

CITY OF BRIDGMAN MASTER PLAN



ACKNOWLEDGMENTS

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This Master Plan was prepared by the Land Information Access Association (LIAA) in cooperation with the City of Bridgman.

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CHAPTER 1 INTRODUCTION

WHAT IS A MASTER PLAN?

The 2018 Bridgman Master Plan serves as the official policy guide for the City's future development and growth, including the management of its natural resources. In Michigan, master plans serve as the legal basis for zoning, and provide policy guidance for changes to infrastructure, land use, transportation, natural resource management and other community systems. In general, the Bridgman Master Plan serves the following purposes:

- Evaluates existing conditions and trends in the City.
- States the community's long-range vision, extending 20 years or more into the future.
- Provides the flexibility to respond to changing conditions with new resources or innovations that align with the goals of the master plan.
- Identifies opportunities for partnerships between residents, community groups, non-profit organizations and regional entities that help support and participate in plan implementation.
- Identifies where new development should be directed and the general character to which new homes and buildings should adhere.
- Gives guidance to property owners, developers, neighboring jurisdictions, and county and state entities about expectations and standards for public investment and future development.
- Provides guidance for the allocation and spending of City funds.
- Guides the day-to-day decisions of City staff and elected officials and the land-use policy decisions of the Planning Commission.
- Establishes the legal basis for the City's zoning ordinance, capital improvements, land-use policies, and other implementation tools and programs.



MASTER PLAN FRAMEWORK

A RESILIENCY FOCUS

WHAT IS RESILIENCE?

The master planning effort in Bridgman was conducted with a focus on building *community resilience*. Resilience is an umbrella term for the planning and design strategies needed to help communities meet the economic, social, environmental and climate challenges of the future. Community resilience is a measure of the sustained ability of a community to utilize available resources to respond to, withstand, and recover from adverse situations.

Bridgman has experienced a number of significant changes over the last several years. While the overall population of the City has decreased, the number of young professionals moving into the City has grown, and there is a renewed sense of entrepreneurship and opportunity within the community.

The City is already learning to practice resilience by maintaining a stable housing stock, directing redevelopment into the downtown core, and maintaining a high quality of life.

Environmentally, a changing climate will mean generally warmer temperatures, increased precipitation and more severe storms in the Great Lakes region. For Bridgman, responding to climate change is a challenge in both the short term and the long term. However, with careful consideration and planning, these challenges are surmountable. It will require local officials and community stakeholders to consider how they plan for new development, transportation, infrastructure, natural resource preservation, energy production and community health. The action strategies in Chapter 8 are designed to help the community prepare for and respond to these challenging conditions.



10 GUIDING PRINCIPLES FOR THE CREATION OF THE MASTER PLAN

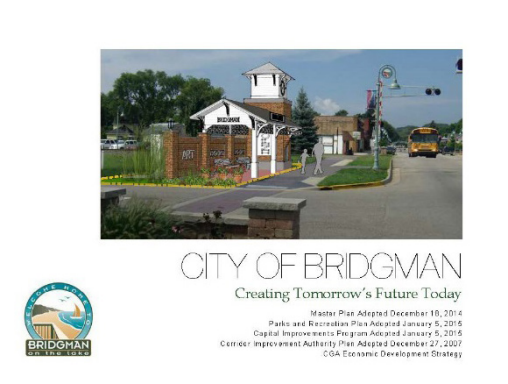
In addition to concepts of resilience, the planning process fostered ideas and conversations about the past, present and future of Bridgman. These ideas coalesced into **10 Guiding Principles** for the creation of the Master Plan and the direction of Bridgman moving forward.

BUILD ON THE PAST

1. BUILD ON WHAT'S WORKING

Bridgman's last Master Plan was developed and adopted in 2014. The Master Plan was a well-written document, outlining the conditions of the community and identifying key community goals and objectives. In the four years since the plan was adopted, some of these goals and actions have been realized. At the same time, Bridgman continues to address many new challenges.

While the conditions and challenges of the City have changed some, many of the overarching goals and policies discussed in the 2014 Master Plan remain applicable. In addition to incorporating language from the 2014 Master Plan, the new 2018 City of Bridgman Master Plan builds upon the existing goals and objectives of the 2014 Master Plan.



SHAPE THE PRESENT

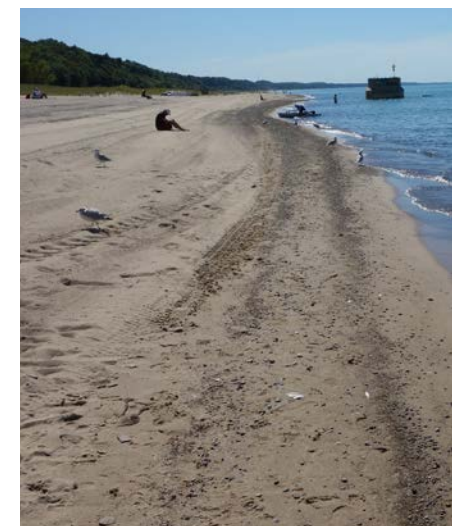
Each of the guiding principles for shaping the present-day Bridgman community reflect the latest learning from planning and community development efforts around Michigan and were recognized as important to Bridgman's planning process.

2. UNDERSTAND COASTAL PROCESSES

Michigan's beautiful coastline is more than an easy way to find Michigan on a map of the United States. The Great Lakes and abundant freshwater resources throughout the state provide a wealth of resources and impact coastal communities in unique ways. Across the state, many efforts are underway to better understand our Great Lakes.

Bridgman has roughly 1.6 miles of Great Lakes coastline. Many people live along the shoreline, enjoying scenic views and recreational opportunities. In addition, one of Bridgman's most admired and visited assets, Weko Beach, is a popular destination for both residents and tourists alike.

For this planning process, a specialized team of researchers from the University of Michigan's Taubman College of Architecture and Urban Planning and Michigan Technological University worked to determine the physical and fiscal impacts of possible climate change and lake level scenarios throughout the City, including the coastal areas. Their research and recommendations influenced the planning process in a number of ways. More information on the research team's involvement and their findings can be found in Chapter 6.



3. UNDERSTAND DUNE DYNAMICS

Michigan's dunes are some of the largest and most dynamic dune formations in the world. The dunes in Warren Dunes State Park rise over 260 feet above Lake Michigan. As dynamic natural features, dunes move and shift around due to wind, erosion and other environmental factors. Across the state, many efforts are underway to better understand these unique dune landscapes.

Much of Bridgman's coastline is made up of Critical Dunes — that is, dunes that have been identified as the most spectacular dune formations in the state by the Michigan Department of Environmental

Quality (DEQ), and thus subject to specific sand dune protection and management regulations. Large portions of these Critical Dunes lie with Warren Dunes State Park. However, one of the neighborhoods in Bridgman is also located within the Critical Dune area.

For this planning process, a specialized team of researchers from the University of Michigan's Taubman College of Architecture and Urban Planning worked to determine the potential impacts of new development within the dune area. More information on the research team's involvement and their findings can be found in Chapter 7.



4. SUPPORT SMART GROWTH

Smart Growth is a national movement with a strong presence in Michigan. According to the Smart Growth Network, growing is “smart” when it creates great communities with more choices, greater return on investment, a thriving natural environment, and a legacy for future generations.¹ There are 10 key tenets of Smart Growth worth noting, as each of these is addressed to some degree in planning efforts across the state and in this Master Plan.

TEN TENANTS OF SMART GROWTH

1. Mix land uses
2. Take advantage of compact building design
3. Create a range of housing opportunities and choices
4. Create walkable neighborhoods
5. Foster distinctive, attractive communities with a strong sense of place
6. Preserve open space, farmland and critical environmental areas
7. Strengthen and direct development toward existing communities
8. Provide for a variety of transportation choices
9. Make development decisions predictable, fair and cost-effective
10. Encourage community and stakeholder collaboration

For Bridgman, Smart Growth is a key tool in shaping the future condition of land use, housing, walkability and redevelopment within the City.



¹ The Smart Growth Network, 2014. This is Smart Growth. <http://www2.epa.gov/sites/production/files/2014-04/documents/this-is-smart-growth.pdf>

5. PLAN FOR PLACE

Whereas location refers to a particular geography, “place” refers to the physical components that make a location recognizable. *Placemaking*, then, is the act of designing and managing elements of the public realm to create places that are exciting, accessible and comfortable. The State of Michigan has promoted and supported placemaking efforts in various communities and has provided a guidebook for communities looking to bring back vibrancy to neighborhoods and downtowns.

For Bridgman, placemaking has been recognized as a key strategy in helping to protect and increase vibrancy in the downtown and other key nodes within the City. In fact, the City’s new Zoning Ordinance includes several “form-based” districts that provide direction, standards and guidelines for the public realm within areas of the downtown.



6. BE A WALKABLE COMMUNITY

A city is walkable when its transportation infrastructure provides multiple ways for people to travel to a variety of locations. Connected sidewalks, bike lanes, trails and public transit all serve to make a community healthier and more accessible for all incomes and ages.² There are currently many initiatives across Michigan that aim to increase awareness about walkability in all types of communities. In Bridgman, the downtown and many of its neighborhoods are highly accessible and walkable, but the City can take additional steps to protect, enhance and, in some areas, increase walkability.



² McCann, Barbara & Rynne, Suzanne. Complete Streets: Best Policy and Implementation Policies American Planning Association (2010)

7. COLLABORATE REGIONALLY

Many elements of a community — from economic health to shoreline management and air and water quality — are not defined by a municipal boundary. City decisions have an impact on surrounding jurisdictions and vice versa. The City of Bridgman has recognized that ongoing collaboration with Lake Township, Berrien County and community/economic entities and agencies throughout the entire Southwest Michigan region is essential to its success and prosperity.

PLAN FOR THE FUTURE

Each of the guiding principles used to plan for Bridgman’s future come from research on future trends for our climate, economy and other areas of public concern.

8. BUILD COMMUNITY RESILIENCE

By their very nature, communities are complex and dynamic. People move and populations shift, industries go out of business and new industries emerge, natural areas are converted to neighborhoods, housing values fluctuate, and shorelines shift and change. Sometimes these changes emerge over a long period of time, while other changes can be quite sudden. Community resilience is a measure of the sustained ability of a community to use available resources to withstand and recover from adverse situations.³

Many strategies can be adopted to increase Bridgman’s ability to learn from adversity, creatively solve problems and adapt to change. Many qualities of a resilient community (such as those listed in the box on this page) will be discussed throughout this plan.⁴

Qualities of Resilient Systems

According to the City Resilience Framework established by the Rockefeller Foundation, a resilient community is:

- Reflective
- Redundant
- Flexible
- Resourceful
- Inclusive
- Integrated



³ Rand Corporation, 2015. Community Resiliency Featured. <http://www.rand.org/topics/community-resilience.html>

⁴ Rockefeller Foundation, 2014. Resilience Framework. <https://www.rockefellerfoundation.org/our-work/topics/resilience>

9. PREPARE FOR CLIMATE VARIABILITY

There is no longer doubt in the scientific community over whether the global climate is changing.⁵ A changing climate will mean generally warmer temperatures, increased precipitation, and more severe storms in the Great Lakes region. As noted earlier, for Bridgman, responding to climate change is a challenge in the short term and long term. It requires City officials and community stakeholders to consider how they plan for new development, transportation, infrastructure, natural resource preservation, energy production and community health.

10. ENCOURAGE ENTREPRENEURSHIP AND COMPETE IN THE NEW ECONOMY

The economic drivers of Michigan's economy have drastically changed. While the recovering manufacturing sector will continue to remain a component of Michigan's economy, most of the manufacturing jobs the state has lost will not return. Most of the economic growth in Michigan will come from a variety of industries, most of which are high technology and service oriented. According to Michigan State University's Land Policy Institute (LPI), sectors like health care, financial management, highly skilled manufacturing, human services and the food industry will become the backbone of what is commonly called the "New Economy." Competing in the New Economy is a way to increase economic resilience and proactively attract growing industries.



⁵ NASA, 2016. Global Climate Change: Vital Sign of the Planet. <http://climate.nasa.gov/evidence>

THE COMMUNITY PLANNING PROCESS

This master plan was developed under the direction of the City of Bridgman Planning Commission and City staff, in a unique collaboration with the nonprofit Land Information Access Association (LIAA), the University of Michigan's Taubman College of Architecture and Urban Planning, and the Great Lakes Research Center at Michigan Technological University. The Planning Commission and consultant team helped oversee and facilitate the planning process. In addition, the Planning Commission acted as a sounding board for new ideas and information and as a venue to review and discuss new findings and materials.

Although the master plan was developed under this collaborative approach, ultimately the final components and content of this master plan were established and approved by City of Bridgman staff members, the City of Bridgman Planning Commission and the City Council.



OUTREACH AND CIVIC ENGAGEMENT ACTIVITIES

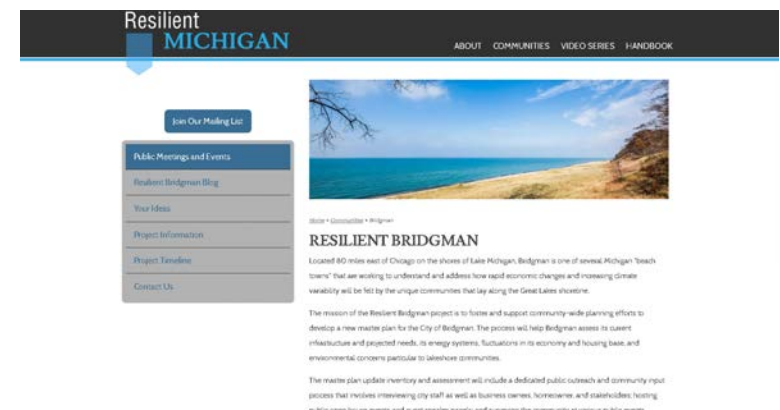
Because the master plan should reflect the values and vision of the community, engaging the public was a critical component of the community-wide planning process. Outreach and engagement activities for the master plan were designed to:

- Build awareness and promote the community-wide planning process.
- Encourage citizens to talk about issues of mutual concern and interest.
- Engage citizens and community stakeholders about the future of the community.
- Inform citizens and build awareness about community trends as well as the potential impacts of climate change and lake dynamics.

The following civic engagement activities were conducted during the community-wide planning effort:

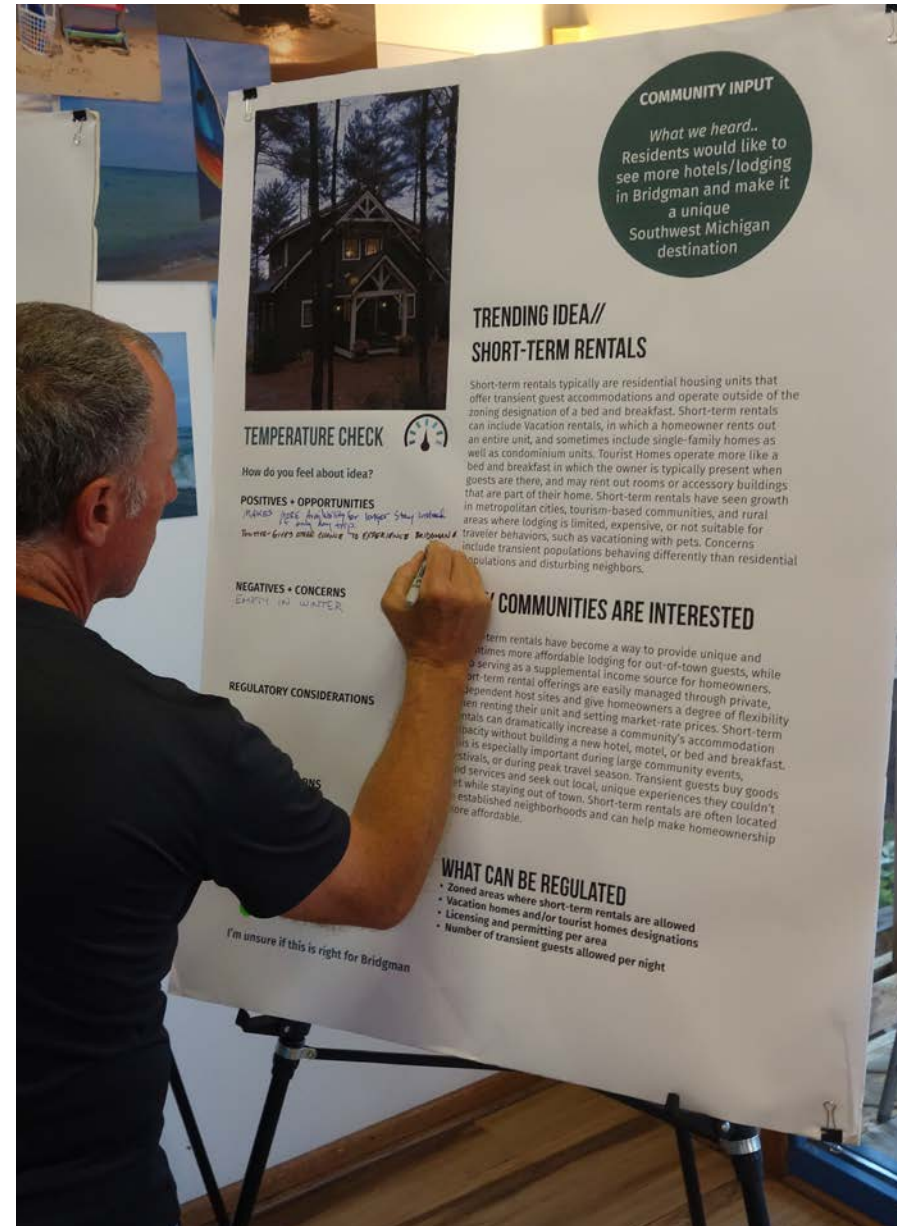
PROJECT WEBSITE

In an effort to raise awareness about the master planning project, the consultant team developed an interactive project website (www.resilientmichigan.org/bridgman.asp). The website provided information about upcoming public meetings, notes and materials from past public meetings, links to presentations, and an interactive forum. At the conclusion of the planning process, the master plan was placed on the City's website.



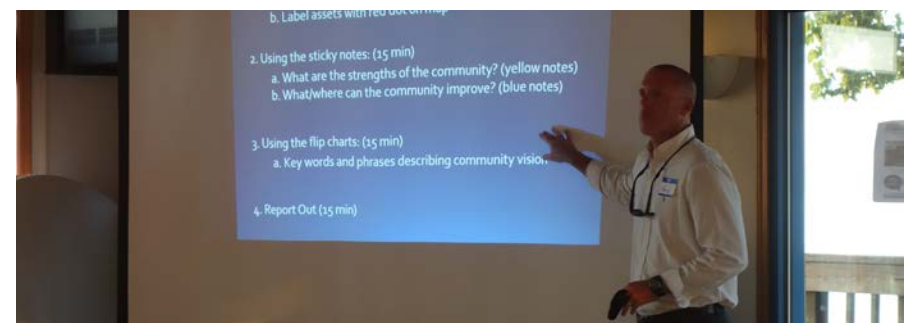
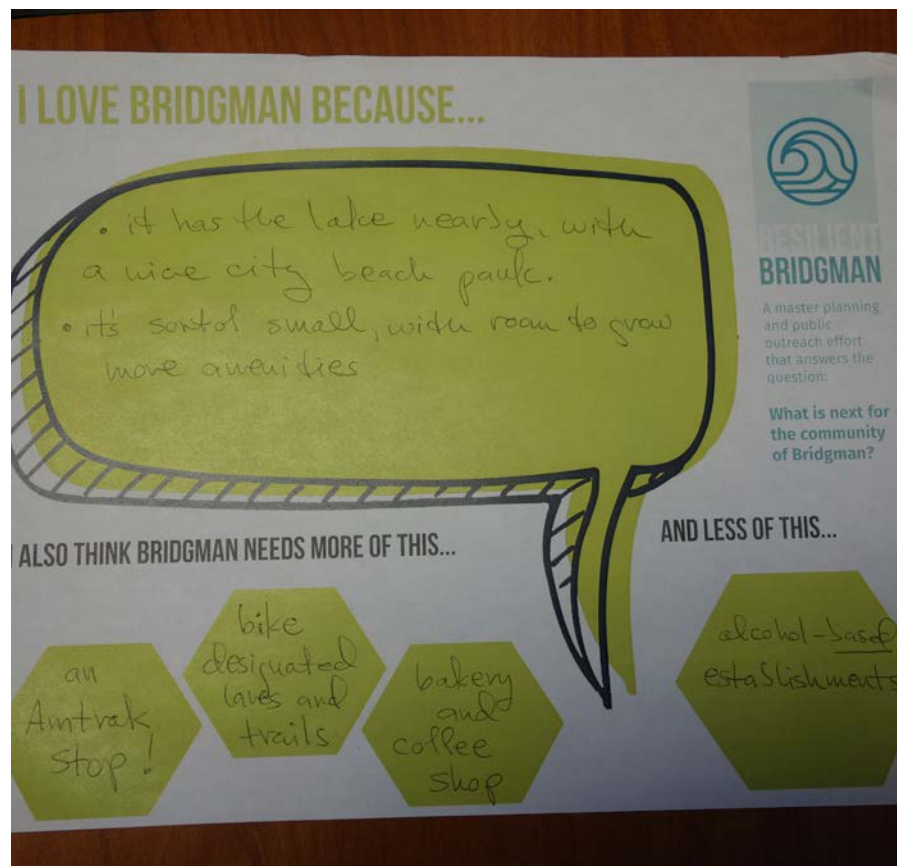
PUBLIC MEETINGS

Over 100 members of the public directly contributed to the master plan by participating in three large community meetings. The three multi-faceted meetings were designed to engage citizens, public officials and community stakeholders in a discussion about community resilience. During the three public meetings, experts from the Great Lakes Integrated Sciences and Assessments Program (GLISA), the University of Michigan and Michigan Technological University delivered presentations on how the community could become more resilient to challenges associated with a changing climate, shoreline processes and fluctuating lake levels. In addition, staff



from the Greater Bridgman Area Chamber and Growth Alliance and LIAA provided presentations on the economic and community development challenges and opportunities facing Bridgman, and how trails and recreation could help leverage additional economic development opportunities.

In addition, over the course of the three meetings, participants identified and mapped assets of and threats to the community, and provided feedback on ideas related to community resilience and community development. The results of these exercises and discussions helped to create the goals and objectives outlined later in this plan.



COMMUNITY OUTREACH

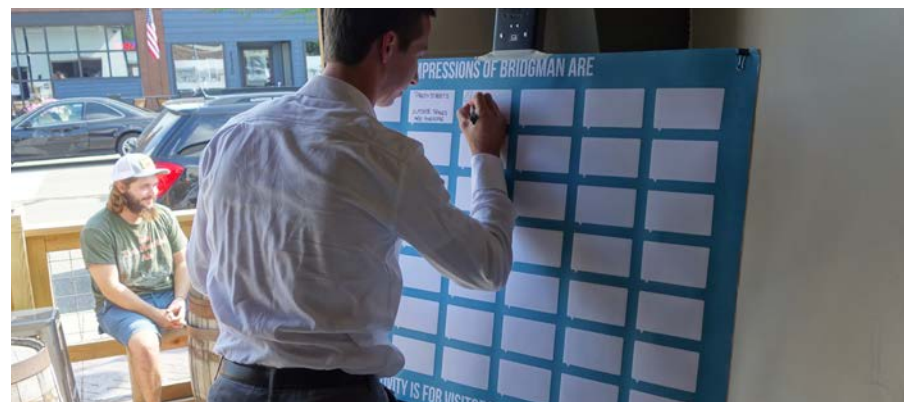
KEY PERSON AND GROUP INTERVIEWS

The consultant team met with staff members from different community organizations such as the Greater Bridgman Area Chamber and Growth Alliance, the Bridgman Public Library and Bridgman Public Schools, as well as municipal staff members, local officials and individual citizens. These meetings and interviews helped to identify current conditions, community development issues and community visions for the future.



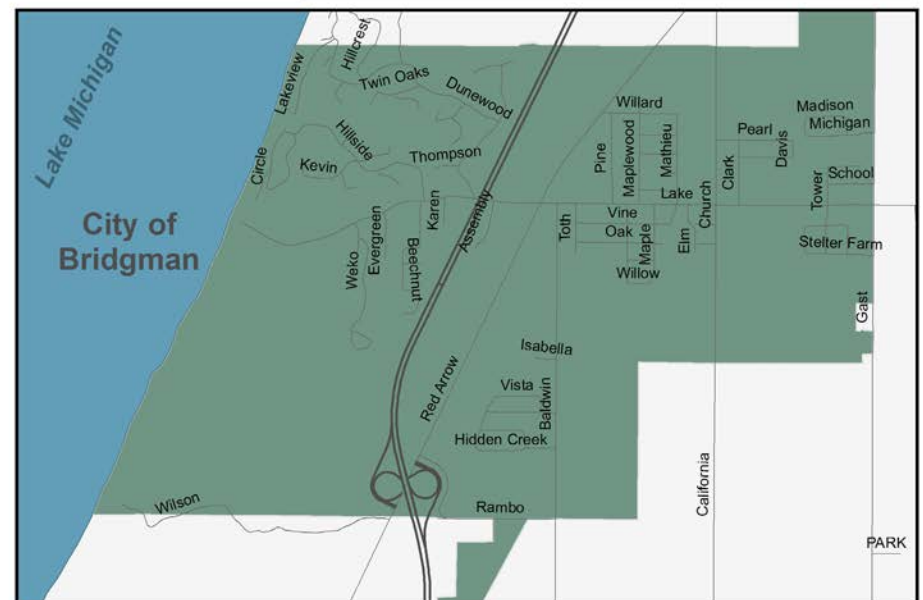
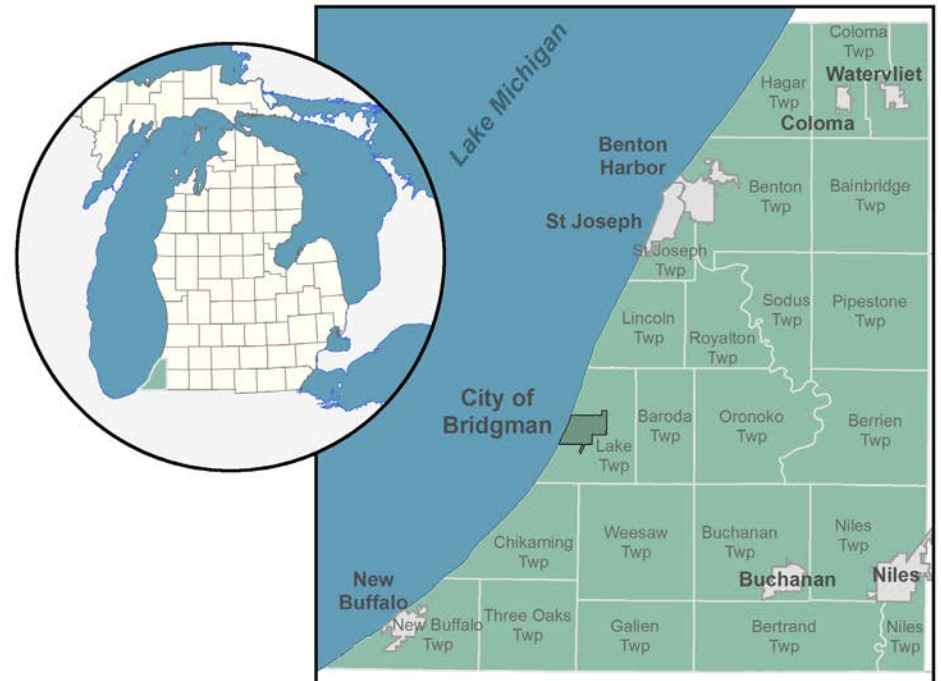
POP-UP MEETINGS

During the summer of 2017, the consultant team conducted two informal “pop-up” community input meetings at Transient Artisan Ales and Eric’s Bridgman Café to solicit visions for the future of Bridgman. The pop-up meetings involved an interactive activity in which participants filled in a speech bubble for what they want to see in their community. A second speech bubble designed for tourists was utilized at Transient Artisan Ales to get a better sense of their “first impressions” of Bridgman. In addition to these pop-up meetings, the consultant team talked with many individuals during a comprehensive tour of the community.



BRIDGMAN’S LOCATION

The City of Bridgman is located along the beautiful shores of Lake Michigan, at about the midpoint of Berrien County in the southwestern corner of Lower Michigan. The City encompasses approximately 2.9 square miles and is fairly unique in that it is completely surrounded by Lake Township. The City is bisected by three major transportation arteries: I-94, Red Arrow Highway and the CSX rail corridor. To the west of I-94, coastal areas include large portions of Warren Dunes State Park, a large and unique residential area (within a dune environment), and the famous Weko Beach. Red Arrow Highway is lined by a series of transit-oriented businesses and large industrial uses. Along Lake Street, a small but emerging and dynamic downtown is a destination for residents and visitors alike. The City is supported by a number of “urban” neighborhoods (small lots in a traditional grid pattern) as well as “suburban” neighborhoods (larger lots in new subdivisions).



HISTORY

The history of the City of Bridgman dates back to the 1850s, when George Bridgman and his partners Warren and Charles Howe established a lumber company and shipped, first by water and then by train, to the growing Chicago area.

With the 1871 construction of a railroad depot, the community of Bridgman was named, and the community added agriculture and tourism to its economy. The “Bridgman on the Lake” identity began in the 1920s with the construction of a beachfront pavilion known as the Weko Beach House. To this day, Weko Beach serves as the primary tourist attraction of Bridgman (and the surrounding region) and provides local residents with their primary Lake Michigan experience.

More recently, Bridgman has become a hub and gateway for an emerging regional wine and craft-brew industry.



CHAPTER 2

ENVIRONMENTAL CONDITIONS

The City of Bridgman is blessed to have some of the most diverse and unique natural environments in Michigan. The following chapter summarizes the water and land assets of the City.

BRIDGMAN'S ENVIRONMENTAL ASSETS

Bridgman is located along the beautiful shores of Lake Michigan, in the middle of Berrien County. The City is completely surrounded by Lake Township. Because of its proximity to Lake Michigan, Bridgman is home to beautiful sand dunes, wetlands, native vegetation and rich soils.

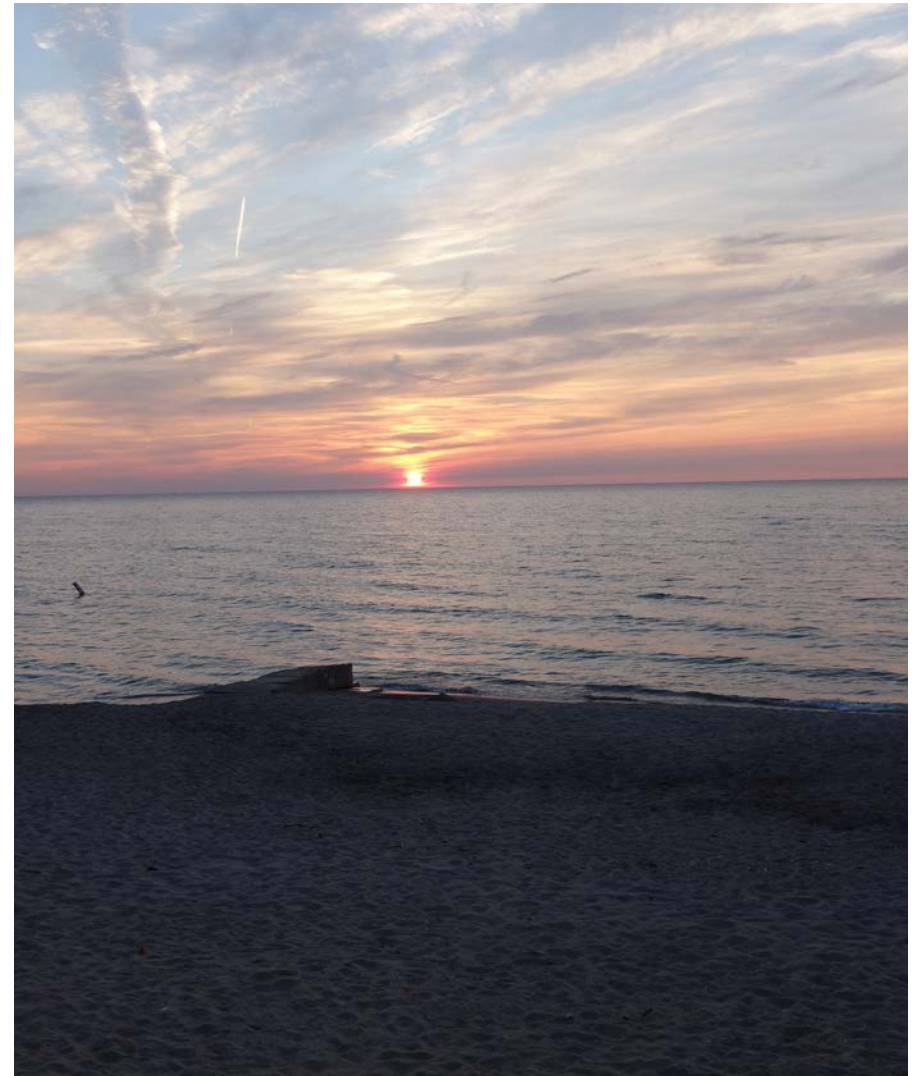
BRIDGMAN'S WATER ASSETS

LAKE MICHIGAN

Bridgman's identity is formed largely around Lake Michigan. The pristine sand and water at Weko Beach and the surrounding 1.6 miles of coastline have been central to Bridgman's history and legacy as well. Lake Michigan and the Great Lakes are truly one of the most special and unique natural resources on the planet, and Bridgman is fortunate to sit right on this doorstep! Home to 20% of the world's supply of fresh surface water (and 90% of the nation's supply), the Great Lakes have been and continue to be the foundation of Michigan's character and our most defining feature. Native Americans and early settlers used the Great Lakes to transfer food and goods to settlements and distant trading posts. In the 18th and 19th centuries, the Great Lakes powered the lumber mills and factories that helped build our cities and the foundation of Michigan's economy.¹

Today, the Great Lakes are center stage for the state's tourism industry and the Pure Michigan marketing campaign. In addition, leaders from around the state are working to utilize the Great Lakes to further what's known as the "Blue Economy" – an economy in which the Great Lakes provide for clean energy, promote sustainable systems, and create new food

¹ Michigan Blue Economy, Making Michigan the World's Freshwater and Freshwater Innovation Capital. John Austin. Michigan Economic Center at Prima Civitas and Alan Steinman, Grand Valley State University Annis Water Resource Institute





and mobility systems. According to a report from the Michigan Economic Center and the Grand Valley State University Annis Water Resource Institute,² “Michigan can be that unrivaled playground if the water is clean and our communities reconnect to it. It’s our ‘blue’ alongside our ‘green.’ And innovation in water makes us the world center of education, research, invention and new “smart water” technologies and business development, the World’s Freshwater and Freshwater Innovation Capital. It can propel a new era of economic growth and job creation.”

REGIONAL WATERSHED

Tanner Creek is a small stream just south of Weko Beach. Tanner Creek is one of several small tributaries that drain directly into Lake Michigan in the greater Bridgman area. The St. Joseph, Galien and Paw Paw watersheds cover roughly 4,872 square miles in Berrien County and in portions of Van Buren and Cass counties and northern Indiana. Water quality within the three watersheds is directly related to land management practices in the region. For example, if new development creates a large amount of

impervious surface (i.e., asphalt) and stormwater is not properly managed on site, runoff into the rivers and associated tributaries deteriorates water quality.

Even though Bridgman does not lie along a major river within the greater watershed area, activities that occur “upstream” could have an impact on the quality of the tributaries within the region. Bridgman should continue to cooperate with the Southwest Michigan Planning Commission, regional stakeholders, and neighboring jurisdictions in efforts to improve water quality. Local watersheds within Berrien County are illustrated on Map 2.1.

HIGH-RISK EROSION AREAS

High-Risk Erosion Areas (HREAs) are those areas of the shore where erosion has been documented to occur at a long-term average of one foot or more per year. According to maps developed by the Michigan Department of Environmental Quality (DEQ), along the southern shore of Bridgman, the 30-year projected recession distance varies from 55 feet in some areas to 145 feet in other areas, while the 60-year projected recession distance varies from 95 in some areas feet to 275 feet in other areas.

² Michigan Blue Economy, Making Michigan the World’s Freshwater and Freshwater Innovation Capital. John Austin. Michigan Economic Center at Prima Civitas and Alan Steinman, Grand Valley State University Annis Water Resource Institute



Unfortunately, this erosion process is irreversible. Once the shoreline has eroded inland, it will never come back as “permanent” shore, although loosely consolidated beach may reappear for periods of time when lake levels are relatively low. In most instances, property owners along the coastline have invested a lot of money, time and family history in their lakefront homes, and they understandably want to take whatever steps they can when their homes are threatened by movement of the shoreline. That desire often includes the expectation of building shoreline “armoring” structures such as revetments, seawalls or groins in an attempt to stop the progression of shoreline erosion.

However, shoreline armoring can cost substantial funds to build, maintain and rebuild over time as the lake continuously works to erode it away. And because shoreline sediments move in response to hardened structures along the shore, such structures can yield a variety of harmful impacts, including: scouring away the entire beach lakeward of the armored structure; preventing natural movement of the beach as a viable ecosystem and a place to walk; interrupting the longshore movement of sediments; scouring away beach at the edges of the structure; and destroying native vegetative cover and nearshore habitat. In short, the armoring may work to protect an individual beach house, but not the beach.

It will be important for City officials to discuss the harmful impacts of armoring with officials from Lake Township, and consider joint regulations that would eliminate the placement of armoring along the coast in both jurisdictions. Map 2.2 illustrates the location of the High-Risk Erosion Areas of the City.

SAND DUNES

Michigan’s sand dunes are one of the most striking environmental features in the world. Together they represent the largest freshwater dune ecosystem in the world. The dunes provide unique habitat for rare and endangered species and hold enormous environmental and recreational value.

There are about 250,000 acres of sand dunes in Michigan. Of that, the Michigan Department of Environmental Quality (DEQ) classifies 70,000 acres of dunes as Critical Dune Areas (CDAs). The City of Bridgman has 676 acres of Critical Dune Areas. They are primarily located between Lake Michigan and Red Arrow Highway and contain one of the most distinctive neighborhoods in the City. Critical Dune Areas are illustrated on Map 2.3.

WETLANDS

Wetlands play a critical role in regulating the movement of water within watersheds. Wetlands are also incredible flood absorbers. The water-holding capacity of a specific wetland varies by the size, slope, type of vegetation, location relative to flooding path and the water levels in the wetland prior to flooding. Coastal wetlands also control the severity of erosion along a shoreline during a storm, absorbing high-energy waves and breaking the flow of currents.

In Michigan, wetlands are classified as either coastal, tree, or shrub, each of which are covered with water





either all or part of the year. This diversity of wetlands was often misunderstood as European settlement began, and many wetlands were dredged, drained and converted to serve agriculture and industry. Today, less than half of the state's wetlands remain, and in a time of changing climate, the need to conserve and restore wetlands is paramount.³

In Michigan, development of wetlands is regulated through a permitting process. Generally, a wetland is regulated if it is connected to or within 1,000 feet of a Great Lake shoreline; is connected to or within 500 feet of an inland lake, pond, or river; or is at least 5 acres in size.

In Bridgman, wetlands constitute about 53 acres of the natural features identified by the City. It is important to note that available data on existing wetlands is collected at a large-scale and may not always be accurate. Map 2.4 illustrates the location of wetlands in the City of Bridgman. This map is intended to illustrate the general location of wetlands and the exact location of any wetland should be determined through a field site inspection by a qualified scientist.

SIGNIFICANT VEGETATION

Along with other natural features, natural vegetation and open space contribute to the character, beauty and high quality of life in Bridgman. Whenever possible, existing mature trees and vegetation should be preserved as development occurs, and additional plantings may be added in areas of the City where aesthetics do not meet the same mature natural standards as in other parts of the City.

SOIL TYPES

Bridgman contains a handful of different soil classifications and varying slopes. The majority of the soils with steep slopes are found generally in the western portion of the City where the sand dunes are located. Overall, according to the Berrien County Soil Survey, the City contains soils in three different classifications, which are described

³ Ardizzone, Kathrine A. Mark A. Wyckoff, FAICP. FILLING IN THE GAPS: Environmental Protection Options for Local Governments, 2nd Ed. December 2010.



below and illustrated on Map 2.5.

- The Spinks-Oakville-Oshstemo Association consists of well-drained soils. In areas of steep slopes, these soils have severe limitations for building site developments. In less sloping areas, when drained, these soils are ideal for asparagus production.
- The Blount-Rimer Association consists of somewhat poorly drained soils. Most of the soils in this association have been cleared and drained. They are often used for cultivated crops. Due to a high water table, these soils are poorly suited for building site developments.
- The Morocco-Thetford-Granby Association consists of somewhat poorly drained and poorly drained sandy soils. Most of the soils in this association are used for farming. Due to wetness, caving of cutbacks and poor filtering capacity, the soils are poorly suited for site developments. Ponding is also a hazard in the Granby soils.

FLOODPLAIN MANAGEMENT

A river, stream, lake or drain may occasionally overflow its banks and inundate adjacent lands, and the land that is inundated by water is defined as a floodplain. In some instances, floodplains serve as water recharge areas and natural water retention basins during periods of heavy precipitation or spring snow thaws. Development within the 100-year floodplain requires an exhaustive permit process.

It is important to understand that floodplains are potentially dangerous places to build houses, and imprudent development in a floodplain can risk lives and property. Controlling development in floodplains protects their natural capacity to convey floodwaters (a process that can be blocked or slowed by poorly located or poorly designed development) and helps to protect structures built on the floodplain margins.

The National Flood Insurance Program (NFIP) is an optional program managed by the Federal Emergency Management Agency where communities can receive flood insurance for disaster relief by agreeing to regulate floodplain development. Most coastal communities participate in the NFIP, including the City of Bridgman.

Flood Insurance Rate Maps (FIRMs) are created and released by the Federal Emergency Management Agency (FEMA), using event-based modeling and lake level elevations determined by a single storm event for various return periods.⁴ It is important to note that individual property owners can petition to change the flood zone designation for their property, so FIRMs may not be fully scientifically derived. As of this writing, the FIRMs for coastal areas subject to Great Lakes flooding have not been formally released.

⁴ The Great Lakes Coastal Flood Study Website, 2015. <http://www.greatlakescoast.org>



GREAT LAKES COASTAL FLOOD STUDY

In 2010, FEMA and the United States Army Corps of Engineers (USACE) began the Great Lakes Coastal Flood Study. The project seeks to update existing FIRMs to account for revised lake levels, wave setup and wave energy. The process to create the drafted maps differs significantly from the process to create the existing FIRMs; the existing FIRMs are based on event-based modeling, whereas the projected flooding impacts are based on the influences of a selected historical storm.⁵ The updated approach is statistically-based, where the influences of wave energy and wave setup are modeled using refined 100-year lake level elevations provided by the USACE.

The Great Lakes Coastal Flood Study facilitated a meeting to discuss the preliminary maps for Berrien and Van Buren Counties in August of 2017.

