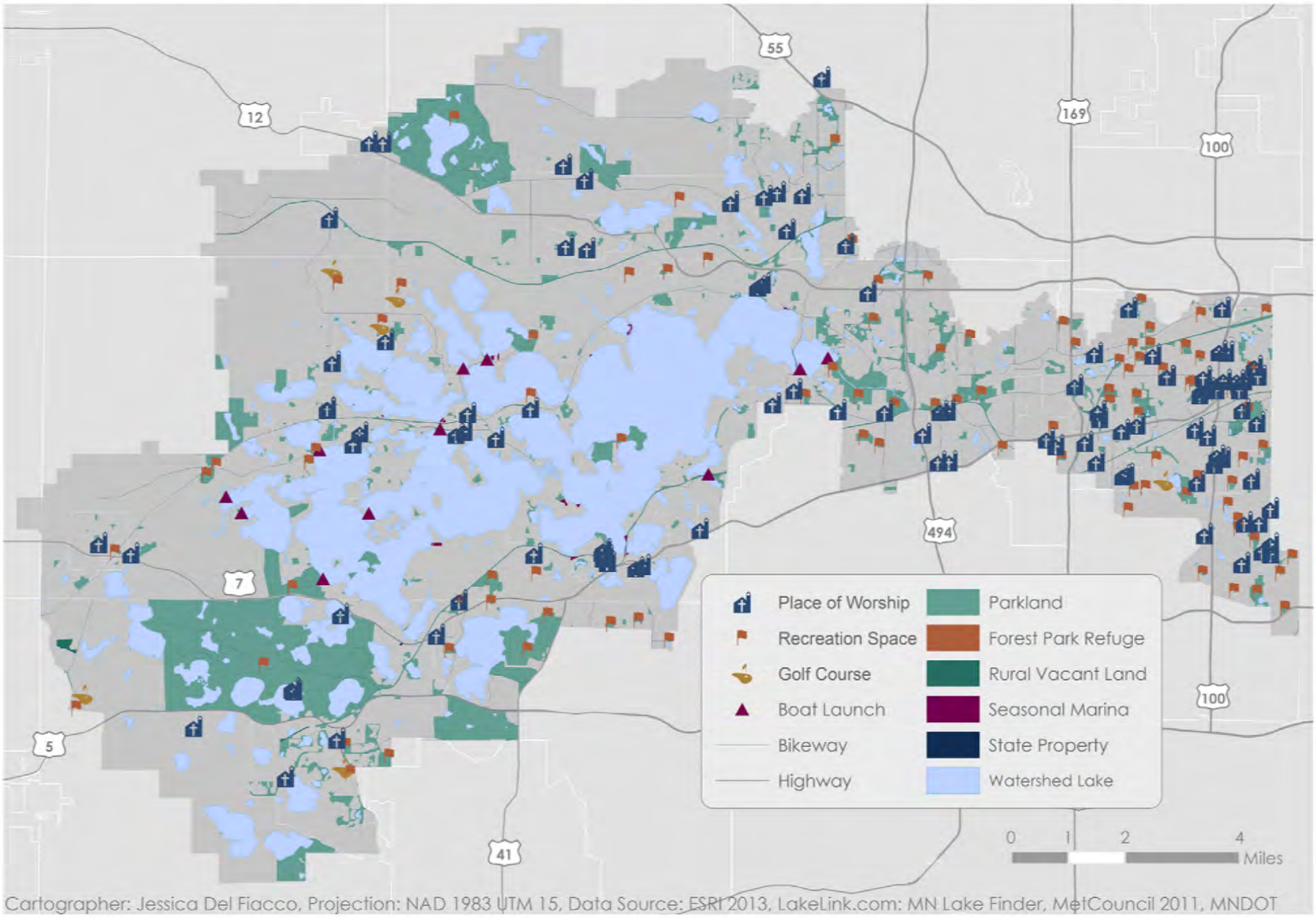
2.5 Vacant Land and MCWD-Owned Land

The watershed has seen rapid growth over the past couple of years, as much of the previously-agricultural land in its western section has been converted into residential uses. However, a fair number of parcels in the western half of the watershed are vacant. Vacant properties generally receive less upkeep than occupied properties, so an owner might have less investment in a vacant property and have less awareness of the lot's effects on the watershed. Vacant lots also have high potential for redevelopment. Many of the vacant properties near and east of Lake Minnetonka are smaller in size and fairly separated from one another, implying that they are smaller, residential parcels. However, the vacant lots located north of Lake Minnetonka are larger in size, which suggests that the vacant lots here are nonresidential parcels (such as agricultural land). While vacant land elsewhere in the watershed is fairly scattered, many vacant parcels north of Lake Minnetonka cluster together and form large swaths of unoccupied land which might be a potential location for future redevelopment.

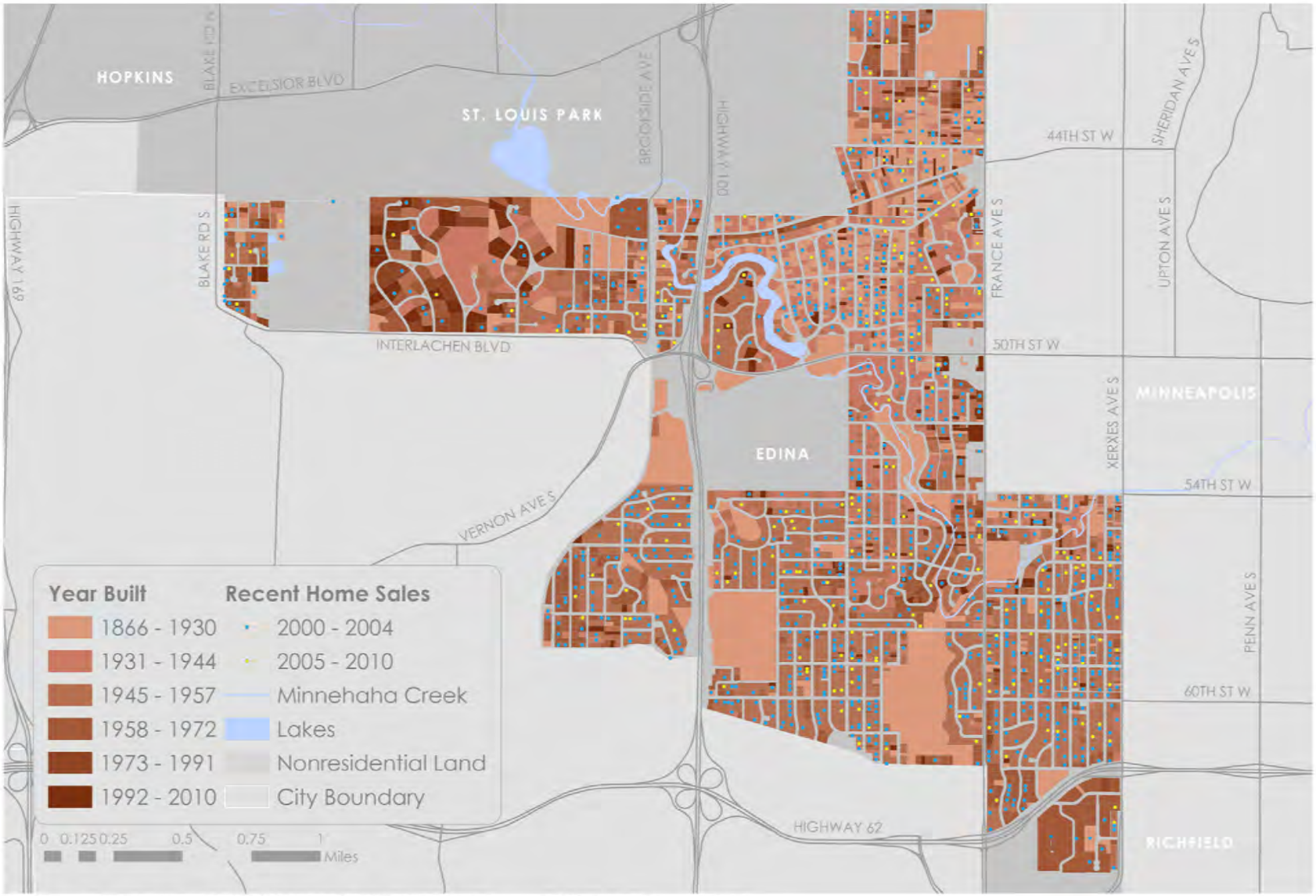
Carver County, in the far southwestern portion of the watershed, has very little vacant land. This area has experienced very high levels of new home construction in the past few years, leaving little land in this area categorized as vacant. In addition, Carver County's portion of the watershed contains much park and recreation land, such as the Minnesota Landscape Arboretum. This distorts the amount of vacant land that shows up on the map, as recreational land is not officially classified as vacant.

The MCWD owns just a few parcels of land in the watershed. A few of those parcels, however, are adjacent to currently vacant properties. Depending on what resources are available to the MCWD, the adjacent vacant properties could be potential sites for future development or land acquisition by the MCWD. If the MCWD steps in

RECREATION AND COMMUNITY SPACES

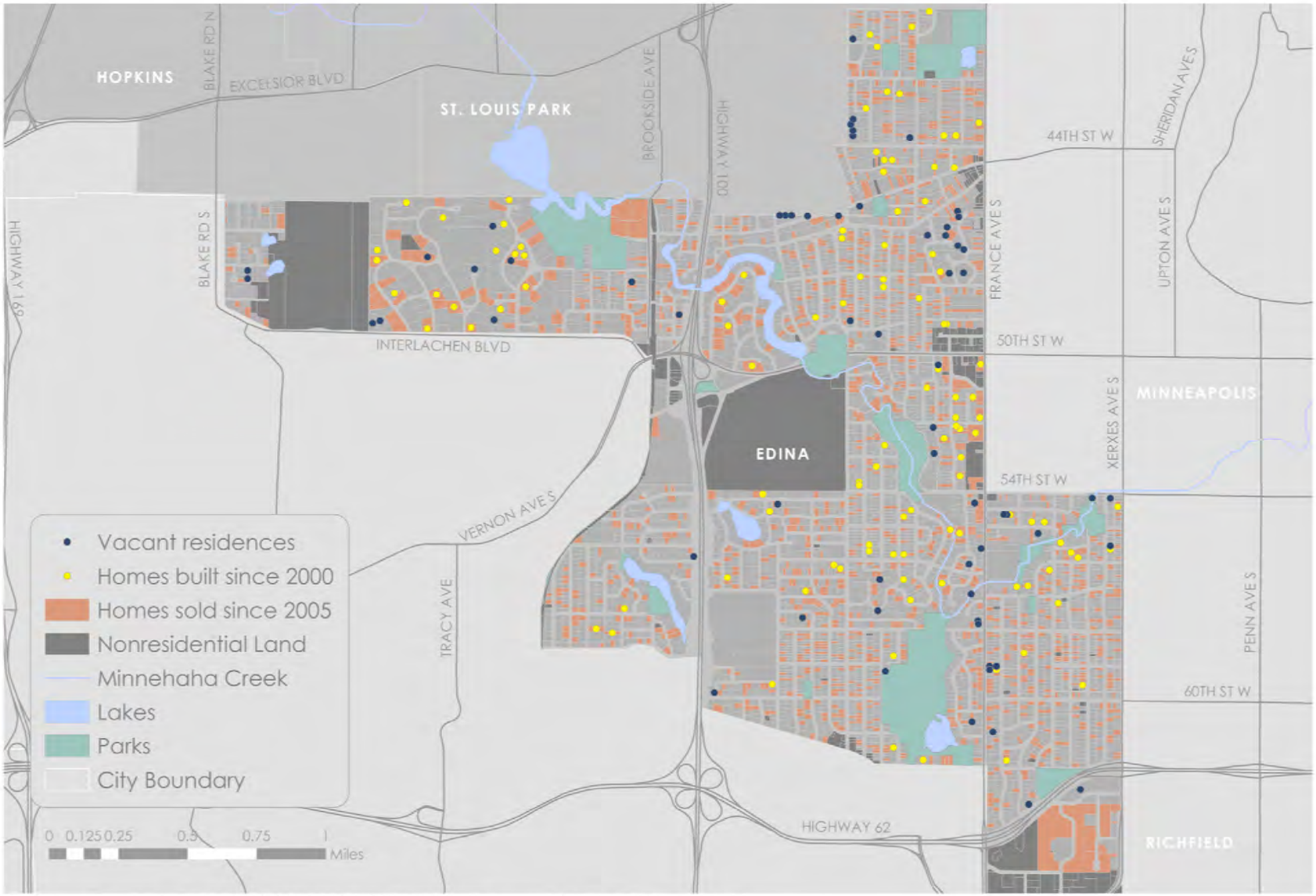


AGE OF HOUSING STOCK AND RECENT HOME SALES IN EDINA



Cartographer: J. Klein. 11/20/2014 NAD 1983 UTM 15N. Source: ESRI, Met Council 2011.

VACANCIES AND RECENT HOUSING TEARDOWNS IN EDINA



Cartographer: J. Klein. 11/20/2014 NAD 1983 UTM 15N. Source: ESRI, Met Council 2011.

and plays a role in the future of these properties, it could have implications for maintaining a high standard of water quality in those areas.

2.6 Age of Individual Home Construction

Residential properties in the western and southern portions of the watershed were constructed more recently than in the eastern part of the watershed. The movement of residential development westward throughout the watershed with time corresponds with increased parcel sizes, likely as a result of increased land available for development and conversions from agricultural to residential land. At the parcel level, it is difficult to see any notable trend in age of home construction along the lakeshore, as there have been quite a few housing teardowns and residences constructed recently, right along older residential properties. The far northwest and southwest areas of the region, generally, have seen the most recent housing construction, while eastern areas of the watershed have not seen much recent home construction. Home construction and building practices have changed over time, so the construction of a house in St. Louis Park many decades ago likely had a different effect on the surrounding environment than a home built in Victoria within the past ten years. Much of the development in the western and southern sections of the watershed is low-density, so the road network in that area is more extensive, which creates more impermeable land surfaces in the area.

2.7 Average Year of Home Construction by Block Group

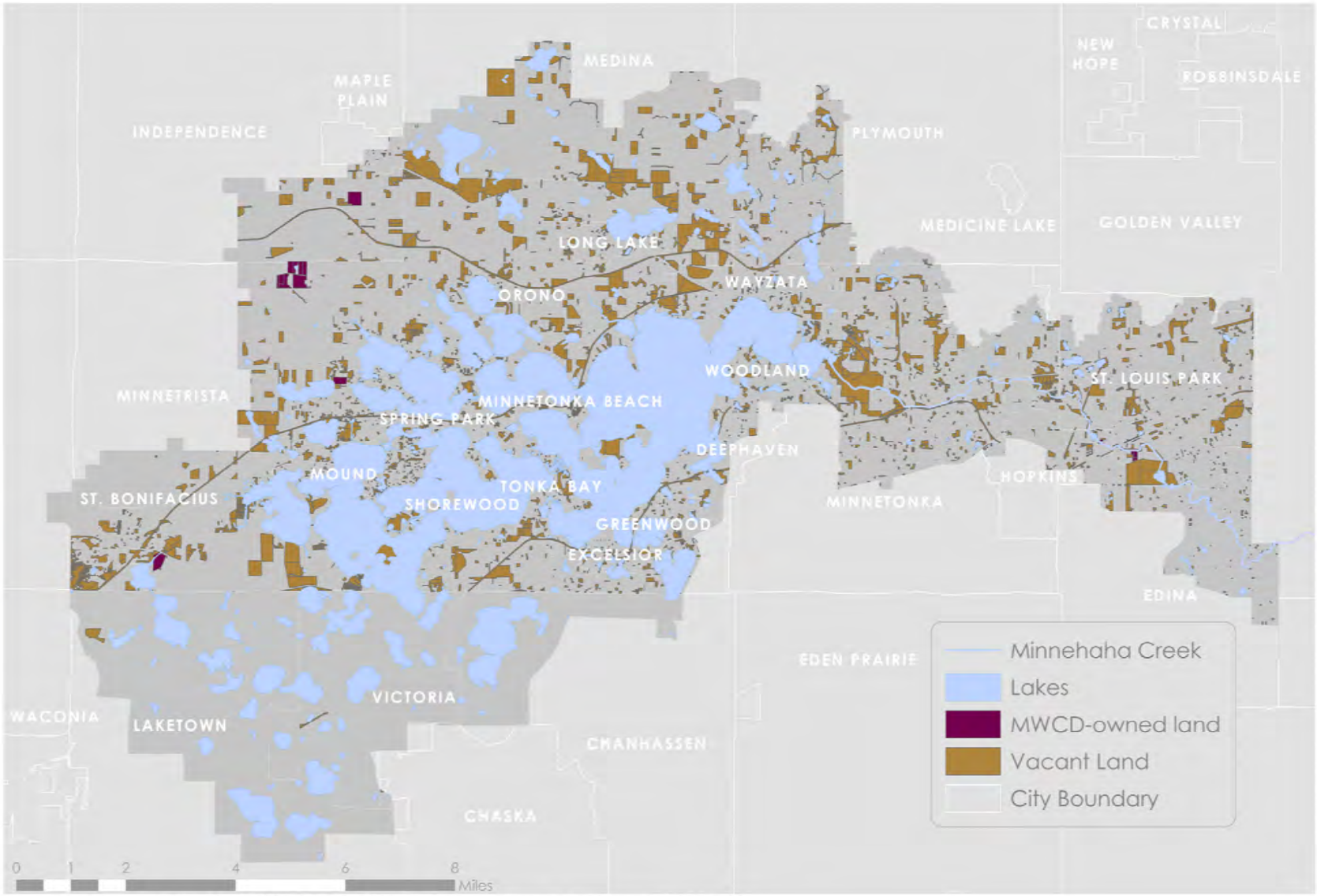
The southern and western parts of the watershed have seen, on average, more recent home construction than other areas in the study area. By looking at overall trends in home construction as opposed to individual parcels, the patterns toward newer houses in the southern and western parts of the watershed become more apparent. Despite many housing teardowns in the central and eastern portions of the watershed (such as in Edina, Minnetonka and other inner-ring suburbs), they are still far from the majority in those block groups, as on average those areas have an older, more-established housing stock. Areas in the watershed with newer homes likely have very different approaches to housing construction than areas with older homes. These changes in construction and types of houses built affect how the lot manages water, which has implications for the rest of the watershed.

2.8 Flood Risk Zones

The **Flood Risk Zones** map documents the relative risk to significant flooding that could damage properties in the MCWD, an important factor that Water Stewards can use to target areas and residents. The map shows high and very high risk levels to flooding based on 100 and 500-year floodplains and presence of basements. FEMA defines a 100-year floodplain as an area with a "1-percent chance of being equalled or exceeded in any given year" and a 500-year floodplain as an area with a "0.2-percent-annual chance".[5] This information is espe-

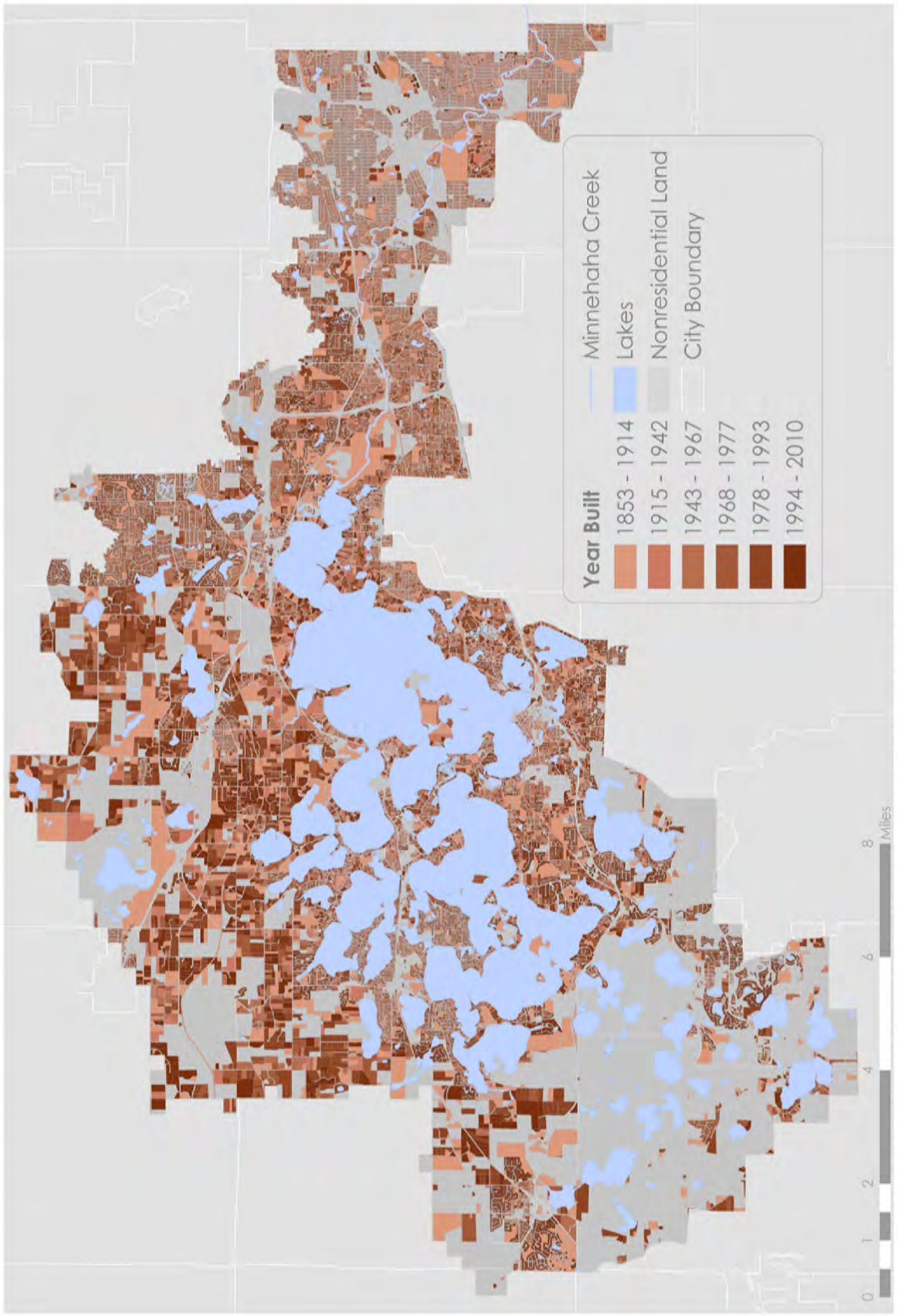
Housing Tear-Downs and Their Replacements are a Problem in Edina.
(*Star Tribune*, 2013)

