NORTHWEST LOWER MICHIGAN COASTAL RESILIENCE ATLAS

ACKNOWLEDGMENTS

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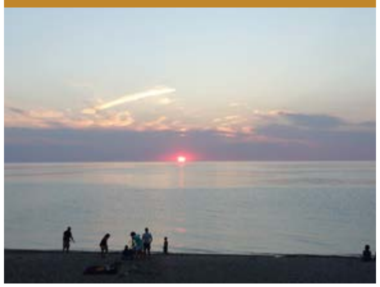
This Atlas was prepared by the Land Information Access Association (LIAA) in cooperation with the Great Lakes Research Center at Michigan Technological University and the Taubman College of Architecture and Urban Planning at the University of Michigan, July 2019.

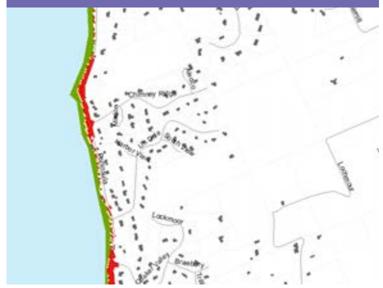
TABLE OF CONTENTS

Chapter 1 1



Introduction

Chapter 2 3



Sample Master Plan Chapter

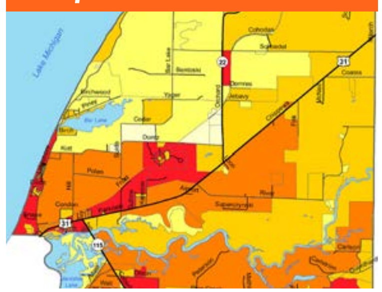
Chapter 3 13

Coastal Flooding

Chapter 4 322

Coastal Recession

Chapter 5 643



Heat Vulnerability

Chapter 6 1082

Local Zoning in Michigan for Great Lakes Coastal Shoreland Management


PRIVATE

CHAPTER 1
Introduction

According to the Urban Sustainability Directors Network, community resilience is the ability of a community to 1.) anticipate, accommodate and positively adapt to or thrive amidst changing climate conditions or hazard events; and 2.) enhance quality of life, reliable systems, economic vitality and conservation of resources for present and future generations.

Resilience includes adaptive capacity. Communities that are resilient are able to learn from adversity and adapt quickly to change. Adaptation is a critically important characteristic of resilience because it allows us to prevent further harm from disasters and disruptions while making the most of the new conditions. By adapting rapidly to changing climate circumstances, communities may not only survive challenges, but thrive.

Communities interested in becoming more resilient asses their vulnerabilities and make action plans to reduce their sensitivities and exposures to hazards of all kinds. For example, local governments can improve building standards to reduce heating and cooling challenges posed by severe temperature swings (cold and heat).

Great Lakes coastal communities face a unique subset of vulnerabilities and challenges that shift and change under unpredictable conditions over long periods of time. The Great Lakes are one of the most unique and dynamic environmental features in the world. The Great Lakes Basin contains more than 20% of the worlds surface freshwater, 84% of North America's surface freshwater and supports a population of more than 33 million people. Michigan — the Great Lakes State — is surrounded by four of the five Great Lakes and is home to 3,300 miles of Great Lakes shoreline.

Yet in general, riparian land (land adjacent to water bodies) in coastal communities throughout the state is not adequately protected from development pressures. Coastal communities have an especially 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 of coastal hazard areas, wetlands and Great Lakes Islands, could be improved through better coastal land use planning."[1] The high Great Lakes water levels of 2019 have brought a new sense of urgency to coastal communities.

Planning for coastal areas at the local level requires knowledge of both local conditions and state and federal regulations. This *Northwest Lower Michigan Coastal Resilience Atlas* has been compiled to provide officials in each coastal community in the region with useful information and data to support more resilient land-use planning and community development decision-making. In doing so, this Atlas will help communities better plan for and respond to changes to the region's climate and the potential for coastal hazards.

The Atlas begins in Chapter 2 with model coastal dynamics and climate change language that can be used and/or inserted in your community master plan and other local plans. Chapter 3 provides an overview and maps of potential coastal flooding scenarios for each coastal community, and Chapter 4 provides an overview and maps of shoreline and bluffline recession in coastal communities. Chapter 5 provides a heat vulnerability assessment for each coastal community. Finally, Chapter 6 provides an overview of potential shoreland management options for coastal communities throughout northwest Lower Michigan.

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

CHAPTER 2
Sample Master Plan Chapter

COASTAL DYNAMICS AND CLIMATE CHANGE IN THE MASTER PLAN

A master plan is a document that is meant to provide a periodic review of all of a community's systems, and to determine or reaffirm the values and goals upon which the community wishes to base its land-use decisions. Preparation and adoption of a master plan are guided by Michigan Planning Enabling Act (MPEA), PA 33 of 2008, which assigns this task to a community's Planning Commission. Though the master plan itself does not constitute a law or regulation, it forms the advisory basis of the zoning ordinance, which is the set of local laws governing land use and land-use intensity.

The comprehensive scope of a master plan is particularly suited to coastal resiliency planning. The holistic context of a master plan gives a community an opportunity to review each of its systems — including its ever-changing coastline — through the lens of resiliency, and also presents an opportunity to consider new practices.

Most master plans are organized into two major sections. The first section of the document includes the goals, objectives and policies that guide the physical development of the community. The second section is the background information or data that provides justification and support for the plan, typically including a summary of past and current socio-economic conditions as well as detailed information on the status, trends and impacts of important and interlinked community systems (e.g., infrastructure, housing, transportation, food systems, natural features, social systems, etc.). For coastal communities looking to improve community resilience, this section of the master plan should also provide background information and data on how these systems are impacted by coastal dynamics, Great Lakes water levels and climate change.

Sample content for a coastal resilience "chapter" for a master plan follows here for reference. Information and links to data and other features (e.g., charts, figures) are referenced and **highlighted** as appropriate.

OUR GREAT LAKES COASTLINE

The Great Lakes represent one of the most unique and precious environmental systems 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."[1] Michigan is home to nearly 3,300 miles of Great Lakes shoreline, along with 36,000 miles of rivers and streams, and 11,000 inland lakes.[2]

Yet in general, riparian land (land adjacent to a water body) throughout Michigan is not adequately protected from development pressures.[3] Coastal communities have an especially important role to play in protecting the Great Lakes. In 2001, the Michigan Department of Environmental Quality (DEQ) acknowledged "fragmentation of coastal habitats, loss of agricultural and forest lands,

1 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
2 Ardizone, Katherine A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.
3 As cited by Norton 2007 – Michigan Department of Environmental Quality. 2001. 309 Enhancement Grants Assessment/Strategy. Lansing, MI: DEQ Coastal Management Program.

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."[4]

Planning for coastal areas requires knowledge of coastal dynamics, climate change and their impacts on current and future local conditions. This chapter provides a summary of these dynamic processes and provides the basis for future land-use planning along our coastline.

OVERVIEW OF COASTAL DYNAMICS AND THE GREAT LAKES

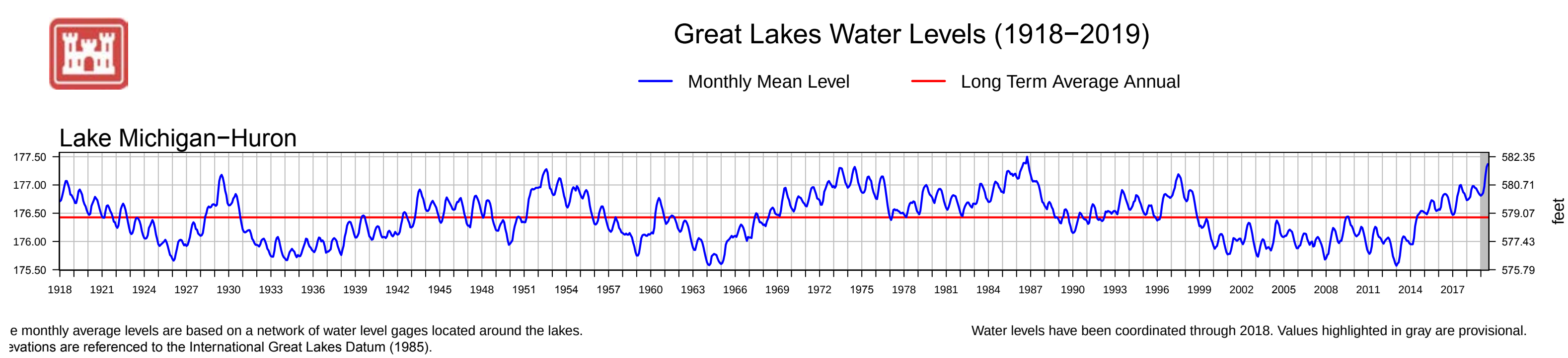
The Great Lakes function differently than other inland water bodies and tidal oceans. Understanding these dynamics can help our community plan for naturally occurring changes along the shoreline.

Changing Water Levels of the Great Lakes

This figure is updated annually by the Army Corps of Engineers and should be included in this summary. The figure can be found at: https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Information-2/Water-Level-Data/

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.[5] 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 1** illustrates the water level of Lake Michigan from 1918 to 2019 (Lake Michigan and Lake Huron are technically considered one lake). However, under certain climate conditions, water levels can dramatically fluctuate over short periods of time. For example, following the extreme winters of 2014 and 2015, water levels in Lake Michigan rose between three to four feet from an all-time low (576 feet) set just a year earlier.

Figure 1. Lake Michigan-Huron Water Level Changes, 1918 – 2019

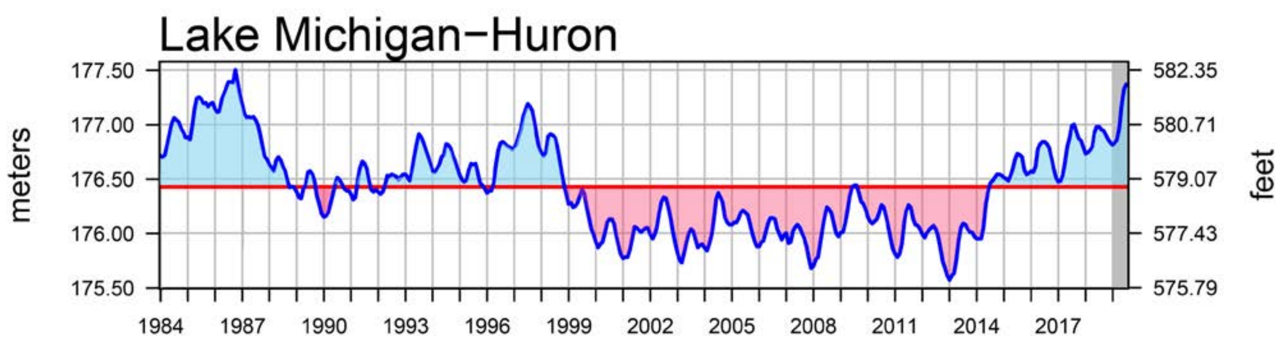


4 Ibid

5 Norton, Richard K., Meadows, Lorelle A. and Meadows, Guy A. (2011) "Drawing Lines in 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 2001 (iFirst).

The Great Lakes are in a period of rising lake levels **(see Figure 2)**. Since the early 2000s, water levels had remained low, but historical patterns over the last century indicated that higher water levels were sure to return.[6] In May of 2019, Lake Michigan's water level rose an astounding nine inches. Lake Michigan's water level on June 5, 2019 was 581.61 feet, which was just 0.19 inches away from the all-time record high set in 1986.[7]

Figure 2. Lake Michigan Water Levels



A brief summary on monthly water levels can be found at: https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Information-2/Basin-Conditions/. Although this summary provides a "snapshot" in time and may be quite different once the master plan is adopted, it can provide a useful comparison during future master plan updates, amendments and/or revisions.

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.

6 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): 678-683. Print.
7 http://www.lre.usace.army.mil

According to a recent U.S. Army Corps of Engineers summary, based on current conditions, Lake Michigan is expected to continue its seasonal rise. From July through September, monthly mean water levels are forecasted to be less than an inch to 2 inches below the record high water levels, while in October and November, monthly mean levels are forecasted to be 8 to 10 inches below record high levels[8] **(see Figure 3)**.

One inch of water on Lake Michigan represents 800 billion gallons of water.

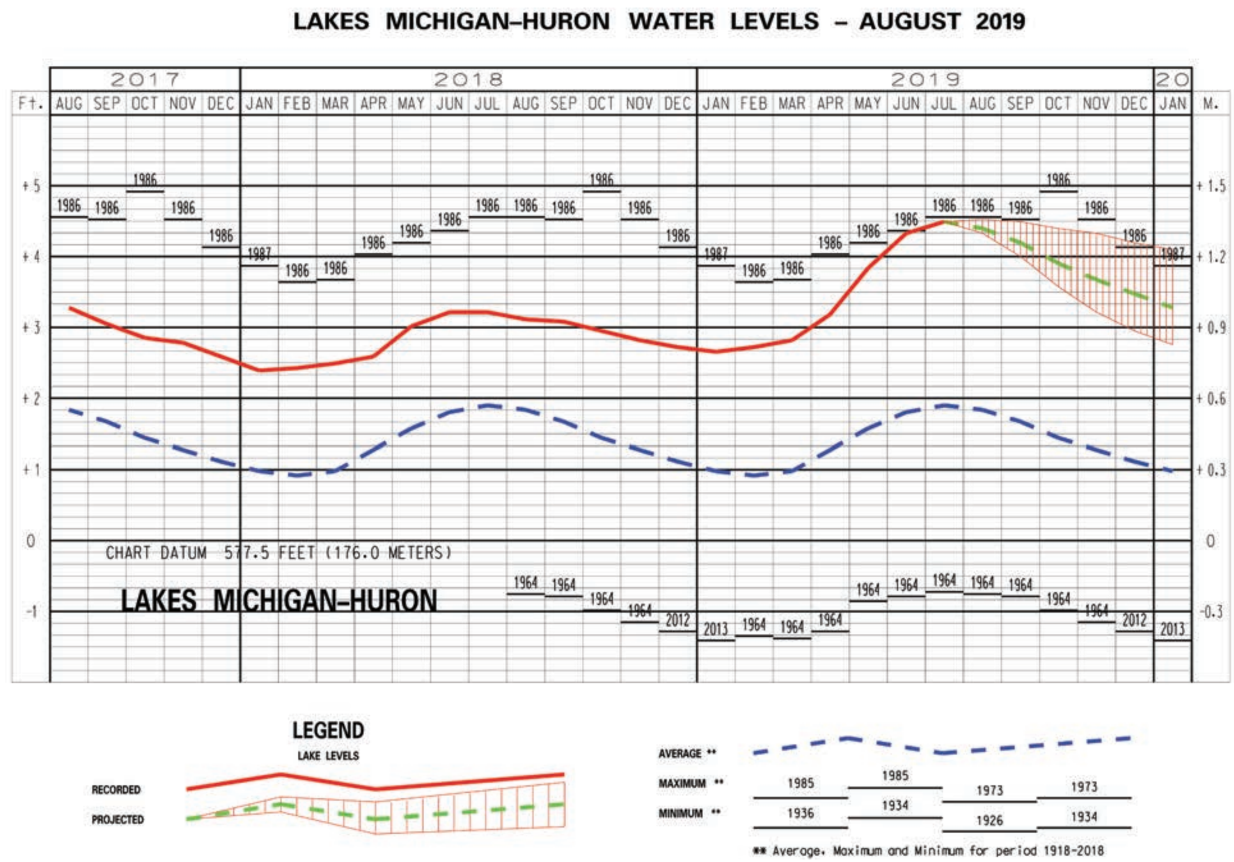
It is important to note that changes in water levels are not solely responsible for the movement of the shoreline landward and lakeward over time. The velocity and height of waves, erosion of shorelines, and the pace of fluctuating water levels also contribute to coastal dynamics on the Great Lakes.

A summary (and figure) on water level forecasts can be found on the following water level summaries:

https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/Weekly-Great-Lakes-Water-Levels/

https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/Monthly-Bulletin-of-Great-Lakes-Water-Levels/

Figure 3. Lake Michigan-Huron Water Level Prediction



8 http://www.lre.usace.army.mil

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.[9] "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.[10] Powerful and tall waves can quicken the rate of erosion and damage structures near the shoreline.[11] **In [insert jurisdiction], the prevailing winds are predominantly from the west and north.**

This statement is generally accurate for every community in northwest Lower Michigan.

Erosion

The shorelines of Lake Michigan are mostly made of gravel and sands that easily erode during times of high-energy waves.[12] Coastal erosion can cause flooding and damage infrastructure along bluffs and beaches. Erosion is caused mainly by storms and winds, and is exacerbated when lake levels are high.[13]

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.[14] 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.[15] 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.[16]

9 National Oceanic and Atmospheric Administration. "Coastal Currents" Ocean Services Education, NOAA, 25 March 2008. Web. Accessed July 2015.
10 Norton, Richard K, Meadows, Lorelle A. and Meadows, Guy A. (2011) "Drawing Lines in Law Books on Sand 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 2001 (iFirst)
11 Ibid.
12 Ibid.
13 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.
14 Dorr, J. A. and D. F. Eschman. 1970. Geology of the Great Lakes. Ann Arbor: University of Michigan Press.
15 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
16 Ibid.

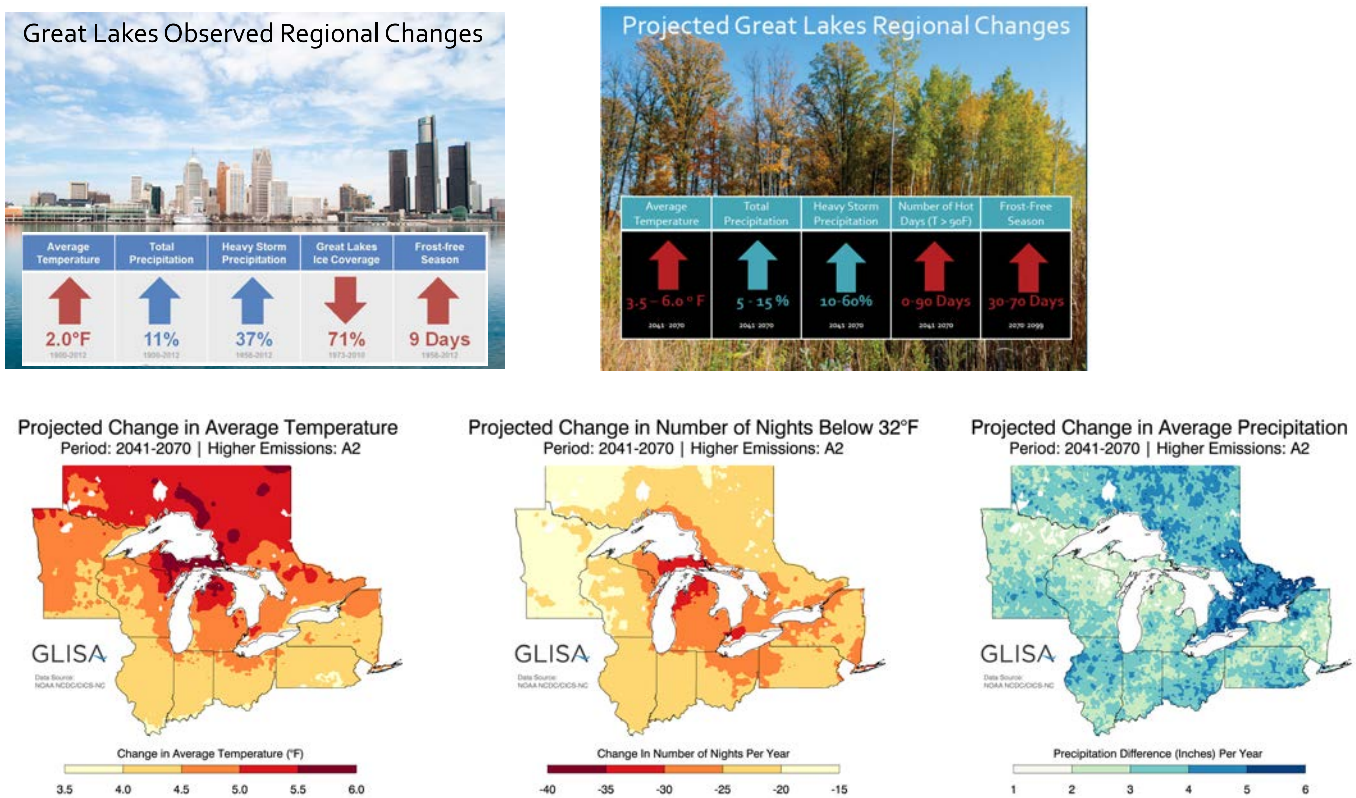
Climate Change and the Great Lakes

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, exacerbates these natural processes, requiring 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.

Figure 4. Historical and Predicted Climate Changes in the Great Lakes Region



Additional information about changes to the region's climate (including maps) can be found at http://glisa.umich.edu/resources/great-lakes-regional-climate-change-maps

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.[17] Warming of the climate system is unequivocal and is now expressed in higher air and ocean temperatures, rising sea levels, and melting ice.[18]

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 (GCMs) have been improved and verified in recent years, resulting in relatively reliable predictions for climate changes over large regions.[19] Scientists downscale these techniques to predict climate change for smaller regions.

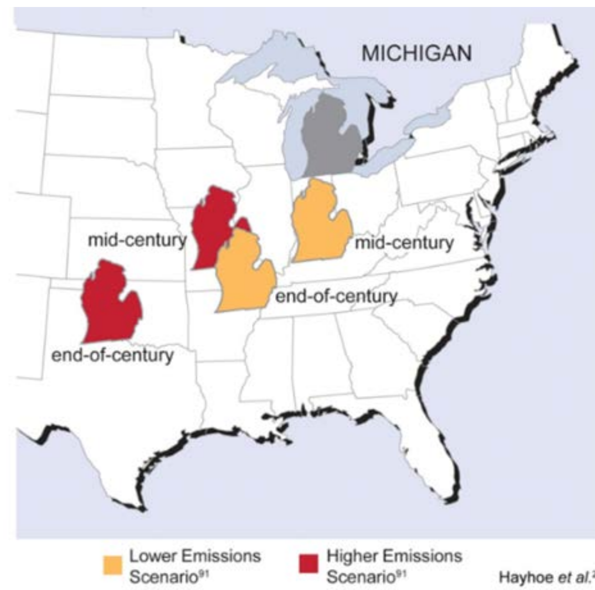
Climate Change on the Great Lakes

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.

Figure 4 illustrates the historical and predicted climate changes from GLISA for the Great Lakes region. According to GLISA, the Great Lakes region experienced a 2.3° Fahrenheit increase in average air temperatures from 1951 to 2017.[20] An additional increase of 3° to 6° 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.

The National Climate Assessment for 2009 included a number of illustrations to help us understand the extent and character of anticipated climate change impacts.[21] One of these illustrations, **Figure 5**, 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.[22]

Figure 5. Emissions Scenarios



Model projections of summer average temperature and precipitation changes in Illinois and Michigan for mid-century (2040-2059), and end-of-century (2080-2099), indicate that summers in these states are expected to feel progressively more like summers currently experienced in states south and west. Both states are projected to get considerably warmer and have less summer precipitation.

17 Intergovernmental Panel on Climate Change. (2007). Observed changes in the climate and their effects. Eb. Accessed July 2015.
18 Ibid
19 Intergovernmental Panel on Climate Change (2013). What is a GCM? Web. Access July 2015
20 Great Lakes Integrated Sciences and Assessments (2019) Temperature. Web. Accessed April 2019.
21 U.S. Global Change Research Program. Global Climate Change in the United States, 2009. Cambridge University Press, Cambridge, MA.
22 Ibid.

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 as a result of climate change.[23] This is already happening as “the amount of precipitation falling in the heaviest 1% of storms increased by 35% in the Midwest from 1951 to 2017.”[24] As storms drop more precipitation and generate stronger sustained winds, the Great Lakes will see stronger and higher waves. 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.[25] 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 Lake shoreline are susceptible to erosion by 2060.[26]

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.[27] 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.[28] 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.[29] However, fast-rising waters can erode shorelines, damage infrastructure, and cause extensive flooding in inland rivers.[30] 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.[31] Additional ramifications of changing lake levels include a drop in water supply,[32] restricted fish habitats,[33] more invasive species,[34] faster erosion, and an overall decline in beach health.[35] 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.

23 Great Lakes Integrated Sciences and Assessments (2019) Temperature. Web. Accessed April 2019.
24 Ibid.
25 Crice, T., & Yurkovich, E. (2011). Adapting to climate change: A planning guide for state coastal managers – a Great Lakes supplement. Silver Springs, MD: NOAA Office of Ocean and Coastal Resource Management.
26 The Heinz Center. (2000). Evaluation of Erosion Hazards. Web. Accessed July 2015.
27 Dinse, Keely. Preparing for extremes: The Dynamic Great Lakes. Michigan Sea Grant. Web. Accessed July 2015.
28 Cruce, T., & Yurkovich, E. (2011). Adapting to climate change: A planning guide for state coastal managers – a Great Lakes supplement. Silver Springs, MD: NOAA Office of Ocean and Coastal Resource Management.
29 Dinse, Keely. Preparing for extremes: The Dynamic Great Lakes. Michigan Sea Grant. Web. Accessed July 2015.
30 Ibid.
31 Ibid.
32 Cruce, T., & Yurkovich, E. (2011). Adapting to climate change: A planning guide for state coastal managers – a Great Lakes supplement. Silver Springs, MD: NOAA Office of Ocean and Coastal Resource Management.
33 Ibid.
34 Ibid.
35 Dinse, Keely. Preparing for extremes: The Dynamic Great Lakes. Michigan Sea Grant. Web. Accessed July 2015.

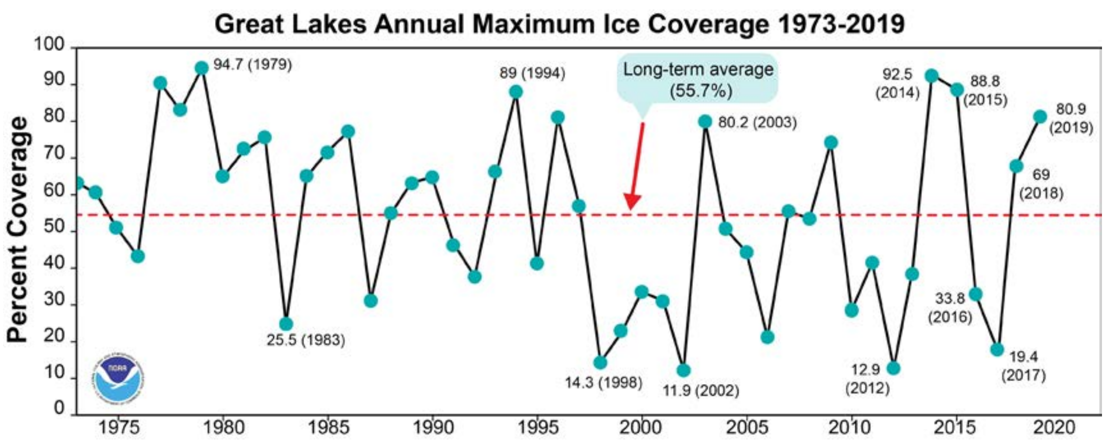
Water Temperature

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. In general, annual average ice cover on the Great Lakes underwent a shift from higher amounts prior to the 1990s to lower amounts in recent decades. However, there remains strong year-to-year variability, and high ice years are still possible.[36] **Figure 6** illustrates the variability in ice coverage in the Great Lakes between 1973 and 2019.

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. In the Great Lakes, average summer lake surface temperatures have been increasing faster than the surrounding air temperatures, with Lake Superior surface temperatures increasing by 4.5°F between 1979 and 2006.[37]

The associated impacts of rising water temperatures include changes to where fish and other aquatic animals can live, increased vulnerability to invasive species, and increased risk of algae blooms.[38] Rising water temperatures also enable winds to travel faster across the surface of the lake, increasing the vulnerability of coastal communities to damaging waves as storms and winds increase.[39] Lastly, ice cover protects the shoreline during winter storms. With less ice cover, the shoreline is more susceptible to erosion and habitat disruption.

Figure 6. Variability in Ice Coverage

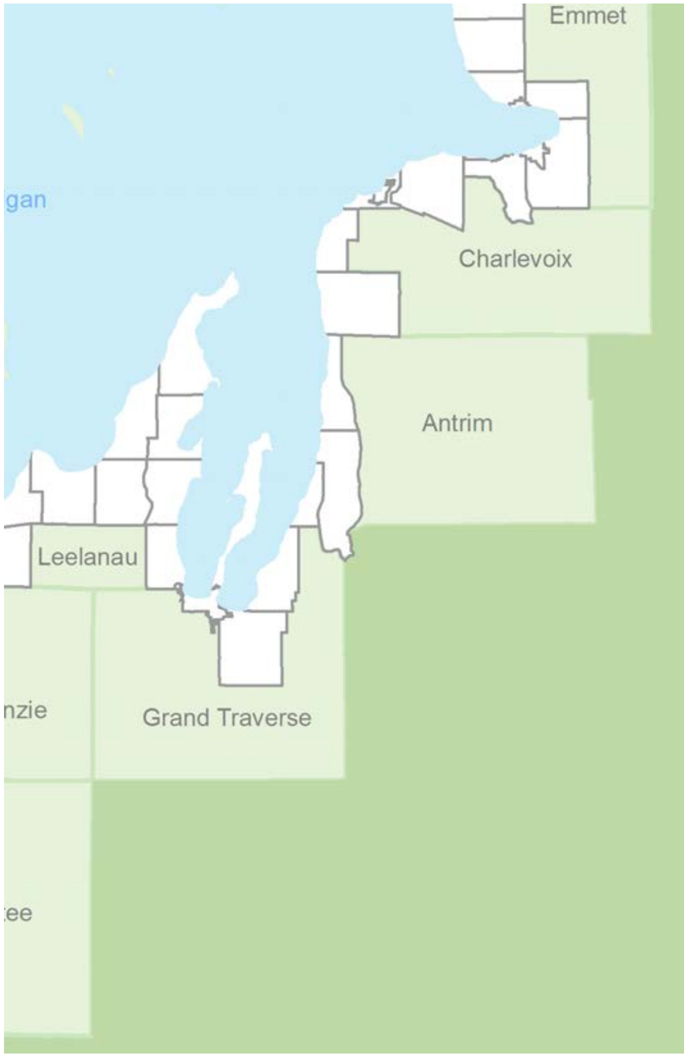


Historic ice cover figures can be found at: https://www.glerl.noaa.gov/data/ice/#historical

36 Great Lakes Integrated Sciences and Assessments (2019) Temperature. Web. Accessed April 2019.
37 Ibid.
38 Dinse, Keely. Preparing for extremes: The Dynamic Great Lakes. Michigan Sea Grant. Web. Accessed July 2015.
39 Cruce, T., & Yurkovich, E. (2011). Adapting to climate change: A planning guide for state coastal managers – a Great Lakes supplement. Silver Springs, MD: NOAA Office of Ocean and Coastal Resource Management.

CHAPTER 3
Coastal Flooding

Climate scientists predict that northwest Lower 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. The potential for substantially larger rain events and severe storms raises concerns of harm to human health and damage to buildings and infrastructure, especially for areas along the Lake Michigan coastline.



SCENARIO PLANNING WITH CLIMATE FUTURES

In preparing this Atlas, LIAA and the University of Michigan researched coastal dynamics to help coastal communities in northwest Lower Michigan better understand and manage the threats from increased coastal flooding. The project team relied on a useful planning tool called “scenario planning” to help envision plausible narratives for the future flooding conditions of coastal communities in the region.

Uncertainty in a planning setting is common, particularly when the planning issues are rooted in environmental processes like water levels on the Great Lakes or unpredictable changes in climate. Scenario planning helps navigate these uncertainties, allowing for adaptive planning by comparing different but reasonable future narratives against each other. These narratives help communities test policies, prioritize strategies and demonstrate potential future conditions[1]. This gives local officials a way to process the future in the present.[2] Unlike a forecast, which concretely lays out a predicted future for a community, scenario planning arranges a palate of reasonable potential futures from which decisions regarding uncertainties can be made and planned for by local officials.

1 Holway. J., Gabbe, C.J., Hebbert, F., Lally, S., Mathews, R., & Policy, L. I of L. (2012) Opening access to scenario planning tools. Policy Focus Report (p. 56) Retrieved from https://wwwlimcolninst.edu/pubs/2027_ Opening-Access-to-Scenarioplannong-Tools

2 Harwood, S. A. (2007) Using Scenarios to Build Planning Capacity. In L.D. Hopkins & M. Zapata (Authors), Engaging the future: Forecasts, scenarios, plans and projects (pp. 135-154). Cambridge, MA: Lincoln Institute of Land Policy.

To develop the scenario planning framework, the research team had to establish assumptions regarding future climate conditions that could affect northwest Lower Michigan. These varying “climate futures” — all of which are reasonably anticipated possibilities — are arranged from a least impactful (“Lucky”) to a most impactful (“Perfect Storm”) 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. The maps in this chapter show 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 green on the maps.

“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 ongoing Great Lakes Coast Flood Study being conducted by the Federal Emergency Management Agency (FEMA). 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 yellow on the maps.

“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 the maps.

Taken together on the maps, the three climate futures are progressively cumulative; that is, the Expected Future is cumulative of all the green (Lucky) and yellow areas put together, and the Perfect Storm Future encompasses all green, yellow and red areas. It is important to note that this flooding analysis is only complete for Lake Michigan coastal areas; inland rivers, streams and other waterbodies may show little or no data.

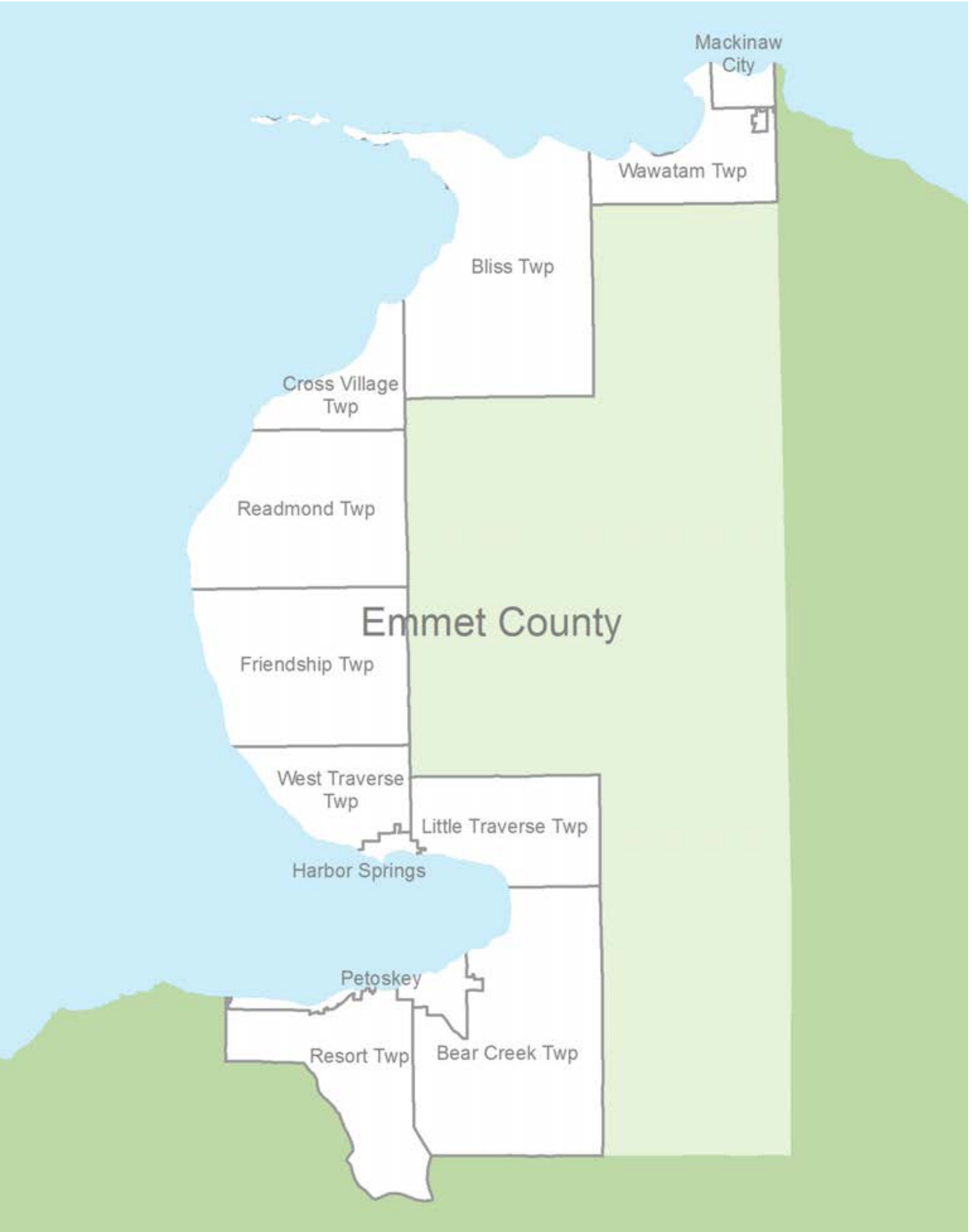
Where data was made available (in Benzie, Charlevoix, Emmet, Grand Traverse and Leelanau counties), tables are included that provide estimates of the State Equalized Value (SEV) of properties impacted by flooding in the different climate futures for each jurisdiction. Each table begins with a listing of the jurisdiction’s total SEV, then lists the SEV of properties impacted by each climate future. These dollar totals are also cumulative; that is, the Expected dollar amounts are cumulative of all of the properties impacted in the green and yellow areas, and the Perfect Storm dollar amounts encompass properties impacted in all green, yellow and red areas.

The following sections are organized first by county, then by each local jurisdiction within that county. Coastal villages are included on the same page as an adjacent township, which is noted in each occurrence.

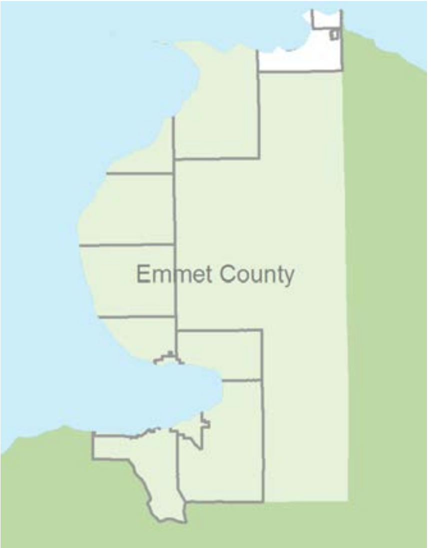
Emmet County

Coastal Flooding Scenario Impacts

Emmet County			
Total SEV	Lucky	Expected	Perfect Storm
$ 3,091,651,050.00	$ 31,044,900.00	$ 259,598,400.00	$ 577,459,700.00



Wawatam Twp./ Mackinaw City



Coastal Flooding Scenario Impacts

Wawatam

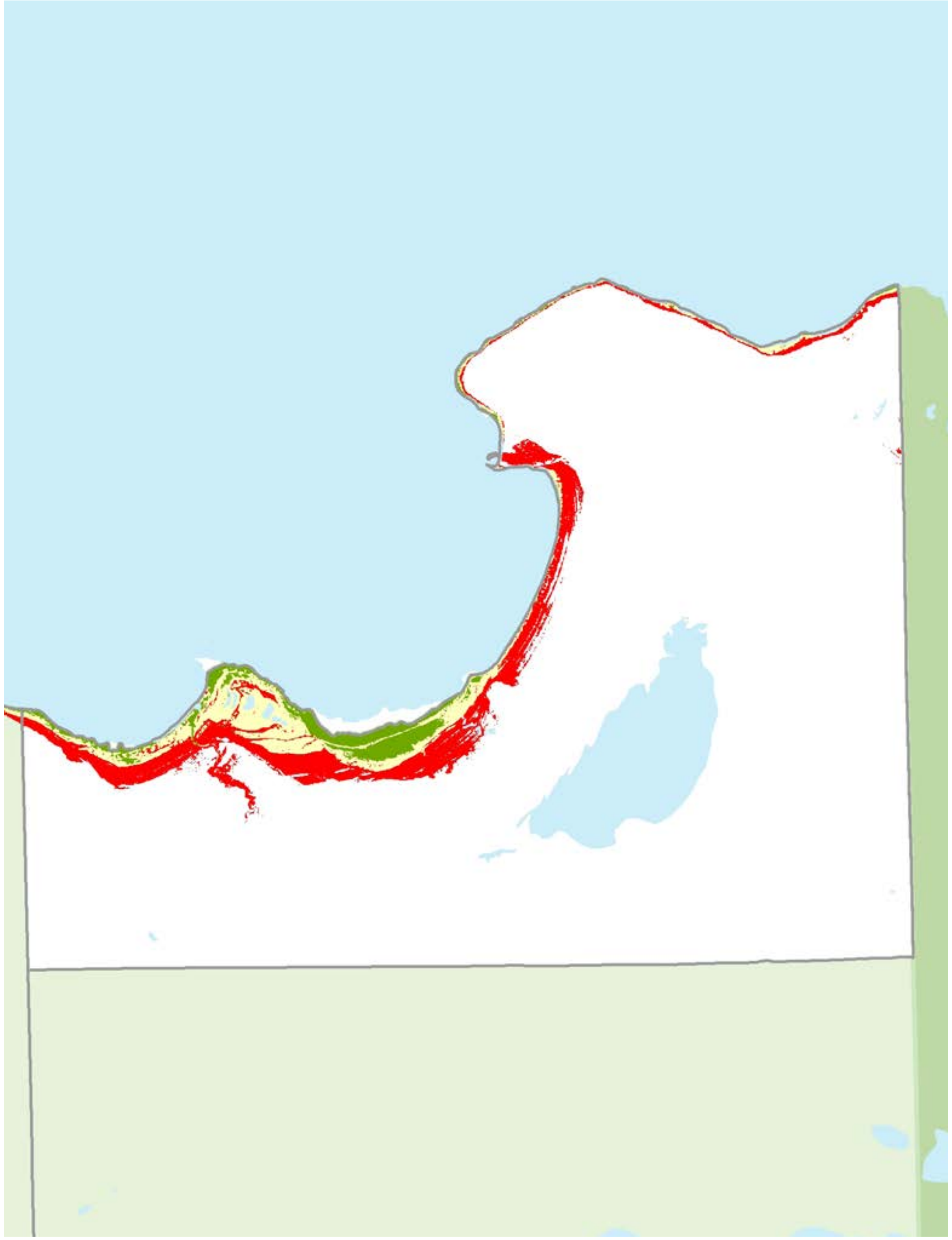
Total SEV	Lucky	Expected	Perfect Storm
$ 27,285,650.00	$ 1,013,800.00	$ 11,021,100.00	$ 18,063,900.00

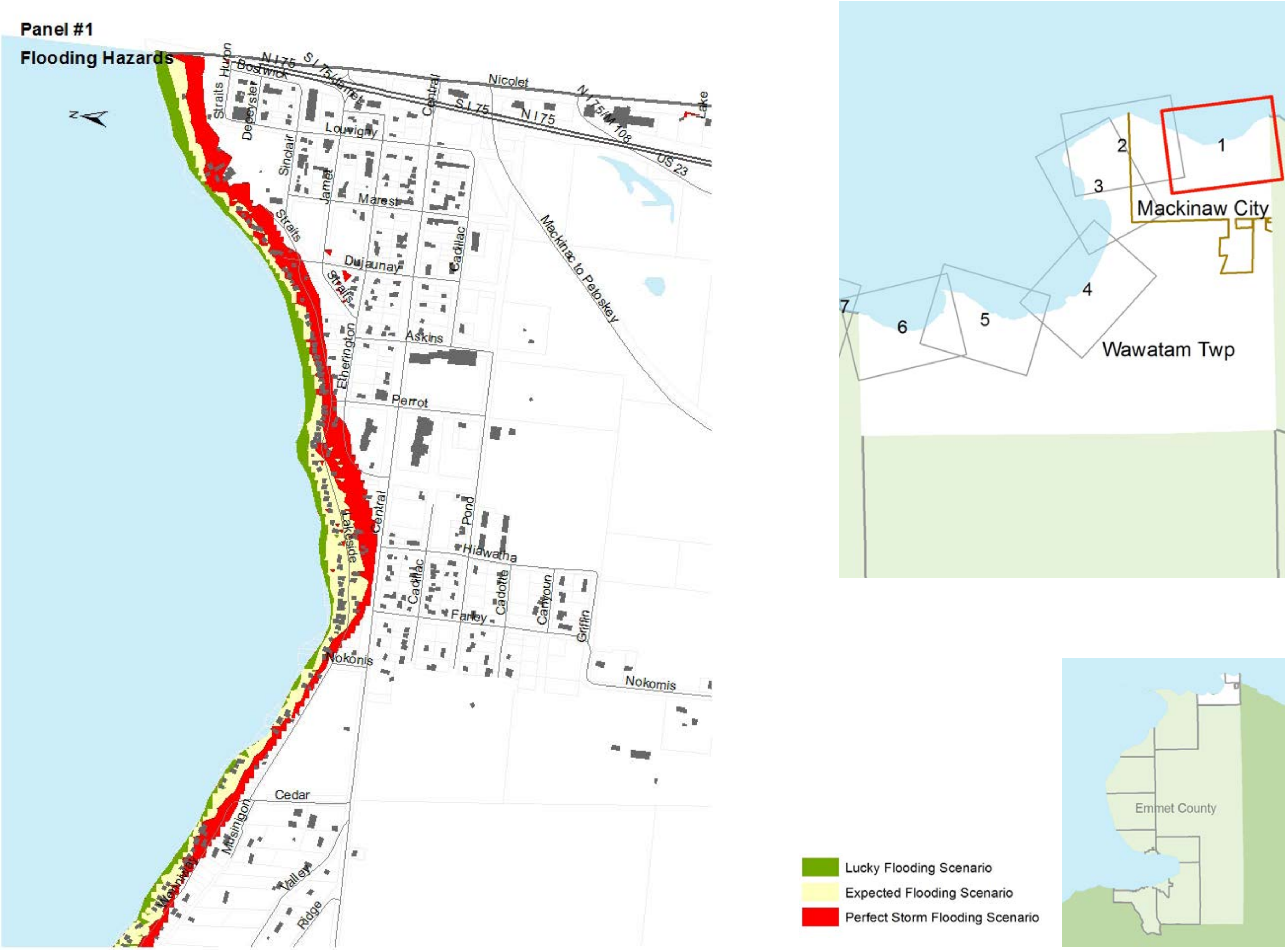
Coastal Flooding Scenario Impacts

Mackinaw City

Total SEV	Lucky	Expected	Perfect Storm
$ 39,006,300.00	$ 1,147,100.00	$ 14,115,200.00	$ 17,639,100.00

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario




Panel #1
Flooding Hazards
N
Straits
Huron
Bostwick
N I 75
S I 75/Jamet
Depeyster
Sinclair
Louvigny
Central
Nicolet
S I 75
N I 75
N I 75/M 108
US 23
Lake
Jamet
Marest
Straits
Cadillac
Dujaunay
Straits
Mackinac to Petoskey
Etherington
Askins
Perrot
Central
Lakeside
Pond
Hiawatha
Cadillac
Cadotte
Calhoun
Farley
Griffin
Nokomis
Nokomis
Cedar
Musingon
Wabnaki
Valley
Ridge
1
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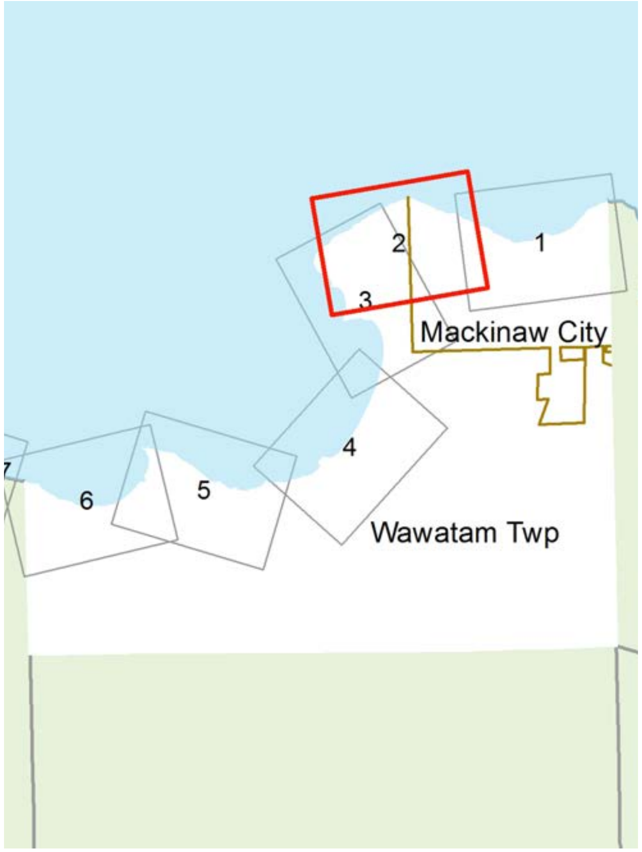
7
Mackinaw City
Wawatam Twp
Emmet County
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



1
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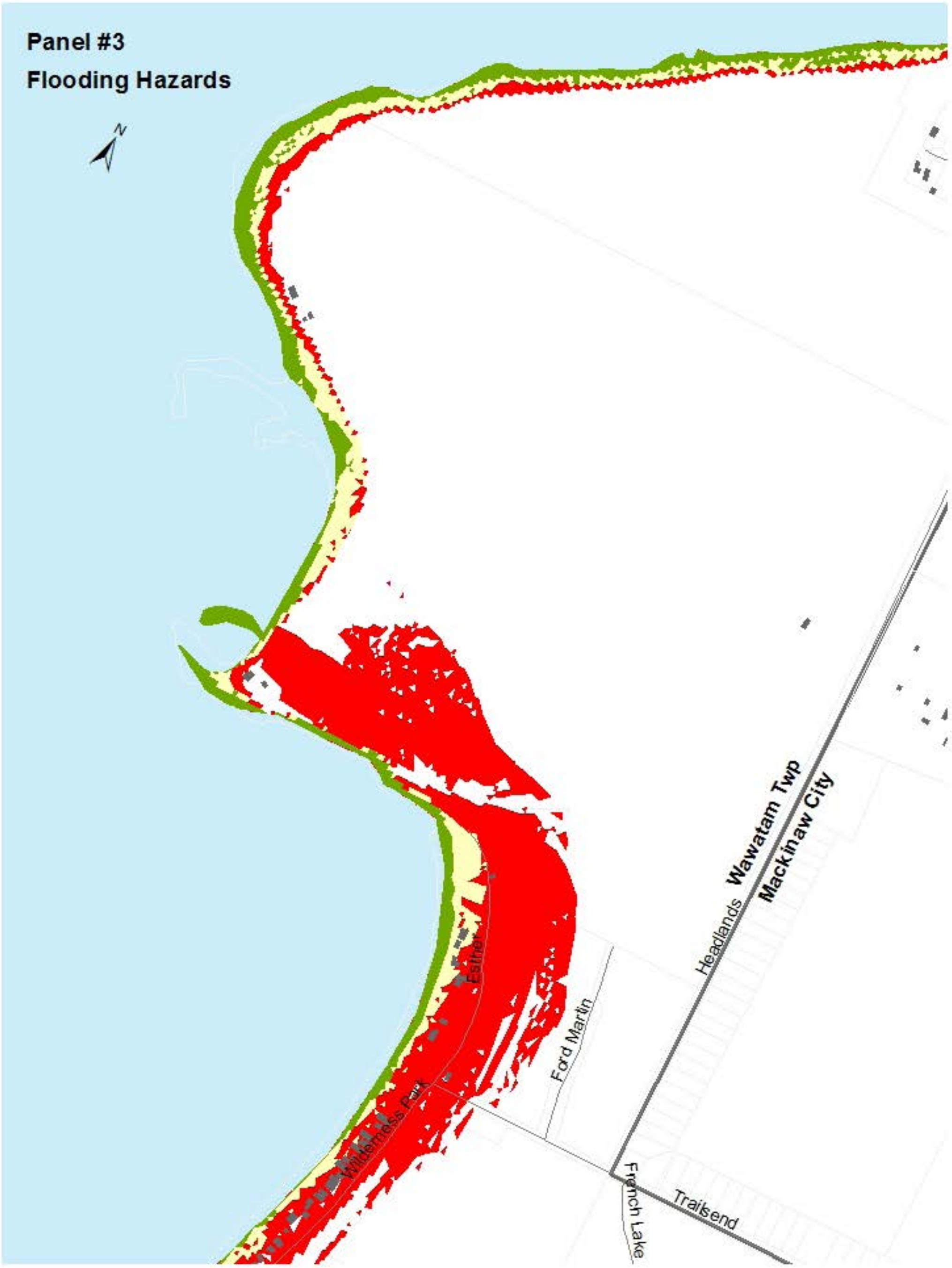
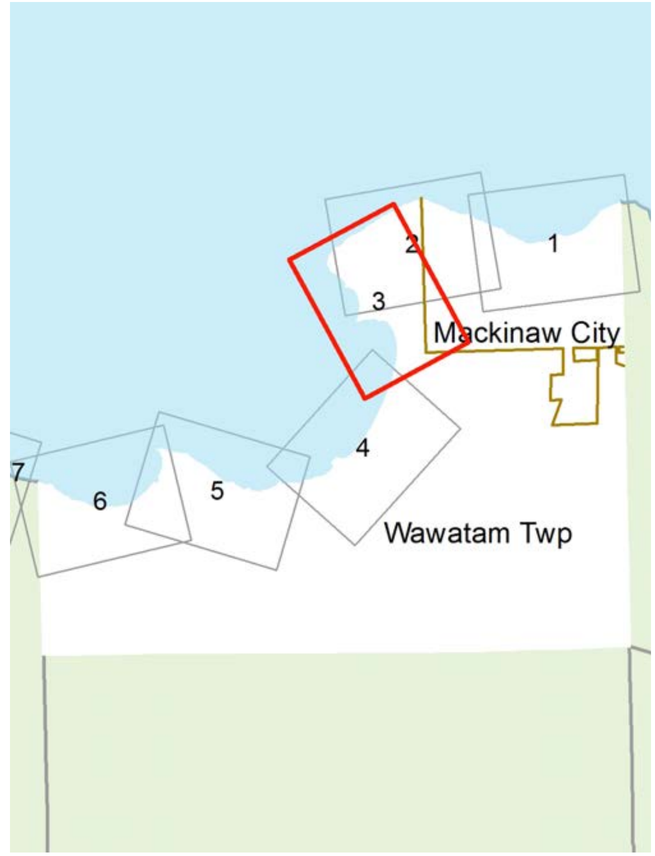
7
Mackinaw City
Wawatam Twp

Emmet County

Panel #2
Flooding Hazards
N
Valley
Ridge
Central
Jane
Birch
Headlands
Mackinaw City
Wawatam Twp
David
Chippewa
Algonquin
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #3
Flooding Hazards
N
Wawatam Twp
Mackinaw City
Headlands
Ford Martin
French Lake
Trailsend
Wilderness Park
Esther


1
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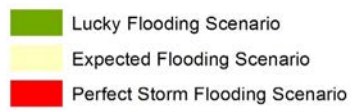
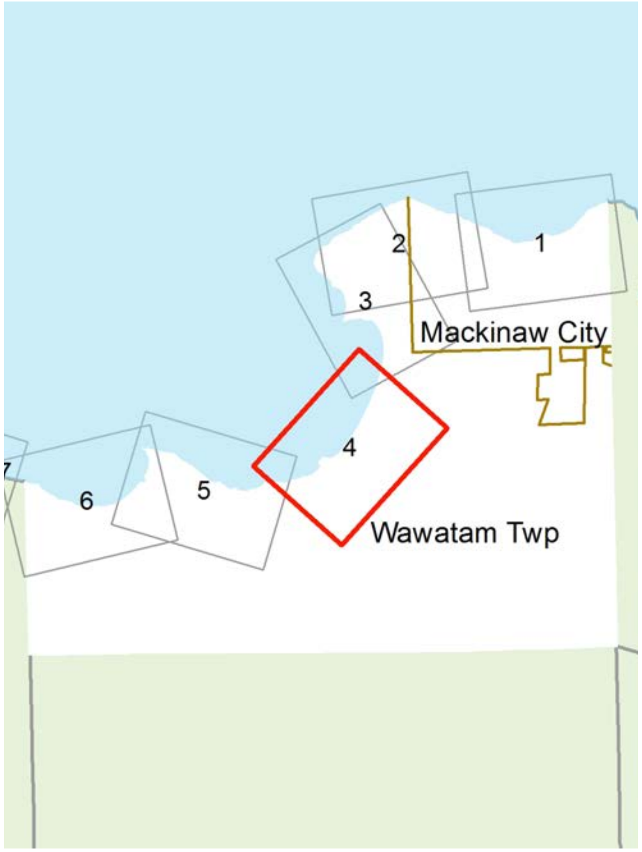
7
Mackinaw City
Wawatam Twp


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Emmet County


1
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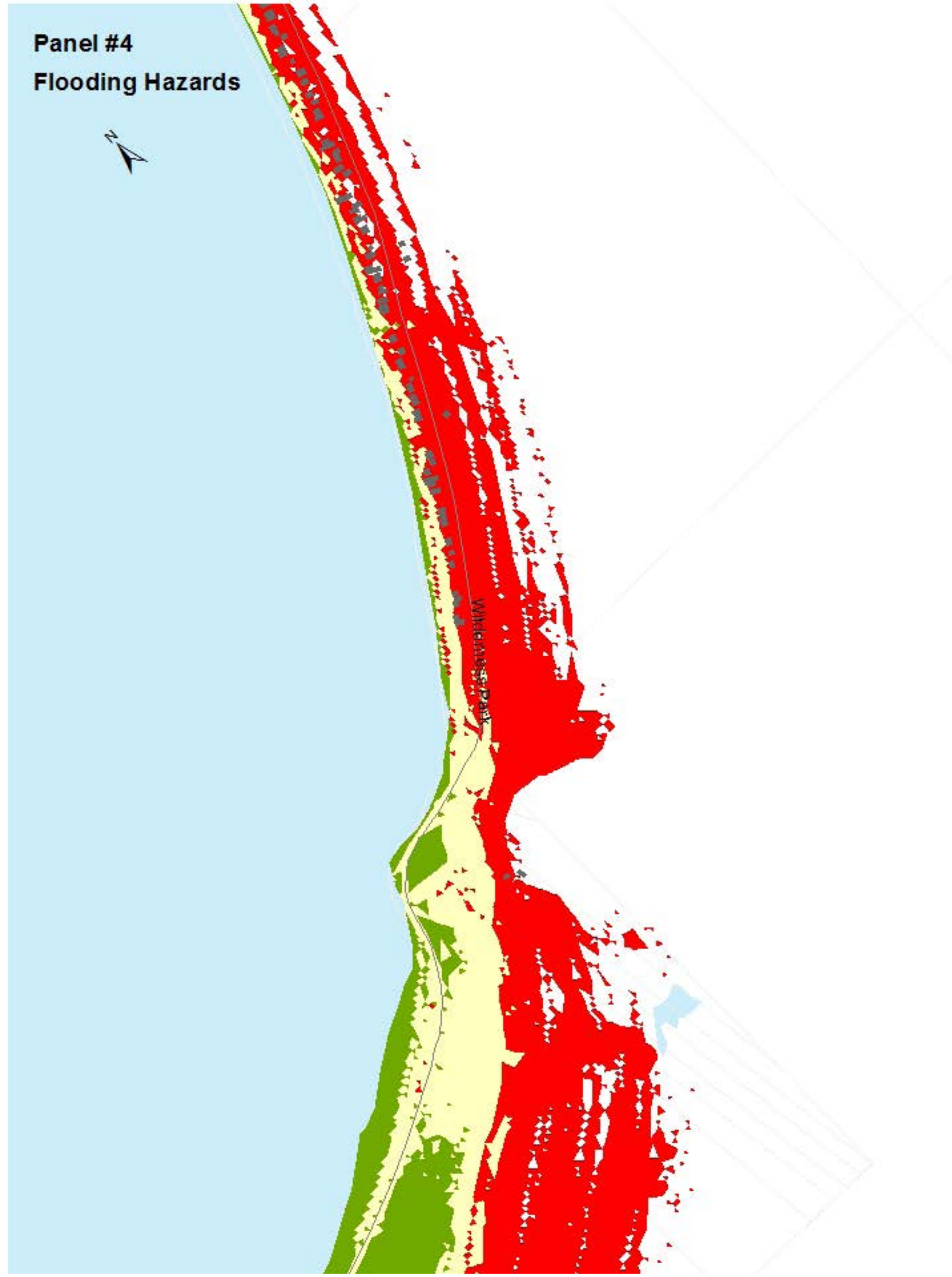
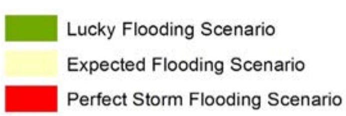
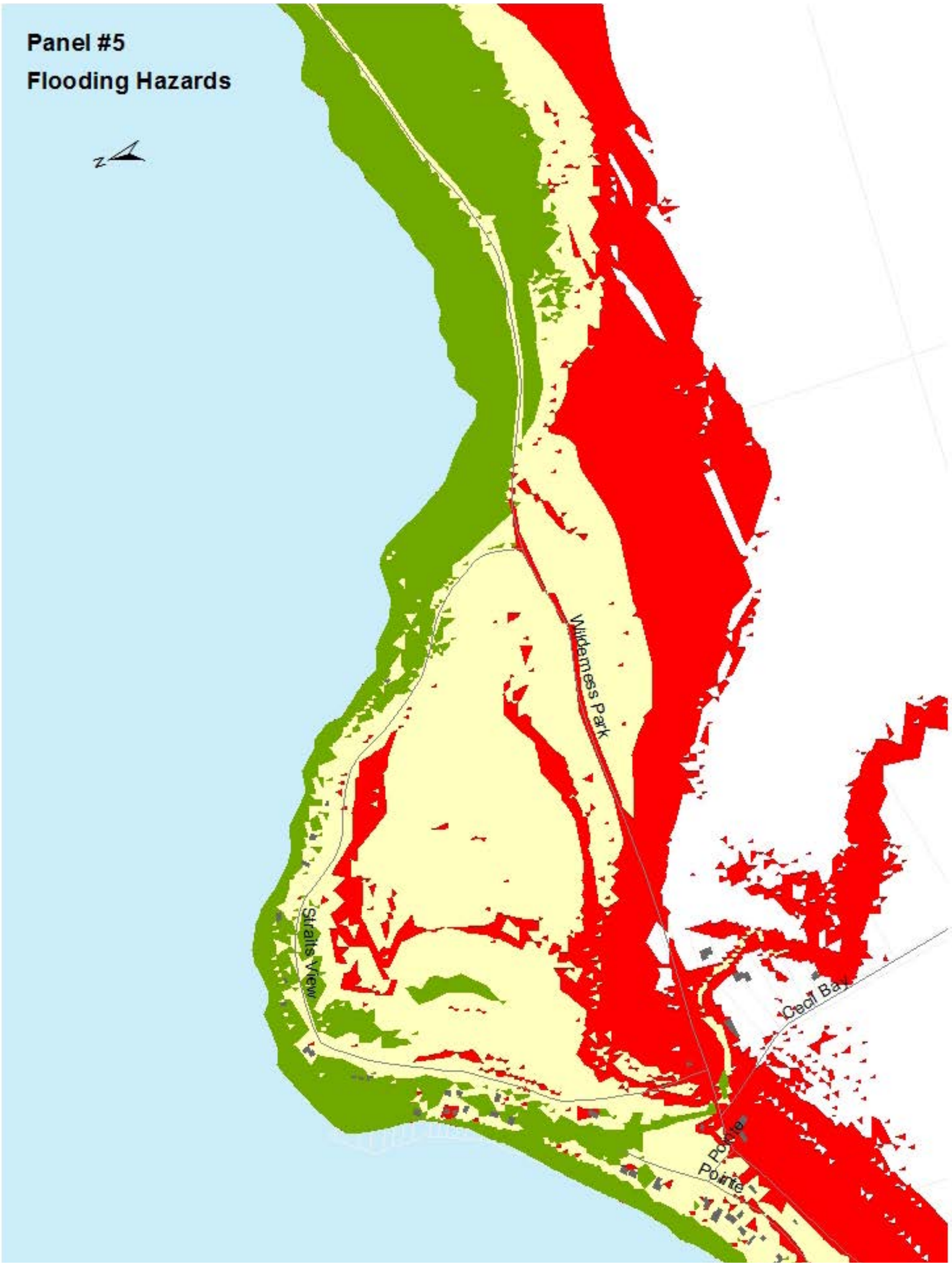
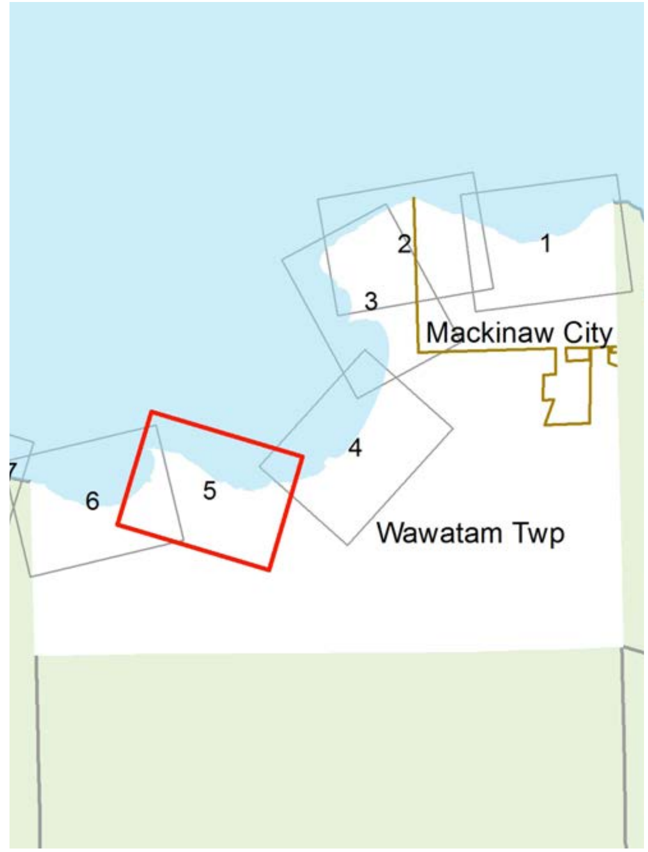
6
Mackinaw City
Wawatam Twp


Emmet County

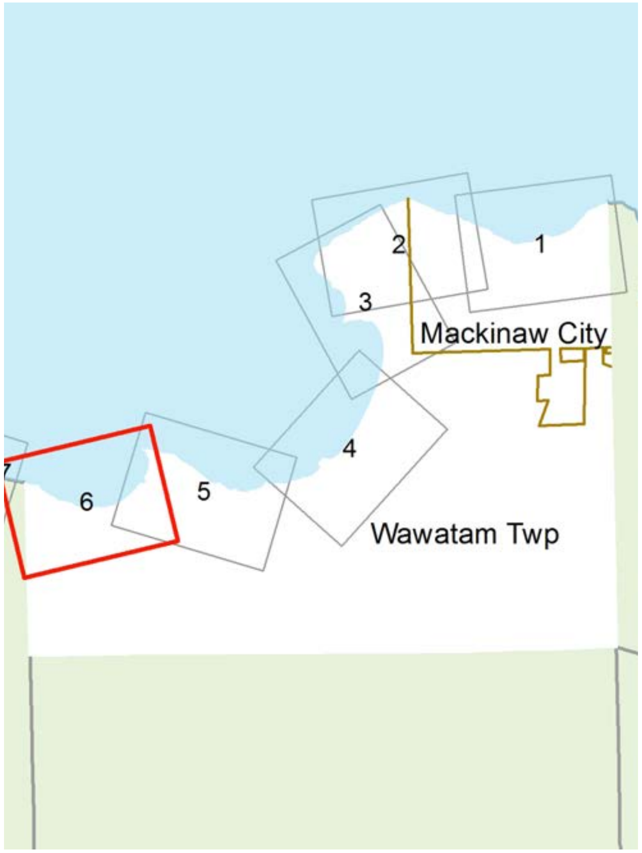

Panel #4
Flooding Hazards
N
Wilderness Park


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

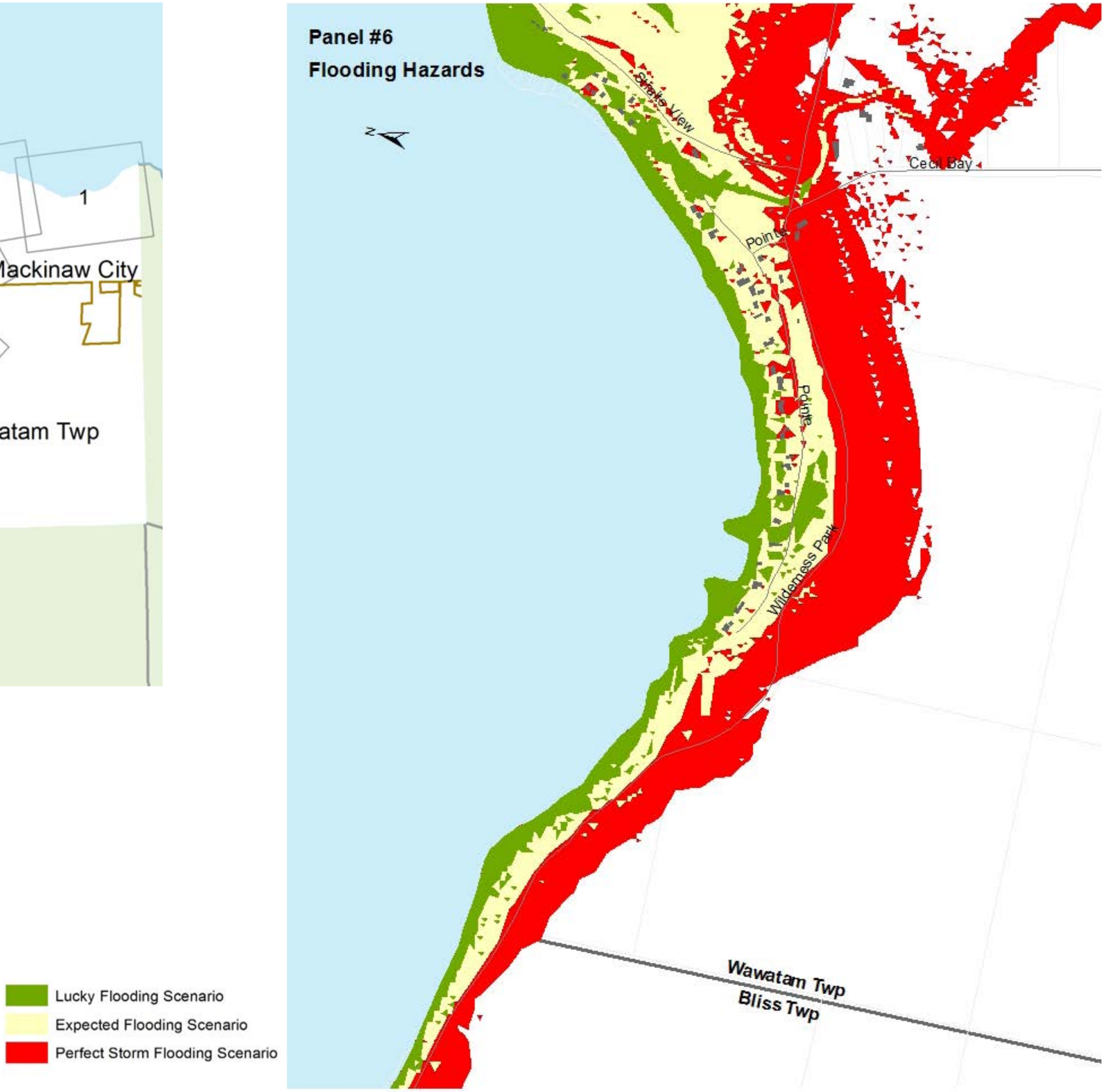


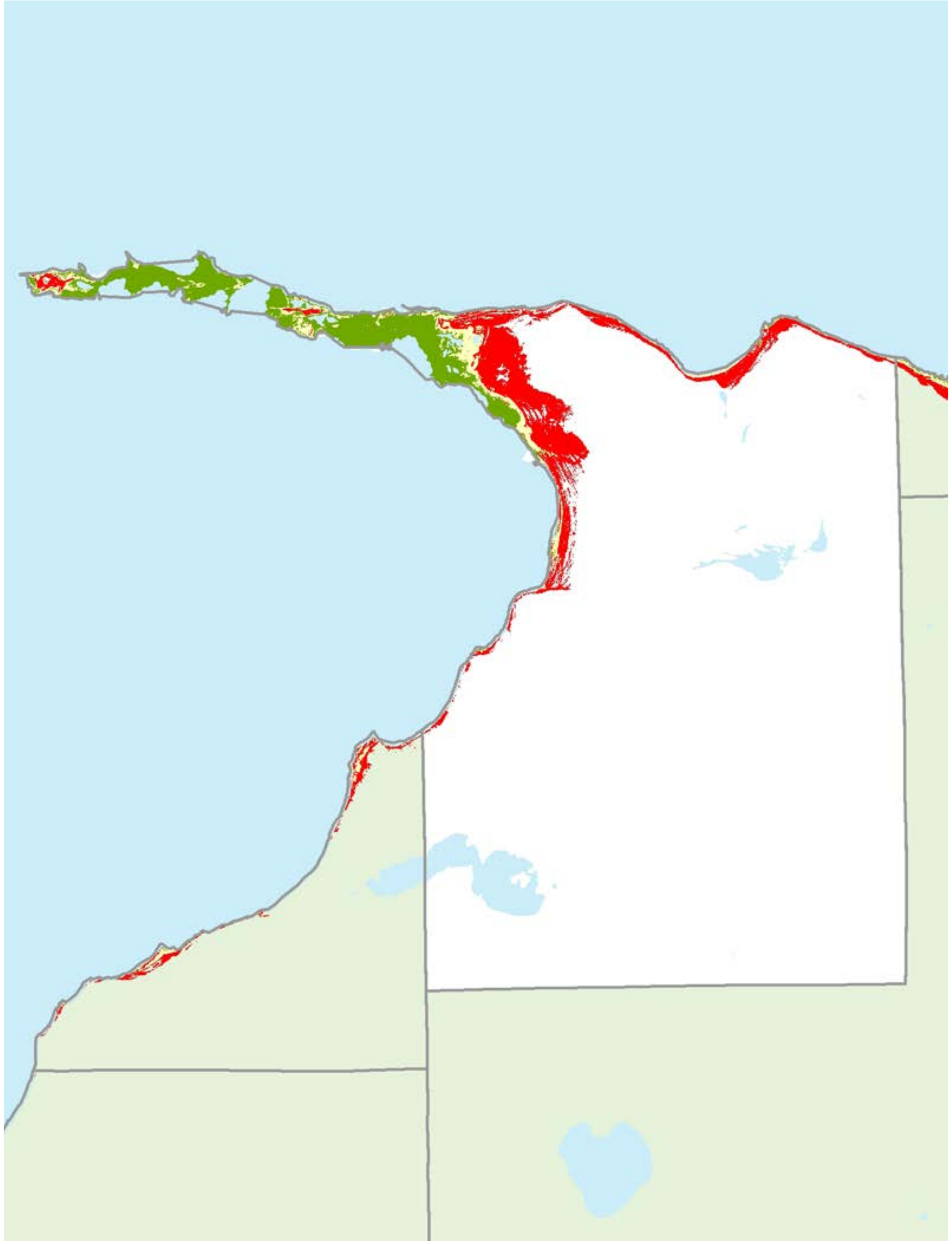


- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario

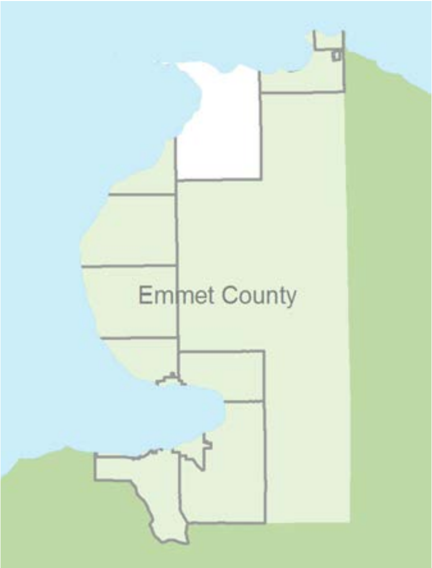

2
1
3
Mackinaw City
4
6
5
Wawatam Twp


Emmet County


Panel #6
Flooding Hazards
Straits View
Cecil Bay
Pointe
Wilderness Park
Wawatam Twp
Bliss Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



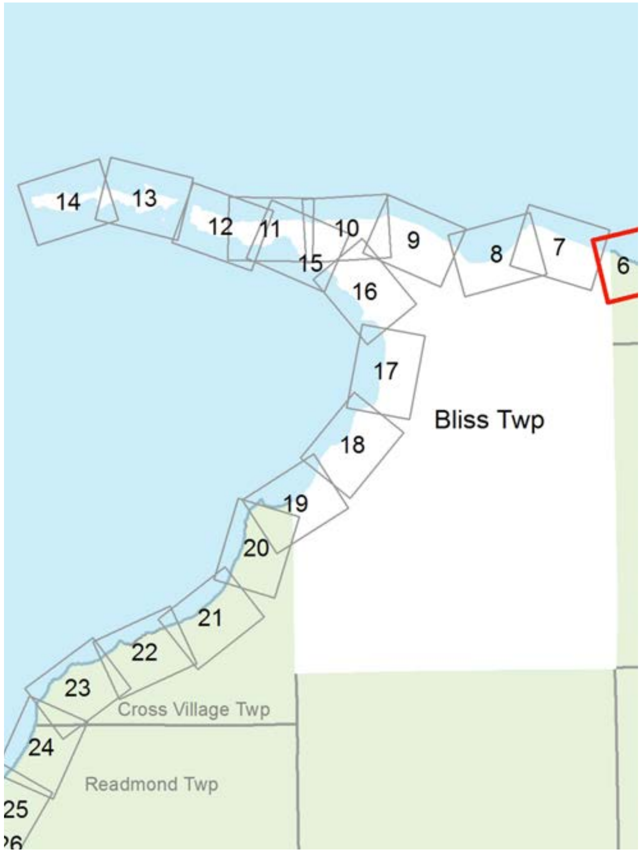
Bliss Twp.



Coastal Flooding Scenario Impacts

Bliss			
Total SEV	Lucky	Expected	Perfect Storm
$ 49,849,300.00	$ -	$ 2,373,300.00	$ 2,706,900.00

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


14
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Bliss Twp
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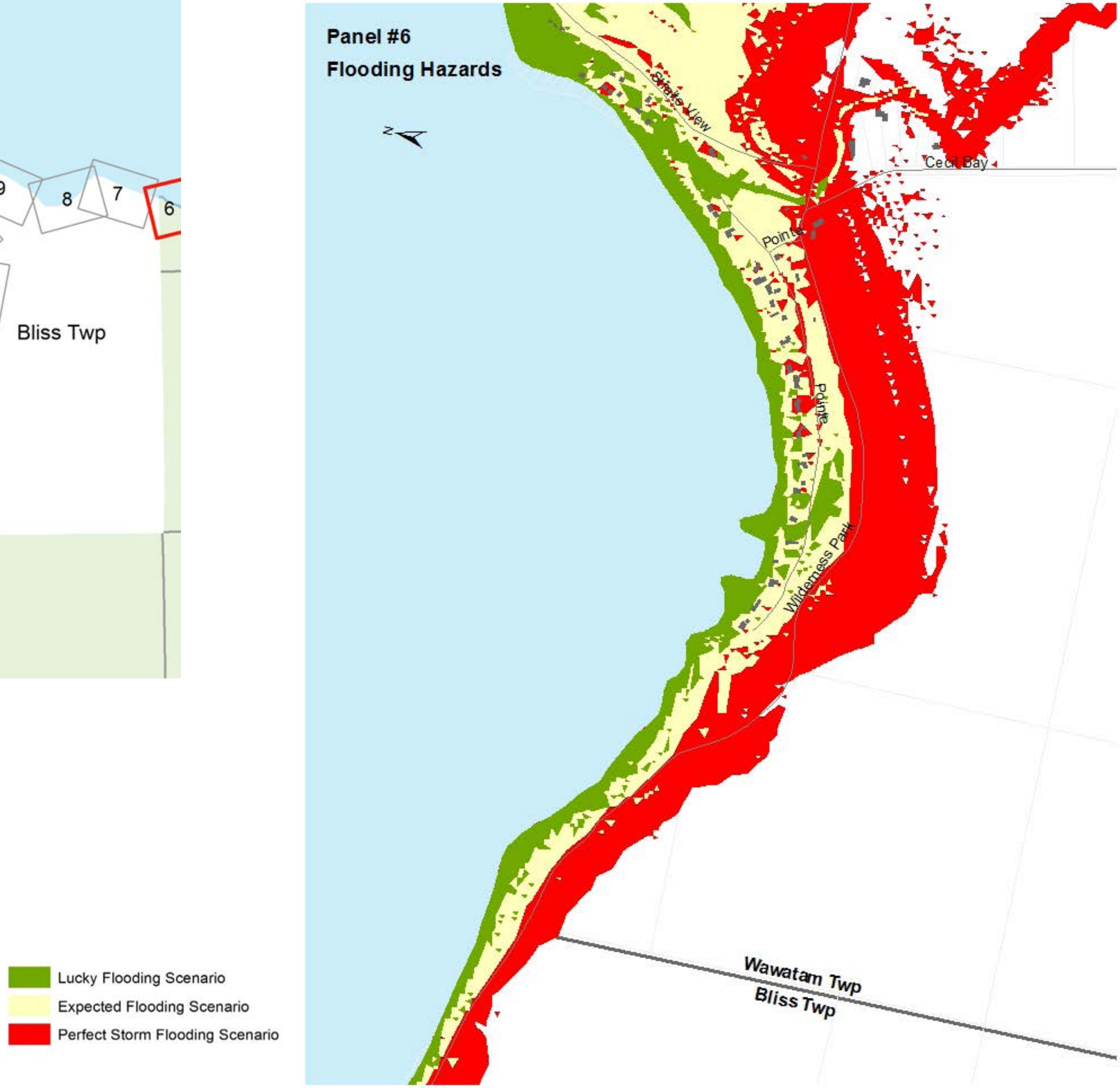
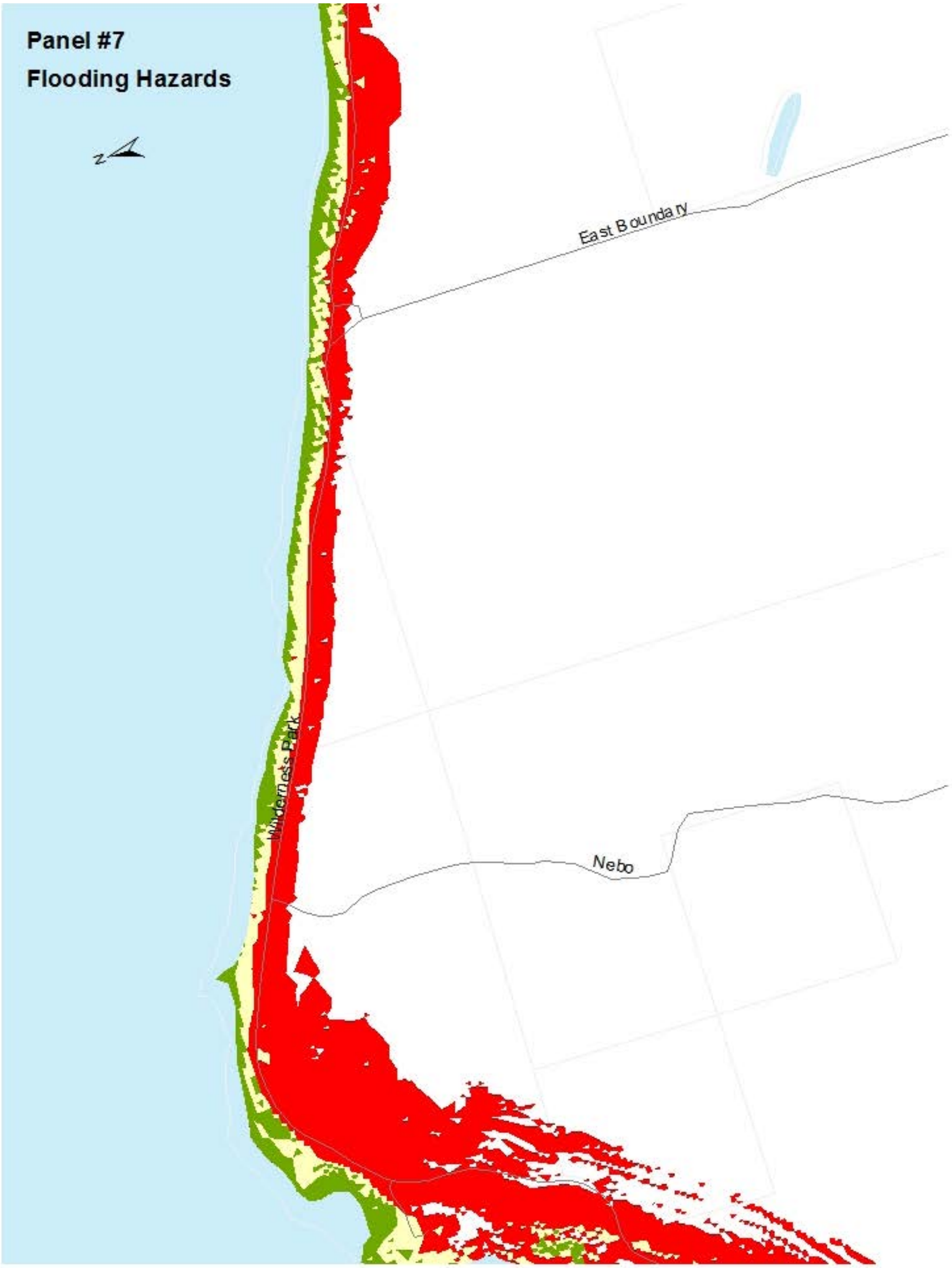
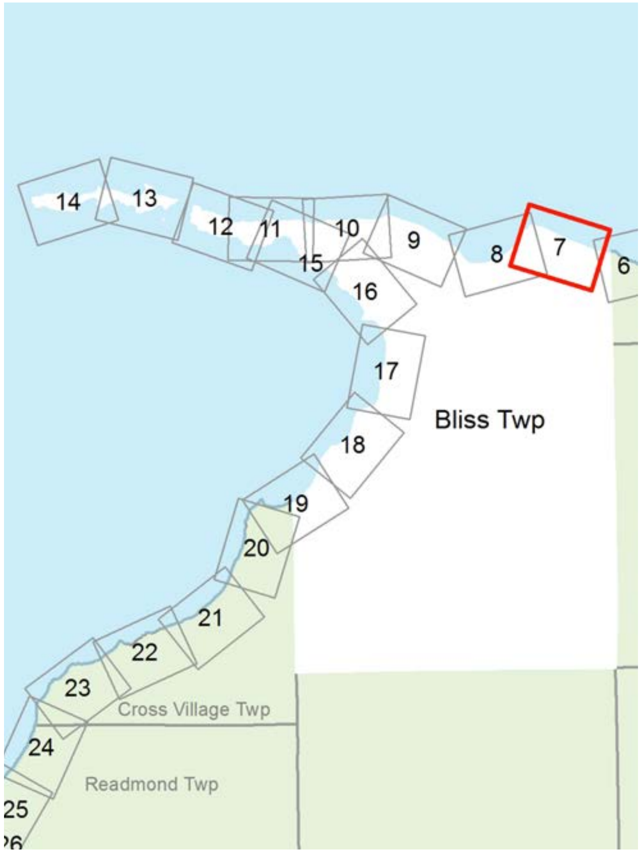
Cross Village Twp
24
Readmond Twp
25


Emmet County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Panel #6
Flooding Hazards
Straits View
Cecil Bay
Pointe
Pointe
Wilderness Park
Wawatam Twp
Bliss Twp


Panel #7
Flooding Hazards
East Boundary
Wilderness Park
Nebo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Bliss Twp
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Cross Village Twp
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Readmond Twp
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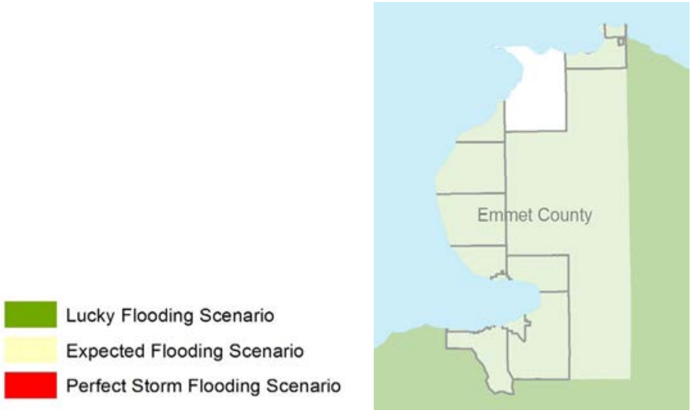
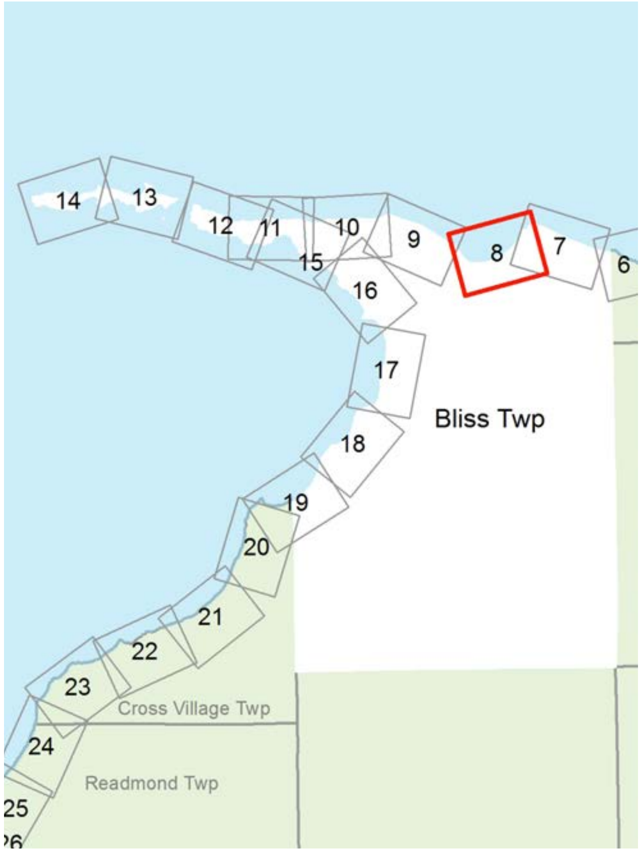

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Emmet County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Bliss Twp
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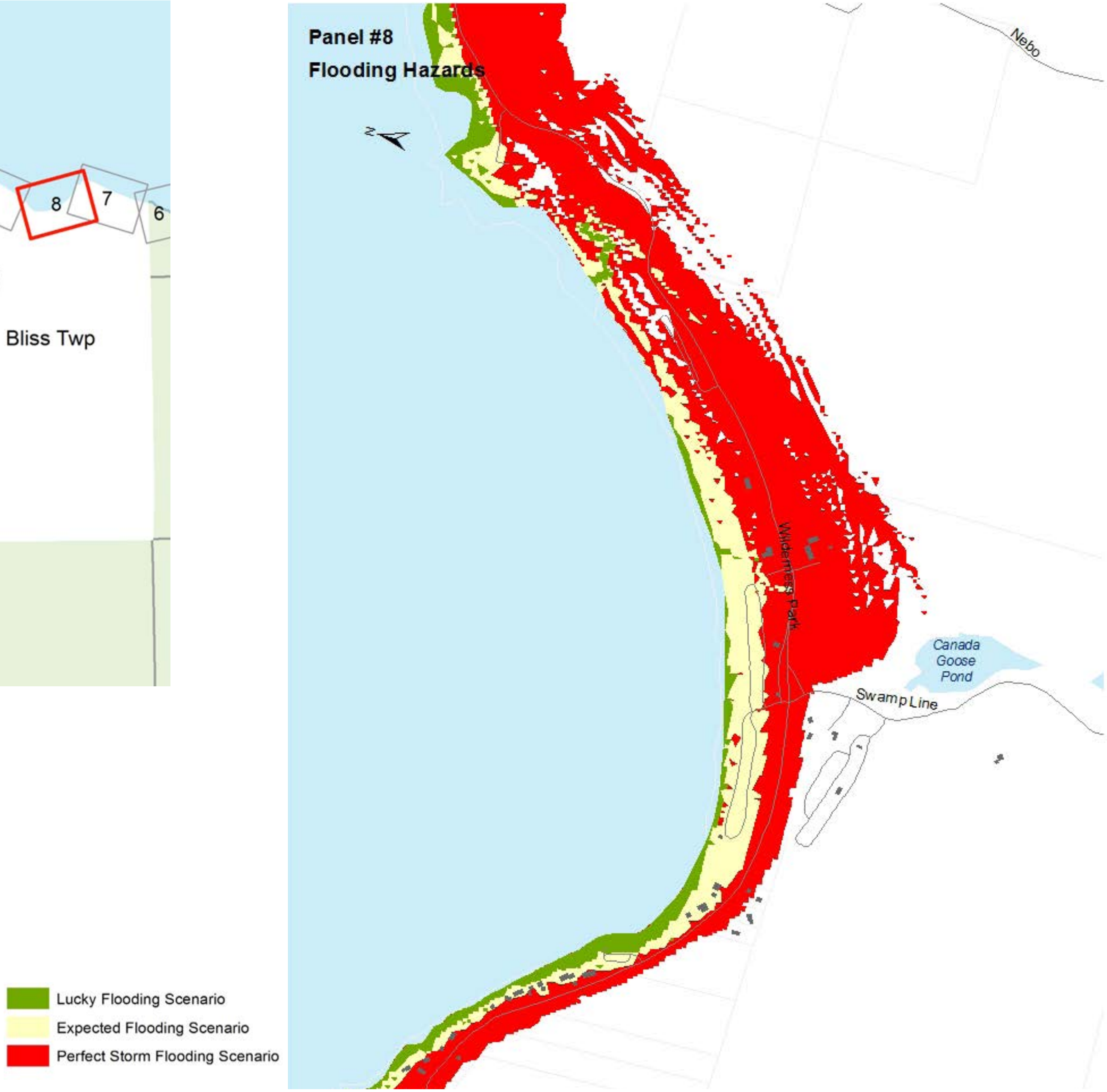
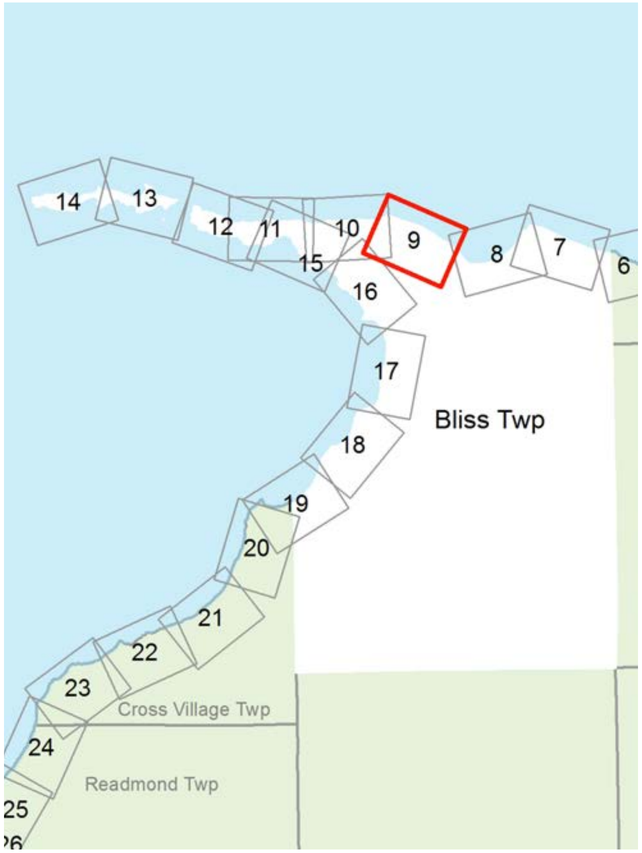
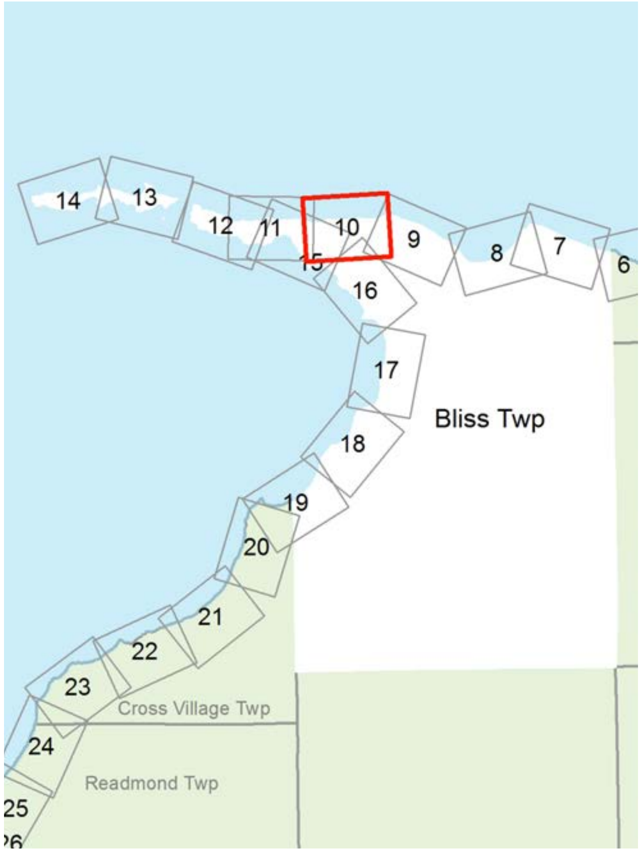
23
Cross Village Twp
24
Readmond Twp
25


Emmet County


Panel #8
Flooding Hazards
Nebo
Wilderness Park
Canada Goose Pond
Swamp Line
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Bliss Twp
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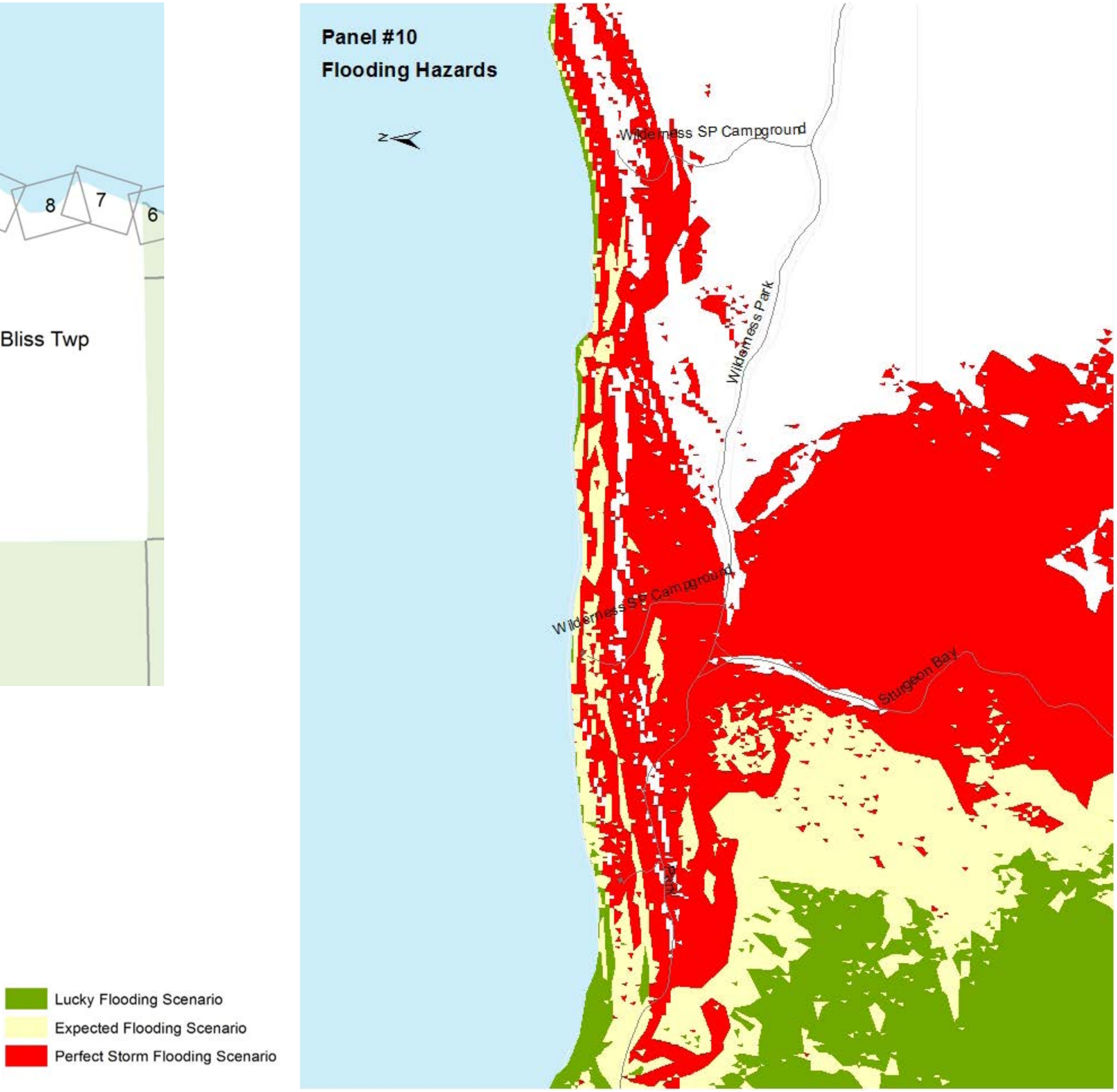
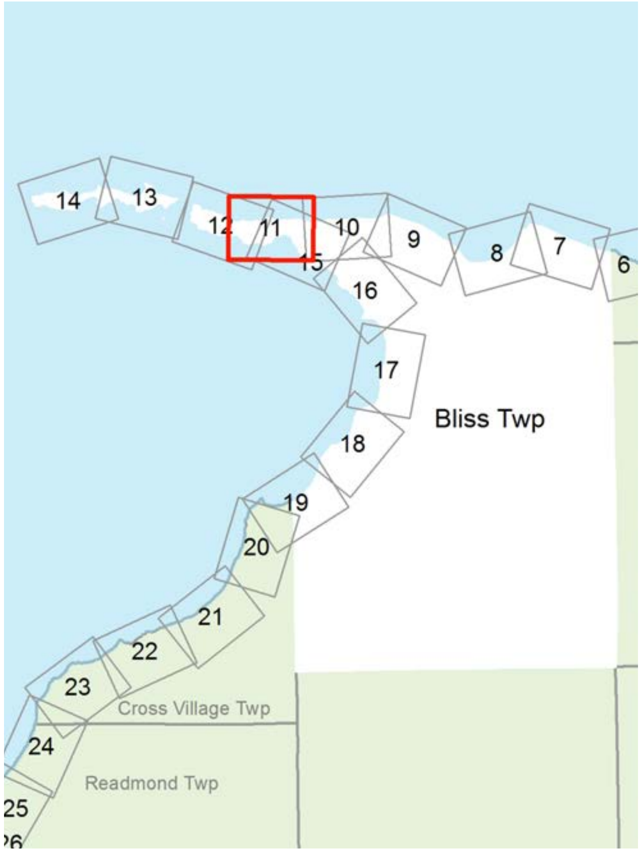
Cross Village Twp
24
Readmond Twp
25


Emmet County


Panel #10
Flooding Hazards
N
Wilderness SP Campground
Wilderness Park
Wilderness SP Campground
Sturgeon Bay
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #11
Flooding Hazards
N
Park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Bliss Twp
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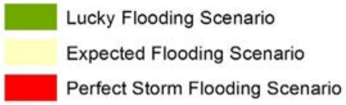
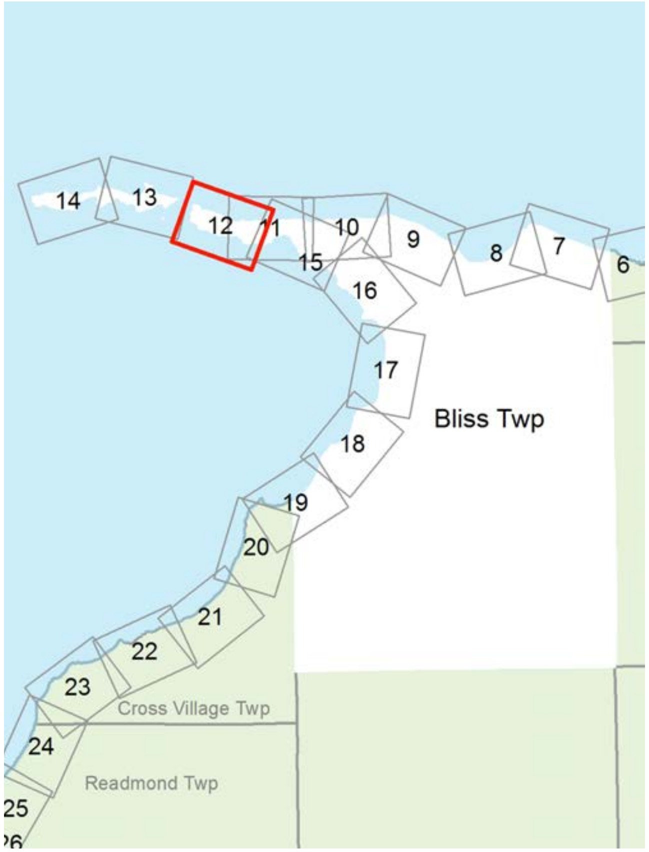
Cross Village Twp
24
Readmond Twp
25


Emmet County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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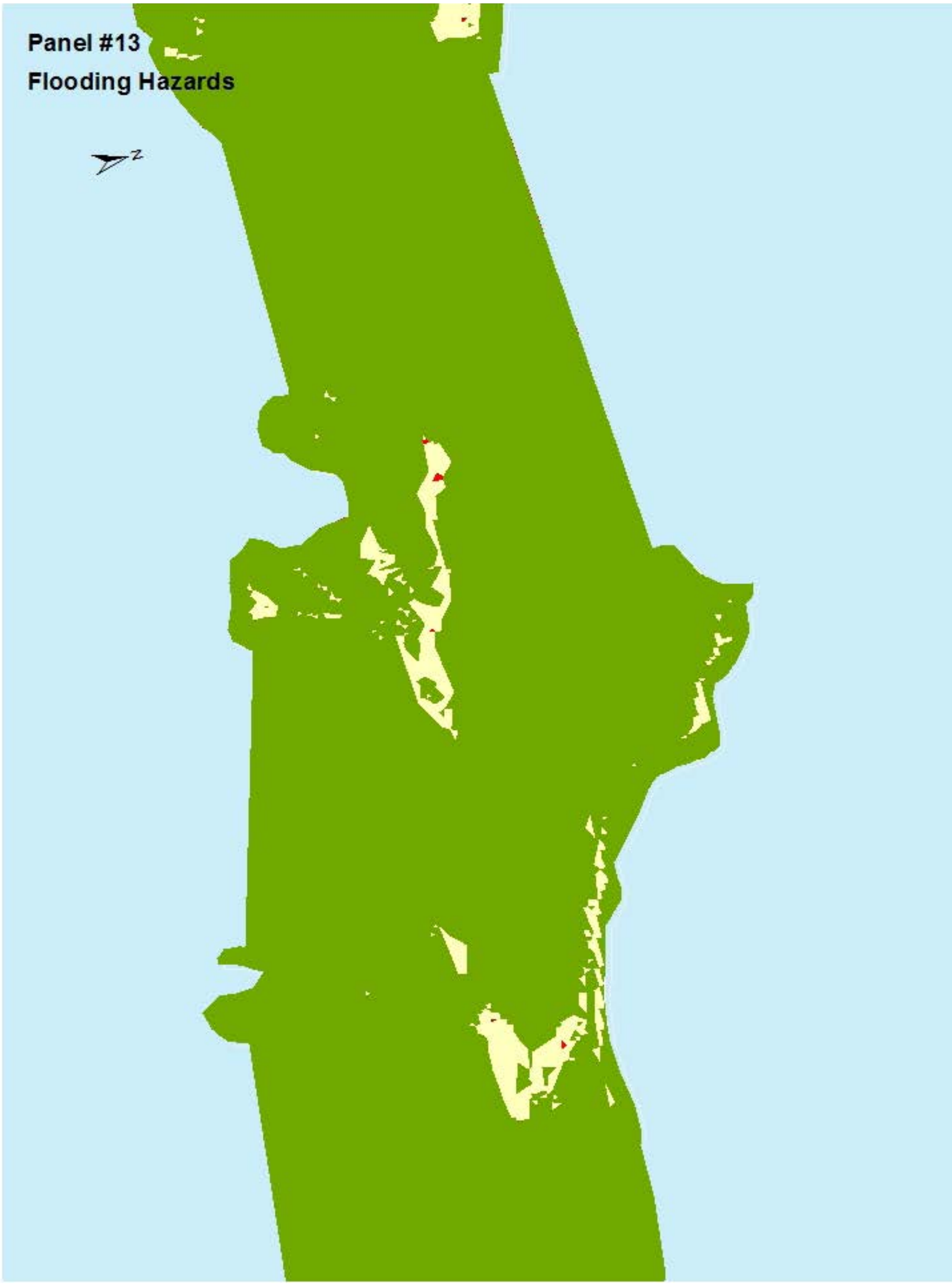
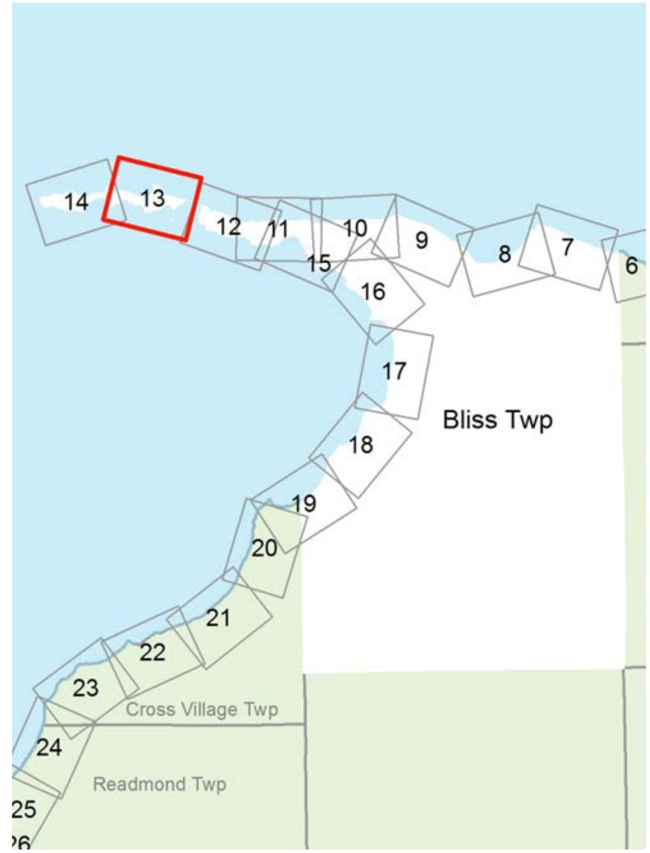
26
Bliss Twp
Cross Village Twp
Readmond Twp

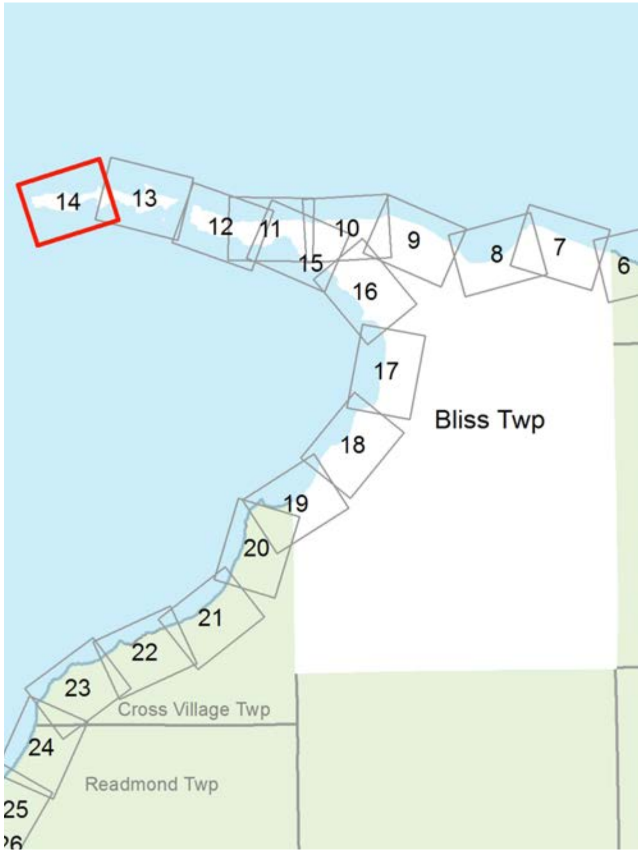

Emmet County


Panel #12
Flooding Hazards
N
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


14
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Bliss Twp
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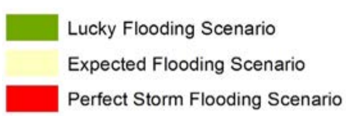
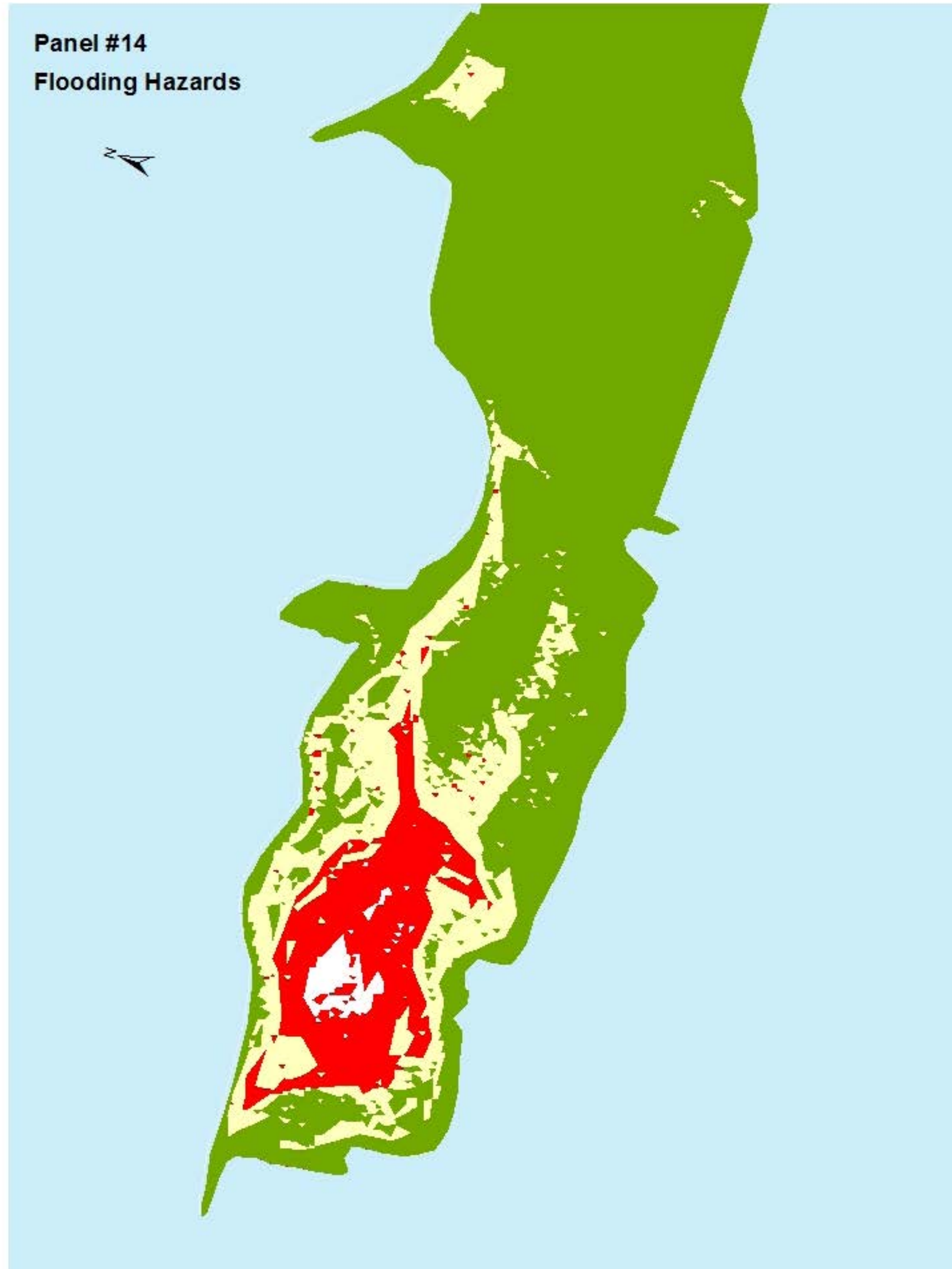
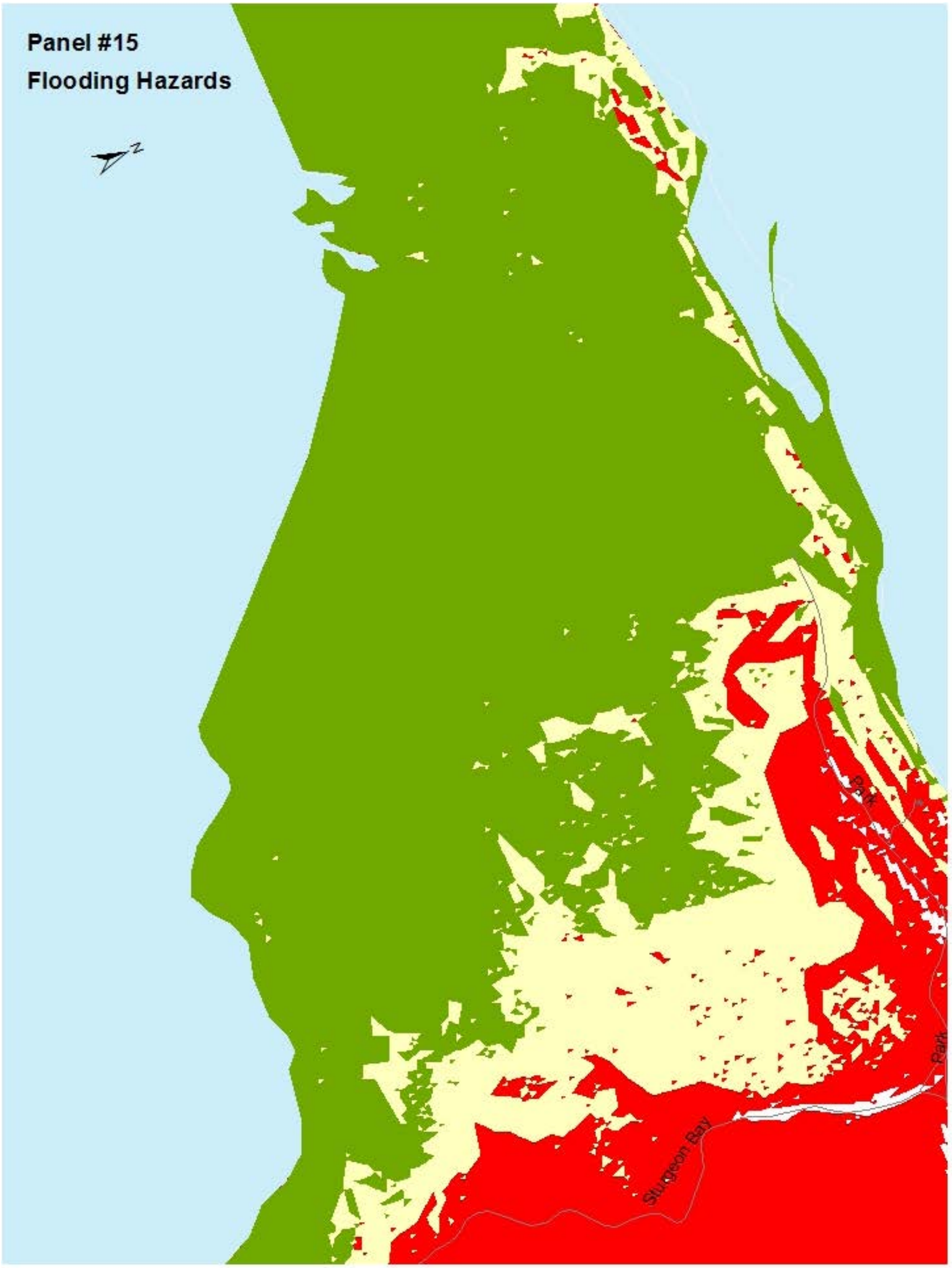
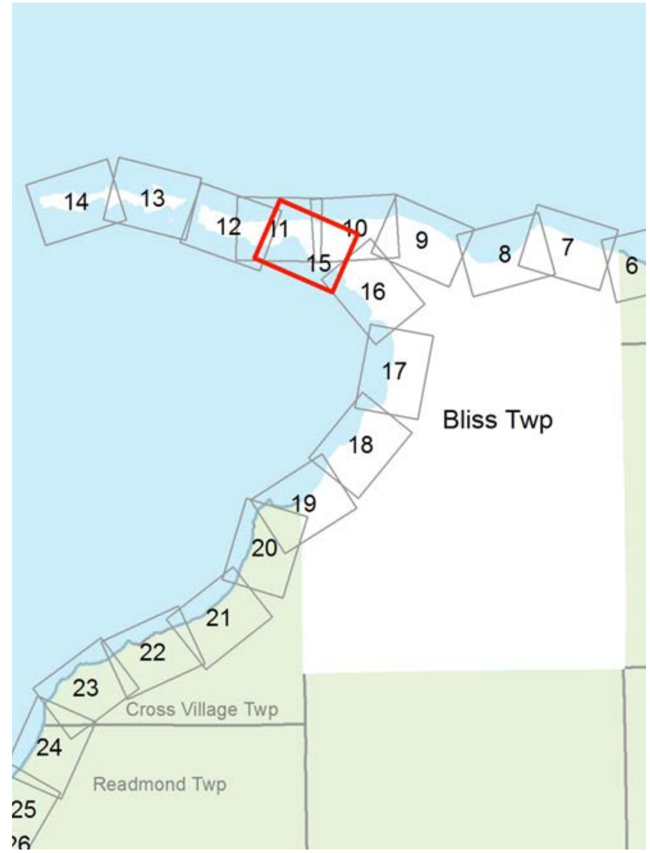
23
Cross Village Twp
24
Readmond Twp
25


Emmet County

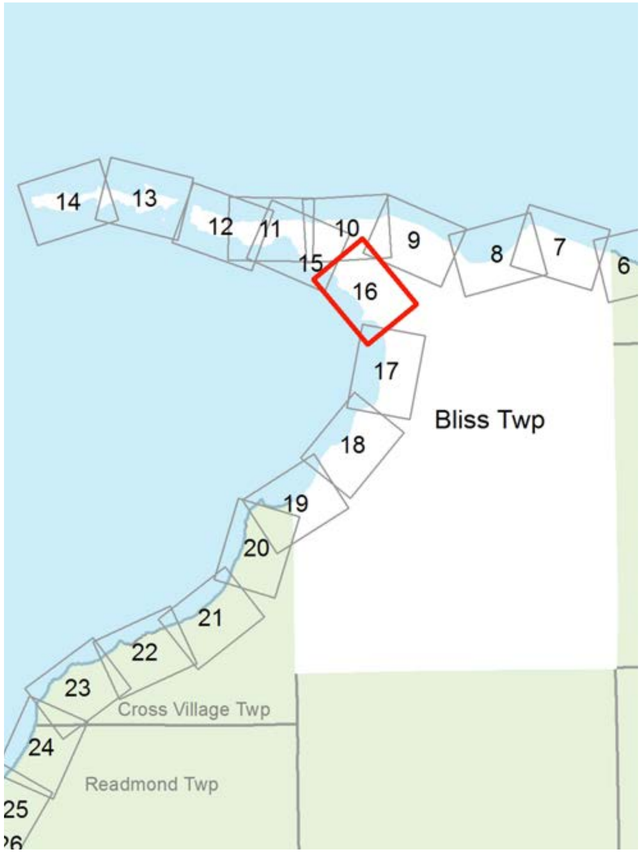

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

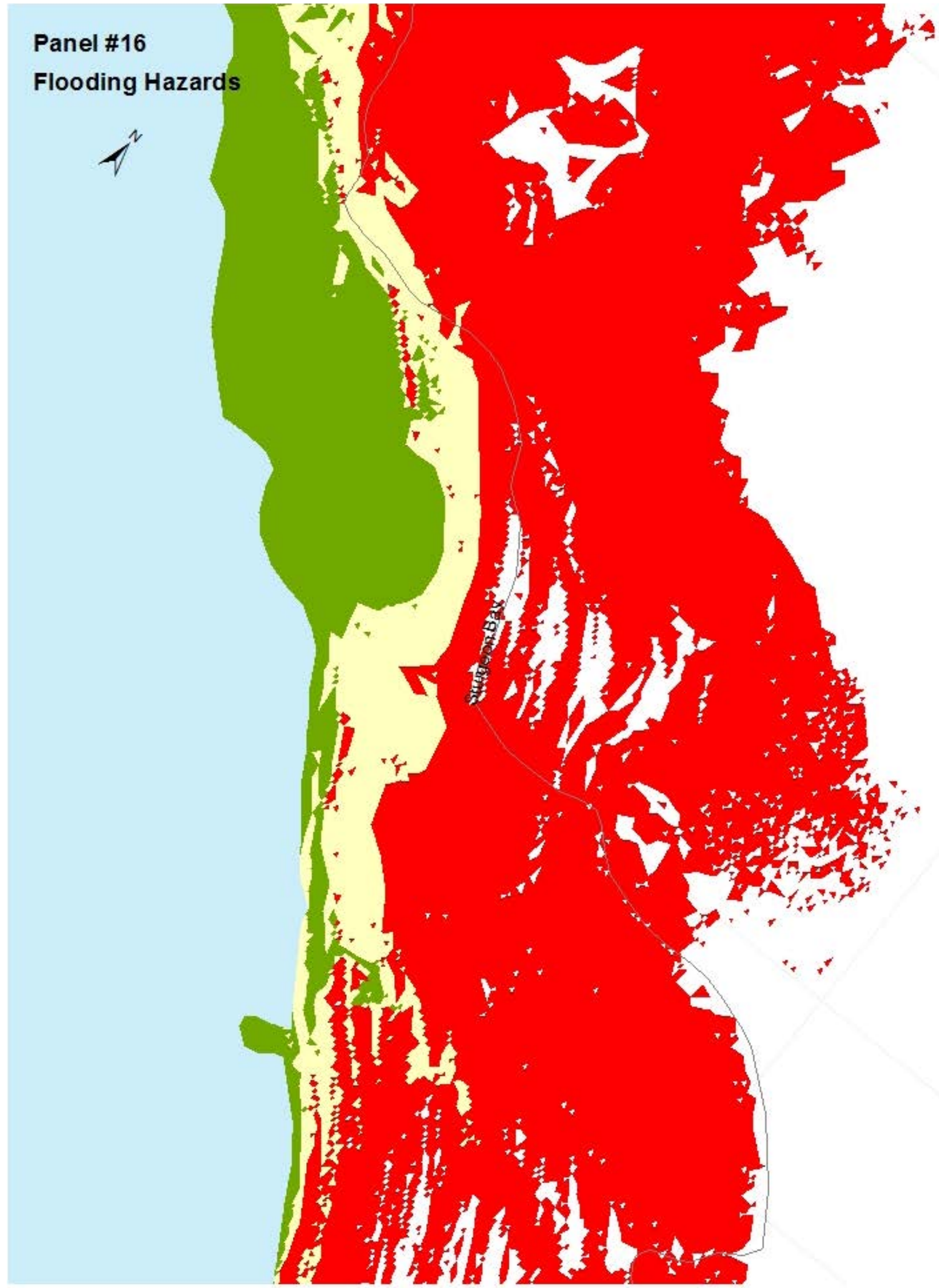

Panel #14
Flooding Hazards
N





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

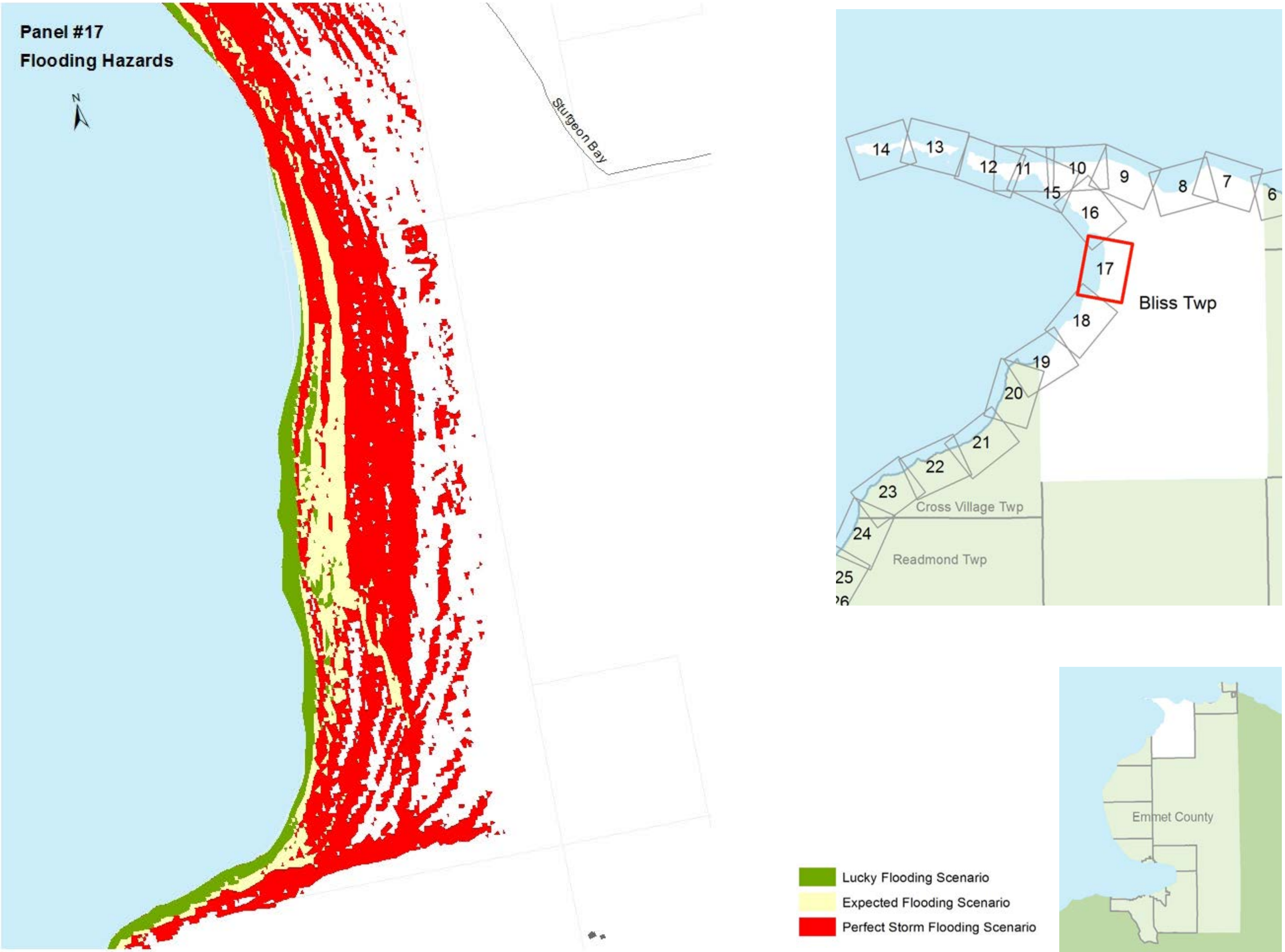




Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario


Panel #17
Flooding Hazards
N
Sturgeon Bay
14
13
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16
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Bliss Twp
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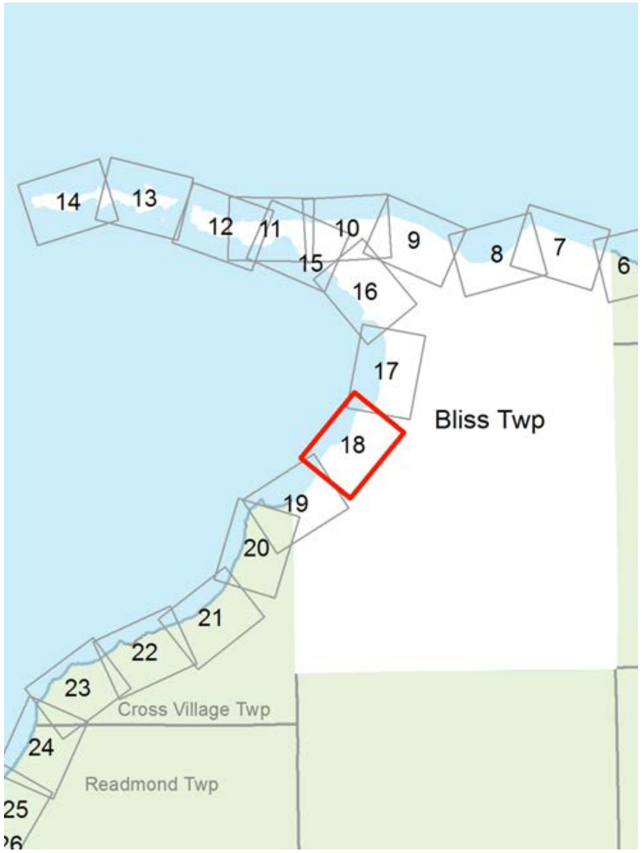
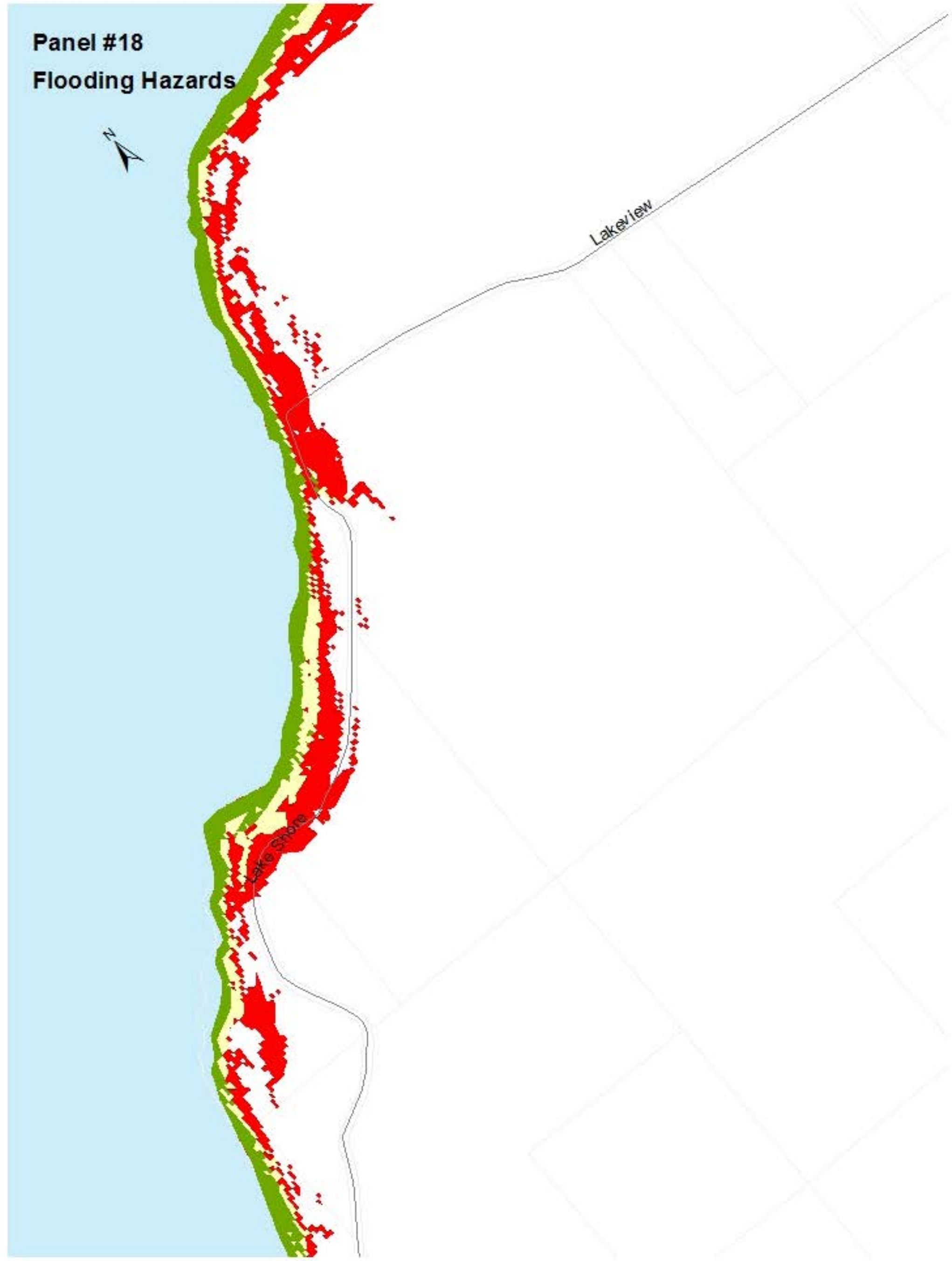
23
Cross Village Twp
24
Readmond Twp
25
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Emmet County

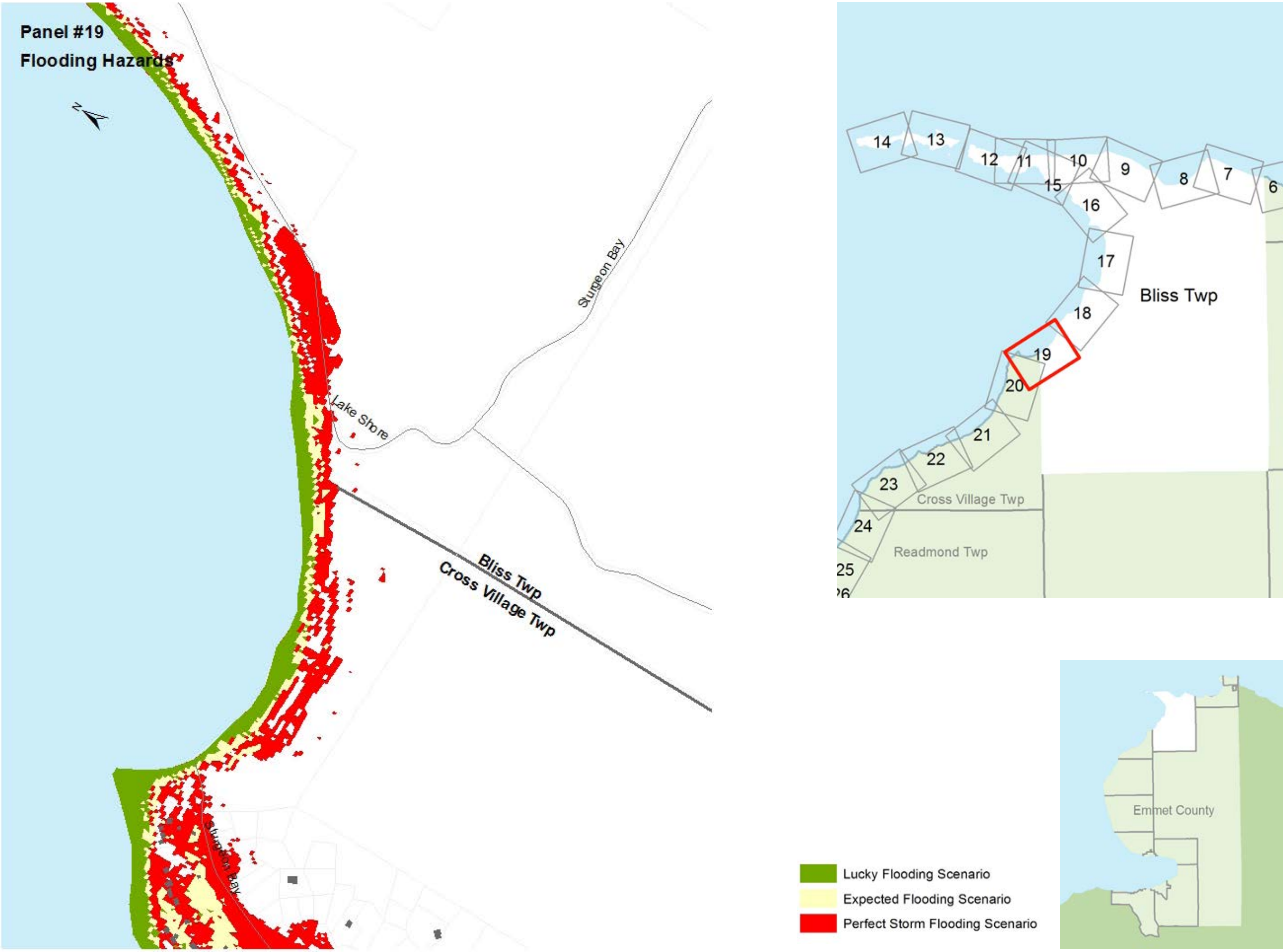




Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario


Panel #19
Flooding Hazards
N
Lake Shore
Sturgeon Bay
Bliss Twp
Cross Village Twp
14
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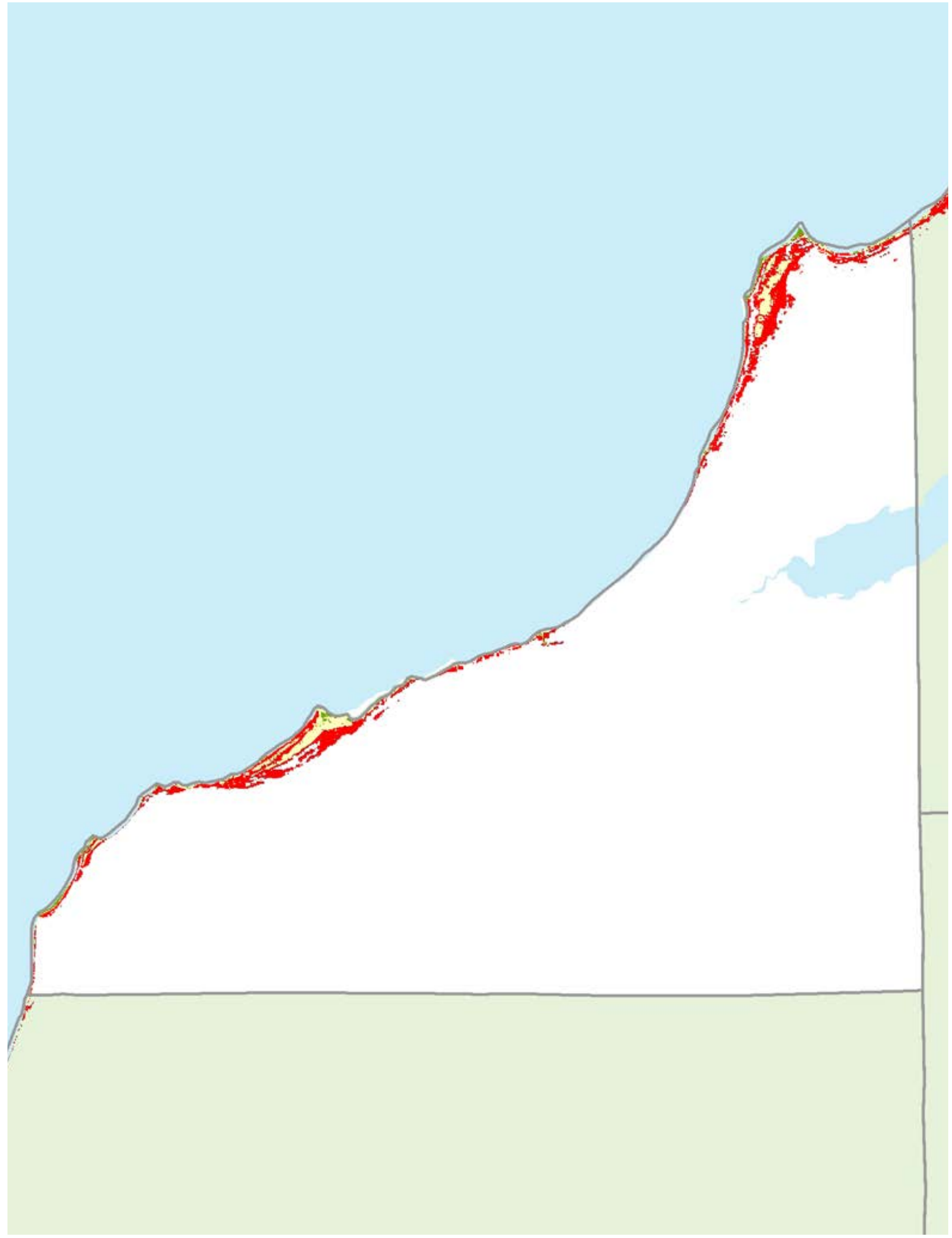
Bliss Twp
Cross Village Twp
Readmond Twp
Emmet County
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

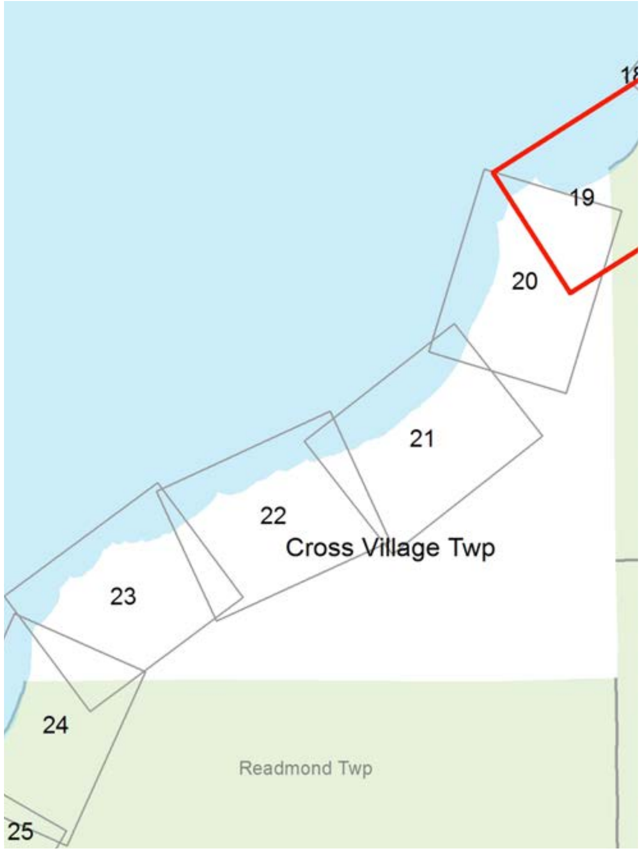
Cross Village Twp.