⁵ FEMA Flood Insurance Rate Maps, Accessed in 2015 from FEMA.Gov

Chapter 3 Demographic, Employment and Housing Characteristics

Through a series of tables and graphs, the next several pages show and discuss the demographic characteristics of the City’s population. In general, each table uses data collected on a rolling basis from 2000 through 2015 by the American Community Survey (ACS, a United States Census Bureau product) to represent the most current conditions in the City of Bridgman. Census data from the 2000 Census is used as a point of comparison, and a change in both number and percentage (using a percent formula) is also given. The information selected is useful for understanding the current conditions of the population, as well as planning for housing and service needs.

Table 3.1 shows the change in Bridgman’s total population from 2000 to 2015, while Table 3.2 shows the projected changes on population as published by the Southwest Michigan Planning Commission. Overall, the total population in the City of Bridgman has decreased by about 18%. Bridgman is expected to slightly increase its current population level between now and 2045, according to projections from the Southwest Michigan Planning Commission.

Table 3.1 Total Population, City of Bridgman

	2000	2015	% Change 2000 to 2015
City of Bridgman	2,428	1,997	-17.8

Source: U.S. Census Bureau (2000), American Community Survey (2011-2015)

Table 3.2 Population Projection, City of Bridgman

	2015	2045	% Change 2015 to 2045
City of Bridgman	1,997	2,295	14.9

Source: American Community Survey (2011-2015), TwinCATS 2045 Projections

Understanding Census Data
 This section displays a number of datasets related to Bridgman’s population. All of this data comes from the United States Census Bureau. While the U.S. Census collects information every 10 years (2000 data is used here), the American Community Survey (ACS), also conducted by the U.S. Census Bureau, collects data on a rolling basis throughout each year. The American Community Survey summarizes data into 5-year ranges, producing confident estimates for 2011 to 2015. The tables and graphs in this section display a number, a percent (where relevant), and a percentage change from the first year (2000 data) to the current conditions (2011 – 2015 data). For example, Table 3.1 shows the number of residents in the City of Bridgman and the percentage change.

Understanding the age distribution of Bridgman can help identify social, economic and public service needs in the community. As shown in Table 3.3, the number of residents ages 20 to 24 and ages 65 and older increased by 14.7% and 13.3% respectively. All other age ranges lost population, with the greatest decrease occurring between the ages of 25 to 44, though in the 15 years between 2000 and 2015, residents who did not move out of the City may be simply counted in a different age classification. The increase in the number of residents in Bridgman over the age of 65 is consistent with communities throughout Southwest Michigan. However, the increase in the number of residents between the ages of 20 and 24 may demonstrate that Bridgman is an attractive location for the often coveted young *Millennials*.

Who is a Millennial?

According to a 2017 report from the Pew Research Center, Millennials consist of the population between 18 and 35 years old as of 2016. According to the report, Millennials now make up the largest living generation by population size (79.8 million people).

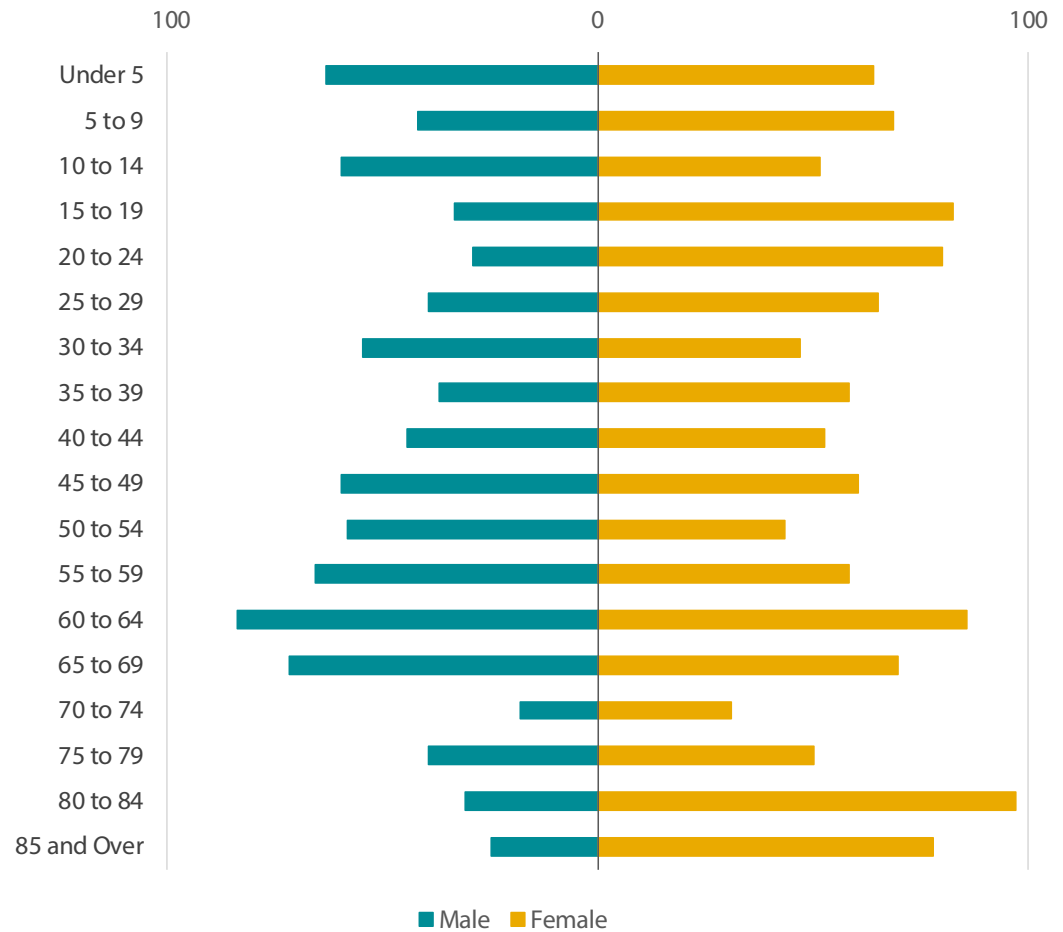
Table 3.3 Population by Age, City of Bridgman

Age Range, In Years	2000		2015		Change 2000 to 2015	
	#	% of total	#	% of total	#	% Change
5 and under	133	5.5	127	6.4	-6	-4.5
5 to 9	142	5.8	111	5.6	-31	-21.8
10 to 19	339	14.0	226	11.3	-113	-33.3
20 to 24	95	3.9	109	5.5	14	14.7
25 to 44	653	26.9	398	19.9	-255	-39.1
45 to 64	615	25.3	515	25.8	-100	-16.3
65 and over	451	18.6	511	25.6	60	13.3
Total Population	2,428	100.0	1,997	100.0	-431	-17.8

Source: U.S. Census Bureau (2000), American Community Survey (2011-2015)

Figure 3.1 is a visual representation of Bridgman’s estimated age distribution in 2015. The blue bars represent the size of the male population, while the yellow bars represent the female population. It is clear that Bridgman has a sizable early retirement population, as indicated by the bars representing ages 60 to 64 and 65 to 69 on the graphic.

Figure 3.1 Age Distribution in the City of Bridgman, 2015



Source: American Community Survey (2011-2015)

Table 3.4 Median Household Income in the City of Bridgman

	2000 (In 2015 inflation-adjusted dollars)	2015 dollars	% Change 2000 to 2015
City of Bridgman	67,868	42,903	-36.8

Source: U.S. Census Bureau (2000), American Community Survey (2011-2015), adjusted for inflation using the Bureau of Labor Statistics Inflation Calculator

Household income is a key measure of the economic condition of the community. One useful way to measure income is through Median Household Income, or the amount of money the “middle” household makes in the community. The Median Household Income for the City of Bridgman (Table 3.4) was \$42,903 annually in 2015, a decrease in spending power of roughly 36% since 2000. The 2000 Median Household Income in Table 3.4 was adjusted for inflation and is shown in 2015 inflation-adjusted dollars.

Table 3.5 Educational Attainment in the City of Bridgman

Year	% of Population Ages 25 and Over with a Bachelor's Degree or Higher
2000	26.4
2010	24.4
2015	29.4

Source: U.S. Census Bureau (2000), American Community Survey (2006-2010) & (2011-2015)

Table 3.5, Educational Attainment, is another measure of the community’s economic condition. Research shows that as people become more educated, their earning potential increases over the course of their lives. Having a college education is also associated with greater economic stability, more positive health outcomes and a number of other social and economic benefits. In Bridgman, the percentage of the adult population (defined as 25 and older) with at least a bachelor’s degree has increased. As of 2015, just over 29% of adults in Bridgman have at least a bachelor’s degree.

Table 3.6 shows that Bridgman is becoming slightly more racially and ethnically diverse. However, the population of the community remains over 96% white. The percentage of the population that is black and Asian increased between 2000 and 2015, while the share of population that is Hispanic decreased by 54%.

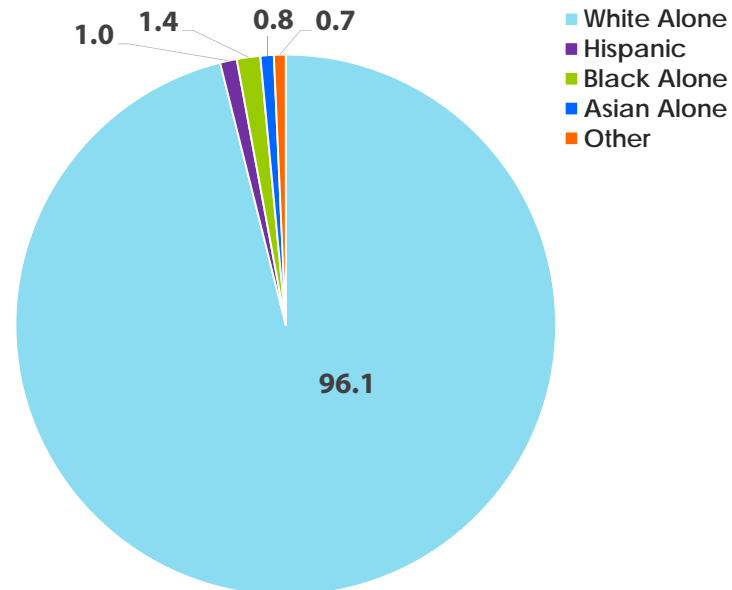
Figure 3.2 displays the information from Table 3.6 for the year 2015 in a visual format.

Table 3.6 Race in the City of Bridgman

	2000		2015		% Change 2000 to 2015
	#	% of total	#	% of total	
White Alone	2,315	95.3	1,919	96.1	-17.1
Hispanic	44	1.8	20	1.0	-54.5
Black Alone	17	0.7	28	1.4	64.7
Asian Alone	11	0.5	16	0.8	45.5
Other	41	1.7	14	0.7	-65.9
Total Population	2,428	100.0	1,997	100.0	-17.8

Source: U.S. Census Bureau (2000), American Community Survey (2011-2015)

Figure 3.2 Race in the City of Bridgman, as a percentage of total population in 2015



Source: American Community Survey (2011-2015)

The next several pages discuss information on the number of households and individuals that live under the poverty threshold in the City of Bridgman. Information on poverty was obtained from the U.S. Census Bureau. The U.S. Census uses one measurement of poverty, but many government aid programs and other organizations may define poverty differently. See the box on this page for more information on how poverty is defined by the U.S. Census Bureau.

Table 3.7 shows that at least 223 residents of Bridgman lived in poverty in 2015. This is an increase of roughly 61 people since 2000 and represents a percentage increase of 37.7%.

How is Poverty Defined in this Master Plan?

The data tables in this plan use the U.S. Census Bureau's definition of poverty. The U.S. Census Bureau determines a dollar value threshold that varies each year according to family size, age of the householder and family composition. If a family's total income is less than the dollar value of the threshold, then every individual in the family is considered in poverty. Non-related persons living with an individual or family in poverty are not considered in poverty. As an example, the dollar value threshold for a family of five (composed of three adults and two children) was \$28,960 in 2015. Poverty status is not determined for the entire population, which explains why the "total population" field in Table 3.7 has smaller values than the total city population in Table 3.1. Individuals under 15 that do not live with family and individuals living in group living quarters are excluded from poverty calculations.

Table 3.7 Total Population in Poverty in the City of Bridgman

	2000		2015		Change (2000 to 2015)	
	#	% of total population	#	% of total population	#	% change
Total Population Below Poverty	162	6.9	223	11.8	61	37.7
Total Population (for whom poverty can be determined)	2,338	100	1,894	100	-444	-19.0

Source: U.S. Census Bureau (2000), American Community Survey (2011-2015)

Table 3.8 shows that the population in poverty (223) is concentrated in 98 households in the City of Bridgman. While the City has lost population since 2000, the number and percentage of households living in poverty has increased from 8.7% of households in 2000 to 11.2% of households in 2015.

Table 3.8 Households in Poverty in the City of Bridgman

	2000		2015		Change (2000 to 2015)	
	#	% of total households	#	% of total households	#	% change
Total Households in Poverty	87	8.7	98	11.2	11	12.6
Total Households	997	100	872	100	-125	-32.1

Source: U.S. Census Bureau (2000), American Community Survey (2011-2015)

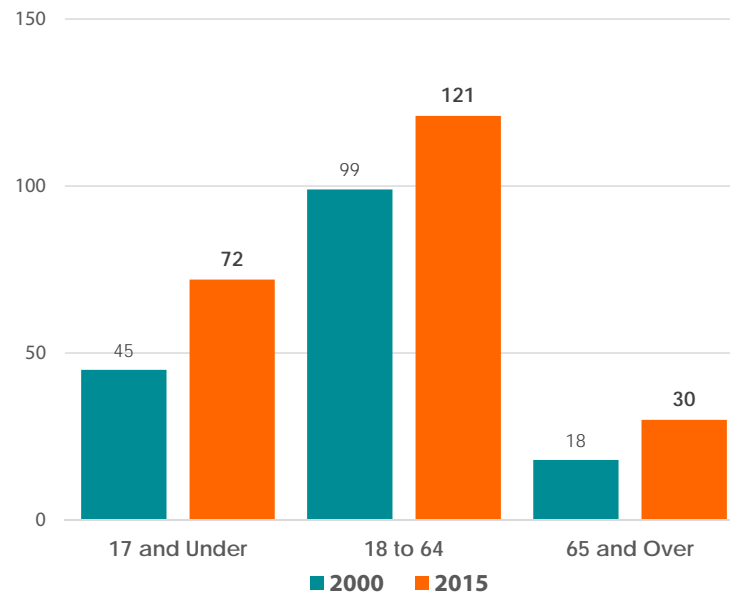
Table 3.9 and Figure 3.3 show the age distribution of the total population living in poverty in 2000 and 2015. The table classifies those in poverty according to three age ranges: 17 and under, 18 to 64 and 65 and older. Figure 3.3 shows the number of residents in poverty in these three age ranges in 2000 and 2015. The majority of the population in poverty is in the 18 to 64 age range. However, Figure 3.4 shows that those aged 17 and under and those aged 65 and older each saw at least a 60% increase between 2000 and 2015.

Table 3.9 Age Distribution of Total Population in Poverty in the City of Bridgman

Age Range (years)	2000		2015		% Change (2000 to 2015)
	# living below poverty	% of total population below poverty	# living below poverty	% of total population below poverty	
17 and Under	45	27.8	72	32.3	60.0
18 to 64	99	61.1	121	54.3	22.2
65 and Over	18	11.1	30	13.5	66.7
Total Population Below Poverty	162	100.0	223	100.0	37.7

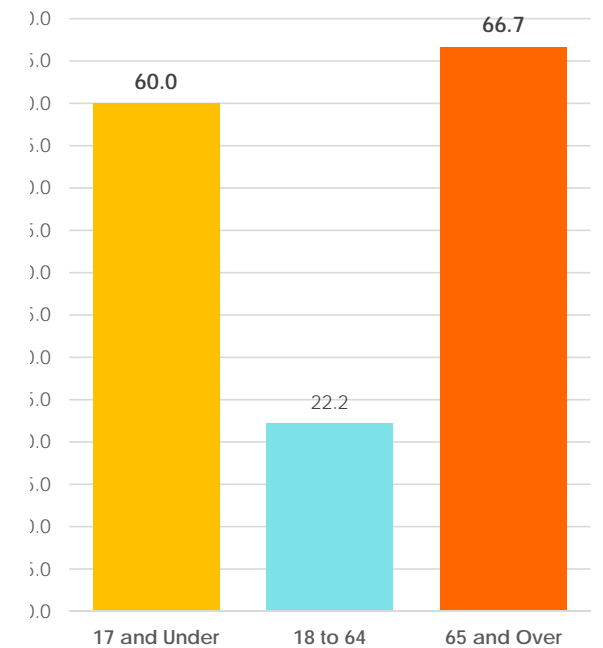
Source: U.S. Census Bureau (2000) American Community Survey (2011-15)

Figure 3.3 Age Distribution of Poverty, City of Bridgman 2015



Source: U.S. Census Bureau (2000), American Community Survey (2011-2015)

Figure 3.4 Percent of Change in Poverty, 2000-2015



Source: U.S. Census Bureau (2000), American Community Survey (2011-2015)

EMPLOYMENT AND HOUSING

UNEMPLOYMENT

Table 3.10 below illustrates the annual unemployment rate in Berrien County, as compared to that of the state for the same period. Data is reported at the county level because statistics are not recorded for individual communities with a population under 25,000 people. In October 2018, the unemployment rate was 3.6 percent in Berrien County and 3.9 percent for the state. Generally, the unemployment rate over the last decade in Berrien County has been just below the state average.

Table 3.10 Unemployment Rate in Berrien County

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Berrien County	7.8	12.7	12.0	10.2	9.0	8.7	6.8	5.2	5.0	5.0
Statewide	8.0	13.7	12.6	10.4	9.1	8.8	7.2	5.4	5.0	4.6

Source: U.S. Bureau of Labor Statistics

Table 3.11 Industry by Occupation

Table 3.11 compares the number of jobs in various industries in the community in 2000 and 2015. In terms of total jobs, the City of Bridgman lost 343 jobs between 2000 and 2015. Overall, the City of Bridgman gained jobs in the industries of retail trade; professional, scientific, management, administrative and waste management; and educational, health and social services. However, these were fairly modest gains at just 14 jobs in total. The most job losses in Bridgman over the same 15-year period were in the industries of transportation and warehousing, and utilities (95 jobs) and manufacturing (59 jobs). Despite its decline, manufacturing still makes up the largest industry in Bridgman.

		Bridgman City		Lake Township		Berrien County	
		#	% of total	#	% of total	#	% of total
Agriculture, forestry, fishing and hunting, and mining	2000	19	1.6	53	3.3	1,462	1.9
	2015	0	0.0	4	0.3	1,167	1.7
	Change	-19	-100.0	-49	-92.5	-295	-20.2
Construction	2000	49	4.1	50	3.3	4,601	6
	2015	11	1.3	106	7.6	3,613	5.3
	Change	-38	-77.6	56	112.0	-988	-21.5
Manufacturing	2000	227	19.0	391	24.6	18,825	24.6
	2015	168	19.7	264	18.8	13,750	20.1
	Change	-59	-26.0	-127	-32.5	-5,075	-27.0
Wholesale trade	2000	31	2.6	81	5.1	2,229	2.9
	2015	14	1.6	0	0.0	1,356	2.0
	Change	-17	-54.8	-81	-100.0	-873	-39.2
Retail trade	2000	111	9.3	175	11	8,254	10.8
	2015	115	13.5	136	9.7	7,194	10.5
	Change	4	3.6	-39	-22.3	-1,060	-12.8
Transportation and warehousing, and utilities	2000	172	14.4	175	11	5,003	6.5
	2015	77	9.0	126	9.0	4,091	6.0
	Change	-95	-55.2	-49	-28.0	-912	-18.2
Information	2000	30	2.5	21	1.3	1,285	1.7
	2015	0	0.0	31	2.2	850	1.2
	Change	-30	-100.0	10	47.6	-435	-33.9
Finance, insurance, real estate and rental and leasing	2000	44	3.7	57	3.6	2,911	3.8
	2015	0	0.0	56	4.0	2,938	4.3
	Change	-44	-100.0	-1	-1.8	27	0.9
Professional, scientific, management, administrative, and waste management	2000	104	8.7	63	4	4,936	6.4
	2015	107	12.5	127	9.1	5,174	7.6
	Change	3	2.9	64	101.6	238	4.8
Educational, health and social services	2000	203	17.0	278	17.5	15,547	20.3
	2015	210	24.6	242	17.3	16,368	23.9
	Change	7	3.4	-36	-12.9	821	5.3
Arts, entertainment, recreation, accommodation and food services	2000	129	10.8	86	5.4	5,690	7.4
	2015	123	14.4	251	17.9	6,887	10.1
	Change	-6	-4.7	165	191.9	1,197	21.0
Other services (except public administration)	2000	49	4.1	99	6.2	3,784	4.9
	2015	23	2.7	58	4.1	3,222	4.7
	Change	-26	-53.1	-41	-41.4	-562	-14.9
Public administration	2000	28	2.3	63	4	2,030	2.7
	2015	5	0.6	0	0.0	1,853	2.7
	Change	-23	-82.1	-63	-100.0	-177	-8.7
Total Employed Population Ages 16 and Over	2000	1,196	100	1,592	100	76,557	100
	2015	853	100	1,401	100	68,463	100
	Change	-343	-28.7	-191	-12.0	-8,094	-10.6

Source: U.S. Census Bureau (2000), American Community Survey 5-year estimates (2011-15)

HOUSING

Table 3.12 demonstrates the change in median household income, median gross rent and median owner-occupied home values between 2000 and 2015. All values from the year 2000 have been multiplied by the inflation rate from 2000 to 2014, according to the U.S. Bureau of Labor Statistics. In general, this table shows the spending power of households in Bridgman, measured in median household income, has decreased by just over 32%. The median gross rent of units within the City has stayed about the same, while the value of an owner-occupied home decreased by about 29%. In other words, this table shows that the price to rent or purchase a housing unit has become less expensive than it was in 2000, but spending power has also decreased.

Table 3.12 Median Income and Housing Costs

		Bridgman	Lake Twp	Berrien Co
Median Household Income	2000 (shown in 2014 dollars)	68,512	69,511	53,813
	2015	46,424	67,120	44,993
	% Change	-32.2	-3.4	-16.4
Median Gross Rent	2000 (shown in 2014 dollars)	660	675	669
	2015	660	649	674
	% Change	0.0	-3.9	0.7
Median Owner-Occupied Home Value	2000 (shown in 2014 dollars)	178,061	152,343	131,122
	2014	126,700	108,400	93,300
	% Change	-28.8	-28.8	-28.8

Table 3.13 shows the occupancy and vacancy of housing units within the City of Bridgman. From 2000 to 2015, the City experienced a decrease in occupied residential units. During the same period, the City experienced a slight increase in the number of seasonal units. Within the region, Lake Township and Berrien County have experienced moderate increases in total housing units, non-seasonal vacant housing units and seasonal vacant housing units.

Table 3.13 Housing Occupancy and Vacancy

		City of Bridgman		Lake Township		Berrien County	
		#	% of total units	#	% of total units	#	% of total units
Occupied	2000	1,013	86.7	1,156	86.4	63,569	86.6
	2015	872	79.6	1,218	83.0	61,167	79.7
	Change	-141	-13.9	62	5.4	-2,402	-3.8
Vacant (non-seasonal)	2000	41	3.5	50	3.7	4,617	6.3
	2015	116	10.6	68	4.6	7,555	9.8
	Change	75	182.9	18	36.0	2,938	63.6
Vacant (seasonal)	2000	101	8.6	145	10.8	5,259	7.2
	2015	107	9.8	181	12.3	8,050	10.5
	Change	6	5.9	36	24.8	2,791	53.1
Total Housing Units	2000	1,168	100	1,338	100	73,445	100
	2015	1,095	100	1,467	100	76,772	100
	Change	-73	-6.3	129	9.6	3,327	4.5

Source: U.S. Census Bureau (2000), American Community Survey (2011-2015)

Table 3.14 compares the value of owner-occupied units within Bridgman between 2000 and 2015. There are 11 value ranges shown as rows in the table, while columns show the number and percentage of total owner-occupied units for 2000 and 2014, as well as the change between 2000 and 2014. In general, there are more homes valued within the \$100,000 to \$399,999 range, but fewer homes valued within the less than \$50,000 and \$100,000 ranges. In short, even though the median owner-occupied home value has declined (see previous table), the overall value of homes within the City has increased.

Table 3.14 Owner-Occupied Housing Values

Unit Value (\$)	City of Bridgman						Lake Township						Berrien County					
	2000		2015		Change		2000		2015		Change		2000		2015		Change	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Less than 50,000	16	2.5	4	0.7	-12	-75.0	214	20.1	102	10.1	-112	-52.3	7,961	17.3	5,128	11.8	-2,833	-35.6
50,000 to 100,000	223	34.4	56	9.1	-167	-74.9	256	24.0	58	5.8	-198	-77.3	17,635	38.4	10,002	23.1	-7,633	-43.3
100,000 to 149,999	169	26.1	199	32.4	30	17.8	271	25.4	203	20.1	-68	-25.1	10,602	23.1	9,378	21.6	-1,224	-11.5
150,000 to 174,999	38	5.9	74	12.1	36	94.7	111	10.4	193	19.1	82	73.9	2,877	6.3	4,345	10.0	1,468	51.0
175,000 to 199,999	40	6.2	44	7.2	4	10.0	75	7.0	71	7.0	-4	-5.3	1,827	4.0	2,642	6.1	815	44.6
200,000 to 249,999	52	8.0	108	17.6	56	107.7	57	5.3	142	14.1	85	149.1	1,855	4.0	3,891	9.0	2,036	109.8
250,000 to 399,999	80	12.3	88	14.3	8	10.0	50	4.7	174	17.3	124	248.0	2,197	4.8	5,175	11.9	2,978	135.5
400,000 to 499,999	26	4.0	14	2.3	-12	-46.2	33	3.1	34	3.4	1	3.0	343	0.7	997	2.3	654	190.7
500,000 to 749,999	4	0.6	0	0.0	-4	-100.0	0	0.0	9	0.9	9	-	385	0.8	962	2.2	577	149.9
750,000 to 999,999	0	0.0	15	2.4	15	-	0	0.0	11	1.1	11	-	109	0.2	316	0.7	207	189.9
1,000,000 or more	0	0.0	12	2.0	12	-	0	0.0	11	1.1	11	-	134	0.3	529	1.2	395	294.8
Total:	648	100	614	100	-34	-5.2	1,067	100	1,008	100	-59	-5.5	45,925	100	43,365	100	-2,560	-5.6

CHAPTER 4

COMMUNITY FACILITIES AND SERVICES

The quality, availability and reliability of community services and municipal facilities play an important role in attracting and retaining residents and businesses. Some community facilities (e.g., parks, beaches schools, libraries) contribute to tourism and the quality of life and general character of the community, while other community facilities (e.g., police, fire, energy) support the health, safety and welfare of area residents and contribute to the expansion of new development and businesses. The location and timing of new infrastructure should be planned in advance to minimize costs and promote efficiency of service.

PARKS AND RECREATION

High-quality recreation facilities are important quality-of-life indicators in Bridgman. In addition, facilities like Weko Beach draw in visitors from throughout the region. Bridgman Public Schools provide local spaces for interaction, learning and community building. Bridgman is also fortunate in that Warren Dunes State Park, which is often cited as the most visited state park in Michigan, sits immediately adjacent to the City. Map 4.1 illustrates the location of each park and school recreational resource in Bridgman.

Legion Park. Legion Park is located at the end of Post Court, between Legion Street and Orchard Street. It has an area of just over a half acre and contains picnic tables, a tire swing, a swing set and a dome climber.

Toth Street Municipal Park. Toth Street Municipal Park is located at the end of Toth Street in the center of the City. This seven-acre park features two basketball courts, a covered pavilion, a dog park, a large playscape, a swing set and a walking track.

Weko Beach. Weko Beach and its associated campground encompass about 42 acres along the beautiful shore of Lake Michigan. Weko Beach features an observation deck on top of an adjacent dune, a playground, a boat launch, picnic tables and outdoor grills. Weko Beach also has an outfitter that rents kayaks and paddleboards, and a large beach house with bathrooms and a concession stand. The beach house also has a large meeting room, where many of the public meetings for this master plan were held.

The campground features bathrooms, hot showers and both developed and semi-developed campsites as well as seven small one-room cabins.

Warren Dune State Park. Warren Dunes State Park is located just south of Weko Beach along Lake Michigan. Warren Dunes State Park encompasses 1,952 acres of beautiful sand dunes and beach. With over 1 million visitors annually, Warren Dunes State Park is one of the most visited state parks in Michigan. The highest dune rises



260 feet above the lake, providing spectacular views and an ideal launching stop for hang-gliding. Among other things, the park is open year-round and features six miles of hiking trails and opportunities for both tent and trailer camping.

Bridgman Public Schools. Bridgman Public Schools provide a number of indoor and outdoor recreational facilities that can be used by members of the community throughout the year, when not in use for school-sanctioned athletic events.

Bridgman High School has a baseball/softball field, a football field, a track and tennis courts. In addition, the high school is home to a community Aquatic Center.

Bridgman Middle School features playground equipment, a basketball court, a baseball field and a soccer field.

Bridgman Elementary School features playground equipment, a basketball court, a baseball field and a soccer field.



COMMUNITY FACILITIES

BRIDGMAN PUBLIC LIBRARY

Located at 4460 Lake Street, the Bridgman Public Library is managed by a nine-member Board of Trustees of appointed officials from the City of Bridgman, Lake Charter Township and Chikaming Township. The library's mission is to provide "high-quality resources, innovative programs and excellent customer service." The library is open six days a week throughout the year. With its large community room and cozy outdoor courtyard, the library plays a key role in the community as a place where computers can be used for free by those without home or work access to the Internet, as a space for adults and kids to gather, and as a focal point for community education. In addition, the library is home to the Historical Society and a large section where residents can research local history and view historical photographs.

The library's 2018-2020 Strategic Plan includes four goals (and subsequent strategies) for four topics:

PROGRAMS AND SERVICES

Goal. Create programs and activities that engage children, youth and adults.

STRATEGIES:

1. Continue to offer creative and high-quality children's and youth programs.
2. Offer programming that provides lifelong learning and entertainment for adults.
3. Create programs that engage patrons in shared experiences — within and outside the library.

TEENS

Goal. Create spaces, programs and opportunities for expanded services to teens.

STRATEGIES:

1. Create a sustainable advisory group that will identify new ways to serve teens.
2. Provide dedicated space where teens can comfortably gather, work and learn.
3. Create and promote new teen programs and activities.

COMMUNITY CONNECTIONS

Goal. Connect community residents to resources and services.

STRATEGIES:

1. Collect and share information that will connect residents to organizations and programs that will provide access to basic and enhanced services.
2. Leverage partnerships to expand the Library's ability — and the community's ability — to provide valuable resources to community residents.
3. Maximize social media and other outlets to let residents know about valuable programs and services.

LIBRARY SPACE

Goal. Maximize space to provide the broadest spectrum of services for our patrons.

STRATEGIES:

1. Conduct an assessment of the Library's current space for function and experience.
2. Improve current space and create a welcoming environment for patrons of all ages.
3. Investigate the potential for additional space in the community that would allow the library to offer more programs and services to library patrons.



COMMUNITY GARDEN

The Community Garden is located directly behind the library. This large vibrant space features vegetables and blooming flowers throughout the growing season. Citizens can rent a 4'x8' plot within the garden for \$10 on a first-come, first-served basis from April through November. Map 4.2 illustrates the location of library and community garden.

**EDUCATION FACILITIES****BRIDGMAN PUBLIC SCHOOLS**

The City of Bridgman is served by the Bridgman Public School District. The school district reaches beyond the City's municipal boundaries, serving all or parts of the surrounding townships.

Bridgman Elementary School has approximately 336 students in grades Kindergarten through 4th. Reed Middle School has approximately 289 students in grades 5th through 8th. Bridgman High School has approximately 248 students in grades 9th through 12th.

According to the Michigan Department of Education, Bridgman High School graduates 95% of its students, and 75% of its students go on to enroll in college upon graduation. In addition, 68% of its students in grades 11 and 12 are enrolled in and passing advanced coursework. Furthermore, the percentage of students who demonstrate a proficiency, or are making progress toward proficiency or increasing their proficiency in all subjects on state tests, is significantly higher than the state average and the average of similar schools. Map. 4.2 illustrates the location of the three schools in Bridgman.

The following Bridgman Public School facilities are located within the City of Bridgman:

- Bridgman Elementary School, 3891 Lake Street
- F.C. Reed Middle School, 10254 California Road
- Bridgman High School, 9964 Gast Road



COMMUNITY SERVICES

Police, fire and hospital services are necessary for any community, as they protect the general welfare, help alleviate crime, and provide treatment when needed. The Bridgman Fire Department consists of 14 firefighters and six pieces of fire suppression equipment. Each firefighter is “1” and “2” certified as well as ice and water rescue certified. The fire department also has a first responder unit and can respond to medical emergencies.

The Bridgman Police Department consists of five full-time officers, six part-time officers and four reserve officers. In addition to the Bridgman Police Department, the Michigan State Police coordinates state-level programs, technologies, and specialized services that help enhance local enforcement and emergency response capabilities. The nearest State Police Post is located in Niles.

Bridgman is home to the Southwestern Medical Clinic, part of the Lakeland Health Network. The clinic provides a broad spectrum of services covering family, internal and geriatric medicine. The nearest emergency room is located in St. Joseph.

UTILITIES

WATER FILTRATION PLANT

A safe, secure, plentiful and reliable source of water is vital to a community’s growth and development. Water for drinking, sanitation, fire suppression and industrial uses are the hallmarks of modern society. The first formal water system in Bridgman was constructed in the late 1920s. The current water treatment plant and buried intake were constructed in 1958.

The source of the water for the treatment plant is Lake Michigan. Water is collected by submerged intakes and treated through a comprehensive filtration and chlorination process. Fluoride is added to the water to help maintain the dental health of the community. The water treatment plant can consistently process up to 1.4 million gallons per day.

To ensure that tap water is safe to drink, the U.S. Environmental Protection Agency established regulations to reduce certain contaminants in public water systems. The water supplied by the Bridgman plant has met and continues to meet all federal and state requirements.



RECYCLING

Recycling is offered to Bridgman residents by Republic Services. Recycling in Bridgman is on a four-week schedule.

POWER

Power and electricity in Bridgman is provided by the nearby Cook Nuclear Power Plant, along Lake Michigan. The plant is owned and operated by American Electric Power. The construction permit for the plant was granted by the Atomic Energy Commission in 1969. The plant was named for the late Donald C. Cook, a Michigan native and former chairman of the board of AEP. Unit 1 began commercial operation in August of 1975, and Unit 2 in July of 1978. Construction cost for both units was \$1.3 billion. With both Cook units at full power, more than 2,100 megawatts of electricity are generated — enough for more than 1.5 million homes.

TRANSPORTATION

A good transportation network provides multiple ways for people to move around a community and connect to surrounding communities and the larger region. A transportation network with a variety of transportation options has a number of benefits. For example, a well-designed grid system of streets can help disperse traffic congestion and ease the load of higher capacity streets. Trails, pathways and sidewalks support active and healthier lifestyles and reduce the need to use cars for short trips. The following section summarizes the transportation network in Bridgman.

REGIONAL TRANSPORTATION PLANNING

While the focus of this section is on the local transportation network within the City, it is important to note that transportation planning in southwest Michigan also happens at the regional level. The Southwest Michigan Planning Commission (SWMPC) is the Metropolitan Planning Organization (MPO) that coordinates the metropolitan transportation planning program for the region, including the City of Bridgman.

ROADS

Bridgman's road network is largely laid out in a grid pattern in the neighborhoods near downtown, providing residents and visitors with multiple ways to navigate around the City. Other parts of the City are served by a well-connected system of roads, linking outlying neighborhoods and rural areas.

ROAD CLASSIFICATIONS

One approach to gaining a better understanding of the City's road network is to classify each road based on the role or function it plays. The United States Department of Transportation classifies all roads by their transportation function. This system is called the National Functional Classification (NFC) System. Map 4.3 shows the road classifications for the City of Bridgman. Road classifications in the City include:

PRINCIPAL ARTERIALS

Roads in this classification tend to serve major centers of metropolitan areas and provide mobility for populations in urban and rural areas.

MINOR ARTERIALS

Minor arterials are similar in function to principal arterials, except they carry trips of shorter distance and to lesser traffic destinations.

COLLECTORS

Collector roads tend to provide more access to property than do arterials. Collectors also funnel traffic from residential or rural areas to arterials.

LOCAL ROADS

Local roads primarily provide access to property.

MAJOR ROADS

Bridgman is home to two primary roads which carry heavy traffic volumes, especially in the summer months.

I-94

I-94 is the primary interstate highway that bisects the City of Bridgman. According to 2017 average daily traffic counts from the Michigan Department of Transportation, I-94 carries approximately 43,500 vehicles a day through the City.

RED ARROW HIGHWAY

Red Arrow Highways runs north and south through Bridgman, parallel to I-94, providing direct access to commercial businesses throughout the region. According to 2009 average daily traffic counts from the Michigan Department of Transportation, Red Arrow Highway carries approximately 6,000 to 8,000 vehicles a day through the City.



CHAPTER 5

Placemaking

Every community is unique in one way or another. For some communities, it's their proximity to a lake or an active tourist area. For others, it's their active downtown, vibrant festivals, or walkable neighborhoods. Each attribute is part of a collage of place-based community assets that shape the identity, quality of place and livability of the community. Bridgman is fortunate to have a number of unique community assets that help shape its character and define its sense of place.

WHY IS PLACEMAKING IMPORTANT?

Placemaking is not a new concept or community development tool in Bridgman. In fact, the City has been actively pursuing place-based projects for many years, including downtown streetscaping and wayfinding signage to name a few. Local business owners have also invested in place-based amenities (e.g., outside seating). Each of these projects, along with others, make Bridgman a distinctly interesting and unique place.

"Place" has always been an important element in sustaining long-term economic activity. It used to be that prosperous places were solely based on their proximity to natural resources (e.g., navigable waterways, extractable minerals). Navigable waterways and industrial areas are still important. However, in the 21st century, prosperous places are also based on their ability to attract entrepreneurial and knowledge-based workers. More and more, these knowledge-based workers (along with most everyone else) want to live in communities with interesting and vibrant settings, outdoor recreational amenities, entertainment, cultural diversity and walkable neighborhoods. In essence, these placemaking attributes make up part of a new strategy for attracting and retaining talented workers and establishing a knowledge-based economy.

What is Placemaking?

Placemaking is both a process and tool to collectively design and manage elements of the public realm (markets, waterfronts, squares, streets, parks, neighborhoods and downtowns, etc.) to create places that are appealing, accessible and comfortable, and that support social activity. Placemaking helps to define the pattern and use of the built environment and the manner and ease in which people are able to access, connect and move around in it. Placemaking can also help build and enhance sense-of-place by creating spaces that encourage social interaction and support interesting activities.



PLACEMAKING ELEMENTS

During his first term and continuing throughout his administration, Michigan Governor Rick Snyder made placemaking a key platform in his plans to revitalize the state. His administration asked each community to make a more concerted effort and take a more deliberate approach to placemaking (and note that incoming Governor Gretchen Whitmer's Making Michigan the Place to Be campaign platform has also pledged to invest in placemaking).

In response, a number of statewide municipal organizations established placed-based initiatives (e.g., MIPLACE Initiative) to help cities better think about how to apply placemaking elements in local projects and position themselves for success in today's economy.

This plan highlights how the City of Bridgman can continue to implement elements of one such initiative: the Michigan Municipal League's Eight Essential Assets of 21st Century Communities.

1. Physical Design and Walkability

Market analysis shows that today's young professionals, Baby Boomers and empty nesters want to live in communities with walkable neighborhoods that are connected to a walkable downtown with access to parks, culture and entertainment. Most of the neighborhoods in and around downtown Bridgman are walkable, featuring an extensive system of sidewalks. The sidewalk system even extends all the way to Weko Beach, providing a pedestrian connection between two of Bridgman's most active and attractive assets. Downtown Bridgman has wide sidewalks that encourage social interaction around public seating areas and restaurants and breweries with outdoor seating. The City should continue to explore ways in which it can expand its pedestrian infrastructure in areas of the City that are not already served by sidewalks and connect with Warren Dunes State Park through a system of trails or pathways. The City should also continue to encourage other/future restaurants to include outdoor seating areas.

2. Green Initiatives

Green initiatives are critical for any community to be viable in today's economy. The way cities use energy and natural resources impacts quality of life and the financial bottom line. Bridgman continues to explore ways to implement sustainable land-use practices, including low-impact development techniques like swales to better manage stormwater runoff. As discussed in more detail in Chapter 7, the City will continue to study how sustainable practices may better protect areas within the City from flooding and the impacts of climate change.

3. Cultural Economic Development

Arts and culture are essential components of a thriving, knowledge-based economy. A healthy creative sector attracts and retains residents and businesses, and produces economic benefits including jobs, a stronger tax base, downtown and neighborhood development, and tourism. The City should continue to consider ways in which it can work with local and regional artists to display art pieces at key areas within the City, especially within the downtown and at Weko Beach. In addition, the City should continue to support events like the summer concert series, Makers Trail Festival and Beach Brewery Festival at Weko Beach.

4. Entrepreneurship

Growing knowledge-based jobs in “ones and twos” creates sustainable economies in the 21st century. Strategies that solely focus on seeking large manufacturers and big-box retailers overlook the positive impact that entrepreneurs and small businesses have on local communities. The City of Bridgman will continue to support the entrepreneurial initiatives of the Greater Bridgman Area Chamber and Growth Alliance. The City will also continue to support efforts to create desirable neighborhoods, affordable housing, and active downtown and community assets that attract talented and entrepreneurial workers.

5. Multiculturalism

Creating and sustaining a genuine commitment to diversity and multiculturalism is vital to attracting key demographics and global businesses. Today’s fluid, mobile and global workforce is seeking out places that embrace people of all religions, ethnicities, national origins and races. Bridgman will continue to work with community partners to support a more diverse community by providing affordable housing and continuing education opportunities.

6. Messaging and Technology

Internet and communication technologies are connecting people and allowing them to share information in the virtual world in unprecedented ways. Social networking application like Twitter, Facebook, Instagram, and YouTube, as well as communication platforms like blogs and Wikis, can build stronger relationships between people and local government. The City of Bridgman currently has a Facebook and Instagram page on which people have placed pictures and comments. The City should explore finding resources to assist in managing and maintaining all communication platforms and explore additional communication technologies as a mode to disseminate information about the City (e.g., initiatives, meetings, alerts, etc.) to residents and visitors.





7. Transit

Developing effective transit options is an important tool for attracting and retaining residents, workers and businesses. Research shows that people across the nation are choosing to reside in communities that offer a variety of transportation options, have easy access to the places they live, work and play, and provide opportunities for travel without having to rely on a car. Given its predominantly rural setting and its relatively small population, Bridgman is not likely to be served by an intensive public transportation system. However, as previously mentioned, Bridgman is a walkable community. The City should continue to explore ways in which it can expand its pedestrian infrastructure in areas of the City that are not already served by sidewalks. The City should also consider alternative methods for getting people between downtown and Weko Beach.

8. Education

Good schools play an important role in the community. They can help in retaining and attracting families, fortify long-term home ownership, increase housing values, and contribute to the culture and sense of place of the community. Bridgman is fortunate to have a very good and well supported school system. The City of Bridgman will continue to support and explore partnerships with the Bridgman Public Schools.