VACANT LAND AND MCWD-OWNED LAND

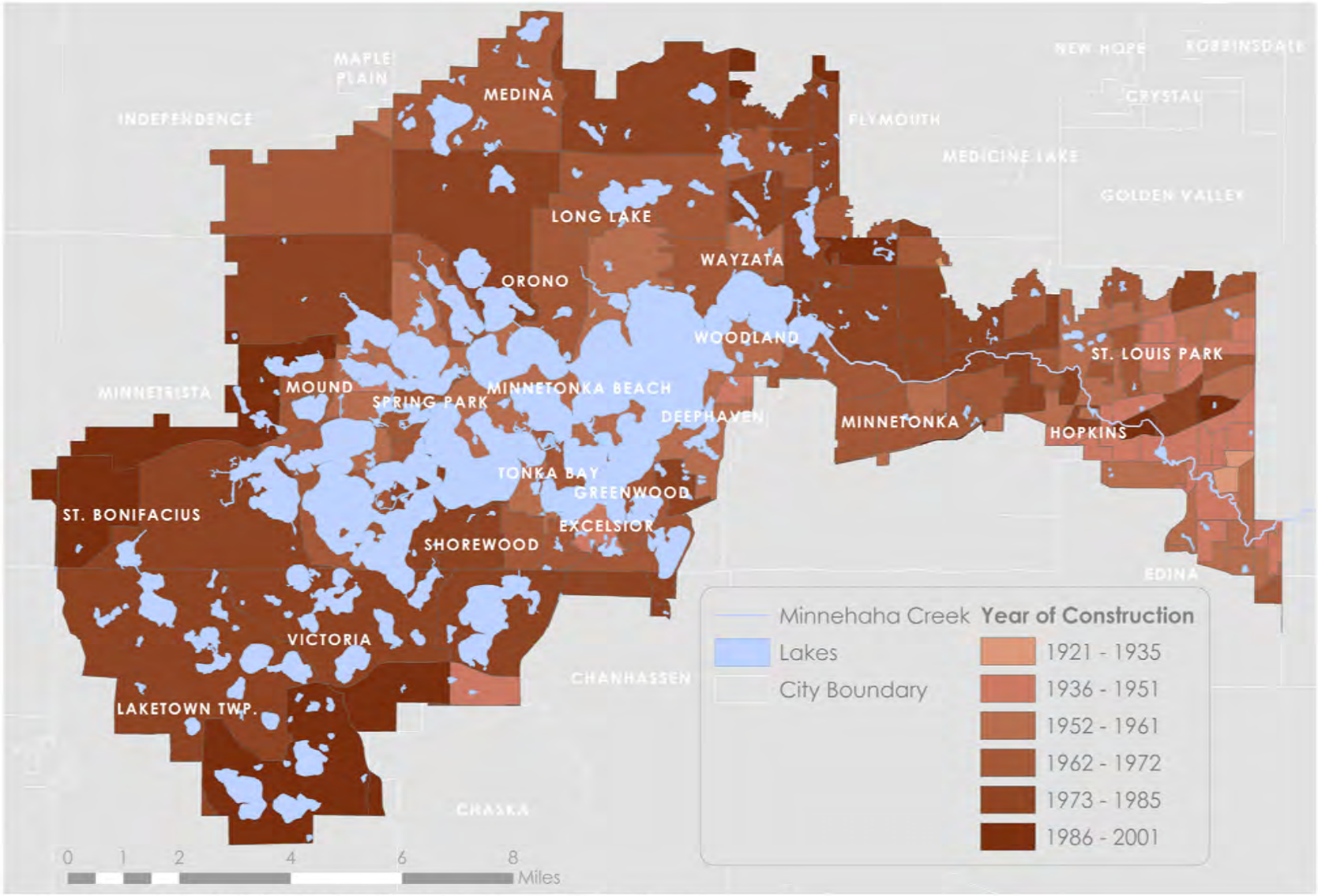


Cartographer: J. Klein. 11/21/2014. NAD 1983 UTM 15N. Source: MetCouncil 2011, ESRI.

AGE OF INDIVIDUAL HOME CONSTRUCTION



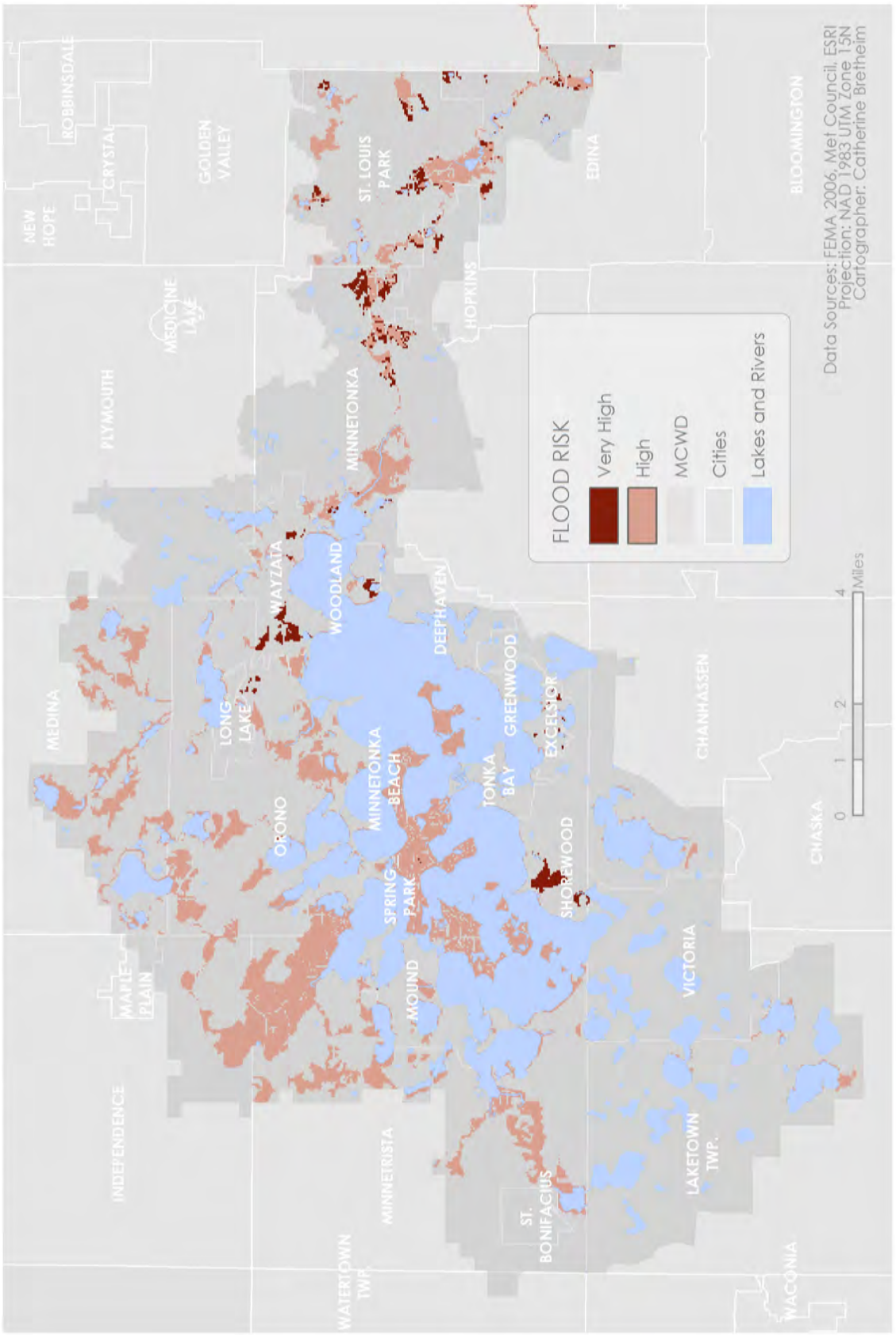
AVERAGE YEAR OF HOME CONSTRUCTION BY BLOCK GROUP



Cartographer: J. Klein. 11/21/2014 NAD 1983 UTM 15N. Source: ESRI, Met Council

FLOOD RISK ZONES

BASED ON 100 AND 500-YEAR FLOODPLAINS AND PRESENCE OF BASEMENTS



cially pertinent considering the record-breaking flooding along the creek and Lake Minnetonka that occurred in the summer of 2014, when water levels exceeded those of all previous years since 1906, if not before. CITATION That flooding forced the city of Mound to release untreated sewage into Lake Minnetonka to prevent it from retreating to residential basements.[6] In the wake of this recent monumental flooding and subsequent challenges for residents in the area, this map can be used to target these specific areas for Water Steward work, as well as an educational tool to encourage property owners to take action to protect the watershed and their own homes from water damage. The map shows concentrations of high-risk areas around the northwest region of Lake Minnetonka and very high flooding risk to the south and northeast areas of Lake Minnetonka and all along Minnehaha Creek. The FWS could target residents and communities along the water to mitigate flood damage to properties and the region as a whole. One limitation of this map is incomplete data for Hennepin and Carver County basement data. Only 24% of Hennepin parcels and no Carver county parcels were counted in this data. This lack of data was accounted for and was weighted lightly compared to the main factor, floodplains, to calculate flood risk zones.

2.9 Home to Plot Size Ratios on Northwest Lake Minnetonka

Home to Plot Size Ratios on Northwest Lake Minnetonka documents the relationship between home size and parcel area which impacts land permeability. This permeability is an important factor in flooding and can be used to determine areas that need installations like rain gardens to counter the impermeability of built homes. The ratios represent properties' finished square feet over parcel square feet for every residential property (other than townhomes, which had errored home size values) in the MCWD. Ideally, home footprints (rather than finished square feet) would be used to calculate the ratios. However, finished square feet can serve as a proxy to indicate the relative mass and area covered by a home. This map hones in on an area that shows a wide array of ratios and the high ratio values that line the waterfront. There are many large and high-value lakefront homes that line Lake Minnetonka (in this extent and beyond). One extreme example is former music producer Jimmy Jam's former 22,000 square foot lakefront home in the southwest corner of the map (see Image 1, Star Tribune). Another area to note is the waterfront in the southeast corner of Mound. This area is marked by a series of dense homes that occupy a large proportion of the parcel area (see Image 2, Google Maps). Areas

Image 1. Minnetonka Mansion
(Star Triune)

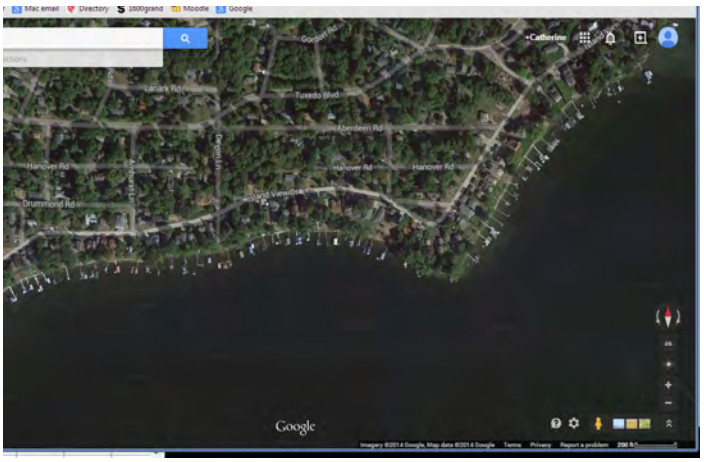
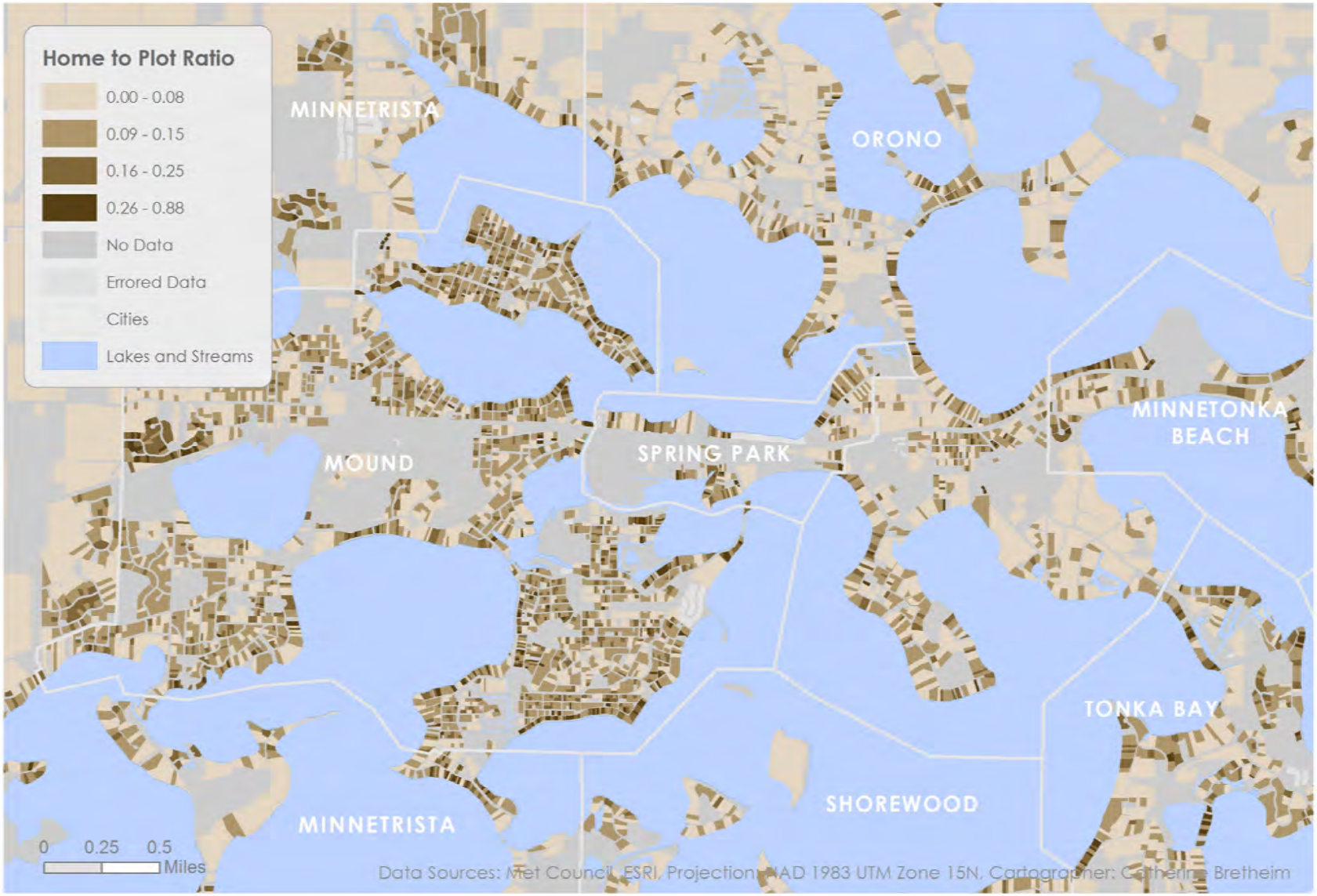


Image 2. Dense Housing Development
(Google Maps)

HOME TO PLOT SIZE RATIOS ON NORTHWEST LAKE MINNETONKA

CALCULATED USING PROPERTIES' FINISHED SQUARE FEET AND PARCEL SQUARE FEET



like those shown with high ratios affect how much water can seep into the ground. Low permeability creates a higher flood risk. Neighborhoods with high ratios are prime targets for rain gardens and other structures that would help alleviate the impermeability that results from high home-to-plot ratios and aid in the prevention of future flooding.

2.10 Out-of-State and Second-Home Owners

This map provides insight into the permanence of residents in MCWD homes in order to form suitable strategies for serving full-time versus part-time occupied homes. At first glance, there is a relatively even distribution of non-homestead and out-of-state owned parcels. Some of these are larger blocks of agricultural land while others are smaller residential parcels. Many of these smaller properties are along Lake Minnetonka. This contributes to a vacation home culture that could impact how people use their properties and treat their land. Master Stewards and the MCWD may want to focus on parcels that are residents' main abodes for consistent partnerships or may want to develop strategies, such as informational sessions at yacht clubs or pamphlets at boat launches, for addressing properties that are not occupied by their owners for much of the year.

2.11a-b Storm Pond Locations: St. Bonifacius and Victoria, MN

Storm ponds are installed by farmers, businesses, and neighborhoods when water runoff becomes a problem. They collect water when it rains and allow it to be slowly absorbed into the soil, also helping to filter out harmful pollution. In order for these ponds to function properly they need to be managed—meaning they need to be regularly dredged and monitored for any issues.[7] If this does not happen, the ponds can exacerbate the very problems they were meant to solve. Importantly, there is no organization currently tracking their installment and use. Without a database of existing ponds, monitoring their effectiveness is impossible, so generating a list of possible locations was specifically requested by the FWS and the MCWD.

This map represents an effort to begin cataloging the storm water ponds in the watershed. St. Bonifacius was chosen because it is one of the smallest townships and serves as a sort of microcosm of the rest of the watershed, as it has housing developments and farm fields side by side; Victoria was chosen because it has a more complicated landscape filled with both dense settlement and wetlands. Features that resembled storm ponds were selected from aerial imagery of both locations and then geographic coordinates, which can later be used to check for accuracy by visiting sites, were generated to go along with each point (**Tables A and B**). Ultimately, these maps can be used for the location confirmation and tracking of storm ponds in order to maintain their effectiveness as water management tools.

If the creation of a greater pond database is successful, the MCWD could either take up the task of continually monitoring their status, or use it to encourage local government or another organization to hold pond constructors and owners to upkeep standards.

2.12 Septic Tank Ownership

The western half of the watershed is very different than the urban east—one way that this manifests is the presence of septic tanks. These tanks require consistent upkeep, and if neglected they can be serious pollution problems, particularly for groundwater.[8] This map displays ownership of septic tanks by percentage of population, to account for the differing township sizes. Orono and Medina have two of the highest rates of ownership while also having many lakes, making them most at risk for potential pollution. These could make good target areas for local outreach and education on the importance of maintaining tanks and what that entails. Due to the difficulty of finding data on septic tanks and the lack of details on individual tank status, if the MCWD determines that they are an important enough potential pollution source in this region, they could make an effort to encourage local municipalities to keep track of septic tank data—such as when it was last pumped, the age of the tank, tank owners, and if there are any unused or abandoned tanks. This could prevent future pollution issues as urban development moves in and tanks are abandoned or under new ownership.

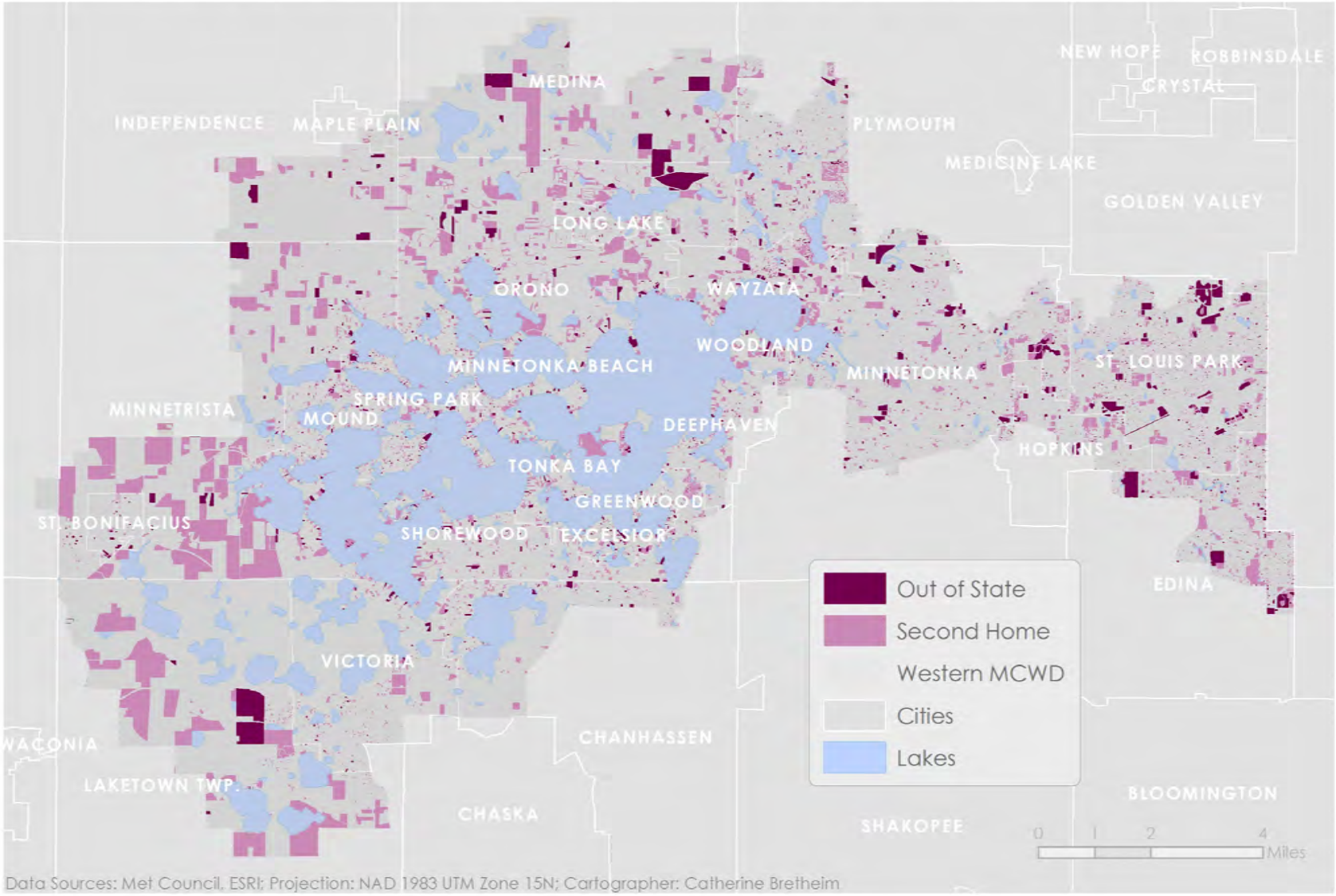
2.13 MPCA Pollution Sites, EPA Water Grades

There are many lakes scattered around the watershed, and their water quality can be a good indicator of health for the rest of the ecosystem, as well as if there are any serious problems that need to be addressed.