Coastal Flooding Scenario Impacts

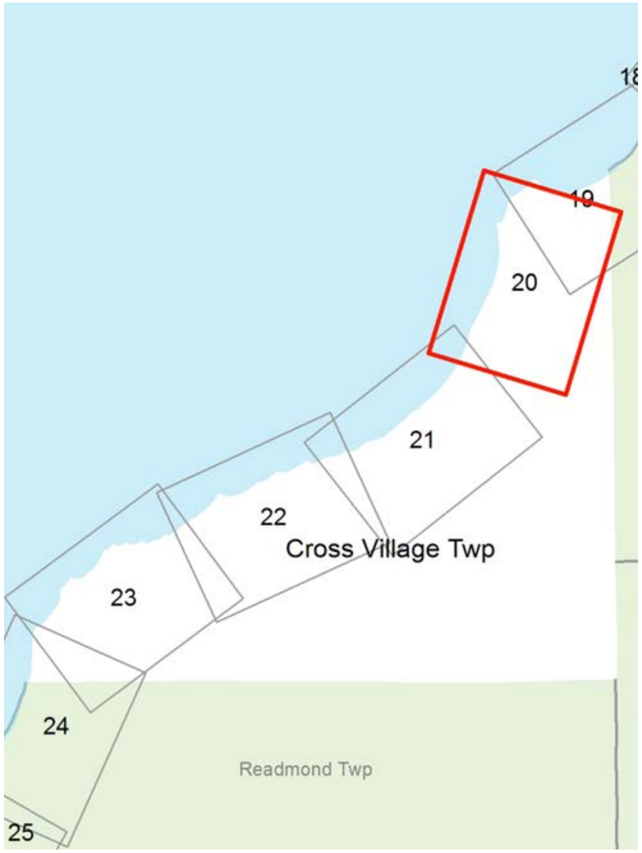
Cross Village			
Total SEV	Lucky	Expected	Perfect Storm
$ 58,624,000.00	$ -	$ 2,676,600.00	$ 19,694,200.00

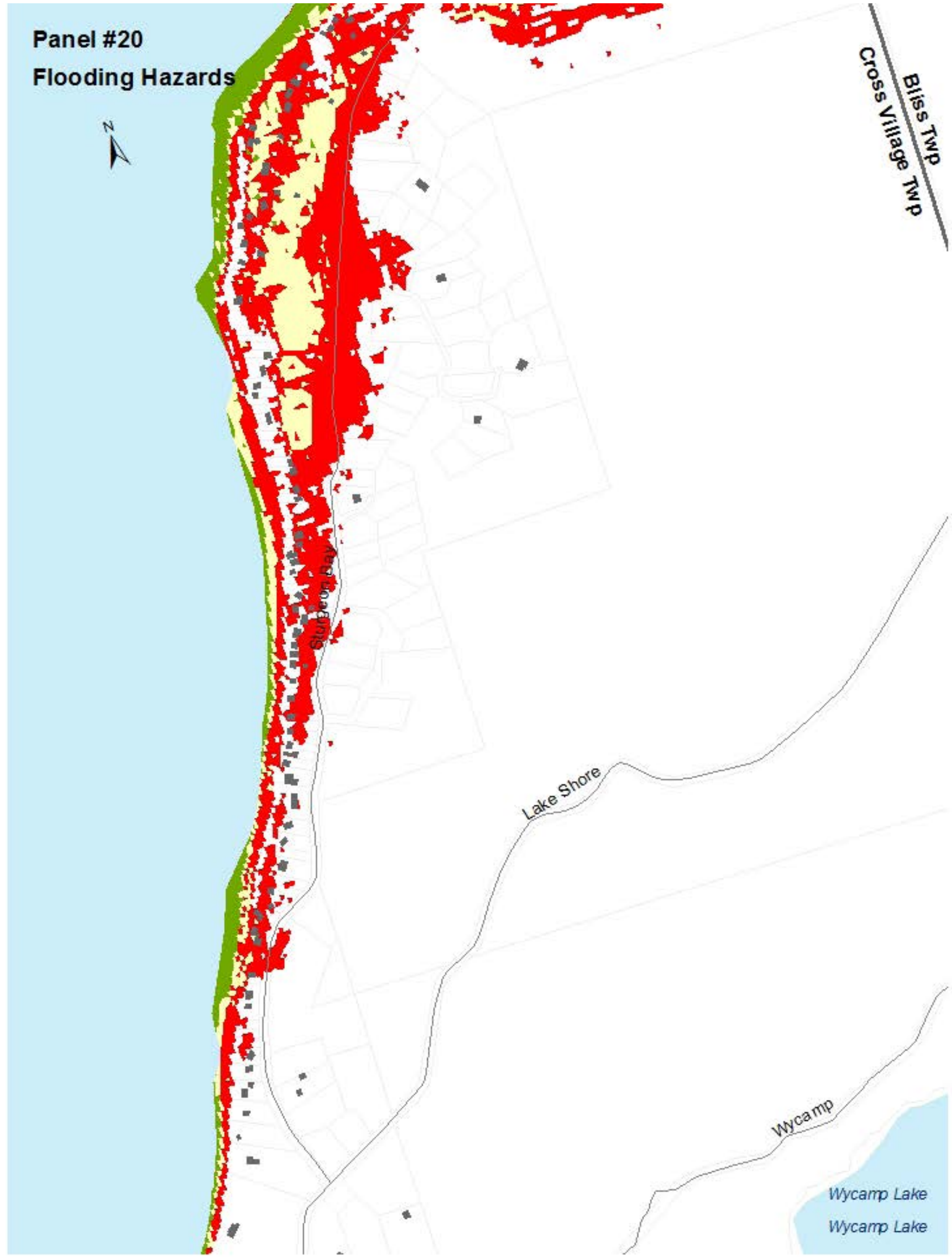


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

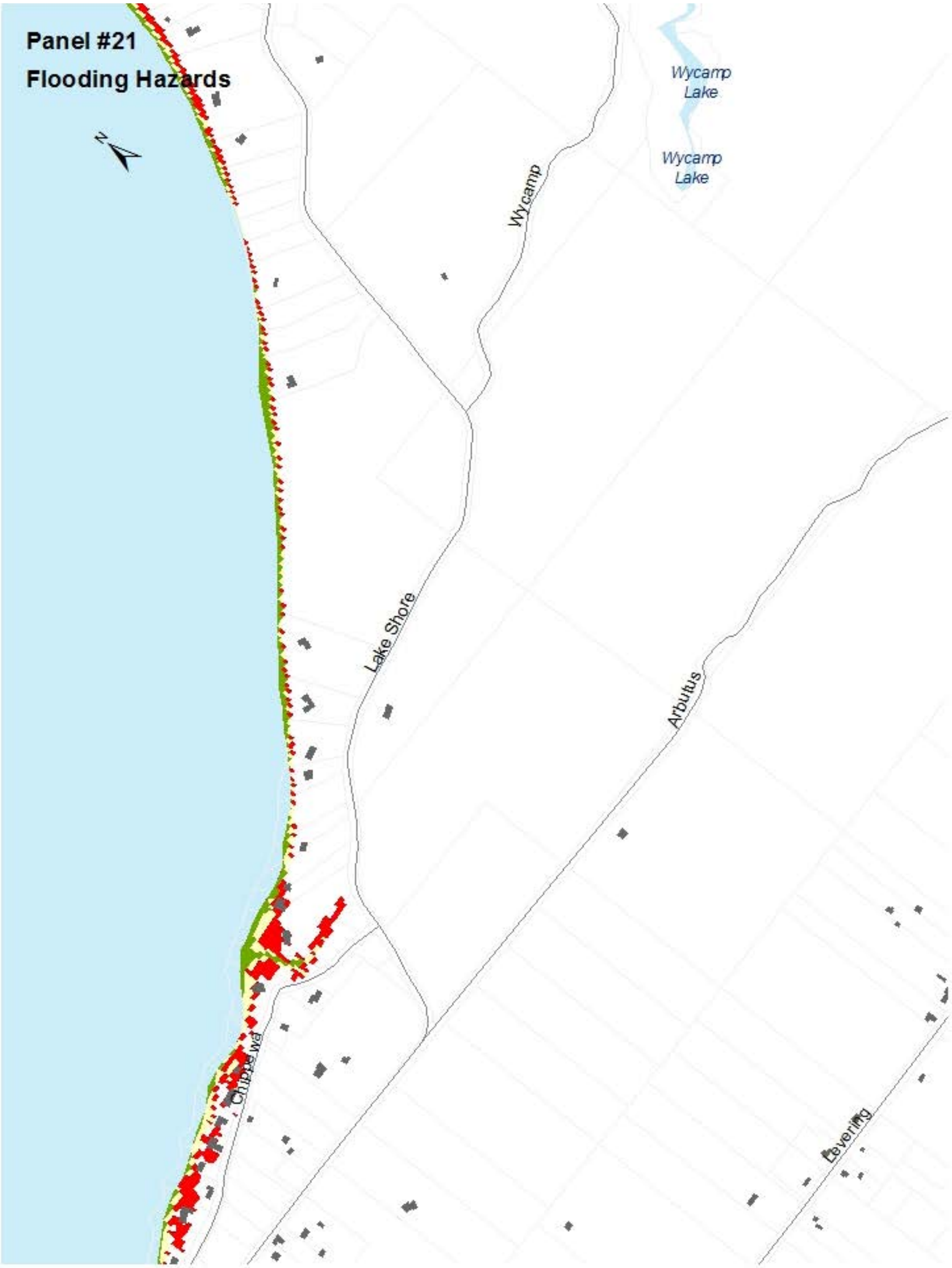


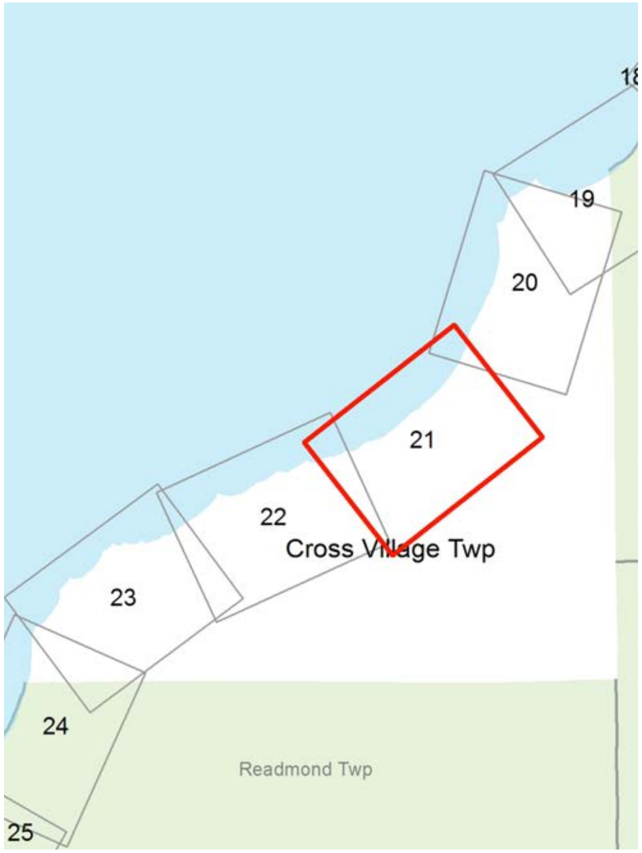
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



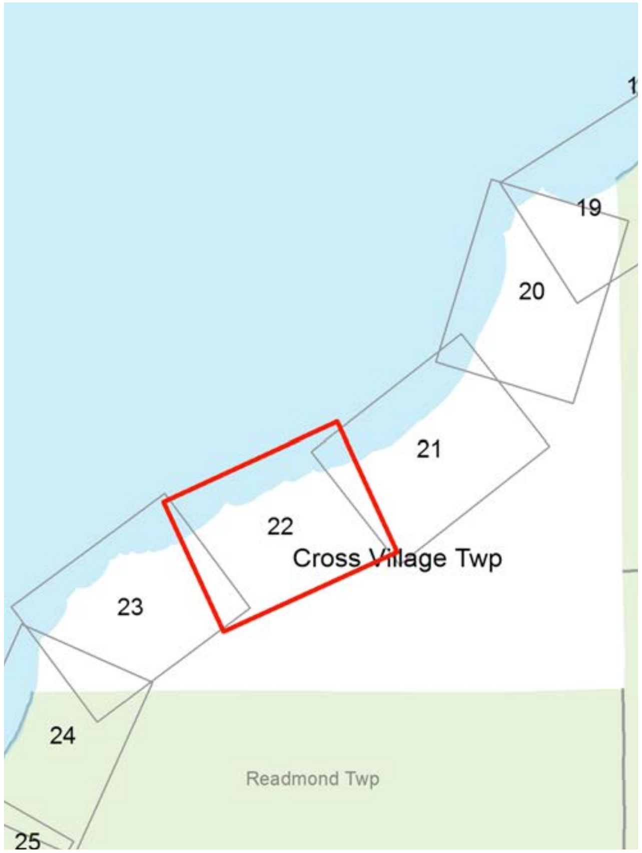


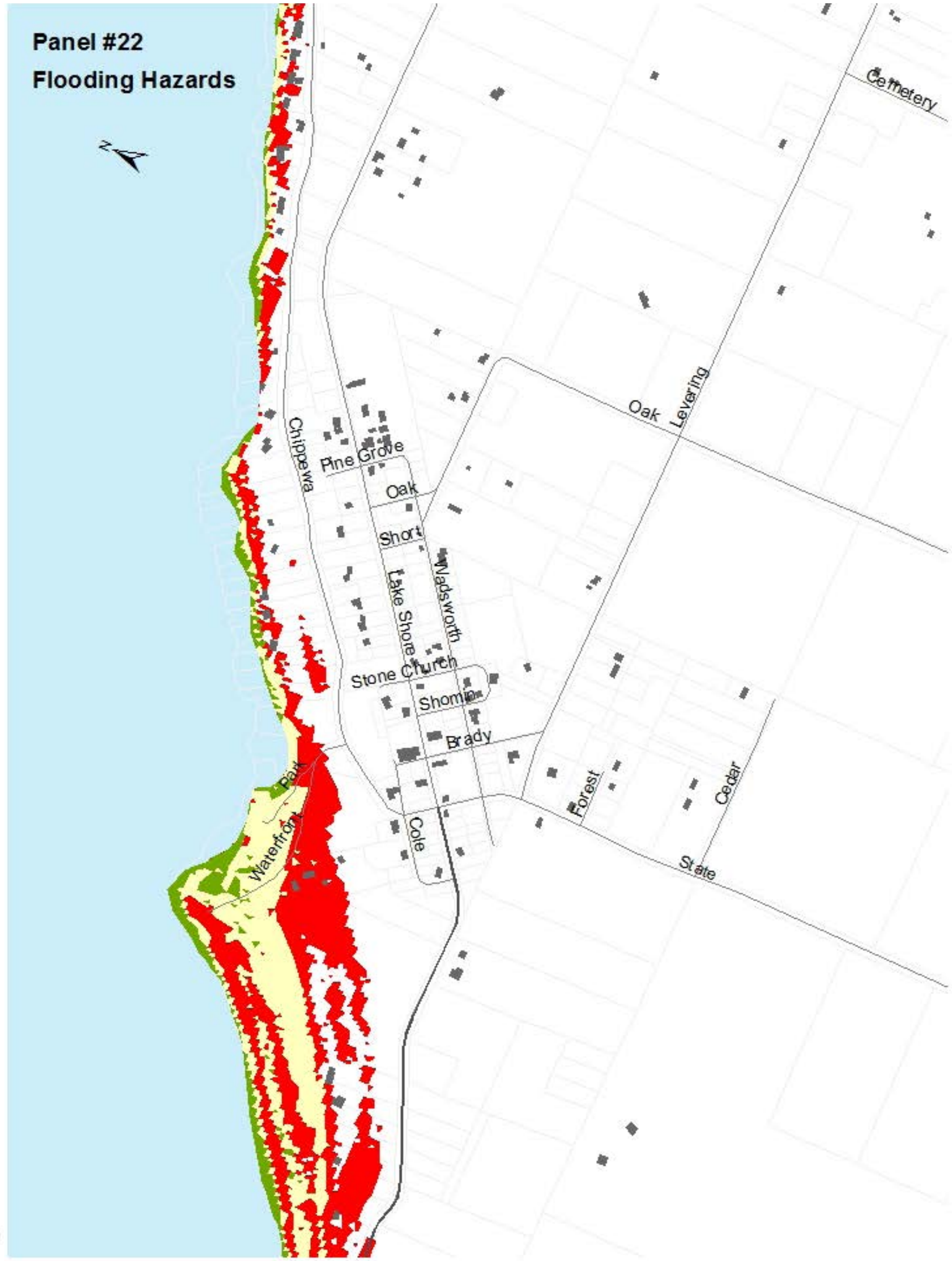
- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario



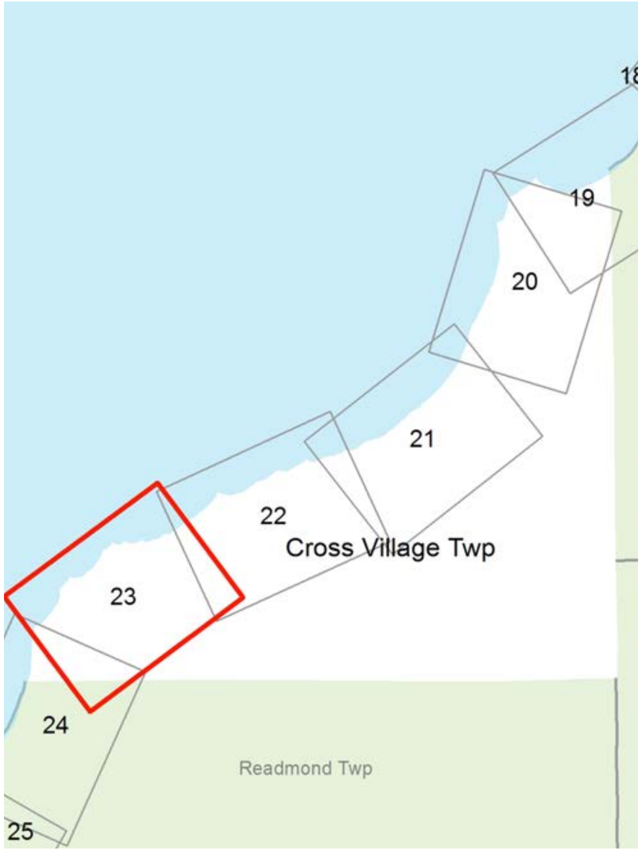


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

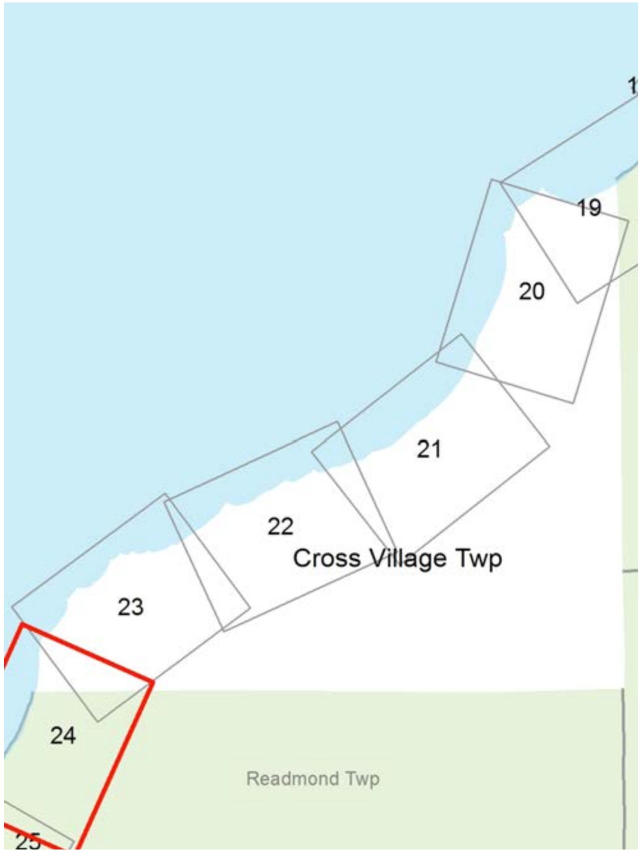




Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Cross Village Twp
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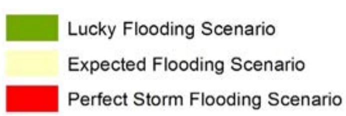
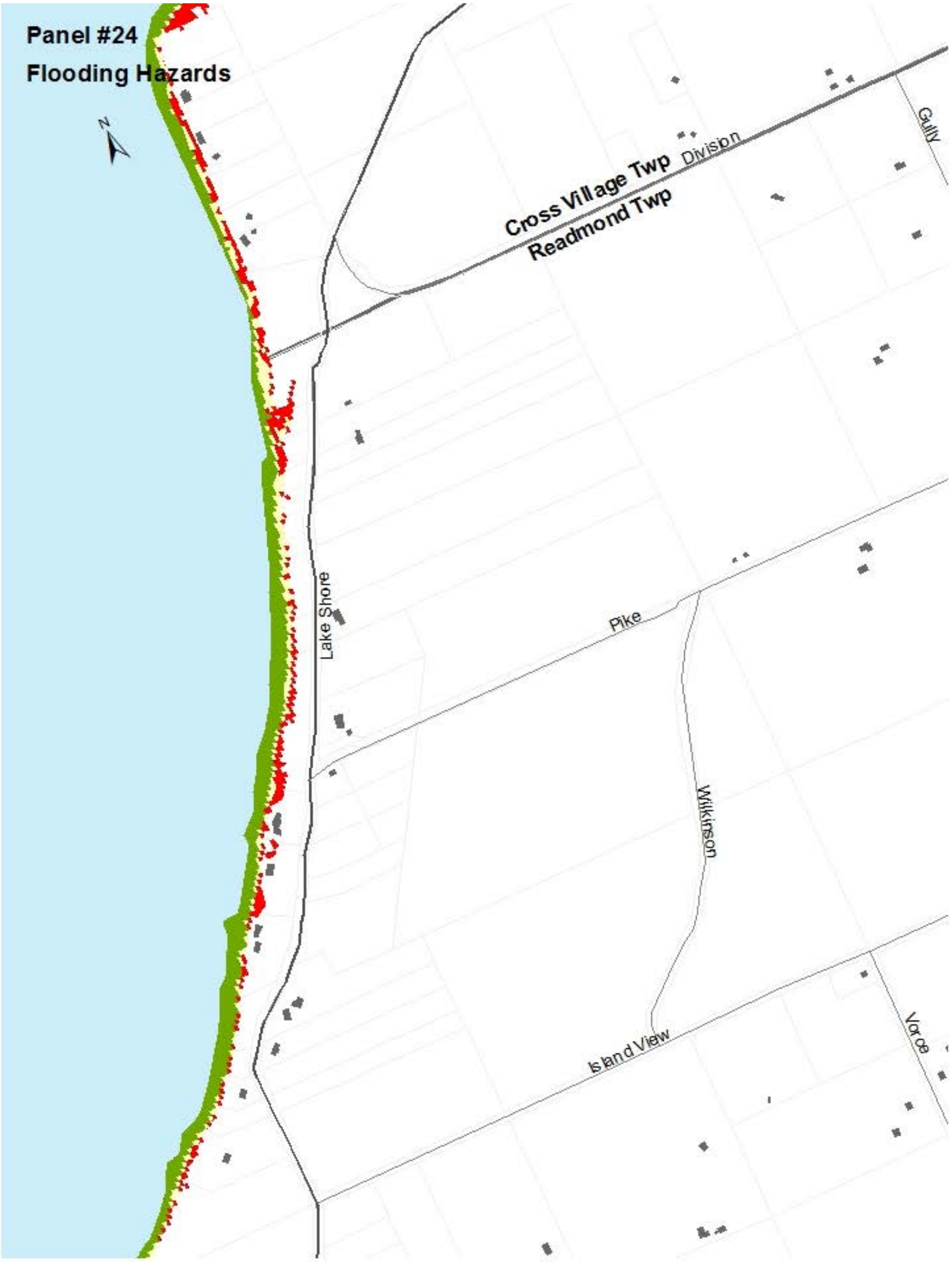
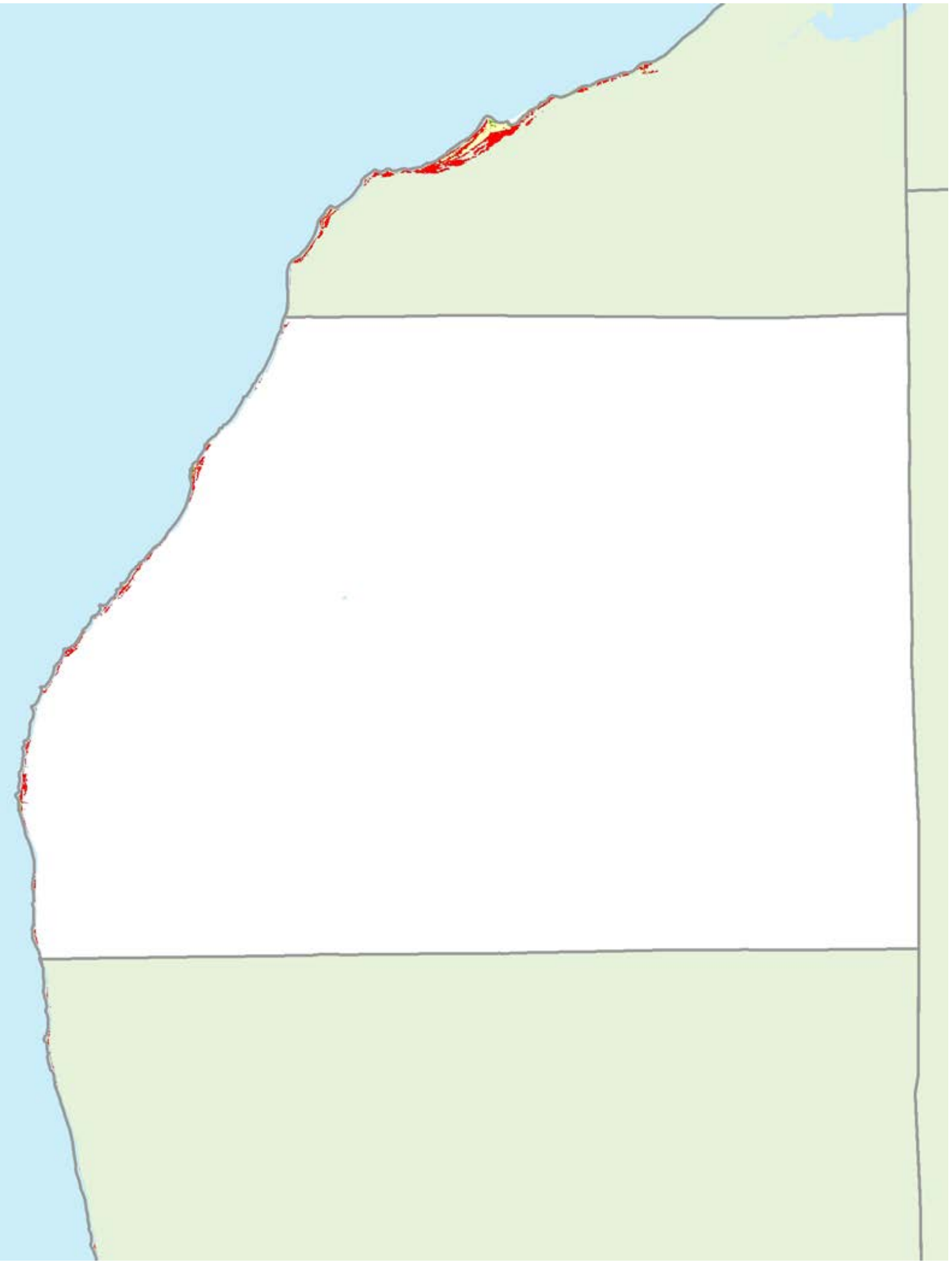
24
Readmond Twp
25


Emmet County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #24
Flooding Hazards
N
Cross Village Twp
Readmond Twp
Division
Gully
Lake Shore
Pike
Wilkinson
Island View
Vorce



Readmond Twp.

Coastal Flooding Scenario Impacts

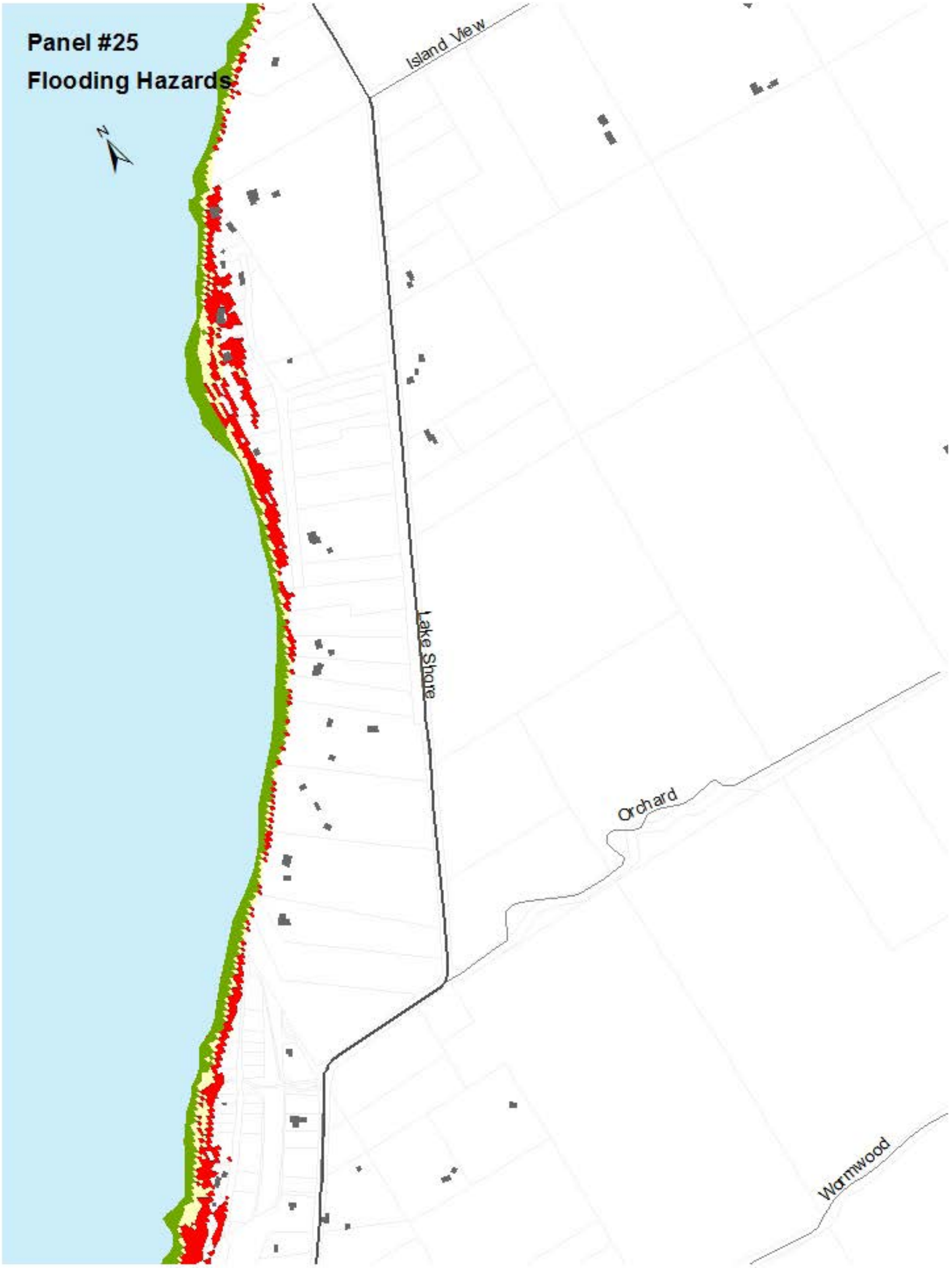
Readmond			
Total SEV	Lucky	Expected	Perfect Storm
$ 80,427,350.00	$ -	$ 390,900.00	$ 1,418,500.00

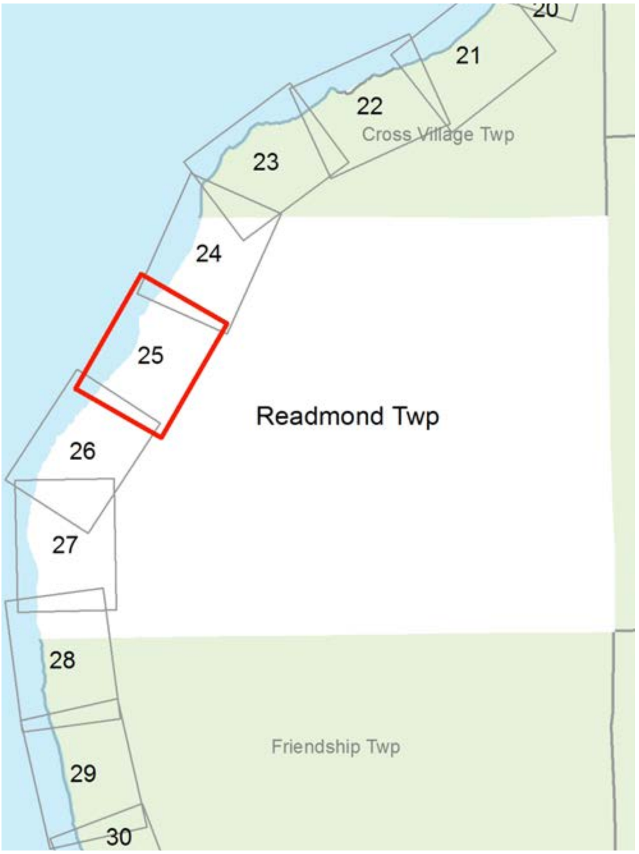
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


20
21
22
Cross Village Twp
23
24
25
Readmond Twp
26
27
28
Friendship Twp
29
30

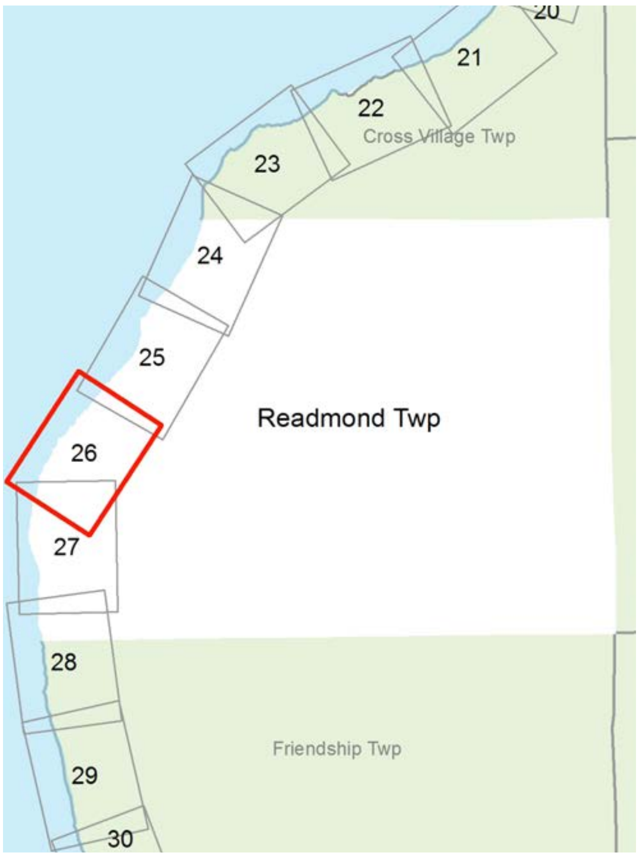

Emmet County


Panel #24
Flooding Hazards
N
Cross Village Twp
Readmond Twp
Division
Gully
Lake Shore
Pike
Wilkinson
Island View
Vorce
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



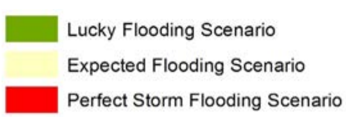


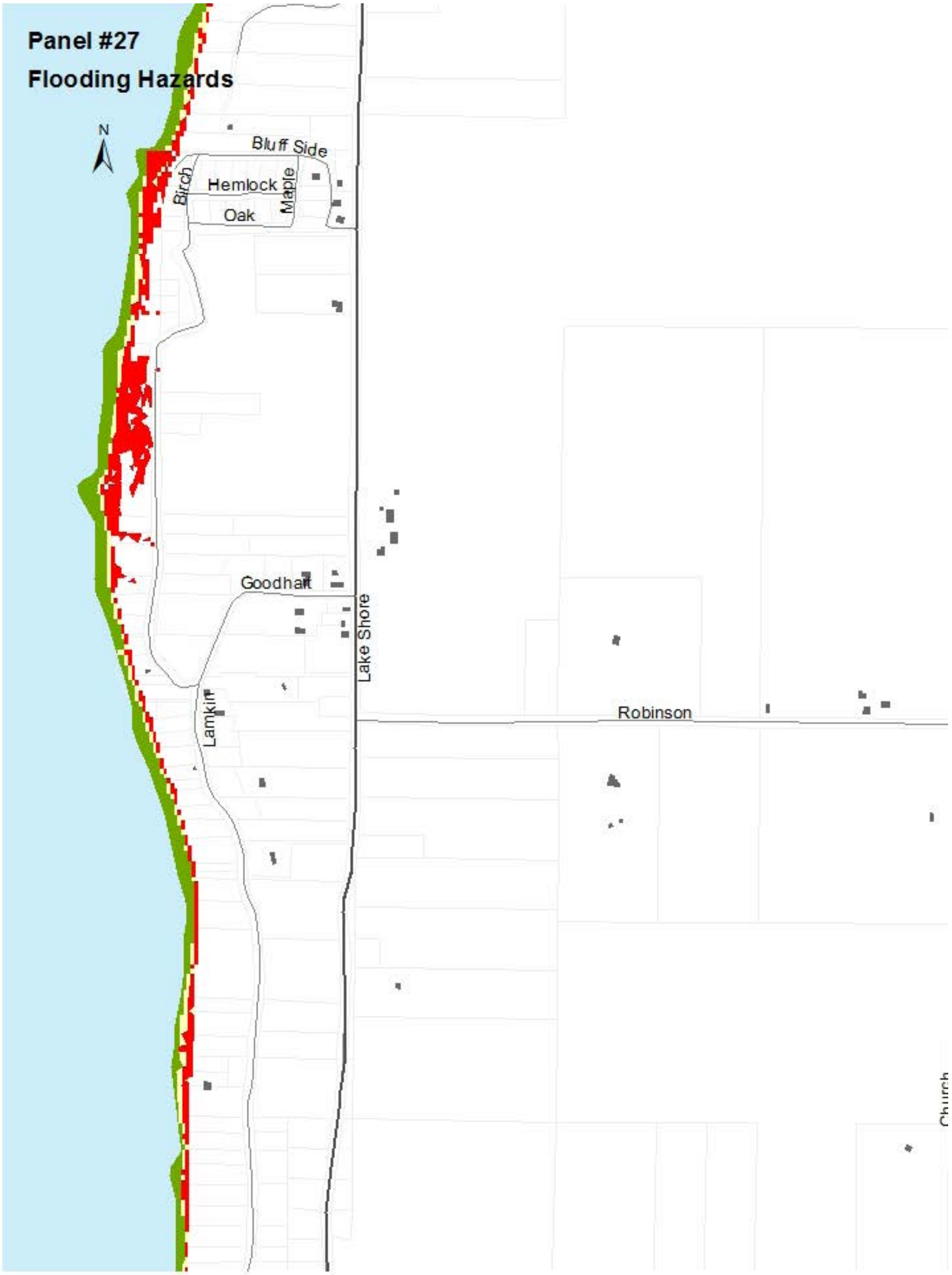
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


20
21
22
Cross Village Twp
23
24
25
Readmond Twp
26
27
28
Friendship Twp
29
30

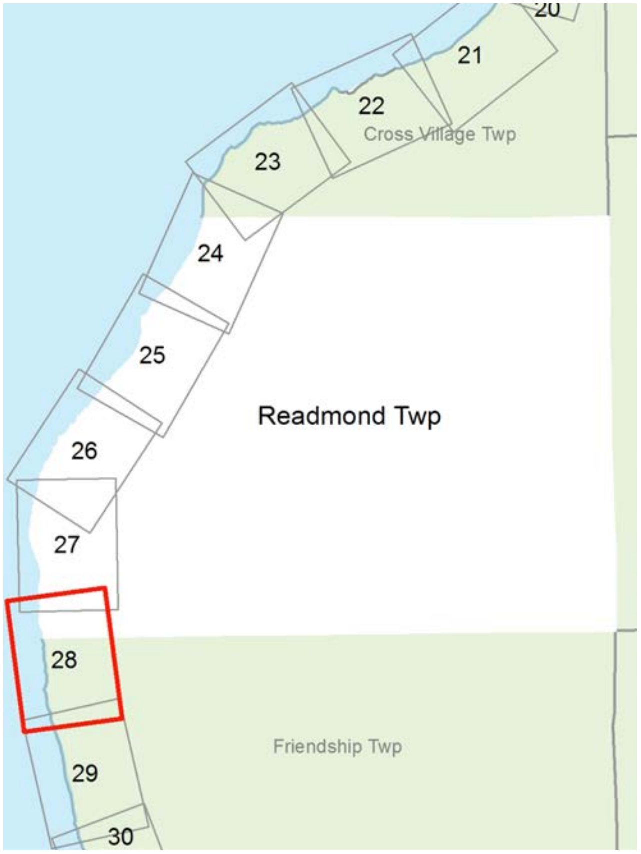

Panel #26
Flooding Hazards
N
Wormwood
Old
Ivan
Marquette
Ivan
Lake Shore
Timber Lake
Buff Side
Birch
Hemlock
Maple
Oak


Emmet County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

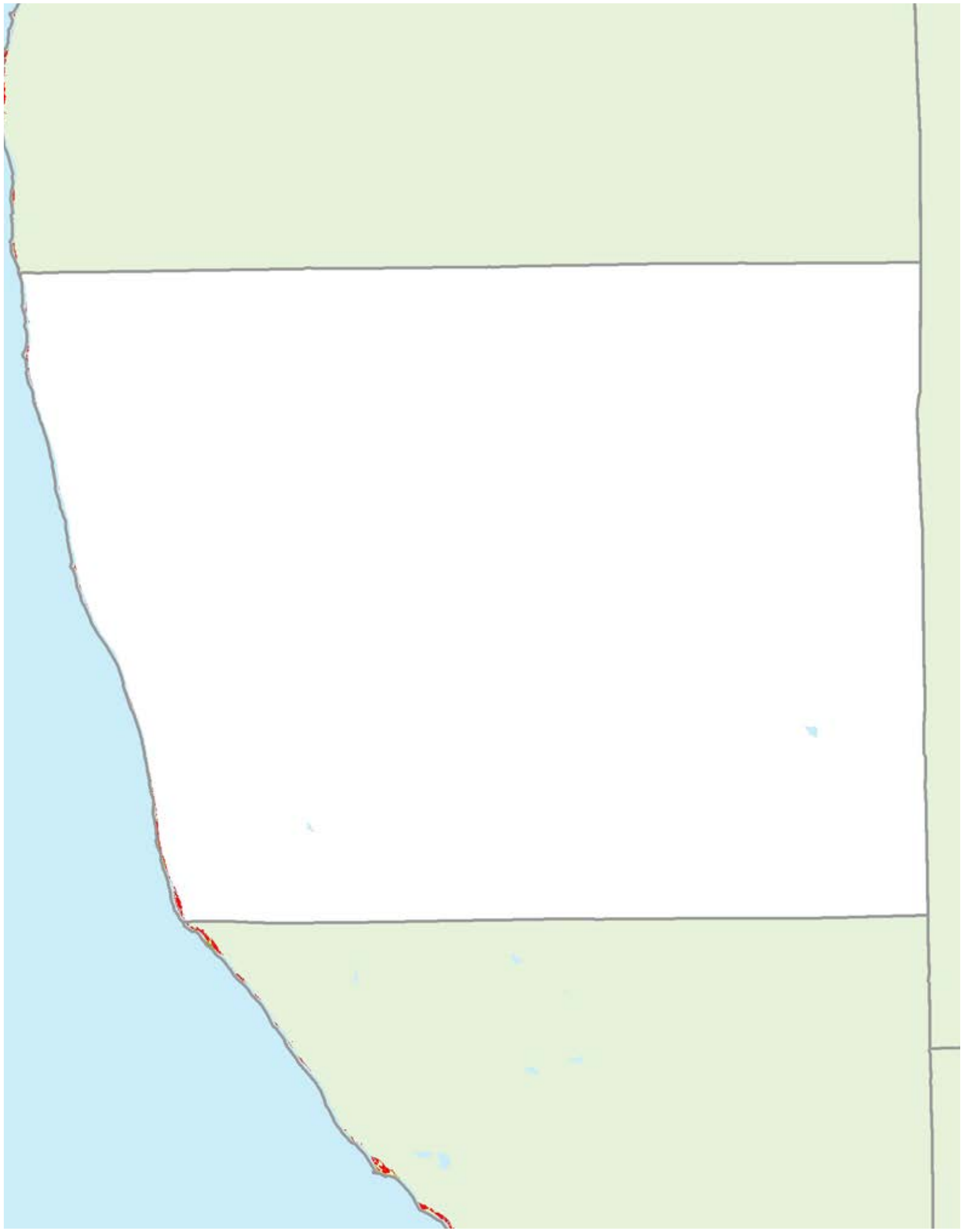


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


20
21
22
Cross Village Twp
23
24
25
Readmond Twp
26
27
28
29
Friendship Twp
30


Emmet County

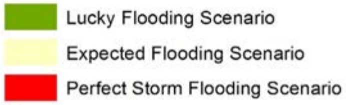

Panel #28
Flooding Hazards
N
Readmond Twp
Middle Village
Friendship Twp
Lamkin
Lake Shore
Townline
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

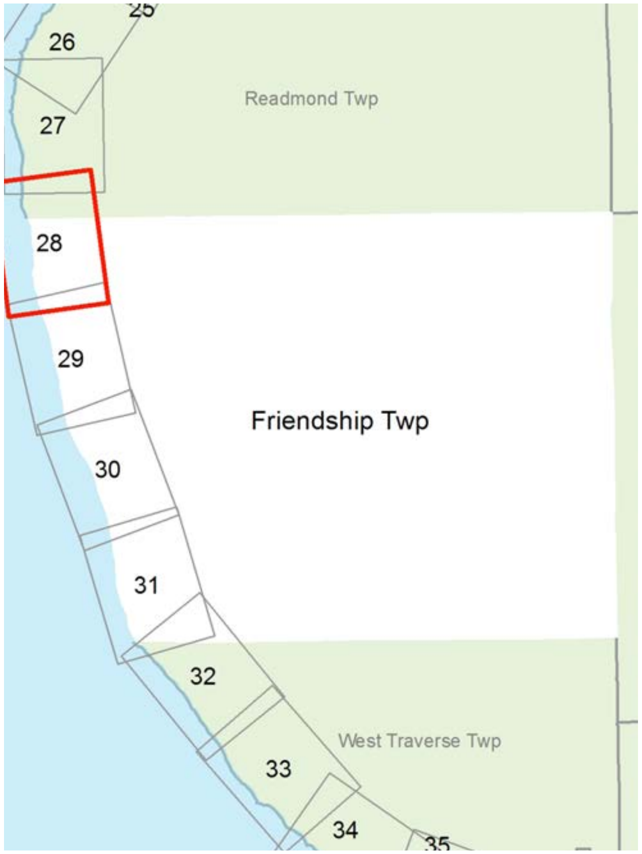


Friendship Twp.

Coastal Flooding Scenario Impacts

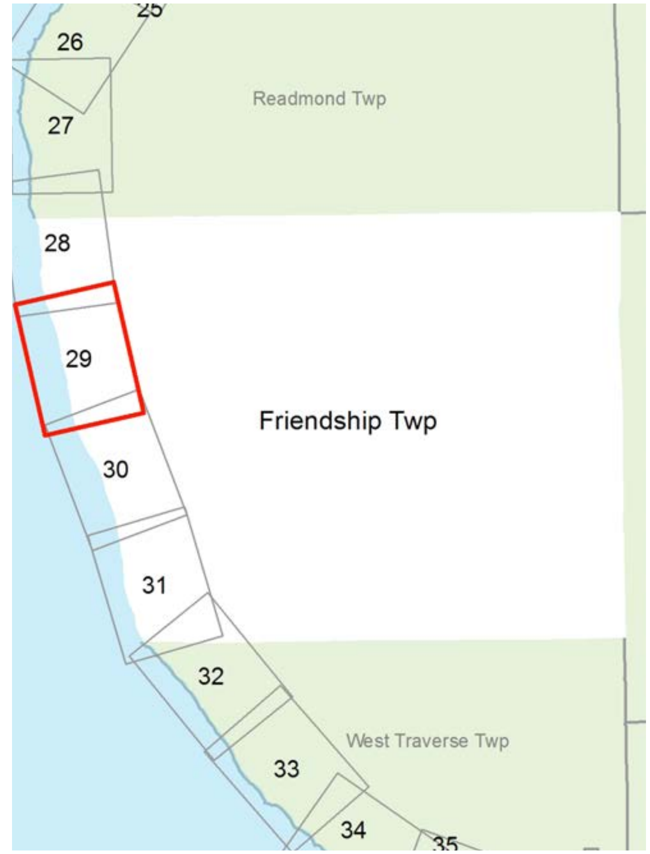
Friendship			
Total SEV	Lucky	Expected	Perfect Storm
$ 114,231,300.00	$ -	$ -	$ 2,965,500.00



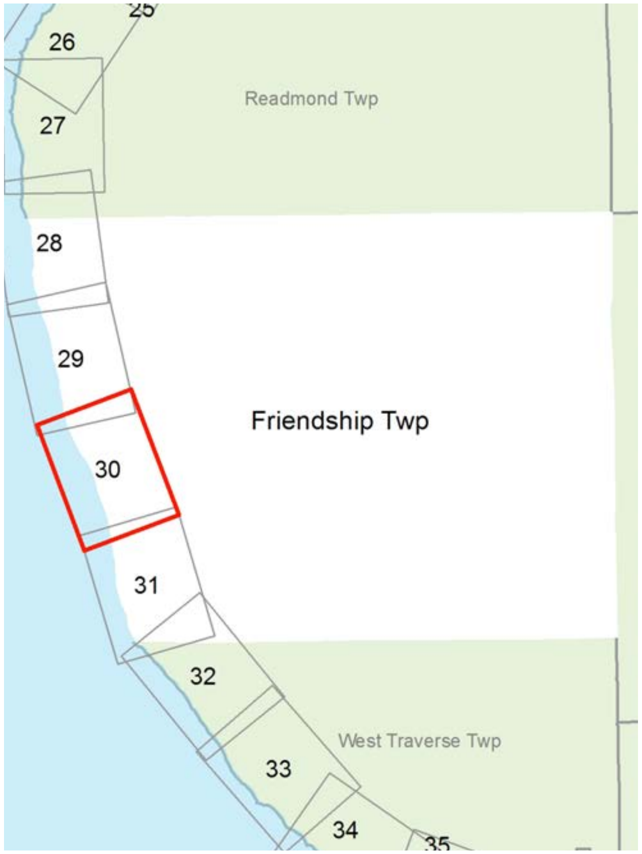

25
26
27
Readmond Twp
28
29
Friendship Twp
30
31
32
33
West Traverse Twp
34
35


Emmet County

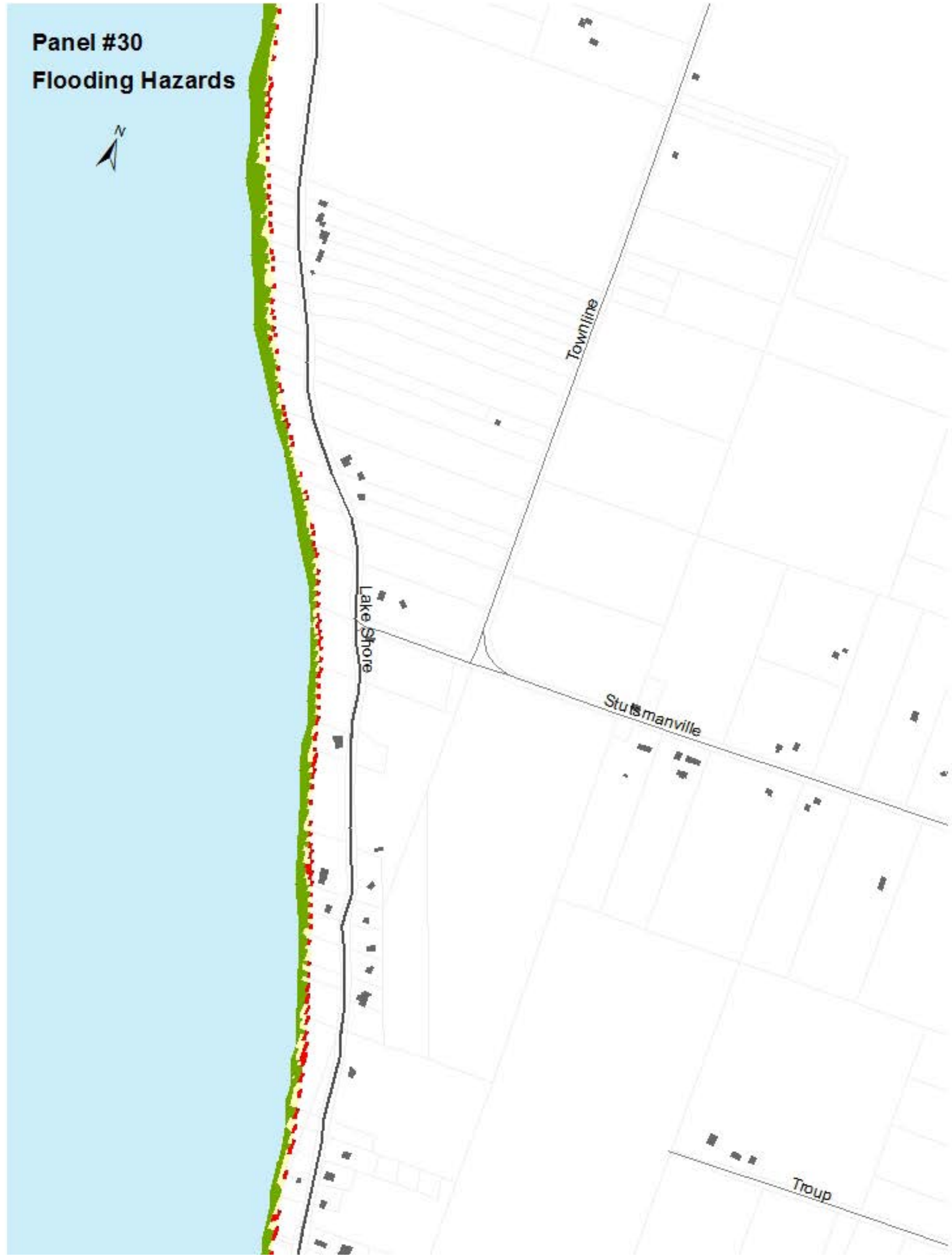

Panel #28
Flooding Hazards
N
Readmond Twp
Friendship Twp
Middle Village
Lamkin
Lake Shore
Townline
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

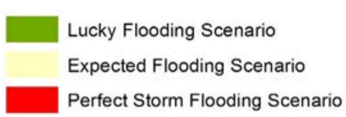


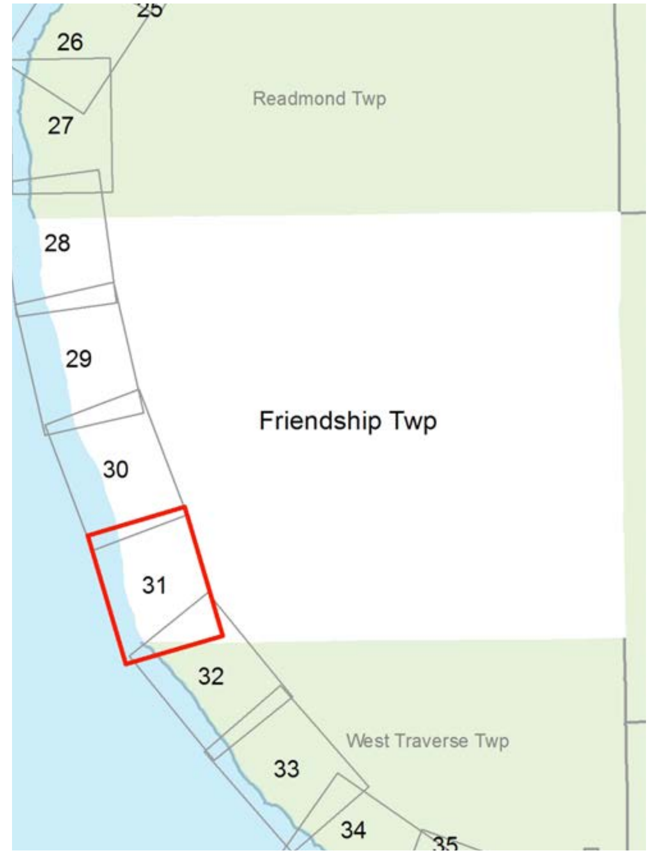
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


25
26
27
Readmond Twp
28
29
Friendship Twp
30
31
32
West Traverse Twp
33
34
35

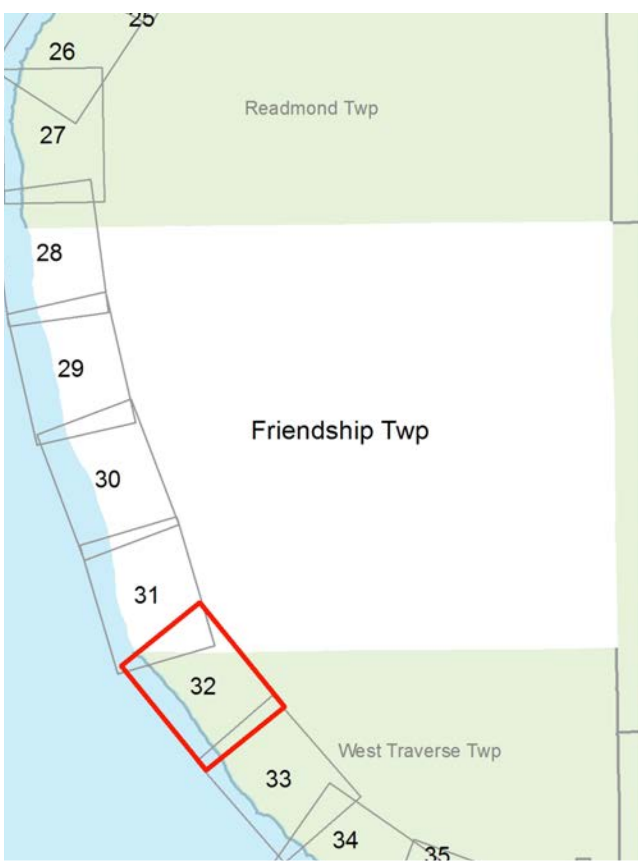

Emmet County


Panel #30
Flooding Hazards
N
Townline
Lake Shore
Stutsmanville
Troup


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


25
26
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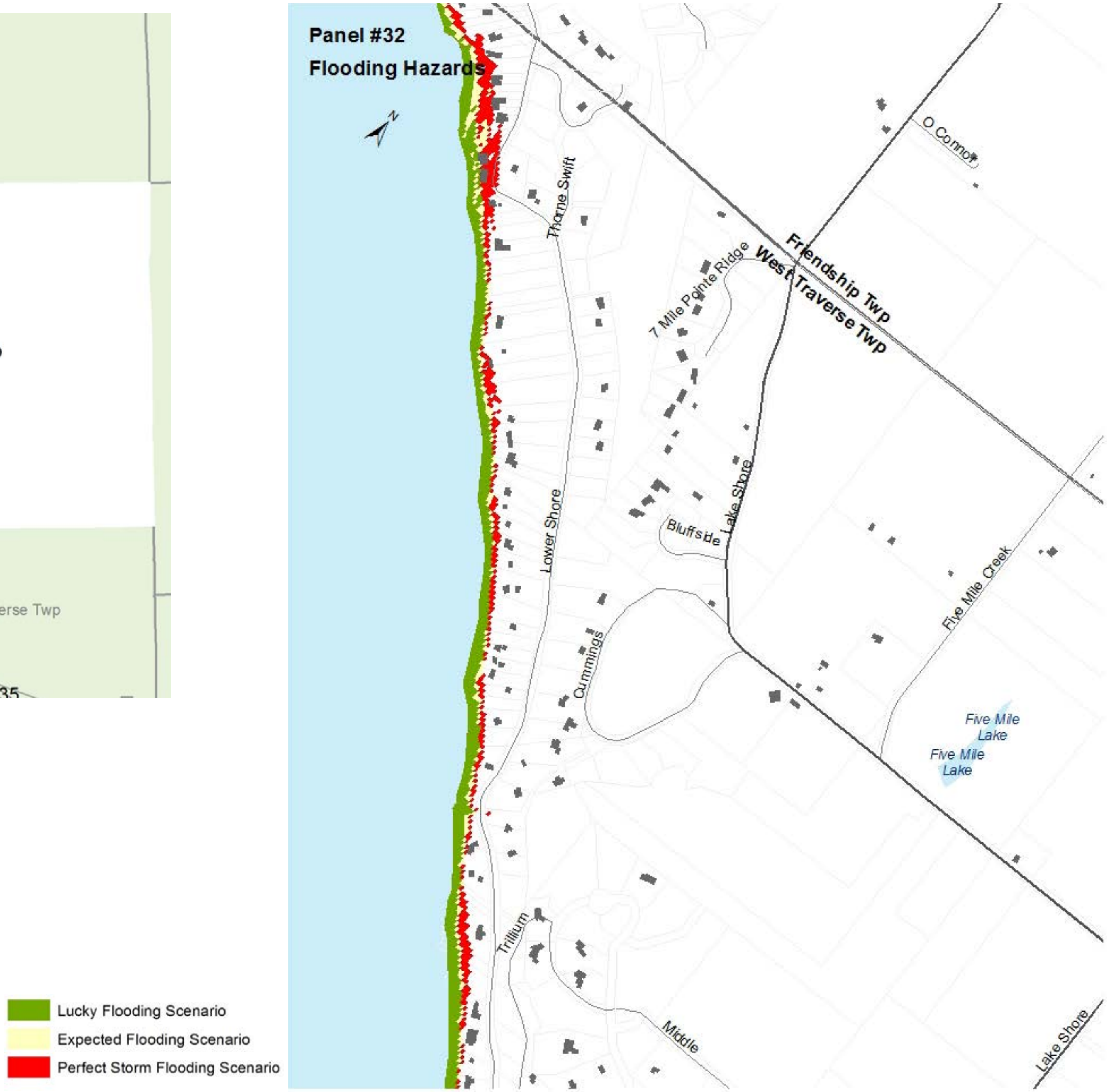
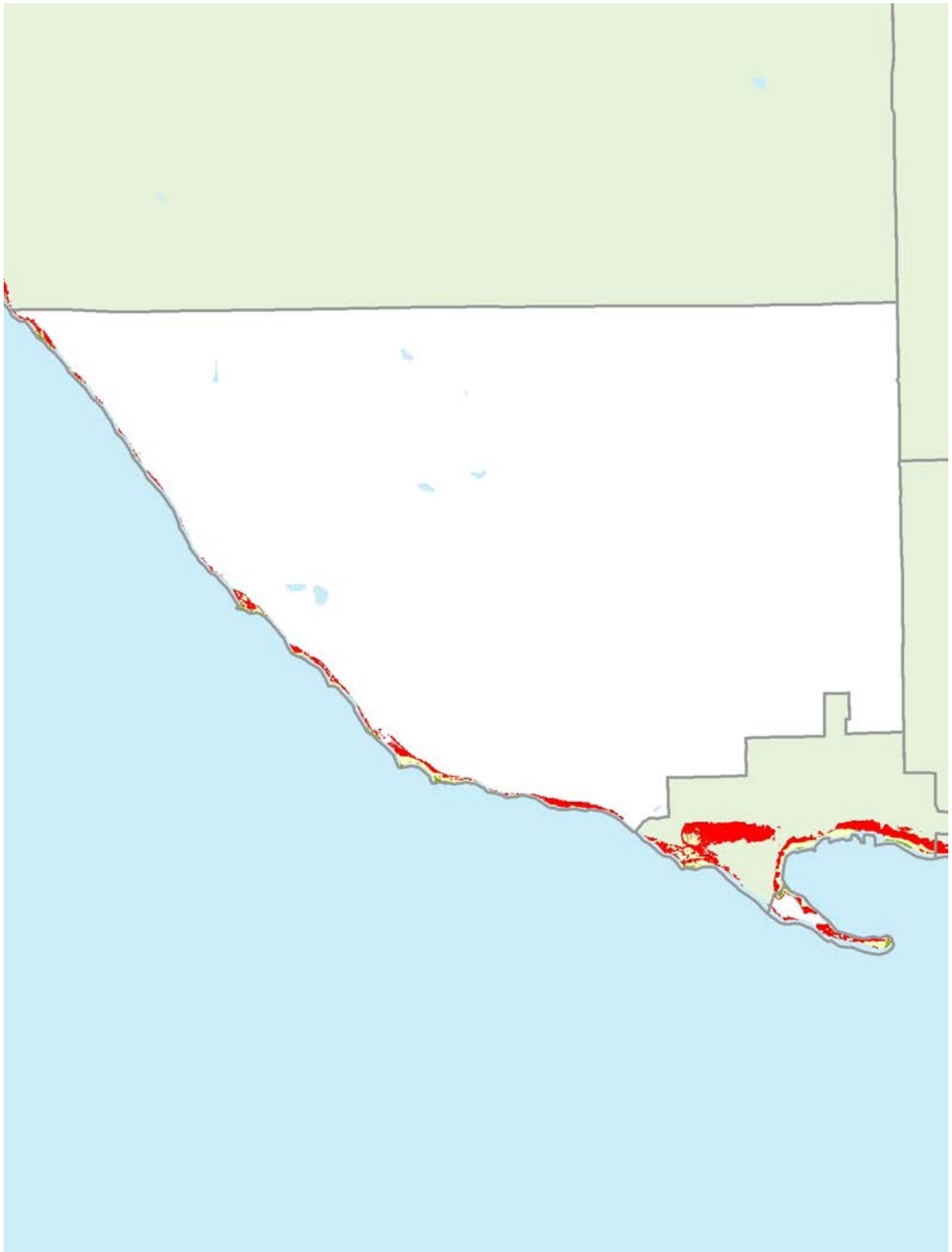
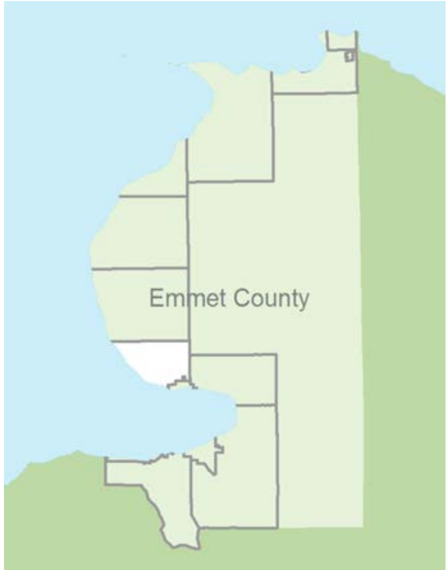
28
29
30
31
32
33
34
35
Readmond Twp
Friendship Twp
West Traverse Twp


Emmet County


Panel #32
Flooding Hazards
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
O Connor
Thorne Swift
7 Mile Pointe Ridge
Friendship Twp
West Traverse Twp
Lake Shore
Bluffside
Lower Shore
Cummings
Five Mile Creek
Five Mile Lake
Five Mile Lake
Trillium
Middle
Lake Shore

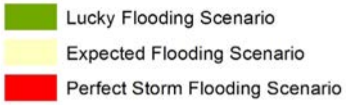


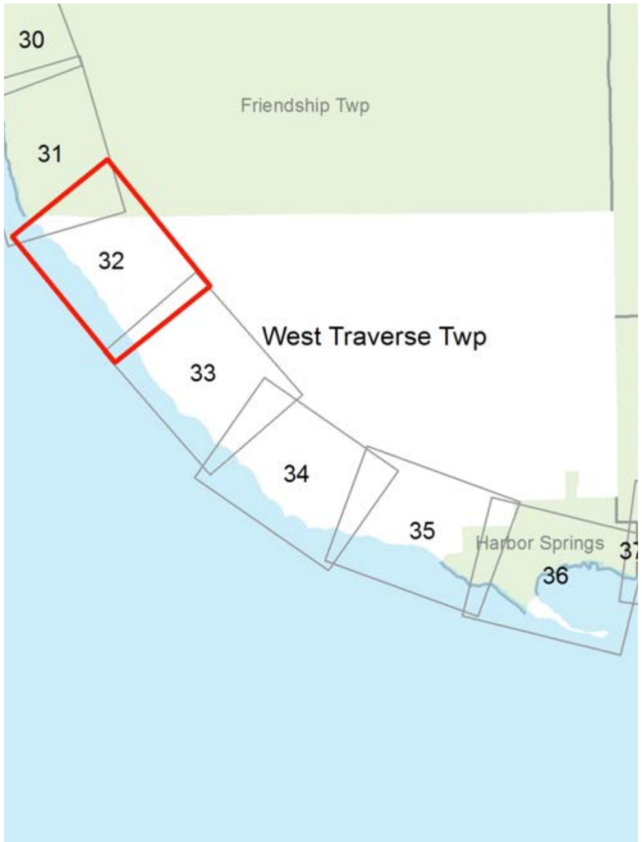
West Traverse Twp.



Coastal Flooding Scenario Impacts

West Traverse			
Total SEV	Lucky	Expected	Perfect Storm
$ 400,989,200.00	$ 979,700.00	$ 34,154,000.00	$ 115,892,300.00

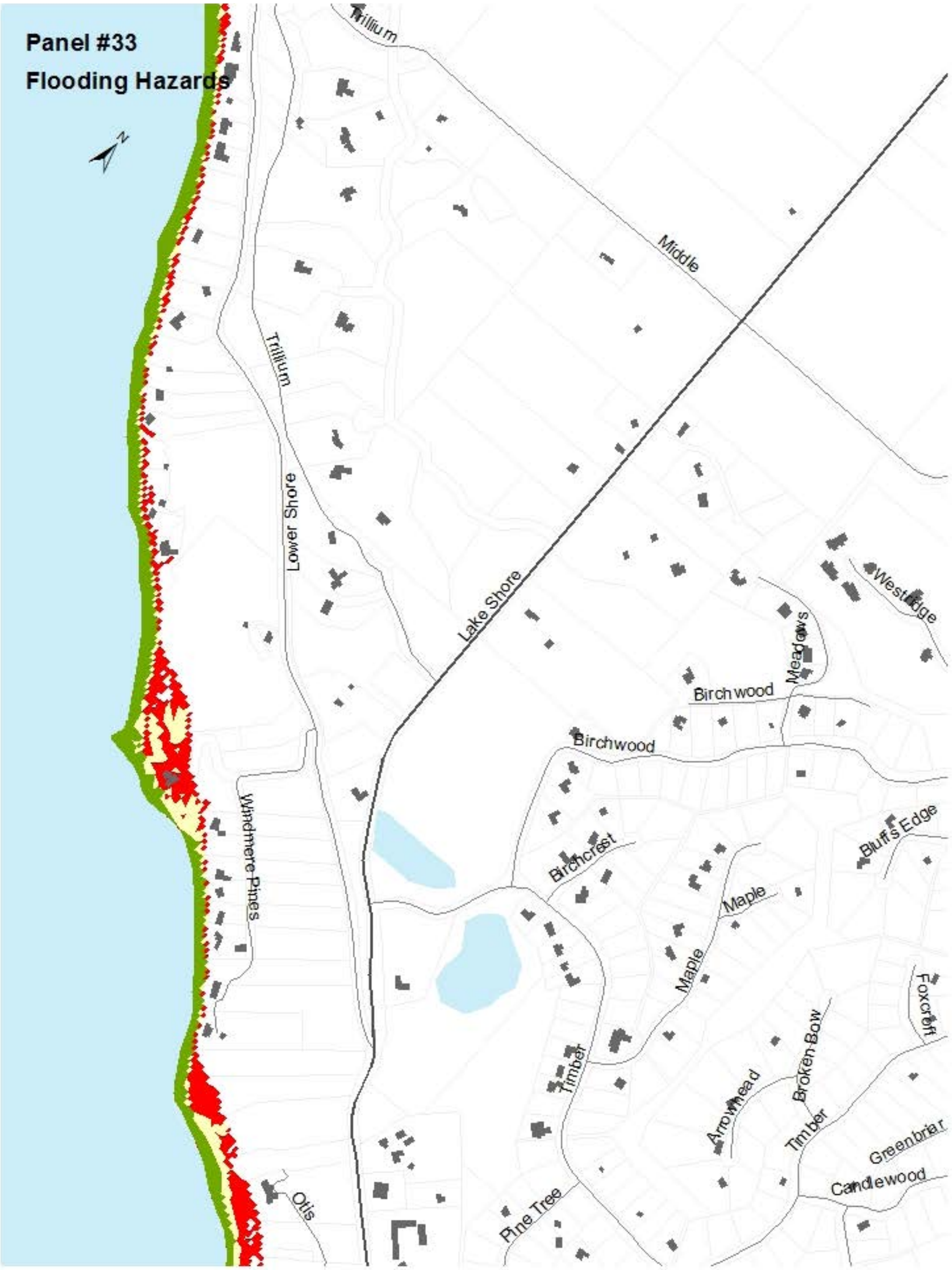




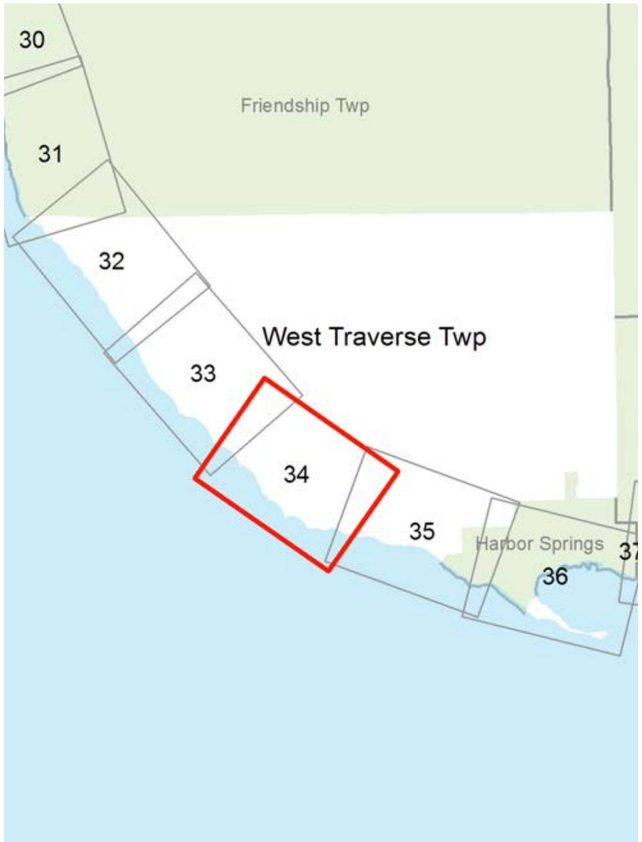
Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


30
31
32
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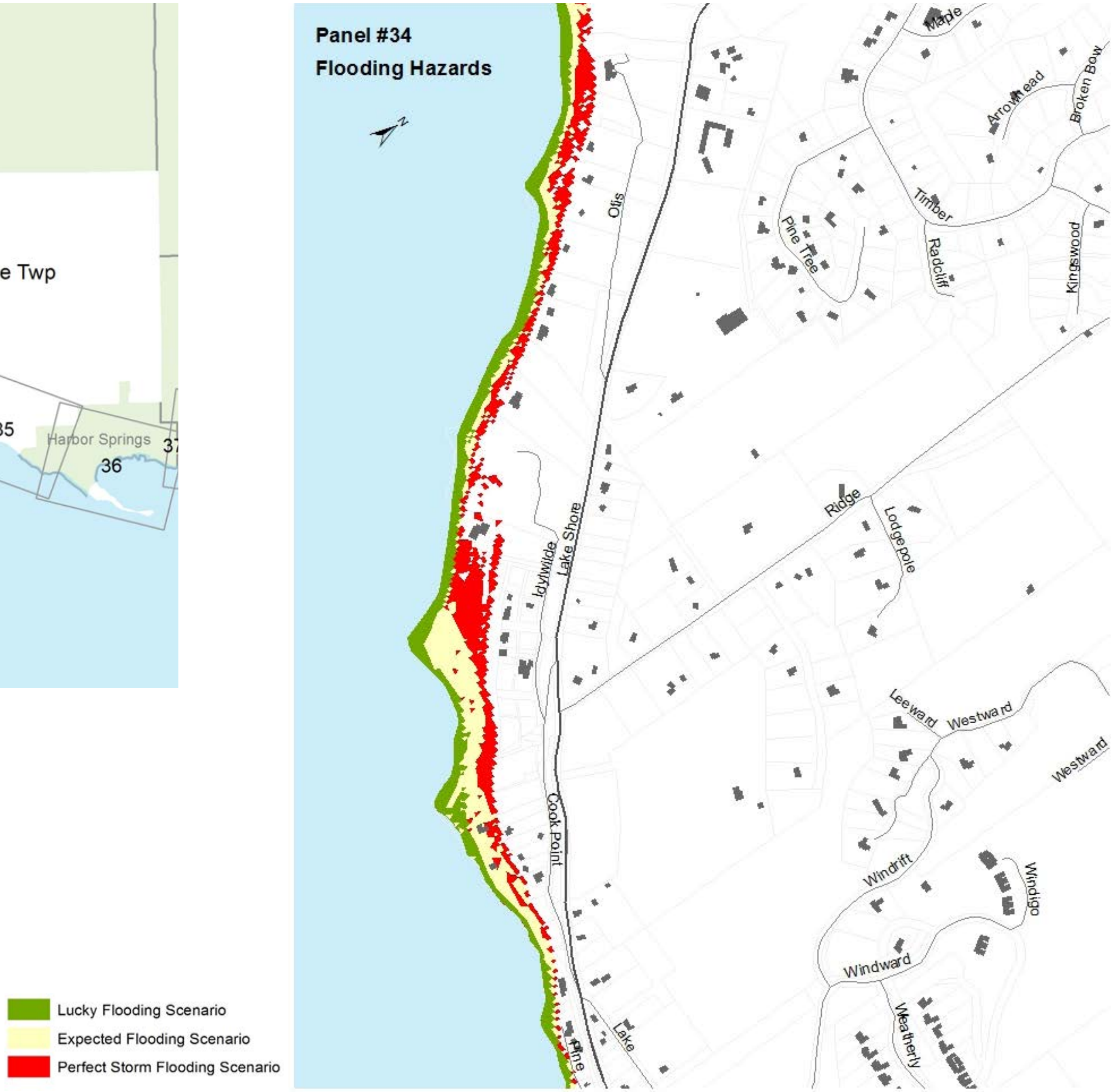
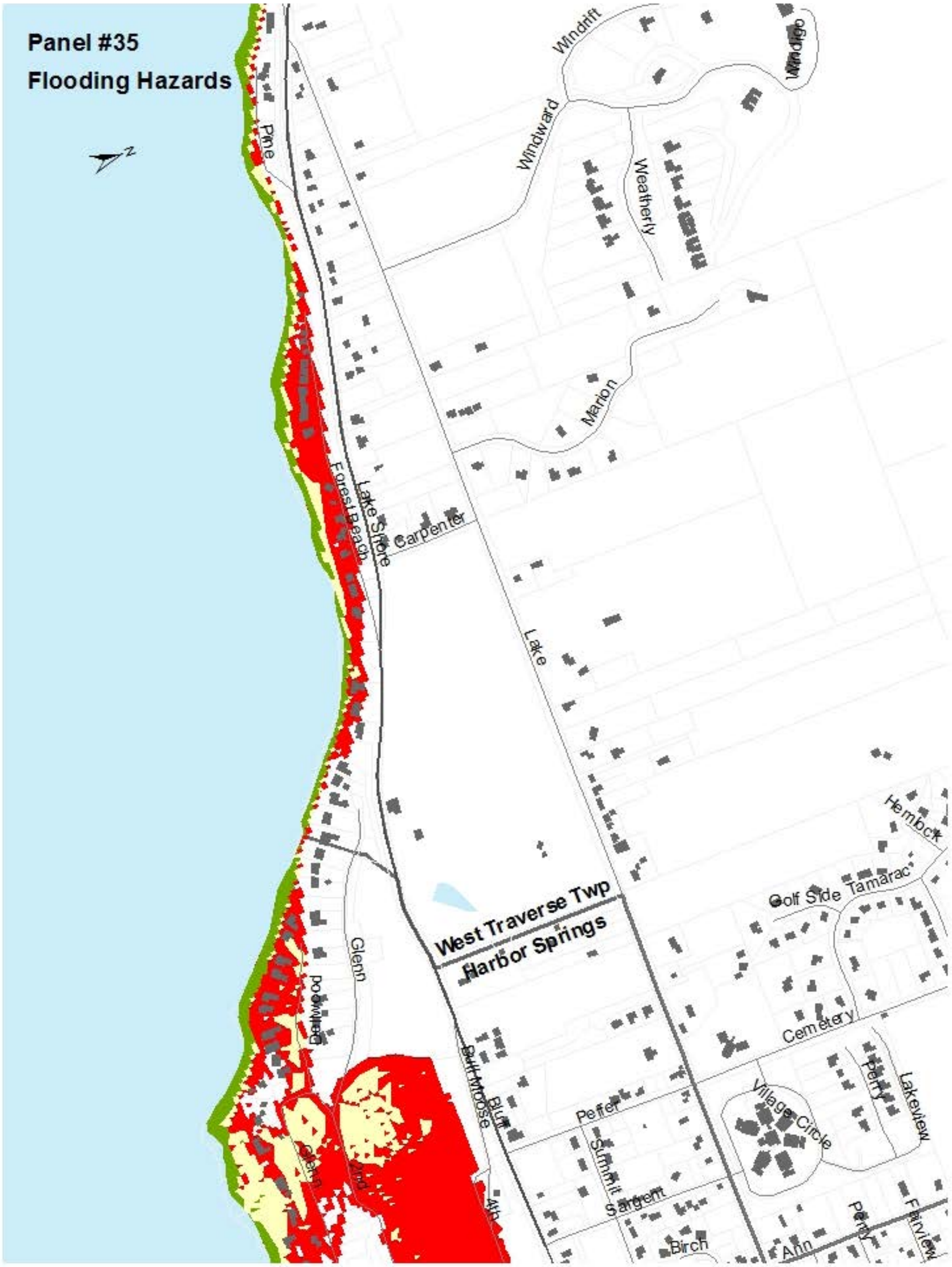
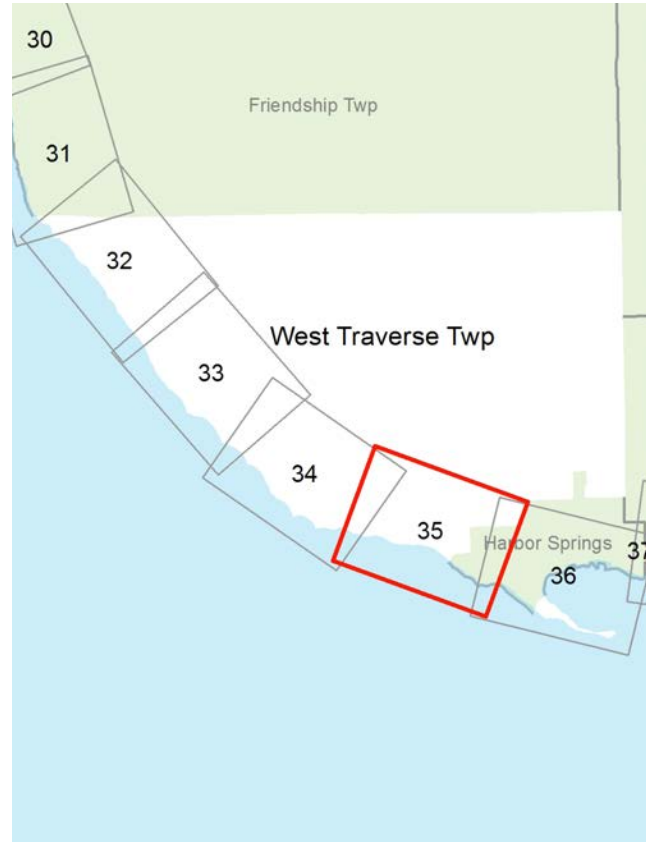
34
35
36
37
Friendship Twp
West Traverse Twp
Harbor Springs

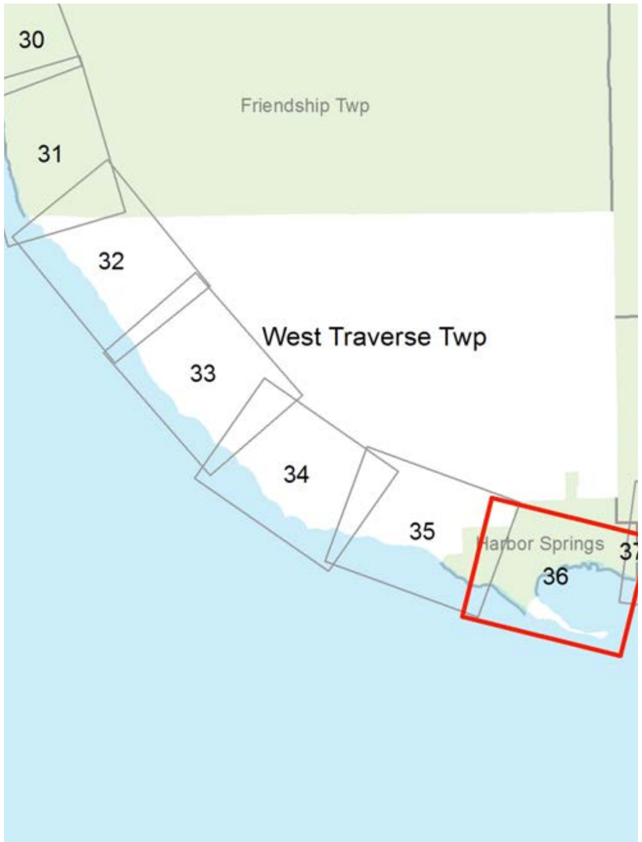

Emmet County

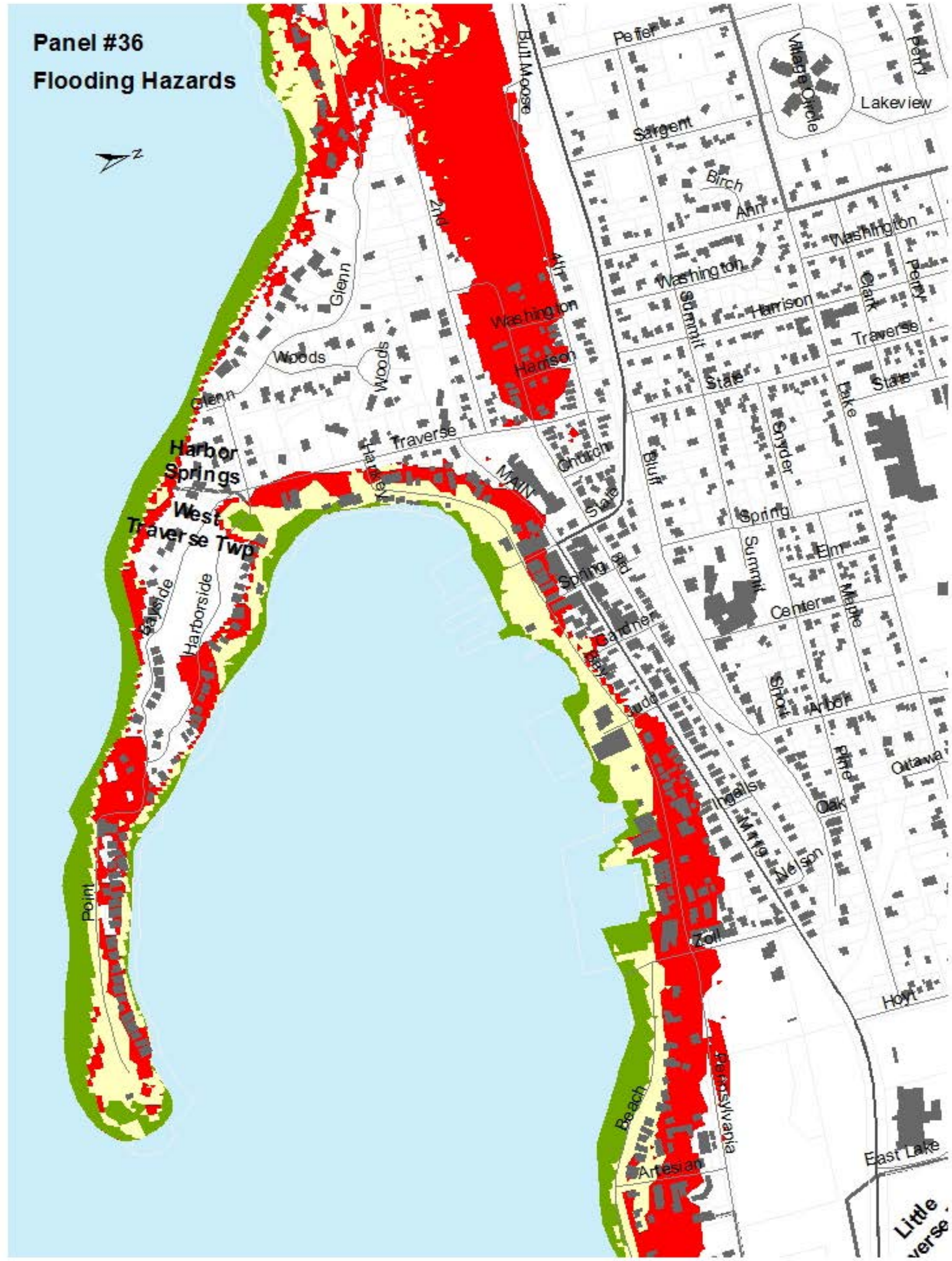

Panel #34
Flooding Hazards
N
Otis
Lake Shore
Idylwilde
Cook Point
Lake
Pine
Maple
Arrowhead
Broken Bow
Timber
Pine Tree
Radcliff
Kingswood
Ridge
Lodgepole
Leeward
Westward
Westward
Windrift
Windigo
Windward
Weatherly
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



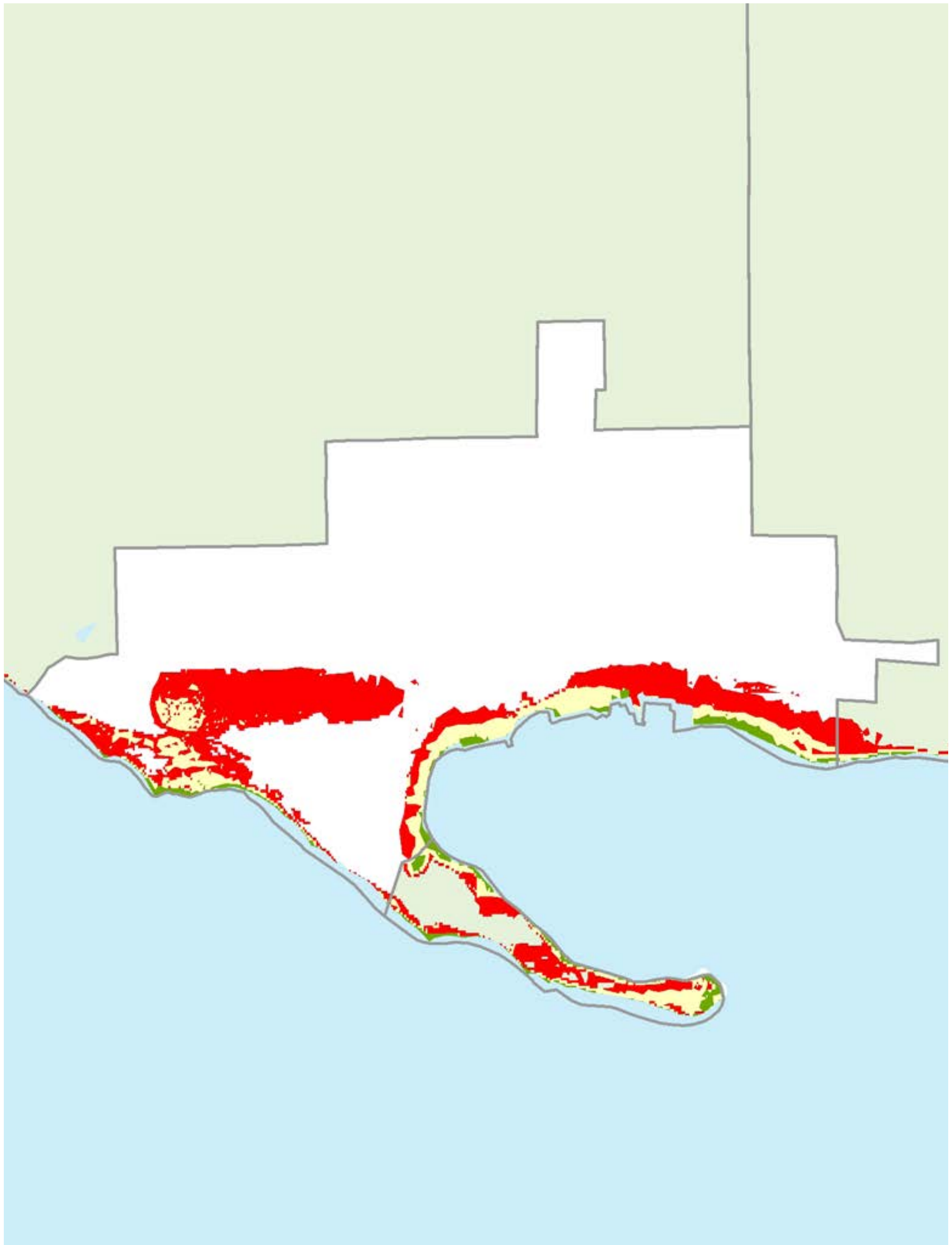


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





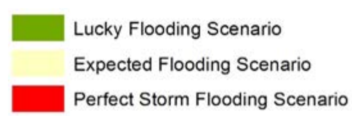
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

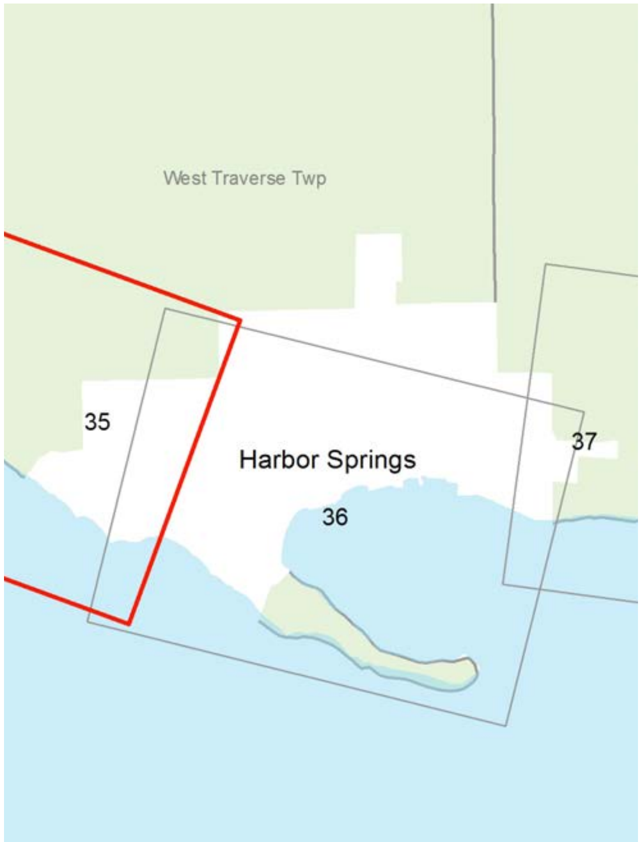


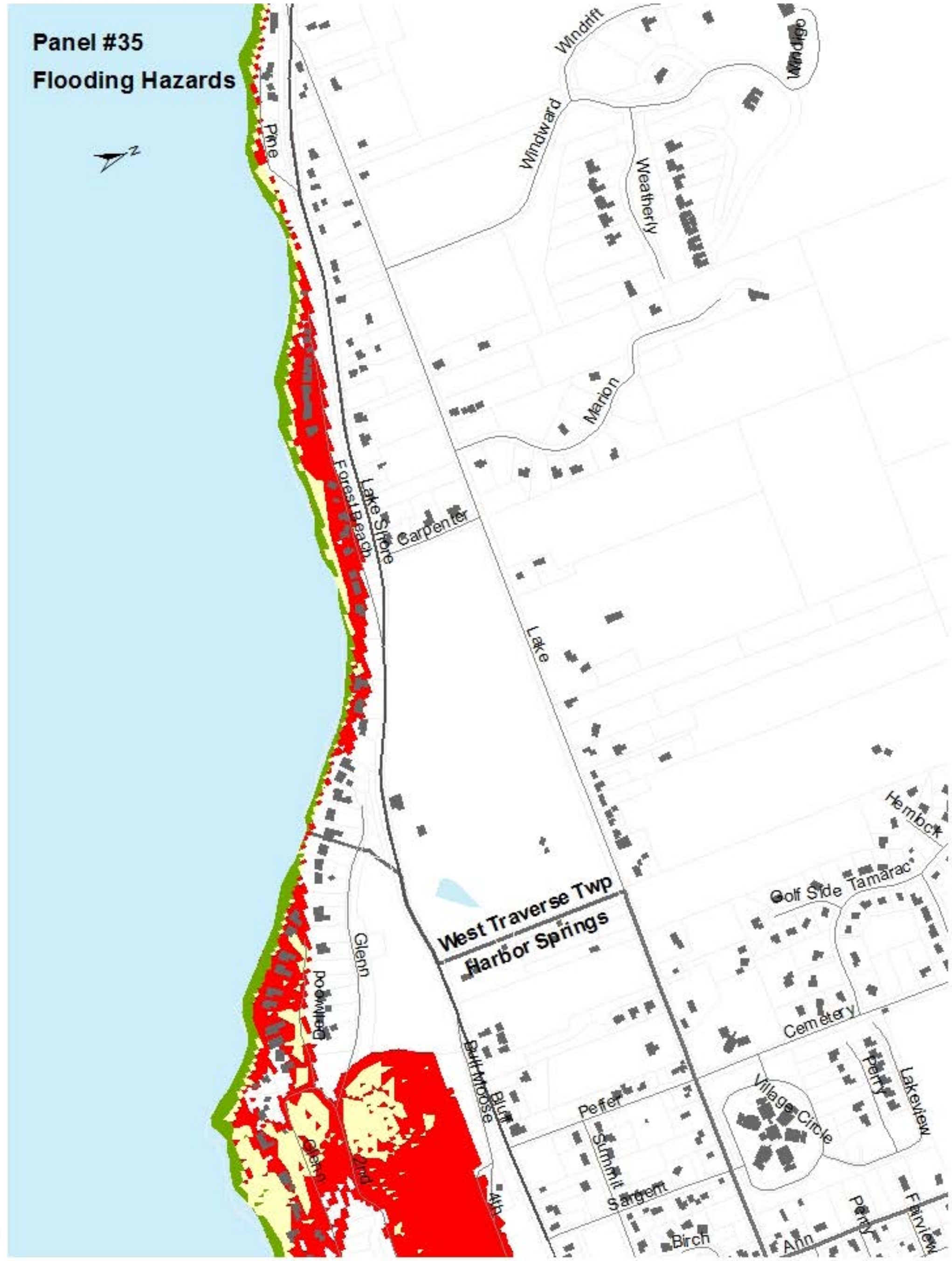
Harbor Springs

Coastal Flooding Scenario Impacts

Harbor Springs			
Total SEV	Lucky	Expected	Perfect Storm
$ 315,996,500.00	$ 7,727,100.00	$ 58,032,600.00	$ 114,688,800.00







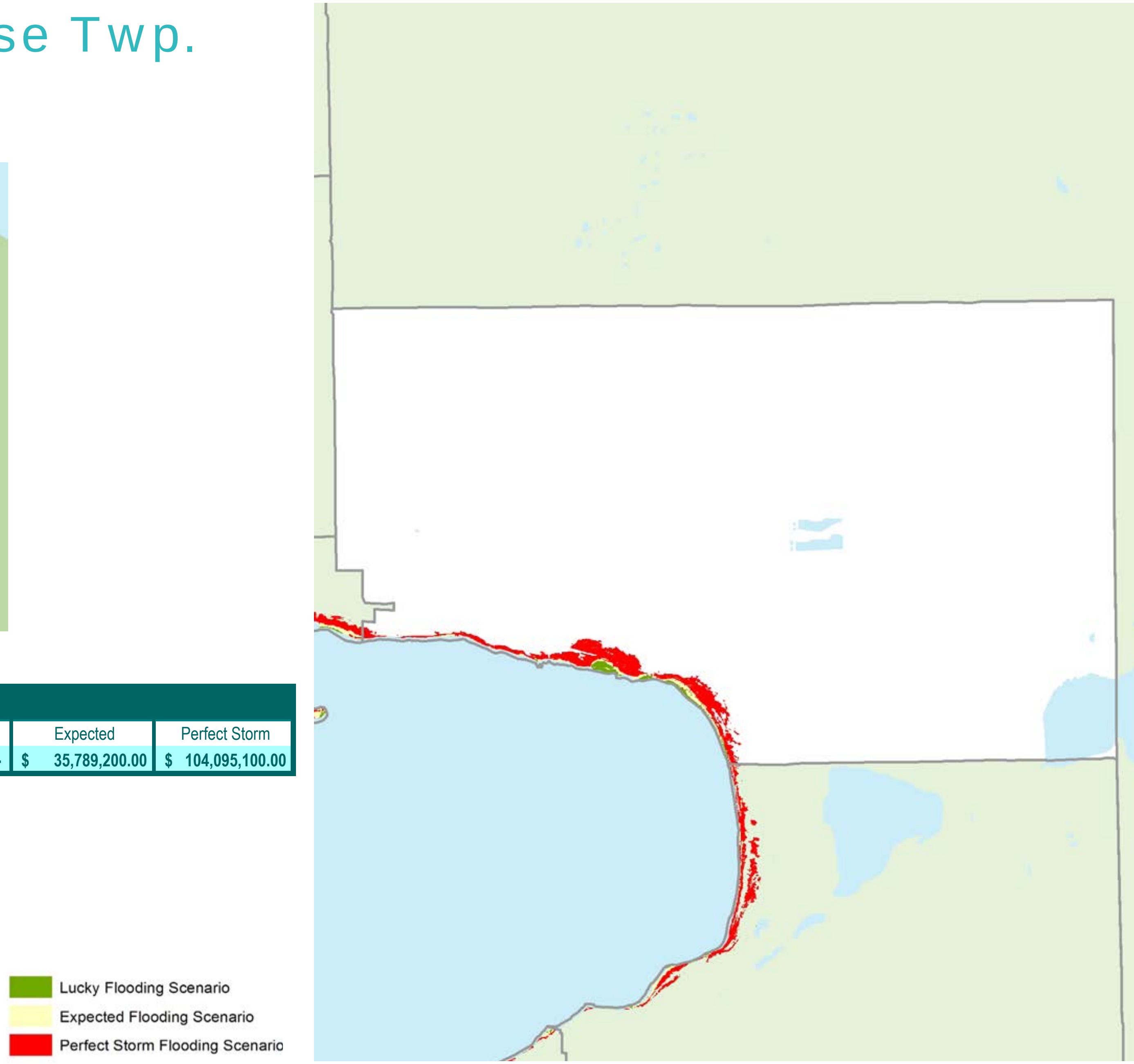
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #36
Flooding Hazards
Harbor Springs
West Traverse Twp
West Traverse Twp
35
Harbor Springs
36
37
Emmet County
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

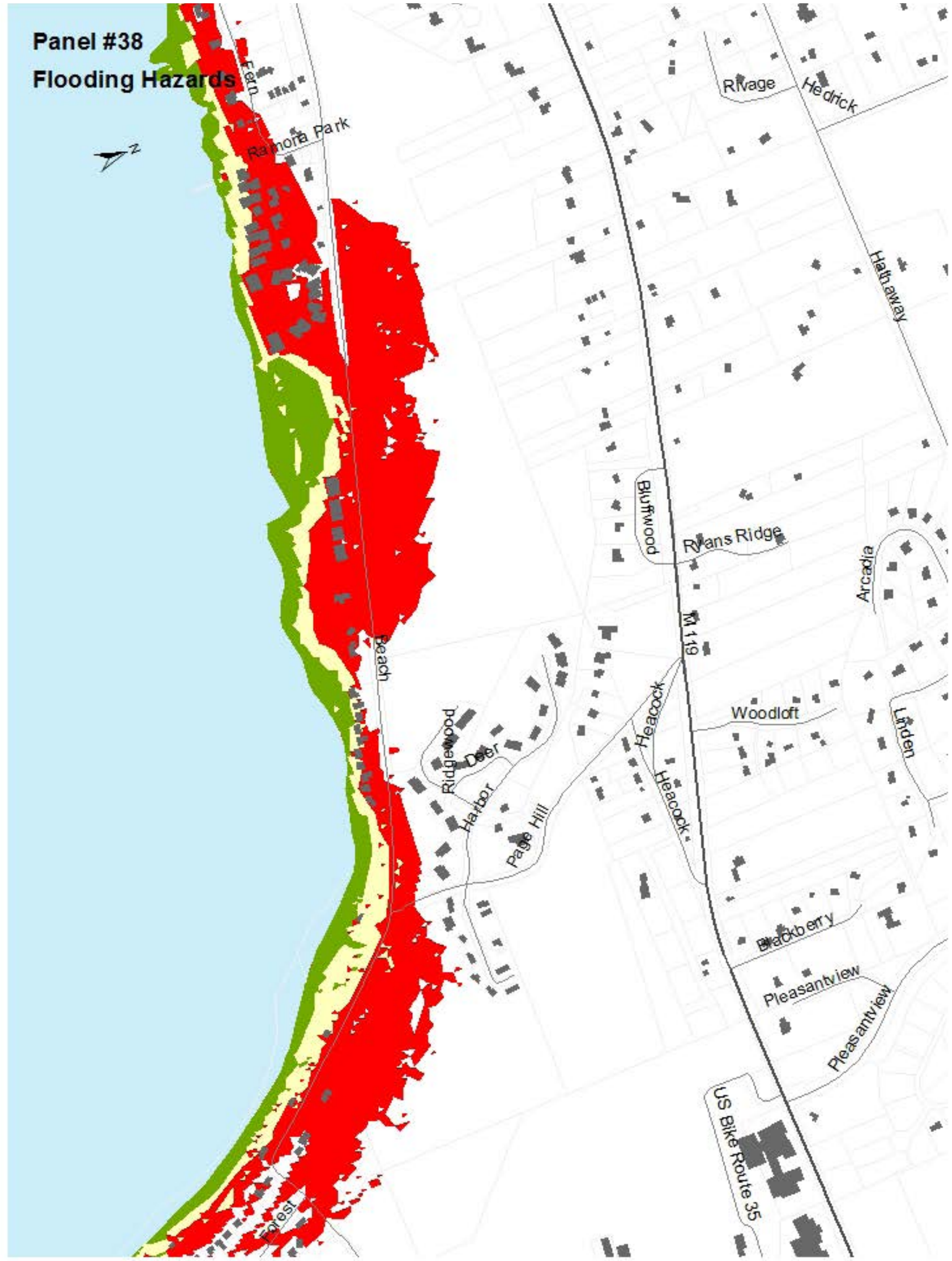
Little Traverse Twp.

Coastal Flooding Scenario Impacts

Little Traverse			
Total SEV	Lucky	Expected	Perfect Storm
$ 406,860,600.00	$ -	$ 35,789,200.00	$ 104,095,100.00



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



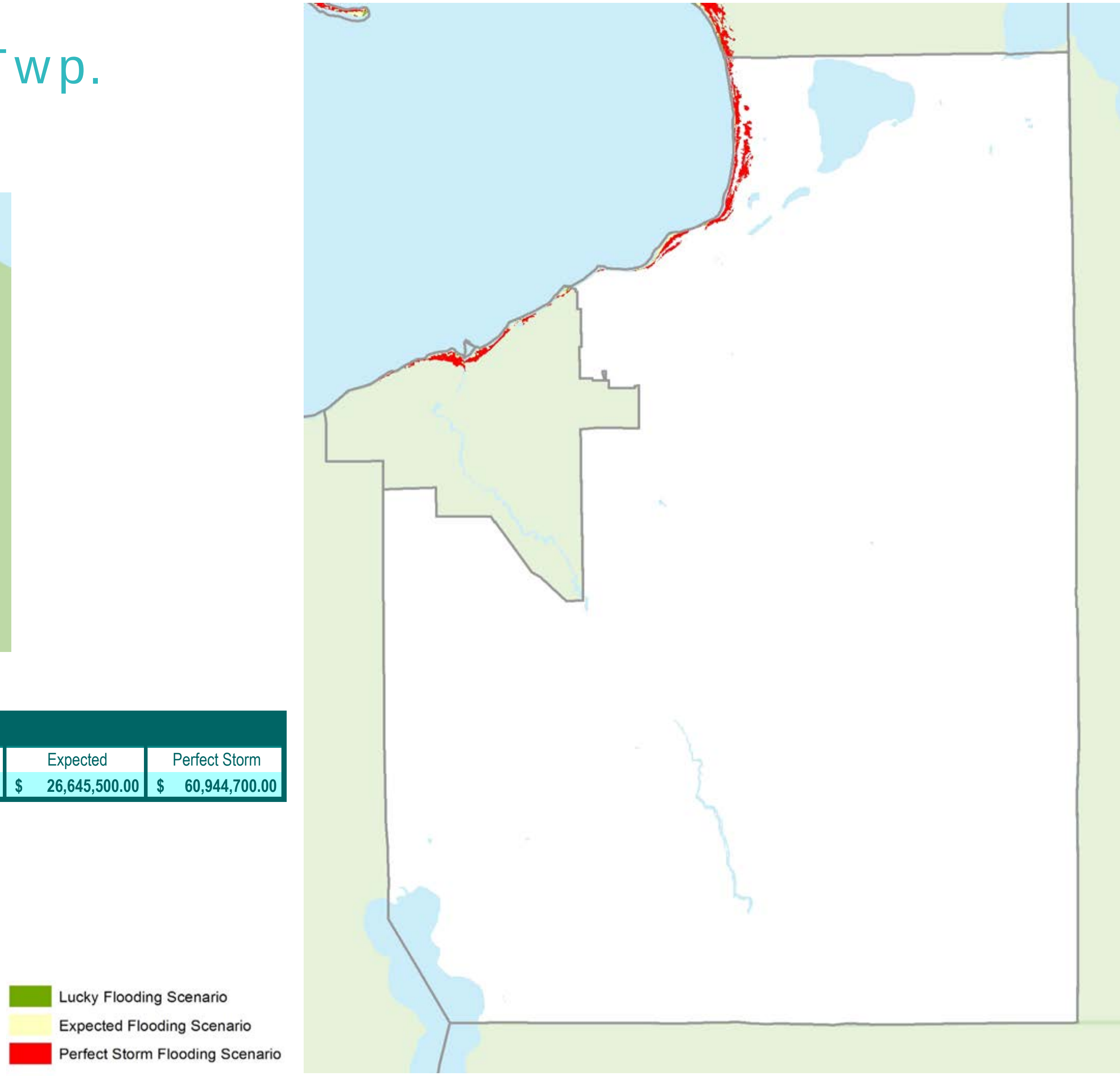
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

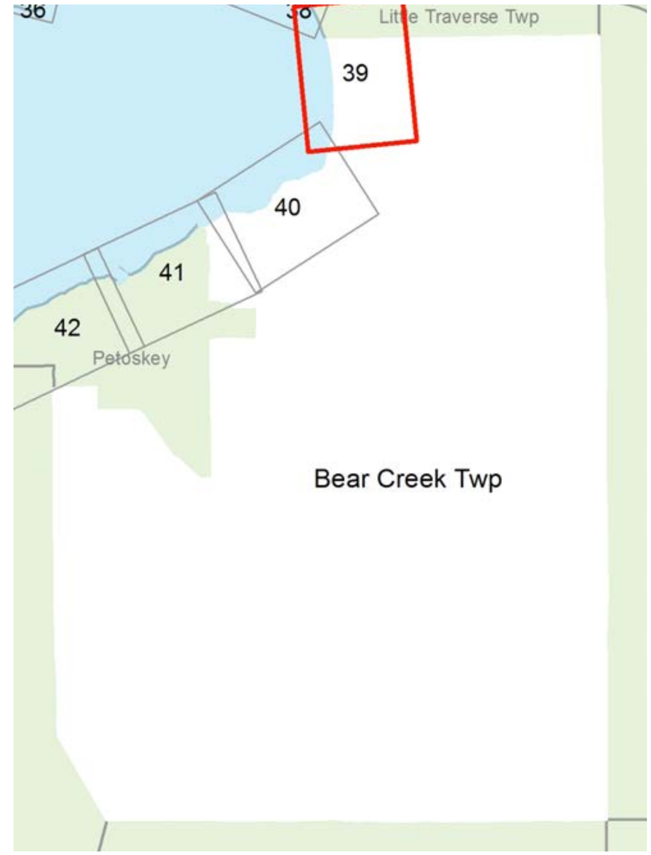
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Bear Creek Twp.

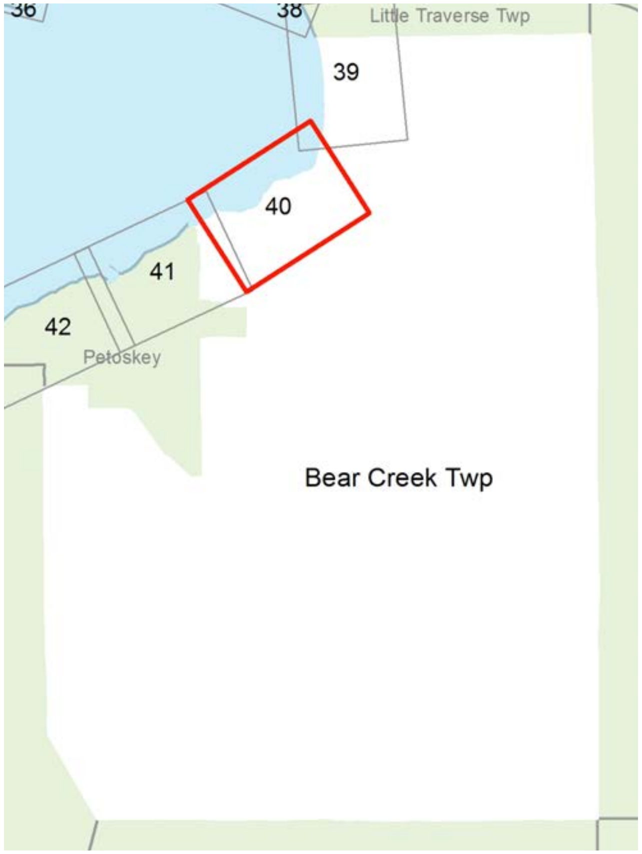
Coastal Flooding Scenario Impacts

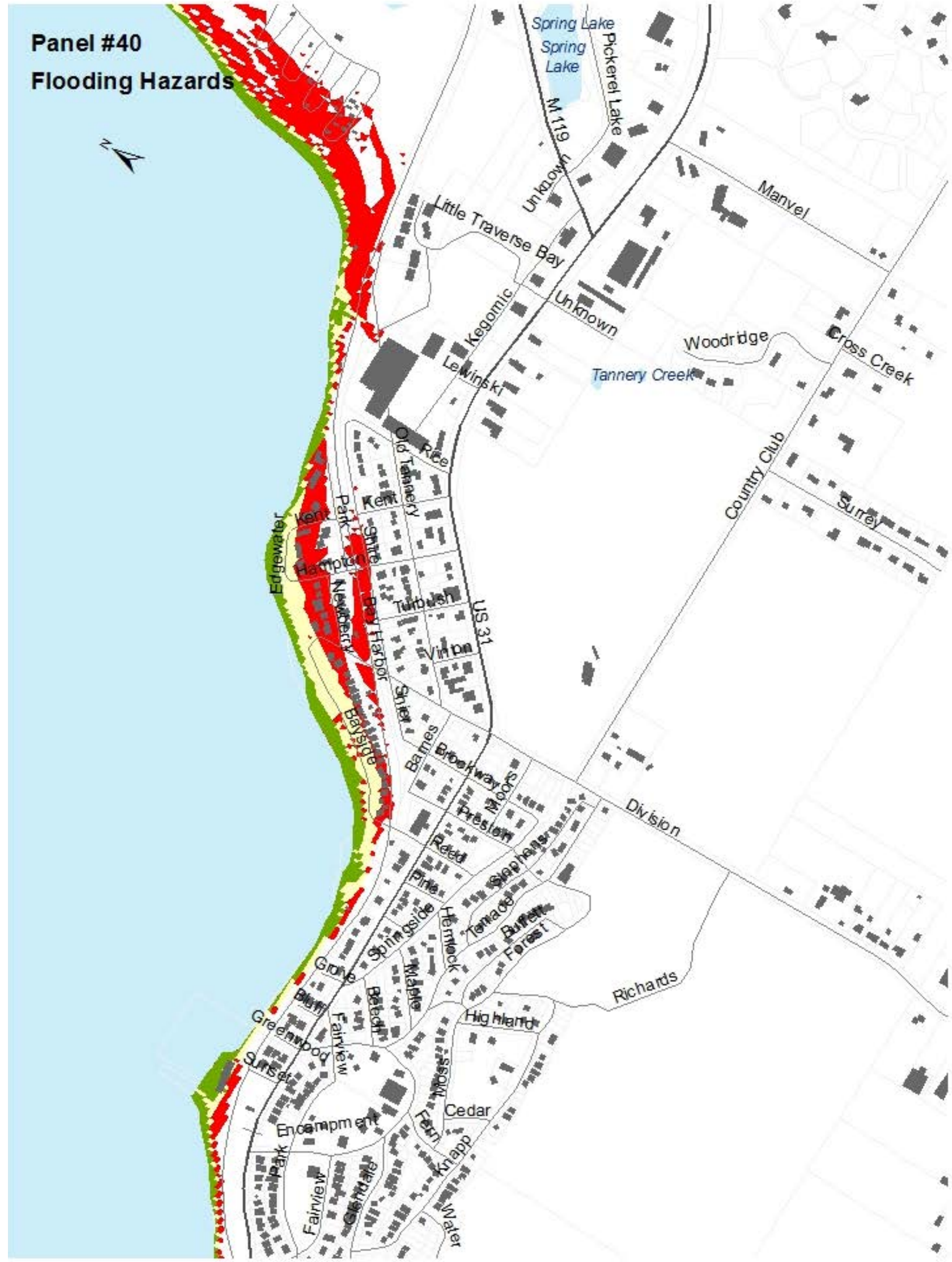
Bear Creek			
Total SEV	Lucky	Expected	Perfect Storm
$ 537,614,800.00	$ -	$ 26,645,500.00	$ 60,944,700.00





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

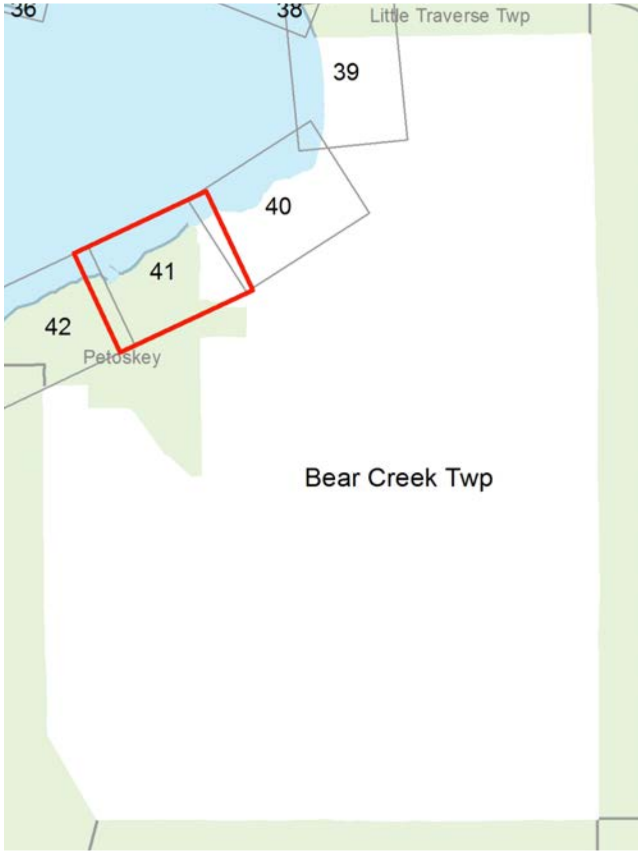




Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario



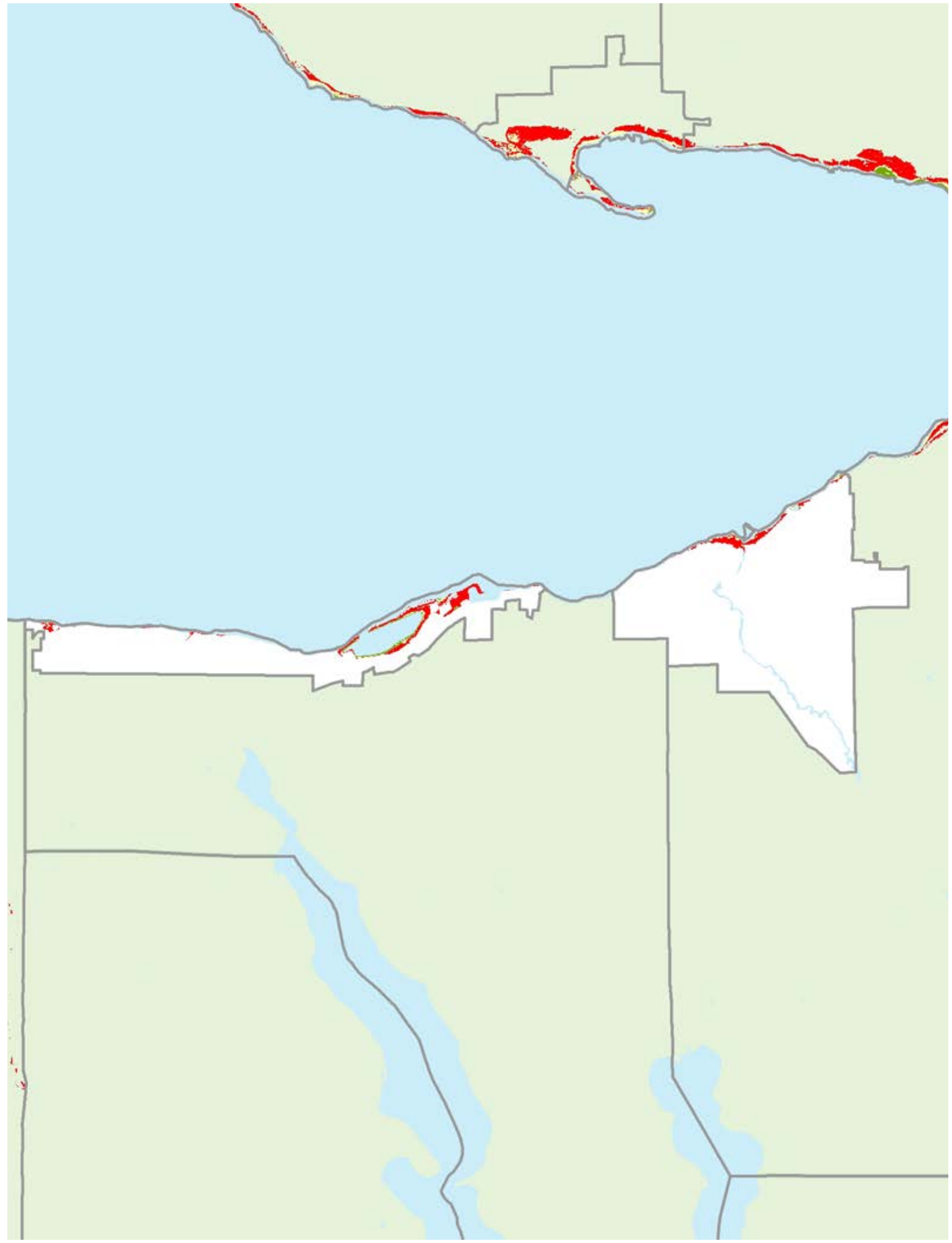
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

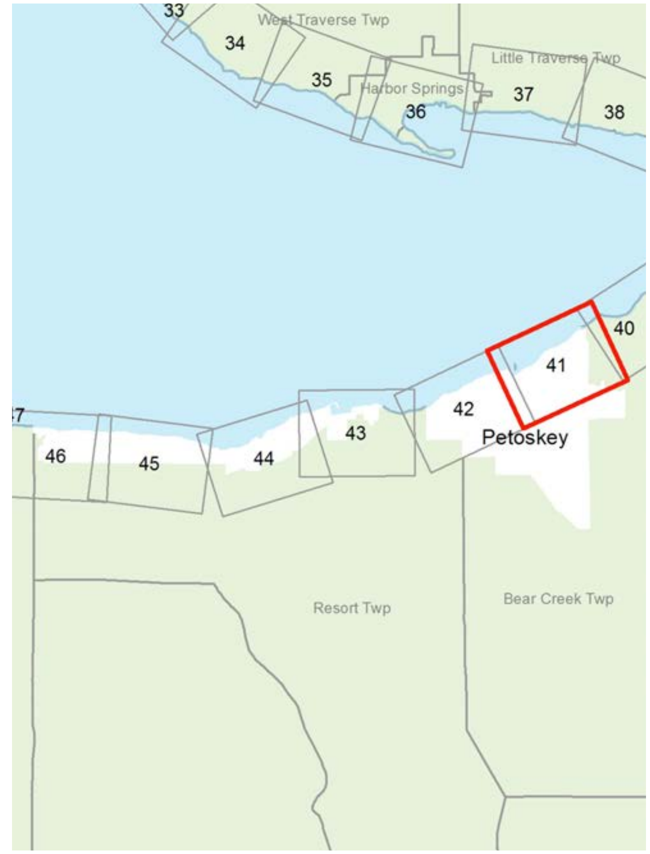
Petoskey

Coastal Flooding Scenario Impacts

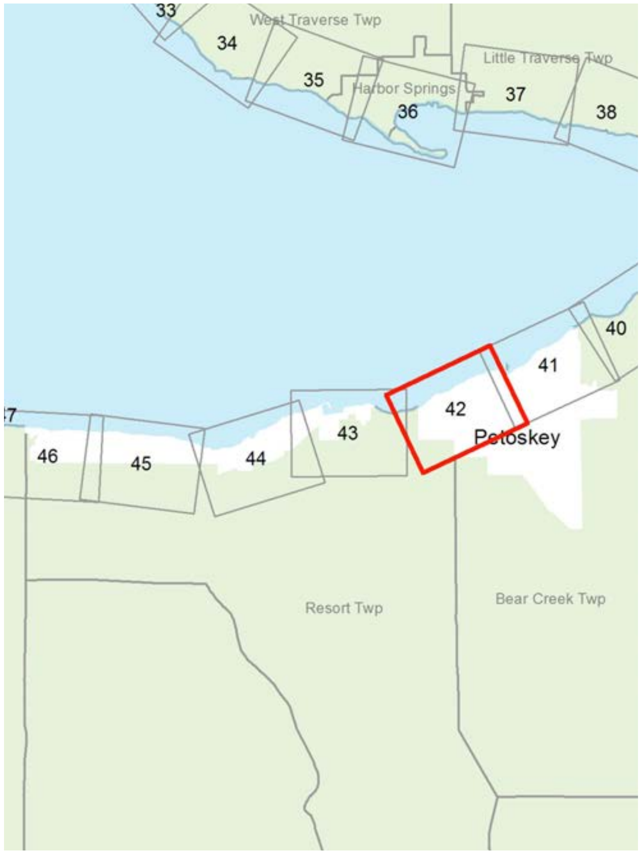
Petoskey			
Total SEV	Lucky	Expected	Perfect Storm
$ 581,874,400.00	$ 20,177,200.00	$ 74,400,000.00	$ 119,350,700.00

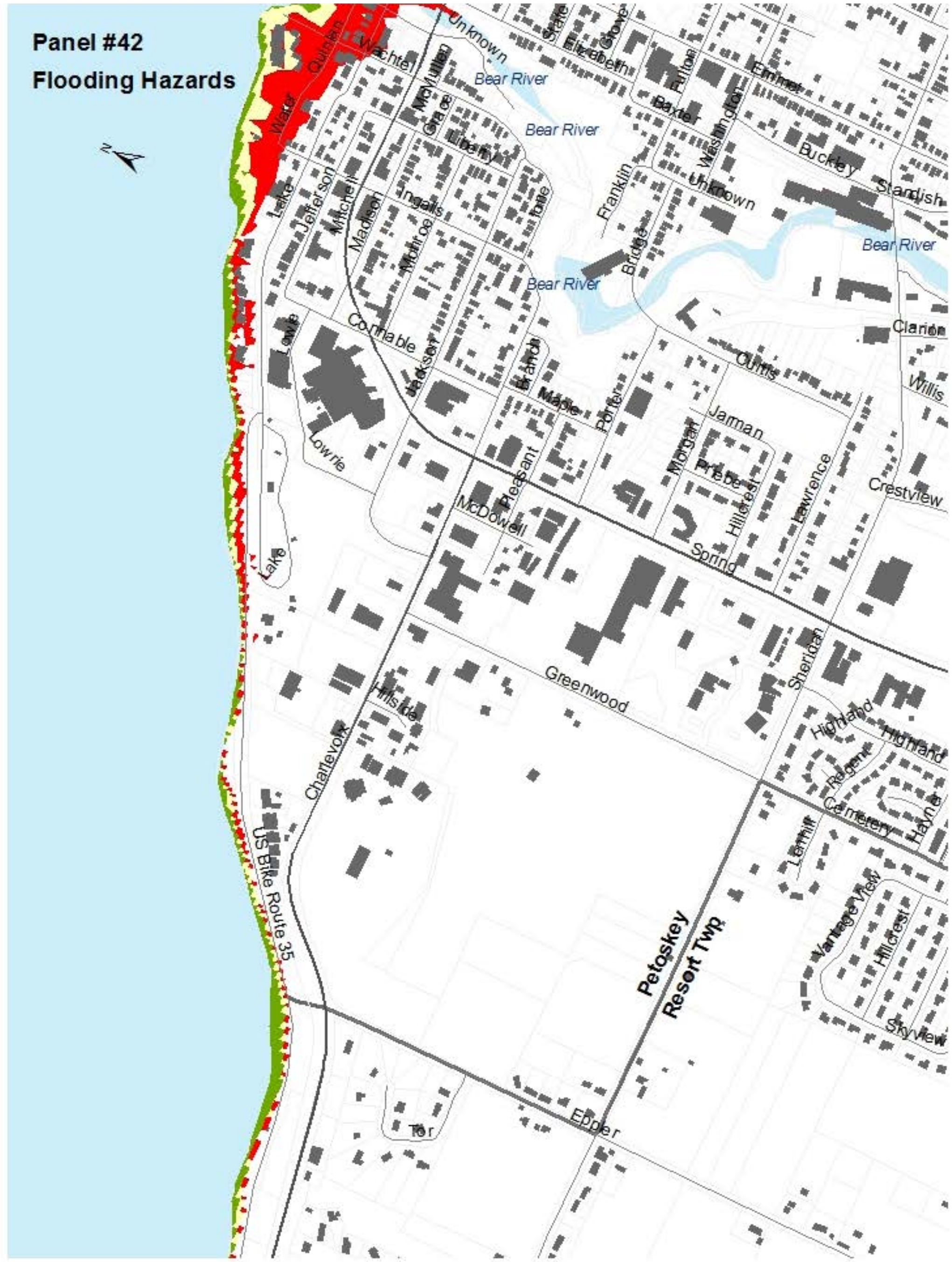
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



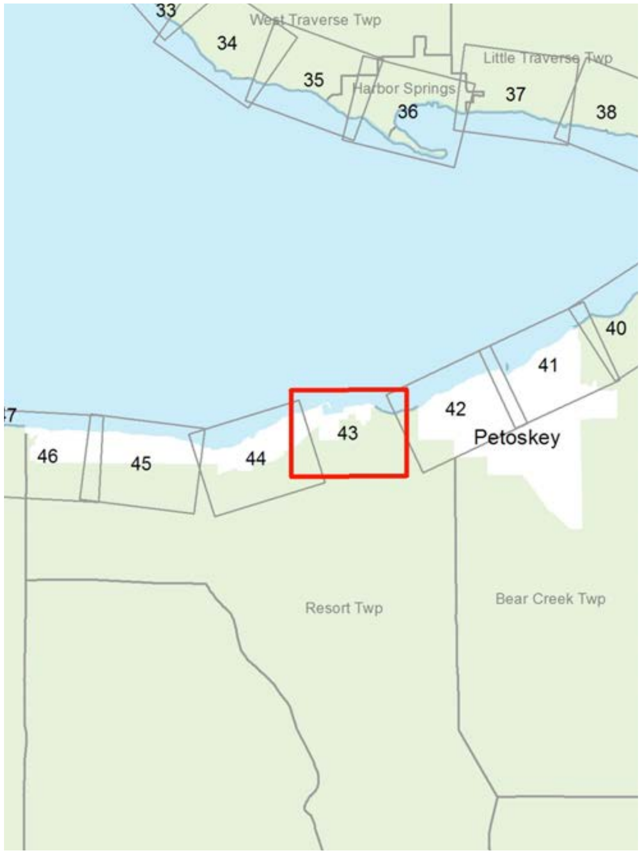


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

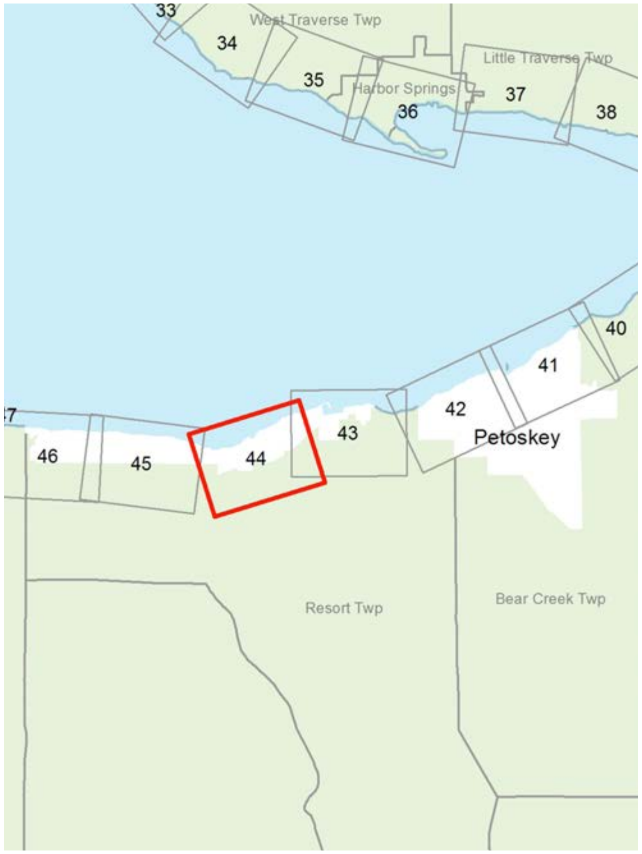




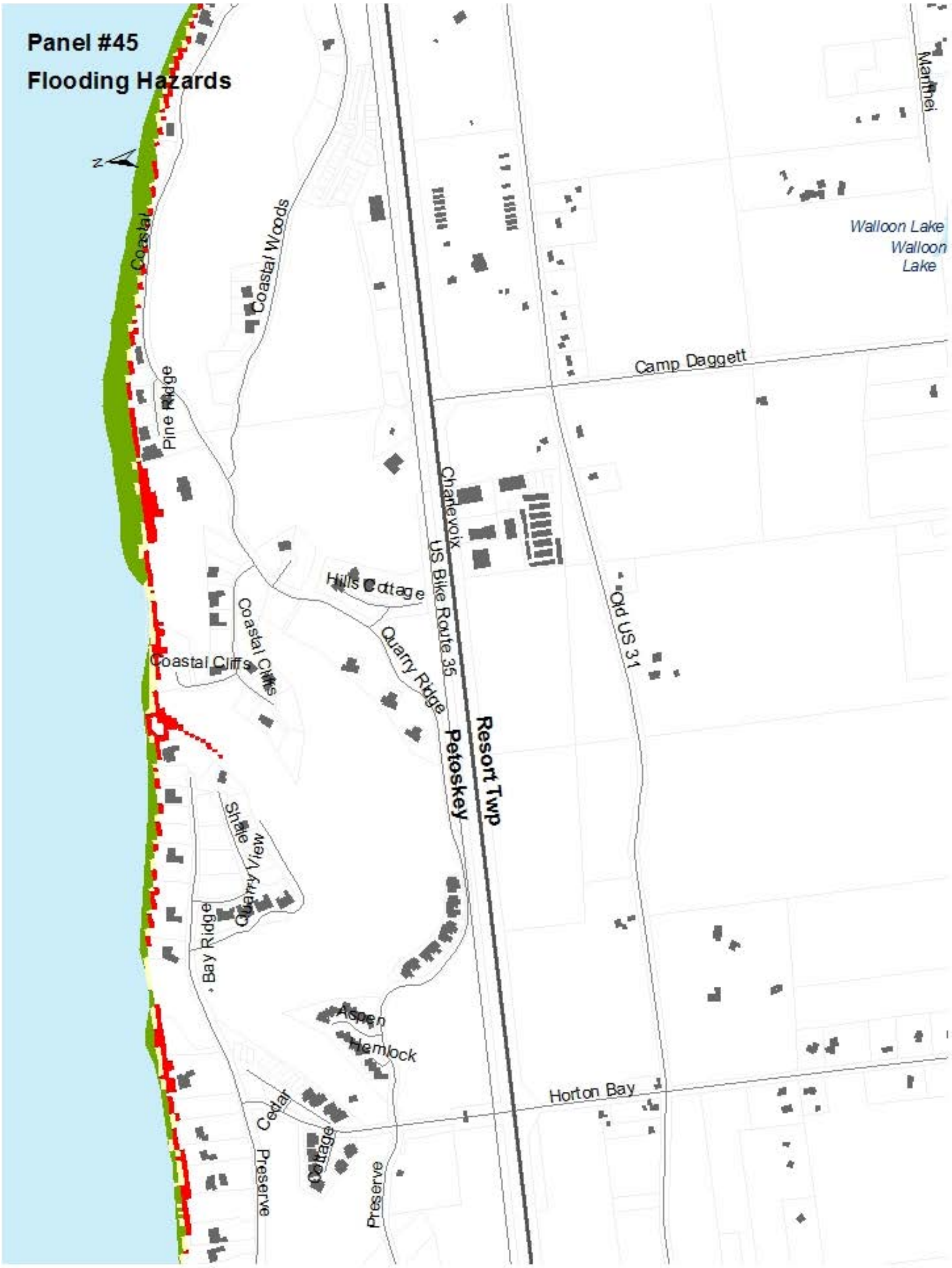
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

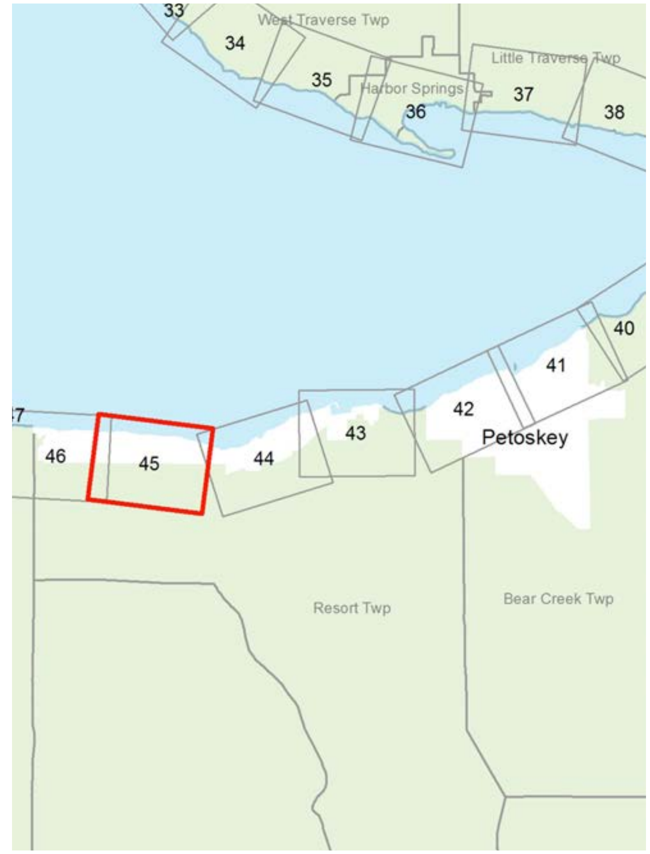


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

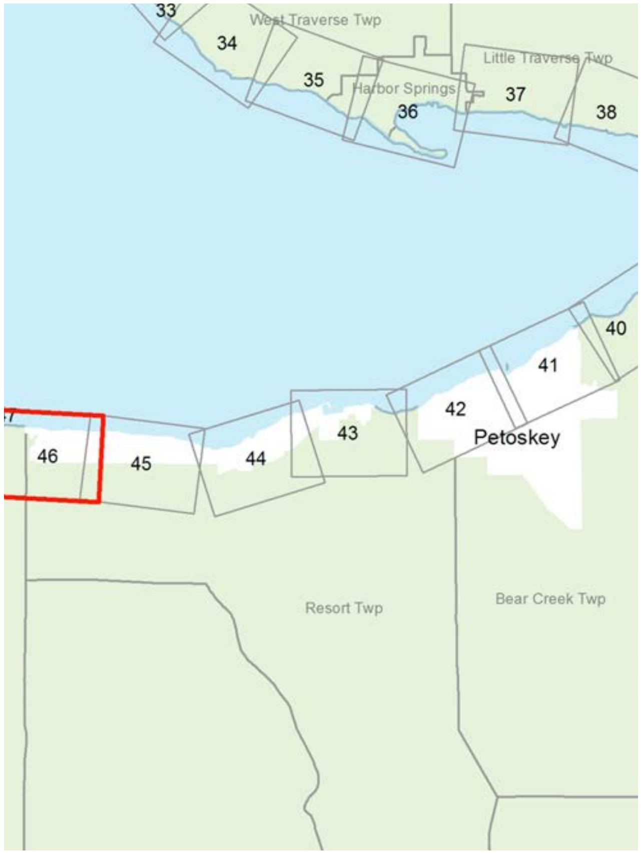


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



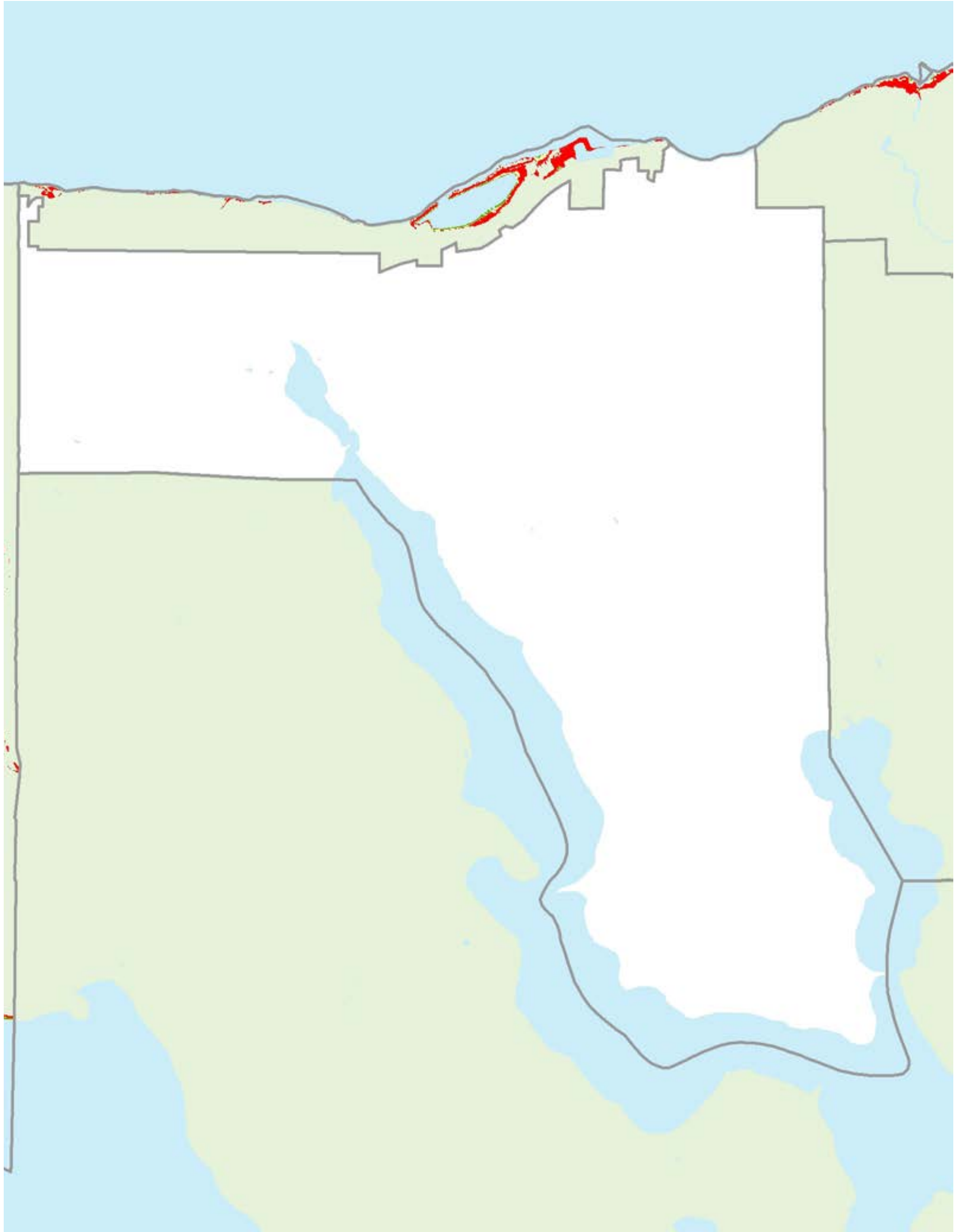


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

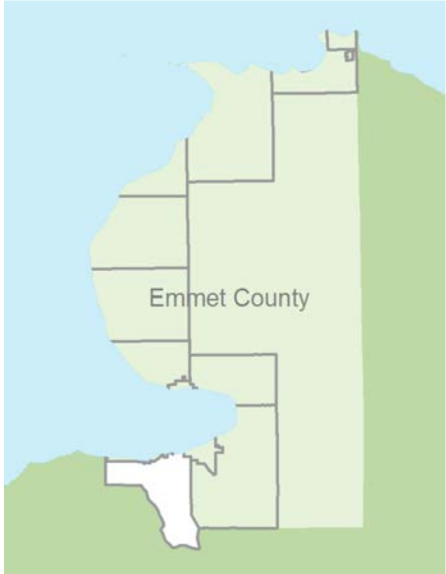

West Traverse Twp
Little Traverse Twp
Harbor Springs
Petoskey
Resort Twp
Bear Creek Twp
33
34
35
36
37
38
40
41
42
43
44
45
46


Emmet County


Panel #46
Flooding Hazards
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Horton Bay
Preserve
US Bike Route 35
Charlevoix
Old US 31
Upper Bay Shore
Bayshore
Petoskey
Resort Twp
Resort Twp
Hayes Twp
Townline
Bay
Terrace
Rocky Beach
Seneca
Spring
Hemlock
Maple
Resort
Division
Charlevoix to Bay Harbor
US 31
Pinchery



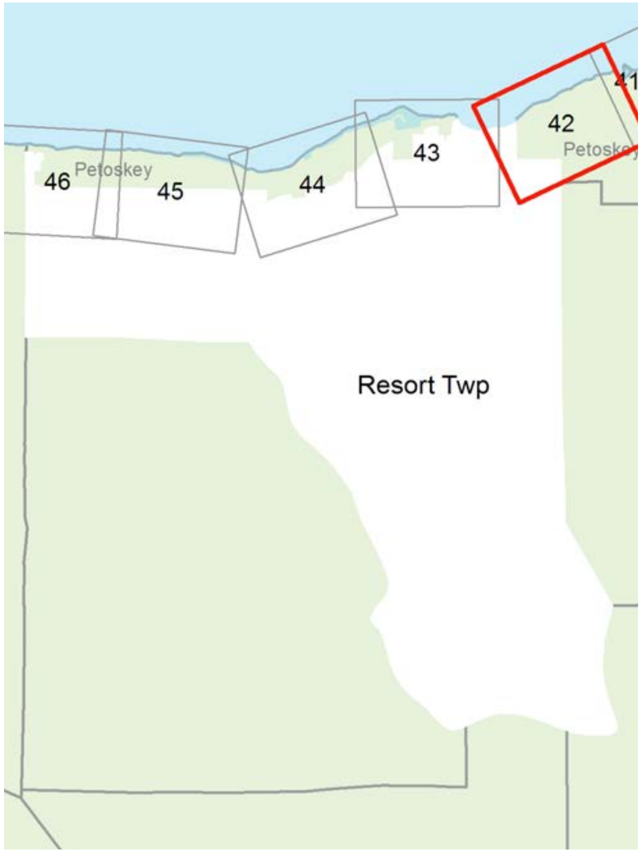
Resort Twp.



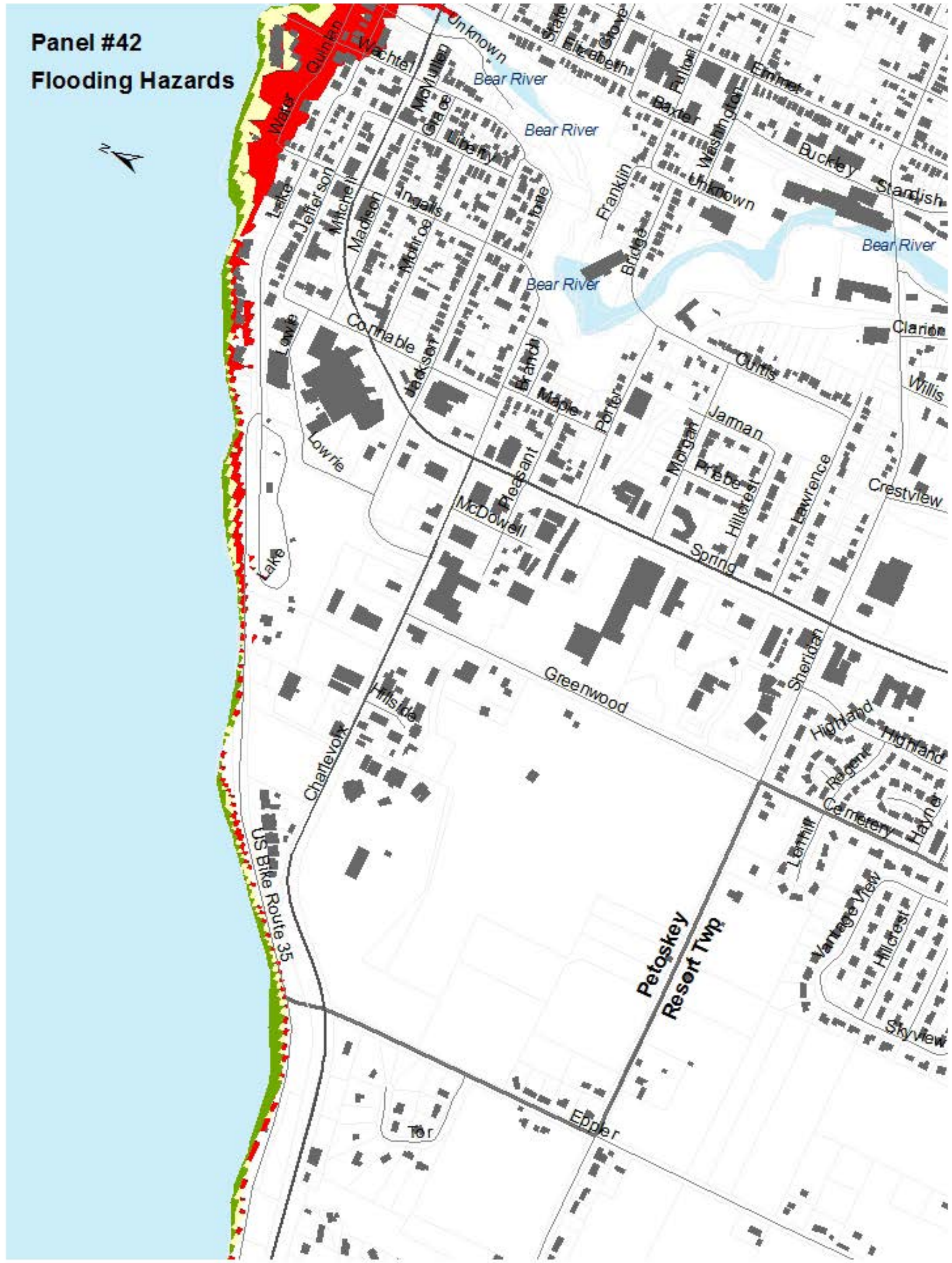
Coastal Flooding Scenario Impacts

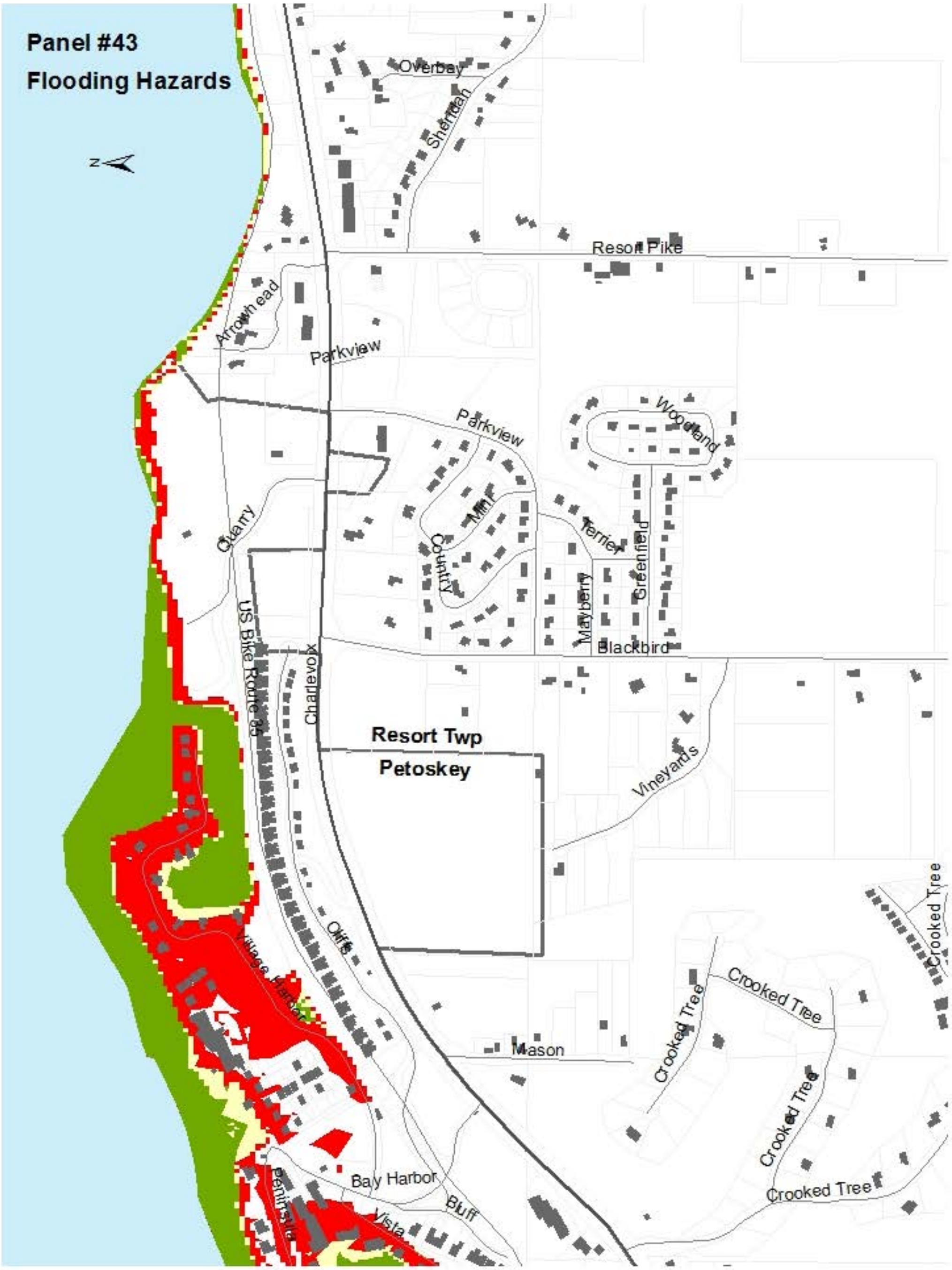
Resort			
Total SEV	Lucky	Expected	Perfect Storm
$ 478,891,650.00	$ -	$ -	$ -

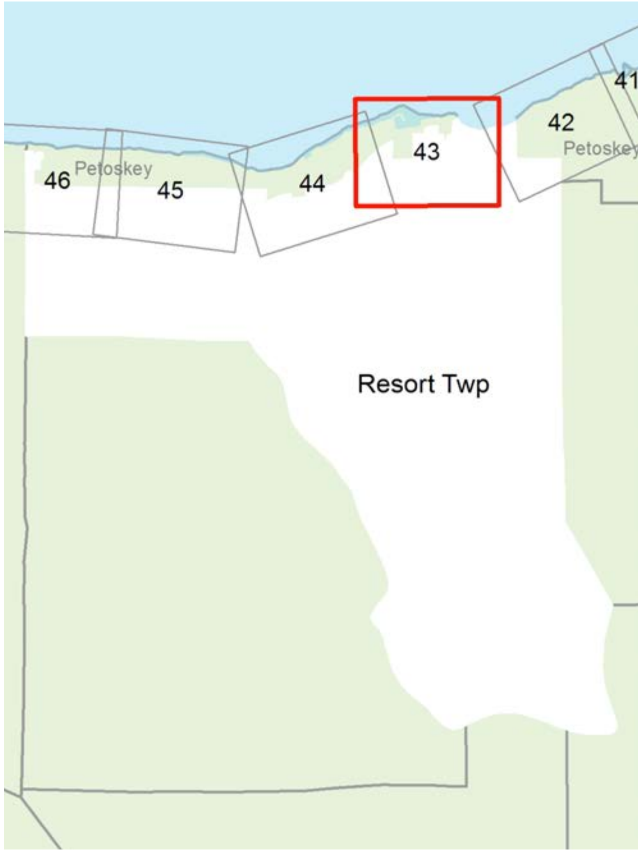
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario







Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

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Charlevoix County

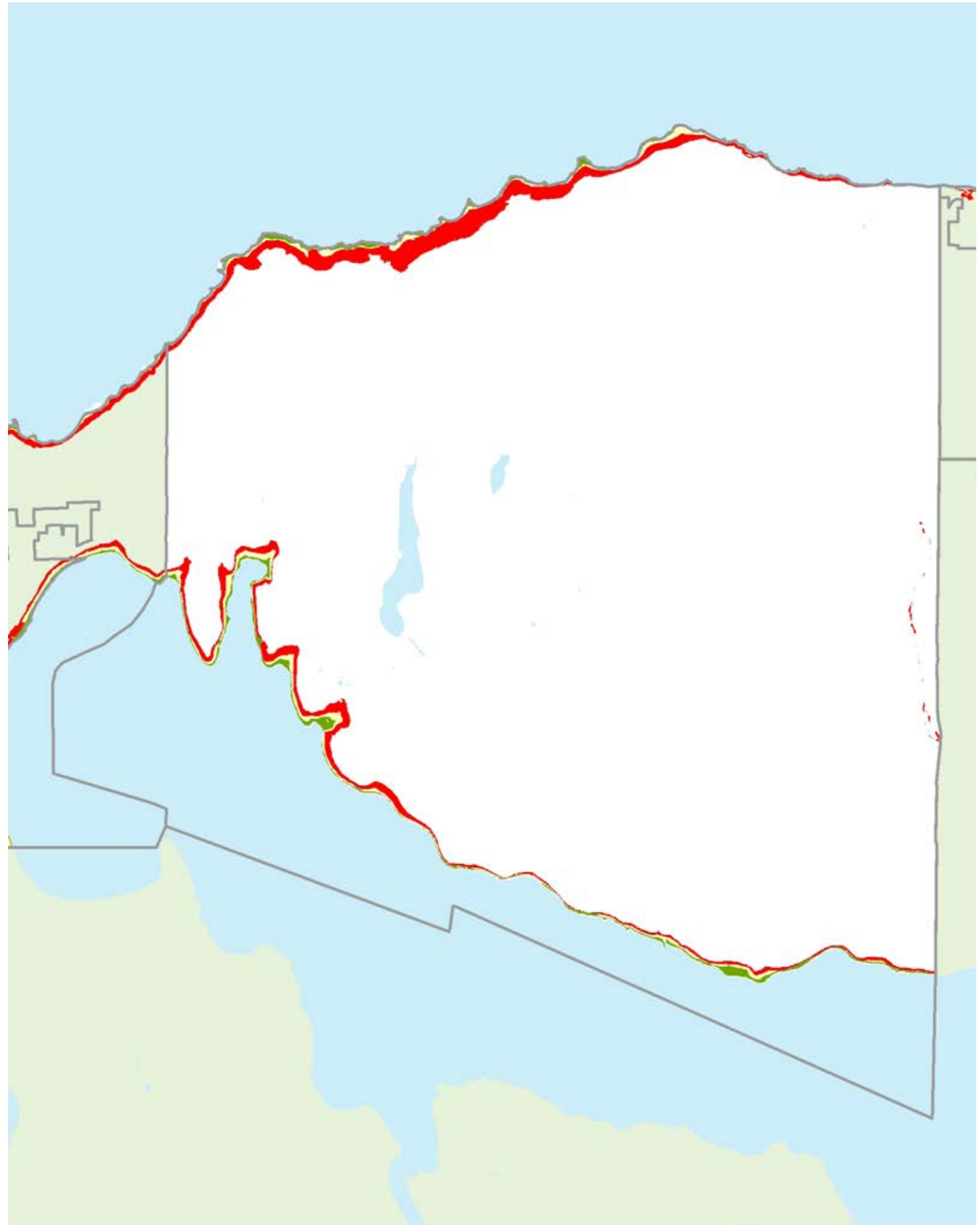
Coastal Flooding Scenario Impacts

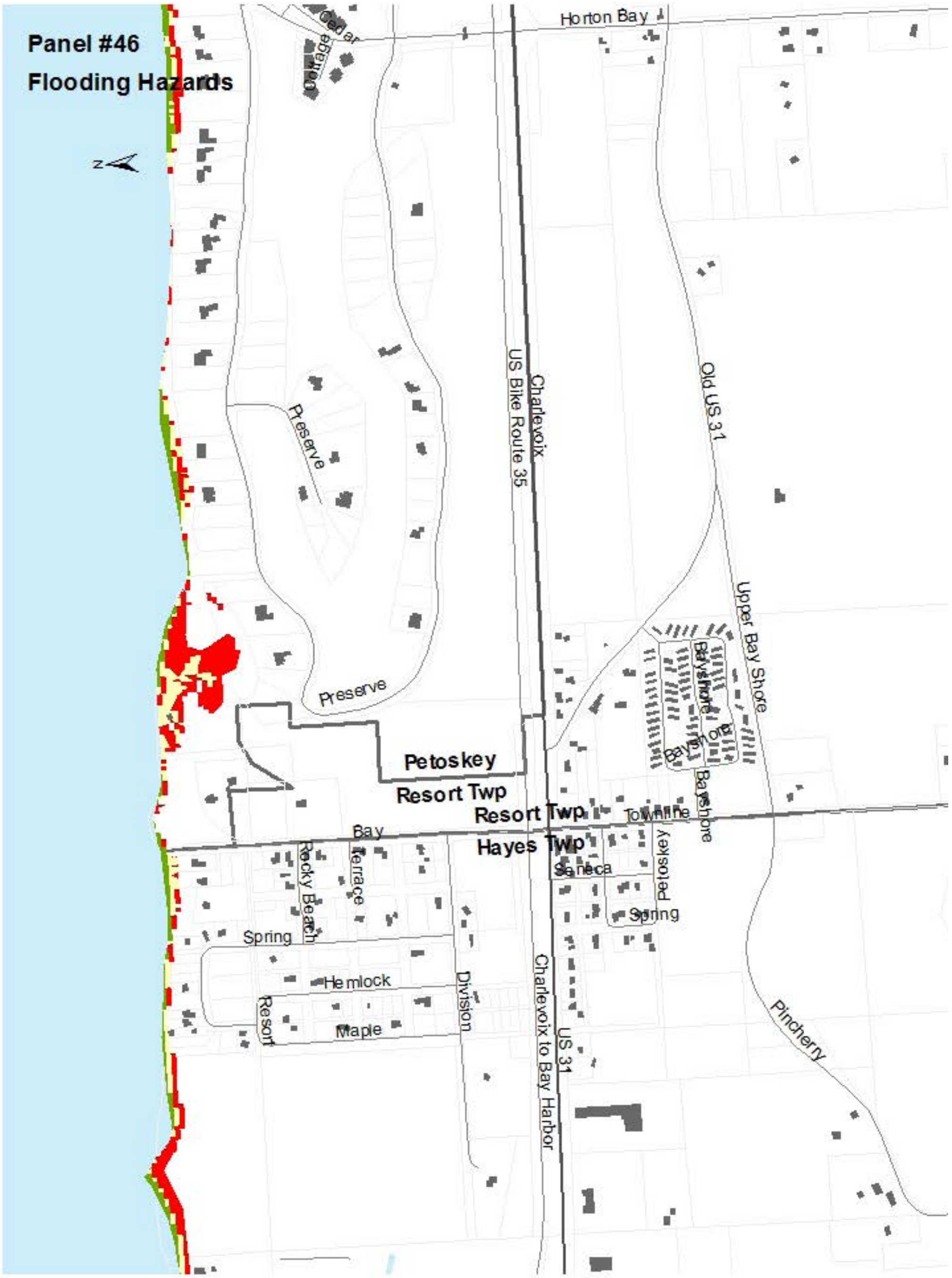
Charlevoix County			
Total SEV	Lucky	Expected	Perfect Storm
$ 820,165,551.00	$ 90,079,300.00	$ 180,384,000.00	$ 295,602,100.00

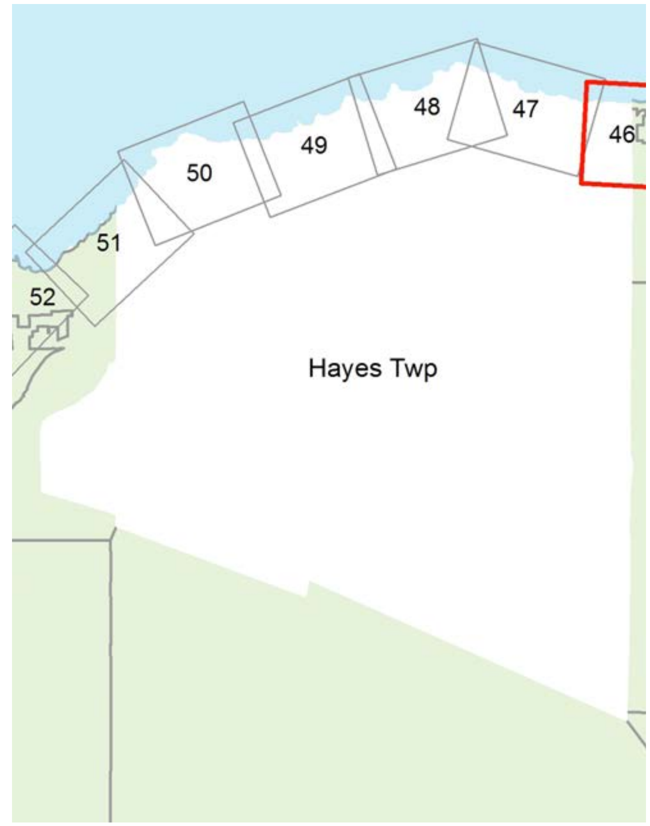
Hayes Twp.