CHAPTER 6

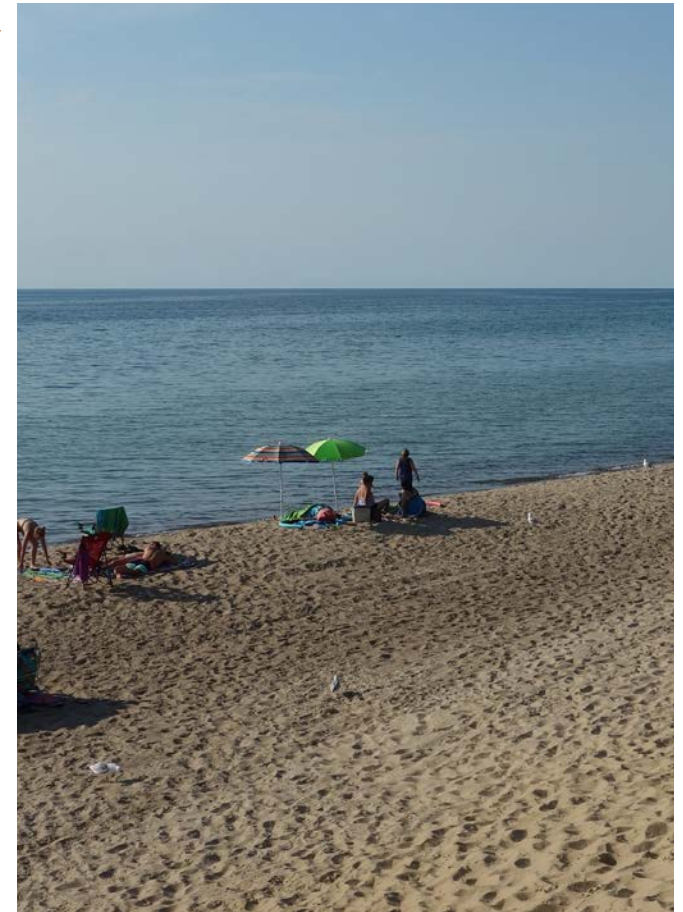
Planning for Coastal and Climate Trends

THE IMPORTANCE OF PLANNING IN COASTAL COMMUNITIES

It is no secret the Great Lakes are one of the most unique and precious environmental features in the world. In fact, “the Great Lakes basin contains more than 20% of the world’s surface freshwater supplies and supports a population of more than 30 million people.”⁷ Michigan is home to nearly 3,300 miles of Great Lakes shoreline, with 36,000 miles of rivers and streams, and 11,000 inland lakes.⁸

Yet in general, riparian land throughout Michigan is not adequately protected from development pressures.⁹ Coastal communities especially have an important role to play in protecting the Great Lakes. In 2001, the Michigan Department of Environmental Quality acknowledged “fragmentation of coastal habitats, loss of agricultural and forest lands, increased impervious surfaces and resulting stormwater runoff, and the increased development in coastal hazard areas, wetlands, and Great Lakes Islands, could be improved through better coastal land use planning.”¹⁰

Planning for coastal areas at the local level requires knowledge of both local conditions and state and federal regulations. This chapter aims to address these challenges for the Bridgman community and provide clear, well-founded recommendations for future land use planning.



⁷ Mackey, S. D., 2012: Great Lakes Nearshore and Coastal Systems. In: U.S. National Climate Assessment Midwest Technical Input Report. J. Winkler, J. Andresen, J. Hatfield, D. Bidwell, and D. Brown, coordinators.

⁸ Ardizzone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.

⁹ As cited by Norton 2007- Michigan Department of Environmental Quality. 2001. 309 Enhancement Grants Assessment/Strategy. Lansing, MI: DEQ Coastal Management Program.

¹⁰ Ibid.

OVERVIEW OF COASTAL DYNAMICS AND THE GREAT LAKES

The Great Lakes function differently than other inland water bodies and tidal oceans. Understanding these dynamics can help Bridgman plan for naturally occurring changes along the shoreline.

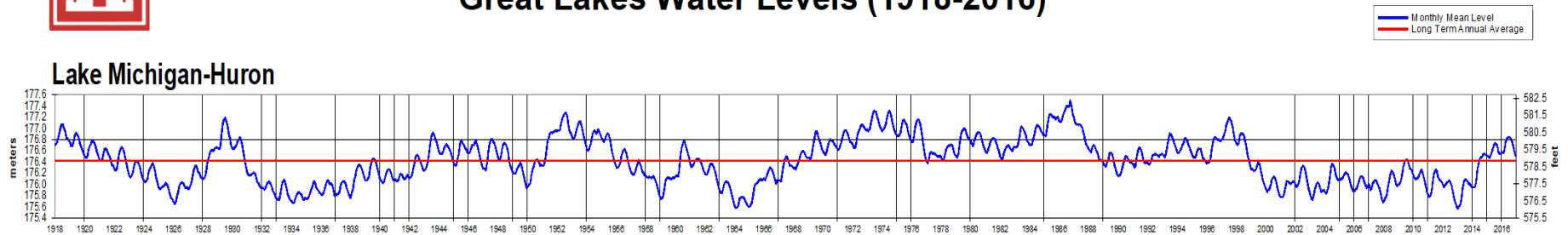
CHANGING WATER LEVELS OF THE GREAT LAKES

Great Lakes water level changes result not from the moon’s gravitational pull, but from cyclical changes in rainfall, evaporation, and river and groundwater inflows.¹¹ These factors work together to raise and lower the water levels of the Great Lakes in small increments daily, and larger increments seasonally and over the course of years and decades. Long-term water levels fluctuate by multiple feet. Figure 6.1 illustrates the water levels of Lake Michigan from 1918 to 2016 (Lake Michigan and Lake Huron are technically considered one lake).

Figure 6.1 Lake Michigan-Huron Water Level Changes, 1918-2016



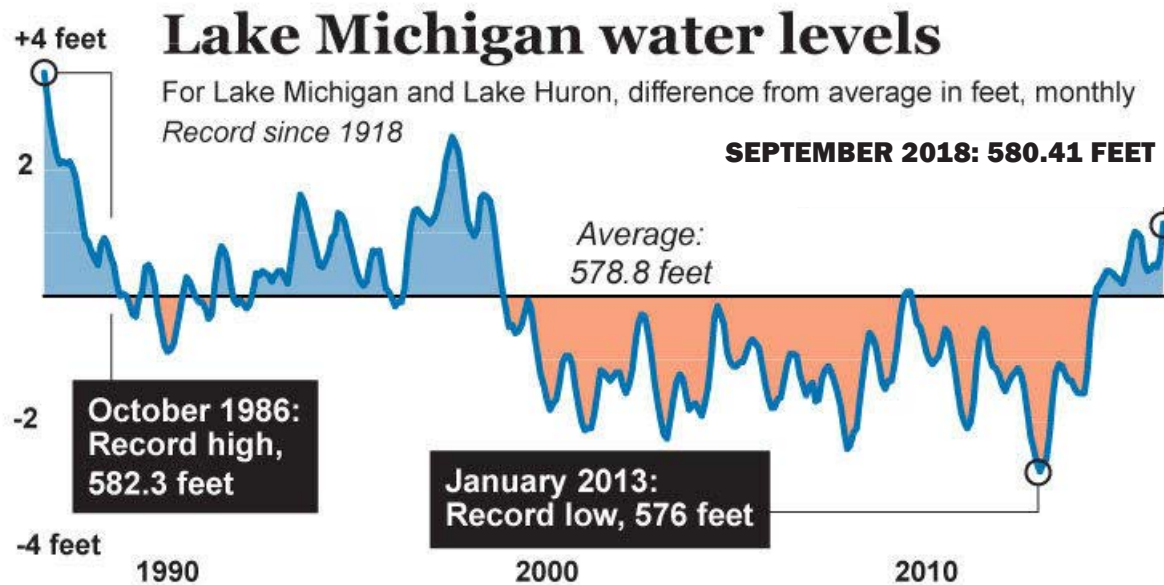
Great Lakes Water Levels (1918-2016)



¹¹ Norton, Richard K. , Meadows, Lorelle A. and Meadows, Guy A.(2011) ‘Drawing Lines in Law Books and on Sandy Beaches: Marking Ordinary High Water on Michigan’s Great Lakes Shorelines under the Public Trust Doctrine’, Coastal Management, 39: 2, 133 — 157, First published on: 19 February 2011 (iFirst)

The Great Lakes are in a period of rising lake levels (see Figure 6.2). Since the early 2000s, water levels have remained low, but historical patterns over the last century indicate higher water levels are sure to return.¹² Lake Michigan’s water level in September of 2018 averaged 580.41 feet, which is equal to the water levels in the fall of 1998. Based on current conditions, water levels on Lake Michigan over the next year are predicted to be lower, but still about a foot above the long-term average¹³ (see Figure 6.3).

Figure 6.2 Lake Michigan Water Levels, 1986-2018



Source: Great Lakes Environmental Research Laboratory

@ChiTribGraphics

How are Great Lakes Water Levels Measured?

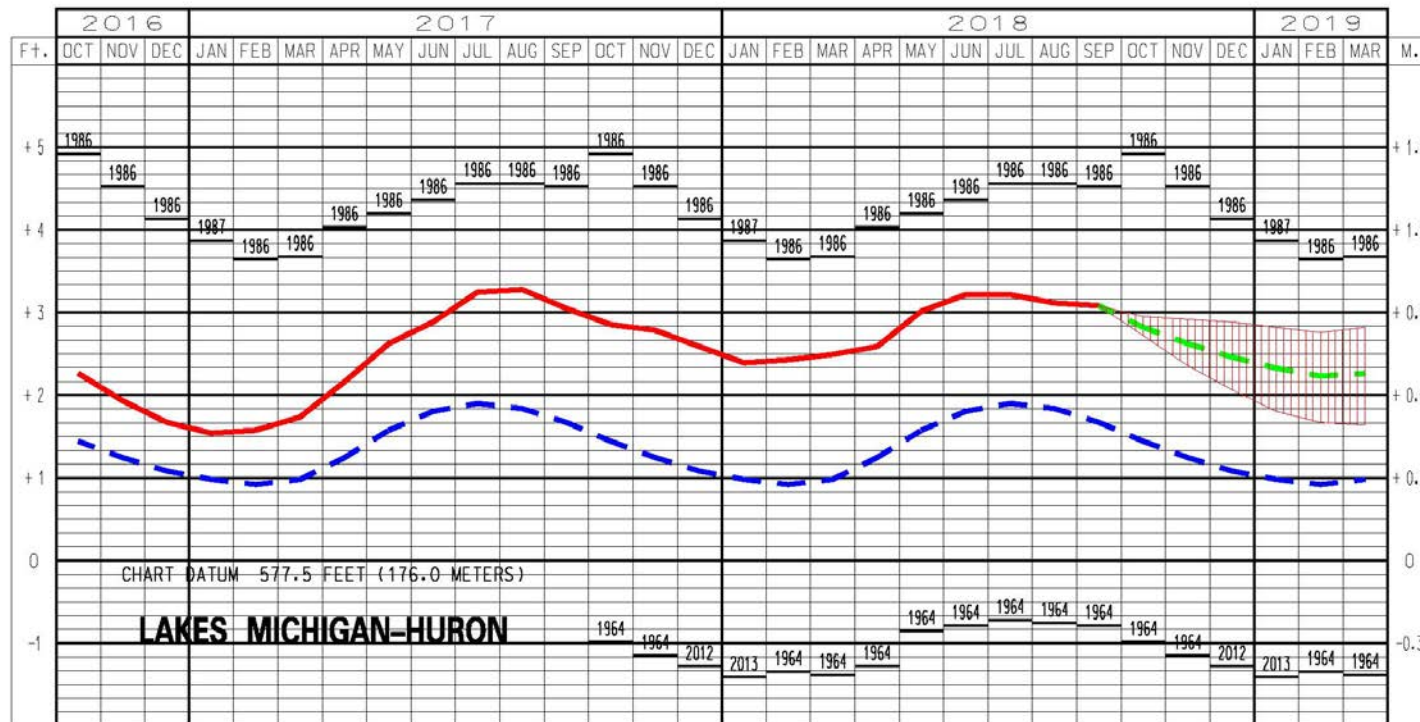
Great Lakes water levels are measured via the International Great Lakes Datum (IGLD), a reference system of benchmarks at various locations on the lakes that approximate sea level. Great Lakes water levels are expressed as measurements above this reference elevation.

¹² Meadows, Guy A., and Meadows, Lorelle A., Wood, W.L., Hubertz, J.M., Perlin, M. "The Relationship between Great Lakes Water Levels, Wave Energies, and Shoreline Damage." Bulletin of the American Meteorological Society Series 78: 4. (1997): 675-683. Print.

¹³ <http://www.glerl.noaa.gov/data/dashboard/GLWLD.html>

The changes in water levels are not solely responsible for the movement of the shoreline landward and lakeward over time. The velocity and height of waves, erosion of shorelines, and pace of changing water levels also contribute to coastal dynamics on the Great Lakes.

Figure 6.3 Lake Michigan-Huron Water Level Prediction



WAVE ENERGY AND HEIGHT

The Great Lakes experience high energy waves and wave setup along the coastline. High energy waves are high in speed and strong in intensity and are primarily created as fast winds move across the surface of the water for extended distances.¹⁴ Wave setup is the height of the water as waves reach the shore. High wave setup results as regional storms create high winds on the Great Lakes.¹⁵ Powerful and tall waves can quicken the rate of erosion and damage structures near the shoreline.¹⁶ In Bridgman, the prevailing winds are predominantly from the west and north.

EROSION

The shorelines of Lake Michigan are mostly made of gravel and sands that easily erode during times of high energy waves.¹⁷ Coastal erosion can flood and damage infrastructure along bluffs and beaches. Erosion is caused mainly by storms and winds, not necessarily by rising lake levels.¹⁸

QUICKLY CHANGING CONDITIONS

The Great Lakes are contained in gradually shifting and tilting basins. This tilting results as the Earth slowly decompresses and rebounds from the immense weight of the glaciers that created the Great Lakes.¹⁹ This shifting causes water levels to change more quickly in some places than others, because the shape of the water basin varies along the coast.²⁰ This attribute of the Great Lakes makes it difficult to predict the pace of shoreline movement. Therefore, it is safest to plan for great variability and rapid change in water levels.²¹

¹⁴ National Oceanic and Atmospheric Administration. "Coastal Currents." Ocean Service Education. NOAA, 25 March 2008. Web. Accessed July 2015.

¹⁵ Norton, Richard K., Meadows, Lorelle A. and Meadows, Guy A. (2011) 'Drawing Lines in Law Books and on Sandy Beaches: Marking Ordinary High Water on Michigan's Great Lakes Shorelines under the Public Trust Doctrine', Coastal Management, 39: 2, 133 — 157, First published on: 19 February 2011 (iFirst)

¹⁶ Ibid.

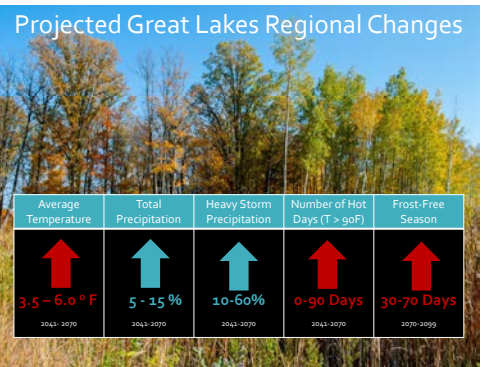
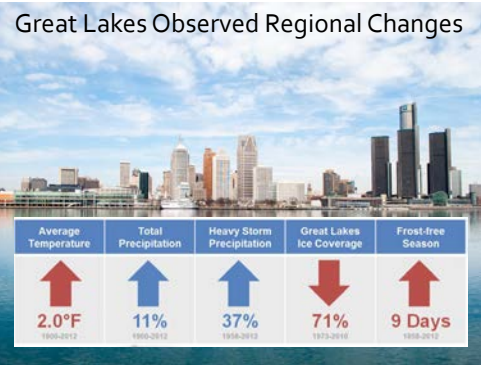
¹⁷ Ibid.

¹⁸ Meadows, Guy A., and Meadows, Lorelle A., Wood, W.L., Hubertz, J.M., Perlin, M. "The Relationship between Great Lakes Water Levels, Wave Energies, and Shoreline Damage." Bulletin of the American Meteorological Society Series 78: 4. (1997): 675-683. Print.

¹⁹ Dorr, J. A., and D. F. Eschman. 1970. Geology of the Great Lakes. Ann Arbor: University of Michigan Press.

²⁰ Wilcox, D.A, Thompson, T.A., Booth, R.K., and Nicholas, J.R., 2007, Lake-level variability and water availability in the Great Lakes: U.S. Geological Survey Circular 1311, 25 p

²¹ Ibid.



CLIMATE CHANGE AND THE GREAT LAKES

Powerful waves, erosion, and changing shorelines on the Great Lakes have been well-documented throughout history, and each has implications for planning efforts along the coast. Climate change, however, augments these natural processes, and requires preemptive planning in coastal communities. This section will discuss climatologist predictions of increased precipitation and storminess in the Great Lakes region, variable lake water levels, and rising water temperature. First, it is important to understand the global context of climate disruption.

GLOBAL CHANGES IN CLIMATE

Climate and weather are directly related, but not the same thing. Weather refers to the day-to-day conditions in a particular place, like sunny or rainy, hot or cold. Climate refers to the long-term patterns of weather over large areas. When scientists speak of global climate change, they are referring to changes in the generalized, regional patterns of weather over months, years and decades. Climate change is the ongoing change in a region’s general weather characteristics or averages. In the long term, a changing climate will have more substantial effects on the Great Lakes than individual weather events.

Evidence collected over the last century shows a trend toward warmer global temperatures, higher sea levels, and less snow cover in the Northern Hemisphere. Scientists from many fields have observed and documented significant changes in the Earth’s climate.²² Warming of the climate system is unequivocal and is now expressed in higher air and ocean temperatures, rising sea levels, and melting ice.²³

To help predict what the climate will be in the future, scientists use computer models of the Earth to predict large-scale changes in climate. These General Circulation Models (GCM) have been improved and verified in recent years, resulting in relatively reliable predictions for climate changes over large regions.²⁴ Scientists downscale these techniques to predict climate change for smaller regions.

²² Intergovernmental Panel on Climate Change. (2007). Observed changes in climate and their effects. Web. Accessed July 2015.

²³ Ibid.

²⁴ Intergovernmental Panel on Climate Change (2013). What is a GCM? Web. Accessed July 2015.

CLIMATE CHANGE ON THE GREAT LAKES

The Great Lakes Integrated Sciences and Assessments Program (GLISA) is a consortium of scientists and educators from the University of Michigan and Michigan State University that provides climate models for the Great Lakes Region in support of community planning efforts like this Master Plan. According to GLISA, the Great Lakes region experienced a 2.3 degree Fahrenheit increase in average air temperatures from 1900 to 2012.²⁵ An additional increase of 1.8 to 5.4° F in average air temperatures is projected by 2050. Although these numbers appear relatively small, they are driving very dramatic changes in Michigan's climate and greatly impact the Great Lakes.²⁶

The National Climate Assessment for 2009 included a number of illustrations to help us understand the extent and character of anticipated climate change impacts.²⁷ One of these illustrations, Figure 9.4, shows Michigan under several emissions scenarios, each leading to changes in Michigan's climate. Just by maintaining current emission levels, Michigan's climate will feel more like present-day Arkansas or Oklahoma by the end of the century.²⁸

INCREASED PRECIPITATION AND STORMINESS

There is strong consensus among climate experts that storms, greater in number and intensity, will occur in the Great Lakes region.²⁹ This is already happening as "the amount of precipitation falling in the heaviest 1% of storms increased by 37% in the Midwest and 71% in the Northeast from 1958 to 2012."³⁰ As storms drop more precipitation and generate stronger sustained winds, the Great Lakes will see stronger and higher waves.³¹ In addition to direct damage caused by storms, sustained increases in the number of storms and their intensity can both directly and indirectly pollute waters by overloading sewage and stormwater capabilities.³² Increases in the intensity of storms also quickens the pace of erosion on Great Lakes shorelines. In fact, the Federal Emergency Management Agency (FEMA) projects approximately 28% of structures within 500 feet of a Great Lakes shoreline are susceptible to erosion by 2060.³³

²⁵ Great Lakes Integrated Sciences and Assessments (2015). Temperature. Web. Accessed July 2015.

²⁶ Ibid.

²⁷ U.S. Global Change Research Program. Global Climate Change in the United States, 2009. Cambridge University Press, Cambridge, MA.

²⁸ Ibid.

²⁹ Ibid.

³⁰ Mackey, S. D., 2012: Great Lakes Nearshore and Coastal Systems. In: U.S. National Climate Assessment Midwest Technical Input Report. J. Winkler, J. Andresen, J. Hatfield, D. Bidwell, and D. Brown, coordinators.

³¹ Great Lakes Integrated Sciences and Assessments. Climate Change in the Great Lakes Region. GLISA, 2014. Web. Accessed July 2015.

³² Cruce, T., & Yurkovich, E. (2011). Adapting to climate change: A planning guide for state coastal managers—a Great Lakes supplement. Silver Spring, MD: NOAA Office of Ocean and Coastal Resource Management.

³³ The Heinz Center. (2000). Evaluation of Erosion Hazards. Web. Accessed July 2015.

VARIABILITY OF LAKE WATER LEVELS

The natural ups and downs in the water levels of Lake Michigan will continue regardless of the impacts of climate change.³⁴ However, climate change is likely to augment this natural process resulting in more variable water levels as warmer air temperatures result in fewer days of ice cover and faster evaporation.³⁵ In other words, lake levels will rise and fall faster and with less predictability than in the past. Fortunately, much of Michigan's coastal infrastructure was built in previous decades during times of high water levels.³⁶ However, fast rising waters can erode shorelines, damage infrastructure, and cause extensive flooding in inland rivers.³⁷ When lake levels fall, access to infrastructure like docks may be restricted and navigation hazards in shallow waters may be exposed. Low lake levels pose a threat to coastal vegetation and can reduce the pumping efficiency of drinking water intake pipes.³⁸ Additional ramifications of changing lake levels include a drop in water supply,³⁹ restricted fish habitats,⁴⁰ more invasive species,⁴¹ faster erosion, and an overall decline in beach health.⁴² Climate change is likely to augment the natural highs and lows of lake levels, causing more variability and a faster rate of change, making each of these potential ramifications both more likely and less predictable.

WATER TEMPERATURE

Climatologists predict there will be fewer days below freezing in Michigan and other Great Lakes states. As temperatures remain warm for a greater part of the year, the winter season will shorten and the lake ice cover that accompanies winter weather will decline. Lake ice cover allows heat radiation from the sun to be reflected, so when ice declines, the surface water temperature will increase as more heat is absorbed by the water. The ice coverage on the Great Lakes and Lake St. Clair declined by 71% from 1973 to 2010, and ice covers the lake for an average of 15 fewer days each year.⁴³

The associated impacts of rising water temperature include changes to where fish and other aquatic animals can live, increased vulnerability to invasive species, and increased risk of algae blooms.⁴⁴ Rising water temperature also enables winds to travel faster across the surface of the lake, increasing the vulnerability of coastal communities to damaging waves as storms and winds increase.⁴⁵ Lastly, ice cover protects the shoreline during winter storms. With less ice cover, the shoreline is more susceptible to erosion and habitat disruption.

³⁴ Dinse, Keely. Preparing for Extremes: The Dynamic Great Lakes. Michigan Sea Grant. Web. Accessed July 2015.

³⁵ Cruce, T., & Yurkovich, E. (2011). Adapting to climate change: A planning guide for state coastal managers—a Great Lakes supplement. Silver Spring, MD: NOAA Office of Ocean and Coastal Resource Management.

³⁶ Dinse, Keely. Preparing for Extremes: The Dynamic Great Lakes. Michigan Sea Grant. Web. Accessed July 2015.

³⁷ Ibid.

³⁸ Ibid.

³⁹ Cruce, T., & Yurkovich, E. (2011). Adapting to climate change: A planning guide for state coastal managers—a Great Lakes supplement. Silver Spring, MD: NOAA Office of Ocean and Coastal Resource Management.

⁴⁰ Ibid.

⁴¹ Ibid.

⁴² Dinse, Keely. Preparing for Extremes: The Dynamic Great Lakes. Michigan Sea Grant. Web. Accessed July 2015.

⁴³ Austin, J. A., & Colman, S. M. (2007). Oceans- L06604 - Lake Superior summer water temperatures are increasing more rapidly than regional air temperatures: A positive ice-albedo feedback (DOI 10.1029/2006GL029021). Geophysical Research Letters, 34, 6.)

⁴⁴ Dinse, Keely. Preparing for Extremes: The Dynamic Great Lakes. Michigan Sea Grant. Web. Accessed July 2015.

⁴⁵ Cruce, T., & Yurkovich, E. (2011). Adapting to climate change: A planning guide for state coastal managers—a Great Lakes supplement. Silver Spring, MD: NOAA Office of Ocean and Coastal Resource Management.

CHAPTER 7

DEFINING VULNERABILITY IN THE BRIDGMAN COMMUNITY

The effects of climate change have been felt by everyone. With planning and preparation, communities can weather the storms and recover, becoming even better places to live and thrive. Through community-wide planning, resilient cities actively cultivate their abilities to recover from adverse situations and events, working to strengthen and diversify their local economies and communication networks, increase social capital and civic engagement, enhance ecosystem services, improve human health and social systems, and build local adaptive capacity.

BUILDING COMMUNITY RESILIENCE

As defined by the Urban Sustainability Directors Network, community resilience is the ability of a community to anticipate, accommodate and positively adapt to or thrive amidst changing climate conditions or hazard events and enhance quality of life, reliable systems, economic vitality and conservation of resources for present and future generations. The Rockefeller Foundation emphasizes equity as an important component of resilience, stating that community resilience is the capacity of people — particularly the poor and vulnerable — to survive and thrive no matter what stresses or shocks they encounter. Communities that are resilient are able to learn from adversity and adapt quickly to change. In general, the most important characteristics of community resilience are: (1) strong and meaningful social connections, (2) social and economic diversity, (3) innovation and creative problem-solving capacity, and (4) extensive use of ecosystems services. The Rockefeller Foundation has identified 12 indicators that make for a resilient community (see inset). However, it is important to acknowledge that Bridgman is unique, and not all of these indicators or characteristics may be necessary for Bridgman to be “resilient.”

The Bridgman planning process aimed to increase community resilience by fostering civic engagement and improving communication and cooperation between local officials, citizens and neighboring jurisdictions and state agencies. To improve economic resilience, Bridgman and communities throughout Berrien County and Southwest Michigan should work to encourage and support local production of goods and supplies, increasing self-reliance and reducing the flow of funds out of the community. Zoning policies and programs to encourage local investing and entrepreneurship can be helpful in building both employment and production capacity. Local investments, consumption of locally-produced products, and locally-owned businesses all help to diversify the community’s economy, giving it greater resilience.

The following is a community vulnerability assessment focused on Bridgman. This assessment begins with an overview of regional climate trends and predicts societal impacts, then transitions to detailed assessments of the community’s vulnerabilities to extreme heat and flooding events. Although the

ACCORDING TO THE ROCKEFELLER FOUNDATION, A RESILIENT COMMUNITY OFTEN HAS...

1. Minimal human vulnerability
2. Diverse livelihoods and employment
3. Adequate safeguards to human life and health
4. Collective identity and mutual support
5. Social stability and security
6. Availability of financial resources and contingency funds
7. Reduced physical exposure and vulnerability
8. Continuity of critical services
9. Reliable communications and mobility
10. Effective leadership and management
11. Empowered stakeholders
12. Integrated development planning

assessment is concentrated on these two specific types of events, many of the considerations and societal impacts identified would be present in other stresses and shocks within the community (e.g., winter storm).

In completing the assessment, factors such as demographics, environmental conditions, locations of critical facilities and essential services, and the built environment are considered. This assessment informs recommendations for reducing identified vulnerabilities through policies, programs and projects, which will inevitably lead to a more resilient community.

CLIMATE VARIABILITY

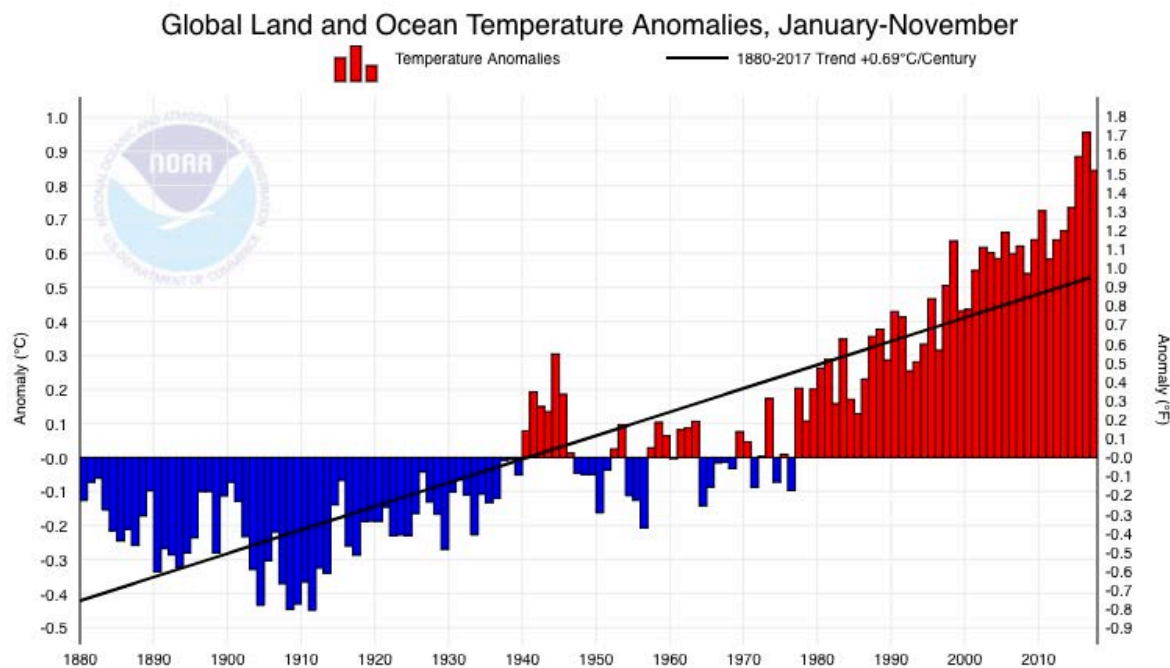
Climate and weather are directly related, but are not the same thing. “Weather” refers to the day-to-day conditions in a particular place: sun or rain, hot or cold. “Climate” refers to long-term weather patterns over regions or large geographic areas. When scientists speak of global climate change, they are referring to generalized, global

patterns of weather over months, years and decades.

To help predict what the climate will be in the future, scientists use three-dimensional computer models of the Earth’s atmosphere, oceans and land surfaces to understand past trends and predict future changes. These General Circulation Models (GCMs) have been improved and verified in recent years, resulting in relatively reliable predictions for climate changes over large regions. To help predict climate trends at the Earth’s surface for smaller regions, scientists apply downscaling techniques.

As stated by the Intergovernmental Panel on Climate Change (IPCC), significant changes in the Earth’s climate have been observed and thoroughly documented.⁴⁶ Warming of the climate system is unequivocal and is now evident in average air and ocean temperatures, rising sea levels and the melting of ice. Figure 7.1 provides a summary of observed changes in global temperatures over the last 137 years.⁴⁷ The graph in Figure 7.2 presents observed changes in the average amount of ice cover on the Great Lakes. Overall, there has been a 71% reduction in the extent of Great Lakes ice cover between

Figure 7.1



⁴⁶ International Panel on Climate Change 2014 Synthesis Report. 2014 <http://www.ipcc.ch/>

⁴⁷ NCDC/NEDIS/NOAA www.ncdc.noaa.gov

1973 and 2010. In addition, the amplitude of the variability of ice coverage has increased from year to year (see Figure 7.3). For example, in the winter of 2015, 88% of the Great Lakes were covered in ice. In the winter of 2016, just 33% of the Great Lakes were covered in ice. The decrease in annual ice cover and the increase in ice cover variability is another strong indicator of change.

The Great Lakes Integrated Sciences and Assessments Program (GLISA) is a consortium of scientists and educators from the University of Michigan and Michigan State University funded by the National Oceanic and Atmospheric Administration (NOAA) to provide climate resources, including downscaled models, for communities across the Great Lakes Region. According to GLISA, the Great Lakes Region has already experienced a 2.0° F increase in average temperatures. An additional increase of 1.5° to 4.0° F in average temperatures is projected by 2040. Although these numbers seem relatively small, they are driving very dramatic changes in Michigan.

Based on the most recent models, the climate of Bridgman will continue to warm, with greater increases in average temperatures during the winter months and at night. There are a variety of weather impacts expected with this change in average temperatures. Some of the potential impacts of climate change in Bridgman include:

- Storms are expected to become more frequent and more severe
- Increases in winter and spring precipitation
- Less precipitation as snow and more as rain
- Less winter ice on lakes
- Extended growing season (earlier spring/later fall)
- More flooding events with risks of erosion
- Increases in frequency and length of severe heat events (heat waves)
- Increased risk of drought, particularly in summer

It is important to note that increased flooding and more intense drought are not mutually exclusive nor contradictory. In the Great Lakes Region, scientists are predicting more intense rain events in the fall and winter along with more intense droughts in the summer months.

Figure 7.2

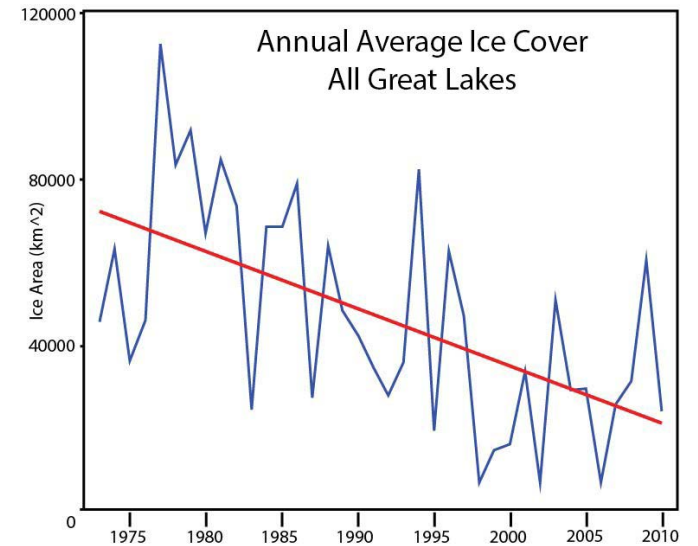


Figure 7.3

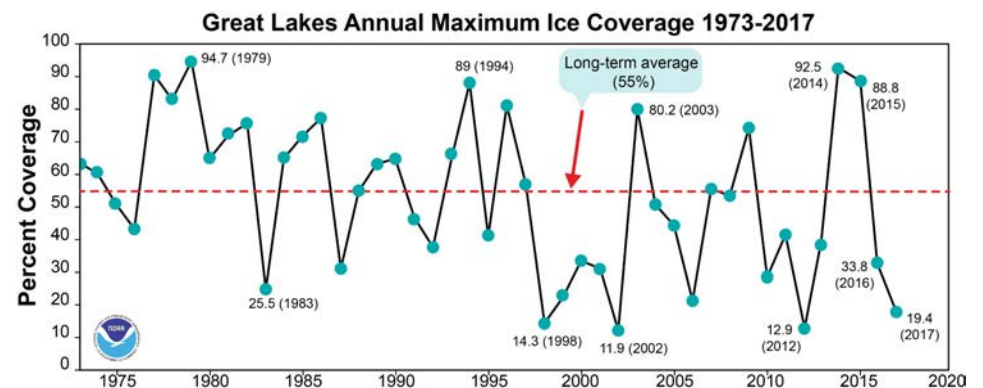
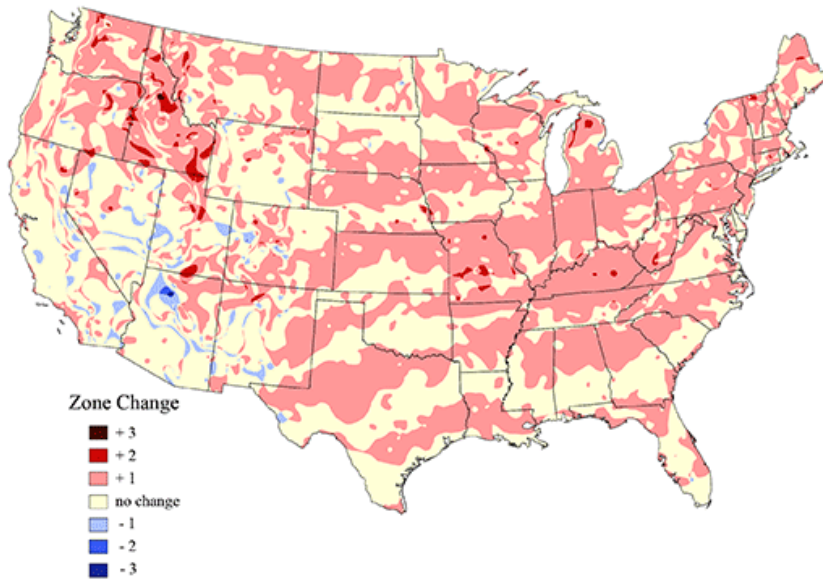


Figure 7.4

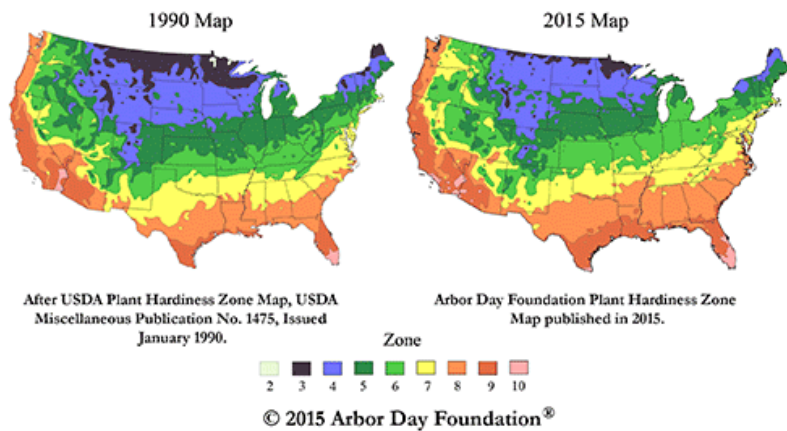
Differences Between 1990 USDA Hardiness Zones and 2015 Arborday.org Hardiness Zones



“FUTURE CROP YIELDS WILL BE MORE STRONGLY INFLUENCED BY ANOMALOUS WEATHER EVENTS THAN BY CHANGES IN AVERAGE TEMPERATURE OR ANNUAL PRECIPITATION. COLD INJURY DUE TO A FREEZE EVENT AFTER PLANT BUDDING CAN DECIMATE FRUIT CROP PRODUCTION, AS HAPPENED IN 2002, AND AGAIN IN 2012, TO MICHIGAN’S \$60 MILLION TART CHERRY CROP.”

THIRD U.S. NATIONAL CLIMATE ASSESSMENT - 2014

These changes in climate could have a number of both positive and negative effects on the Bridgman community. For example, an extended growing season could help support new crops and increase crop yields for area farmers. On the other hand, the highly variable weather conditions — such as severe storms and flooding mixed with summer droughts — present big challenges to farming. Much of the U.S. has been warmer in recent years, and that affects which plants grow best in various regions. The Arbor Day Foundation completed an extensive updating of U.S. Hardiness Zones based on data from 5,000 National Climatic Data Center cooperative stations across the continental United States. As illustrated in Figure 7.4, zones in West Michigan are shifting northward. A few decades ago, Bridgman was solidly in Zone 5; today, Zone 6 plants that once thrived in states like Tennessee can now successfully survive in Bridgman.



LOCAL AND REGIONAL HAZARDS

SEVERE WEATHER EVENTS IN THE BRIDGMAN COMMUNITY

The following section summarizes a few of the major weather-related events in the Bridgman Community and West Michigan over the past century. Oftentimes, severe weather events result in negative impacts to the local economy and to vulnerable populations in the community.

Figure 7.5 Severe Weather Events Timeline

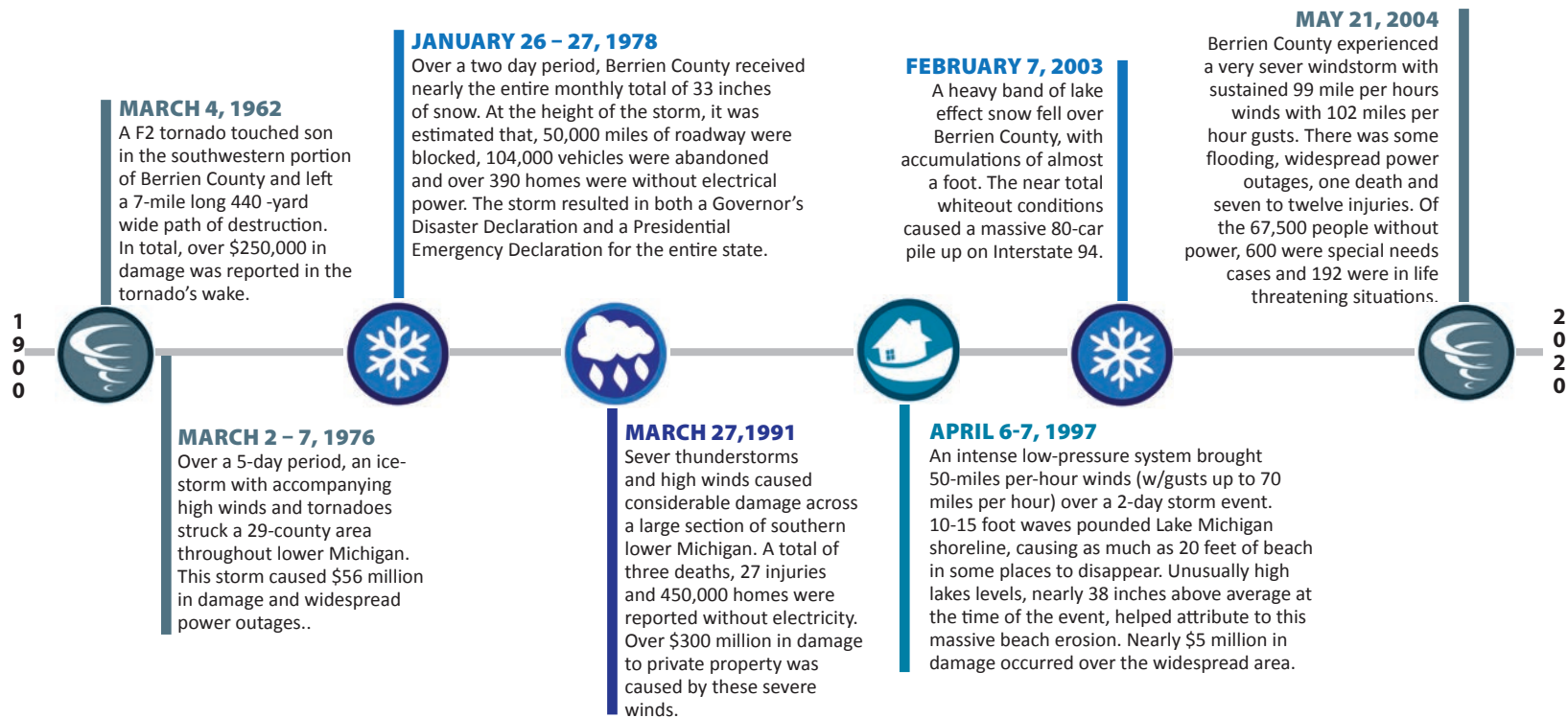
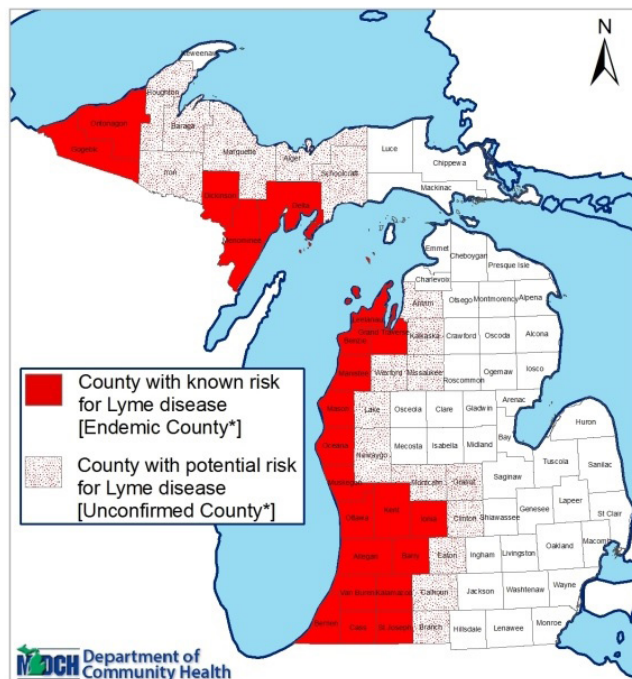


Figure 7.6 Michigan Lyme Disease Risk Map, 2014



* Lyme disease risk in this map is based on known, field confirmed populations of infected blacklegged ticks, or laboratory confirmed human cases.
 a) Counties labeled "endemic" are counties where infected tick populations have been confirmed - and/or -
 Two or more laboratory confirmed human cases have been identified with local exposure.
 b) Counties labeled "unconfirmed" are counties bordering endemic counties, but which do not meet the above criteria for "endemic" counties.