Pollution points are evaluated by the Minnesota Pollution Control Agency (MPCA) as being either sources of pollution or potential threats. Potential sources of pollution, as defined by the MPCA, include sites such as Fair-

OUT-OF-STATE AND SECOND-HOME OWNERS

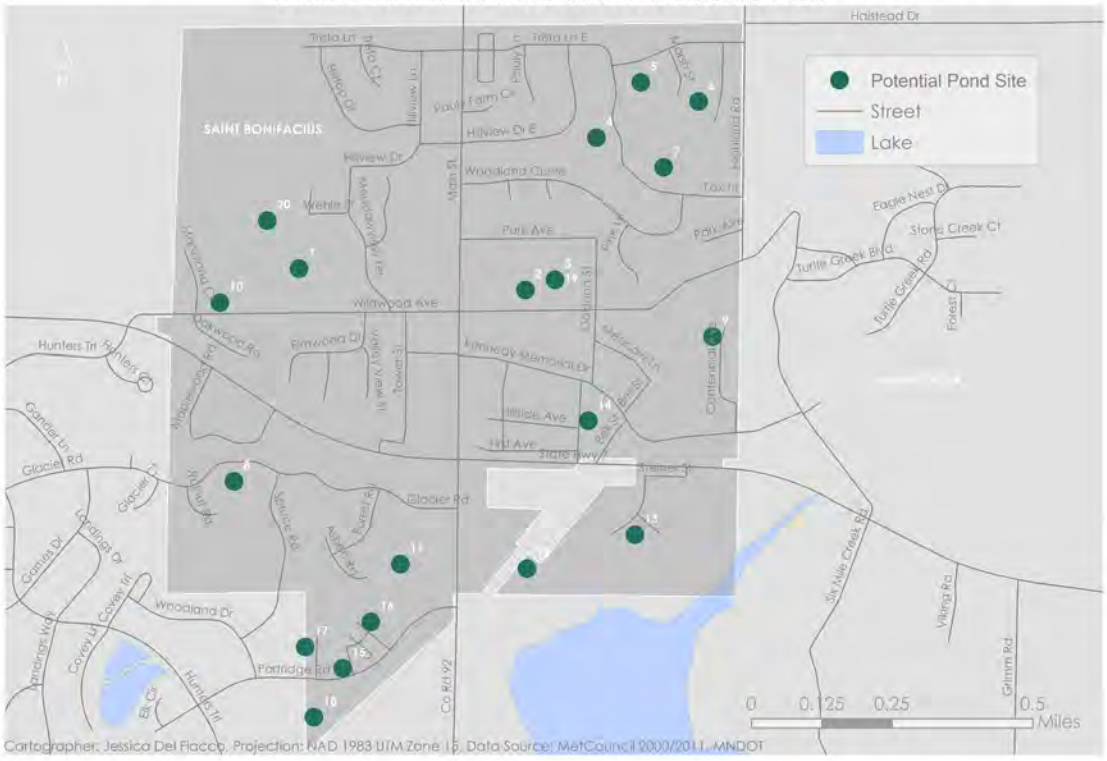
BASED ON NON-MINNESOTA TAX ADDRESSES AND NON-HOMESTEAD STATUS



Data Sources: Met Council, ESRI; Projection: NAD 1983 UTM Zone 15N; Cartographer: Catherine Bretheim

STORM POND LOCATIONS: ST. BONIFACIUS

*POSSIBLE COORDINATES BASED ON AERIAL IMAGERY



STORM POND LOCATIONS: VICTORIA

*POSSIBLE COORDINATES BASED ON AERIAL IMAGERY

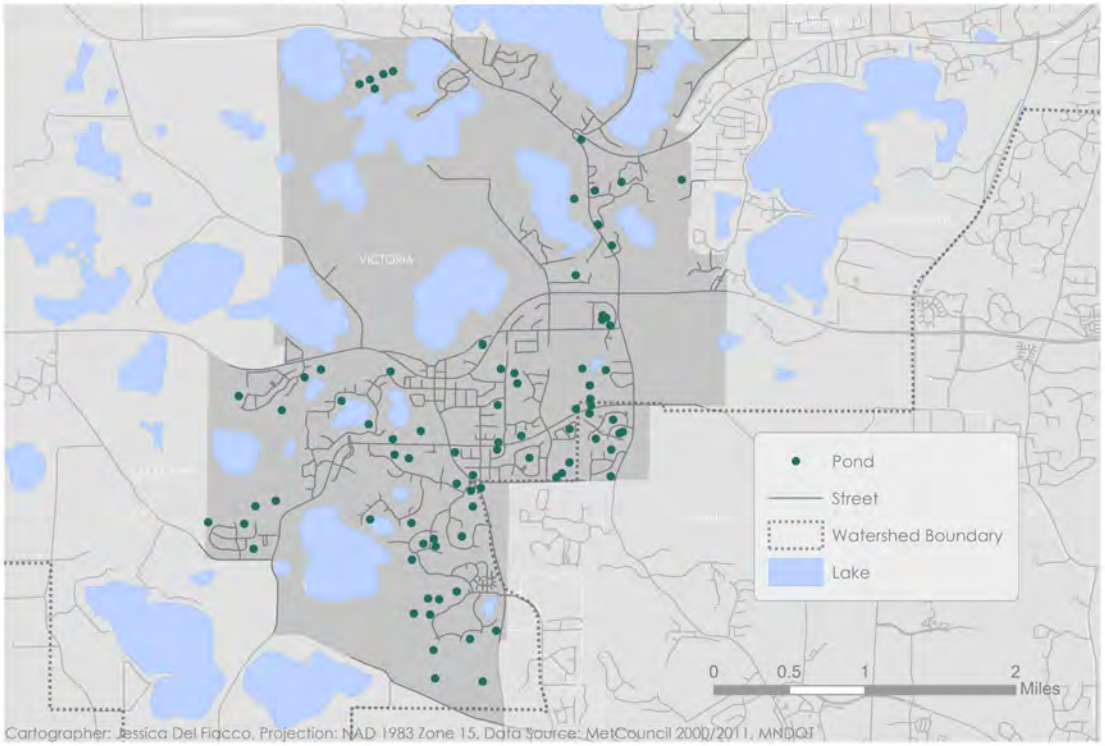


Table 2A. St. Bonifacius Storm Pond Coordinates

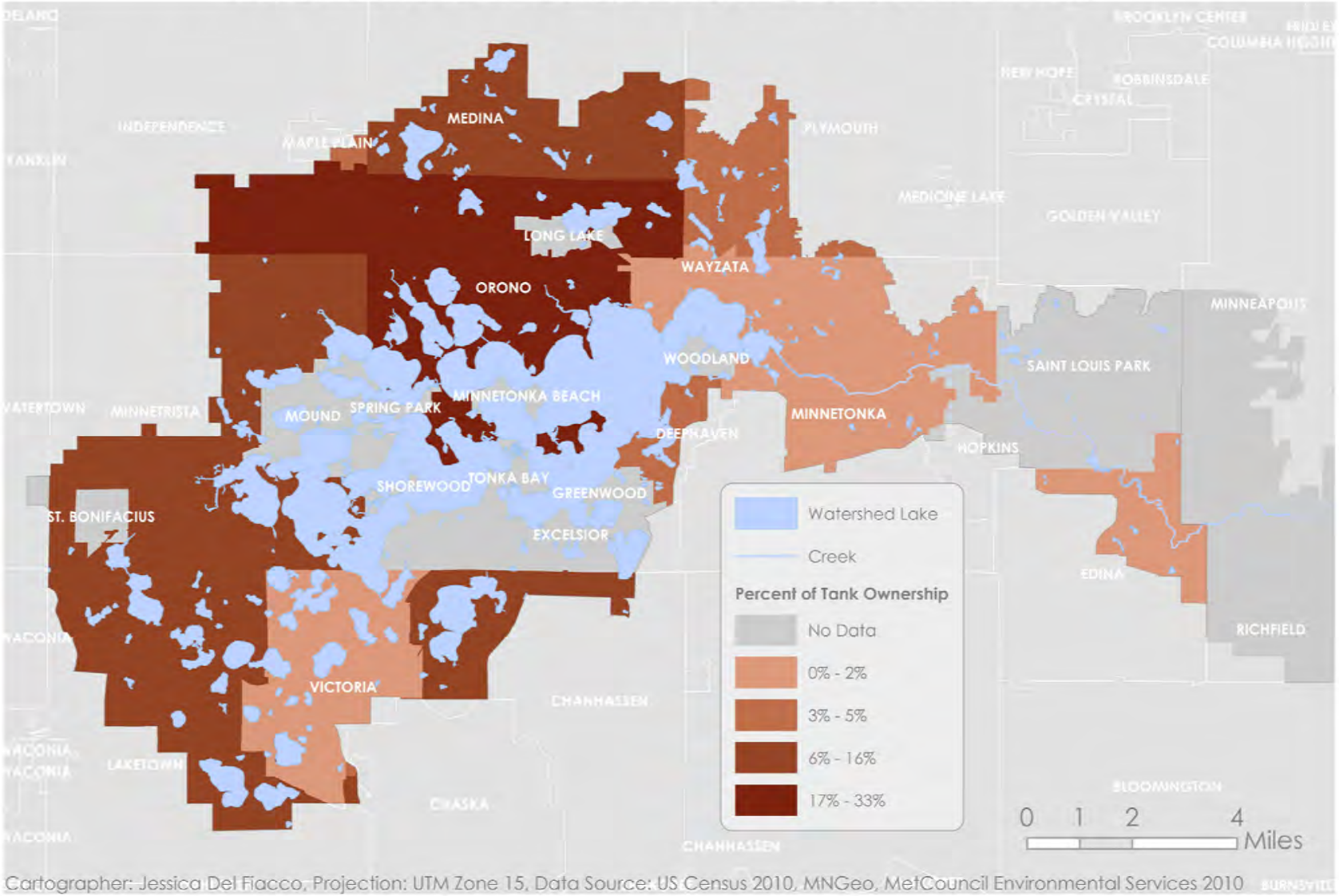
Name	X	Y
1	-93.75314300	44.90667700
2	-93.74493200	44.90617800
3	-93.74386300	44.90645200
4	-93.74240900	44.91012000
5	-93.74081900	44.91156000
6	-93.73872100	44.91107800
7	-93.73995900	44.90937400
8	-93.75543100	44.90119300
9	-93.73813400	44.90502200
10	-93.75600100	44.90578200
11	-93.74937200	44.89909900
12	-93.74478600	44.89901500
13	-93.74088400	44.89991700
14	-93.74261000	44.90284000
15	-93.75142800	44.89639900
16	-93.75042500	44.89760600
17	-93.75279900	44.89694300
18	-93.75245700	44.89513500
19	-93.74386300	44.90645200
20	-93.75431300	44.90790800

Table 2B. Victoria Storm Pond Coordinates

Name	X	Y
1	-93.667845	44.888142
2	-93.670951	44.887302
3	-93.670288	44.886448
4	-93.672353	44.886855
5	-93.669148	44.887855
6	-93.642353	44.881713
7	-93.636873	44.877662
8	-93.643259	44.876016
9	-93.640465	44.876836
10	-93.640007	44.873583
11	-93.638109	44.871554
12	-93.64294	44.868679
13	-93.638255	44.863867
14	-93.639341	44.864391
15	-93.638774	44.864609
16	-93.639271	44.864838
17	-93.638788	44.859655
18	-93.640922	44.858156
19	-93.641964	44.859773
20	-93.642775	44.855888
21	-93.640739	-93.640739
22	-93.640827	-93.640827
23	-93.640952	-93.640952
24	-93.637751	-93.637751
25	-93.636412	-93.636412
26	-93.636883	-93.636883
27	-93.63796	-93.63796
28	-93.640061	-93.640061
29	-93.638022	-93.638022
30	-93.643582	-93.643582
31	-93.644585	-93.644585
32	-93.645323	-93.645323
33	-93.648991	-93.648991
34	-93.653206	-93.653206
35	-93.653359	-93.653359
36	-93.656595	-93.656595
37	-93.656869	-93.656869
38	-93.658796	-93.658796
39	-93.655507	-93.655507
40	-93.656581	-93.656581
41	-93.658031	-93.658031
42	-93.661552	-93.661552
43	-93.663212	-93.663212
44	-93.661812	-93.661812
45	-93.664751	-93.664751
46	-93.653309	-93.653309
47	-93.656815	-93.656815
48	-93.661756	-93.661756
49	-93.66223	-93.66223
50	-93.664424	-93.664424
51	-93.662516	44.837557
52	-93.661042	44.837482
53	-93.658674	44.838246
54	-93.655061	44.829632
55	-93.661491	44.829893
56	-93.687422	44.844591
57	-93.692294	44.844704
58	-93.686138	44.842193
59	-93.685919	44.846291
60	-93.683196	44.846831
61	-93.682462	44.855541
62	-93.688304	44.856852
63	-93.679419	44.858715
64	-93.677248	44.859471
65	-93.664859	44.844809
66	-93.67042	44.845121
67	-93.665275	44.851004
68	-93.667208	44.851354
69	-93.659068	44.851621
70	-93.663685	44.853652
71	-93.670711	44.854259
72	-93.667453	44.852849
73	-93.67442	44.856485
74	-93.667836	44.859335
75	-93.652951	44.859678
76	-93.655442	44.861988
77	-93.651111	44.859279
78	-93.650698	44.8583
79	-93.653327	44.856208
80	-93.643591	44.853948
81	-93.650119	44.853263
82	-93.628735	44.877926

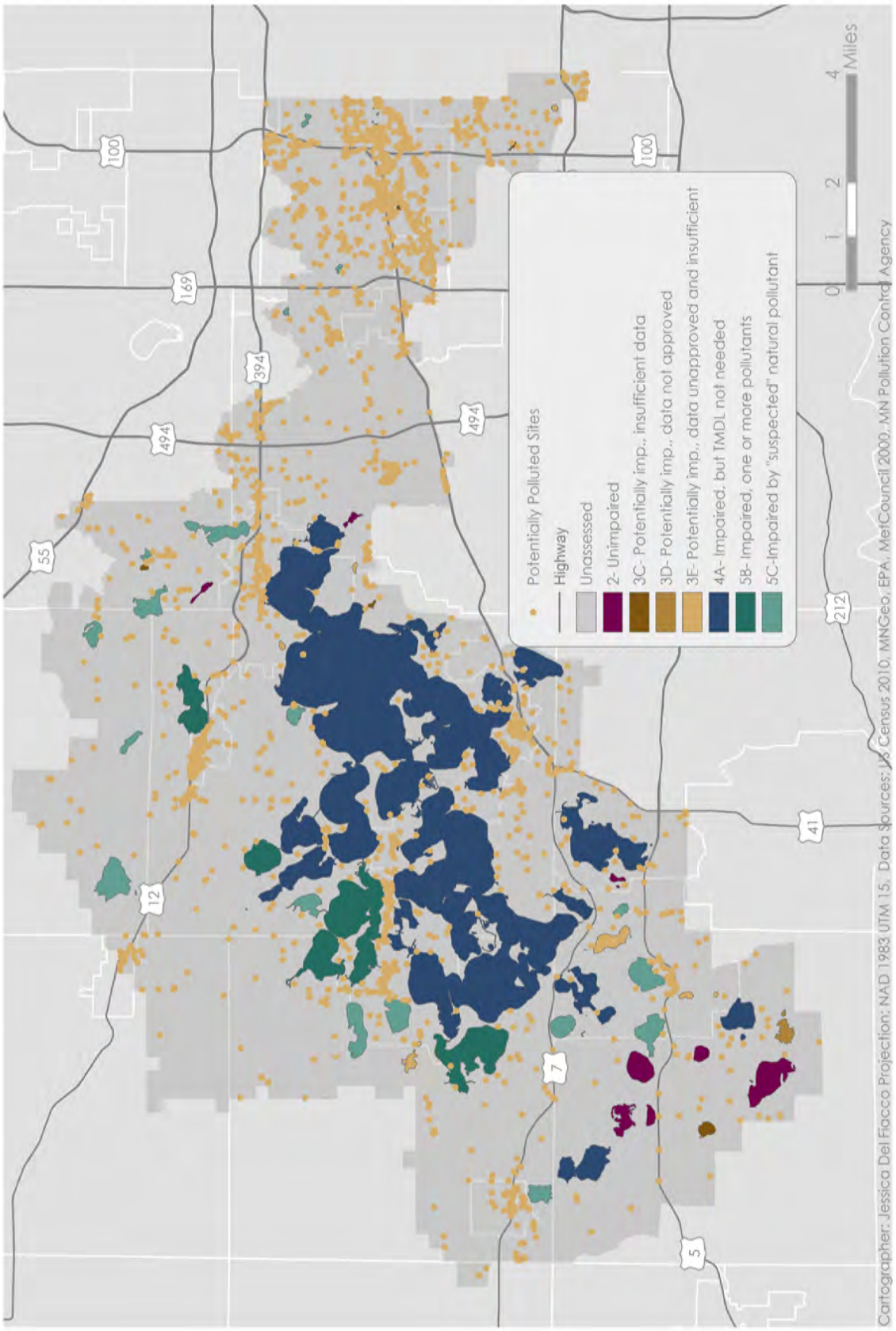
SEPTIC TANK OWNERSHIP

PERCENTAGE OF TOTAL POPULATION OF TOWNSHIP



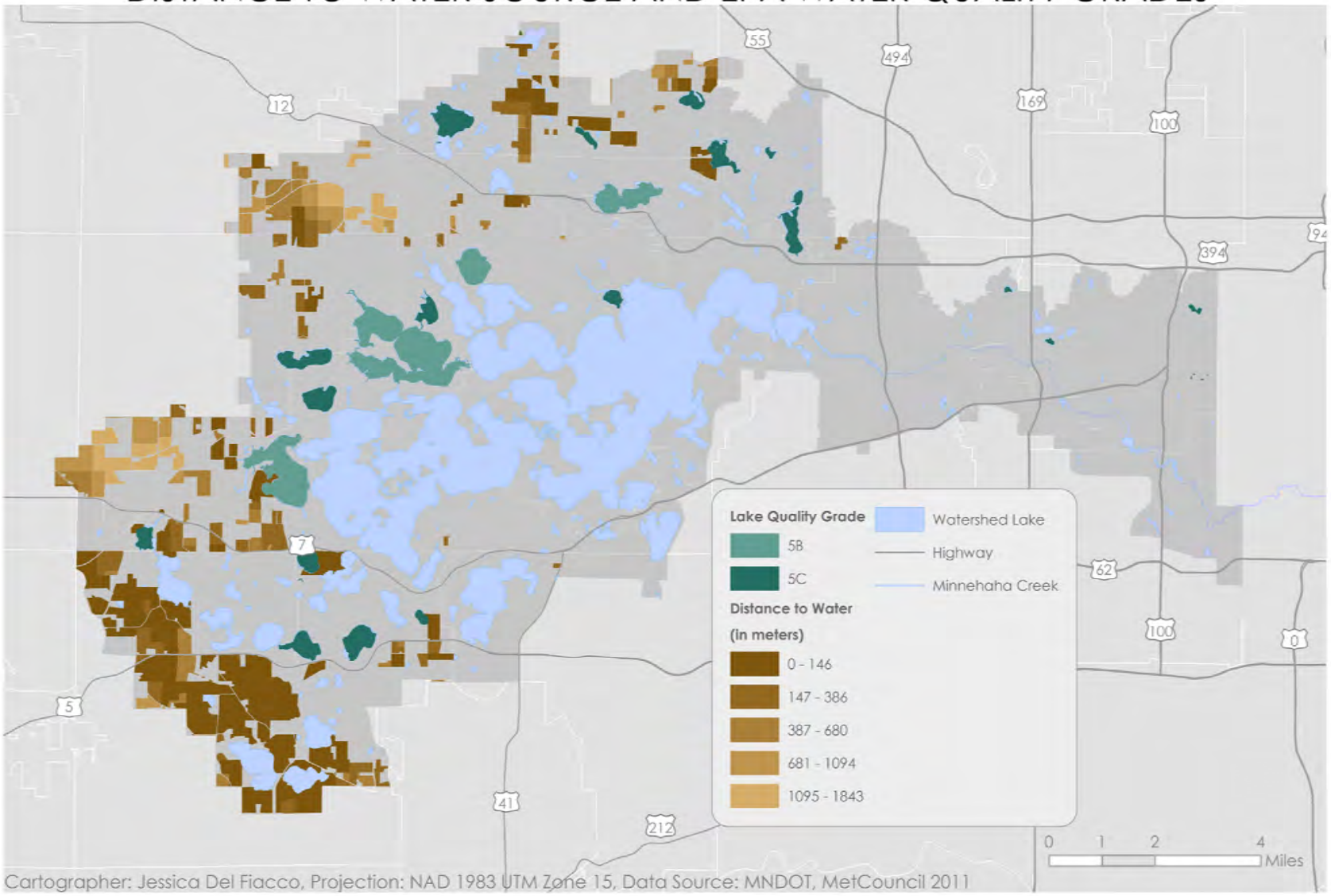
Cartographer: Jessica Del Fiacco, Projection: UTM Zone 15, Data Source: US Census 2010, MNGeo, MetCouncil Environmental Services 2010

MPCA POLLUTION SITES, EPA WATER GRADES



WATER AND AGRICULTURAL PARCELS

DISTANCE TO WATER SOURCE AND EPA WATER QUALITY GRADES



Cartographer: Jessica Del Fiacco, Projection: NAD 1983 UTM Zone 15, Data Source: MNDOT, MetCouncil 2011

view Southdale Hospital, the Oak Ridge Country Club, Special Waste Disposal Inc., and many farms (full listing: **Table 3**). They regularly update their database but do not remove sites that have already been addressed and no longer pose a direct pollution threat, so the amount of points shown on the map may be over representing the problem. It is, however, a good general representation of areas that have a higher potential for environmental damage.