Coastal Flooding Scenario Impacts

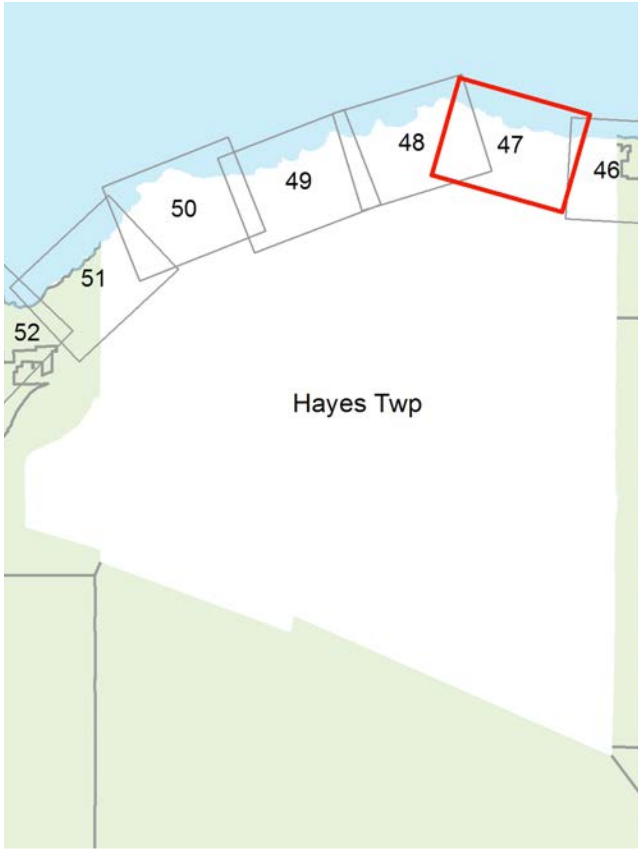
Hayes			
Total SEV	Lucky	Expected	Perfect Storm
$ 261,673,595.00	$ 12,803,100.00	$ 52,352,700.00	$ 116,771,600.00



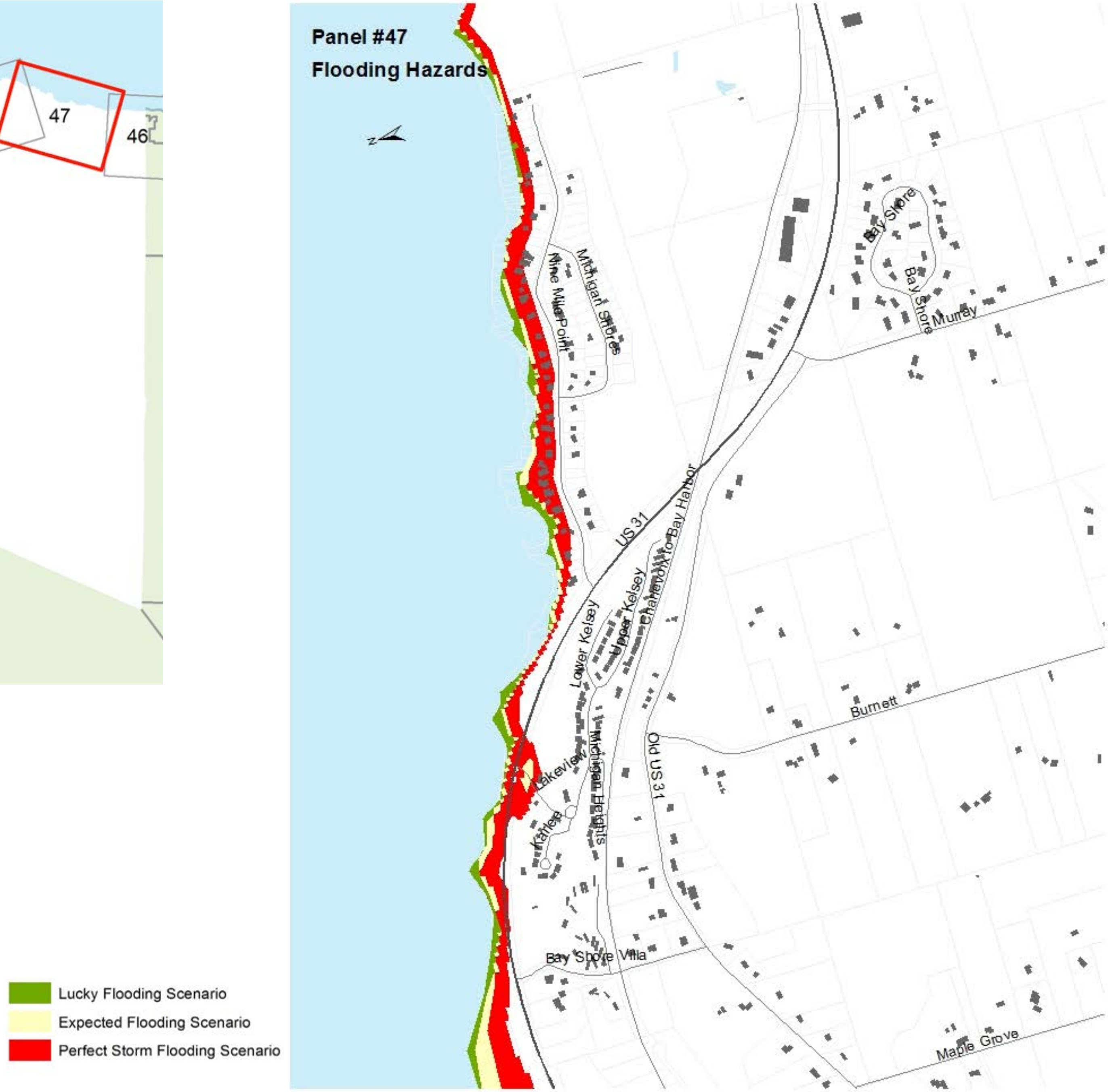


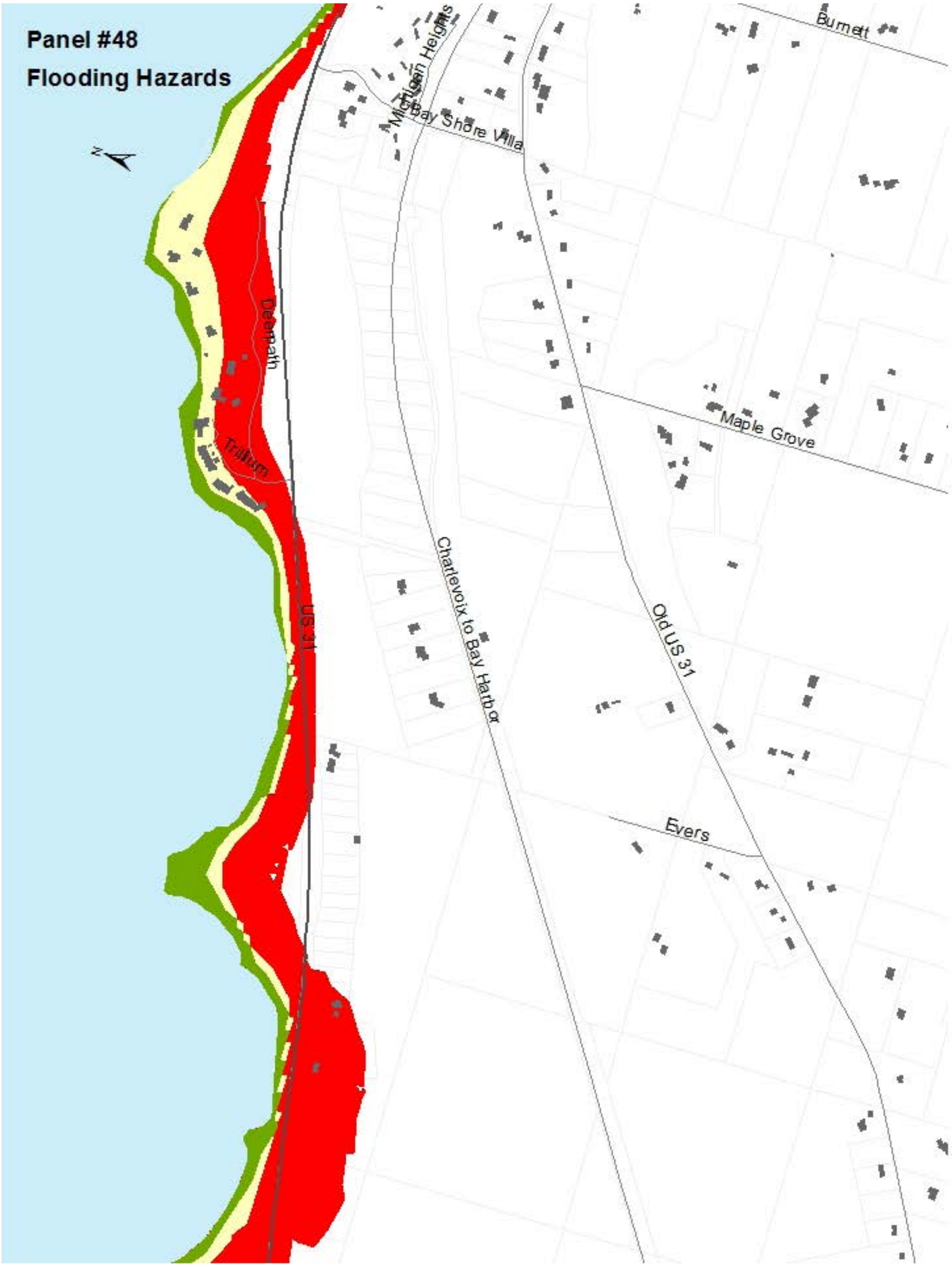


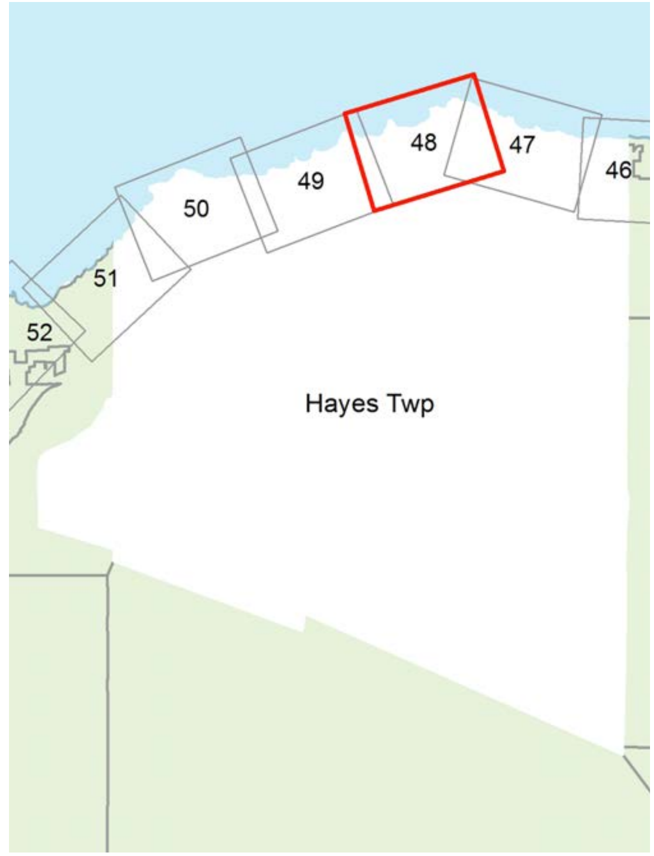
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


47
48
46
49
50
51
52
Hayes Twp

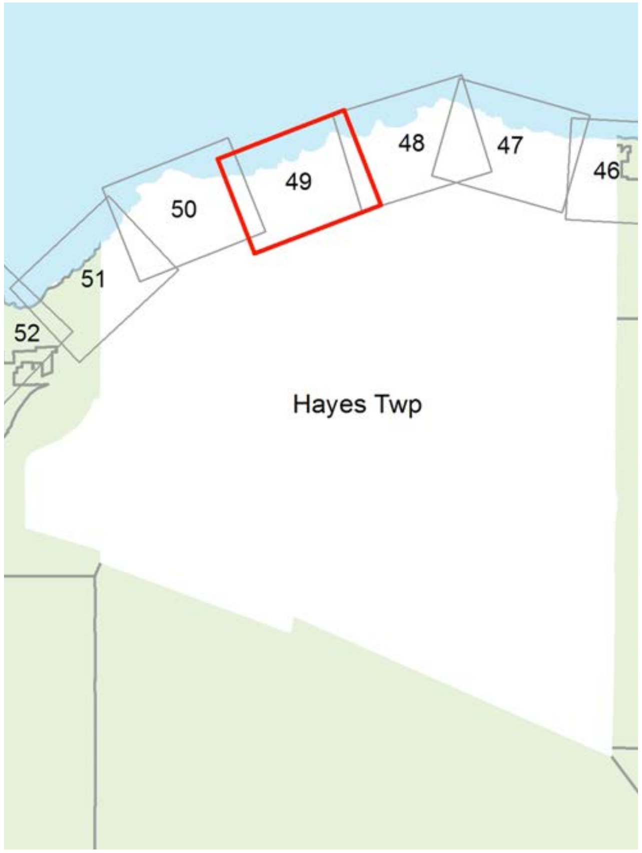

Charlevoix County


Panel #47
Flooding Hazards
Michigan Shores
Nine Mile Point
Bay Shore
Murray
US 31
Charlevoix to Bay Harbor
Lower Kelsey
Upper Kelsey
Burnett
Old US 31
Lakeview
Michigan Heights
Kailee
Bay Shore Villa
Maple Grove
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


48
47
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49
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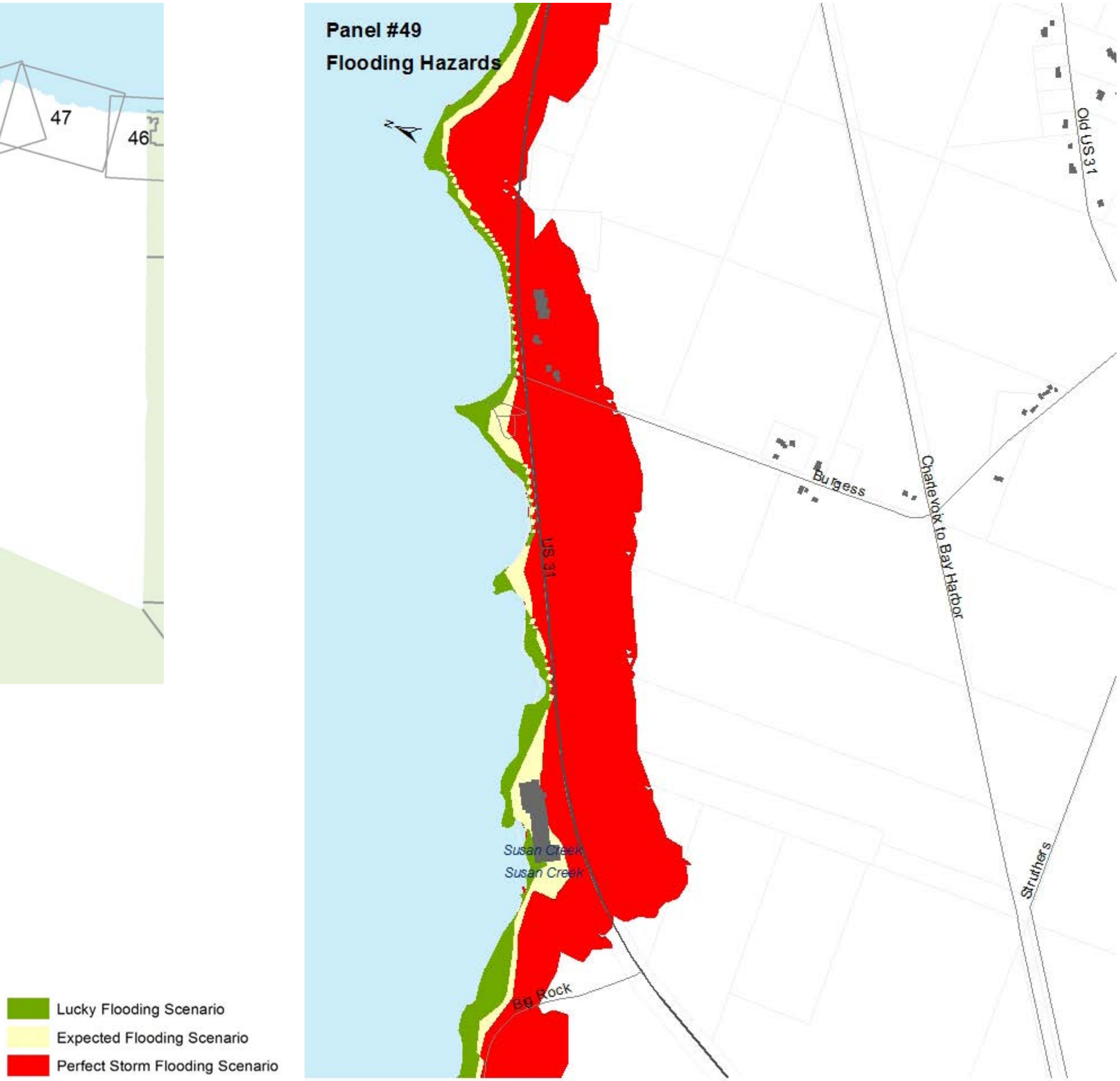
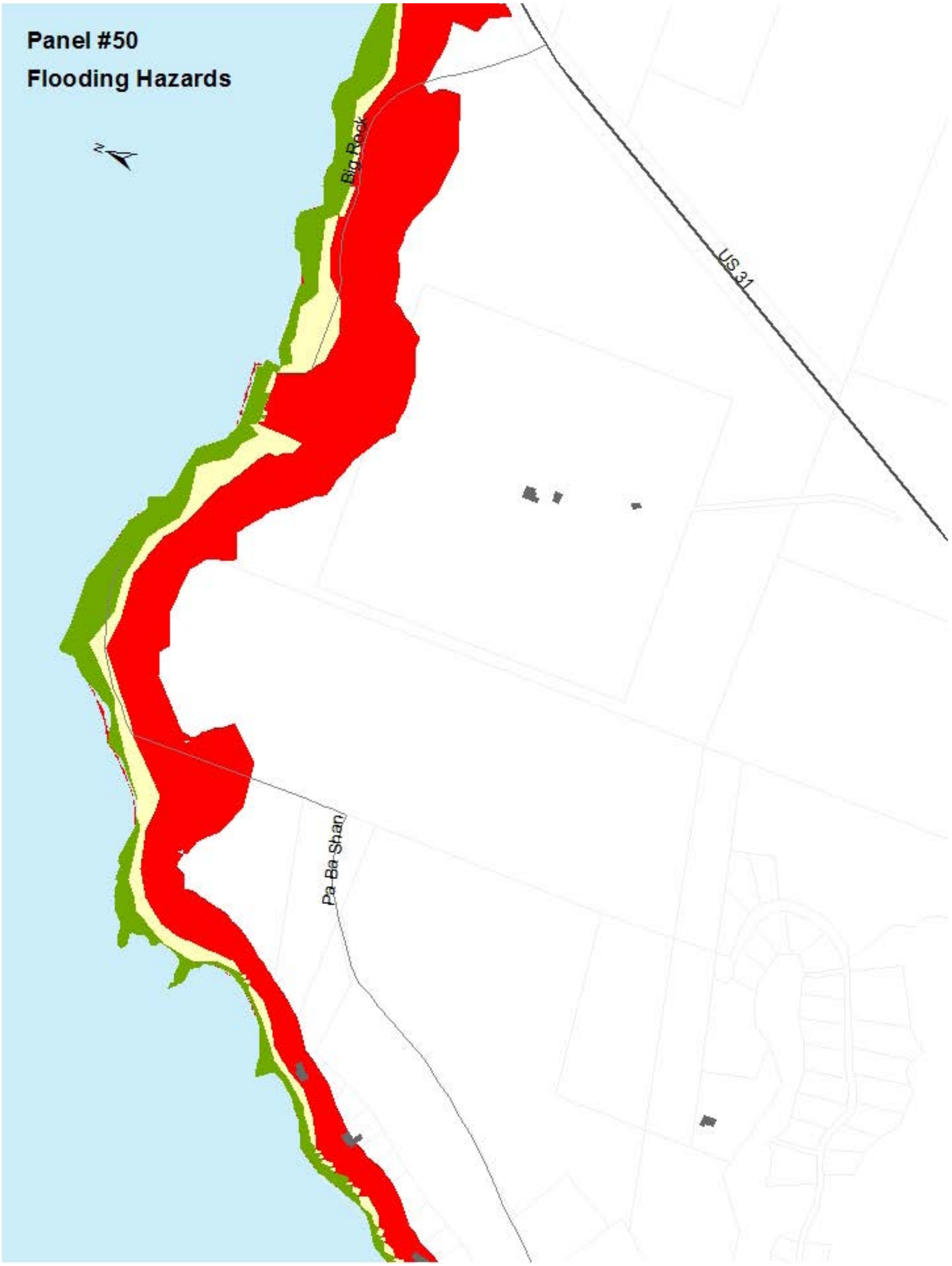
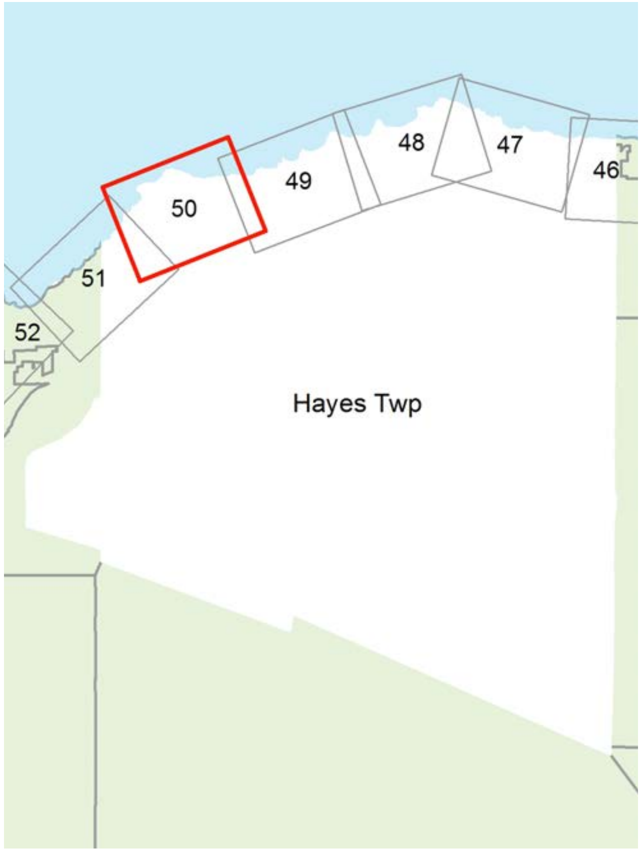
51
52
Hayes Twp

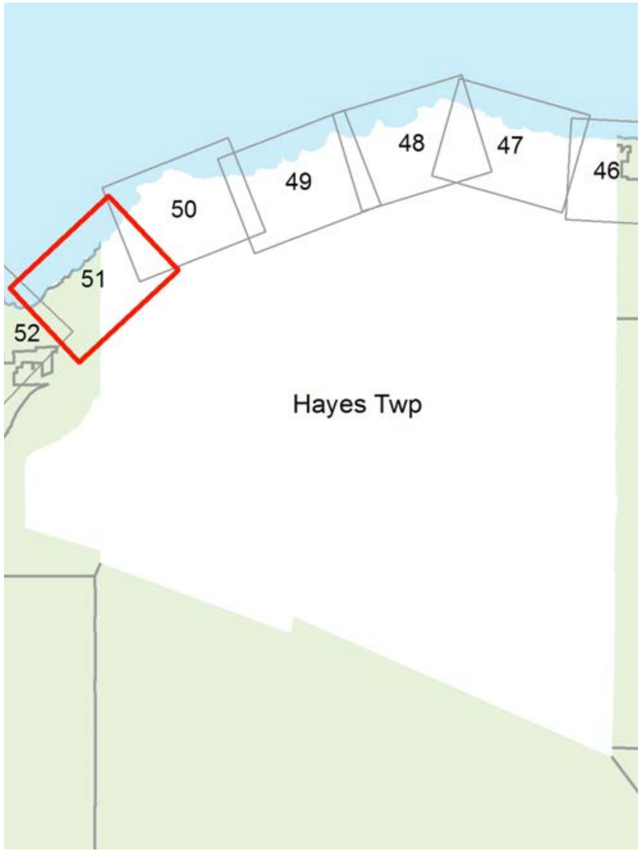

Charlevoix County


Panel #49
Flooding Hazards
Old US 31
Burgess
Charlevoix to Bay Harbor
US 31
Susan Creek
Susan Creek
Struthers
Big Rock
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario


48
47
46
49
50
51
52
Hayes Twp


Charlevoix County

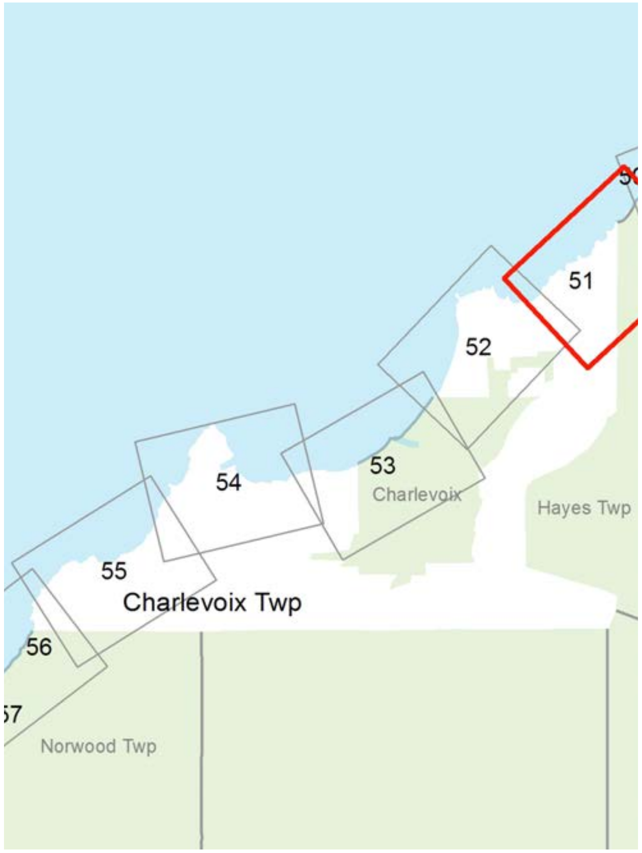

Panel #51
Flooding Hazards
N
Pa Ba Shan
Hayes Twp
Charlevoix Twp
Stonebridge
Clubhouse
Cottage
DeToro
Norton
Walker
US 31
Old Orchard
Pine Ridge
Whippoorwill
Wetsik
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Charlevoix Twp.

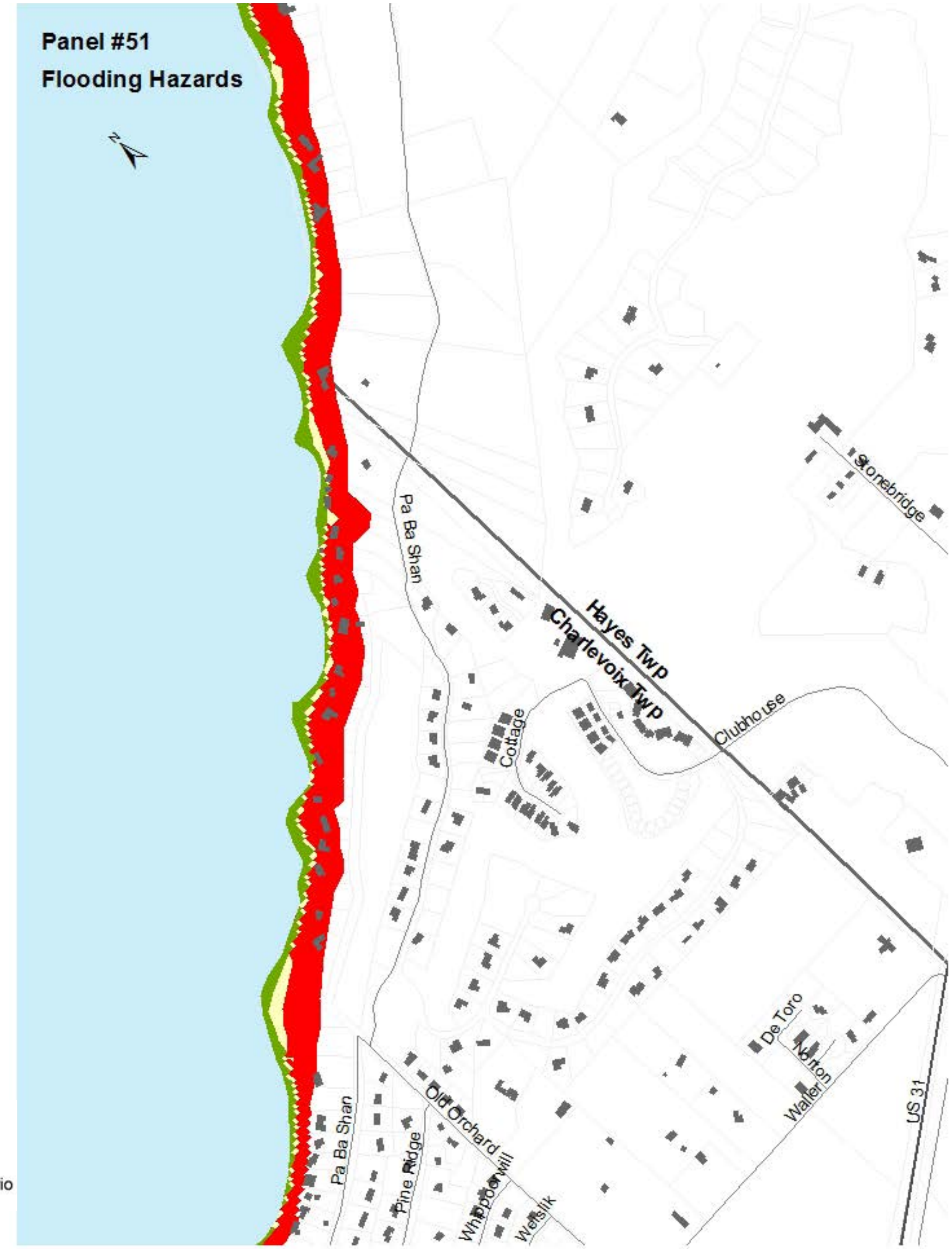
Coastal Flooding Scenario Impacts

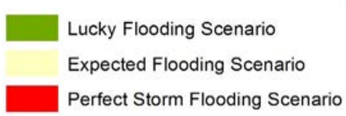
Charlevoix Twp			
Total SEV	Lucky	Expected	Perfect Storm
$ 184,155,806.00	$ 20,293,700.00	$ 47,369,000.00	$ 65,391,800.00

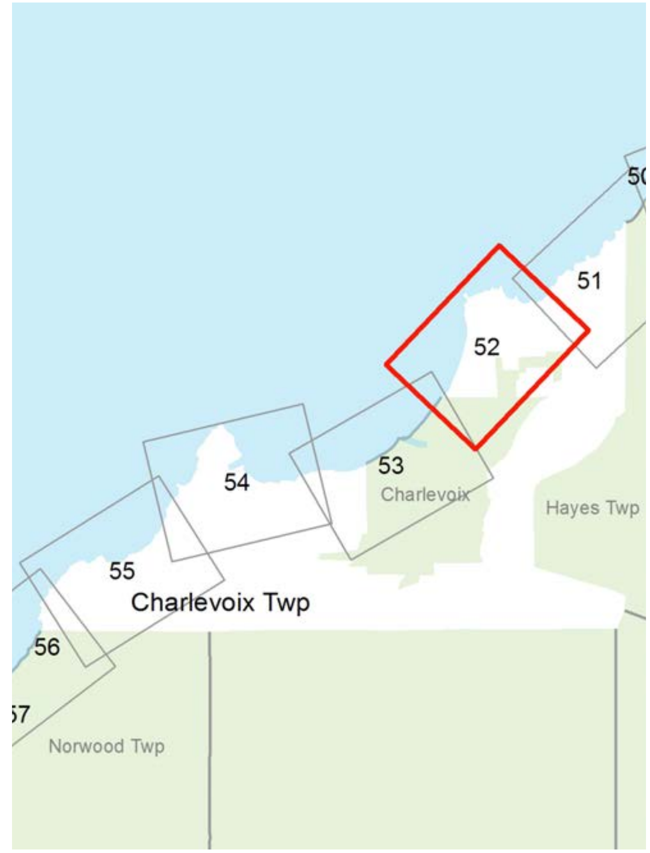
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


51
52
53
54
55
56
Charlevoix
Hayes Twp
Charlevoix Twp
Norwood Twp

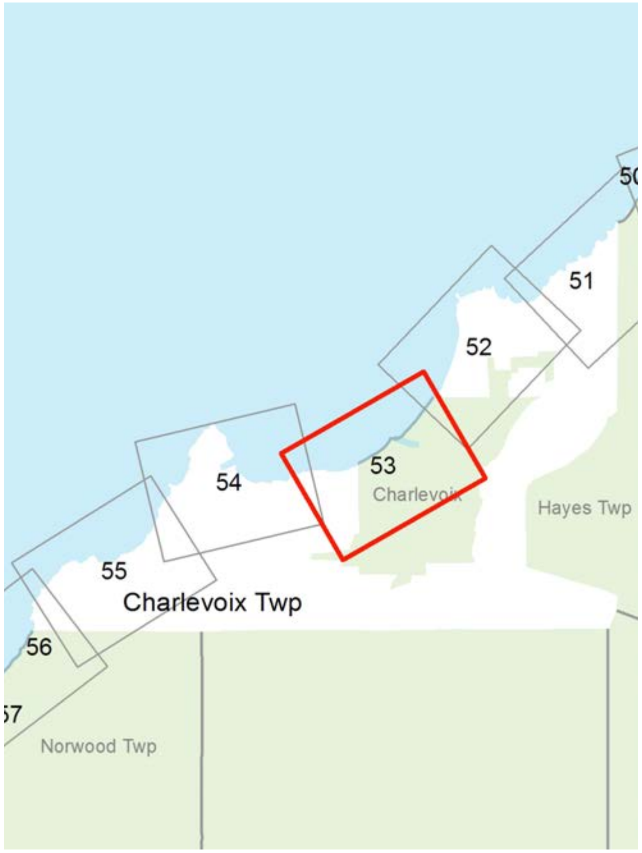

Charlevoix County


Panel #51
Flooding Hazards
Pa Ba Shan
Hayes Twp
Charlevoix Twp
Stonebridge
Clubhouse
Cottage
De Toro
Norton
Walter
US 31
Pine Ridge
Old Orchard
Whippoorwill
Wetstik

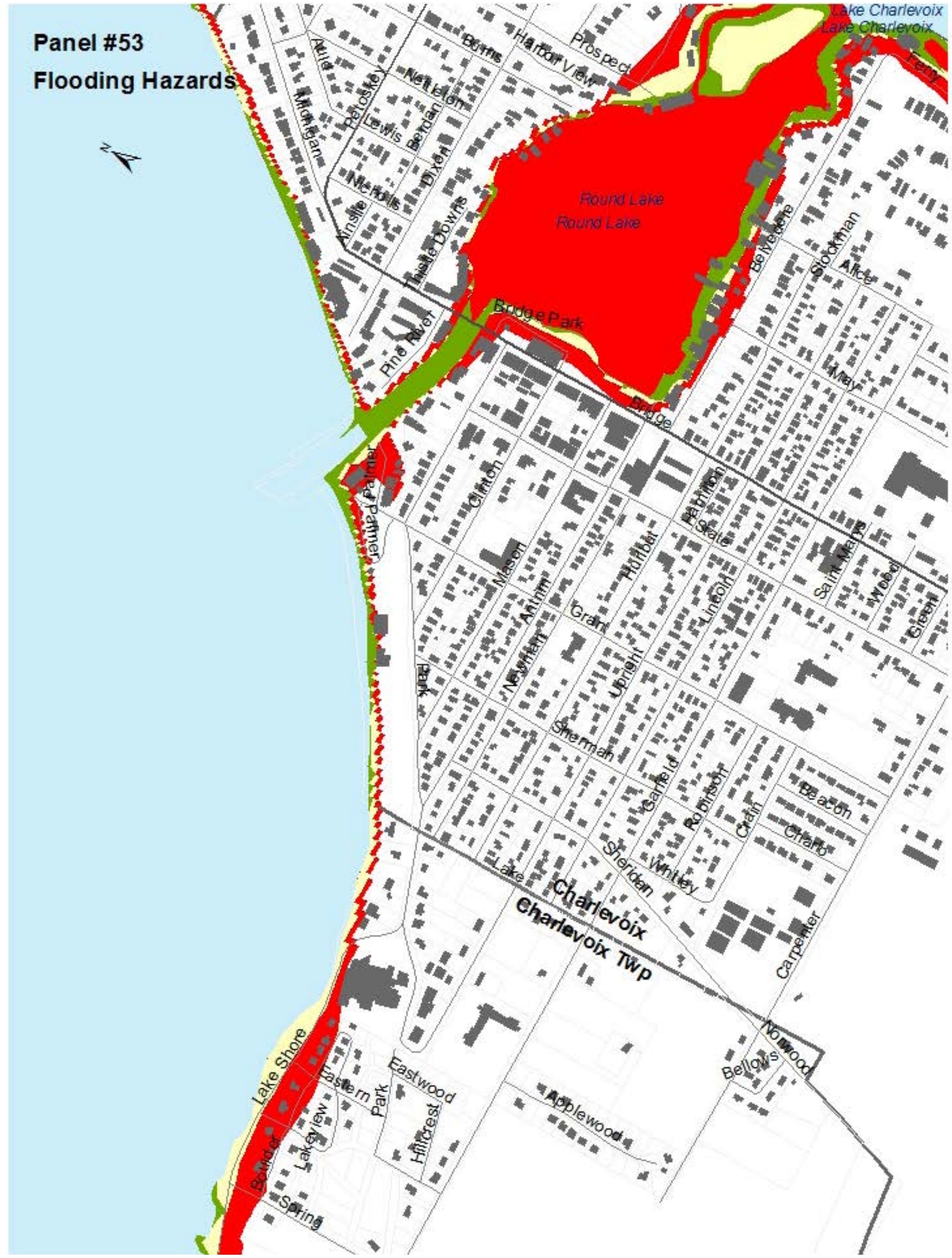

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



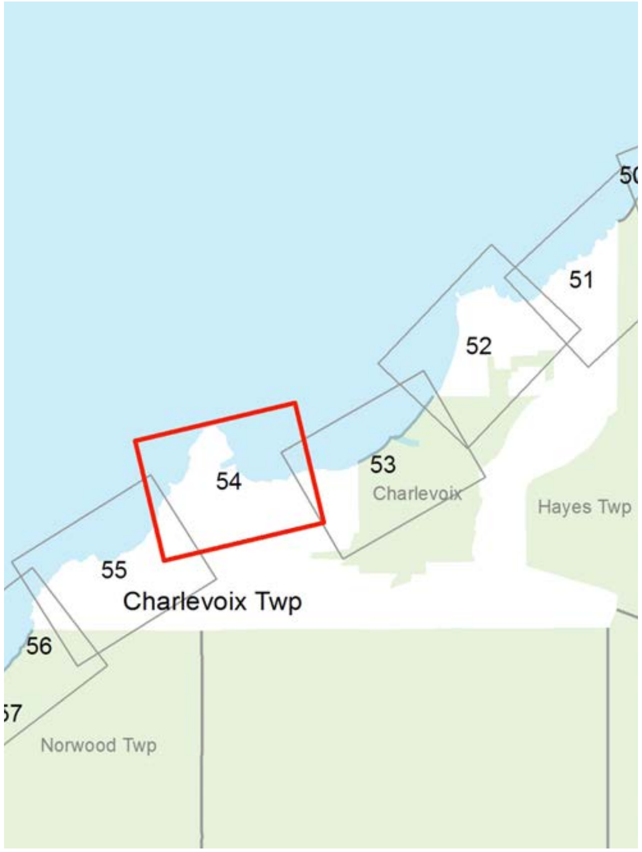
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



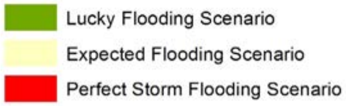
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

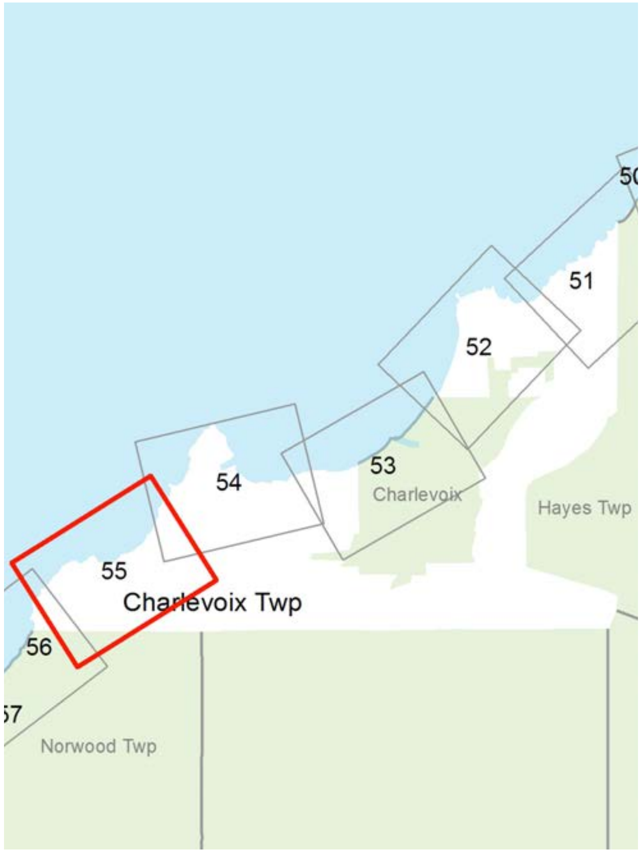



Panel #54
Flooding Hazards
Lake Shore
Spring
Garfield
Lake Shore
Bells Bay

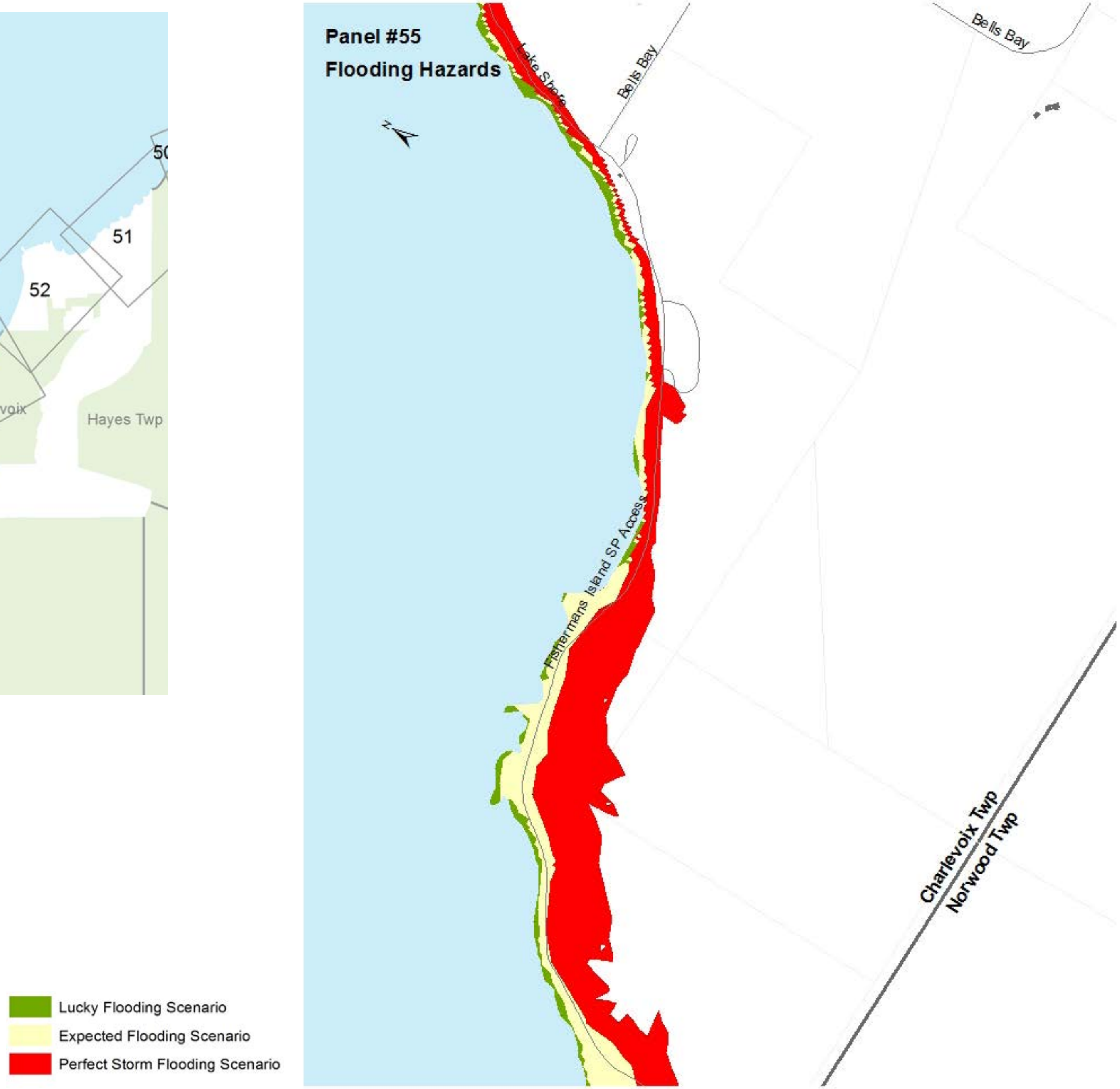

50
51
52
53
54
55
56
57
Charlevoix
Hayes Twp
Charlevoix Twp
Norwood Twp

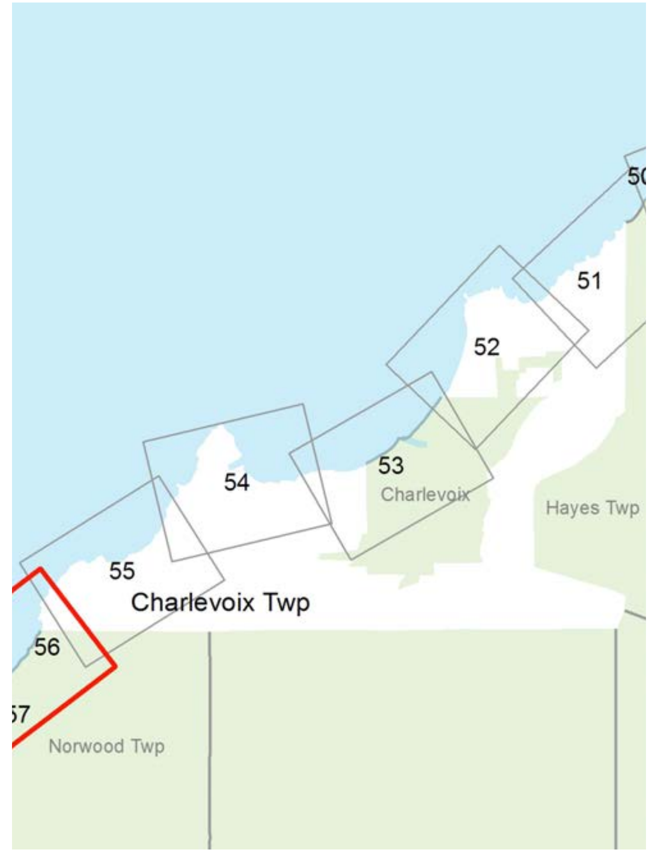

Charlevoix County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


50
51
52
53
54
55
56
57
Charlevoix
Hayes Twp
Charlevoix Twp
Norwood Twp


Charlevoix County


Panel #55
Flooding Hazards
Lake Shore
Bells Bay
Bells Bay
Fishermans Island SP Access
Charlevoix Twp
Norwood Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

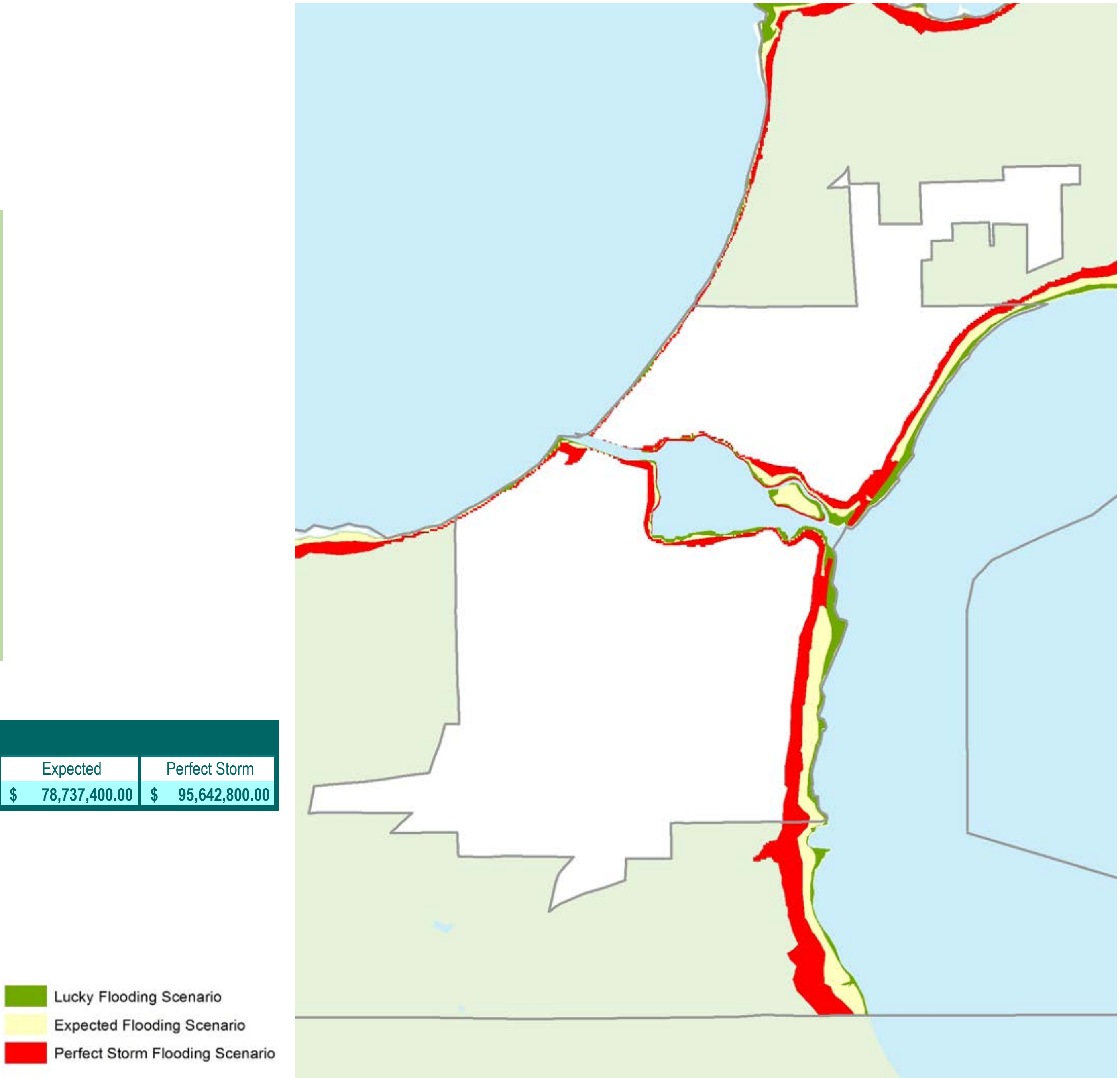


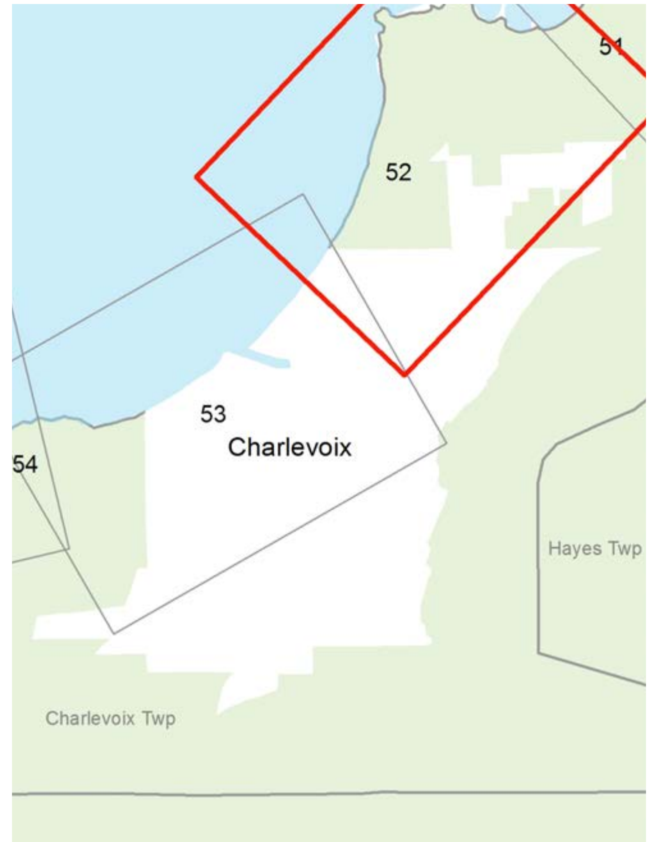
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Charlevoix

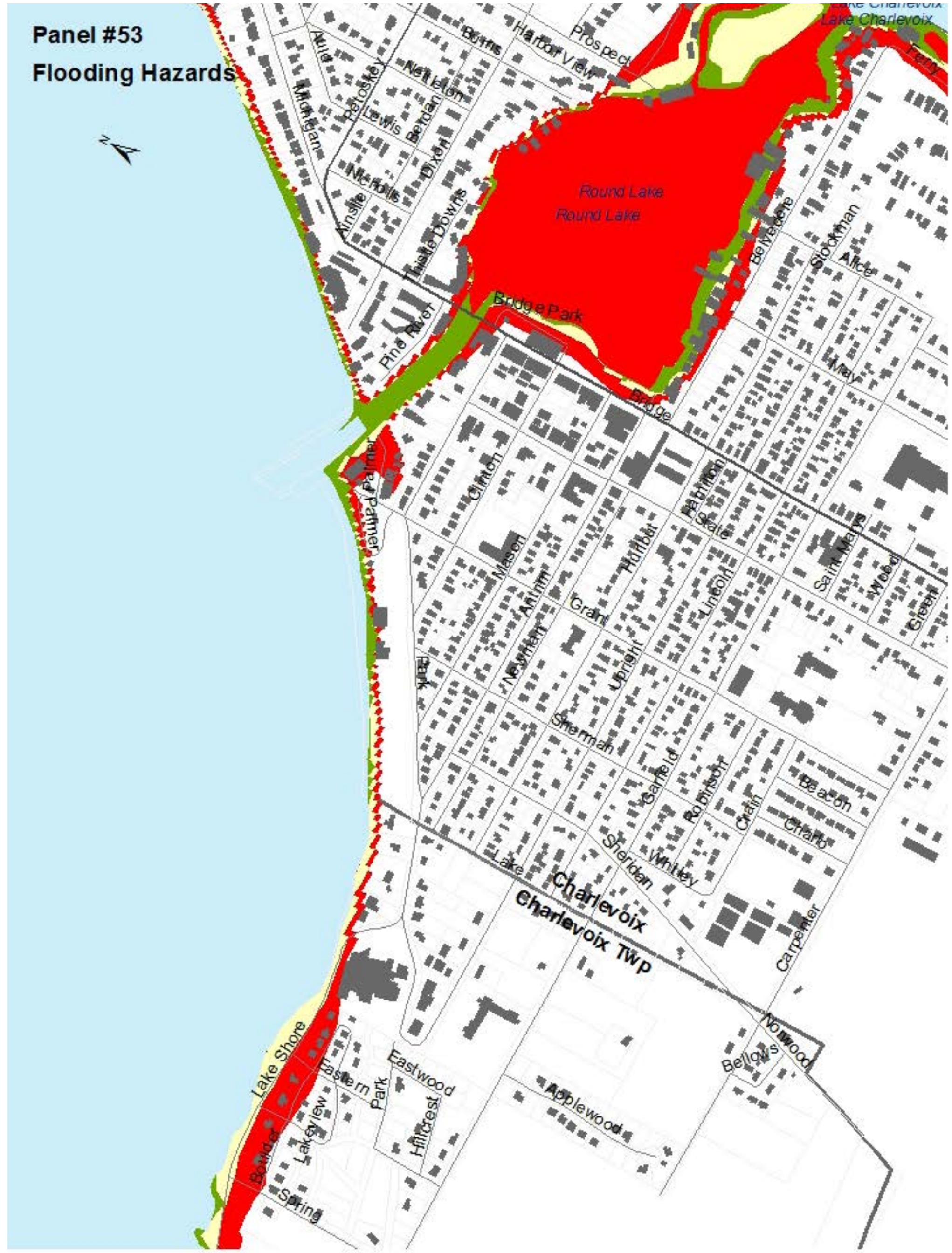
Coastal Flooding Scenario Impacts

Charlevoix			
Total SEV	Lucky	Expected	Perfect Storm
$ 299,884,200.00	$ 56,982,500.00	$ 78,737,400.00	$ 95,642,800.00





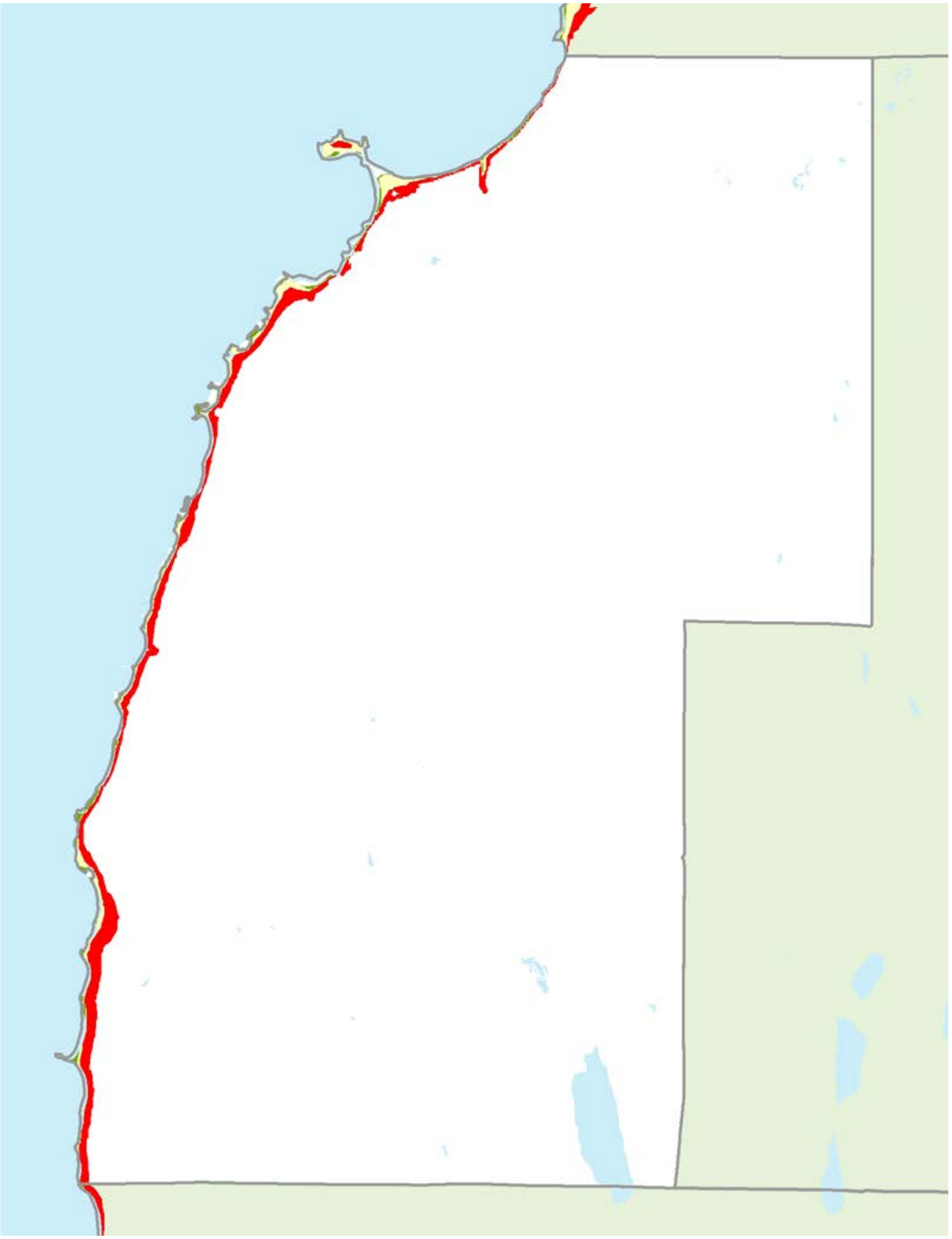
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario

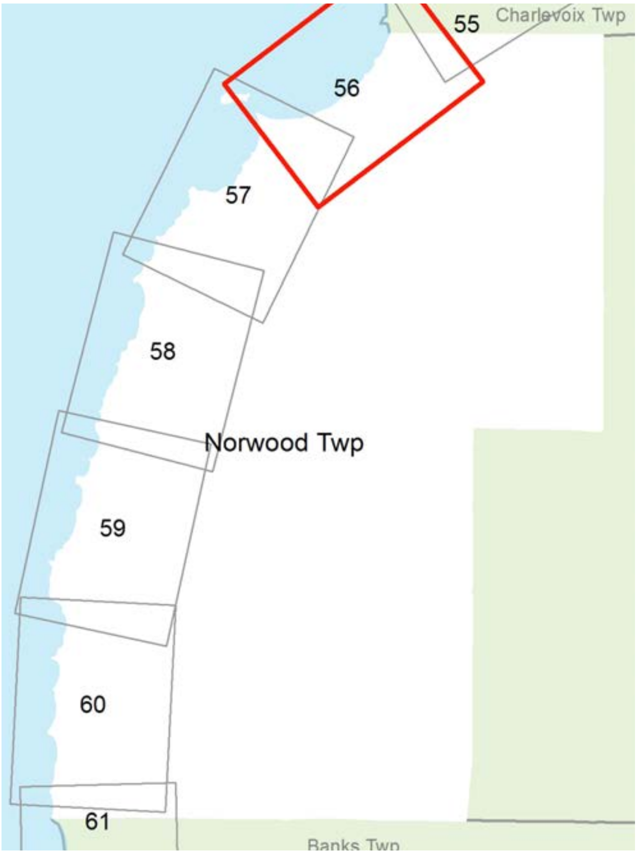


Norwood Twp.

Coastal Flooding Scenario Impacts

Norwood			
Total SEV	Lucky	Expected	Perfect Storm
$ 74,451,950.00	$ -	$ 1,924,900.00	$ 17,795,900.00

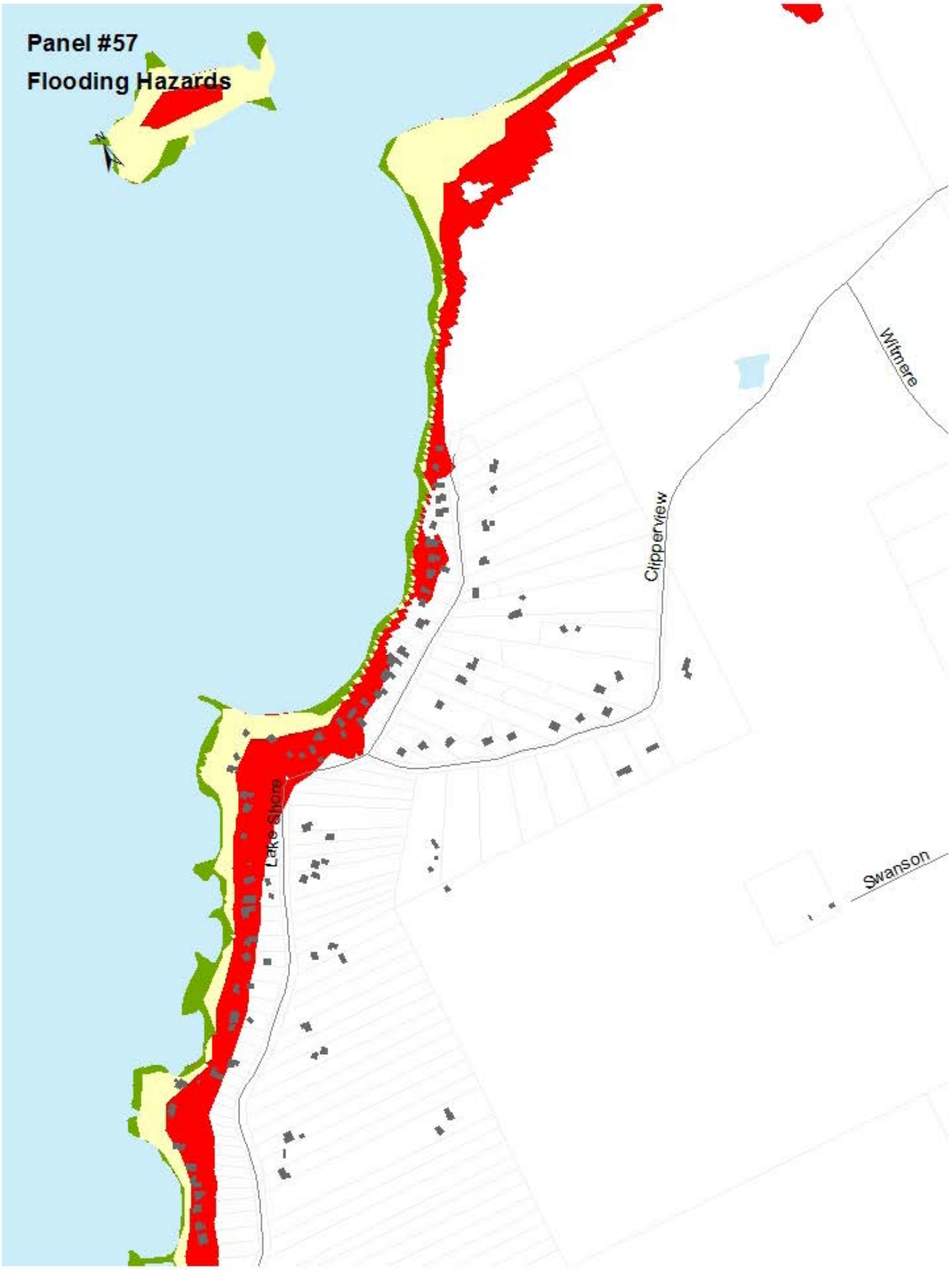
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

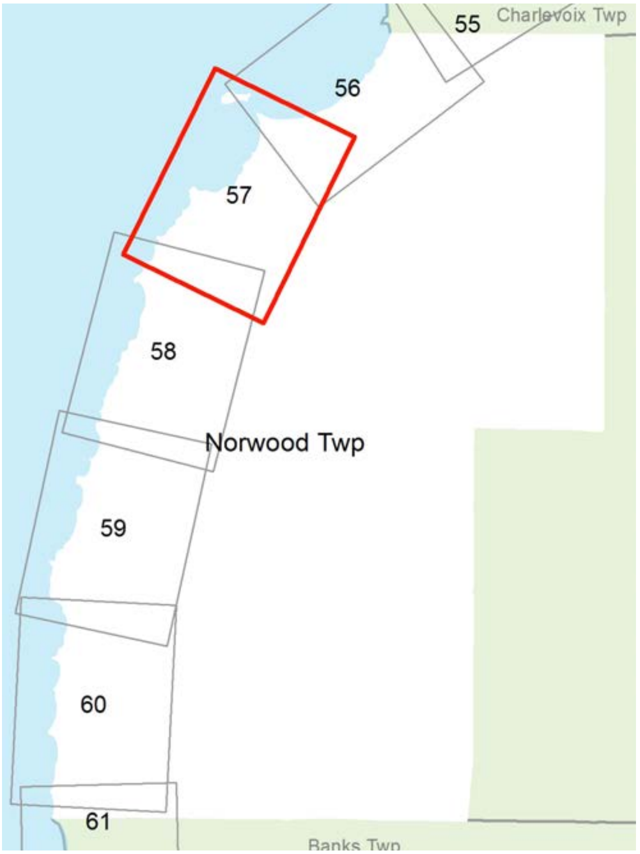

55
Charlevoix Twp
56
57
58
Norwood Twp
59
60
61
Banks Twp


Charlevoix County

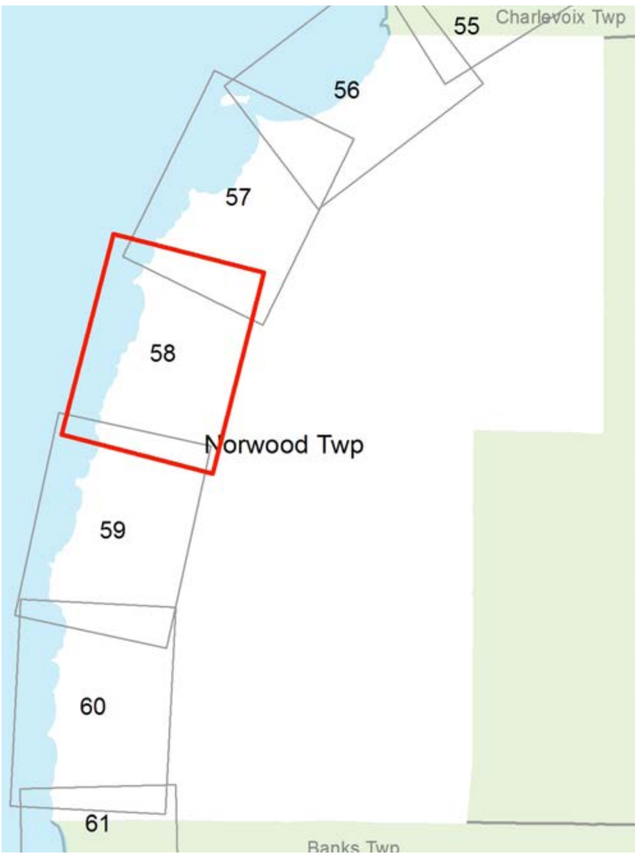

Panel #56
Flooding Hazards
Charlevoix Twp
Norwood Twp
Fishermans Island SP Cmpgrnd
Fishermans Island SP Access
Clipperview
Witmere

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



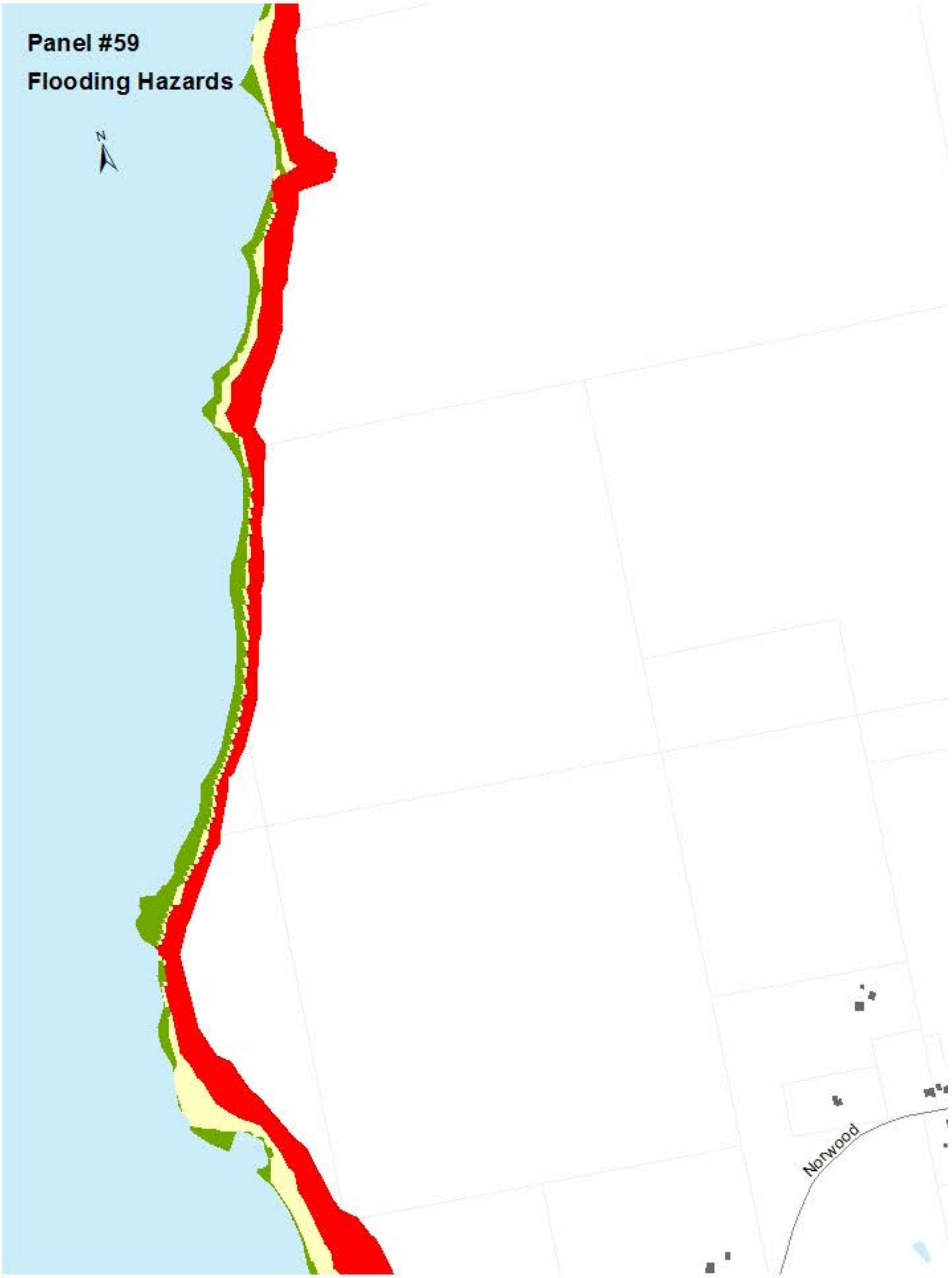


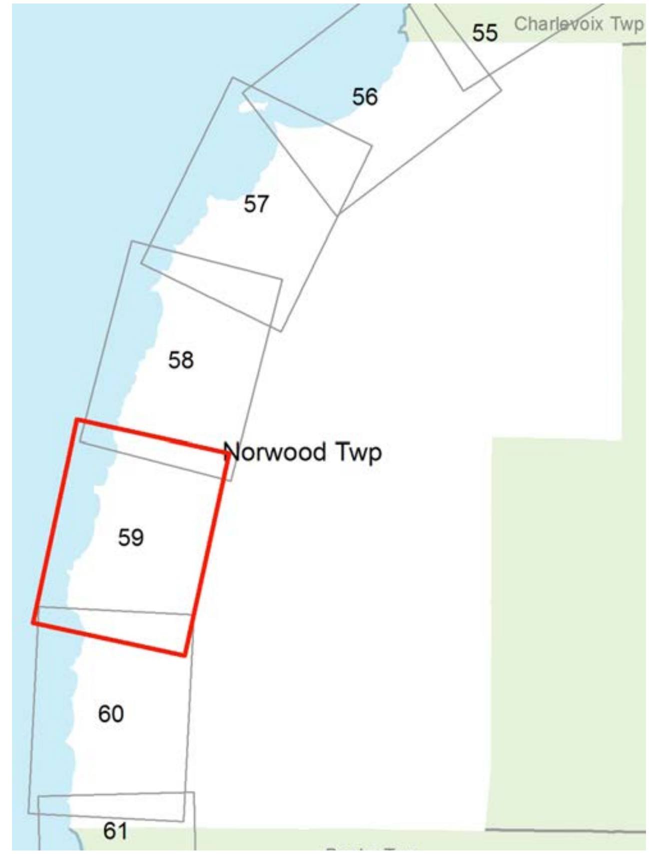
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


55
Charlevoix Twp
56
57
58
Norwood Twp
59
60
61
Banks Twp

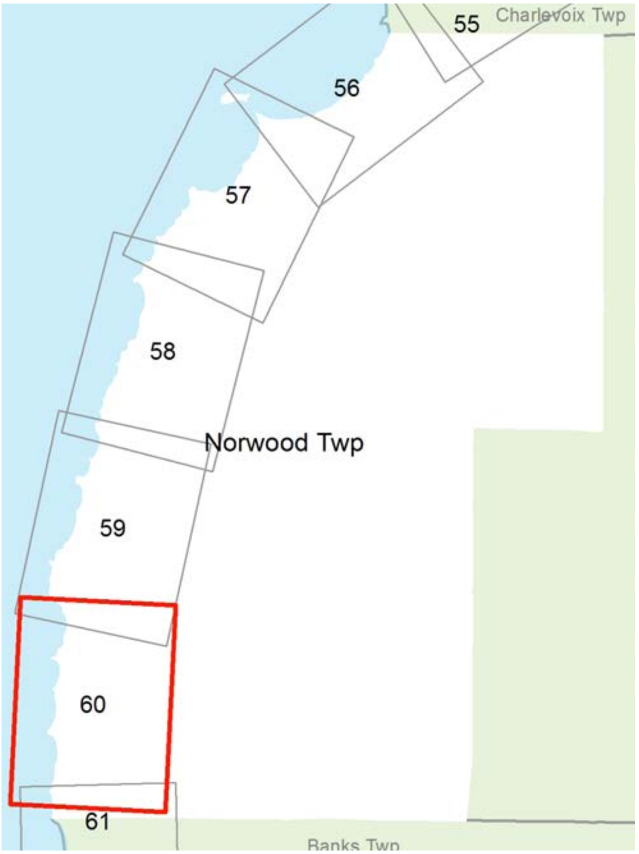

Charlevoix County

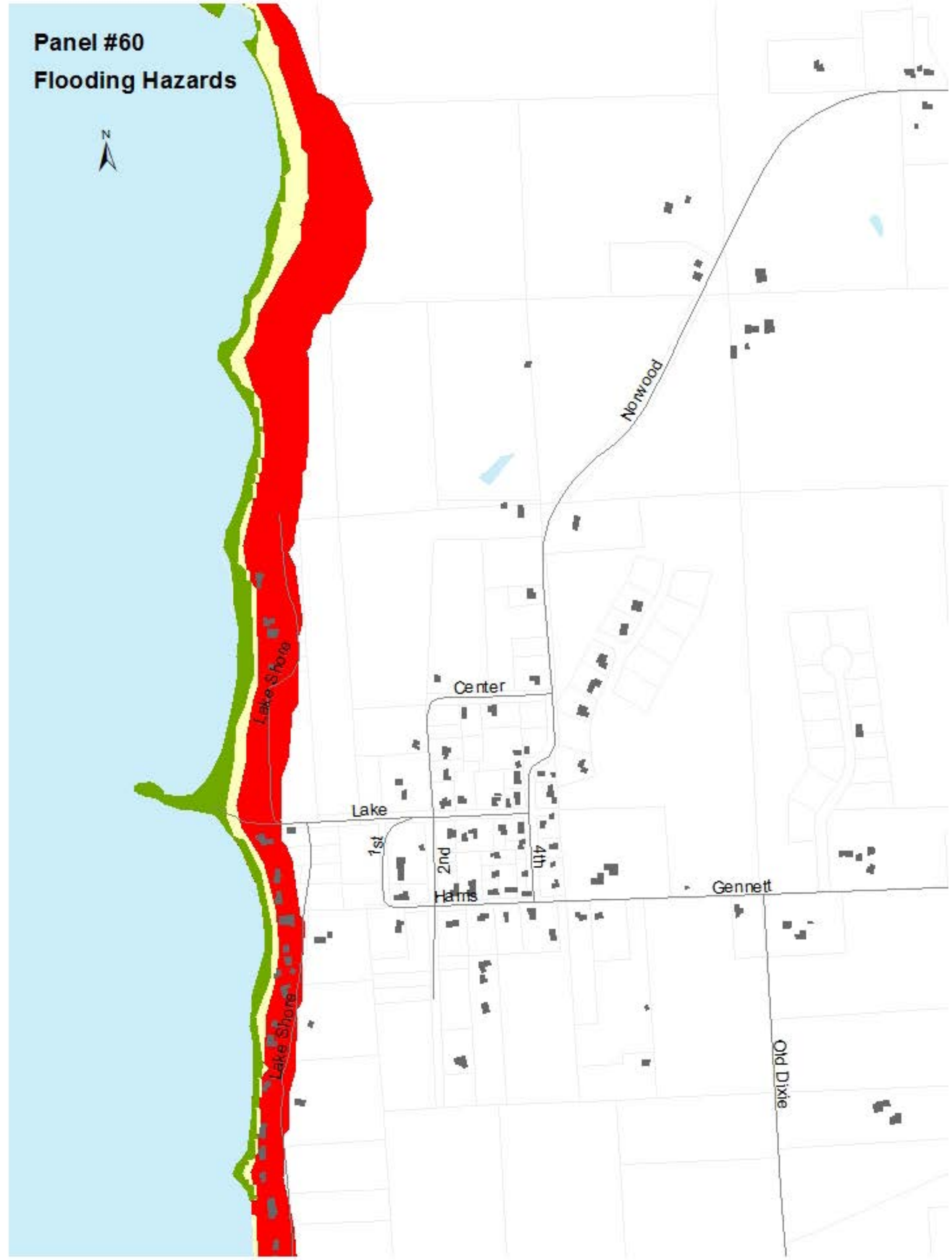

Panel #58
Flooding Hazards
N
Lake Shore
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

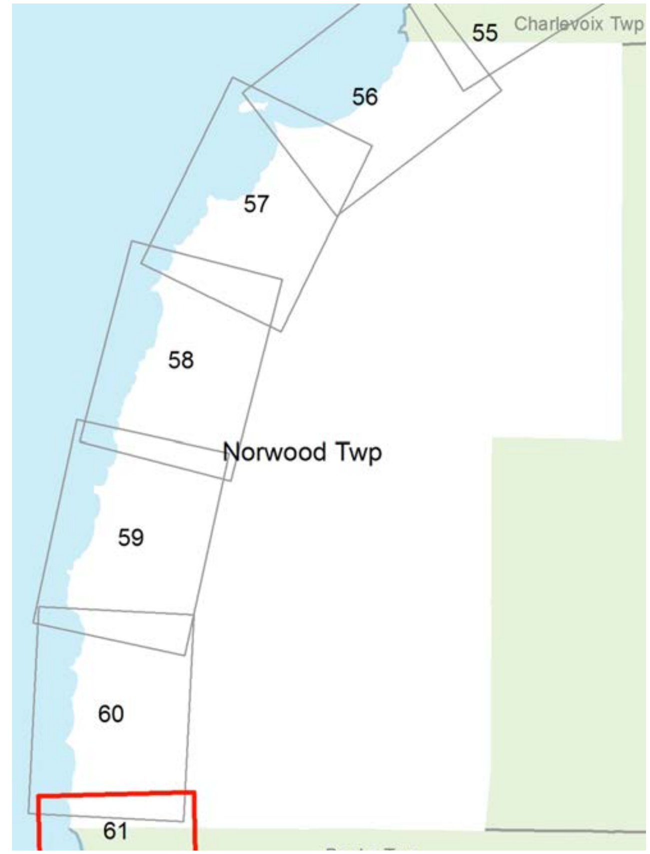




Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario

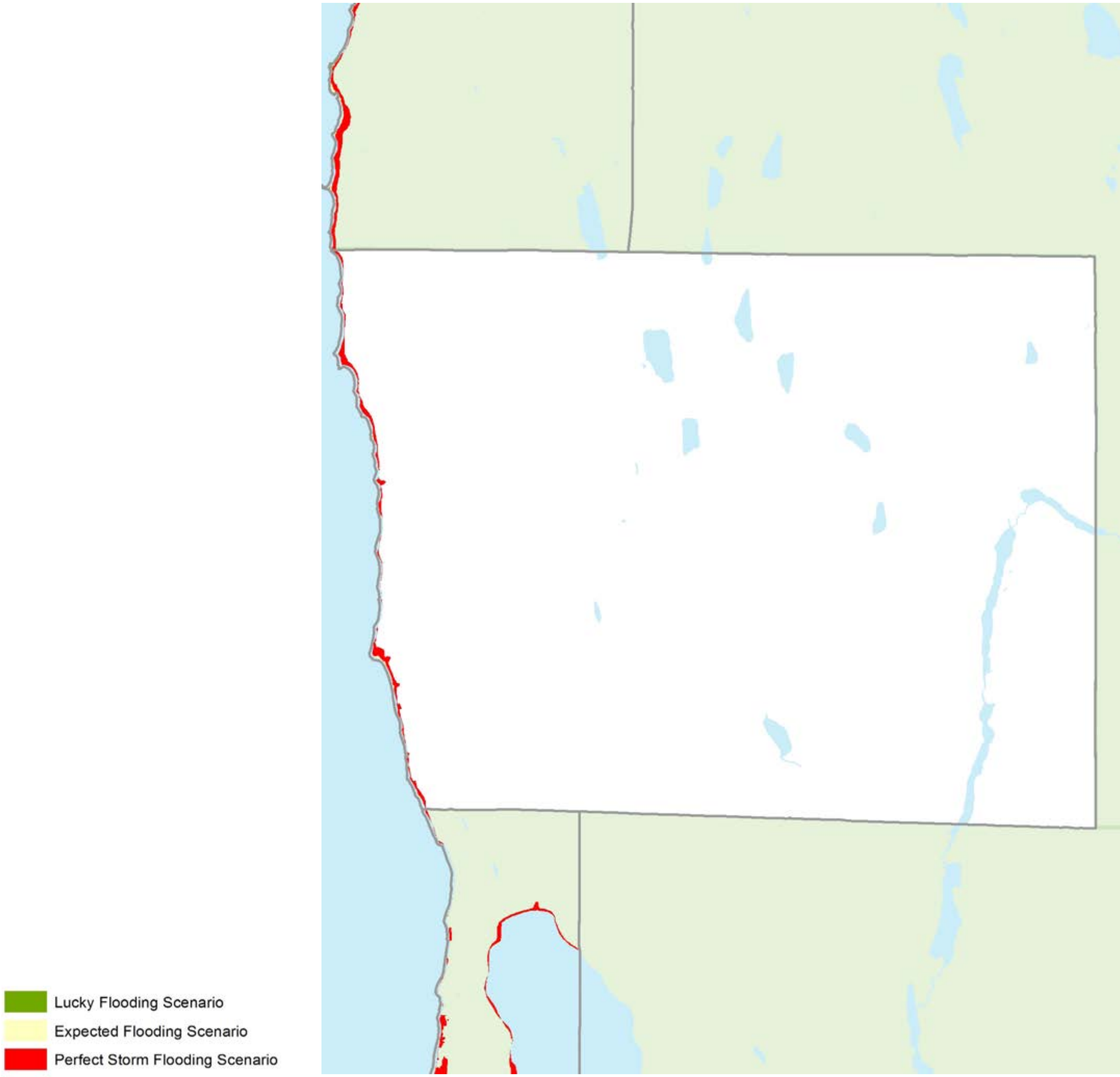


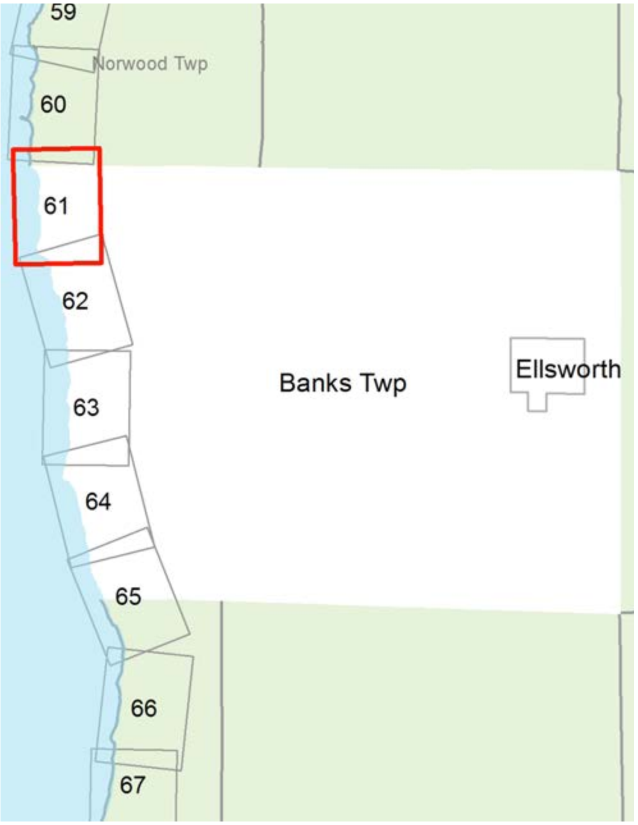
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Antrim County

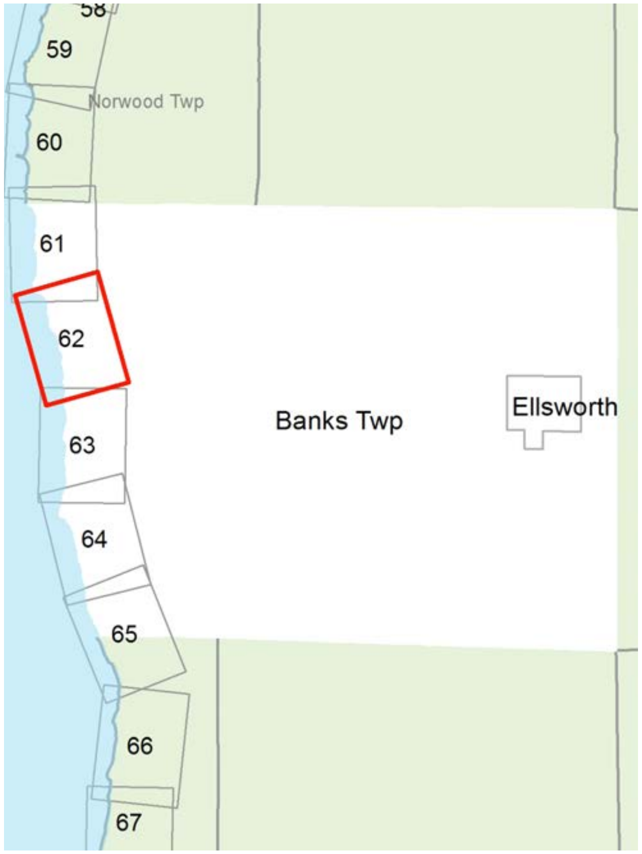
Banks Twp.


Antrim County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

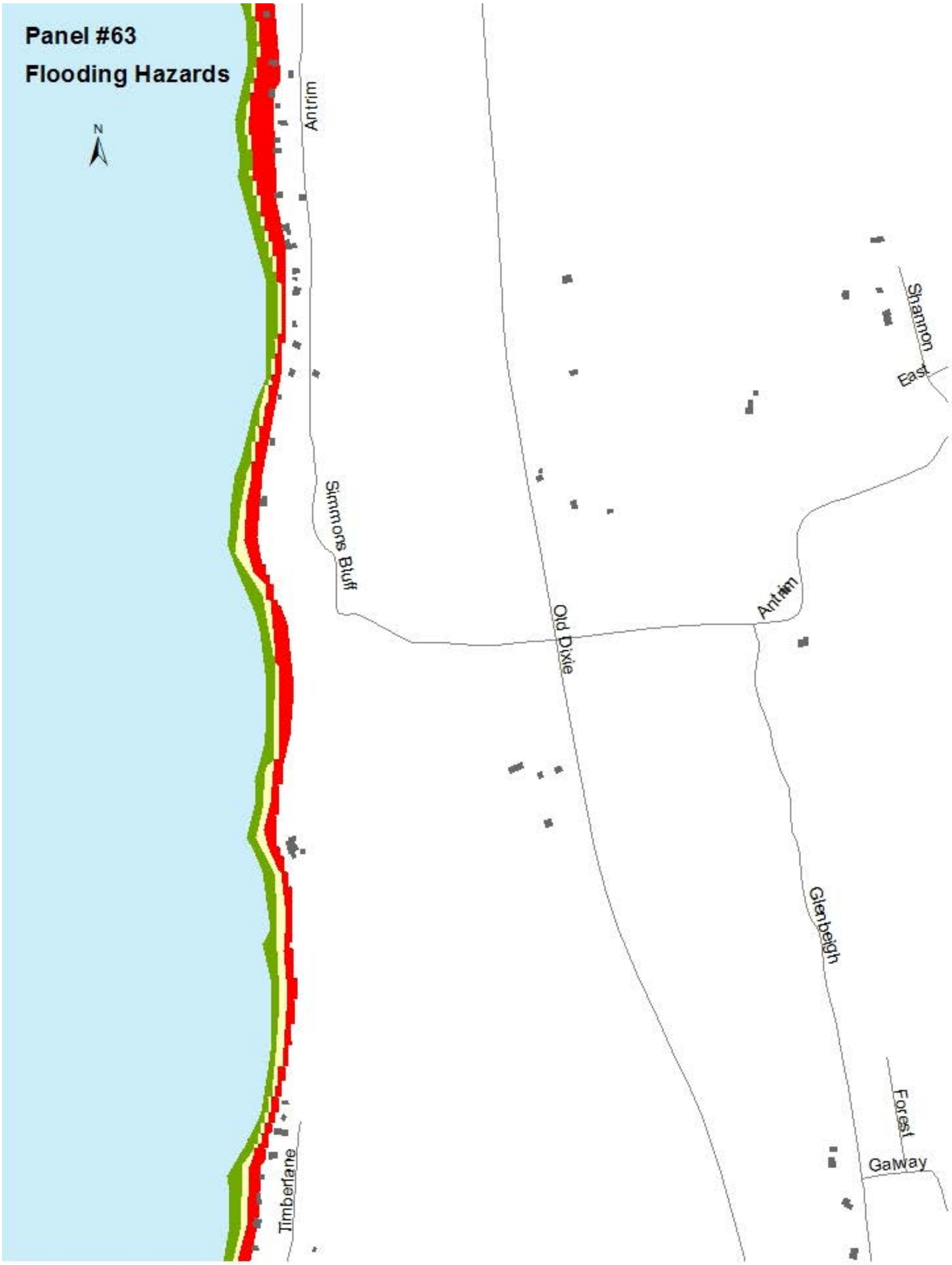


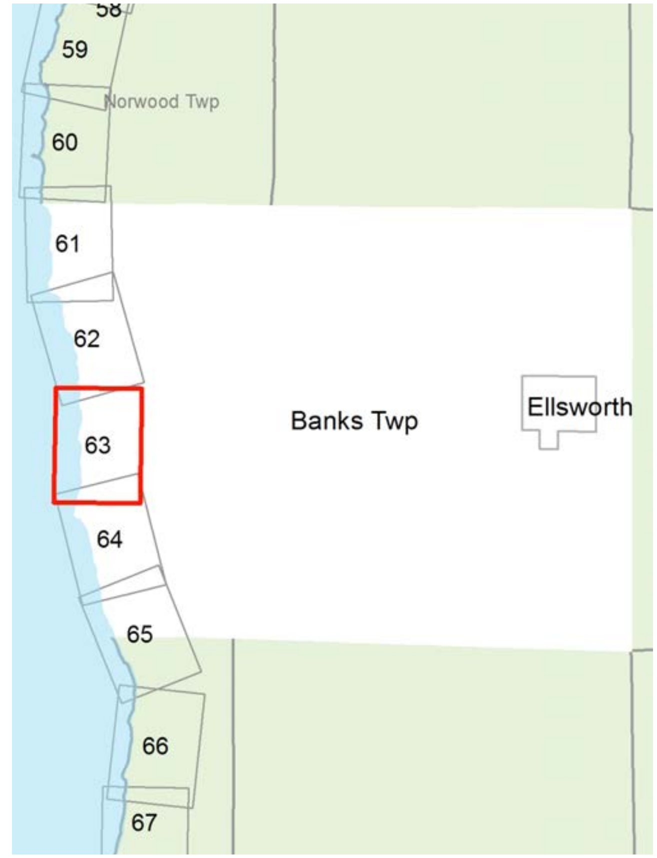
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


58
59
Norwood Twp
60
61
62
Banks Twp
Ellsworth
63
64
65
66
67

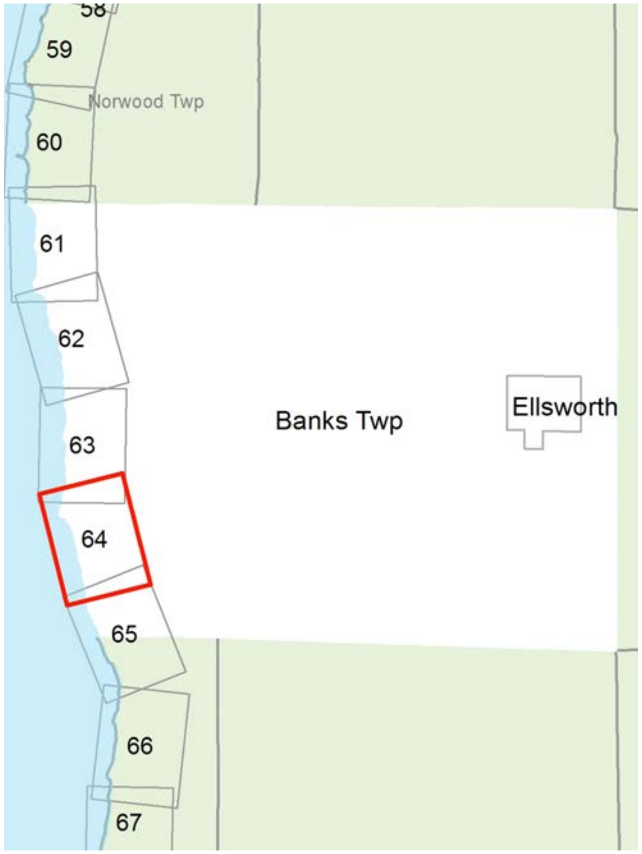

Antrim County


Panel #62
Flooding Hazards
N
Brinkers
Banks Twp Park
Old Dixie
Rex Beach
Brant
Tyrrell Beach
Antrim
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

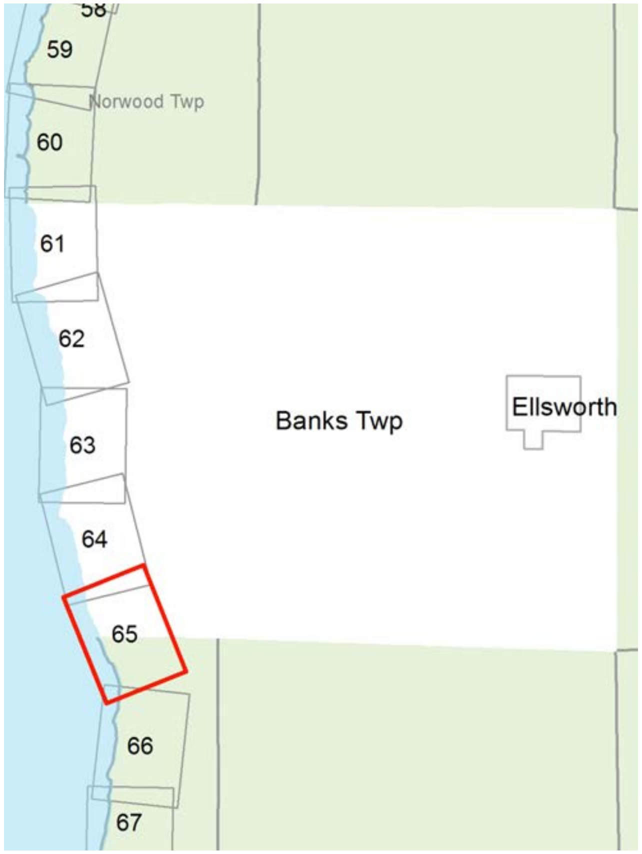




Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

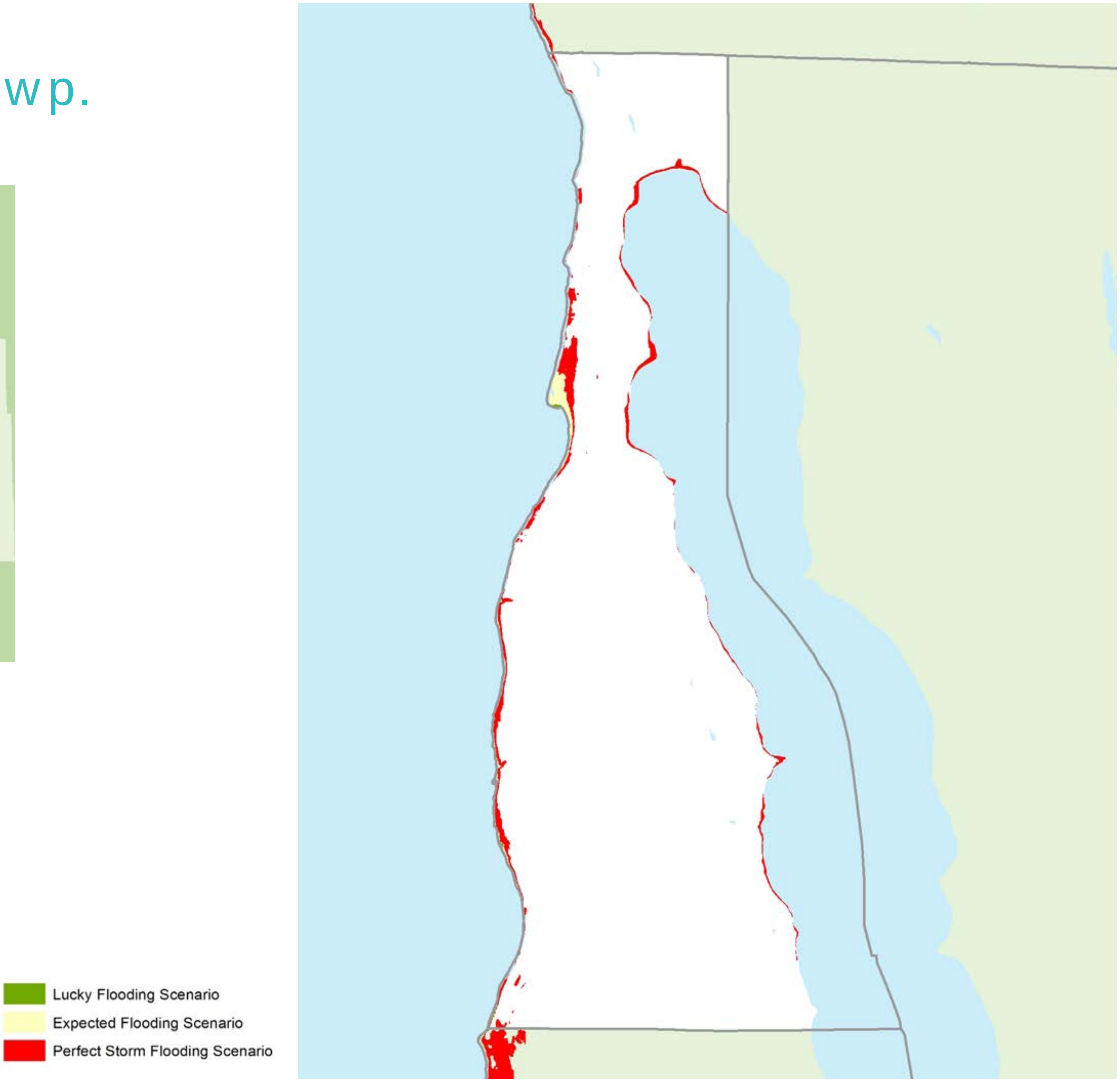


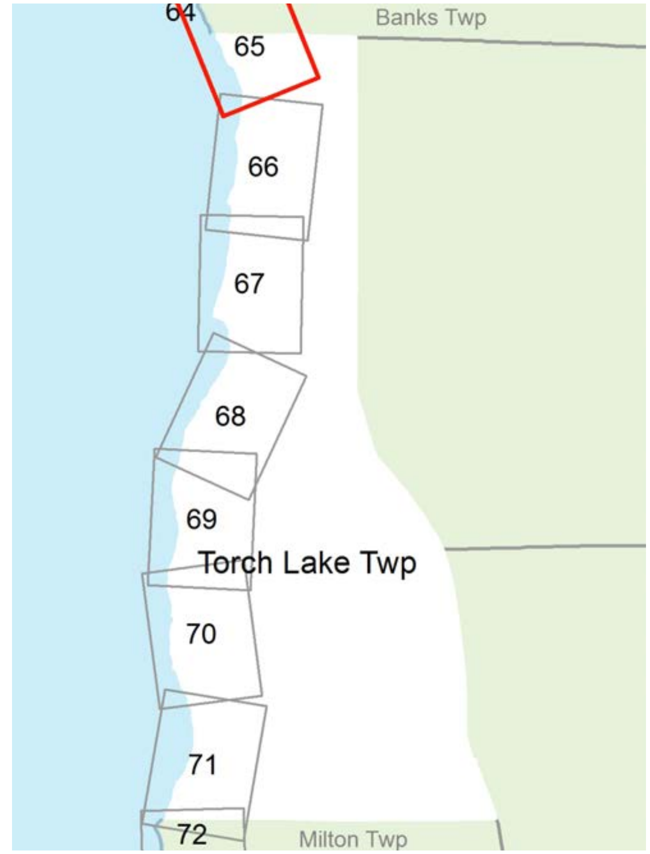
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



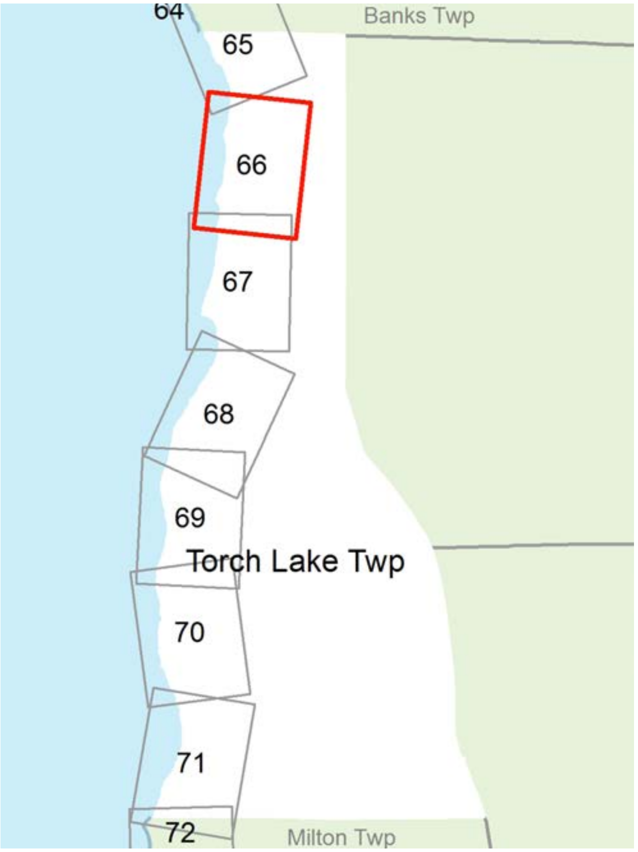
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Torch Lake Twp.

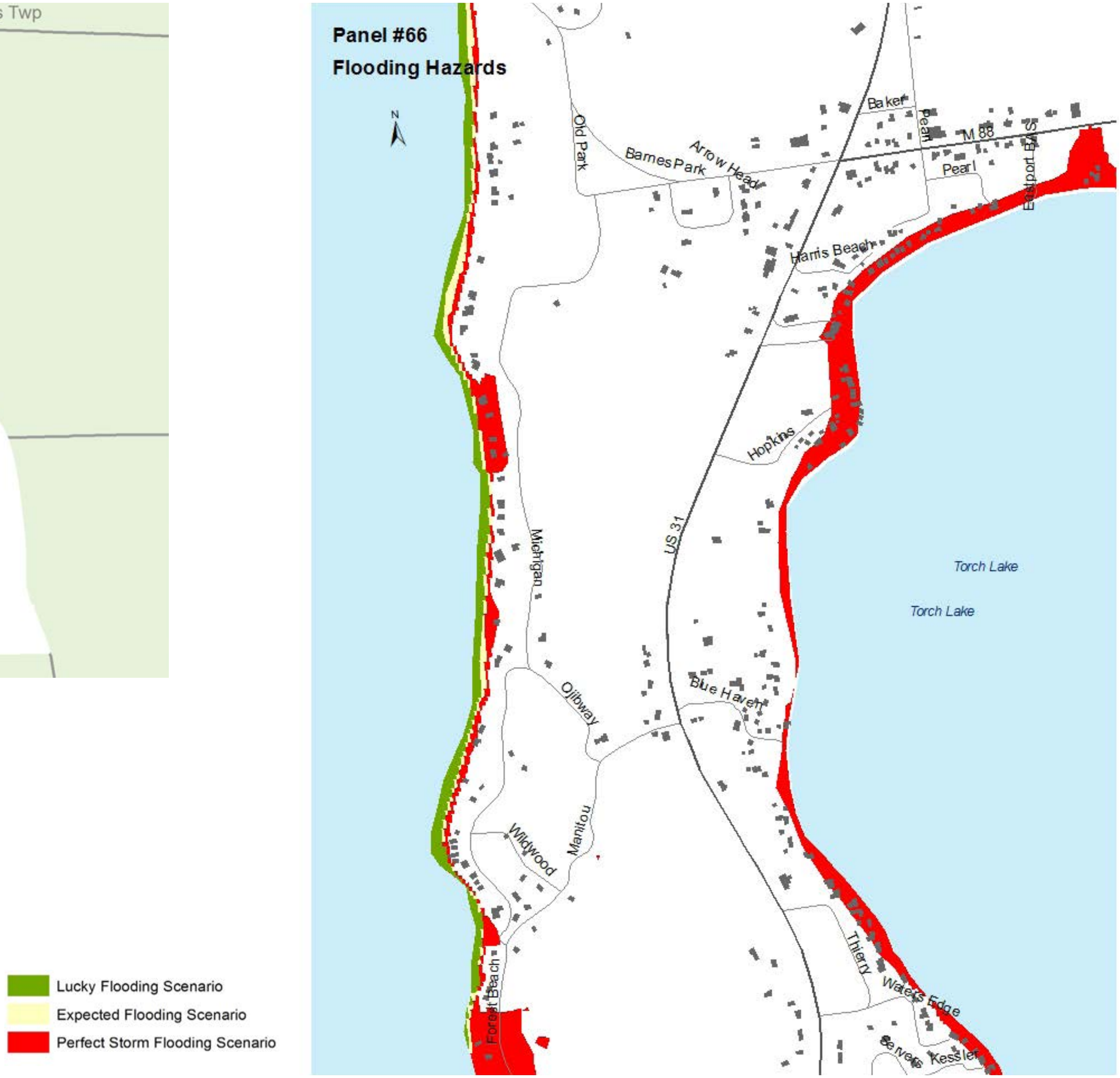


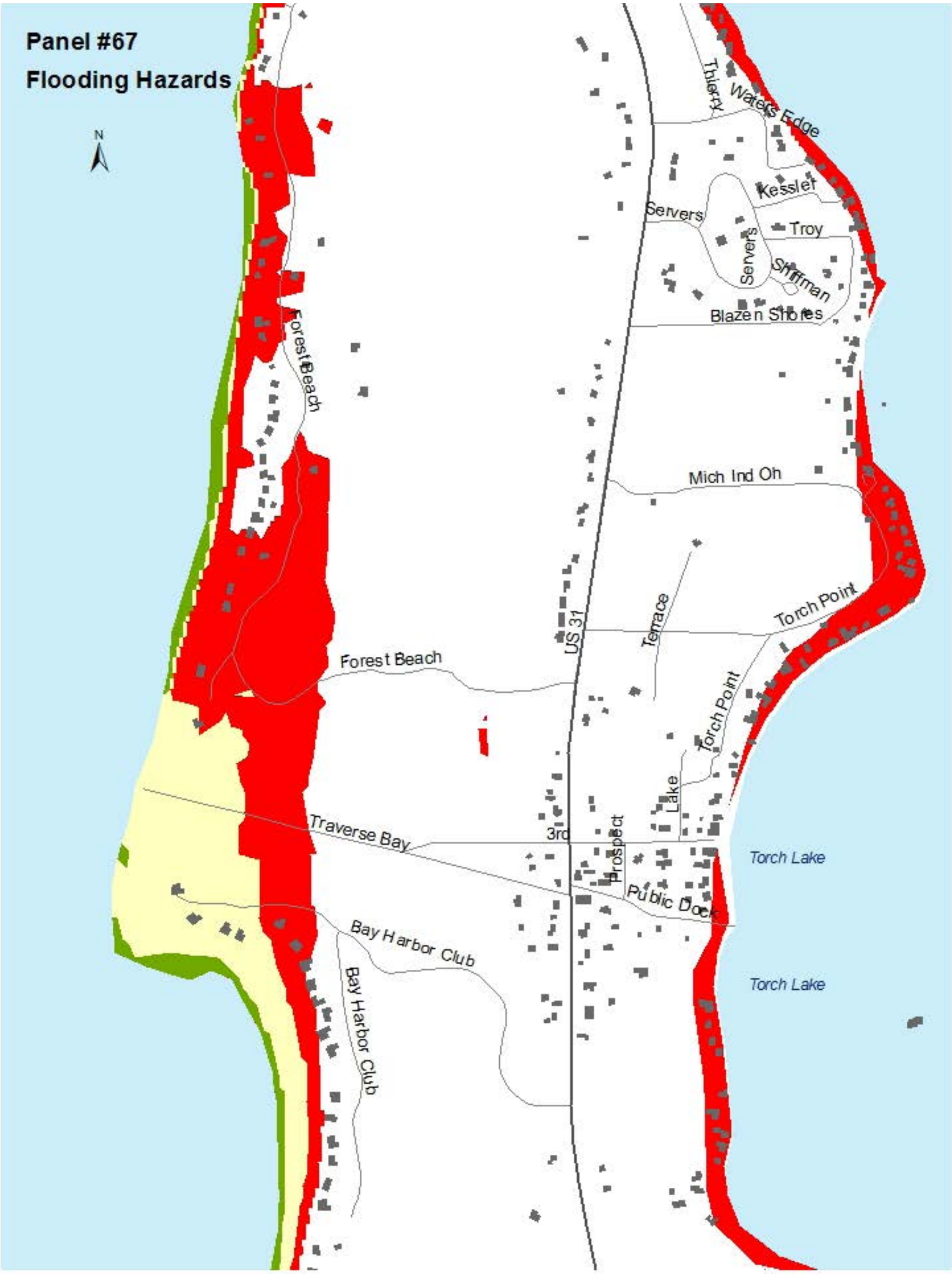


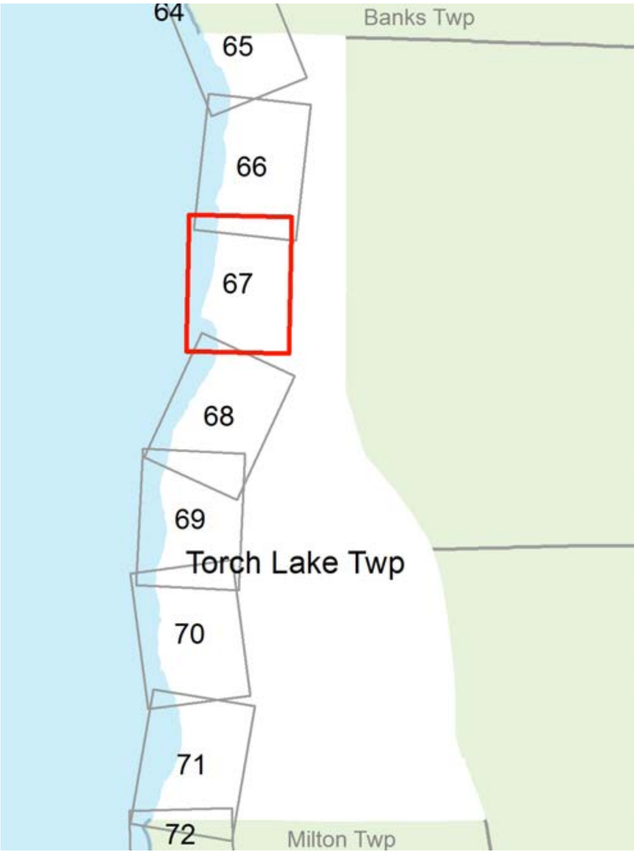
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


64
65
Banks Twp
66
67
68
69
Torch Lake Twp
70
71
72
Milton Twp

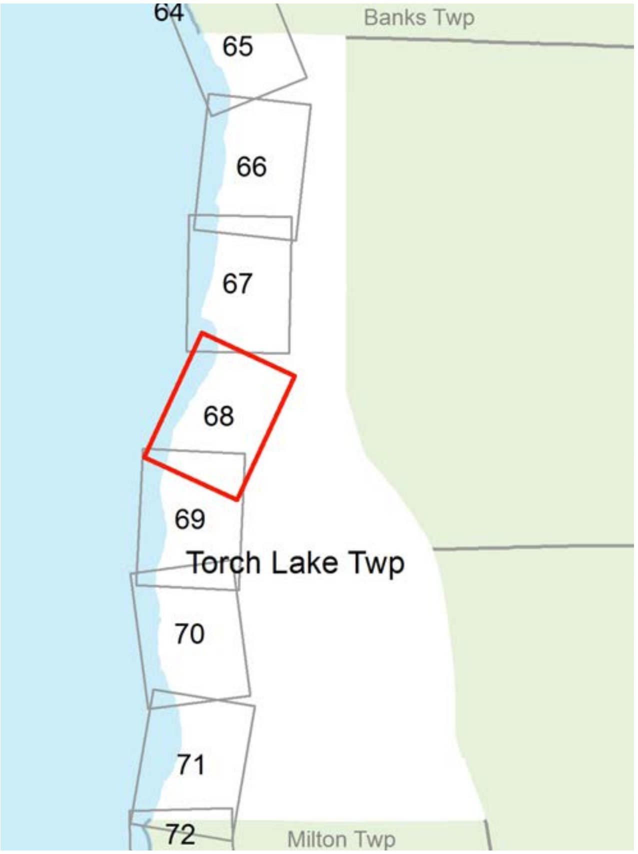

Antrim County


Panel #66
Flooding Hazards
N
Old Park
Barnes Park
Arrow Head
Baker
Pearl
M 88
Pearl
Eastport B/S
Harris Beach
Hopkins
Michigan
US 31
Torch Lake
Torch Lake
Ojibway
Blue Haven
Wildwood
Manitou
Forest Beach
Thierry
Waters Edge
Kessler
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



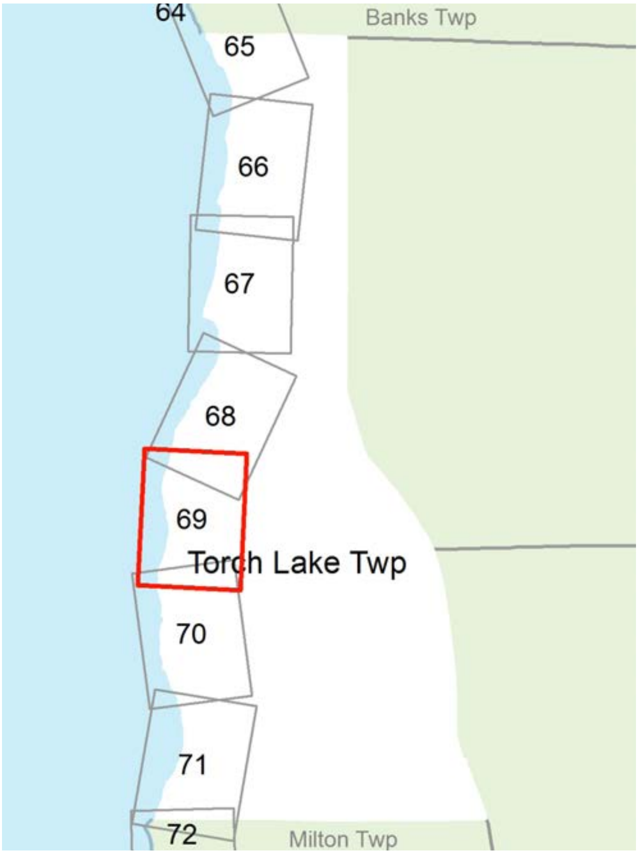


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

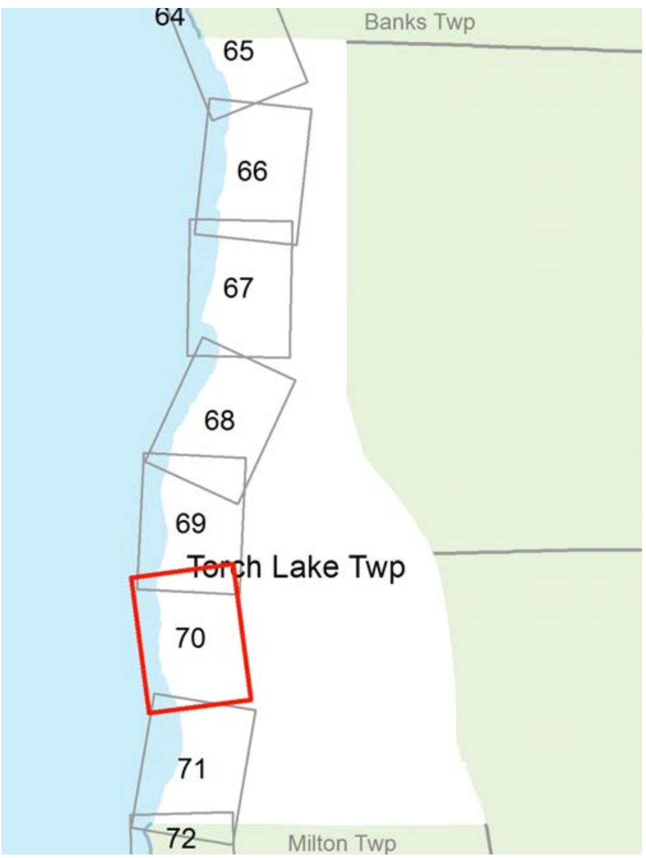

64
65
Banks Twp
66
67
68
69
Torch Lake Twp
70
71
72
Milton Twp

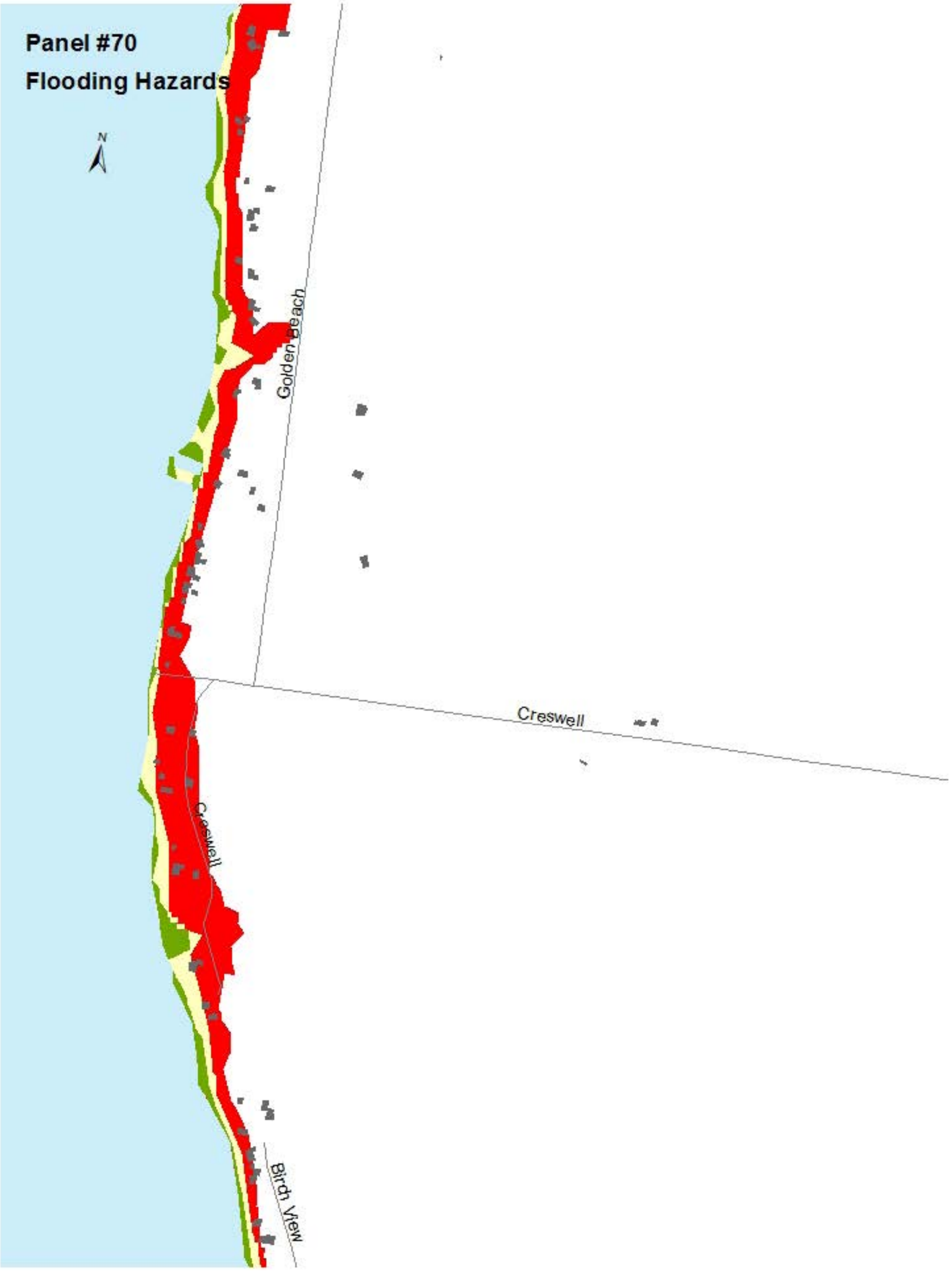

Antrim County


Panel #68
Flooding Hazards
Pine Ridge
Moulton
US 31
San Marino
Bay Colony
Nichols
Bay View
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

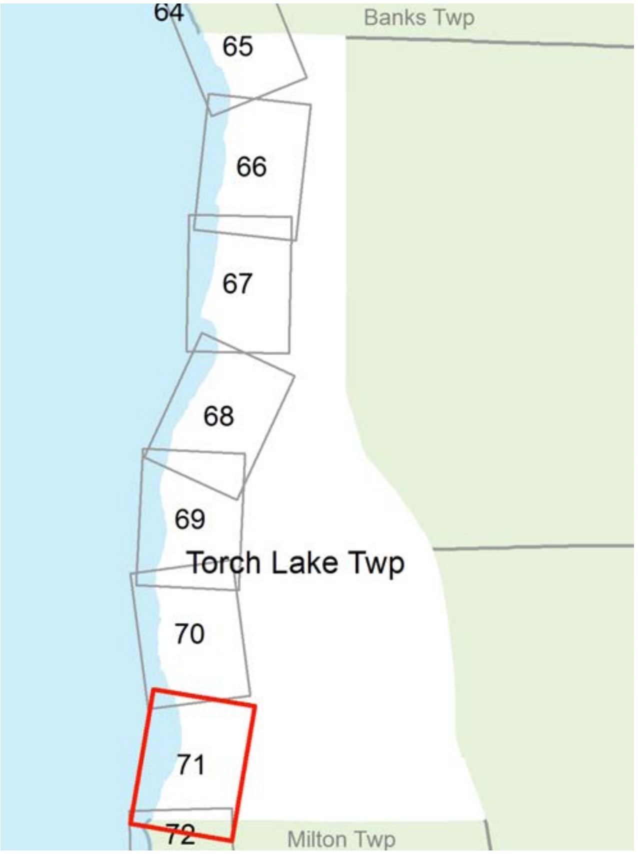


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





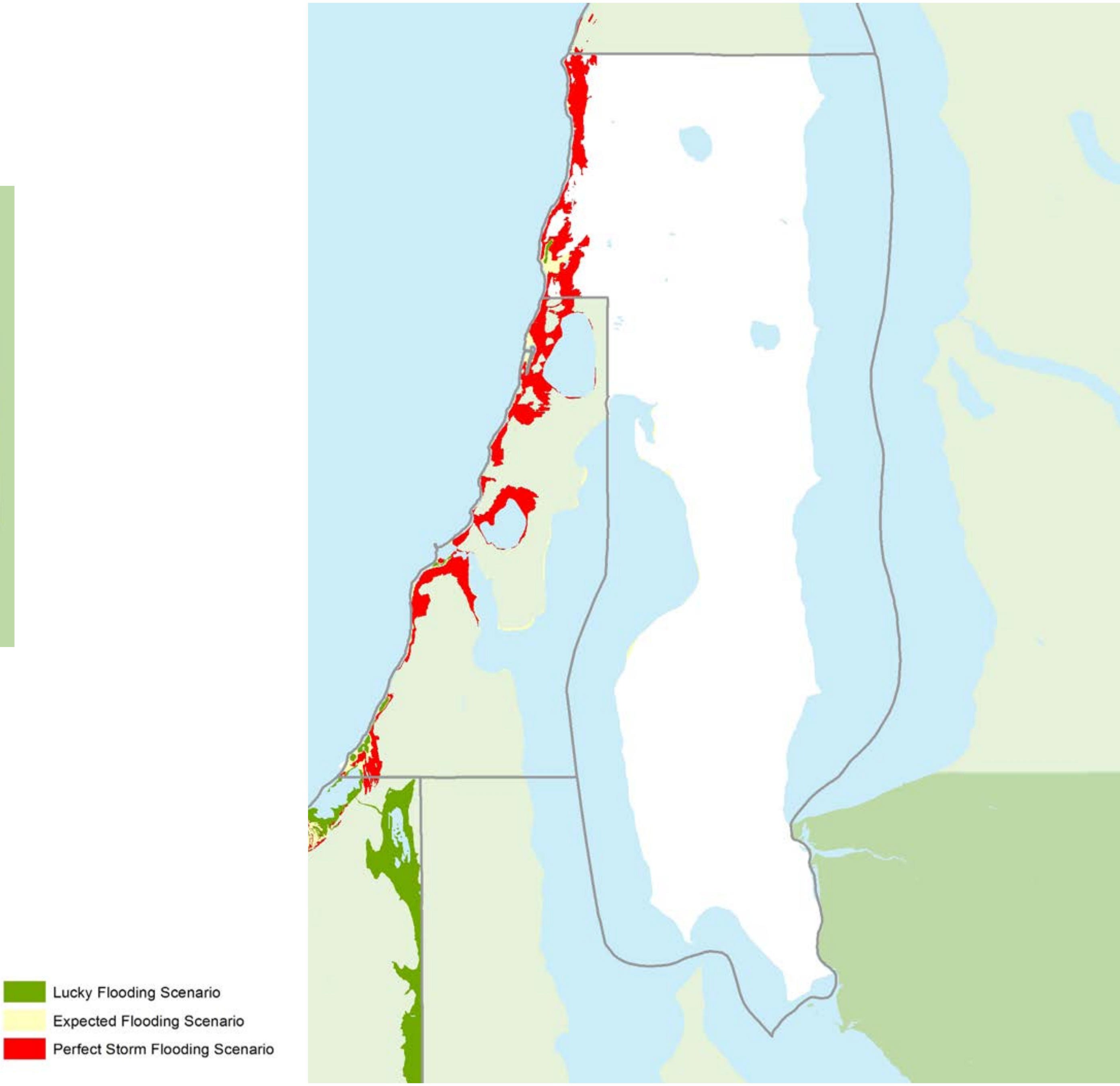
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

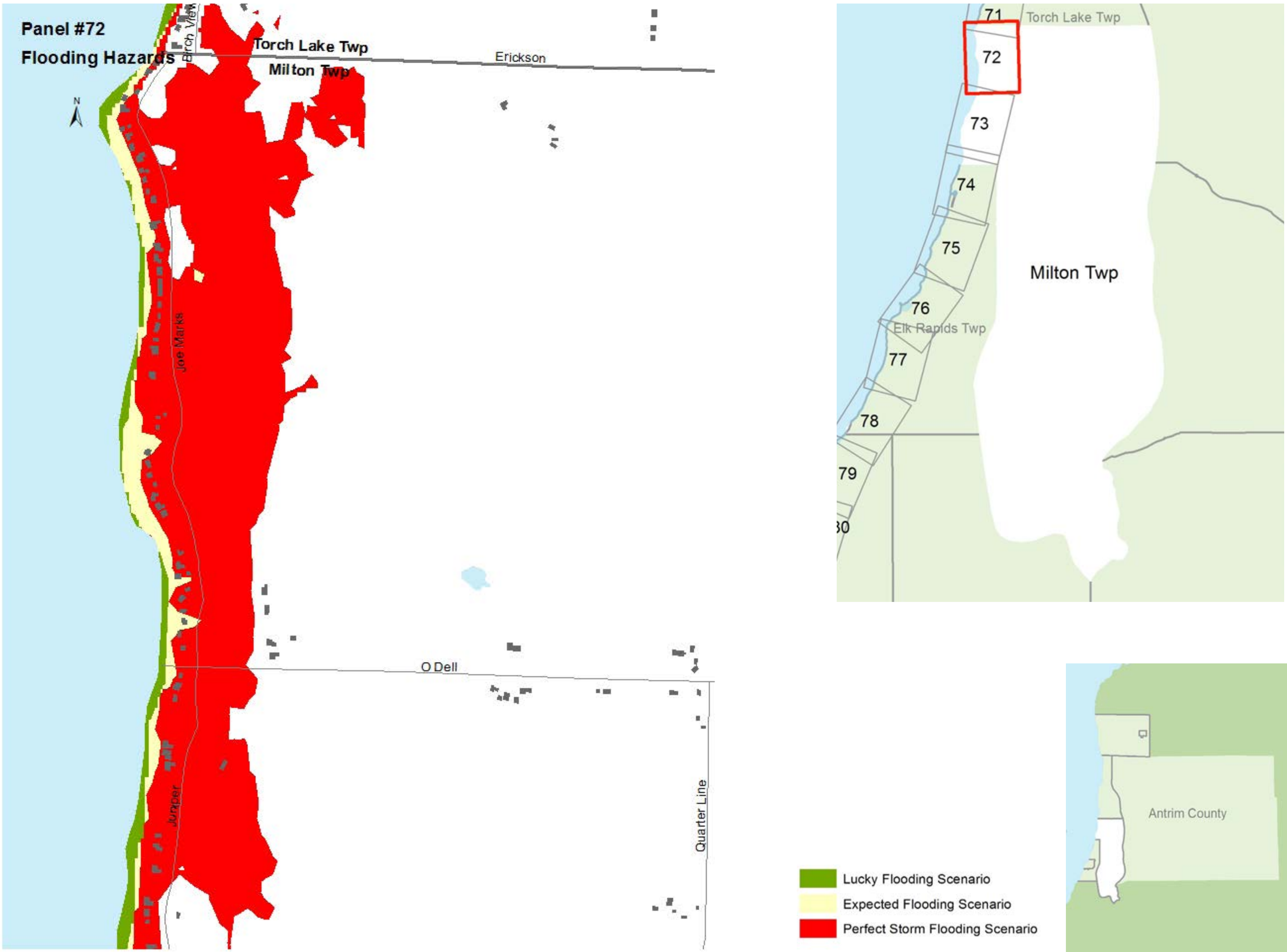


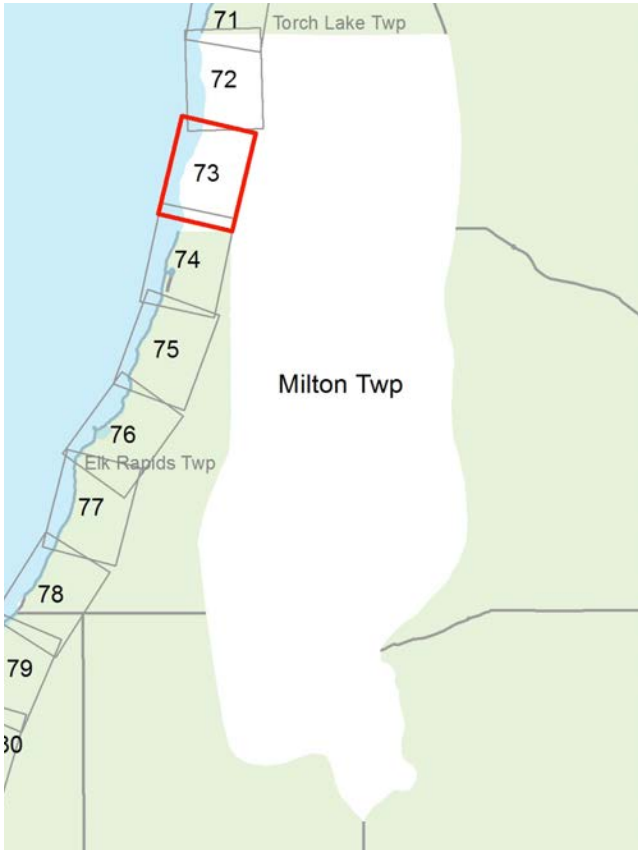
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Milton Twp.