MDCH Zoonotic Disease and Special Projects Section: Revised April, 2014

Source: MDCH 2014, Disease and Special Projects Section

PUBLIC HEALTH AND CLIMATE

Major health effects of long-term climatic change are predicted for the U.S. Midwest. Already, people in Michigan are experiencing higher rates of skin and eye damage from increased exposure to ultraviolet radiation, increased incidence of respiratory and cardiovascular diseases, and increased incidence of vector-borne and water-borne diseases.⁴⁸ Weather conditions and high heat events exacerbate poor health conditions like allergies, asthma, and obesity.

The Michigan Department of Health and Human Services (MDHHS) published the Michigan Climate and Health Adaptation Plan (2011). The Plan indicates there is an increase in the number of illnesses and deaths as a result of extreme heat events; declining air quality as a result of increased production of ozone and particulate matter from heat and drought events; and adverse changes to water quality and availability following severe weather events. In the long term, health experts are most concerned with a rising incidence of infectious diseases and outbreaks of new diseases not currently endemic to Michigan; increasing numbers of disease vectors and the appearance of new vectors not currently established in Michigan; and a degradation of food safety, security and supply. For example, blacklegged ticks are one disease vector that has increased in recent years. According to the MDHHS, the first official reported human case of Lyme disease was in 1985. Cases have now been reported in both the Upper and Lower Peninsula and are increasing. It is anticipated that the number of cases reported will continue to increase due to public and medical personnel education, and expanding tick ranges. Figure 7.6 illustrates the distribution of the risk for Lyme disease in Michigan, which has increased in recent years.

VULNERABILITY ASSESSMENTS

Communities interested in becoming more resilient assess their vulnerabilities and make action plans to reduce their sensitivities and exposures to hazards of all kinds. This Community Vulnerability Assessment has been compiled by the Land Information Access Association (LIAA) to provide a wide variety of useful information aimed at improving climate resilience by reducing human and community vulnerabilities..

$$VULNERABILITY = SENSITIVITY + EXPOSURE$$

⁴⁸ National Research Council. Reconciling observations of global temperature change. Washington, DC: National Academy Press, 2000:86.

A Vulnerability Assessment is designed to identify and help prioritize adaptation strategies in the community planning process. A model that defines vulnerability as “exposure plus sensitivity” is used to complete the assessment.⁴⁹ “Exposure” refers to hazards in the natural or built environment, while “sensitivity” refers to the degree to which a community or certain segments of a community could be impacted by an event. This concept has been used recently in a variety of studies such as equity and adaptation assessments conducted by the NAACP,⁵⁰ vulnerability and its relationship to adaptation,⁵¹ and hazard-specific vulnerability assessments aimed at measuring exposure, sensitivity, and resilience.⁵²

By assessing the potential for exposure to a hazard and the sensitivities of specific populations, maps are generated that identify the community’s areas with relatively greater vulnerability (that is, where exposure and sensitivity overlap). This tool provides direction for community planners and public health workers in reducing risks to human health by understanding where the areas of vulnerability lie and why the vulnerability exists.

For the purposes of this tool, based on the greatest risks in Michigan and most likely predicted climate changes, the vulnerability assessments for Bridgman were limited to extreme heat waves and flooding. However, climate change is predicted to result in increases of other exposures that should also be considered in community planning and development (e.g., high winds, tornadoes).

Our assessments were based in part on data obtained from the American Community Survey (ACS), a continuing survey program operated by the U.S. Census Bureau. This data includes information on housing, income and education characteristics of the population in geographic areas called “Block Groups,” which contain between 600 and 3,000 individuals. Data from the 2010 Census was also used, including population age and racial composition collected at the Census “Block” level, which is the smallest available geographic area for demographic data. Data sets concerning parcel characteristics were obtained from Berrien County. Building footprint data was digitized using an orthophotograph from 2011, and tree canopy cover was digitized using an orthophotograph from 2009.⁵³

HEAT VULNERABILITY

Community vulnerability to heat events varies spatially on local, regional and national scales. In Michigan communities there are varying degrees of vulnerability to heat based on proximity to the Great Lakes, access to air conditioning, and surrounding environmental factors like tree canopy and impervious surfaces. Studies have shown that heat-related mortality generally occurs in areas of the community that are warmer, less stable, and are home to more disadvantaged populations.⁵⁴ One study found that neighborhoods with the highest

EXPOSURE REFERS TO HAZARDS IN THE NATURAL OR BUILT ENVIRONMENT WHILE SENSITIVITY REFERS TO THE DEGREE TO WHICH A COMMUNITY OR CERTAIN SEGMENTS OF A COMMUNITY COULD BE IMPACTED BY AN EVENT.

⁴⁹ Foundations for Community Climate Action: Defining Climate Change Vulnerability in Detroit. University of Michigan. December 2012.

⁵⁰ Equity in Building Resilience in Adaptation Planning. National Association for the Advancement of Colored people (NAACP)

⁵¹ Adger, W. N. (2006). “Vulnerability.” *Global Environmental Change* 16 (3): 268-281. Adger, W. N., N. Arnell, and E. Tompkins (2005). “Adapting to climate change-perspectives across scales.” *Global Environmental Change* 15(2):77-8

⁵² Polsky, C., R. Neff, and B. Yarnal (2007). “Building comparable global change vulnerability assessments: the vulnerability scoping diagram.” *Global Environmental Change* 17(3-4): 472-485.

⁵³ USDA and NRCS Geospatial Data Gateway

⁵⁴ Foundations for Community Climate Action: Defining Climate Change Vulnerability in Detroit. University of Michigan. December 2012

temperatures and the least amount of open space and vegetation were also likely to be the most socioeconomically disadvantaged.⁵⁵ The same study also found the strongest protective factor for residents was access to air conditioning in the home and in other places, as well as having access to transportation.

A 2012 literature review conducted by researchers at the University of Michigan indicates that children under five and persons over age 65 are highly sensitive to heat events, as are persons living in lower-income Census tracts and minority populations. Living alone, being confined to bed, having a mental illness, not leaving home daily, living on higher floors of multistory buildings, and suffering from alcoholism are additional factors that are associated with increased risk of heat-related mortality.

HEAT SENSITIVITY ASSESSMENT

To create the sensitivity and exposure maps, as well as the resulting vulnerability maps, the project team relied on methodologies developed at the University of Michigan's Taubman College of Architecture and Urban Planning in a 2012 report.⁵⁶

To conduct the heat sensitivity assessment of the Bridgman Community, the project team used a geographic information system (GIS) for spatial data analyses to show the relative distribution of people most at risk. Five factors have been identified as primary contributors to the sensitivities and risks of people exposed to a heat wave, including: people over 65 years of age; people living alone; people over 25 with less than a high school education; minority populations; and people living below the poverty line. Using the U.S. Census data, the project team identified the percentages of people living in each area (Block Group or Block) for each sensitivity factor.

People who are older have greater sensitivity to extreme heat events. The technical literature also indicates that older age is associated with higher hospital admission rates in heat waves. The Percent of Population 65 and Older (Map 7.1) depicts the relative concentration of older adults in the community by Census Block.

Another sensitivity factor is living alone, which serves as a measure of social isolation. Although living alone is not necessarily a risky thing, people who are socially isolated are at greater risk during an extreme heat event. Isolated people may not be able to recognize symptoms of heat-related illness and take proper action. In this case, the project team

⁵⁵ Semenza JC, Rubin CH, Falter KH, et al. Heat-related deaths during the July 1995 heat wave in Chicago. *N Engl J Med* 1996; 335:84–90.

⁵⁶ Foundation for Community Climate Action: Defining Climate Change Vulnerability in Detroit (December 2012) University of Michigan's Taubman College of Architecture and Urban Planning.

used the American Community Survey data for Census Block Groups, broken out into individual Census Blocks for geographic representation (Blocks with no population were not included). Map 7.2 depicts the high concentrations of people living alone. The higher concentration of people living alone in the downtown core is in line with nationwide trends because downtowns generally have a greater supply of live-work units, single apartments and/or condominium units, and accessory dwelling units.

Literature suggests that minorities are at greater risk during extreme heat events for various reasons, including less reliable access to health care, transportation and other social supports needed to reduce heat exposures.⁵⁷ Census Blocks were used to map the relative percentages of non-white populations in the Bridgman Community (see Map 7.3).

Two socioeconomic factors associated with increased heat-related morbidity and mortality are the percentage of the people living in poverty and percentage of people without a high school diploma. In general, persons living at or below the poverty line have less access to air conditioning or cooling options for their residences. This could limit a person's access to relief from an extreme heat event. Census Block Groups were used to map the relative percentages of households living below the poverty threshold in the Bridgman Community (please see Map 7.4).

Similarly, University of Michigan researchers found studies that demonstrate a direct link between low education attainment and poor health as well as income.⁵⁸ There is also an established correlation between lower educational attainment and income. Based on these findings, Census Block Groups were used to map the relative percent of persons 25 years and older with less than a high school education in the Bridgman Community (see Map 7.5).

To complete the heat sensitivity assessment, a cumulative score for all five sensitivity factors for each Census Block was created. In each of the sensitivity factors, the percentages were grouped into five categories (ranging from a very low percentage of people to a relatively high percentage living with the identified sensitivity). The five categorical groupings were generated by the GIS software ArcMap using natural breaks in the data (groupings). A ranking of 1 to 5 was assigned to each of the categories, ranging from 1 for the lowest percentage to 5 for the highest. Finally, the team combined the scores within each Census Block. Thus, the most sensitive Census Blocks could be scored up to 25. The sensitivity is color coded for ease of identifying areas with the greatest sensitivity.

The Bridgman Community Sensitivity to Excessive Heat Map (Map 7.6) provides a reasonably detailed map of locations where the highest percentages of at-risk residents live. This does not mean these community residents are in immediate danger. Rather, the map provides planning officials a new way of identifying areas where heat waves could present serious problems for a significant number of citizens. These are populations that could be sensitive to extreme heat events.

The Census data used likely double-counts some people, such as in cases where a person is both a minority and over

⁵⁷ Waugh and Tierney (eds.) *Emergency Management: Principles and Practices for Local Government*. Chapter 13: Identifying and addressing social vulnerabilities by Elaine Enarson.

⁵⁸ Curriero FC, Heiner KS, Samet JM, et al. Temperature and mortality in 11 cities of the eastern United States. *American Journal of Epidemiology*. 30 (2001): 1126-8.

65; this may overestimate the severity of the sensitivities in some locations. Additionally, the sensitivity analysis may underestimate risk because it leaves out several key sensitive populations, such as those with preexisting health concerns that denote vulnerability to heat (for example, cardiovascular disease or psychiatric disorders), since such health data is not often available publicly. Emergency managers, hospitals, and community health departments may have additional data available that can be included as the community looks to better understand its overall sensitive populations. To further improve the analysis, additional variables could be collected through local surveys and observation, such as the degree of social connections among individuals within a community, or materials used in housing.⁵⁹

HEAT EXPOSURE ASSESSMENT

When larger communities experience heat waves, air temperatures can vary significantly from place to place both during the day and at night. Some of these differences can be attributed to the varying types of land cover found throughout the community. For example, temperatures can be significantly lower at night in locations with a heavy tree canopy and very little pavement, versus locations with little greenery and lots of pavement.

Impervious surfaces such as paved parking lots, roadways, and buildings absorb large amounts of heat from the air and from sunshine that is then radiated back into the surroundings, and this heat continues to radiate even after the sun has set. At the same time, tree canopy and other vegetation tend to help cool an area through evaporation and transpiration of water, and by providing shade. In places with a high percentage of impervious surface and little tree canopy, the immediate surroundings can be much warmer. Urban areas typically have higher heat indexes (combinations of temperature and humidity) than surrounding suburban or rural areas. This condition has been termed the Urban Heat Island Effect.⁶⁰

⁵⁹ Mapping Community Determinants of Heat Vulnerability. *Environ Health Perspectives* 117:1730–1736 (2009). doi:10.1289/ehp.0900683 available via <http://dx.doi.org/> [Online 10 June 2009]

⁶⁰ Basu and Samet. (2002) Relation between Elevated Ambient Temperature and Mortality: A Review of the From the Department of Epidemiology, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD.

People living in settings with an Urban Heat Island Effect suffer greater exposures to heat over longer periods of time (e.g., warmer nights), making them more vulnerable to health impacts. Studies of the Urban Heat Island Effect (whereby air temperatures in an urban area are 2–9° F higher than in a nearby rural area) have shown that the albedo, or reflectivity, of an urban area is one of the most important determinants in reducing the magnitude of the heat island.⁶¹ Increasing the tree canopy cover can also reduce air temperature by 2–5° F. Green roofs (vegetative plantings on roofs) may also decrease the Urban Heat Island Effect and decrease stormwater runoff and building energy use. Added benefits from increasing albedo and vegetation include reductions in ground level ozone pollution and reduced energy costs associated with air conditioning use.⁶²

To complete a heat exposure assessment, the project team focused on the Urban Heat Island Effect. With data obtained from Berrien County, two separate exposure maps were created. The first exposure map depicts the percentage of impervious surfaces within each Census Block, as used in the sensitivity assessment (Map 7.7). These percentages are divided into five categories using the GIS software's natural breaks calculation. Since exposure is lowest in areas with the lowest percentage of impervious surfaces, those scored a 1, with a rating of 5 assigned to areas with the highest percentage of impervious surfaces.

The second exposure factor is percentage of tree canopy. Here tree canopy is mapped within each Census Block (Map 7.8) and scored using a similar five category process. To see a map of the raw mapping data of locations of tree canopy throughout the City, please refer to Map 7.9. On Map 7.8, the highest percentage of tree canopy (and therefore the lowest heat exposure) received a score of 1, and the areas with the least amount of tree canopy received a 5.

The project team combined the results of the two exposure maps to provide a single Community Excessive Heat Exposure Map (Map 7.10), which provides a reliable depiction of where the Urban Heat Island Effect would be most or least intense during a heat wave. Local officials in Bridgman can use this map to better assess where new vegetation and tree canopy would be helpful to reduce the heat impact.

COMPOSITE HEAT VULNERABILITY

The Bridgman Community Heat Vulnerability Map is a simple additive combination of the overall sensitivity map and the overall exposures map (see Map 7.11). The resulting vulnerability index depicts where concentrations of exposures and sensitive populations create a higher risk for community residents. In general, those areas with a composite score of 22 to 27 (red) have residential populations that may be particularly vulnerable to extreme heat events.

⁶¹ Kolokotroni M, Giridharan R. Urban heat island intensity in London: An investigation of the impact of physical characteristics on changes in outdoor air temperature during summer. *Solar Energy* 2008;82(11):986–998.

⁶² Akbari H. Shade trees reduce building energy use and CO2 emissions from power plants. *Environmental Pollution* 2002;116:S119–S126. [PubMed: 11833899]

HEAVY RAIN AND FLOODING

Climate scientists say the Bridgman Community and West Michigan can expect more frequent storms of increasing severity in the decades ahead. The total amount of rainfall per year is also likely to increase. However, climate models suggest the precipitation will be more concentrated in the winter, spring and fall seasons and there will be more localized, intense storms at almost any time of year. The potential for substantially larger rain events raises concerns over the potential for harm to human health and damage to buildings and infrastructure.

The following summarizes a Flooding Vulnerability Assessment conducted for the Bridgman Community. In assessing vulnerability, community planners evaluate potential exposures as well as sensitivity to flooding. Buildings, roads, bridges, sewer lines and other infrastructure located in a flood zone are exposed to greater risks. Where flowing floodwaters have the greatest energy, structures may be undercut, collapse or move, and soils will erode. Even areas outside of an identified floodplain are subject to flooding from heavy downpours. Where the soils have low permeability and physical drainage is inadequate, water will accumulate and cause ponding during large storm events. Appropriate planning and land-use regulations can help reduce exposures caused by poor site selection. The sensitivity of structures can be modified to reduce risk of damage by applying flood-resistant design standards. See Figure 7.7 for an overview of recommendations from the Federal Emergency Management Agency (FEMA) for retrofitting homes to make them more resilient to flooding events.

EXPOSURE TO FLOODING HAZARDS

The Digital Elevation Model Map (Map 7.12) offers a useful view of the topography of the City of Bridgman, including the most prominent drainage patterns. On this map, the darkest green colors identify the lowest elevations, while the darkest red colors identify the highest elevations.

FEMA develops Flood Insurance Rate Maps (FIRMs) for many counties in the United States. According to FEMA, the FIRM is “the primary tool for state and local governments to mitigate the effects of flooding in their communities.” The National Flood Insurance Program was created in 1968 to reduce future

Figure 7.7

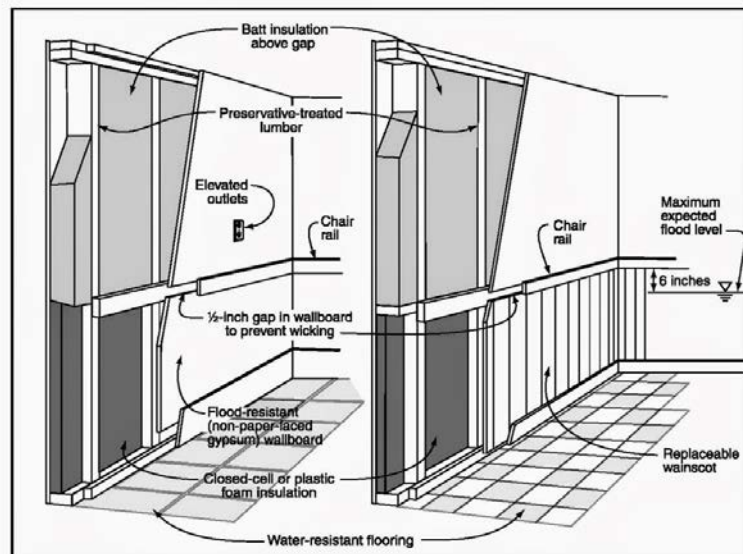


Figure 4. Partial wet floodproofing technique using flood damage-resistant materials for finished wall construction.

damage and provide an insurance program that would help protect property owners from losses. The FIRM shows areas subject to flooding, based on historic, hydraulic and meteorological data as well as flood controls. The FIRM identifies a base flood elevation (BFE), sometimes referred to as the 100-year flood zone. These are areas that have a 1% chance of flooding in any given year. The maps also identify the areas with a 0.2% chance of flooding in any given year, also known as the 500-year flood zone. FEMA points out these percentages are only probabilities, not forecasts. (Map 7.13)

HOUSEHOLD SENSITIVITY TO FLOODING

In many communities, flooding impacts are felt most significantly at the household level. A home's flood risk is based on its relative location to floodplains and other flooding hazard areas. Household flood sensitivity refers to how well the house structure is equipped to deal with flooding. As modeled by the University of Michigan, household sensitivity to flooding can be determined by looking at the age of the housing stock and the homeowner's financial ability to maintain and improve the home, which is approximated using the median household income.

FLOODING VULNERABILITY

By looking at the overlap of flooding exposure and housing sensitivity, the project team identified a number of Census Blocks that are the most vulnerable in the community to flooding damage, based on available data. It is important to note that other factors contribute to flood risk. For example, mobile and manufactured homes are often particularly susceptible to flood damage because they generally lack a reinforced foundation. In addition, municipal infrastructure plays an important role in protecting homes from flood damage. Communities with an aging storm sewer system or ones where the storm sewer has not been fully disconnected from the sanitary sewer are more prone to damage from an overloaded system in the event of a severe rain event. Map 7.14 depicts the Community Flooding Vulnerability.

OTHER CONSIDERATIONS FOR DEFINING COMMUNITY VULNERABILITY

Mapping the locations of key community assets can help provide insight into how accessible they are to residents. It is also helpful to map locations of key infrastructure and assets that could be at risk, or would be most negatively impacted by an adverse event.

CRITICAL FACILITIES

In general usage, the term “critical facilities” is used to describe all man-made structures or other improvements that — because of their function, size, service area, or uniqueness — have the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if they are destroyed, damaged, or if their functionality is impaired.⁶³ Map 7.15 shows locations of critical facilities within the Bridgman Community, including:

- emergency response facilities (fire stations, police stations, rescue squads, and emergency operation centers);
- custodial facilities (hospitals, long-term care facilities, jails and other detention centers, and other health care facilities);
- schools;
- emergency shelters;
- utilities (water supply, wastewater treatment facilities, and power);
- communications facilities;
- other assets determined by the community to be of critical importance for the protection of the health and safety of the population; and
- places where 300+ people congregate.

ACCESS AND DISTRIBUTION OF SOCIAL SERVICES

Service centers and institutions (such as homeless shelters and churches) are important in delivering day-to-day support to residents. In the event of an emergency, such as an extreme heat event or flash flooding episode, service centers and institutions are especially important as a safe place where residents can go if they cannot return home. Map 7.16 highlights key locations of places where residents may seek temporary refuge in the event of an emergency. These locations include schools, places of worship, governmental buildings, hospitals and clinics, libraries, and other non-profit social service organizations. In Bridgman, social services are concentrated in the downtown core and along major commercial corridors.

Communities with high population densities, frequent extreme weather events, or both are likely to have designated services centers. In the event of extreme heat waves, designated community cooling centers may provide refuge for sensitive populations and those without access to air conditioning. In the event of loss of power due to flooding or extreme storms, locations with a backup power source, such as a generator, are essential. A best management practice for a resilient community is to designate community service centers that are accessible, evenly distributed across the population, open 24 hours, and well known to residents.

⁶³ Risk Management Series Design Guide for Improving Critical Facility Safety from Flooding and High Winds. FEMA 543 January 2007.

FOOD AVAILABILITY

Climate change is likely to significantly impact the availability and prices of food throughout the globe. A community can decrease its vulnerability to disruptions in food sources through a strong local food economy. Support for and reliance upon locally produced foods not only alleviates potential future challenges in the food market, but also helps foster another strong economic sector for the region.

Just as cultivating local entrepreneurship makes a community stronger, the capacity of a community to produce and process its own food greatly increases resilience. Because of its ability to impact health, wealth and quality of life, there is a national trend in support of the local food movement. Communities can leverage their existing assets — such as the local Farmer’s Market, community gardens, and an established agricultural base — to lay the foundation for additional local food-related jobs. Communities can take more creative approaches as well, such as allowing for agriculture on publicly owned and vacant lands in existing neighborhoods and parklands. To evaluate community vulnerabilities, locations of full-service grocery stores in relation to where people live are mapped. In the event of loss of power or disruption in potable water supplies, it is important to ensure that residents have access to affordable food and drinking water.

The project team also evaluated access to healthy food to see if there are areas of the community that qualify as a “food desert.” According to the United States Department of Agriculture (USDA), a food desert is defined as an area lacking fresh fruit, vegetables and other healthful whole foods, usually found in impoverished areas. This is largely due to a lack of grocery stores, farmer’s markets, and healthy food providers.⁶⁴ Communities looking to reduce the number of residents living in a food desert can promote or zone for pop-up farm stands in low income areas, enact housing policies supportive of mixed income, and establish community gardens in areas identified as food deserts.

Map 7.17 identifies neighborhoods within the City of Bridgman that are located within one mile of a full-service grocery store.

ADDITIONAL RESOURCES

Snover, A.K., L. Whitely Binder, J. Lopez, E. Willmott, J. Kay, D. Howell, and J. Simmonds.

2007 Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments. In association with and published by ICLEI – Local Governments for Sustainability, Oakland, CA

Michigan Climate and Health Adaptation Plan 2010-2015 Strategic Plan, Prepared by the Michigan Department of Community Health (2001)

⁶⁴ <http://americannutritionassociation.org/newsletter/usda-defines-food-deserts>

COASTAL HAZARD ANALYSIS

As part of this master planning process, LIAA and the University of Michigan analyzed shoreline and riverine ecosystem and physical dynamics to help Bridgman manage its shoreline and riverine areas. This chapter presents a brief summary of the team’s framework, results and recommendations.

OVERVIEW OF RESEARCH FRAMEWORK

The Research Framework for this study employs scenario planning to assess environmental and land-use conditions under different management options and climate futures. Scenario planning, in general, identifies driving forces to inform a range of scenarios that are then analyzed and evaluated. In this context, the project team identified two driving forces: (1) natural forces, especially increasing storminess and lake-level fluctuations causing increased problems with flooding; and (2) local government shoreline management options. These forces informed the creation of multiple climate futures, each of which are managed differently. Each climate future was tested against each management option and evaluated for impacts on the environment and land use in the community. This framework is presented in Table 7.1.

Table 7.1 Scenario-Based Research Framework

Management Options	Climate Futures		
	Lucky	Expected	Perfect Storm
Current Conditions	Scenario 1A	Scenario 1B	Scenario 1C
Build-Out According to Current Zoning	Scenario 2A	Scenario 2B	Scenario 2C
Build-Out According to Best Management Practices	Scenario 3A	Scenario 3B	Scenario 3C

CLIMATE FUTURE DEFINITIONS

Rather than presenting a prediction of what the future will bring, each of the following “climate futures” lays out a possible future that might occur. These varying climate futures — all of which are reasonably anticipated possibilities — are arranged from a least impactful to a most impactful condition in terms of the potential for wave damage and flooding hazards they would bring. The following descriptions outline the key assumptions made in defining each of the climate futures as compared to the others. Map 7.18 shows the estimated land areas that would be affected by waves and flooding under these three climate futures.

“Lucky” Future: Under the Lucky Climate Future, Great Lakes water levels will continue to stay relatively low. Although there will be wave and wind action, major storm events and wave impacts will not encroach on properties landward of current beaches. A Lucky Future projection, indicating the land areas that would be affected by high-energy waves along the shorefront and/or adjacent riverine flooding under these conditions, is shown in yellow on Map 7.18.

“Expected” Future: Under the Expected Climate Future, Great Lakes water levels will continue to fluctuate according to long-term decadal patterns, including recent extreme storm events incorporated into the Federal Emergency Management Agency’s (FEMA) ongoing Great Lakes Coast Flood Study. Given those ongoing fluctuations, this Climate Future accounts for periods when Great Lakes still-water elevations are closer to the long-term average. In addition, this Climate Future anticipates the so-called “100-year storm event” (or 1% storm) becoming more like a 20- or 50-year storm event (i.e., an expected storm within the normal community planning time horizon) because of increased storminess. The Expected Future projection, is shown in orange on Map 7.18.

“Perfect Storm” Future: Under the Perfect Storm Climate Future, Great Lakes water levels will continue to fluctuate according to decadal patterns, consistent with assumptions made for the Expected Future. However, for this Perfect Storm Climate Future, the estimated still-water elevation is set higher than the long-term average and closer to the long-term high (583 feet). In addition, this Climate Future anticipates the occurrence of a so-called “500-year storm event” (or 0.2% storm) occurring within the planning time horizon while lake levels are high. The Perfect Storm Future projection, is shown in red on Map 7.18.

MANAGEMENT OPTIONS

The management options used for this scenario-based planning analysis are designed to represent feasible arrays of options a community might reasonably address, ranging from making no changes to current programs to adopting “best management practices” (BMPs) designed to mitigate potential harms from flooding conditions. Each of the following descriptions outline the key assumptions made in defining each of the management options compared to the others.

1. Current Practices

Under this option, the assumption is made that the Bridgman Community will continue to manage land in the same manner it currently employs, in accordance with adopted plans, zoning ordinances, and relevant local ordinances.

2. Buildout According to Current Zoning

Under this option, the community will experience a full buildout of residential development according to its existing zoning code. Additional homes are built in areas at the base flood elevation and are at risk for flooding. See Map 7.19 for a visual of where these potential development areas are located. This is not an exact picture of the development capacity in the community; rather, this work equates to an estimate of where development may possibly occur under current zoning, with additional land set aside for open space, driveways, streets and yards. The dots on the map do not represent actual physical locations of structures. Rather, the dots are randomly placed by the CommunityViz software to provide a quick visual representation of the potential for additional buildout in Bridgman under current zoning. A greater number of dots in an area indicates a greater potential for buildout in that area.

3. Built-Out According to Best Management Practices (BMPs)

Under this option, the Bridgman Community will adopt and implement Best Management Practices to preserve natural resources and protect private property, and then experience full development under the revised zoning provisions.

For this study, only a handful of best management practices are modeled, as described below. The selected BMPs were chosen because each can have a significant spatial effect and a policy or regulatory effect that can be achieved through a zoning ordinance. These BMPs are easily modeled using CommunityViz software. The intent of including this management option is to present several amendments that could be adopted that may influence the impact on land use and the environment in the community.

The BMPs modeled in this management option are:

- 50-foot buffers around any inland water (rivers, lakes and streams).
- 50-foot buffers around any wetland 5 or more acres in size, as defined by the State of Michigan's Final Wetland Inventory data.
- A complete restriction of any development within a wetland 5 or more acres in size, as defined by the State of Michigan's Final Wetland Inventory data.

SCENARIO PLANNING TO ASSESS LAND USE AND ENVIRONMENTAL CONDITIONS

Each management option can be combined with each of the three Climate Futures to create distinct scenarios, which can then be analyzed for selected conditions, as noted above. This array of scenarios represents a range of conditions the City could reasonably encounter in the foreseeable future regarding potential wave and flooding impacts, given changing natural conditions and the development management decisions made in response. For analysis here, each scenario focuses on potential impacts to land use and environmental conditions in Bridgman. Land-use impacts include the acreage, parcels, structures and critical facilities that would be at risk under different Climate Futures for each management option. Environmental conditions include the acreage of wetlands, impervious surfaces, Critical Dune Areas and high-risk erosion areas impacted in each Climate Future for each management option.

LAND USE RESULTS

TOTAL ACRES

The total acres of land impacted by flooding increases from the Lucky Climate Future to the Perfect Storm Climate Future. The number of acres impacted increases the most between the Lucky and Expected forecast (158% increase in land area). Between the Expected and Perfect Storm scenarios, the total acres impacted increases by about 41%. Table 7.2 shows the total acres of land impacted under each future flood forecast in Bridgman.

Table 7.2 Total Land Acres Impacted by Flooding

	Lucky	Expected	Perfect Storm
City of Bridgman	41	106	150

PARCELS

As Table 7.3 shows, between 108 and 151 parcels are impacted depending on the severity of the Climate Future in Bridgman. Map 7.20 illustrates the extent of inundation for each Climate Future.

Table 7.3 Total Parcels (and Acres) Impacted by Flooding, by Zoning District

Zoning Districts	Lucky	Expected	Perfect Storm
Downtown Edge	1 (<1 acre)	1 (<1 acre)	2 (1 acre)
Transitional Industrial	3 (26 acres)	5 (28 acres)	8 (64 acres)
Residential Central	5 (3 acres)	13 (4 acres)	21 (7 acres)
Commercial Gateway	6 (4 acres)	7 (6 acres)	7 (6 acres)
Open Space	15 (449 acres)	19 (506 acres)	20 (508 acres)
Corridor Commercial	22 (52 acres)	26 (60 acres)	28 (62 acres)
Residential Suburban	27 (25 acres)	33 (29 acres)	34 (29 acres)
Residential Lake	29 (24 acres)	29 (24 acres)	31 (34 acres)
Total	108 (583 acres)	133 (657 acres)	151 (711 acres)

In the Lucky Climate Future, about 9% (108 parcels) of the total parcels within the City would be impacted. Of these parcels, about 29 (2% of total parcels) are located in the Residential Lake Zoning District. An additional 22 parcels (1.7% of the City's total) are located in the Commercial Corridor Zoning District. While the number of parcels (15) impacted under a Lucky Climate Future in the Open Space Zoning District is fairly low, the largest number of acres (449) would be impacted in that district. While 250 acres of the Open Space Zoning District are located in Warren Dunes State Park, there are numerous large parcels within the Open Space Zoning District in other parts of the City that could eventually hold more development and be impacted by flooding.

In the Expected Climate Future, the number of parcels impacted increases by 18% to a total of 133 parcels. In addition, the number of parcels impacted in the Corridor Commercial Zoning District and the Residential Suburban Zoning District increases to 26 and 33 parcels respectively.

In the Perfect Storm Climate Future, about 12% (151) of the total parcels within the City would be impacted. An additional two parcels would be impacted in the Corridor Commercial Zoning District.

In general, as climate changes cause more severe flooding, just a handful of residential and commercial parcels within the City may be impacted. However, parcels in and around the Commercial Corridor Zoning District may wish to employ low-impact development (LID) practices to reduce the potential impacts of severe flooding.

STRUCTURES

Between 12 and 186 structures may be impacted in the City depending on the severity of the Climate Future experienced and the management practices the City pursues. Table 7.4 summarizes the total number of structures impacted under the varying Climate Futures and management options.

Table 7.4 Number of Structures Impacted By Flooding

	Lucky	Expected	Perfect Storm
Current Development	12	36	62
Build-Out According to Current Zoning Ordinance	+33	+91	+124
Build-Out According to Best Management Practices	+30	+85	+114

In the Lucky Climate Future, 12 structures are currently built in areas subject to inundation. If no best management practices are implemented and the City achieves a full build-out, an additional 33 structures (45 total) would be built in areas subject to inundation. This number shrinks slightly to 42 total structures if the City implements the best management practices.

In the Expected Climate Future, 36 structures are currently built in areas subject to inundation. A total of 121 structures could be impacted if the best management practices are implemented for future development. If no best management practices are implemented, 127 structures could be subject to inundation.

In the Perfect Storm Climate Future, 62 structures are currently built in areas subject to inundation. A total of 176 structures could be impacted if the best management practices are implemented for future development. If no best management practices are implemented, 186 structures could be subject to inundation.

In general, as the future climate causes more severe flooding, implementing best management practices reduces the number of structures damaged by about 5% as the community grows.

FISCAL IMPACT

Given the number of parcels and structures potentially impacted by the severity of the climate, Table 7.5 summarizes the property value at risk under each Climate Future.

Table 7.5 Property Value Impact

	Lucky	Expected	Perfect Storm
Current	\$3 Million	\$10 Million	\$12 Million

It was estimated that the total property value for all of Bridgman is roughly \$133 million. Therefore, roughly 3% to 11% of the total property value in the City is at risk.

ENVIRONMENTAL RESULTS**WETLANDS**

Wetlands are an important tool for community resilience, particularly for benefits related to flood control and water quality. Table 7.6 illustrates the number and percentage of acres of wetlands impacted by inundation within each Climate Future. Existing wetlands are estimated using national and state data. Map 7.21 illustrates the inundation areas of the three Climate Futures in wetland areas in Bridgman.

Table 7.6 Acres and Percent of Wetlands Impacted by Inundation

	Acres Wetlands	Percent Wetlands
Lucky	13.6	17%
Expected	17.6	22%
Perfect Storm	20.8	26%

Bridgman has approximately 80 acres of wetlands, about 4% of its total land area. Of the 80 acres total, up to 21 acres (26%) of wetlands would be impacted by inundation depending on the Climate Future. These wetlands provide some flood protection by absorbing flood water and by allowing unimpeded conveyance of flood waters through the floodplain. However, even the wetlands outside the flood hazard area (“non-inundated” wetlands shown in blue in Map 7.21) are also important for flood protection, because they capture and temporarily hold stormwater runoff that would otherwise run downhill and into the floodplain, making the flooding there even worse. While this study does not quantify the benefit of the existing wetlands to the City, studies have shown that one acre of coastal wetland can hold

up to one million gallons of water. Contrary to the presence of structures and other impervious surfaces, having additional wetlands provides additional water quality and hazard mitigation benefits, so working to increase these wetland acreages rather than decreasing them represents an environmental improvement.

IMPERVIOUS SURFACES

Impervious surfaces have a well-understood negative impact in a flood event. The increased runoff can exacerbate the risk of structural damage and reduce regional water quality. This is an especially important variable to consider in a flood zone. Impervious surfaces include building footprints as well as sidewalks, driveways and roads.

The purpose of this analysis is to roughly estimate the percentage of each flood zone that is currently impervious. These numbers only reflect current conditions and can be seen as conservative in light of inevitable future growth.

Bridgman has 341 acres of impervious surfaces, about 18% of its total land area. Map 7.22 illustrates the inundation areas of the three Climate Futures in areas with impervious surface in Bridgman. Table 7.7 illustrates the number and percentage of acres of impervious surface impacted by inundation within each Climate Future. Of the 341 acres of impervious surfaces in Bridgman, up to 23 acres (7%) would be impacted by inundation depending on the Climate Future.

Table 7.7 Acres and Percent of Impervious Surfaces Impacted by Inundation

	Acres Impervious Surface	Percent Impervious Surface
Lucky	20	3%
Expected	20	6%
Perfect Storm	23	7%

Studies recommend that the percentage of impervious surface in any general area be below 10% to remain protected from harmful amounts of runoff. This analysis suggests that there is currently a higher percentage of open space and wetlands within high risk flood areas than impervious surfaces. This analysis also suggests that the City should take steps to protect all wetlands within the watershed of the high risk flood areas, and to require low-impact development measures or other measures to reduce stormwater runoff in these same watersheds.

CRITICAL DUNE AREAS

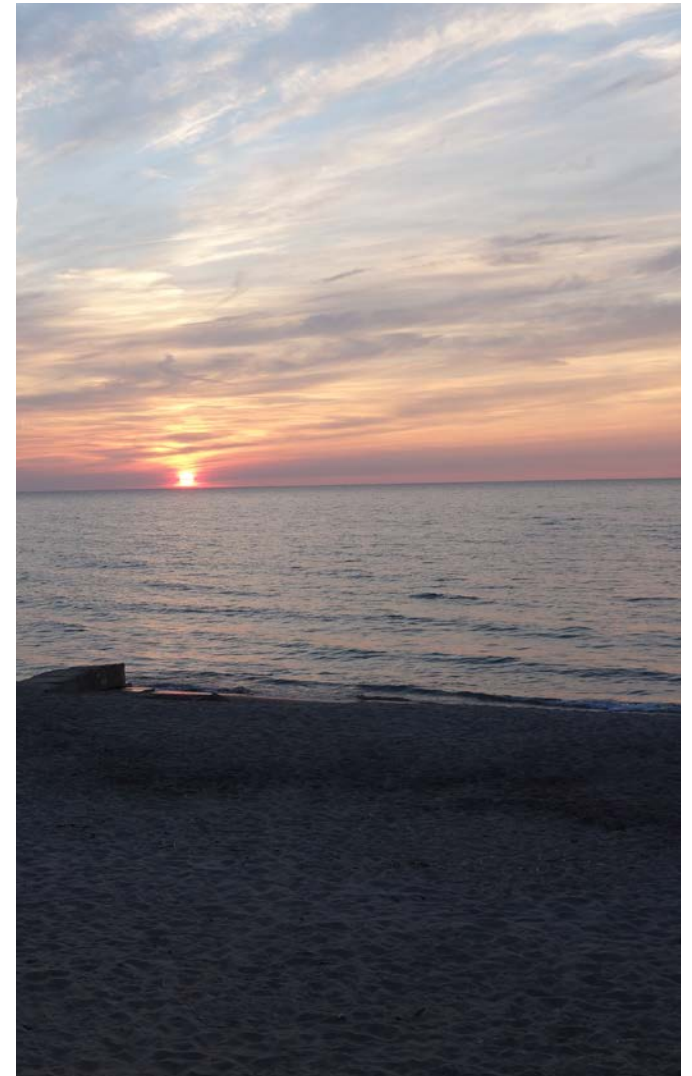
Critical Dune Areas are important assets for the Bridgman Community that, due to their soil composition, may be especially vulnerable to damage from flooding. Our intent is to provide some base of analysis for the future health of Critical Dunes, especially as development on Critical Dunes could increase due to weakened regulations under the amended (2012) Critical Dunes Act. There are currently 675.5 acres of Critical Dunes in Bridgman (35% of the total land area of the City), all of which reside either within Warren Dunes State Park or in the Residential Lake Zoning District (see Map 7.23). Within the Residential Lake Zoning District, there are 79 vacant parcels (see Map 7.24). Based on a build-out analysis and 2015 LiDAR imagery (as opposed to the state delineated slopes), it appears that up to about 15 of those parcels could have structures built on them given current development limitations created by parcel size requirements and steep slopes.

While these parcels and structures may not be at risk from flooding, they could represent new structures at risk from shift in the dunes themselves over time (see Map 7.25). One important role for the City is to guard against unpermitted activities in Critical Dune Areas by monitoring and reporting unauthorized tree cutting, bulldozing, etc.

CHAPTER 8

GOALS AND ACTION STRATEGIES

As a result of the City's effort to have a conversation about growth and development in the community, 17 goal statements have been developed and are listed on the following pages. Each goal is supported by more specific actions, and the policies of this Master Plan are founded in these statements. The goals are intended to describe a desirable end state or the condition of the City in the future. The goals are intentionally general but are felt to be attainable through concerted effort. The action statements tend to be more specific and may be regarded as milestones in the journey to achieve the larger goal.



HOUSING AND NEIGHBORHOODS

Goal 1. Residential units in Bridgman will include a broad range of housing types, including duplexes, rowhouses, live/work buildings, second-floor apartments and detached homes.