The lake grades[9] are determined by the Environmental Protection Agency and are defined as followed: Lake is able to support one or more designated uses (Categories 1-2); Undetermined, more data needed (Category 3); Impaired without needing a Total Maximum Daily Load (TMDL) study (Category 4); and Impaired while needing a TMDL study (Category 5). Basically, if a lake is assigned a 4-5 grade it is not completely healthy and has at least one source of pollution.

When displayed together, these two do not actually show an obvious correlation between the MPCA's points and water quality, but there is some clustering of pollution points near the lowest graded lakes, most of them located west of Lake Minnetonka. This could be a useful starting point if water stewards or the MCWD wanted to address things that may be impeding lake quality, or to obtain more specific details on what the effects of different sorts of development are in the watershed.

2.14 Water and Agricultural Parcels

In this part of the watershed, particularly west of Lake Minnetonka, agriculture has a huge role in influencing local policy and lifestyle—and for this reason is an important aspect to keep in mind when shifting from previous work in the urban sections of the watershed to this one. This map of agricultural plots (taken from land use data gathered by the Metropolitan Council), shows the distances of agricultural land from water sources. Fertilizer and pesticide use can lead to runoff or erosion, especially on large farms, which can directly influence water quality. The impaired lakes, shown in **Map 2.14**, also provide more context for the decision to look at these farms. Though there is not a clear correlation between agriculture and lake grades, it is perhaps something to look into further on a smaller scale. For the most part, the farms closest to water sources are in the southwestern part of the watershed, where the lakes are mostly unimpaired. The only place where agriculture may be to blame is the northcentral region, so this region could be chosen for further research and possible outreach.

CONCLUSION

The maps highlighted in this section of the report focus on community and built environment features that illuminate who and what exists in the western MCWD in order to tailor Water Steward Programs to the area. Some of the information shown poses challenges to, others, opportunities for, protecting water quality and conditions in the district. Certain areas face water pollution (**Maps 2.13 and 2.14**); others, such as Edina, face the growing trend of tear-downs or aged homes that are susceptible to additions that would increase flooding risk (**Maps 2.3 and 2.4**); and the vacation home culture could pose challenges to consistent Water Steward Program participation (**Map 2.10**). The maps indicate specific areas that could support the FWS's activities. Vacant plots could become new study areas for the MCWD (**Map 2.5**), community institutions can serve as gathering places for Water Steward meetings (**Map 2.2**), and flood risk zones can encourage at-risk homeowners to install water-absorbing structures like rain gardens to protect their (and others') properties (**Map 2.8**). Moving forward, the FWS can take several steps to improve water quality and conditions in the western area of the district as the environment undergoes changes. Improving water quality in low-graded lakes, implementing restrictions for chemical use in agricultural areas near lakes, recruiting Master Water Stewards from areas in Edina susceptible to tear-downs, and harnessing the power of community spaces to spread the word about Water Steward Programs are active measures that can be taken to improve and protect the water in the western MCWD.

Endnotes

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Lifestyles

Rachel Fehr - Luciano Guzman - Elizabeth Isaac-Herzog

INTRODUCTION

The Master Water Stewards Program involves creating relationships through which effective projects can be designed and implemented. The development of these connections is only possible when one has a general knowledge of the population with which they will be working. Demographic data is crucial in gaining this knowledge. Trends in variables such as socioeconomic status, levels of education, racial composition, household size, voting habits, and consumer spending can hint at other underlying qualities of a population.

This chapter provides a general overview of the demographic and social landscapes of the western portion of the watershed. The primary objectives of this chapter are to 1) give an overview of the lifestyles of the residents in this area; 2) identify geographic areas within the watershed which contain large percentages of residents who are engaged in their communities; and 3) determine the level of environmental concern amongst this population using key indicators. Using these last two criteria, the results of this chapter will help to identify areas of the watershed that contain the highest number of potential Water Stewards and residents who may be interested in getting involved at various levels of the project.

3.1 MCWD Tapestry Demographic Segments by Census Tract (2011)

The Environmental Systems Resarch Institute (ESRI) compiles demographic data to help businesses reach their target markets, and this information can be helpful in generalizing about the populations in the Western Watershed. ESRI's Tapestry data uses the US Census, ACS, and other consumer surveys to assign every census tract to one of 65 groups. Communities that fall within the same group share key characteristics such as spending habits, life stage, and household size. The data used in the Census is averaged for all of the tracts in the country, so it is useful for looking at general trends rather than specific numbers. With this in mind, Tapestry can be a helpful starting point for analyzing the watershed's demographics.

The map shows that the majority of the tracts in the watershed belong to "Boomburbs" and "Suburban Splendor" (detailed definitions: **Table A**). These two groups are similar in that they contain mostly young couples without children and who are wealthy homeowners working in professional fields. "Retirement Communities" around Lake Minnetonka are also significant. Their title is somewhat self-explanatory; the majority of this group consists of older singles or couples, mainly retired from long-term careers, who live in multiunit buildings. They are politically active and value volunteerism. Finally, there are five tracts belonging to the "Exurbanites" group. This group consists of many empty-nesters who are highly educated and civically engaged. The most important point to take away from this map is that two similar groups (Boomburbs and Suburban Splendor) dominate the edges of the watershed district, while there is more demographic diversity along the shores of Lake Minnetonka. Similar strategies for recruiting Water Stewards may be used in Suburban Splendor and Boomburbs communities; perhaps planning programs that accommodate busy schedules since these areas contain many commuters and those who devote much of their time to their careers. In the interior of the MCWD, however, there is more variation in lifestyles and engagement methods must be more flexible.

3.2 Percentage White Population by Census Tract, 2012

In Minnesota, racially and ethnically diverse populations are largely, although not exclusively, found in more urbanized areas of the state. This diversity includes residents who are both US- and foreign-born, lending an especially international dimension to diversity in and around the Twin Cities. For example, Minnesota is home to some of the largest political refugee populations consisting of Hmong, Somali, and Liberian immigrants (About Refugees, 2014). This diversity is important to recognize when understanding the demographics of the MCWD and how to engage with the residents. This diversity does tend to exist in more densely urban centers, such as Minneapolis, making MCWD's proximity to the Twin Cities a good reason to examine racial and ethnic diversity. This map depicts the percentage of the population in each census tract that is White. There exists racial and ethnic diversity within the non-White categories represented on this map; however, through close examination of the different categories, it is clear that there is much less diversity in the western watershed than in the eastern sections of the watershed. The lowest percentage of white residents in the lightest category is 75.6% (towards the eastern edge of the study area), while the highest proportion of White residents is found within the western portion of the watershed (99.60%). The importance of this map lies in its visual representation of just how homogenous this area is in terms of racial makeup. This portion of the MCWD is much whiter than the eastern portion, leading to the conclusion that if the FWS is seeking racial and ethnic diversity amongst the Water Stewards, they will need to target their recruitment to quite specific areas, using the social networks and community institutions of each of these groups.

3.3 Education in Minnehaha Watershed District by Census Tract

The National Center for Higher Education Management Systems uses the attainment of a bachelor's degree or higher as an indicator to distinguish more educated populations from those with lower educational attainment (Kelly & Strawn, 2011). This map examines the census tracts for the percentage of residents, aged 25 and older, having earned at least a bachelor's degree. Within the map, looking east to west there is a trend of declining formal education attainment. The map visualizes the education disparity through its categorization where 27.4% remains the lowest point with the highest reaching 73%, a difference of 45.6%. This trend appears to follow the east-to-west trend of increasingly rural areas; in other words, the percentage of people obtaining a bachelor's degree decreases as you examine more rural areas to the west. This trend is significant in that within the MWCD there are very diverse levels of formal education among residents. The difference in formal education does not mean that one population would be more receptive to outreach than another but rather that they might have different values that need to be considered when communicating importance of reducing water run-off. While a person with less formal educational attainment might lack experience or understanding of certain topics, they could hold unique knowledge of agricultural practice and a local mindset that the MWCD could benefit from. This is an especially important consideration when seeking participation from both ends of the education spectrum, as having Stewards from both populations would allow for a wider audience to be reached.

3.4 Percentage Age 65 and Over by Census Tract

This map gives additional context to the MCWD regarding the age of residents. In many situations there are generalizations and assumptions to be made about the residents when grouping them into market segments. It is common to use the age of 65 as the proxy for retirement age. Knowing the percentage of people in retirement age provides insight into why some of the groups might have lower median incomes than others. Retirees' pensions and social security wages are typically lower than those of a person employed in the workforce of similar socioeconomic status (What is the Social Security Retirement Age?, n.d.). Locations on the lower end of the financial spectrum, as seen in **Median Household Income, 2011** (**Map 3.5**), could express lower categorization due to the higher amount of retired residents, who are most likely living on retirement pensions, social security or other financial investments

When examining areas of development in conjunction with this map, similarities can be seen along areas such as Spring Park, Excelsior, and Mound. These are areas where urban development seems concentrated, as seen by the high imperviousness of these areas that Google Maps shows retirement communities with big parking lots and large buildings. According to **MCWD Tapestry Demographic Segments by Census Tract (2011)** (**Map 3.1**), these older workers and retiree communities like to volunteer and invest in causes they care about, which supports the idea that these retired populations could be a target for steward outreach.

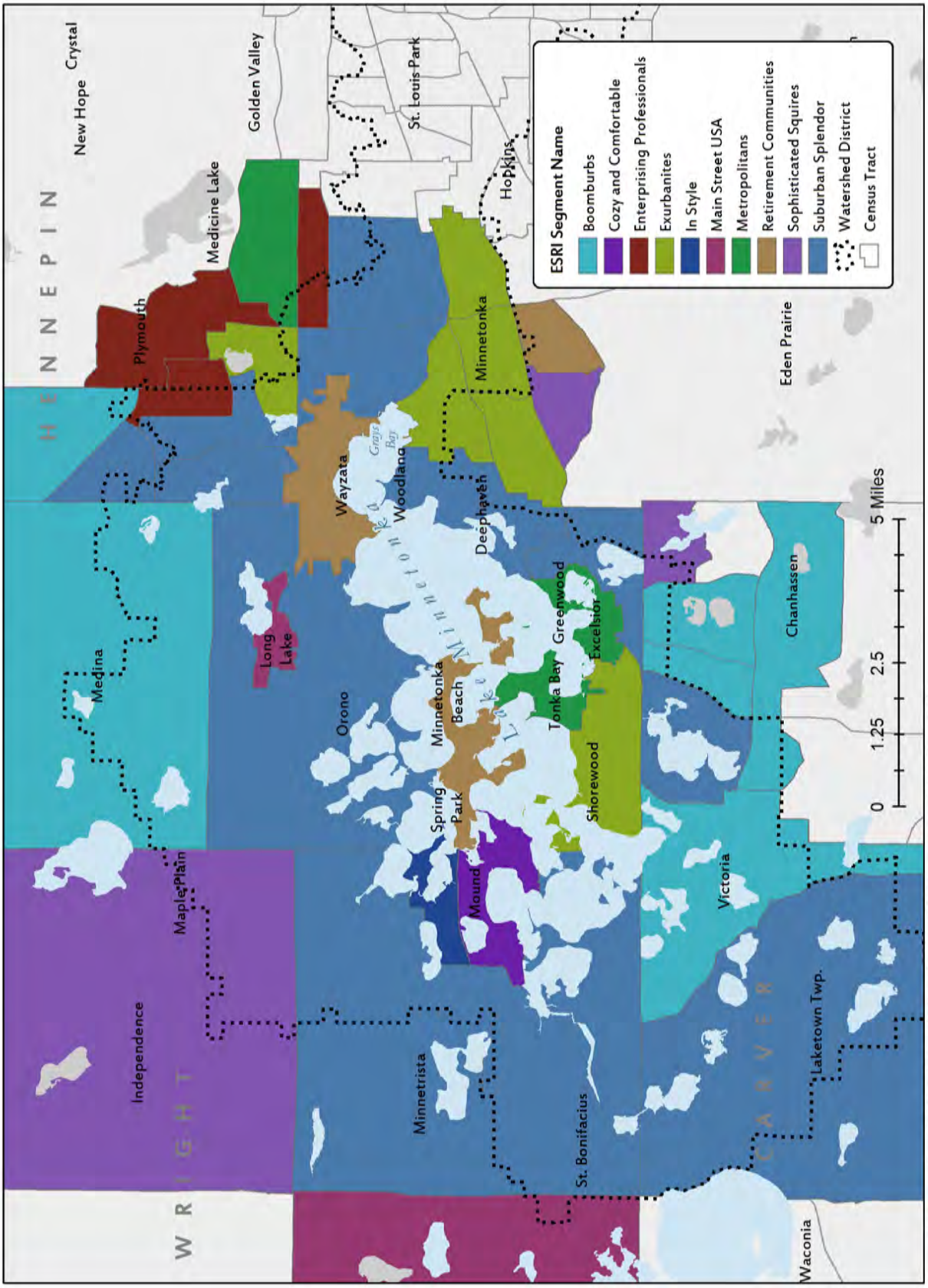
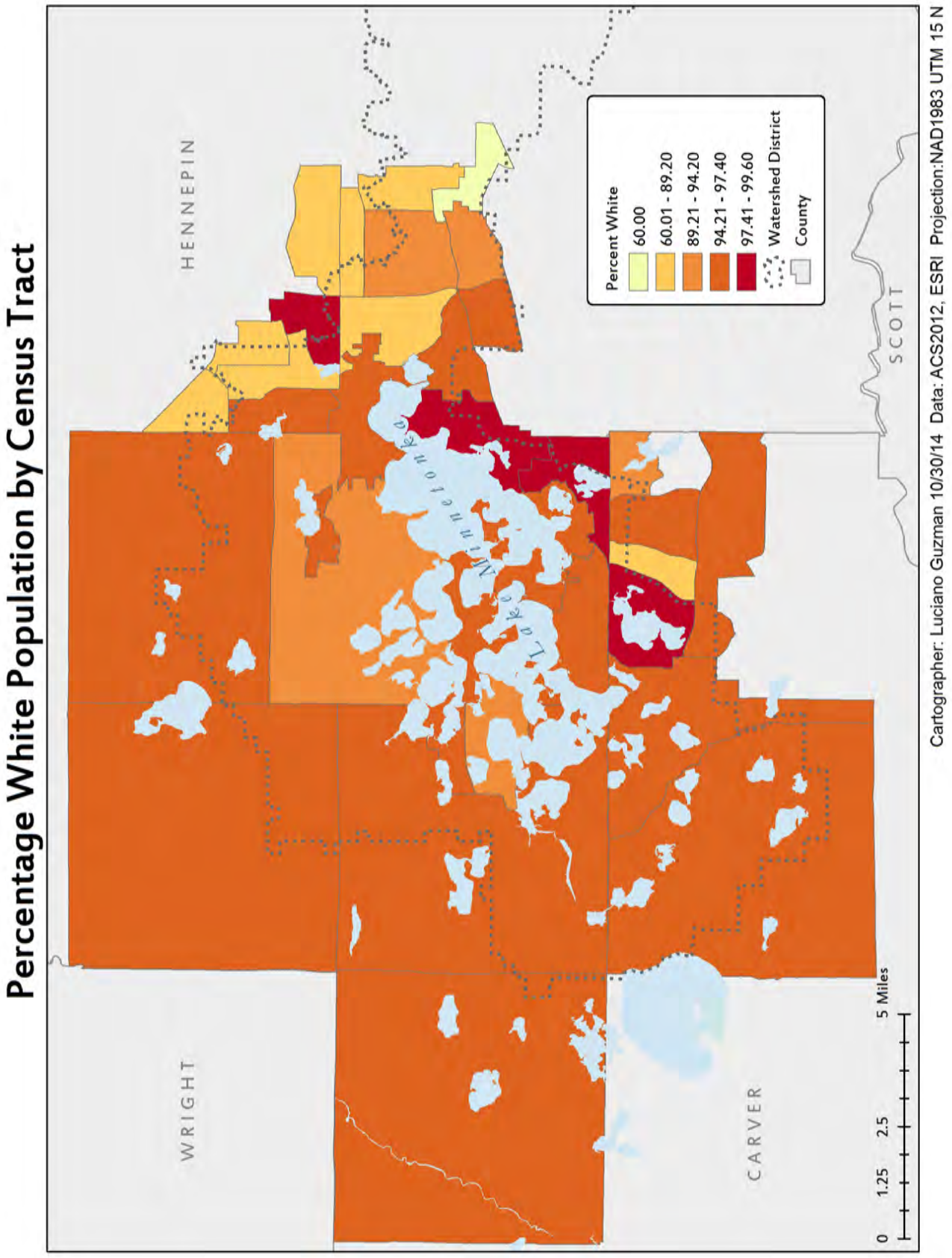
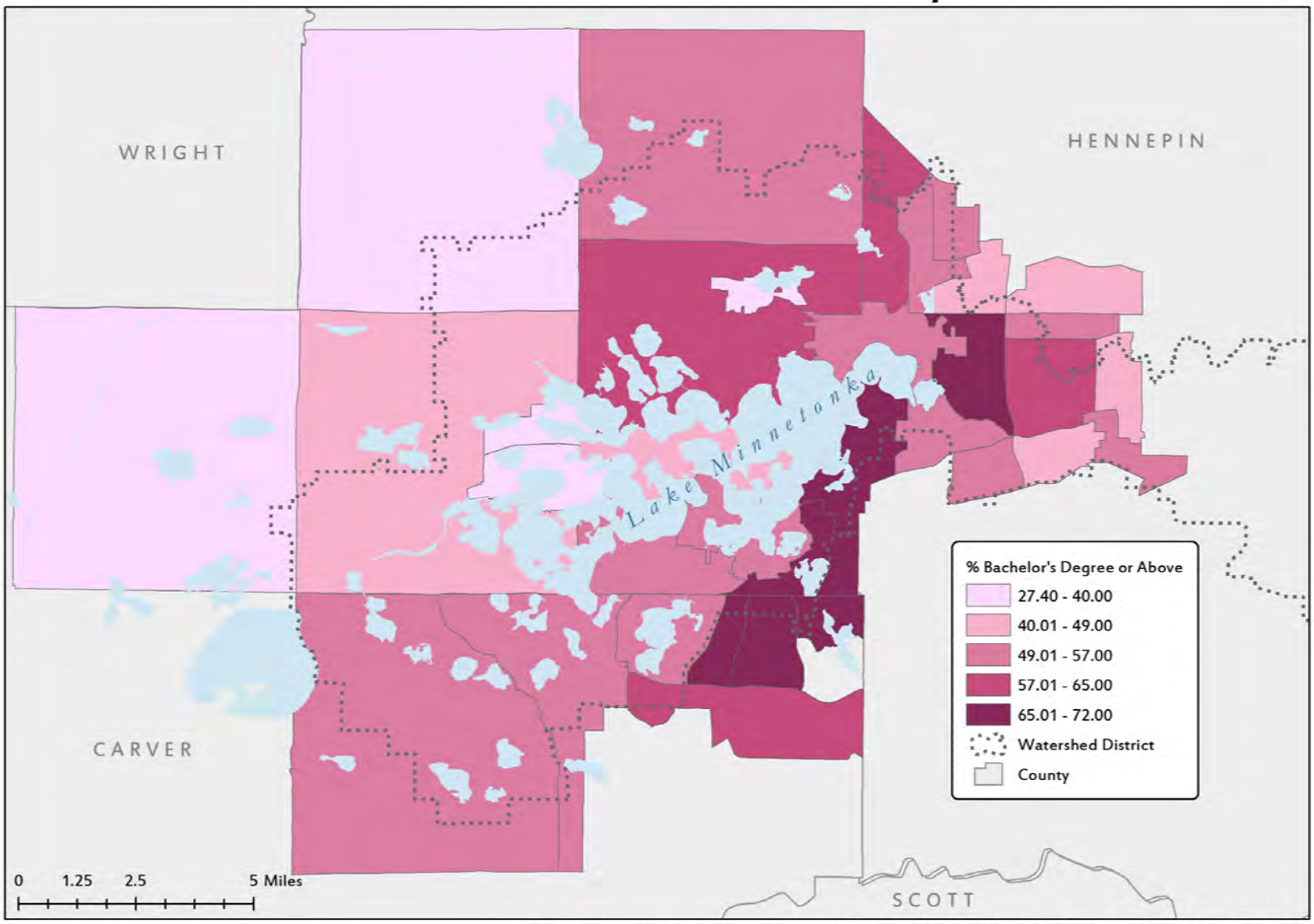

MCWD Tapestry Demographic Segments by Census Tract (2011)
HENNEPIN
WRIGHT
CARVER
New Hope
Crystal
Golden Valley
Medicine Lake
Plymouth
St. Louis Park
Hopkins
Minnetonka
Eden Prairie
Wayzata
Gray's Bay
Lake Minnetonka
Woodland
Deephaven
Greenwood
Excelsior
Long Lake
Medina
Orono
Minnetonka Beach
Tonka Bay
Shorewood
Spring Park
Mound
Maple Plain
Independence
Minnetrista
St. Bonifacius
Victoria
Chanhassen
Laketown Twp.
Waconia
ESRI Segment Name
Boomburbs
Cozy and Comfortable
Enterprising Professionals
Exurbanites
In Style
Main Street USA
Metropolitans
Retirement Communities
Sophisticated Squires
Suburban Splendor
Watershed District
Census Tract
0
1.25
2.5
5 Miles
Cartographer: R. Fehr, 10-6-14 Data Source; ESRI Projection: UTM Zone 15N