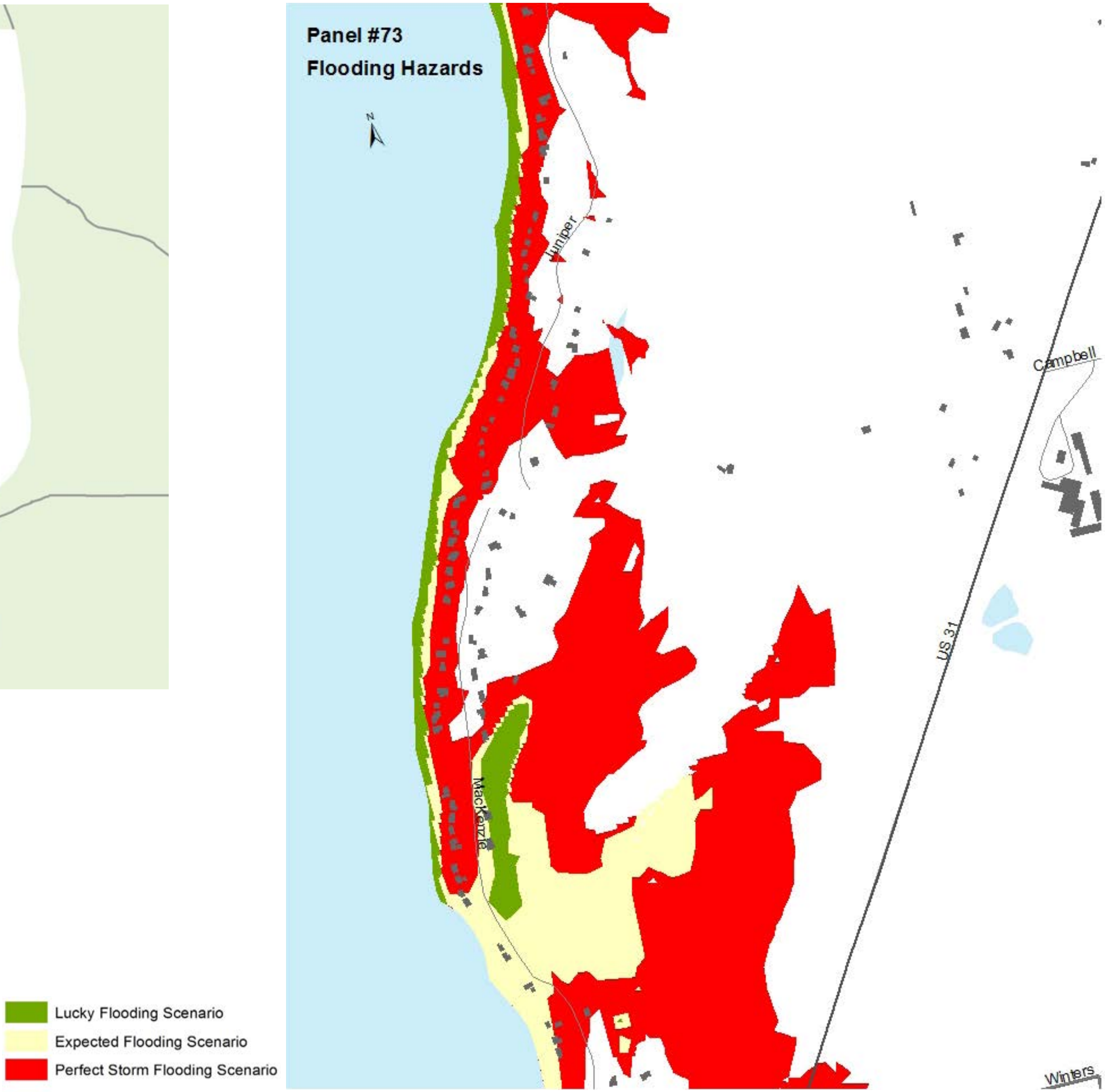

Antrim County

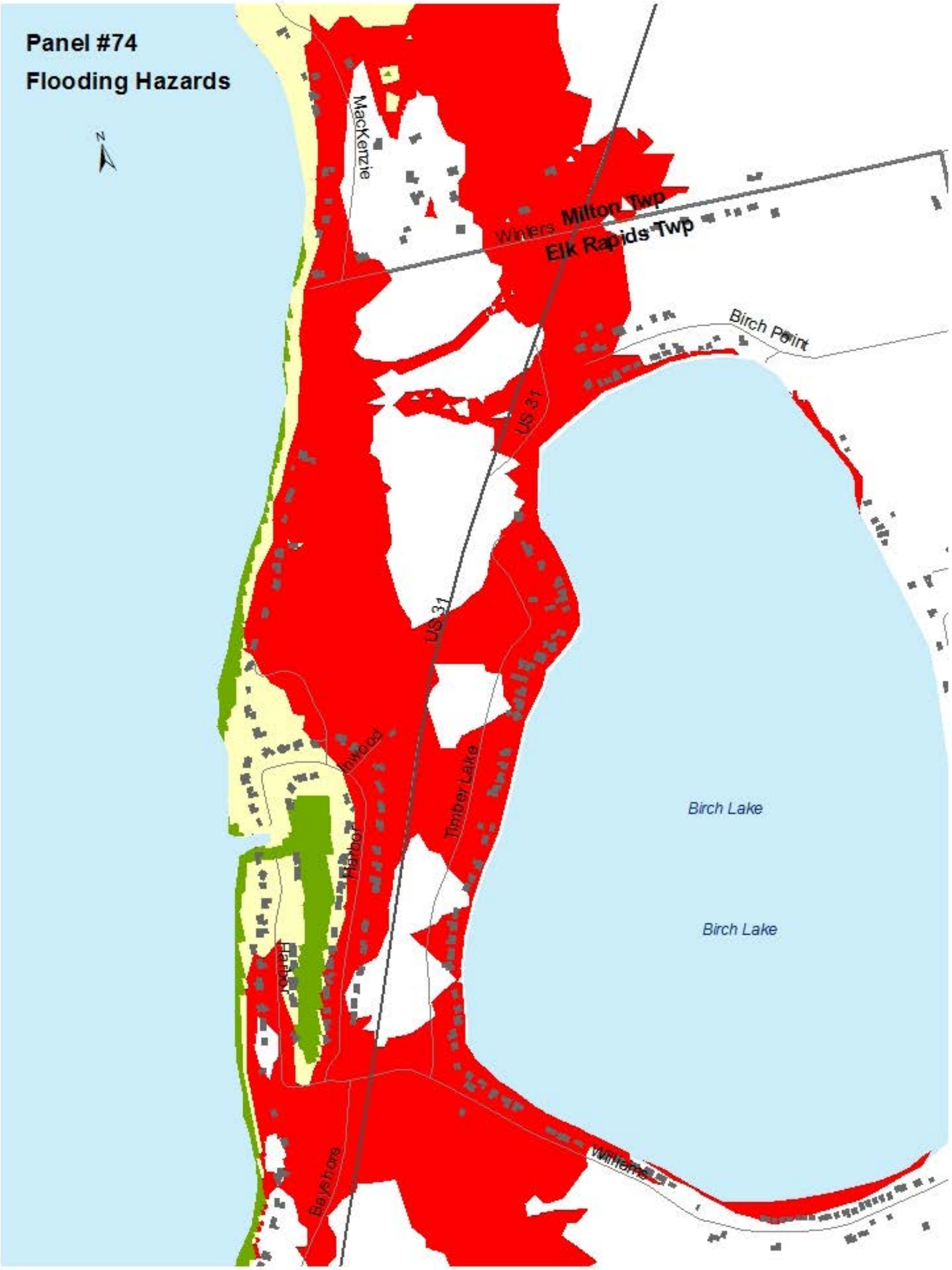

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

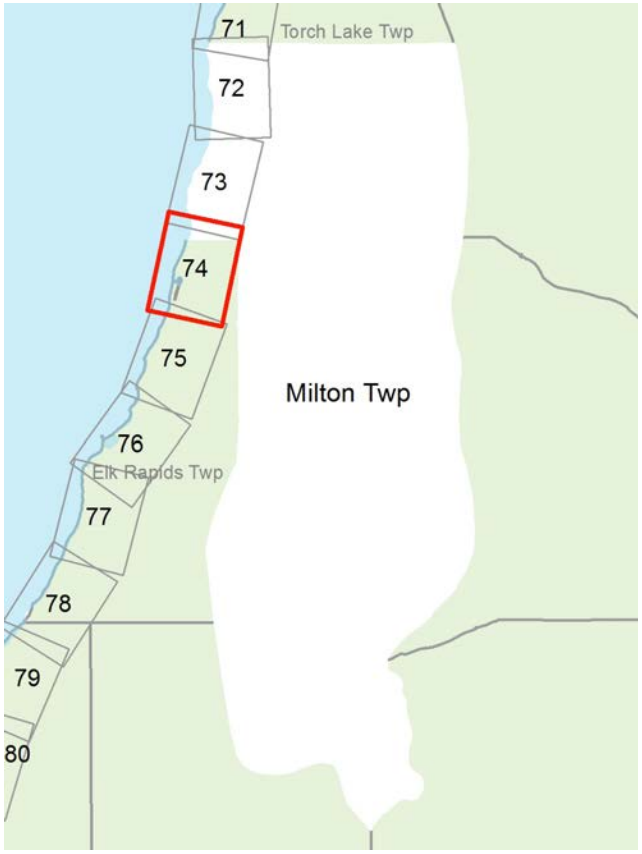

Panel #72
Flooding Hazards
N
Birch View
Torch Lake Twp
Milton Twp
Erickson
Joe Marks
O Dell
Juniper
Quarter Line
71
72
73
74
75
76
77
78
79
Torch Lake Twp
Milton Twp
Elk Rapids Twp
Antrim County
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


71
Torch Lake Twp
72
73
74
75
Milton Twp
76
Elk Rapids Twp
77
78
79


Antrim County

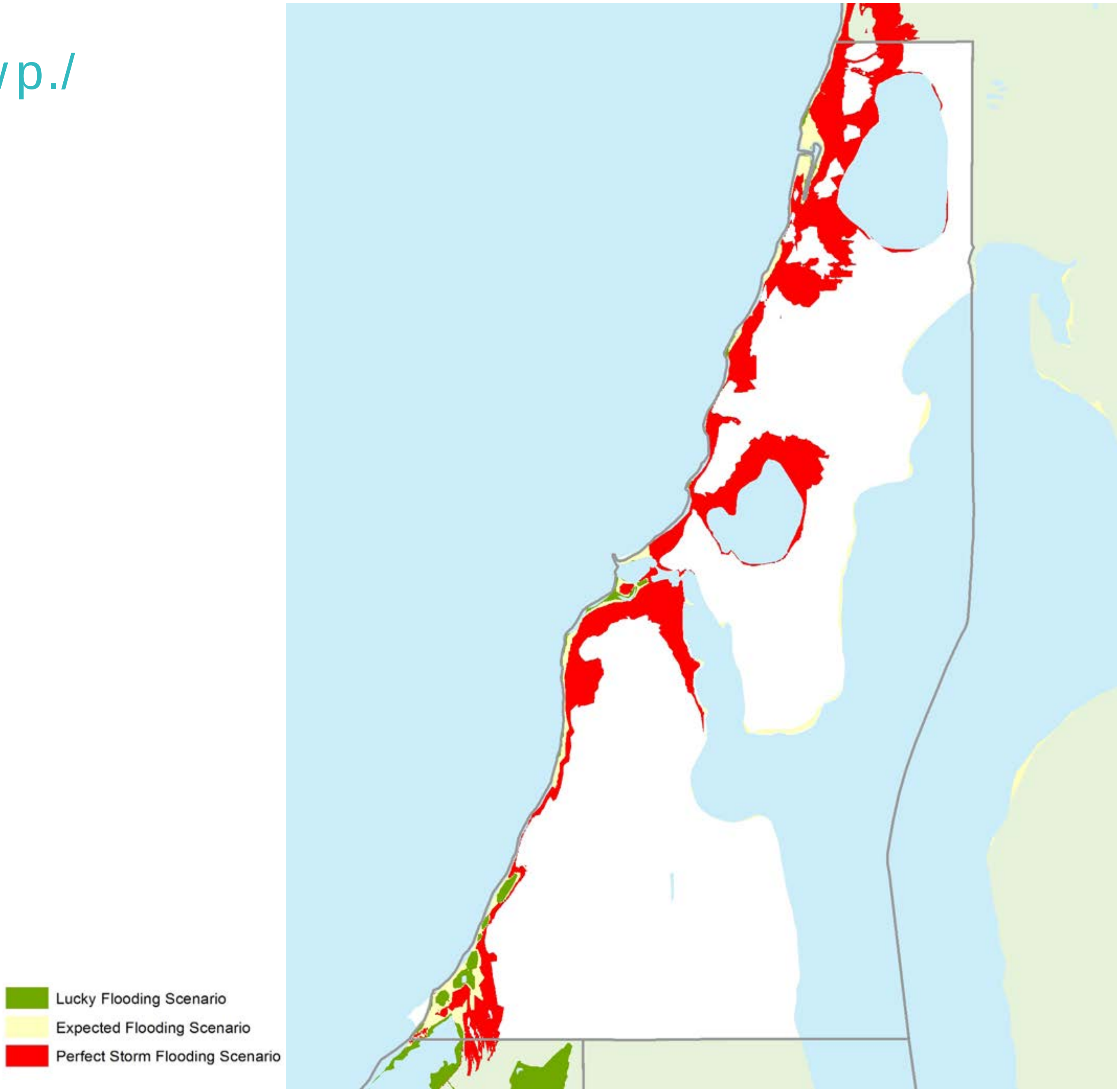

Panel #73
Flooding Hazards
Juniper
Campbell
US 31
Mackenzie
Winters
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

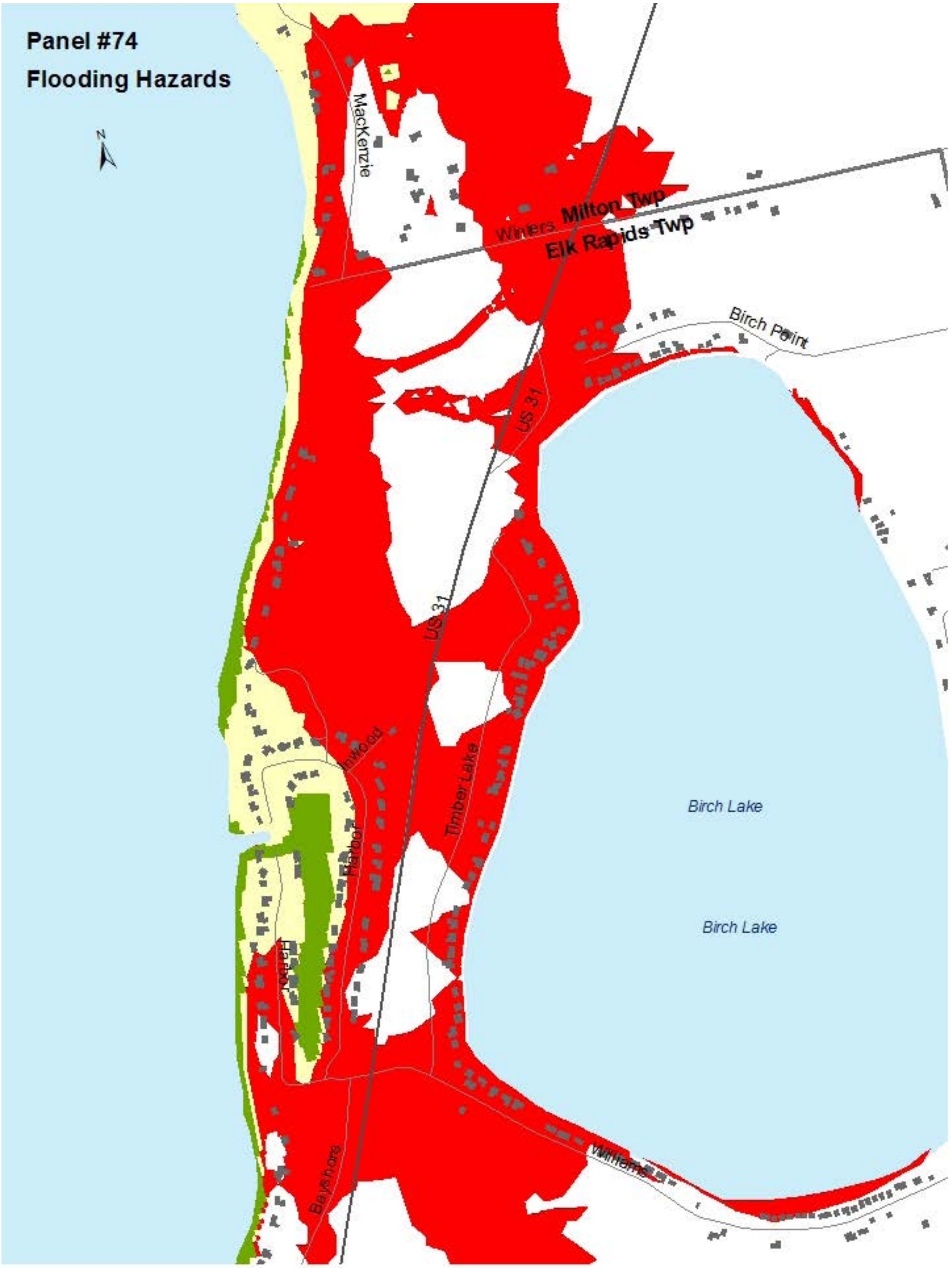


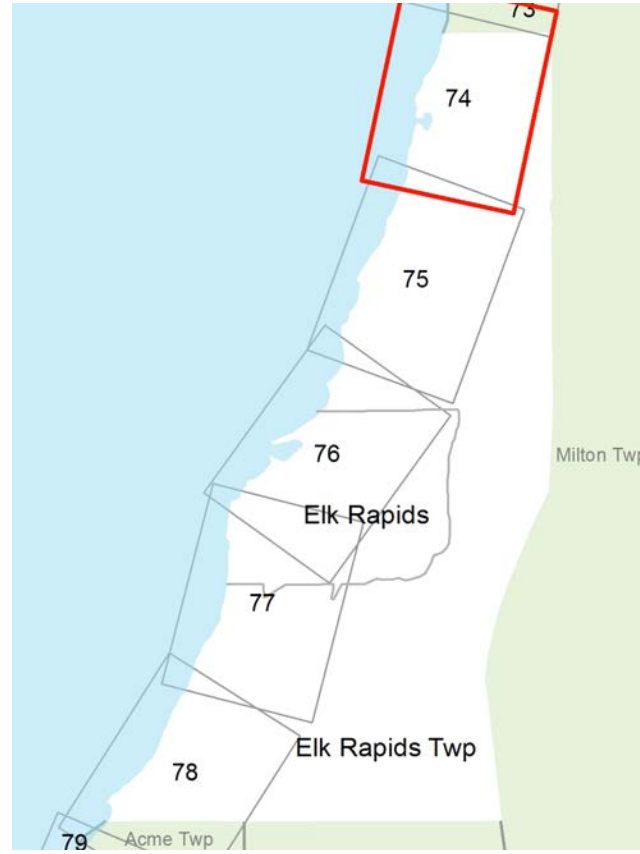


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

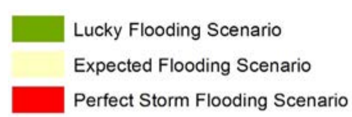
Elk Rapids Twp./ Elk Rapids

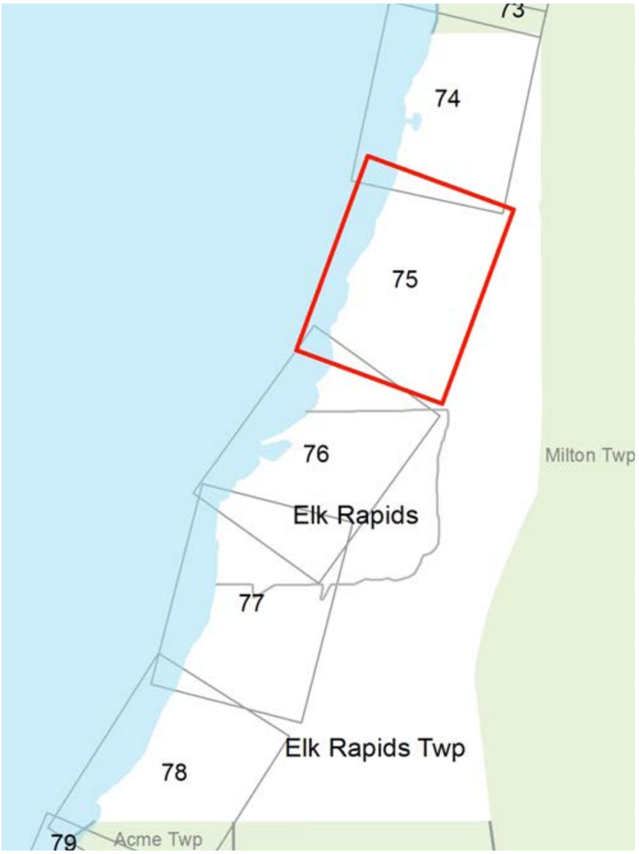



Panel #74
Flooding Hazards
N
MacKenzie
Winters
Milton Twp
Elk Rapids Twp
Birch Point
US 31
US 31
Timber Lake
Birch Lake
Birch Lake
Bayshore
Williams


73
74
75
76
Elk Rapids
77
78
79
Elk Rapids Twp
Milton Twp
Acme Twp


Antrim County

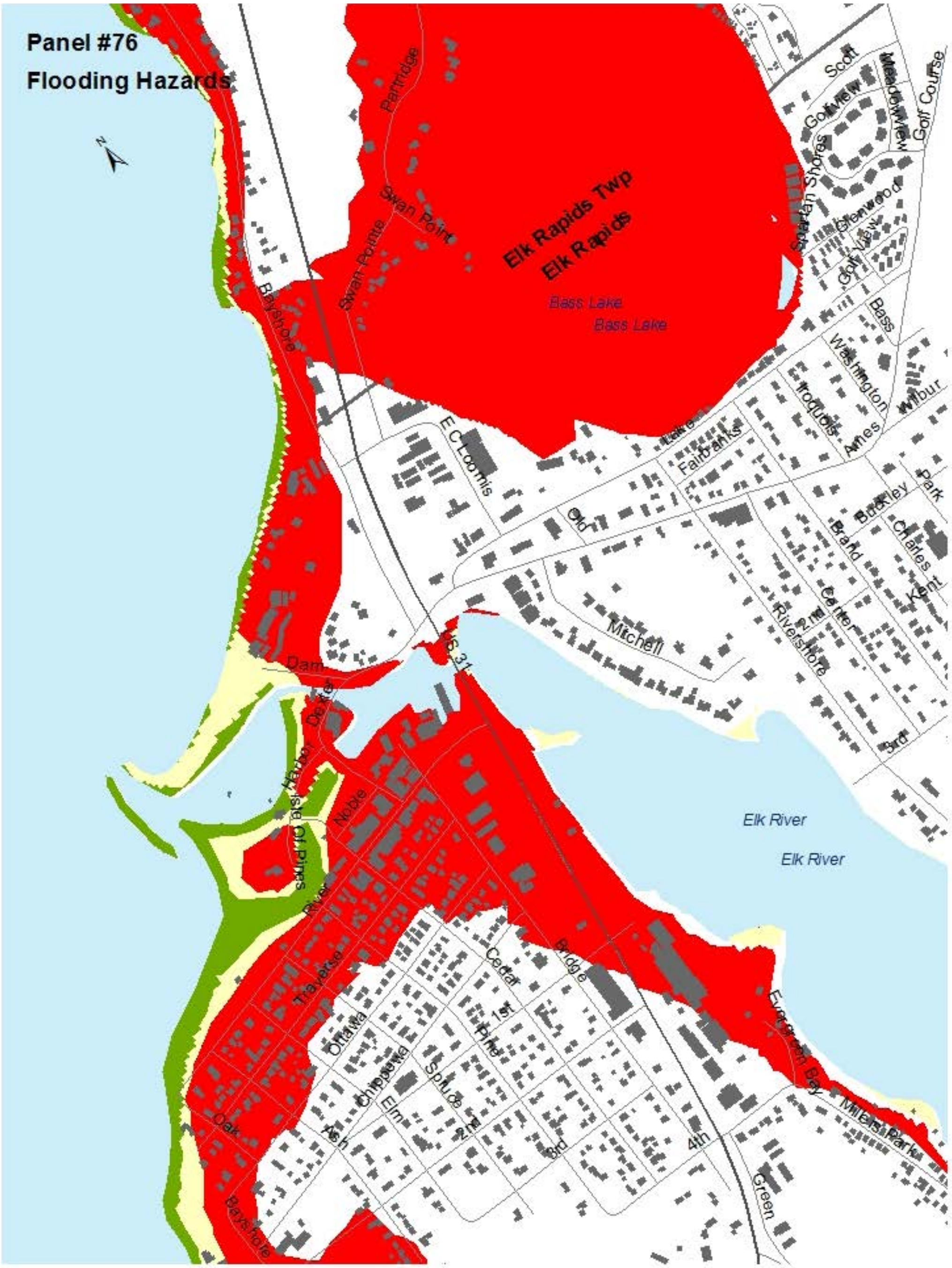

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

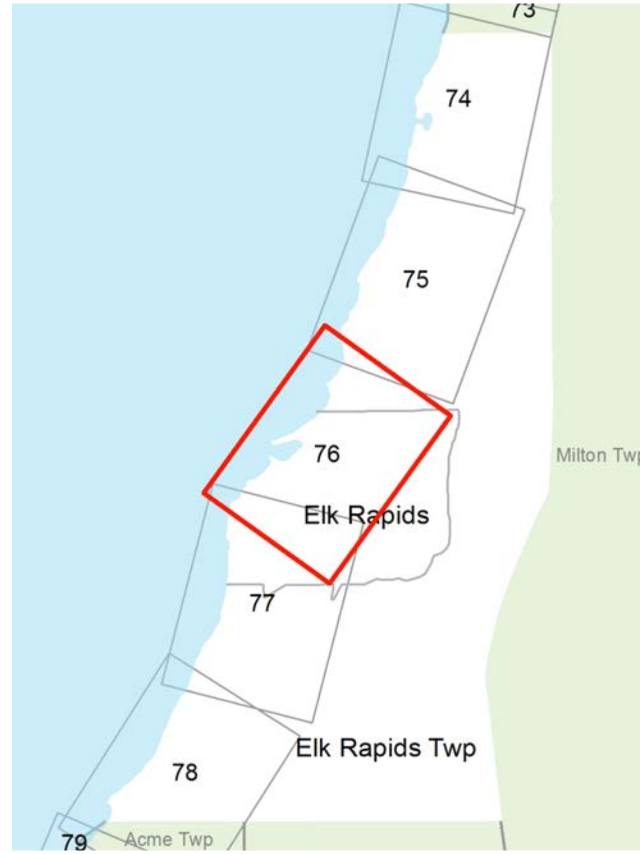


Lucky Flooding Scenario

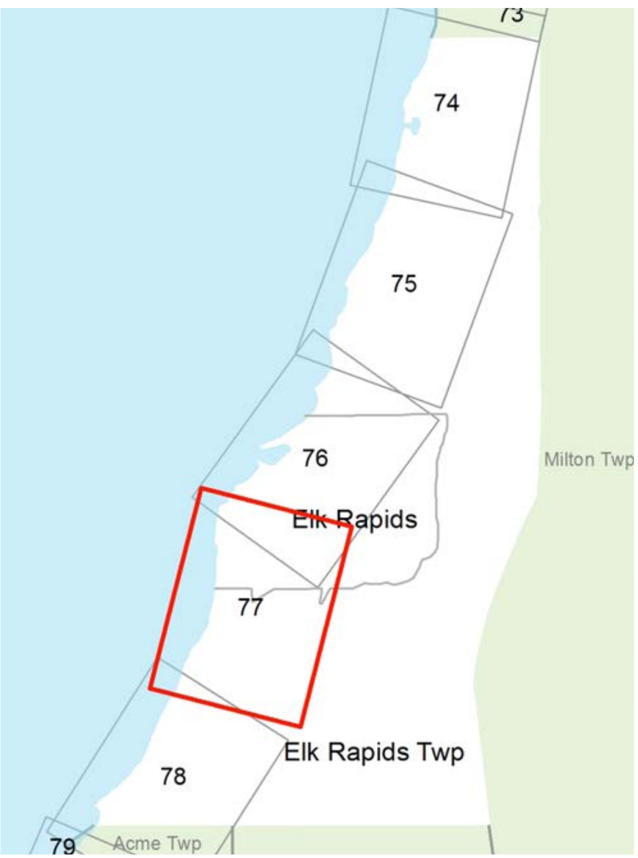
Expected Flooding Scenario

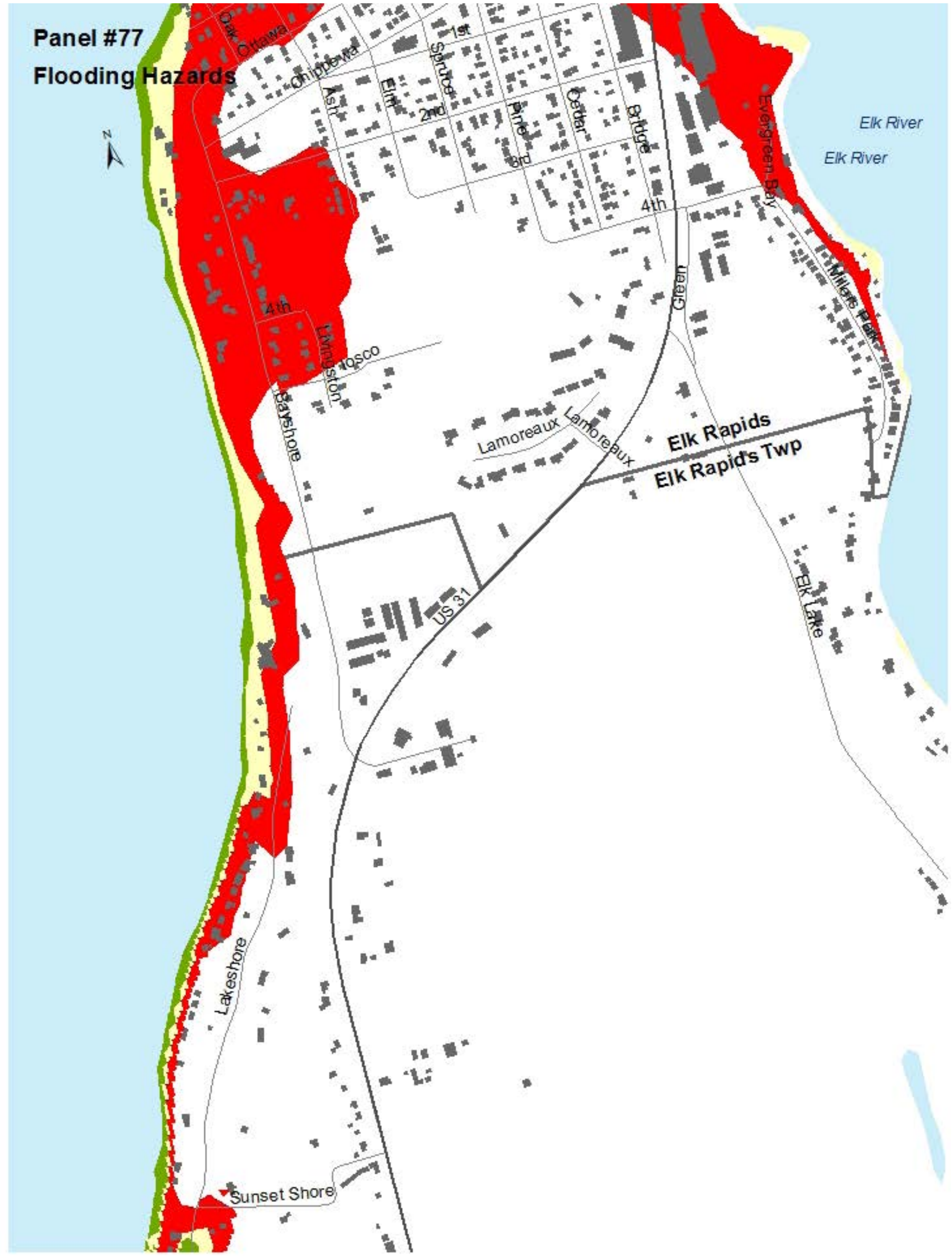
Perfect Storm Flooding Scenario



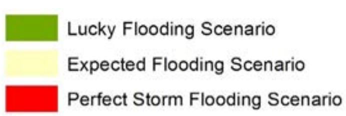


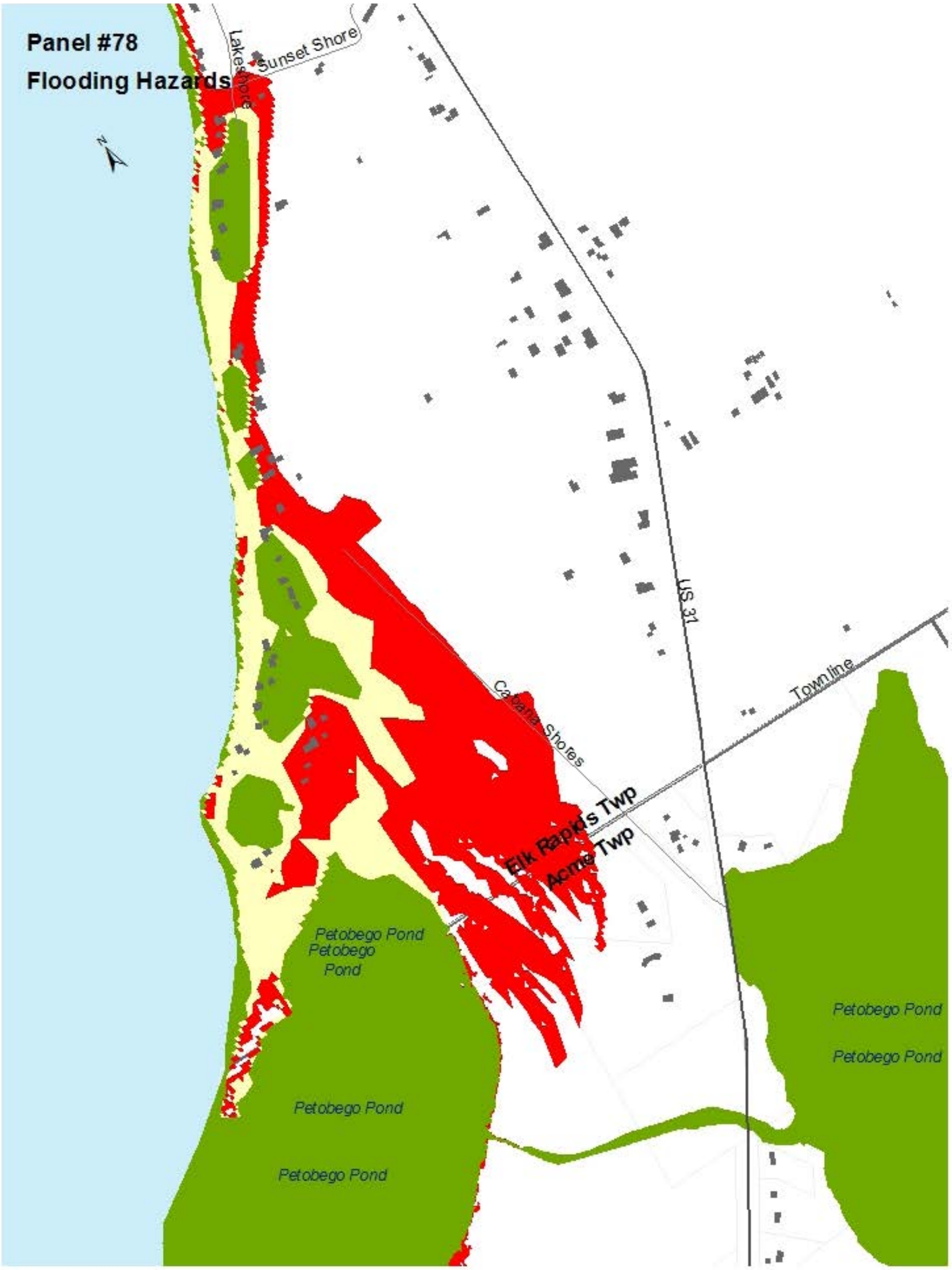
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

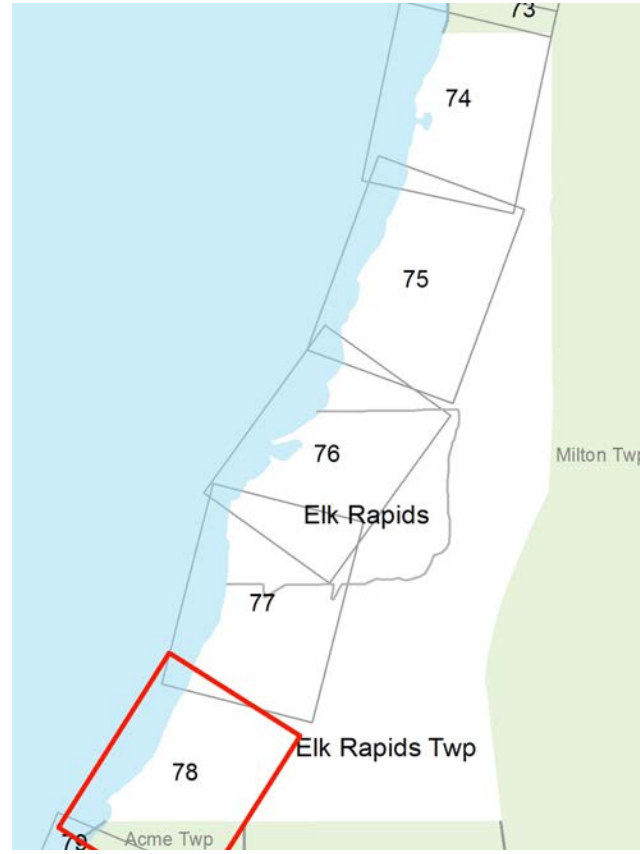

73
74
75
76
Elk Rapids
77
Milton Twp
Elk Rapids Twp
78
79
Acme Twp


Panel #77
Flooding Hazards
Elk River
Elk River
Oak
Ottawa
Chippewa
1st
Spruce
Ash
Elm
2nd
Pine
Cedar
Bridge
3rd
4th
Evergreen Bay
4th
Livingston
Iosco
Bayshore
Green
Lamoreaux
Lamoreaux
Elk Rapids
Elk Rapids Twp
US 31
Elk Lake
Lakeshore
Sunset Shore


Antrim County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

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Grand Traverse County

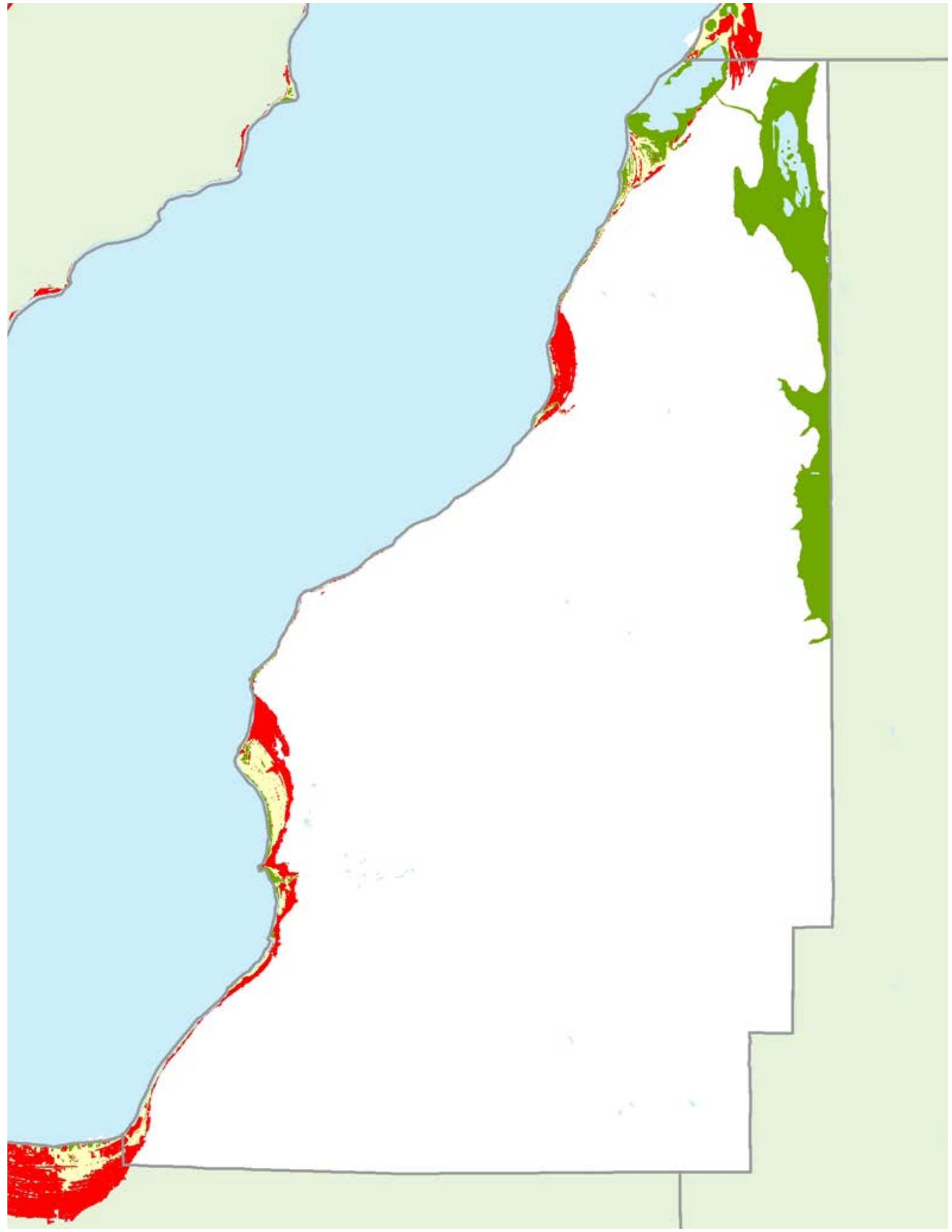
Coastal Flooding Scenario Impacts

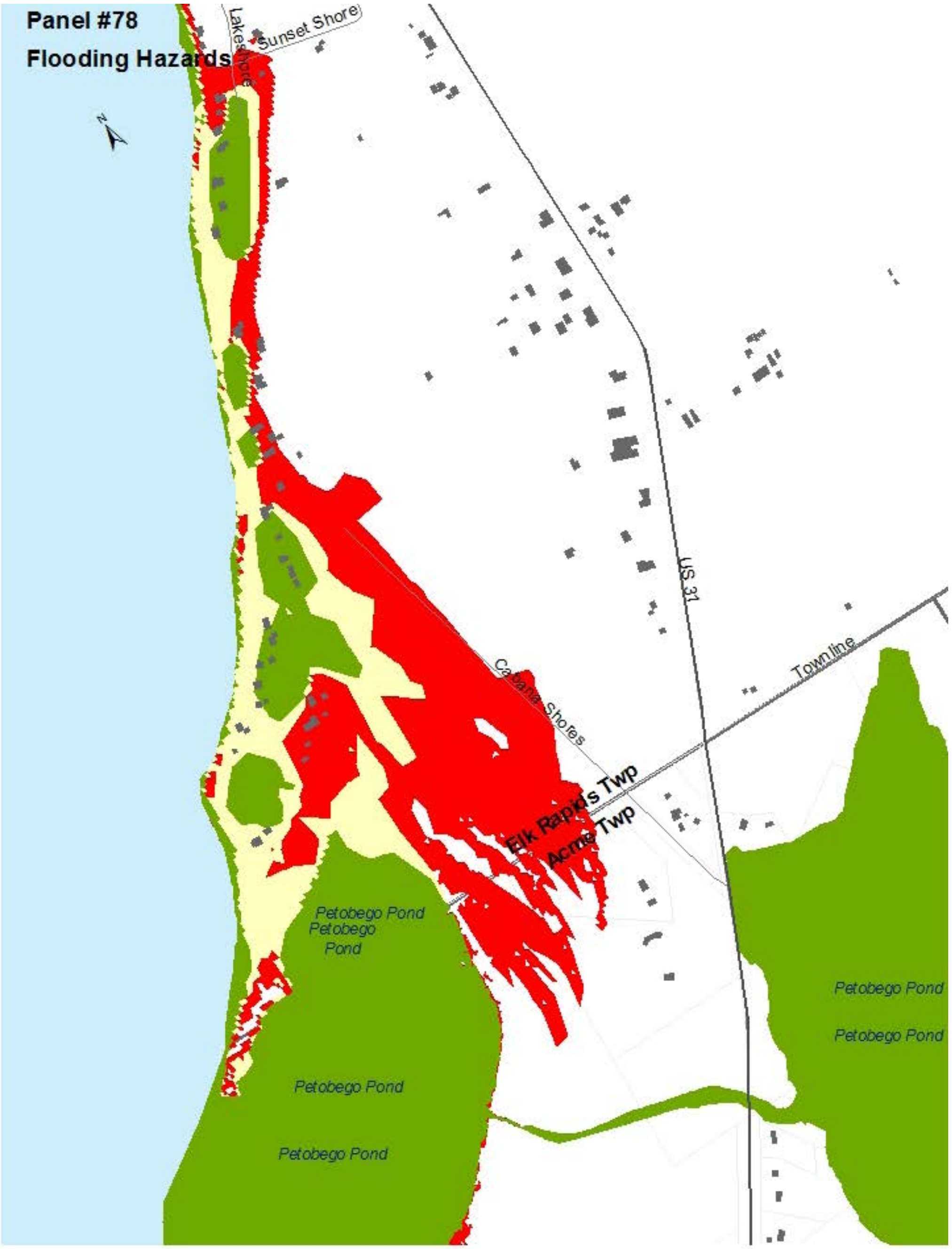
Grand Traverse County			
Total SEV	Lucky	Expected	Perfect Storm
$ 3,500,025,000.00	$ 75,857,200.00	$ 209,592,600.00	$ 465,142,900.00

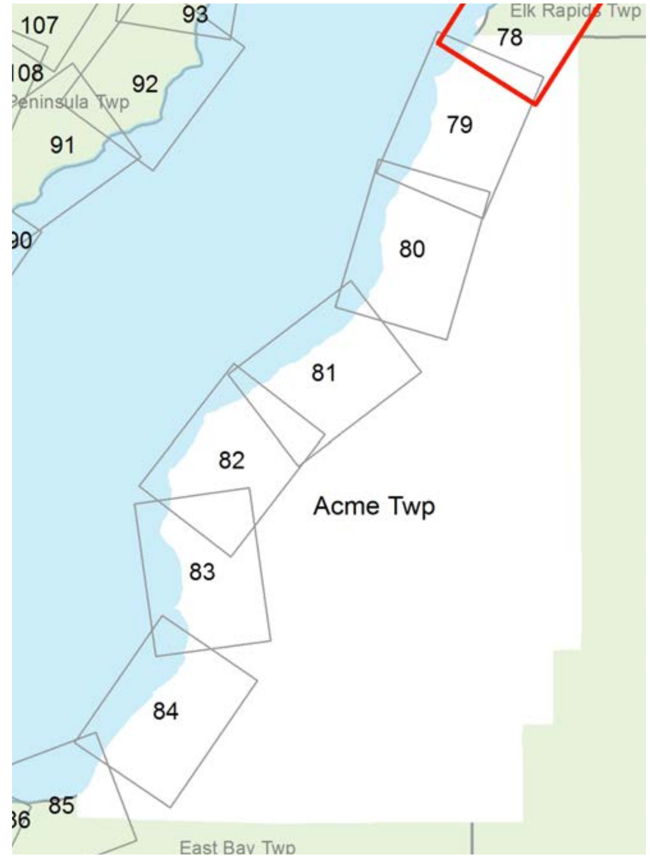
Acme Twp.

Coastal Flooding Scenario Impacts

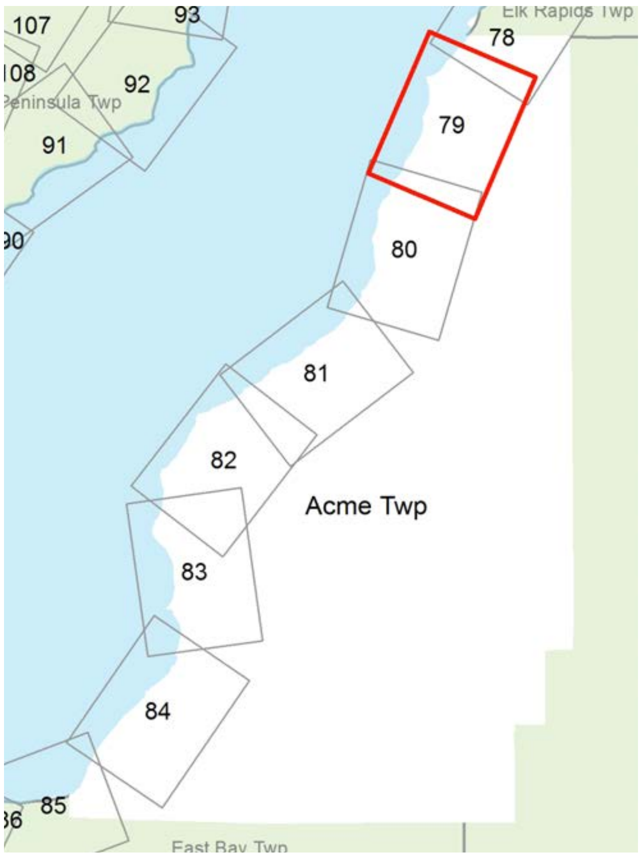
Acme			
Total SEV	Lucky	Expected	Perfect Storm
$ 432,433,800.00	$ 4,146,200.00	$ 21,034,100.00	$ 48,999,300.00

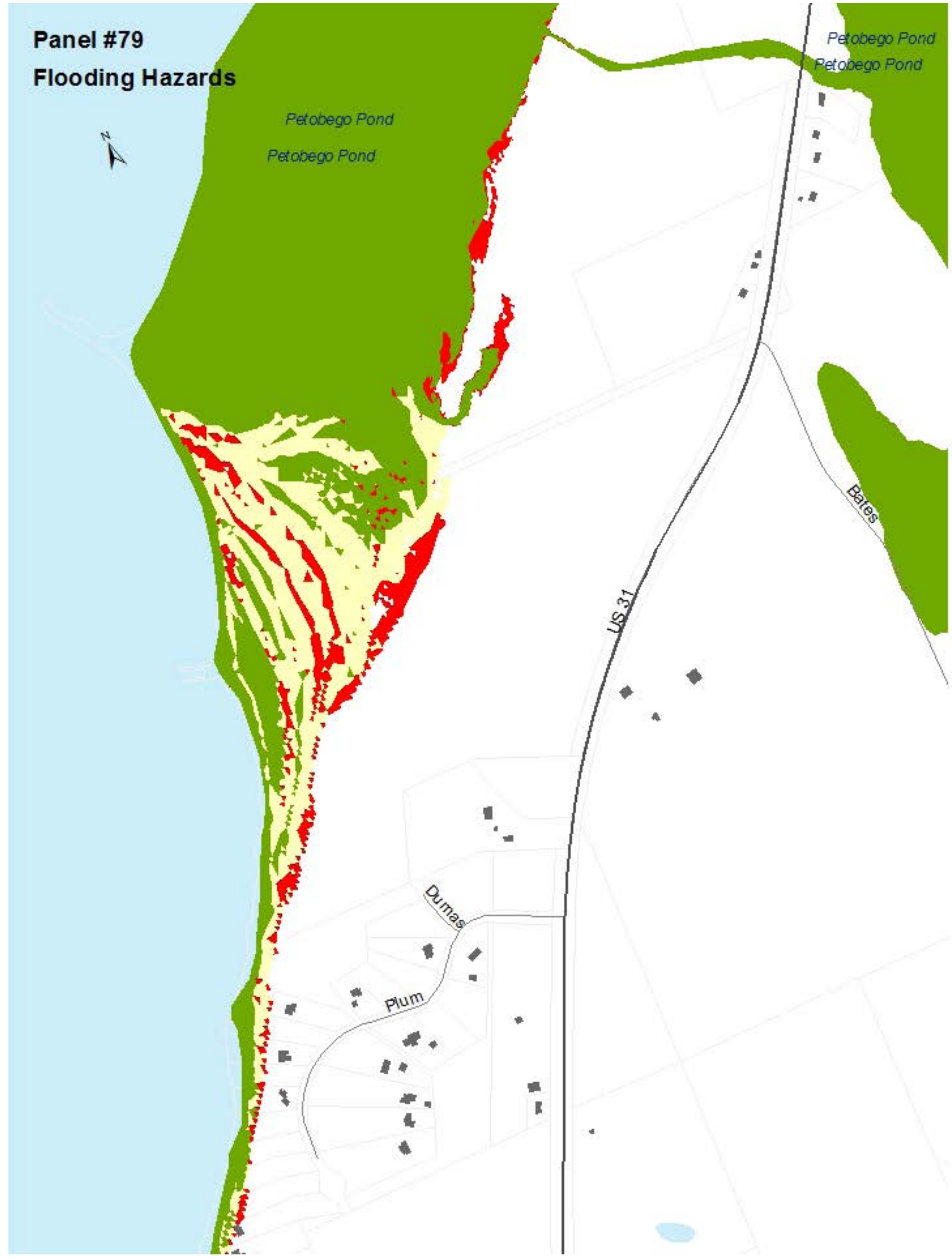




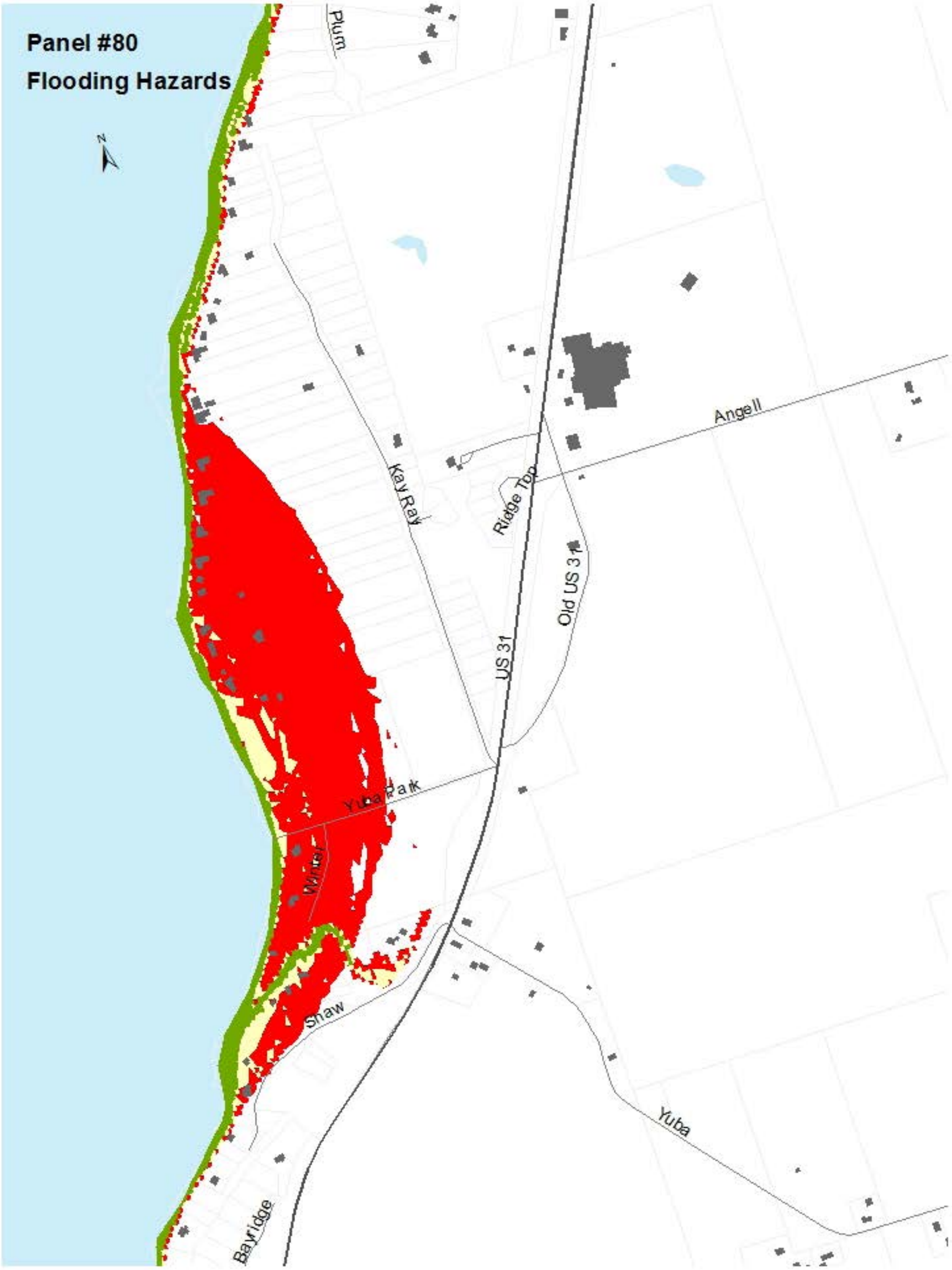


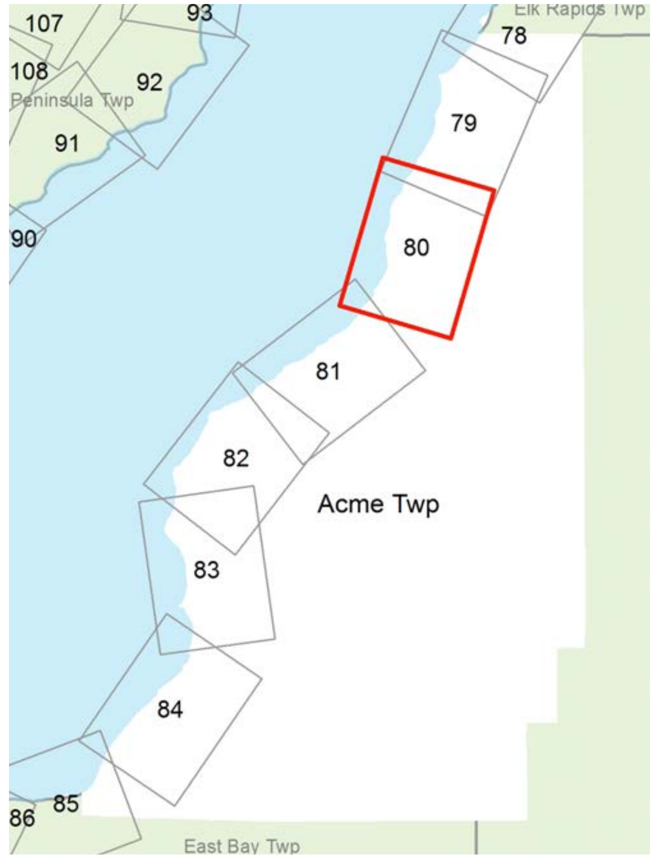
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



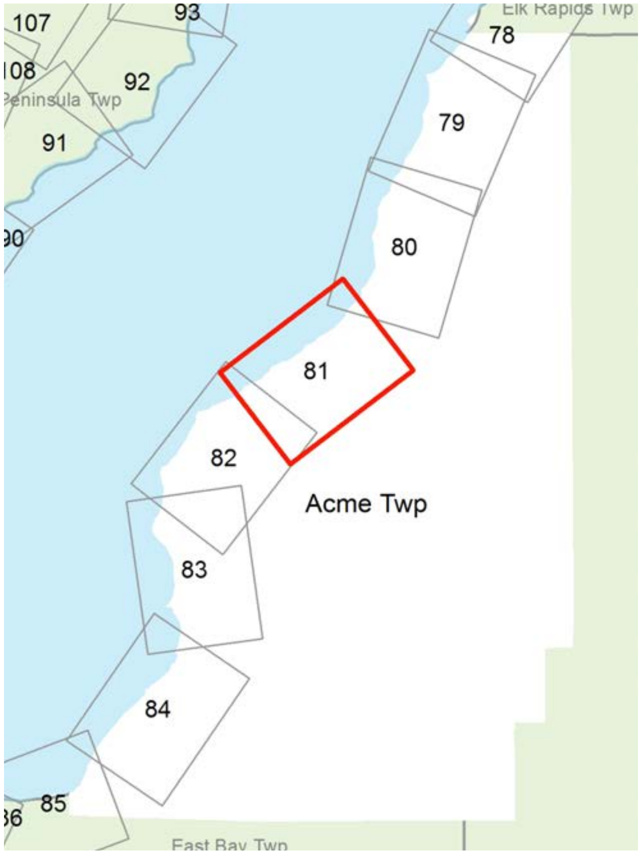


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





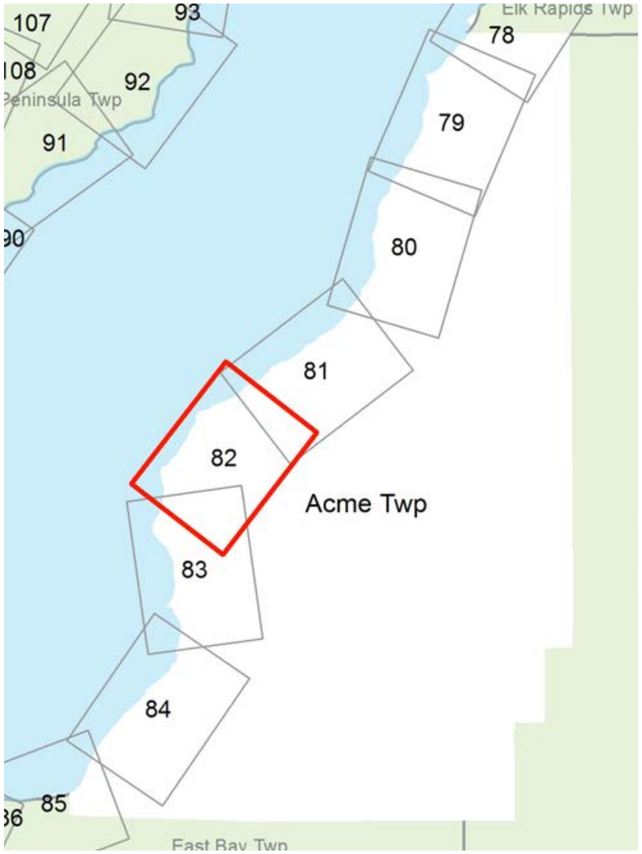
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



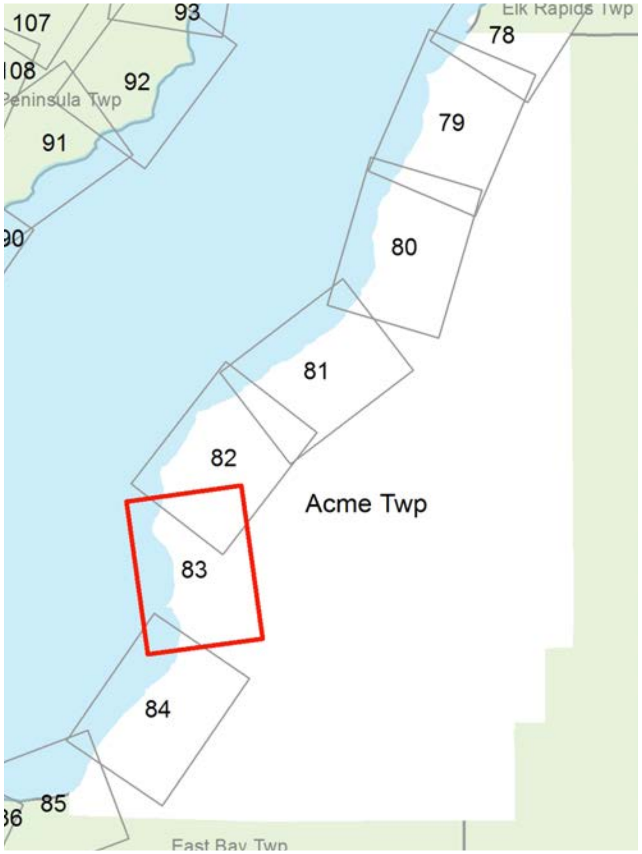
Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario



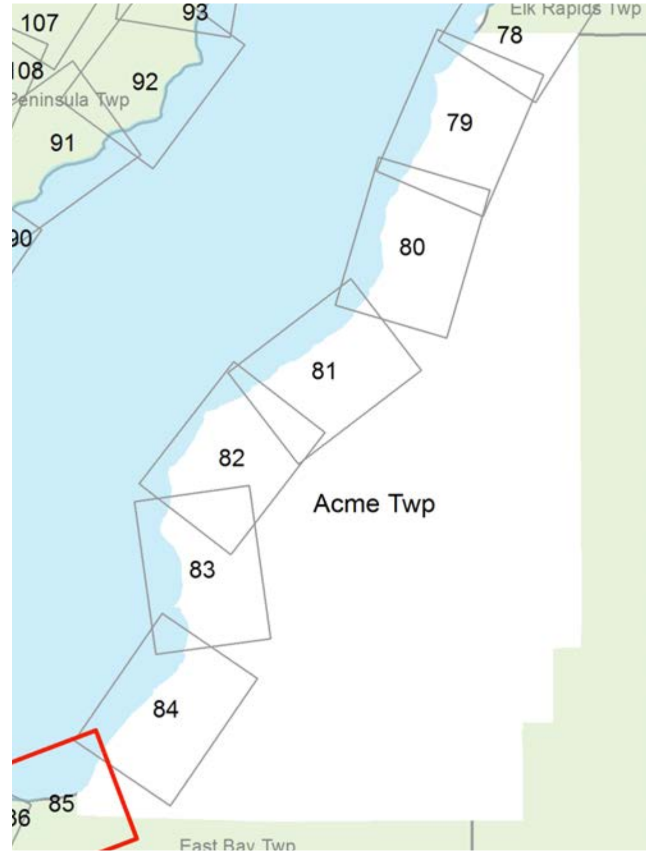
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario

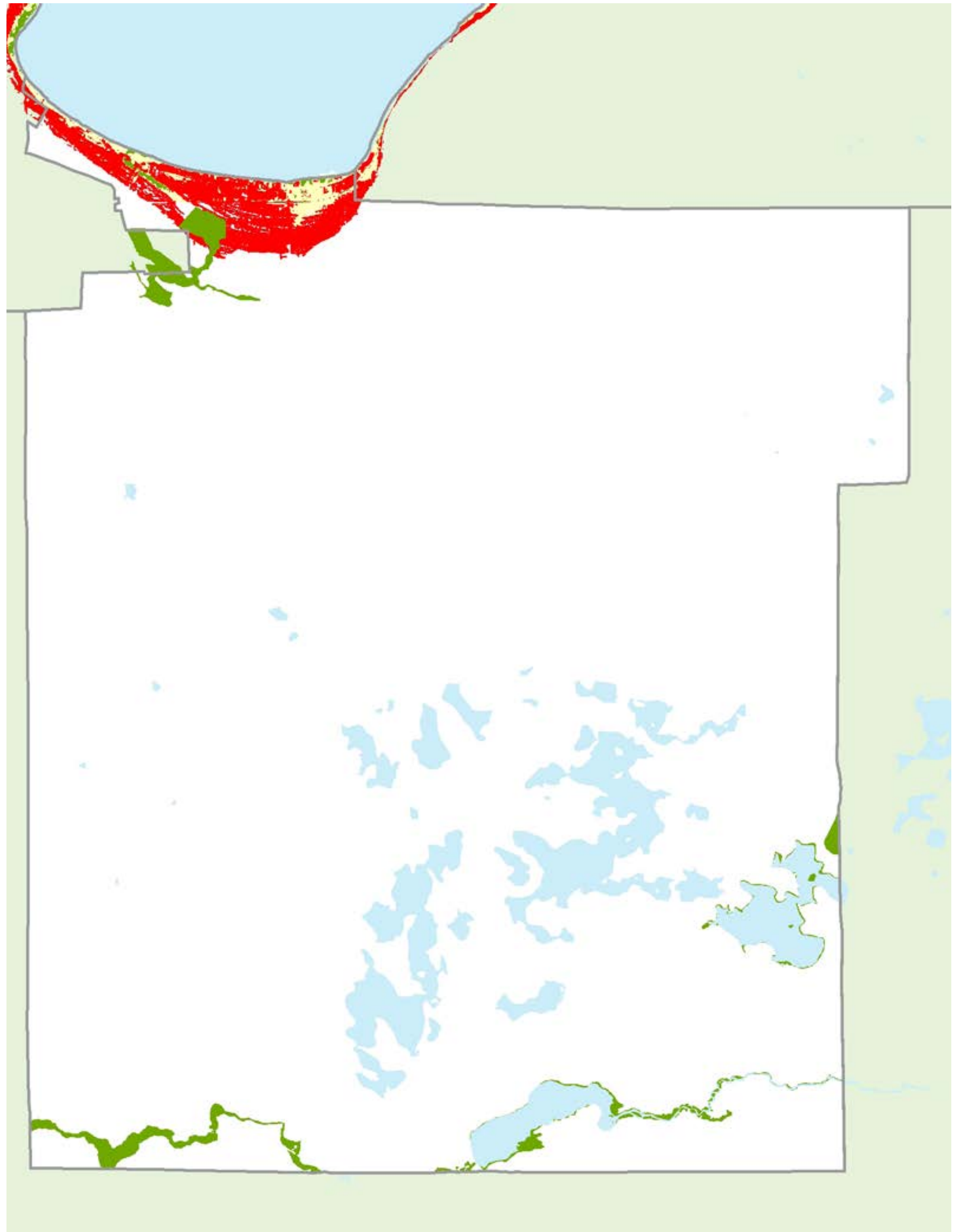


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

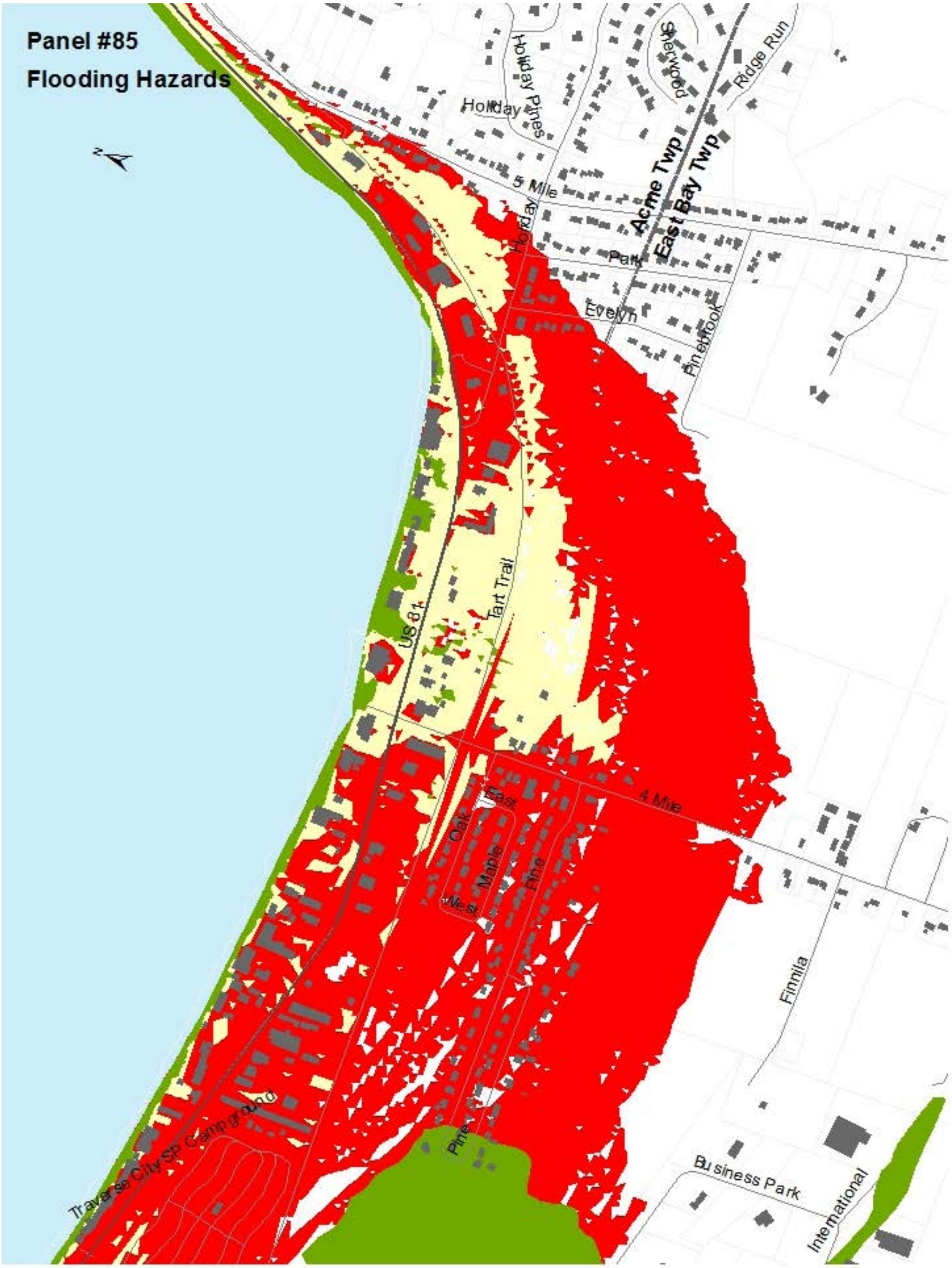
East Bay Twp.

Coastal Flooding Scenario Impacts

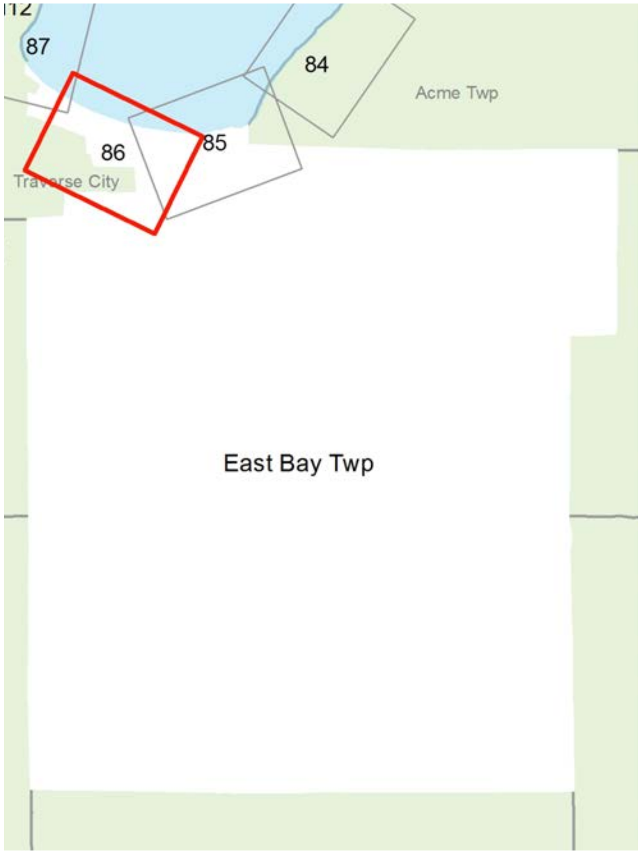
East Bay			
Total SEV	Lucky	Expected	Perfect Storm
$ 742,917,500.00	$ 13,607,600.00	$ 31,328,300.00	$ 70,844,000.00



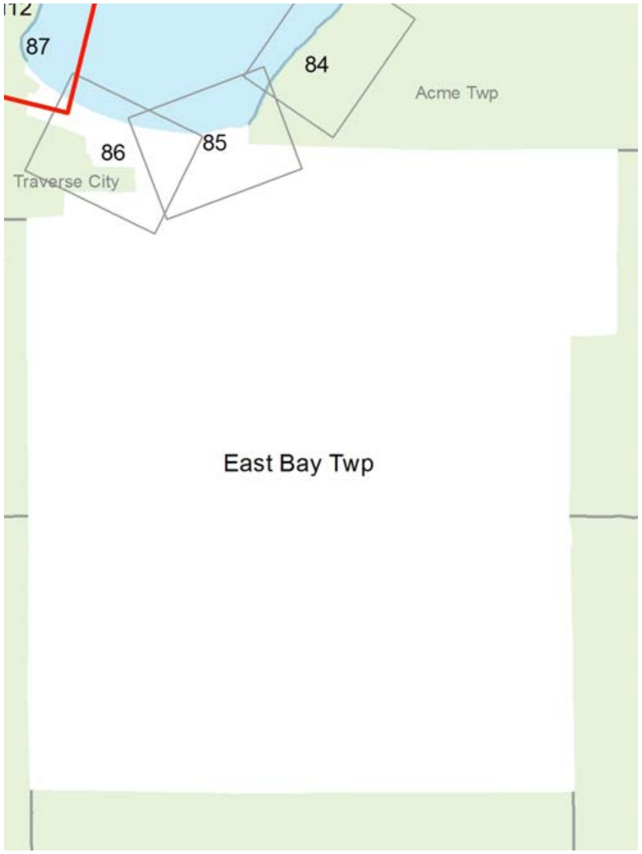
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

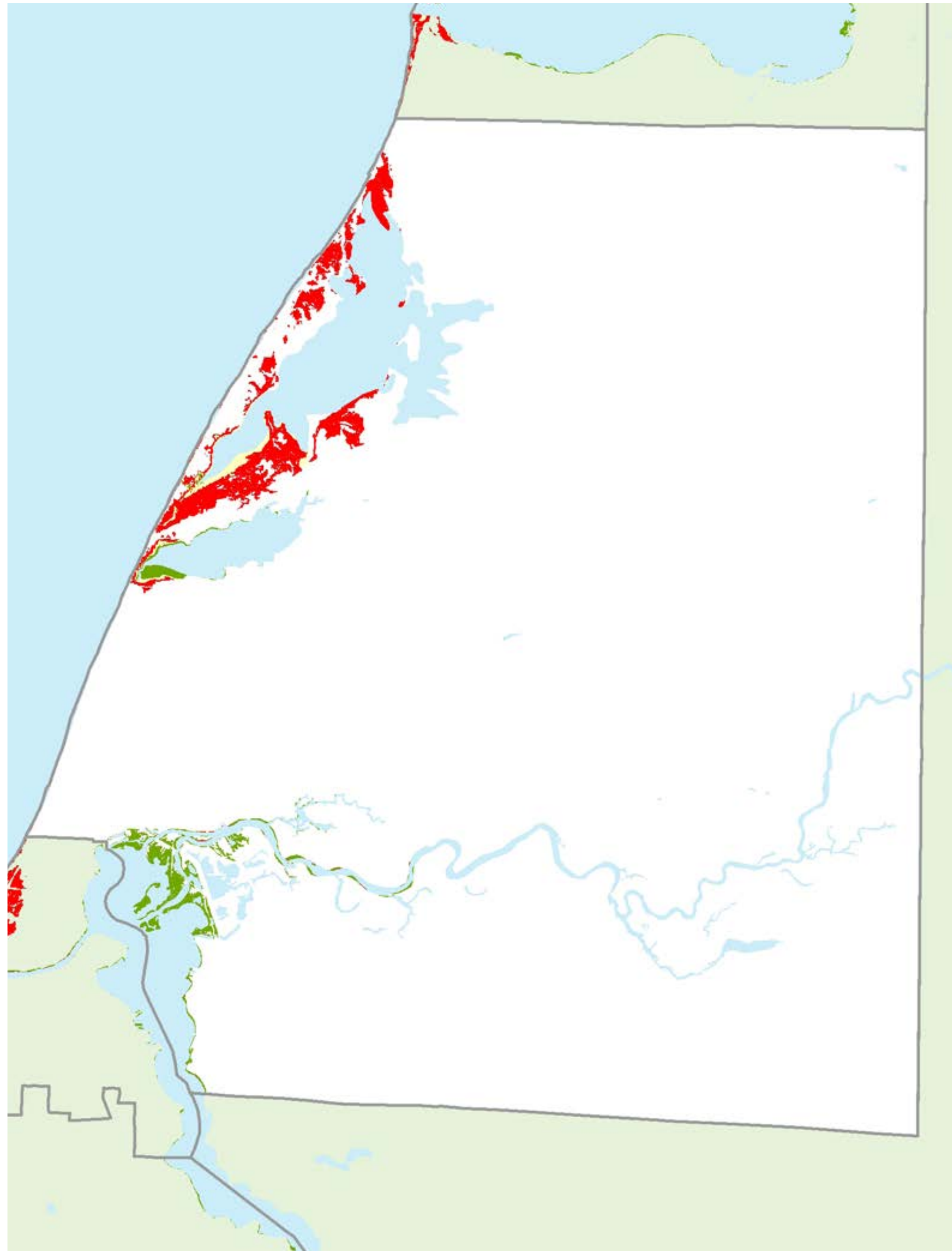


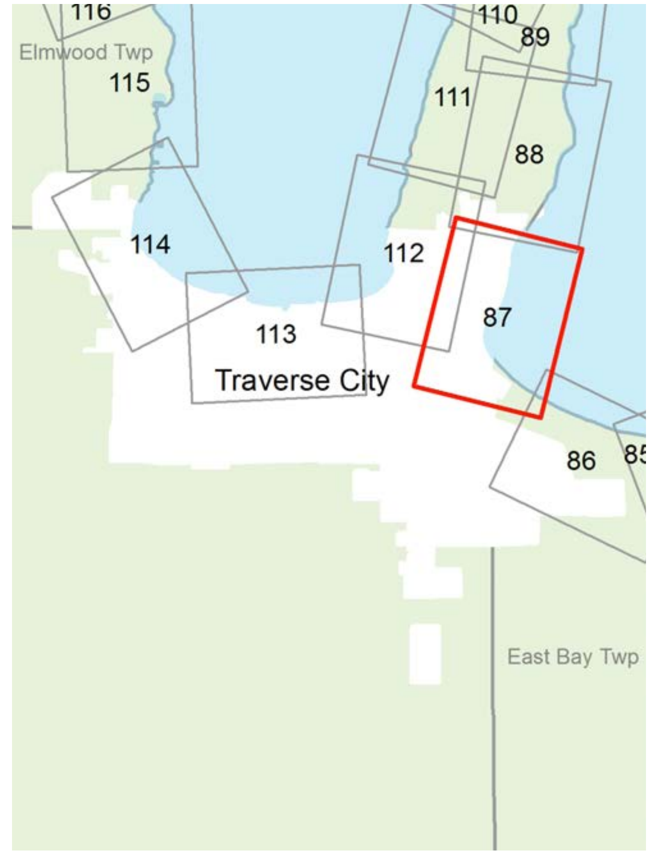
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Traverse City

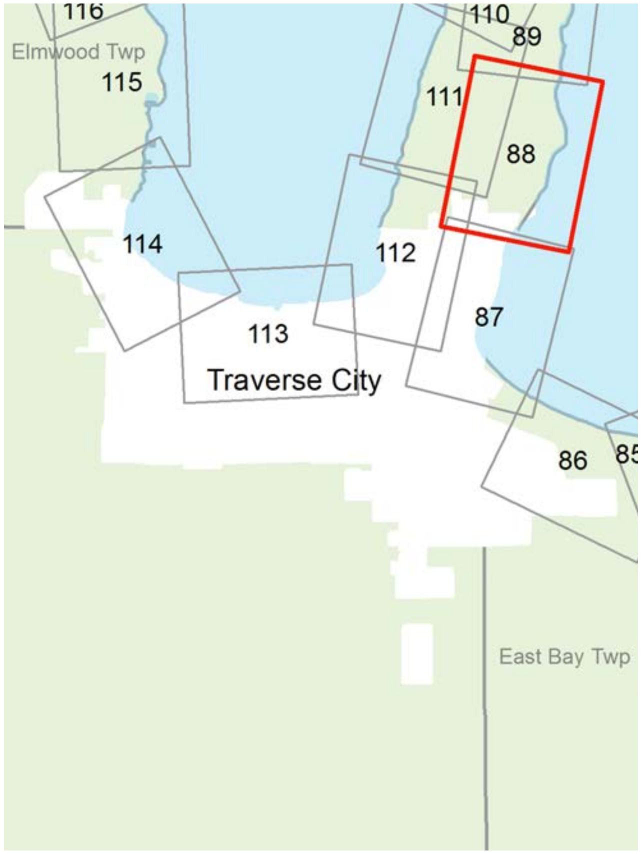
Coastal Flooding Scenario Impacts

Traverse City (within Leelanau County)			
Total SEV	Lucky	Expected	Perfect Storm
$ 41,623,200.00	$ 4,270,900.00	$ 6,169,800.00	$ 7,949,800.00

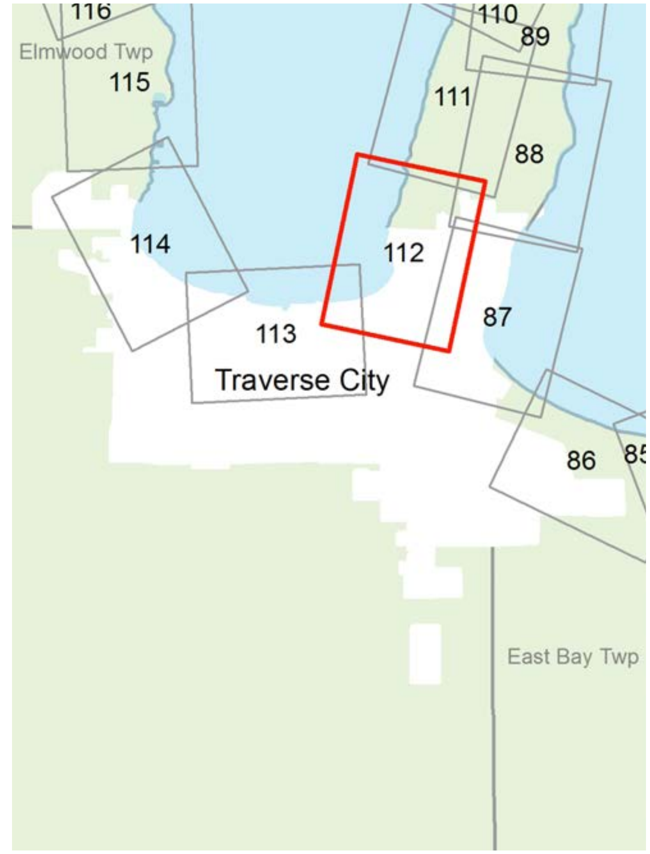




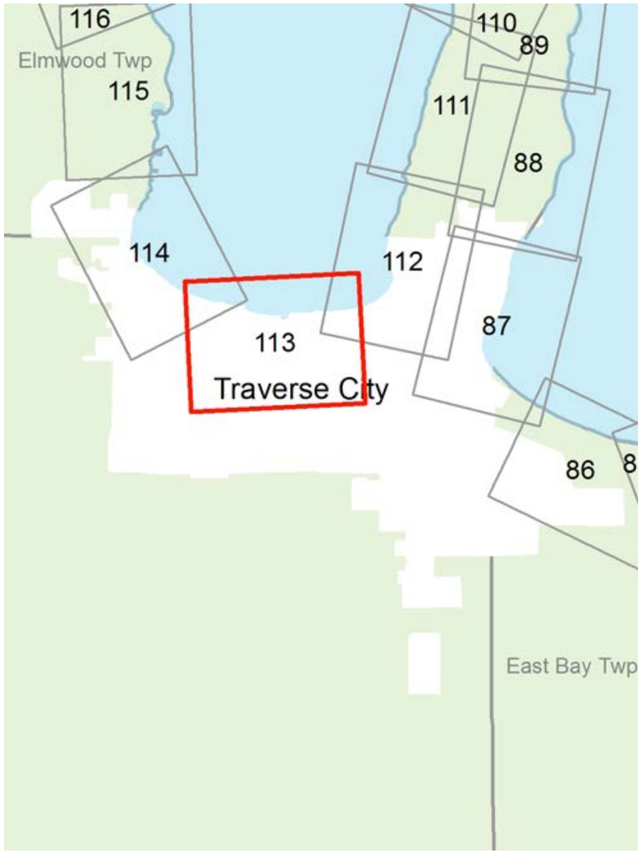
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



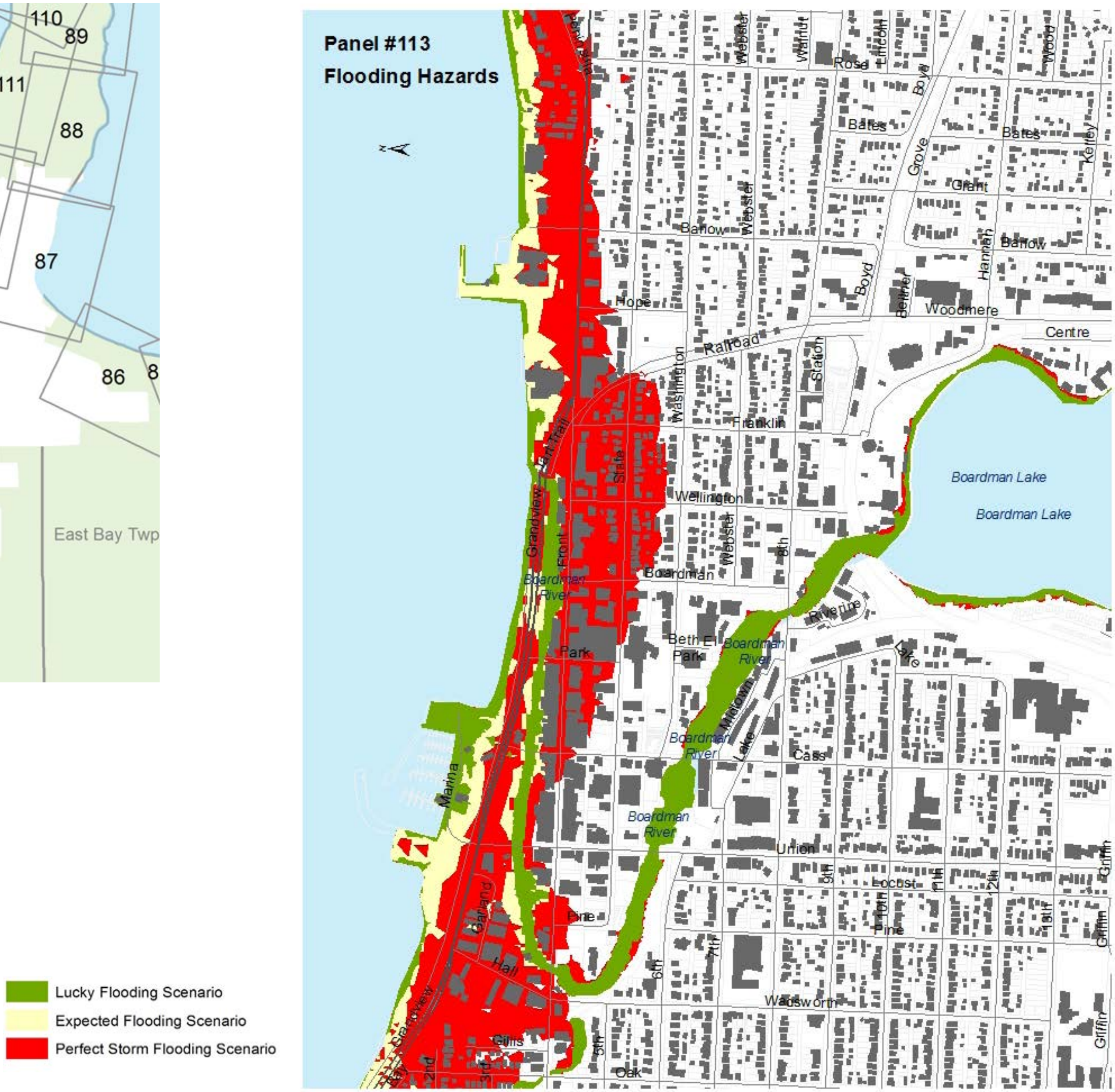
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

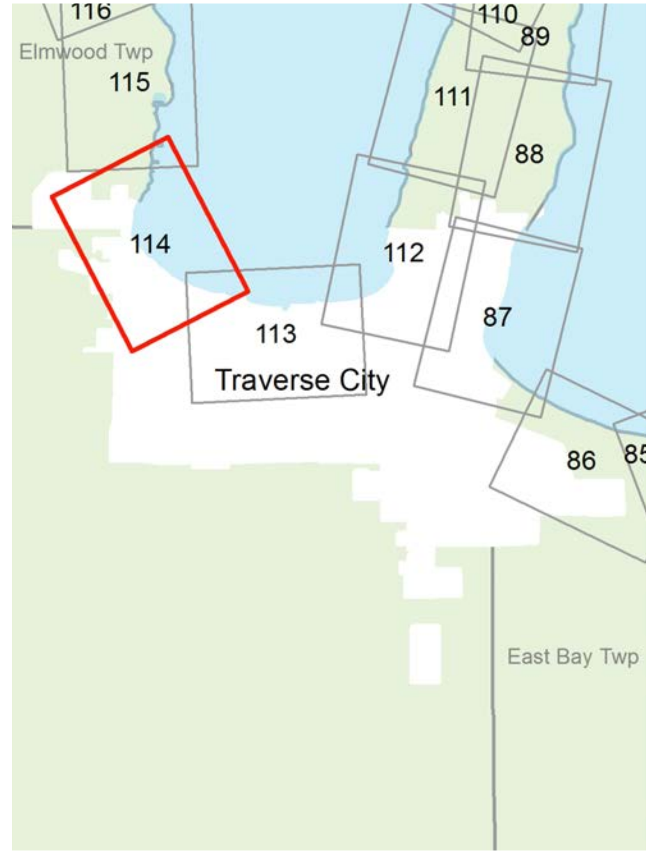


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


116
Elmwood Twp
115
110
89
111
88
114
112
113
Traverse City
87
86
East Bay Twp


Grand Traverse County


Panel #113
Flooding Hazards
Boardman Lake
Boardman River
Grandview
Front
State
Washington
Railroad
Franklin
Wellington
Boardman
Park
Union
Cass
Wadsworth
Pine
Hall
Garland
Marina
Woodmere
Centre
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

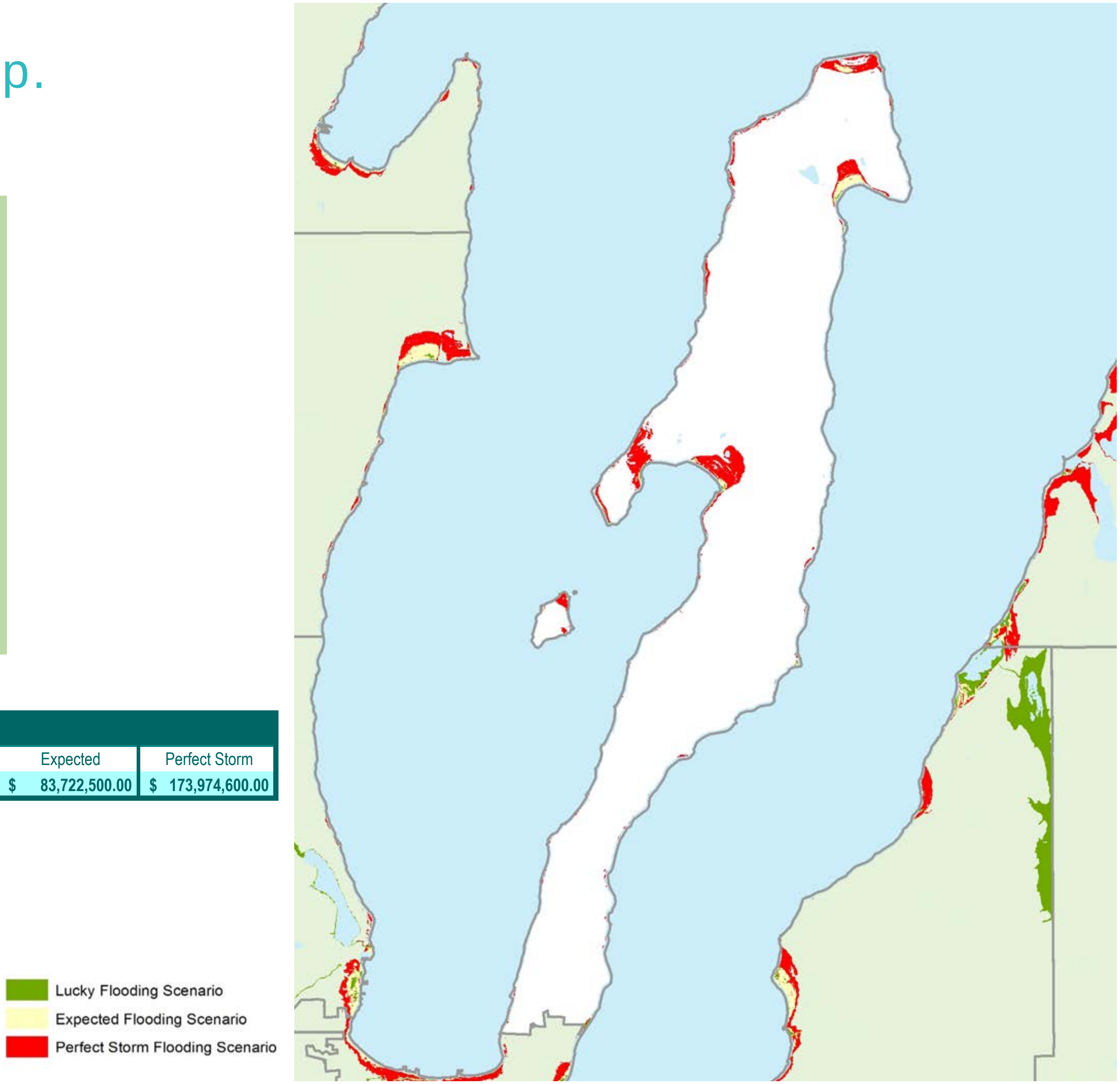


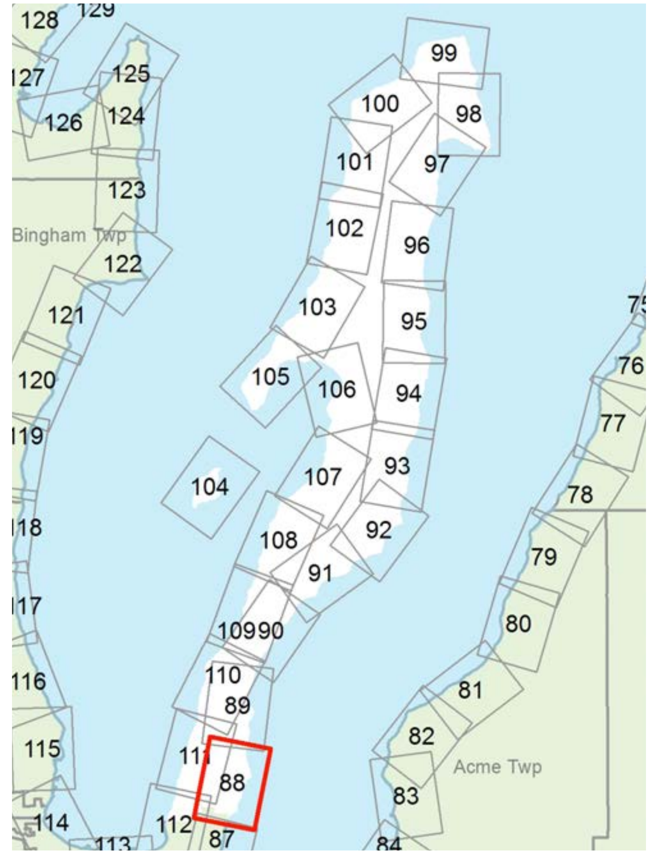
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Peninsula Twp.

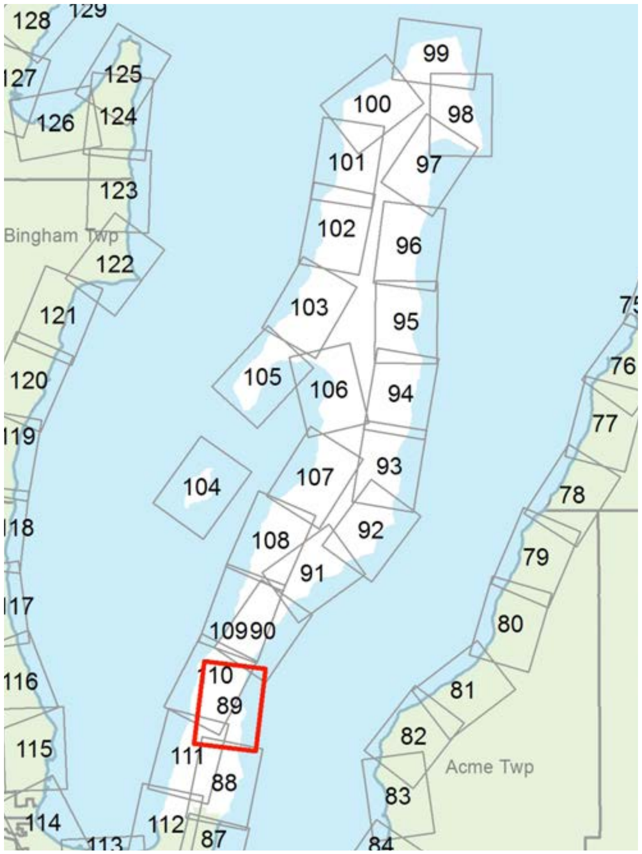
Coastal Flooding Scenario Impacts

Peninsula			
Total SEV	Lucky	Expected	Perfect Storm
$ 983,995,100.00	$ 27,833,100.00	$ 83,722,500.00	$ 173,974,600.00





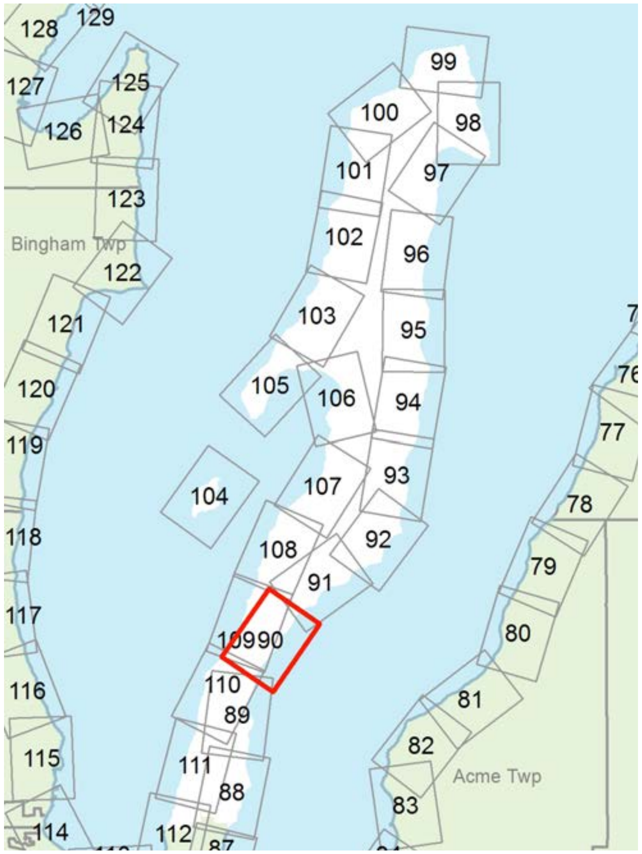
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



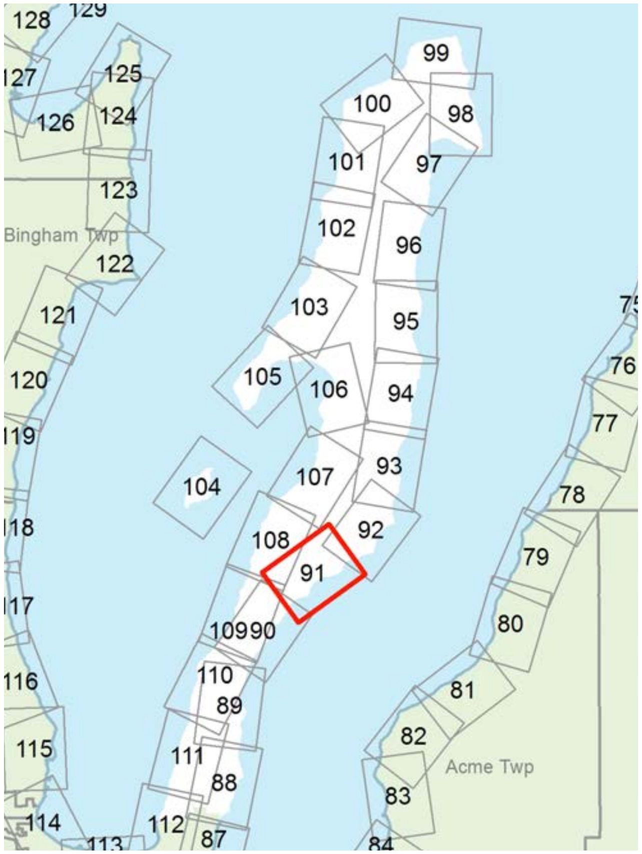
Lucky Flooding Scenario

Expected Flooding Scenario

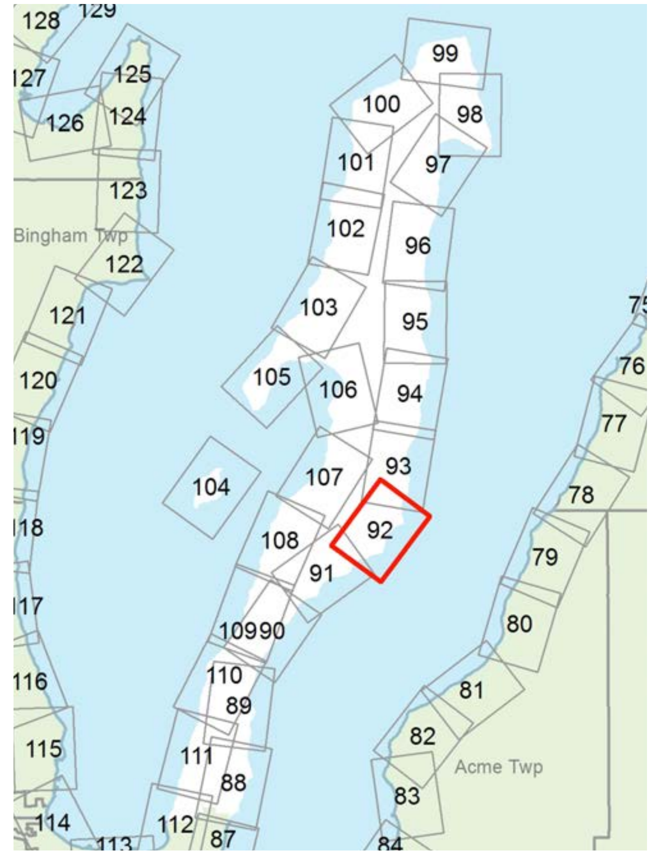
Perfect Storm Flooding Scenario



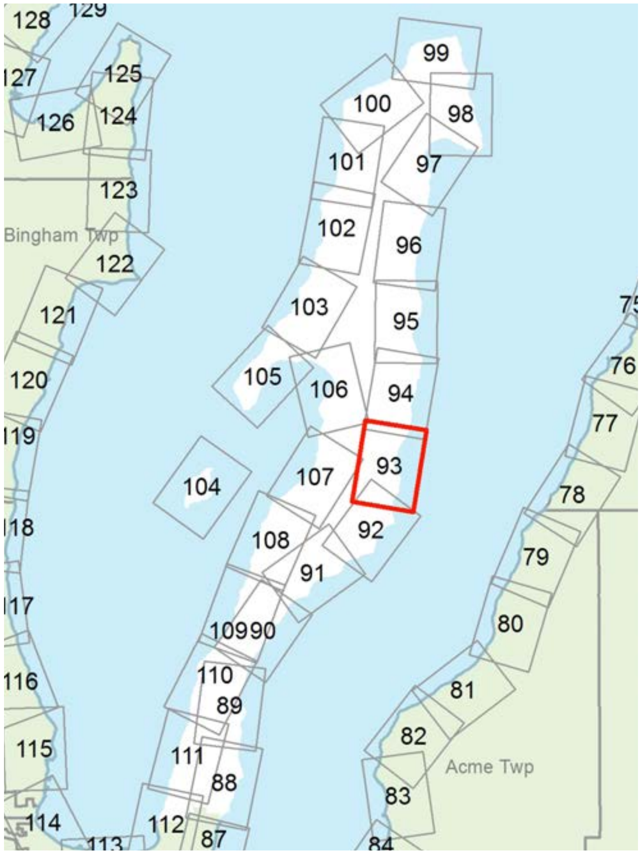
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



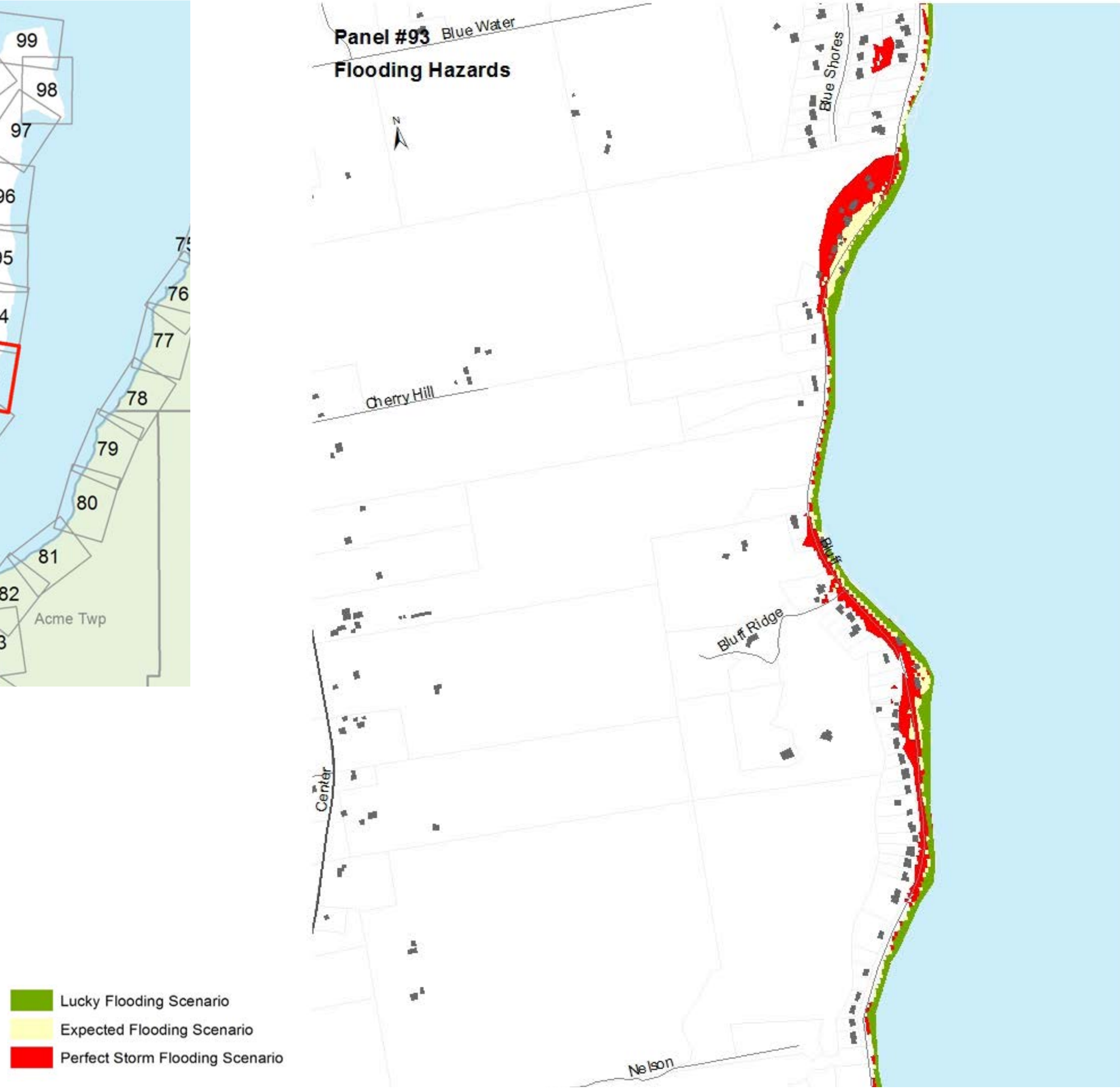
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

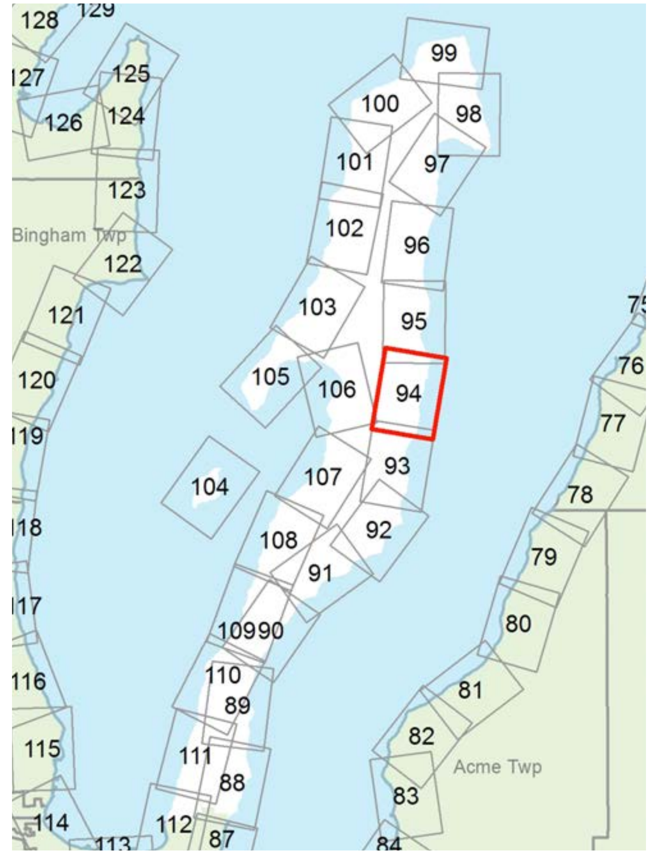


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

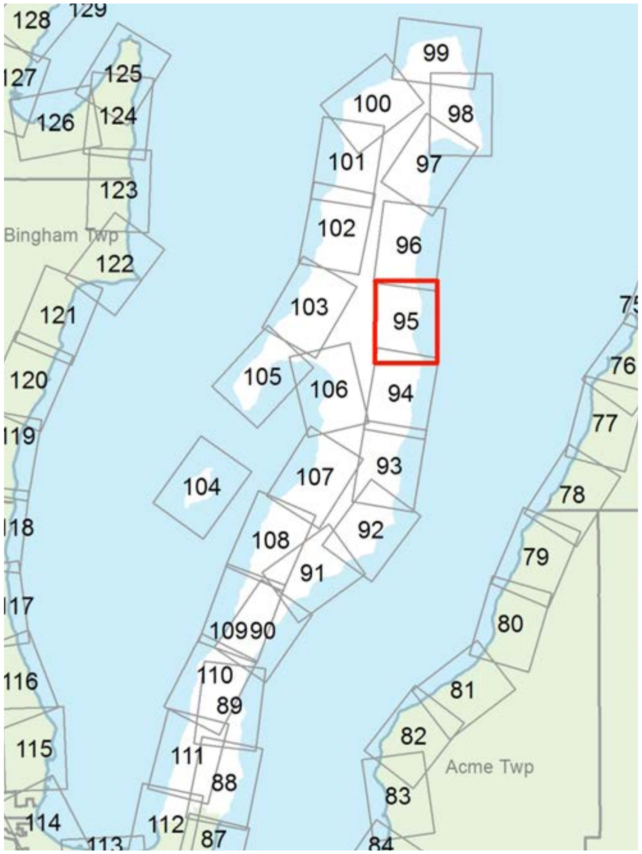

Bingham Twp
Acme Twp

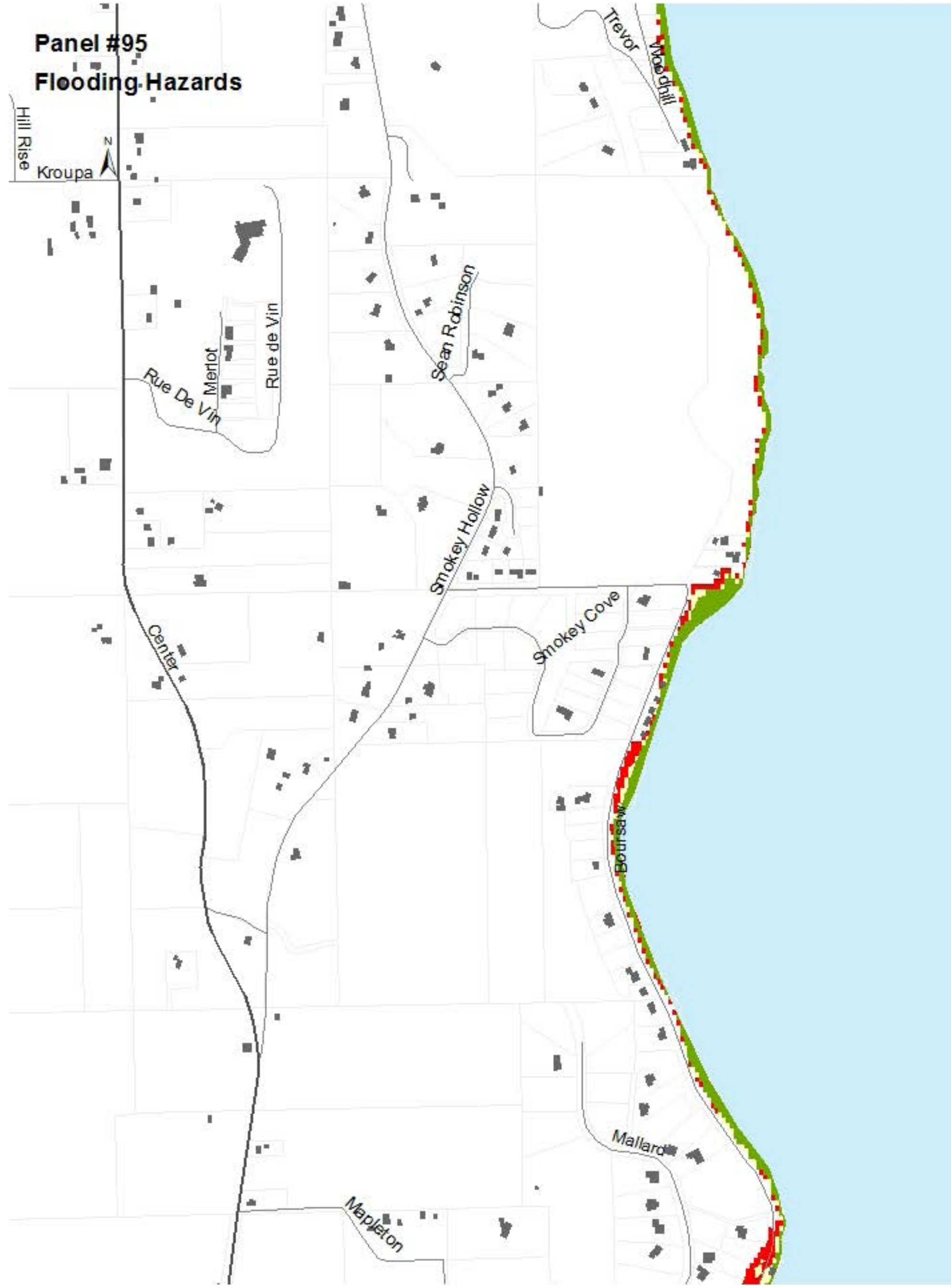

Grand Traverse County


Panel #93
Flooding Hazards
Blue Water
Blue Shores
Cherry Hill
Bluff
Bluff Ridge
Center
Nelson
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

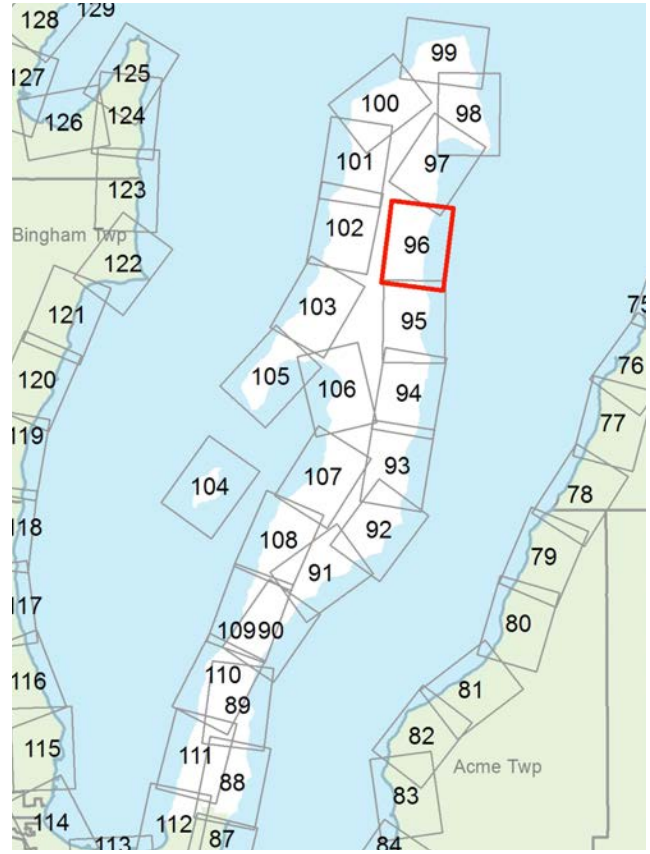




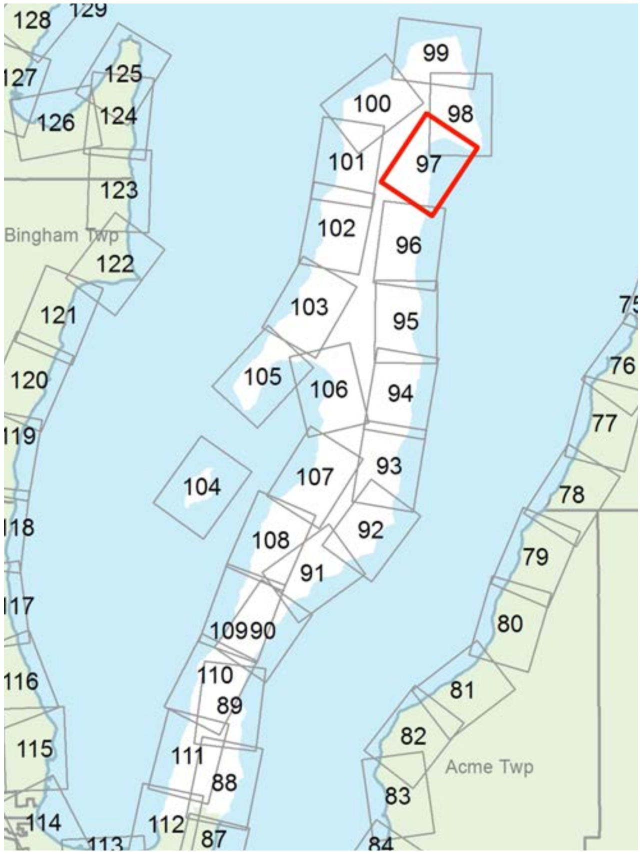
Lucky Flooding Scenario

Expected Flooding Scenario

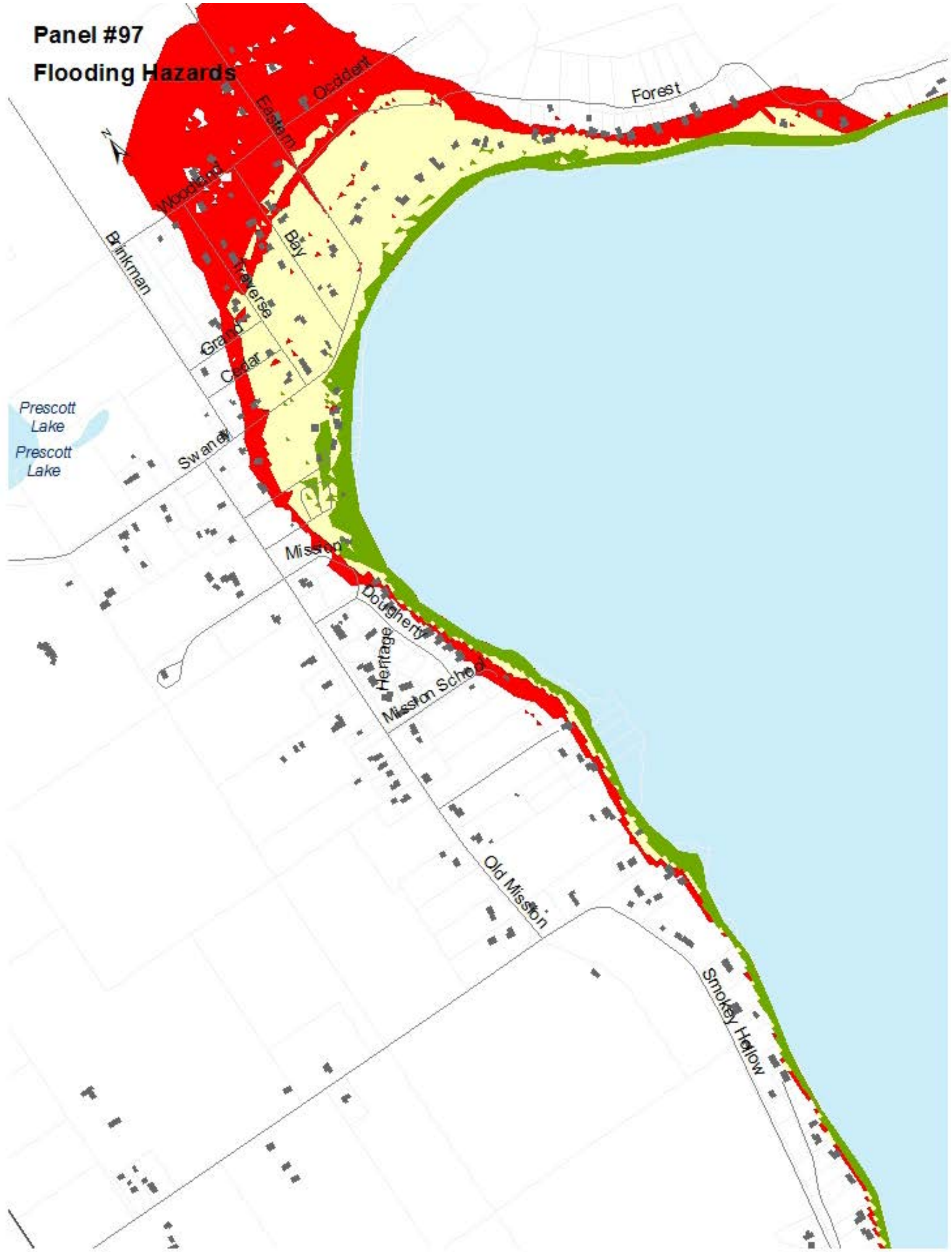
Perfect Storm Flooding Scenario

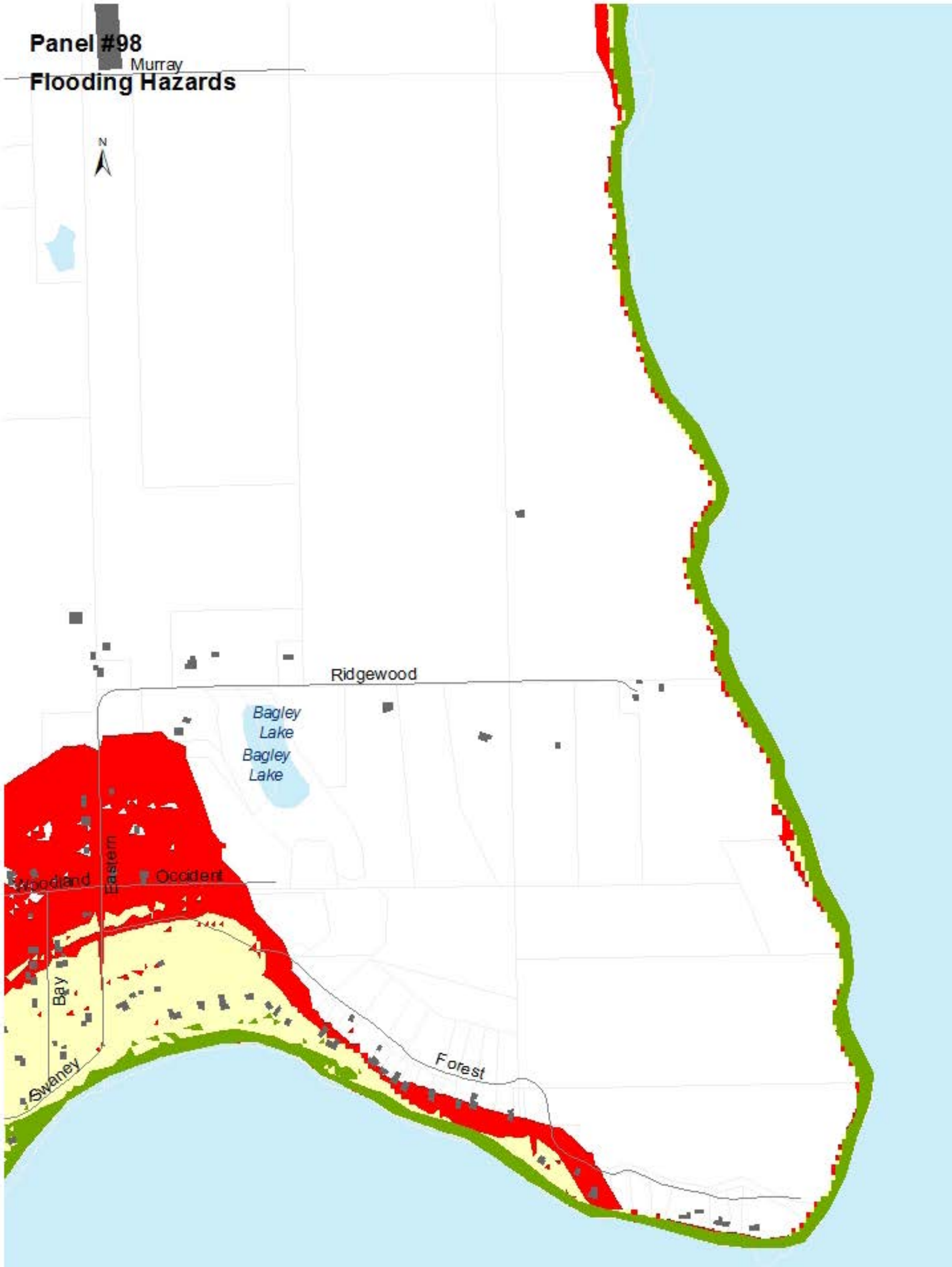


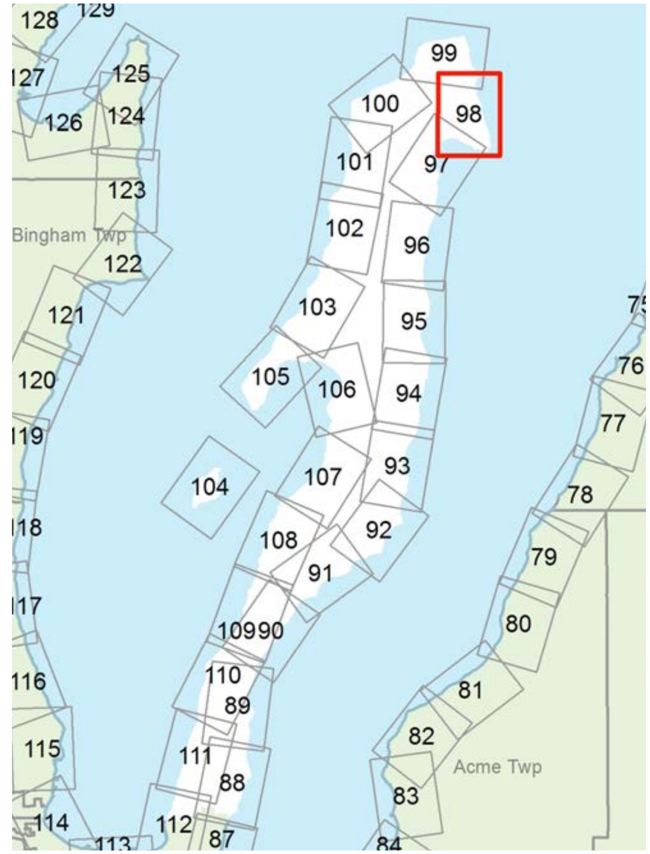
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



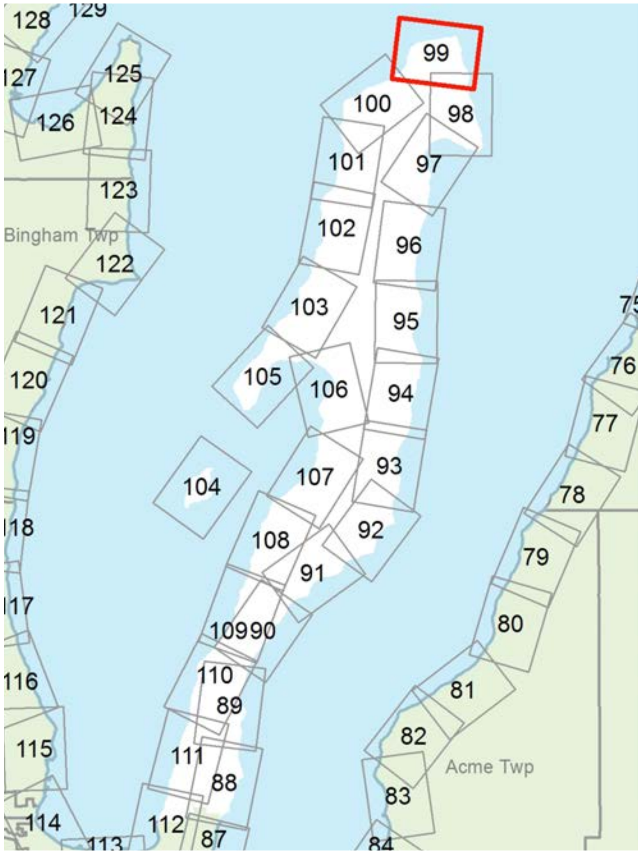
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario







Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Bingham Twp
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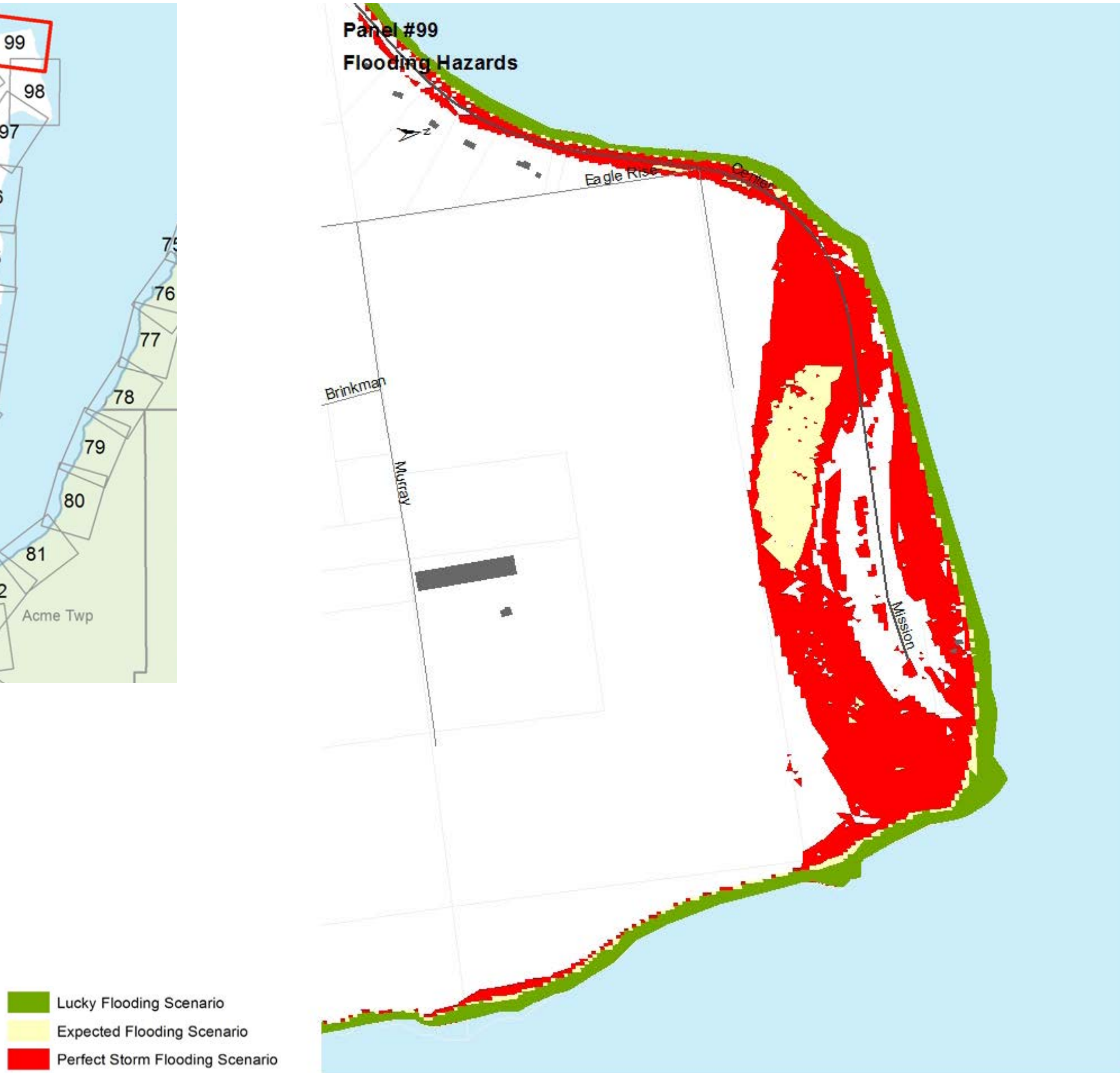
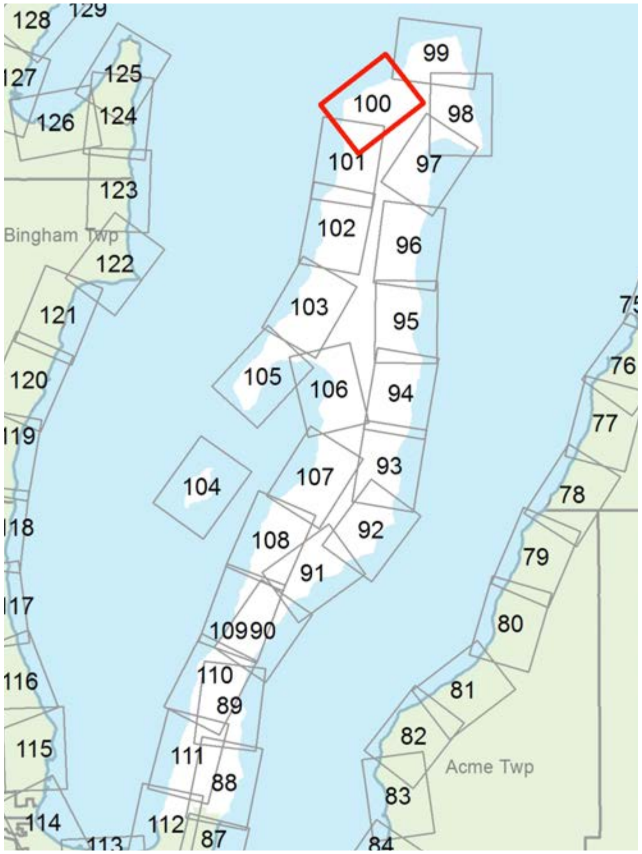
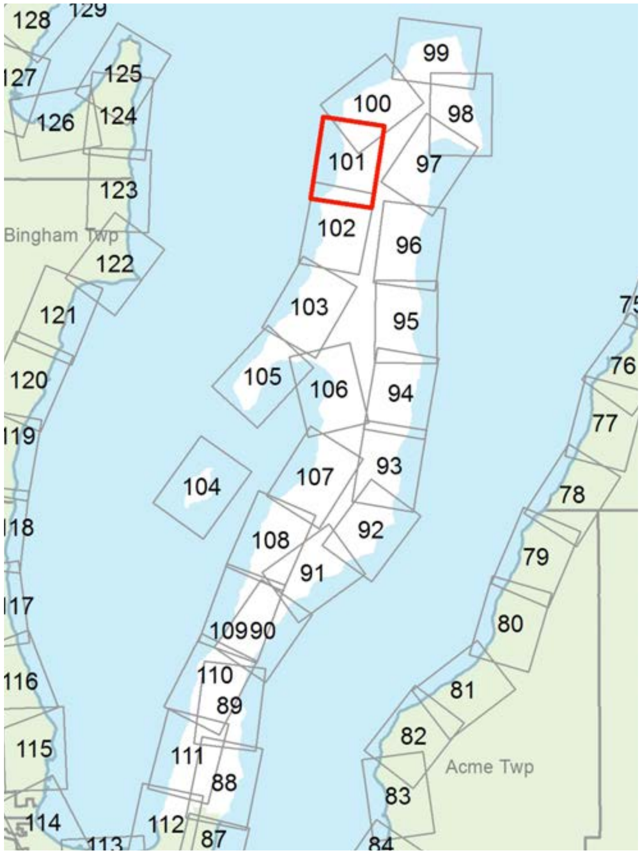
Acme Twp


Grand Traverse County


Panel #99
Flooding Hazards
Eagle Rise
Center
Brinkman
Murray
Mission
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Bingham Twp
Acme Twp
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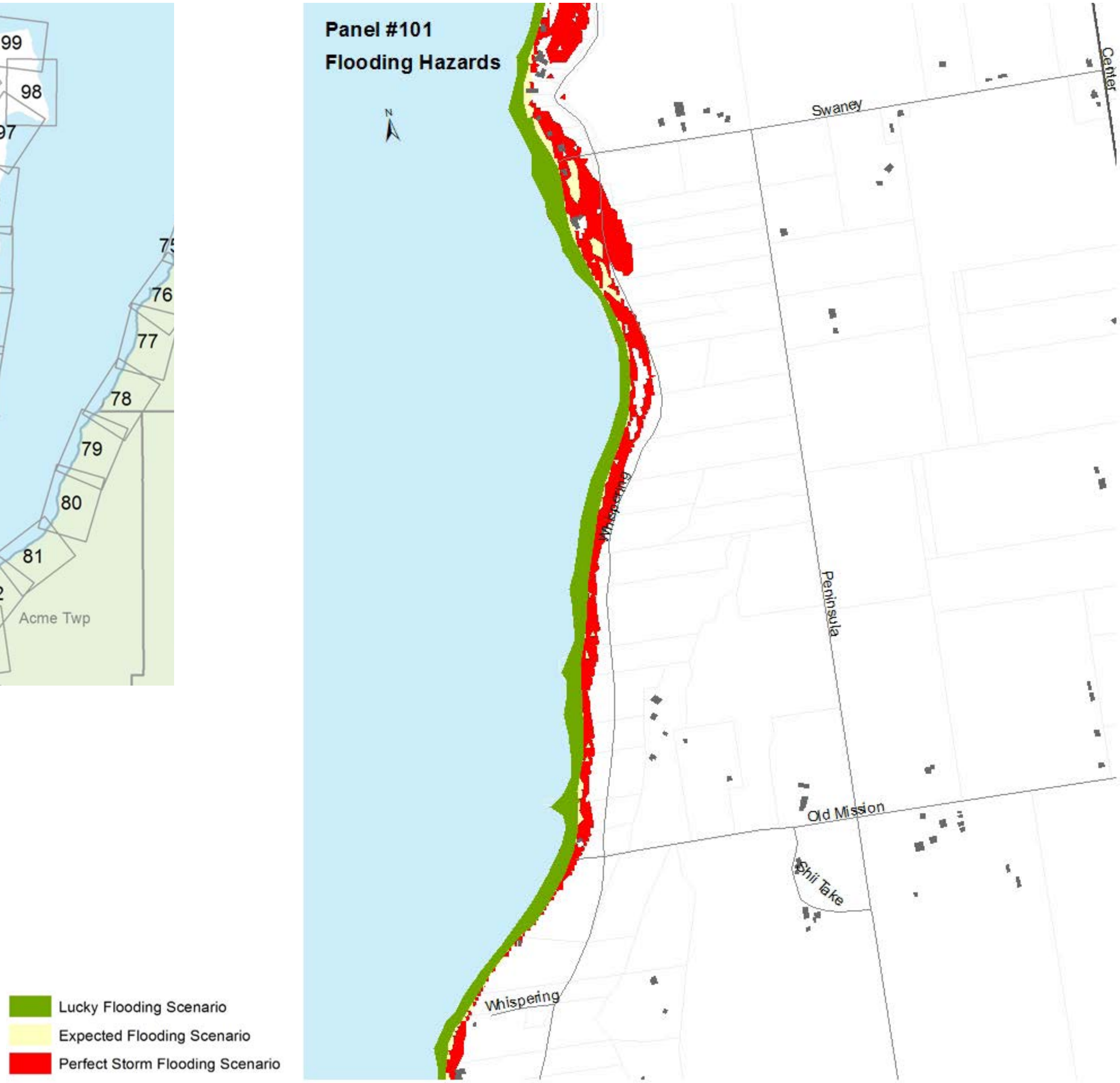
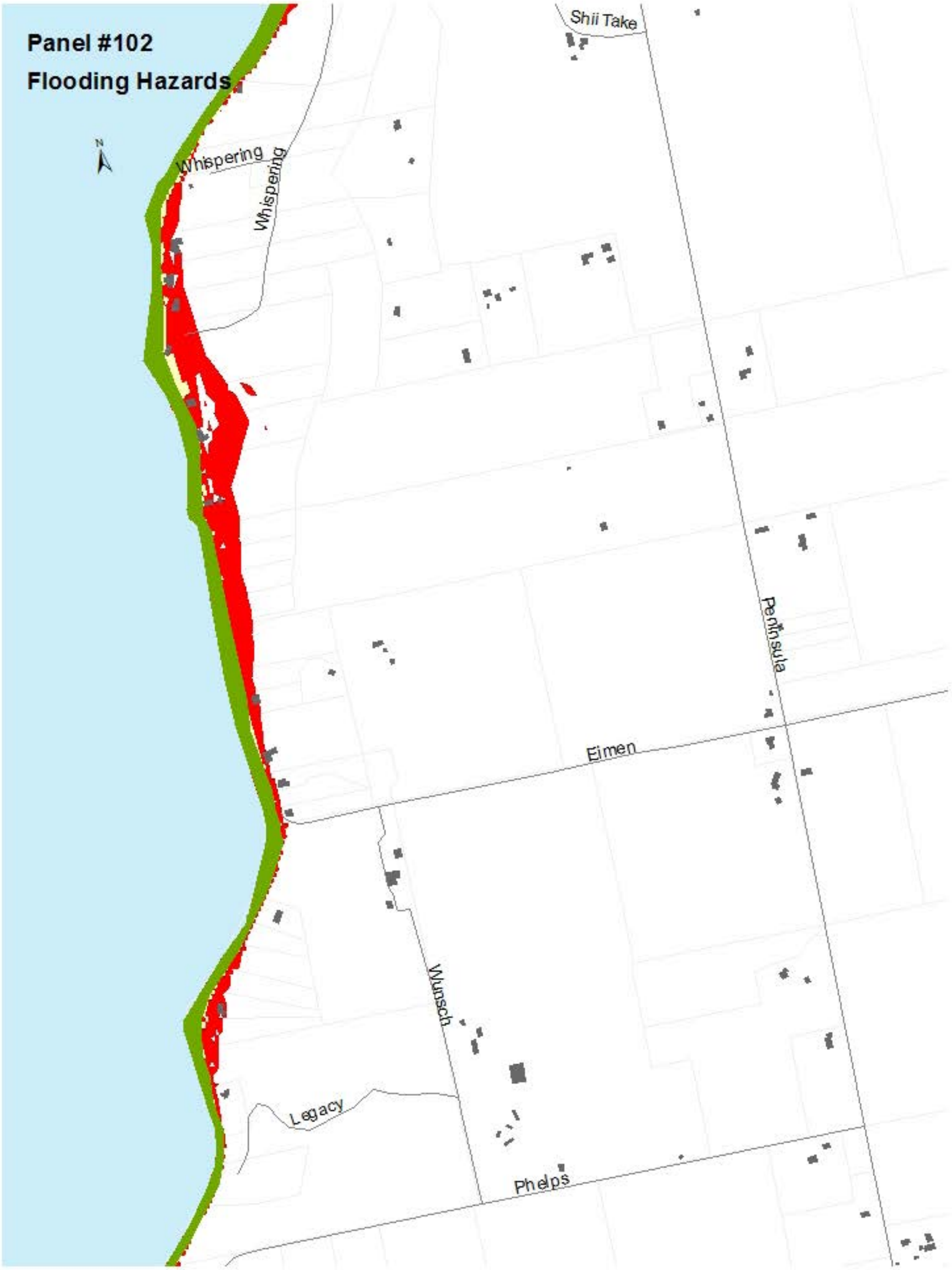
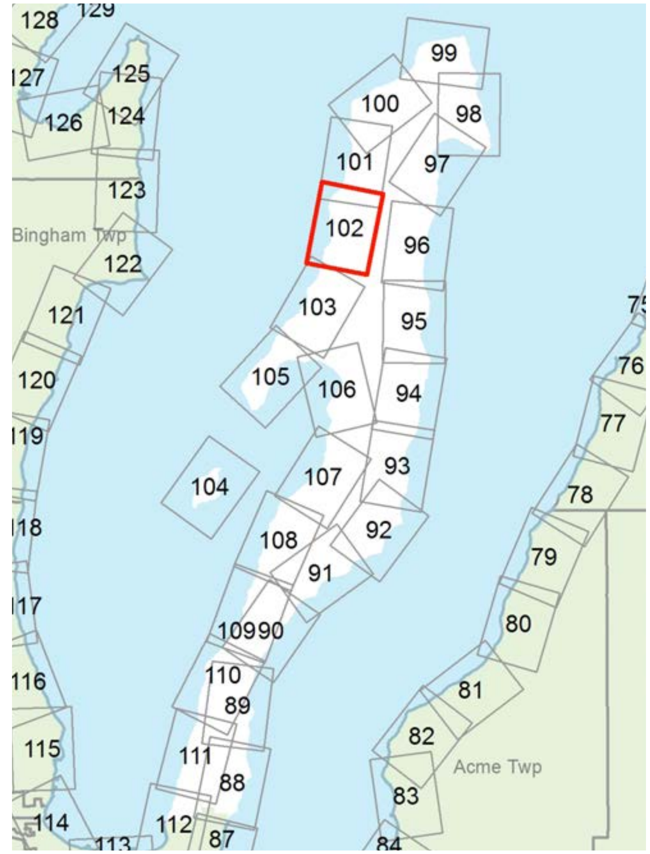
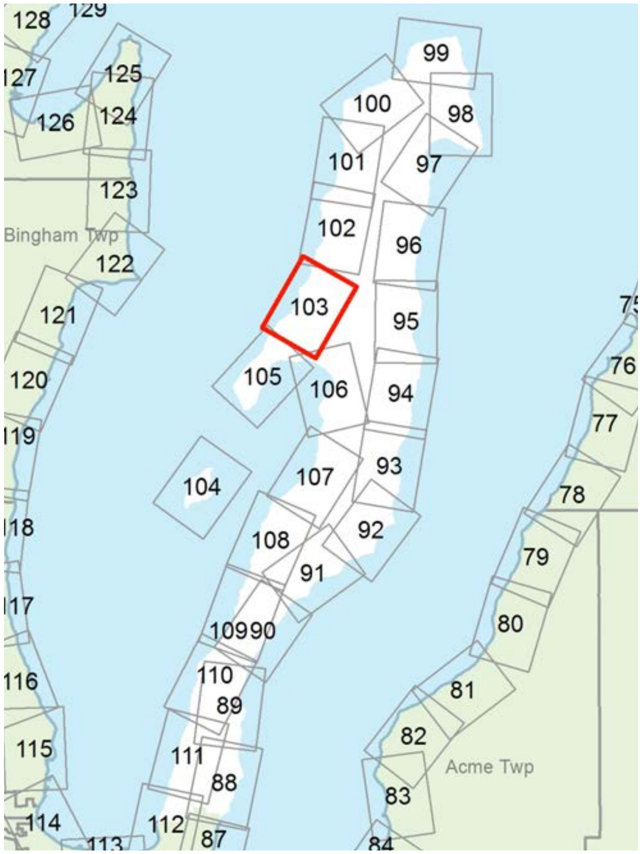
Grand Traverse County

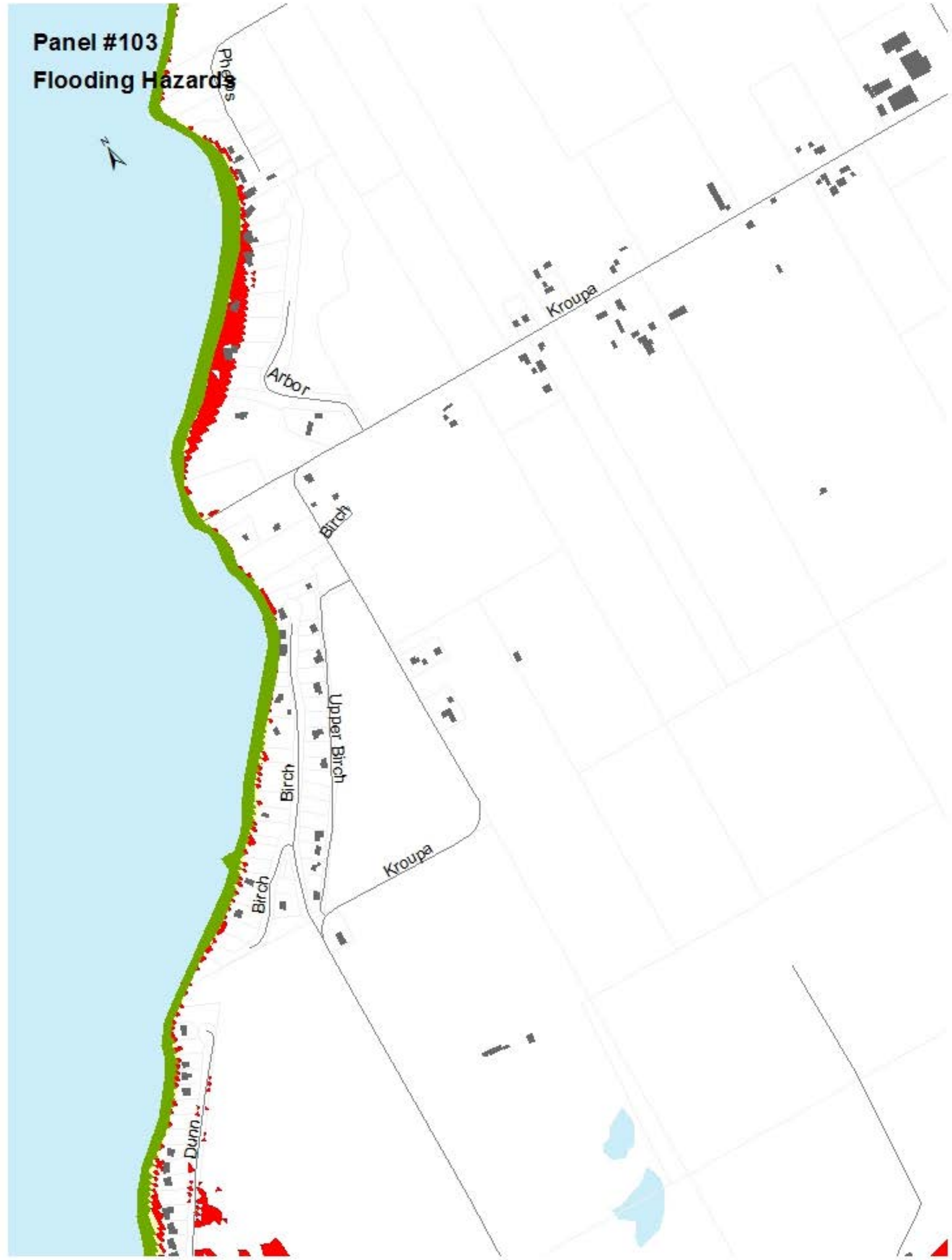

Panel #101
Flooding Hazards
N
Swaney
Center
Whispering
Peninsula
Old Mission
Shi Take
Whispering
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



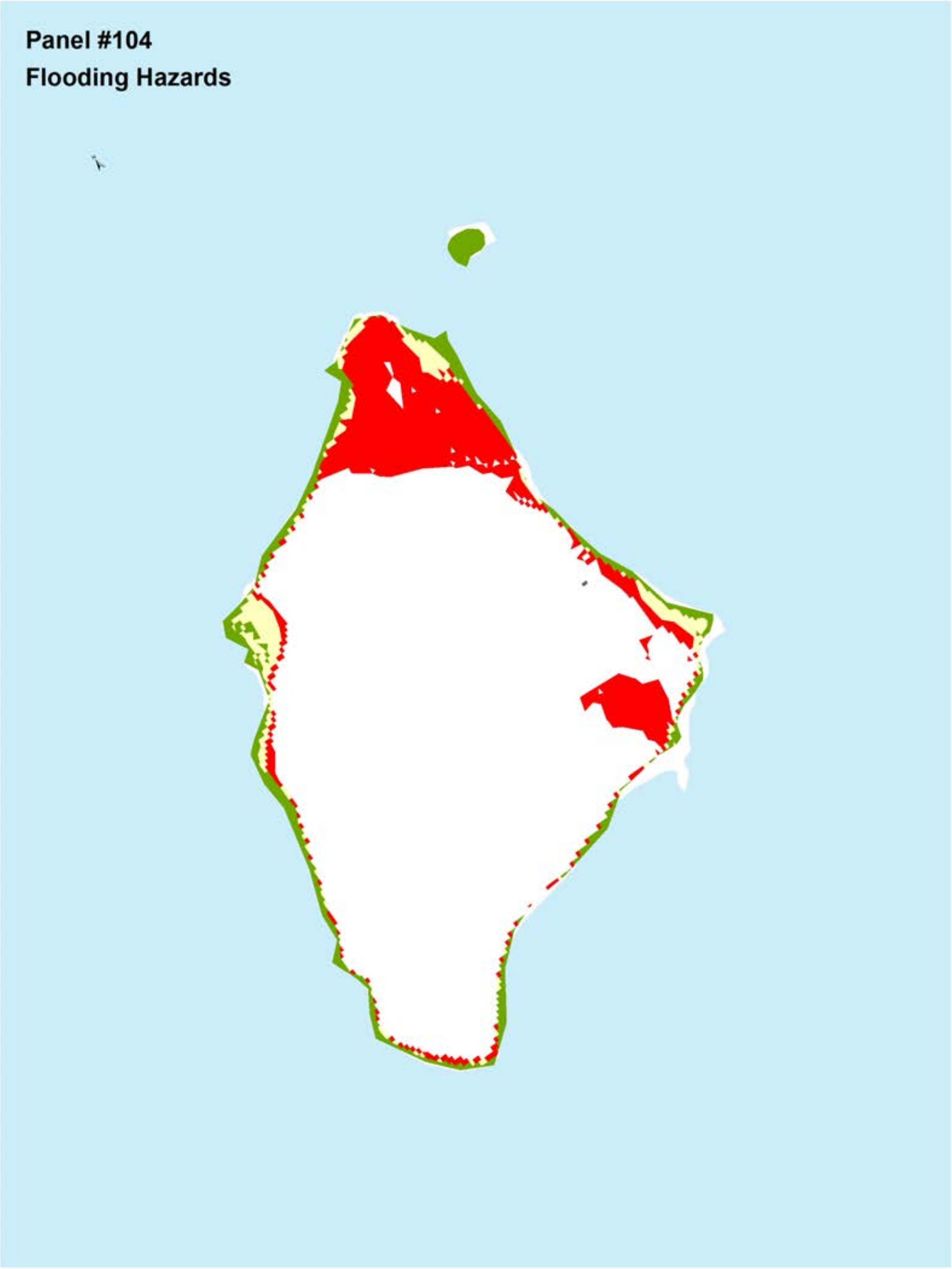


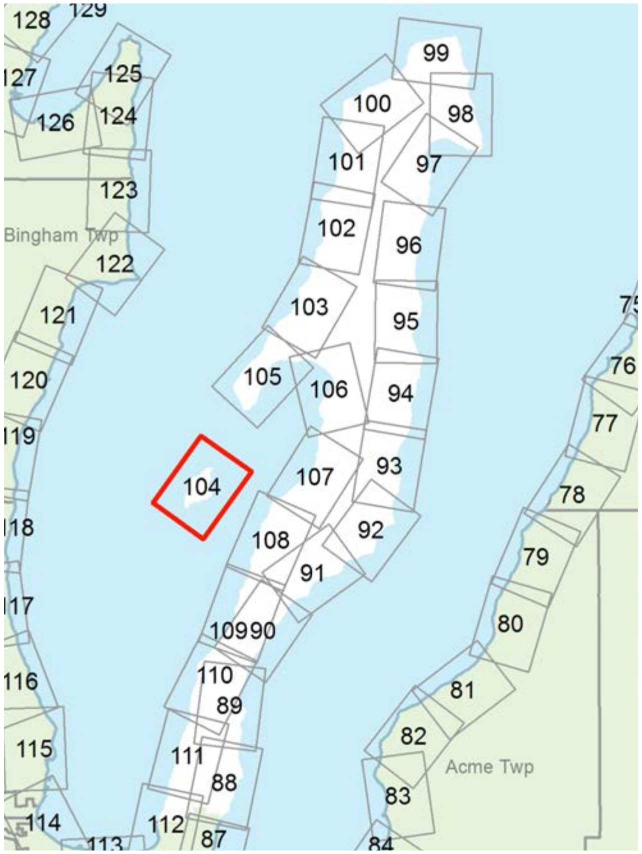
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