- a. *Evaluate the City's housing stock to determine if the form-based zoning ordinance is creating a broad range of housing types.*
- b. *Promote new housing opportunities, including redevelopment and infill opportunities within downtown and along Lake Street.*
- c. *Allow for a range of housing types to provide residents the opportunity to progress through various life stages while maintaining their attachment to a particular area of the City.*
- d. *Support and encourage the development of quality senior housing and assisted living facilities to meet expected demand.*
- e. *Consider adjusting the zoning ordinance to enable the construction or redevelopment of smaller homes.*

Goal 2. Downtown Bridgman and its residential neighborhoods will be safe, attractive, well-maintained and inviting places with walkable streets and convenient connections to recreation facilities, schools, employment, shops, services and natural areas.

- a. *Maintain a building maintenance enforcement program and a full-time compliance officer.*
- b. *Evaluate the capacity and willingness of neighborhoods for accommodating seasonal rentals.*
- c. *Protect the character, safety and historical patterns of development in residential neighborhoods from inappropriate development.*
- d. *Strengthen and enforce a tree protection and replacement ordinance for public property within residential areas.*
- e. *If feasible, install sidewalks and/or pathways in each neighborhood and fill in missing sidewalk infrastructure.*
- f. *Enforce safe traffic speeds and stop signs on neighborhood streets to enhance safety for drivers and residents.*
- g. *Encourage the development and maintenance of parks and other safe and attractive gathering spaces in all neighborhoods.*

Goal 3. Residents will have the skills and resources necessary to improve and maintain their homes.

- a. *Evaluate the construction/building permitting process to improve, streamline and clarify if possible, and continue to seek input from builders for standardization.*

TRANSPORTATION AND CONNECTIVITY

Goal 4. Residents and visitors to Bridgman will move about the community safely and conveniently using private and public transportation options that connect to Lake Michigan and the greater Southwest Michigan region.

- a. *Evaluate and implement, if feasible, a requirement for shared driveways and cross-access agreements for compatible adjacent land uses along Red Arrow Highway.*
- b. *Continue to support and modify as necessary the streetscape design standards outlined in the zoning ordinance.*

- c. Continue to incorporate low-impact development (LID) tools in streetscape designs to establish green streets.*
- d. Consider electric-car charging stations at key locations, including City Hall and Weko Beach.*
- e. Continue to explore the feasibility of a transportation system to help bring people from Weko Beach to downtown and vice versa.*

Goal 5. Non-motorized connections — including sidewalks, bicycle paths and recreational trails — will serve all areas of the community, offering safe, attractive and barrier-free connectivity.

- a. Install sidewalks and/or pathways throughout the City and fill in missing sidewalk infrastructure, where feasible.*
- b. Continue to work with the DNR and officials at Warren Dunes State Park to establish a trail connection to Weko Beach and Lake Street.*
- c. Develop and implement trails and pathway designs that minimize runoff through the use of porous surfaces.*
- d. Continue to participate in county and regional intra- and inter-county trailway planning to offer trail connectivity between downtown Bridgman and the outlying population centers.*
- e. Promote and implement a community or vendor bicycle-sharing program between downtown Bridgman and Weko Beach.*
- f. Continue to retrofit existing sidewalk crossings with accessible ramps to provide increased accessibility.*
- g. Identify areas of the City that are not conducive to safe bicycling, running and walking due to a lack of lighting or poor surface conditions. Develop a plan to improve these routes.*

EMPLOYMENT AND THE ECONOMY

Goal 6. Bridgman will be a vital economic center in Southwest Michigan with a variable balance of clean manufacturing, technology, healthcare, agriculture, professional and seasonal services, hospitality, retail and institutional employment.

- a. Support the activities of the Greater Bridgman Area Chamber and Growth Alliance and its strategic planning for economic development and business retention.*
- b. Support the development of a “new business relocation guide” to make prospective entrepreneurs aware of available sites within the City, and assist with the permitting process to legally occupy and operate in the City.*
- c. Research the viability of offering alternative incentives for development, such as density bonuses for providing a percentage of affordable housing units.*
- d. Continue to support the Lake to Grapes marketing and branding program for the community and consider establishing a similar branding campaign for microbrewing.*
- e. Continue to discuss the impacts and opportunities that might come about if the Cook Power Plant were decommissioned or if Whirlpool Corporation relocation or downsizing occurs.*

Goal 7. Commercial and industrial development will be clean, attractive and efficiently designed to adapt to changing business needs.

- a. *Evaluate if the City has streamlined permitting and approval processes for job-generating economic development projects.*
- b. *Consider establishing requirements for electric vehicle parking infrastructure.*

Goal 8. Bridgman will include world-class education and training opportunities and facilities.

- a. *Improve access to high-speed and reliable wireless broadband service throughout the community.*
- b. *Strengthen collaboration between area schools and the local business community.*
- c. *Encourage curriculum development with local schools to learn about careers in manufacturing and agriculture.*
- d. *Explore the possibility of developing and then recruiting a satellite campus within the region.*
- e. *Assure the development of well prepared and educated students/young people ready to compete in the global knowledge economy.*
- f. *Assure the development of a well prepared and educated workforce that is continually ready to compete in the global knowledge economy.*

Goal 9. Hospitality and tourism will be an important part of the local economy, structured to offer visitors year-round memorable and enjoyable experiences while balancing the interests of local residents and the other key sectors of the economy.

- a. *Use the study completed by the Greater Bridgman Area Chamber and Growth Alliance to recruit and build a hotel in the city.*
- b. *Continue to pursue the development of a small-scale movie theater.*
- c. *Evaluate capacity of neighborhoods for accommodating seasonal rentals, and establish standards to balance local interests with hospitality and investment objectives.*
- d. *Develop and implement improved communication channels to communicate with seasonal residents (e.g., “snow birds” when they have left town for the winter, and summer residents from Chicago).*
- e. *Support “buy local” programs.*
- f. *Continue to look for opportunities to market Bridgman as a “Trail Town” along the Lake Michigan Water Trail.*
- g. *Evaluate opportunities for encouraging longer-term winter activities in addition to the existing weekend festivals.*
- h. *Continue to allow food trucks at Weko Beach and/or at a vacant location in the downtown.*

NATURAL FEATURES AND THE ENVIRONMENT

Goal 10. The preservation and enhancement of natural features of the community will be a central consideration in all civic decisions in Bridgman. Buildings and infrastructure will be planned, constructed and maintained to protect and improve the quality of the natural environment while serving the needs of the population and giving residents and visitors appropriate access to enjoy natural features.

- a. *Develop a green infrastructure plan to enhance and sustain the network of natural features of the City and the ecological interaction of those features, within the context of the built environment and the community.*
- b. *Establish goals and ordinances to increase percent tree cover, especially east of Red Arrow Highway.*
- c. *Adhere to the 10-20-30 formula for municipal street tree planting (no more than 10% of a single species, no more than 20% of a single genus, no more than 30% of a single family).*
- d. *Look for opportunities to establish green roofs on buildings.*
- e. *Encourage programs to promote energy conservation in municipal operations and in local businesses and residences.*
- f. *Evaluate the local ordinance to support renewable energy, and adjust as needed to improve feasibility and encourage use.*
- g. *Work with local builders to host energy efficiency training programs such as LEED, and encourage builders to seek professional certifications in these programs.*
- h. *Identify methods to encourage the development of energy-efficient buildings and sites, such as an energy audit program.*
- i. *Encourage residential and commercial rainwater capture and reuse.*
- j. *Install — or continue to retrofit existing — light fixtures with energy-efficient light fixtures.*

INFRASTRUCTURE AND GOVERNANCE

Goal 11. Bridgman's public facilities, including roads, utilities, parks and buildings, will be carefully planned, constructed and maintained to effectively serve the needs of current and future generations.

- a. *Periodically review the policies, goals, and objectives of the City's Master Plan.*
- b. *Develop assured sources of revenue to support strong maintenance programs for public infrastructure, buildings and facilities.*
- c. *Undertake an evaluation of City buildings and facilities to identify improvements to reduce energy consumption and stormwater runoff and implement those that prove feasible.*
- d. *Regularly review (and update as necessary) the future land use map and coordinate with adjacent communities wherever possible.*
- e. *Coordinate capital improvement projects such as street projects with other infrastructure projects to minimize disruption.*
- f. *Provide incentives for on-site stormwater treatment to reduce standing water.*
- g. *Study the capacity of the stormwater sewer system to better understand if it can handle heavy precipitation events.*
- h. *Require street vacuuming or street sweeping on a regular basis.*

- i. *Limit the percentages of impervious surfaces in new developments wherever possible.*

Goal 12. Information on planning, development and governmental decision-making will be broadly available through numerous sources of outreach, and community participation in local governance will be informed, thoughtful and transparent.

- a. *Work with local schools to expand curriculum on local government processes.*
- b. *Improve communication among elected officials, appointed officials and City staff to promote understanding of roles.*
- c. *Improve feedback mechanisms for citizens and visitors to provide more timely and robust input regarding issues and concerns.*

Goal 13. Bridgman will be a leader in Southwest Michigan in working with other units of government, state agencies, schools and special authorities to manage growth and to plan and deliver services to the residents and businesses of the area in the most effective, efficient and transparent manner possible.

- a. *Work with neighboring communities to form a Joint Planning Committee to improve inter-local coordination and communication and to consider common planning strategies and issues of sustainability in a regional context.*
- b. *Cooperate with other area communities in the evaluation and implementation of any joint approach to service delivery.*
- c. *Collaborate with local units of government to buy locally to achieve a balance between the least dollar cost and the smallest carbon footprint to meet governmental needs.*

RESILIENCY

Goal 14. The City will be a resource and educator for Bridgman residents on the importance of developing and maintaining a resilient community.

- a. *Coordinate with Bridgman Public Schools to incorporate resiliency and environmental education curricula, and to encourage volunteer opportunities for community projects that support resiliency efforts.*
- b. *Develop a best practices plan to provide educational information to homeowners living within sensitive landscapes (e.g., native vegetation, shoreline stabilization, erosion prevention, etc.).*

Goal 15. Bridgman will be prepared for natural disasters.

- a. *Identify and review emergency preparedness plans.*
- b. *Identify existing and potential new locations for emergency shelters.*
- c. *Establish a network of organizations and resources to assist post-emergency efforts.*
- d. *Enhance existing and/or establish redundant public emergency communication systems.*

Goal 16. All residents will have access to affordable, locally-sourced foods.

- a. *Consider enhancing the current site of the Farmer's Market, including providing for electricity.*

- b. Encourage daily destinations such as grocery stores to accommodate bicyclists and pedestrians in their site plans.*
- c. Support and promote convenient access to local food sources such as roadside stands, edible landscaping and front-yard gardens.*
- d. Support the use and development of community gardens and establish regulations to promote them.*

Goal 17. The sensitive natural landscapes that distinguish the Bridgman landscape will be protected as context-sensitive development will be carefully permitted.

- a. Consider changing the setback in the Residential Lake district for Lake Michigan fronting properties to more than 25 feet.*
- b. Consider establishing an overlay district that would not allow for the placement of a seawall or any other hardening along Lake Michigan.*
- c. Discuss adopting a similar provision with planning and legislative officials in Lake Township.*
- d. Establish a pilot program for the use of native vegetation in order to stabilize sensitive landscapes.*
- e. Require buffers around all wetlands to prevent imprudent development in high-risk areas, prevent the degradation of natural features, and protect water quality.*
- f. Move the flood plain district ordinance from the “general ordinances” into the zoning ordinance, with regard to development in flood-prone areas.*
- g. Consider requiring elevation certificates for new structures within the flood plain district.*
- h. Expand the flood plain district to include areas that fall within the “500-year flood zone.”*

CHAPTER 9

Future Land Use Plan and Zoning Plan

ABOUT THIS CHAPTER

According to the Michigan Planning Enabling Act, a Master Plan in Michigan must contain a future land use plan and zoning plan. These are each important tools for taking the public's input and ensuring it is reflected in the legal ordinances that shape policies for development, the environment, transportation, housing and other community-based characteristics of the city.

In general, the *future land use plan* depicts the preferred general composition of land uses in the community and seeks to answer the question, "How should land be used in the future?"

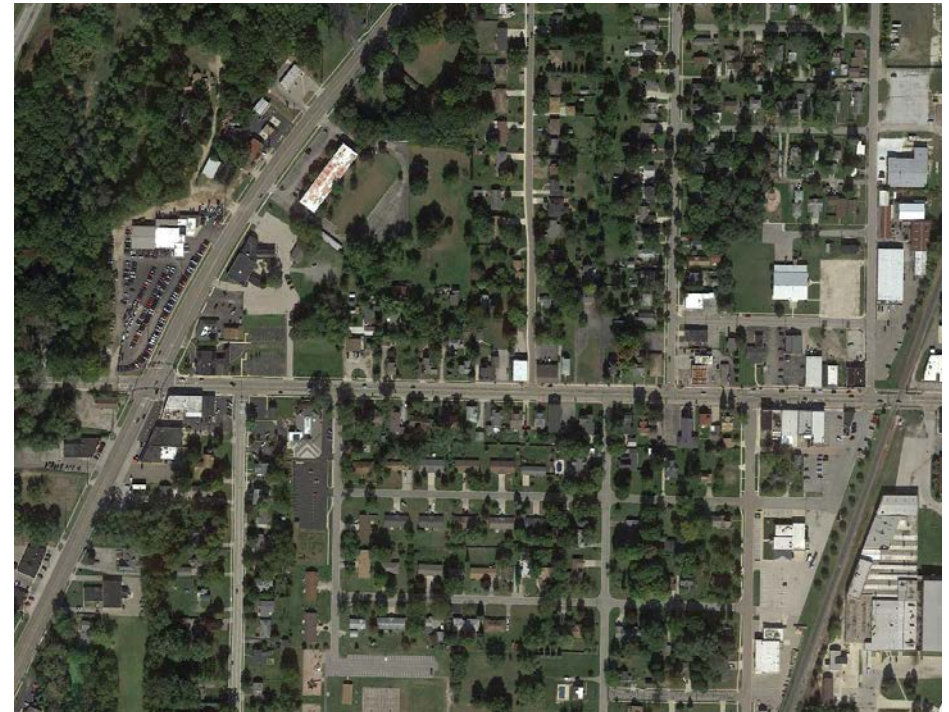
The *zoning plan* is designed to identify amendments to the City Zoning Ordinance that would be supported by the public's vision identified in this Master Plan.

RELATIONSHIP TO THE MASTER PLAN

The Master Plan describes the city's vision for the future, including a vision for the way land is used and developed. As a key component of the Master Plan, the future land use plan is the framework upon which land use and policy decisions should be based.

The zoning plan then identifies areas where existing zoning is consistent and/or inconsistent with objectives and strategies of the Master Plan. As the primary implementation tool for the future development of the City, the Zoning Ordinance contains written regulations and standards that define how properties in specific geographic zones can be used and how they can look.

Typically, the zoning plan is developed prior to the revision of the Zoning Ordinance, helping to frame and guide the development of the Zoning Ordinance based on the recommendations of the Master Plan. However, the City of Bridgman adopted a new Zoning Ordinance in July 2017, midway through the development of this Master Plan. Given this timing, the land use regulations and intent of the new Zoning Ordinance instead helped to frame and guide the development of the Master Plan and the future land use plan.



FUTURE LAND USE PLAN



Developing a future land use plan is an important component of any master planning effort. The future land use plan depicts the general preferred organization of land uses in the community. The future land use plan for the City of Bridgman was developed with careful consideration of several factors, including existing land use patterns, the location of environmental features, desired community character, and consistency with the intent of the new Zoning Ordinance. The future land use plan is now more consistent with the zoning plan and ultimately the Zoning Ordinance.

There are two key elements to a future land use plan: the future land use map (Map 9.1), which designates specific land uses that are to occur on certain parcels or areas of the city; and the future land use text, which defines the map's classifications and summarizes the map's overall purpose.

RESIDENTIAL AREAS

Residential areas in Bridgman currently exist in a number of neighborhoods that provide a diverse range of housing options and character. Whether for new or infill development, new homes and residential structures should be built in a manner that adds to and complements existing neighborhood character, while providing housing opportunities that meet the needs and desires of existing and future populations. The following types of residential land use are envisioned for Bridgman's future.

■ Lake Residential District

The intent of this district is to provide for and maintain single-family housing on relatively large lots that appropriately fits in with, protects and adapts to the unique environmental characteristics and physical features of the area, including critical dune formations and tall mature woods and tree canopy. In addition, residents in this district should be cognizant of the dynamic nature of Lake Michigan (e.g., changing lake levels, wave impacts, and storm surge) and its potential impact on the coastline and property.

■ Suburban Residential District

The intent of this district is to provide for the development, preservation and enhancement of Bridgman's suburban residential neighborhoods, which include primarily single-family housing. This area supports single-family residential developments that are designed as one home on one lot. Streets in this district do not necessarily need to follow a traditional grid pattern, and accompanying uses should include parks, recreational areas, and large institution uses like schools and places of worship. Pedestrian connections are encouraged within these areas and with adjacent neighborhoods.

■ Urban Residential District

The intent of this district is to maintain the traditional downtown neighborhoods in the City of Bridgman. The urban residential district is primarily characterized by smaller single-family residential uses. However, attached single-family residential units may be appropriate within this district. Blocks in these areas are defined by traditional grid street patterns, and sidewalks are prevalent. Many complementary uses such as schools, parks and places of worship could also be located in this district.





COMMERCIAL AREAS

Bridgman's existing commercial areas vary in scale and character. Small commercial nodes are located on Lake Street, near Red Arrow Highway to the west and Mathieu Street to the east. Downtown Bridgman is the primary hub of the city, providing a vibrant and bustling destination for both residents and visitors. Other commercial areas in the city developed as the popularity of the automobile grew; these areas are located along Red Arrow Highway and near I-94 and primarily cater to drivers. Future development and redevelopment within commercial areas should be attractive and add to the character of the city, provide for a higher density of uses in some areas, and provide efficient transportation options (e.g., driving and walking) to the surrounding neighborhoods.

■ Mixed Use Village District

The intent of this district is to provide an attractive and walkable area with a mix of commercial and high-density residential areas along areas of Lake Street near the I-94 overpass and on either side of the Central Downtown district. Appropriate uses include row houses, multiplexes, office space and small retail stores. This district should provide a transition between the high-density areas of the Central Downtown district along Lake Street and the surrounding neighborhoods.

■ Central Downtown District

The intent of this district is to preserve and enhance the existing mixed-use development pattern and inviting atmosphere of downtown Bridgman typically found along Lake Street. The attractive, walkable form of the Central Downtown district and its mix of higher density commercial and residential uses creates a vibrant environment that serves the region's residents and visitors with entertainment, dining, service and shopping opportunities.

■ Highway Commercial District

The intent of this district is to provide commercial uses that serve the greater region and traveling motorists along Red Arrow Highway. Appropriate uses include, but are not limited to, hotels, restaurants, grocery stores, big-box retail stores, automotive sales and apartment complexes. Sites should be developed with shared parking, consideration of access management, and attractive façades and landscaping. Areas near the intersection of Red Arrow Highway and Lake Street should elicit a sense of arrival through a mixture of well-maintained public spaces and mixed-use development.

INDUSTRIAL USES

Industrial uses within Bridgman are important for the long-term viability of the city, as they provide jobs for residents and a tax base for the city. Several of Bridgman's industrial businesses have been in the community for several years; retaining them while adding new businesses will help strengthen the local economy. It is important to consider the potential impacts of industrial uses on adjacent neighborhoods, natural areas and transportation corridors when planning for the future.

■ Industrial District

The intent of this district is to accommodate and provide for a mix of traditional and emerging light-industrial uses as well as office and retail uses. The uses in these areas provide employment opportunities for area residents and generally require large lots, buildings, parking lots and loading areas. Sites and facilities should be developed with appropriate utility services and transportation links, shared parking where appropriate, consideration of access management, and buffers to limit any potential negative impacts on adjacent uses and natural resources.

OTHER AREAS

■ Open Space District

The intent of this district is to provide for a mix of single-family residential uses on large lots, agricultural uses, recreational uses and large areas devoted to open space. In areas where development occurs, emphasis will be placed on preserving natural features through the use of low-impact development tools and cluster development.





TRADITIONAL (NON-FORM) ZONING DISTRICTS

A number of uses are permitted in Non-Form Zoning Districts within the city. There are three residential districts, one industrial district, one commercial district and one open space district identified in the Zoning Ordinance:

■ RL Residential Lake District

This district provides for low-density, large single-family housing. The regulations of this district encourage development that accounts for the unique and sensitive environment of this district, most notably its steep slopes, critical dunes and heavily wooded landscape. This district is situated between Lake Michigan to the west and I-94 to the east. Currently, 18.8% of the city's land is zoned RL.

■ RS Residential Suburban District

This district provides for single-family housing on relatively large lots. This district is primarily located along newer streets that do not necessarily follow the traditional grid pattern of more established districts closer to downtown Bridgman. However, this district is intended to be walkable and connect to adjacent neighborhoods. This district is primarily located on the eastern edge of the city and in the south-central areas of the city, between Red Arrow Highway and Baldwin Road. Currently, 7.4% of the city's land is zoned RS.

■ RC Residential Central District

This district provides for single-family housing on relatively small lots. The density of residential development in this district is higher than in the RS district. This district is primarily located along streets that follow a traditional grid pattern, consistent with the historical layout of the city. This district is primarily located on the north and south side of Lake Street. Currently, 7.7% of the city's land is zoned RC.

■ TI Transitional Industrial District

This district accommodates the needs of industrial uses as well as a mix of office and retail uses. The district is primarily located along Red Arrow Highway and near the I-94 interchange. As a result, access management and shared parking is encouraged. Currently, 7.3% of the city's land is zoned TI.

■ CC Commercial Corridor District

This district provides for auto-oriented commercial and offices uses along Red Arrow Highway. The density of commercial development in this district is higher than in the TI district. Because of its location near the gateway intersection of Lake Street, greater importance is placed on building façades and landscaping. Currently, 7.3% of the city's land is zoned CC.

■ OS Open Space District

This district provides for lands used for large-lot homes, agriculture and/or open space and recreational purposes. Residential uses located in open space areas should have a smaller footprint and utilize low-impact development (LID) practices. The Open Space District encompasses Warren Dunes State Park and large areas in the east end of the city. Currently, 48.2% of the city's land is zoned OS.



FORM-BASED ZONING DISTRICTS

The four form-based zoning districts are intended to provide for a mix of uses that fit in with the character of the surrounding districts. As noted earlier in this chapter, particular attention is placed on building form (e.g., materials, placement).

■ DC Downtown Core District

This district is intended to provide for a continued pattern of mixed-use development within the heart of downtown Bridgman. Commercial and retail uses on the lower floors of buildings should be mixed with residential uses on the upper floors. The maximum height for buildings in this district is no more than four stories. This district is located in an approximately three-block stretch along Lake Street, roughly between Maplewood Avenue and Mathieu Street. Currently, just 0.2% of the city's land is zoned DC.

■ CG Commercial Gateway District

This district is intended to provide for a mix of uses that provides for a sense of arrival and further supports the existing commercial and retail uses within the district. Because of its location at the gateway intersection of Lake Street, greater importance is placed on building placement, building façades and landscaping. Currently, 1.0% of the city's land is zoned CG.

■ DE Downtown Edge District

This district is intended to provide for redevelopment and infill along the edges of downtown Bridgman and the Red Arrow Highway/Lake Street intersection. In addition, this district should act as a transition between the more urban areas of the city and the surrounding neighborhoods. A wide variety of commercial, retail and higher-density residential uses (e.g., multiplex live/work, row house) are allowed. This district is primarily located just east and west of the I-94 overpass, and along Lake Street between the railroad tracks and Church Street. Currently, 1.6% of the city's land is zoned DE.

■ NE Neighborhood Edge District

This district is intended to provide for redevelopment and infill along Lake Street that preserves the residential character of the corridor by allowing for building types that are compatible in size and scale. A wide variety of commercial, retail and higher-density residential uses are allowed. This district is located on Lake Street between the Downtown Core District and the Red Arrow/Lake Street intersection. Currently, 0.5% of the city's land is zoned NE.

FUTURE CHANGES TO THE ZONING ORDINANCE

In order to remain consistent with the resiliency framework identified in this Master Plan, a number of zoning ordinance amendments may be necessary. The following list identifies several opportunities to amend the Bridgman Zoning Ordinance to be consistent with the resiliency framework set forth in this Master Plan.

- Encourage alternative energy through zoning. Allow by right a number of non-intrusive alternative energy installations such as small-scale solar or geothermal.
- Evaluate the Zoning Ordinance to determine if coastal setbacks are restrictive enough to prevent homeowners from experiencing harm, given the climate trend of increasingly severe coastal storms and increased erosion risk.
- Establish an overlay zone that would restrict the placement of a seawall or armoring along the shoreline.

Table 9.1 Traditional (Non-Form) Zoning Districts in Bridgman, 2017

Zoning District	Total Acres	Minimum Area	Maximum Density (Units Per Acre)*	Maximum Height (FT.)	Minimum Front Yard Setback (FT.)	Minimum Side Yard Setback (FT.)	Minimum Rear Yard Setback (FT.)	Minimum Lot Width (FT.)
RL - Residential Lake	307	20,000 sq. ft.	2.1	35	30	12	30	110
RS - Residential Suburban	121	12,000 sq. ft.	3.6	35	30	8	20	80
RC - Residential Central	126	7,000 sq. ft.	6.2	35	20	8	20	70
TI - Transitional Industrial	119	20,000 sq. ft.	2.1	60	30	15	25	150
CC - Commercial Corridor	118	8,000 sq. ft.	5.4	60	20	5	10	75
OS - Open Space	789	20,000 sq. ft.	2.1	35	30	12	30	110

Source: City of Bridgman Zoning Ordinance, Adopted July 10, 2017

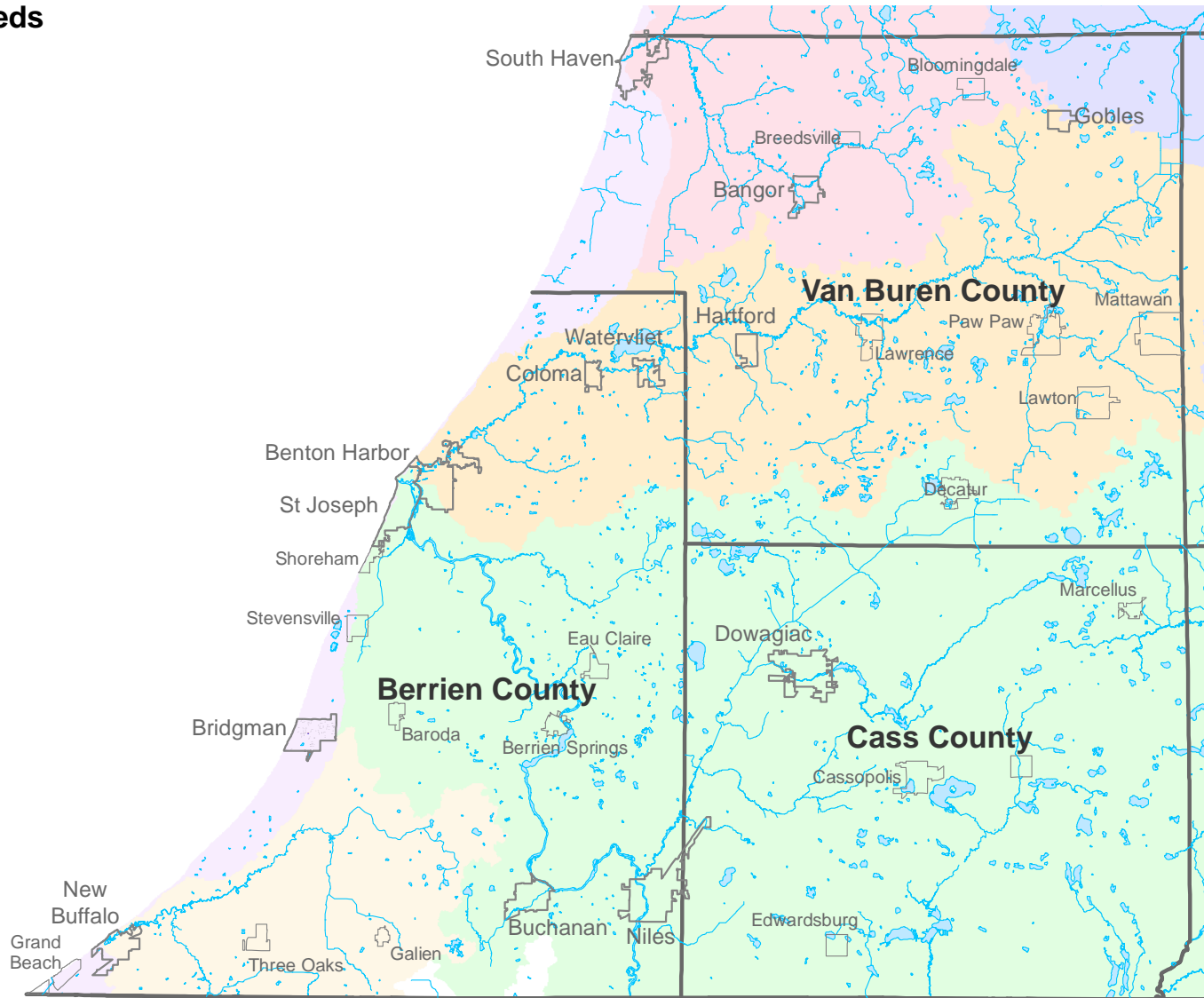
Form-based zoning district standards can be found in the Zoning Ordinance

* Density was calculated based on the number of residential units permitted per acre according to the minimum lot size. Accessory and secondary buildings were not included in the calculation of density.

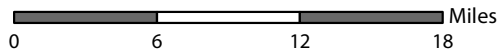
MAPS

Map 2.1 Regional Watersheds

- Black
- Direct
- Galien
- Kalamazoo
- Paw Paw
- St. Joseph



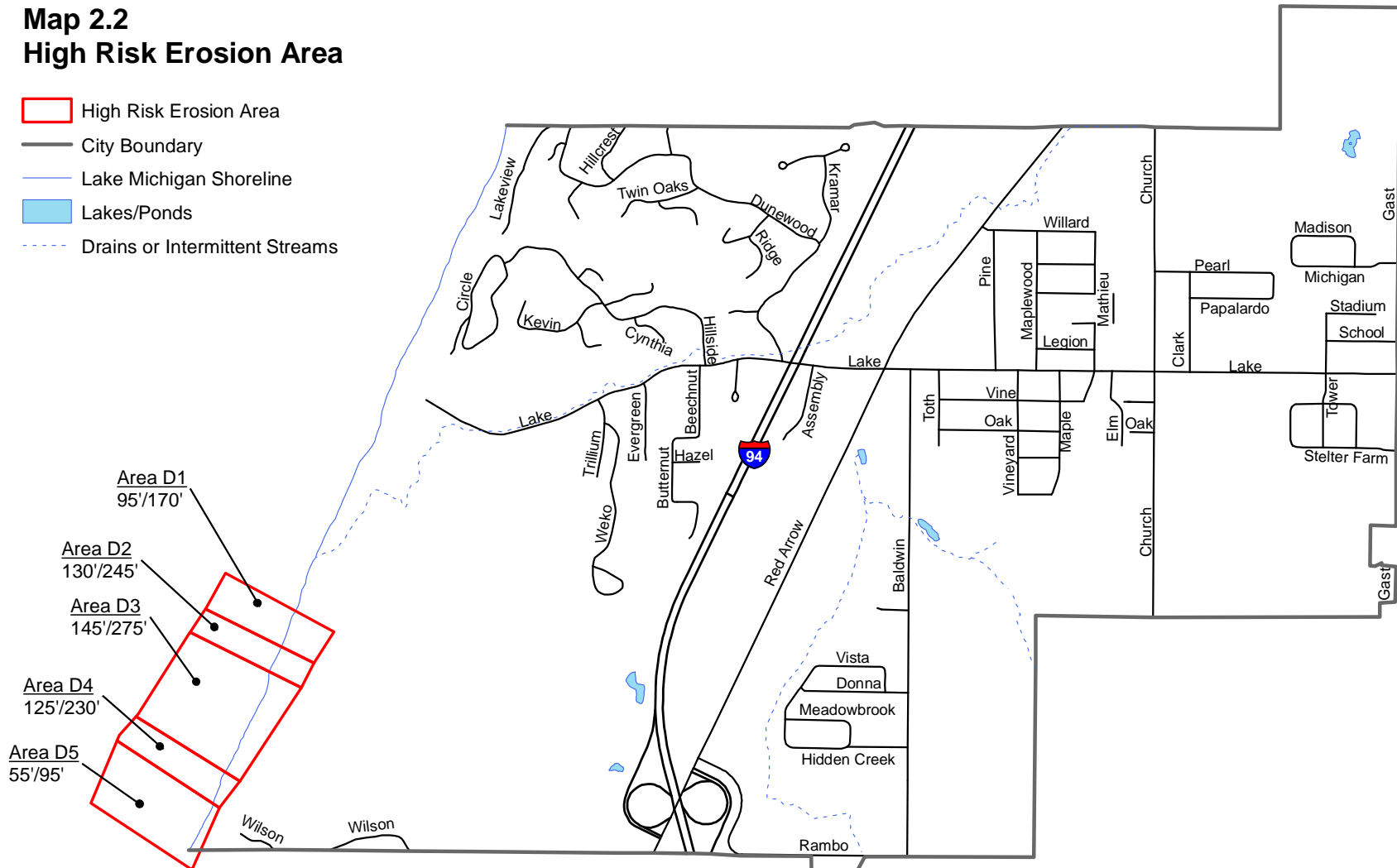
Prepared December 2018 by LIAA for the City of Bridgman.



Data Sources:
Berrien County GIS
Michigan Geographic Data Library

Map 2.2 High Risk Erosion Area

- High Risk Erosion Area
- City Boundary
- Lake Michigan Shoreline
- Lakes/Ponds
- Drains or Intermittent Streams



The numbers for each High Risk Erosion Area (HREA) are the 30-year and 60-year recession distances, respectively for that specific HREA

65' -> 30-yr recession distance
 115' -> 60-yr recession distance

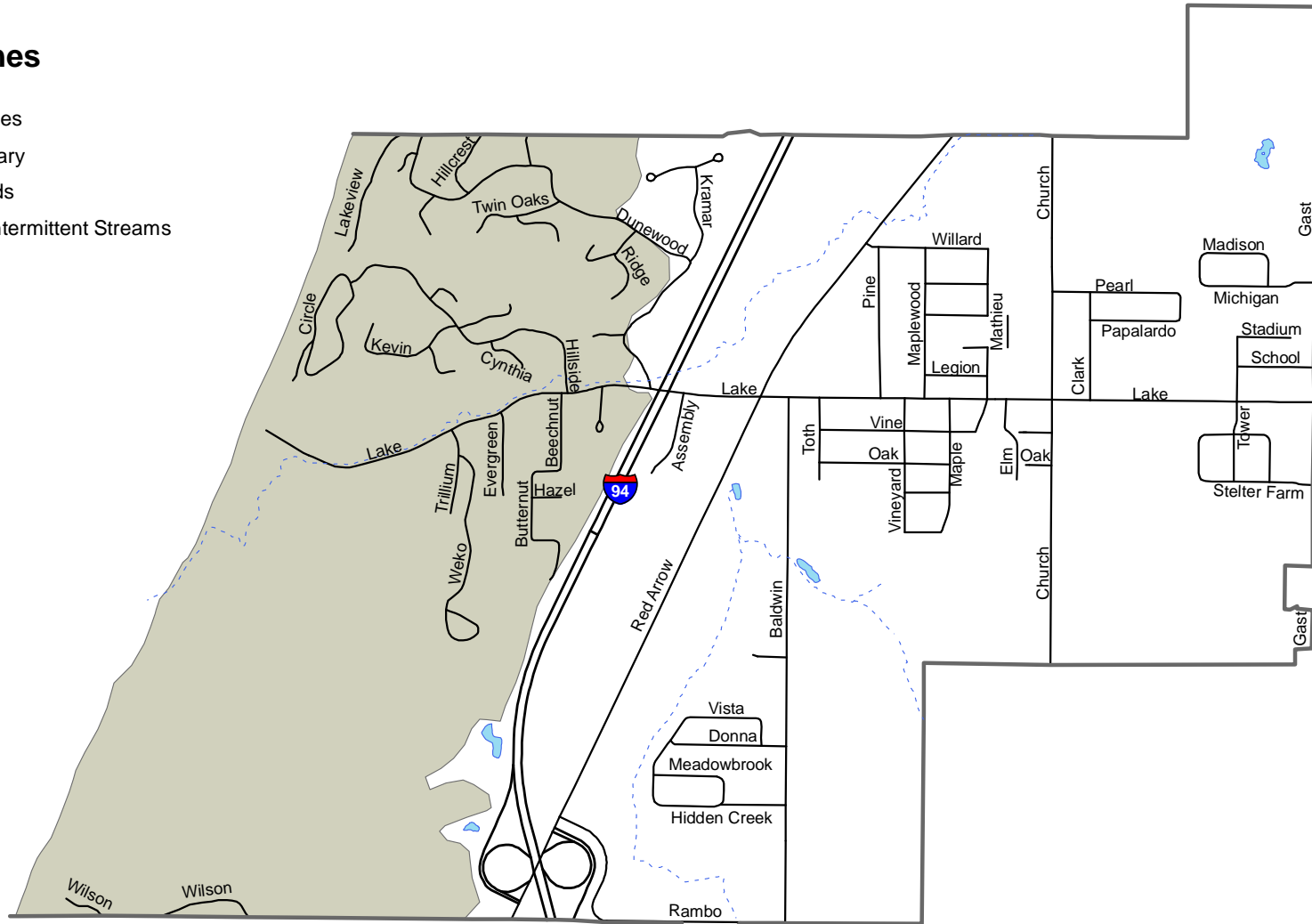
Data Sources:
Berrien County GIS, LIAA
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



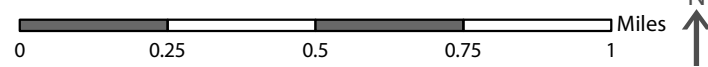
Map 2.3 Critical Dunes

- Barrier Dunes
- City Boundary
- Lakes/Ponds
- Drains or Intermittent Streams






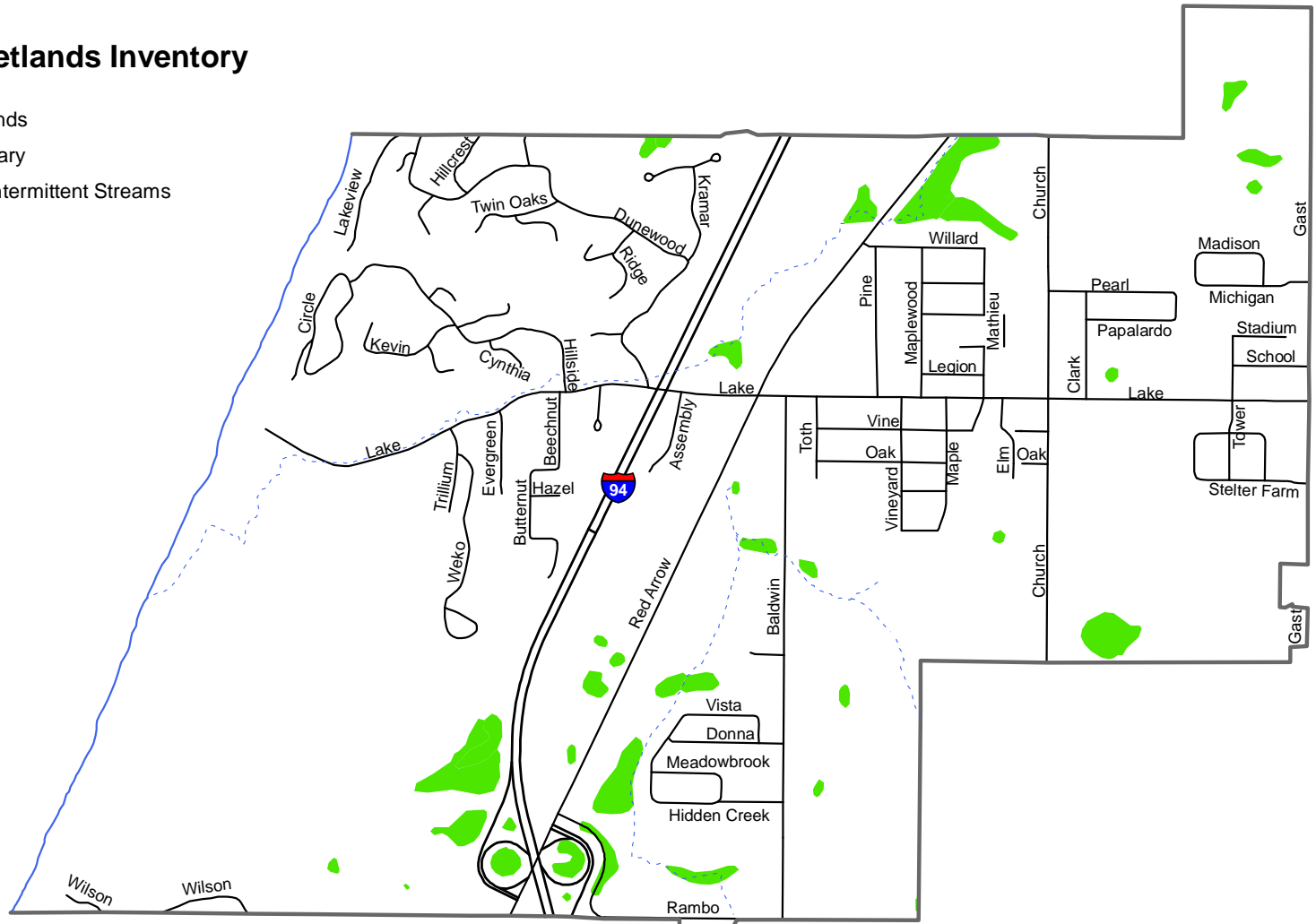
Data Sources:
Berrien County GIS,
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



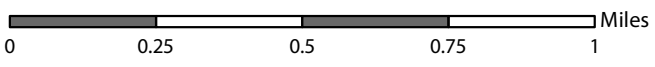
Map 2.4 National Wetlands Inventory

-  NWI Wetlands
-  City Boundary
-  Drains or Intermittent Streams



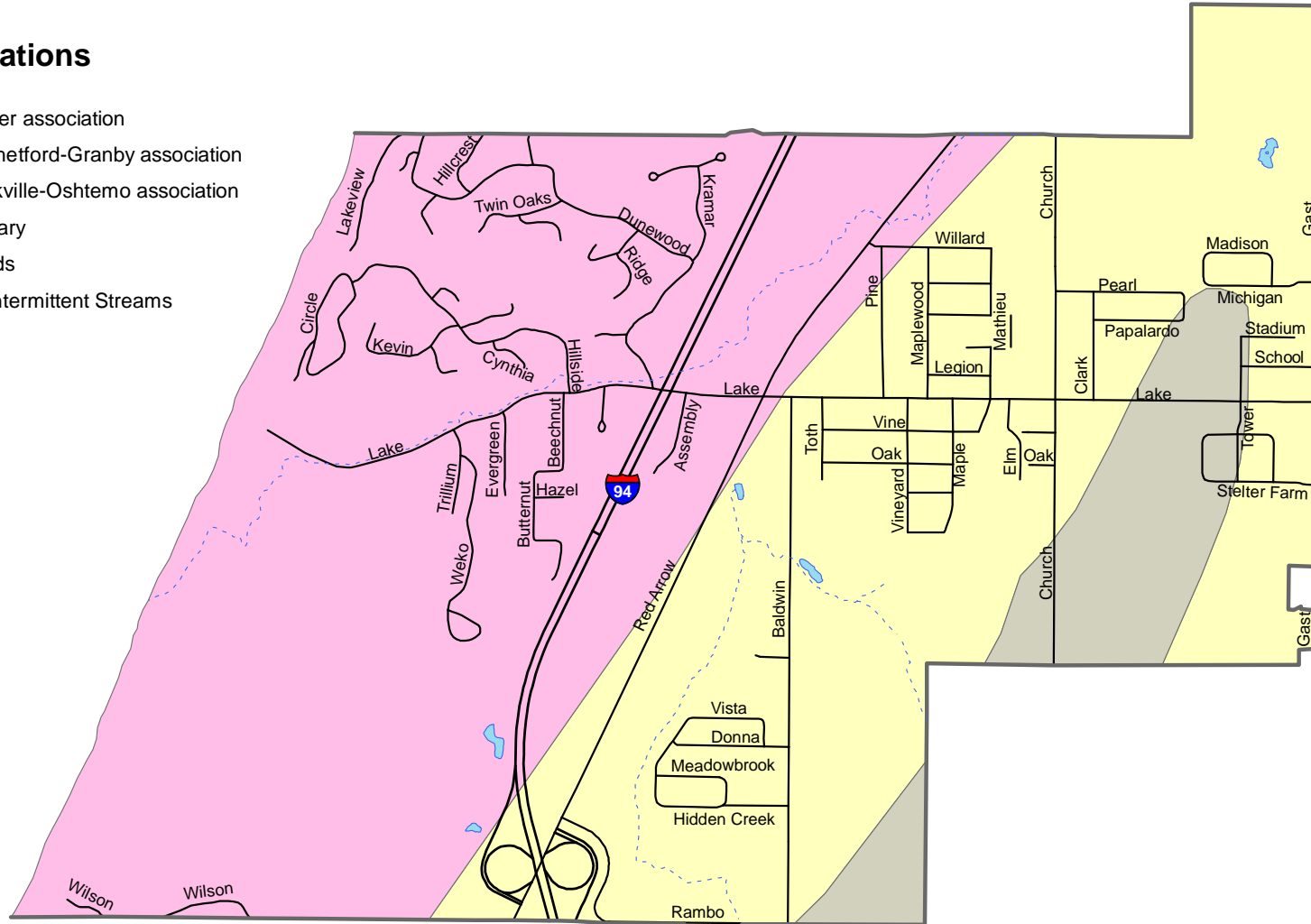
Data Sources:
Berrien County GIS
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



Map 2.5 Soil Associations

- Blount-Rimer association
- Morocco-Thetford-Granby association
- Spinks-Oakville-Oshtemo association
- City Boundary
- Lakes/Ponds
- Drains or Intermittent Streams



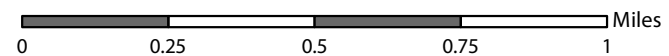
Blount-Rimer association: Nearly level and gently sloping, somewhat poorly drained, loamy and sandy soils on till plains and moraines.