Table 3A. Tapestry Demographic

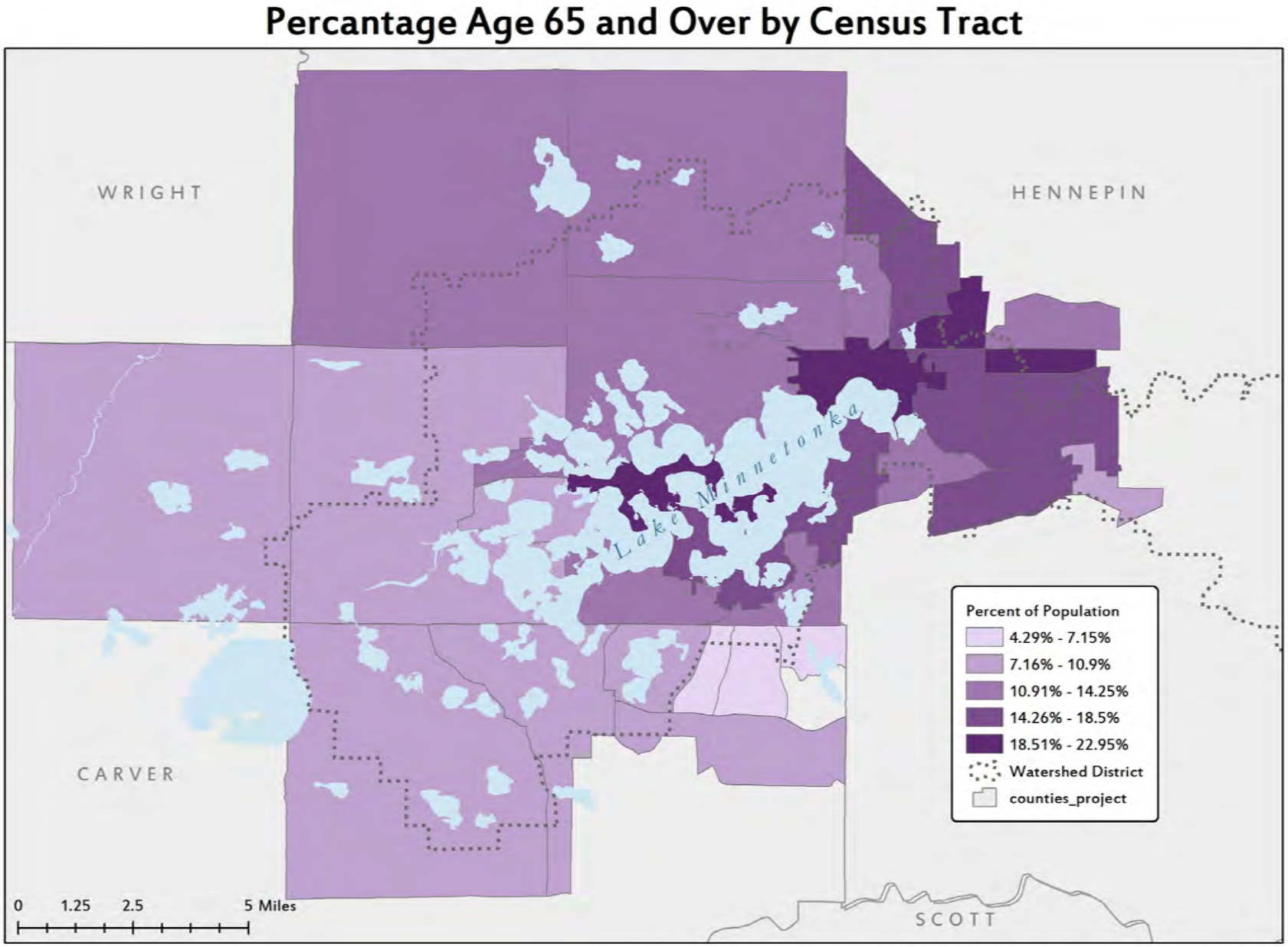
Segment Name	Family Type	College Attendence Rate	Occupations	Housing	Lawn Care	Political Participation	Etc.
Boomburbs	Young families with children	>50%	Mgmt, Professional, sales (commuters)	Homeowners, Newer single-family	Hire services, do some work themselves		Prefer homes with fireplaces and hot tubs
Cozy and Comfortable	Middle aged married couples	No data	Mgmt, Professional, service	Homeowners Single-family	Mostly do it themselves		Own at least four televisions
Exurbanites	Empty nesters, married with children	75%	Mgmt, Professional	Homeowners, built after 1969	Do it themselves, spend a lot on garden care, shrubs/plants	Members of charitable orgs, participate in civic activities (local orgs, public meetings, fundraising)	Frisbee; bird-watching; top market for college sports
In Style	No children	>42%	Mgmt, Professional (esp finance, insurance, health care, tech)	Mostly Homeowners	Likely to hire services		Take vitamins; gamble at casinos
Main Street USA	Mix of HH types (30% single parent)	50%	Mix	Approx. half homeowners	Lawns/gardens priority; plant bulbs, fertilize, apply lawn care products regularly		Own pet cats
Metropolitans	Singles, Married with children	75%	Mgmt, professional	Approx. half homeowners	Hire lawn maintenance services	Join civic clubs, volunteer for environmental causes, work for political parties	Yoga; kayaking; listen to jazz; watch foreign films on DVD
Retirement Communities	Single Seniors	60%	Retired, white-collar	Mostly multiunit buildings		Politically active: belong to civic clubs and charitable organizations	Spoil their grandchildren, watch daytime TV
Sophisticated Squires	Married with young children	60%	White collar (range: mgmt. to unskilled labor)	Newer, single-family homes	"Do-it-yourselfers"		Own motorcycles; go on weight-watchers
Suburban Splendor	Couples with or without children	>50%	Mgmt, professional, sales (high employment for men and women)	Home owners, built after 1979	Hire services to cut grass, plant own trees/shrubs, treat lawn with fertilizer, weed control, or insecticide		Hot tubs, espresso machines, granite countertops; "favorite hobby is furniture refinishing"


Percentage White Population by Census Tract
HENNEPIN
WRIGHT
CARVER
SCOTT
Lake Minnetonka
Percent White
60.00
60.01 - 89.20
89.21 - 94.20
94.21 - 97.40
97.41 - 99.60
Watershed District
County
0
1.25
2.5
5 Miles
Cartographer: Luciano Guzman 10/30/14 Data: ACS2012, ESRI Projection:NAD1983 UTM 15 N

Education in Minnehaha Watershed District by Census Tract



Cartographer: Luciano Guzman 10/30/14 Data: ACS2012, ESRI Projection:NAD1983 UTM 15 N


Percantage Age 65 and Over by Census Tract
WRIGHT
HENNEPIN
CARVER
SCOTT
Lake Minnetonka
Percent of Population
4.29% - 7.15%
7.16% - 10.9%
10.91% - 14.25%
14.26% - 18.5%
18.51% - 22.95%
Watershed District
counties_project
0
1.25
2.5
5 Miles
Cartographer: Luciano Guzman 10/30/14 Data: ESRI Projection:NAD1983 UTM 15 N

3.5 Median Household Income by Census Tract

Many of the largest houses in the MCWD are on the shores of Lake Minnetonka, around Minnetonka Beach, Tonka Bay and Excelsior. However, this map shows that these tracts have a relatively low median household income when compared to tracts further from the lake. This puzzling pattern may be explained by a combination of the following factors:

1) The income data used in this study comes from the American Community Survey, which estimates median income over a period of time, rather than at a certain point. If more residents around Lake Minnetonka were surveyed during the winter, the median income will appear low because many wealthier residents may live elsewhere in the colder months.

2) The communities around the lakeshore contain high concentrations of individuals who are over age 65. Retired residents may not receive an earned income, and rather live off of investments and their wealth and savings, and thus do not raise the median income of their tract even if they are wealthy.

3) The communities around the lakeshore are changing rapidly. The trend is for smaller houses to be torn down and replaced with larger, more expensive ones (see **Maps 2.3 and 2.4**). This map is a snapshot of a small window of time, and may not be representative of the income distribution in the next few years.

In general, median household incomes in the Western watershed are higher than tracts around St. Louis Park or Hopkins. Chanhassen and Minnetonka especially show high median incomes. This map is intended to give context to the other maps in our study, and show that higher incomes tend to be in Lake Minnetonka's outlying tracts, with lower incomes (possible as a result of older populations or second home owners) along its shores.

3.6 Household Size and Percentage Owner Occupied Units

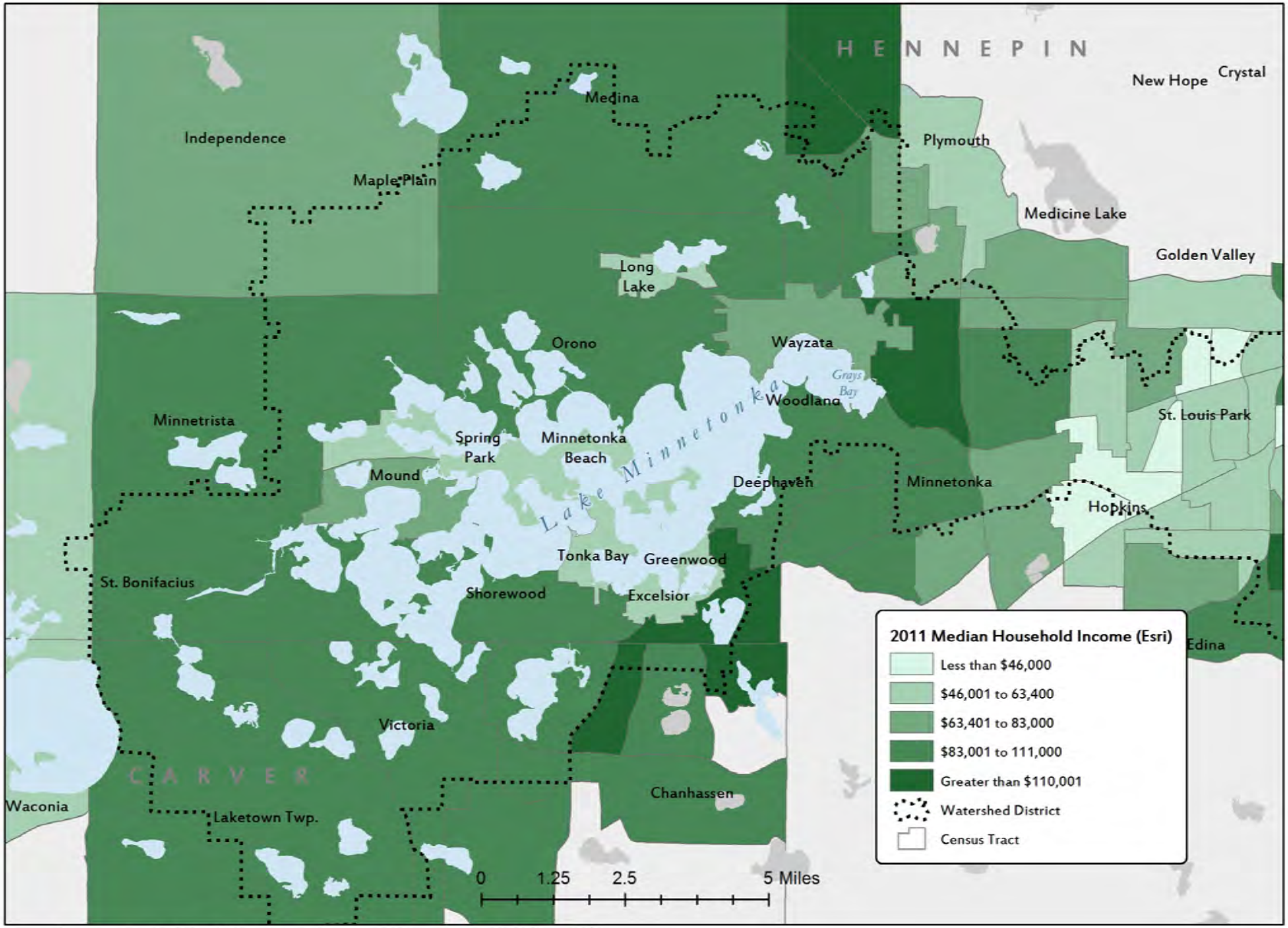
Family size and whether a residence is owned or rented can play a major role in understanding the mindsets and lives of residents in the district. This map focuses on the aspects of residents' lifestyles that could affect the way they value the environment around them. Each census tract's household sizes are averaged for the numbers represented. Most homes in the district have about two residents. In the south-western portion of the study area, there are two instances of averages falling into the three-person-per-household category. This area of the district contains newer houses and smaller plots of land (as seen in **Home to Plot Size Ratios on Northwest Lake Minnetonka, Map 2.9**), likely due to recent developments of suburbs in this area. Larger household sizes are important to consider when thinking of how families with children prioritize causes, their time, or interest in environmental impact, and how this compares to childless households. Significance of household size could be drawn from the way parents would value environmental efforts. A parent might view an investment in the environment as a long-term investment for the world their children will inherit, making them more willing to participate. In contrast, knowing sizes of households could help prepare for the possibility that parents are busier with children to take care of which could result in less willingness to volunteer time.

Also examined in this map is the percentage of homes in each census tract that are owned, rather than rented, by residents. The land around the center of Lake Minnetonka lies in the lowest category of residents owning their homes. This could be due to the nature of lakeside land ownership and the seasonality of lake culture. In Minnesota, it is not uncommon for families to have or rent homes or cabins that they can use recreationally on weekends or holidays. If this area is being primarily rented out to residents, this means that residents might not remain at this location for the majority of the year when compared to nearby peers who own their home. This could provide insight into the way different households in the district feel environmental issues regarding Lake Minnetonka are relevant to them. A homeowner, whether full-time or part-time, might want to preserve the environment around the lake to keep their asset values from declining or even just to protect area they plan to interact with throughout owning the home

3.7-8a-b Date of Last Sale by Parcel (Full Extent and Zoom)

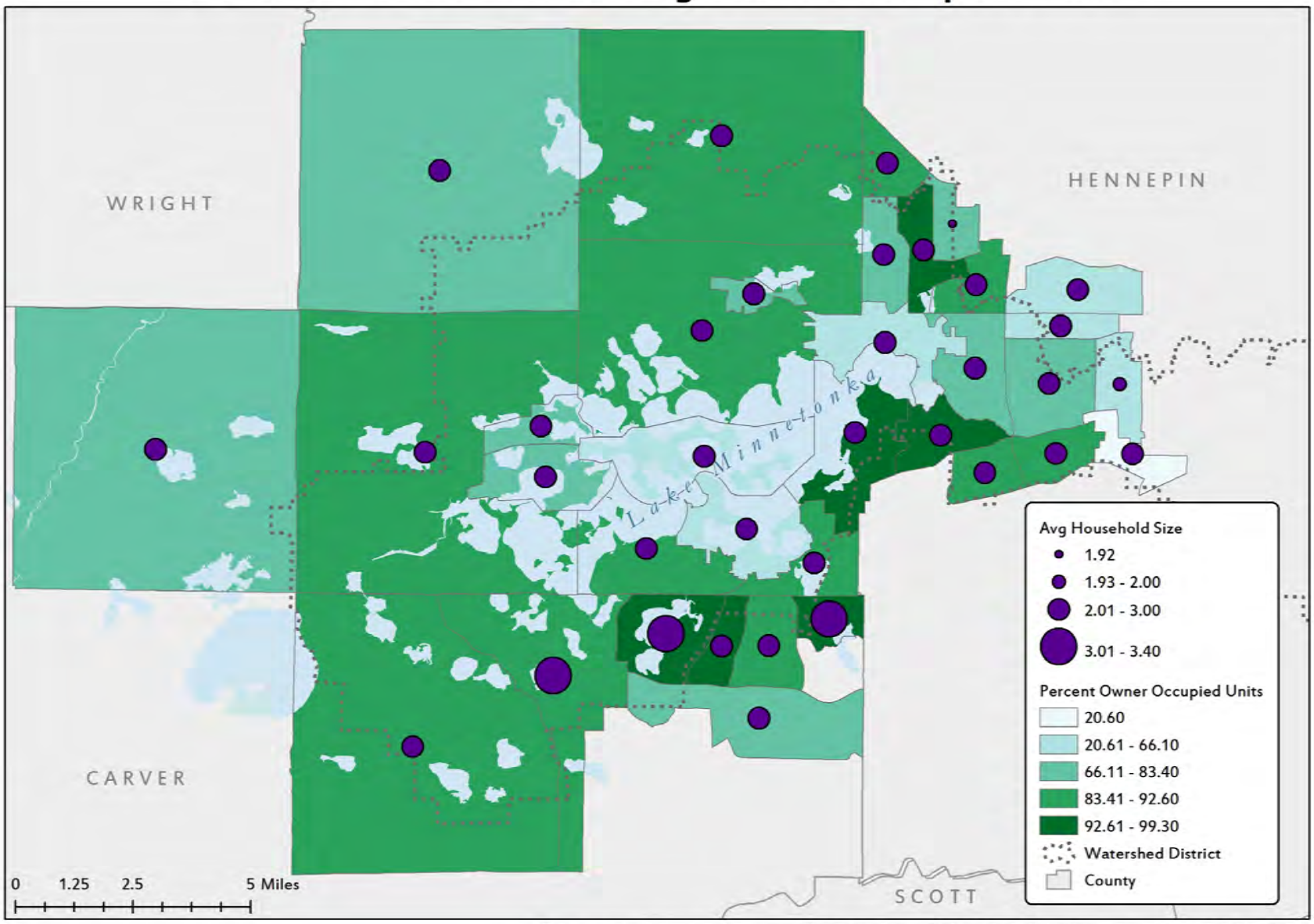
This map is intended to give a general idea of the varying lengths of residency within the watershed. It is likely that some parcels have been passed down through a family and thus a sale date does not accurately show how long the current resident has lived there. However, this tentative pattern of residency lengths gives an idea of how invested different community members might be in their neighborhood and in the watershed at large. Parcels that have been in the same hands since the 1970s and 1980s are most likely to be home to engaged citizens

Median Household Income by Census Tract



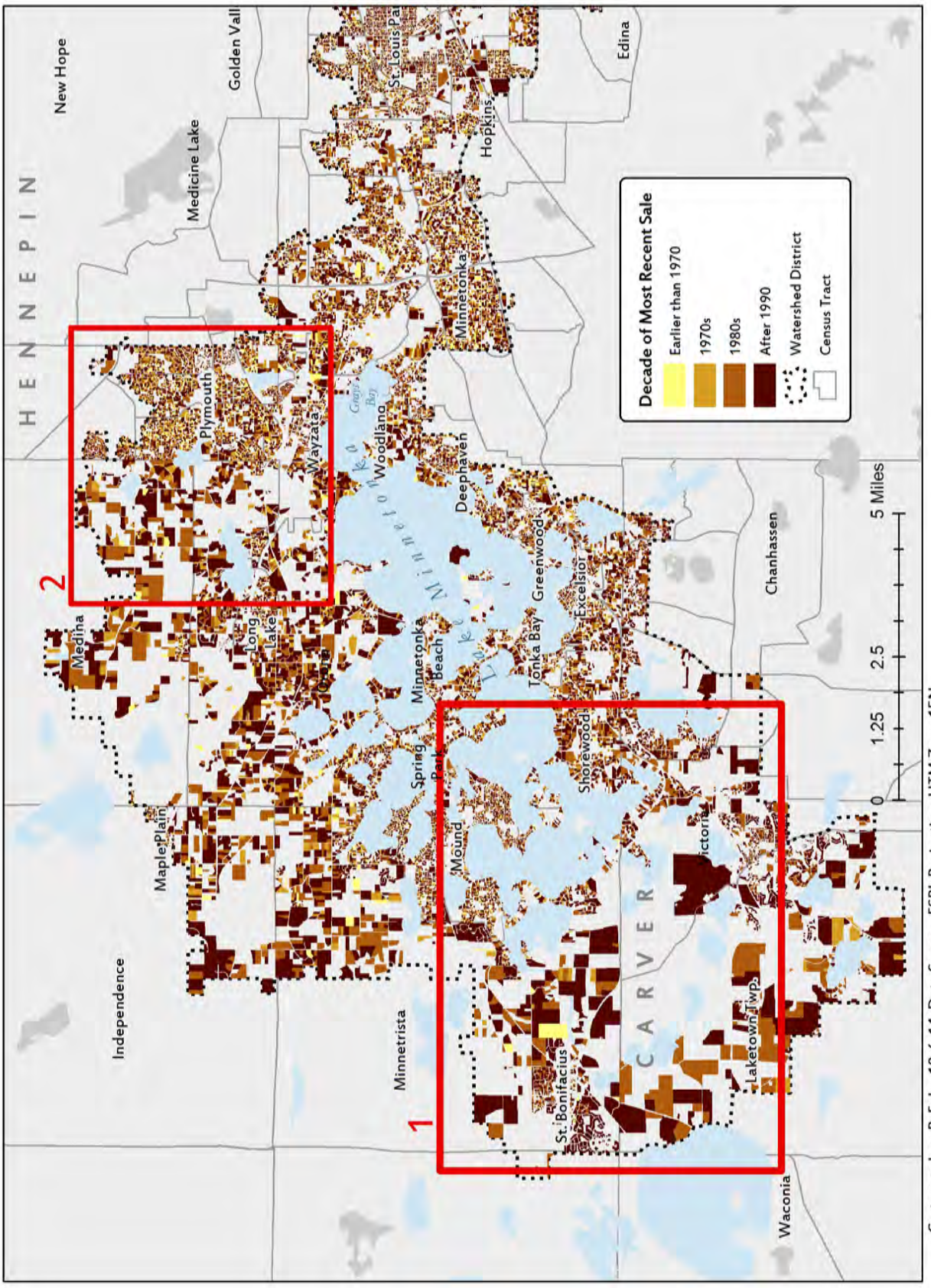
Cartographer: R. Fehr, 10-6-14 Data Source; ESRI Projection: UTM Zone 15N