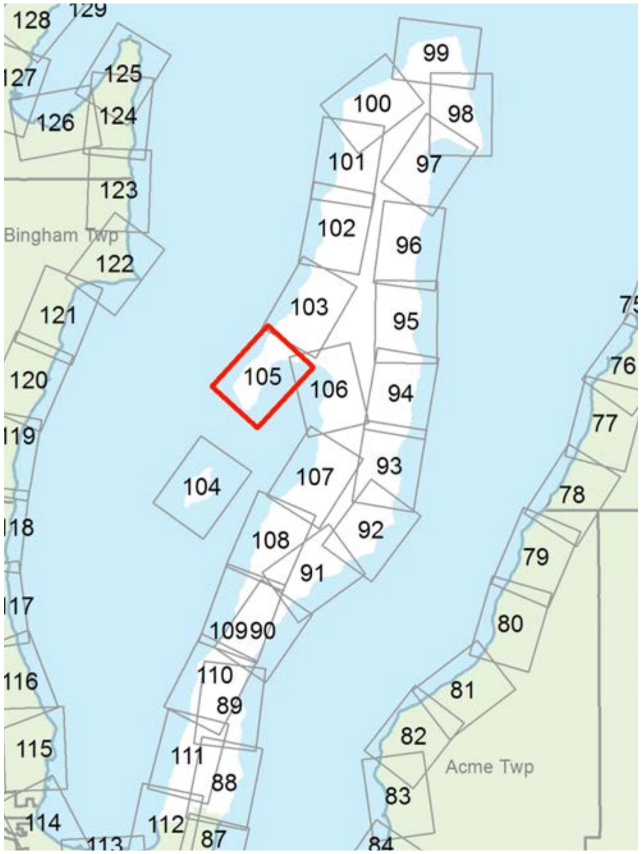


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

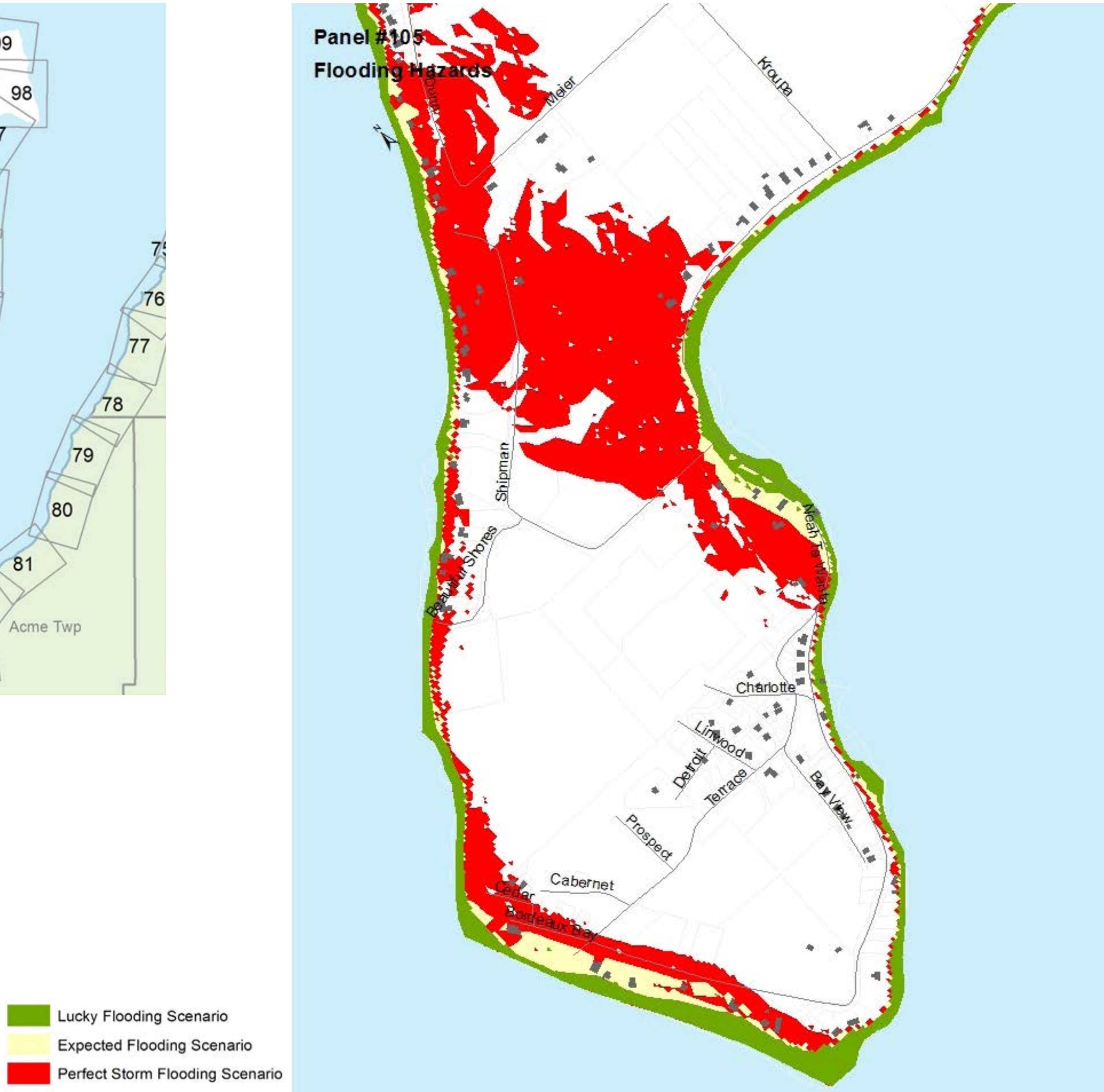


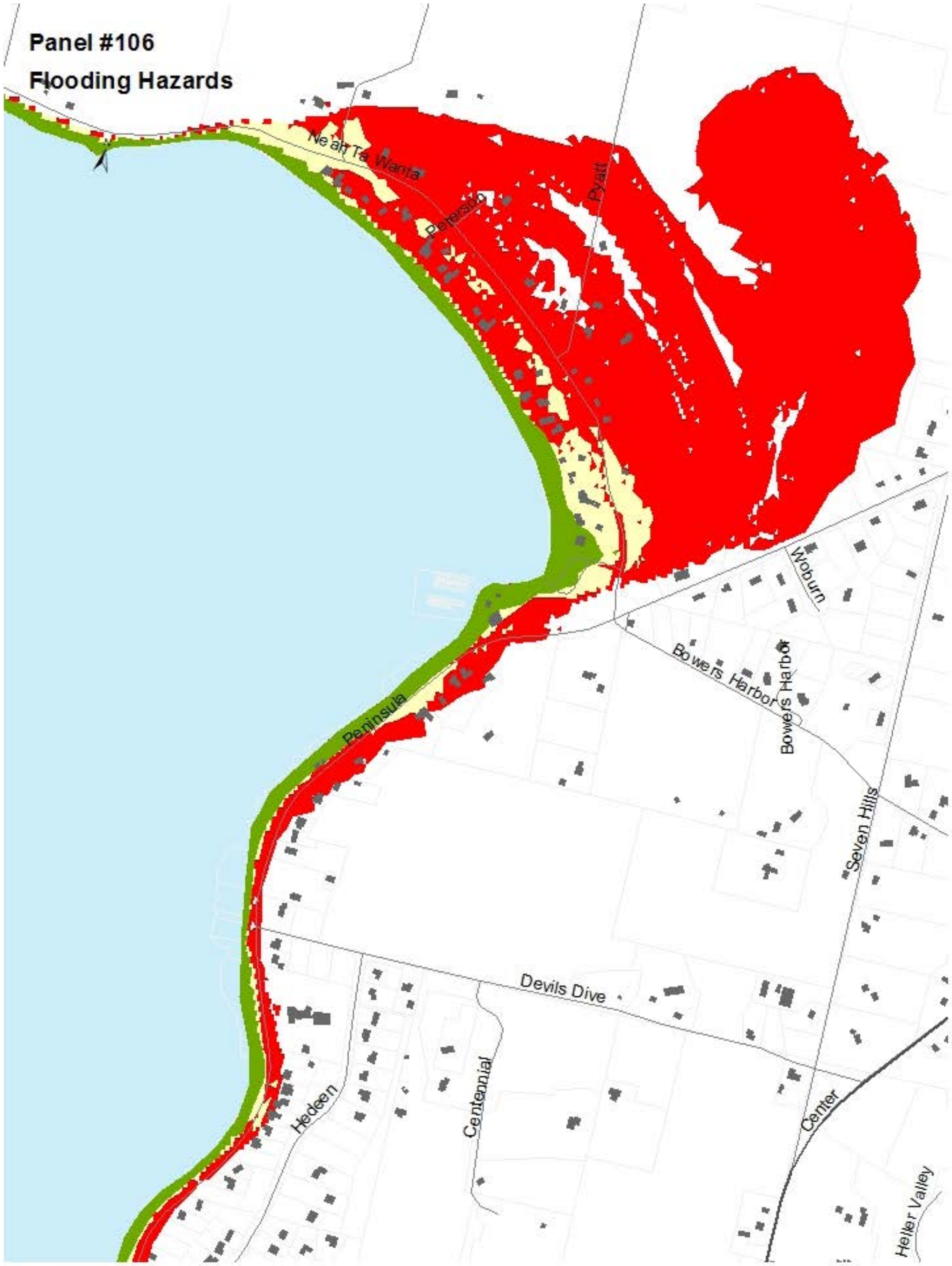


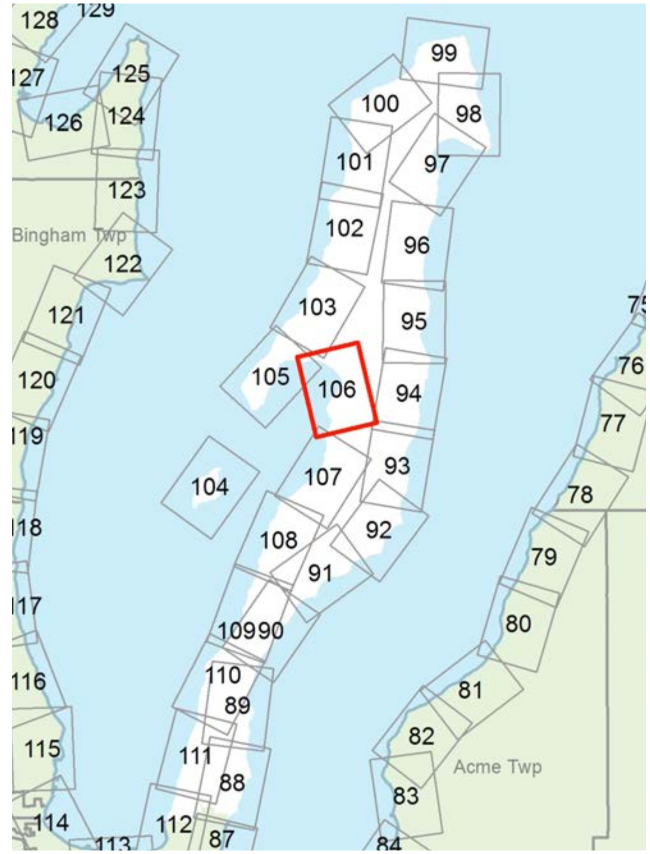
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Bingham Twp
Acme Twp

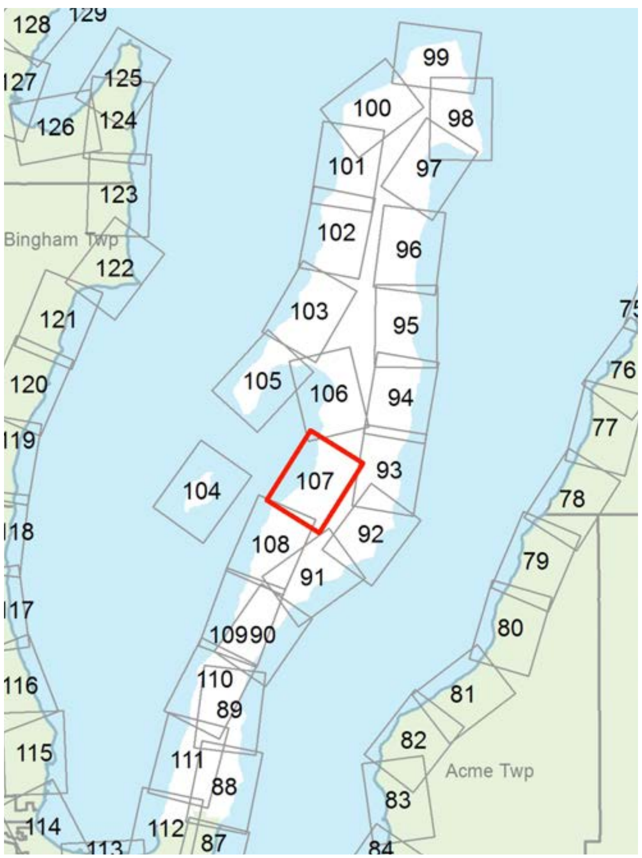

Grand Traverse County


Panel #105
Flooding Hazards
Meier
Kroupa
Shipman
Beaufort Shores
Neah Ta Wanta
Charlotte
Linwood
Detroit
Terrace
Bay View
Prospect
Cabernet
Cedar
Bordeaux Bay
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

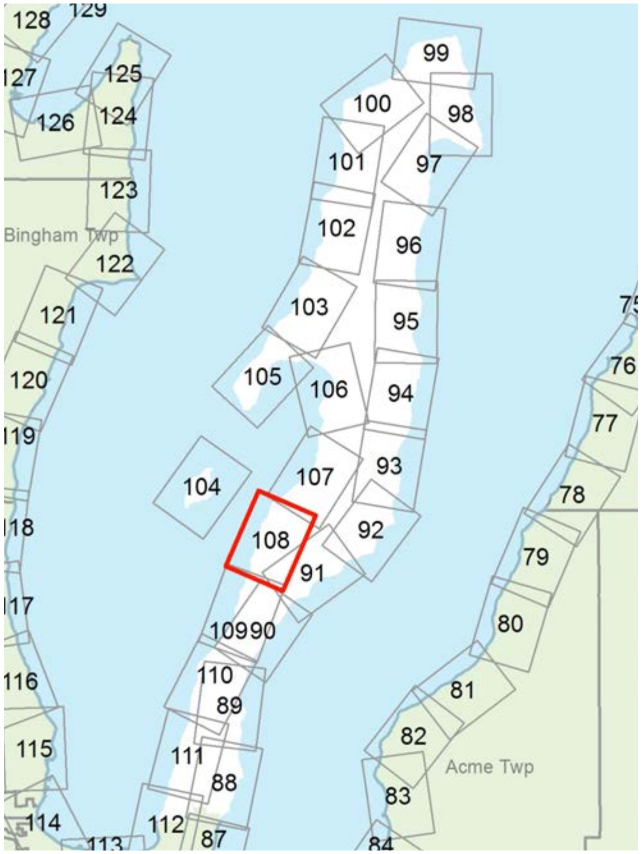




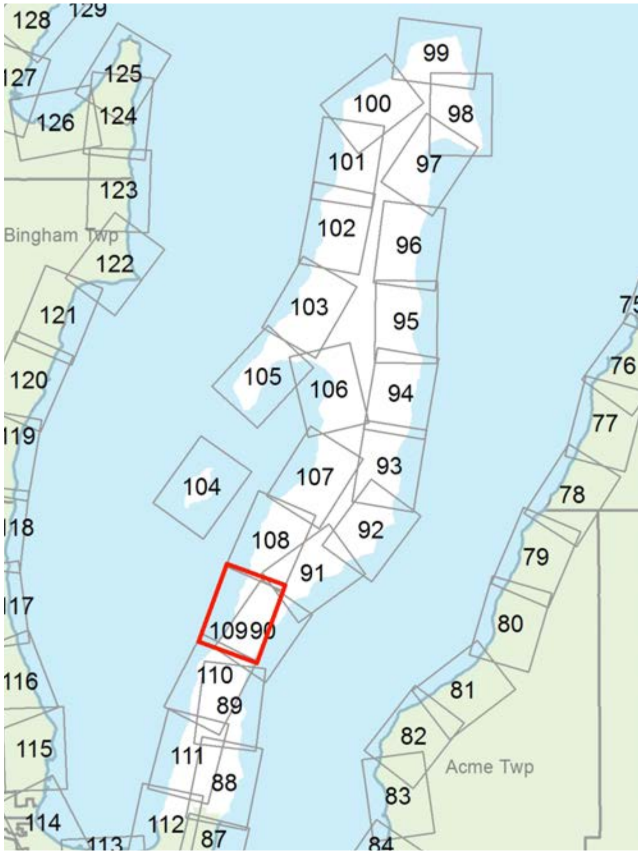
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Bingham Twp
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Acme Twp
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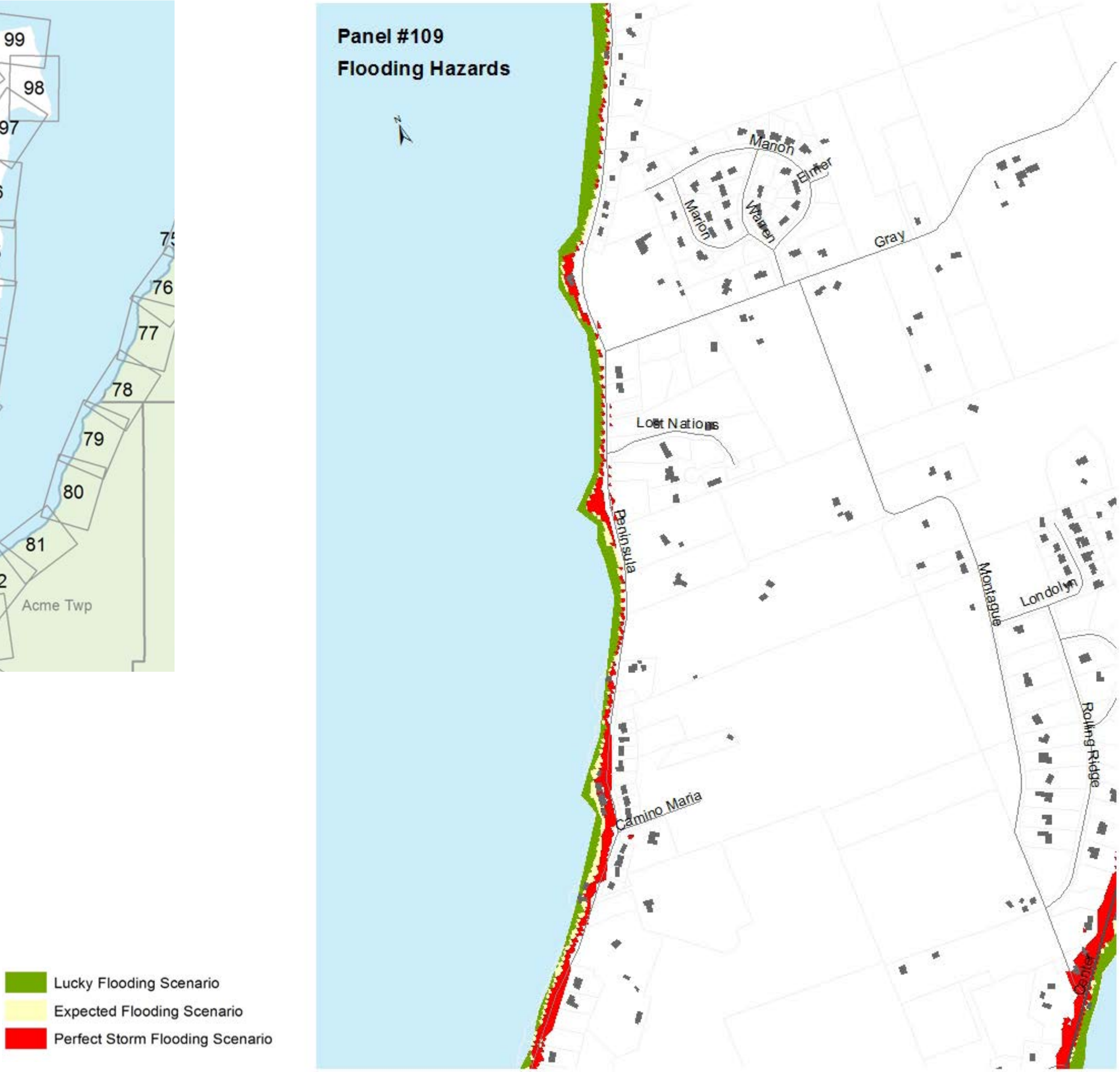
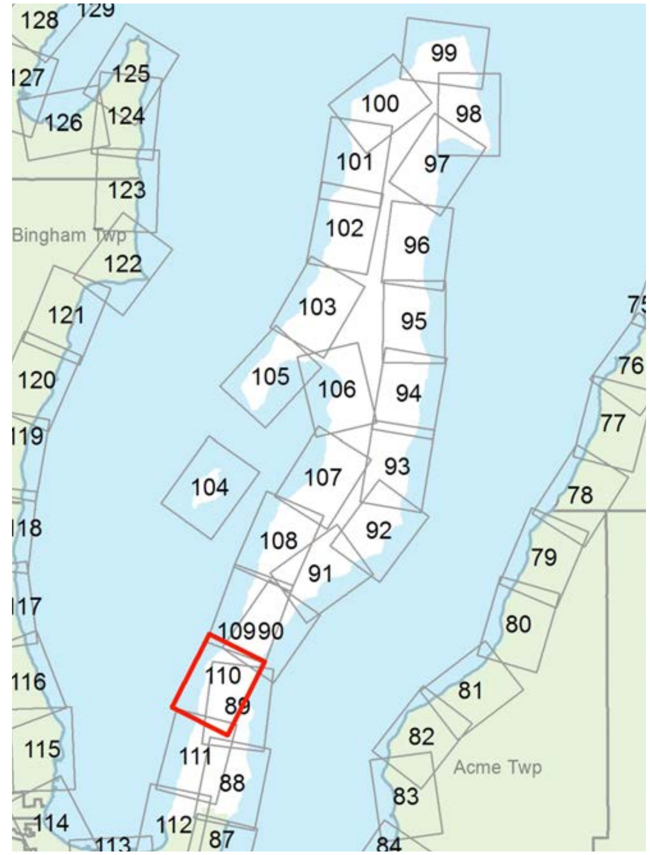
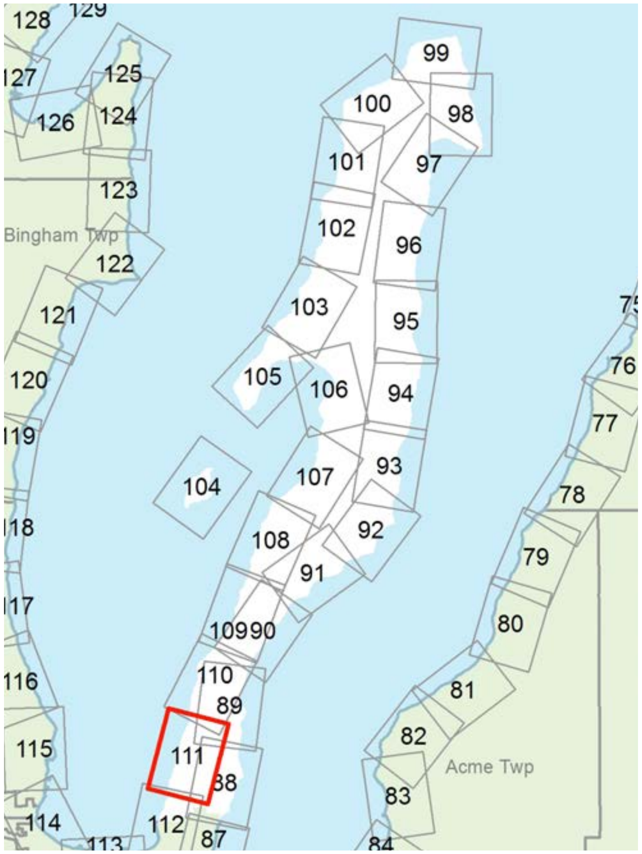
Grand Traverse County


Panel #109
Flooding Hazards
Manon
Elmer
Marion
Warren
Gray
Lost Nations
Peninsula
Montague
Londolyn
Rolling Ridge
Camino Maria
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



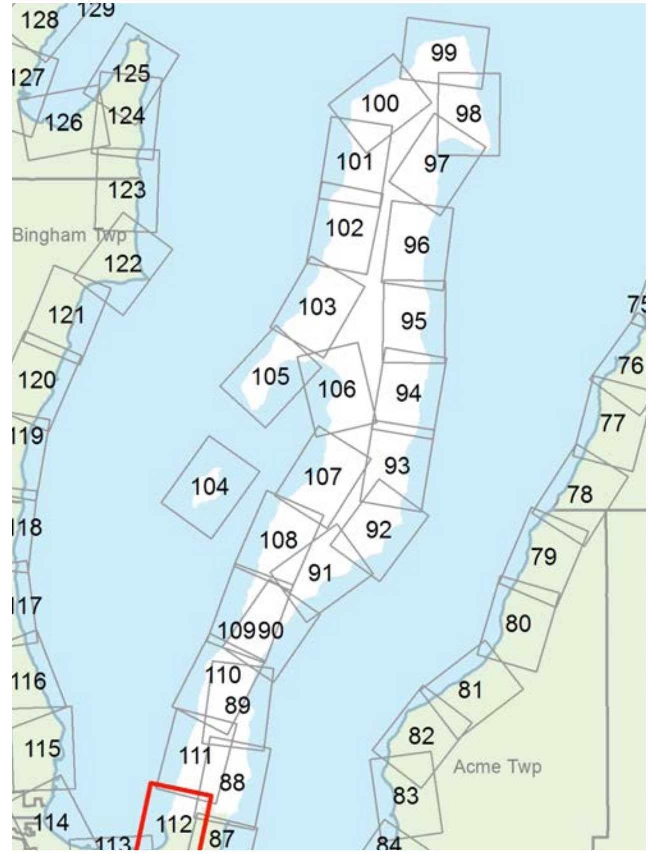
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

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Leelanau County

Coastal Flooding Scenario Impacts

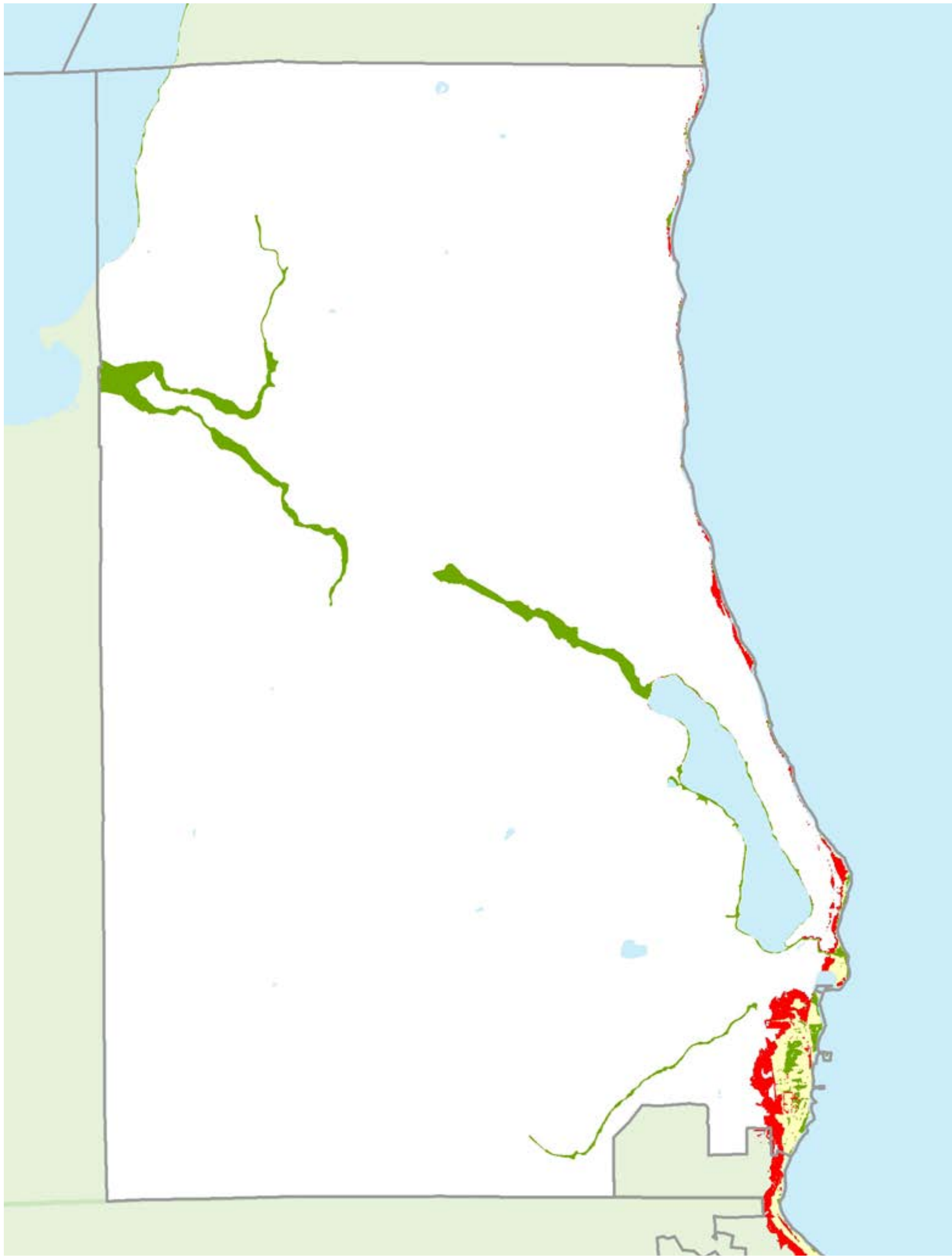
Leelanau County			
Total SEV	Lucky	Expected	Perfect Storm
$ 3,402,236,245.00	$ 114,536,520.00	$ 255,435,310.00	$ 585,910,250.00

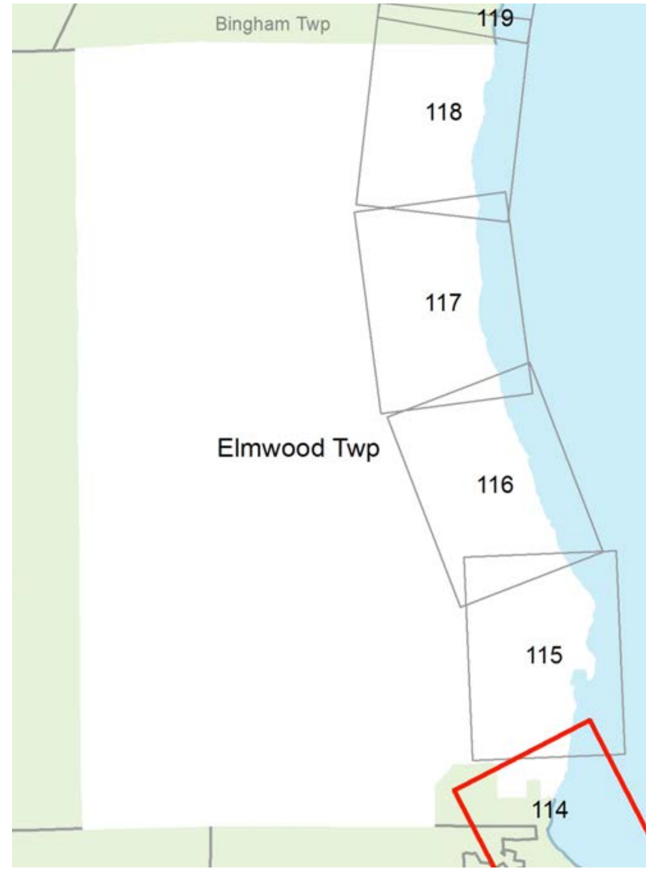
Elmwood Twp.

Coastal Flooding Scenario Impacts

Elmwood			
Total SEV	Lucky	Expected	Perfect Storm
$ 375,149,300.00	$ 15,989,600.00	$ 37,820,300.00	$ 50,055,500.00

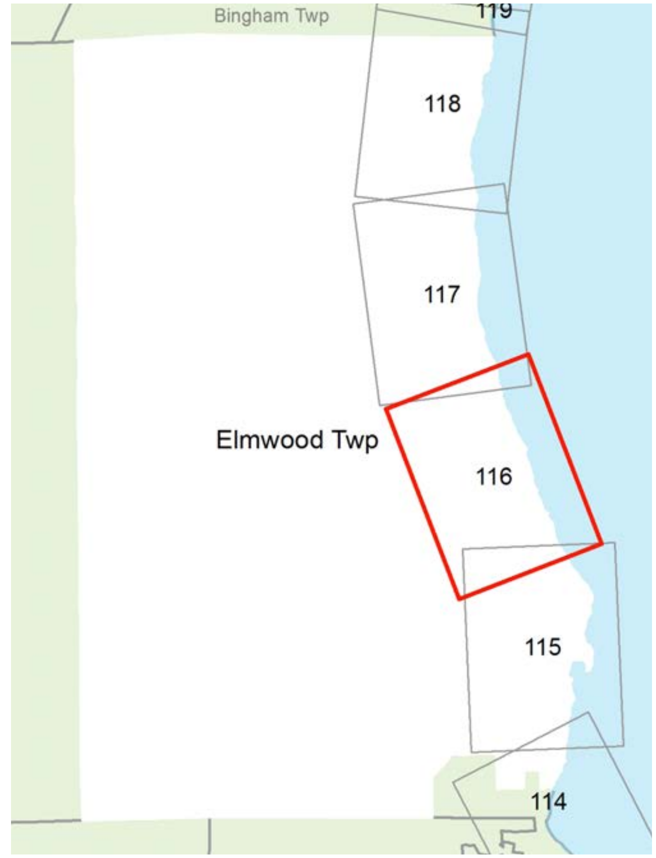
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



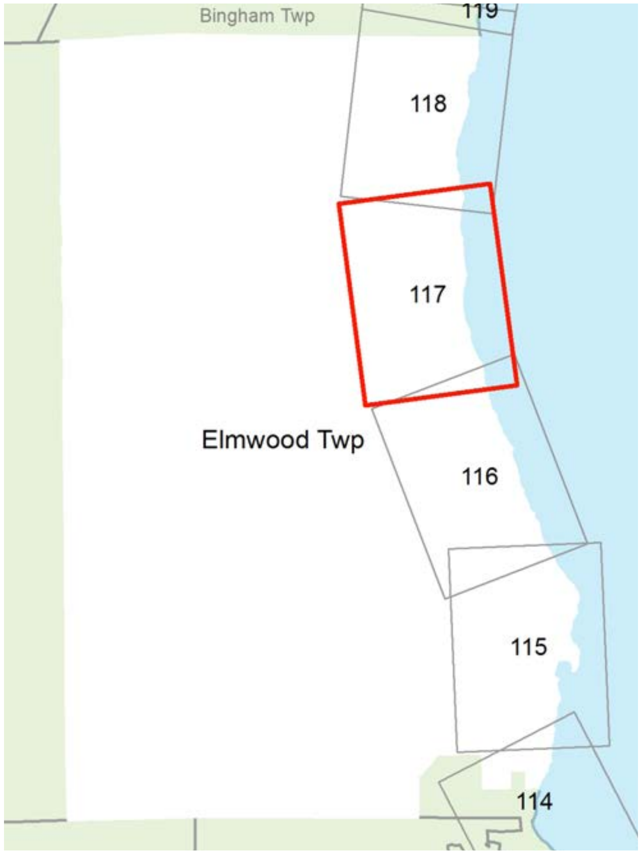


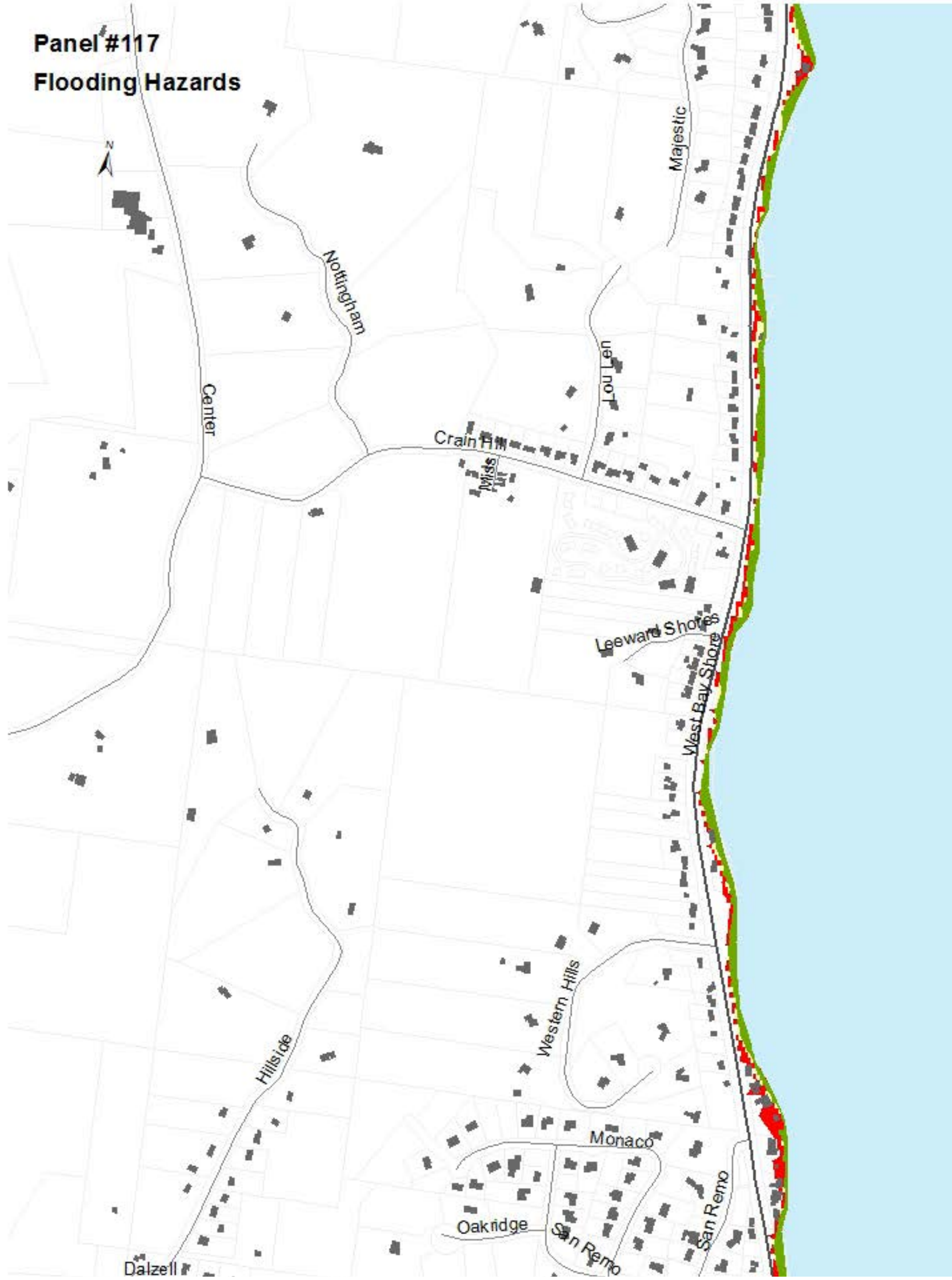
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

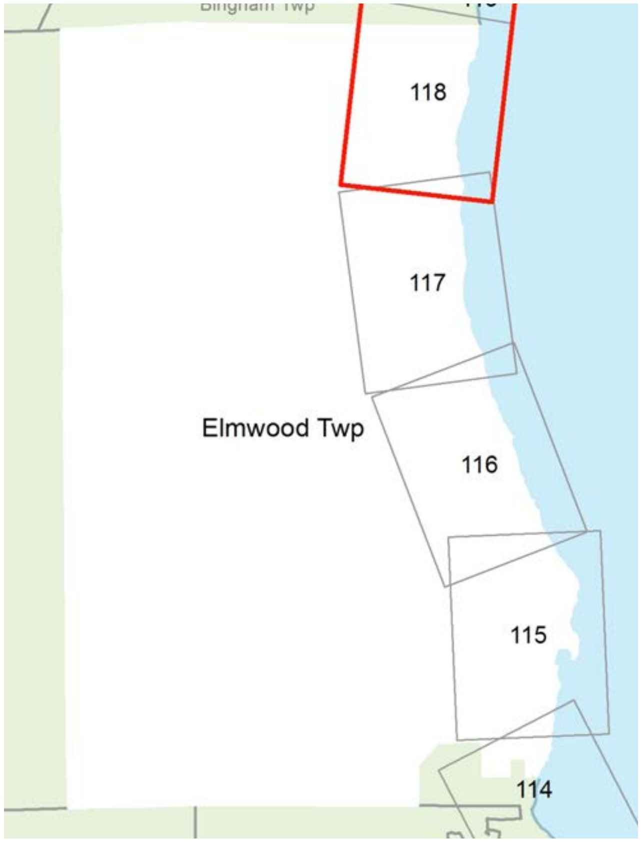


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

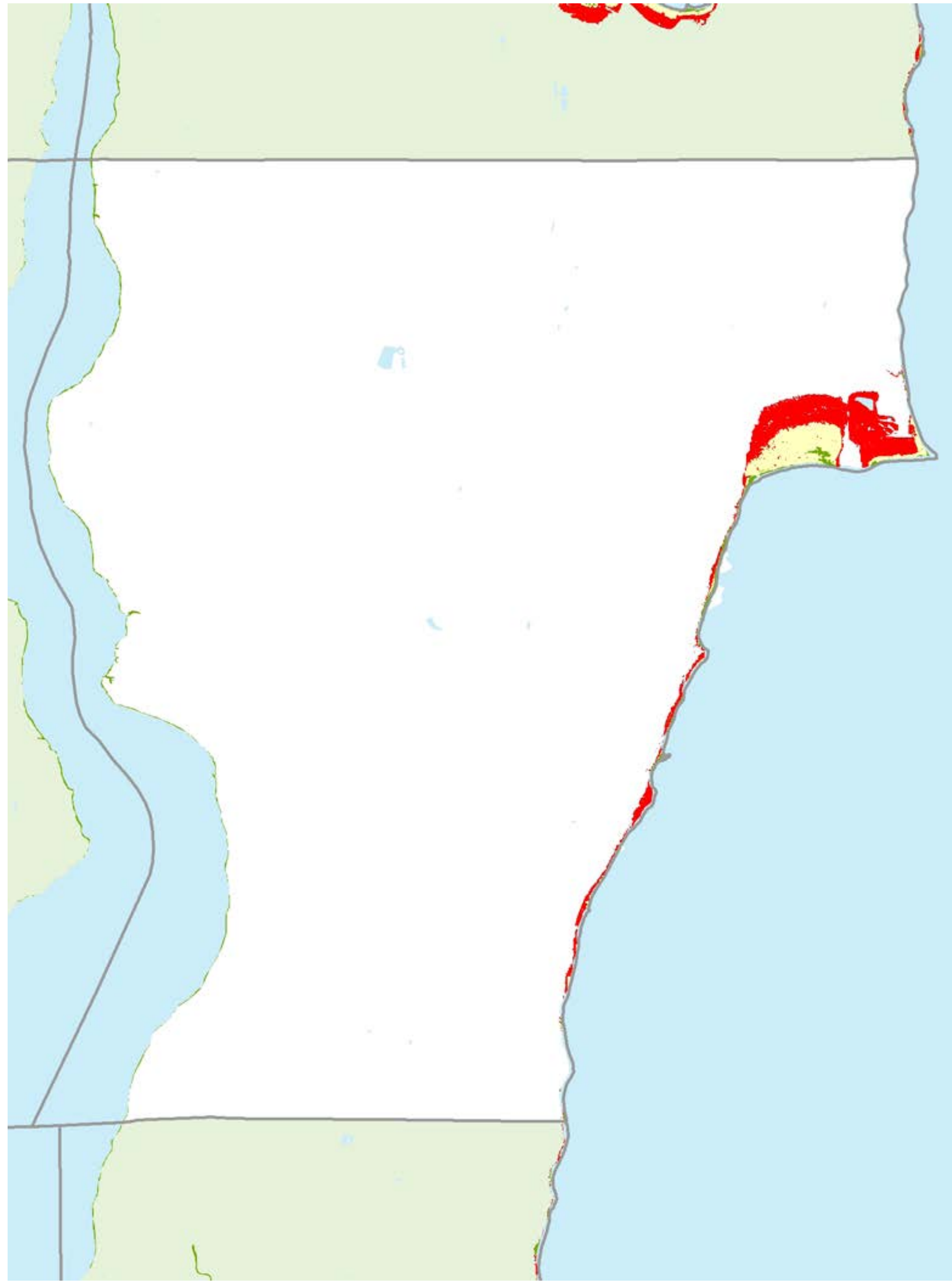


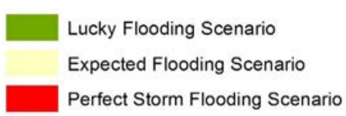
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

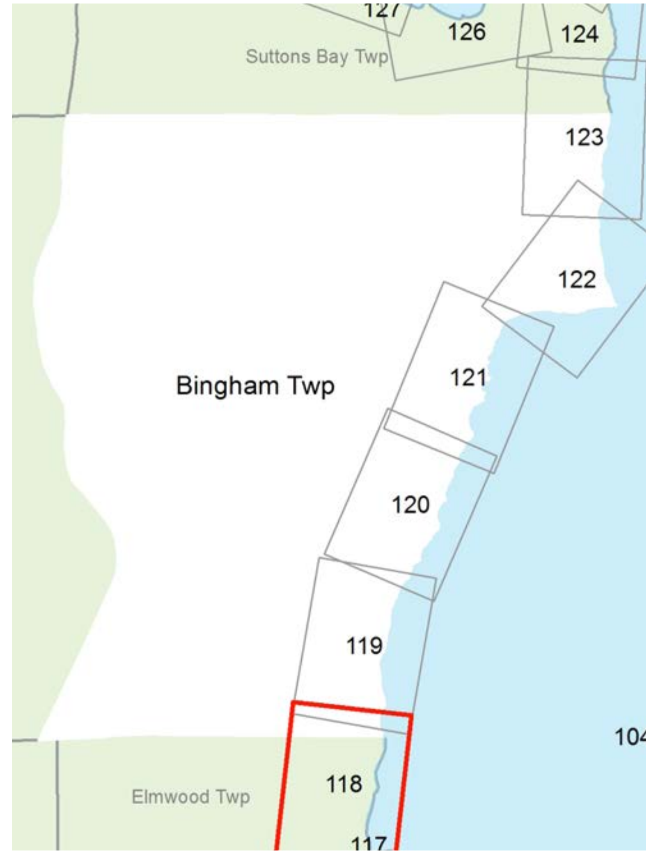
Bingham Twp.

Coastal Flooding Scenario Impacts

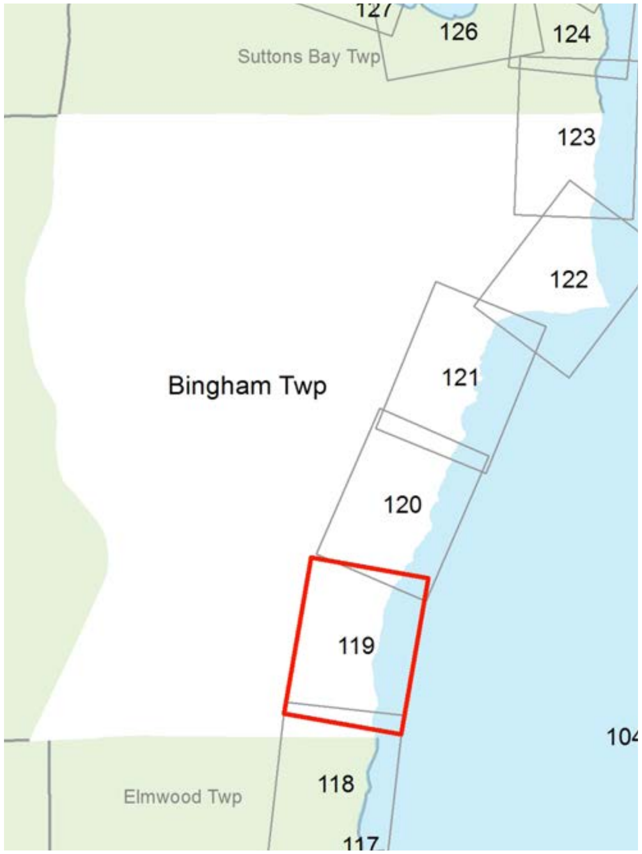
Bingham			
Total SEV	Lucky	Expected	Perfect Storm
$ 276,936,100.00	$ 5,043,600.00	$ 19,431,400.00	$ 33,101,900.00







Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



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Suttons Bay Twp
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Bingham Twp
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Elmwood Twp
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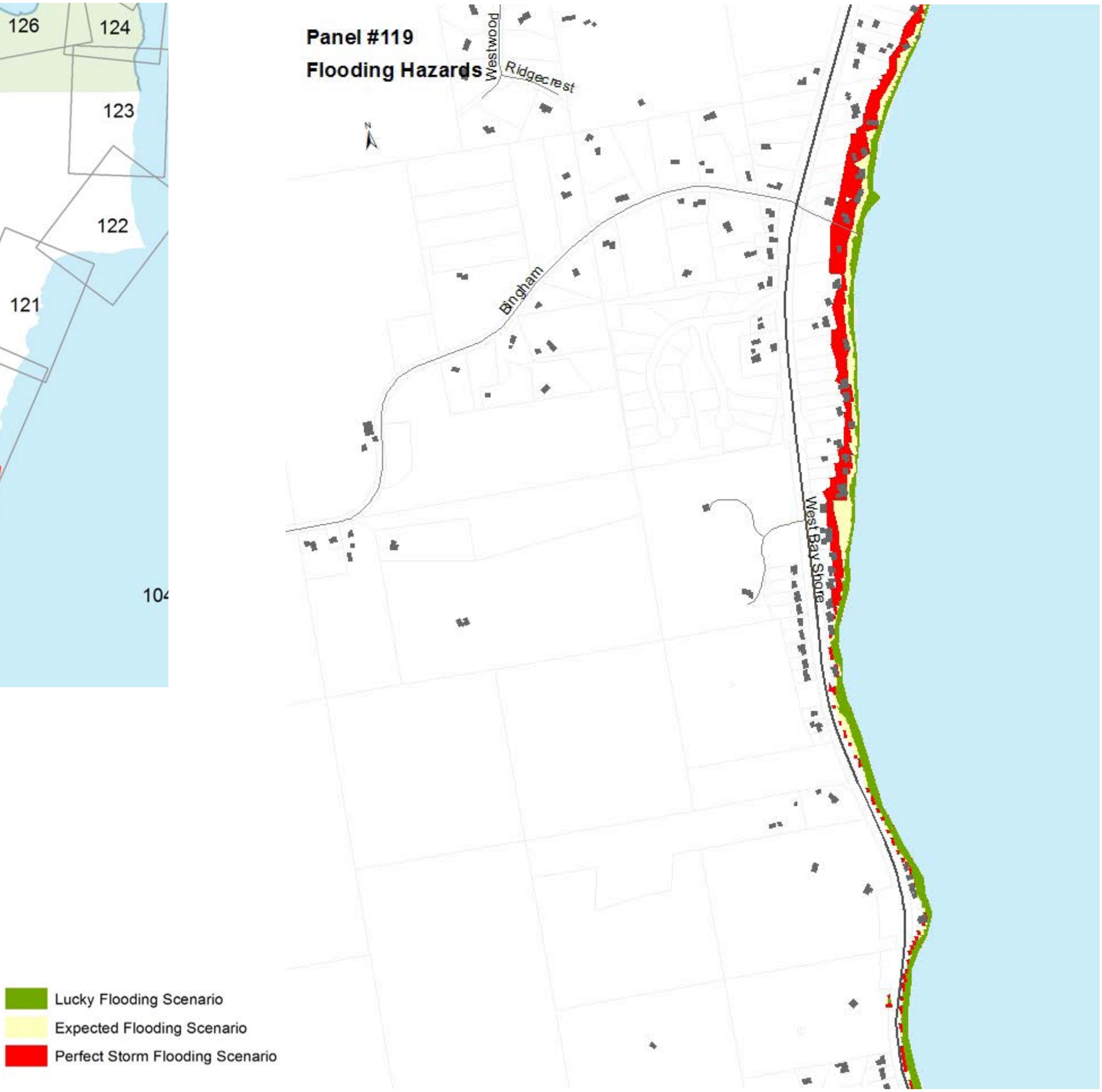
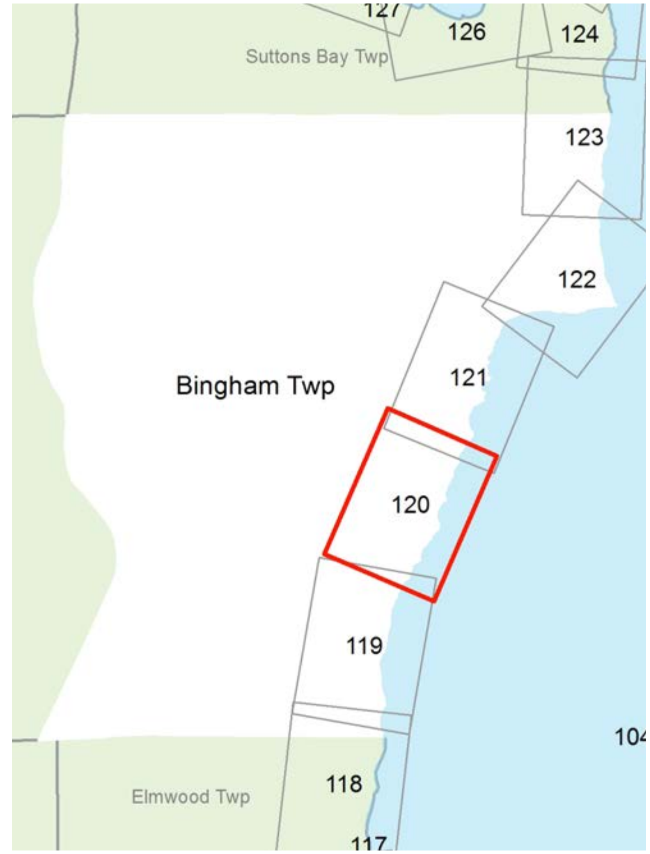
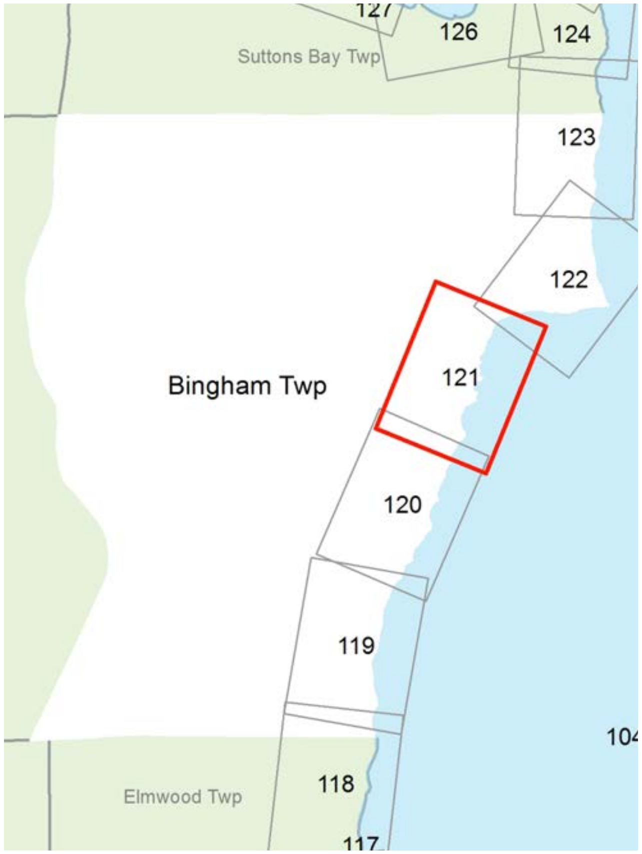
Leelanau County

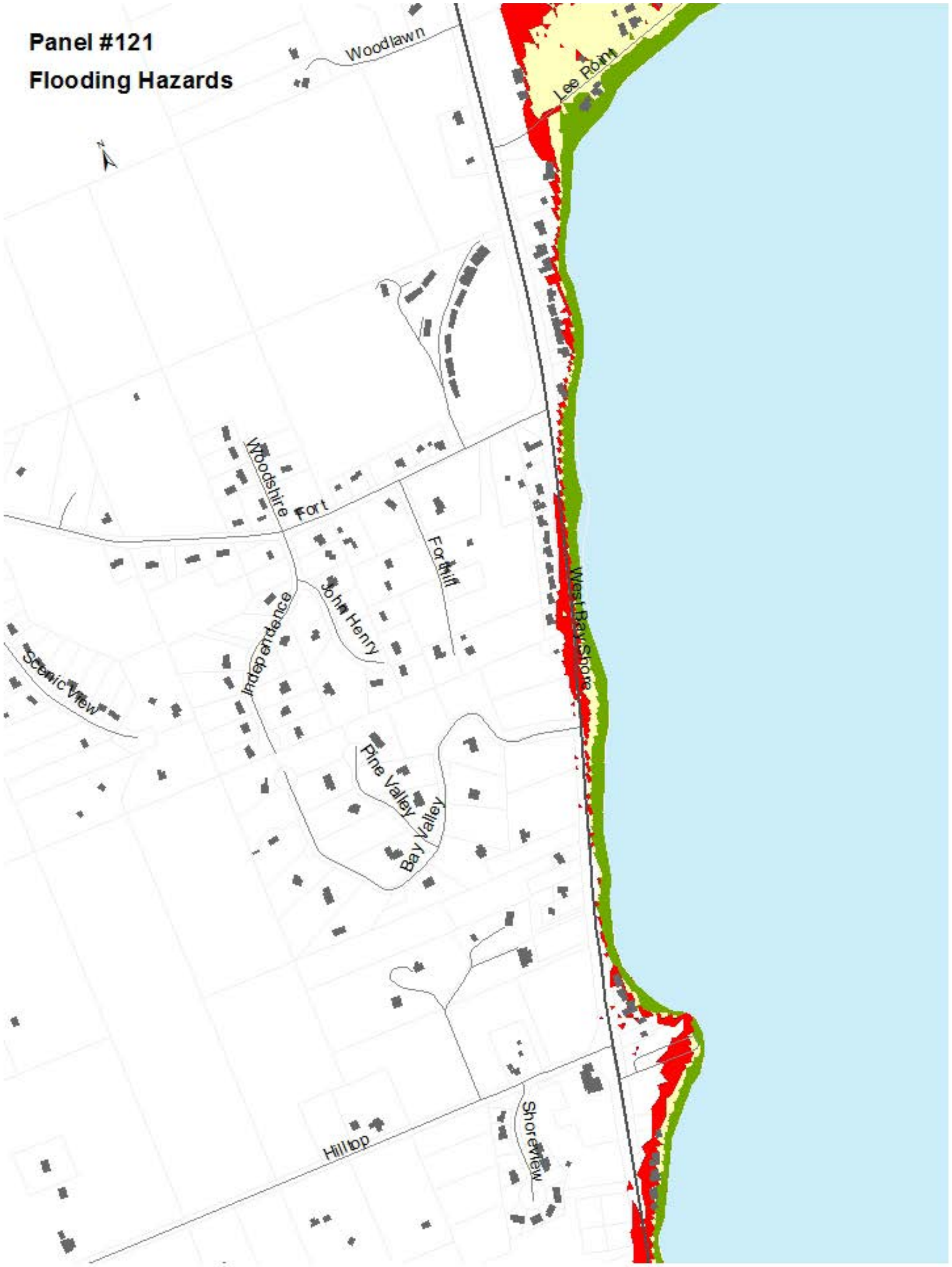


Panel #119
Flooding Hazards
Westwood
Ridgecrest
Bingham
West Bay Shore
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

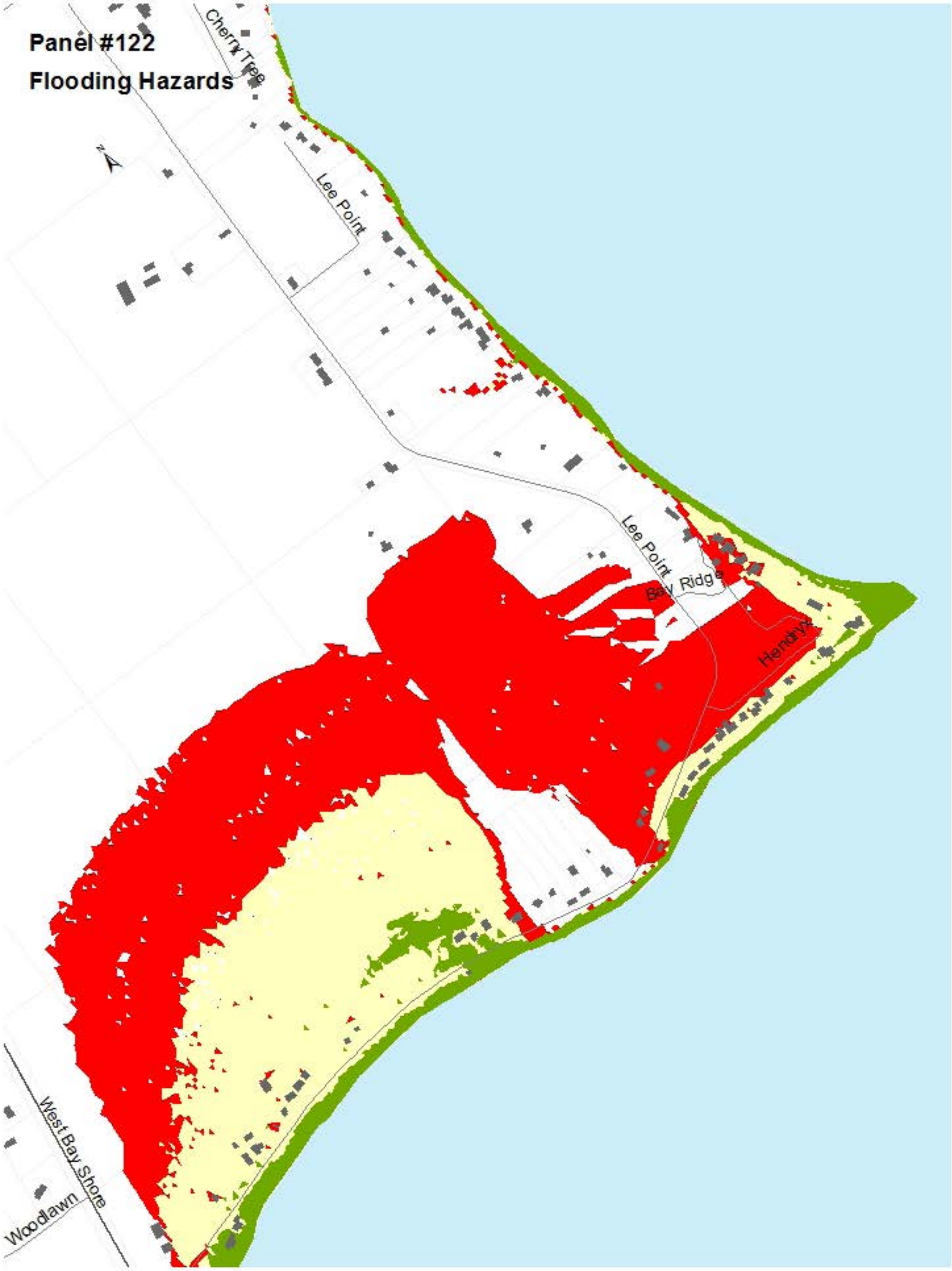


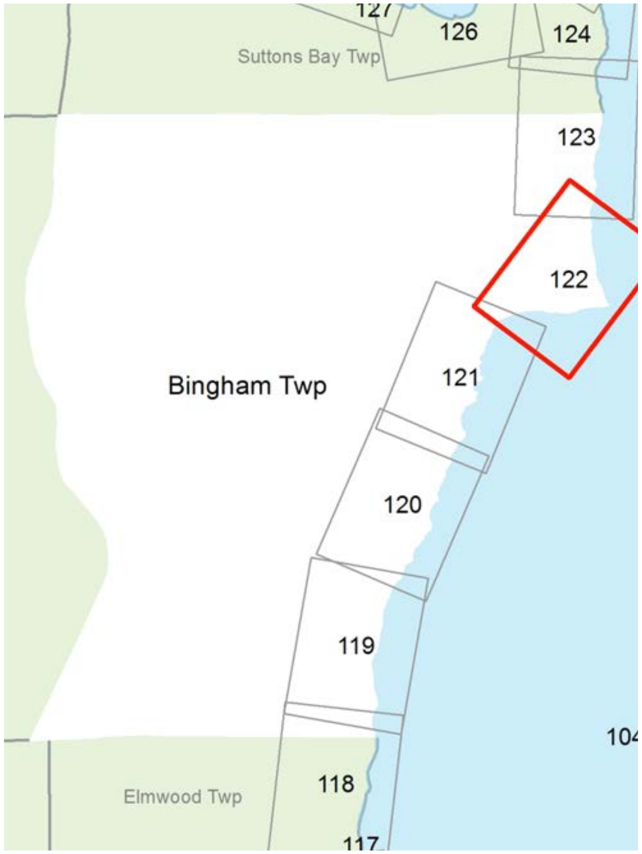
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



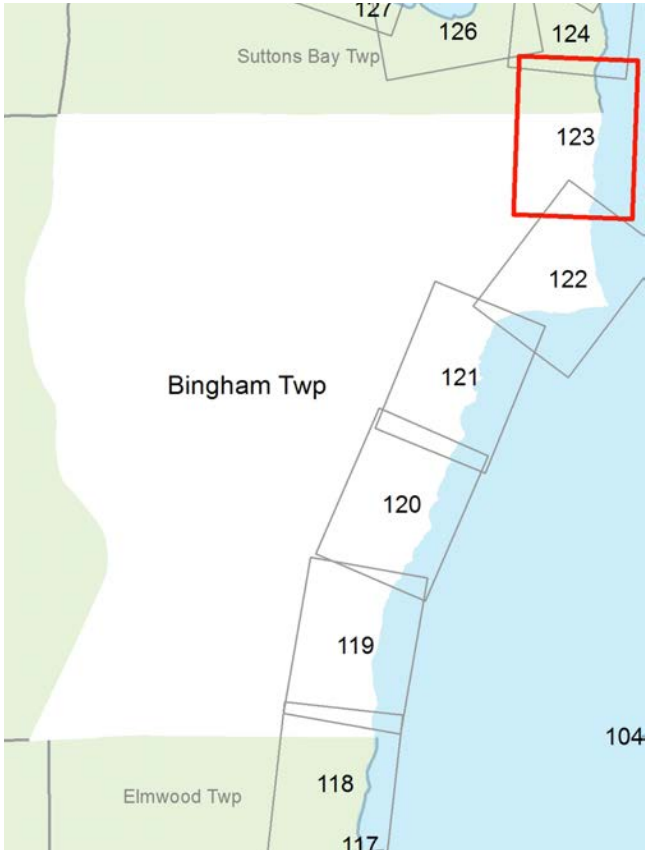


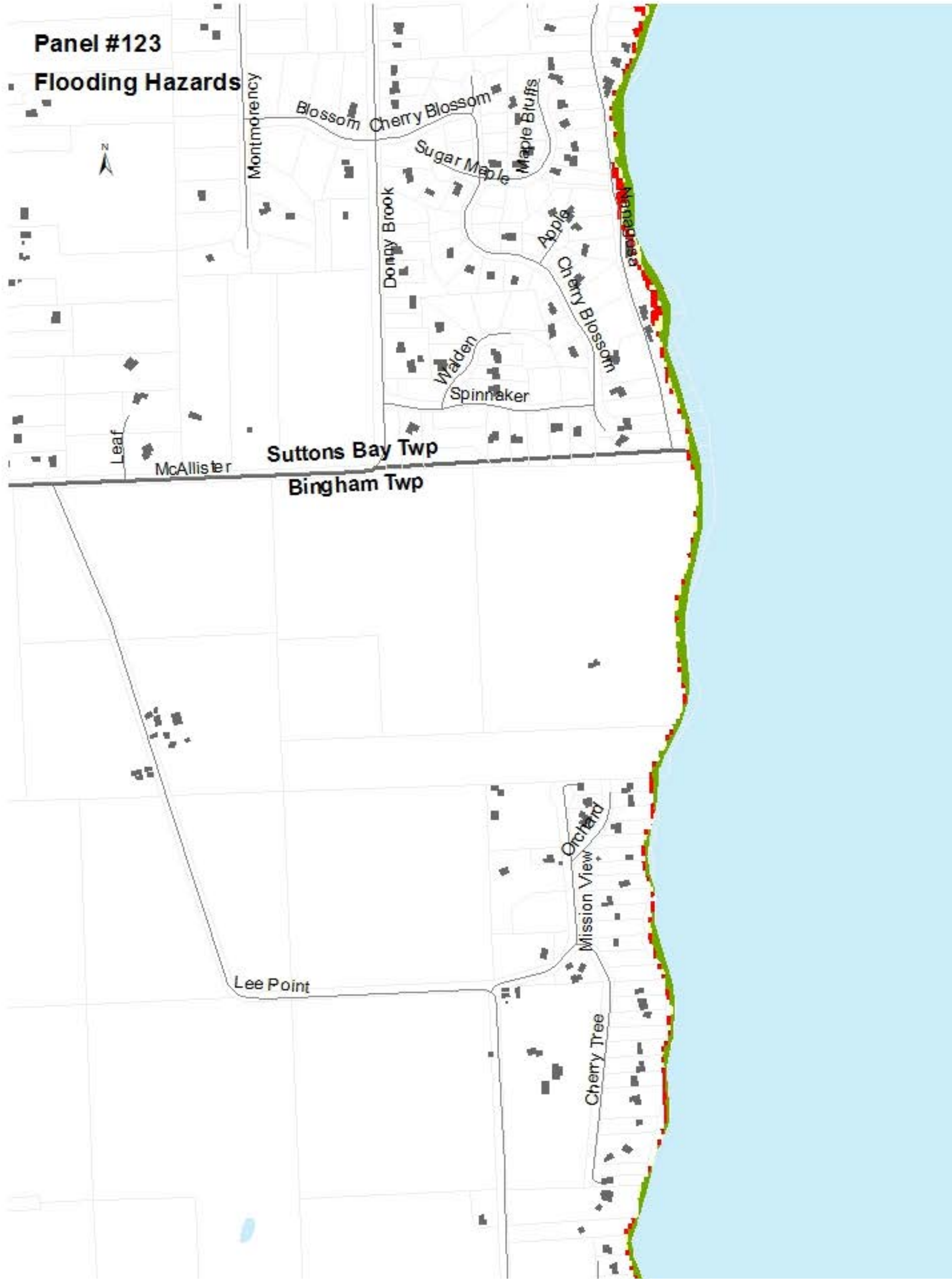
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



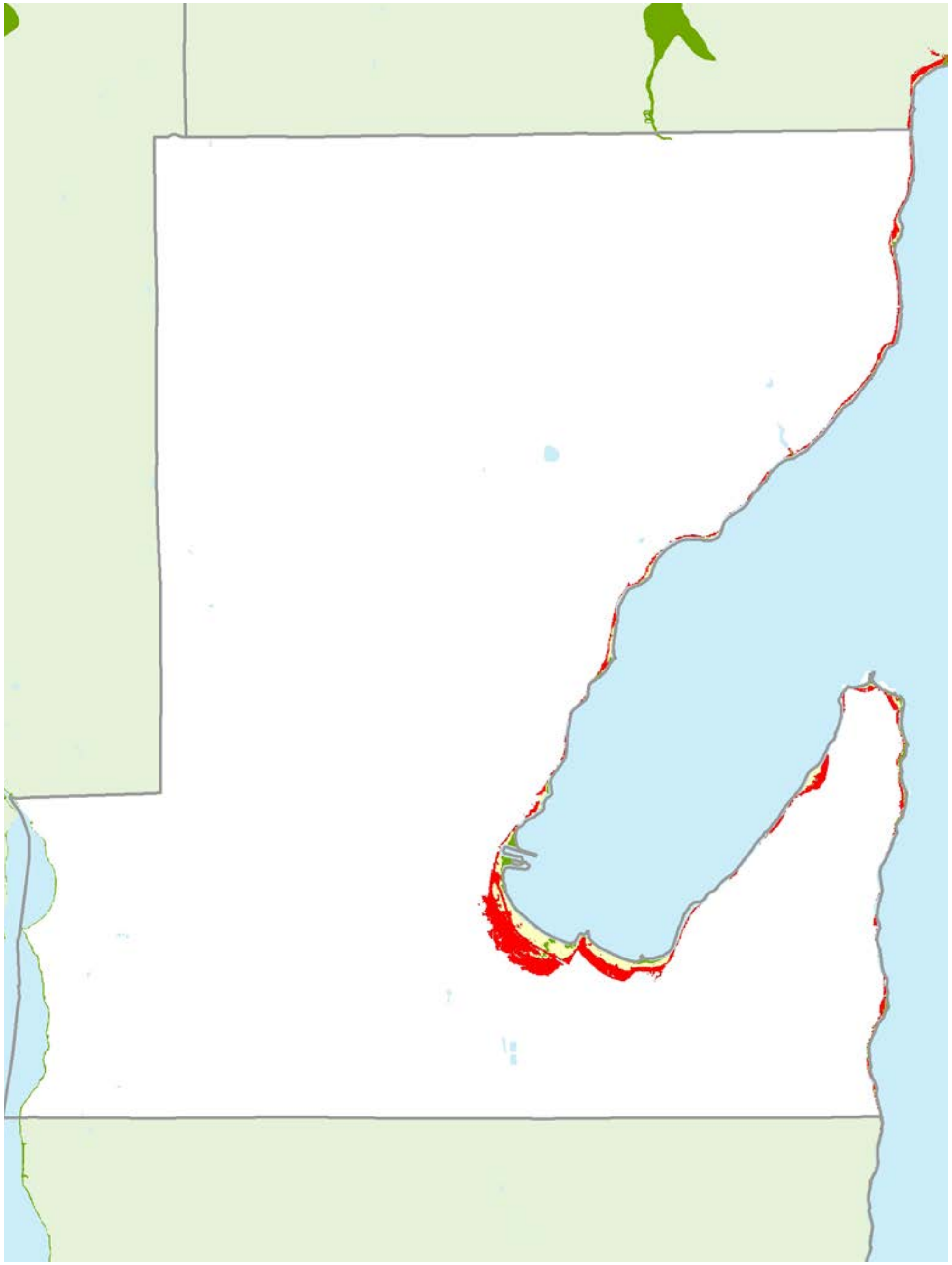


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Suttons Bay Twp./ Suttons Bay

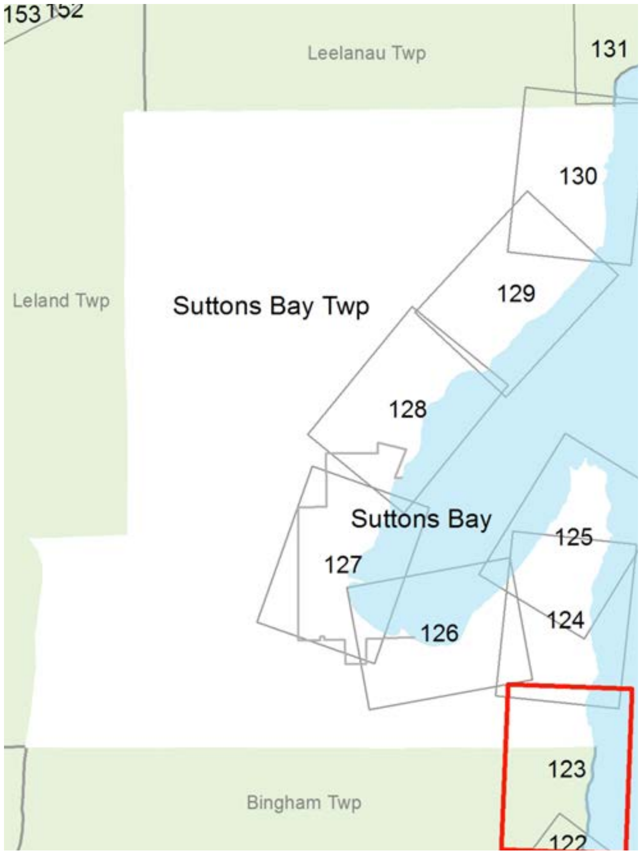
Coastal Flooding Scenario Impacts

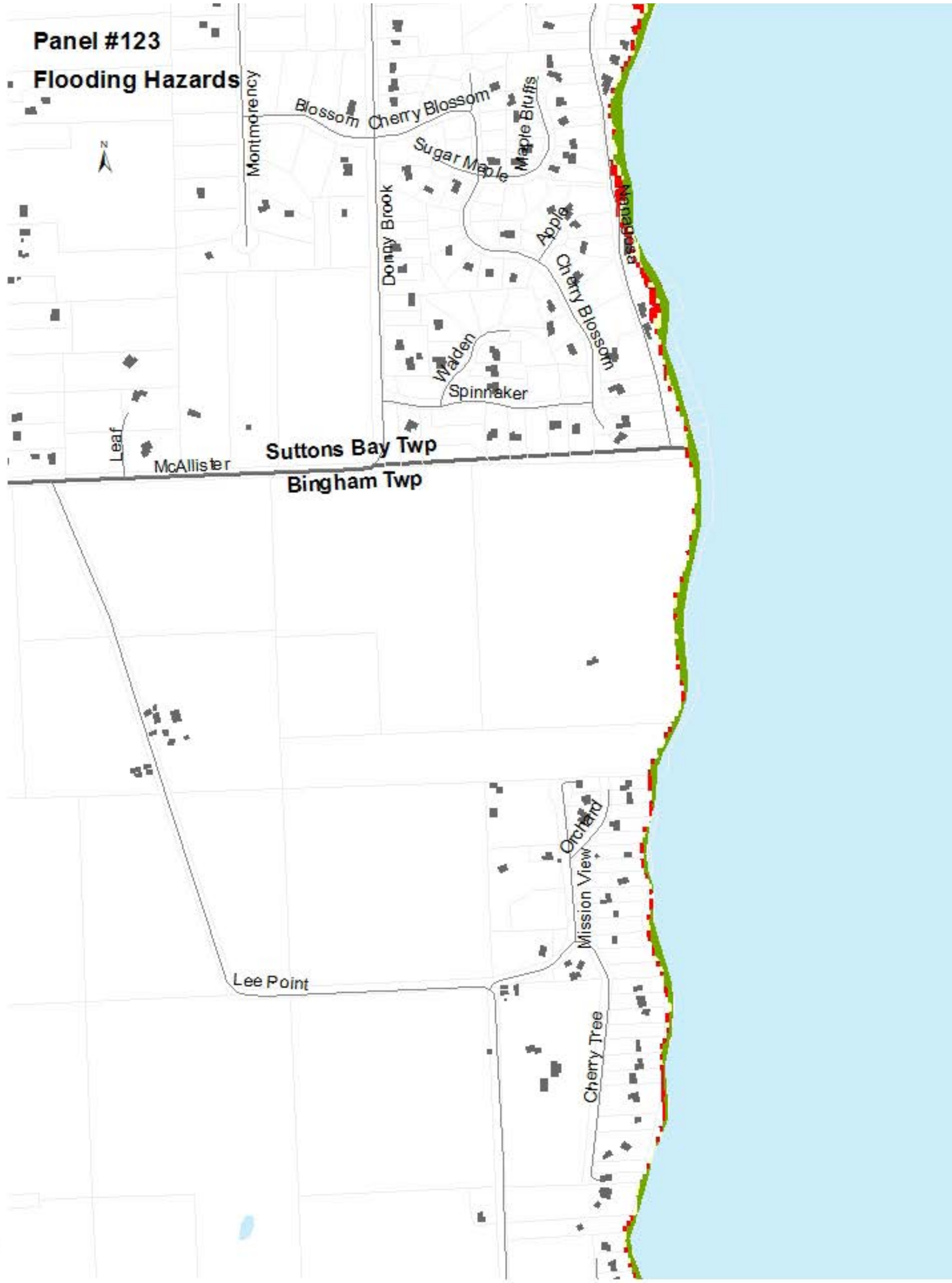
Suttons Bay Twp			
Total SEV	Lucky	Expected	Perfect Storm
$ 210,405,570.00	$ 6,259,620.00	$ 17,482,500.00	$ 40,173,740.00

Coastal Flooding Scenario Impacts

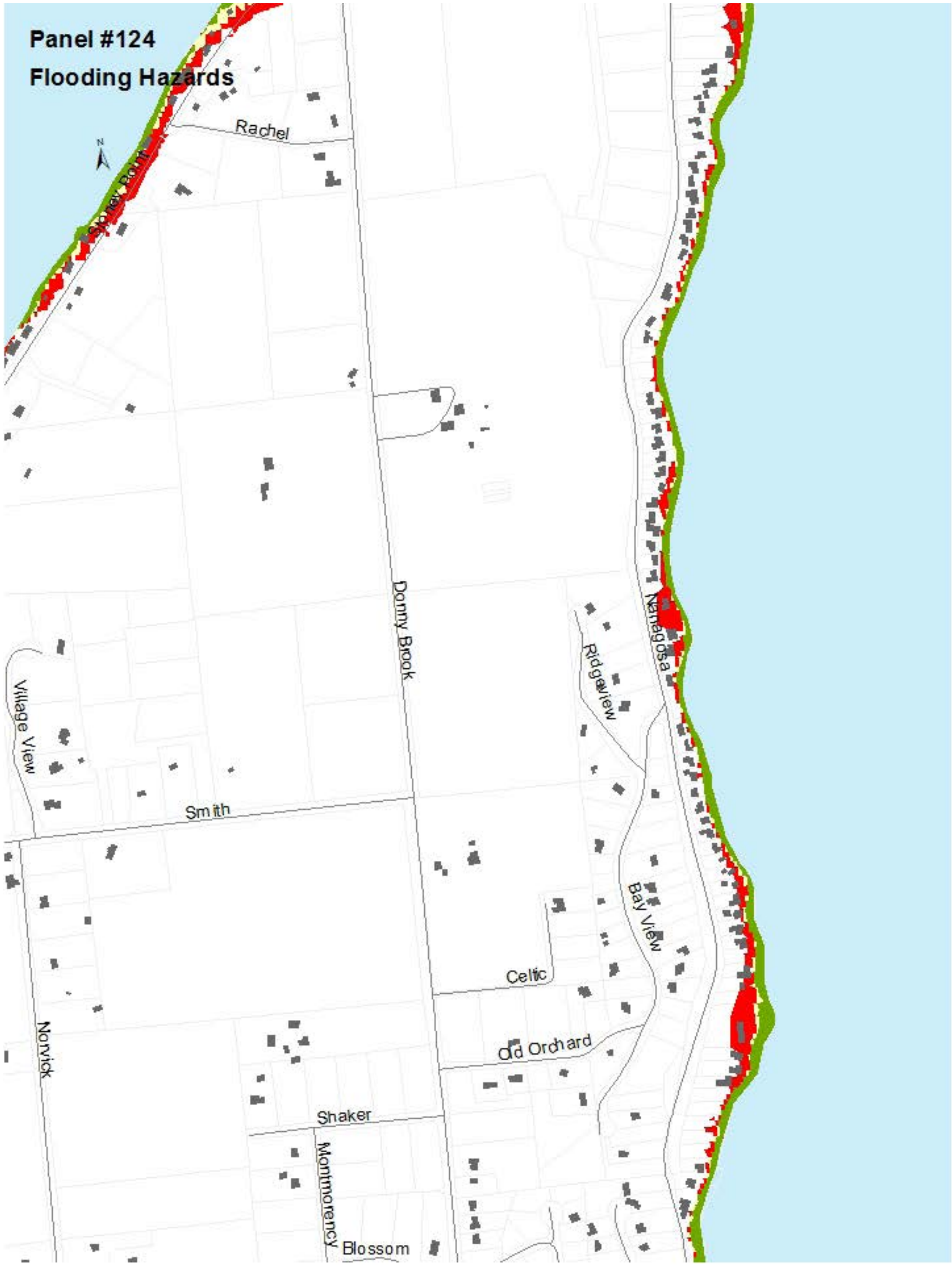
Suttons Bay			
Total SEV	Lucky	Expected	Perfect Storm
$ 85,486,600.00	$ 3,392,400.00	$ 18,739,210.00	$ 27,962,210.00

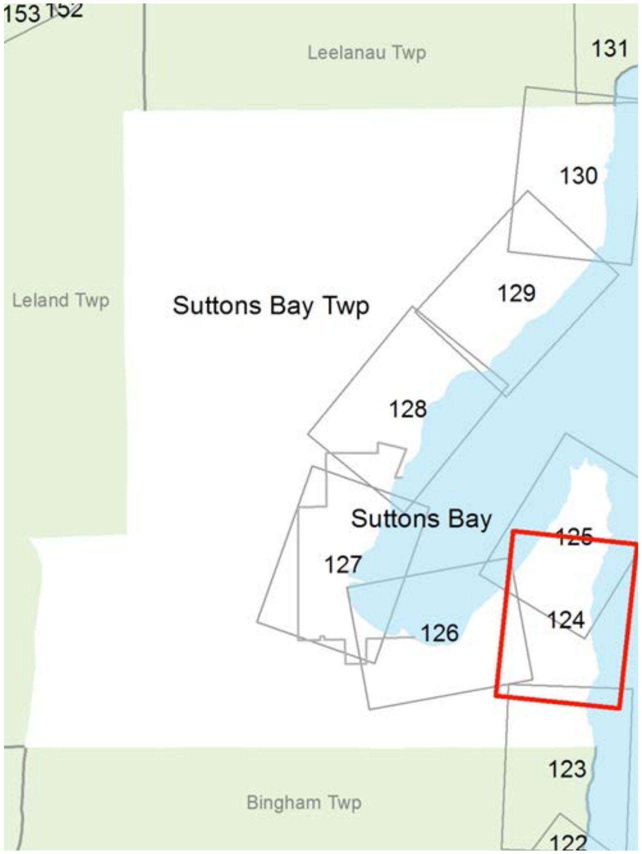
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



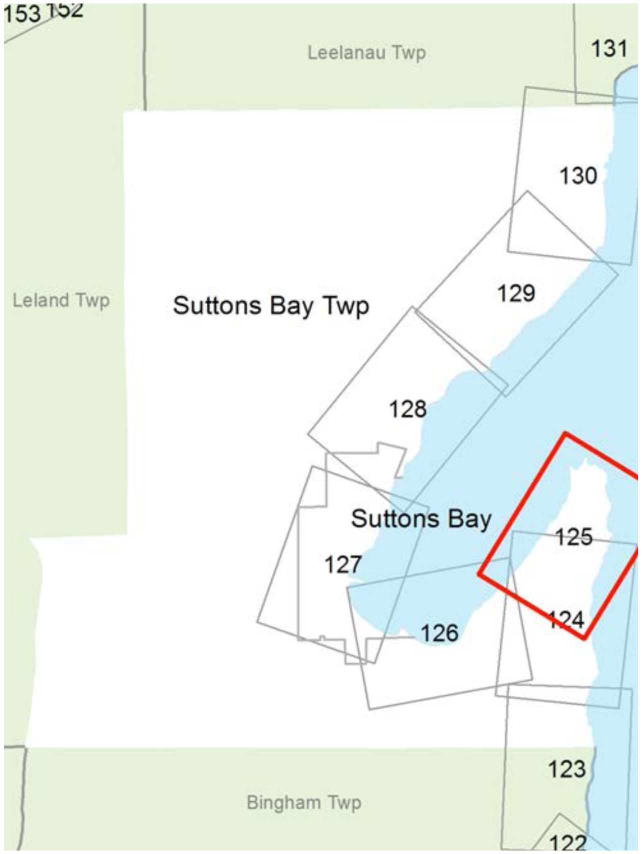


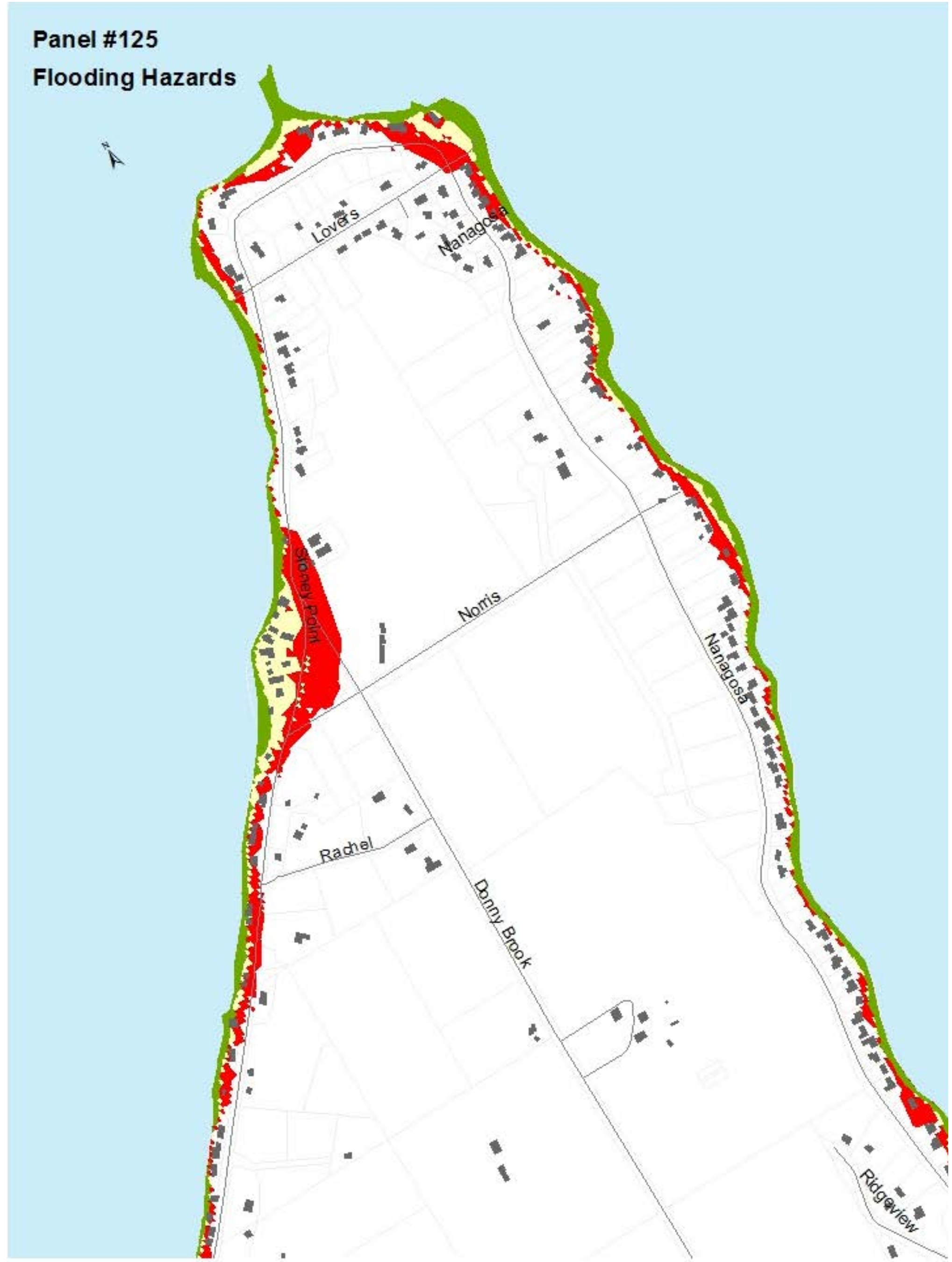
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



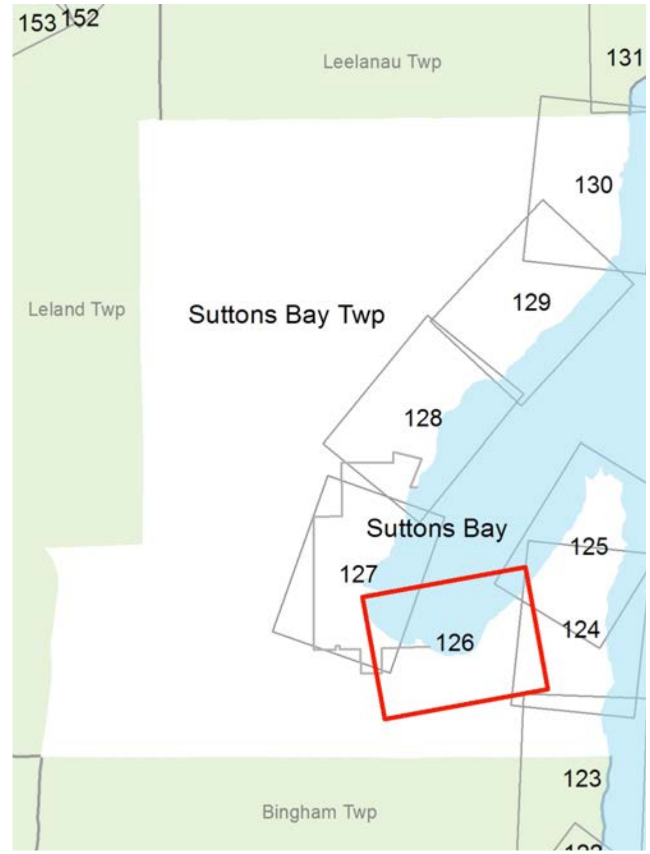


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

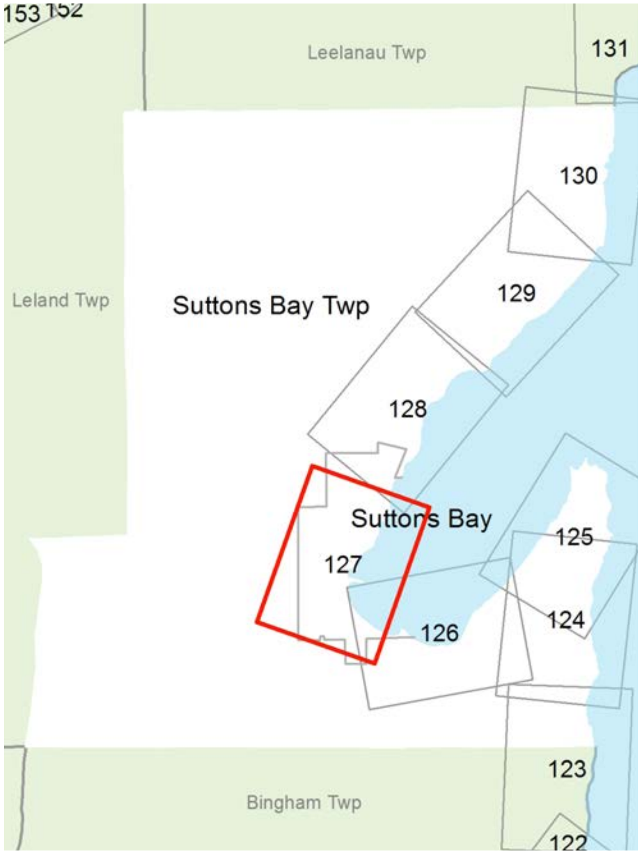




Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Leelanau Twp
Leland Twp
Suttons Bay Twp
Suttons Bay
Bingham Twp
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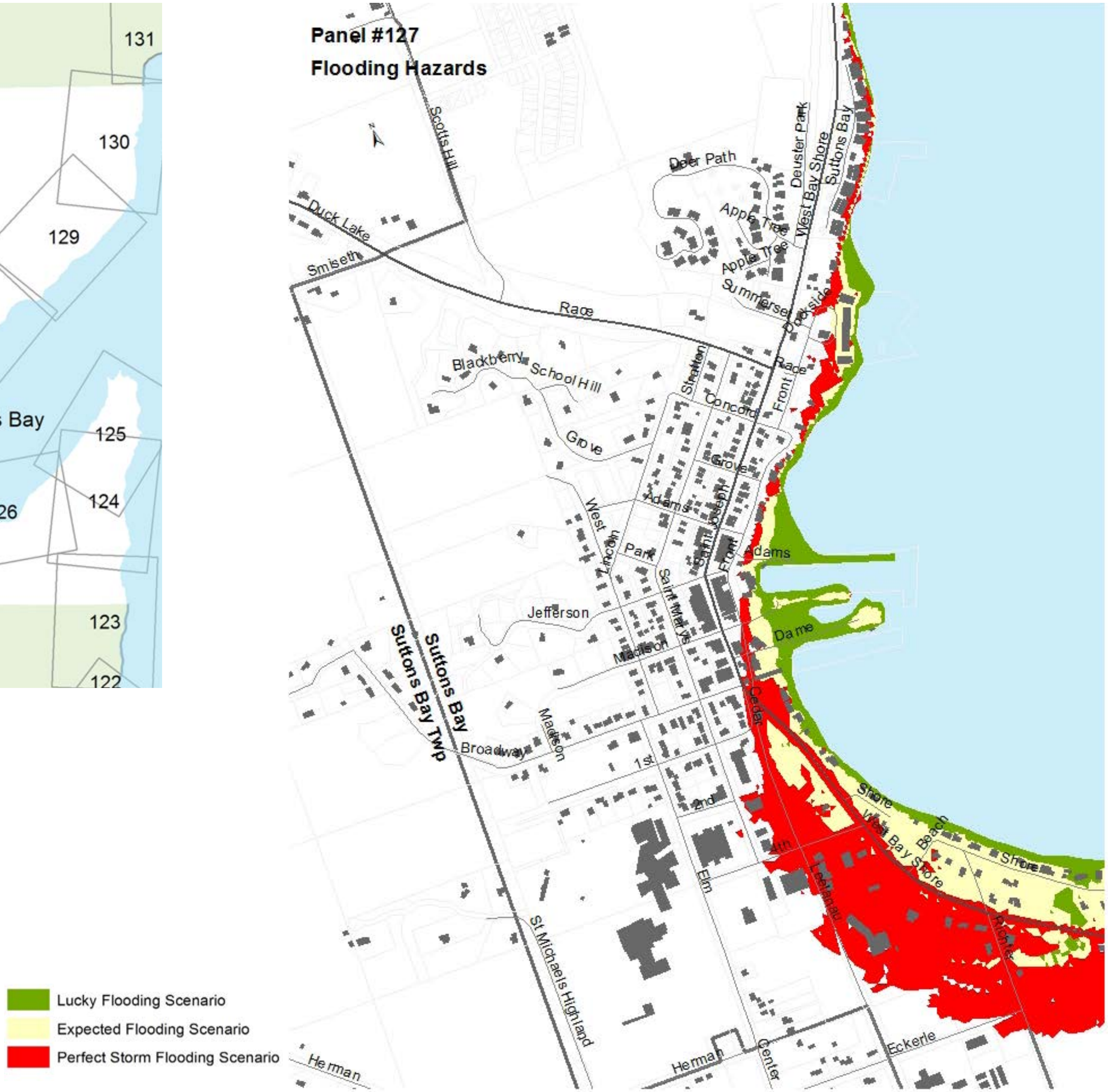
Leelanau County


Panel #127
Flooding Hazards
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Suttons Bay
Suttons Bay Twp
Scotts Hill
Duck Lake
Smiseth
Race
Deer Path
Deuster Park
West Bay Shore
Suttons Bay
Apple Tree
Summerset
Dockside
Blackberry
School Hill
Stratton
Concord
Front
Grove
West
Adams
Saint Joseph
Park
Lincoln
Saint Marys
Jefferson
Madison
Dame
Cedar
Broadway
1st
2nd
Elm
Leelanau
Shore
Beach
Richter
St Michaels Highland
Center
Herman
Eckerle


Panel #128
Flooding Hazards
Jacobson
Blue Water
Pebble Beach
Setterbo
West Bay Shore
Suttons Bay Twp
Suttons Bay
Dumas
Windward
153
152
131
Leelanau Twp
130
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Leland Twp
Suttons Bay Twp
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Suttons Bay
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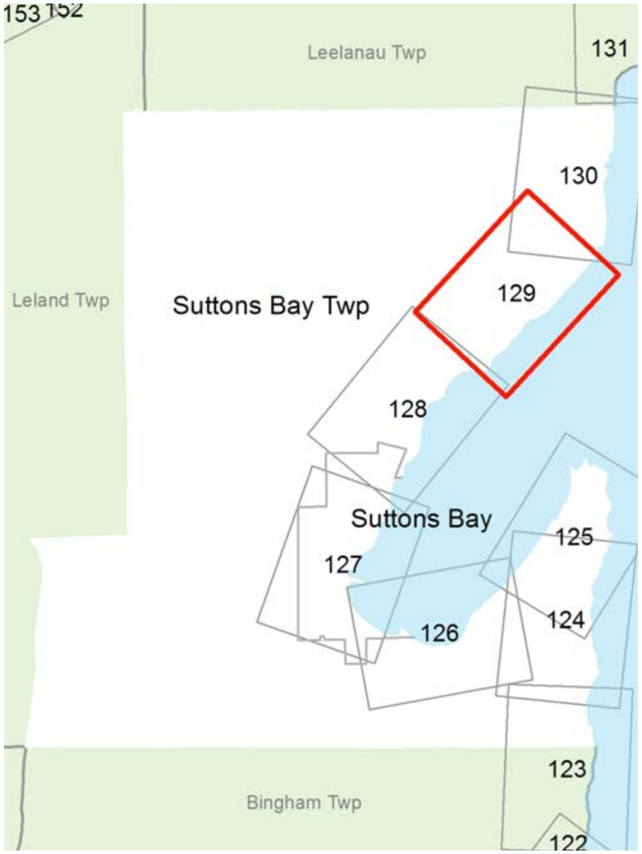
Bingham Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Leelanau County


153
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Leelanau Twp
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Leland Twp
Suttons Bay Twp
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Suttons Bay
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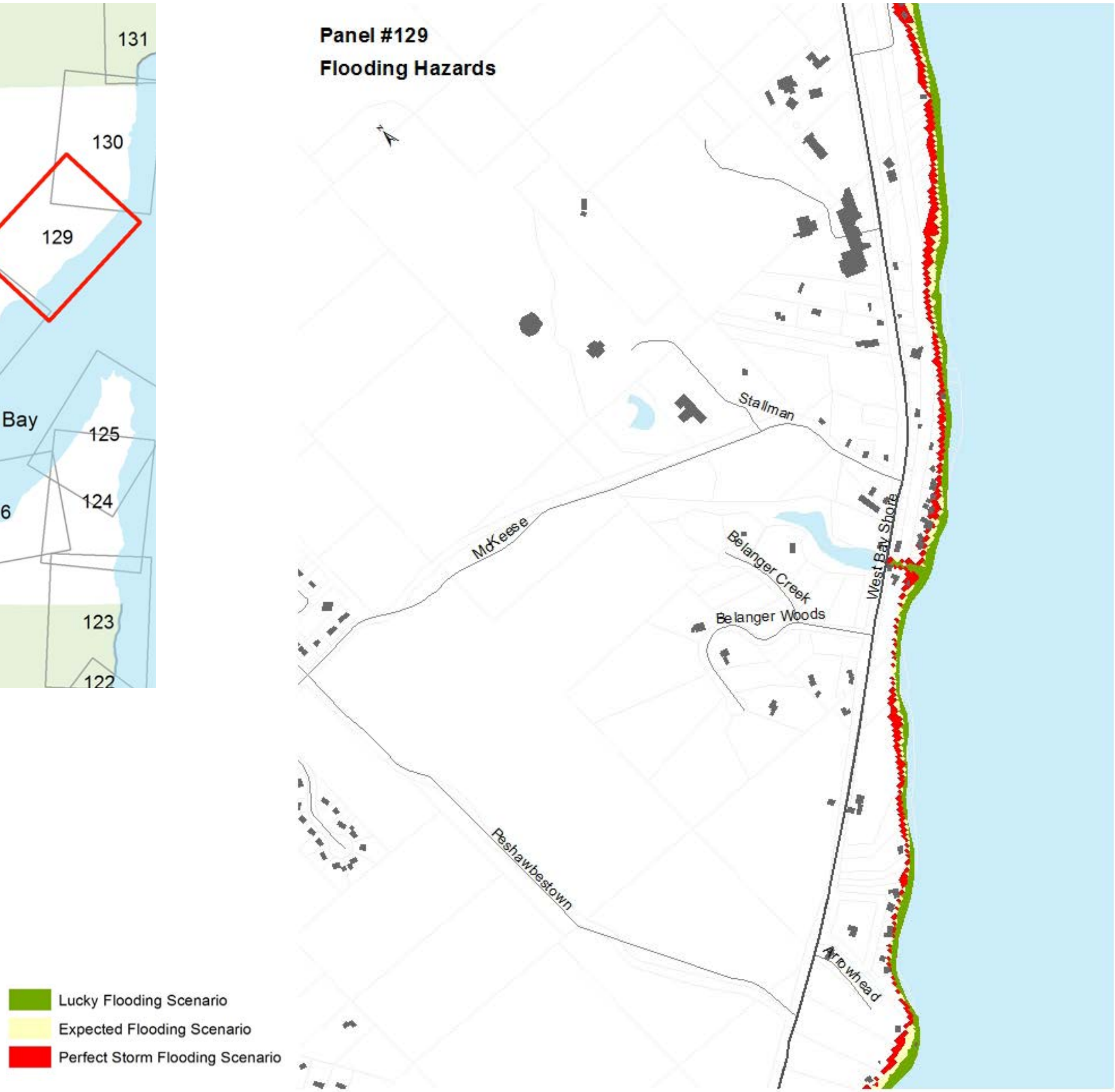
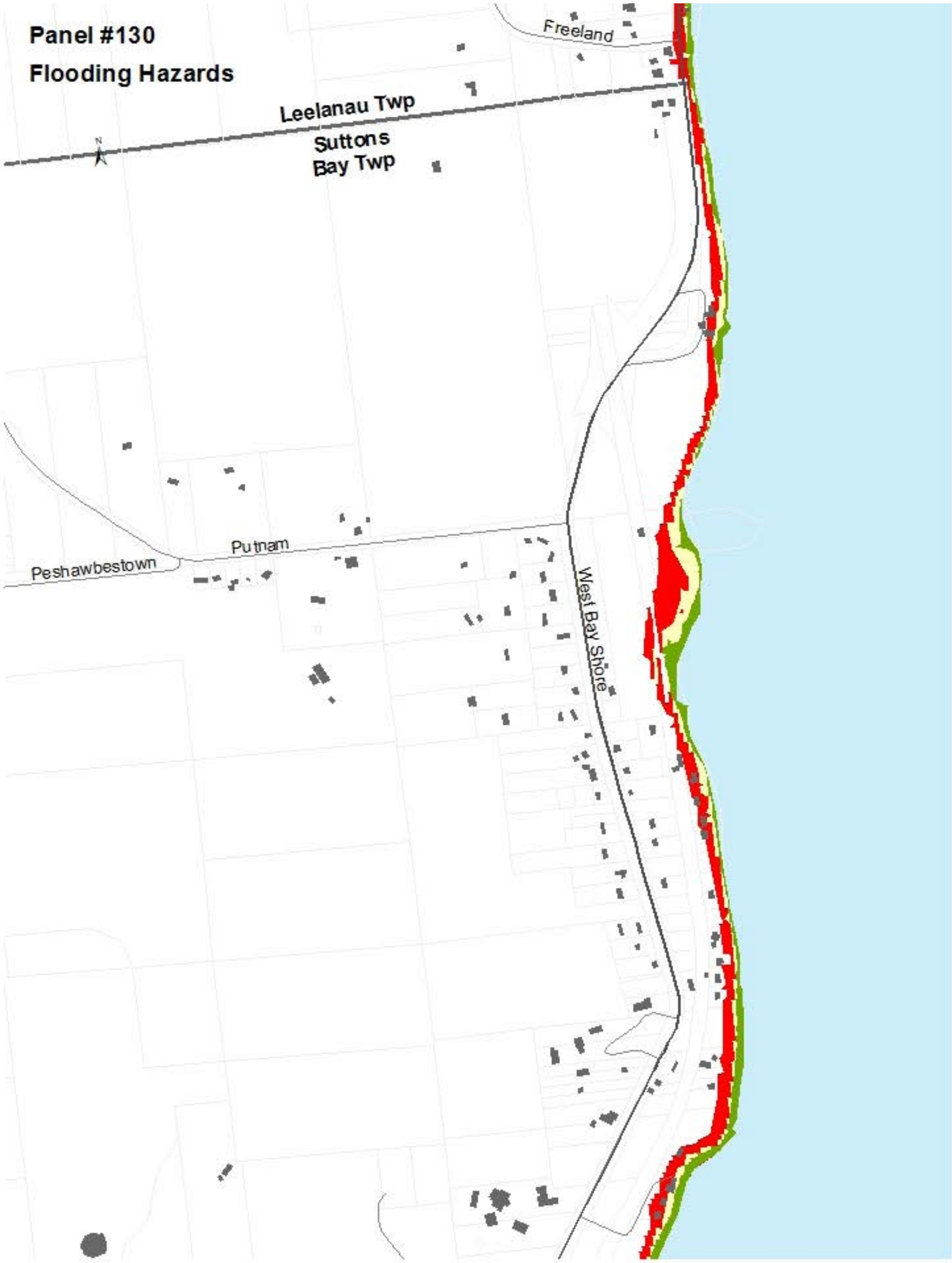
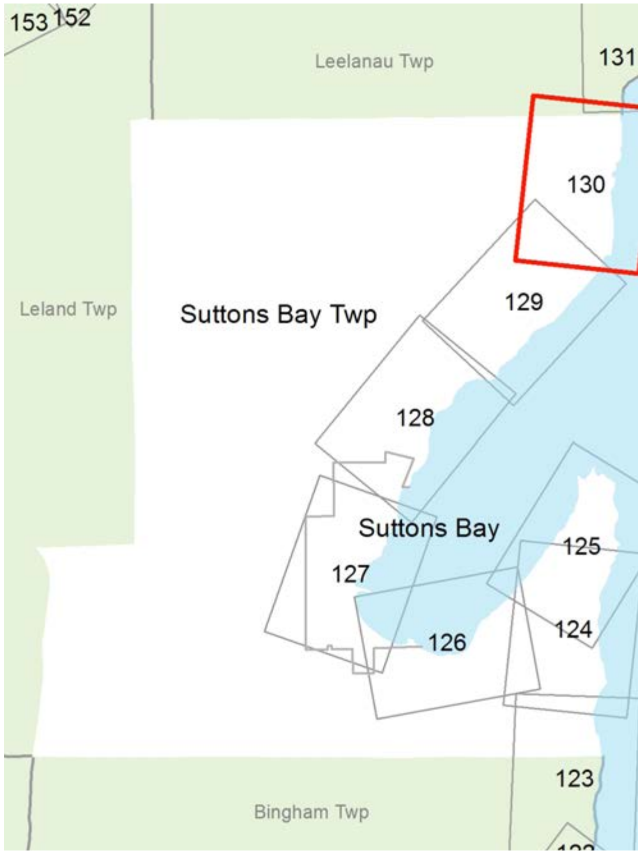
Bingham Twp
122


Leelanau County


Panel #129
Flooding Hazards
Stallman
McKeese
Belanger Creek
Belanger Woods
West Bay Shore
Peshawbestown
Arrowhead
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #130
Flooding Hazards
Freeland
Leelanau Twp
Suttons Bay Twp
Putnam
Peshawbestown
West Bay Shore


153
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Leelanau Twp
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Leland Twp
Suttons Bay Twp
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Suttons Bay
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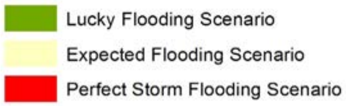
123
Bingham Twp

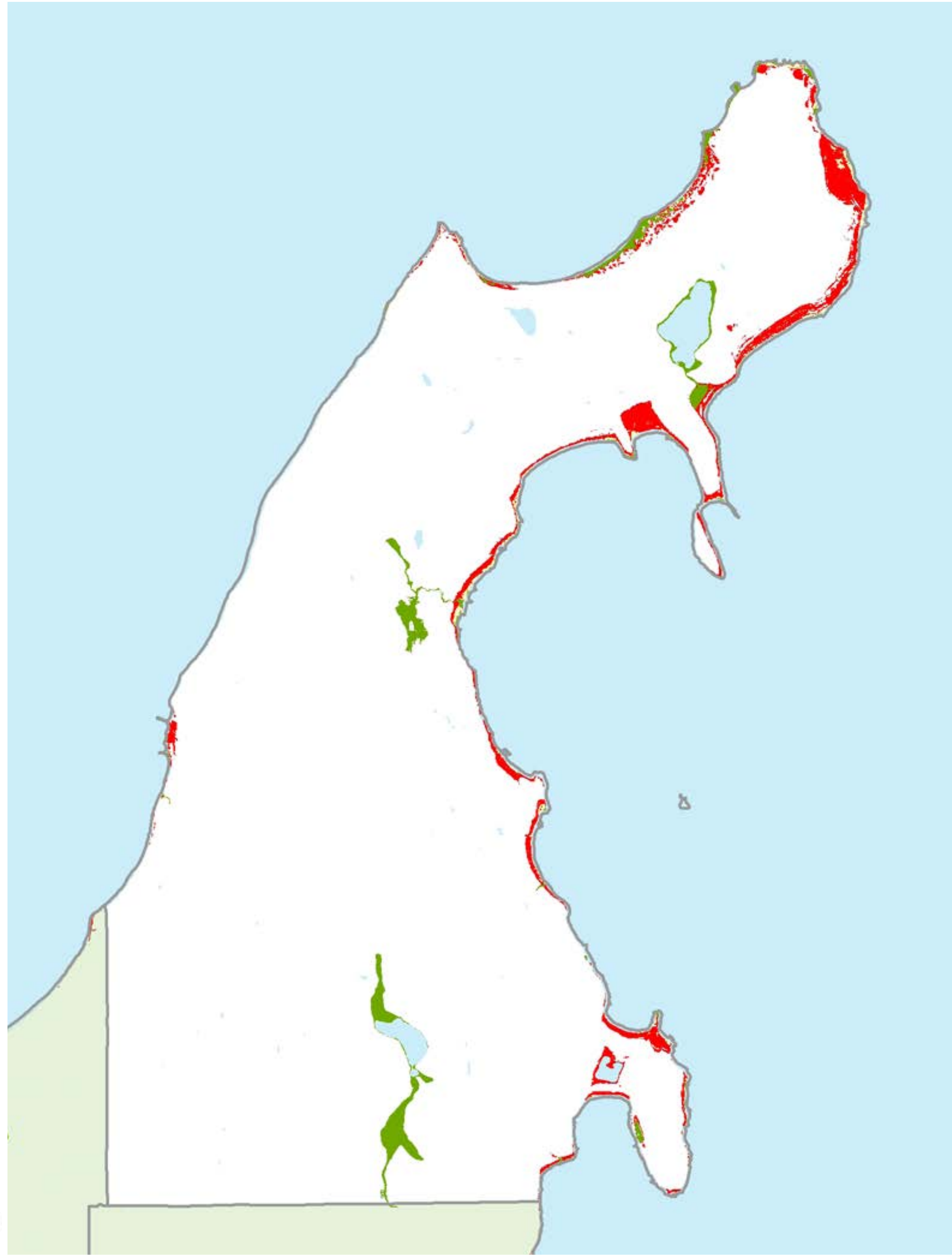

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

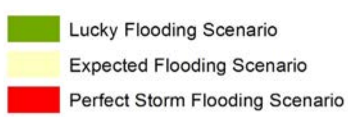

Leelanau County

Leelanau Twp.

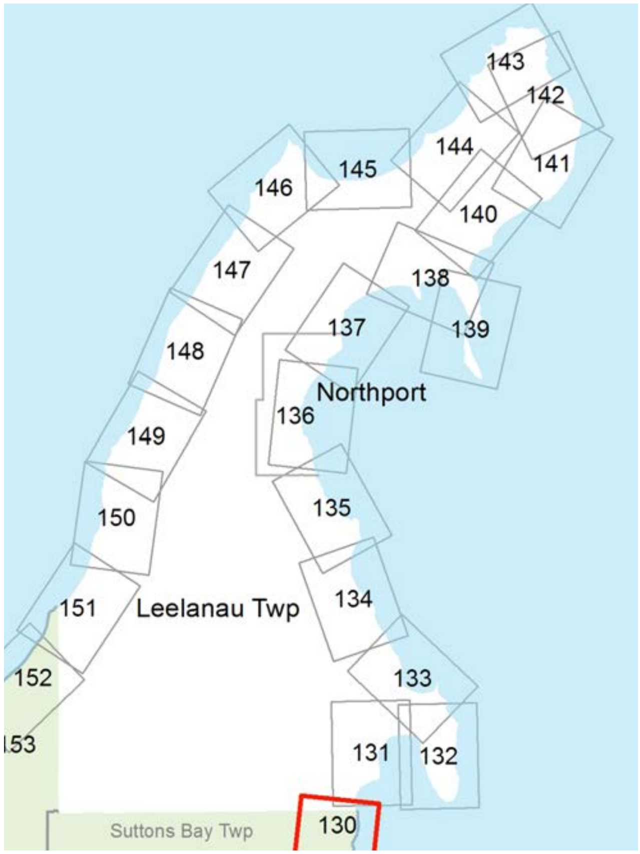
Coastal Flooding Scenario Impacts

Leelanau			
Total SEV	Lucky	Expected	Perfect Storm
$ 519,607,475.00	$ 26,011,100.00	$ 81,005,200.00	$ 194,589,000.00






Panel #130
Flooding Hazards
Leelanau Twp
Suttons Bay Twp
Freeland
Putnam
Peshawbestown
West Bay Shore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Northport
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Leelanau Twp
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Suttons Bay Twp
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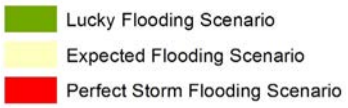
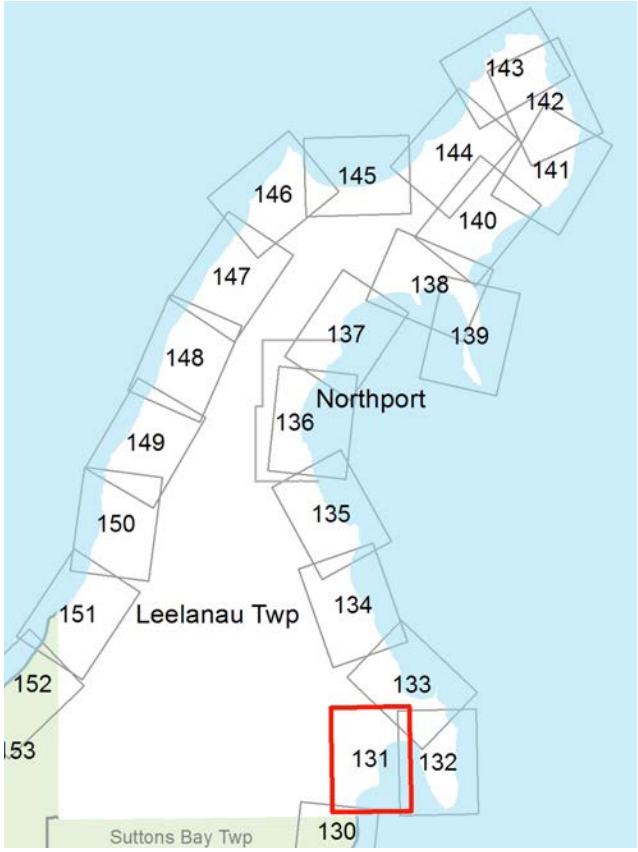

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Leelanau County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Leelanau Twp
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Suttons Bay Twp
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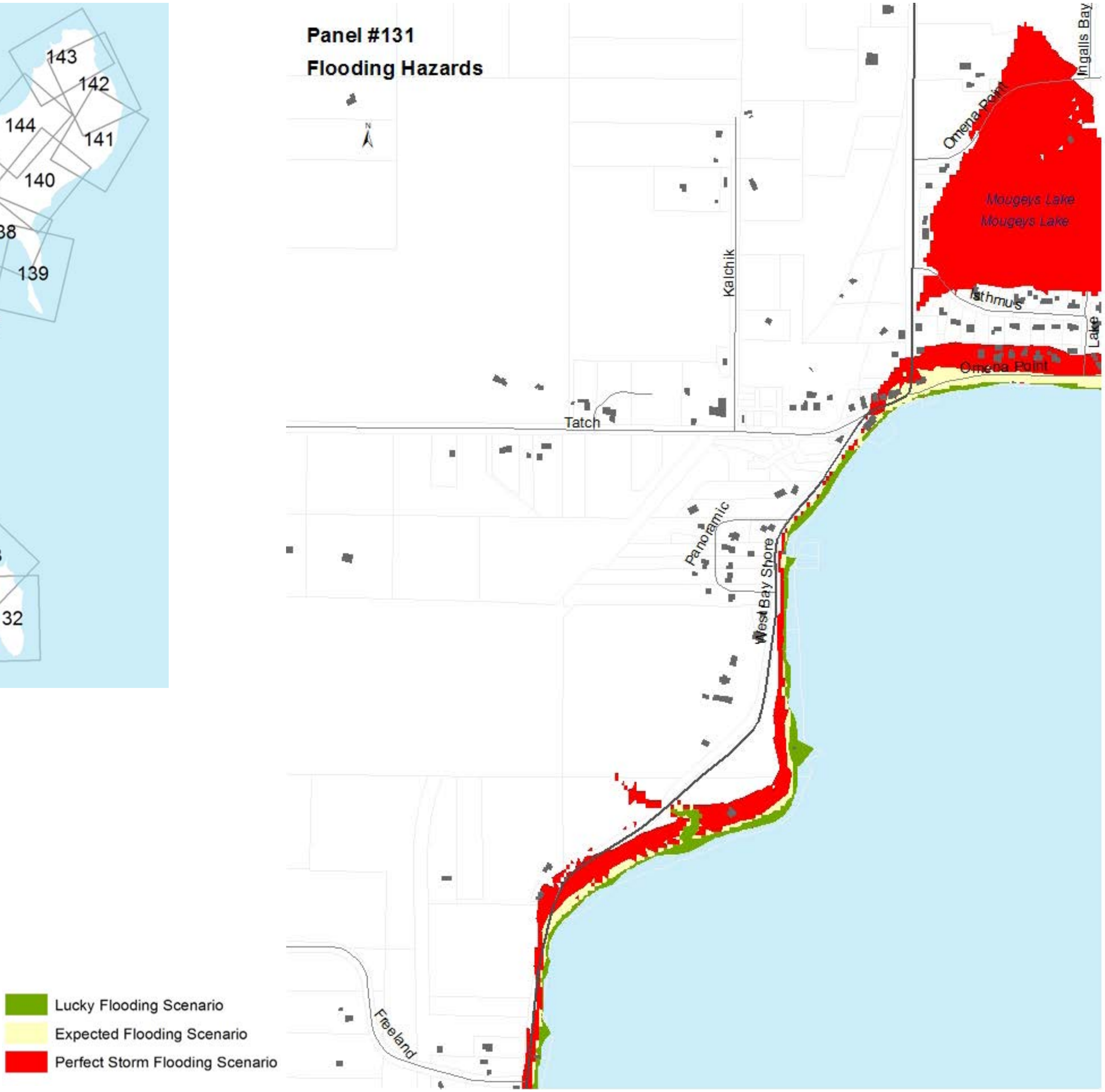
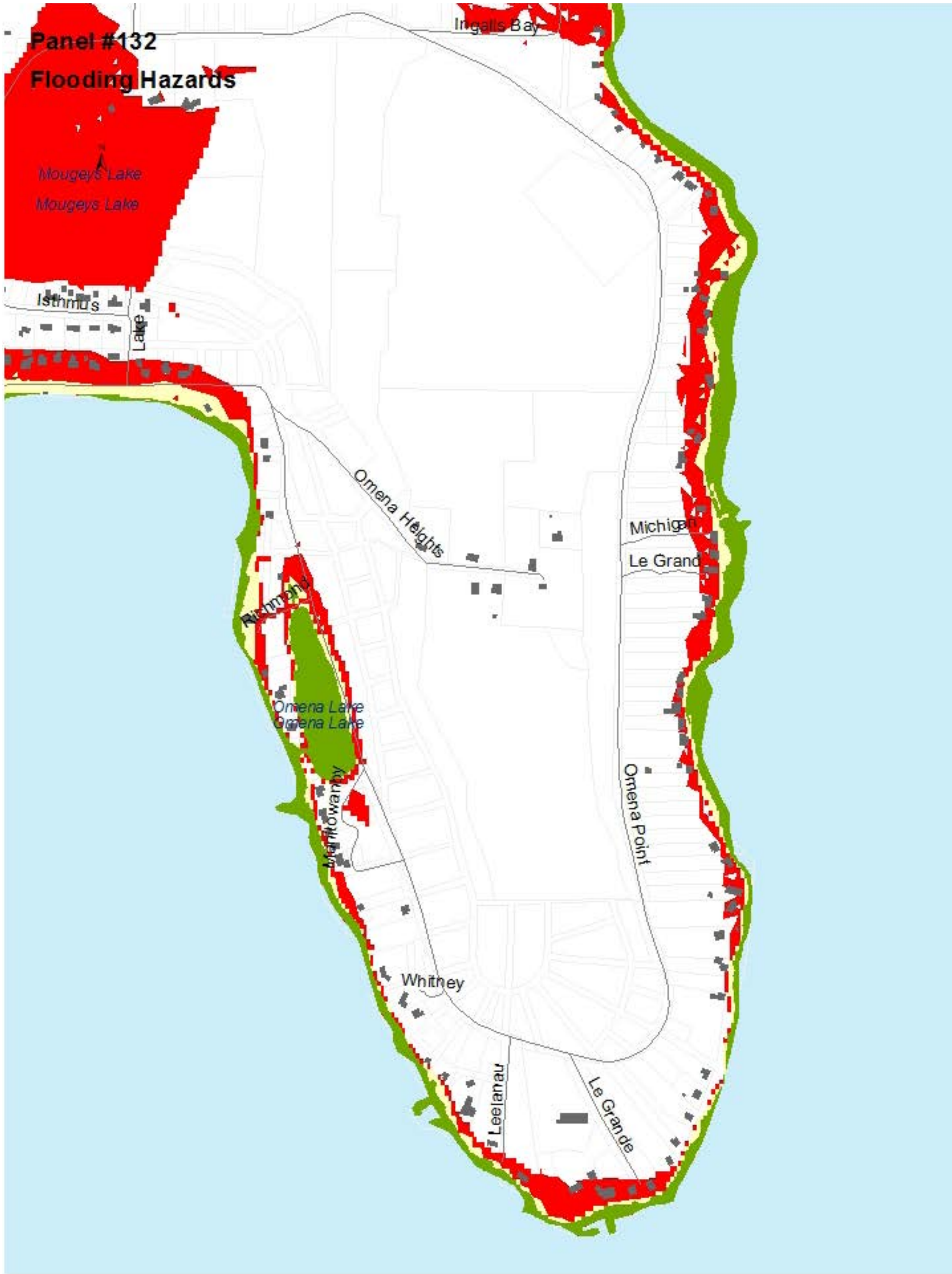
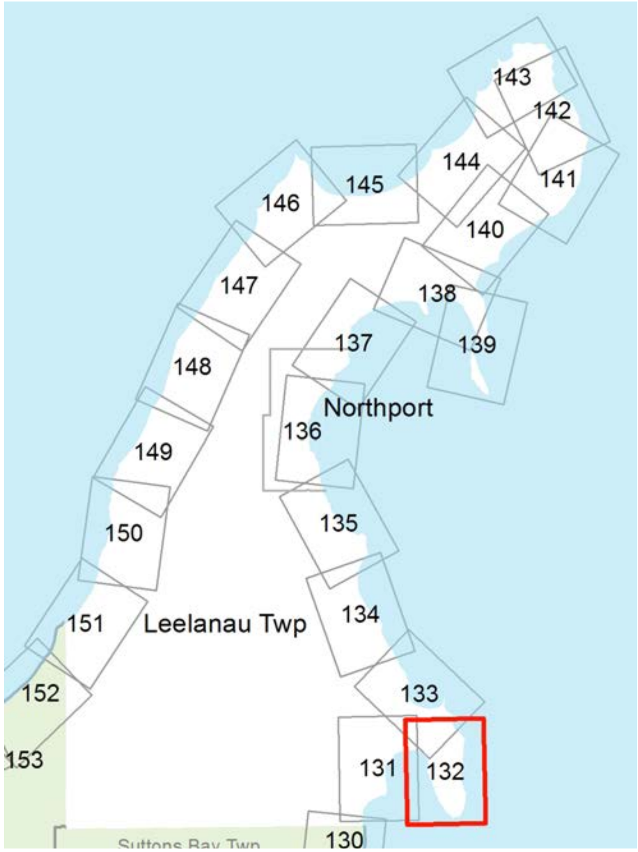
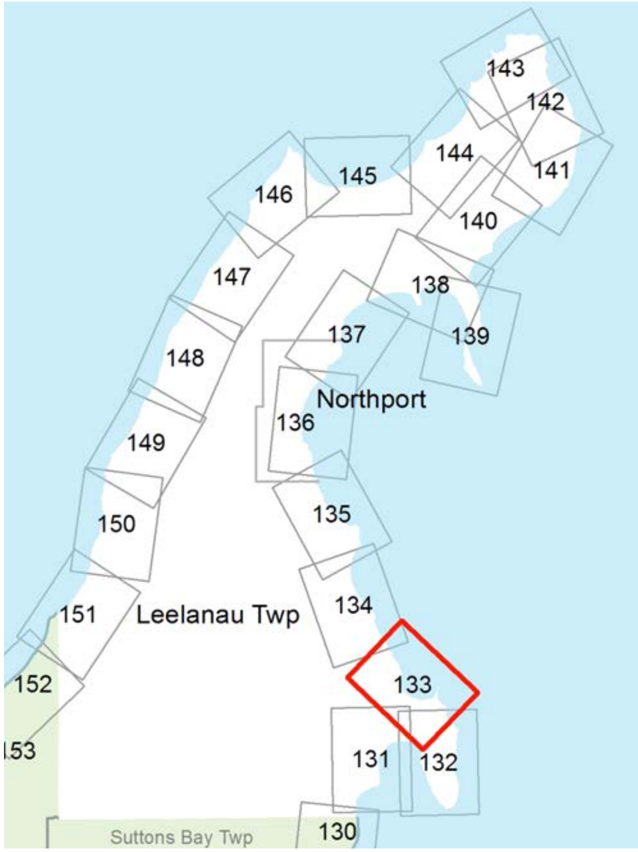
Leelanau County


Panel #131
Flooding Hazards
Ingalls Bay
Omena Point
Mougeys Lake
Mougeys Lake
Isthmus
Lake
Omena Point
Kalchik
Tatch
Panoramic
West Bay Shore
Freeland
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Northport
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Leelanau Twp
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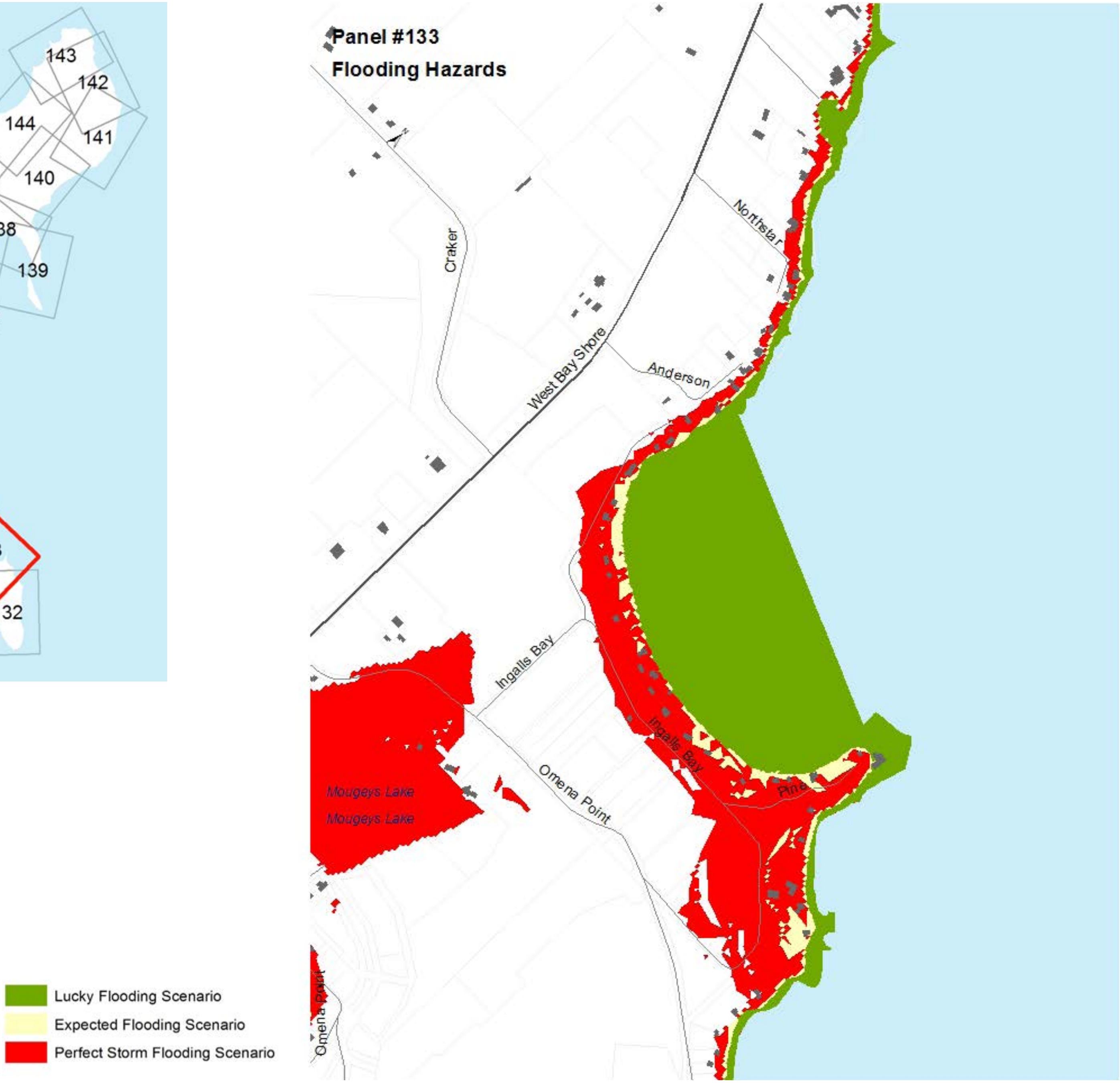
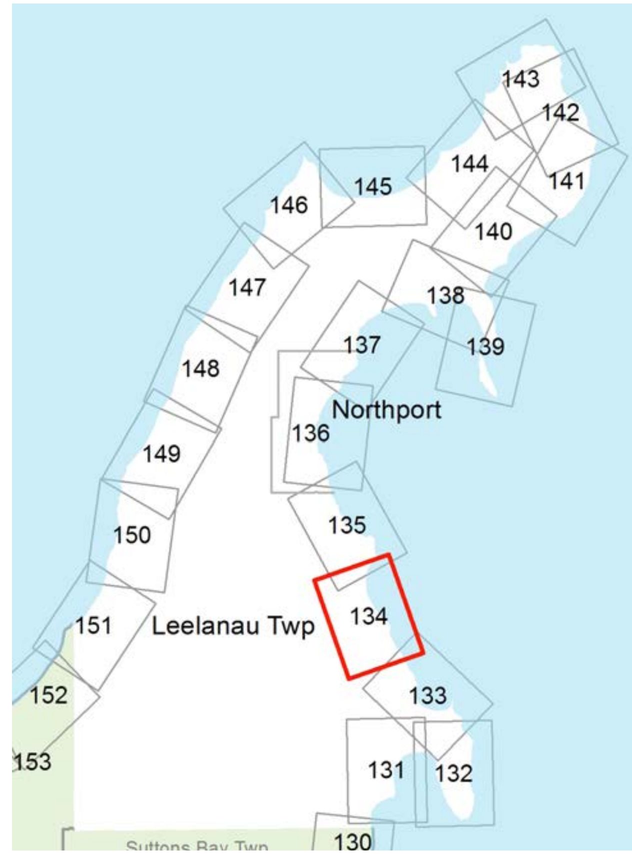
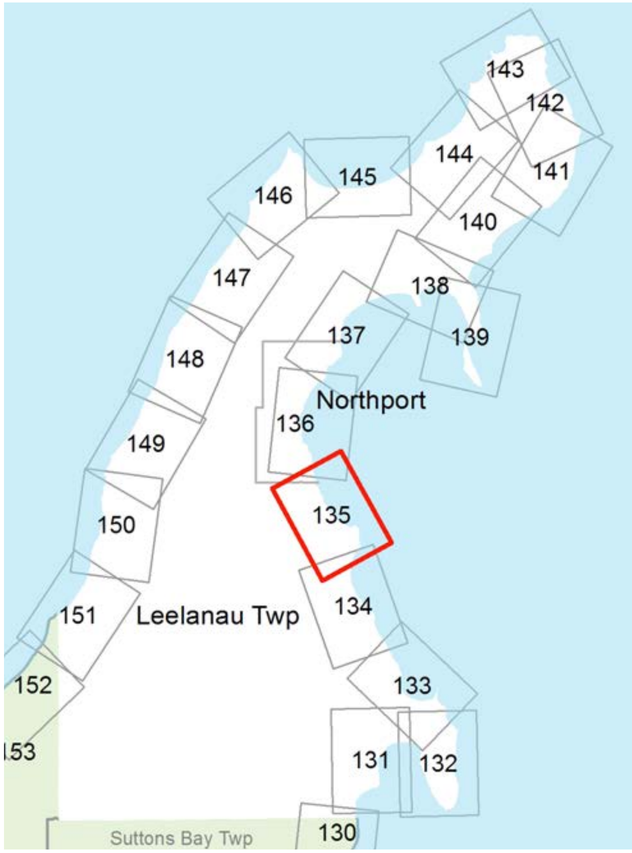
Suttons Bay Twp
130


Leelanau County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Panel #133
Flooding Hazards
Craker
Northstar
West Bay Shore
Anderson
Ingalls Bay
Ingalls Bay
Omena Point
Pine
Mougeys Lake
Mougeys Lake
Omena Point



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Northport
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Leelanau Twp
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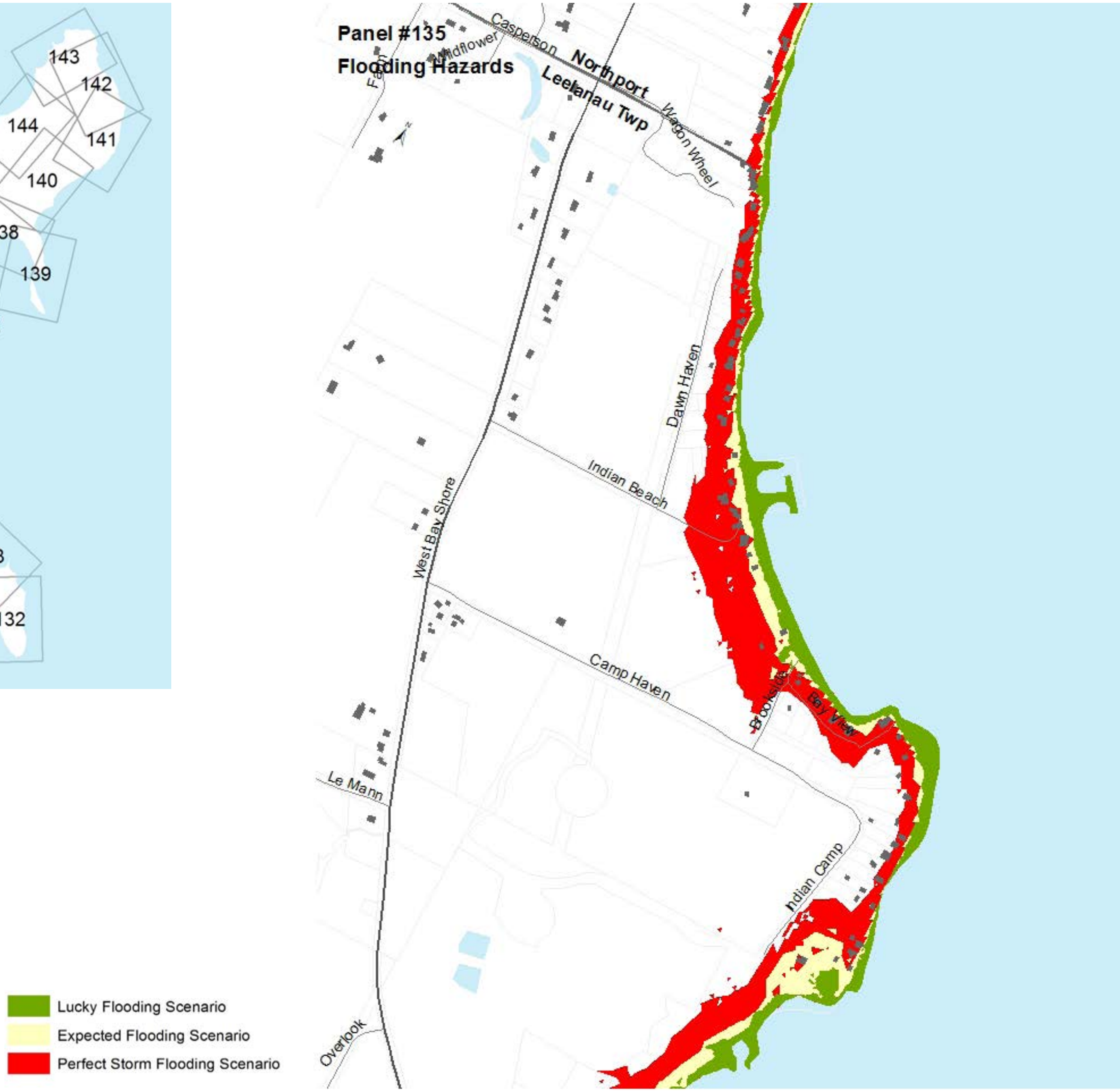
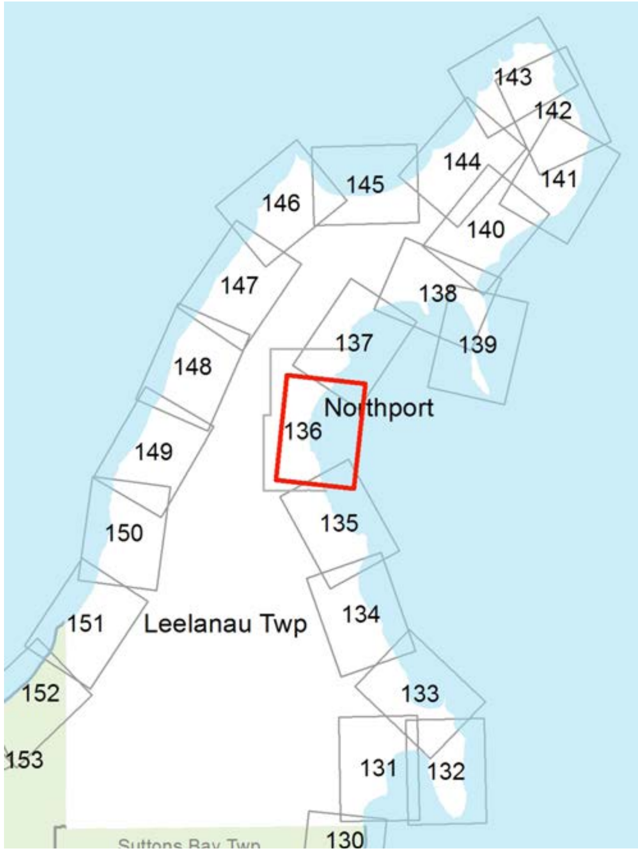
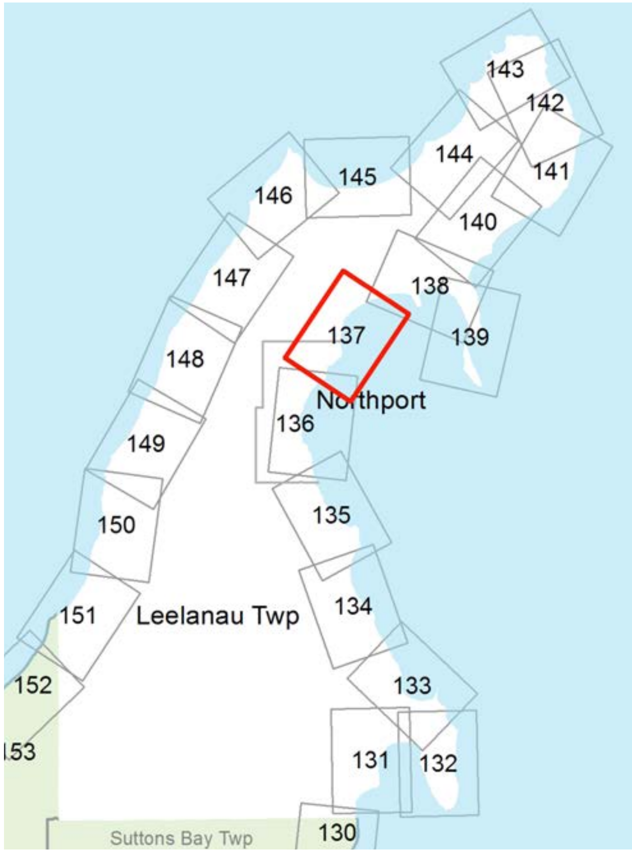
Suttons Bay Twp
130


Leelanau County


Panel #135
Flooding Hazards
Casperson
Wildflower
Northport
Leelanau Twp
Wagon Wheel
Dawn Haven
Indian Beach
West Bay Shore
Camp Haven
Brookside
Bay View
Le Mann
Indian Camp
Overlook
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Northport
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Leelanau Twp
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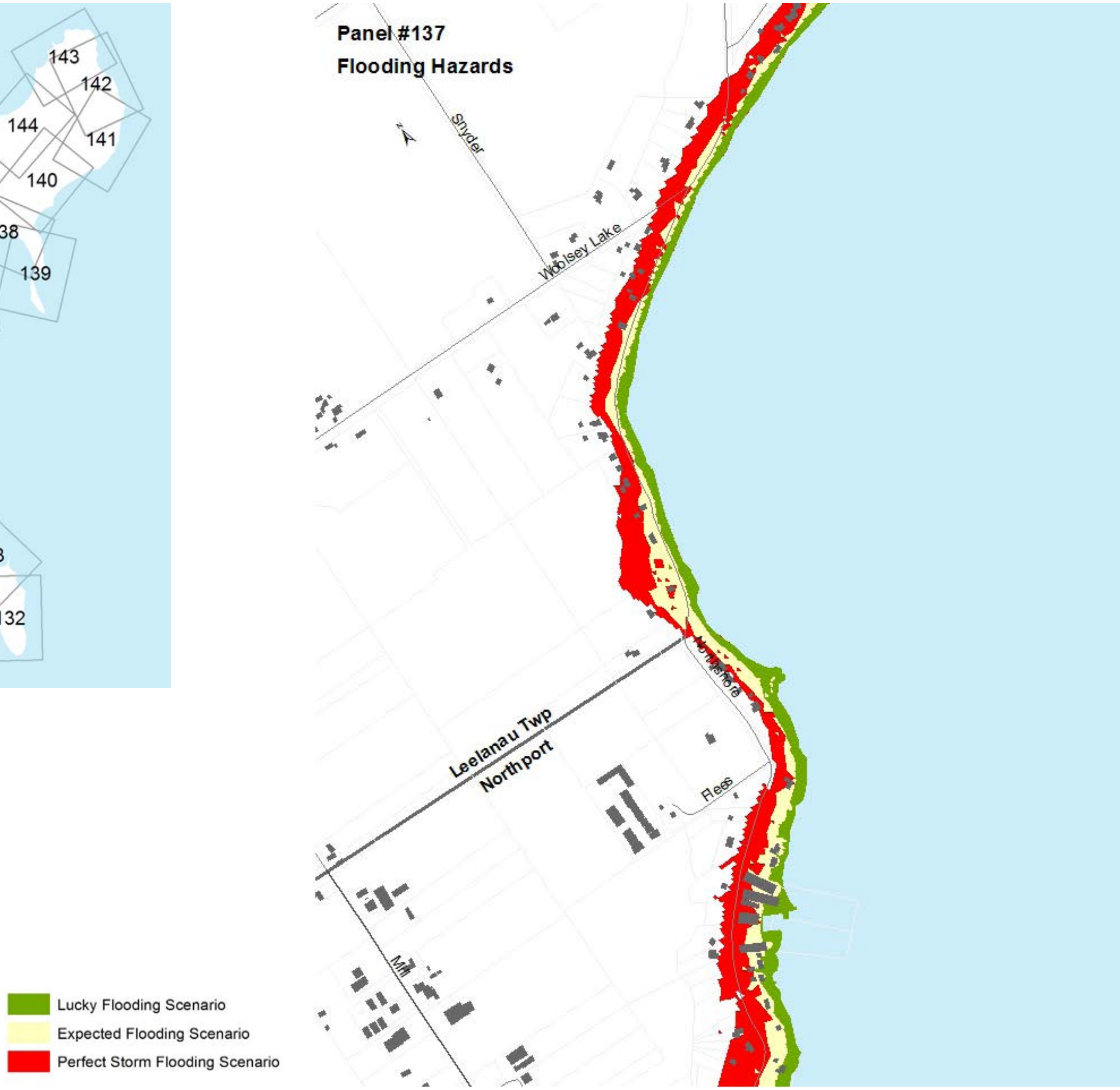
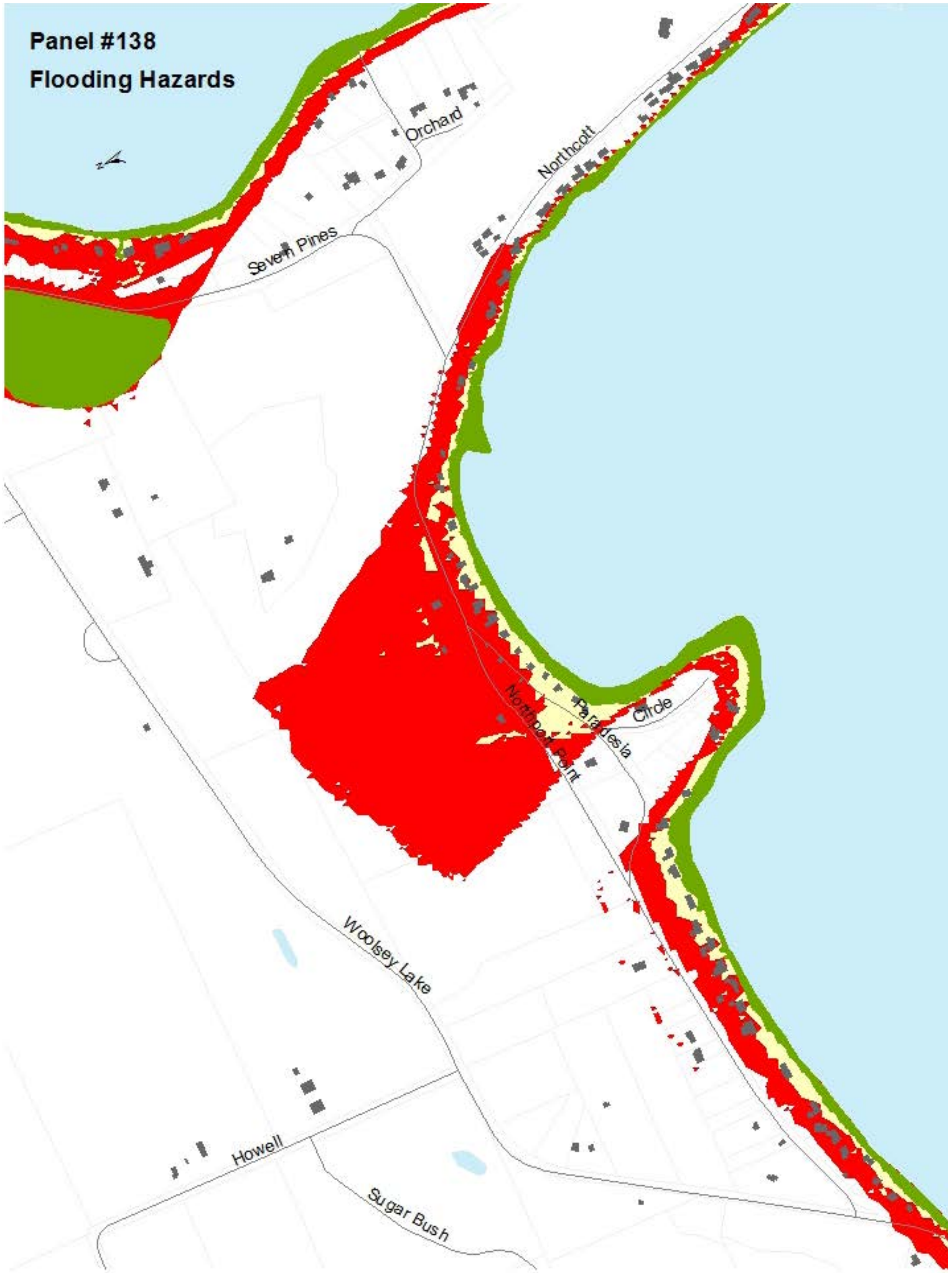
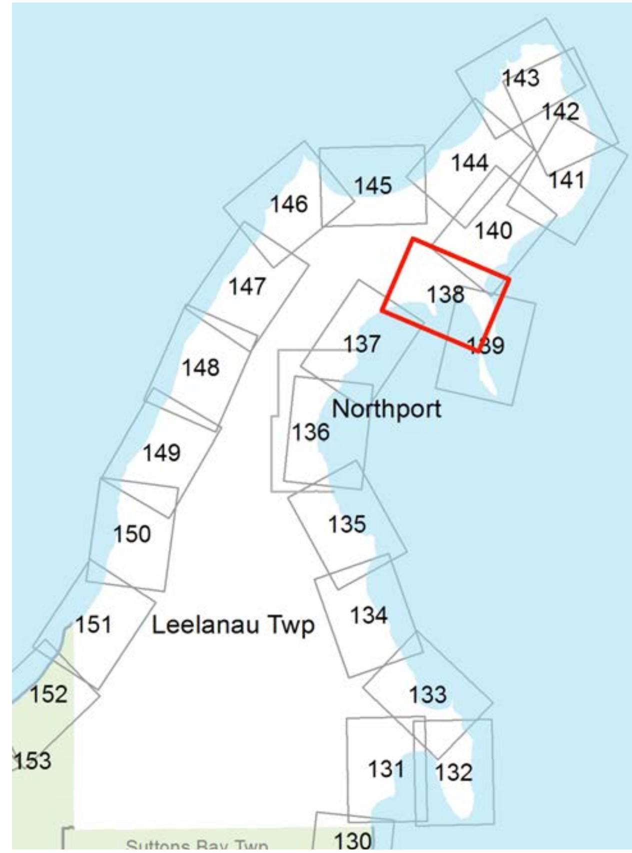
Suttons Bay Twp
130