Morocco-Thetford-Granby association: Nearly level, somewhat poorly drained and poorly drained, sandy soils on moraines, till plains, outwash plains, lake plains, and beach ridges.

Spinks-Oakville-Oshtemo association: Nearly level to very steep, well drained, sandy and loamy soils on moraines, till plains, outwash plains, and beach ridges

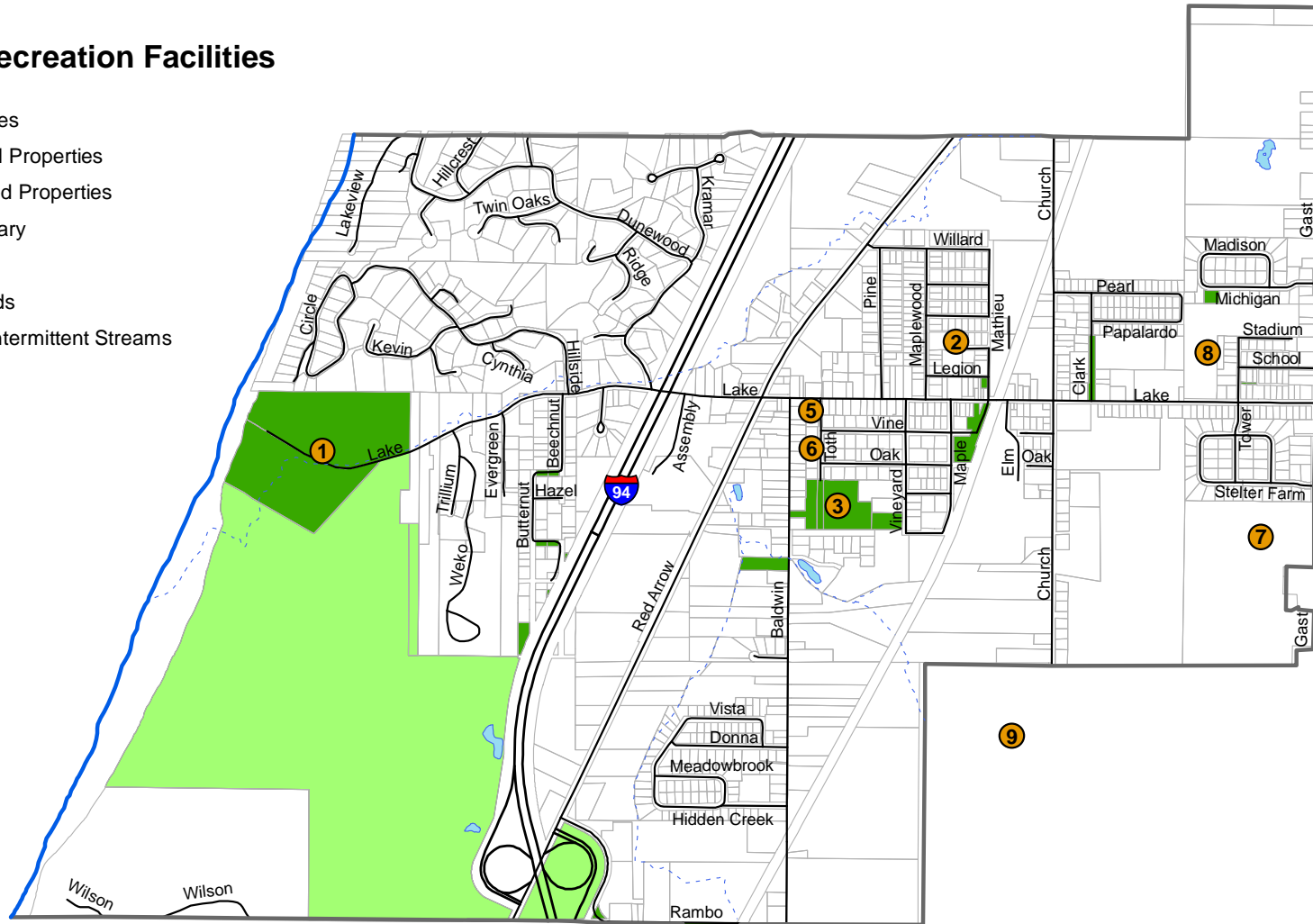
Data Sources:
Berrien County GIS, Berrien County Soil Survey
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



Map 4.1 Park and Recreation Facilities

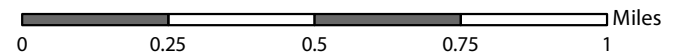
-  Park Facilities
-  City Owned Properties
-  DNR Owned Properties
-  City Boundary
-  Shoreline
-  Lakes/Ponds
-  Drains or Intermittent Streams



- 1 - Weko Beach
- 2 - Legion Park
- 3 - Toth Park
- 4 - Warren Dunes State Park
- 5 - Bridgman Public Library
- 6 - Community Gardens
- 7 - Bridgman High School
- 8 - Bridgman Elementary School
- 9 - F.C. Reed Middle School




Data Sources:
Berrien County GIS, LIAA,
Michigan Geographic Data Library

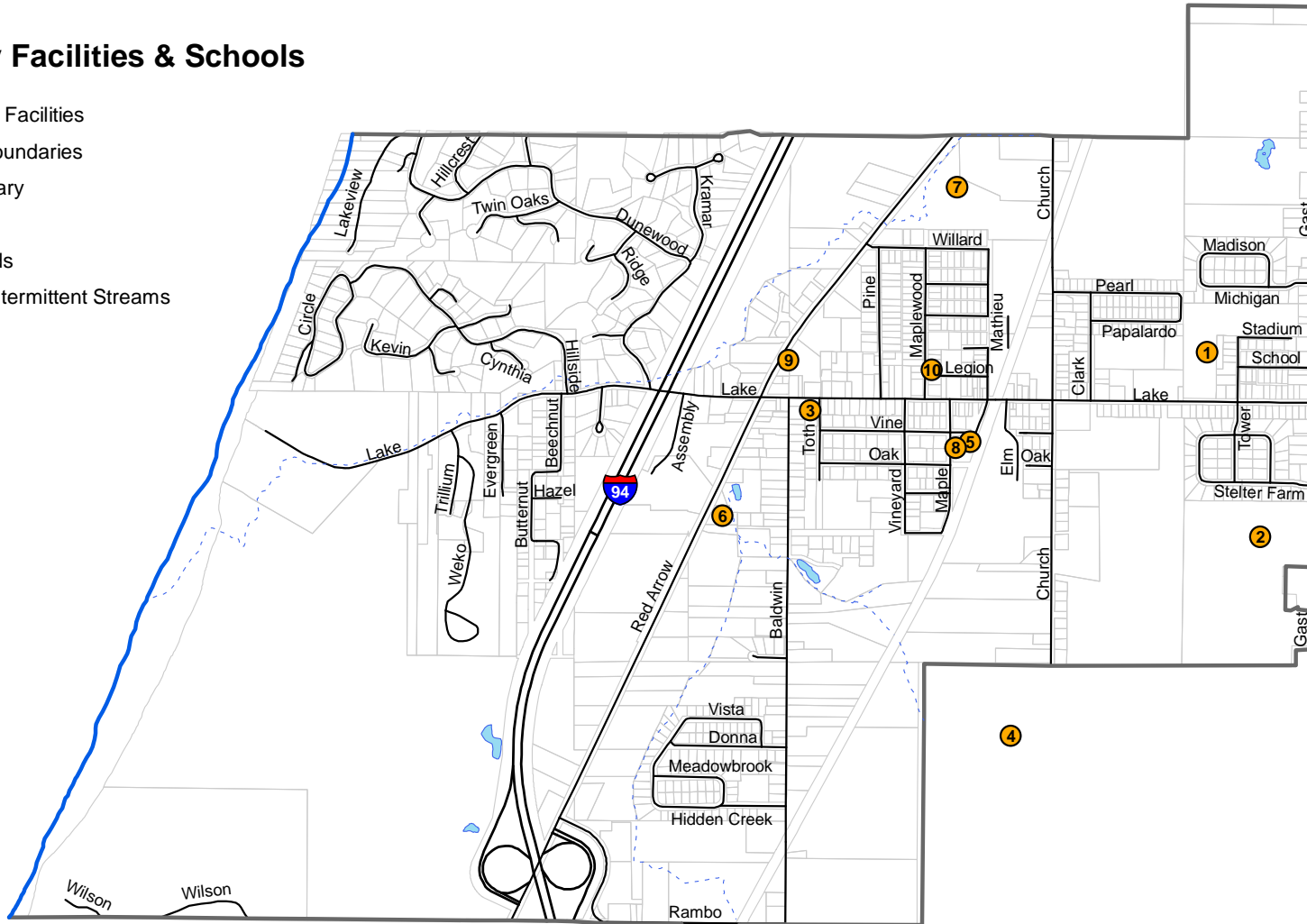
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4

Map 4.2 Community Facilities & Schools

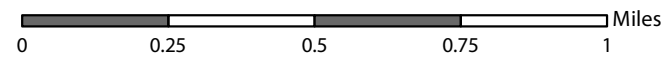
-  Community Facilities
-  Property Boundaries
-  City Boundary
-  Shoreline
-  Lakes/Ponds
-  Drains or Intermittent Streams












- 1 - Bridgman Elementary School
- 2 - Bridgman High School
- 3 - Bridgman Public Library
- 4 - F.C. Reed Middle School
- 5 - Fire Department
- 6 - I & M Electric Substation
- 7 - Michigan State Police Department
- 8 - Police Department
- 9 - Southwestern Medical Clinic
- 10 - U.S. Postal Service

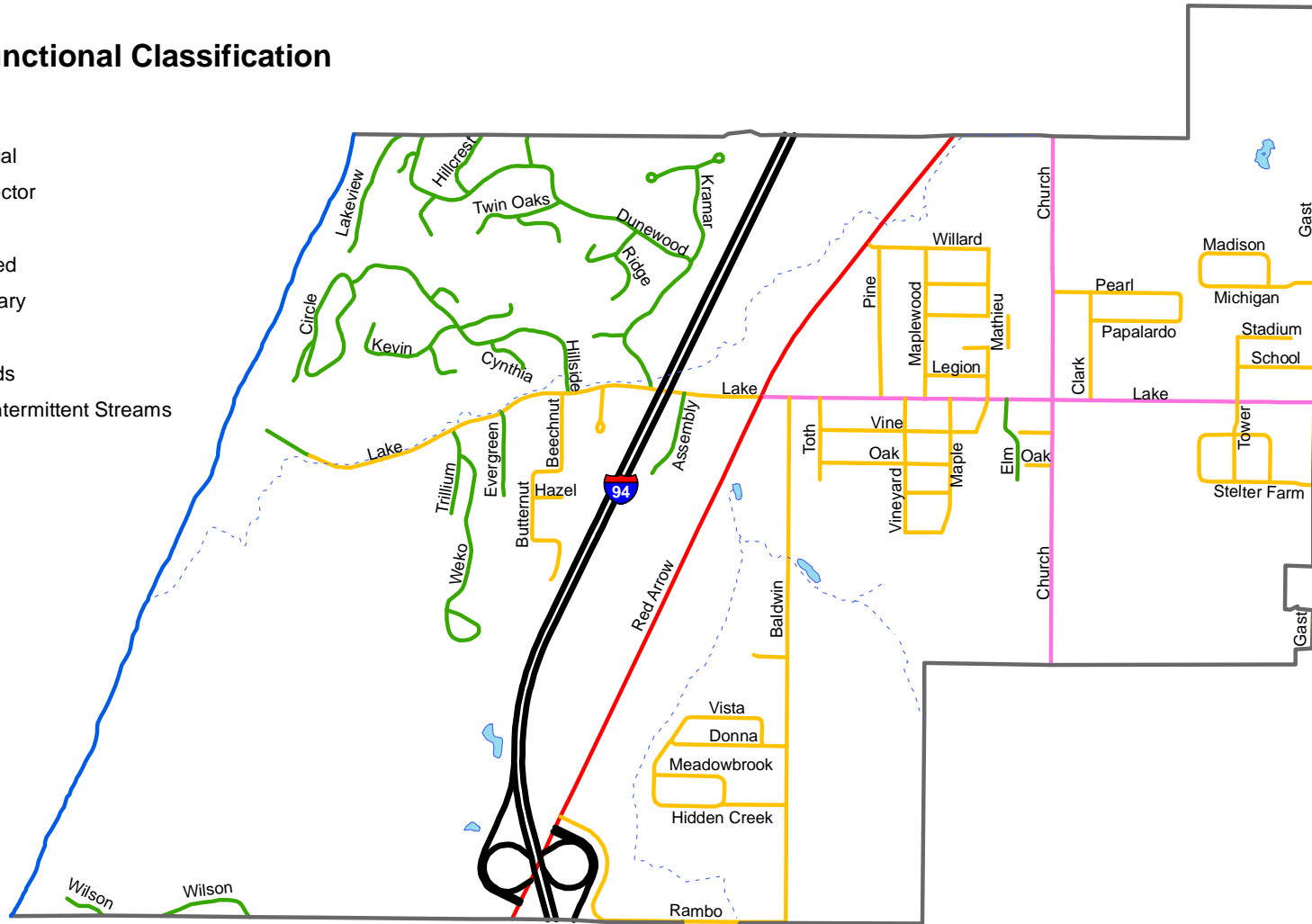
Data Sources:
Berrien County GIS, LIAA
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



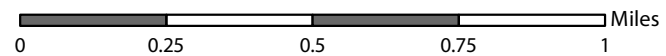
Map 4.3 National Functional Classification

-  Interstate
-  Minor Arterial
-  Major Collector
-  NFC Local
-  Non-Certified
-  City Boundary
-  Shoreline
-  Lakes/Ponds
-  Drains or Intermittent Streams

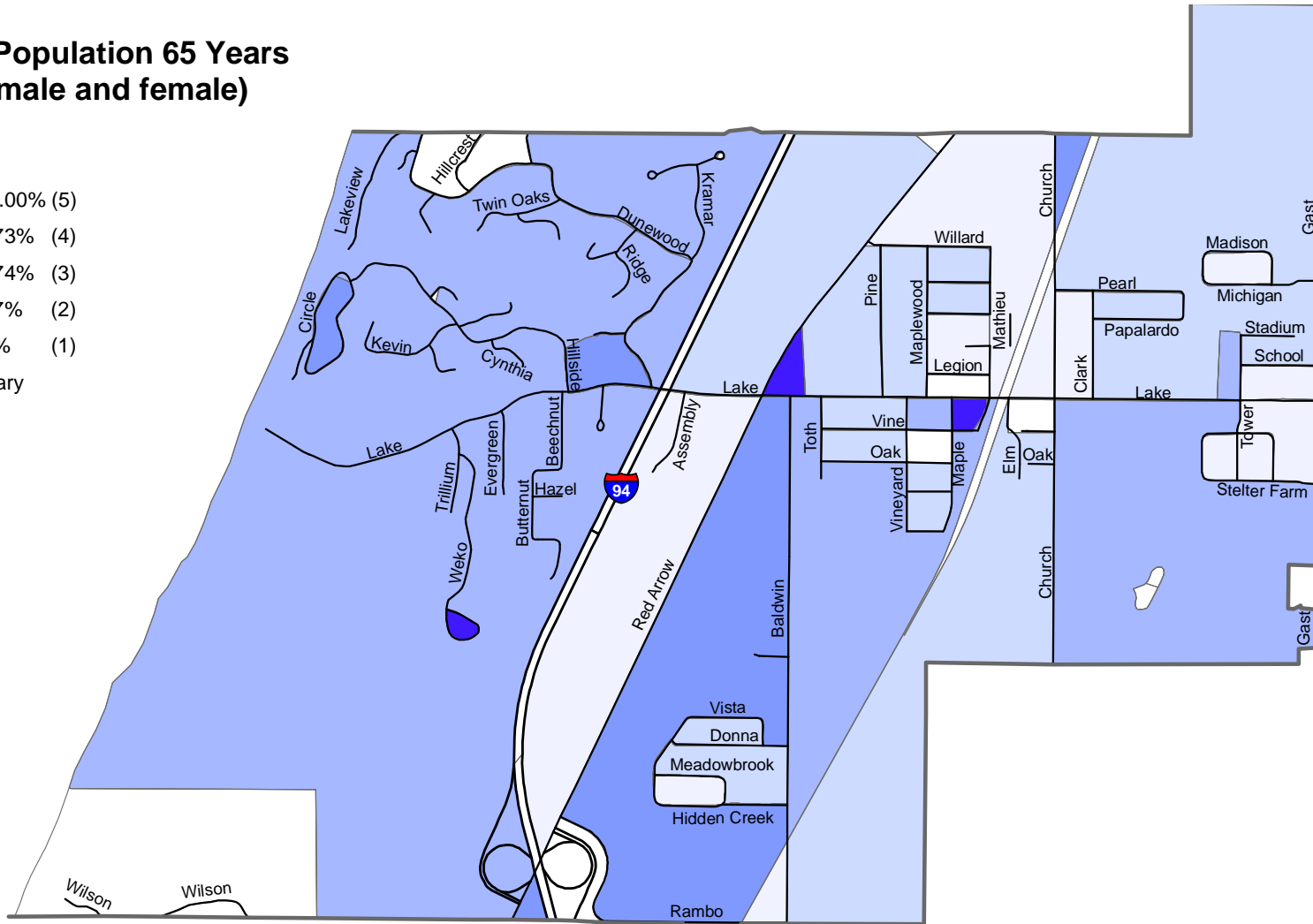
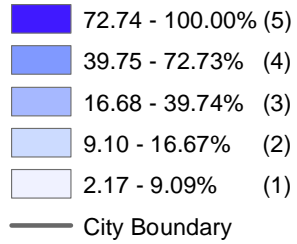


Data Sources:
Berrien County GIS
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.

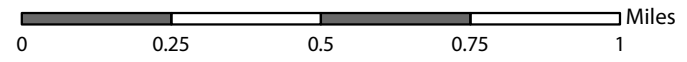


Map 7.1 Percent of Population 65 Years and Older (male and female)

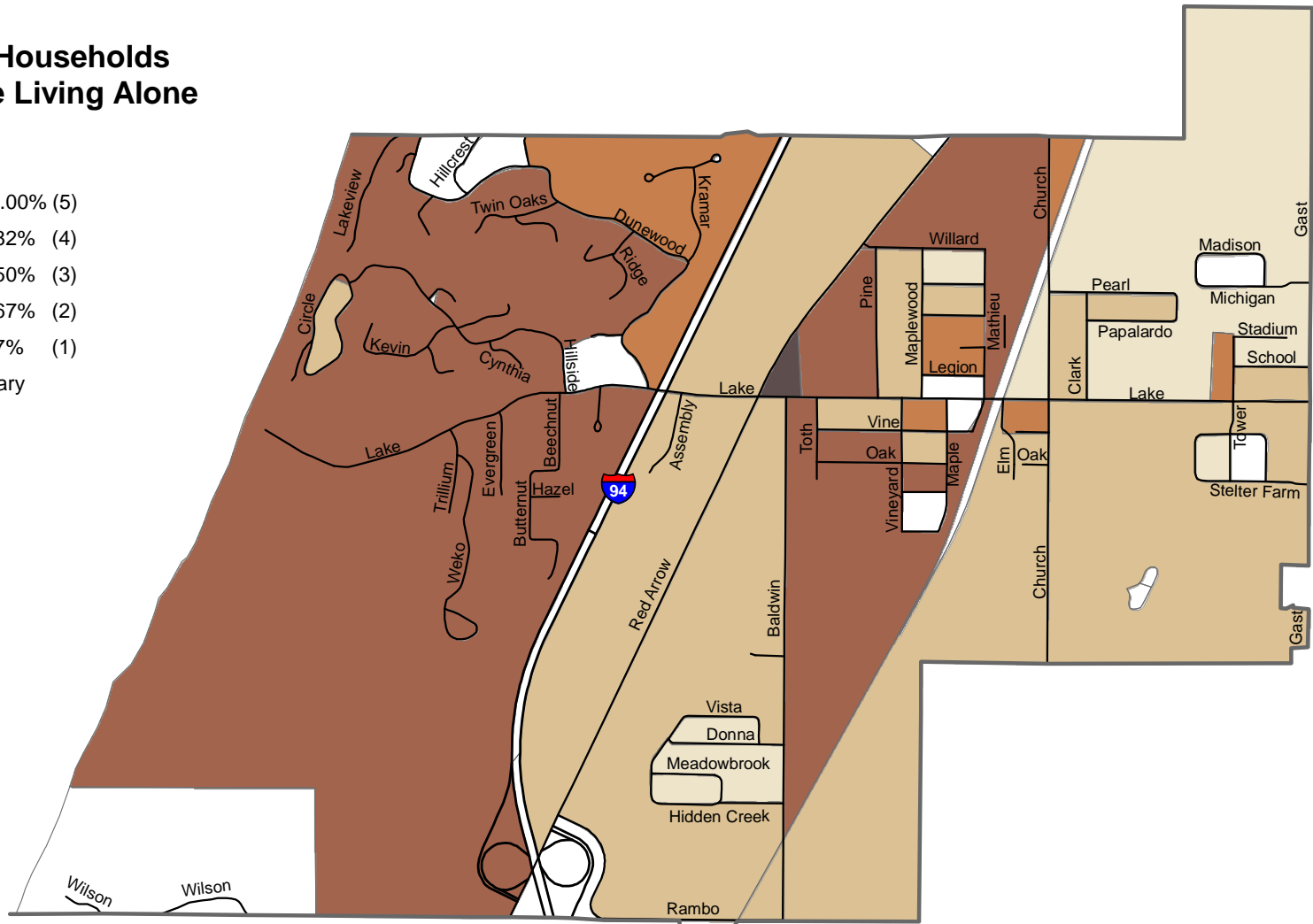
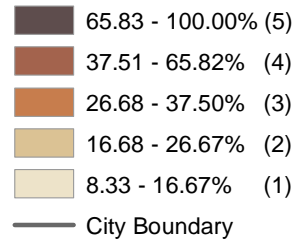


Data Sources:
 U.S. Census Bureau, Block Level Data (2010), ACS (2011-2015)
 Michigan Geographic Data Library, Berrien County GIS

Prepared December 2018 by LIAA for the City of Bridgman.

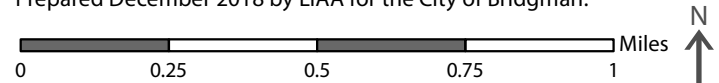


Map 7.2
Percent of Households
with People Living Alone



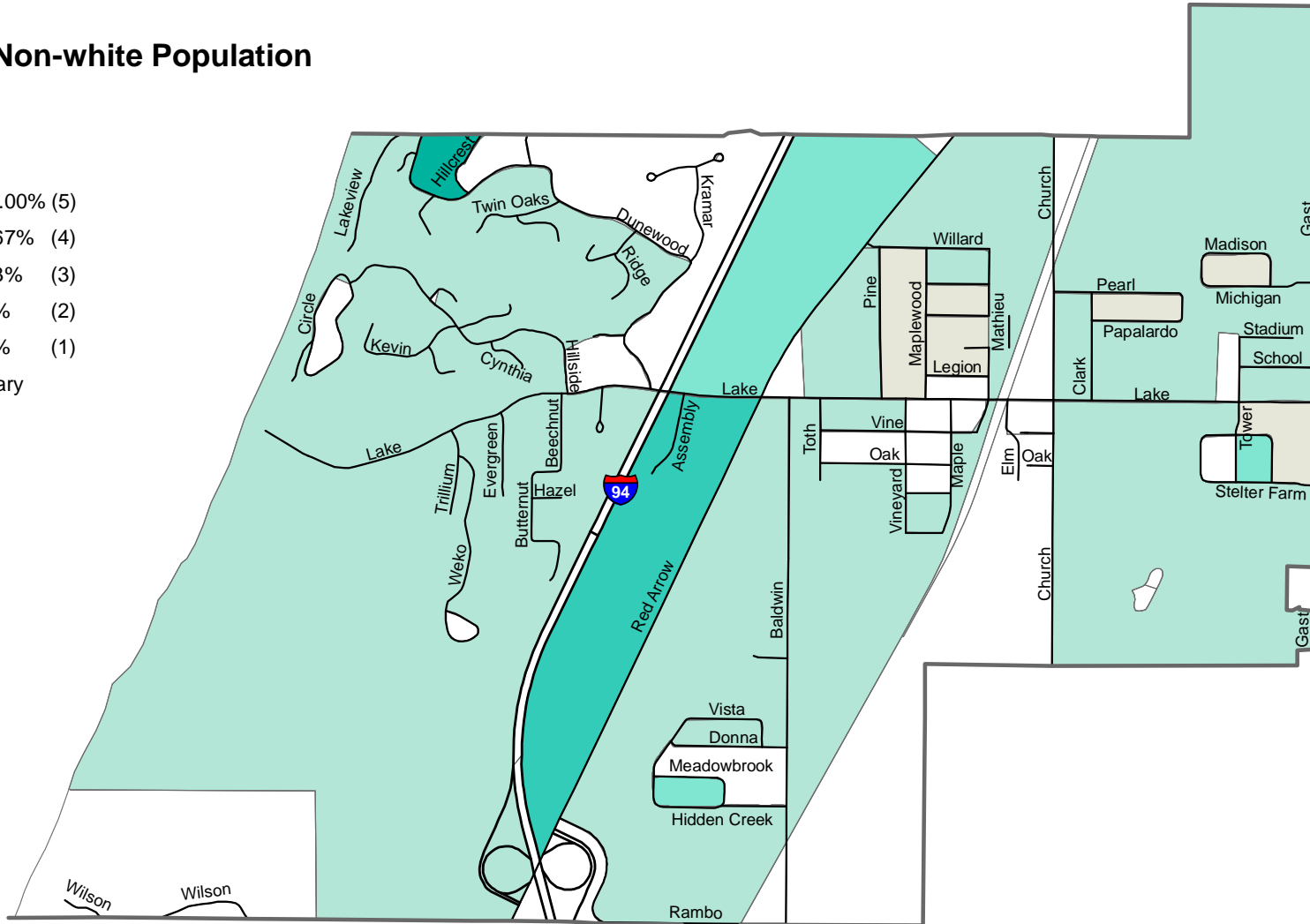
Data Sources:
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 Michigan Geographic Data Library, Berrien County GIS

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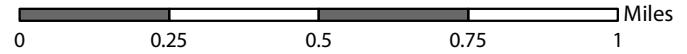
Map 7.3 Percent of Non-white Population

- 41.68 - 100.00% (5)
- 20.84 - 41.67% (4)
- 9.86 - 20.83% (3)
- 3.04 - 9.85% (2)
- 1.10 - 3.03% (1)
- City Boundary



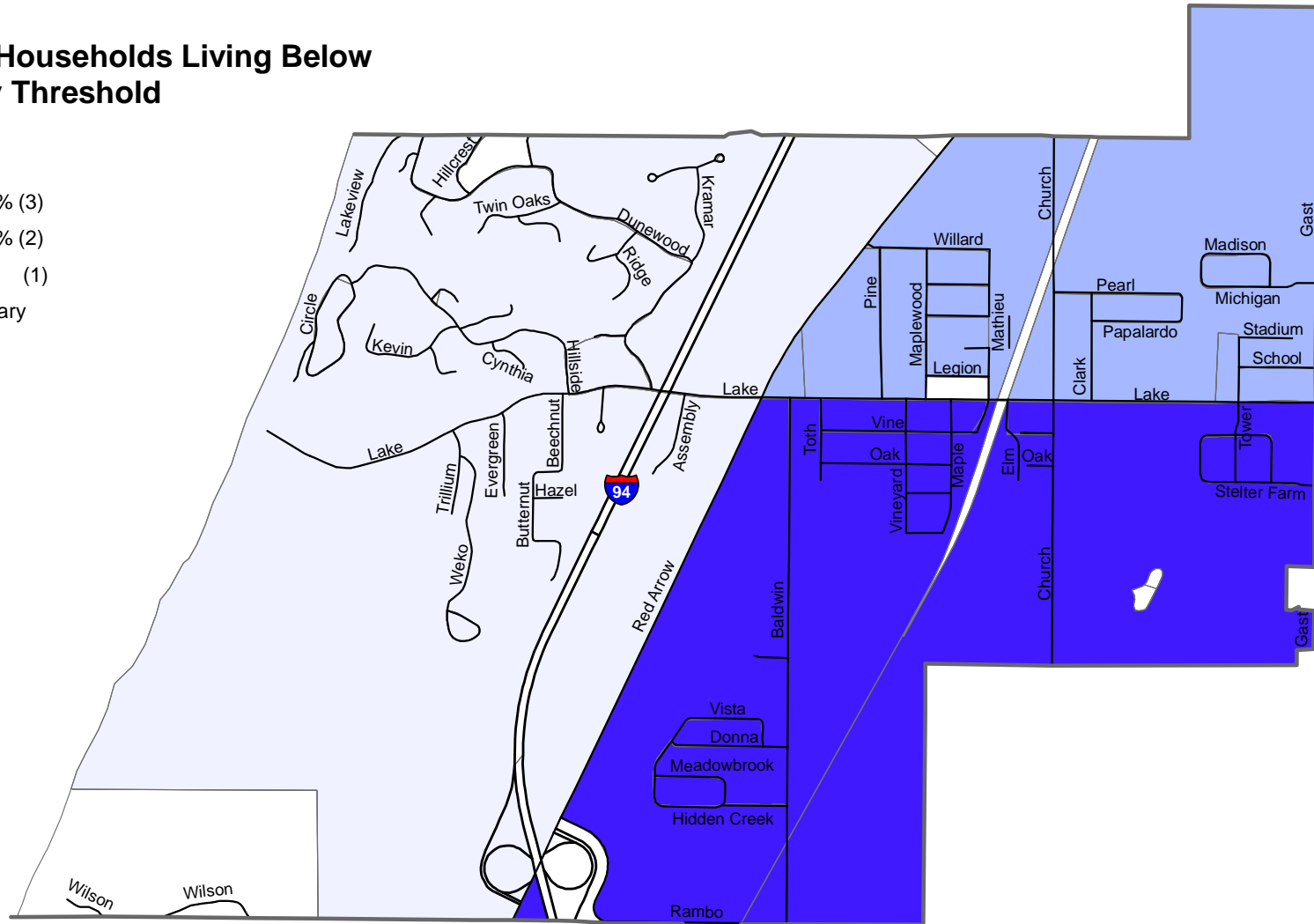
Data Sources:
U.S. Census Bureau, Block Level Data (2010), ACS (2011-2015)
Michigan Geographic Data Library, Berrien County GIS

Prepared December 2018 by LIAA for the City of Bridgman.



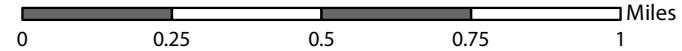
Map 7.4 Percent of Households Living Below the Poverty Threshold

- 8.21 - 8.80% (3)
- 1.21 - 8.20% (2)
- 1.20 (1)
- City Boundary



Data Sources:
U.S. Census Bureau, Block Level Data (2010), ACS (2011-2015)
Michigan Geographic Data Library, Berrien County GIS

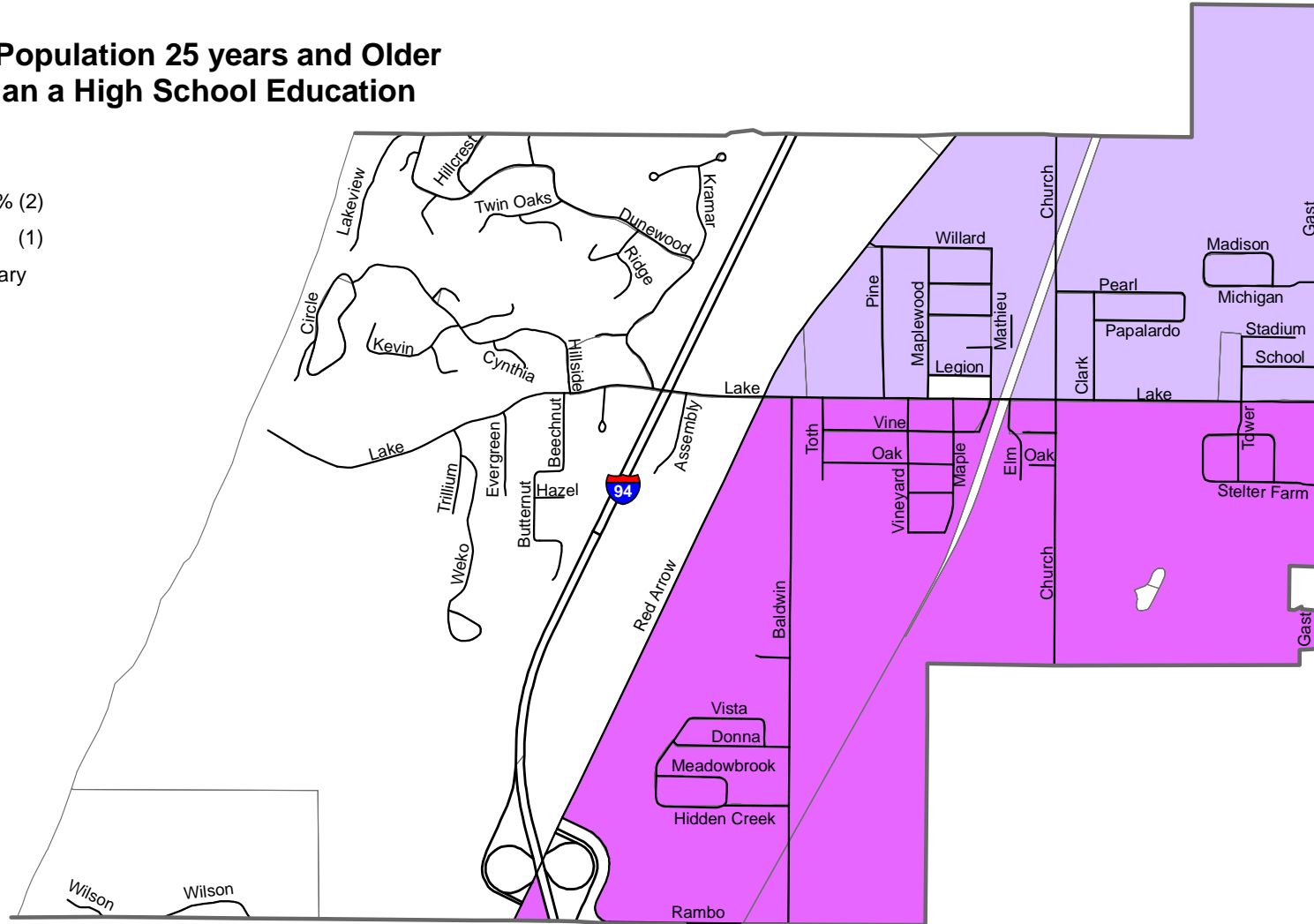
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Map 7.5

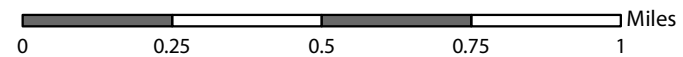
Percent of Population 25 years and Older with less than a High School Education

- 5.21 - 5.80% (2)
- 5.20% (1)
- City Boundary



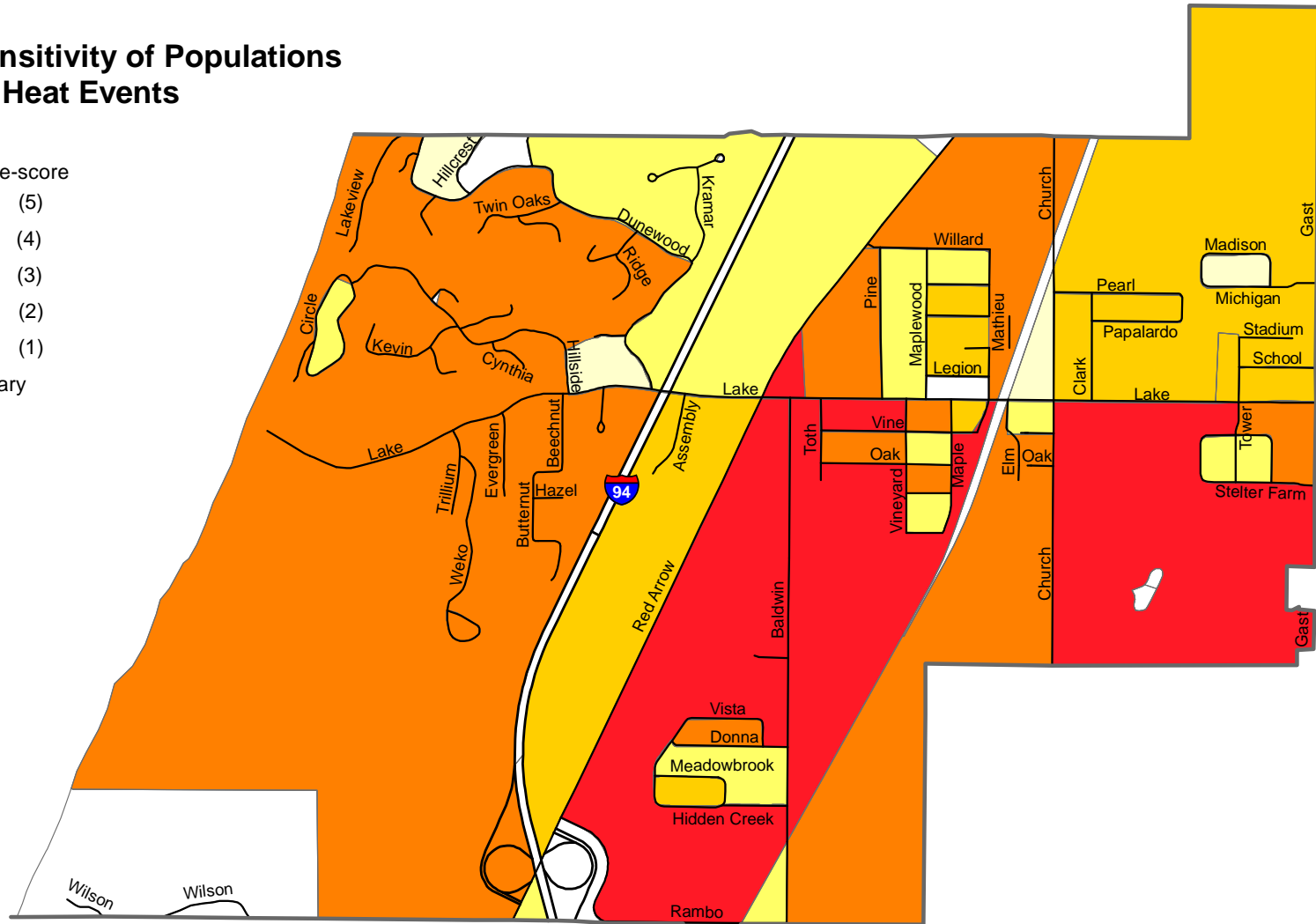
Data Sources:
 U.S. Census Bureau, Block Level Data (2010), ACS (2011-2015)
 Michigan Geographic Data Library, Berrien County GIS

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Map 7.6 Relative Sensitivity of Populations to Extreme Heat Events

additive score	re-score
 13 - 15	(5)
 11 - 12	(4)
 10	(3)
 8 - 9	(2)
 5 - 7	(1)
 City Boundary	



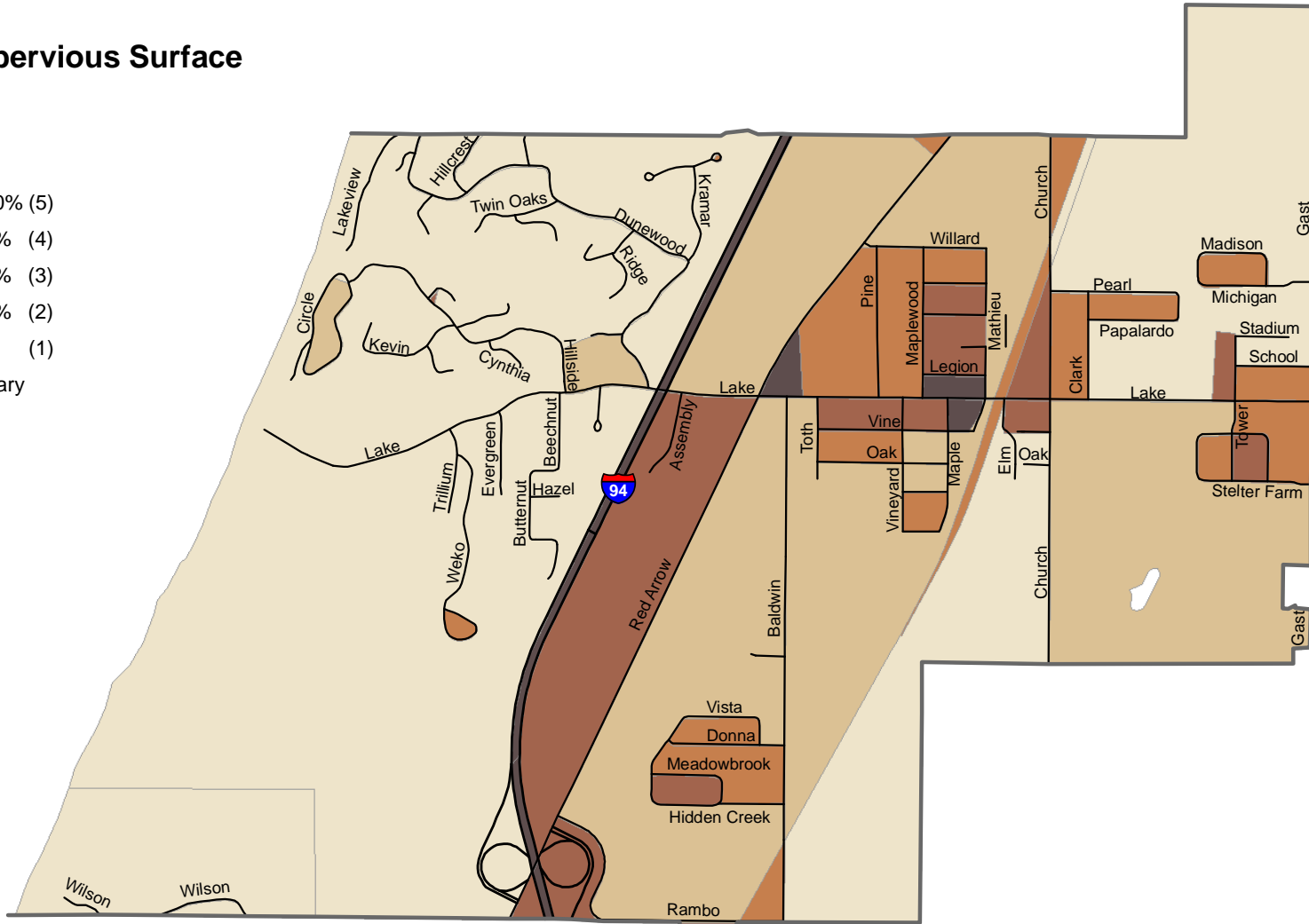
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 Michigan Geographic Data Library, Berrien County GIS

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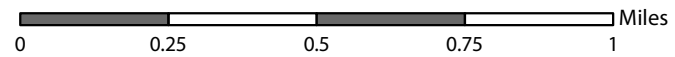
Map 7.7 Percent Impervious Surface

- 62.1 - 100.0% (5)
- 39.3 - 62.0% (4)
- 26.9 - 39.2% (3)
- 12.4 - 26.8% (2)
- 1.1 - 12.3% (1)
- City Boundary



Data Sources:
 U.S. Census Bureau, Block Level Data (2010), ACS (2011-2015)
 Michigan Geographic Data Library, Berrien County GIS

Prepared December 2018 by LIAA for the City of Bridgman.