Houshold size and Percentage Owner Occupied Units

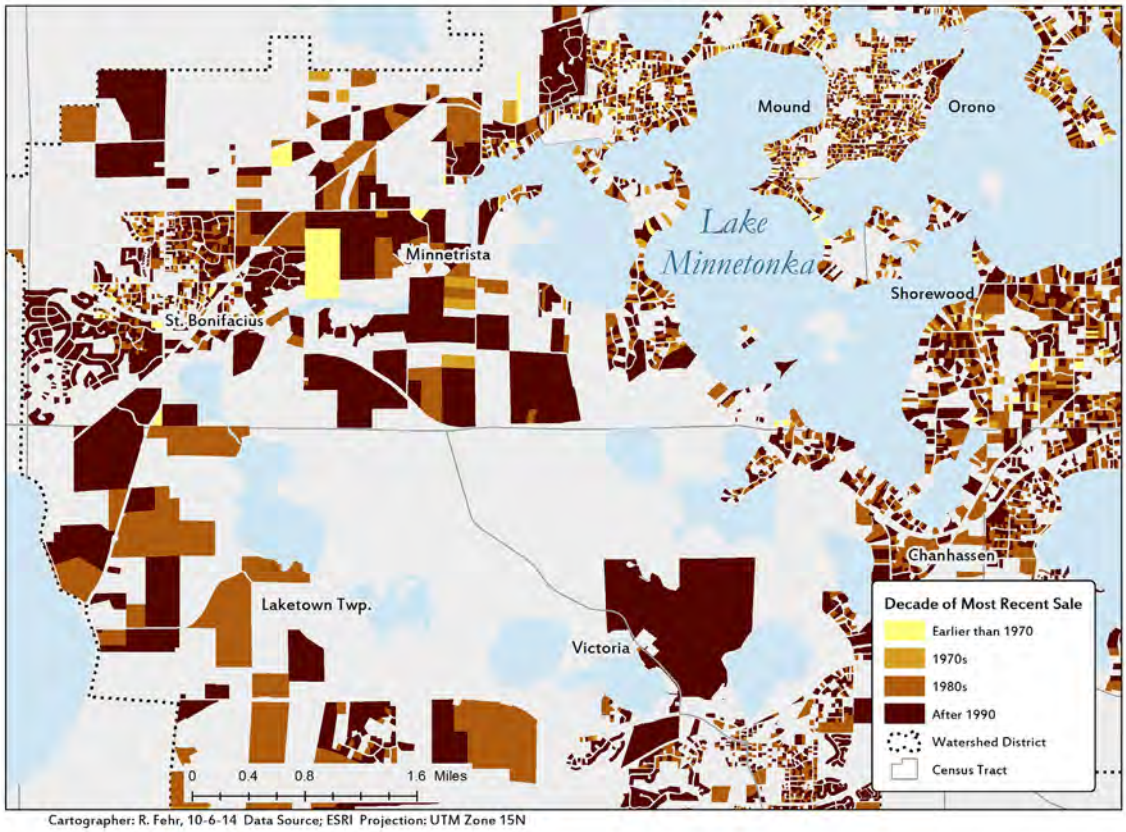


Cartographer: Luciano Guzman 10/30/14 Data: ACS2012, ESRI Projection: NAD1983 UTM15N

Date of Last Sale by Parcel

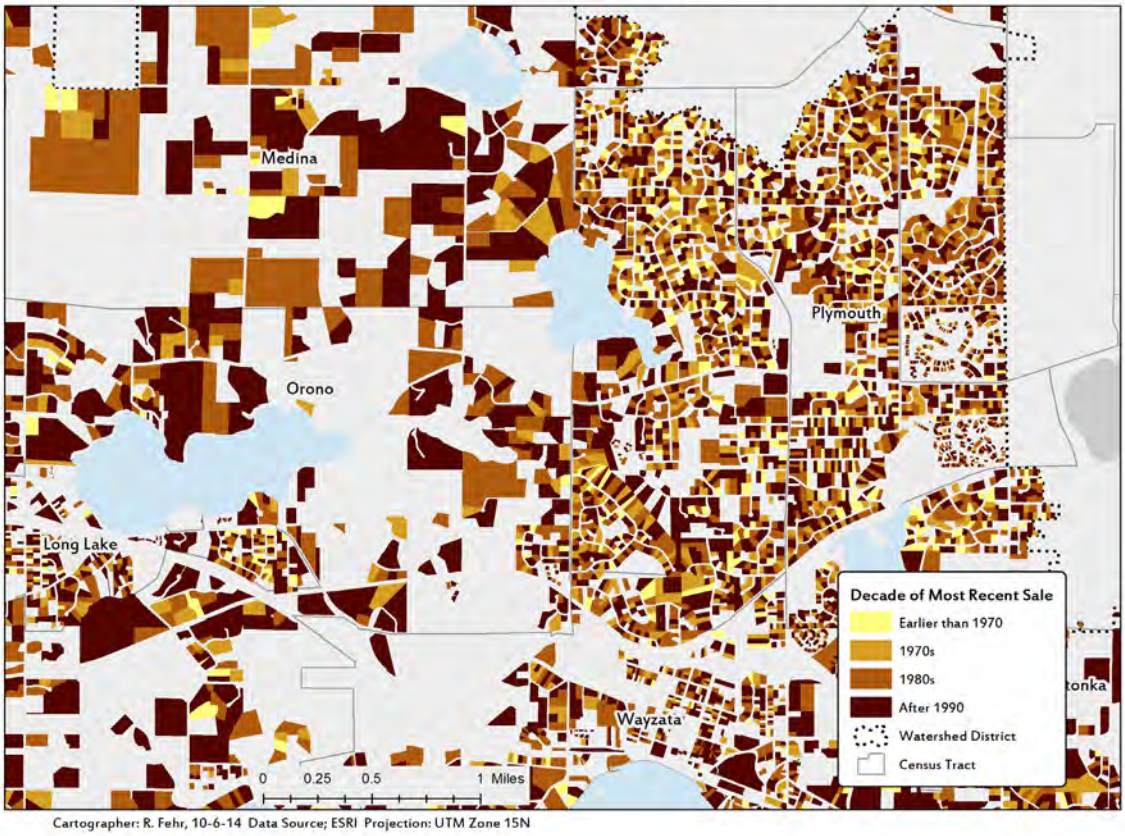


1. Date of Last Sale by Parcel



Cartographer: R. Fehr, 10-6-14 Data Source; ESRI Projection: UTM Zone 15N

2. Date of Last Sale by Parcel



Cartographer: R. Fehr, 10-6-14 Data Source; ESRI Projection: UTM Zone 15N

who may be potential Water Stewards.

In general, it is evident that larger parcels tend to have more recent sale dates than smaller parcels. The parcels along the western edge of the watershed are mainly large agricultural plots and have sale dates in the 1980s and 1990s. This may be the result of farmers selling off portions of their land or dividing it up between buyers. However, parcels in the west tend to have more recent sale dates regardless of their size because of more recent development, as we can see in the neighborhood to the west of St. Bonifacius.

Map 3.8b, which is focused on Plymouth and its surrounding areas, is intended to show residency patterns in communities with smaller plots of land. There is no discernable pattern in the date of last sale; parcels sold before 1970 are right next to parcels sold after 1990. The parcels around Medina align with the pattern of more recent sales of larger parcels, particularly around Holy Name Lake. In short, the larger parcels to the west have best recently sold and are more likely to contain new residents who are not yet engaged in community issues. The neighborhoods with smaller parcels are more mixed in their residency patterns, and will contain more longtime residents.

3.9 Predicted Lawn Care Practices by Census Tract (2011)

One key variable that Tapestry data includes (for most tracts) is the typical attitude of a demographic group's members toward landscaping and gardening. These data are hard to find elsewhere and are helpful in determining pollution risk in various areas of the watershed as well as in finding likely candidates for rain gardens. In the map titled "Predicted Lawn Care Practices by Census Tract," it appears that the MCWD is divided fairly evenly between people who hire services, those who do all lawn care themselves, and those who hire some services (for more complicated landscaping projects) but do other tasks on their own (e.g., cutting the grass). A key group to look at is those who live along Lake Minnetonka and hire services, because these residents have a great impact on water quality and are also willing to spend money on the maintenance of their property. These residents are good candidates for impactful rain gardens, or other environmentally friendly landscaping innovations.

POLITICAL MAPS

Looking at political leanings of any group of people can give insight into their values, their beliefs, and the ways in which they spend their time. Knowing a little bit about the voting behaviors of the MCWD's residents can help the FWS and administrators at the MCWD when deciding how to approach residents with the topics of water quality and pollution, recruiting new Water Stewards, and proposing water quality-improving projects. It is suggested based on the findings described in following three maps that the FWS and MCWD partner with local organizations that are respected by the residents, who are generally conservative. Discussing environmental issues with this population from a frank, altruistic perspective may not be as effective as framing them within the context of how such activities as hunting and boating may be affected by low water quality.

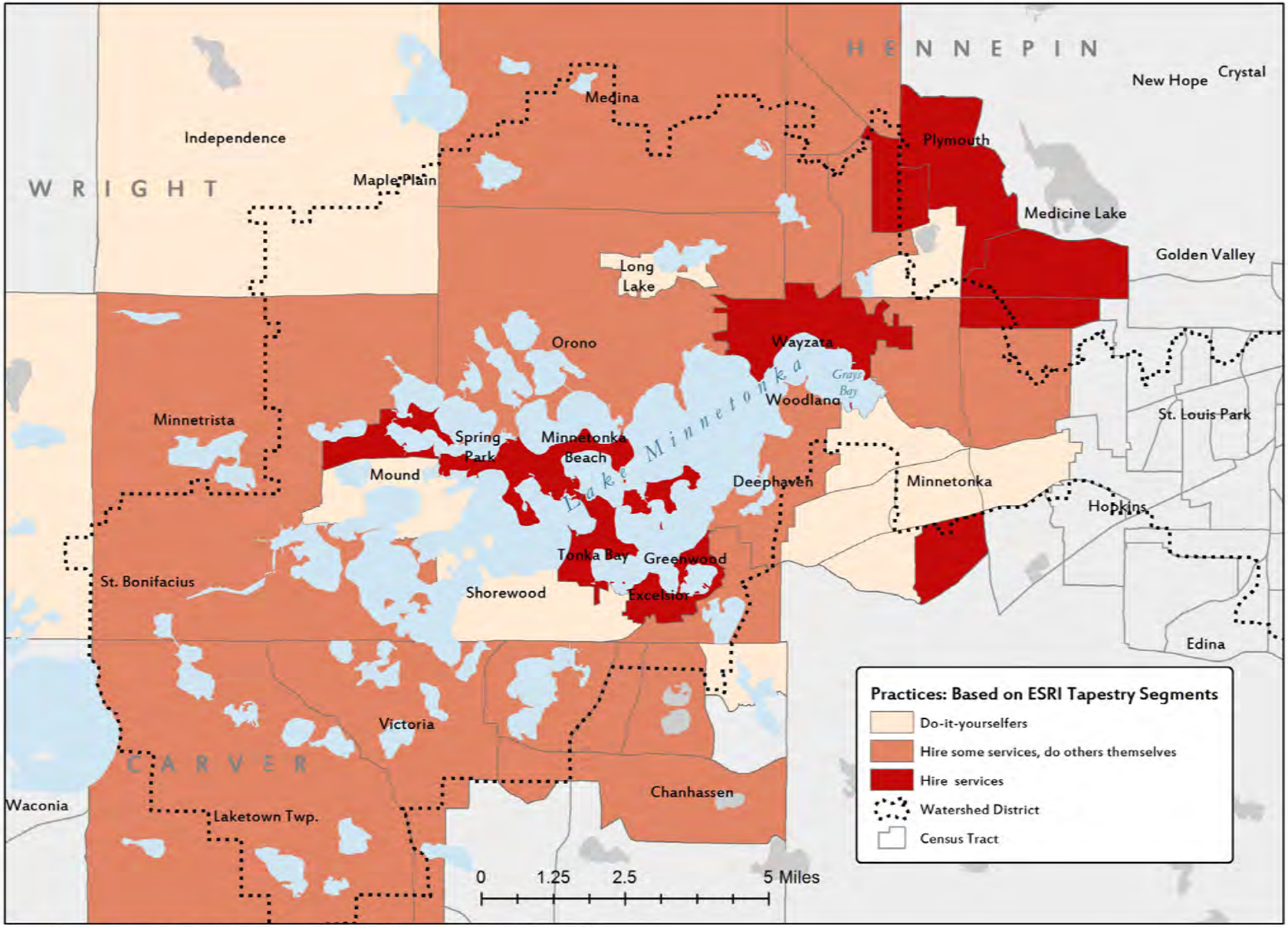
3.10 Voter Turnout, 2012

Voter turnout can give an idea of the willingness of a particular population to become educated on national issues, as well as the degree to which they trust their own efficacy. Because the presidential seat was on the ballot, turnout was quite high across the nation, but the precincts that overlap with the watershed district had a turnout of 100.1%, which was significantly higher than the US turnout of 56.5%, though it should be mentioned that Minnesota as a state is known for its high turnout, which was 70.5% in the same election (Census Bureau, 2012). Note also that voter turnout in this case can be more than 100%, as it is measured here as the number of voters in a given precinct divided by the number of voters registered at 7AM that morning. In other words, Election Day registration allowed a larger number of people to vote. Besides certain specific areas, particularly in the south-western area of the watershed district, voter turnout was 95.01% or higher. These numbers indicate an interest in national politics and the willingness to be involved, at some level, in social issues. The 2012 ballot also included two hotly contested amendments to the Minnesota state constitution: the Voter ID bill and the Same-Sex Marriage amendment. The presence of these amendments may have encouraged more voters to come out.

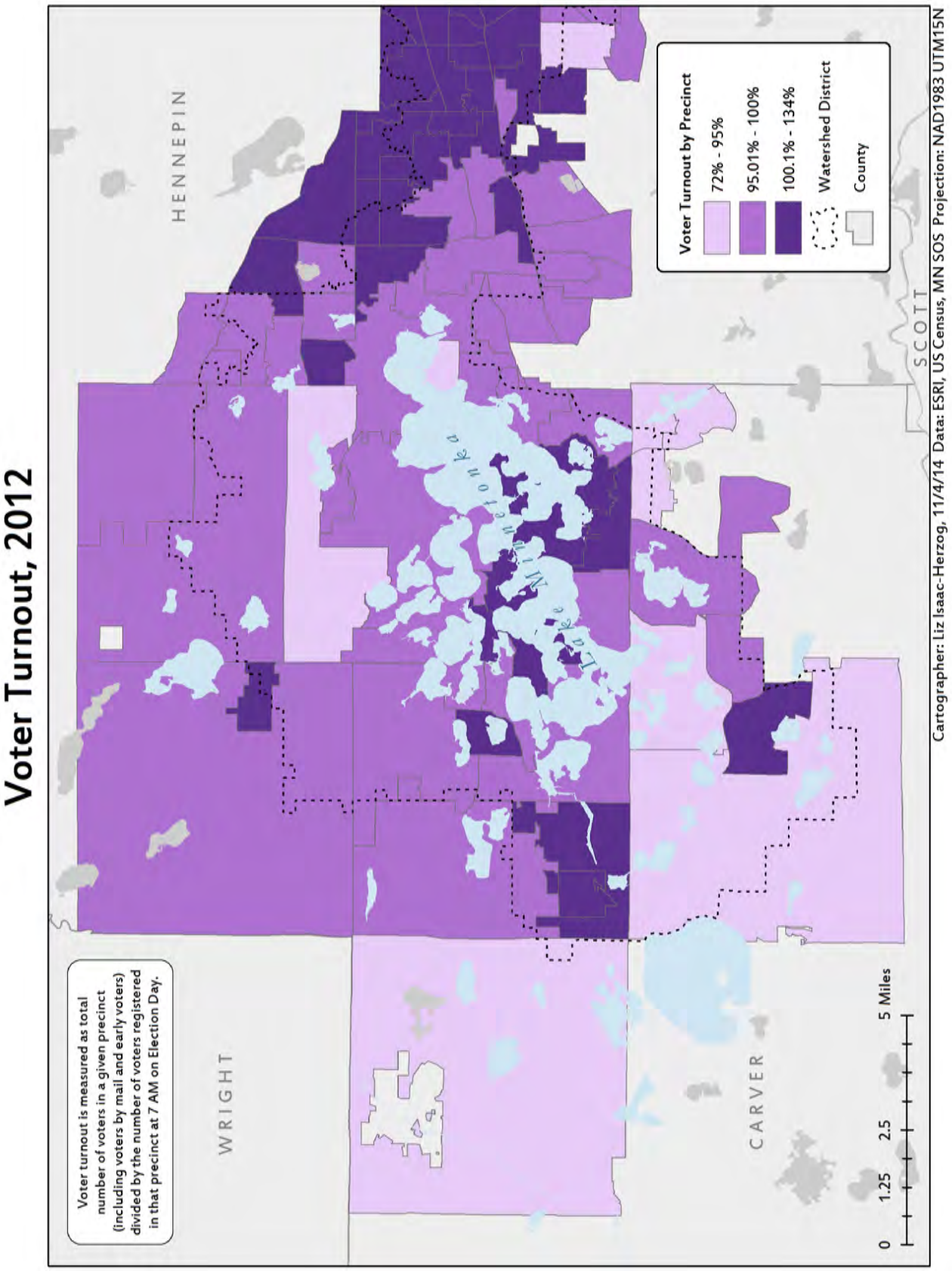
3.11a Support for Democratic Presidential Candidate (Barack Obama)

Looking at voter turnout is helpful, but to understand the actual beliefs of a population, it is important to look at election results at the precinct level. This map displays the percentage of voters who cast their votes for Barack Obama in the 2012 election. The western part of the MCWD shows low support for the President: In most

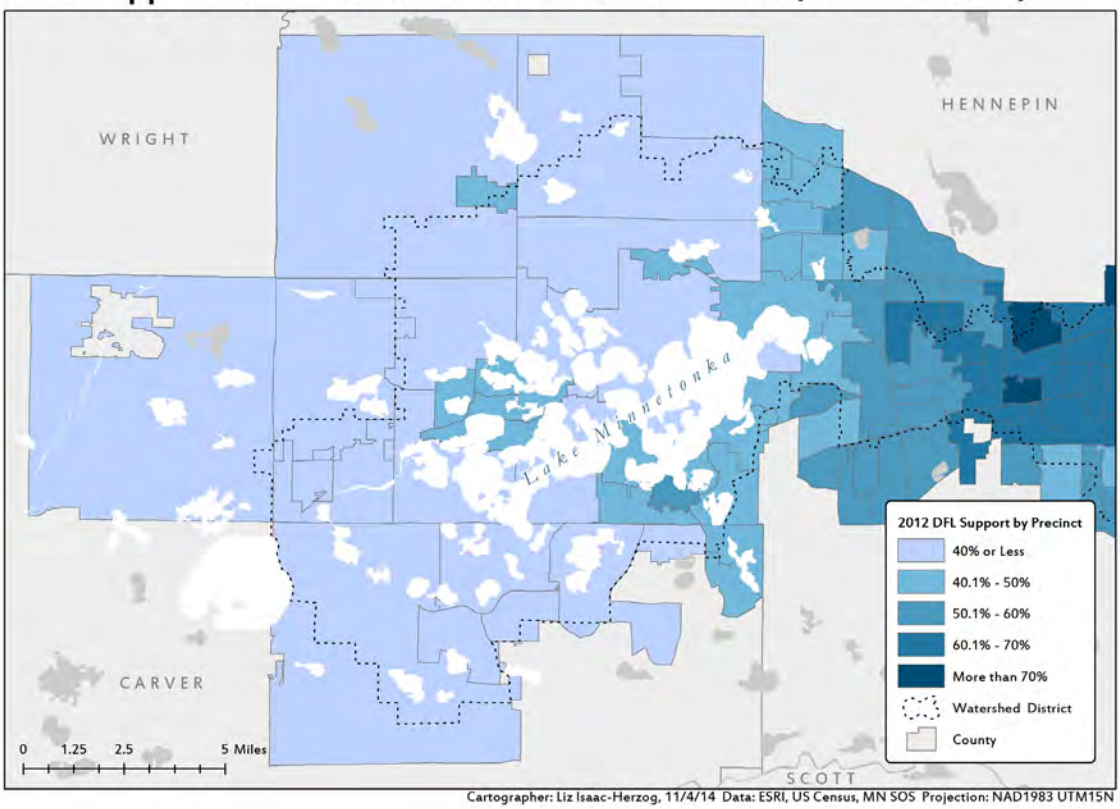
Predicted Lawn Care Practices by Census Tract (2011)