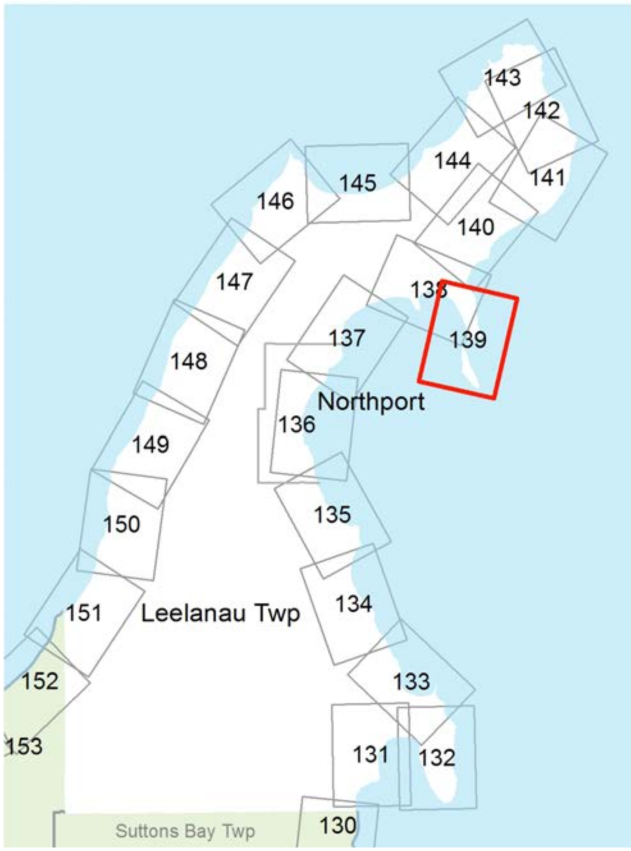

Leelanau County


Panel #137
Flooding Hazards
Snyder
Woolsey Lake
Northshore
Leelanau Twp
Northport
Fees
Mill
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

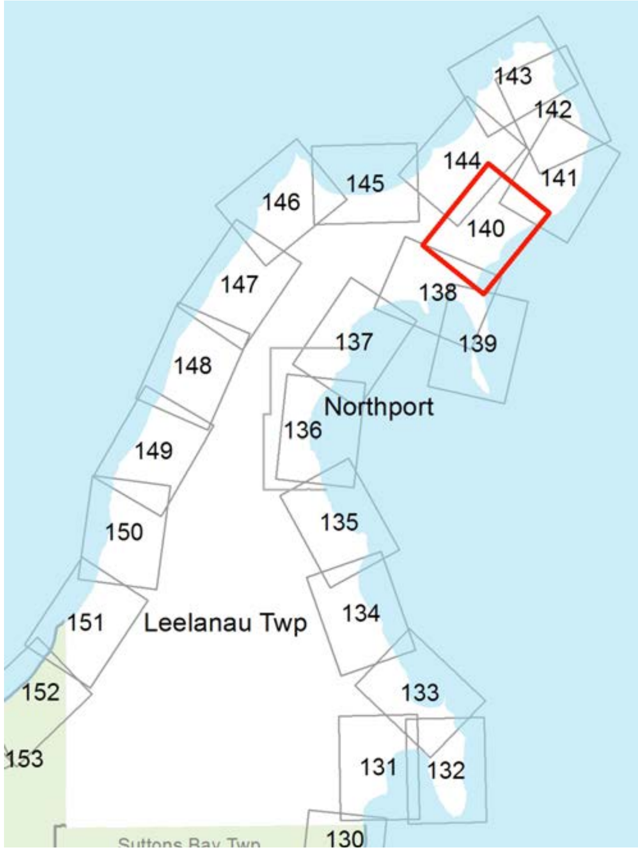




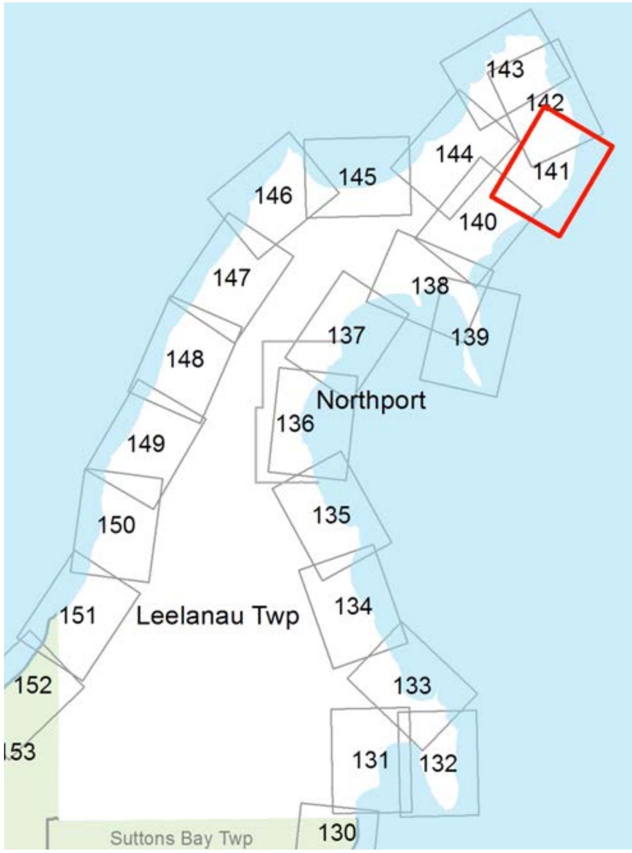
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Northport
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Leelanau Twp
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Suttons Bay Twp
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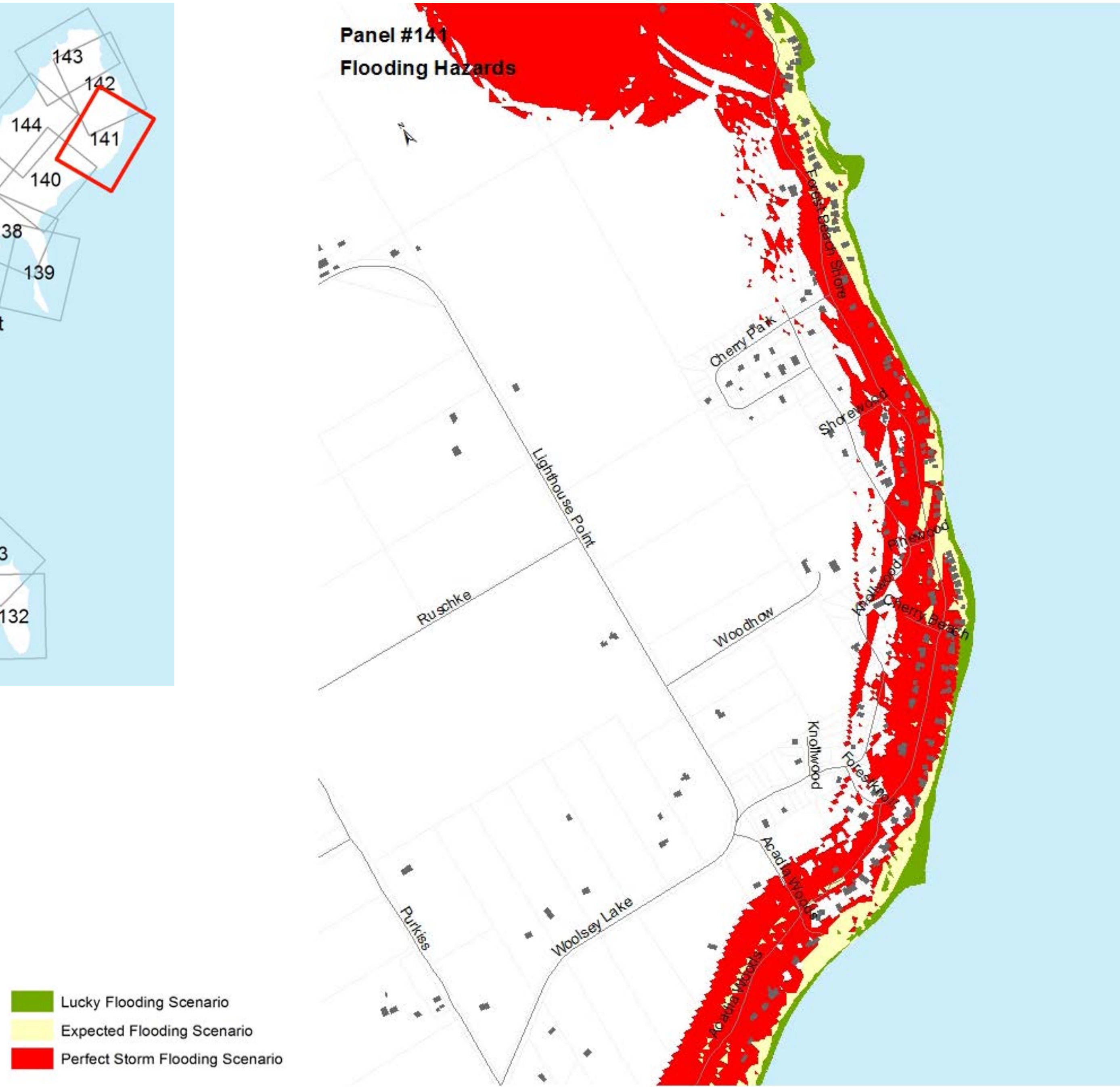
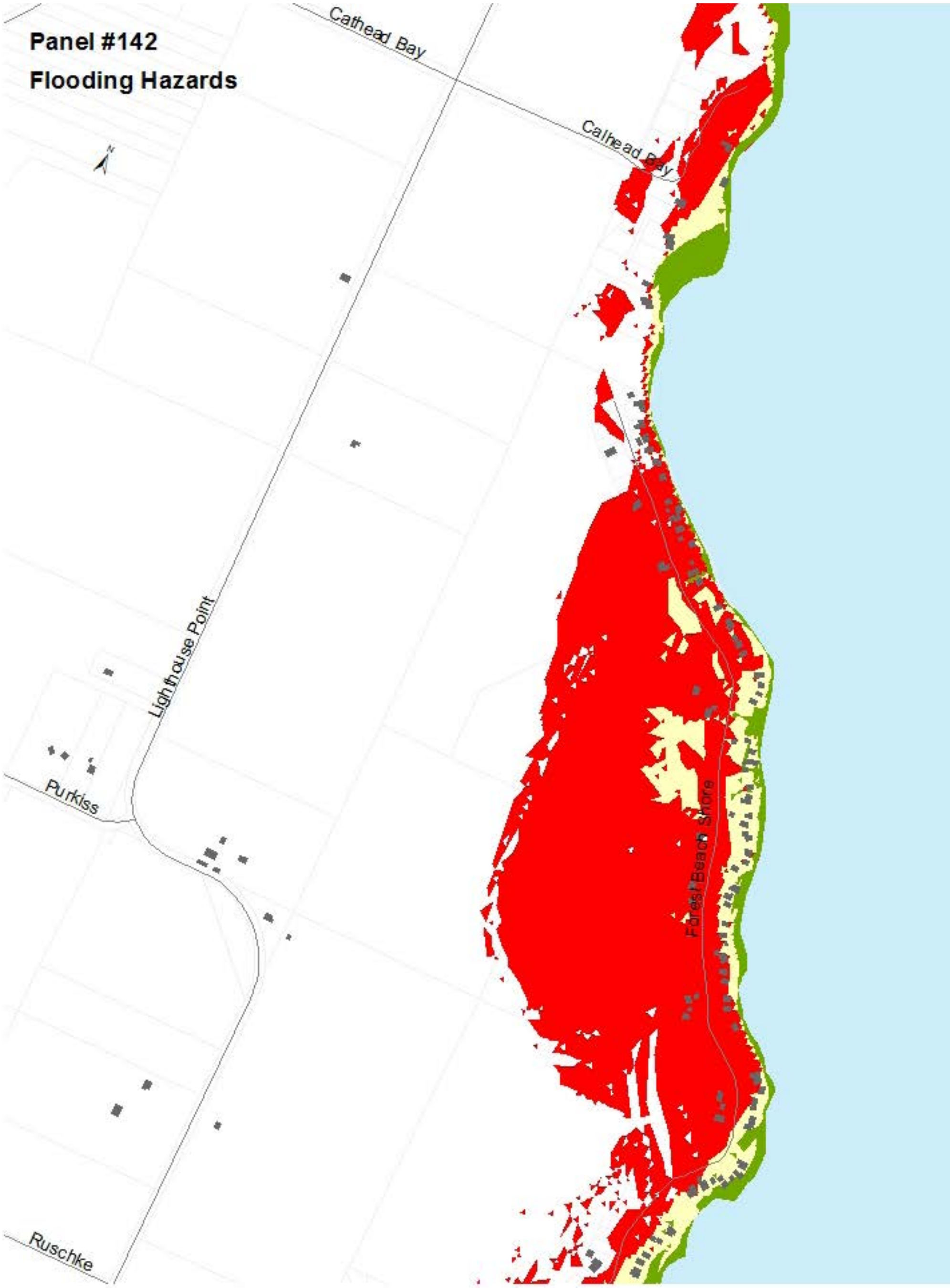
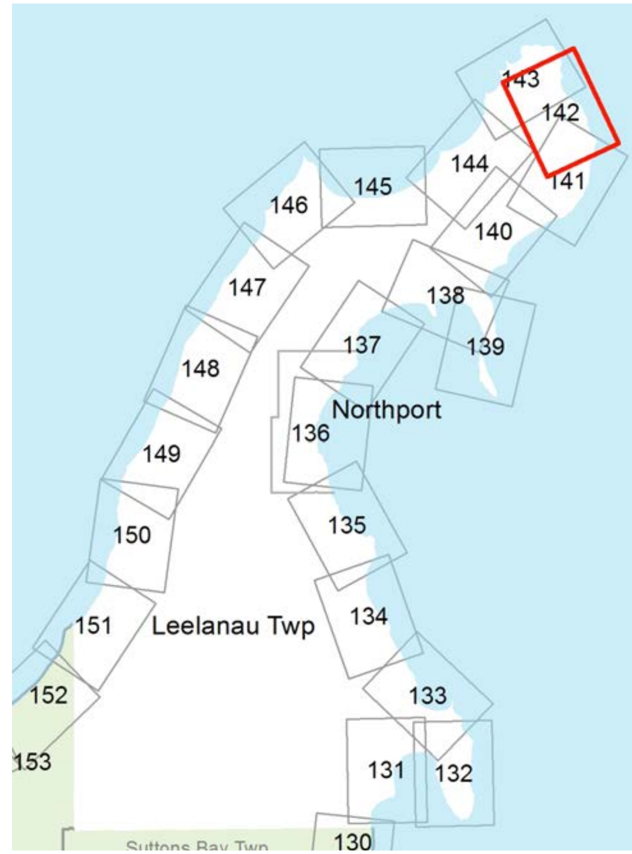
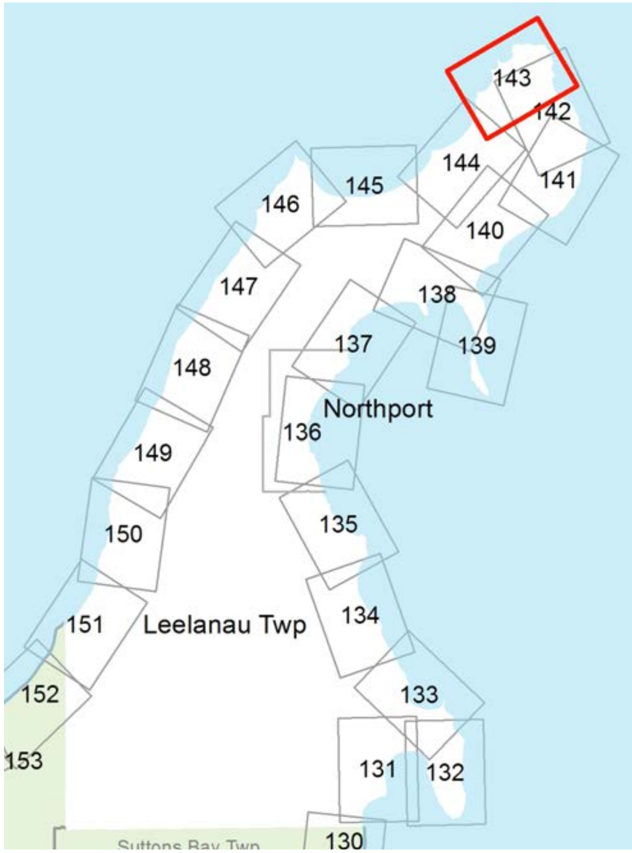
Leelanau County

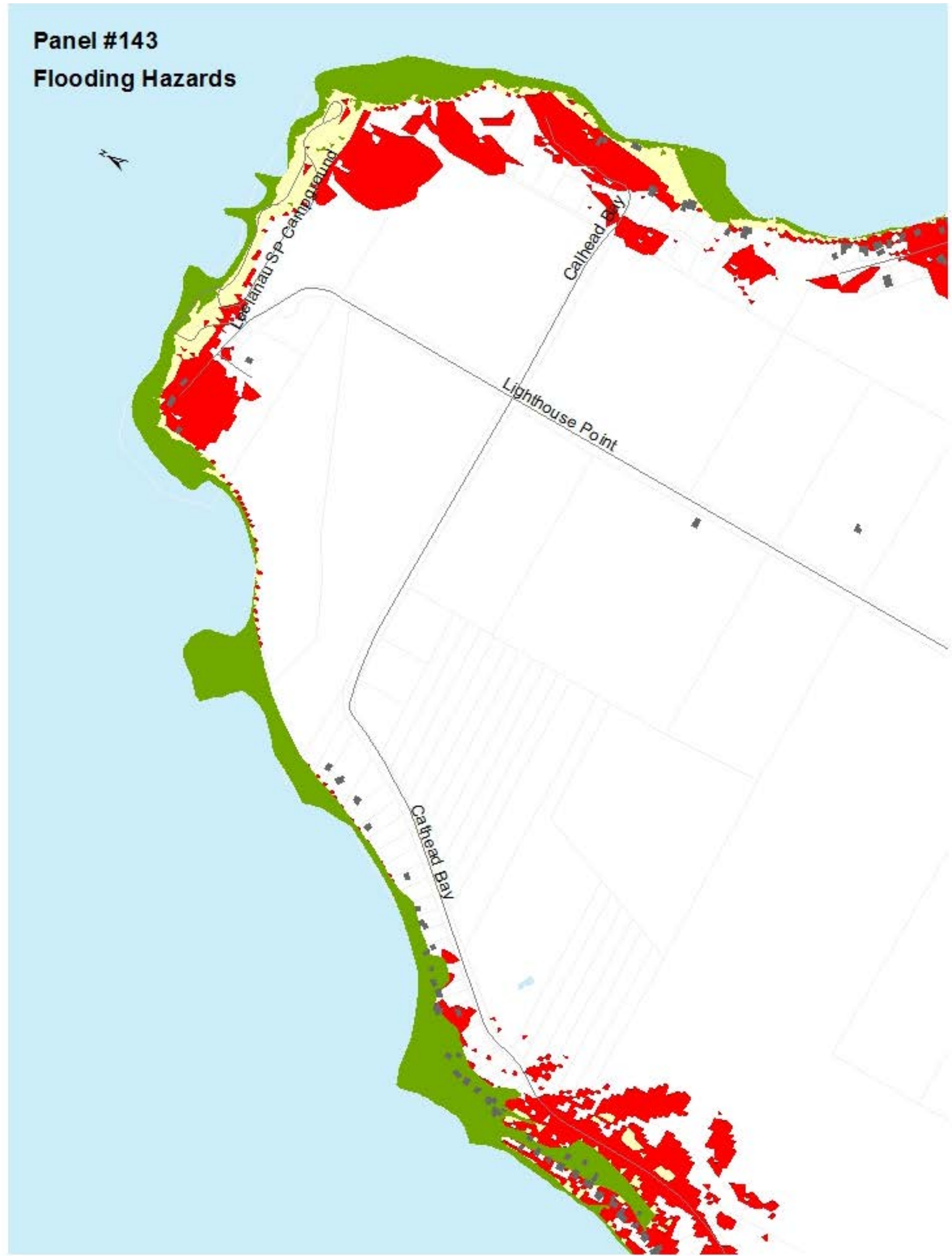

Panel #141
Flooding Hazards
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Forest Beach Shore
Cherry Park
Shorewood
Lighthouse Point
Pinewood
Knollwood
Cherry Beach
Ruschke
Woodhow
Knollwood
Foresthill
Acadia Woods
Purkiss
Woolsey Lake
Acadia Woods



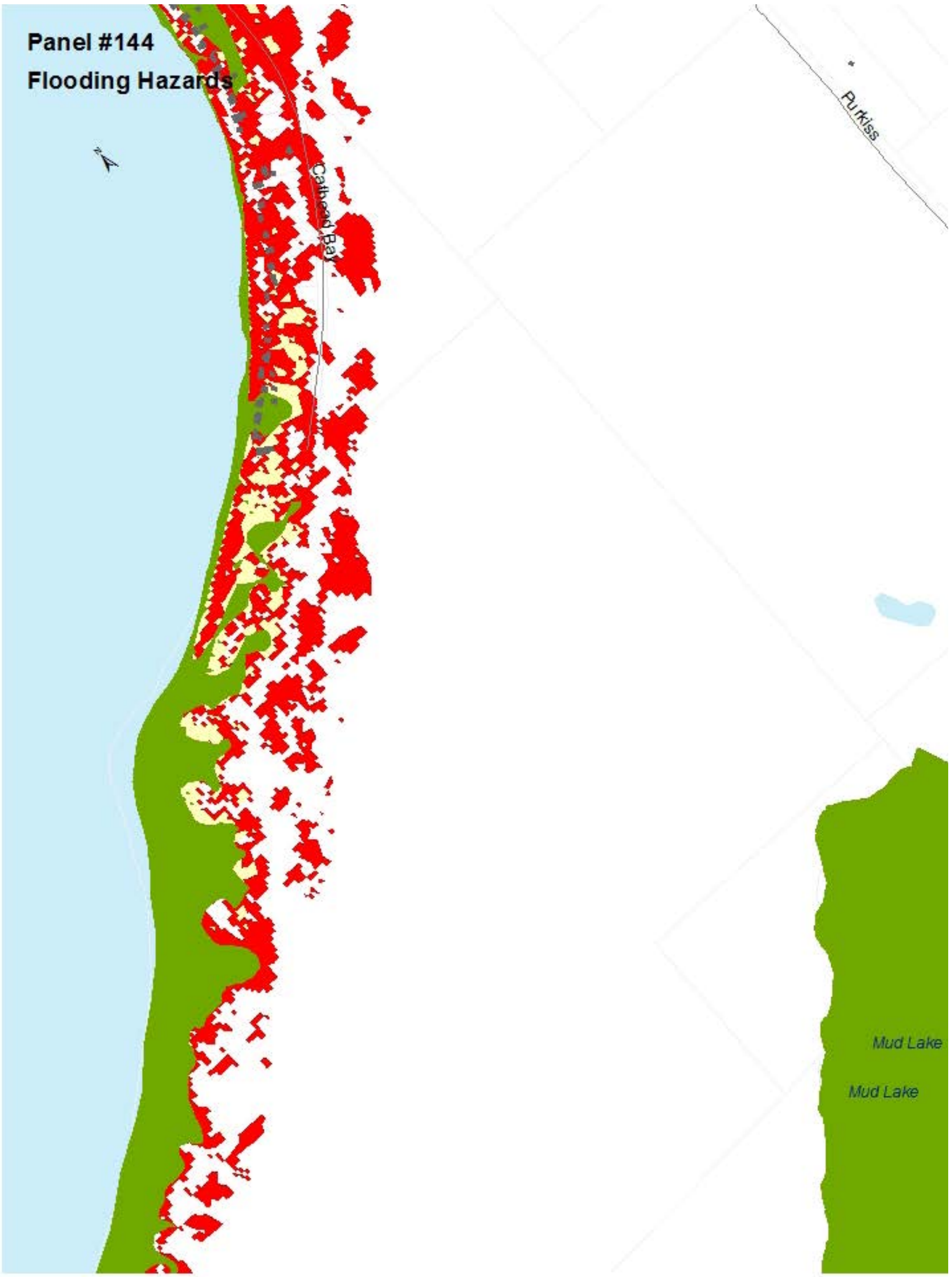


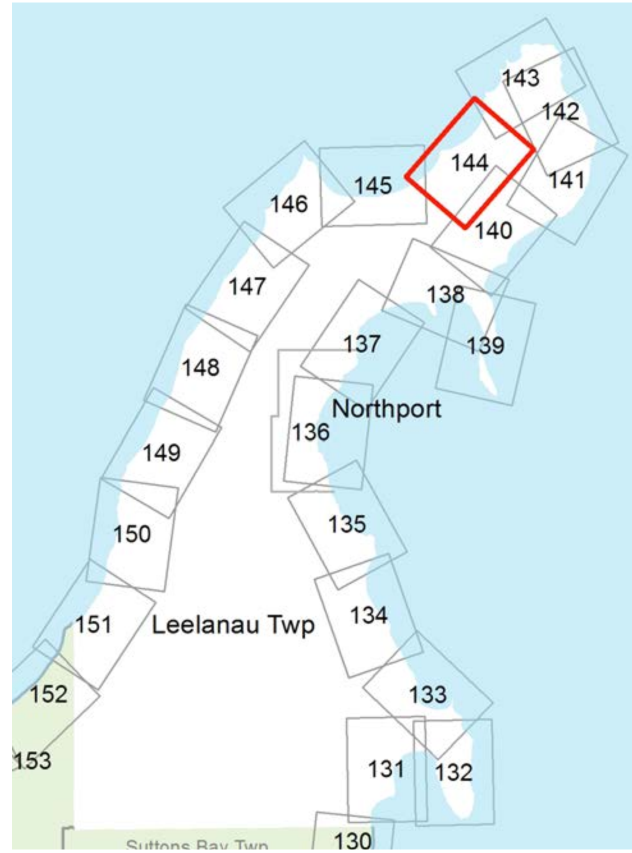
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



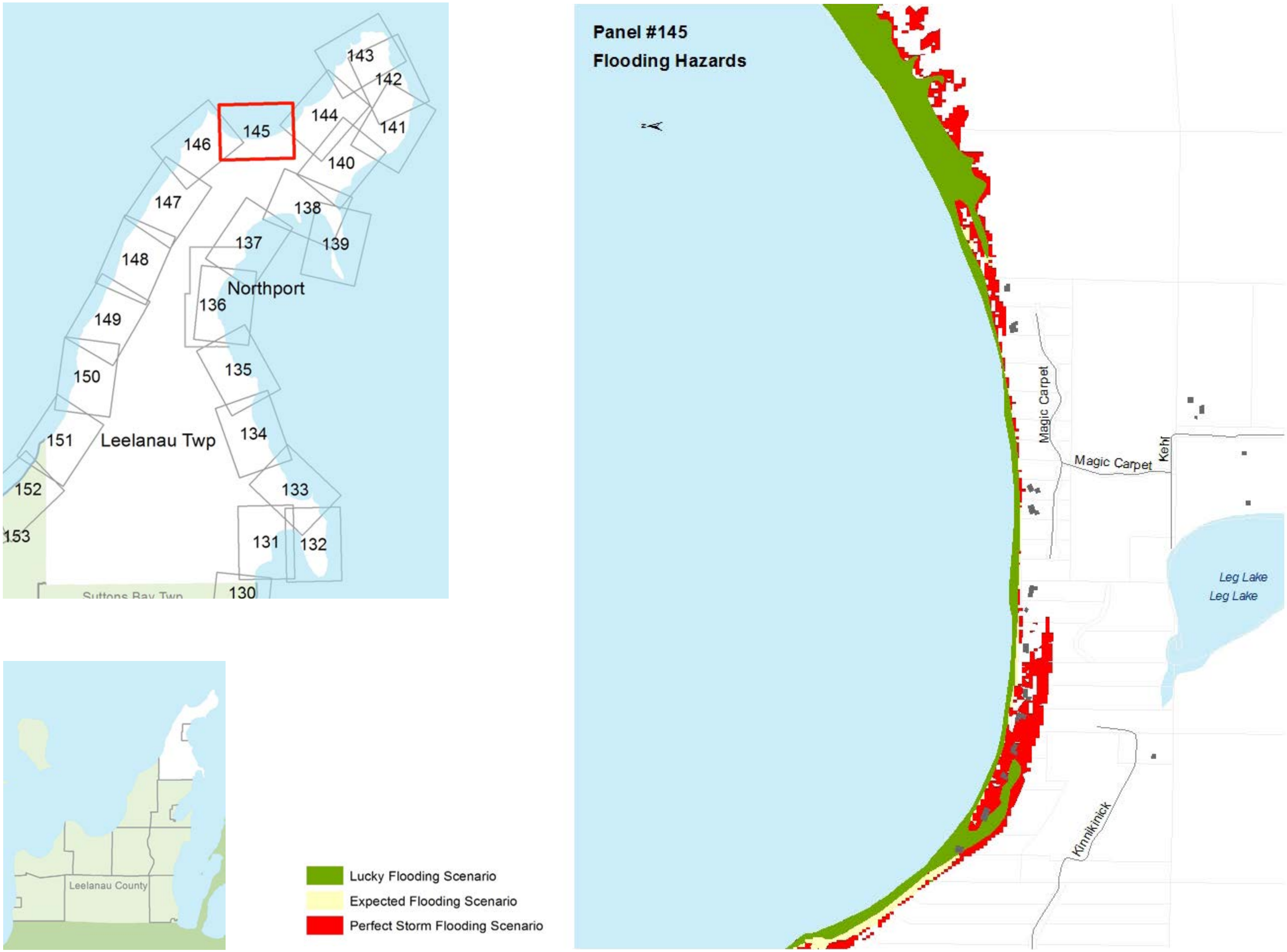


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



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Northport
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Leelanau Twp
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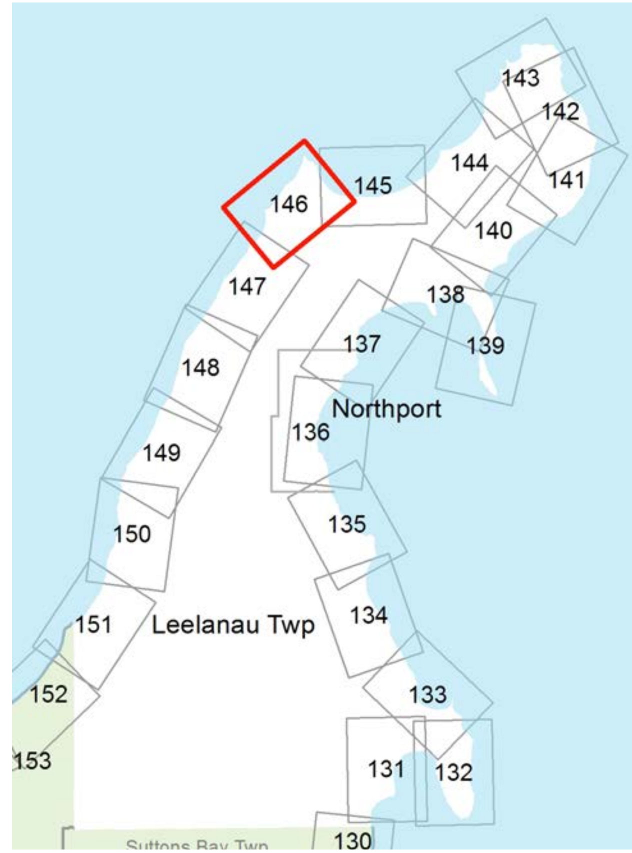
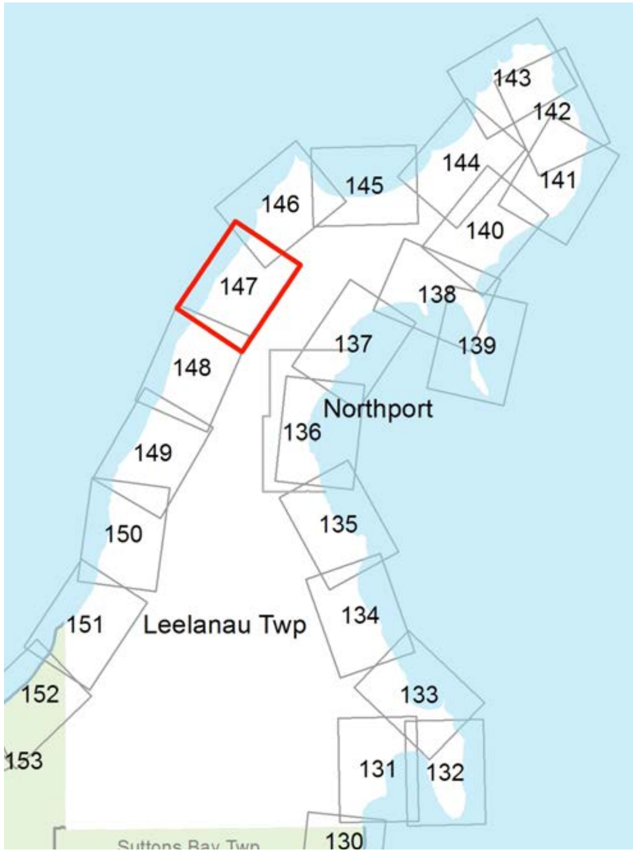
Suttons Bay Twp
130
Leelanau County
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Panel #145
Flooding Hazards
Magic Carpet
Magic Carpet
Kehl
Leg Lake
Leg Lake
Kinnikinick



- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario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Northport
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Leelanau Twp
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Suttons Bay Twp
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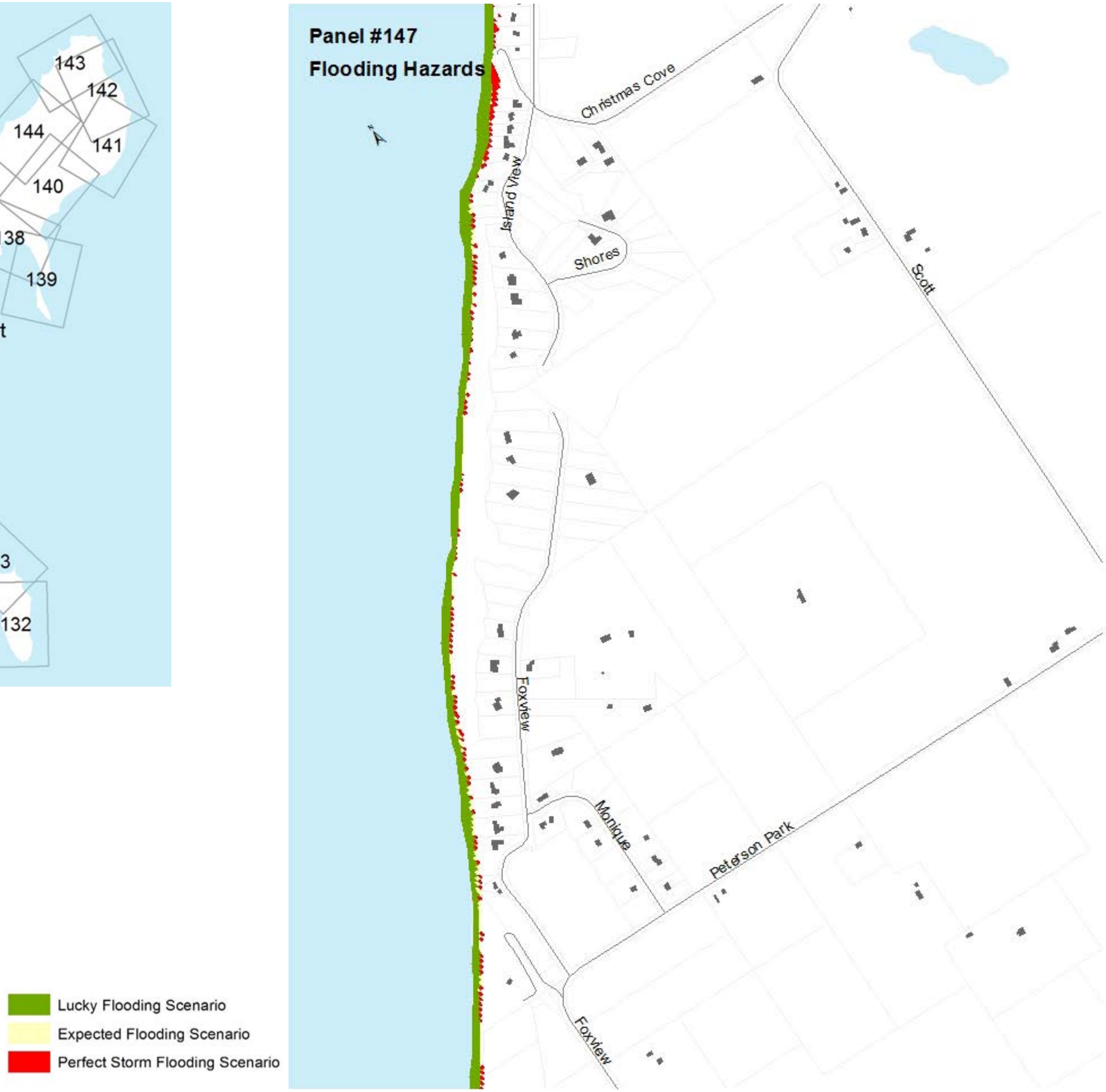
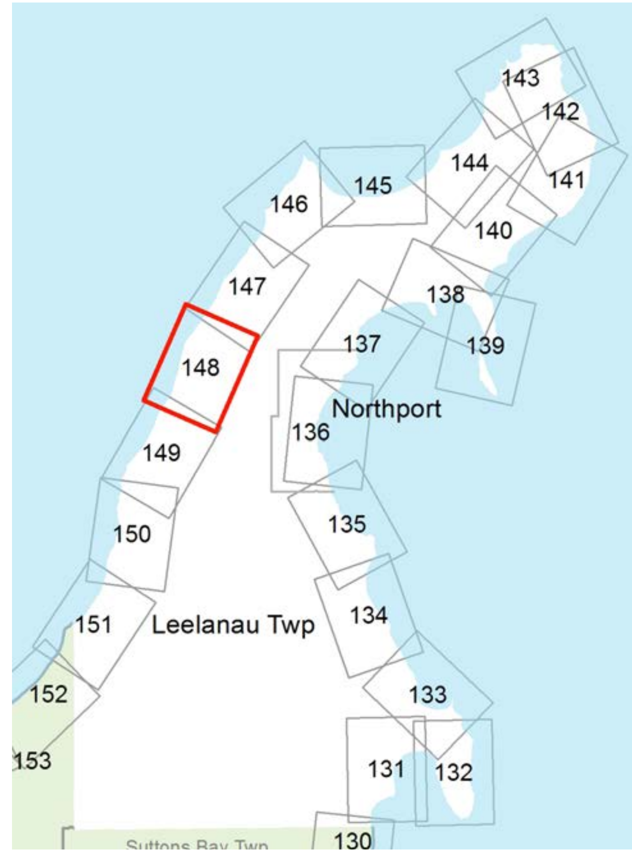
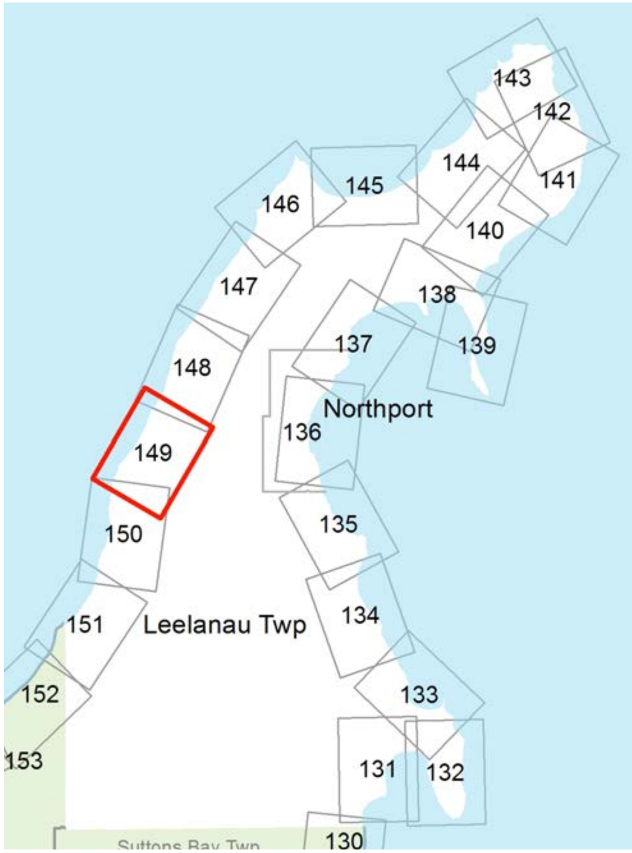
Leelanau County

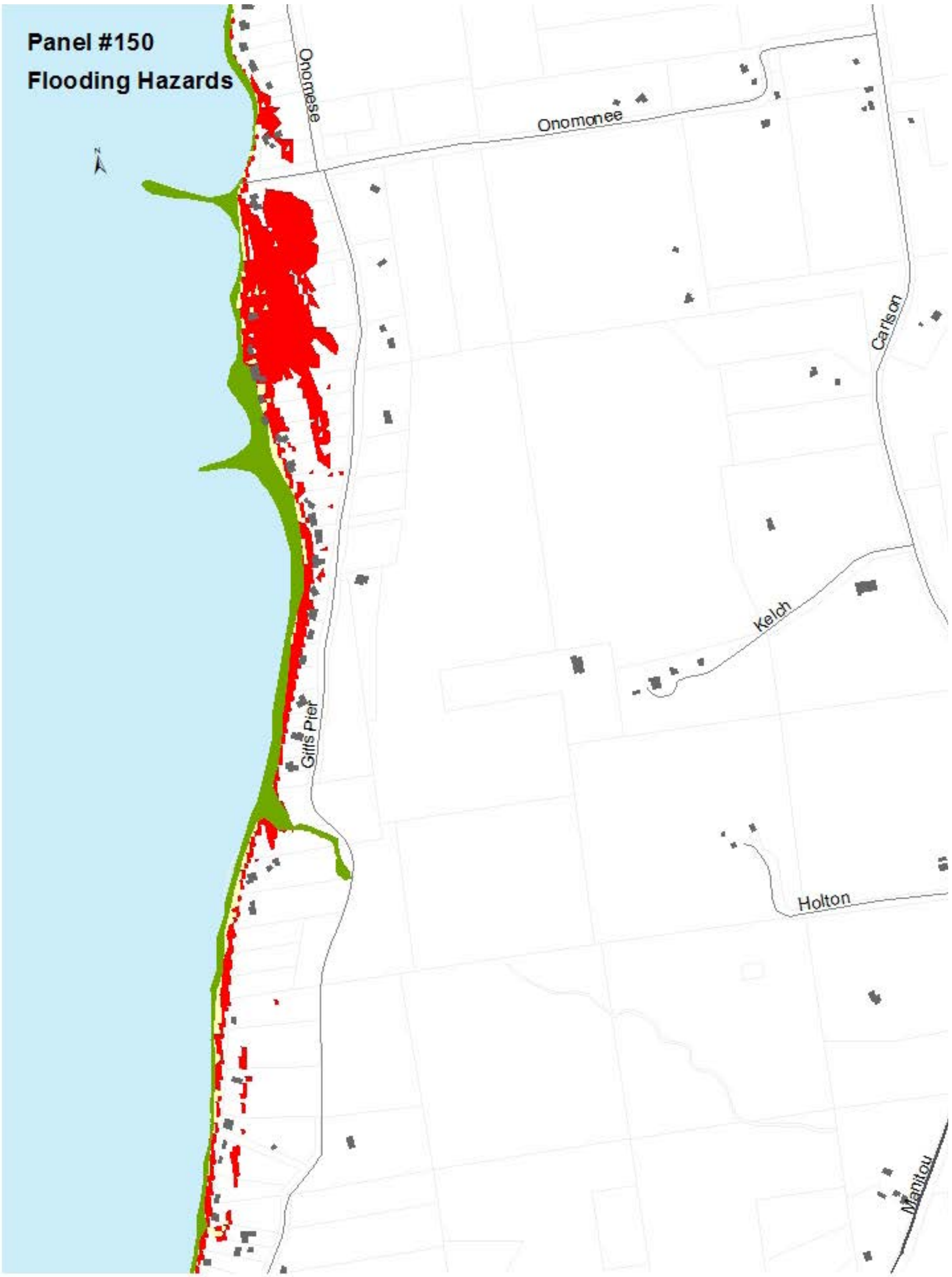

Panel #147
Flooding Hazards
Christmas Cove
Island View
Shores
Scott
Foxview
Monique
Peterson Park
Foxview
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

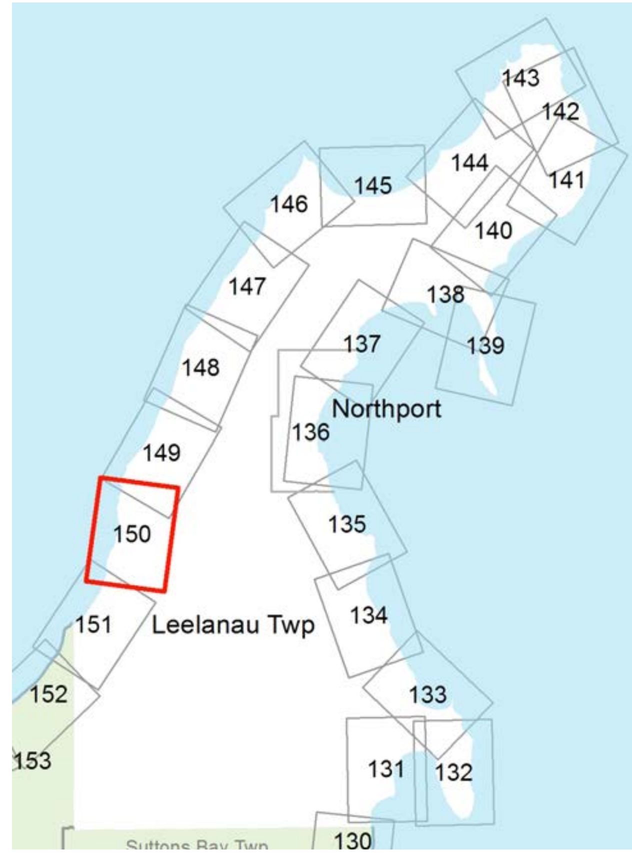


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

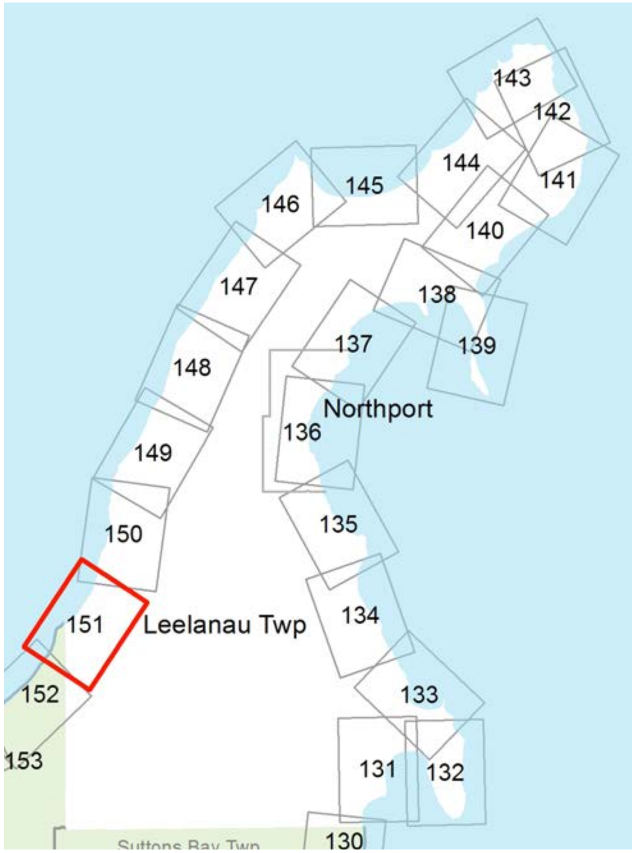


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario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Northport
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Leelanau Twp
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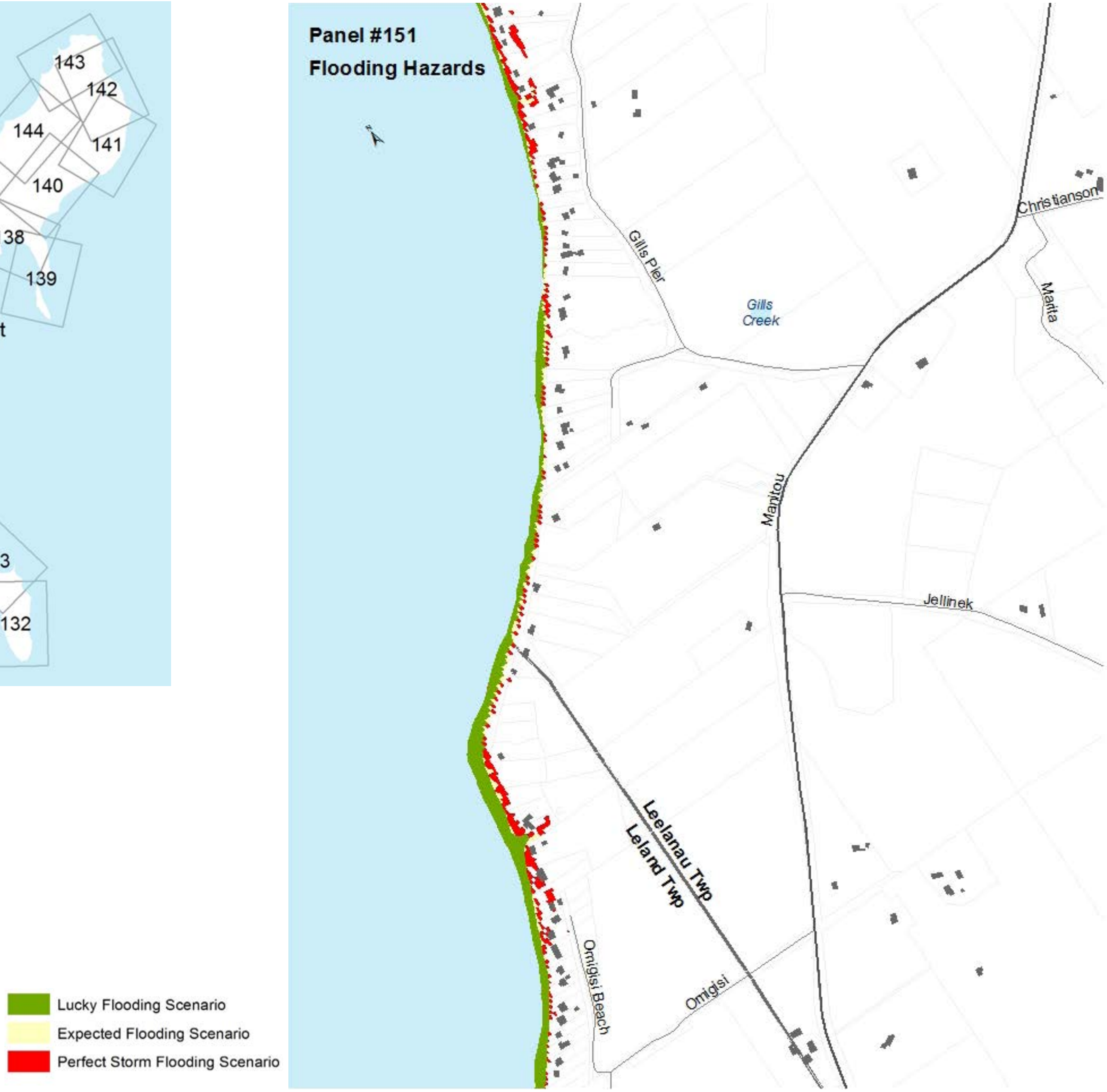
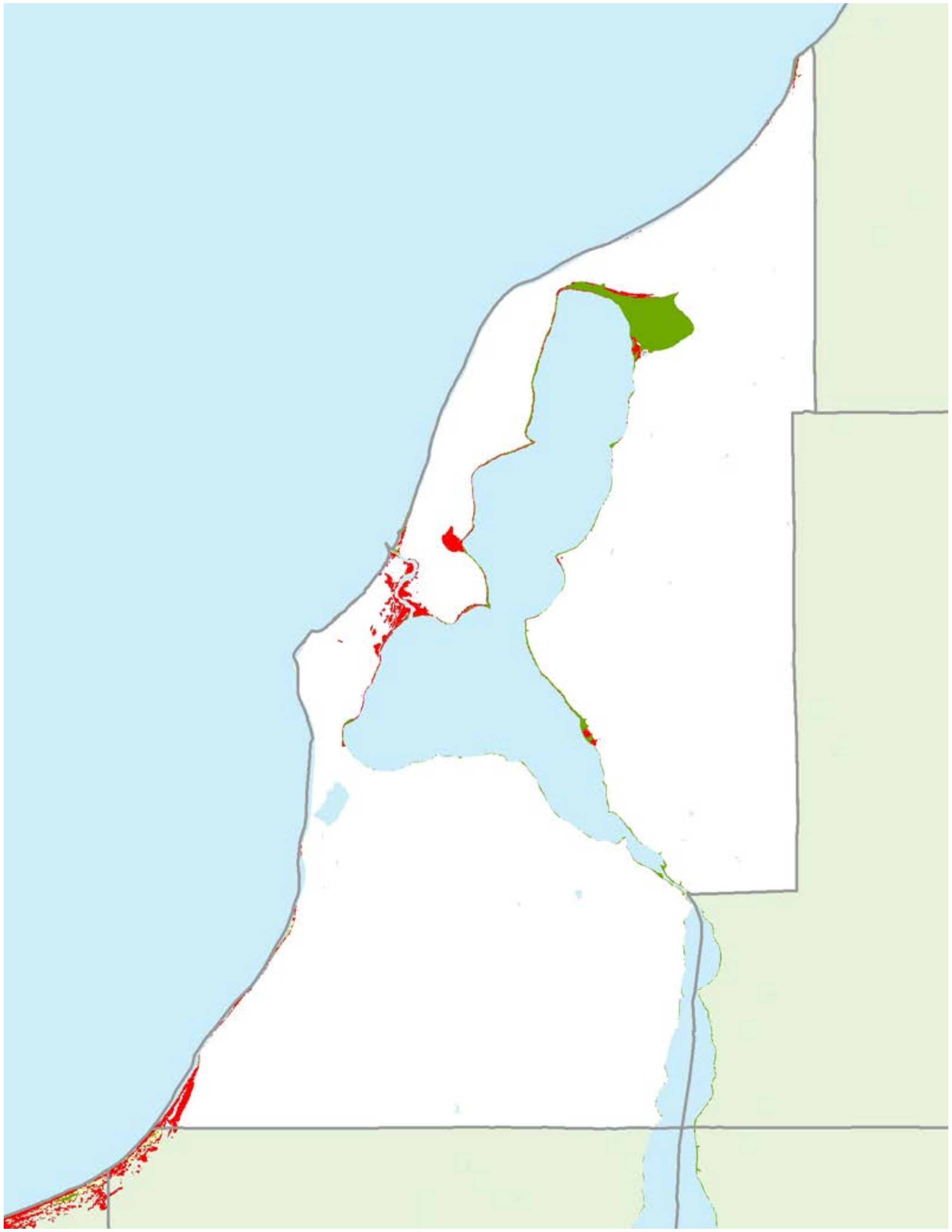
Suttons Bay Twp
130


Leelanau County


Panel #151
Flooding Hazards
Gills Pier
Gills Creek
Christianson
Marita
Manitou
Jellinek
Leelanau Twp
Leland Twp
Omigisi Beach
Omigisi
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

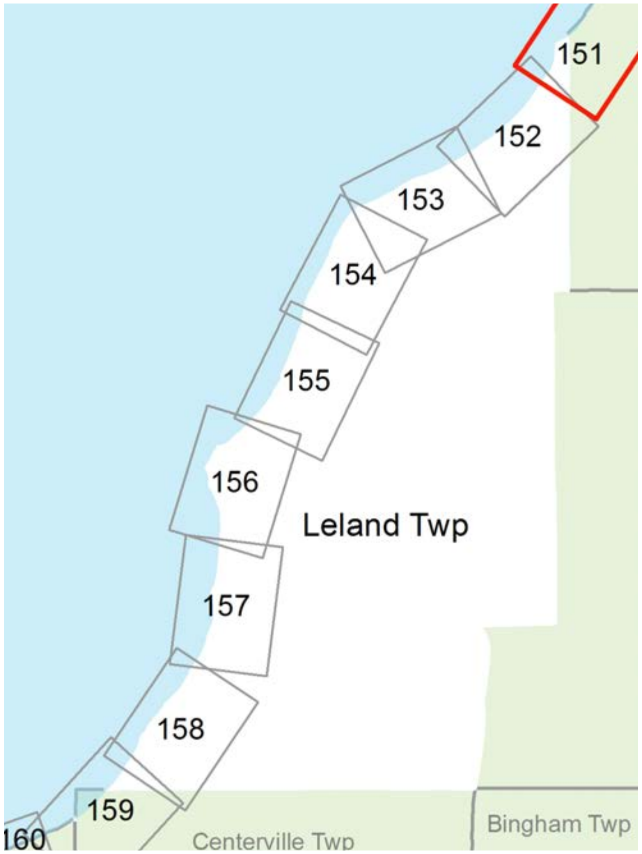


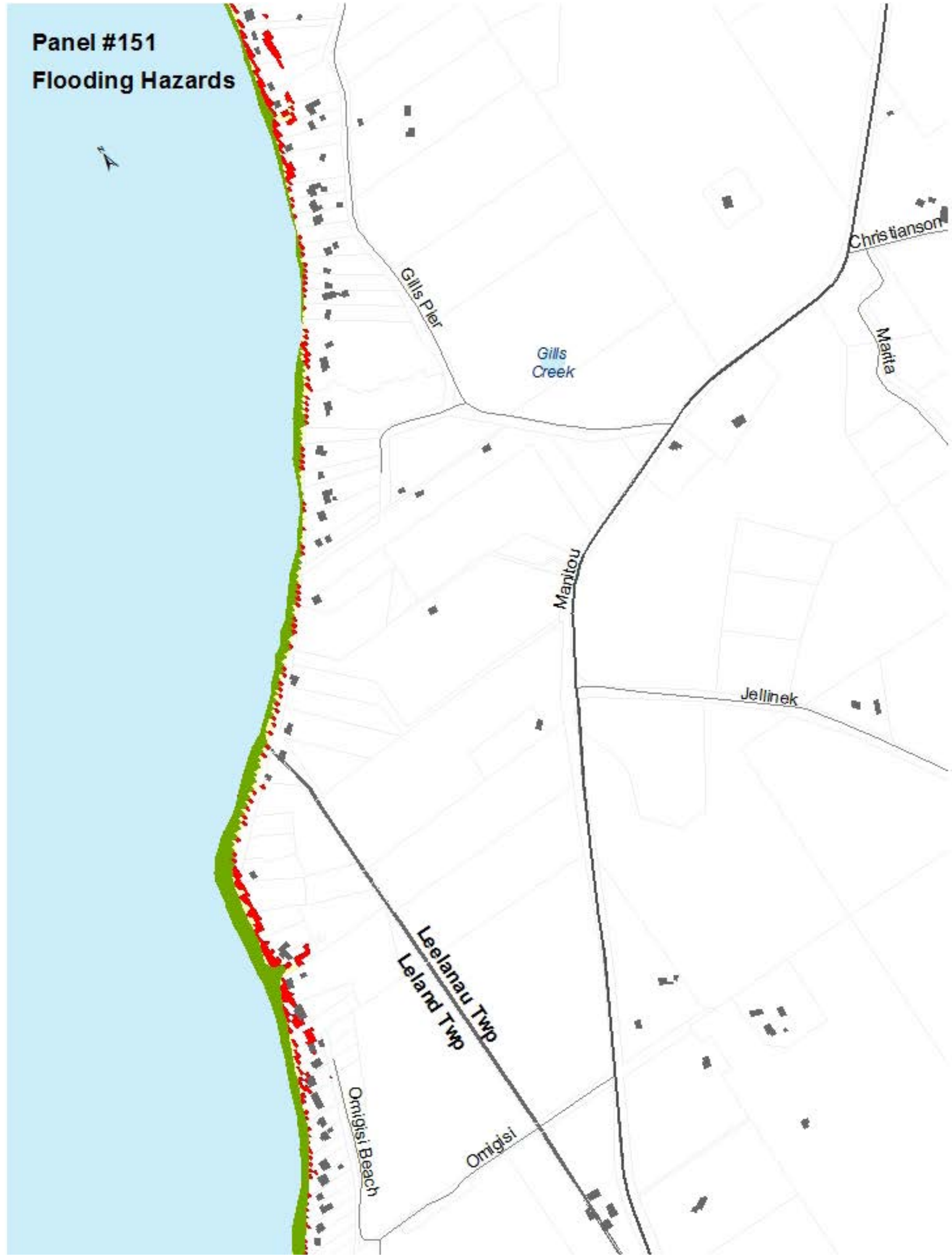
Leland Twp.

Coastal Flooding Scenario Impacts

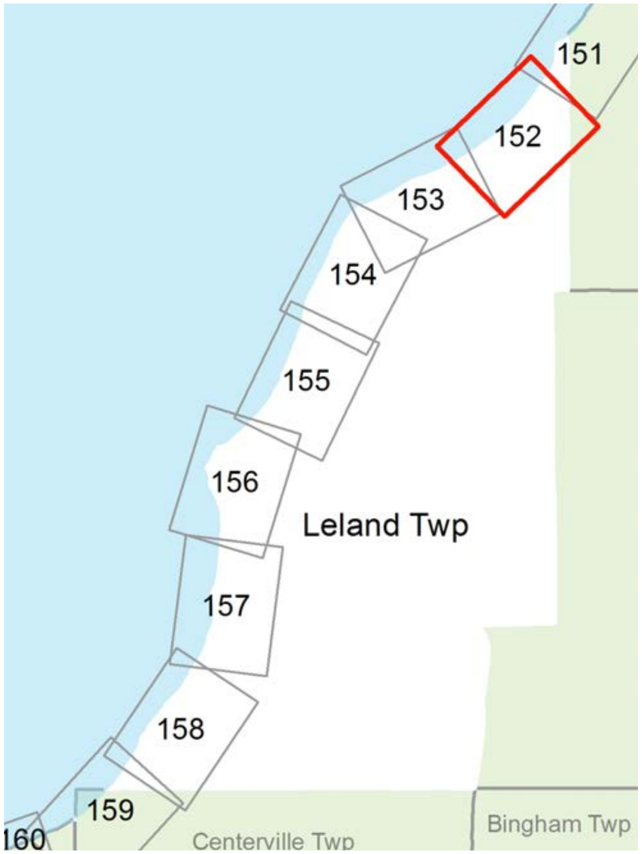
Leland			
Total SEV	Lucky	Expected	Perfect Storm
$ 646,221,700.00	$ 30,862,700.00	$ 32,737,500.00	$ 79,348,800.00

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

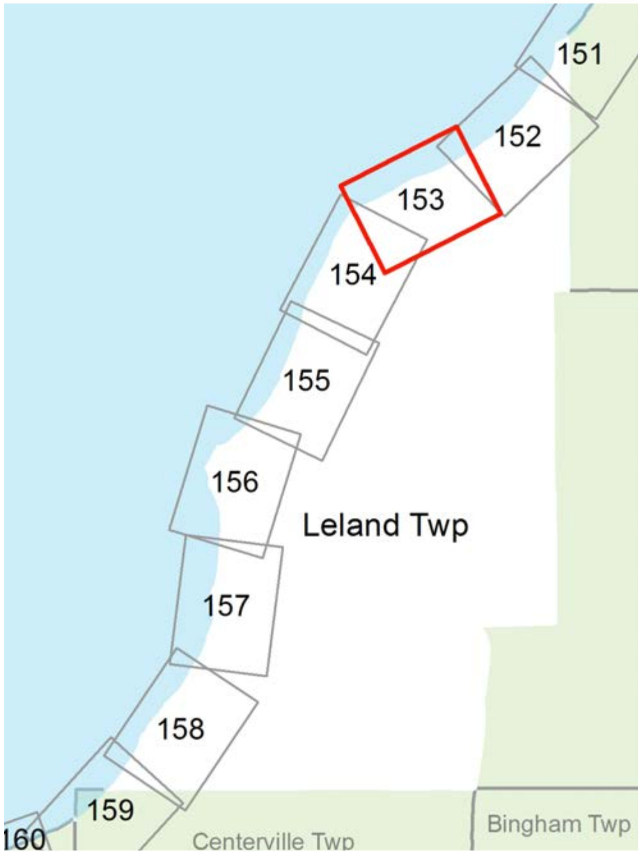




Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



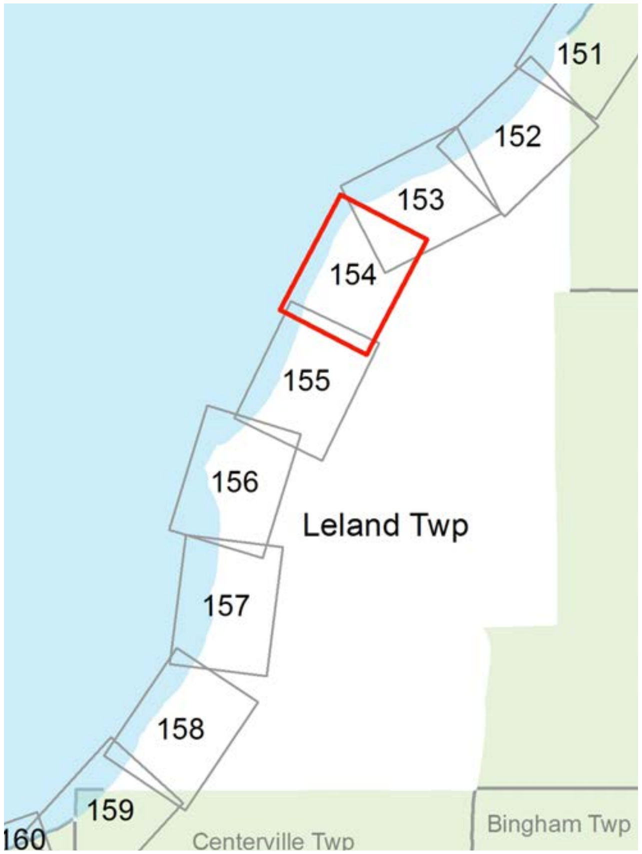
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



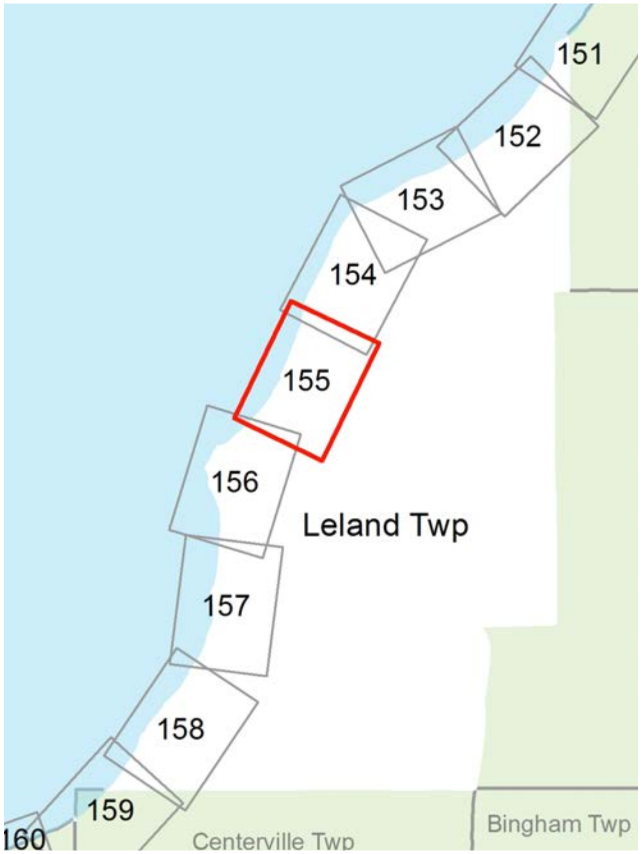
Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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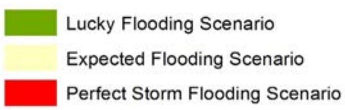
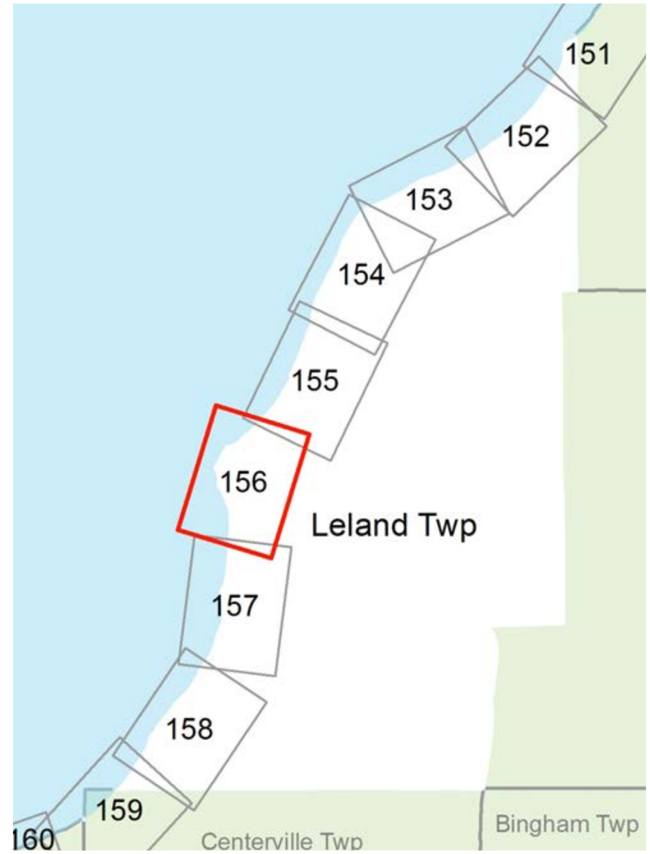
Leland Twp
Centerville Twp
Bingham Twp

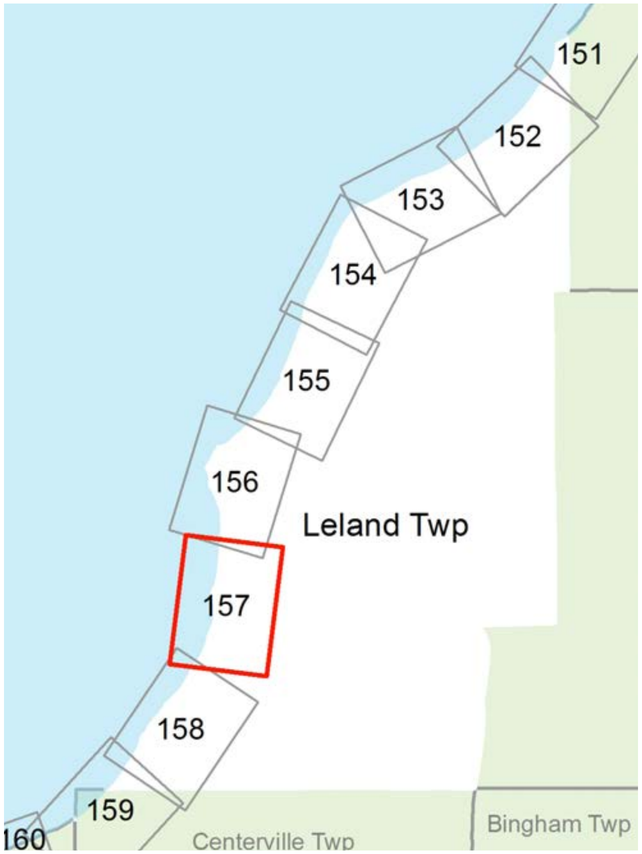

Leelanau County

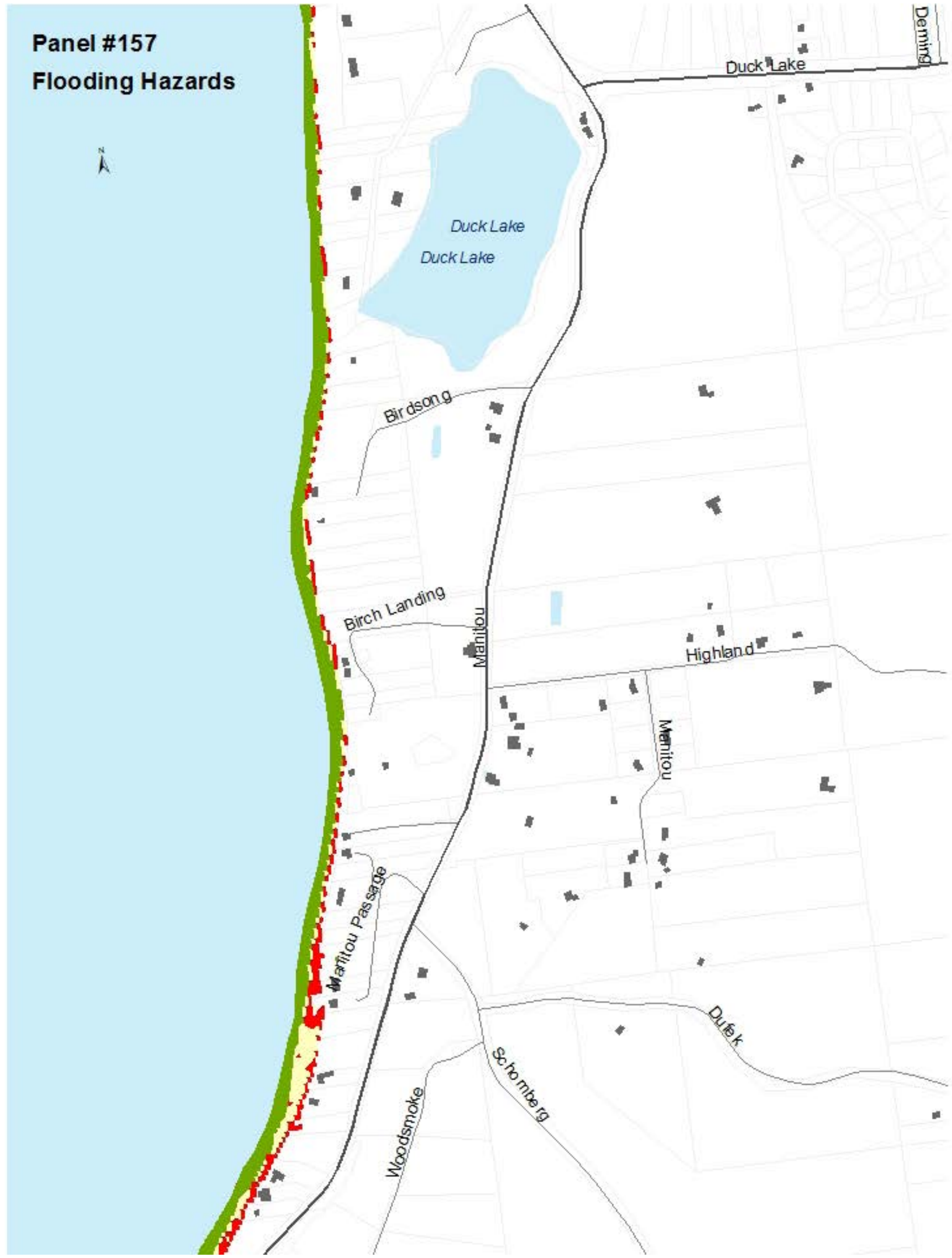

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #155
Flooding Hazards
Lake Leelanau
Leland River



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

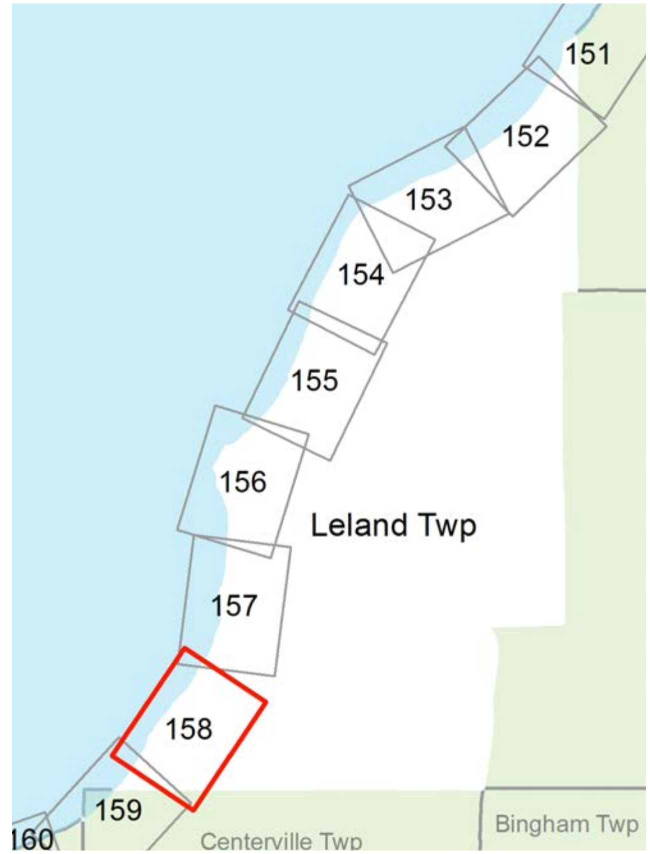




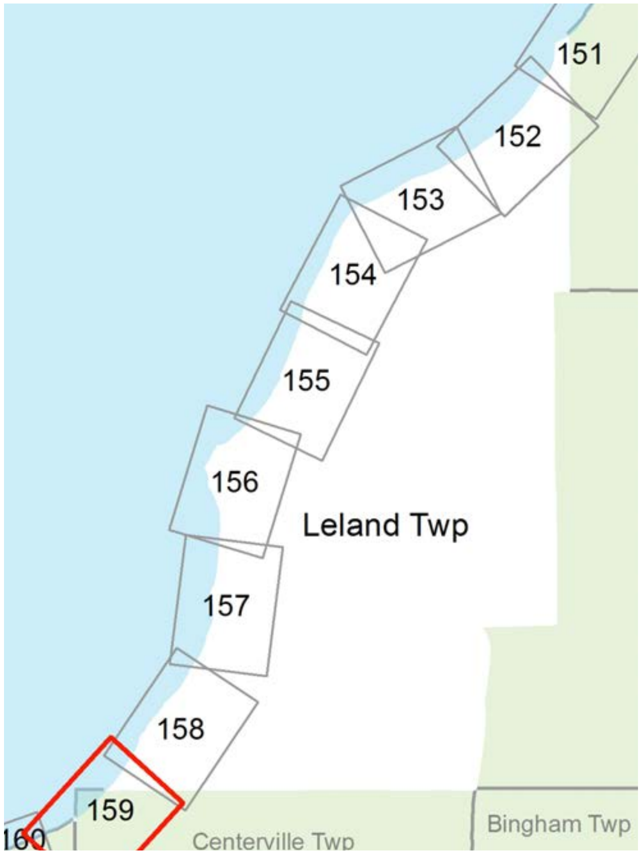
Lucky Flooding Scenario

Expected Flooding Scenario

Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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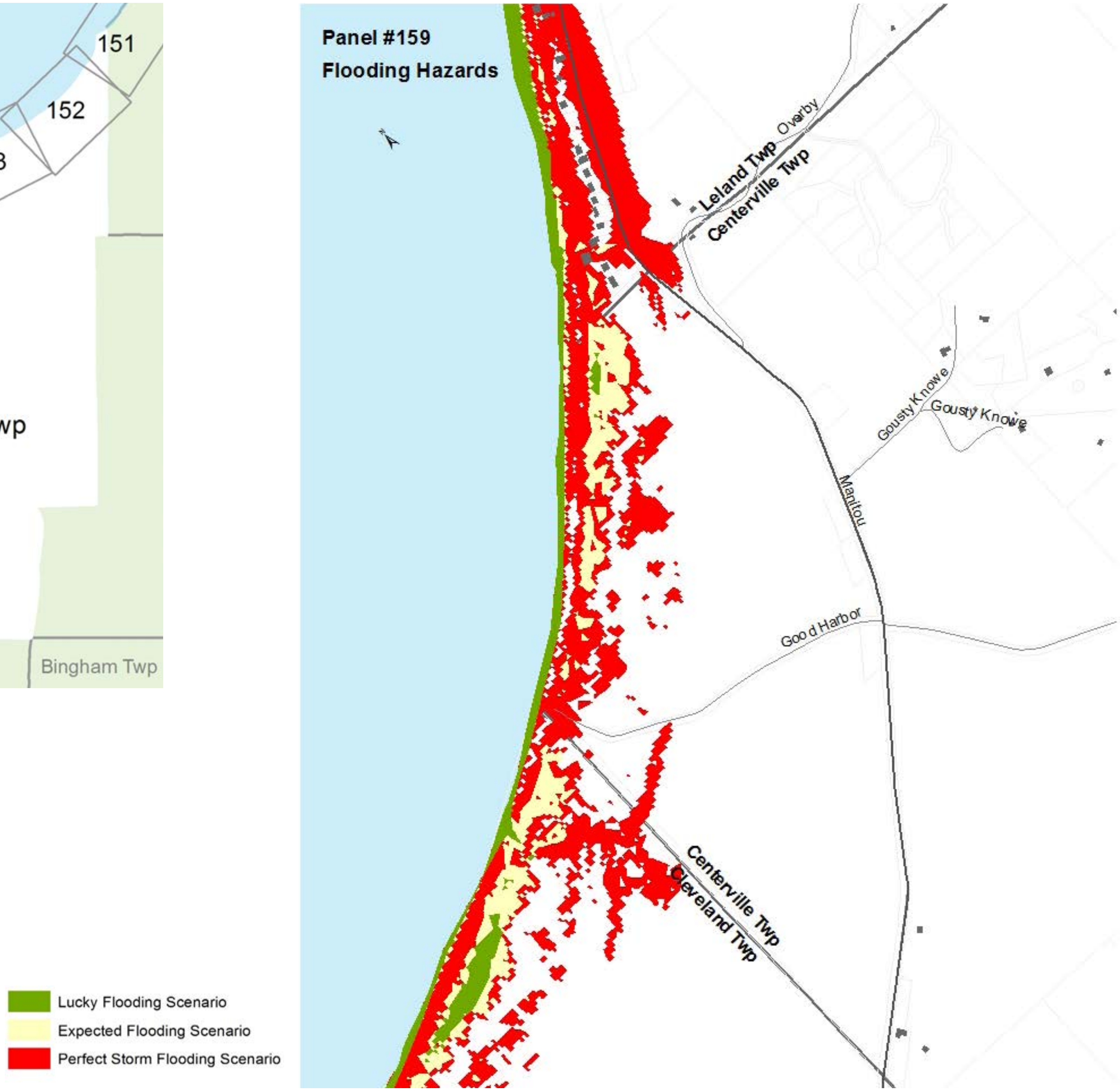
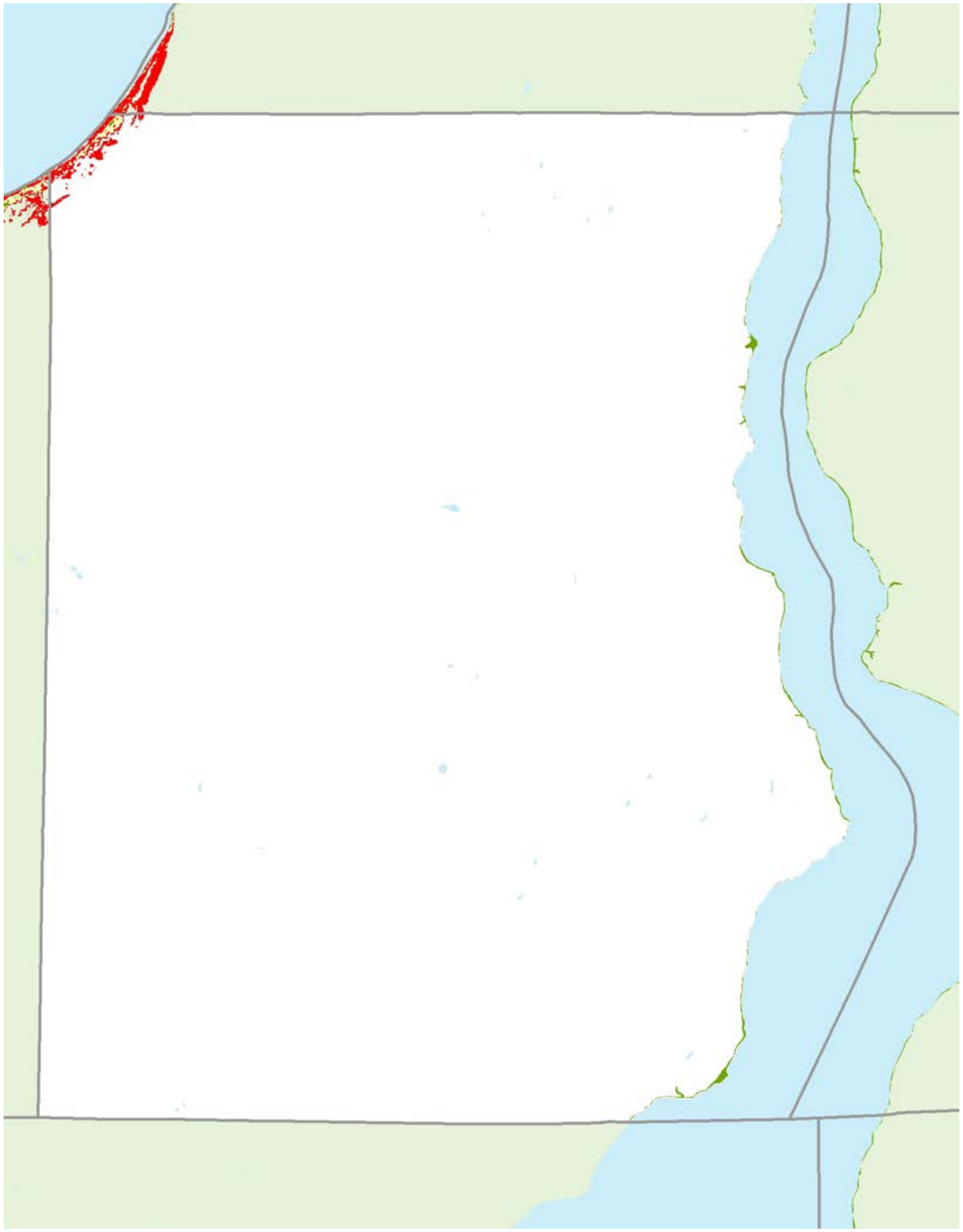
Leland Twp
Centerville Twp
Bingham Twp


Leelanau County


Panel #159
Flooding Hazards
Leland Twp
Centerville Twp
Overby
Gousty Knowe
Gousty Knowe
Manitou
Good Harbor
Centerville Twp
Cleveland Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

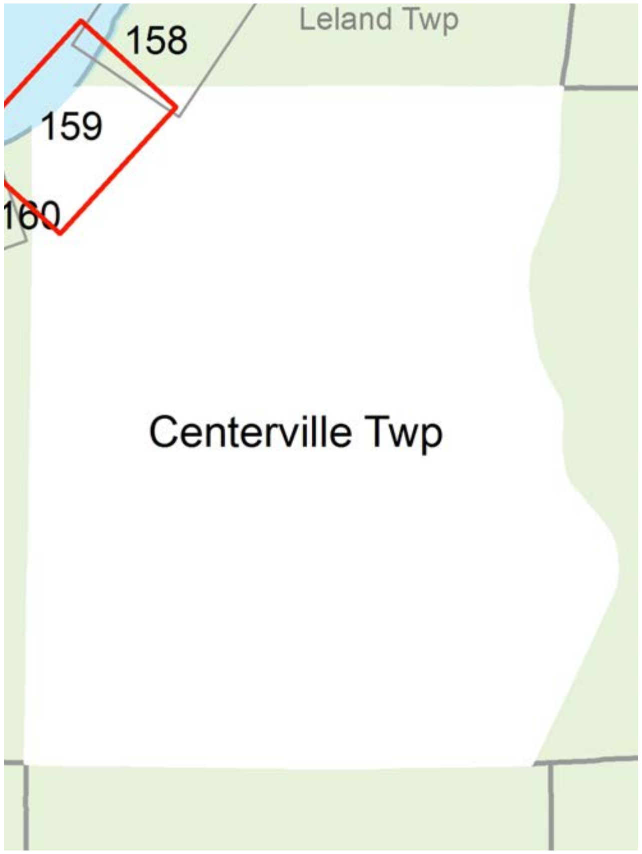
Centerville Twp.



Coastal Flooding Scenario Impacts

Centerville			
Total SEV	Lucky	Expected	Perfect Storm
$ 146,368,500.00	$ 3,071,700.00	$ 3,071,700.00	$ 3,071,700.00

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Leland Twp
158
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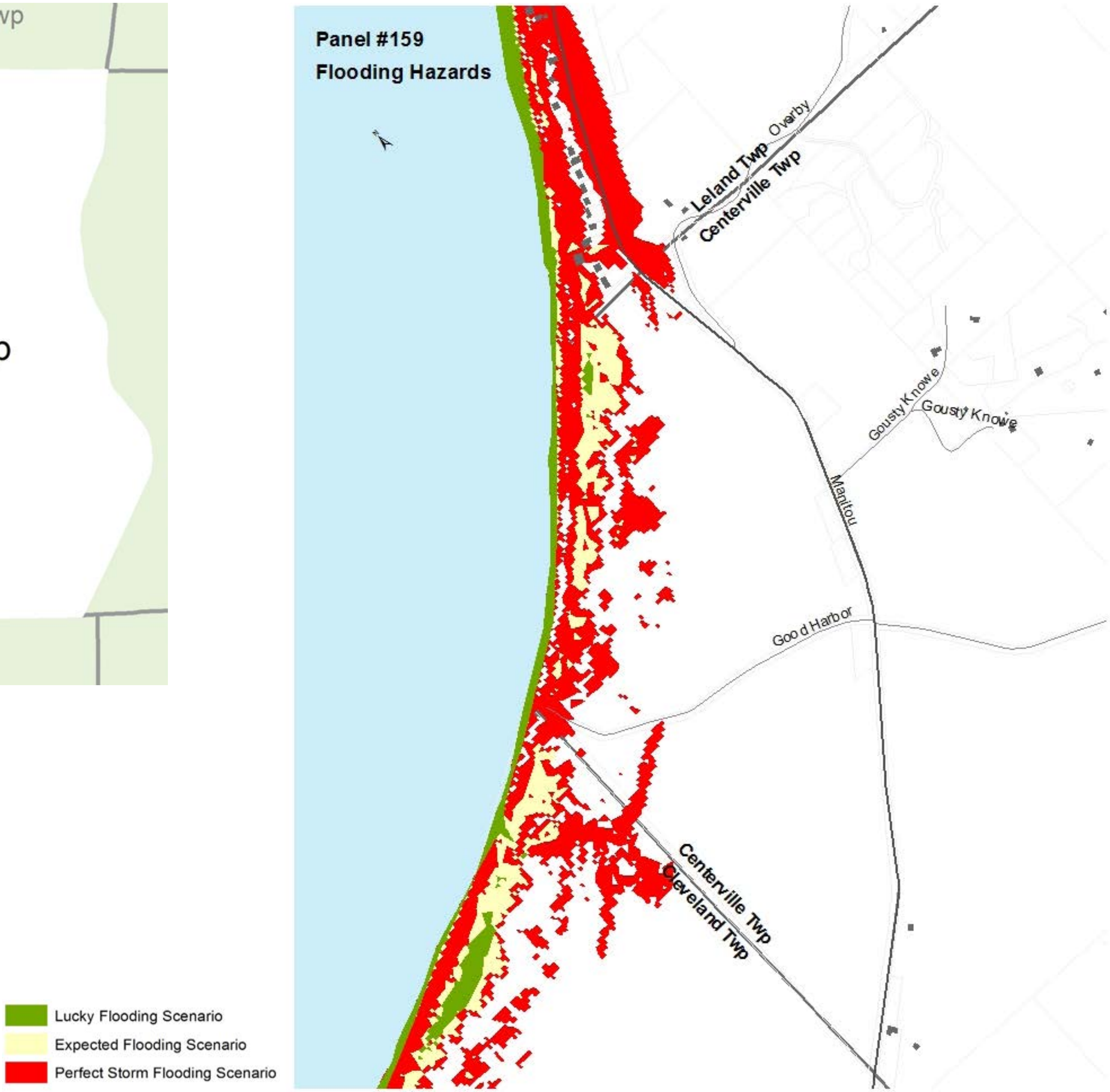
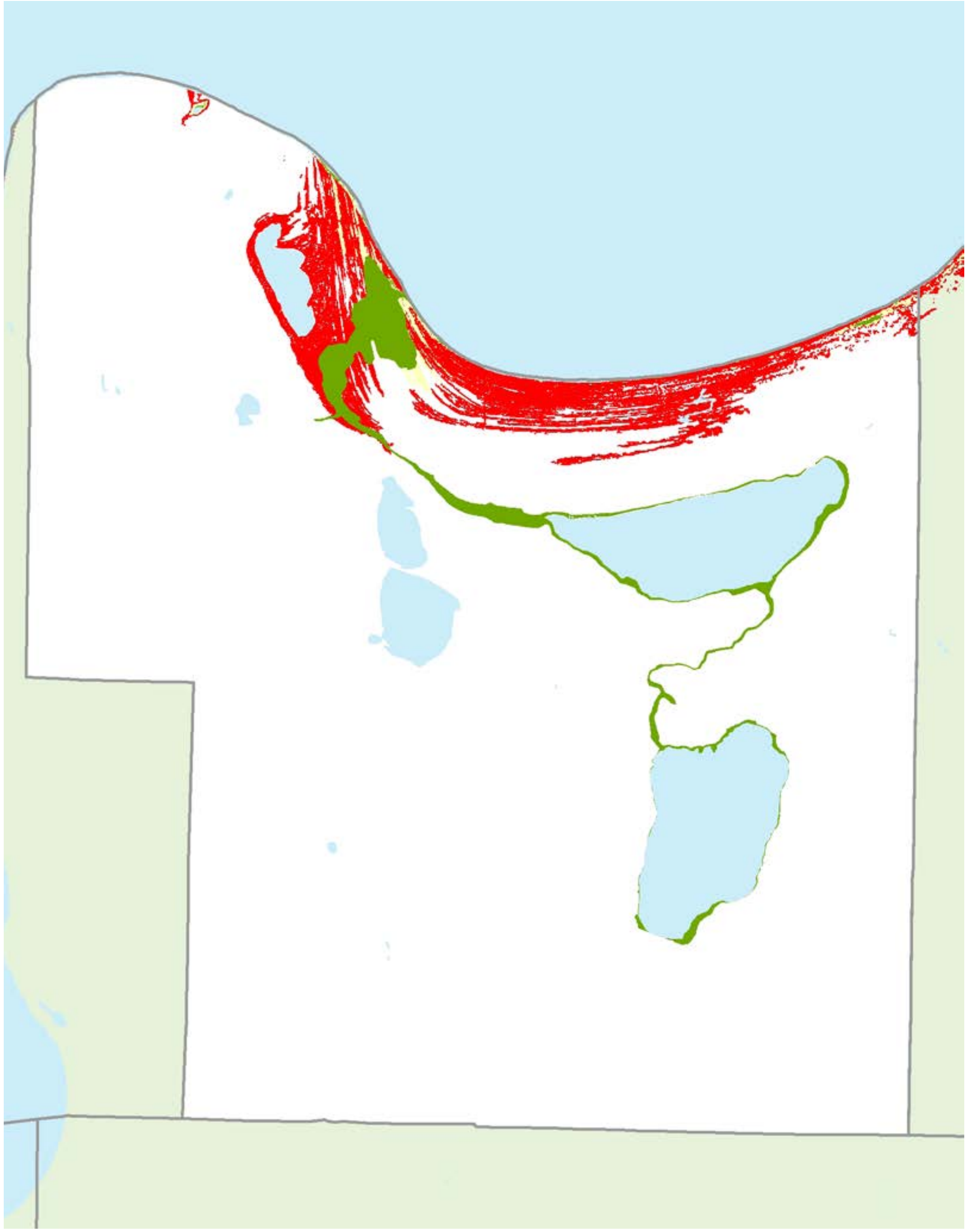
Centerville Twp


Leelanau County


Panel #159
Flooding Hazards
Leland Twp
Centerville Twp
Overby
Gousty Knowe
Gousty Knowe
Manitou
Good Harbor
Centerville Twp
Cleveland Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

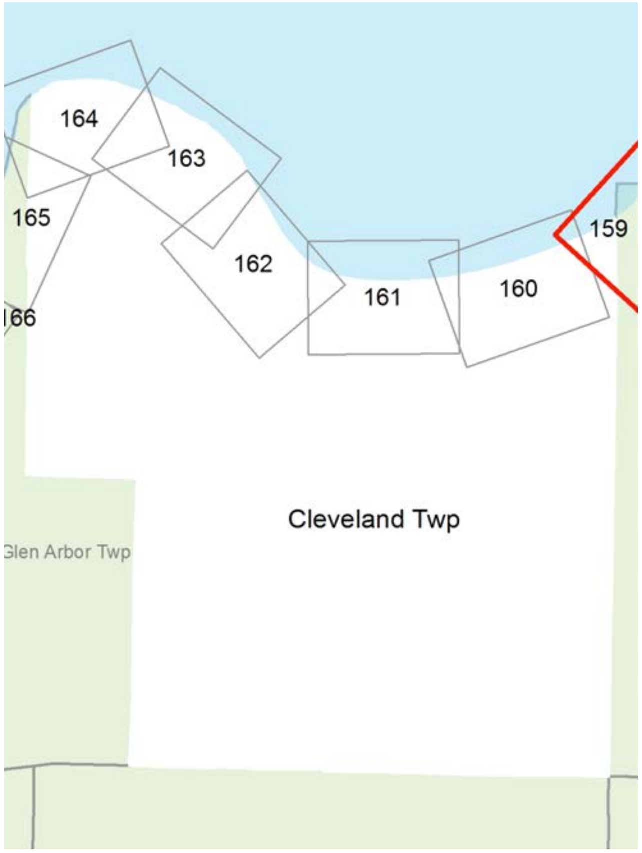


Cleveland Twp.

Coastal Flooding Scenario Impacts

Cleveland			
Total SEV	Lucky	Expected	Perfect Storm
$ 156,108,600.00	$ 15,596,300.00	$ 15,596,300.00	$ 15,596,300.00

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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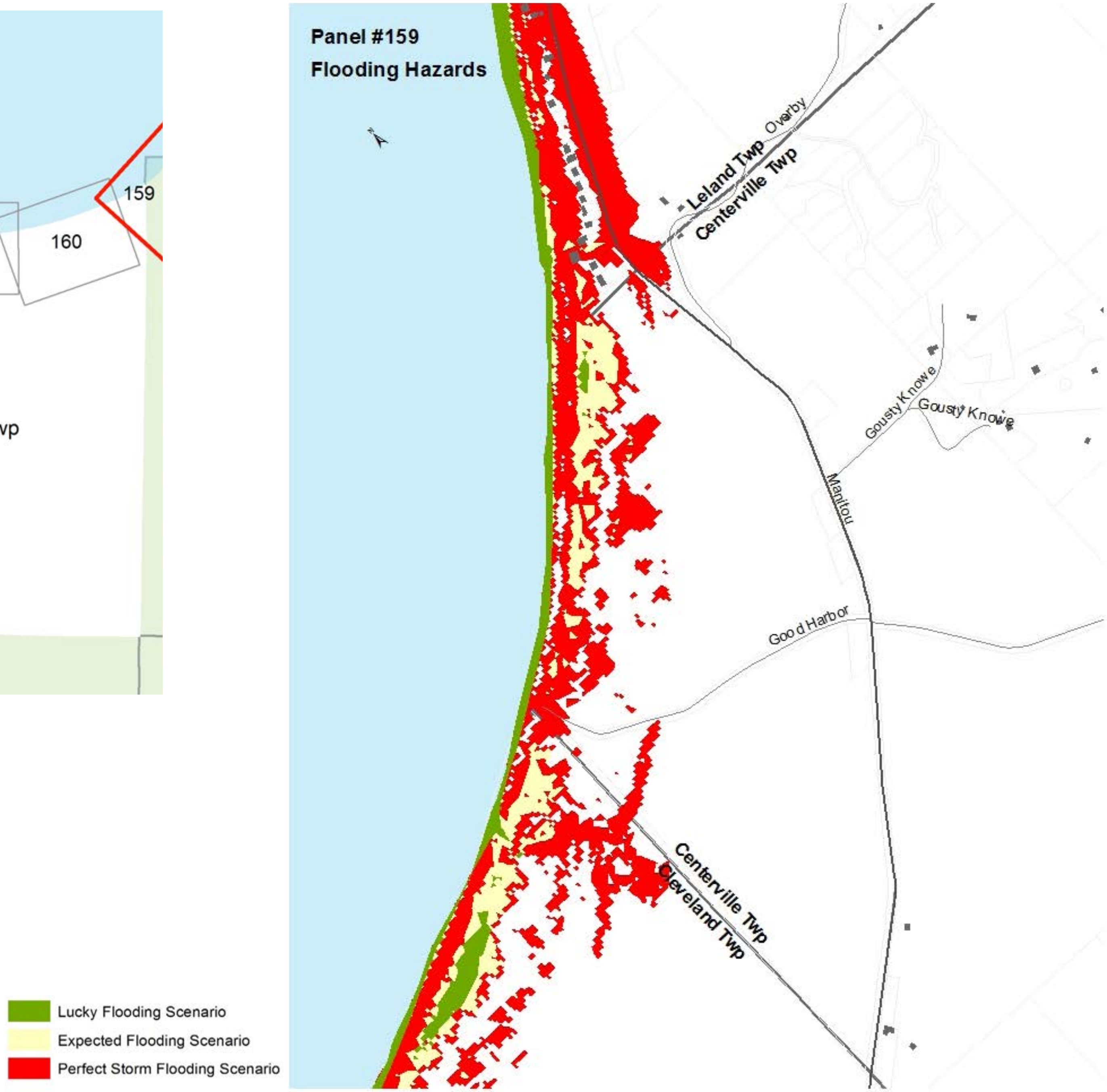
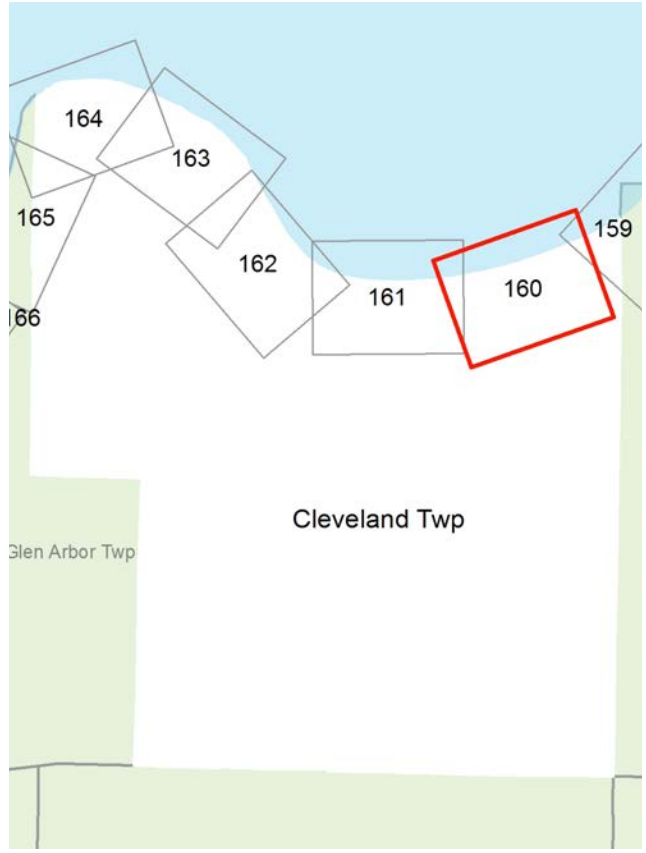
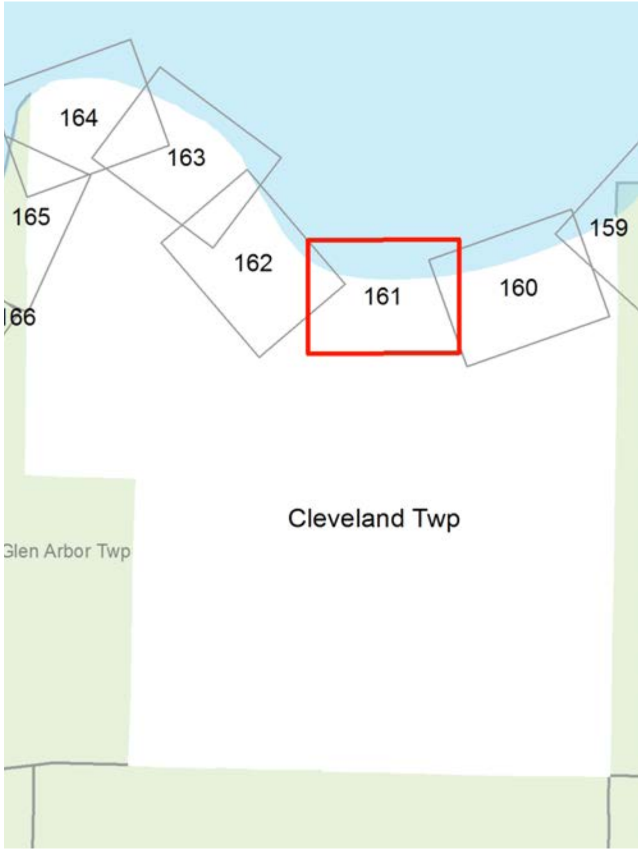
166
Cleveland Twp
Glen Arbor Twp


Leelanau County


Panel #159
Flooding Hazards
Overby
Leland Twp
Centerville Twp
Gousty Knowe
Gousty Knowe
Manitou
Good Harbor
Centerville Twp
Cleveland Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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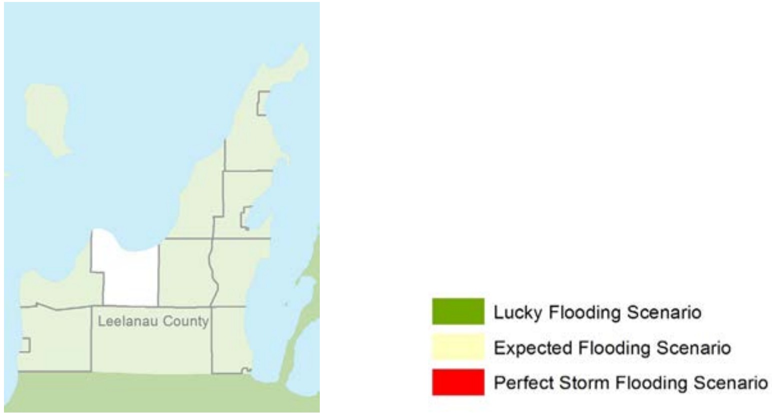
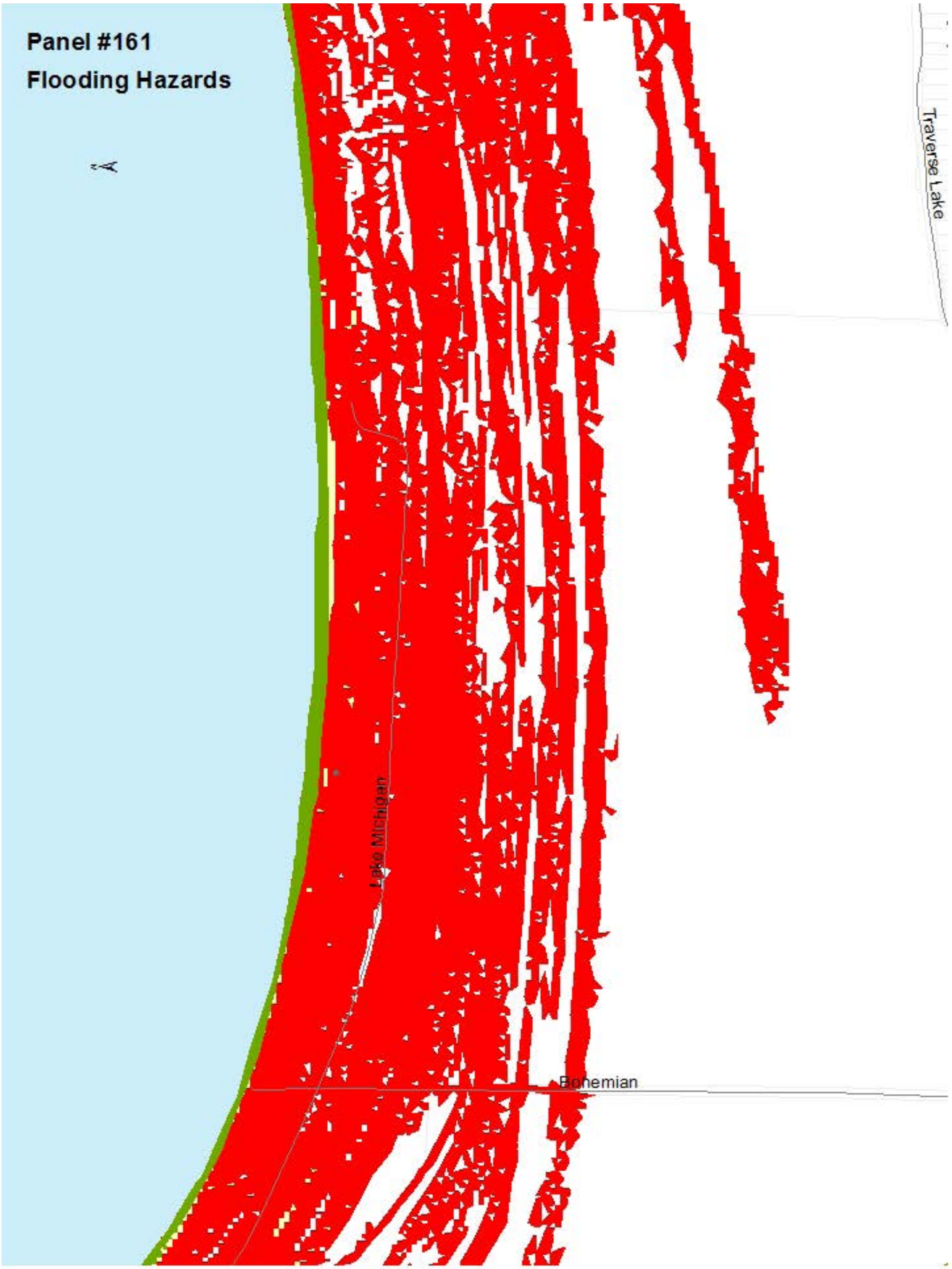
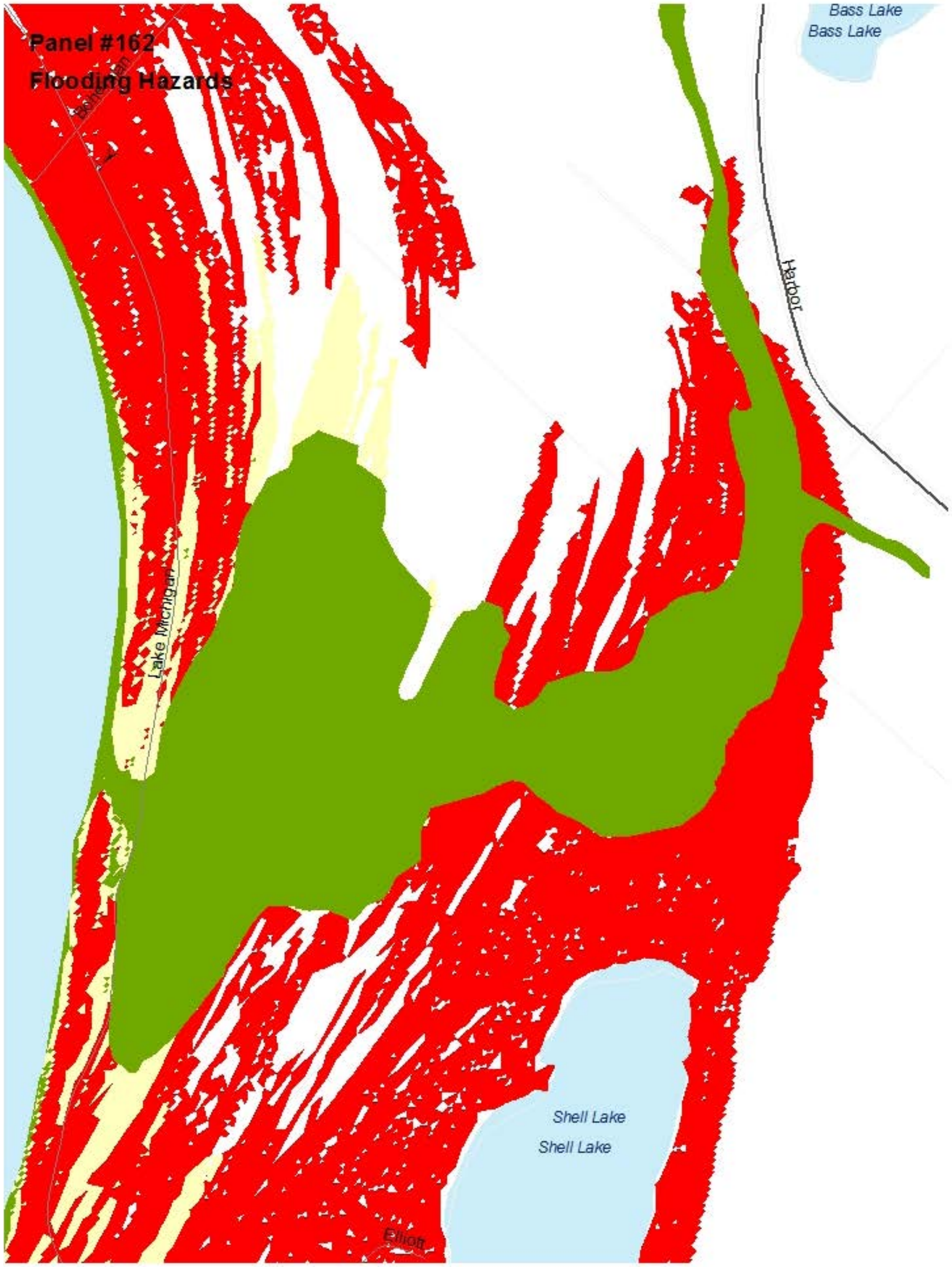
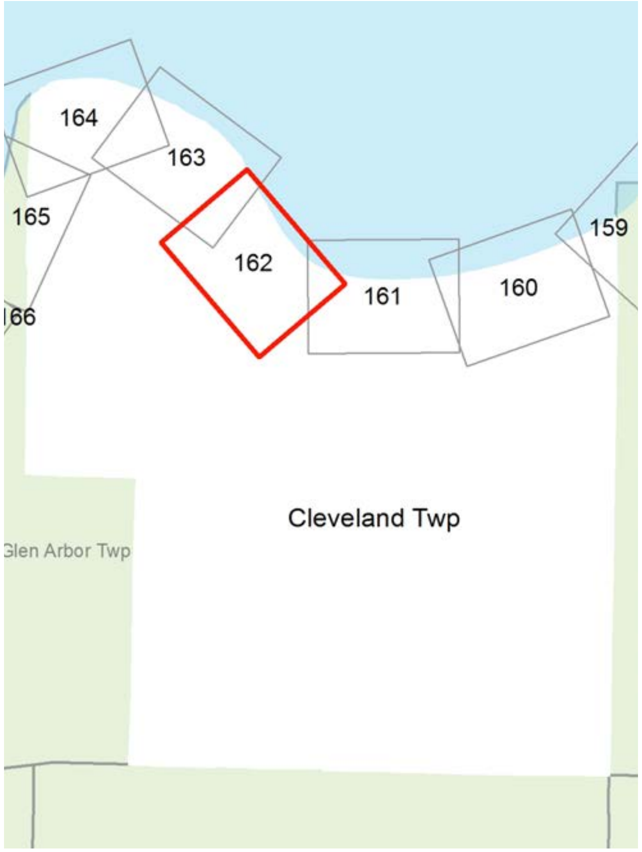
Cleveland Twp
Glen Arbor Twp

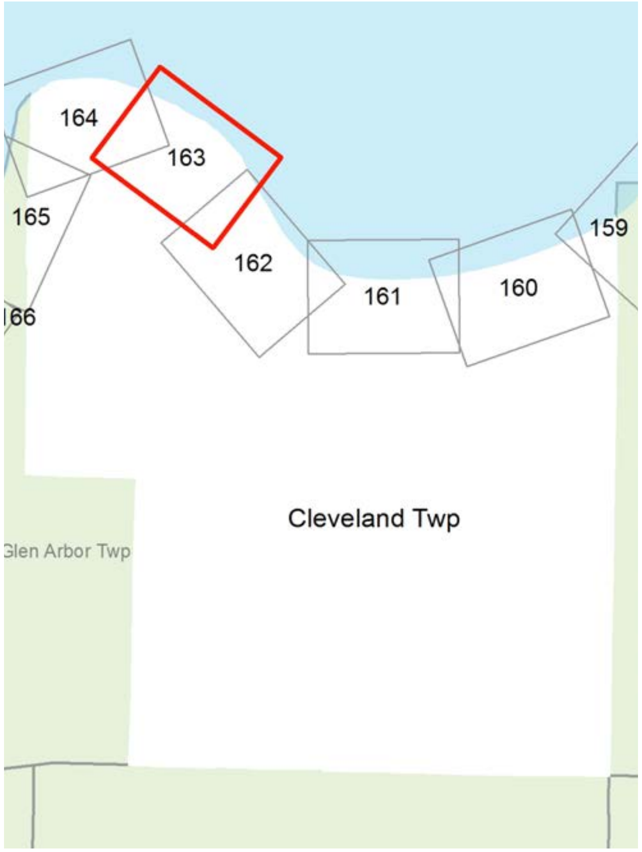

Leelanau County
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #161
Flooding Hazards
Traverse Lake
Lake Michigan
Bohemian





- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario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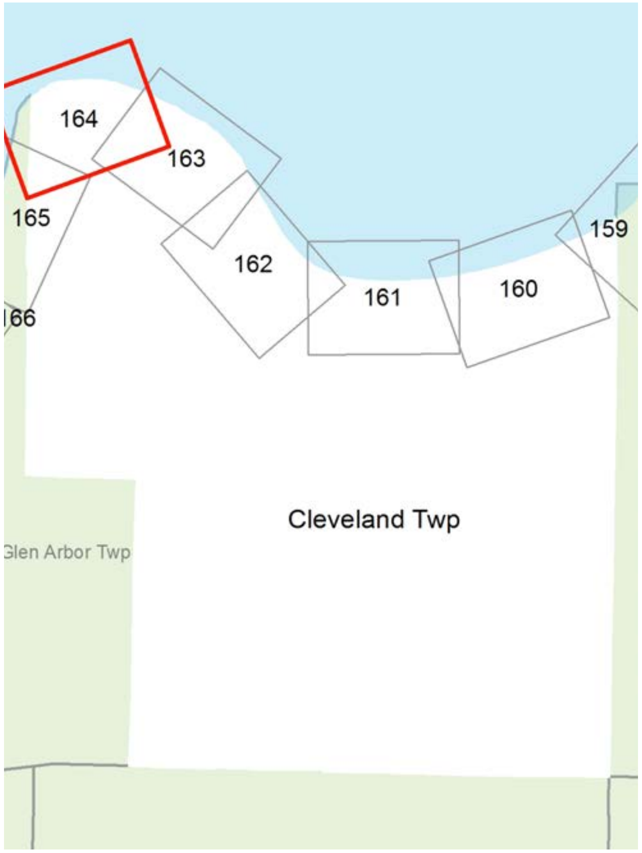
166
Cleveland Twp
Glen Arbor Twp


Leelanau County


Panel #163
Flooding Hazards
Shell Lake
Shell Lake
Lake Michigan
Good Harbor
Elliott
Hatt Pond
Hatt Pond
Basch
Hidden Lake
Hidden Lake
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #164
Flooding Hazards
Hidden Lake
Hidden Lake
Basch
Cleveland Twp
Glen Arbor Twp
Port Oneida
Baker
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


164
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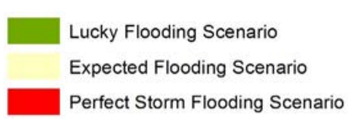
166
Cleveland Twp
Glen Arbor Twp

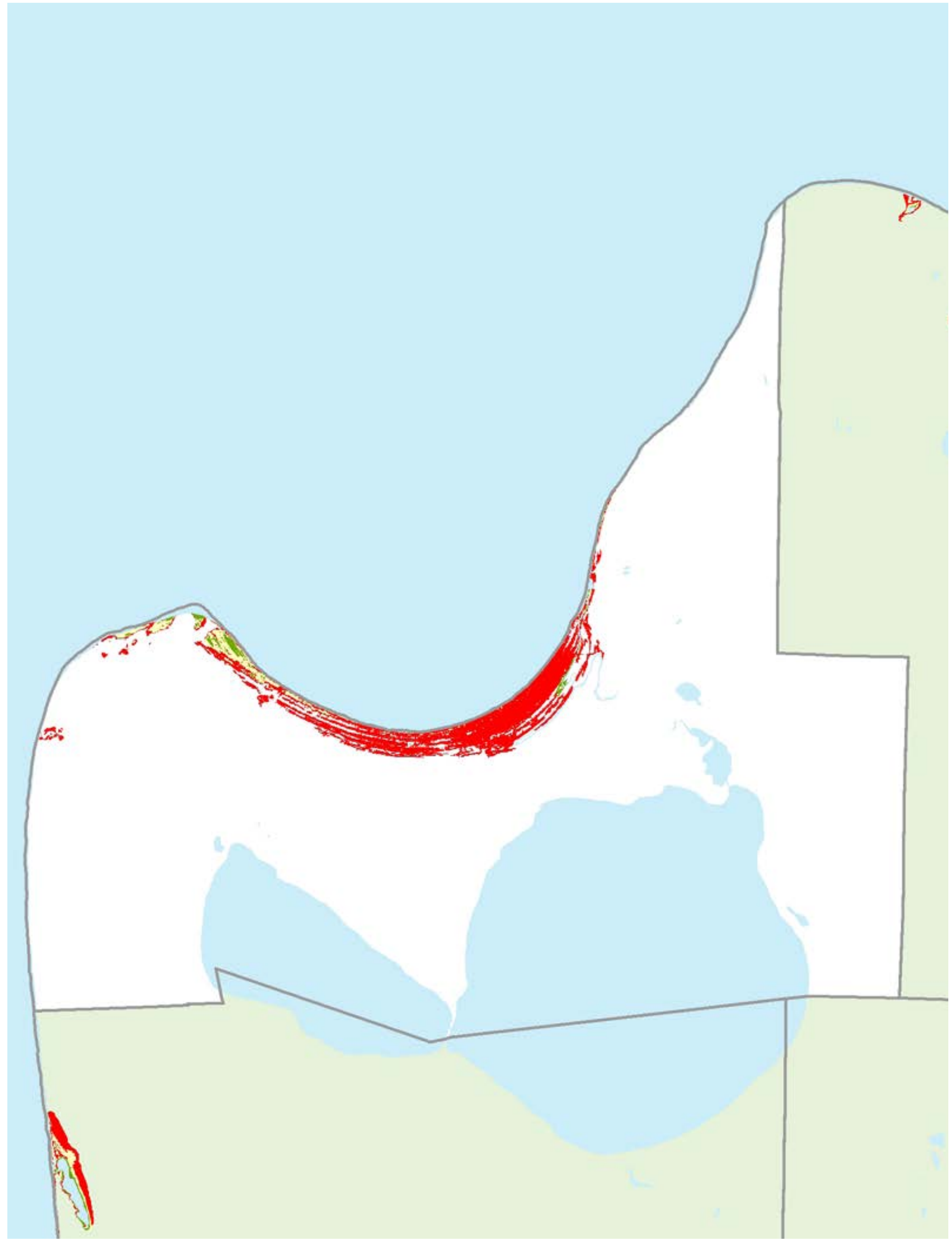

Leelanau County

Glen Arbor Twp.

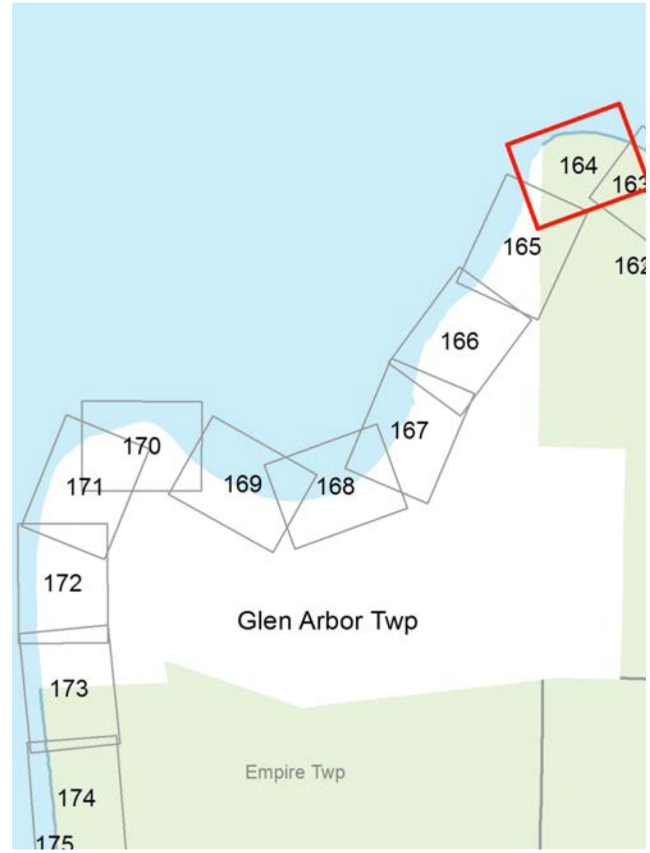
Coastal Flooding Scenario Impacts

Glen Arbor			
Total SEV	Lucky	Expected	Perfect Storm
$ 618,873,600.00	$ 307,200.00	$ 9,445,800.00	$ 107,853,300.00






Panel #164
Flooding Hazards
Hidden Lake
Hidden Lake
Basch
Cleveland Twp
Glen Arbor Twp
Port Oneida
Baker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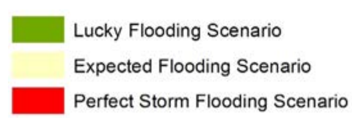
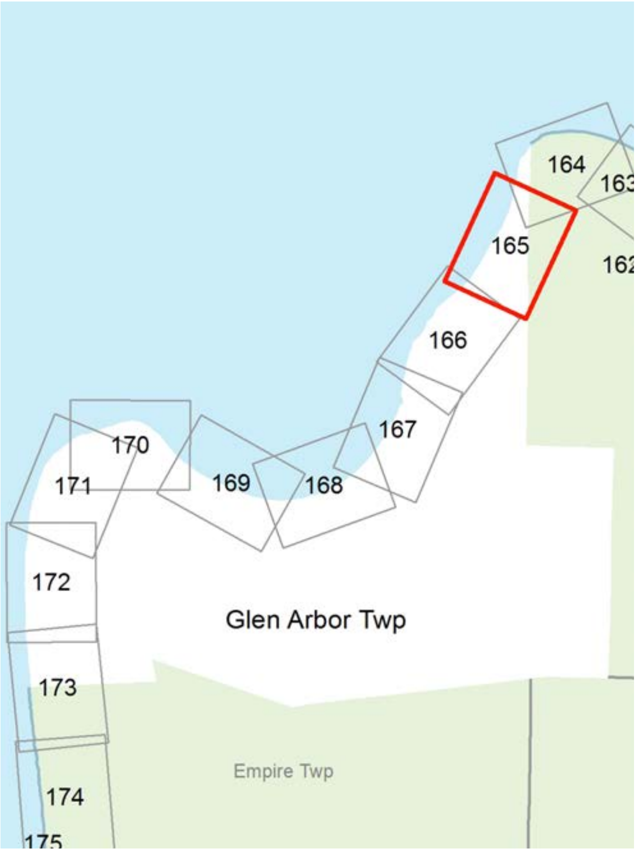
175
Glen Arbor Twp
Empire Twp


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Leelanau County



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #166
Flooding Hazards
Hooper
Harbor
Thoreson
Sunset
Sunset
Sunset Shores
Vantage Pointe
Woodridge
Chimney
Chimney
164
165
166
167
168
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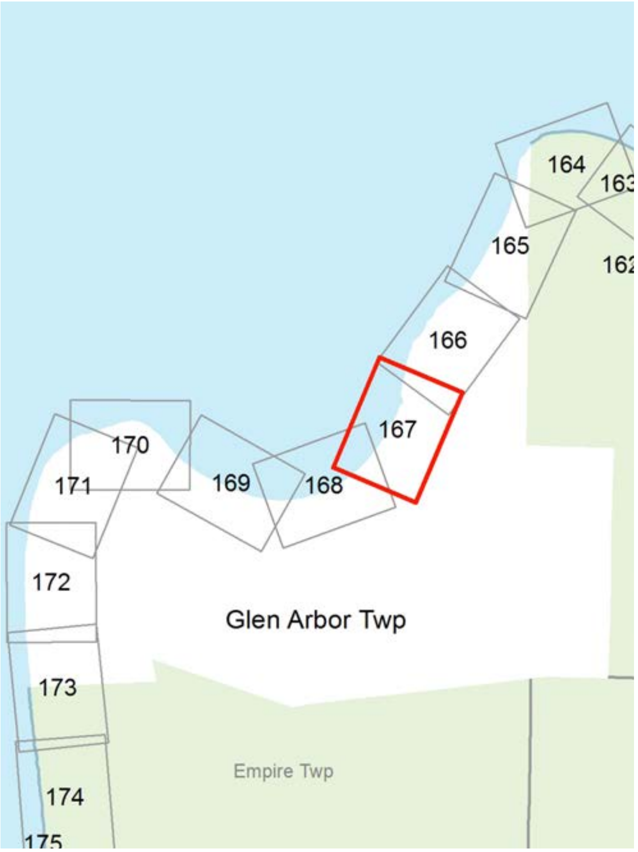
175
Glen Arbor Twp
Empire Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Leelanau County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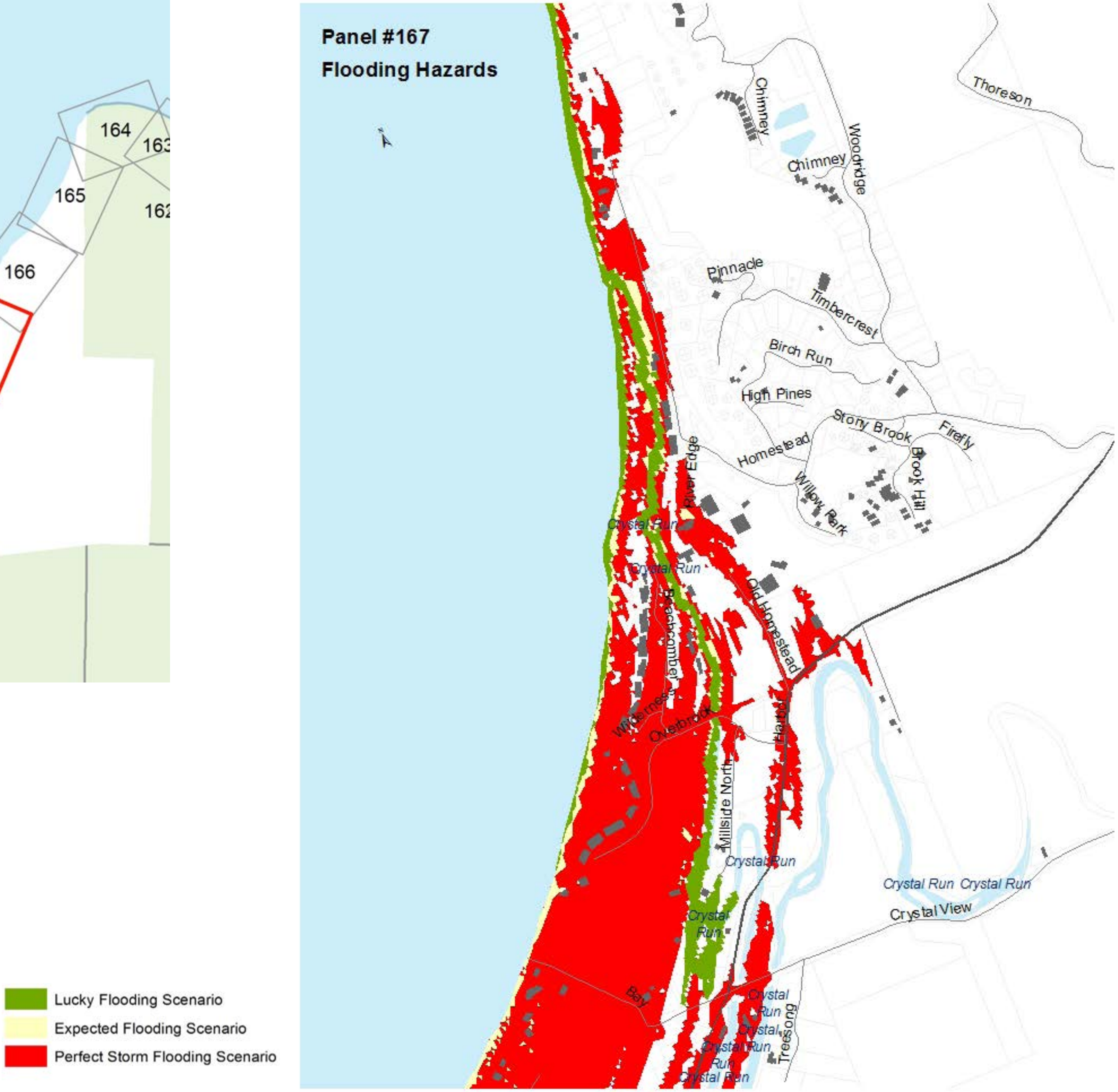
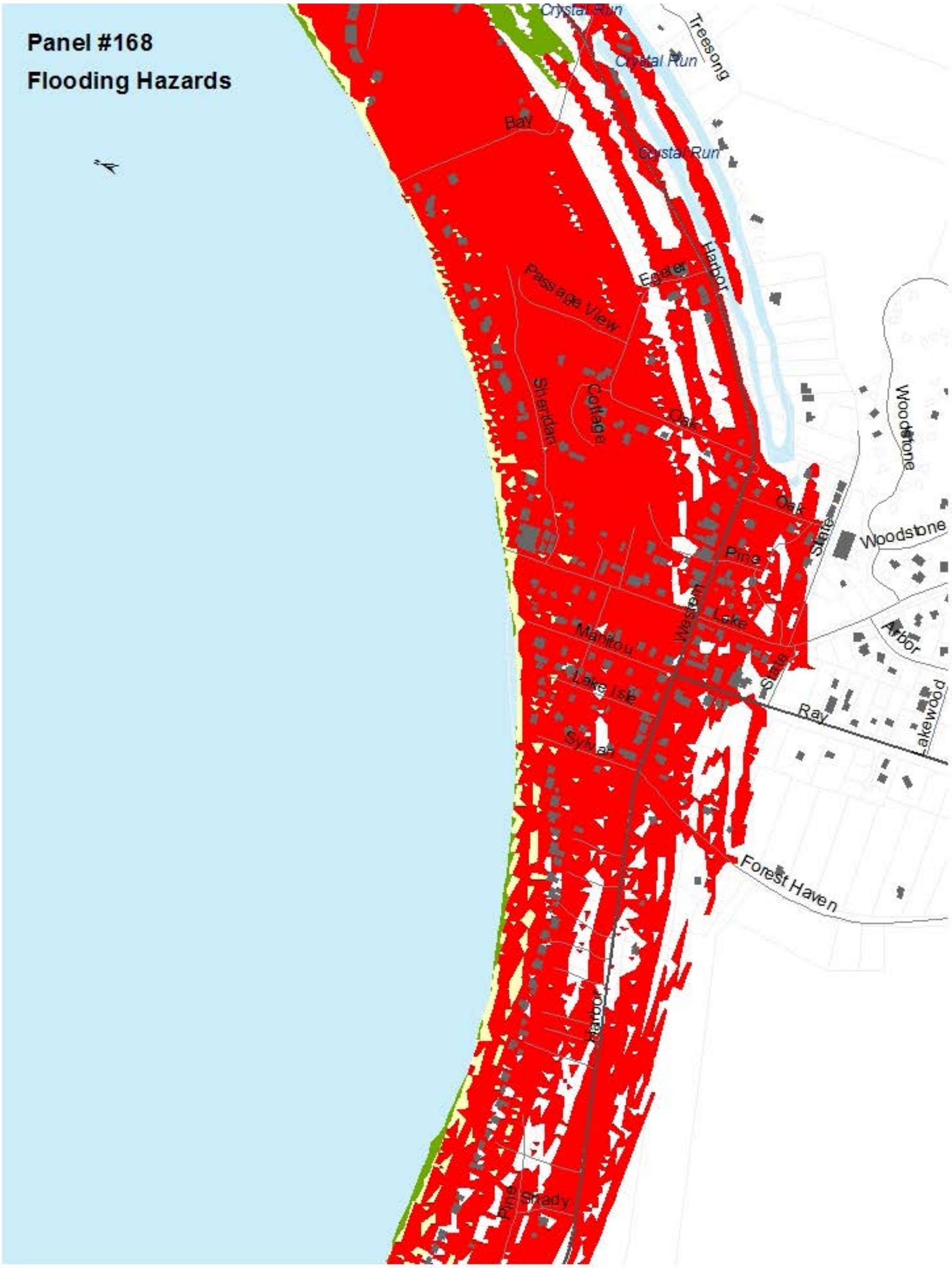
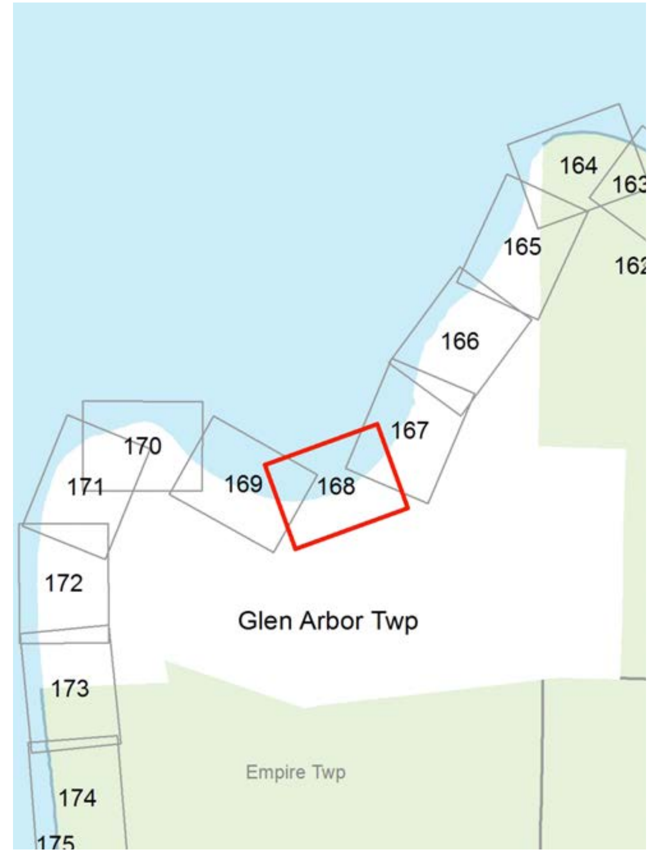
Glen Arbor Twp
173
Empire Twp
174
175

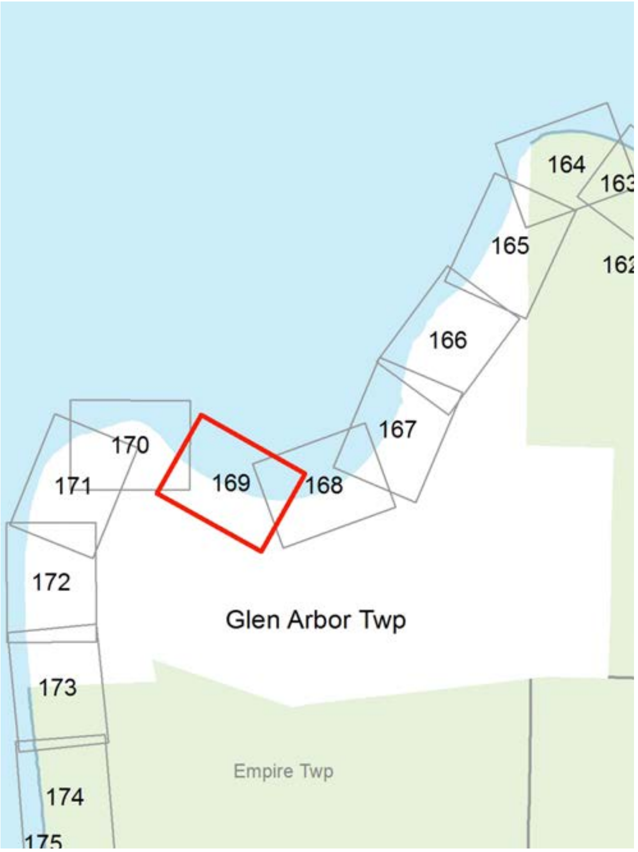

Leelanau County


Panel #167
Flooding Hazards
Chimney
Chimney
Woodridge
Thoreson
Pinnacle
Timbercrest
Birch Run
High Pines
Stony Brook
Firefly
Homestead
Willow Park
Brook Hill
River Edge
Crystal Run
Crystal Run
Beachcomber
Old Homestead
Wilderness
Overbrook
Harbor
Hillside North
Crystal Run
Crystal Run Crystal Run
Crystal View
Crystal Run
Bay
Crystal Run
Crystal
Treesong
Crystal Run
Crystal Run
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

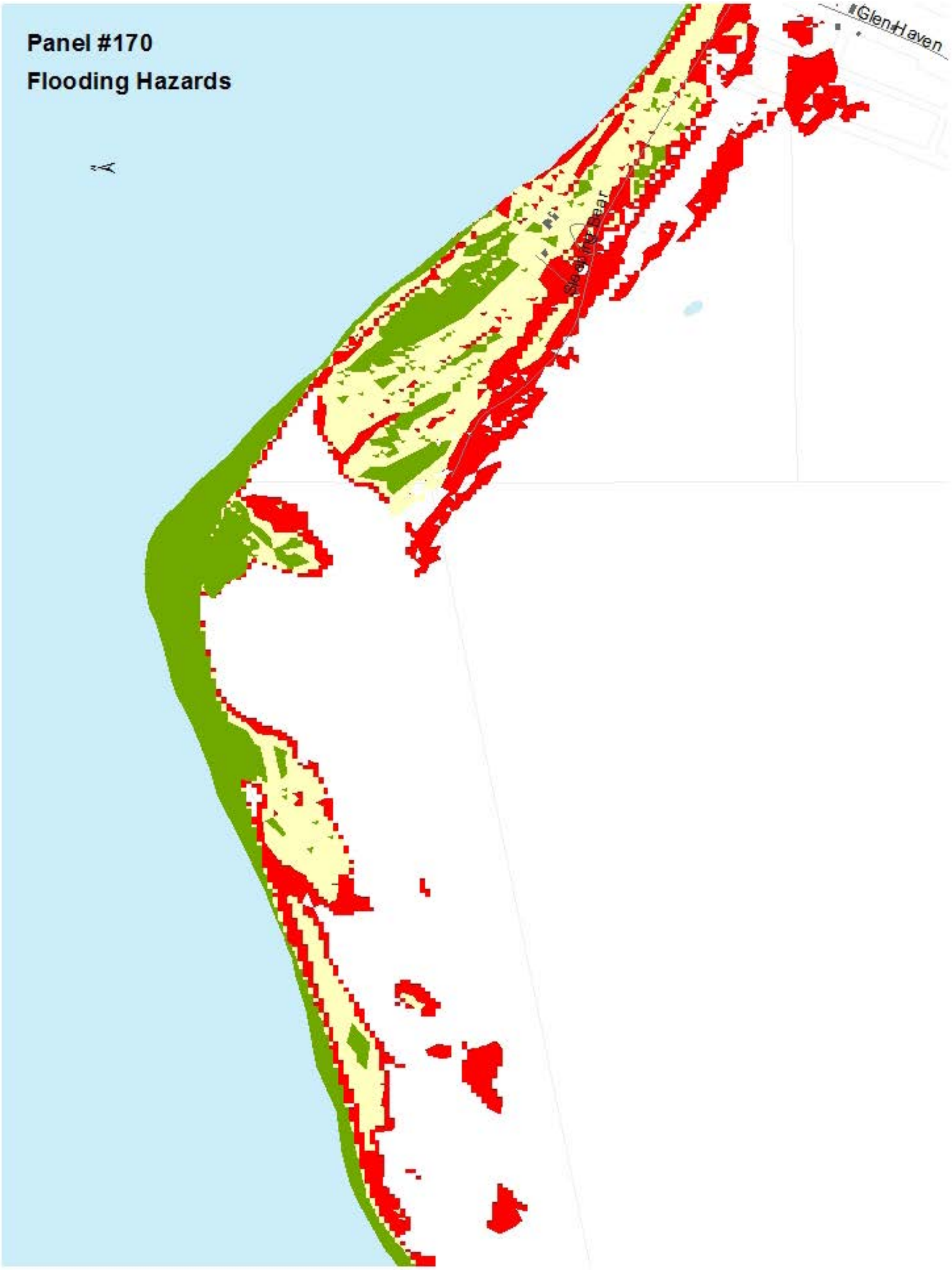


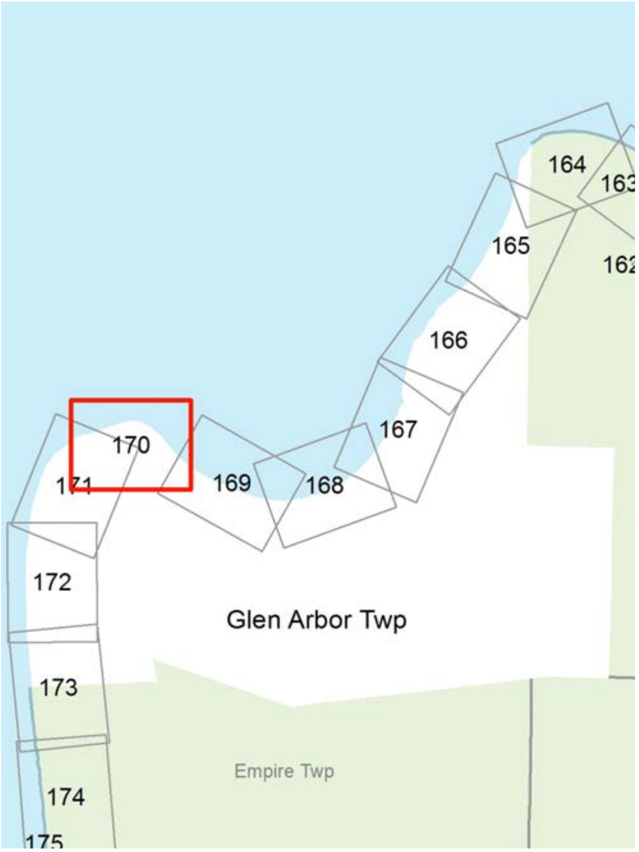


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

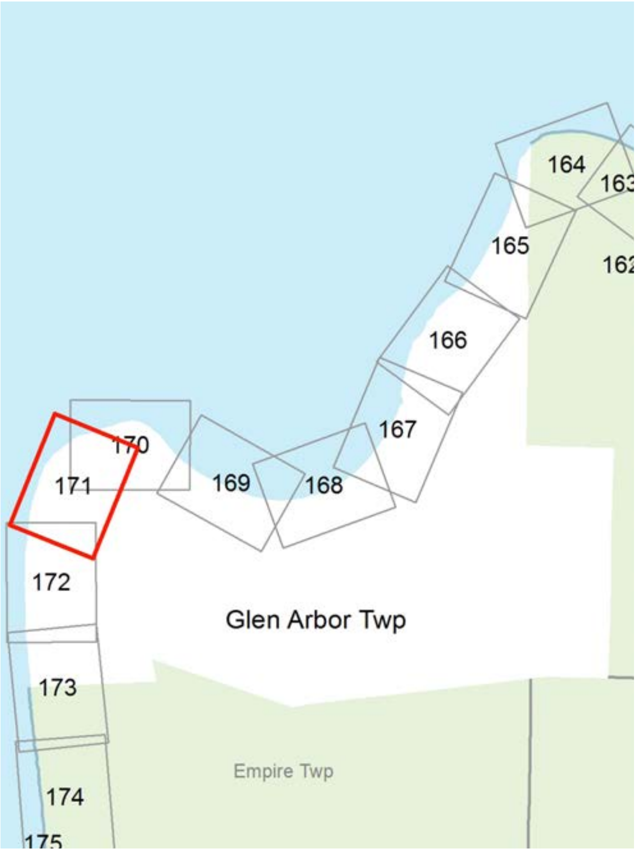


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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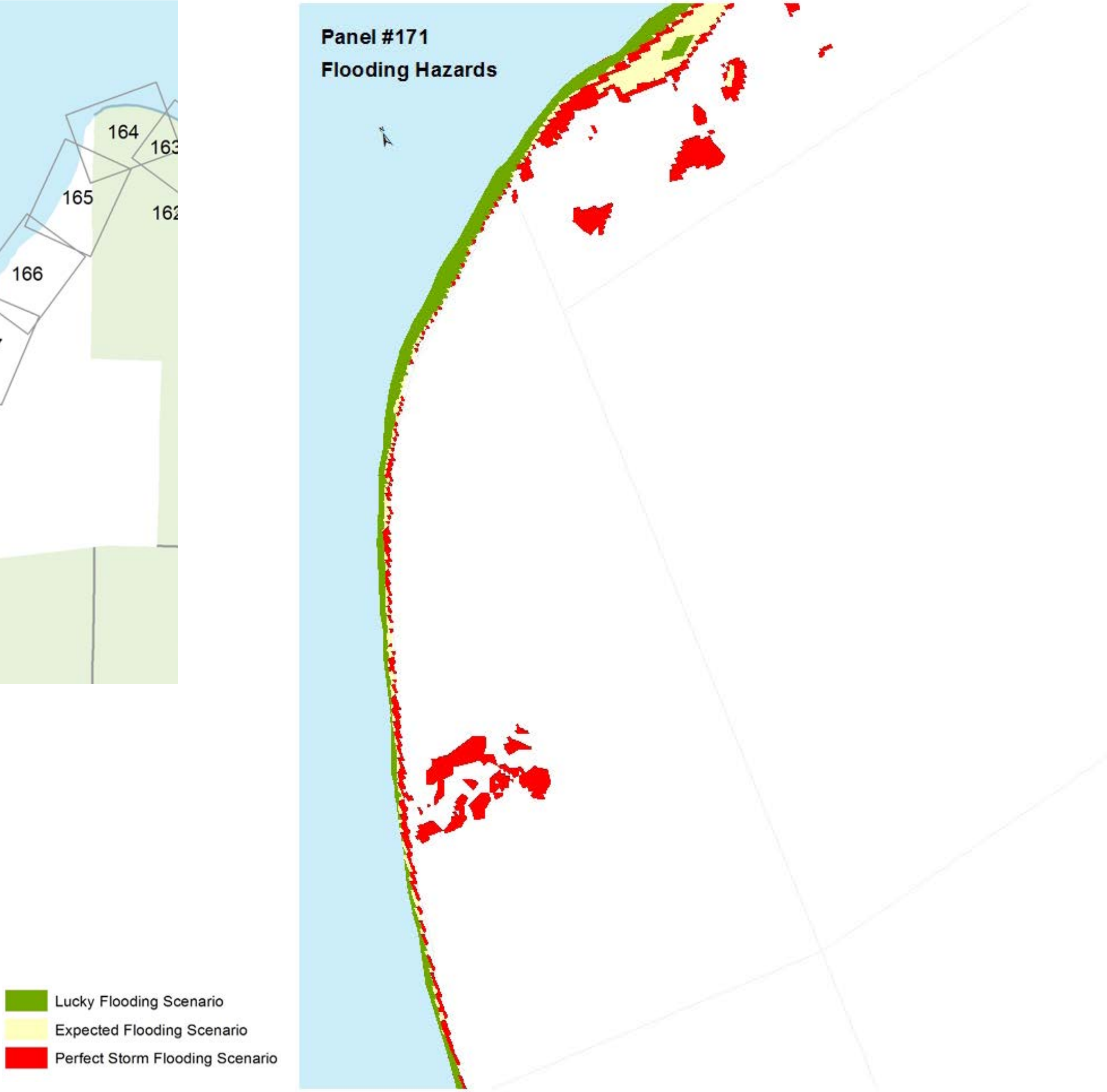
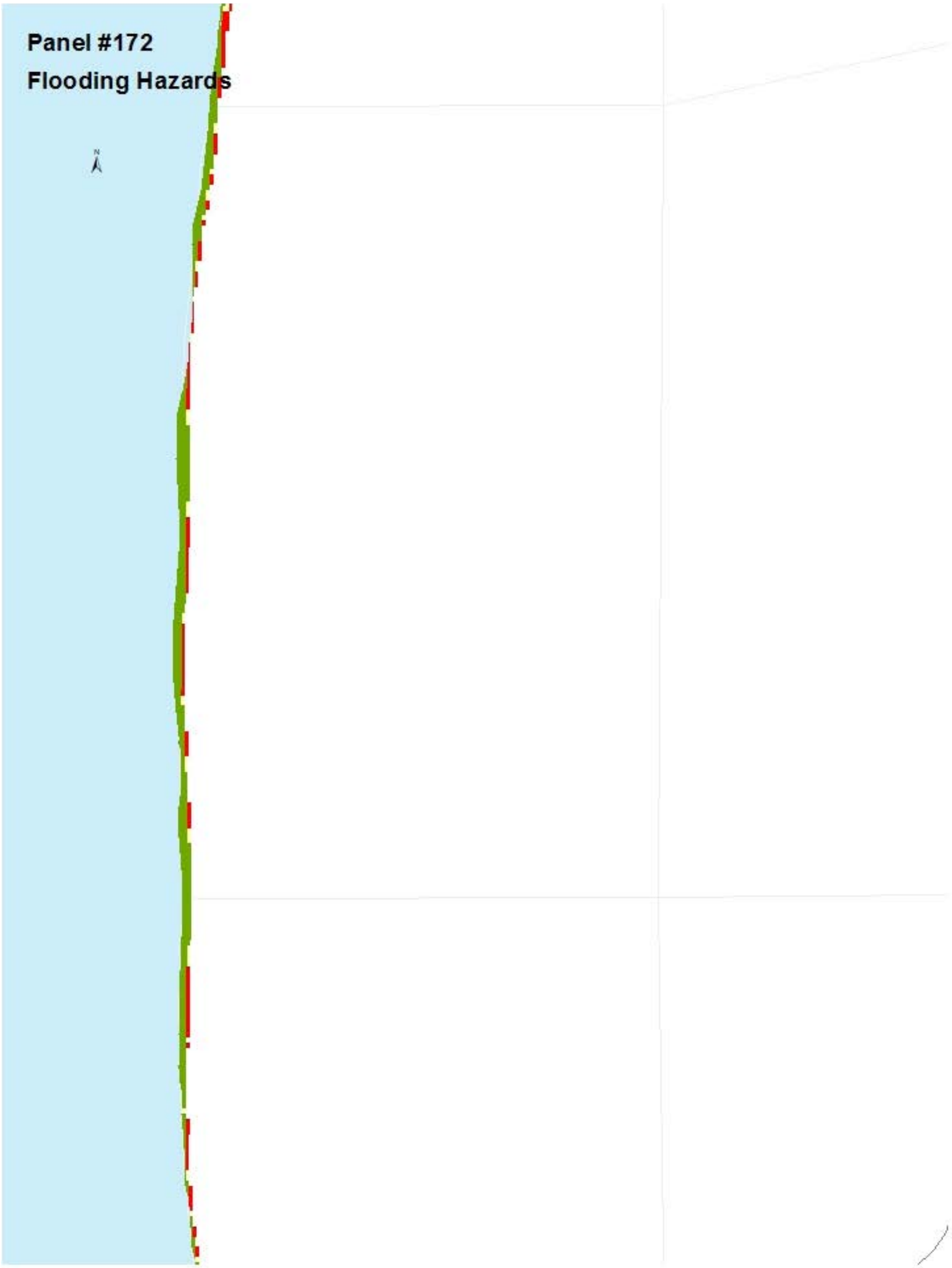
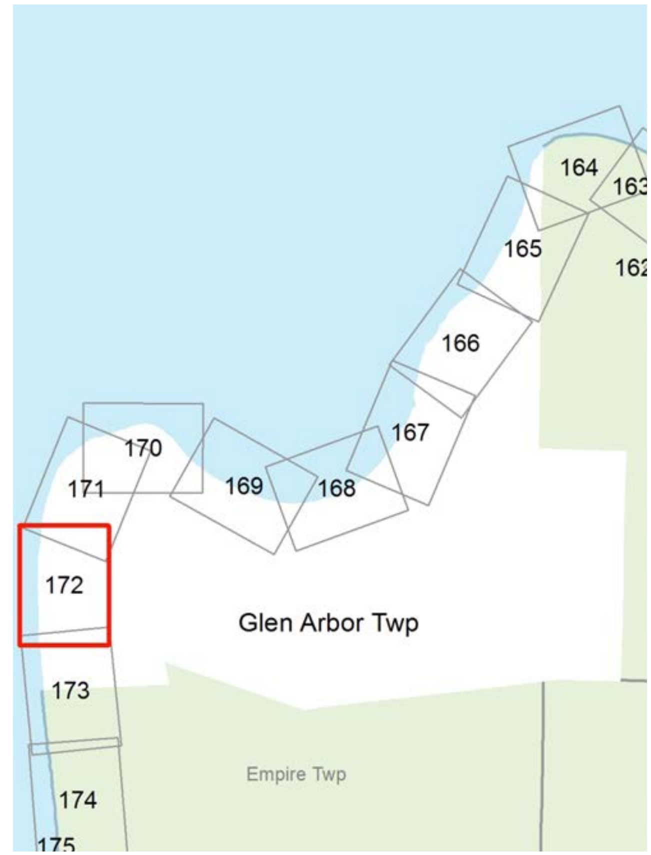
Glen Arbor Twp
173
Empire Twp
174
175