Map 7.8 Percent Tree Canopy

- 66.3 - 99.0% (5)
- 42.1 - 66.2% (4)
- 26.4 - 42.0% (3)
- 13.3 - 26.3% (2)
- 0.5 - 13.2% (1)
- City Boundary








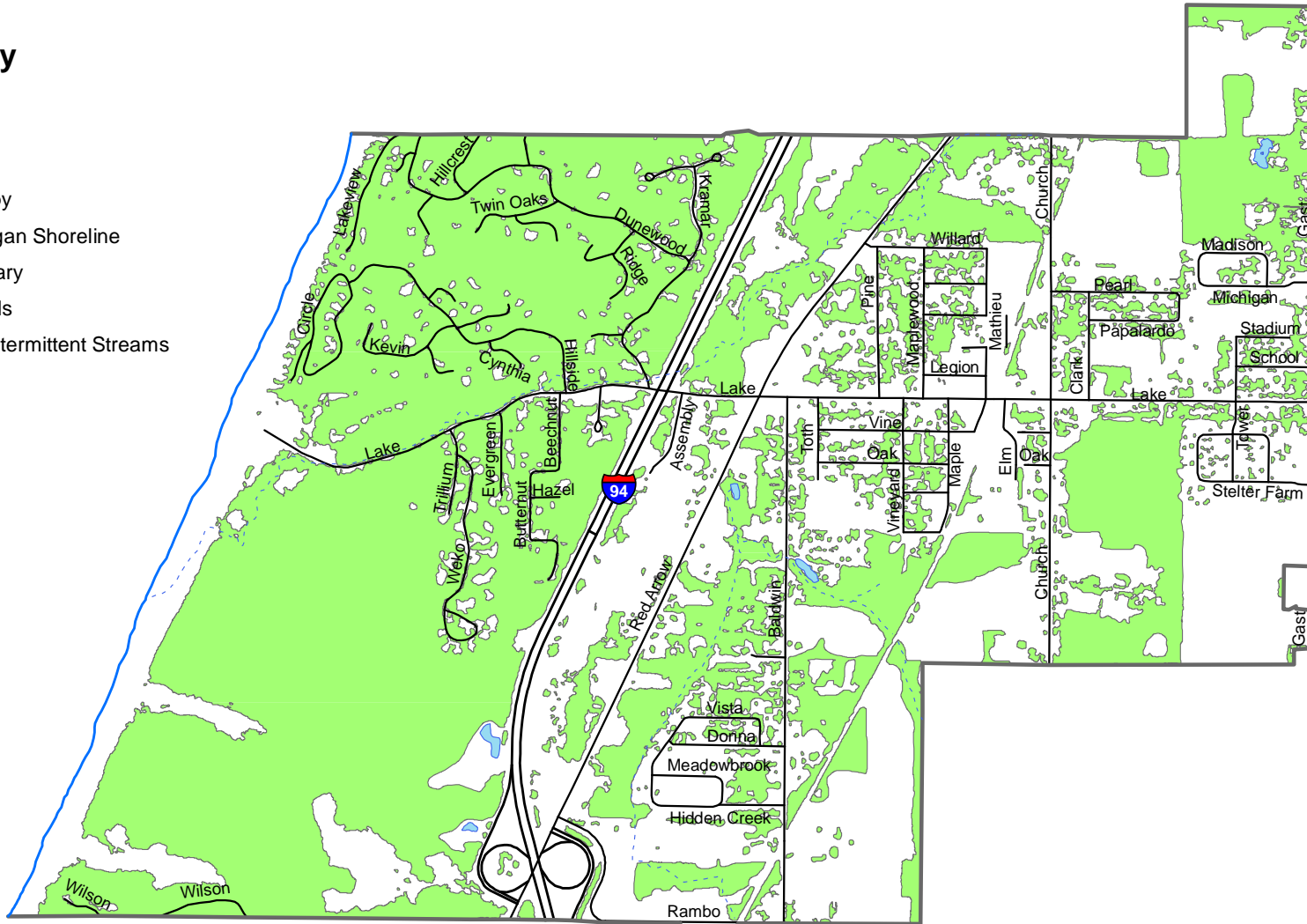
Data Sources:
 U.S. Census Bureau, Block Level Data (2010), ACS (2011-2015)
 Michigan Geographic Data Library, Berrien County GIS

Prepared December 2018 by LIAA for the City of Bridgman.



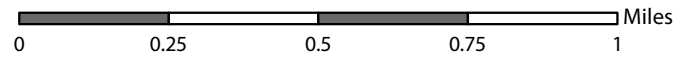
Map 7.9 Tree Canopy

-  Tree Canopy
-  Lake Michigan Shoreline
-  City Boundary
-  Lakes/Ponds
-  Drains or Intermittent Streams

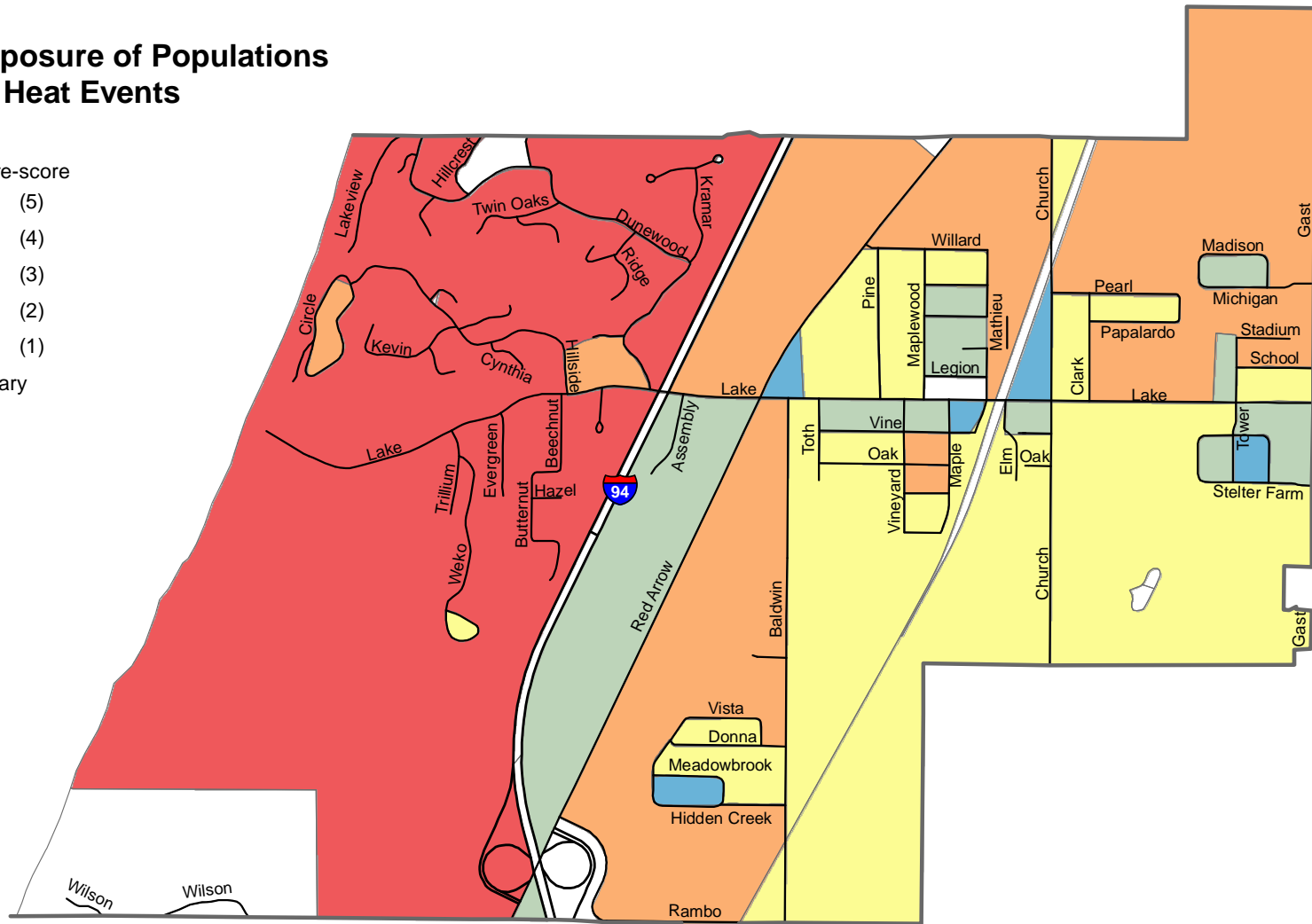
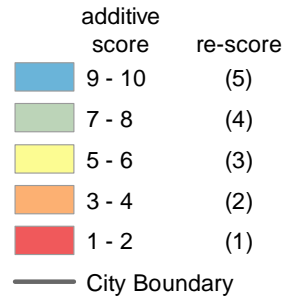


Data Sources:
Berrien County GIS, LIAA,
Michigan Geographic Data Library

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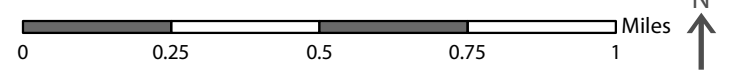


Map 7.10 Relative Exposure of Populations to Extreme Heat Events

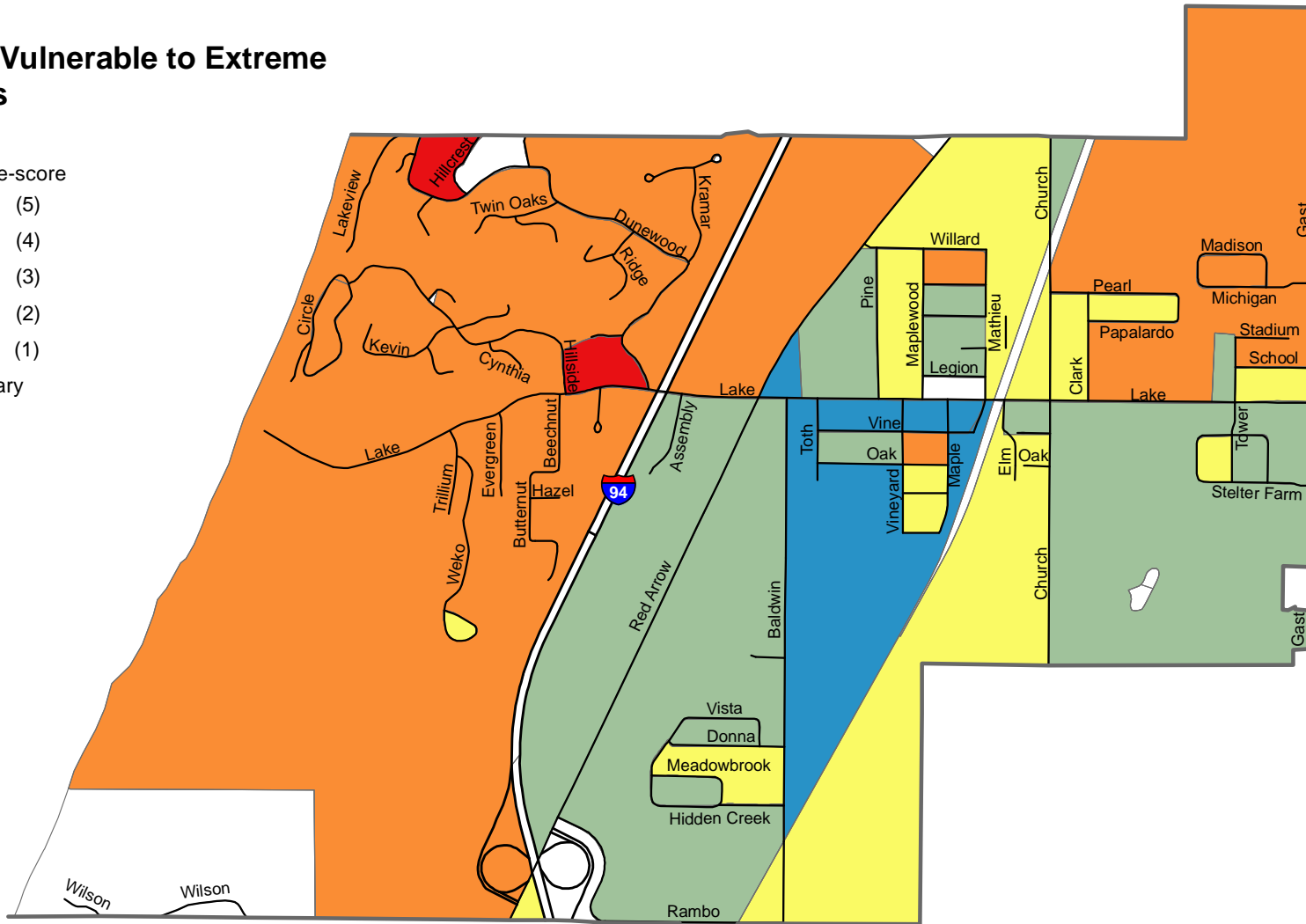
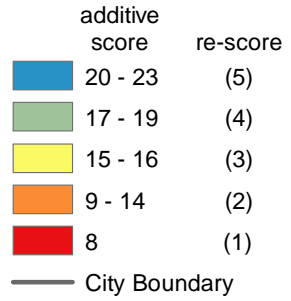


Data Sources:
U.S. Census Bureau, Block Level Data (2010), ACS (2011-2015)
Michigan Geographic Data Library, Berrien County GIS

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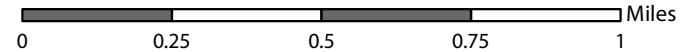


Map 7.11 Population Vulnerable to Extreme Heat Events

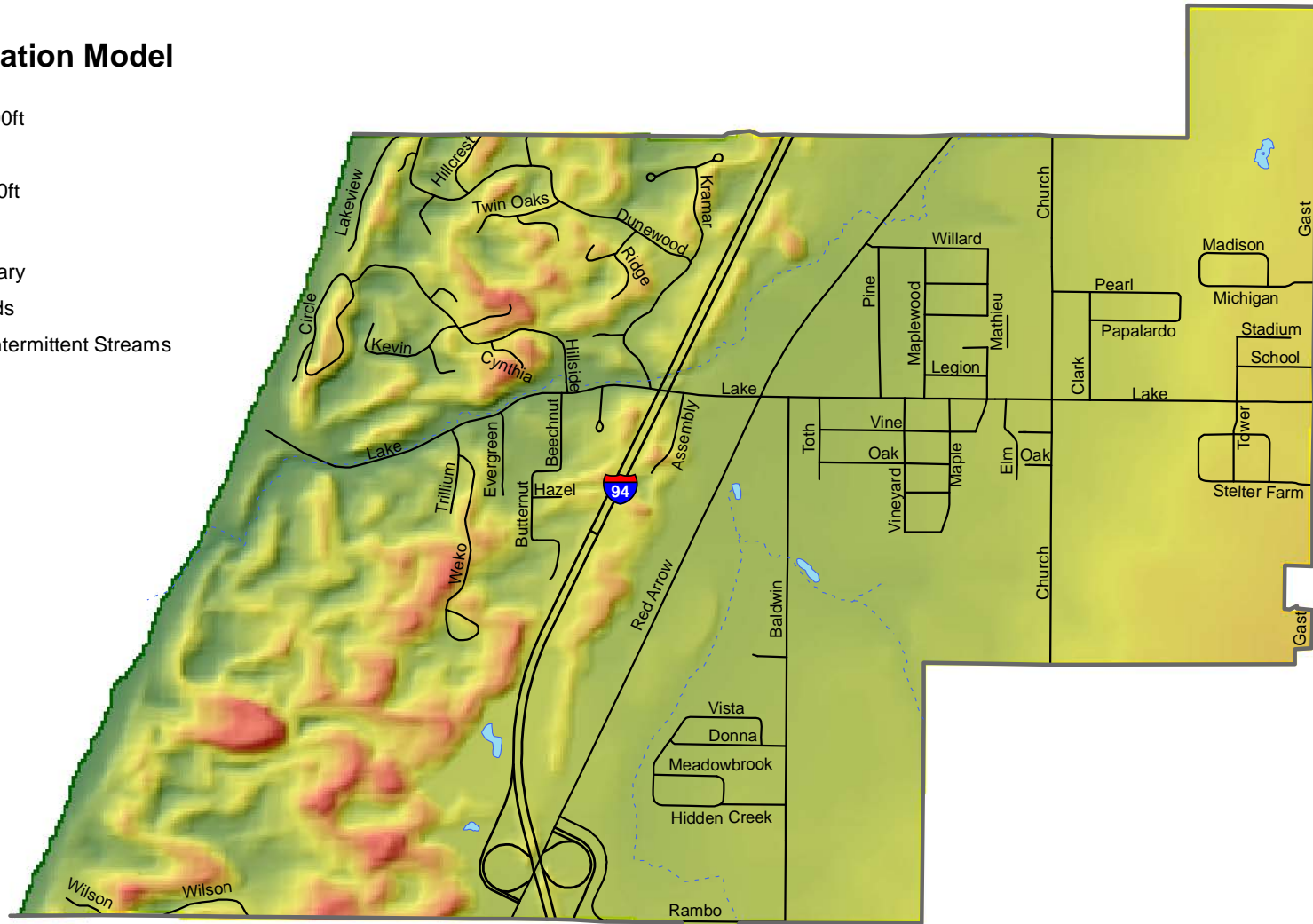
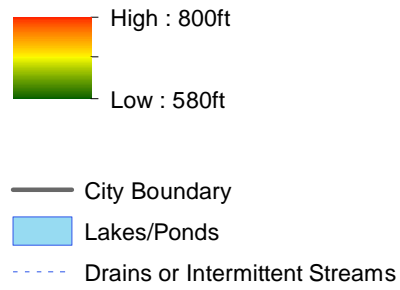


Data Sources:
 U.S. Census Bureau, Block Level Data (2010), ACS (2011-2015)
 Michigan Geographic Data Library, Berrien County GIS

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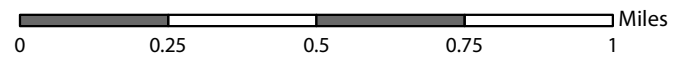


Map 7.12 Digital Elevation Model



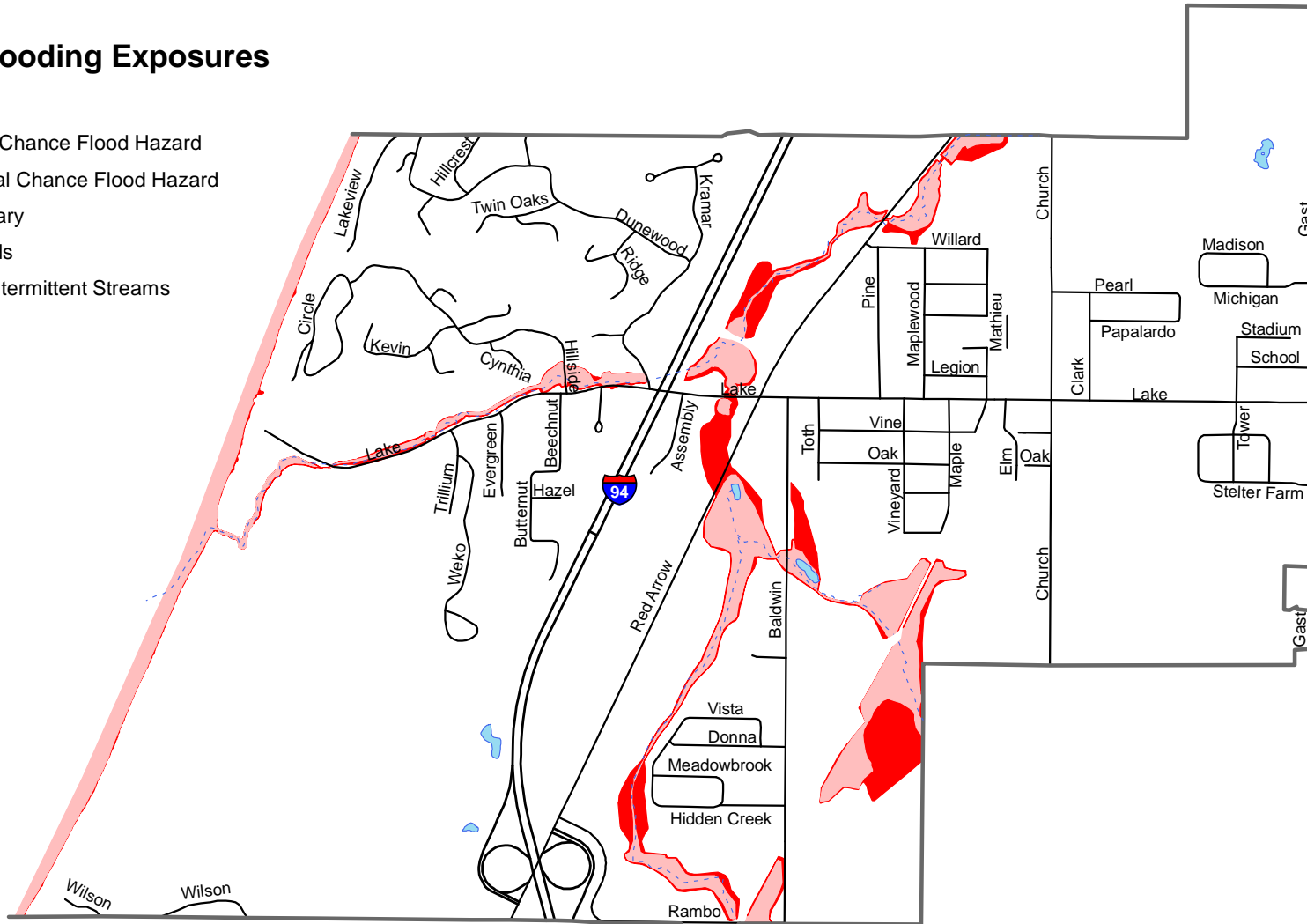
Data Sources:
Berrien County GIS, USGS 3DEP,
Michigan Geographic Data Library

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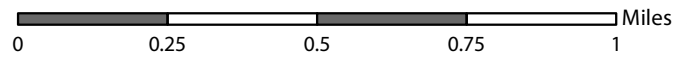
Map 7.13 Potential Flooding Exposures

- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard
- City Boundary
- Lakes/Ponds
- Drains or Intermittent Streams



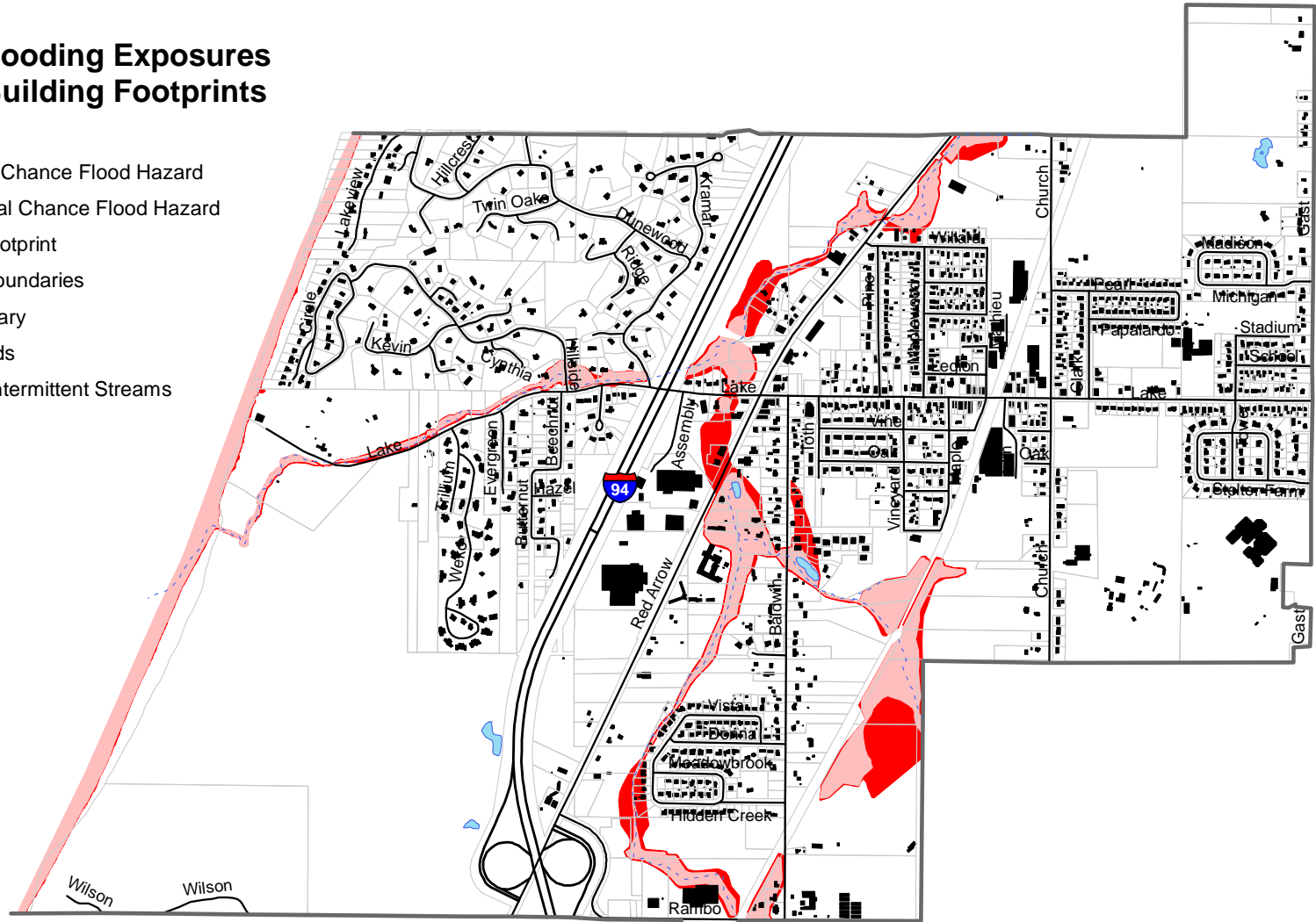
Data Sources:
Berrien County GIS, FEMA,
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



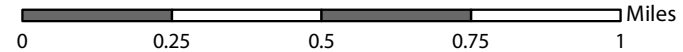
Map 7.14 Potential Flooding Exposures including Building Footprints

- 1% Annual Chance Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Building Footprint
- Property Boundaries
- City Boundary
- Lakes/Ponds
- Drains or Intermittent Streams



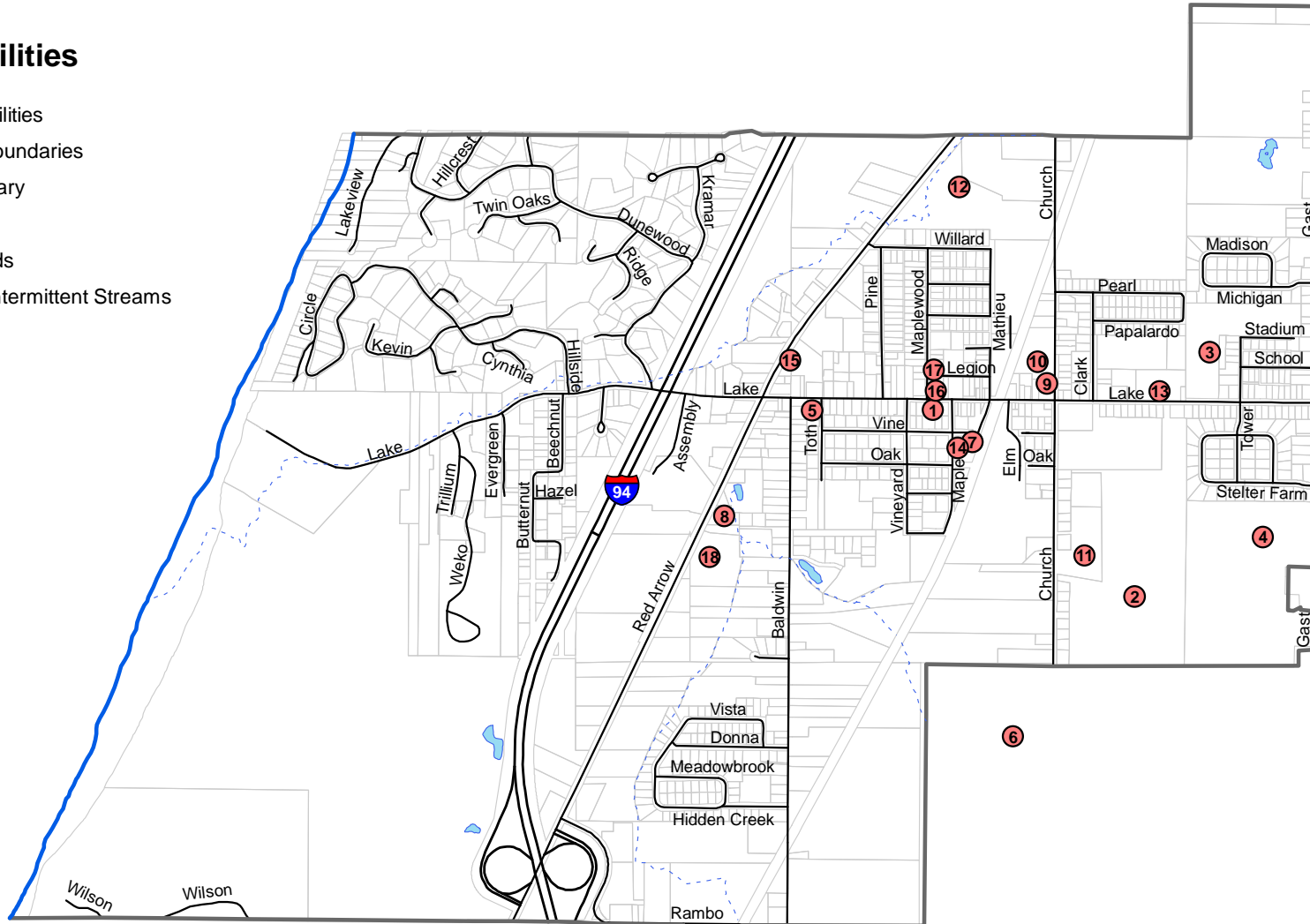
Data Sources:
Berrien County GIS, FEMA, LIAA
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



Map 7.15 Critical Facilities

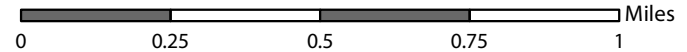
- Critical Facilities
- Property Boundaries
- City Boundary
- Shoreline
- Lakes/Ponds
- Drains or Intermittent Streams



- | | |
|--------------------------------|---------------------------------------|
| 1 - Berrien Community Church | 10 - Immanuel Lutheran School |
| 2 - Bethel Park Retreat Center | 11 - Lake Michigan Christian Center |
| 3 - Bridgman Elementary School | 12 - Michigan State Police Department |
| 4 - Bridgman High School | 13 - Our Lady Queen of Peace |
| 5 - Bridgman Public Library | 14 - Police Department |
| 6 - F.C. Reed Middle School | 15 - Southwestern Medical Clinic |
| 7 - Fire Department | 16 - Speedway Gas Station |
| 8 - I & M Electric Substation | 17 - U.S. Postal Service |
| 9 - Immanuel Lutheran Church | 18 - West Woods of Bridgman |

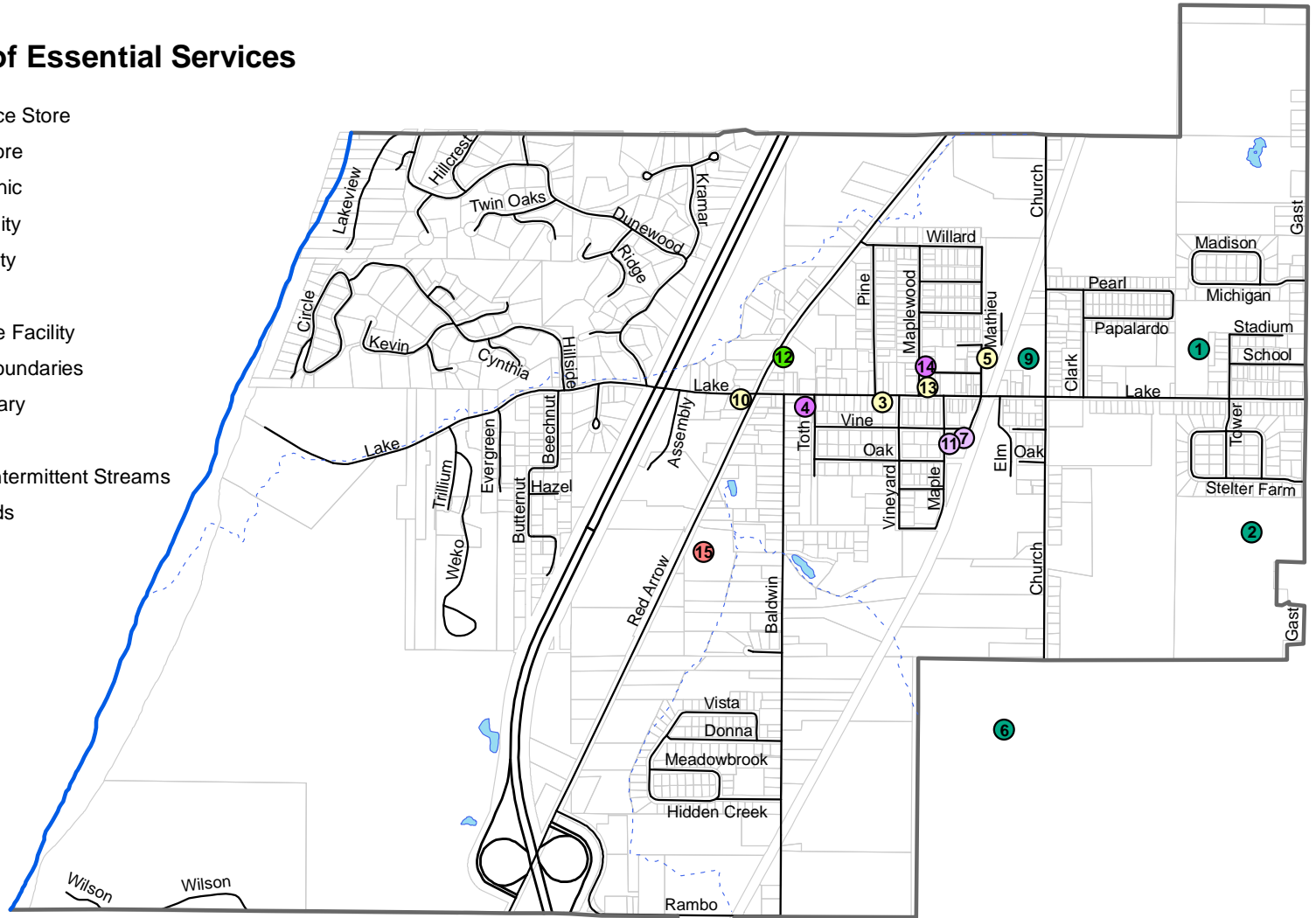
Data Sources:
Berrien County GIS, LIAA
Michigan Geographic Data Library

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Map 7.16 Locations of Essential Services

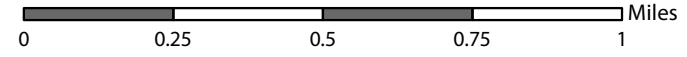
- Convenience Store
- Grocery Store
- Medical Clinic
- Public Facility
- Public Safety
- School
- Senior Care Facility
- Property Boundaries
- City Boundary
- Shoreline
- Drains or Intermittent Streams
- Lakes/Ponds



- | | |
|----------------------------------|----------------------------------|
| 1 - Bridgman Elementary School | 10 - Midtown Party Store |
| 2 - Bridgman High School | 11 - Police Department |
| 3 - Bridgman Premier Meat Market | 12 - Southwestern Medical Clinic |
| 4 - Bridgman Public Library | 13 - Speedway Gas Station |
| 5 - Dollar General | 14 - U.S. Postal Service |
| 6 - F.C. Reed Middle School | 15 - West Woods of Bridgman |
| 7 - Fire Department | |
| 8 - Harding's Friendly Market | |
| 9 - Immanuel Lutheran School | |

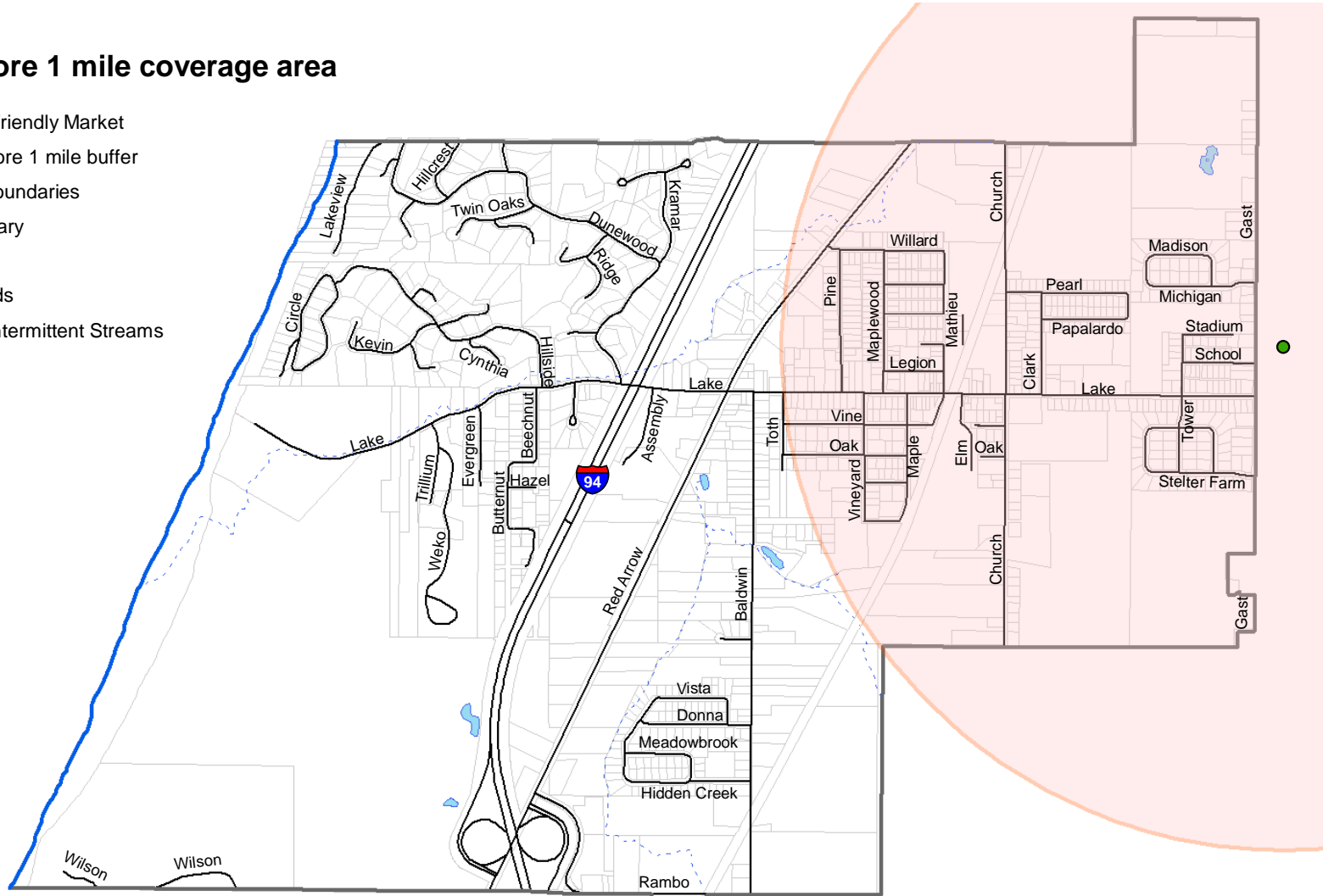
Data Sources:
Berrien County GIS, LIAA
Michigan Geographic Data Library