Cartographer: R. Fehr, 10-6-14 Data Source; ESRI Projection: UTM Zone 15N

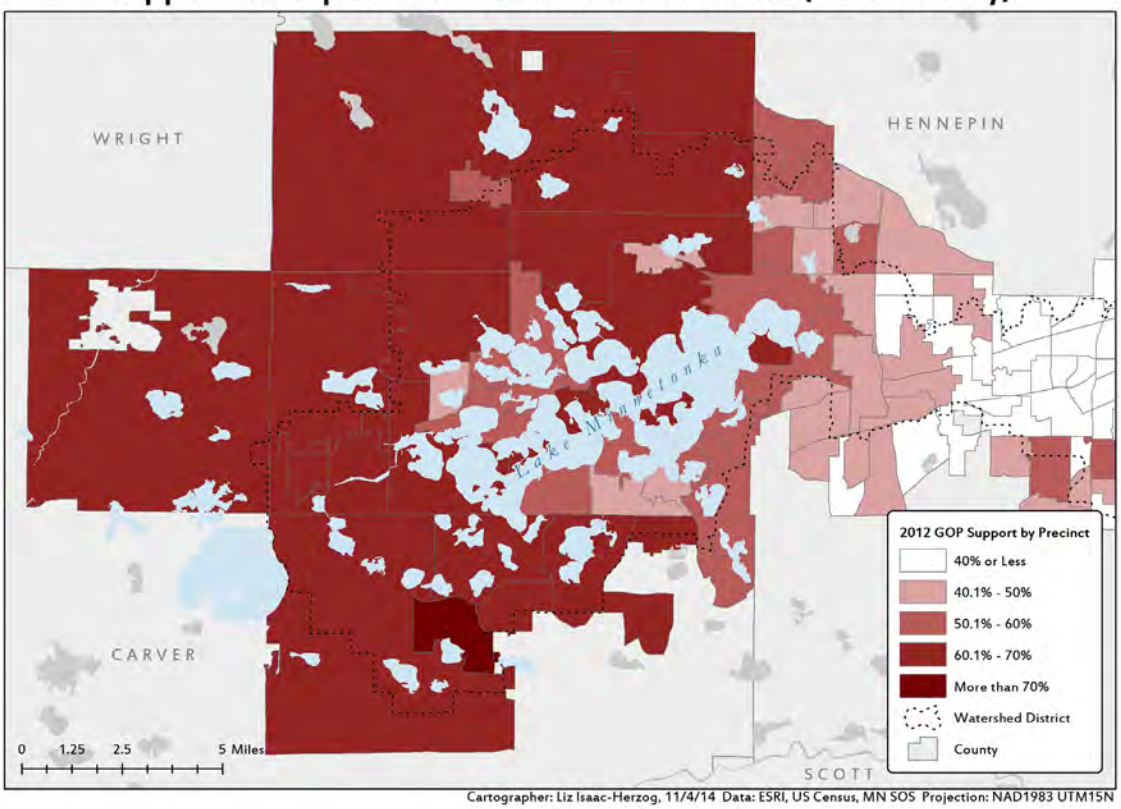

Voter Turnout, 2012
HENNEPIN
WRIGHT
CARVER
SCOTT
Lake Minnetonka
Voter Turnout by Precinct
72% - 95%
95.01% - 100%
100.1% - 134%
Watershed District
County
Voter turnout is measured as total number of voters in a given precinct (including voters by mail and early voters) divided by the number of voters registered in that precinct at 7 AM on Election Day.
0 1.25 2.5 5 Miles
Cartographer: Liz Isaac-Herzog, 11/4/14 Data: ESRI, US Census, MN SOS Projection: NAD1983 UTM15N

Support for Democratic Presidential Candidate (Barack Obama)



Cartographer: Liz Isaac-Herzog, 11/4/14 Data: ESRI, US Census, MN SOS Projection: NAD1983 UTM15N

Support for Republican Presidential Candidate (Mitt Romney)



Cartographer: Liz Isaac-Herzog, 11/4/14 Data: ESRI, US Census, MN SOS Projection: NAD1983 UTM15N

precincts, numbers were 40% or less. Moving eastward toward the Twin Cities shows higher percentages. In this map and the next (**Support for Republican Presidential Candidate (Mitt Romney), Map 3.11b**) support for a party's presidential candidate is used as a proxy for political party affiliation, as Minnesota does not require voters to register with a particular party. It can be concluded by looking at this map that most residents of the western part of the MCWD are generally conservative in their political views.

3.11b Support for Republican Presidential Candidate (Mitt Romney)

To confirm these conclusions, this map examines support for Mitt Romney, the 2012 Republican presidential candidate. It is clear that residents have generally right-wing political views. The further west one looks in the watershed, the more this is the case. This is an important consideration when moving the Master Water Stewards Program into this area. It may be effective to partner with organizations like Ducks Unlimited, which is generally more conservative-leaning than other conservation organizations and pushes for increased waterfowl populations for various (generally human-centric) reasons including hunting supply (Ducks Unlimited Position on Hunting, n.d.).

CONSUMER EXPENDITURE MAPS

It is also useful to look at how people spend their money, as it reveals, in perhaps a different way, their values and the ways in which they like to spend their time. The first two consumer expenditure maps show residents' contributions to political organizations and to churches and religious organizations. These maps demonstrate that the population in this area is quite generous in its donations, both political and religious, and that they spend larger amounts of money on outdoor recreational activities of all sorts. It is important to recognize, however, that a lot of the numbers in various block groups correlate with their respective median incomes. In other words, wealthier people spend more money, although it may represent a smaller or equal proportion of their overall income.

3.12 Average Household Contributions to Political Organizations (2010)

This first spending map shows the average contributions by household to political organizations in 2010. The main trend we see here is that the highest spenders are located on the northeastern and southwestern ends of Lake Minnetonka. The numbers themselves, ranging from about $15 to about $85, may seem to be low, but they actually range from 71% to 404% the national average. It is obvious, therefore, that in addition to voicing their opinions through votes, as is evident in the political maps (**Maps 3.10-11**), these residents use their wallets to take part in the political process.

3.13 Average Household Contributions to Churches and Religious Organizations (2010)

Average contributions by household to churches and other religious organizations in 2010 are shown in this map. The numbers are perhaps stunning at first; average household contributions range from a little under $700 to more than $2,500 per year. They are, like the political donations, significantly higher than national averages, by a factor of about 1.6 on average. This data makes it clear that religious organizations are an important force in the lives of these residents. We might assume by extension that the community they provide, and perhaps the social and political views they espouse, are important to these residents.

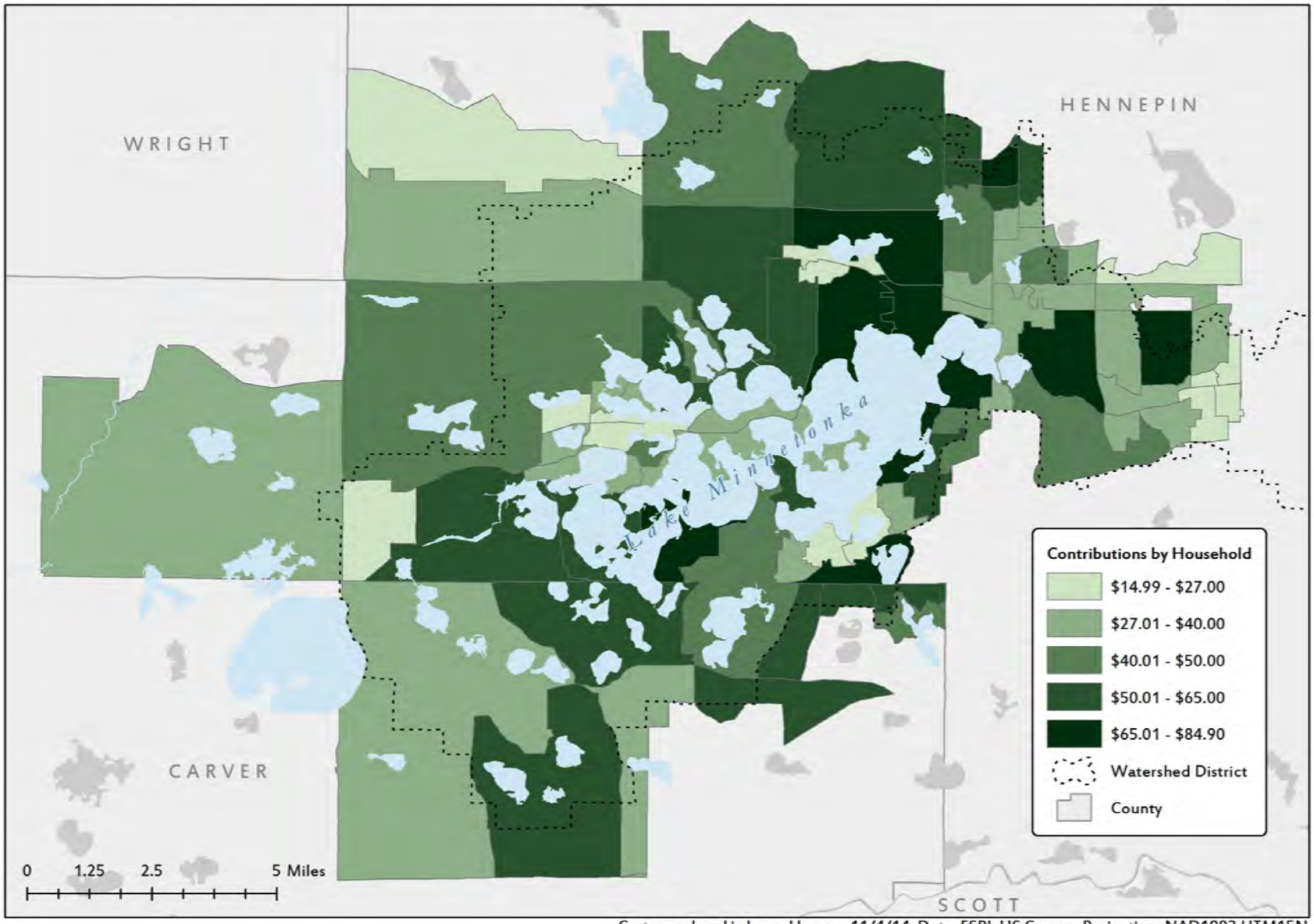
3.14 Spending on Water Sports Equipment, RVs, and Boats (2010)

Recreational spending says a little bit more about what these residents do in their leisure time. **Map 3.15** shows spending on water sports equipment, RVs, and boats in 2010, per block group. These numbers indicate a demographic that is willing to spend significant amounts of money on recreational activities. Perhaps the most important trend that can be seen on the map is that the highest amounts spent (ranging from about $300 to about $750) were directly north and south of Lake Minnetonka, as well as in the outer western reaches of Minneapolis. The people spending money on this high-end recreational equipment are not necessarily "close with nature" in the ways we might at first assume, but they are certainly in regular contact with the water that the FWS is trying to protect. Appealing to them shouldn't be difficult.

3.15 Spending on Hunting, Fishing, and Camping Equipment (2010)

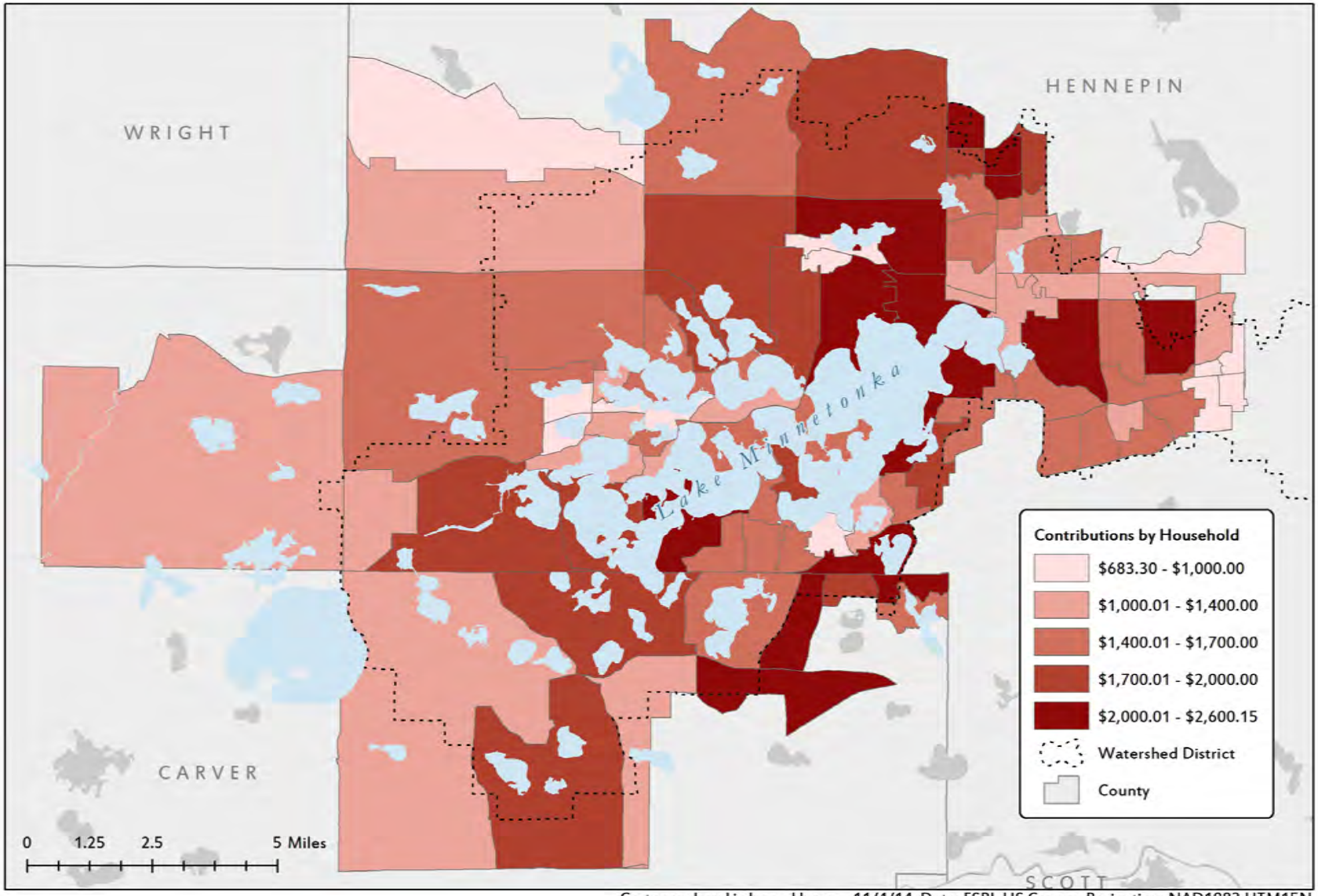
The final consumer expenditure map displays spending on hunting, fishing, and camping equipment in 2010, per block group. In looking at them side-by-side, it is striking that, across the extent with almost no excep-

Average Household Contributions to Political Organizations (2010)



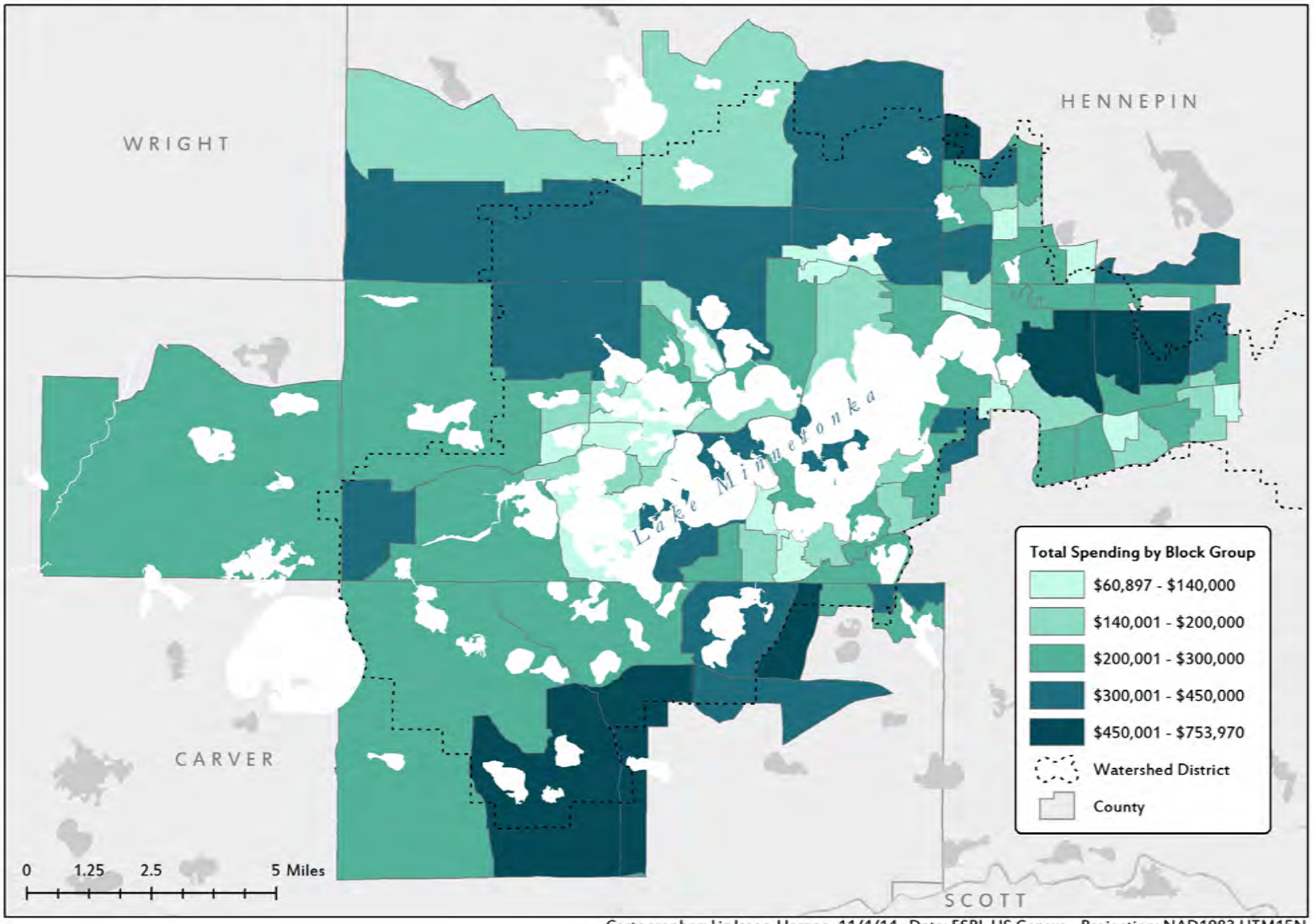
Cartographer: Liz Isaac-Herzog, 11/4/14 Data: ESRI, US Census Projection: NAD1983 UTM15N

Average Household Contributions to Churches and Religious Organizations (2010)



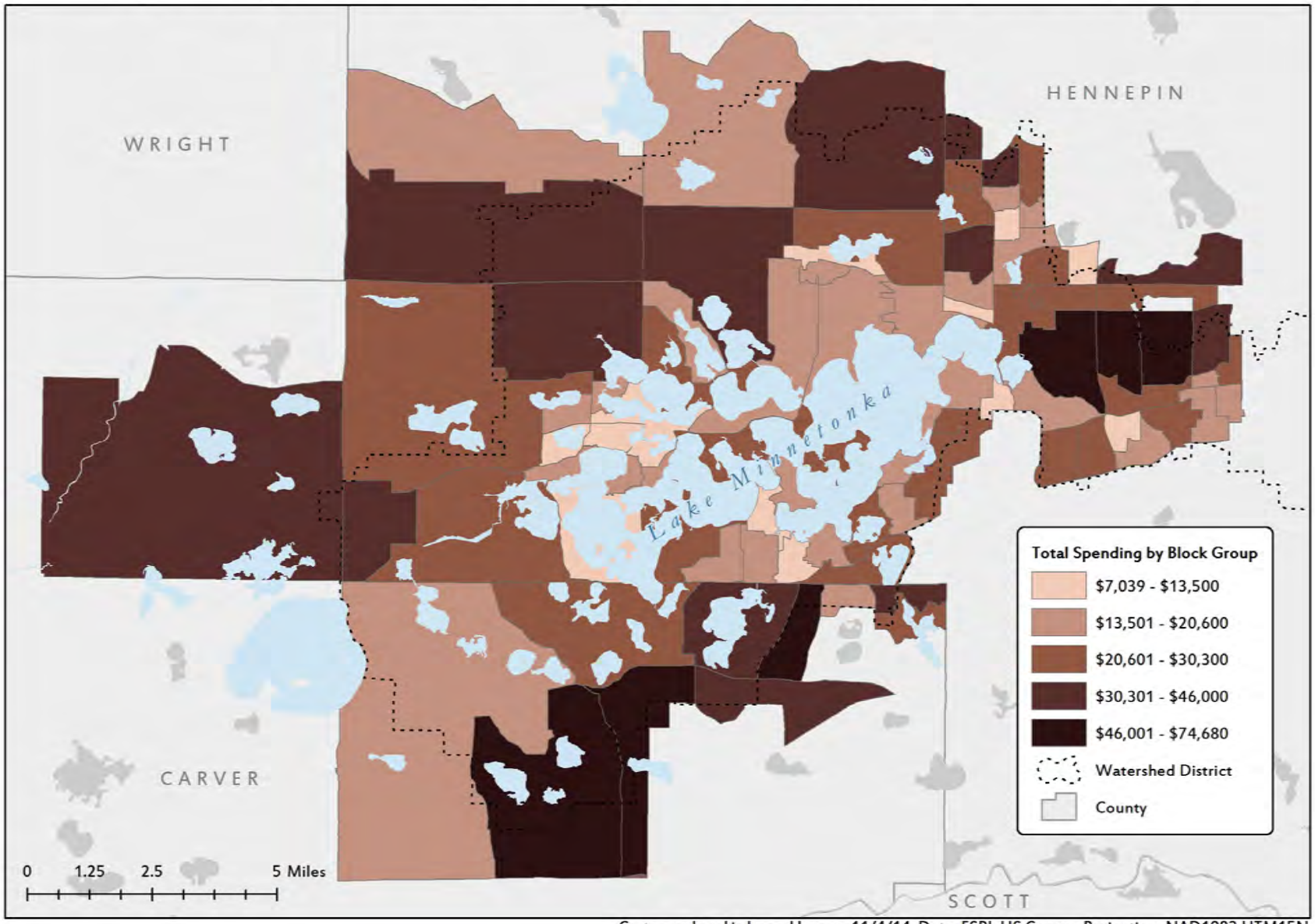
Cartographer: Liz Isaac-Herzog, 11/4/14 Data: ESRI, US Census Projection: NAD1983 UTM15N

Spending on Water Sports Equipment, RVs, and Boats (2010)



Cartographer: Liz Isaac-Herzog, 11/4/14 Data: ESRI, US Census Projection: NAD1983 UTM15N

Spending on Hunting, Fishing, and Camping Equipment (2010)



Cartographer: Liz Isaac-Herzog, 11/4/14 Data: ESRI, US Census Projection: NAD1983 UTM15N

tion, block groups' spending is correlated between water sports equipment and hunting, fishing, and camping equipment. The actual dollar amounts are much lower for hunting, fishing, and camping, as would be expected, as these items generally cost less than boats and RVs, for example. Though one cannot make a solid conjecture about these residents' inclination to be outdoors based on their spending on water sports equipment, this map does serve as a good proxy for such a culture. This emotional proximity to the environment might bode well for the Freshwater Society as it goes into the area and attempts to generate awareness about the non-point source pollution that wants to remedy and prevent. Discussing the impact of low water quality on the availability and safety of water sports and other recreational activities could be very effective in the process of educating these residents.