Leelanau County


Panel #171
Flooding Hazards
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #172
Flooding Hazards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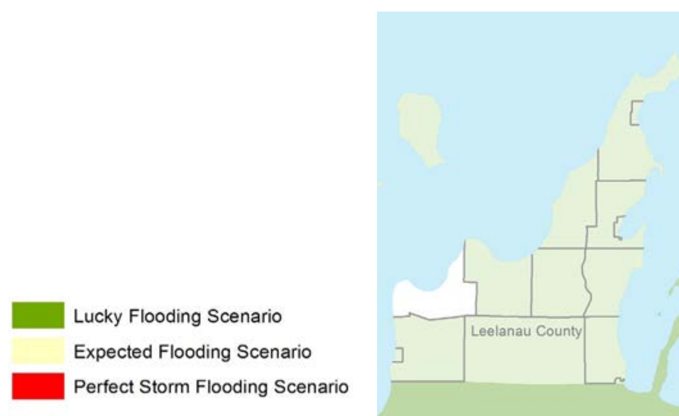
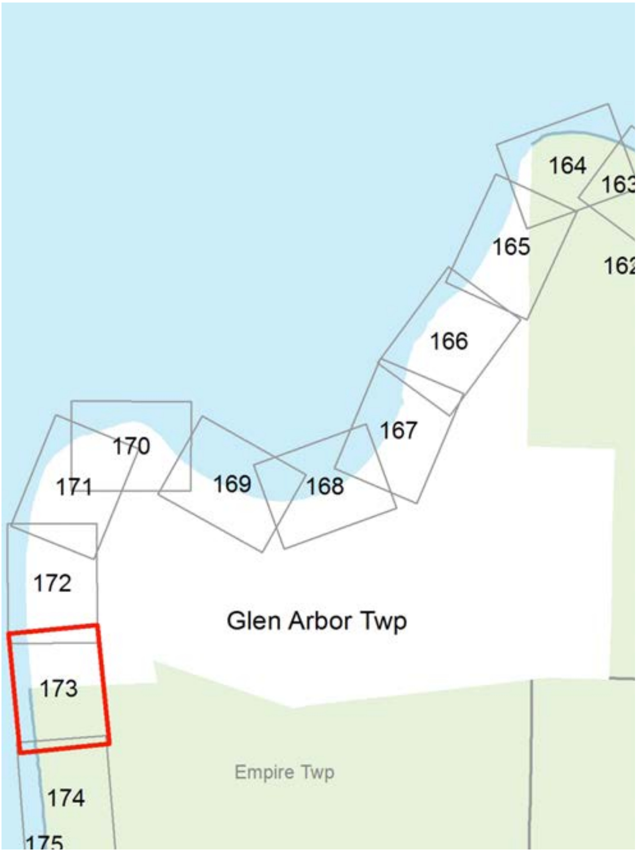
Glen Arbor Twp
173
Empire Twp
174
175


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Leelanau County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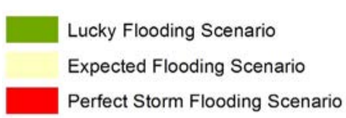
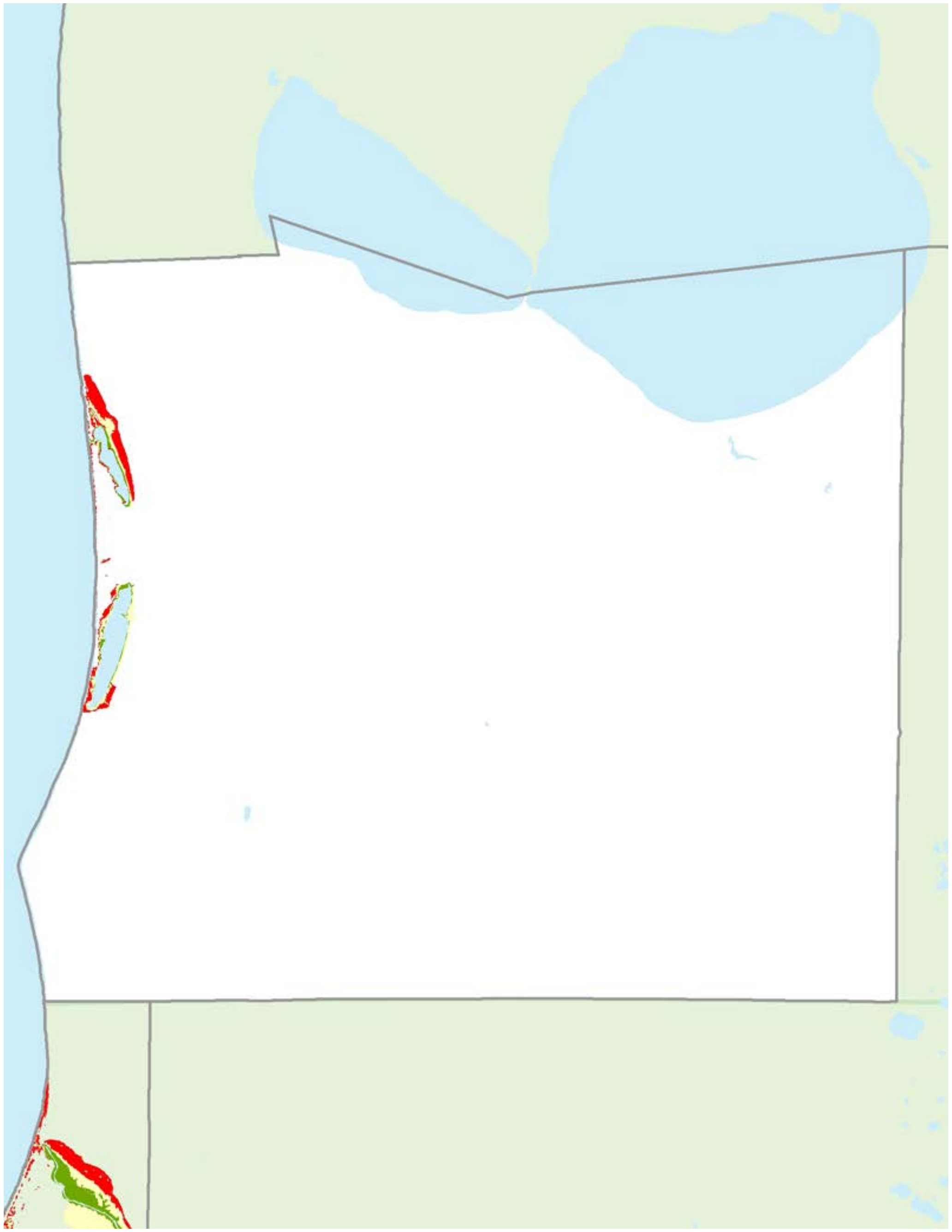
Glen Arbor Twp
173
Empire Twp
174
175


Leelanau County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #173
Flooding Hazards
Glen Arbor Twp
Empire Twp



Empire Twp./Empire

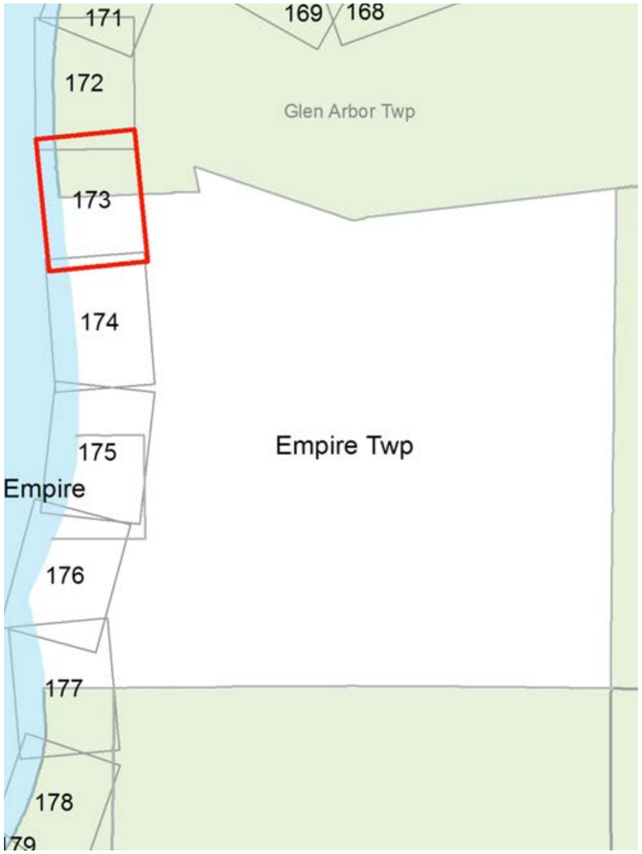
Coastal Flooding Scenario Impacts

Empire Twp			
Total SEV	Lucky	Expected	Perfect Storm
$ 203,772,600.00	$ 320,700.00	$ 320,700.00	$ 1,160,500.00

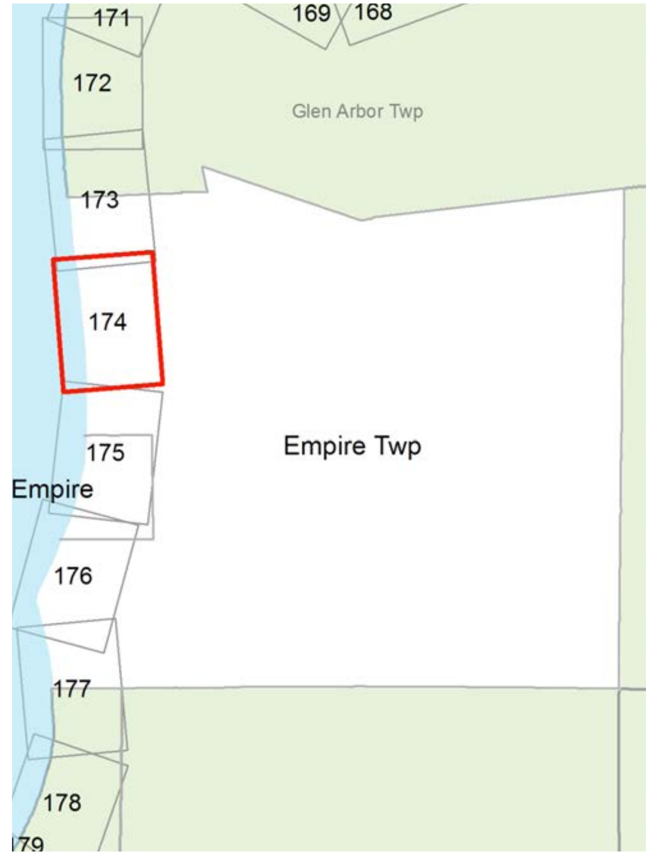
Coastal Flooding Scenario Impacts

Empire			
Total SEV	Lucky	Expected	Perfect Storm
$ 59,230,900.00	$ -	$ 1,859,100.00	$ 4,817,100.00

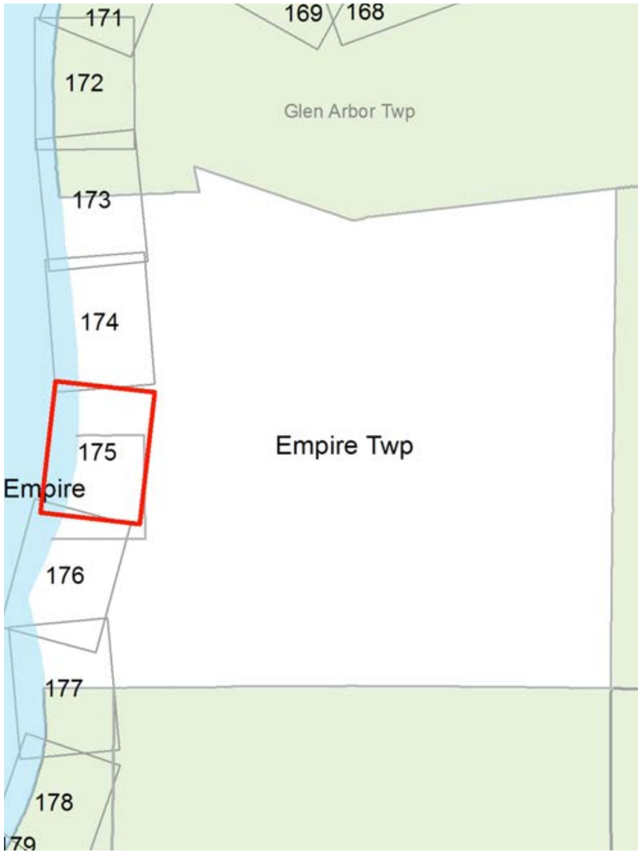
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


171
169
168
172
Glen Arbor Twp
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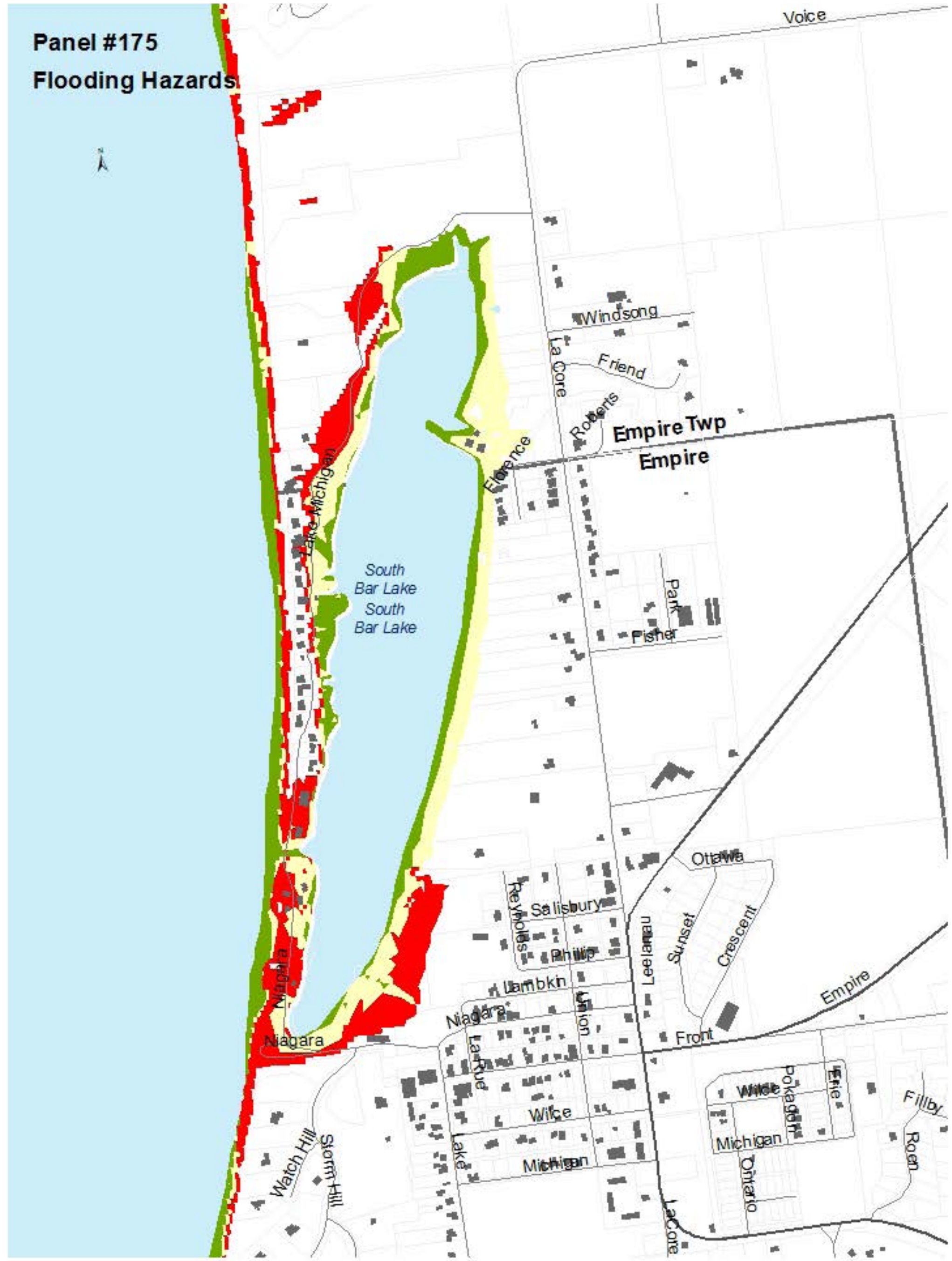
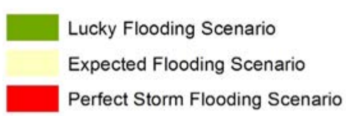
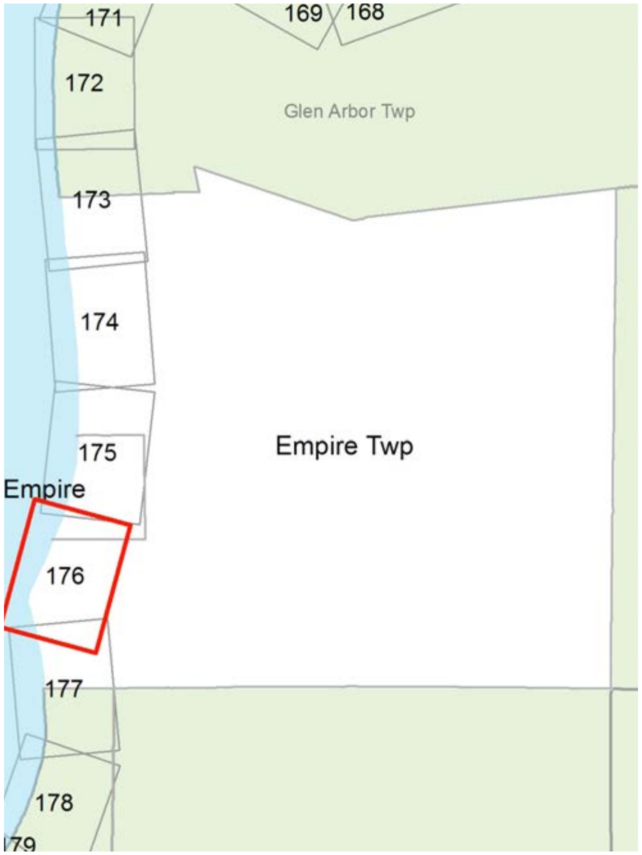
174
175
Empire
Empire Twp
176
177
178
179

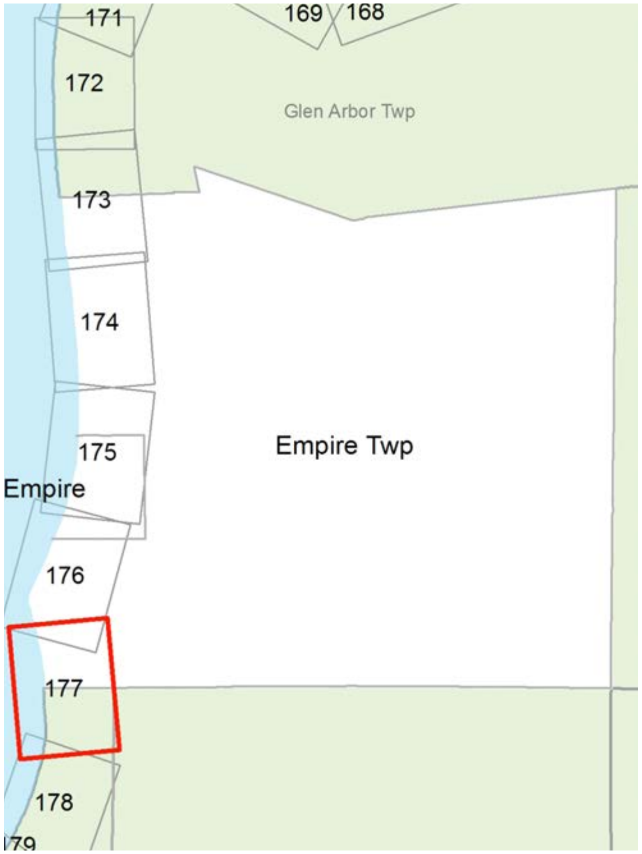

Leelanau County


Panel #175
Flooding Hazards
Voice
Windsong
La Core
Friend
Roberts
Empire Twp
Empire
Florence
Lake Michigan
South Bar Lake
South Bar Lake
Park
Fisher
Ottawa
Reynolds
Salisbury
Phillip
Lambkin
Leelanau
Sunset
Crescent
Niagara
Union
Niagara
Front
Empire
LaRue
Wilce
Wilce
Pokagon
Erie
Fillby
Michigan
Michigan
Lake
Watch Hill
Storm Hill
Ontario
Roen
LaCore


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


171
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Glen Arbor Twp
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Empire Twp
Empire
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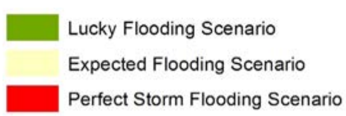
179


Leelanau County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #177
Flooding Hazards
Empire Twp
Lake Twp
Aral Hills
Aral

Benzie County

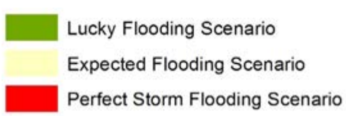
Coastal Flooding Scenario Impacts

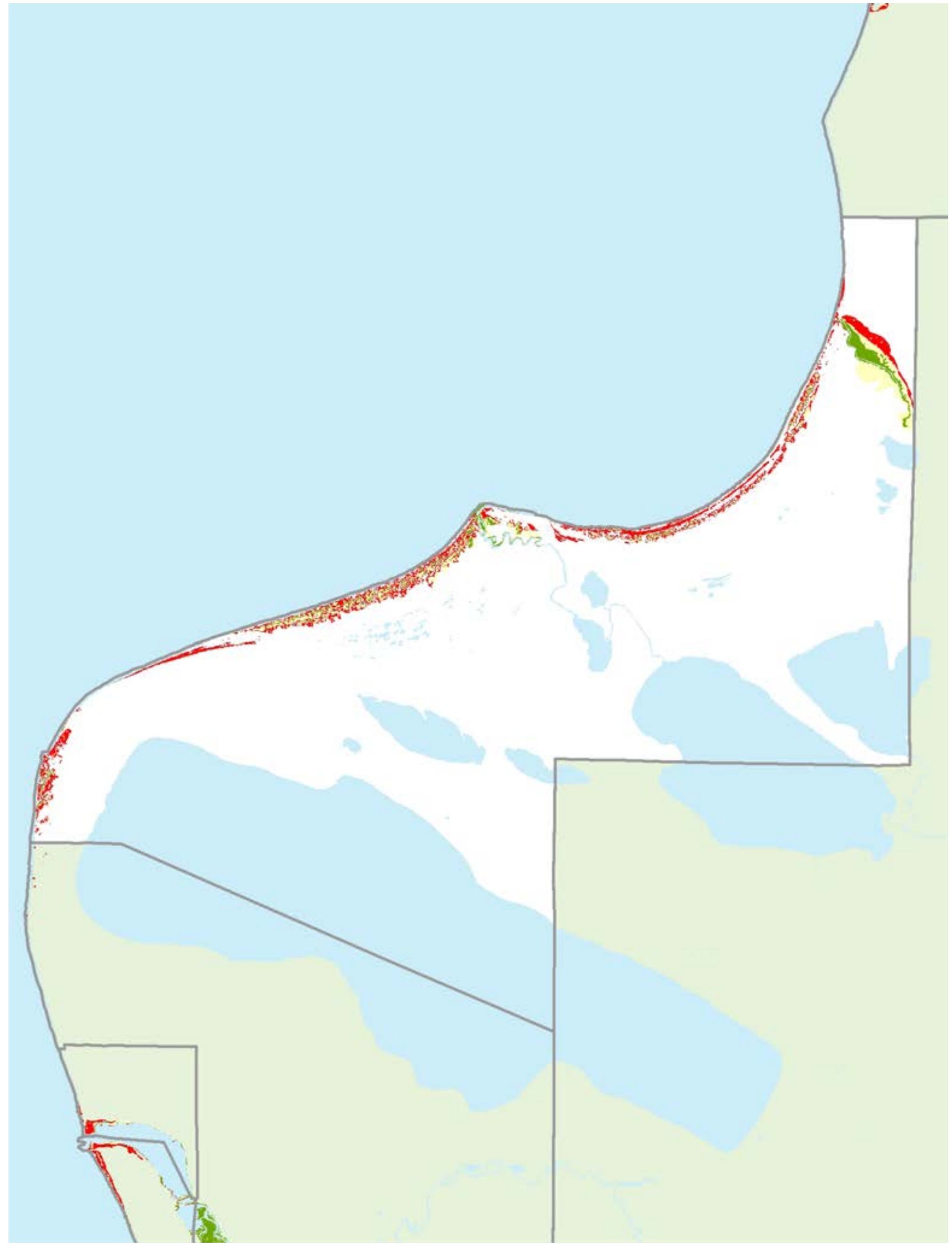
Benzie County			
Total SEV	Lucky	Expected	Perfect Storm
$ 600,931,285.00	$ 1,225,002.00	$ 10,457,468.00	$ 27,462,065.00

Lake Twp.

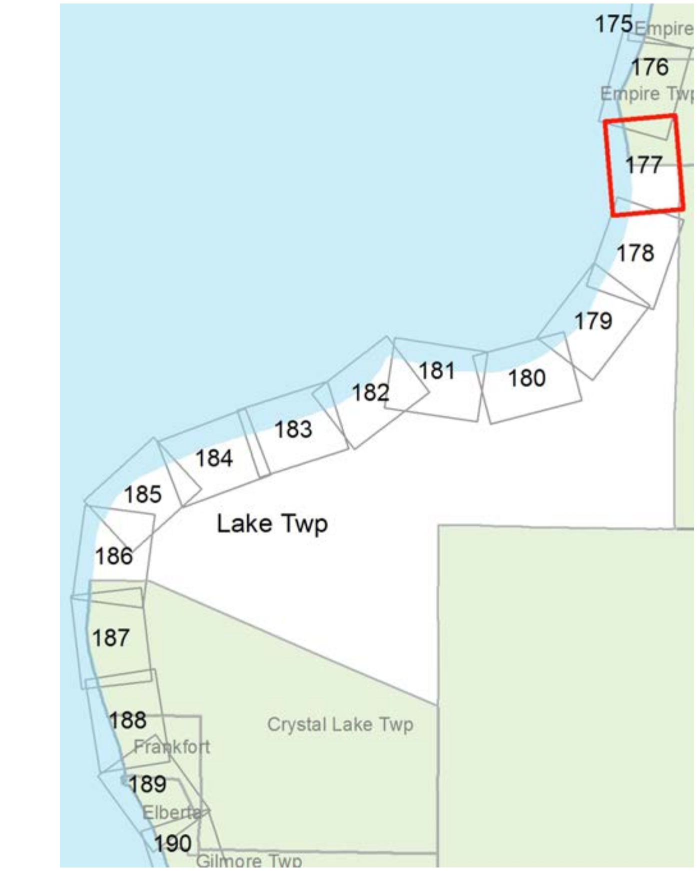
Coastal Flooding Scenario Impacts

Lake			
Total SEV	Lucky	Expected	Perfect Storm
$ 253,341,015.00	$ -	$ 22,231.00	$ 7,982,680.00






Panel #177
Flooding Hazards
Empire Twp
Lake Twp
Aral Hills
Aral


175
Empire
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Empire Twp
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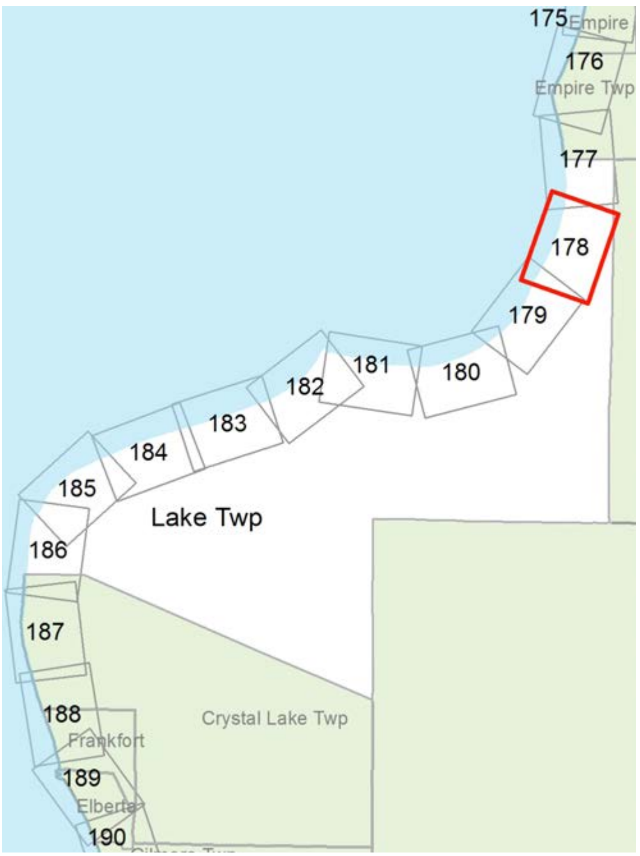
Lake Twp
Crystal Lake Twp
Frankfort
Elberta
Gilmore Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Benzie County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Empire
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Empire Twp
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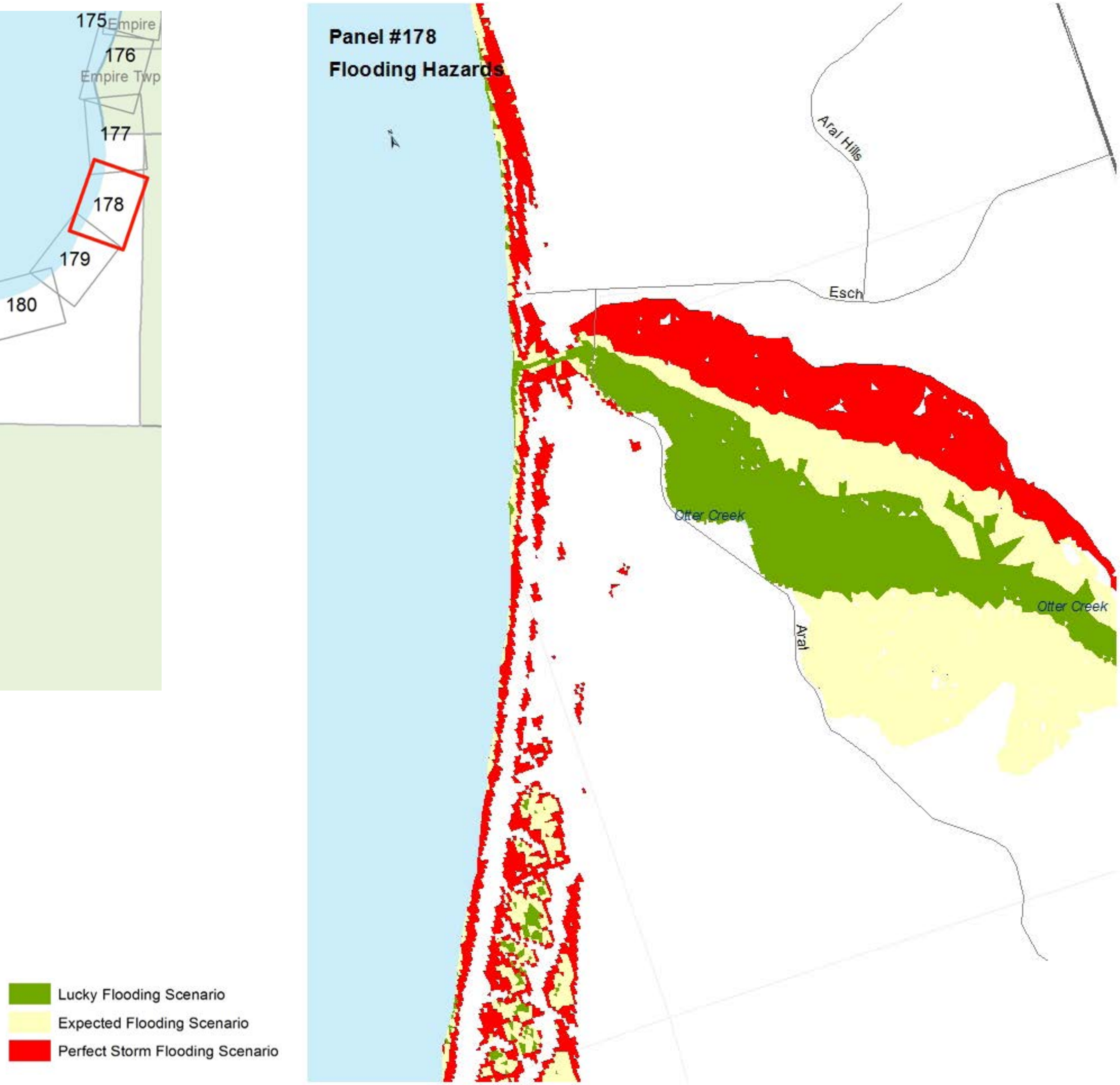
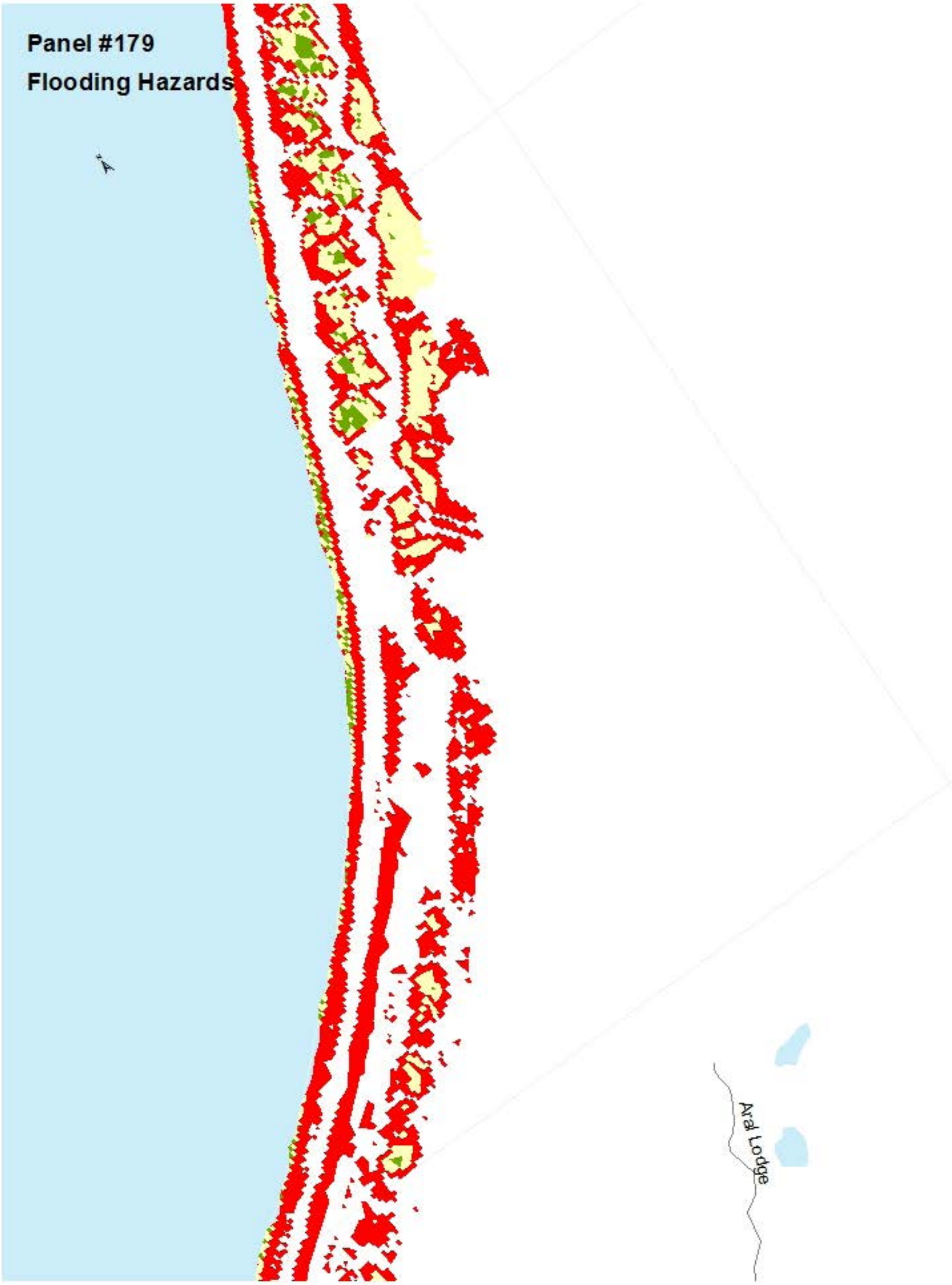
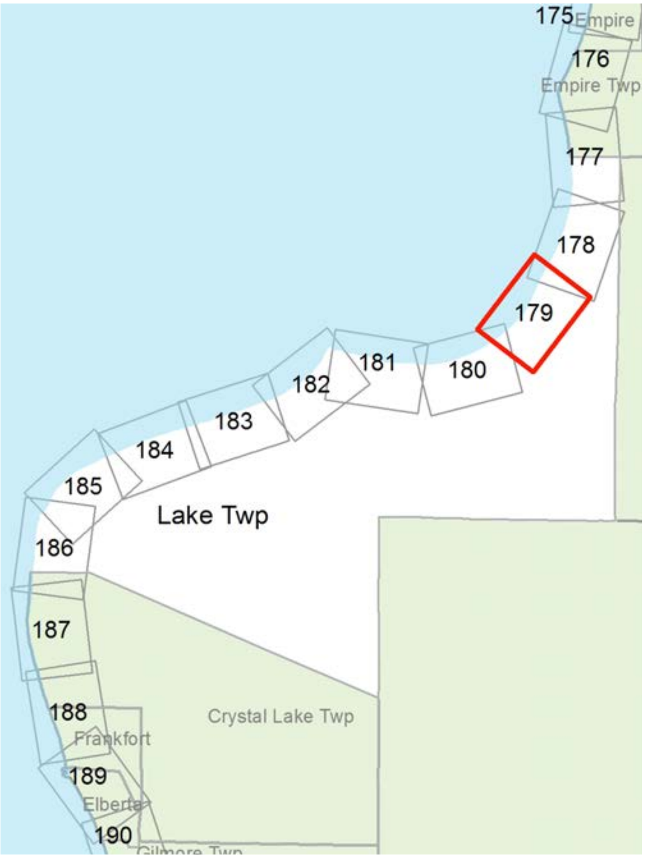
Lake Twp
Crystal Lake Twp
Frankfort
Elberta

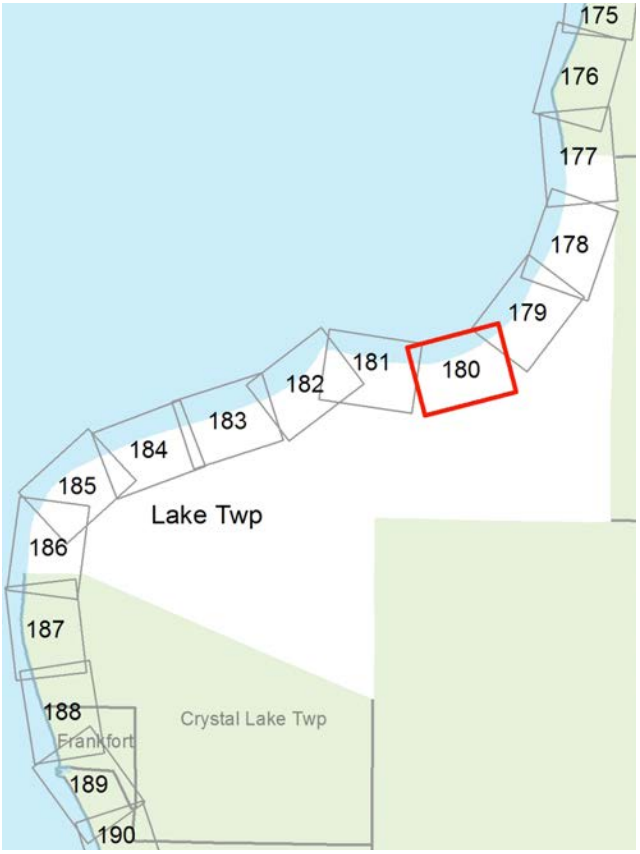

Benzie County


Panel #178
Flooding Hazards
Aral Hills
Esch
Otter Creek
Otter Creek
Aral
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

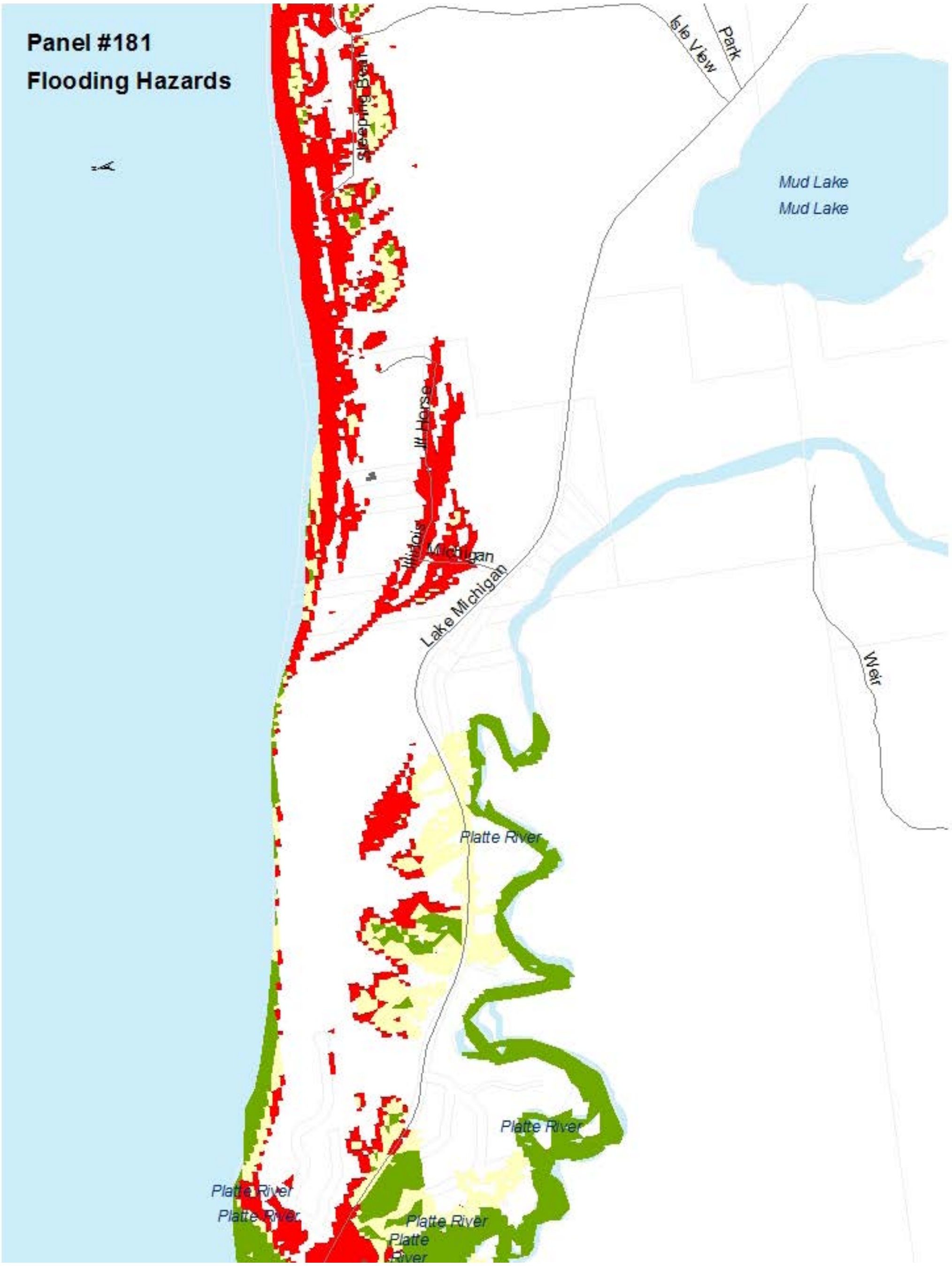


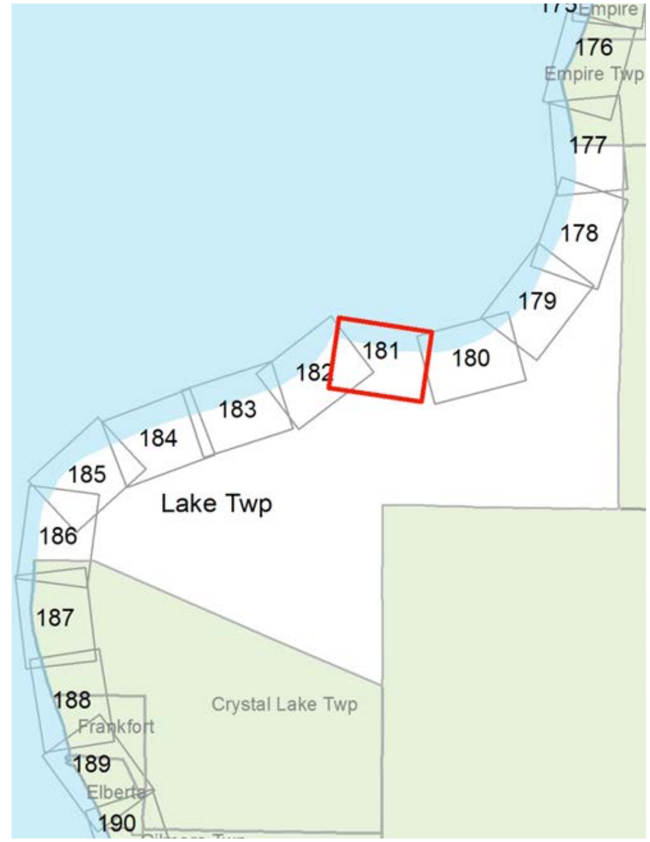


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

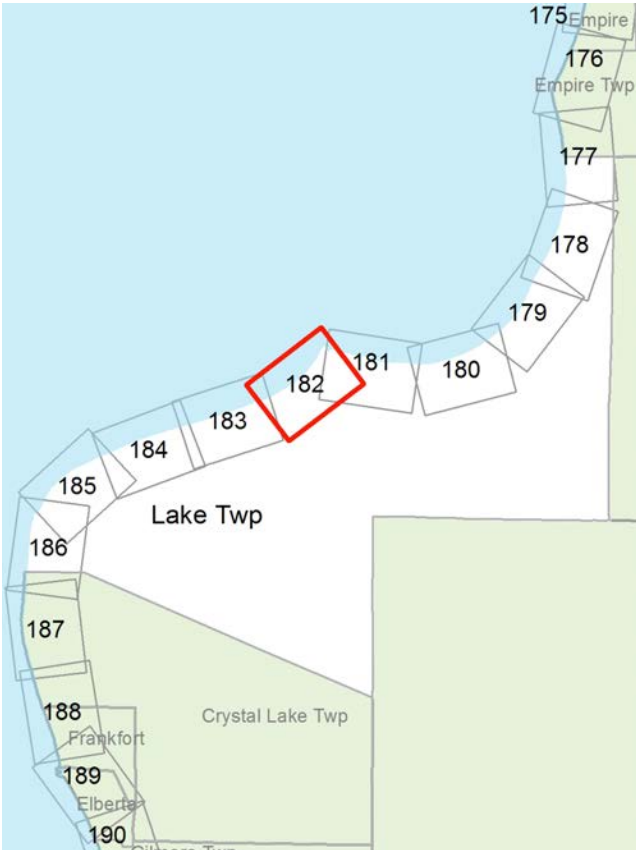


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

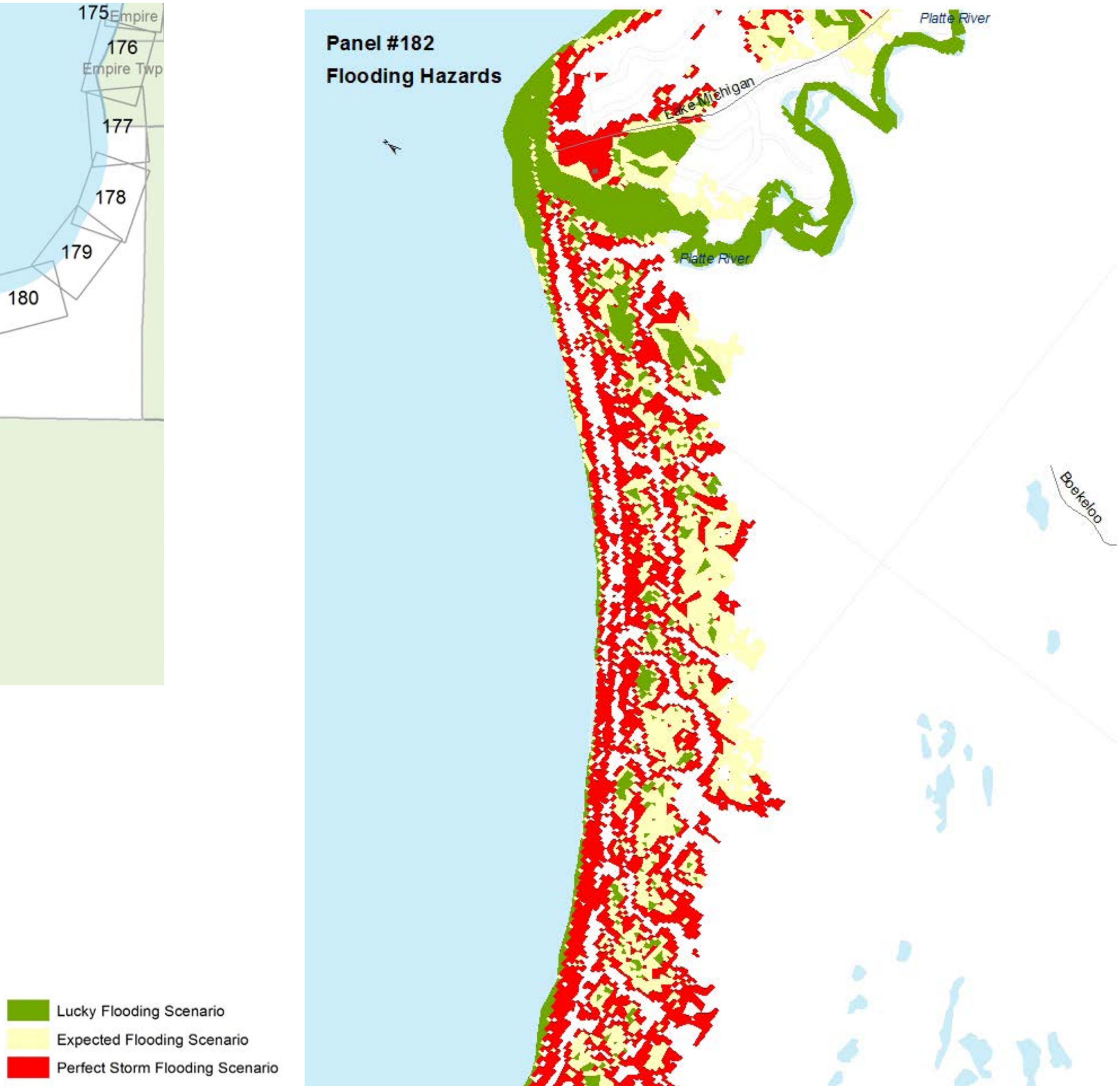




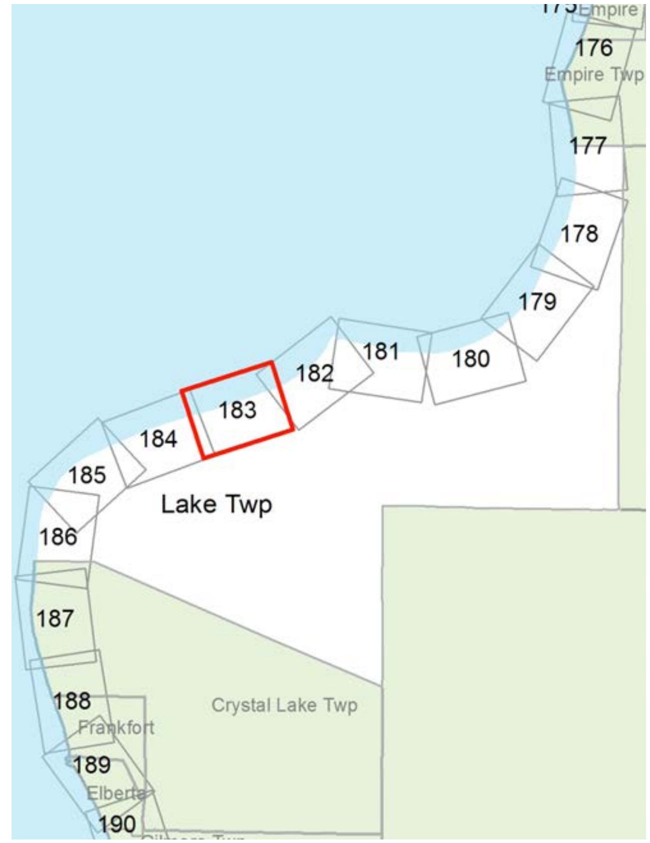
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


175
Empire
176
Empire Twp
177
178
179
180
181
182
183
184
185
186
187
188
189
190
Lake Twp
Crystal Lake Twp
Frankfort
Elberta

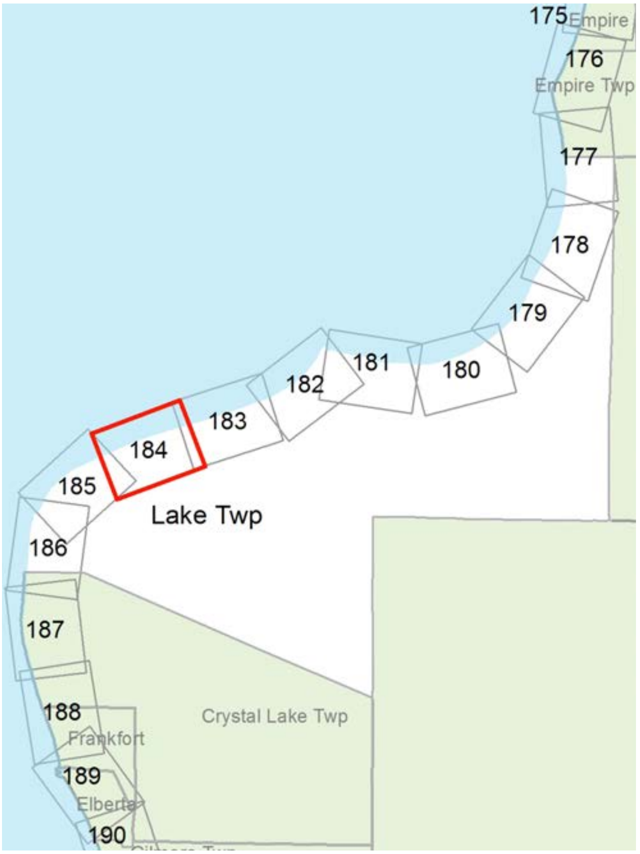

Benzie County


Panel #182
Flooding Hazards
Platte River
Lake Michigan
Platte River
Boekeloo
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #183
Flooding Hazards
Sutter
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

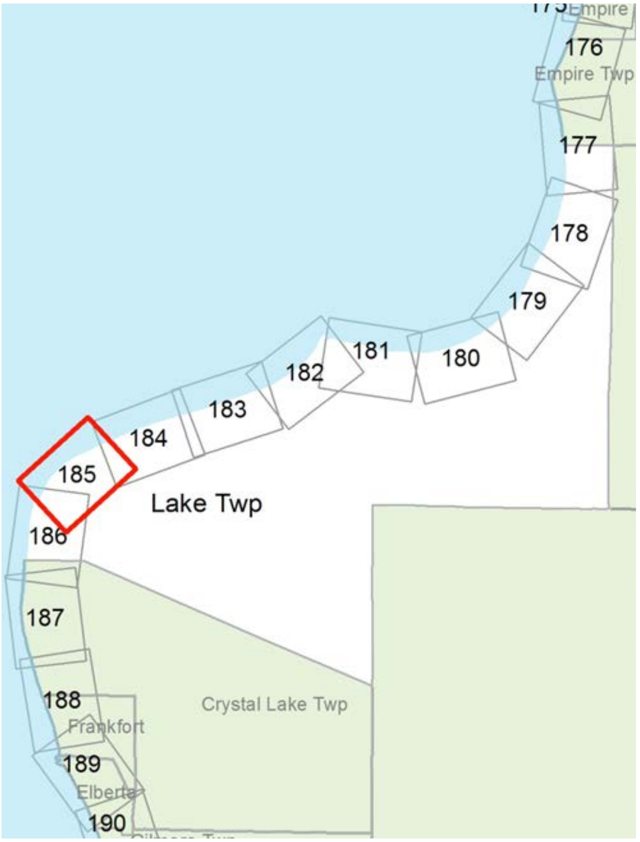

Empire
176
Empire Twp
177
178
179
180
181
182
183
184
185
186
187
188
189
190
Lake Twp
Crystal Lake Twp
Frankfort
Elberta


Benzie County

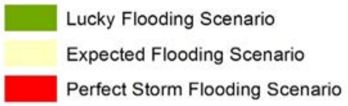


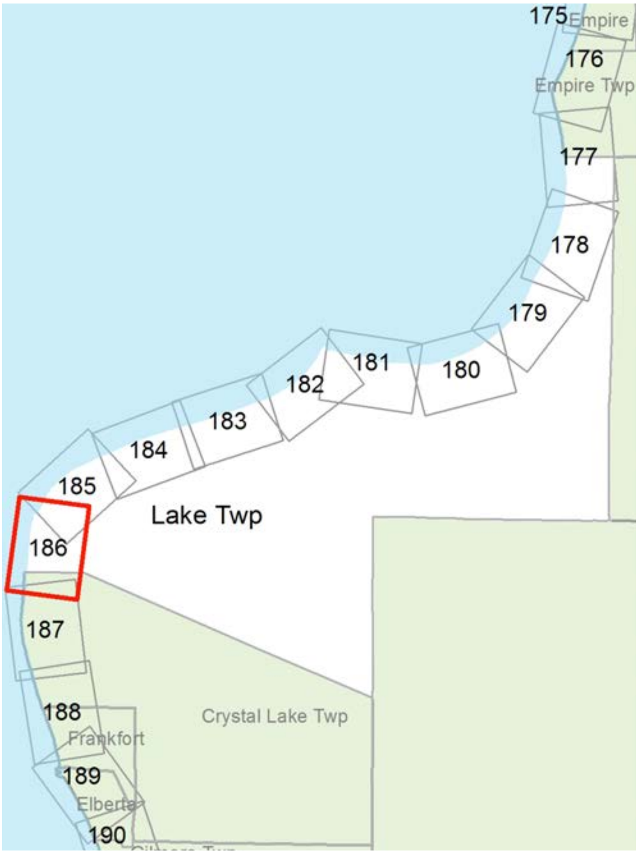
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #185
Flooding Hazards
Crystal Downs
Sutter
Crystal
Crystal Lake
Crystal Lake
Pilgrim
Point Betsie
Point Betsie
Old State

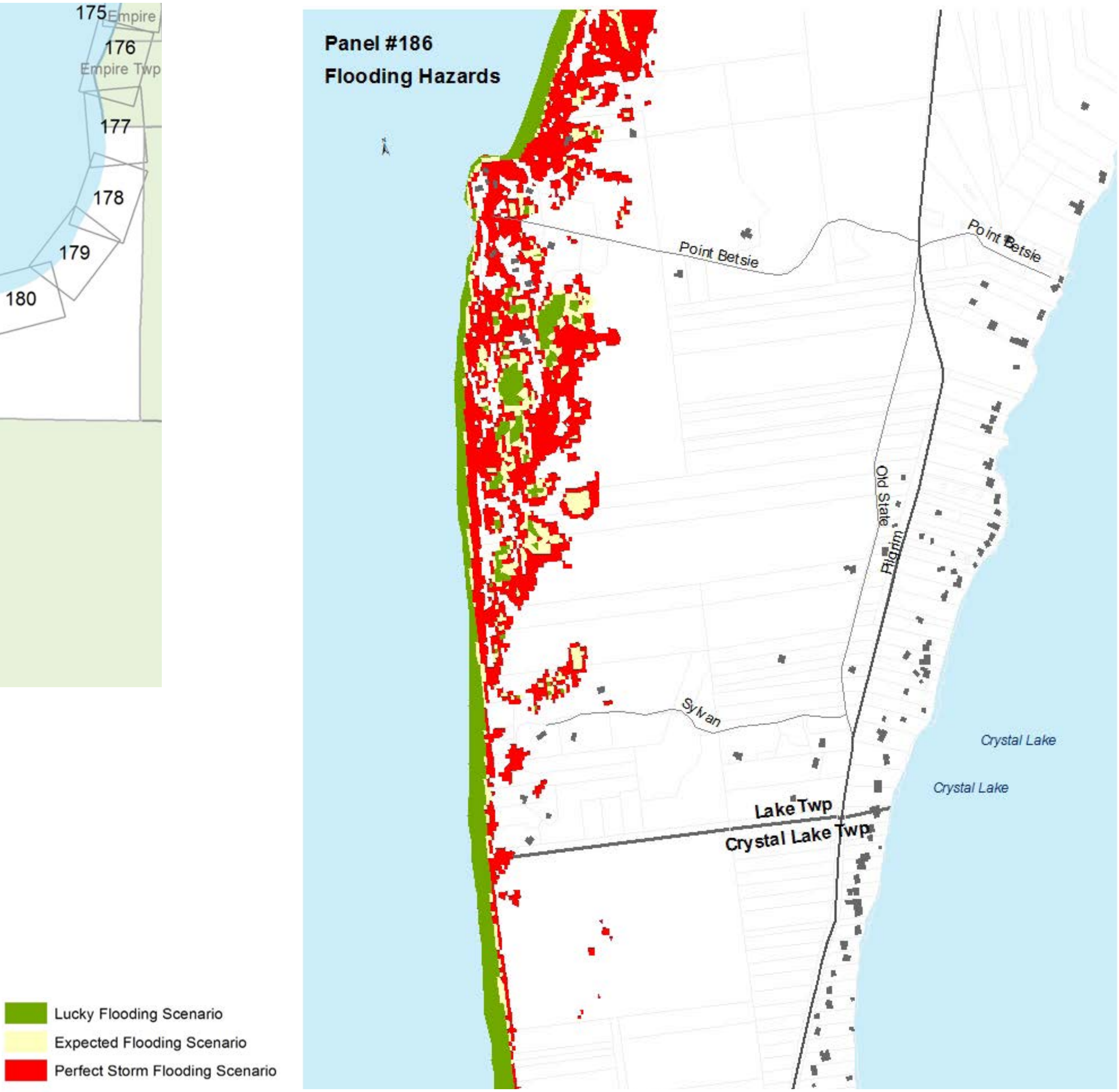

176
Empire Twp
177
178
179
180
181
182
183
184
185
186
187
188
189
190
Lake Twp
Crystal Lake Twp
Frankfort
Elberta

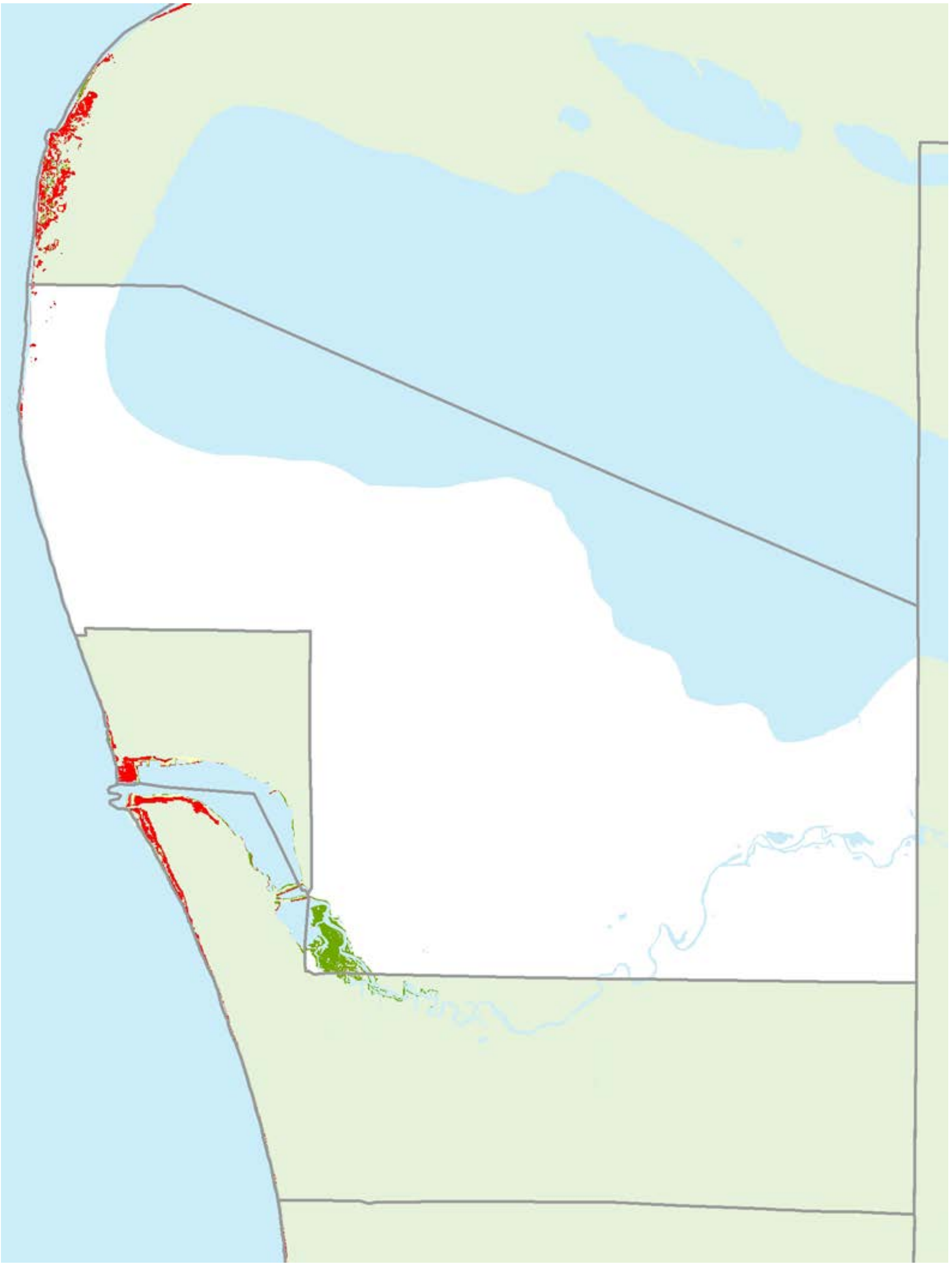

Benzie County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


175
Empire
176
Empire Twp
177
178
179
180
181
182
183
184
185
186
Lake Twp
187
188
Frankfort
Crystal Lake Twp
189
Elberta
190


Benzie County


Panel #186
Flooding Hazards
Point Betsie
Point Betsie
Old State
Pilgrim
Sylvan
Crystal Lake
Crystal Lake
Lake Twp
Crystal Lake Twp
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

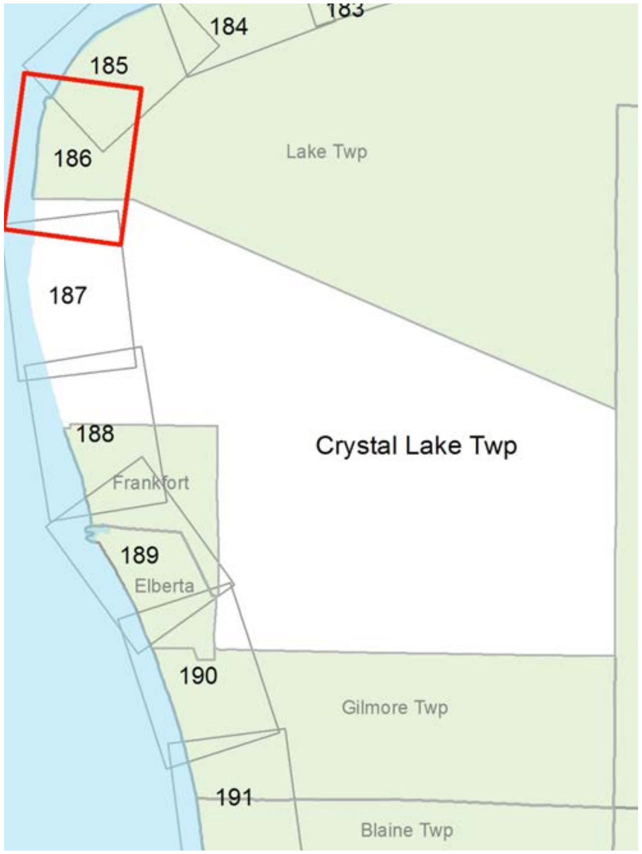


Crystal Lake Twp.

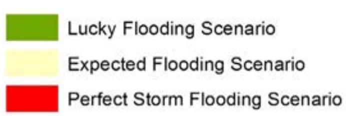
Coastal Flooding Scenario Impacts

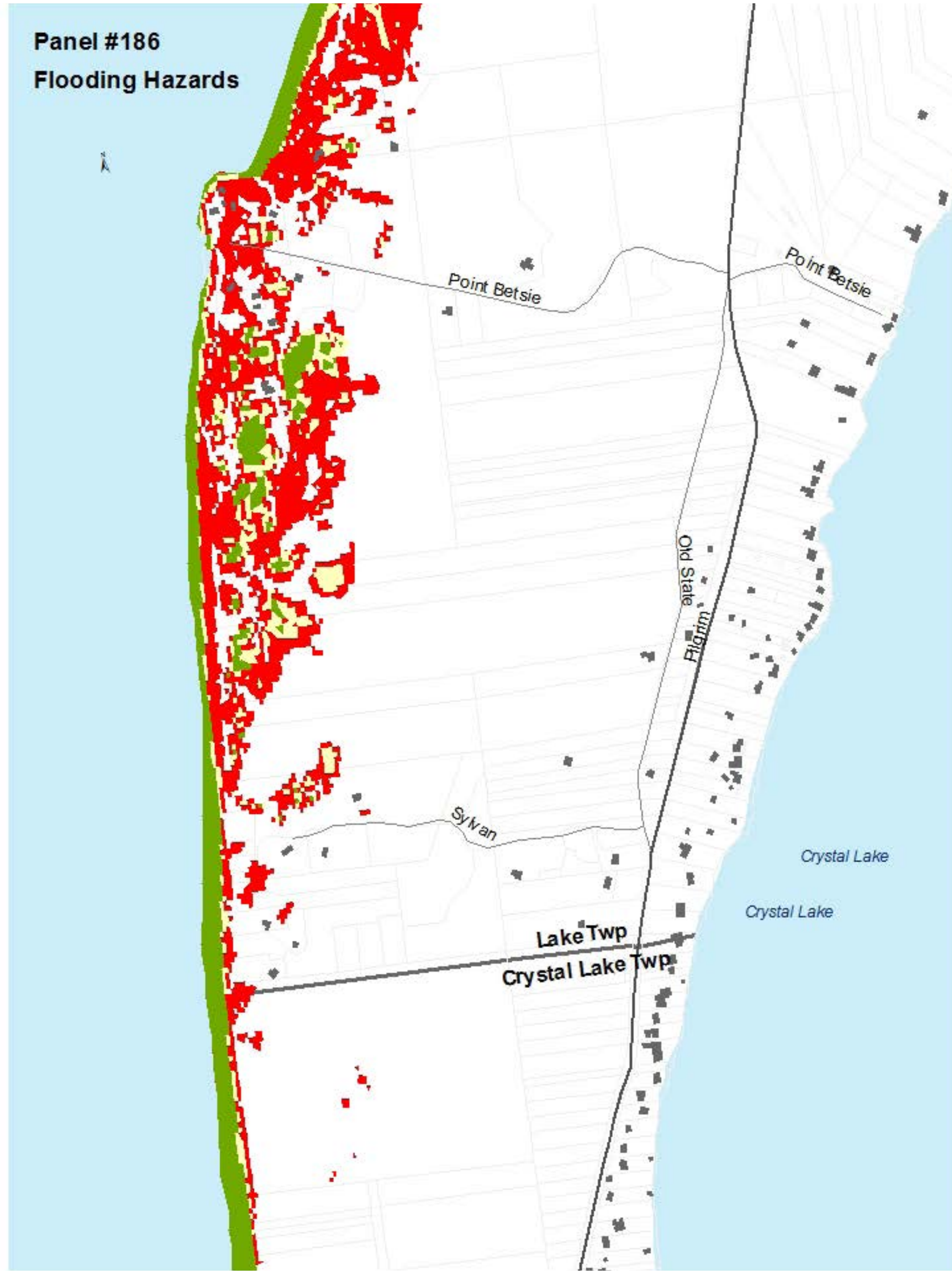
Crystal Lake			
Total SEV	Lucky	Expected	Perfect Storm
$ 177,071,750.00	$ 33,739.00	$ 33,739.00	$ 33,739.00

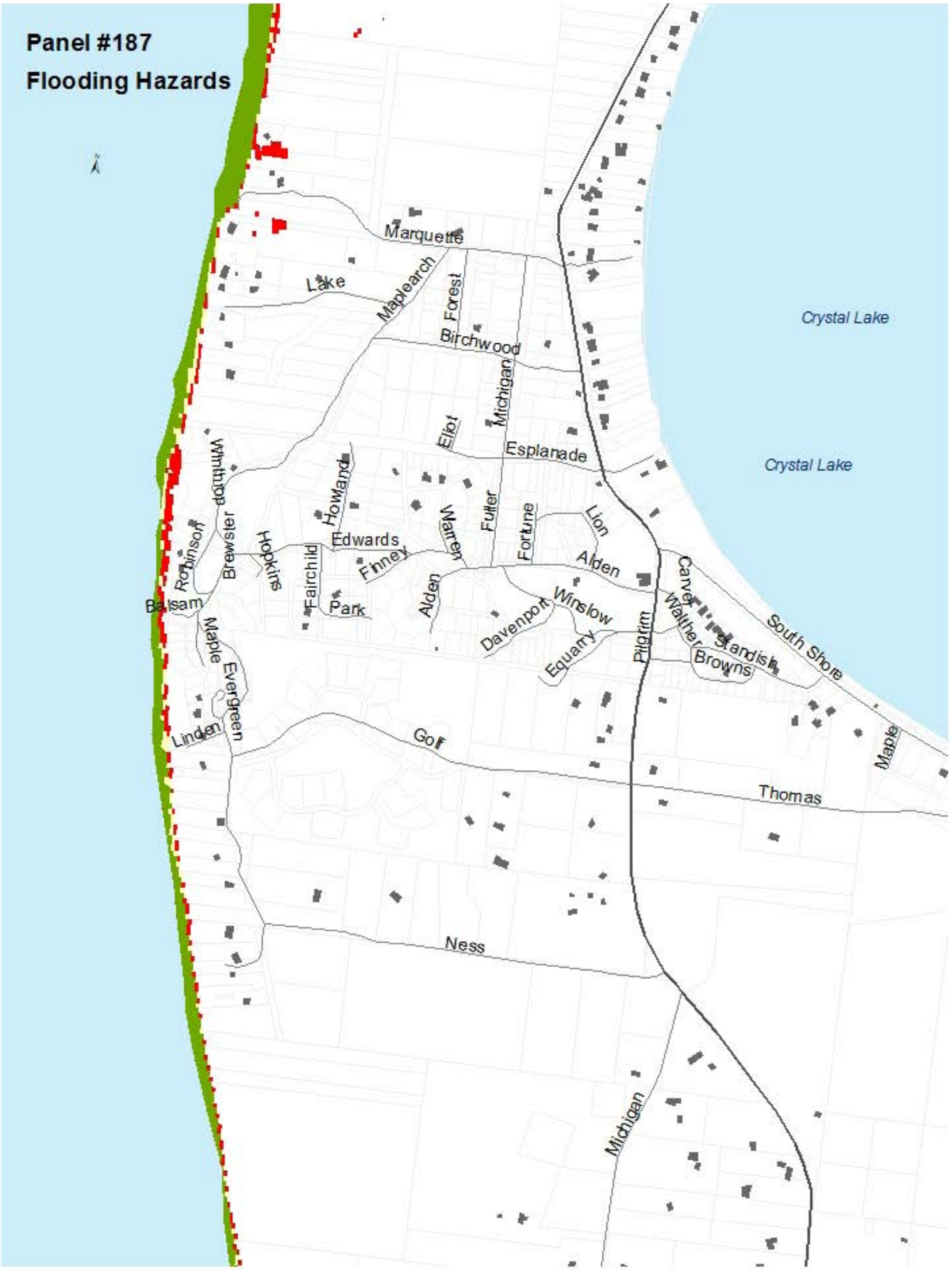
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

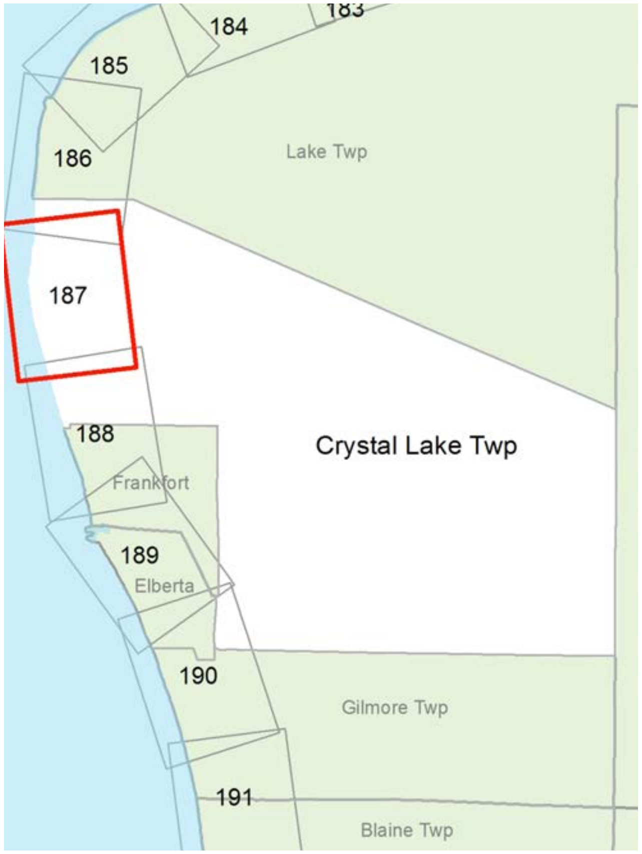

184
183
185
186
Lake Twp
187
188
Crystal Lake Twp
Frankfort
189
Elberta
190
Gilmore Twp
191
Blaine Twp


Benzie County

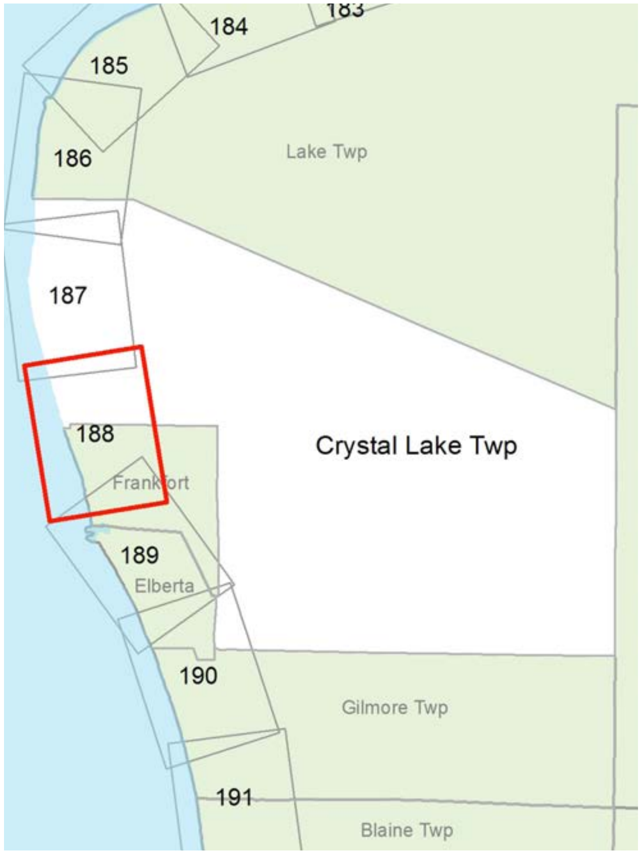

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

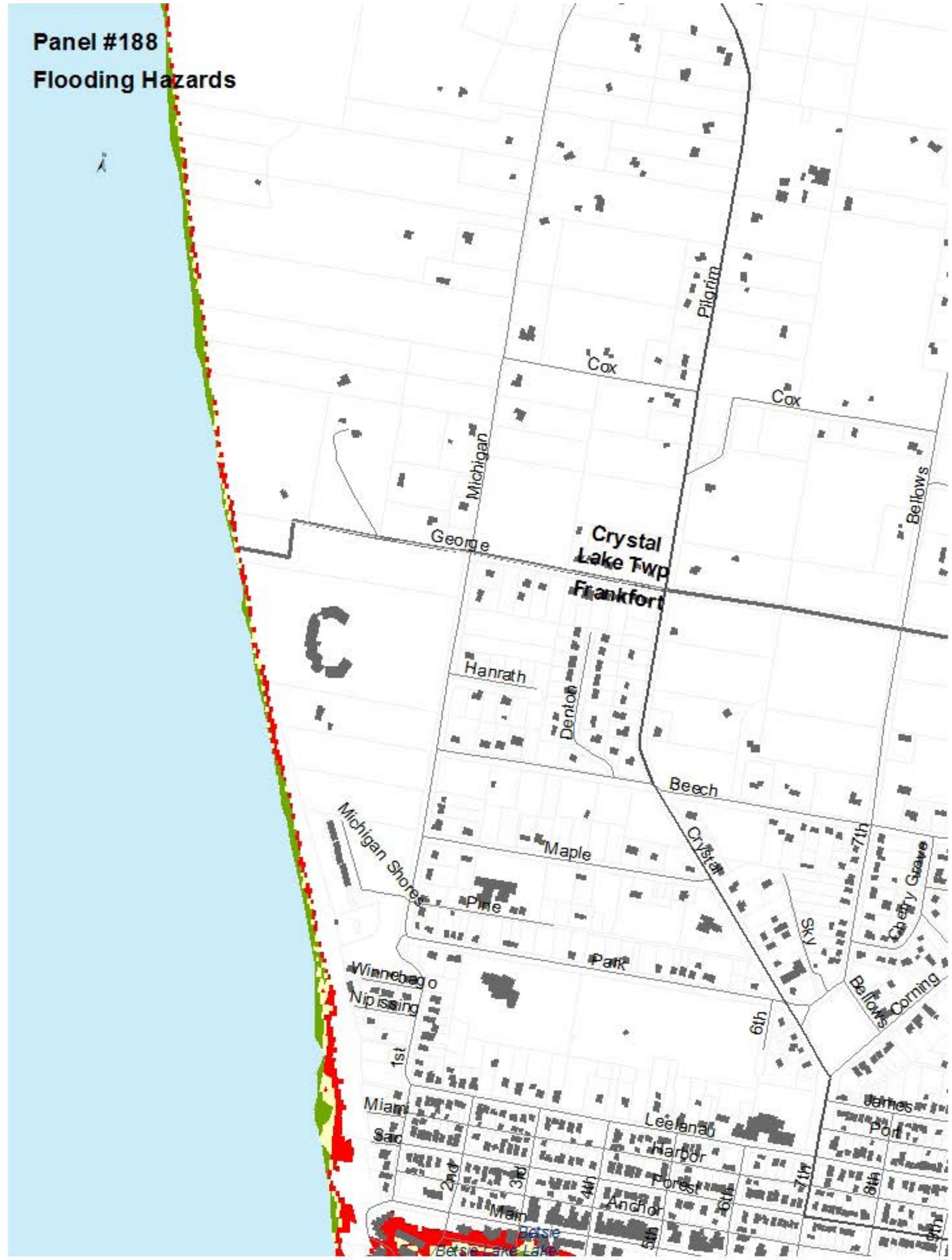

Panel #186
Flooding Hazards
Point Betsie
Point Betsie
Old State
Pilgrim
Sylvan
Lake Twp
Crystal Lake Twp
Crystal Lake
Crystal Lake





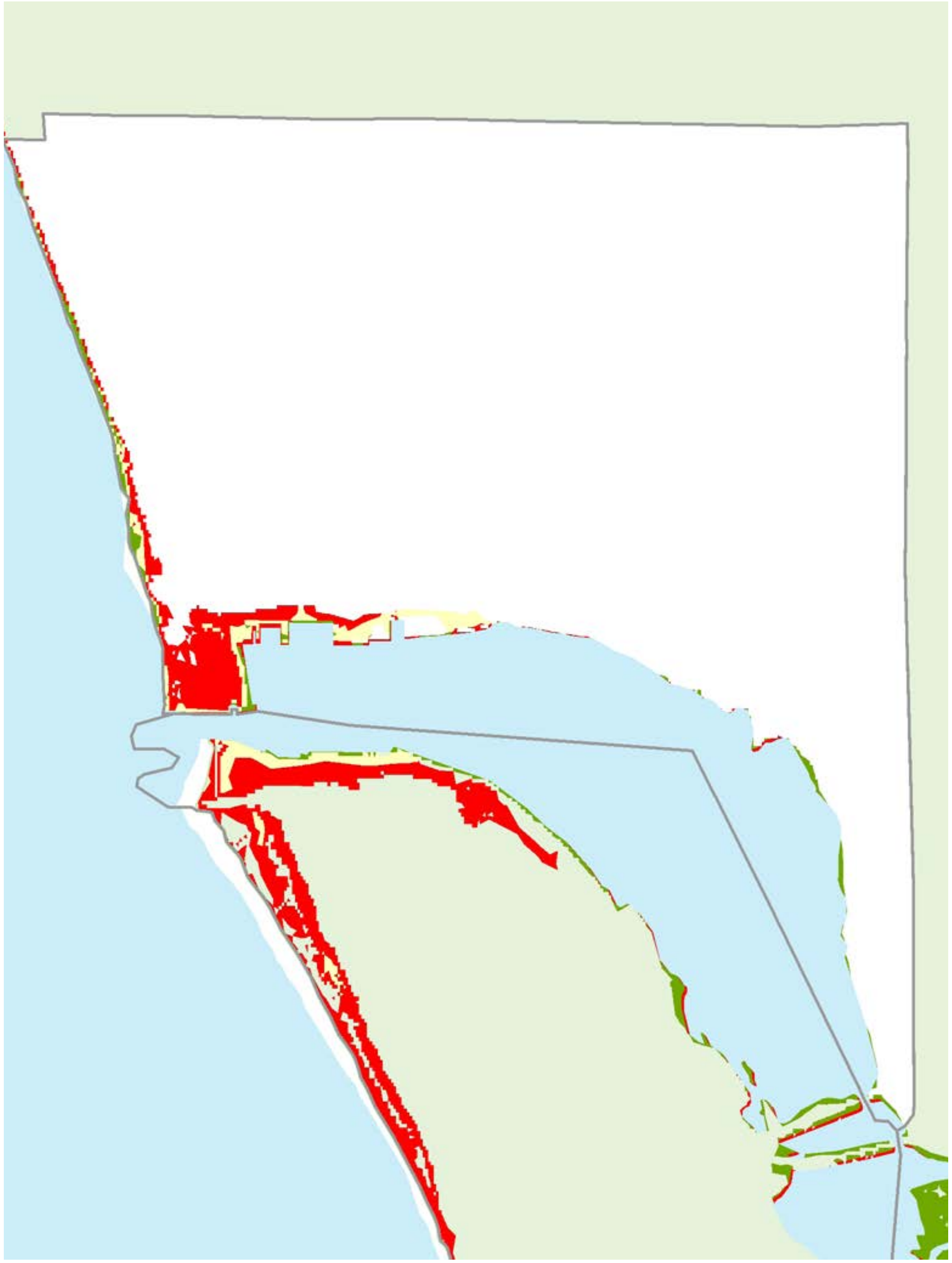
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


183
184
185
186
187
188
189
190
191
Lake Twp
Crystal Lake Twp
Frankfort
Elberta
Gilmore Twp
Blaine Twp


Panel #188
Flooding Hazards
Crystal Lake Twp
Frankfort
Cox
Pilgrim
Michigan
George
Bellows
Hanrath
Denton
Beech
Maple
Crystal
Michigan Shores
Pine
Park
Winnebago
Nipissing
1st
2nd
3rd
4th
5th
6th
7th
8th
Sky
Cherry Grove
Corning
Miami
Sac
Main
Leelanau
Harbor
Forest
Anchor
James
Port
Betsie Lake


Benzie County

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



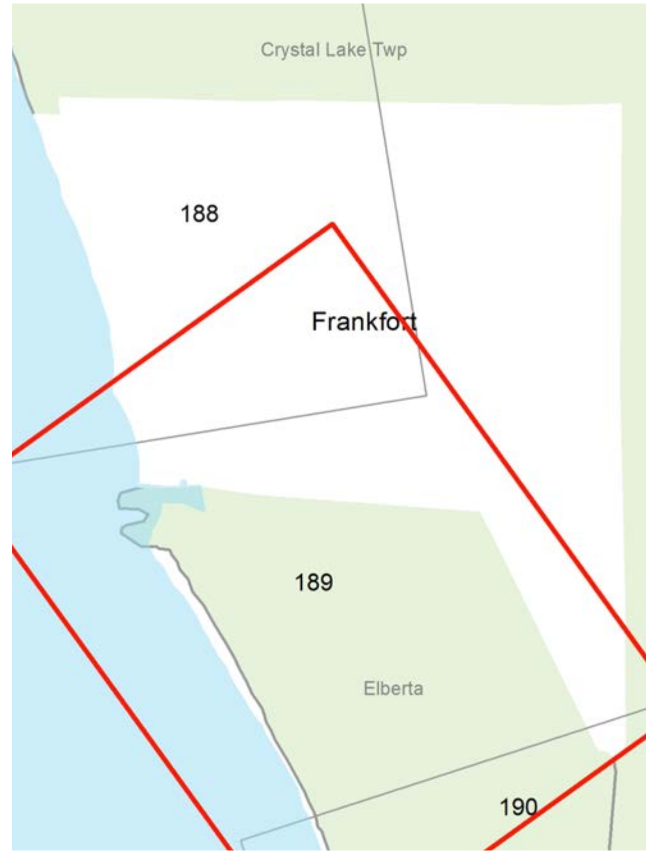
Frankfort

Coastal Flooding Scenario Impacts

Frankfort			
Total SEV	Lucky	Expected	Perfect Storm
$ 90,103,518.00	$ 1,131,684.00	$ 7,000,943.00	$ 15,707,007.00

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Crystal Lake Twp
188
Frankfort
189
Elberta
190
Benzie County
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Panel #188
Flooding Hazards
Pilgrim
Cox
Cox
Michigan
Bellows
George
Crystal Lake Twp
Frankfort
Hanrath
Denton
Beech
Maple
Crystal
Michigan Shores
Pine
Park
Sky
Winnebago
Nipissing
Bellows
Corning
6th
1st
Miami
Sac
Leelanau
James
Port
Harbor
Forest
Anchor
Main
Betsie
Betsie Lake
2nd
3rd
4th
5th
7th
8th
9th

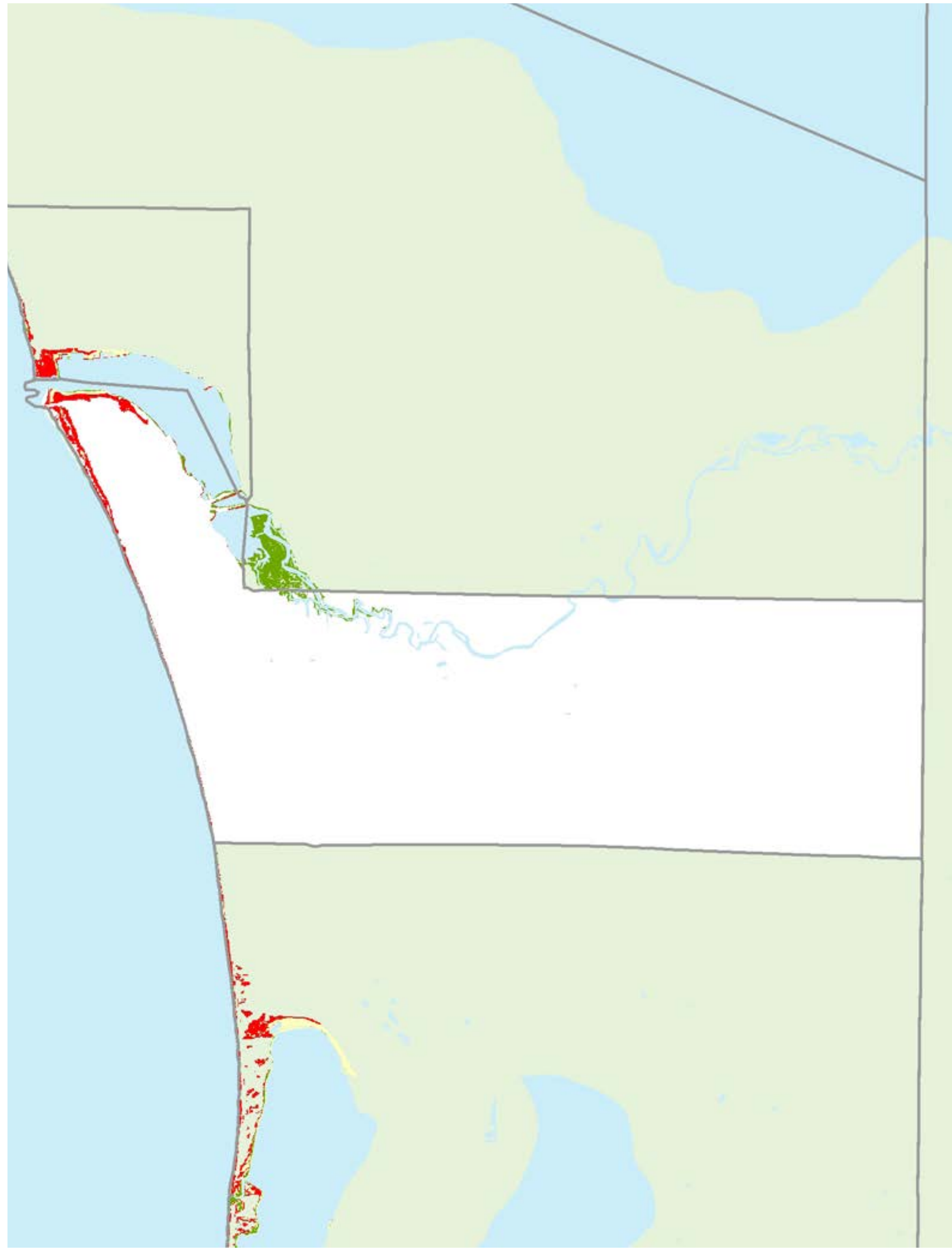


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

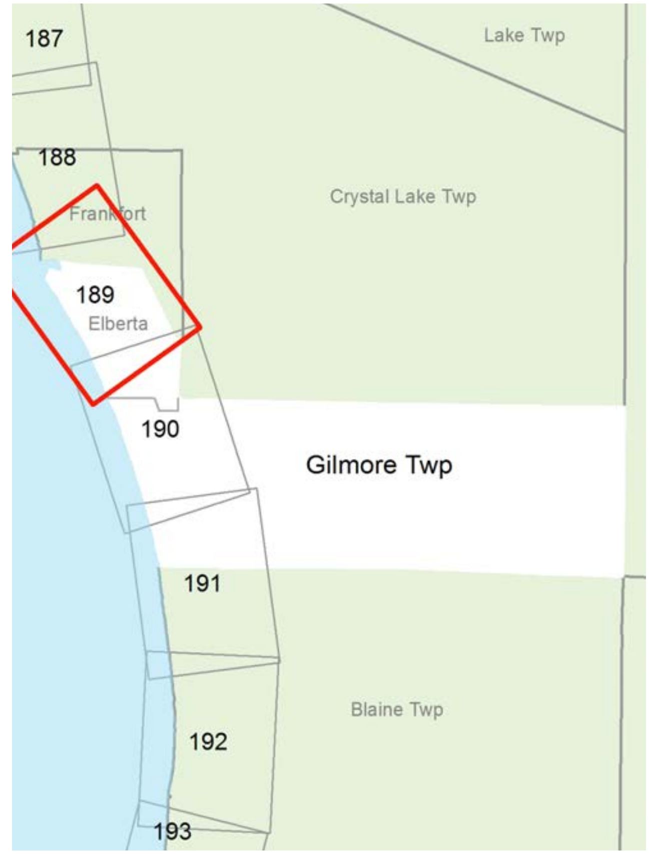
Gilmore Twp./ Elberta

Coastal Flooding Scenario Impacts

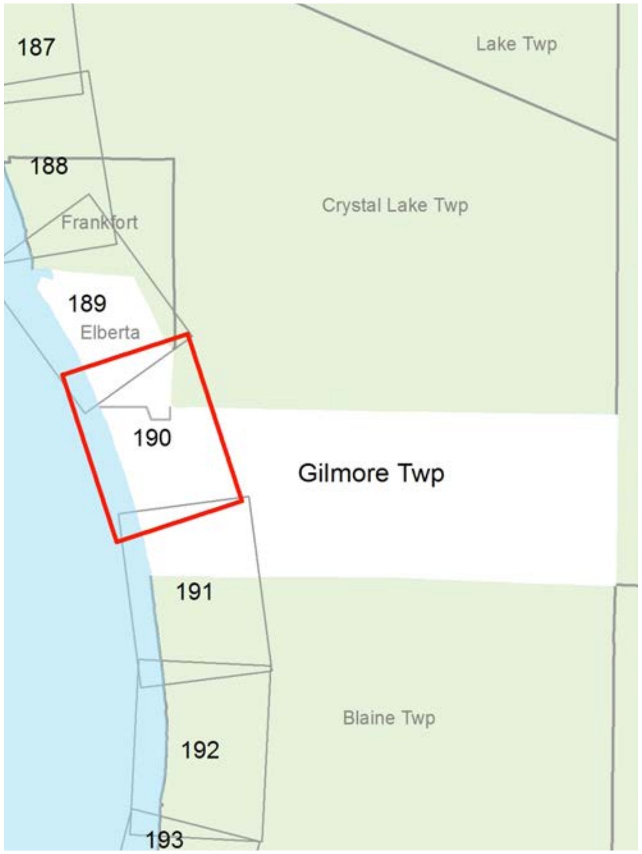
Gilmore Twp./Elberta			
Total SEV	Lucky	Expected	Perfect Storm
$ 37,006,843.00	$ -	$ 717,878.00	$ 836,868.00

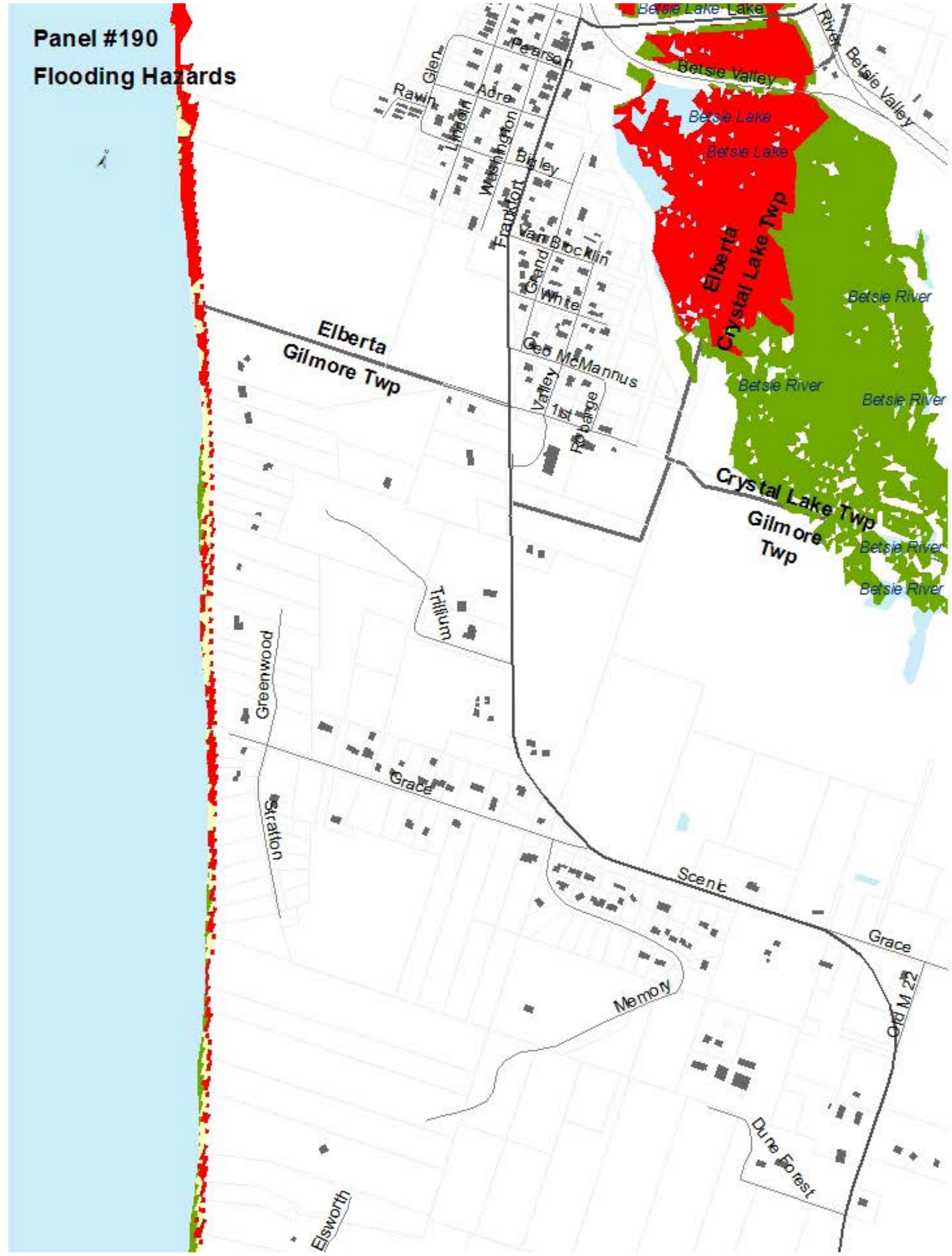


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

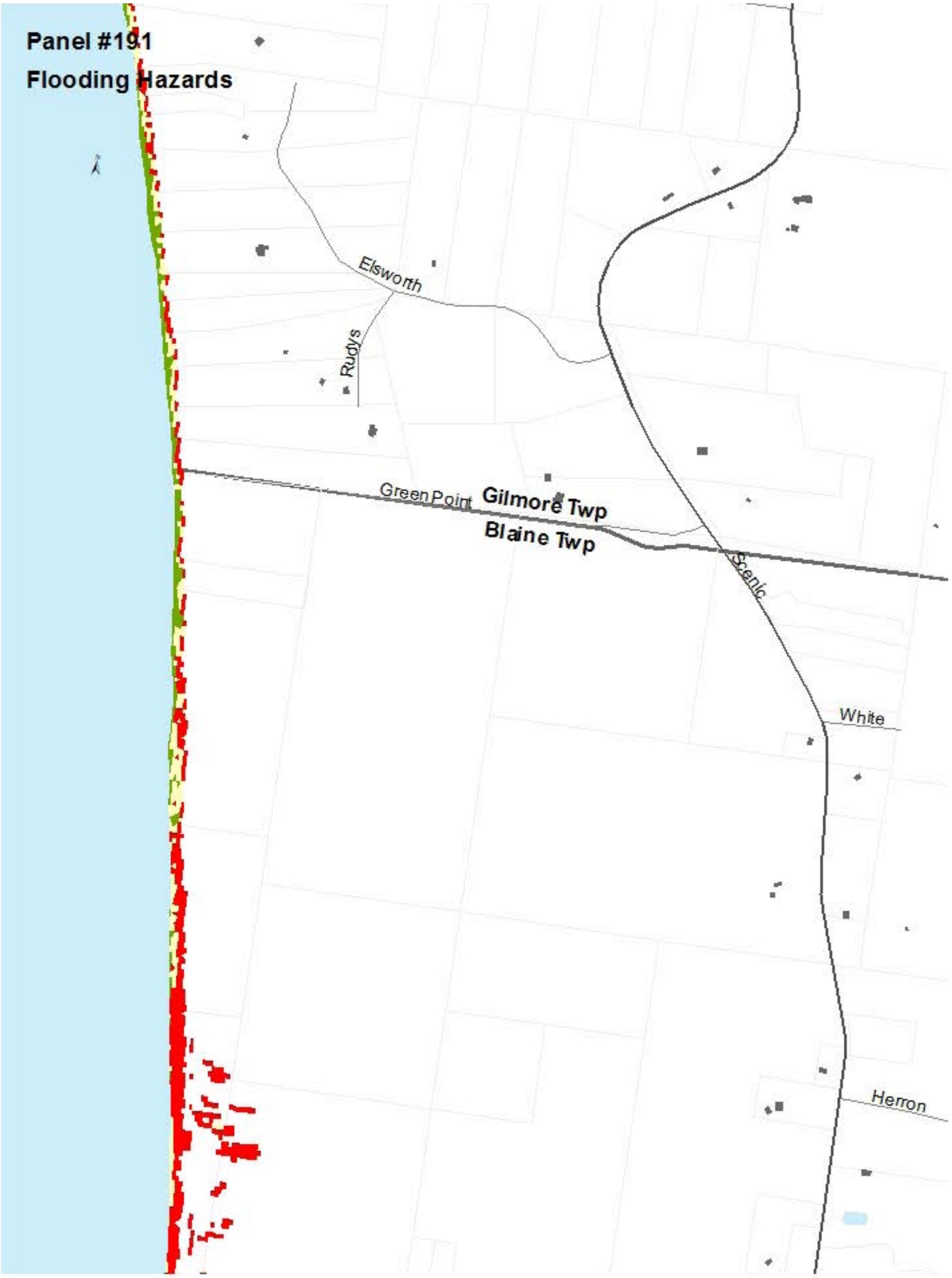


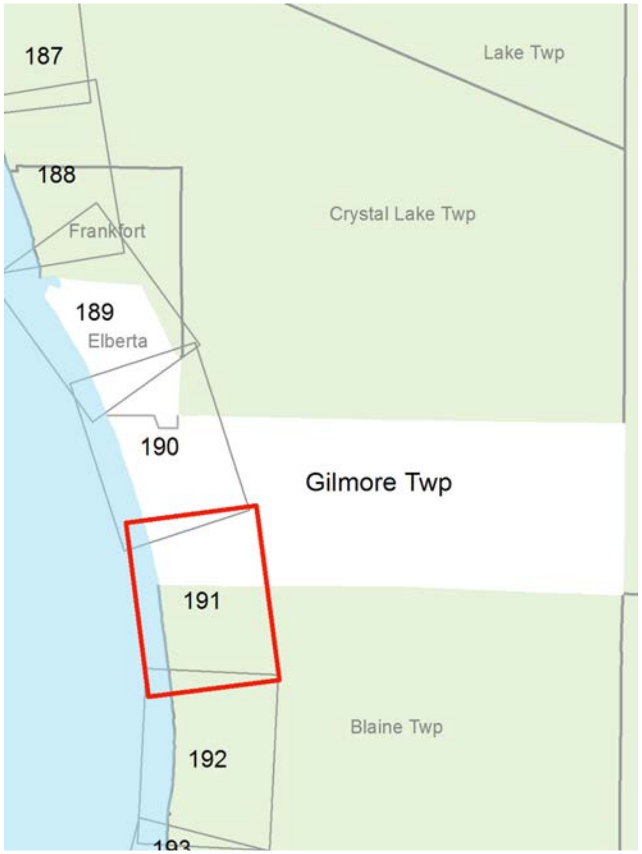
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario



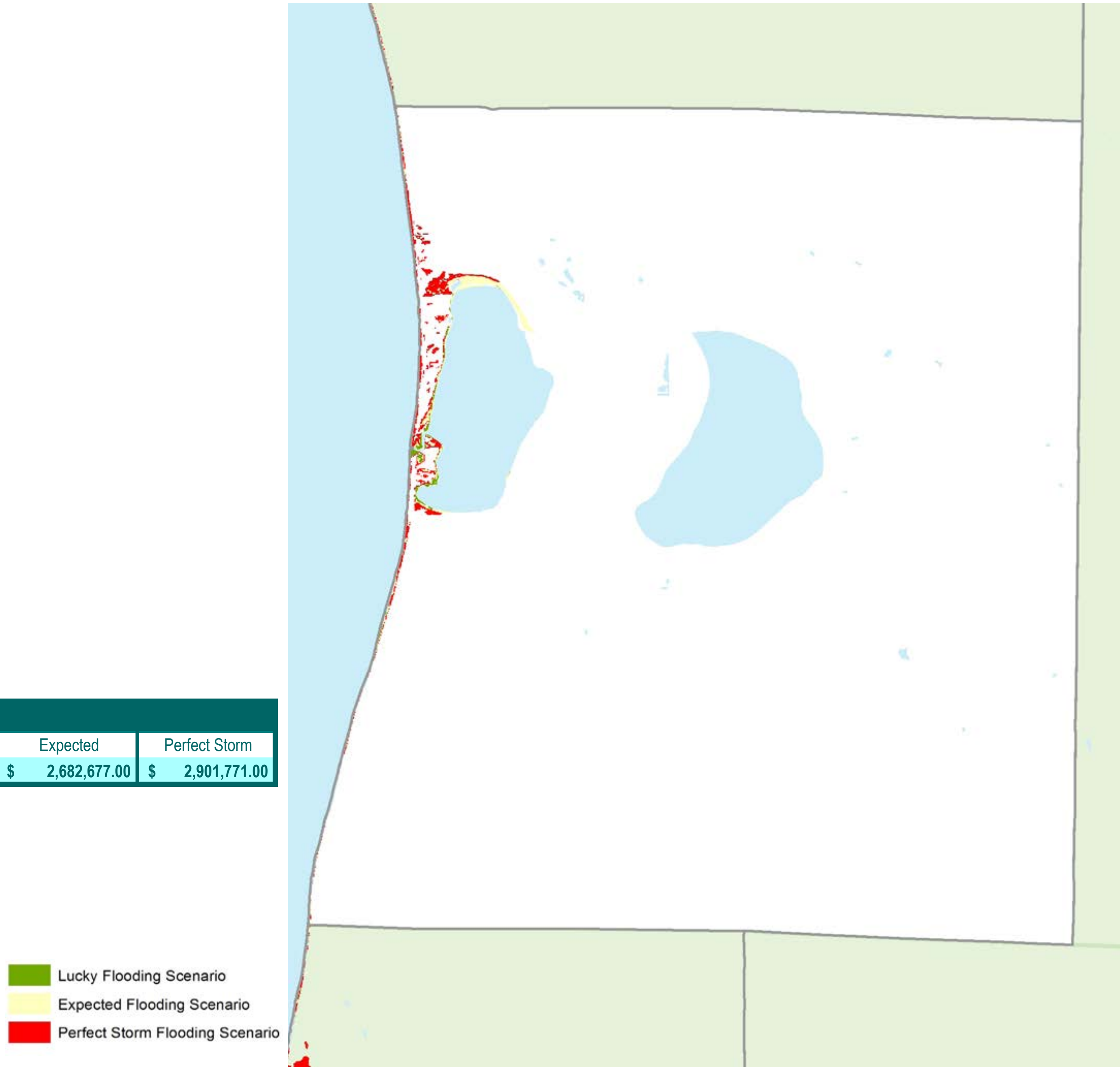


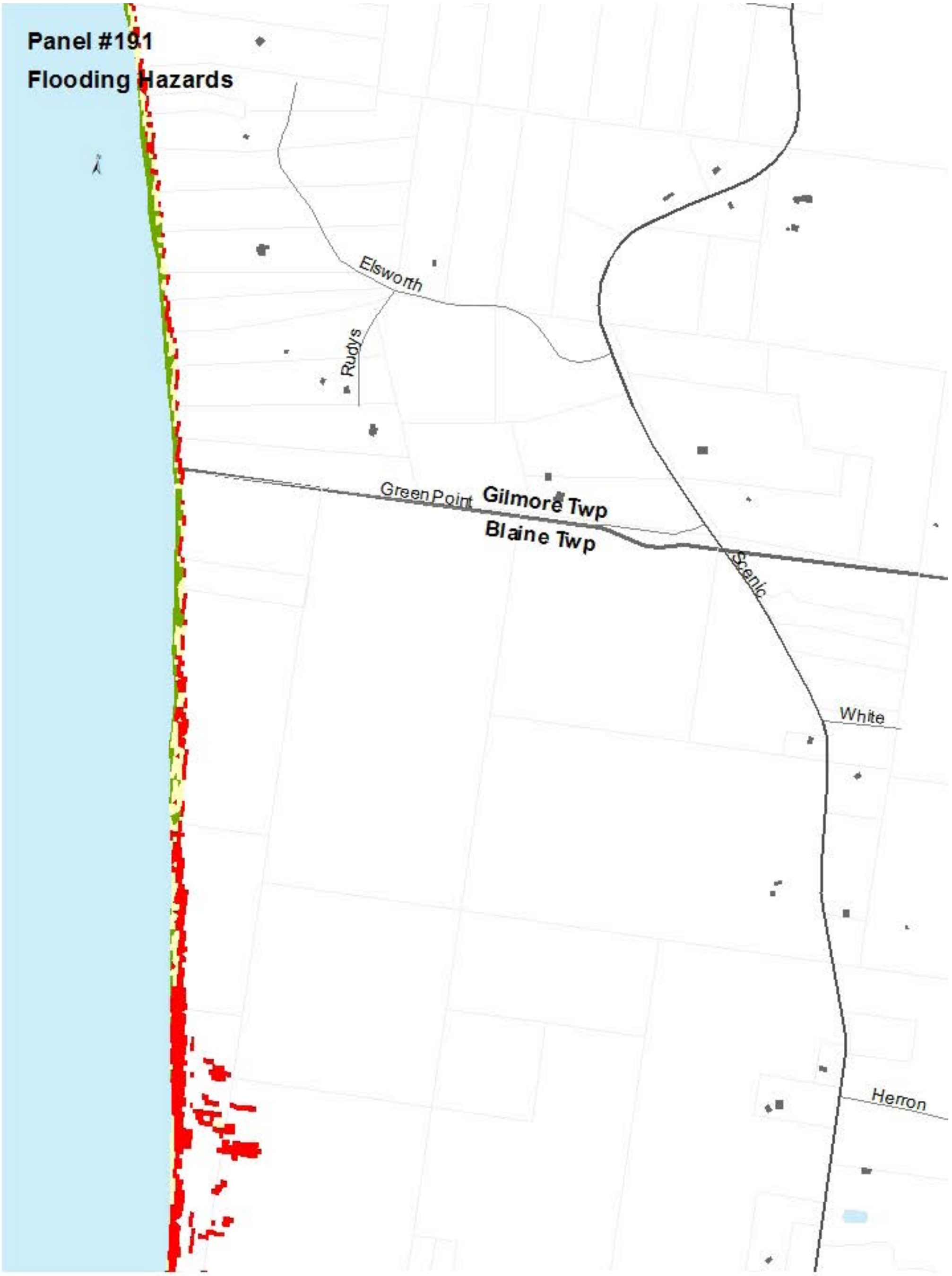
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

Blaine Twp.

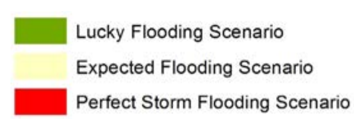
Coastal Flooding Scenario Impacts

Blaine			
Total SEV	Lucky	Expected	Perfect Storm
$ 43,408,159.00	$ 59,579.00	$ 2,682,677.00	$ 2,901,771.00




Panel #191
Flooding Hazards
Elsworth
Rudys
Green Point
Gilmore Twp
Blaine Twp
Scenic
White
Herron

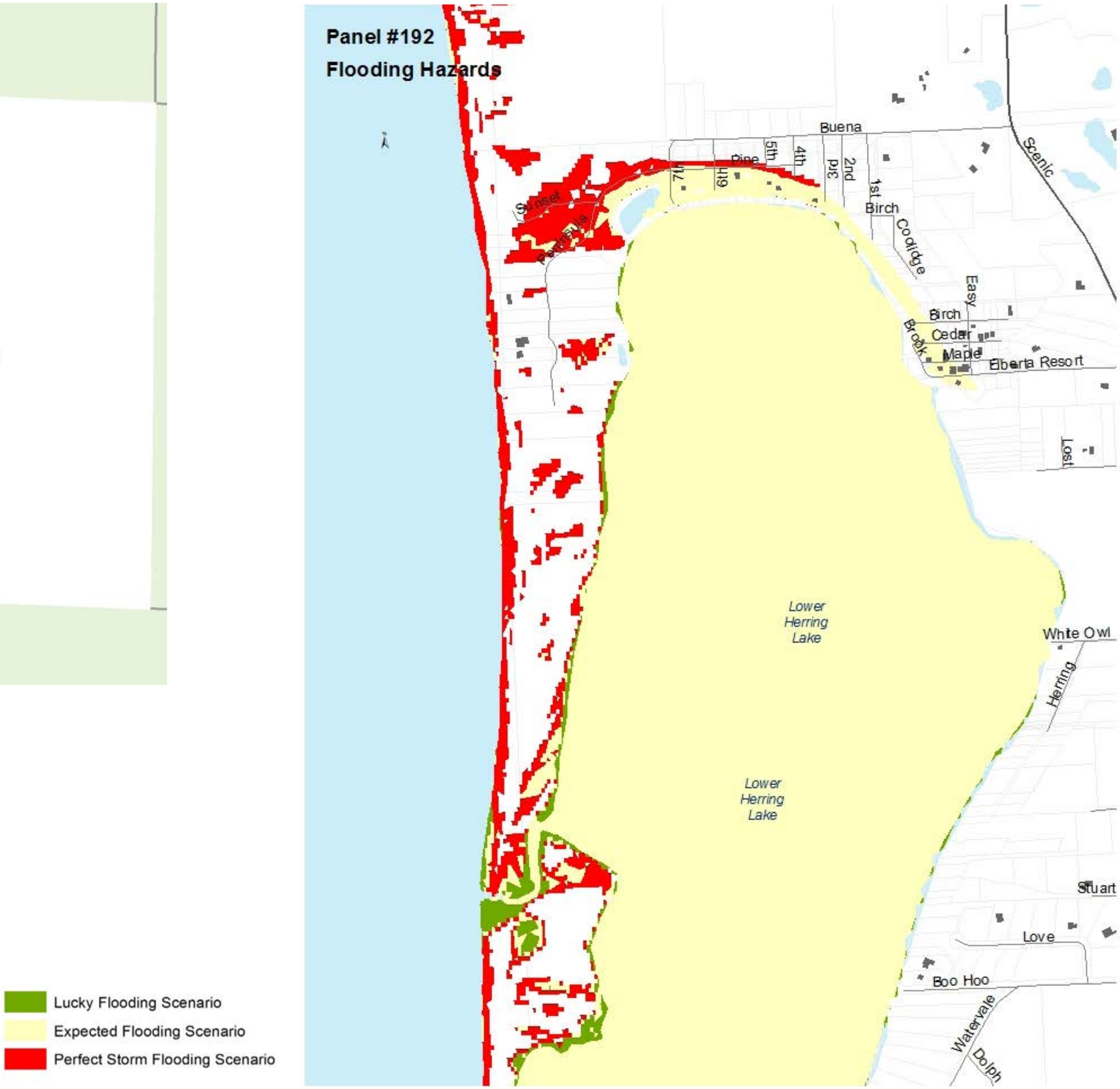

190
Gilmore Twp
191
192
Blaine Twp
193
194
Arcadia Twp
195

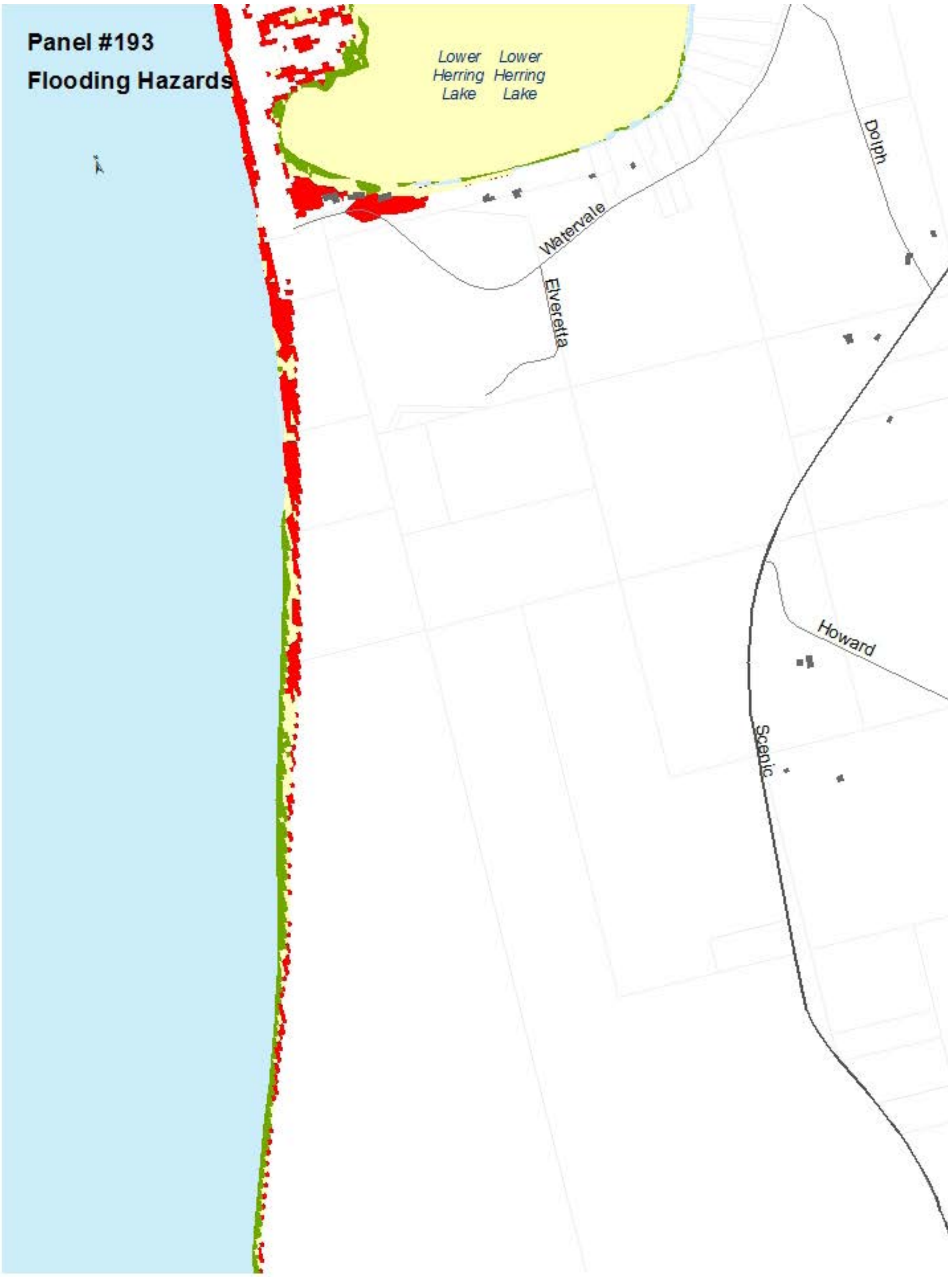

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Benzie County


190
Gilmore Twp
191
192
Blaine Twp
193
194
Arcadia Twp
195


Benzie County

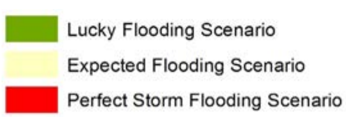

Panel #192
Flooding Hazards
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Buena
Pine
5th
4th
3rd
2nd
1st
7th
6th
Birch
Coolidge
Scenic
Easy
Birch
Cedar
Maple
Brook
Elberta Resort
Lost
Lower Herring Lake
White Owl
Herring
Lower Herring Lake
Stuart
Love
Boo Hoo
Watervale
Dolph



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


190
Gilmore Twp
191
192
Blaine Twp
193
194
Arcadia Twp
195

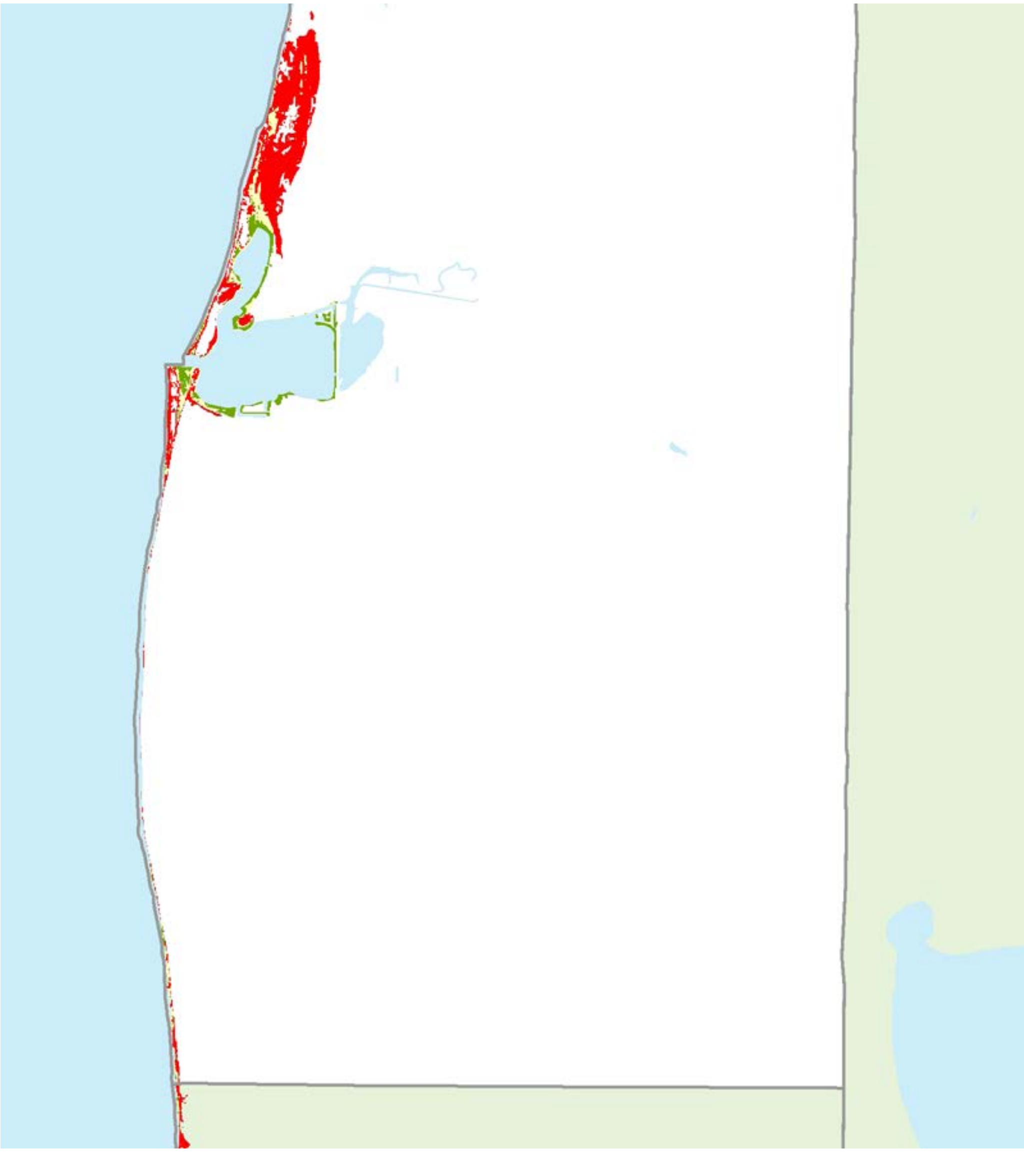

Benzie County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

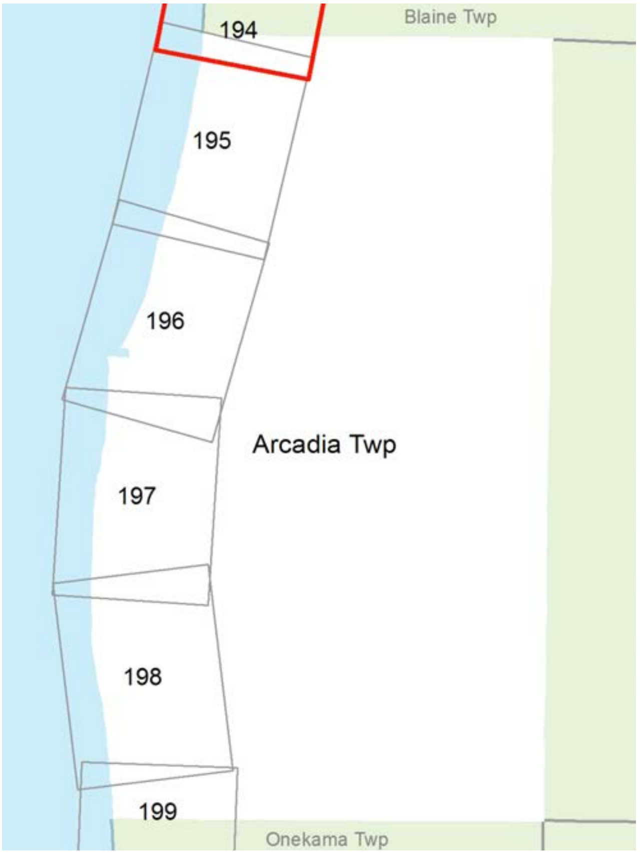

Panel #194
Flooding Hazards
Matzinger
Scenic
Saint Pierre
Blaine Twp
Arcadia Twp
Taylor
Northwood

Manistee County

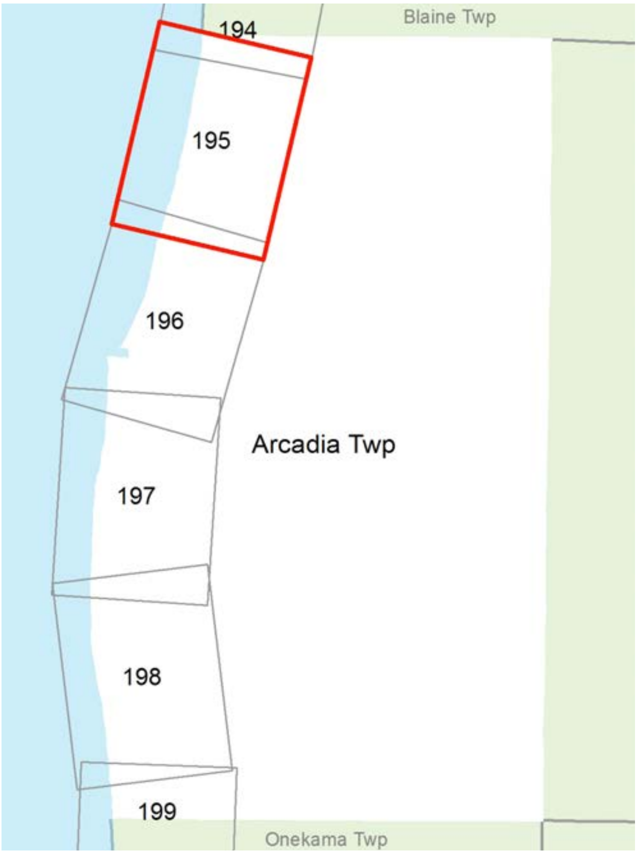
Arcadia Township



Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

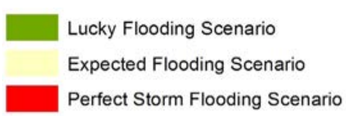


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

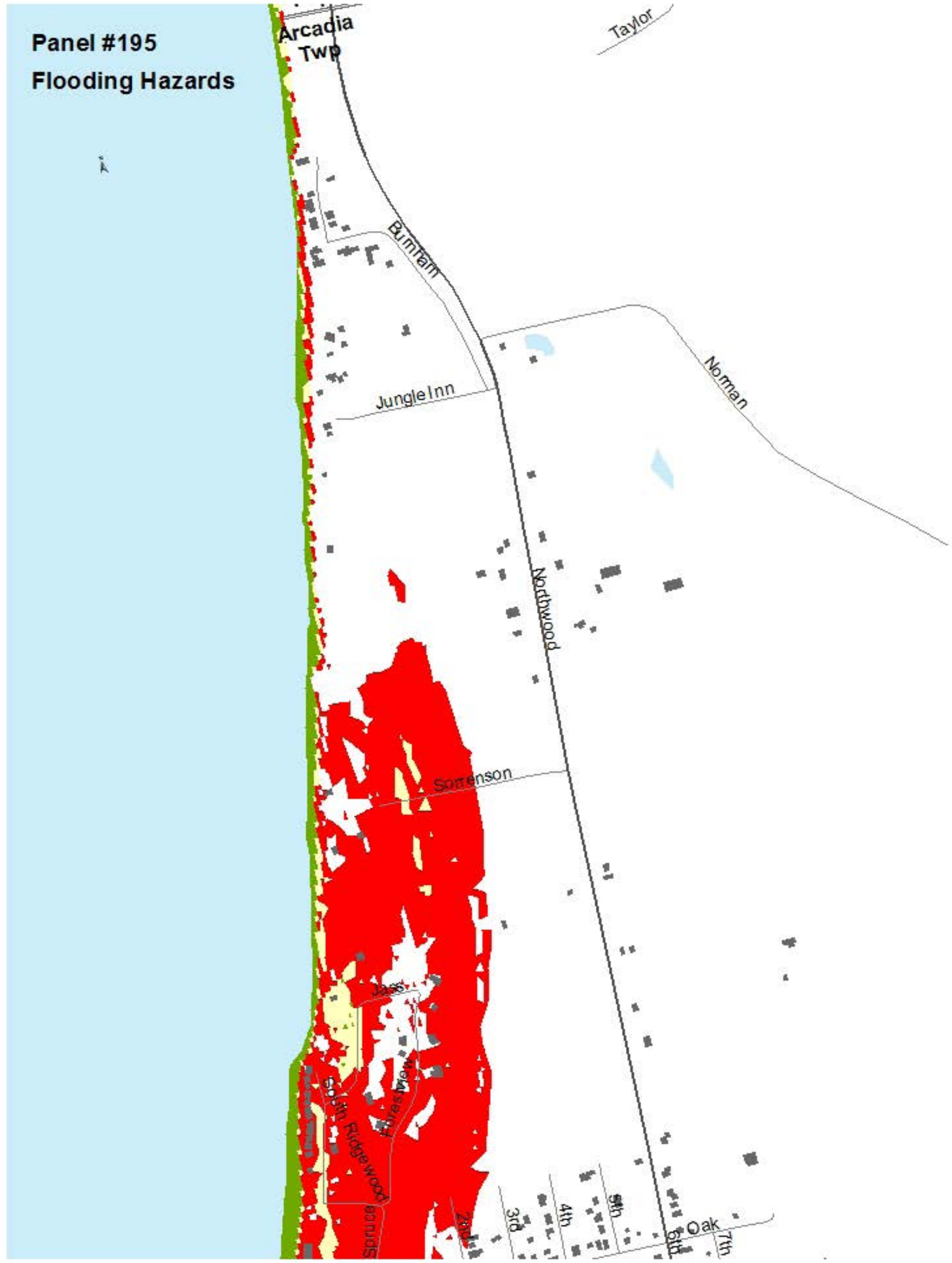


Blaine Twp
194
195
196
197
198
199
Arcadia Twp
Onekama Twp

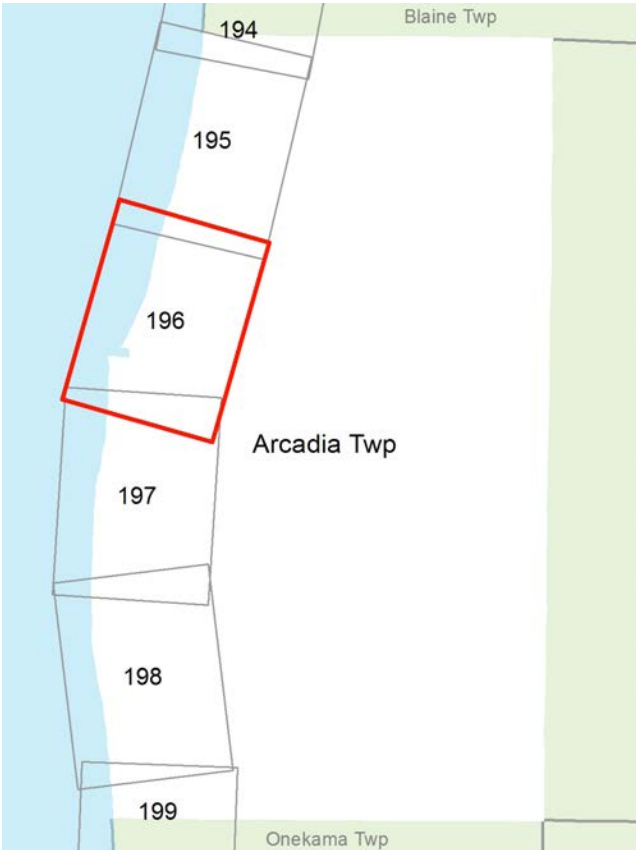
Manistee County



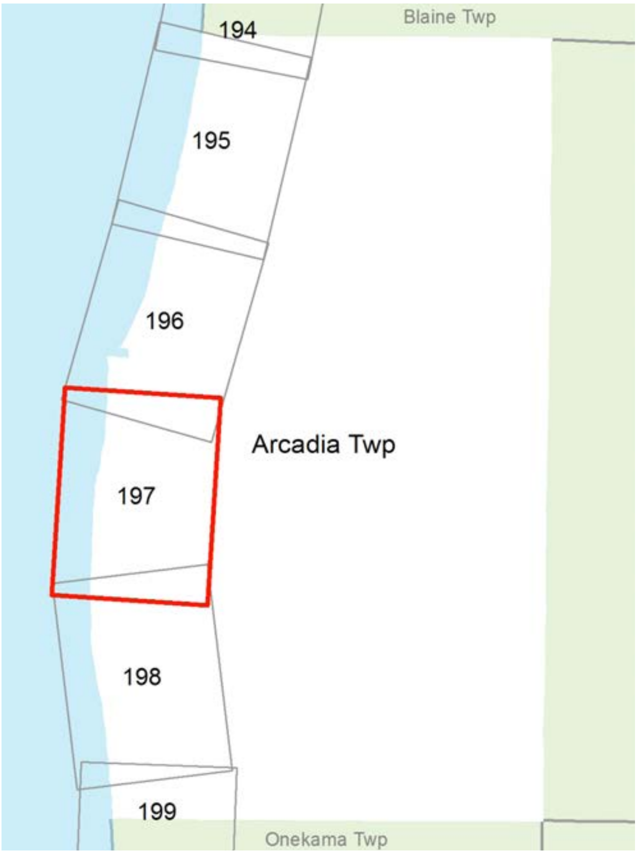
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



Panel #195
Flooding Hazards
Arcadia Twp
Taylor
Burntam
Norman
Jungle Inn
Northwood
Sorrenson
Jass
South Ridgewood
Forestview
Spruce
2nd
3rd
4th
5th
6th
7th
Oak



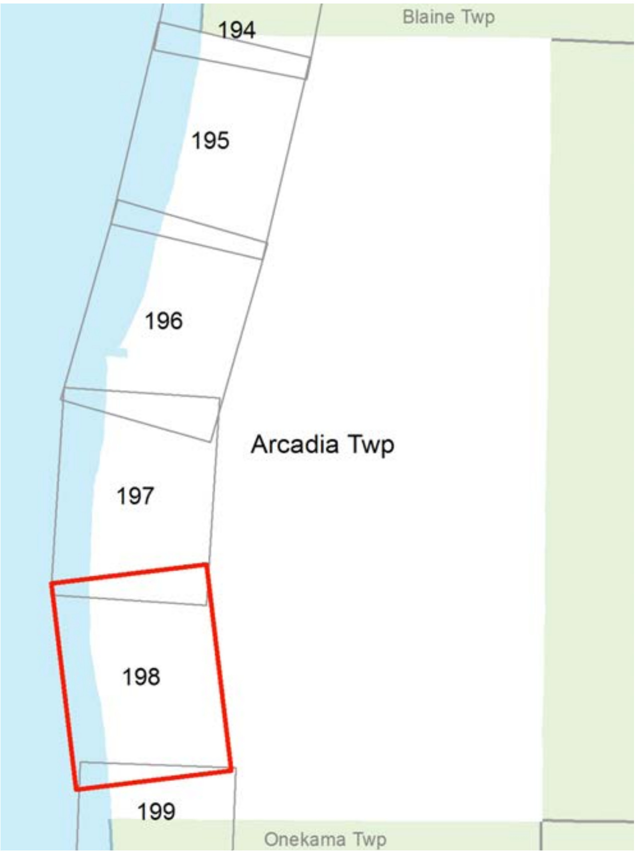
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Blaine Twp
194
195
196
197
Arcadia Twp
198
199
Onekama Twp

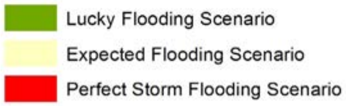

Manistee County

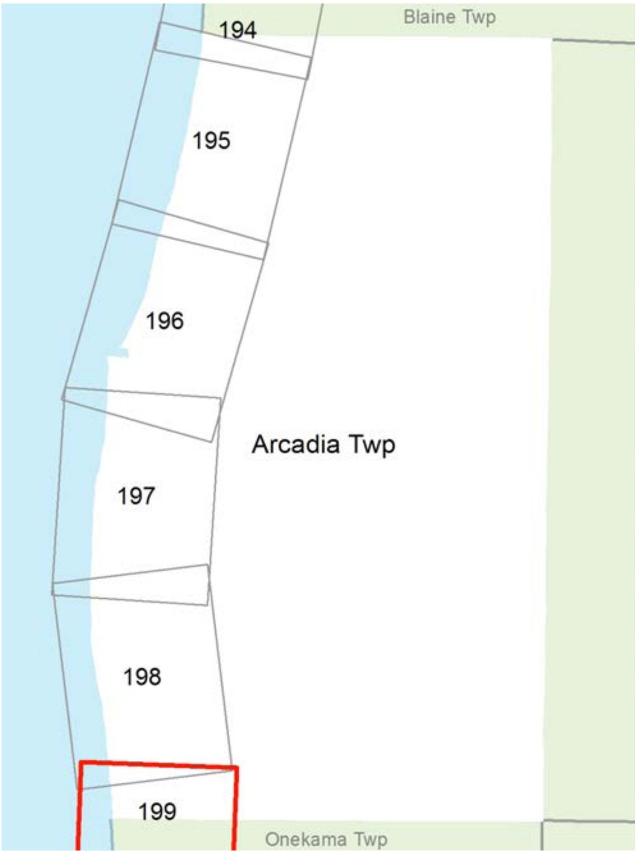

Panel #197
Flooding Hazards
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Northwood
Lake Bluff
Maxey
Paluszny
Bischoff


Panel #198
Flooding Hazards
Northwood
Schaef
Gear
Lakeview
Szerlong
Leos


Blaine Twp
194
195
196
197
198
199
Arcadia Twp
Onekama Twp

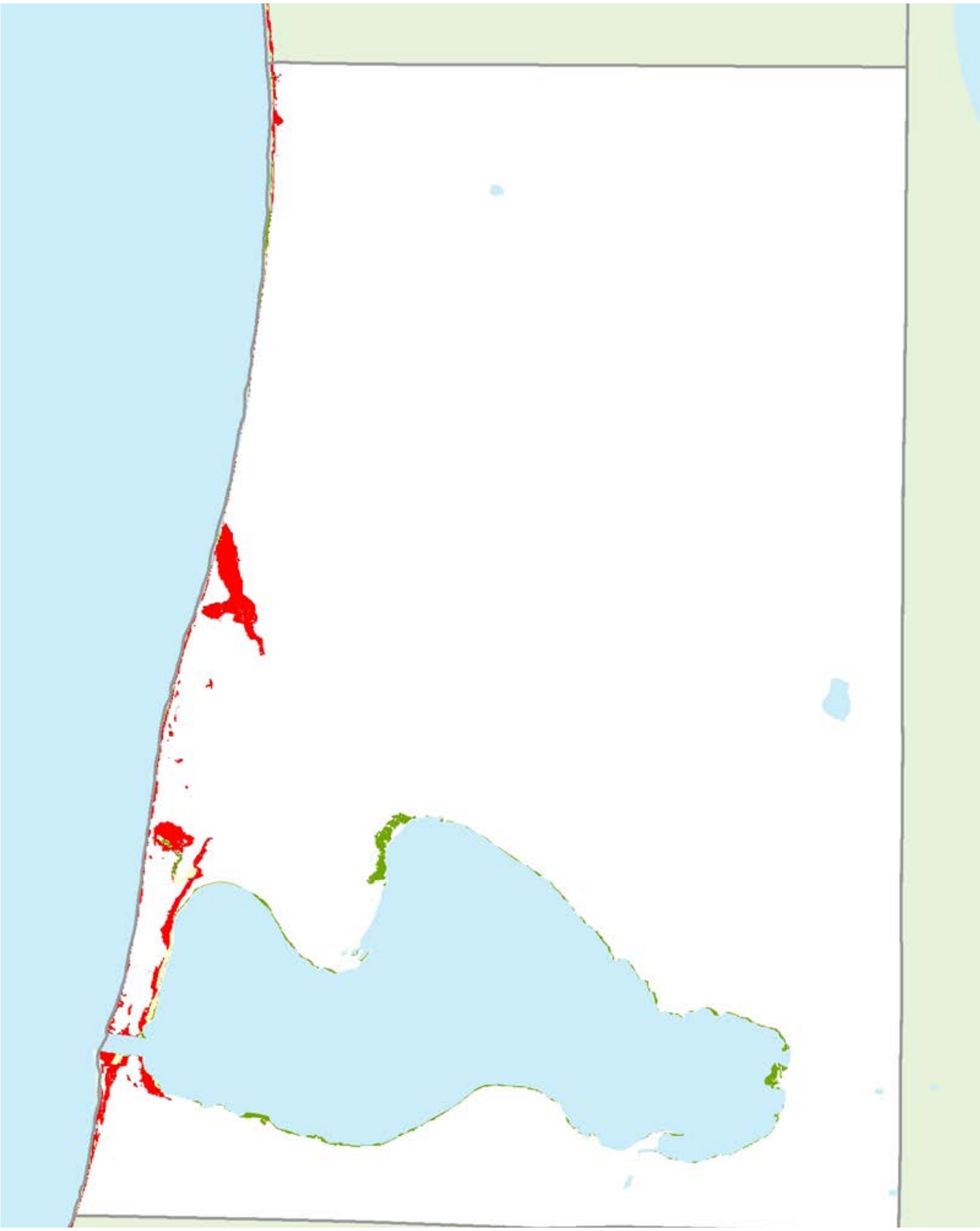

Manistee County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

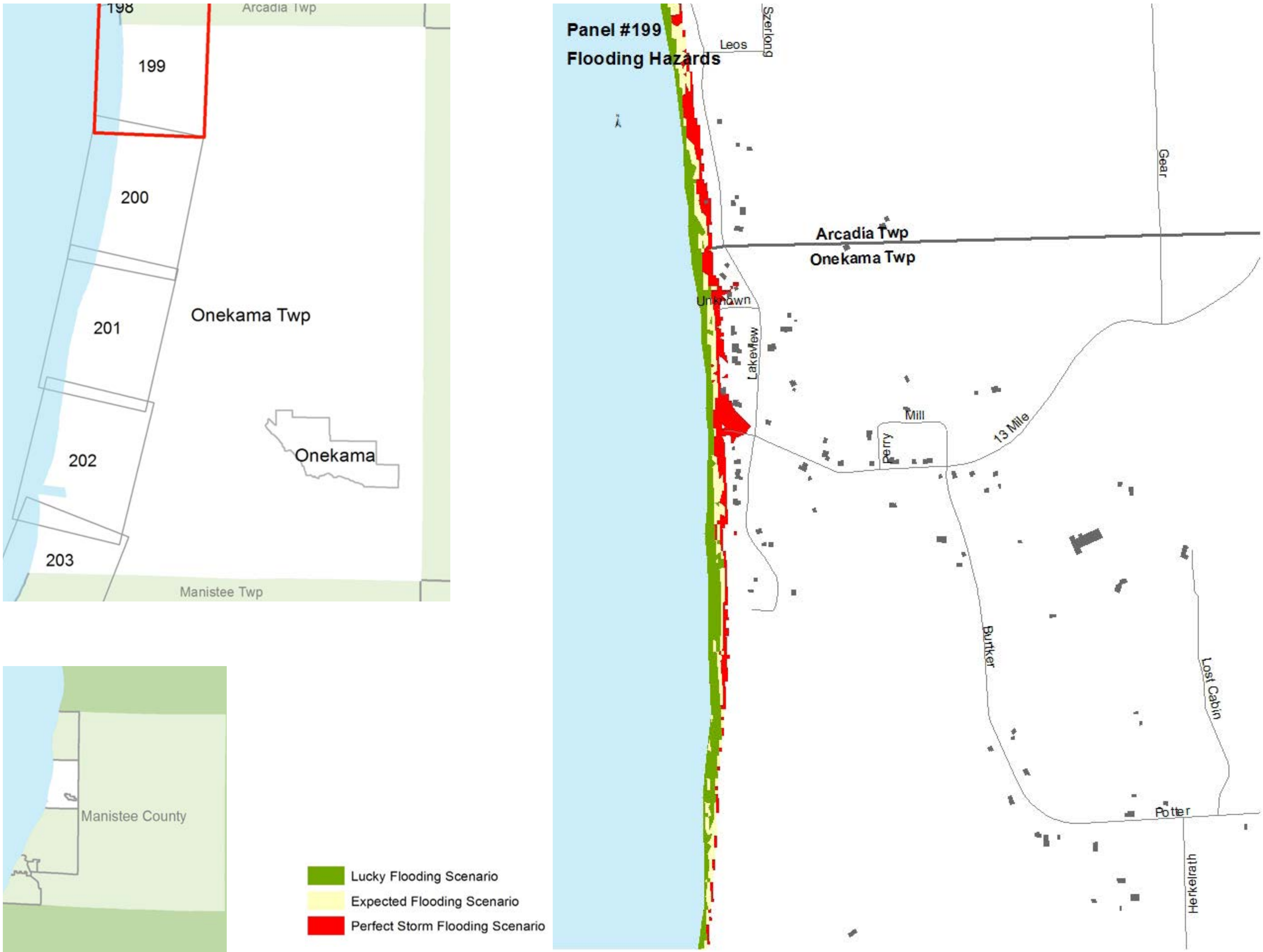


- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario

Onekema Twp.