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Map 7.17 Grocery Store 1 mile coverage area

- Harding's Friendly Market
- Grocery Store 1 mile buffer
- Property Boundaries
- City Boundary
- Shoreline
- Lakes/Ponds
- - - Drains or Intermittent Streams



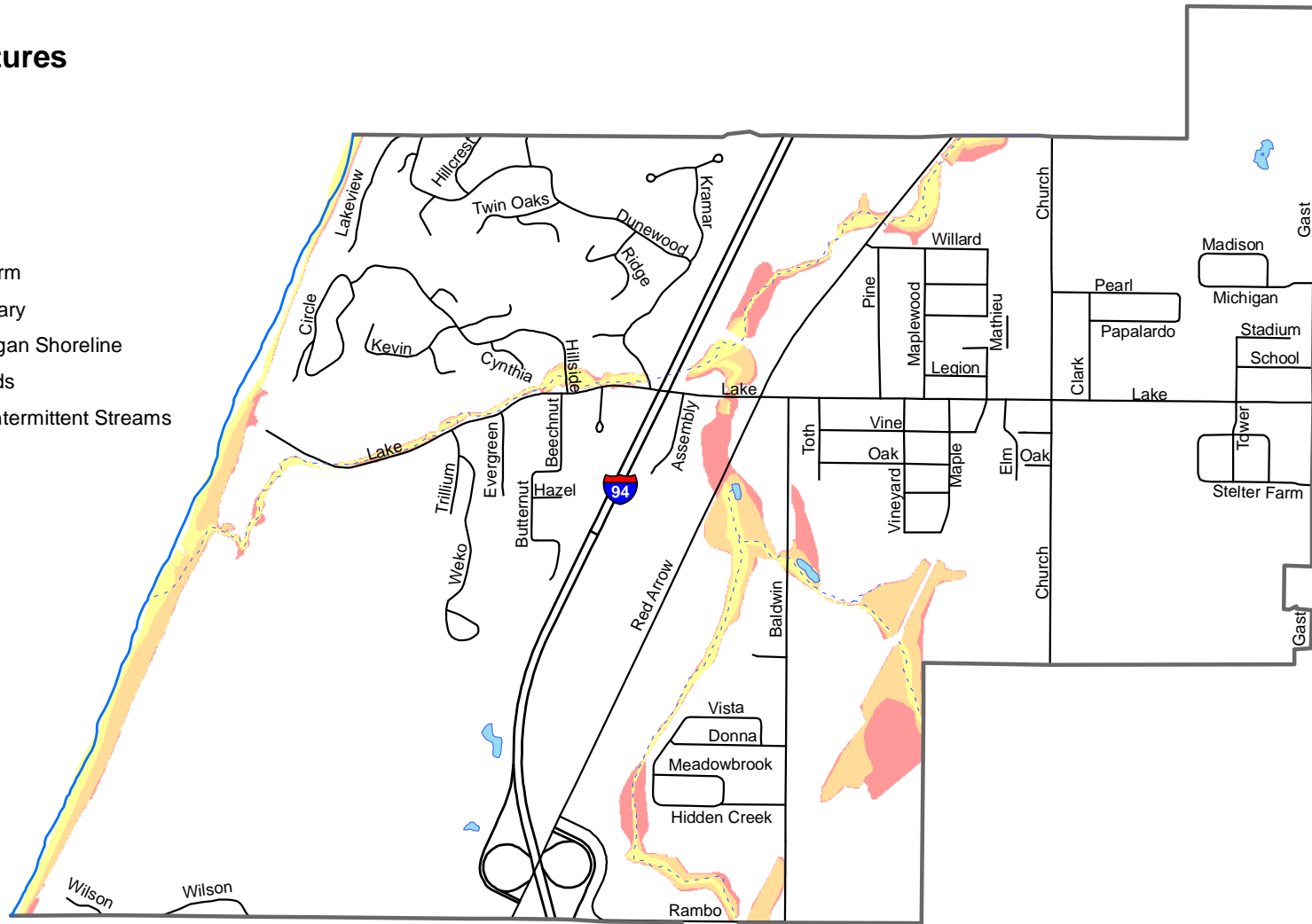
Data Sources:
Berrien County GIS, LIAA
Michigan Geographic Data Library

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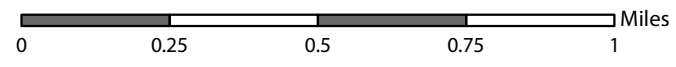
Map 7.18 Climate Futures

- Lucky
- Expected
- Perfect Storm
- City Boundary
- Lake Michigan Shoreline
- Lakes/Ponds
- Drains or Intermittent Streams



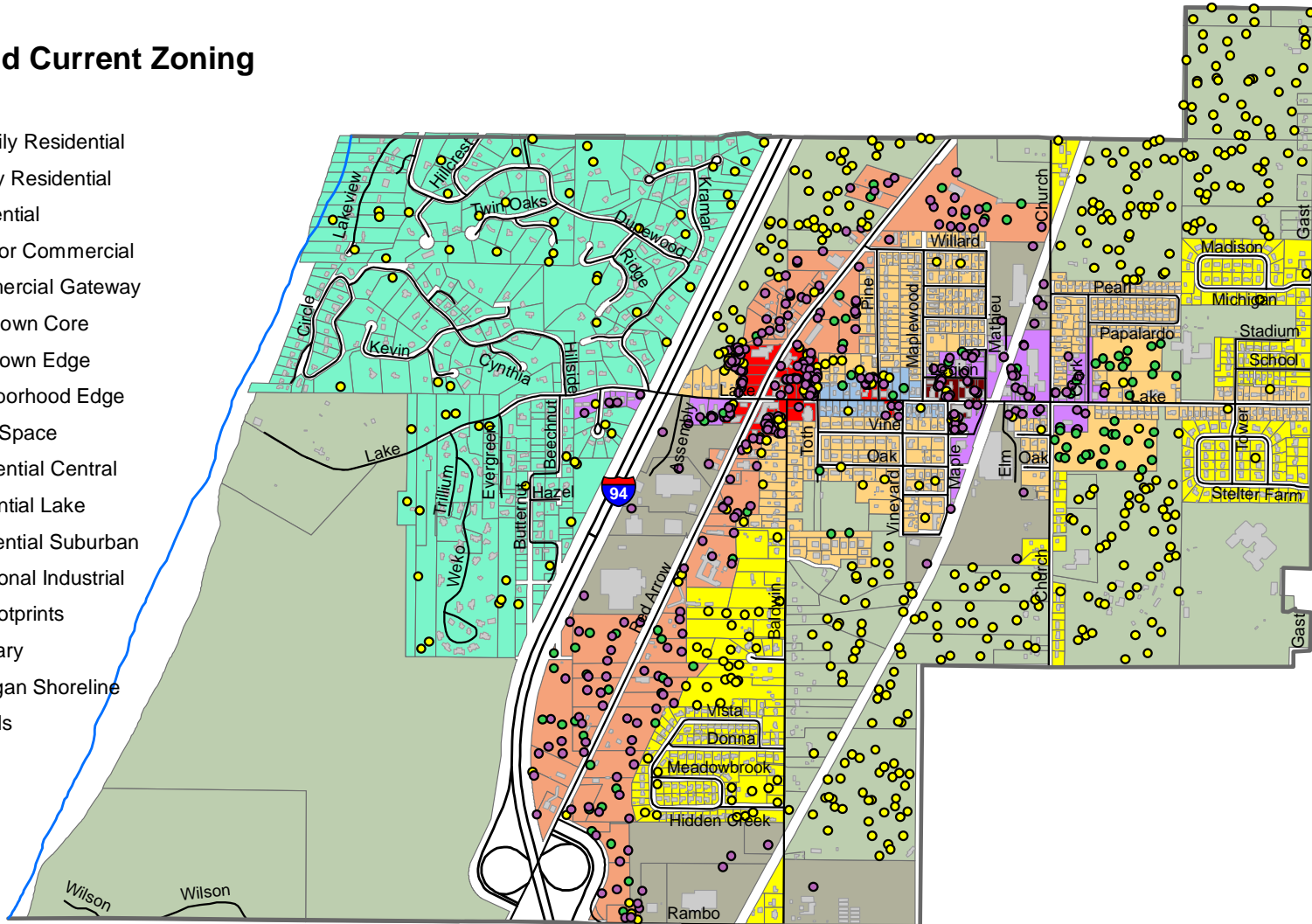
Data Sources:
Berrien County GIS, UM, LIAA,
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



Map 7.19 Buildout and Current Zoning

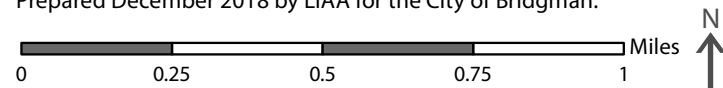
- Single Family Residential
- Multi-Family Residential
- Non-Residential
- CC - Corridor Commercial
- CG - Commercial Gateway
- DC - Downtown Core
- DE - Downtown Edge
- NE - Neighborhood Edge
- OS - Open Space
- RC - Residential Central
- RL- Residential Lake
- RS - Residential Suburban
- TI - Transitional Industrial
- Building Footprints
- City Boundary
- Lake Michigan Shoreline
- Lakes/Ponds



Note: The dots on this map do not represent actual physical locations of structures. Rather, the dots are randomly placed by the CommunityViz software to provide a quick visual representation of the potential for additional buildout in Bridgman under current zoning. A greater number of dots in an area indicates a greater potential for buildout in that area.

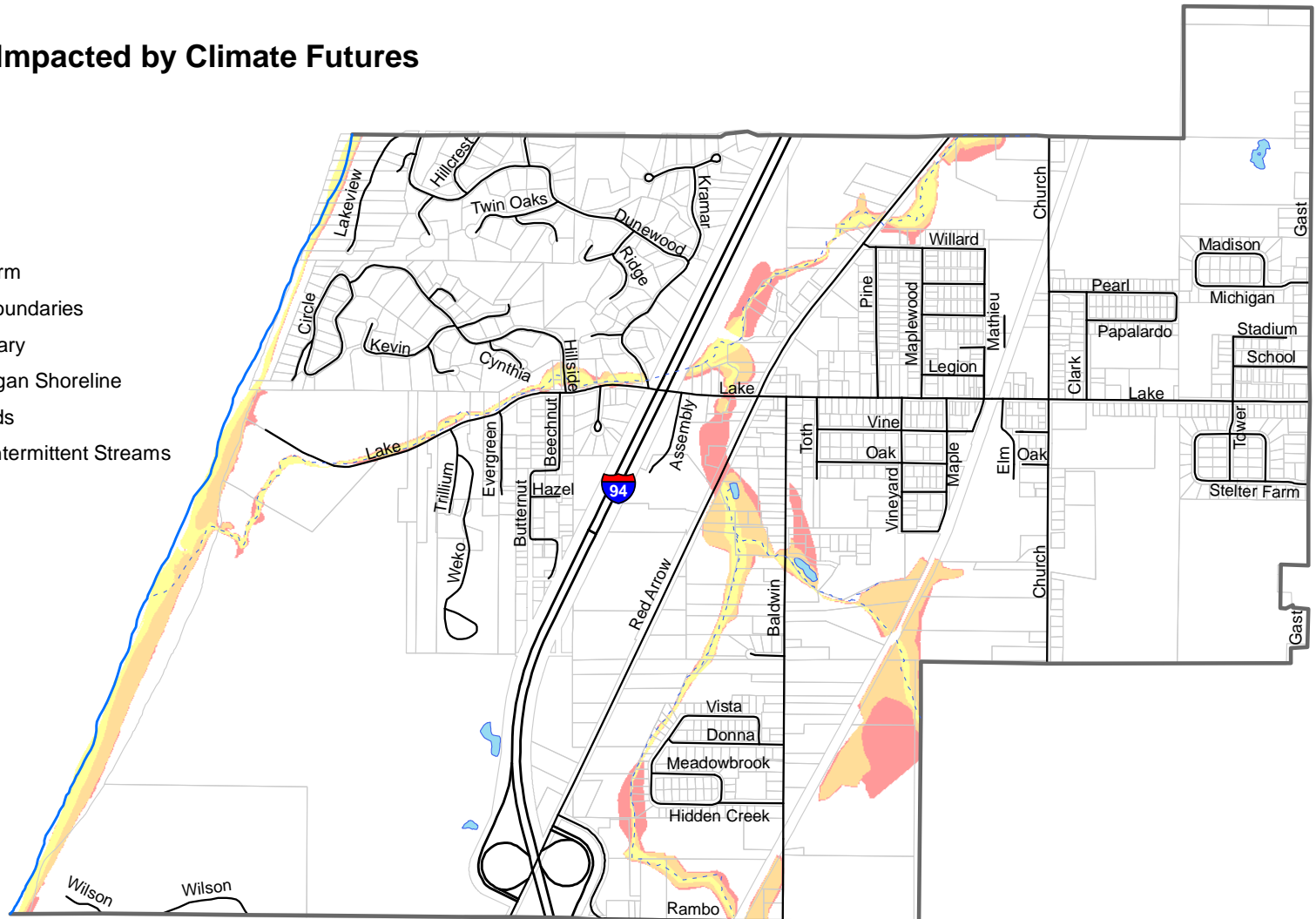
Data Sources:
Berrien County GIS, UM, LIAA,
Michigan Geographic Data Library

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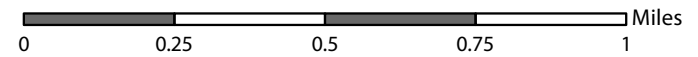
Map 7.20 Properties Impacted by Climate Futures

- Lucky
- Expected
- Perfect Storm
- Property Boundaries
- City Boundary
- Lake Michigan Shoreline
- Lakes/Ponds
- Drains or Intermittent Streams



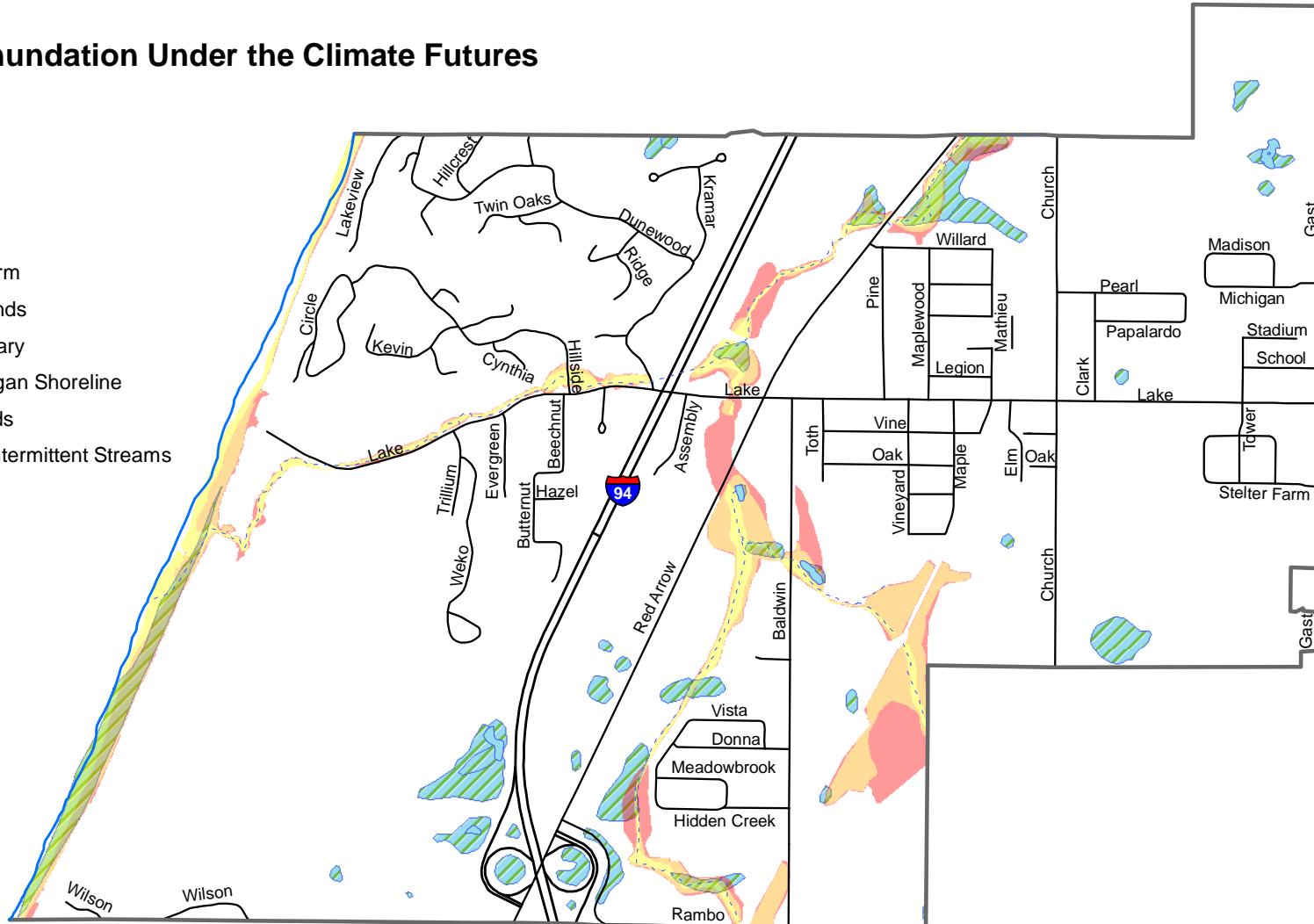
Data Sources:
Berrien County GIS, UM, LIAA,
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



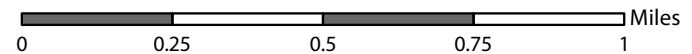
Map 7.21 Wetlands Inundation Under the Climate Futures

- Lucky
- Expected
- Perfect Storm
- NWI Wetlands
- City Boundary
- Lake Michigan Shoreline
- Lakes/Ponds
- Drains or Intermittent Streams



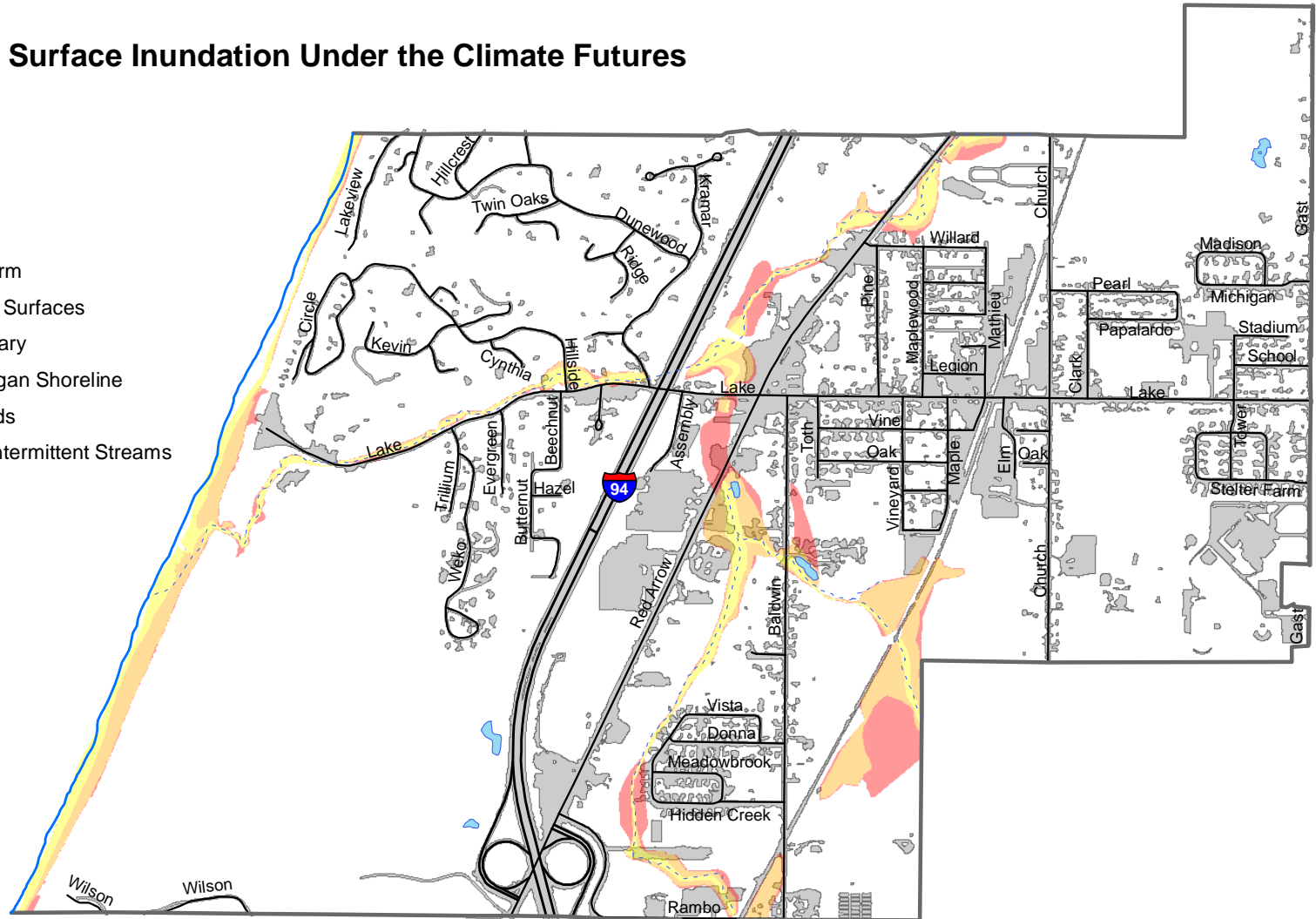
Data Sources:
Berrien County GIS, UM, LIAA,
Michigan Geographic Data Library

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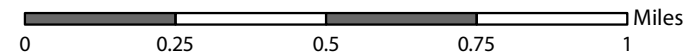
Map 7.22 Impervious Surface Inundation Under the Climate Futures

- Lucky
- Expected
- Perfect Storm
- Impervious Surfaces
- City Boundary
- Lake Michigan Shoreline
- Lakes/Ponds
- Drains or Intermittent Streams

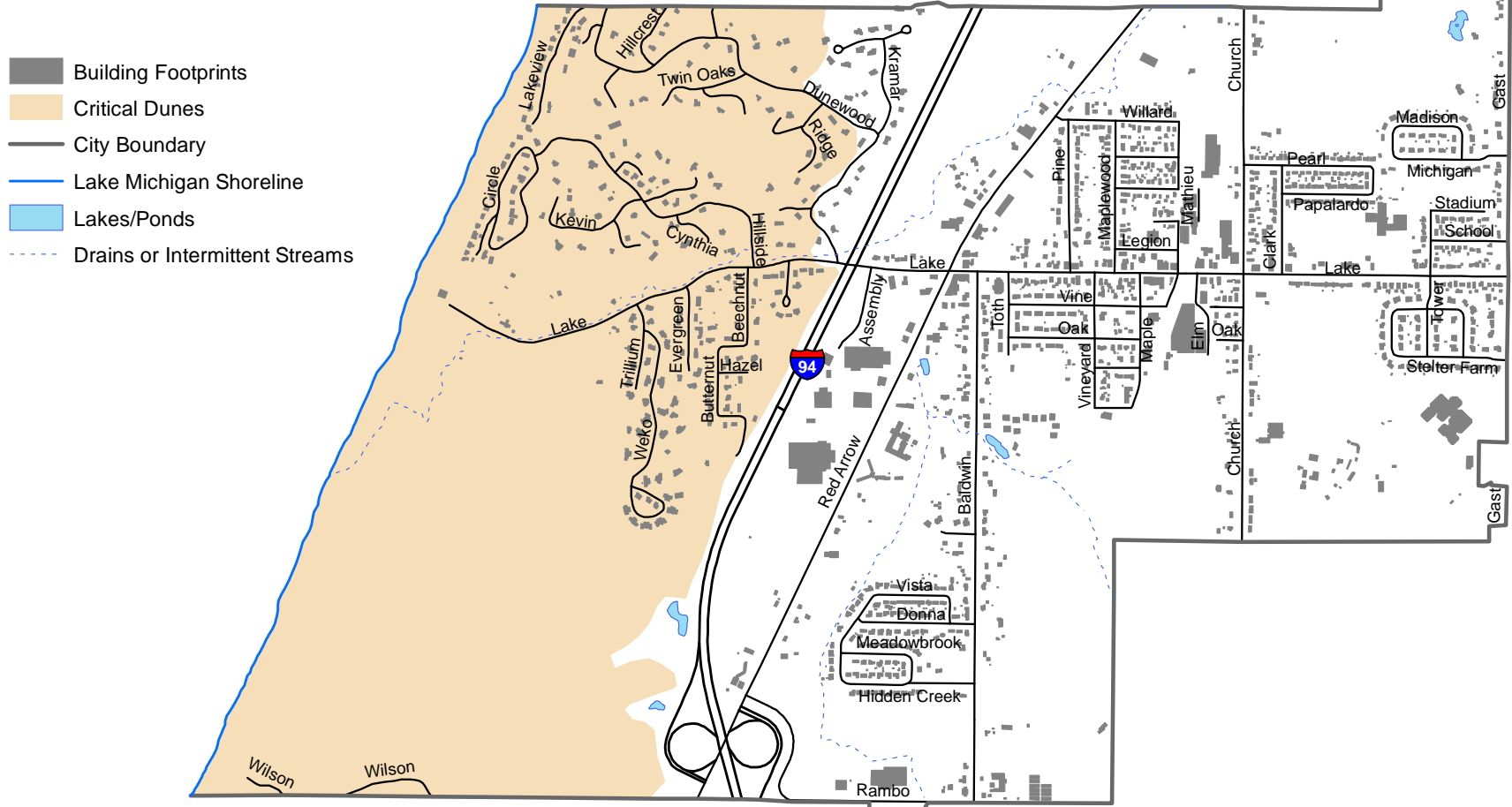


Data Sources:
Berrien County GIS, UM, LIAA,
Michigan Geographic Data Library

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Map 7.23 Critical Dunes in Lake Zoning District










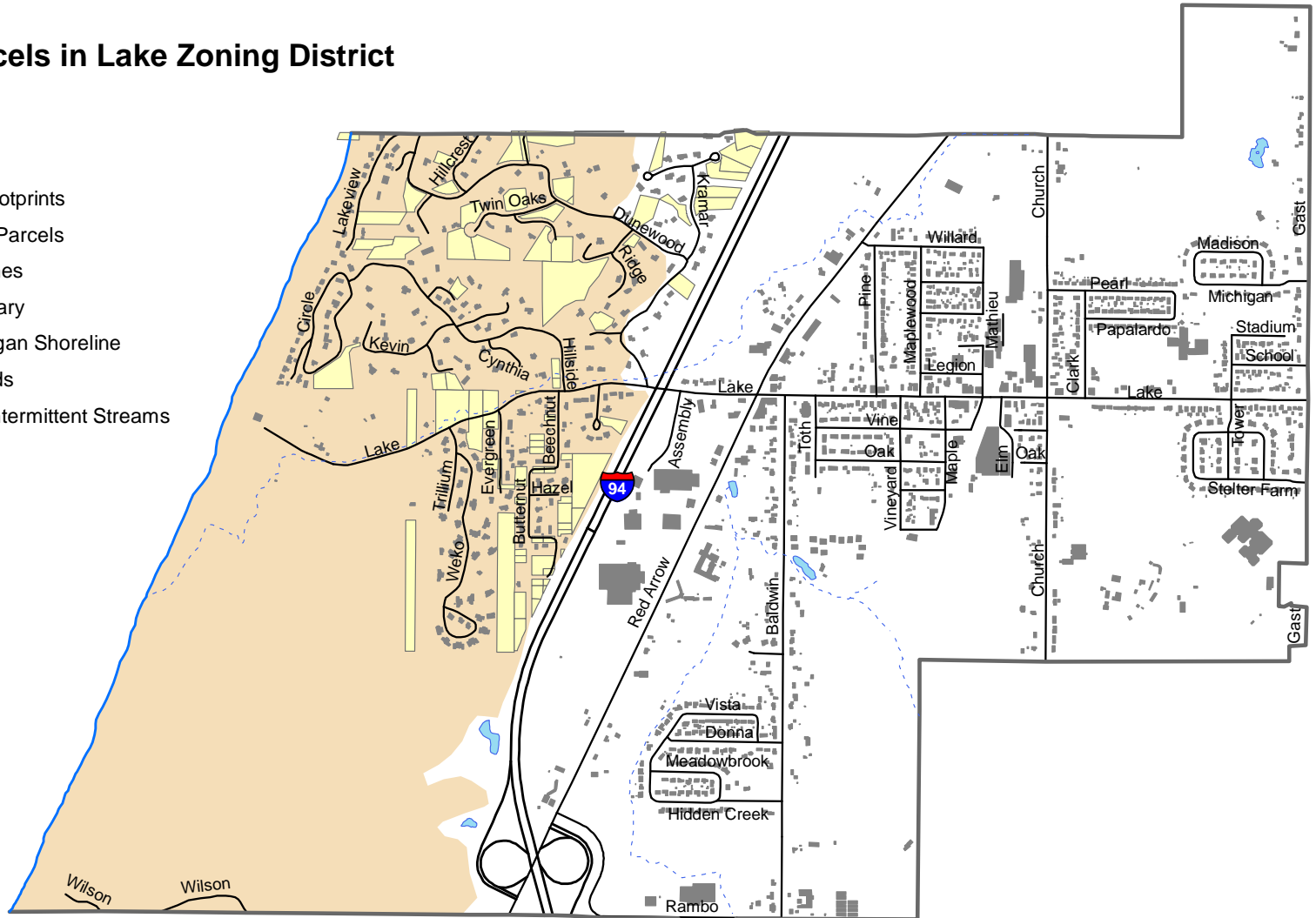
Data Sources:
Berrien County GIS, UM, LIAA,
Michigan Geographic Data Library

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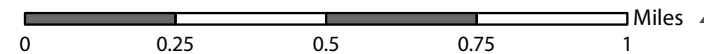
Map 7.24 Vacant Parcels in Lake Zoning District

-  Building Footprints
-  Vacant RL Parcels
-  Critical Dunes
-  City Boundary
-  Lake Michigan Shoreline
-  Lakes/Ponds
-  Drains or Intermittent Streams



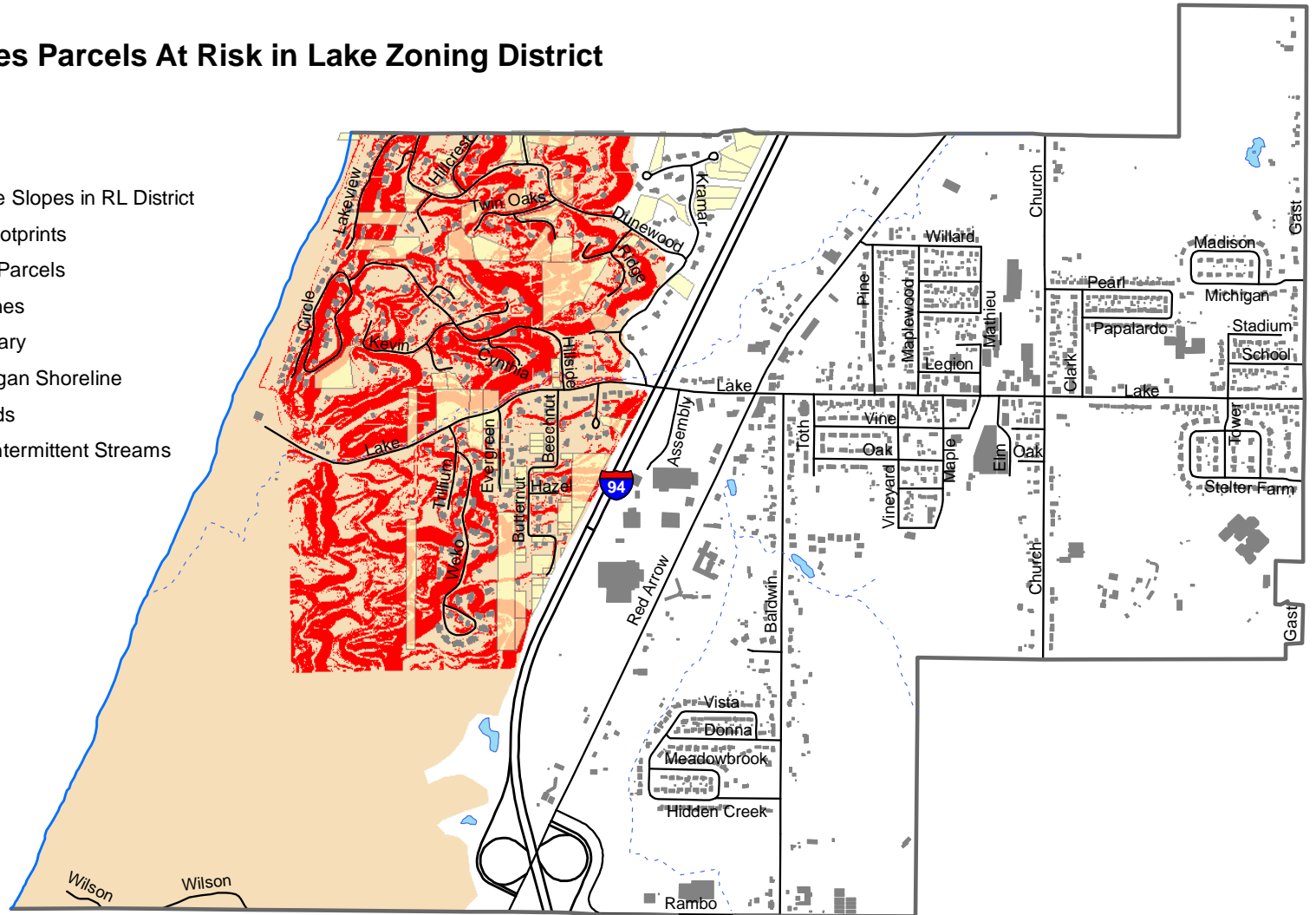
Data Sources:
Berrien County GIS, UM, LIAA,
Michigan Geographic Data Library

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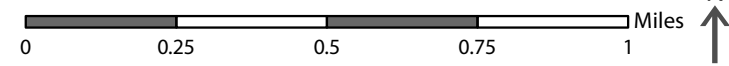
Map 7.25 Steep Slopes Parcels At Risk in Lake Zoning District

- Unbuildable Slopes in RL District
- Building Footprints
- Vacant RL Parcels
- Critical Dunes
- City Boundary
- Lake Michigan Shoreline
- Lakes/Ponds
- Drains or Intermittent Streams



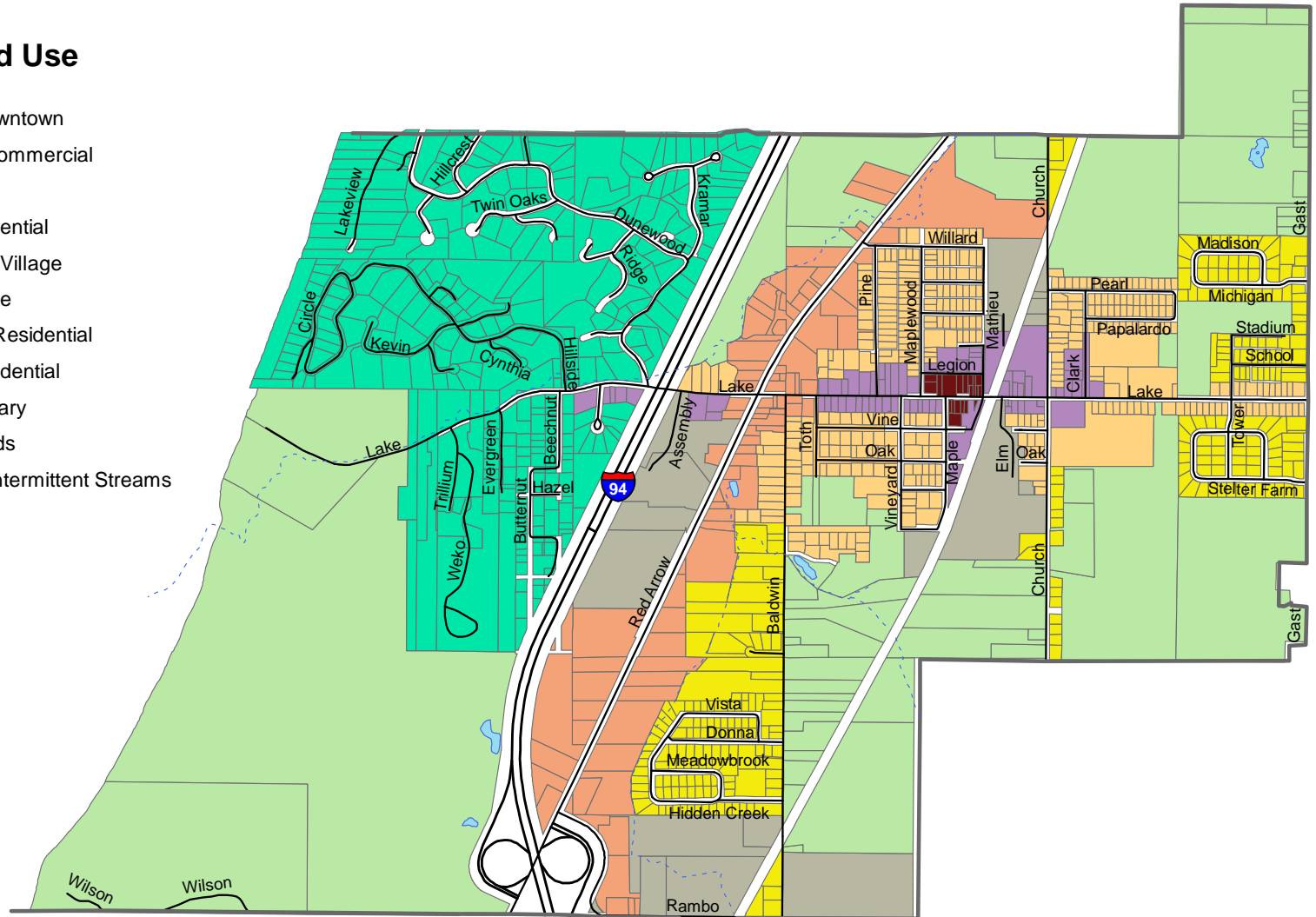
Data Sources:
Berrien County GIS, UM, LIAA,
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



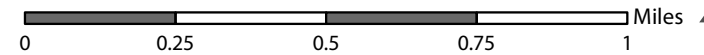
Map 9.1 Future Land Use

- Central Downtown
- Highway Commercial
- Industrial
- Lake Residential
- Mixed Use Village
- Open Space
- Suburban Residential
- Urban Residential
- City Boundary
- Lakes/Ponds
- Drains or Intermittent Streams



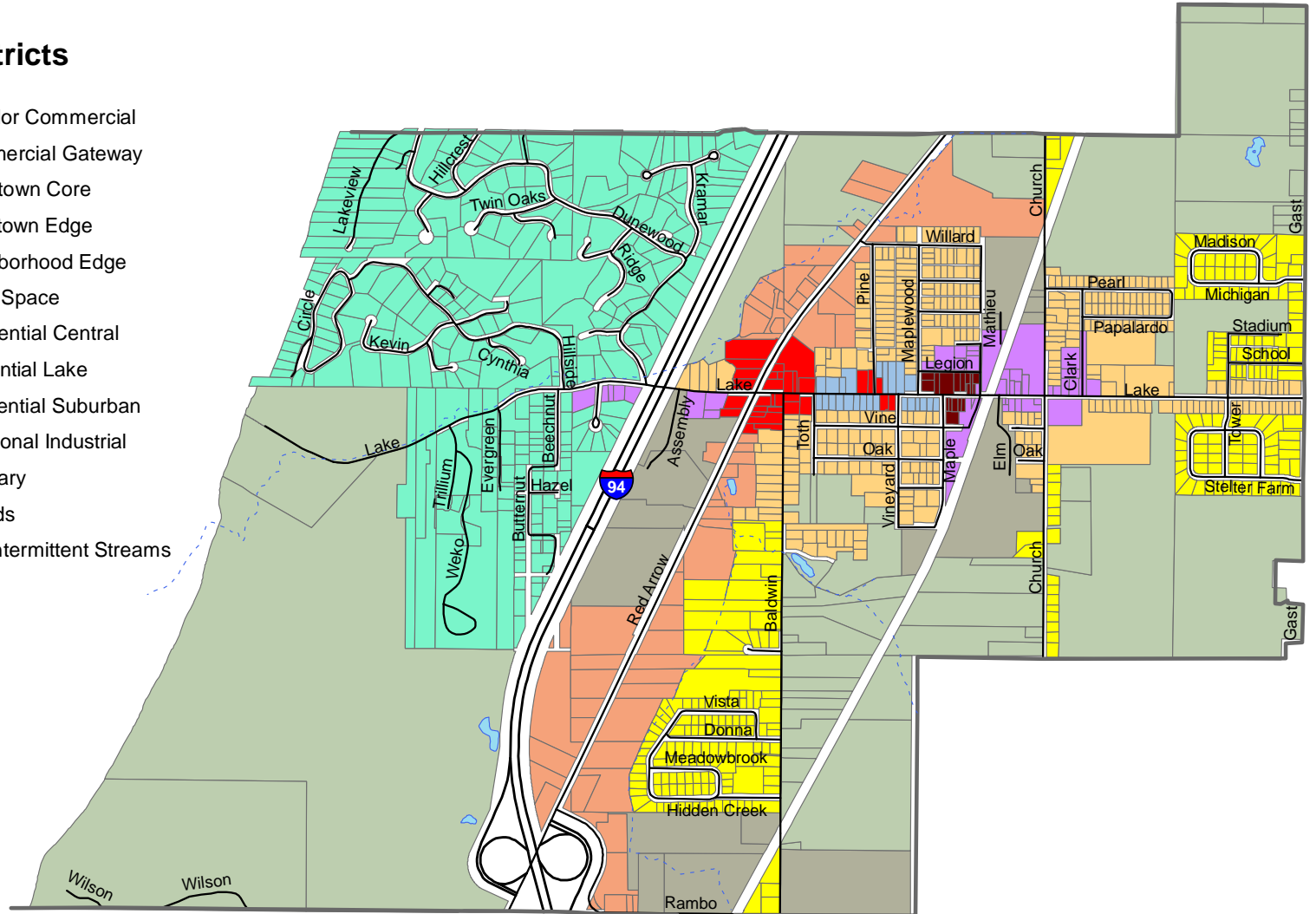
Data Sources:
Berrien County GIS, LIAA
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.



Map 9.2 Zoning Districts

- CC - Corridor Commercial
- CG - Commercial Gateway
- DC - Downtown Core
- DE - Downtown Edge
- NE - Neighborhood Edge
- OS - Open Space
- RC - Residential Central
- RL - Residential Lake
- RS - Residential Suburban
- TI - Transitional Industrial
- City Boundary
- Lakes/Ponds
- Drains or Intermittent Streams



Data Sources:
Berrien County GIS, LIAA
Michigan Geographic Data Library

Prepared December 2018 by LIAA for the City of Bridgman.