Conclusions

This chapter used demographic and lifestyle data to look carefully at the ways in which residents' lifestyles affect how they engage with their communities and environment. Generally speaking, the residents of the area are overwhelmingly white, predominantly conservative in political beliefs, and of relatively high income. The population is active at the polls and enjoys spending time outdoors, whether boating on the lake or experiencing nature through hunting, fishing, and camping. There is a distinct divide between the eastern and western portions of the watershed; moving west, the population becomes somewhat less educated and more conservative, and shows shorter lengths of residency.

Residents work mainly in professional fields like corporate management and sales. Household sizes are rather small, the average number of family members being approximately two across most of the region. Young career-oriented couples without children and older empty-nesters make up a large portion of the population. The watershed is split evenly between residents who hire lawn care services and those who do landscaping work themselves, indicating varied opportunities for promoting rain gardens and other environmentally-friendly lawn care practices.

The true value of this chapter lies within the recognition of these lifestyle trends in order to better understand their values and perceptions to be leveraged by the FWS for future outreach. While this information can be used to identify various target populations for water steward promotion, it also holds value in that it can help identify populations that will require more innovative outreach strategies. One group might value the opportunity to invest time and effort into stewardship, while others could be involved in different ways such as volunteering to have rain gardens, permeable pavers, and other runoff reduction efforts installed on their properties.

A Rain Garden on a Residential Property in the MCWD
(Holly Barcus, 2014)

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Synthesis

Introduction

All three groups—Physical, Community/Built Environment, and Lifestyles—have spent the past several months collecting and analyzing data on the Minnehaha Creek watershed. This extensive analysis has allowed for an examination of the spatial relationships that exist across those three categories. Examining multiple datasets for spatial trends allowed us to connect different variables and learn more about both the geography and the people of the region. Although this report has been divided into three separate categories, these variables do not stand independent from one another—in many cases, patterns and overlaps can be seen across these data.

The following synthesis attempts to look at these data across different dimensions and provide an overview of apparent trends in the watershed district. It examines three separate areas of the watershed, first discussing Orono and Long Lake, then moving to the rapidly developing area of Victoria, and ending with the "retirement community" of Spring Lake. It is important to note, however, that although this chapter describes visual trends and relationships across these data, a visual correlation does not imply any sort of causation between variables.

Orono and Long Lake

The Towns of Orono and Long Lake both contain trends that are worthy of note in the broader context of the MCWD. Starting with the town of Long Lake, we see by looking at the map of impervious land cover that there is a large amount of built environment. This includes parking lots, strip malls, office parks, and other urban land uses. This particular area is one of the few areas in the western watershed with a high density of impervious land cover, and one of the only in the northwestern section. From this, we gather that a lot of water is running off of the land and collecting urban contaminants. This proposition is supported by the MPCA polluted sites map, which shows a high density of polluted sites clustered on and around the Town of Long Lake. The combined ability for the water to run off and also collect a large number of pollutants is troubling, especially combined with the knowledge that Long Lake itself is already classified as impaired by the MPCA.

The western portion of Orono and the neighboring section of Minnetrista are home to another interesting visual correlation. Looking at Risk of Erosion and Erodibility, we see a large area that is particularly at risk. The risk of erosion map looks at the intersection of two things, severe risk of soil erodibility and a severe grade of slope. Therefore, areas that are red are shown to be areas where both severe risks meet. This is problematic in and of itself; however, when coupled with the flood risk map, we see that this area is not only at risk of high erosion in the future, but also higher danger in case of an extreme flood. It is possible that using a combination of these datasets, residents in the area could be persuaded to pursue projects that attempt to mitigate erosion risk.

Victoria

The city of Victoria in Carver County is representative of many of the changes that have been occurring in the southwestern area of the watershed. This is the most rapidly-developing area of the watershed and has seen recent increases in population and new home con-

struction over the past few decades (see **Map 2.7, Average Year of Home Construction by Block Group** and **Map 2.6, Age of Individual Home Construction**). Victoria was identified as an area that had some of the highest voter turnout in the watershed (upwards of 100% by our measurements), and much higher than its immediate surroundings. This can be attributed to the relatively high concentration of government or educational institutions in Victoria's city limits, which can led to increased civic participation and community ties. Victoria defies the trend of the southwestern part of the watershed not having many supporting civic institutions, as it is well-served by schools, places of worship and other community gathering centers (see **Map 2.1, Presence of Government / Educational Institutions** and **Map 2.2, Recreation and Community Spaces**). Heightened civic engagement and political awareness in Victoria make it a natural starting point for any potential expansions of the Master Water Stewards Program or educational outreach from the FWS.

Victoria's rapid conversion from agricultural use to urban use is also connected to many other variables related to the physical environment of the watershed. The area has experienced some of the most recent housing construction in the watershed (on average, most of the homes built in Victoria have been built in the past thirty years), which has been located in areas where this conversion has taken place. In addition, Victoria has high levels of soil erodibility and imperviousness as a result of this rapid development of housing in the region.

Spring Park

Spring Park is an area that has experienced somewhat recent development throughout, which has contributed to its potential importance to the FWS. Examining the **Imperviousness of Minnehaha Creek Watershed District, 2007 map (1.2)**, it can be seen that the land of Spring Lake has around 80% imperviousness or above, while the surrounding coastline is more permeable. In this location, there is the lowest category of spending for each map regarding pest/termite control, lawn care, and lawn care supplies, demonstrating that, compared to most of the other regions, Spring Park consists mainly of built urban environment that contributes to high levels of runoff. This is especially important to the FWS, because it could be a key target when addressing water runoff and is home to potential stewards. Examining the **Percentage Age 65 and Over by Census Tract map (3.4)** and the **MCWD Tapestry Demographic Segments by Census Tract (2011) map (3.1)**, we can see this area is typically older and willing to engage with causes they feel passionate about. Using Google Maps, retirement communities can be identified, and in these communities there is potential to recruit these people for the Water Stewards program.

Conclusion

We have explored three case studies of areas in the watershed where patterns across all of our findings are apparent. Orono and Long Lake, Spring Park, and Victoria are all examples in the watershed where we found correlation between different variables. These serve as a jumping-off point for further analysis of the watershed, and any exploration of patterns should not be limited to just these areas. Our findings affirm that many variables and factors interplay to create the complex ecosystem that is the Minnehaha Creek Watershed.

Conclusion

GIS and Community Partnerships Visited a Variety of Sites in the Watershed in Fall 2014. (Holly Barcus, 2014)

Through the three lenses of study—land use and natural environment, community and built environment, and lifestyles—this report gives a comprehensive view of both potential challenges and opportunities for the FWS's future work in the western part of the MCWD. This phase of research aimed to determine 1) key demographic and lifestyle characteristics of the watershed's population; 2) how they engage in their communities; and 3) which areas are at the highest risk of water quality threats.

The general conclusions are as follows:

Western watershed residents are predominantly white, politically conservative, and of relatively high income. Residents work mainly in professional fields such as corporate management and sales. Young career-oriented couples without children and older empty-nesters make up a large portion of the population, although this is changing rapidly in the Carver County area.

This study has identified vacant plots as potential new study areas for the MCWD, community institutions that can facilitate outreach by the Water Stewards Program, and flood-risk areas where homeowners should be encouraged to consider implementing changes to encourage water infiltration, such as rain gardens.

The area around St. Bonifacius is at high risk for poor water quality. This study finds that agricultural practices in that area are likely to impair water quality. There has been a change in the rate of infiltration around St. Bonifacius, as land cover has become more impervious. This, combined with the steep slope and erodibility of some parts of the area, allows contaminated water to runoff, erode and pollute various sources of water.

Limitations of this study and next steps

One important thing to remember in using this chapter's findings is that this is a snapshot of the watershed at a time when the area is rapidly changing. The rate of suburbanization is increasing steadily in the watershed, and new populations with different priorities are moving into the area (Aitchinson, 2009). This study finds trends toward larger houses and rising populations of commuters bringing higher incomes to the western watershed. Suburbanization is likely to have detrimental effects on the environment in the watershed as natural areas are developed, making water conservation even more critical. Because of these changes, the data included in this chapter should be continually reevaluated to ensure accuracy.

The data used to create many of the maps in this report are aggregated at various levels. As a result of time and data limitations, much of the population data is mapped at the census tract level, and the environmental data is at a relatively low resolution. Future research should determine areas of focus within the watershed and evaluate the variables mapped in this report in more detail.

Storm pond identification is a critical next step for the FWS and its research partners. This report made significant progress toward locating existing storm ponds, but resource limitations did not allow a ground level search for ponds. Future research should confirm this study's projected storm pond locations and expand the search to other areas of the watershed. With this extension, and continual updates of the rest of the data, this project should prove useful in informing the Freshwater Society's future efforts in the MCWD.

The interactions between the Minnehaha Creek Watershed District residents and their environment are complex and constantly evolving. This diverse social landscape presents substantial challenges to the Freshwater Society in expanding their operations to the west. However, if the results included in this report can be built upon and extended, the Freshwater Society, in partnership with the Macalester College Geography department, can continue to preserve water quality.

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Glossary

GeoCoding: Combining an address or place name with spatial coordinates.

Impervious: Describes a surface that does not allow water or other fluids to pass through it.

Permeability: The degree to which a surface allows water or other fluids to pass through it.

Raster: A data format that holds information in a grid in which every cell is an equal size and has an assigned value. Rasters are commonly used for environmental datasets such as temperature and elevation.

Resolution: Specifies the dimensions of the cells contained in a raster grid. For example, a 30 meter resolution means that each cell within a raster grid represents a 30 meter by 30 meter square on the ground.

Slope: The rise or fall of a land surface.

Weighted Overlay Tool: Combines separate data sets to analyze multiple criteria together, weighting variables differently to indicate their importance in the output layer.

Data Sources Index

Physical Environment

Data	Source	Variables	Manipulations	Limitations
Land Cover	University of Minnesota Remote Sensing and Geospatial Analysis Laboratory	Class_Name	Categories reclassified to reduce the number of categories in data. For "Imperviousness of the Minnehaha Creek Watershed District, 2007," all permeable categories combined into one class. Also used for "Land Cover in the Western Watershed, 2007."	Data was already classified, so we had to depend on those classifications.
Soil Erodibility	Soil Survey Geographic Database, United States Department of Agriculture, ESRI	forpehrtdc	Symbolized data with three categories: severe, moderate, and slight, to represent the level of erodibility throughout the watershed.	Data was already classified, so we had to depend on those classifications.
Soil Type	Soil Survey Geographic Database, United States Department of Agriculture, ESRI	taxpartsiz	Symbolized data with the categories given in data set to represent different types of soil, based on particle size.	Data was already classified, so we had to depend on those classifications.
Infiltration Rates	Land Management Information Center, Minnesota State Planning AGency	HYDRO4: Legend	Symbolized data with six categories based on High, Moderate, Low, and Very Low infiltration rates.	Generalized over 40 acres, so this data does not portray small-scale trends; some areas have combinations of high and low infilitration rates because there is a mixture of particle sizes in the soil.
Consumer Expenditure Data	ESRI	X4010_A: Lawn Care Service X4011_A: Lawn Care Supplies X4020_A: Termite/Pest Control	Each variable visualized by average household expenditure by block group.	Data comes from a sample survey, so cannot accurately represent all the data. It is also unknown what specific items go into each category.
Census of Agriculture	United States Department of Agriculture	Group: Animal Totals, Geographical Level: Zip Code of Minnesota	Calculated total number of livestock farms by ZIP code Added to ZIP Code zip file.	Census of agriculture only had zipcode data for 2007. Some of the ZIP code data did not exist as well.
Contaminated Sites	Minnesota Pollution Control	Activity	Selected feedlot sites that were in the watershed district	It is not clear if this data differentiates between contaminated and sustainable sites, or if it assumes that all feedlot sites are contaminated

Data	Source	Variables	Manipulations	Limitations
Satellite Imagery	United States Geological Survey	Value 1 = Agriculture, 2 = Natural Areas, 3 = Residential, 4 = Urban, and 5 = Water	Created training sites (see variables) for each calss with a minimum class size of 70 pixels, created class signatures, and then ran a maximum likelihood classification for both 1992 and 2013	Low accuracy due to low spatial resolution of the imagery
Digital Elevation Model	United States Geological Survey	Value from 0 to 90	Ran the 'Slope' geoprocessing tool in ARCmap to create a raster of slope in degrees	Low spatial resolution (30m)

Community and Built Environment

Data	Source	Variables	Manipulations	Limitations
assessedlakes_clipped	MPCA 2011, EPA	Lake quality grades	Clipped to watershed	Data last collected in 2011
Agricultural_Parcels	MetCouncil 2011	Lot size, property type	Exracted fom parcel data Used Euclidean Dist. Tool to find distance between water and plots Assigned choropleth color scheme	Does not include type of agriculture
all_streets	US Census 2011	All roads, highways, etc.	Clipped to watershed	
all_townhms	MetCouncil 2011	Townhome and condominium properties	Extracted from parcel data	Errored measure of finished square feet for units within townhomes
bikeways_clipped	MetCouncil 2011	Bike paths	Clipped to watershed	
creek	ESRI 2013 Water Bodies	Minnehaha Creek		
CTU_2000	MetCouncil 2011	Cities and townships		
edina_newhomes	MetCouncil 2011	Homes in Edina built since 2000	Extracted from parcel data (henn_carv_minne_parcels) Symbolized all parcels in Edina tht were designated residential and had a YEAR_BUILT value of 2000 or later	Up to date only through 2011
edina_parcels	MetCouncil 2011	Nonresidential properties in Edina	Extracted from parcel data (henn_carv_minne_parcels) Clipped to Edina study area inside watershed	Up to date only through 2011
edina_parks	MetCouncil 2011	Park and recreational property in Edina	Extracted from parcel data (henn_carv_minne_parcels) Symbolized all plots designated as parks inside the Edina study area	
edina_recentsales	MetCouncil 2011	Homes in Edina sold since 2011	Extracted from parcel data (henn_carv_minne_parcels) Symbolized all parcels in Edina that were designated residential and had a year of 2000 or later in SALE_DATE	Up to date only through 2011
edina_studyarea	MetCouncil 2011	Portion of Edina located within the MCWD	Extracted from watershed (mcwd_base)	Up to date only through 2011

Data	Source	Variables	Manipulations	Limitations
edina_vacant	MetCouncil 2011	Vacant residential properties in Edina	Extracted from parcel data (henn_carv_minne_parcels) Symbolized all parcels in Edina that were designated residential and vacant	Does not differentiate vacant structures vs. vacant lots
edina_yearbuilt	MetCouncil 2011	Age of housing stock in Edina	Extracted from watershed-level data on age of housing stock (westMCW_yearbuilt)	Up to date only through 2011
geocode_boats	Minnesota Lake Finder	Boat launches	Made an Excel spreadsheet of geographic coordinates of boat launches Created a shapefile and joined the spreadsheet to spatial data	Only included boat launches on Lake Minnetonka, there are others.
institutions_clip	ESRI 2013 Landmarks	Places of Worship, Schools, etc.	Clipped to watershed	
lakes_clipped		Lakes in watershed	Clipped to watershed	
mcwd_base	MetCouncil 2011	Borders of the Minnehaha Creek Watershed District		
mcwd_cities	MetCouncil 2011	City and township boundaries in MCWD	Clipped to watershed	
MCWD_highways	MNDOT	All highways	Clipped to watershed	
mnctu061014	MetCouncil 2011	MN cities and townships	Extracted from parcel data	
no_finsqft	MetCouncil 2011	Parcels lacking recordings for homes' finished square feet	Extracted from parcel data	Incomplete data collection from original parcel data
noHmstd_merge	MetCouncil 2011	Non-homestead parcels	Extracted residential-only parcels with 'N' as the homestead status	Very incomplete data collection for the Homestead field
ponds_victoria	ESRI World Imagery	All potential storm pond locations	Examined base map and digitized points that looked like they could be storm ponds Generated table of spatial coordinates	
Out_State_west	MetCouncil 2011	Parcels with non-Minnesota tax addresses	Clipped to MCWD Identified and extracted tax addresses not including MN Excluded non-residential properties	
potential_ponds_proj	ESRI World Imagery	All potential storm pond locations		
sourcepollution_clipped	MPCA	Potential sources of pollution	Clipped to watershed	
st_bon	MetCouncil 2011	St. Bonifacius	Clipped to relevant township	
townships_minnehaha	MetCouncil 2011		Clipped to watershed	
USA Landmarks.lyr	ESRI 2013	Places of worship	Clipped to watershed	
USA Parks.lyr	ESRI 2013	All public parks	Clipped to watershed	
USA Recreational Areas.lyr	ESRI 2013	All rec areas	Clipped to watershed	

Data	Source	Variables	Manipulations	Limitations
useful_ratios	MetCouncil 2011	Finished square feet of plots' homes and parcel area	Plot acres converted to square feet Finished square feet divided by plot square feet	Errored data for townhome properties
Victoria	MetCouncil 2011	Victoria	Clipped to relevant township	
Weighte_fldp2	MetCouncil 2011, FEMA 2006	100- and 500-year flood zones overlayed with presence of basements	Extracted parcels that indicated basement presence; performed a weighted overlay with 80% weight on floodplain data, 20% on basement data, Clipped to MCWD	Very limited basement data collection
west_MCW	MetCouncil 2011	Western MCWD study area	Clipped to watershed	
westMCW_colleges	ESRI 2013 Institutions	Colleges and higher education institutions in the western MCWD	Extracted from ESRI 2013 Landmarks	
westMCW_ governmentoffices	ESRI 2013 Institutions	City and township halls in the western MCWD	Extracted from ESRI 2013 Landmarks	
westMCW_lakes	ESRI 2013 Water Bodies	Lakes in the western MCWD study area	Extracted from lakes_clipped	
westMCW_ mcwdowned	MetCouncil 2011	Property owned by the MCWD	Extracted from parcel data (henn_carv_minne_parcels) by identifying parcels that had "Minnehaha Creek Watershed District," or a similar variation, listed as owner	May not be complete; some property might be owned under a different name
westMCW_museums	MetCouncil 2011	Minnesota Landscape Arboretum	Extracted from ESRI 2013 Landmarks	
westMCW_roads	US Census 2011	Major roads in the western MCWD	Extracted from all_streets	
westMCW_schools	ESRI 2013 Schools	Elementary and high schools in the western MCWD	Extracted from ESRI 2013 Landmarks	Individually selected from ESRI 2013 Landmarks; may not be complete
westMCW_studyarea	MetCouncil 2011	Western MCWD	Identical to west_MCW	
westMCW_vacant	MetCouncil 2011	Parcels in the western MCWD designated as vacant	Extracted from parcel data (henn_carv_minne_parcels) by identifying parcels that were designated as vacant, regardless of land use	Does not differentiate vacant structures vs. vacant lots Only up to date through 2011
westMCW_yearbuilt	MetCouncil 2011	Year of construction of all residential parcels in the western MCWD	Extracted from parcel data (henn_carv_minne_parcels) Symbolized all residential parcels based on age of construction	Only up to date through 2011
westMCW_yearbuilt_ blockgroup	MetCouncil 2011	Average year of construction of all residential properties in the western MCWD, by block group	Extracted from parcel data (henn_carv_minne_parcels) Aggregated data upward to block group level, so the average year of construction per block group was displayed	Only up to date through 2011

Lifestyles

Data	Source	Variables	Manipulations	Limitations
2010 Consumer Expenditure	Esri	Water Sports Equipment Purchase of RVs or Boats Hunting & Fishing Equipment Camping Equipment Cash Contributions to Churches/Religious Organizations Cash Contributions to Political Organizations	Raw numbers for Water Sports Equipment and Purchase of RVs or Boats were added together Raw numbers for Hunting & Fishing Equipment and Camping Equipment were added together	Data is from 2010 and therefore may be slightly outdated Category names are somewhat vague, and more specific descriptions are unavailable
Election 2012	Minnesota Secretary of State	Number of voters casting ballots US President Democratic-Farmer-Labor Party candidate votes US President Republican Party candidate votes Number of voters registered in precinct as of 7AM on election day (pre-registered voters)	US President Democratic-Farmer-Labor Party candidate votes and US President-Republican Party candidate votes were normalized by Number of voters casting ballots Number of voters casting ballots was normalized by Number of voters registered in precinct as of 7AM on election day (pre-registered voters)	We use the presidential race of 2012 as a proxy for probable political leaning; this may not be a perfect representation of the population's general political leanings
American Community Survey, 2012		Education obtained, Bachelor's degree and above Race of residents Household size Owner occupancy of residents	Owner occupancy and Household size were both represented Joined data to a shape containing spatial data	Data is an estimate with slight margins of error as expected Data is from 2012 which is the most recent and reliable data
Esri Tapestry Data, Census 2000, American Community Survey 2012		Segment name Family type College attendance rate Occupations Housing Lawn care Political participation		The data is generalized for the entire country
MCWD Parcel Data		Date of last sale	Grouped sale dates by decade	This is intended as a proxy for residency length, but homes may have been passed down within a family