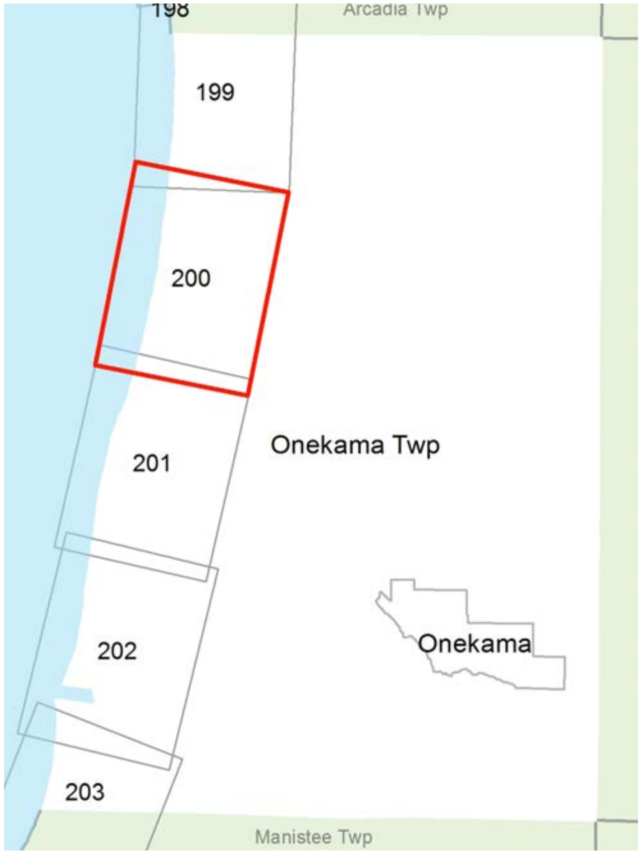


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

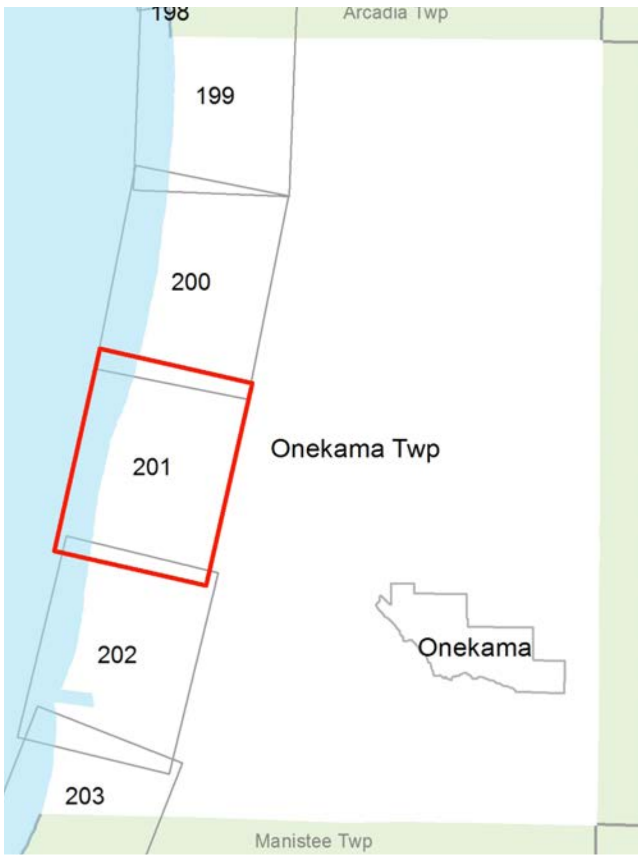


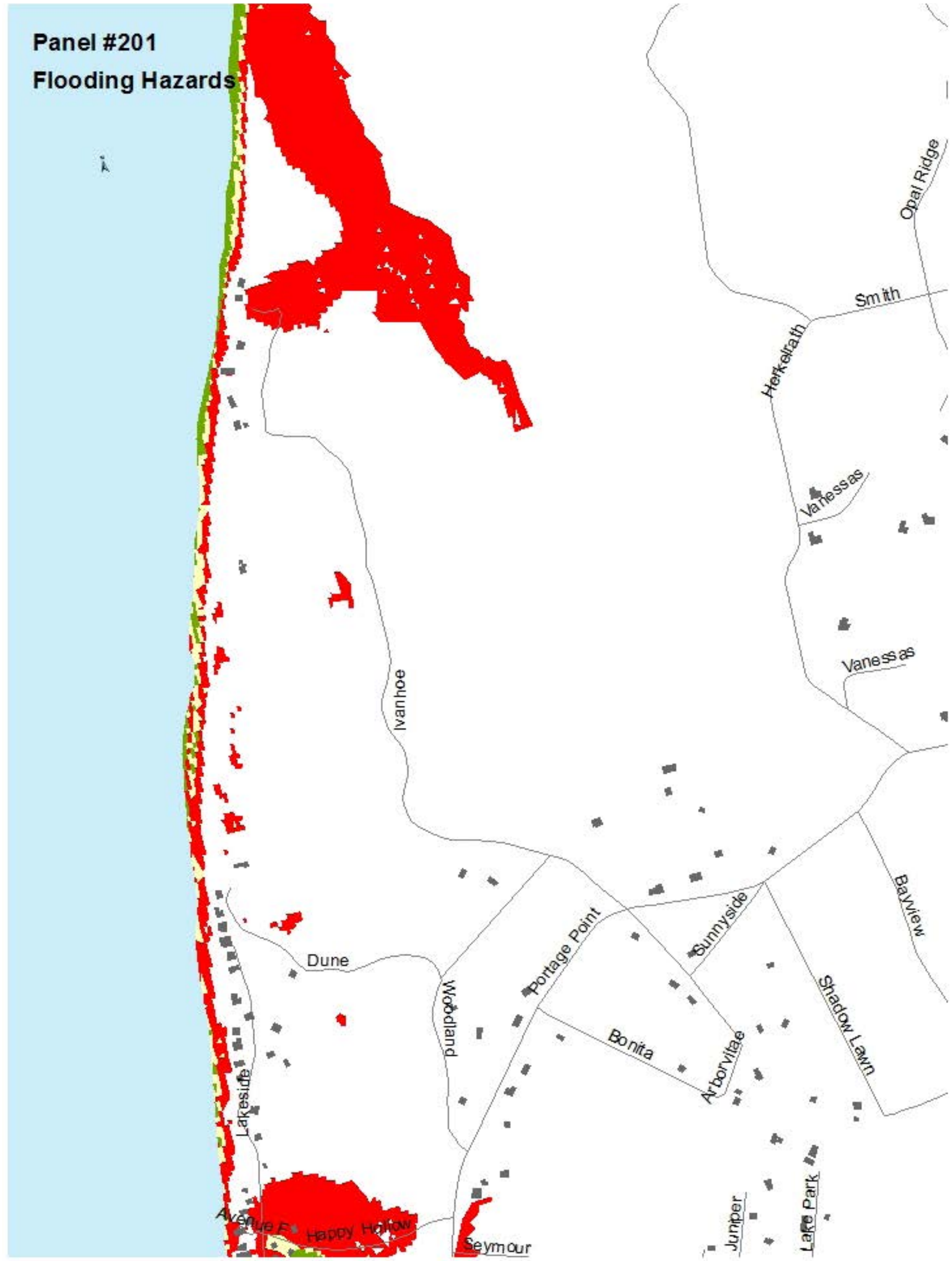
198
Arcadia Twp
199
200
201
202
203
Onekama Twp
Onekama
Manistee Twp
Manistee County
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario
Panel #199
Flooding Hazards
Leos
Szerlong
Gear
Arcadia Twp
Onekama Twp
Unknown
Lakeview
Mill
Perry
13 Mile
Burtker
Lost Cabin
Potter
Herkelrath


Panel #200
Flooding Hazards
Lukens
Herkerath
11 Mile
Ceylon
Herkerath
Starlight Ridge
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

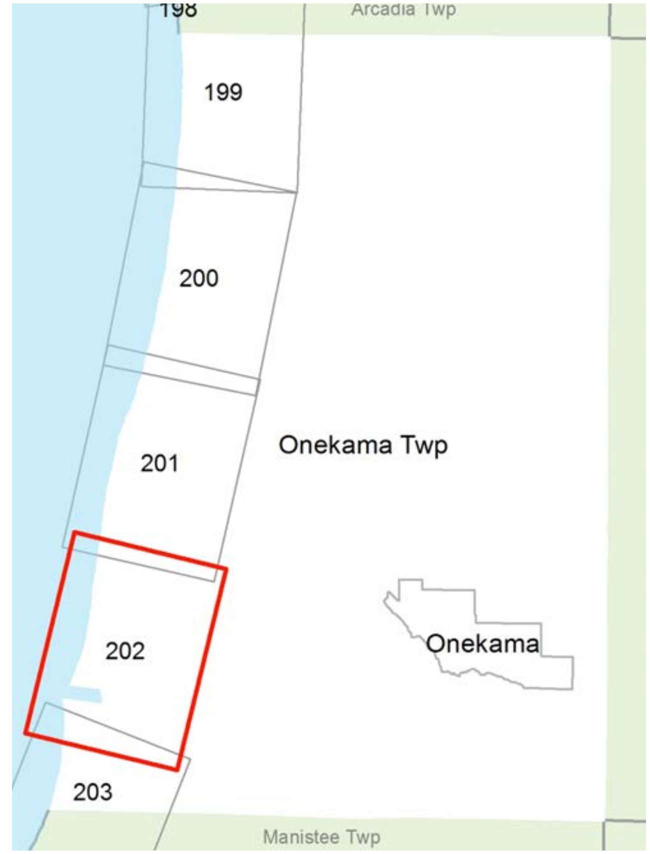

198
Arcadia Twp
199
200
201
Onekama Twp
202
Onekama
203
Manistee Twp


Manistee County

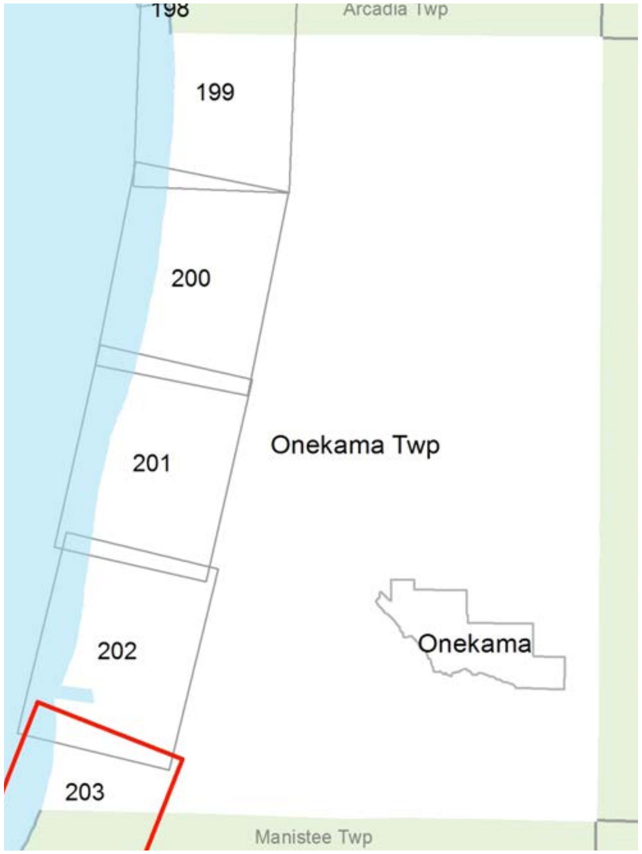




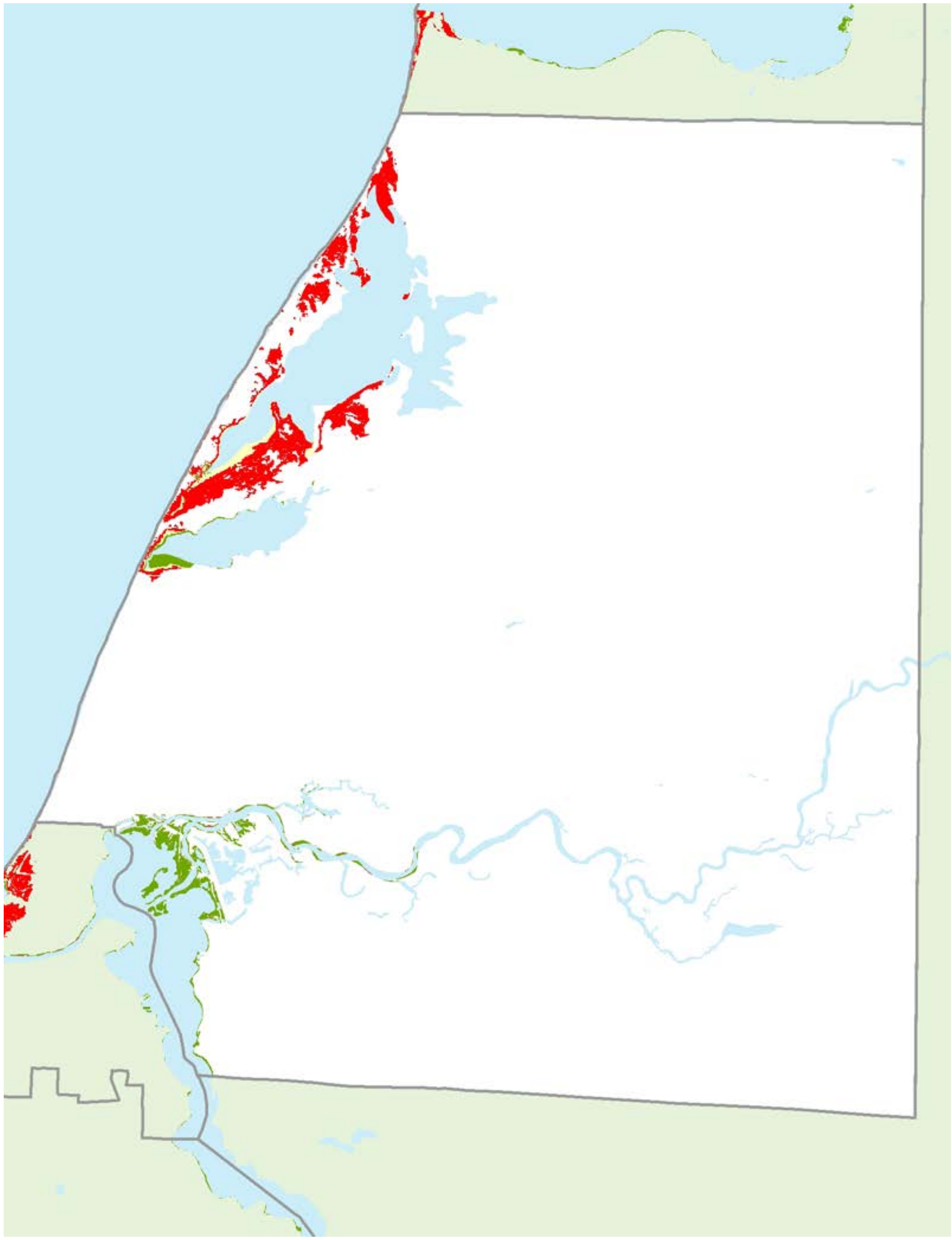
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



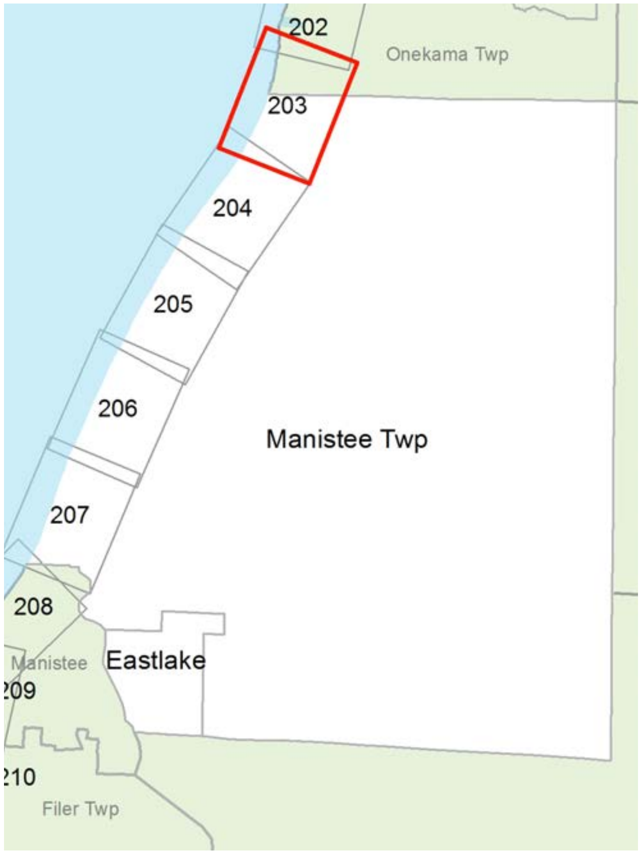
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



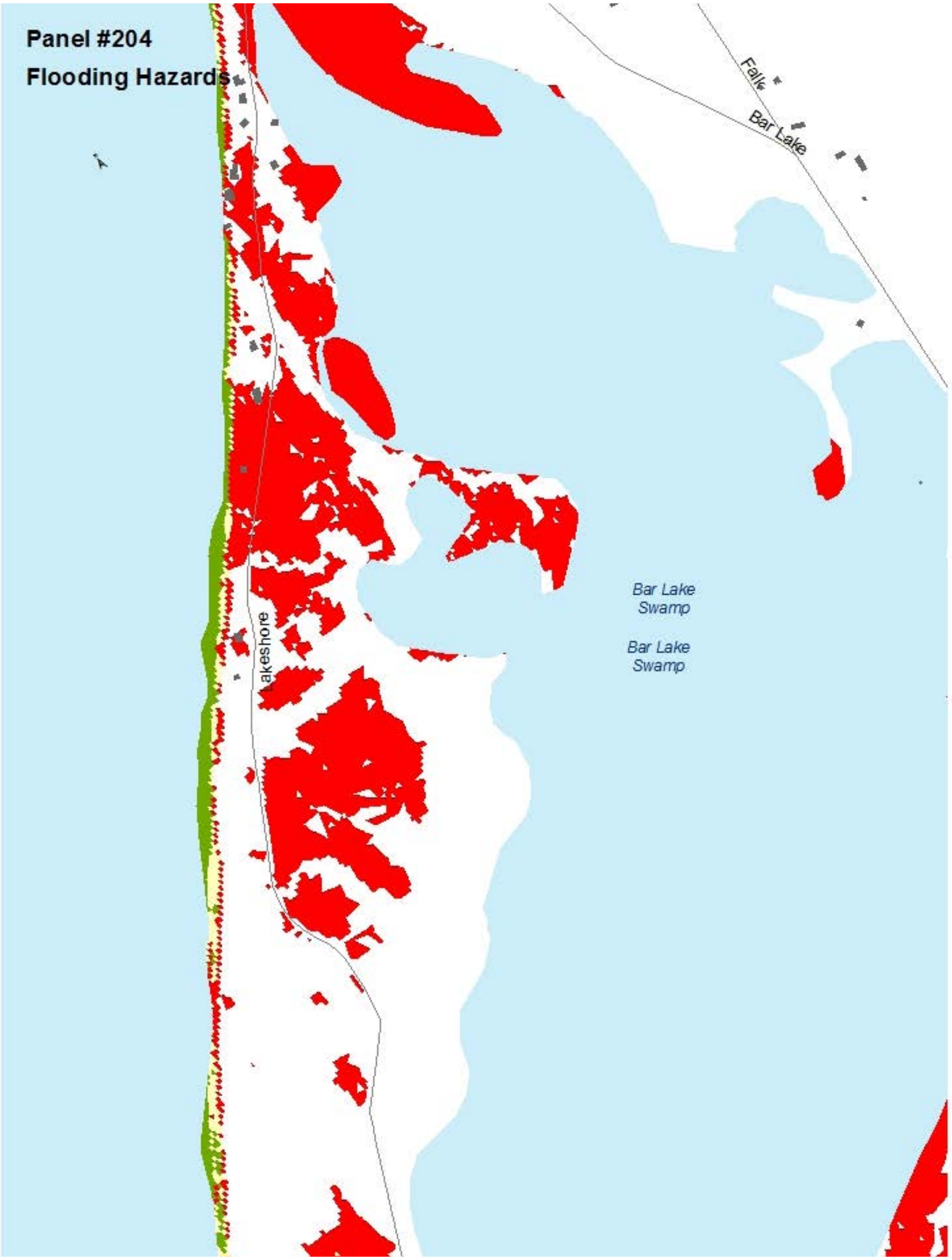
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

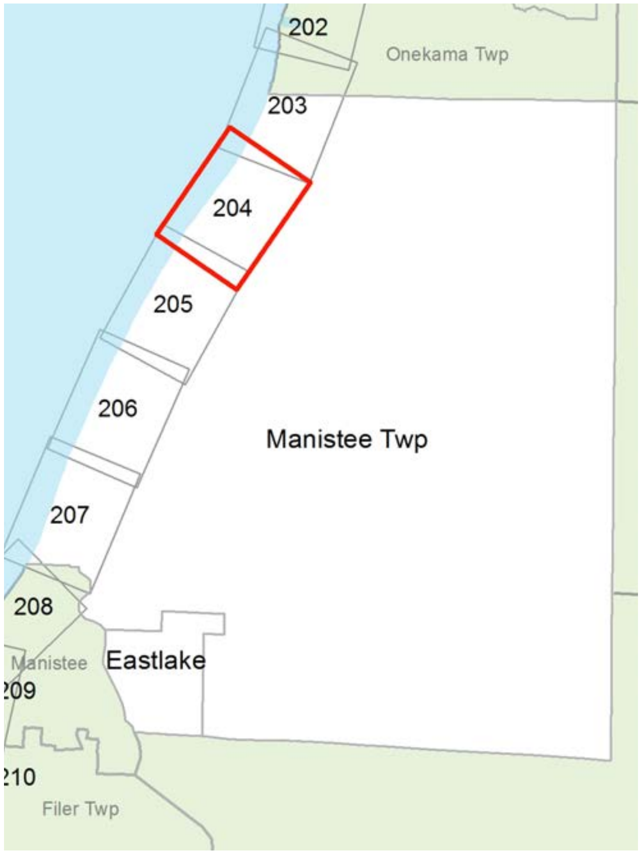


Manistee Twp.

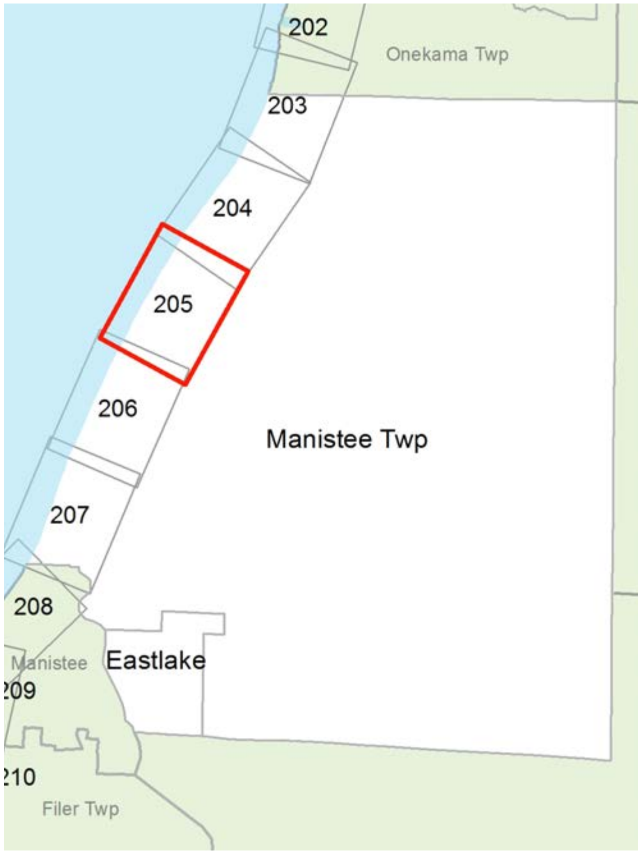


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Onekama Twp
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Manistee Twp
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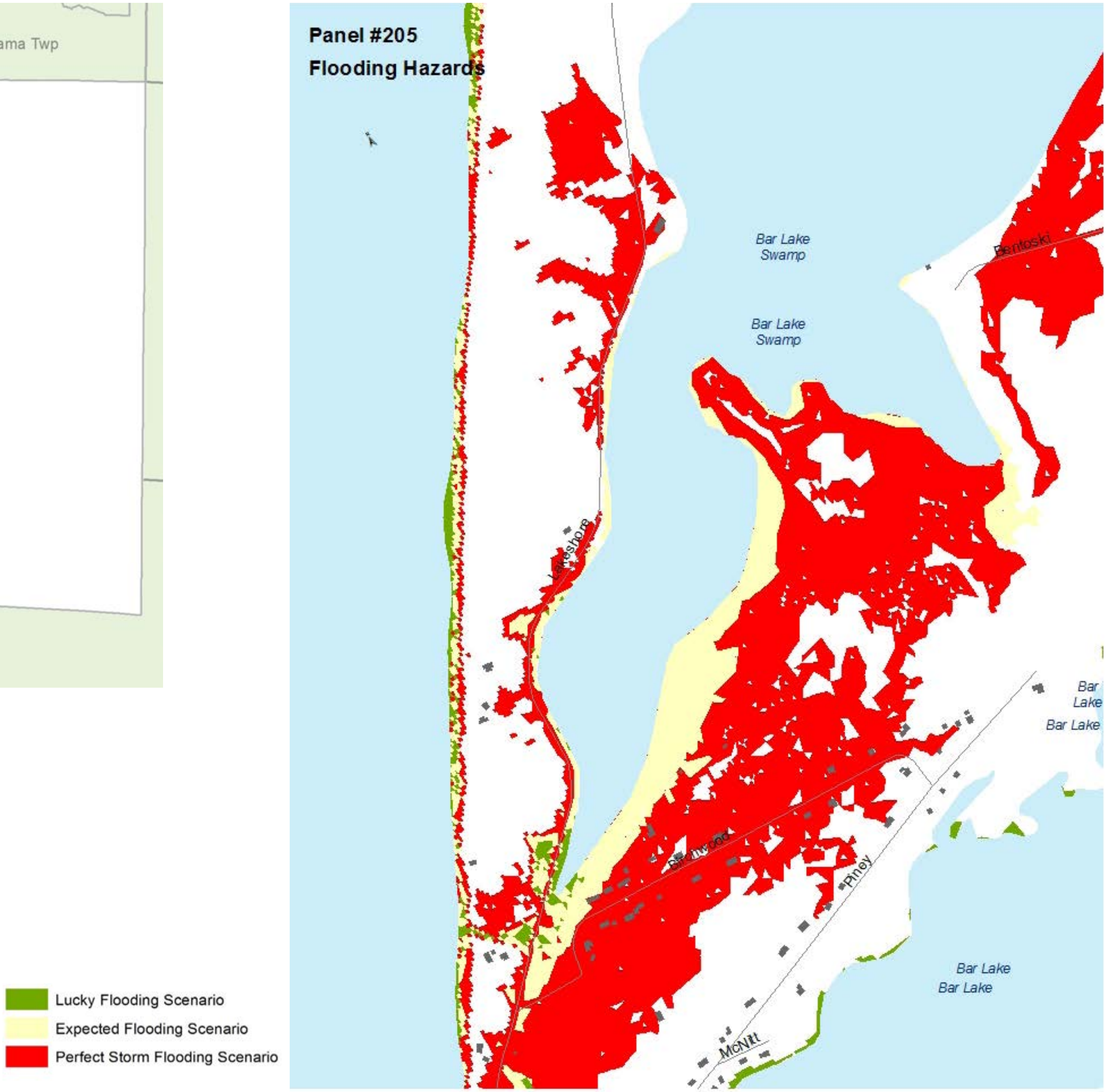
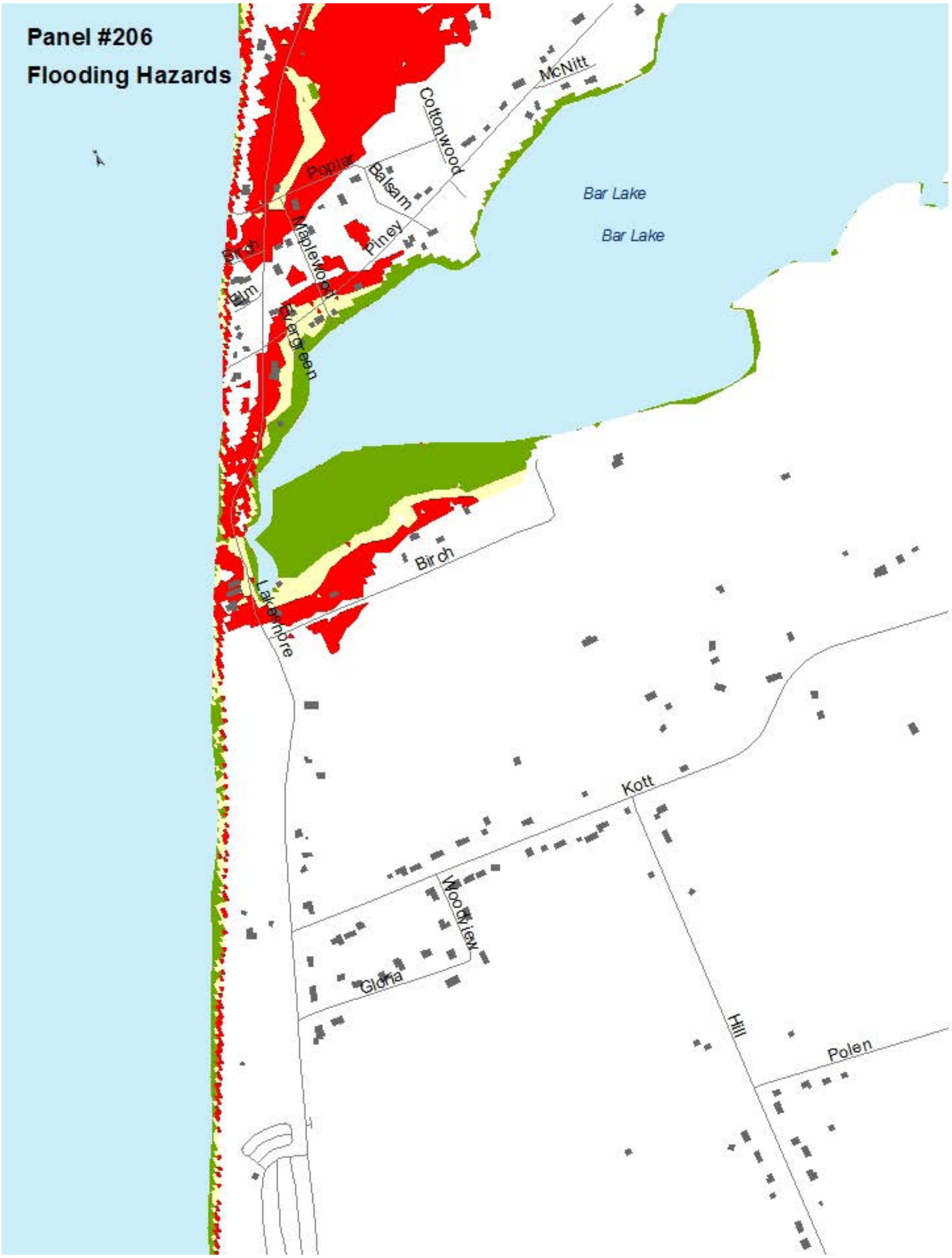
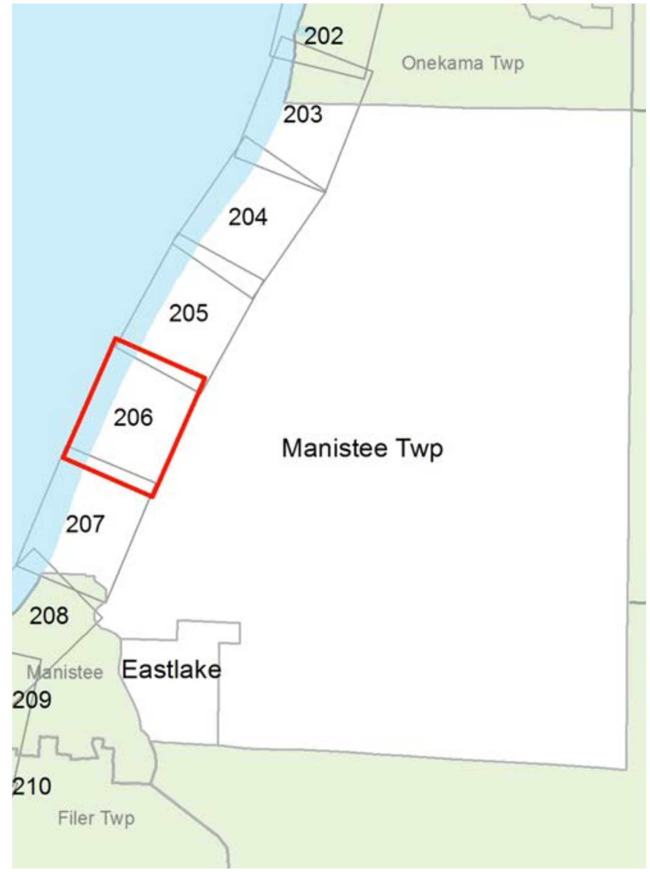
Manistee
Eastlake
209
210
Filer Twp

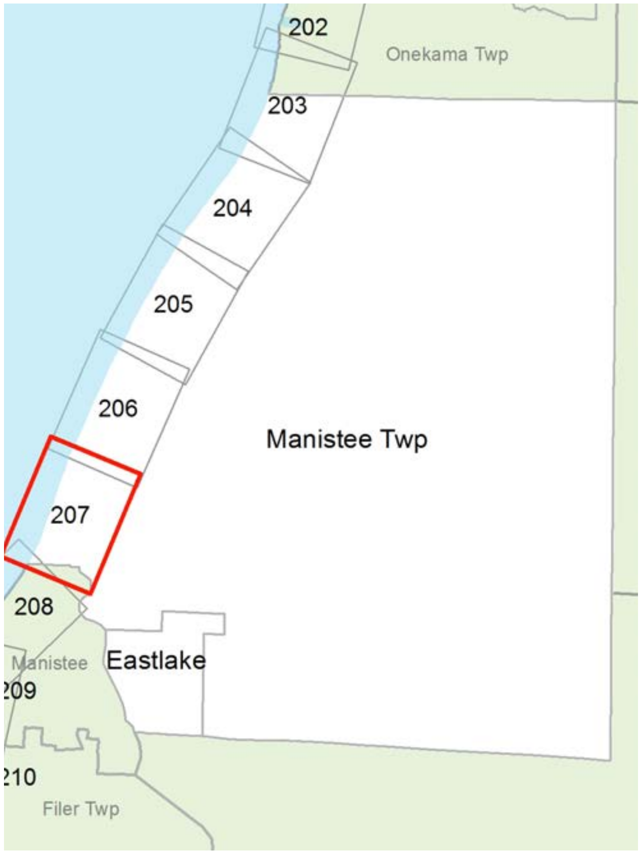

Manistee County


Panel #205
Flooding Hazards
Bar Lake Swamp
Bar Lake Swamp
Bentoski
Lakeshore
Birchwood
Piney
McNitt
Bar Lake
Bar Lake
Bar Lake
Bar Lake
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario





Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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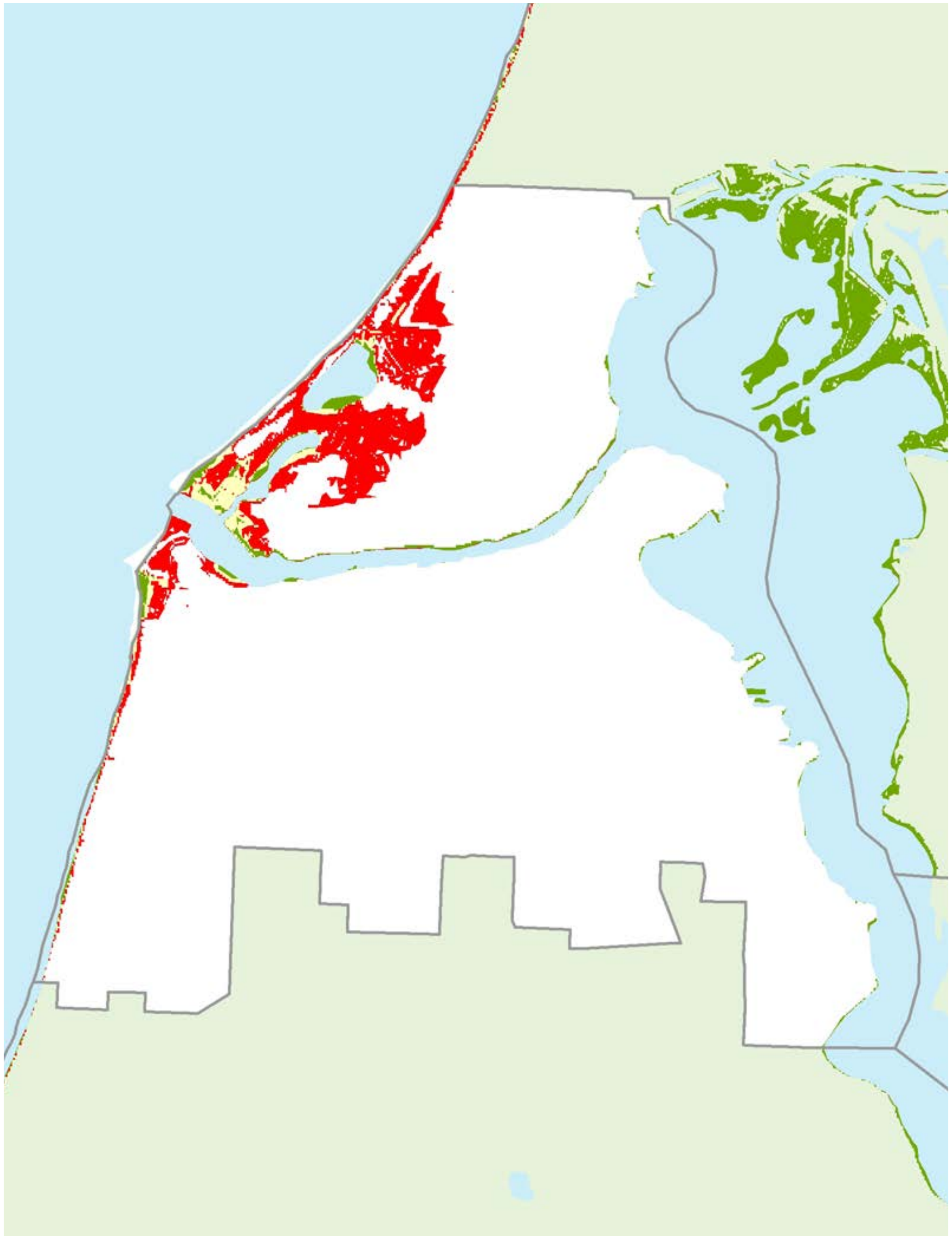
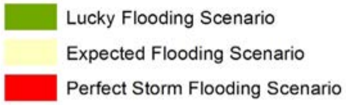
Manistee Twp
207
208
Manistee
Eastlake
209
210
Filer Twp

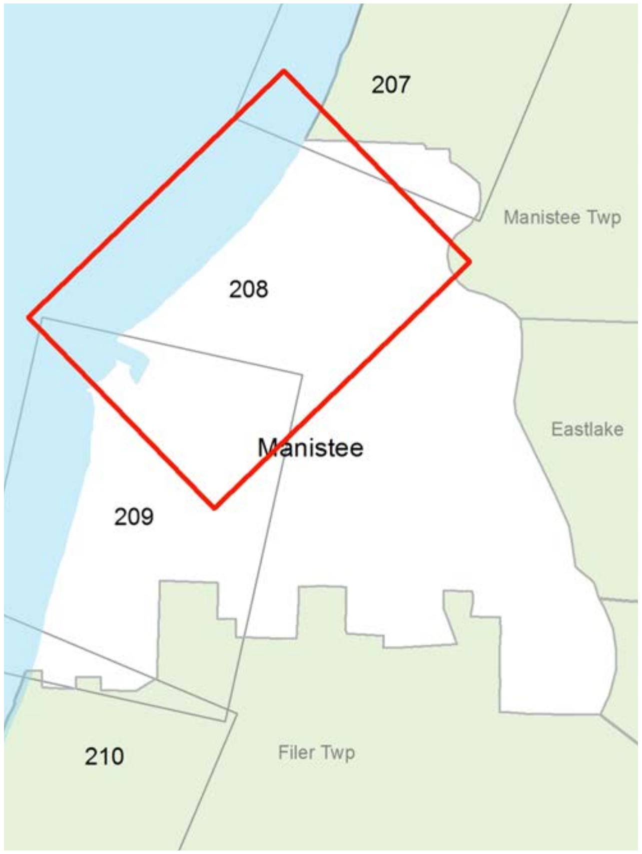

Manistee County


Panel #207
Flooding Hazards
Orchard Beach SP Campground
Elliott
Driftwood
Lakeview
Surfside
Mar Lawn
Hillcrest
Lakeshore
Hill
Condon
Hahn
Snape
Gillespie
Parkdale
Manistee Lake
Manistee Twp
Manistee
Veterans Oak Grove
Washington
Arthur
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario



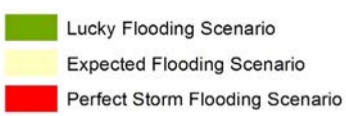
Manistee City

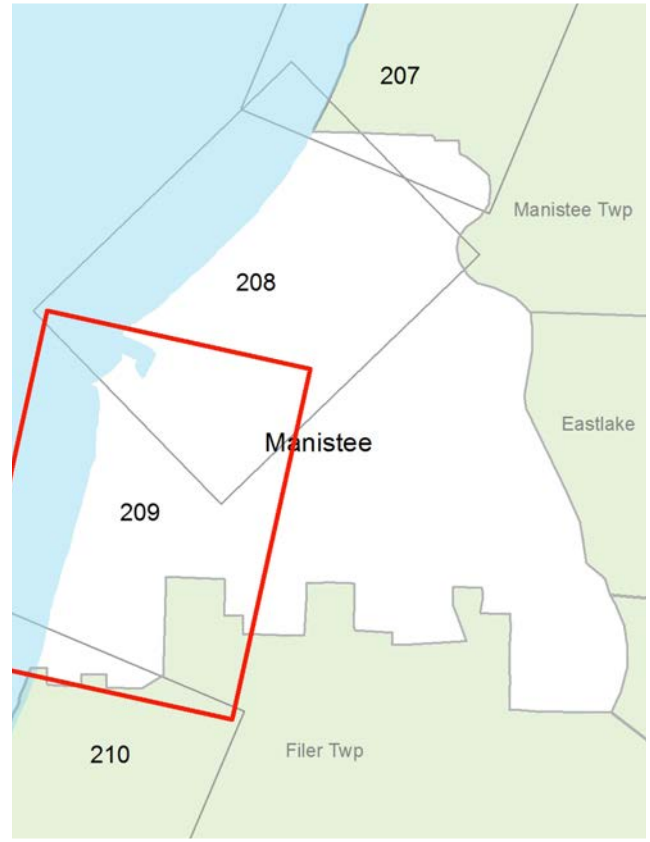



207
Manistee Twp
208
Eastlake
Manistee
209
210
Filer Twp


Manistee County


Panel #208
Flooding Hazards
Manistee Twp
Manistee
Manistee Lake
Manistee Lake
Veterans
Oak Grove
Arthur
Cleveland
Jackson
Van Buren
Harrison
Lincoln
Jefferson
Taylor
Fillmore
Memorial
Madison
Washington
Quincy
Residential
Monroe
Grove
Duffy
Saint Marys
Hughes
Ford
Franklin
Fremont
Short
Maple
Cottage
Broadway
Oakwood
Mellizer
Daniels
River
Oak
Pine
Water
North
Hastings
Spruce
Elm
Cedar
Tamarack
Harvard
Birch
Bryant
Broad
Lakeshore
Beach
Lighthouse
Landings
Cherry
Harbor Point
Anchor Ridge
Lakeside
5th

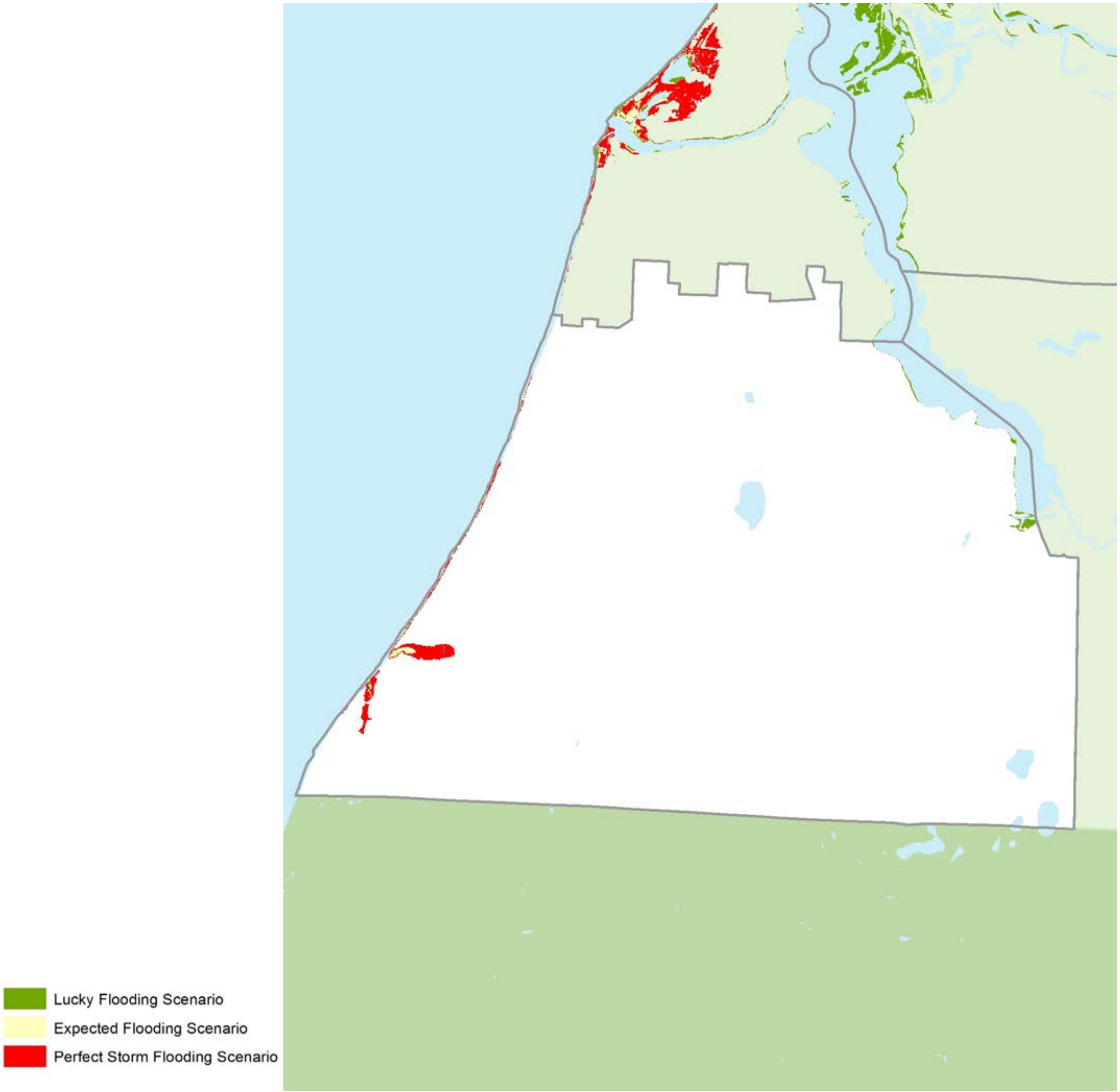

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

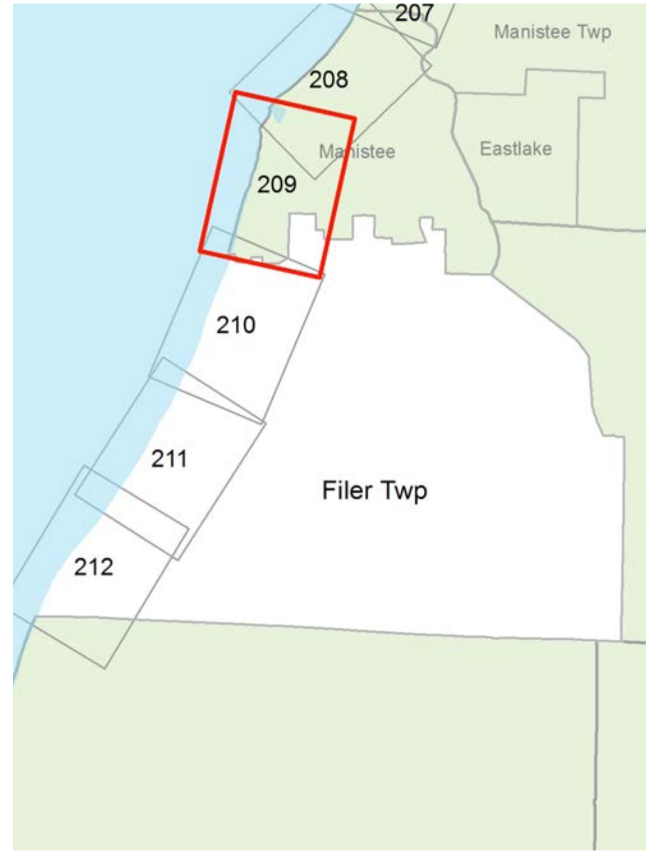


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

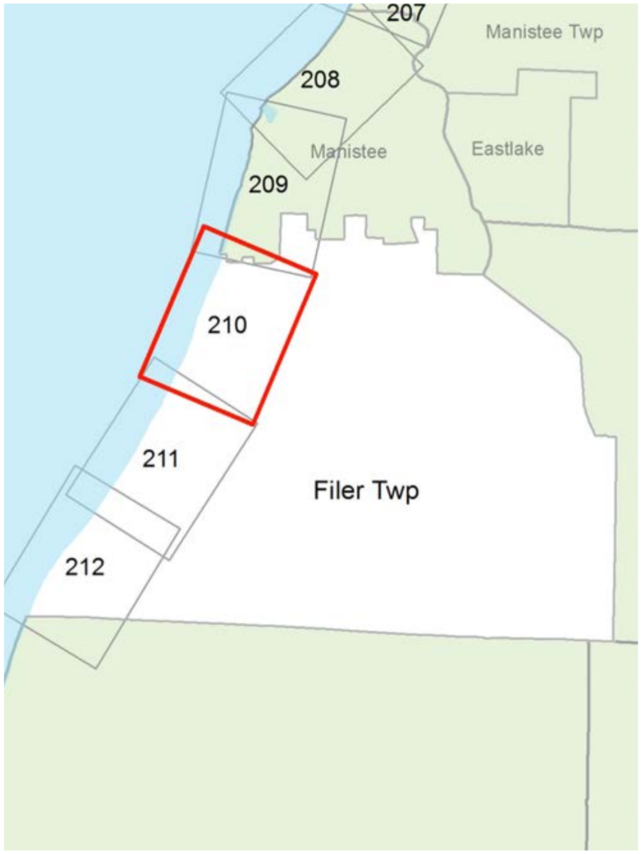
Filer Twp.


Manistee County


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

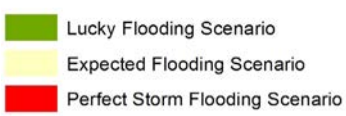


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario

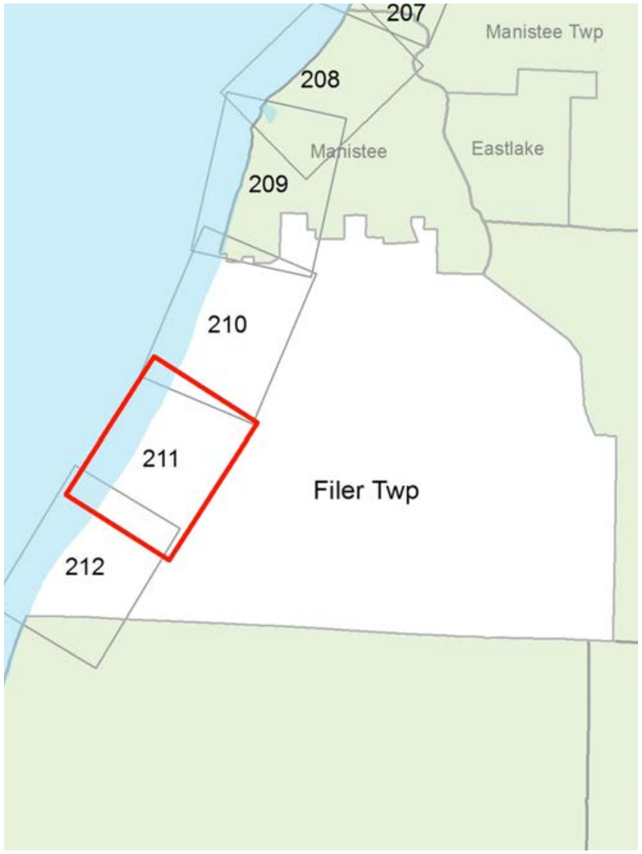

207
Manistee Twp
208
Manistee
Eastlake
209
210
211
Filer Twp
212


Manistee County


Panel #210
Flooding Hazards
Merkey
Manistee
Filer Twp
Snow Trails
Blossom
Cherry
Fruit
Anthony
Red Apple
Old Red Apple
Wildwood


Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #211
Flooding Hazards
Indian Trail
Red Apple
Henker
Stan Del
Aikens
Fox Farm
Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario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Manistee Twp
208
Manistee
Eastlake
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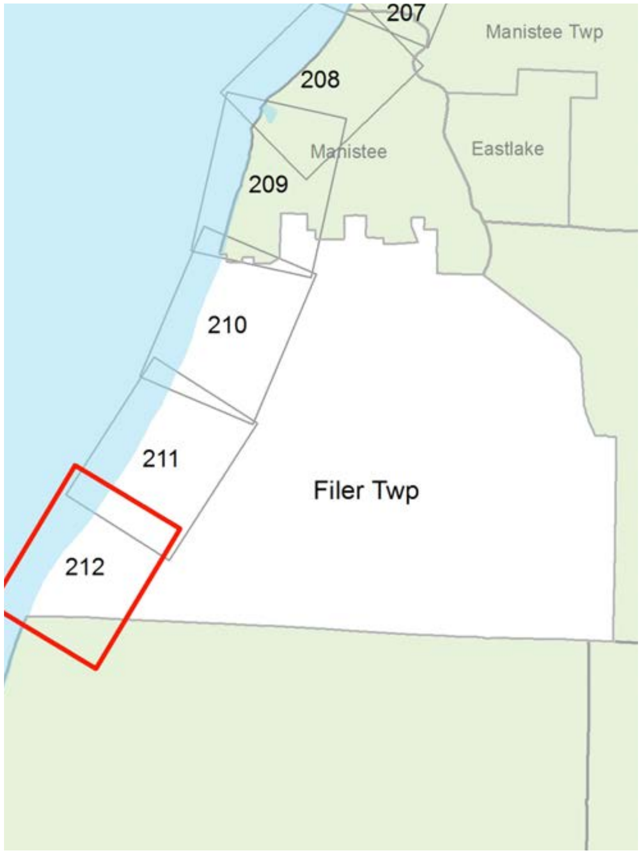
210
211
Filer Twp
212


Manistee County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Manistee Twp
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Manistee
Eastlake
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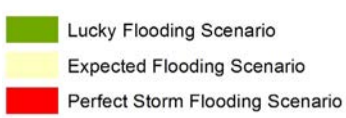
210
211
Filer Twp
212


Manistee County

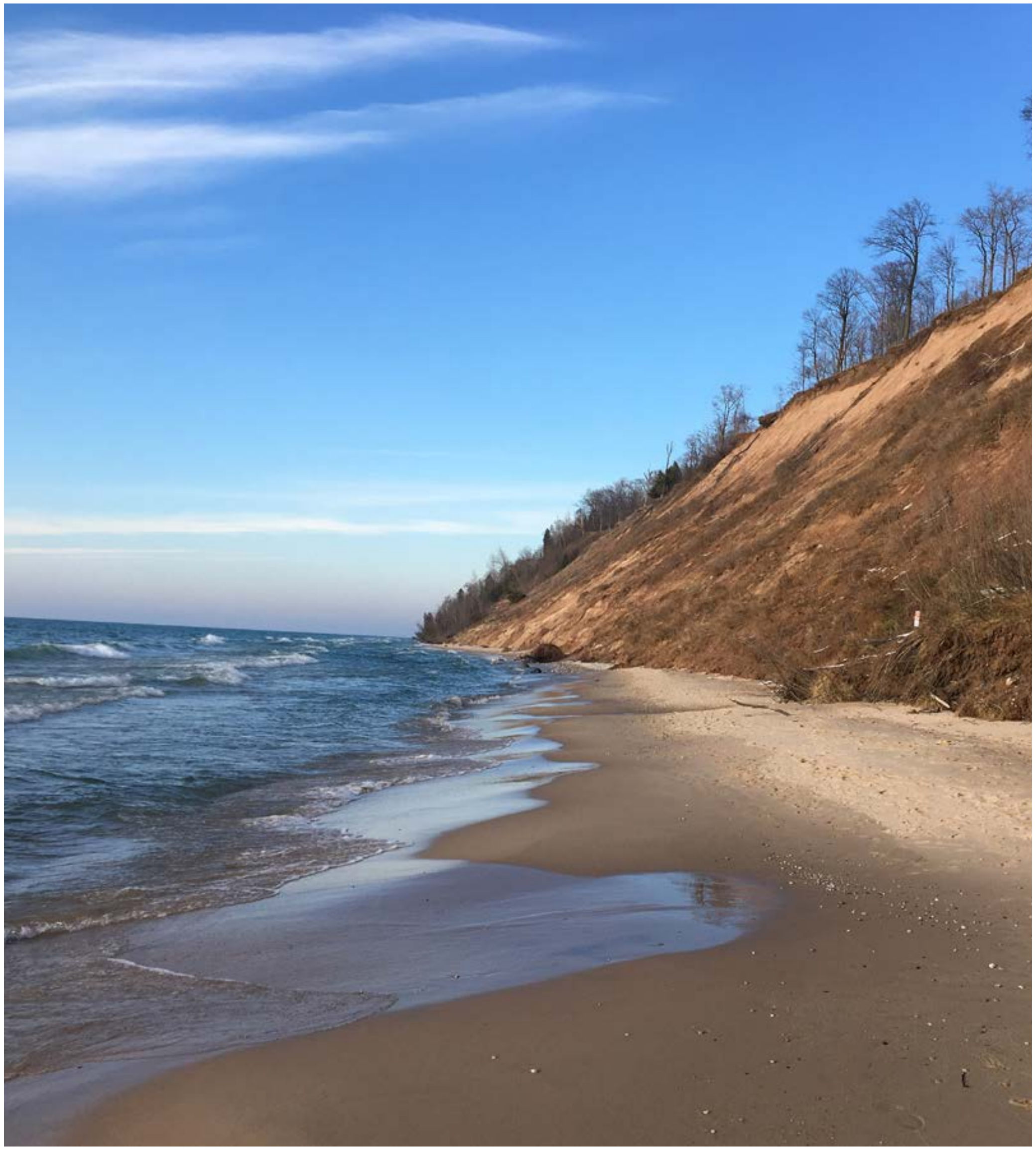

Lucky Flooding Scenario
Expected Flooding Scenario
Perfect Storm Flooding Scenario


Panel #212
Flooding Hazards
Red Apple
College
University
University
Fox Farm
Pro Club
County Line

CHAPTER 4
Coastal Recession

As previously discussed, Great Lakes water level fluctuations do not result from the moon's gravitational pull like oceans, but from cyclical changes in rainfall, evaporation, and riverine and groundwater inflows. 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.

Unlike our nation's ocean coasts (which change in shoreline level over a 24-hour tidal period), the significantly longer time spans of mean water level change on the Great Lakes give the beach and nearshore region significant time to readjust to new water levels and wave characteristics. During multiple years of high-water levels, wave base moves landward, coastal erosion (bluff and beach) is accelerated, and the nearshore profile steepens. Conversely, during prolonged years of low water levels the reverse happens, although not completely. As the wave base moves offshore, coastal erosion decreases but it does not always stop completely, and the beach area grows larger. Because the beach readjustment from high water episodes to low water episodes is not complete (due to losses of beach sediment to offshore and into longshore sediment traps), there exists a net shoreline retreat over several cycles. For most Great Lakes shoreline, this is on the order of one foot per year of coastal retreat.



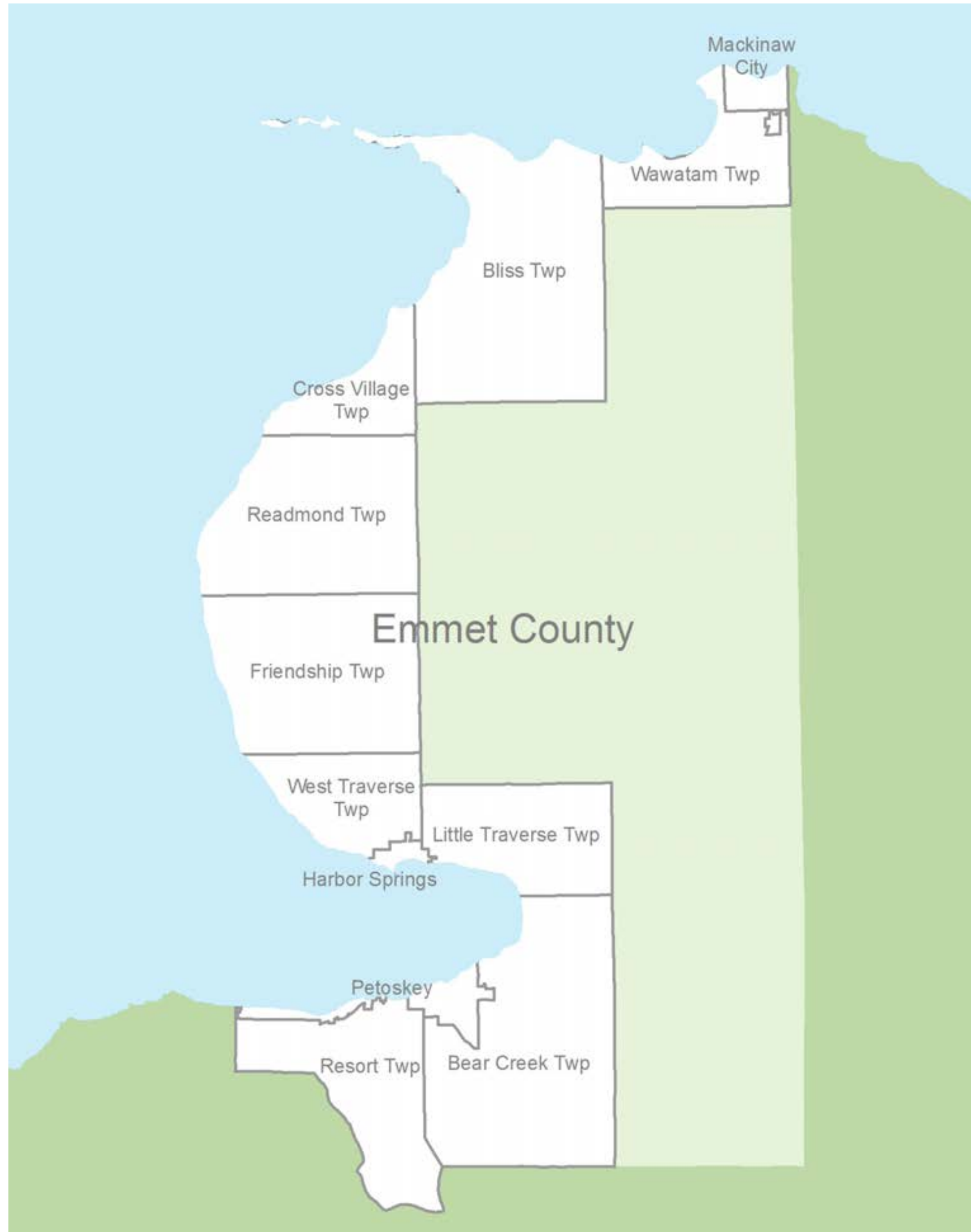
Accretion is the process of coastal sediment (sand) returning to the beach from the movement of waves and currents. Over time, this sand dries out and is blown to other areas of the beach by the prevailing winds, causing the beach to appear inflated and wider. However, during periods of rising lake levels, any apparent “accretions” are quickly lost. Even worse, those short-lived beaches can be lost especially quickly because the cumulated materials are unconsolidated and easily eroded during storm events (i.e., more so than shorelands not yet attacked by erosional processes with post-glacial compaction). These issues are exacerbated in coastal regions with high glacial bluffs or unstable perched dunes. To make matters even worse during high water years in the Great Lakes, the storms that bring increased precipitation (which results in the high water within the basin) also bring more frequent and greater wind events, resulting in a 25% increase in wave energy at the shoreline. Higher water levels coupled with higher waves can produce devastating coastal results.

Unlike ocean coasts, which are now facing a steady (if accelerating) submersion from rising sea levels, Great Lakes shorelands have always eroded (and been periodically submerged) in fits and starts — taking two steps inland, then one step back, then two steps inland — as lake levels fluctuate up and down over time. Unfortunately, the decadal timeline for these fluctuations aligns with short memories, such that pressures to build in nearshore areas continually grow as lake levels stay down for extended periods. Hence, one of the big challenges for Great Lakes coastal communities is convincing shoreland property owners and public officials that the large sandy beaches they see in front of their homes are likely only temporary in their current state and require regulatory actions to prevent risky development there.

The project team used data from Michigan Technological University (MTU) to develop the following maps of historic shoreline and bluffline recession along the Lake Michigan coastline, along with a 30-year projection for further natural recession along bluffs. The default base map representing “present day” is from 2016. Occasional gaps in shoreline data do occur and indicate that data could not be secured by the research team for that given stretch of shoreline.

The shoreline and bluffline recession maps are organized first by county, then by each local jurisdiction within that county for which data is available. At least one “zoomed in” detail example of historic bluffline recession and future projections is provided at the beginning of each county section of this chapter. These maps are only part of the available data; shoreline and bluffline recession data can be viewed in greater detail online at http://geospatialresearch.mtu.edu/czmp. The online viewer was developed by the Great Lakes Research Center at MTU.

Emmet County

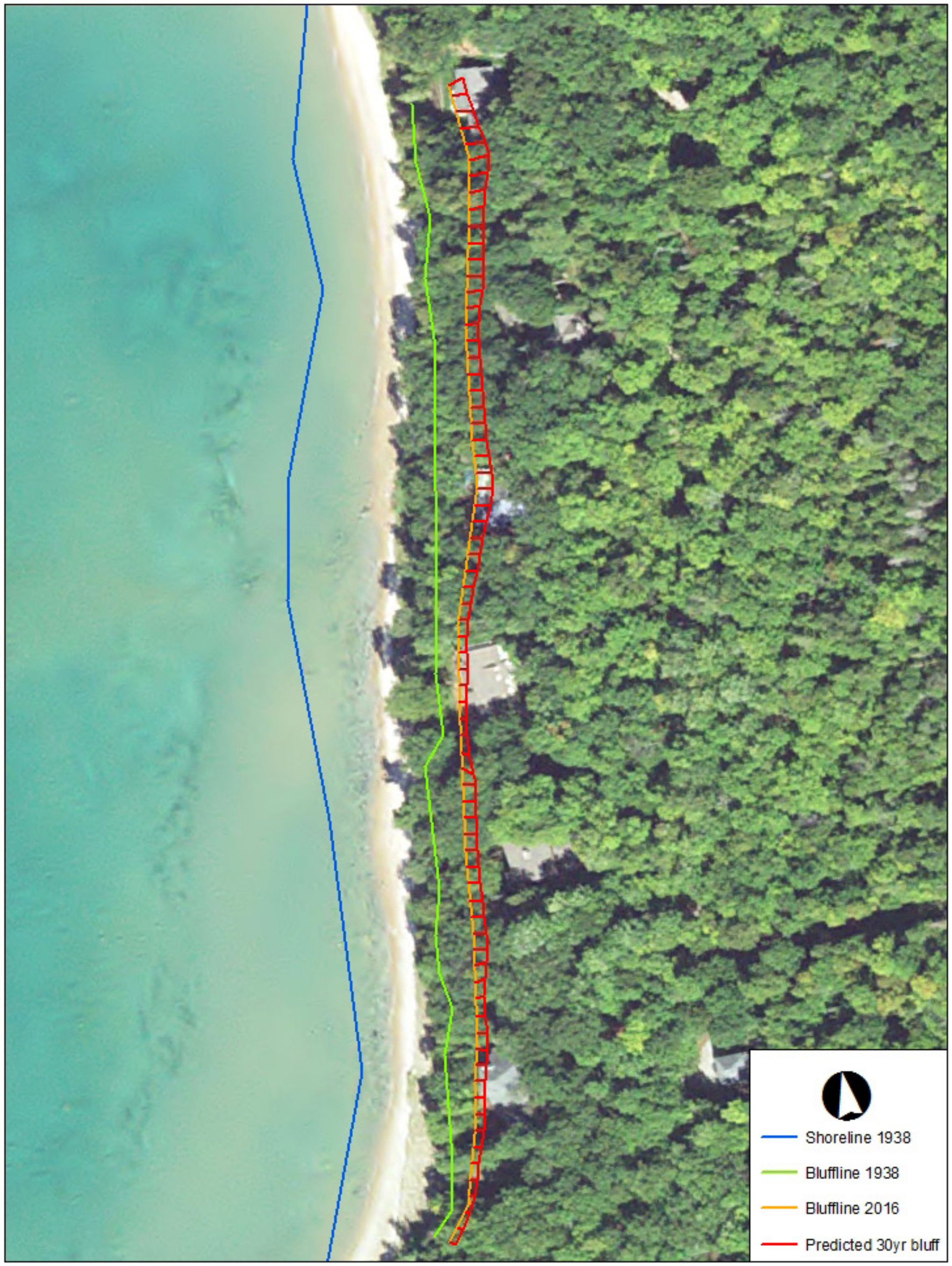


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

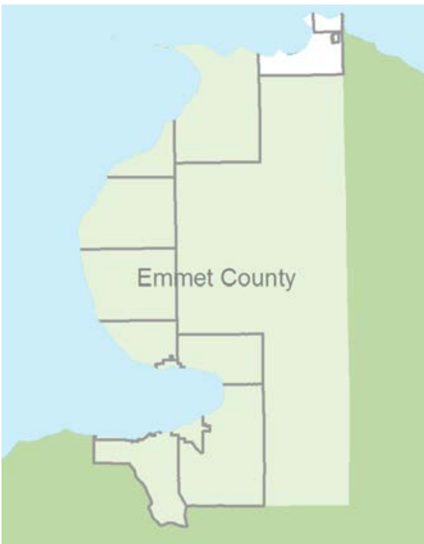
BLUFF RECESSION DETAIL

At least one "zoomed in" detail example of historic bluffline recession and future projections is provided at the beginning of each county section of this chapter. Shoreline and bluffline recession data can be viewed in greater detail online at http://geospatialresearch.mtu.edu/czmp.

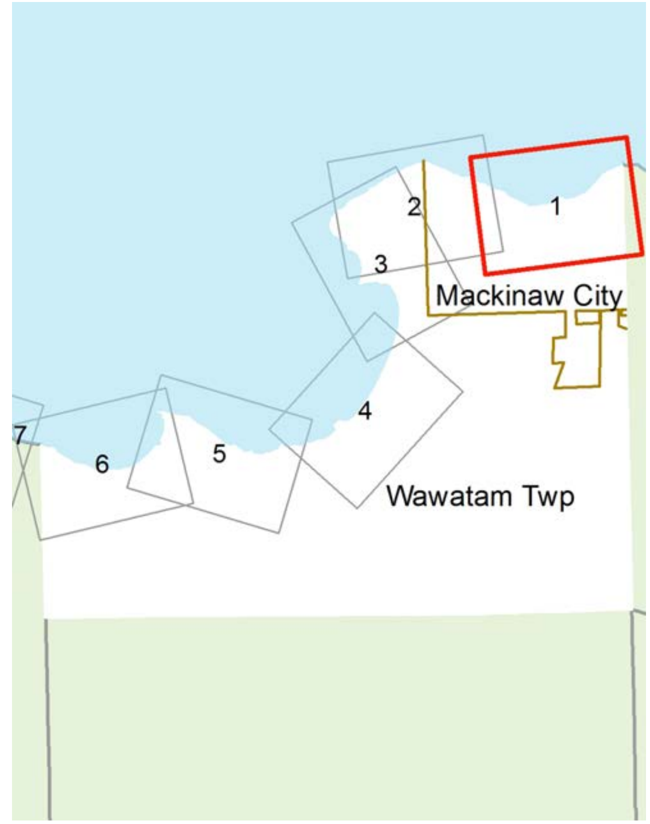
Bluff Detail, Panel 27, Readmond Twp.



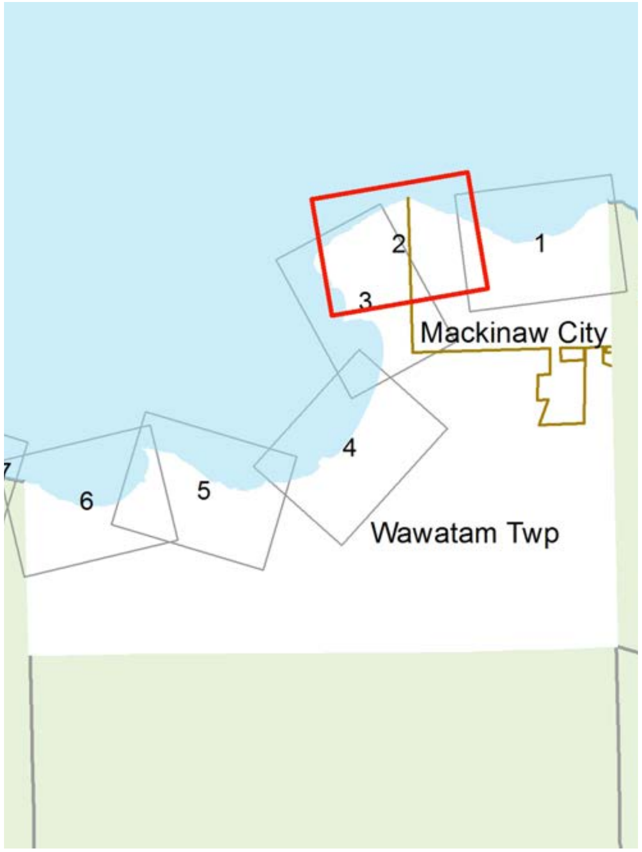
Wawatam Twp.


Emmet County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



2
1
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Mackinaw City
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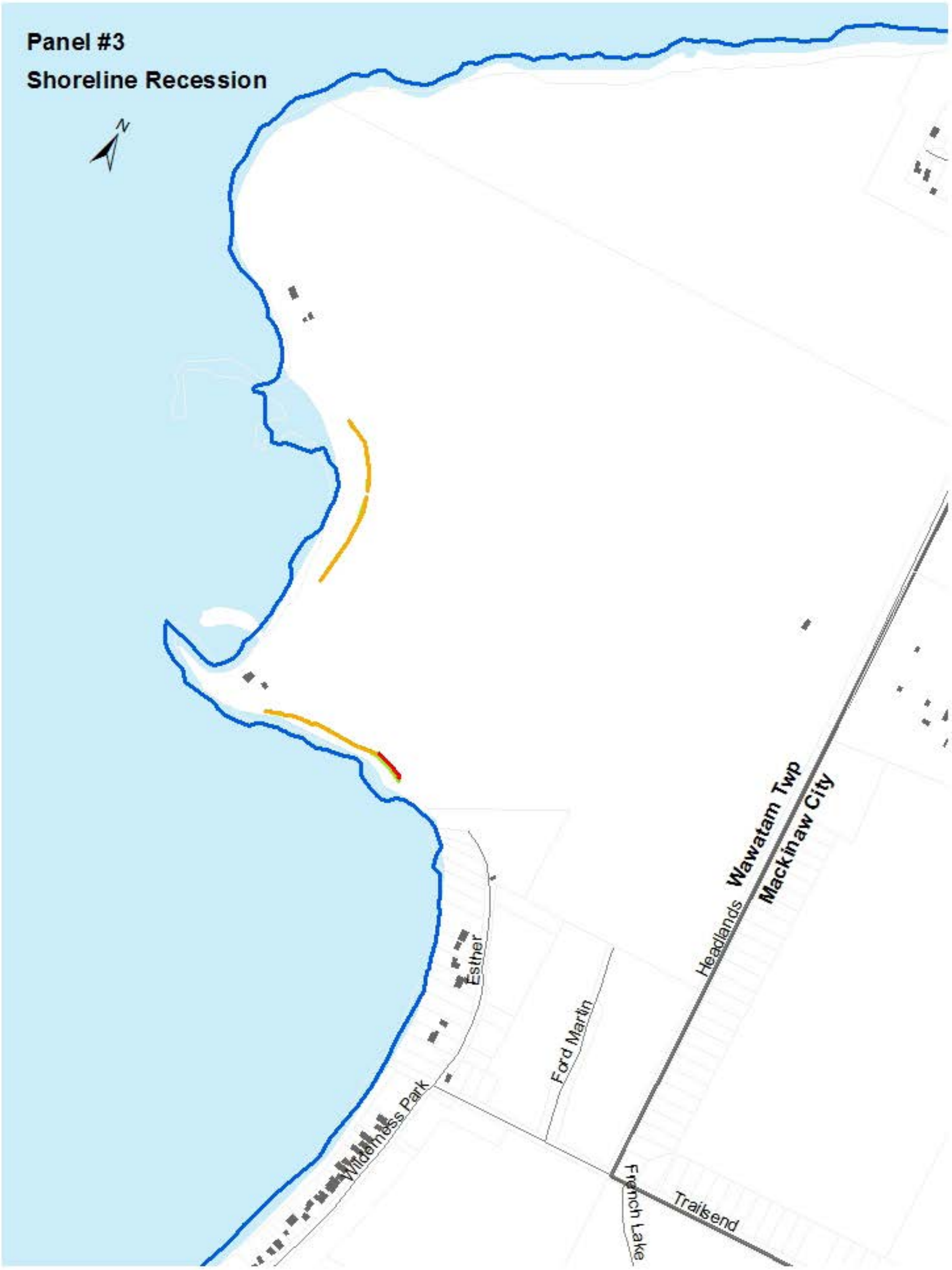
5
Wawatam Twp

Emmet County

Panel #2
Shoreline Recession
Wenniway
Valley
Ridge
Central
Jane
Birch
Headlands
Mackinaw City
Wawatam Twp
David
Chippewa
Algonquin
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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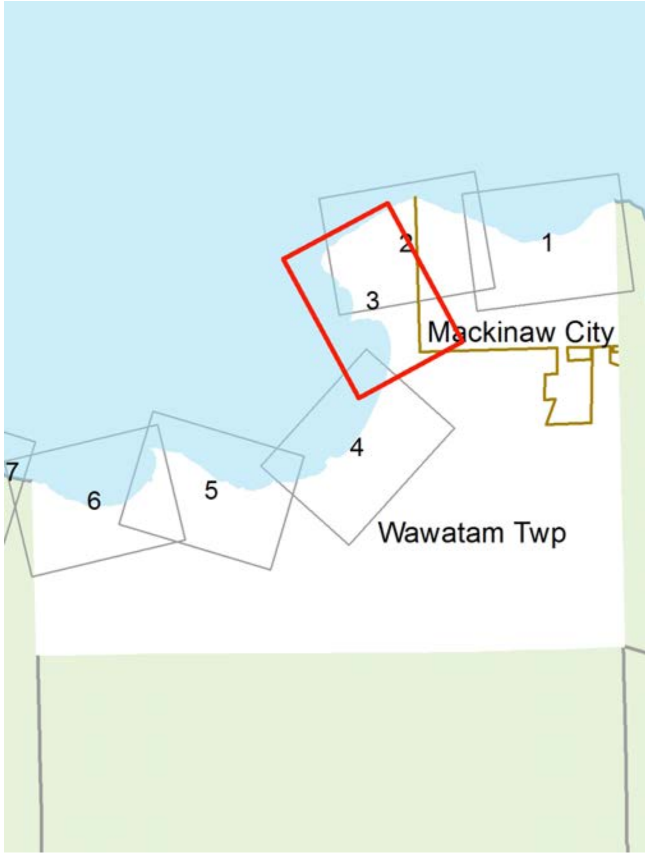
Wawatam Twp
Mackinaw City
Headlands
Esther
Ford Martin
Wilderness Park
French Lake
Trailsend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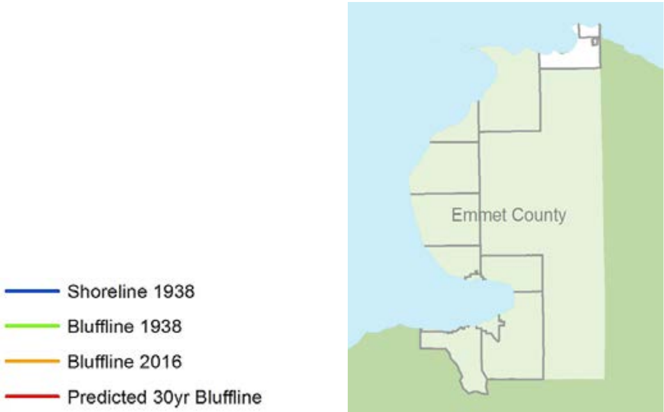
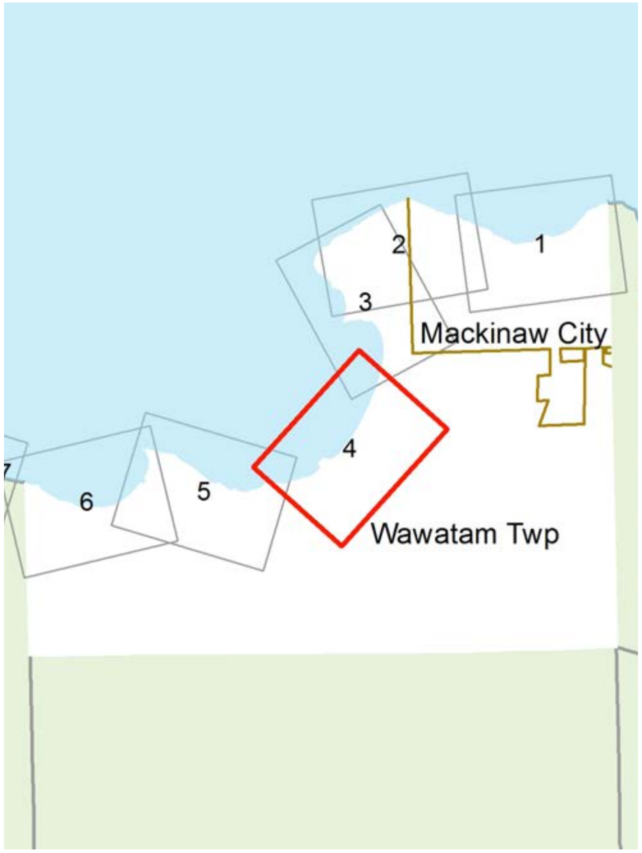
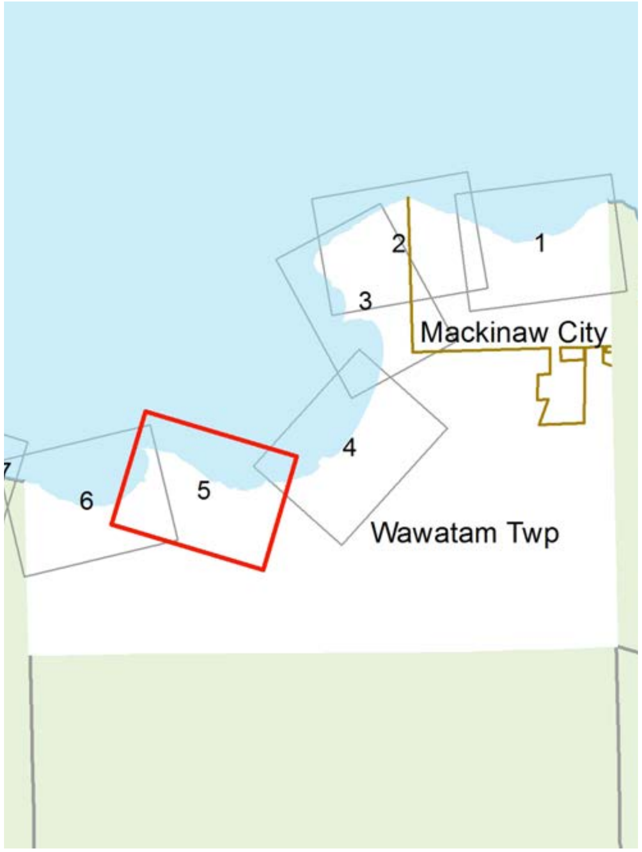
Mackinaw City
Wawatam Twp

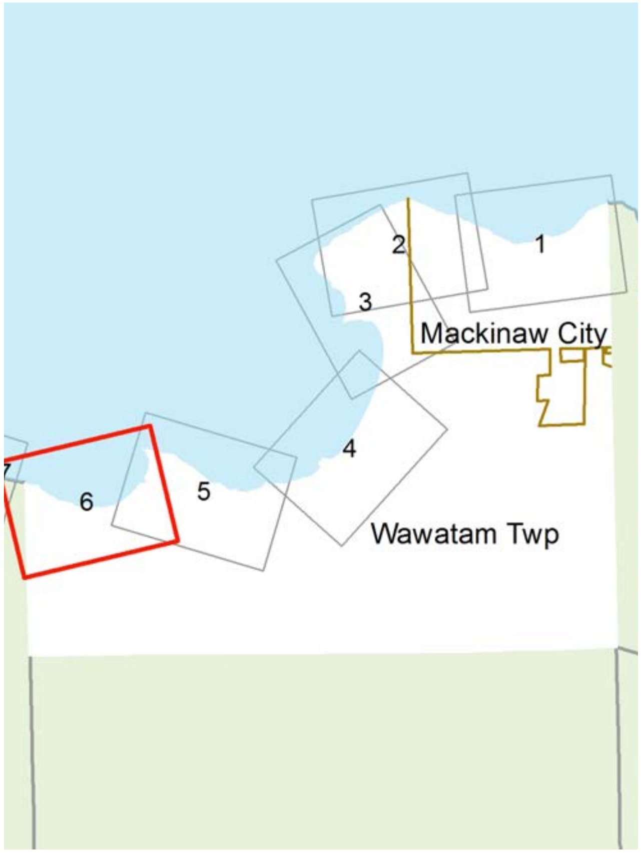

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline
Emmet County



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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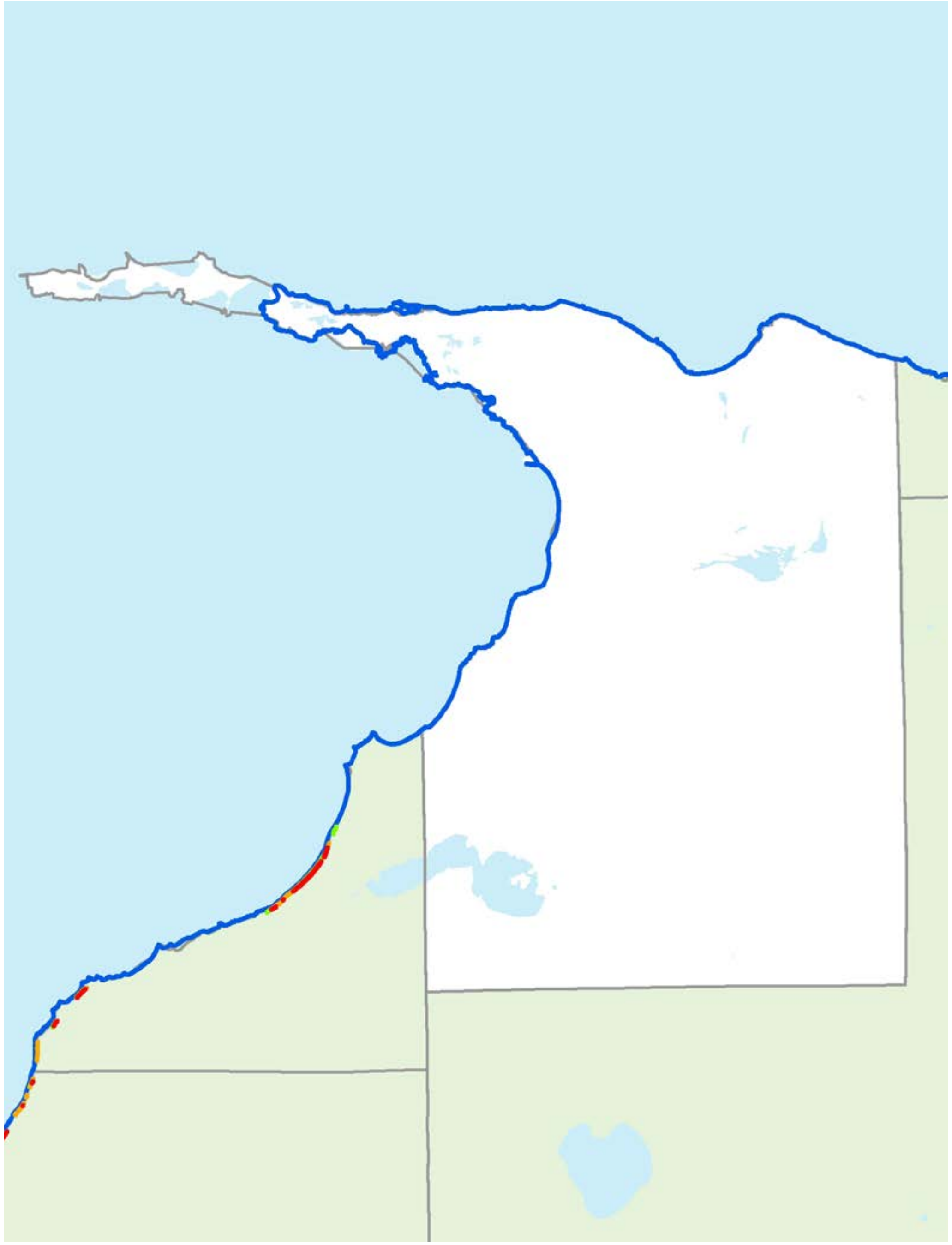
Mackinaw City
Wawatam Twp

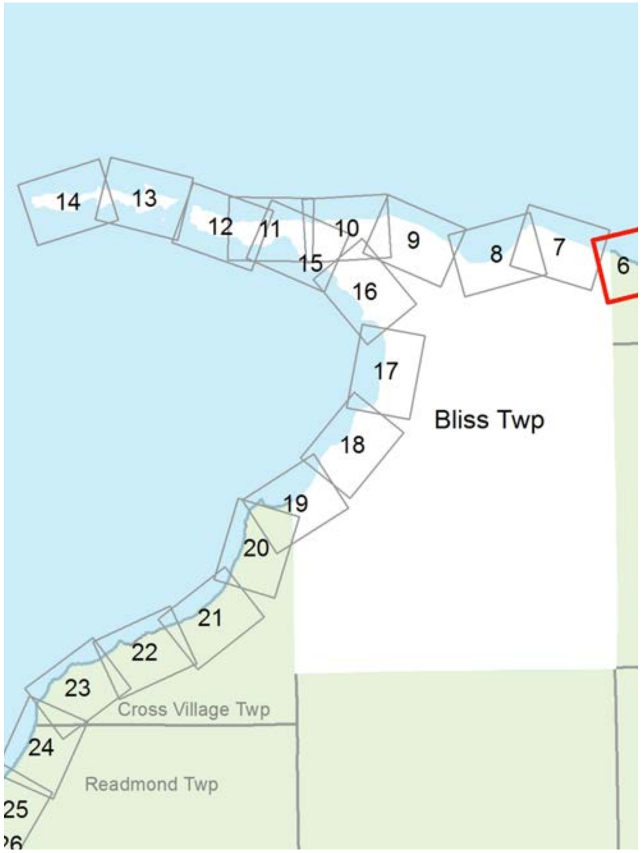

Emmet County


Panel #6
Shoreline Recession
N
Straits View
Cecil Bay
Pointe
Pointe
Wilderness Park
Wawatam Twp
Bliss Twp
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

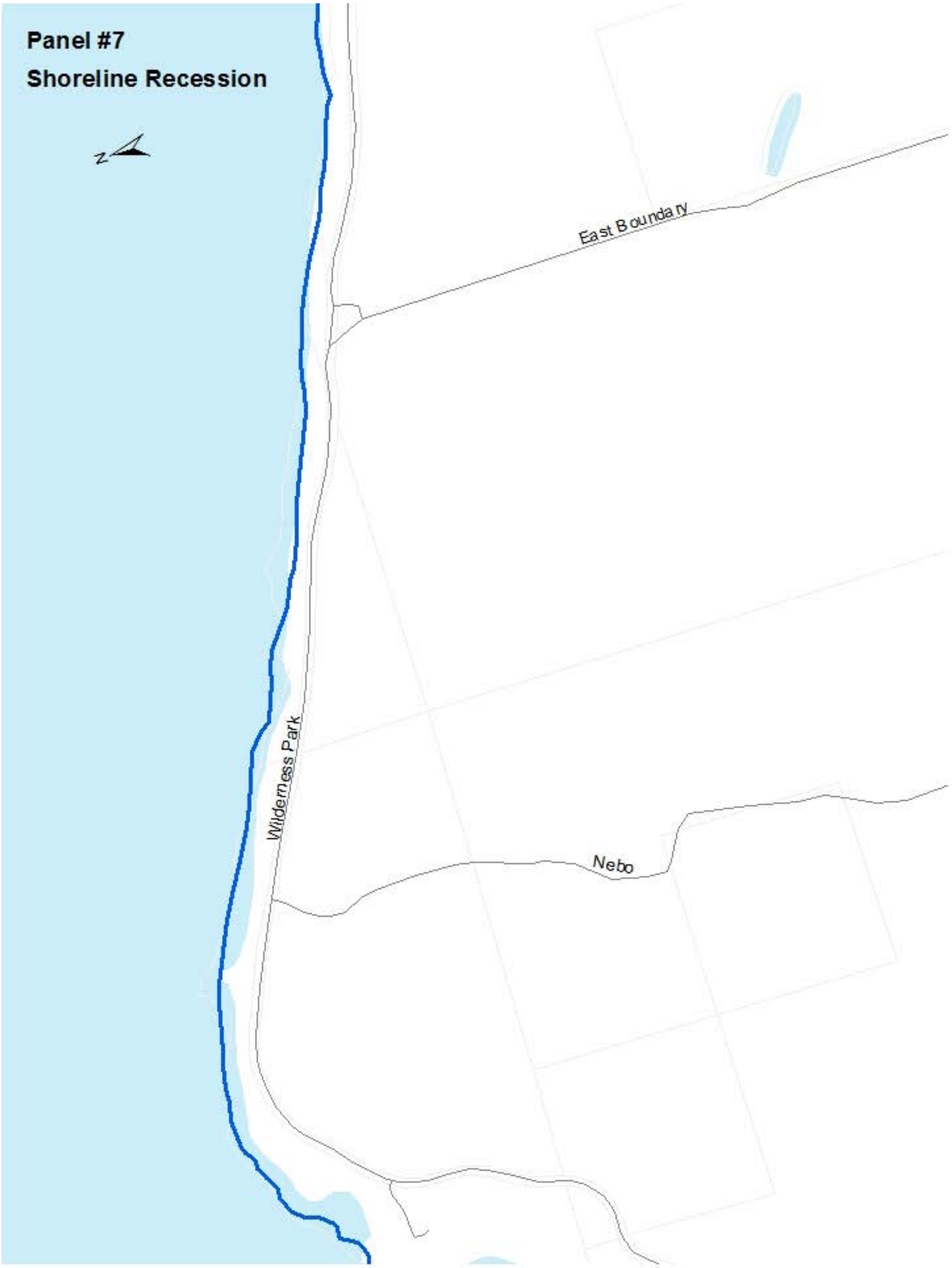
Bliss Twp.

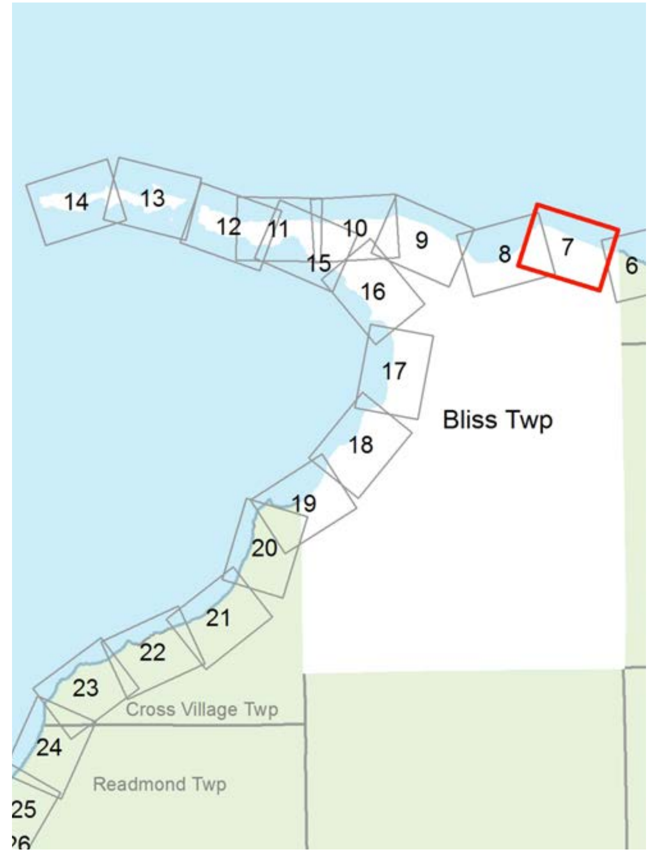


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #7
Shoreline Recession
N
East Boundary
Wilderness Park
Nebo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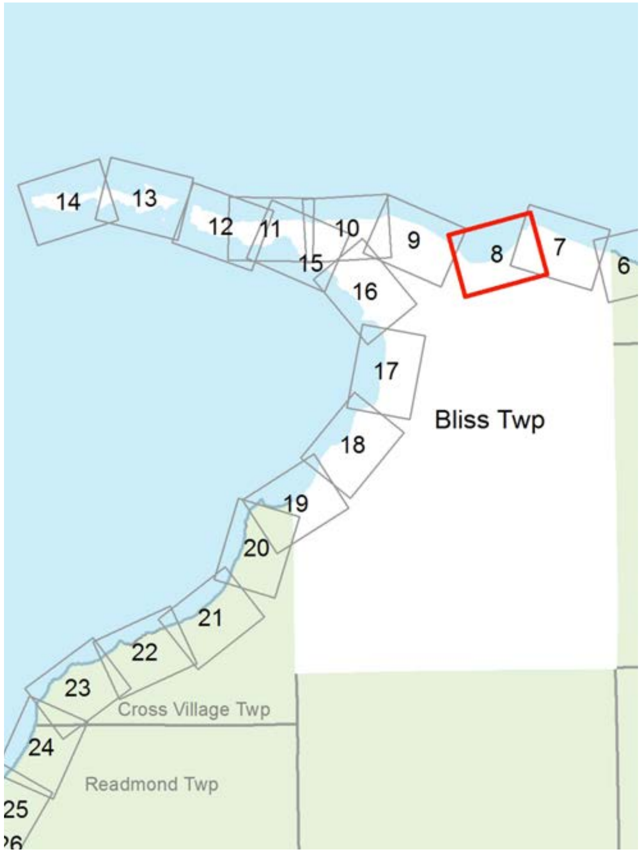
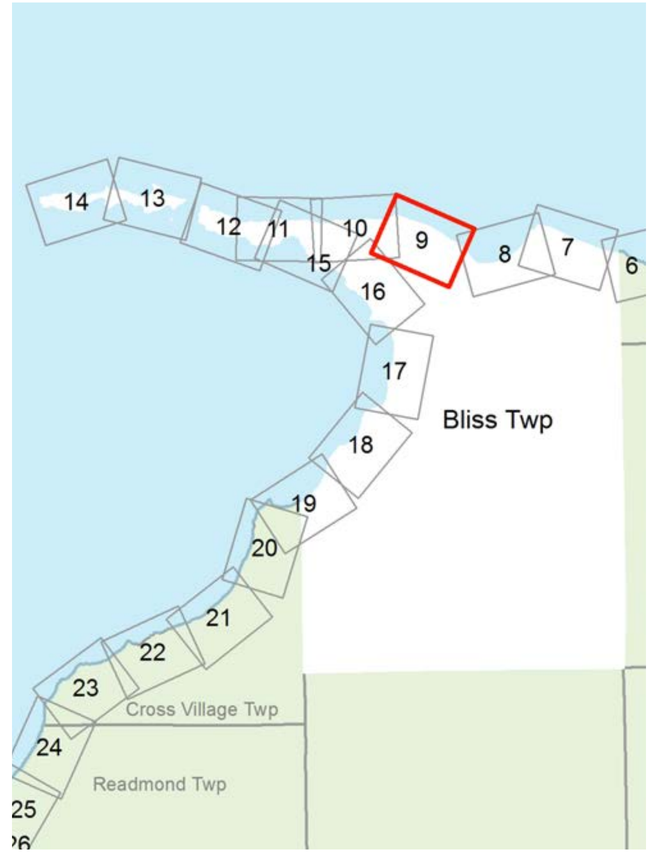
Bliss Twp
Cross Village Twp
Readmond Twp


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

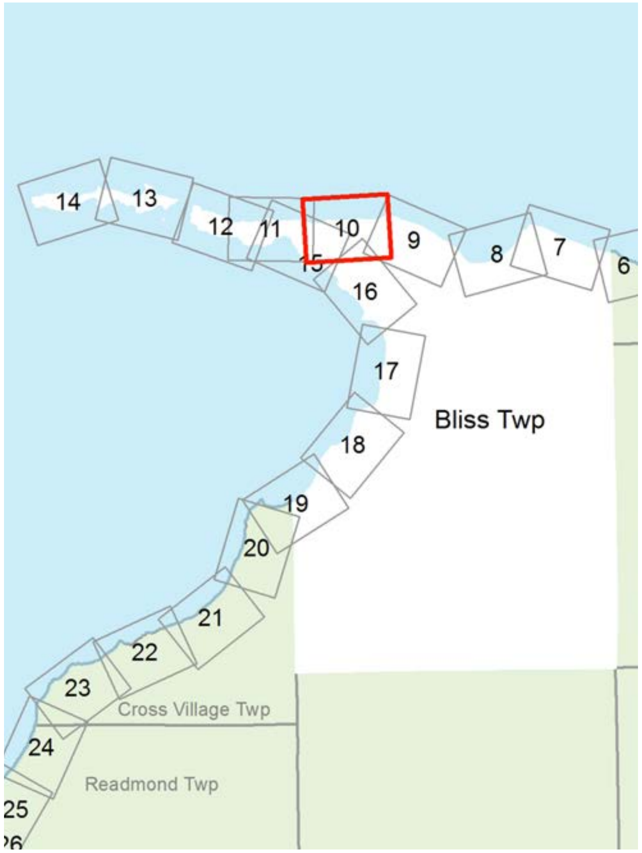

Emmet County



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Bliss Twp
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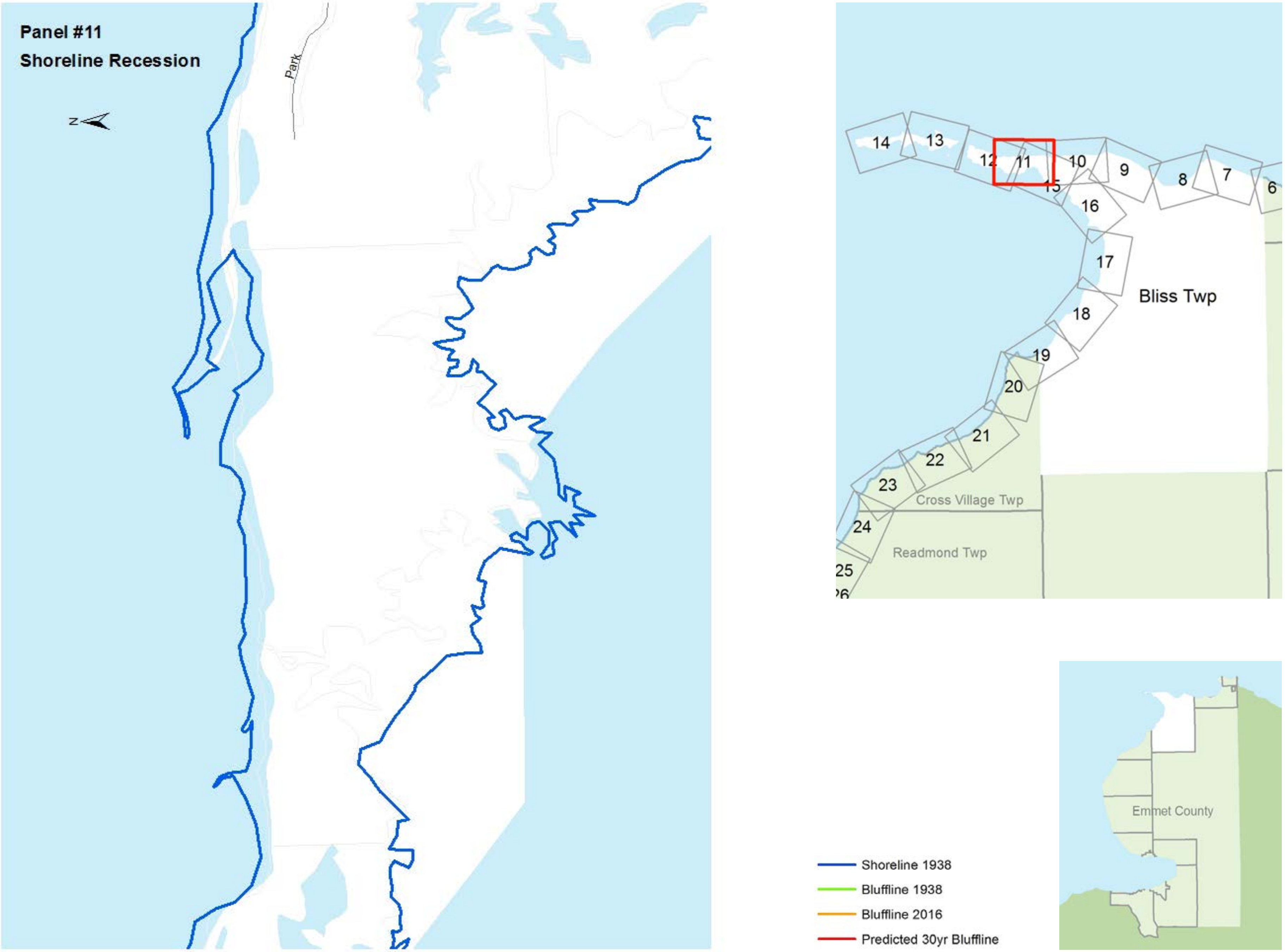
Cross Village Twp
24
Readmond Twp
25


Emmet County


Panel #10
Shoreline Recession
N
Wilderness SP Campground
Wilderness Park
Wilderness SP Campground
Sturgeon Bay
Park
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #11
Shoreline Recession
N
Park
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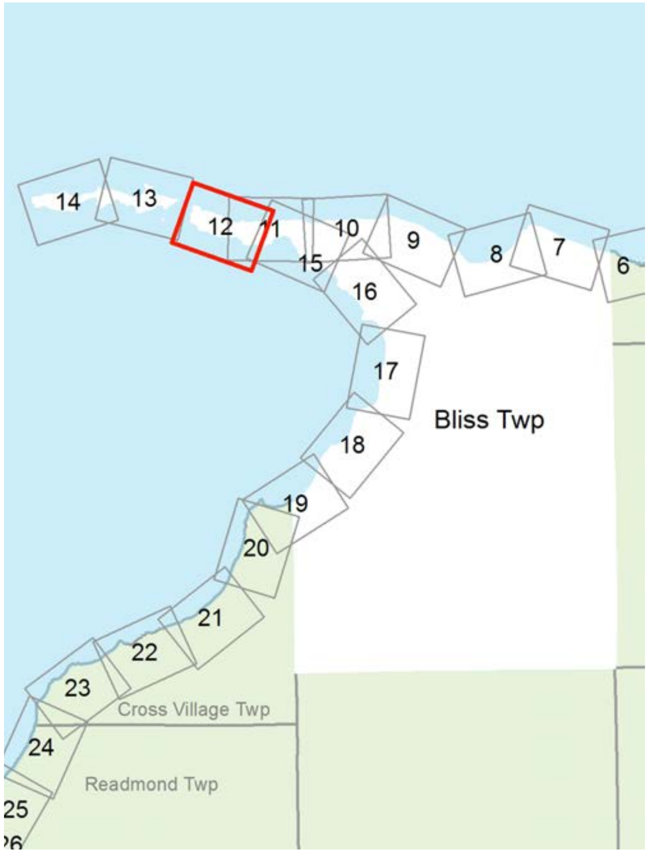
Bliss Twp
Cross Village Twp
Readmond Twp
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline
Emmet County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Bliss Twp
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Cross Village Twp
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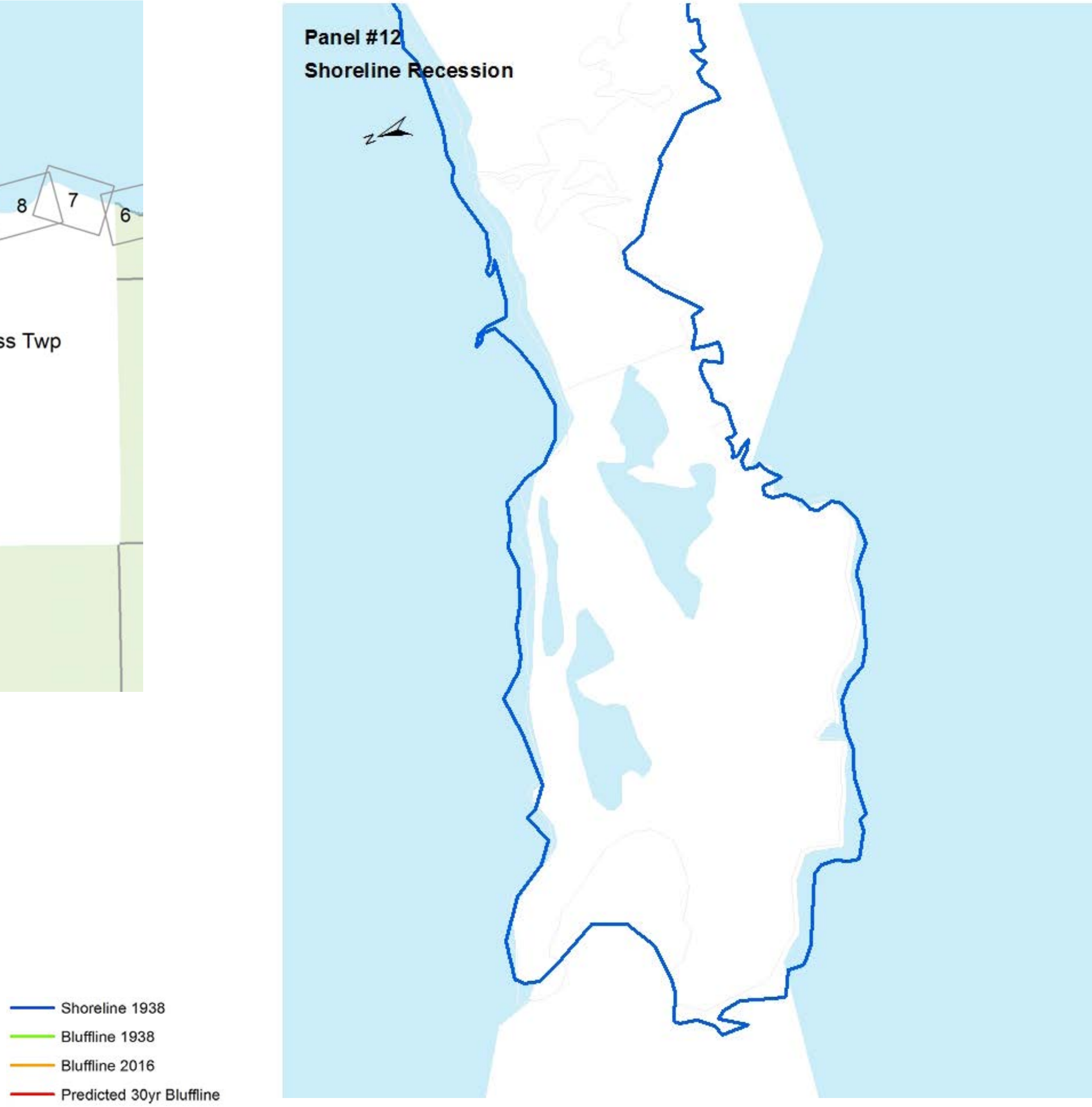
Readmond Twp
25


Emmet County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Shoreline Recession
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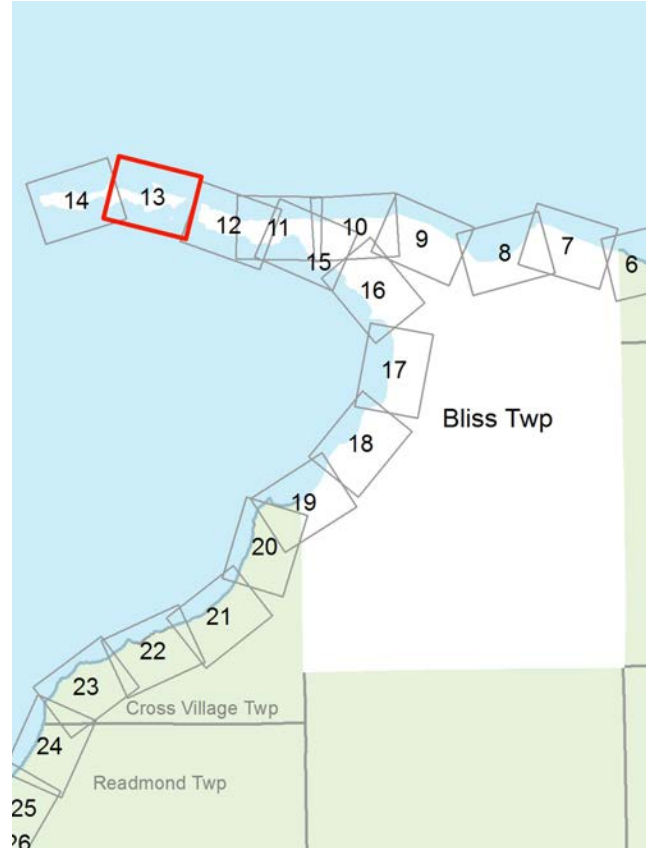
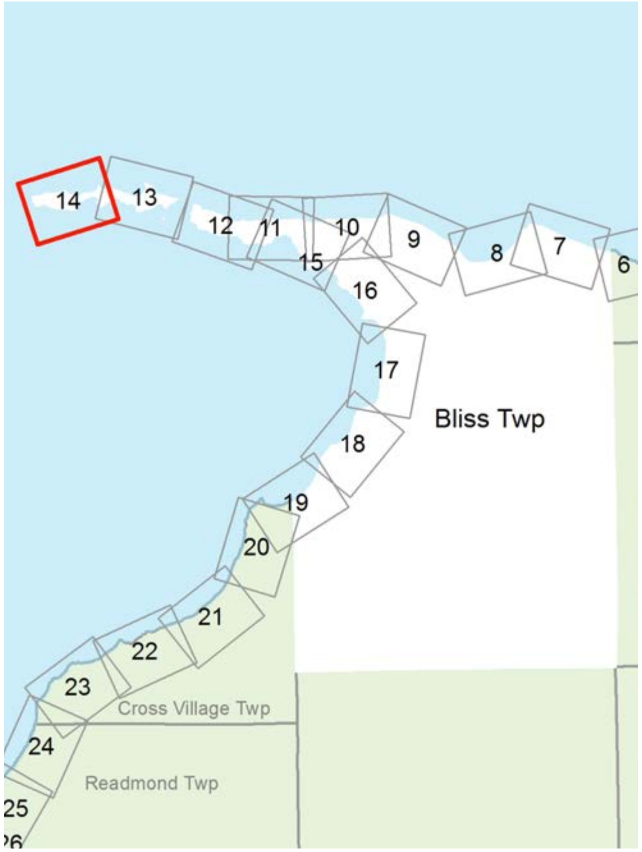
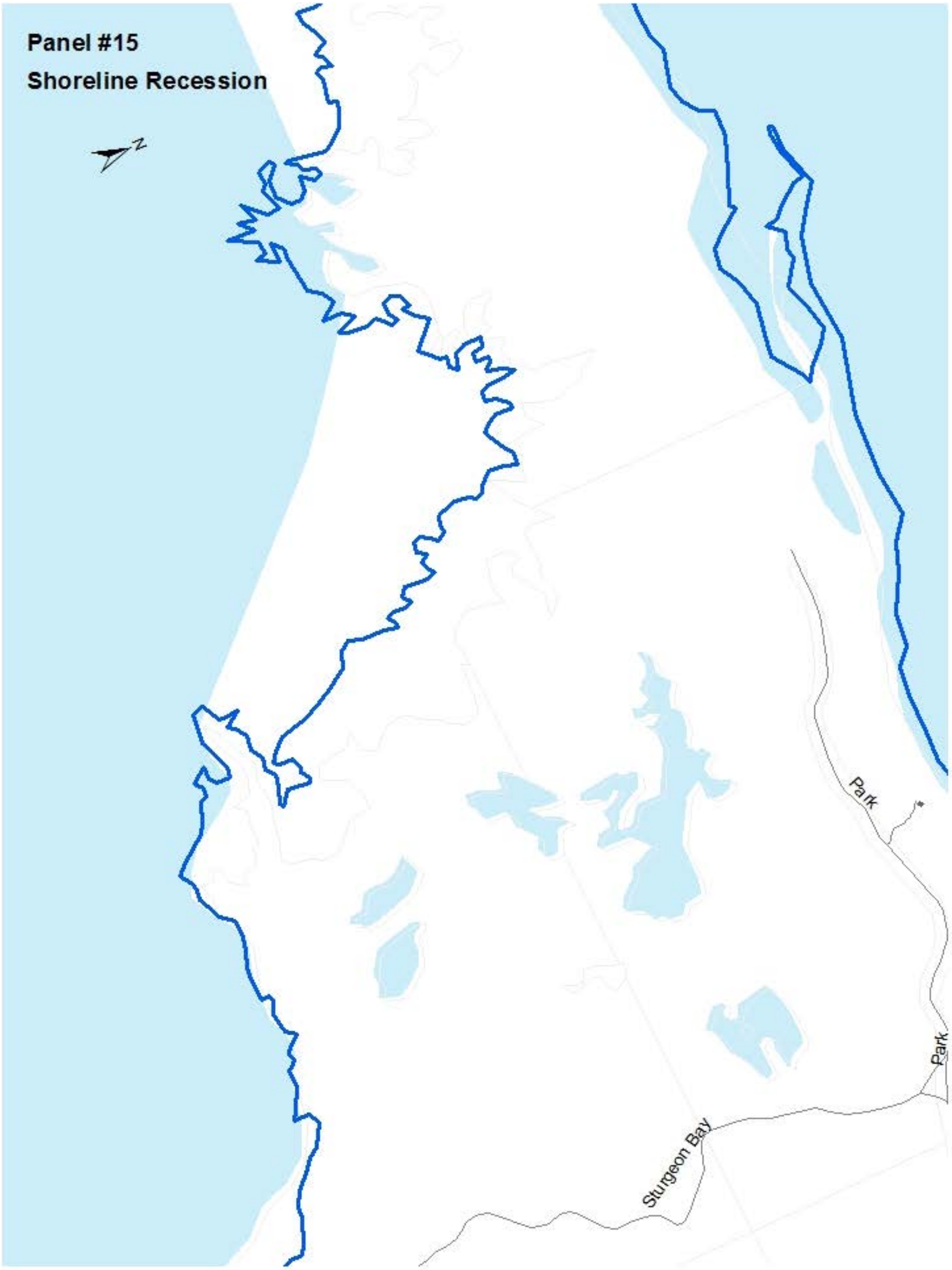
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

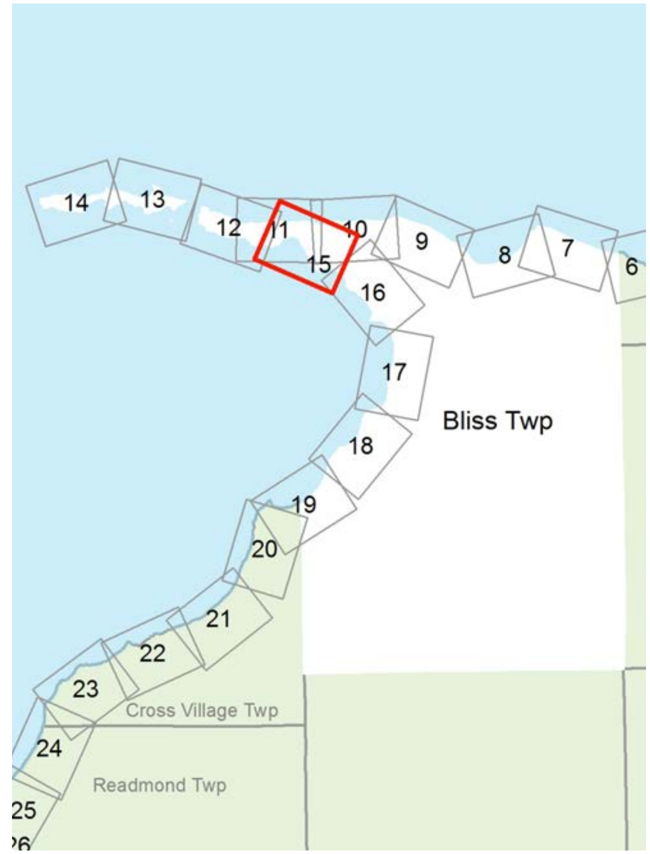


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

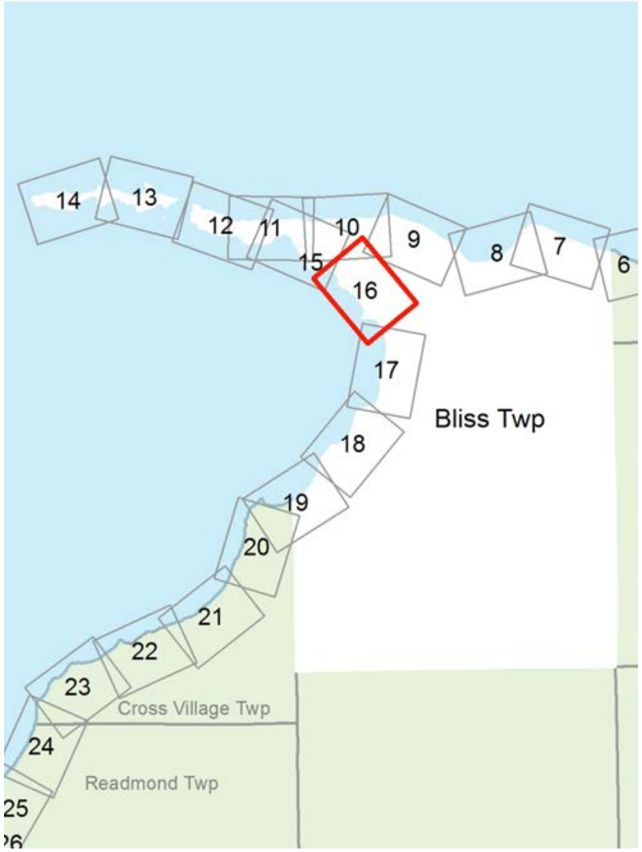


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


14
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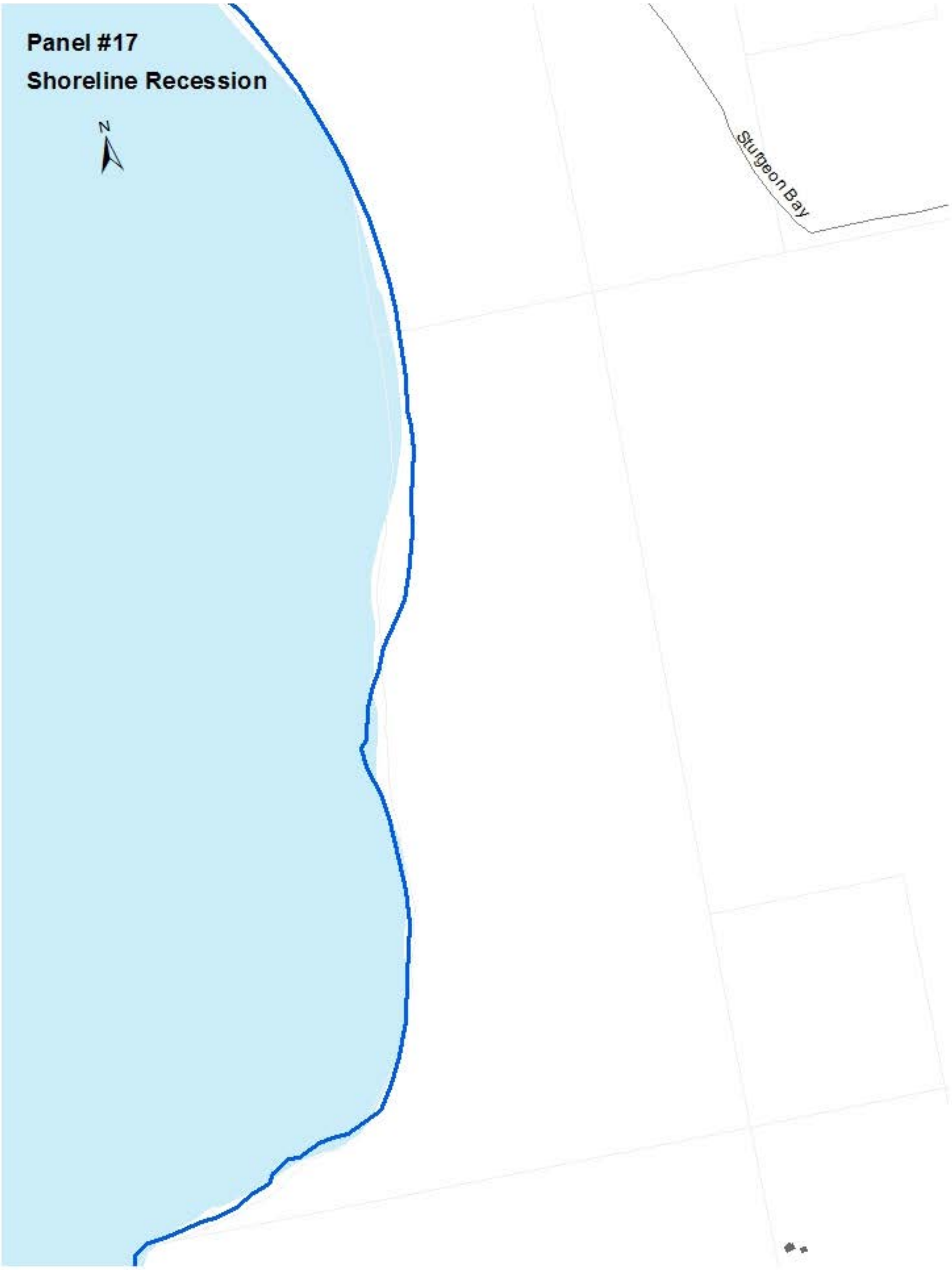
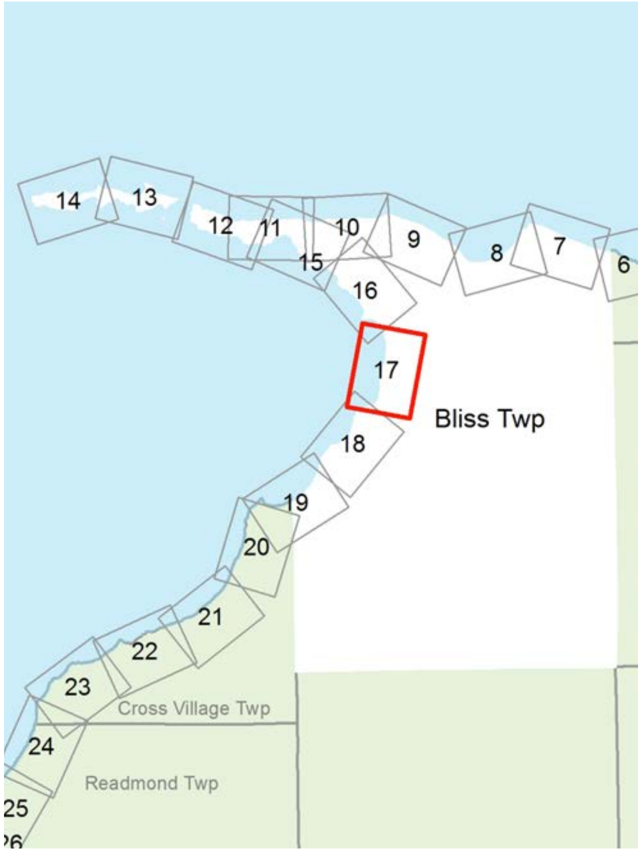
16
17
Bliss Twp
18
19
20
21
22
23
Cross Village Twp
24
Readmond Twp
25

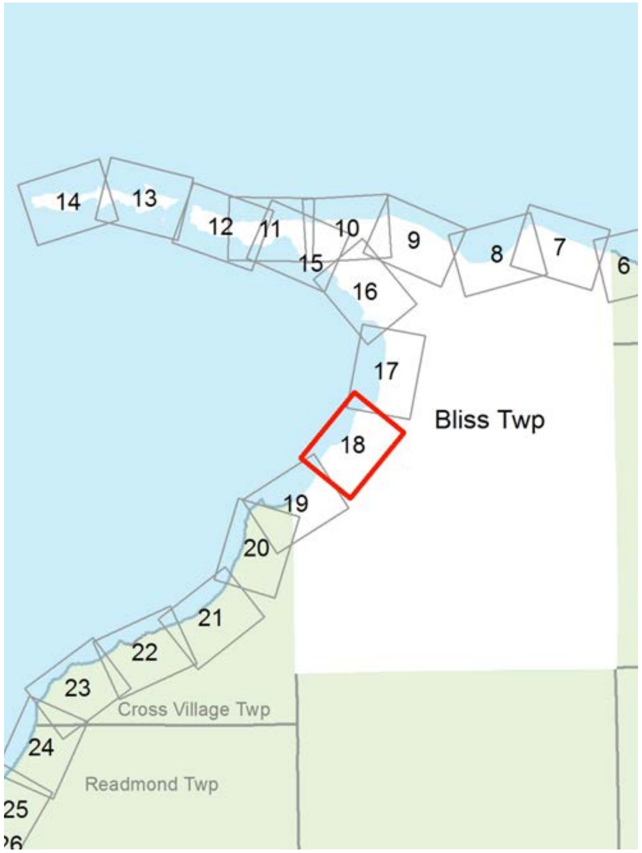

Emmet County


Panel #16
Shoreline Recession
N
Sturgeon Bay
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



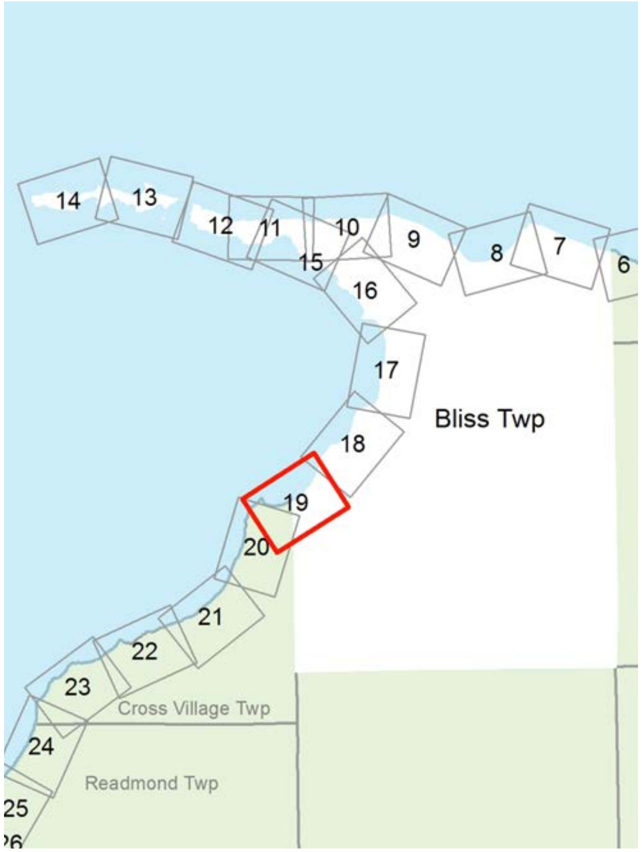


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #19
Shoreline Recession
N
Lake Shore
Sturgeon Bay
Bliss Twp
Cross Village Twp
Sturgeon Bay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16
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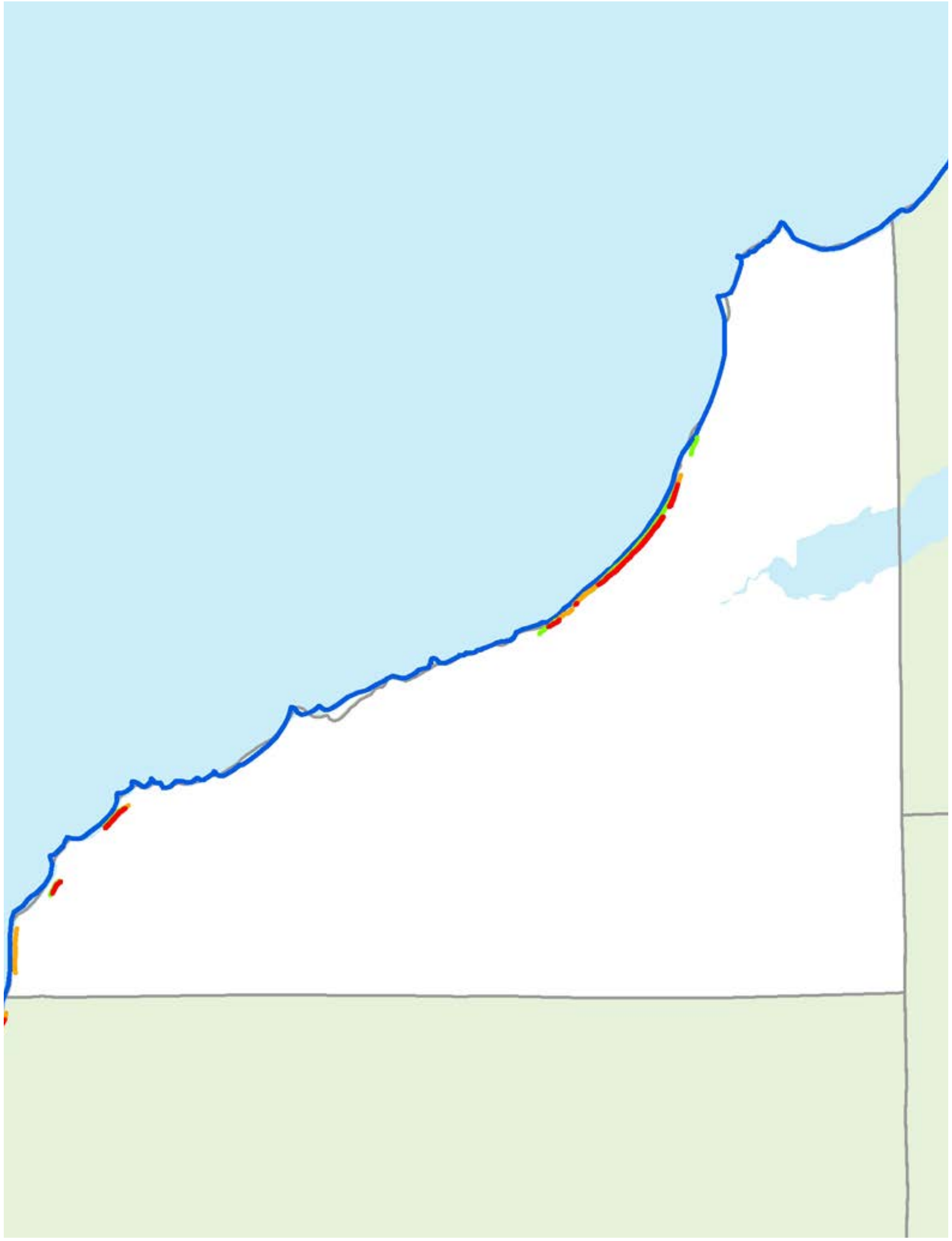
19
20
21
22
23
24
25
26
Bliss Twp
Cross Village Twp
Readmond Twp


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

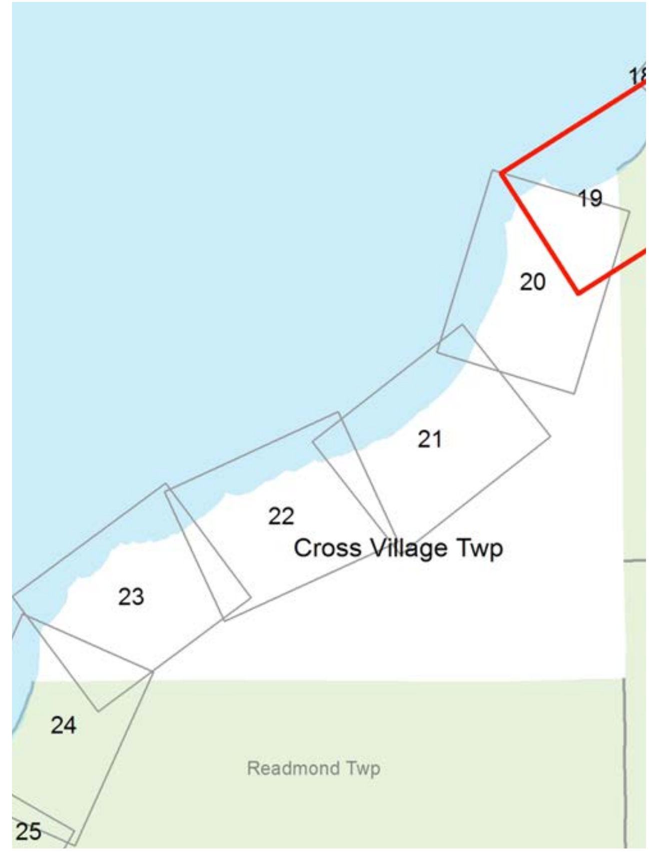

Emmet County

Cross Village Twp.



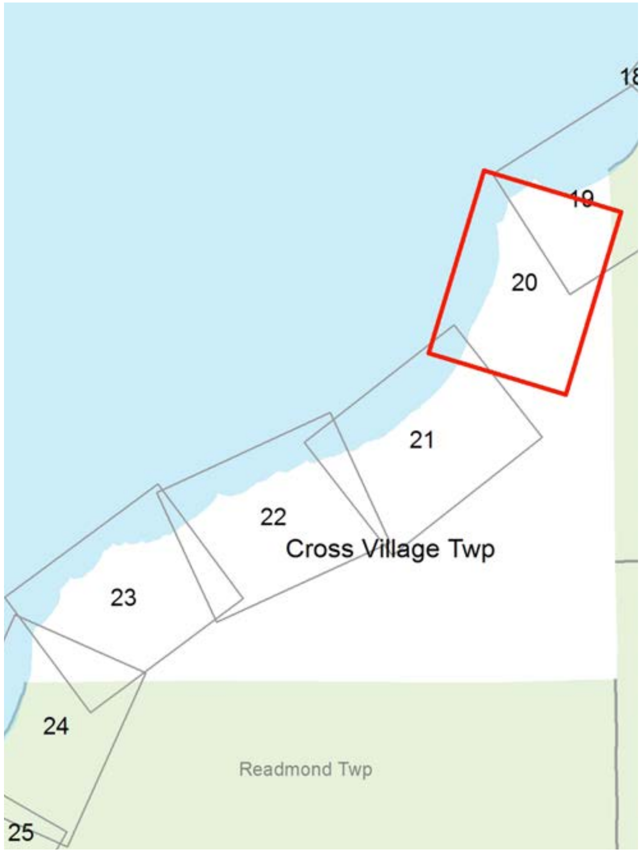
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #19
Shoreline Recession
N
Lake Shore
Sturgeon Bay
Bliss Twp
Cross Village Twp
Sturgeon Bay


19
20
21
22
Cross Village Twp
23
24
Readmond Twp
25


Emmet County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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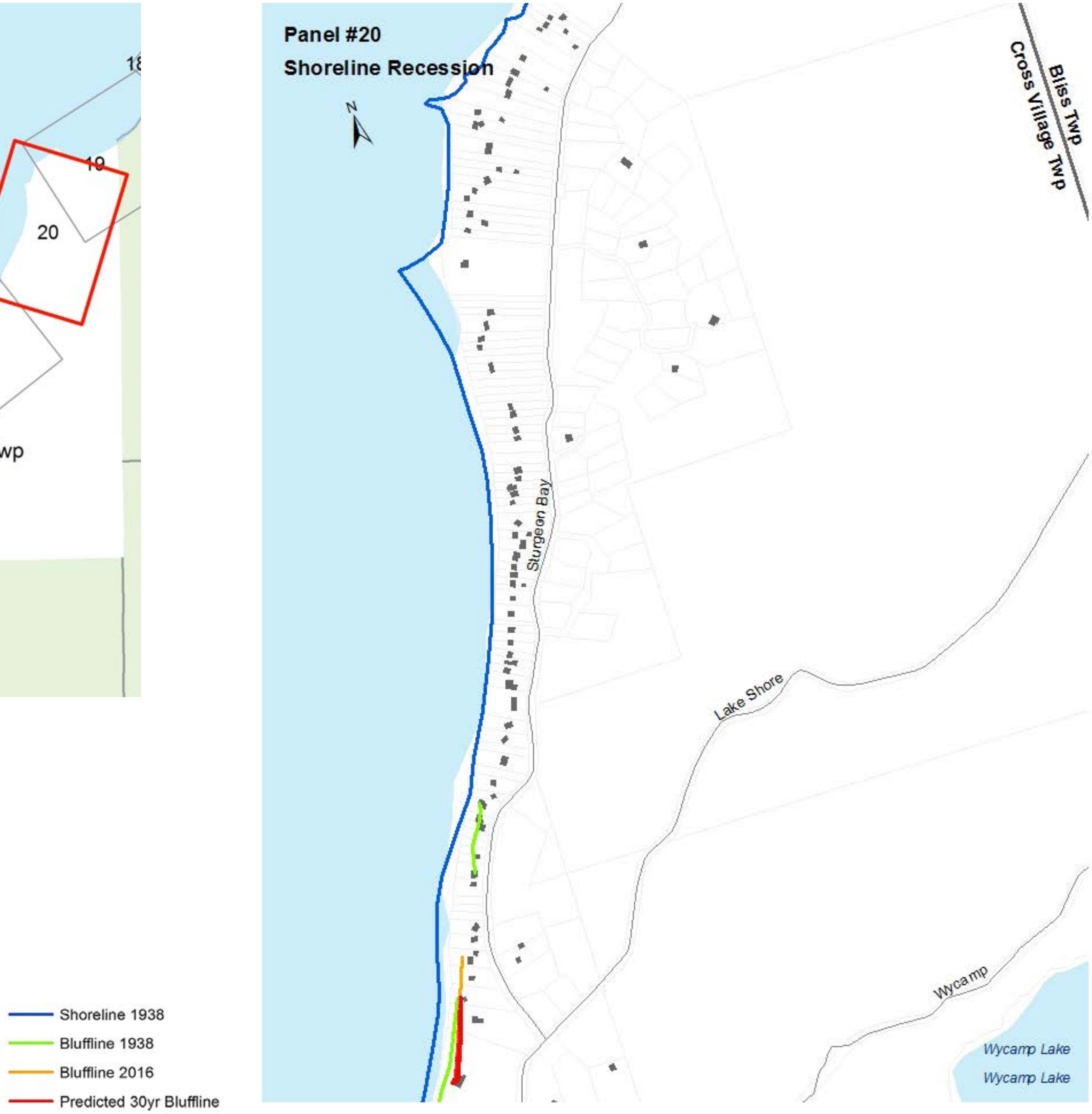
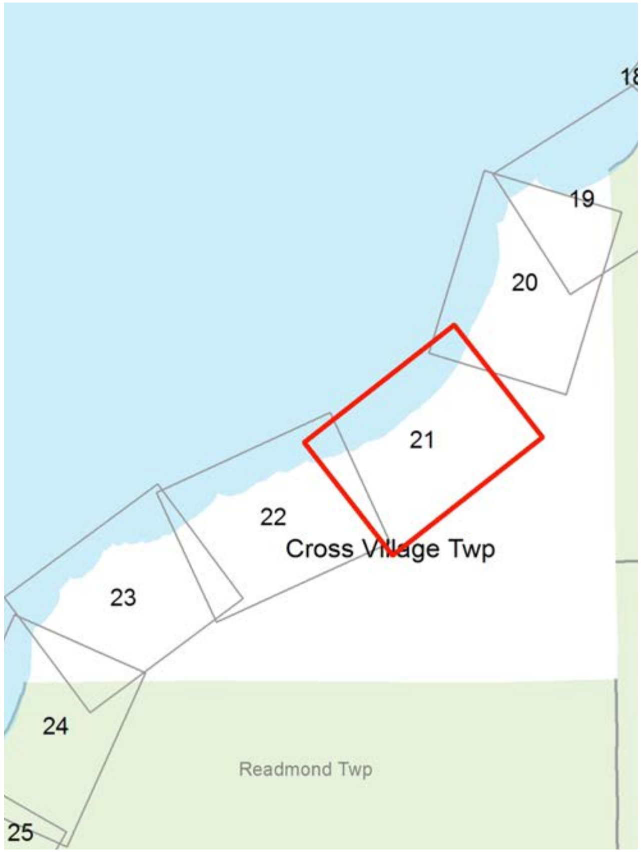
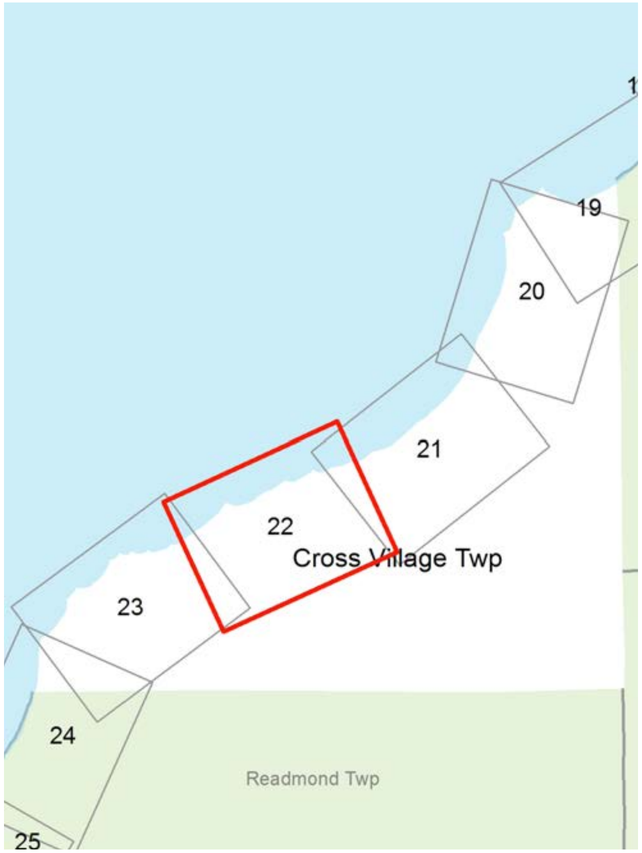
19
20
21
22
23
24
25
Cross Village Twp
Readmond Twp


Emmet County


Panel #20
Shoreline Recession
N
Bliss Twp
Cross Village Twp
Sturgeon Bay
Lake Shore
Wycamp
Wycamp Lake
Wycamp Lake
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


19
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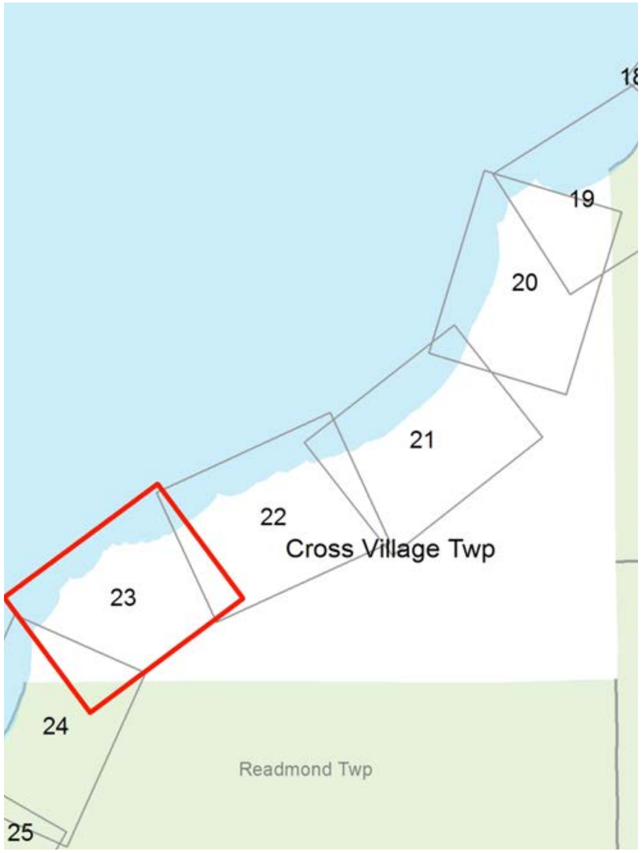
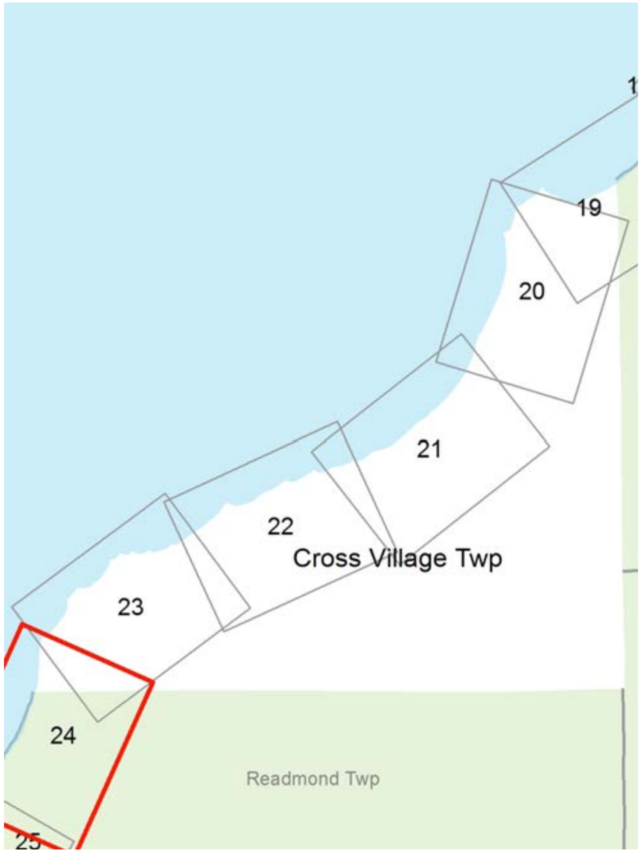
22
23
24
25
Cross Village Twp
Readmond Twp


Emmet County


Panel #22
Shoreline Recession
N
Cemetery
Oak
Levering
Chippewa
Pine Grove
Oak
Short
Lake Shore
Wadsworth
Stone Church
Shomin
Brady
Park
Waterfront
Cole
Forest
Cedar
State
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

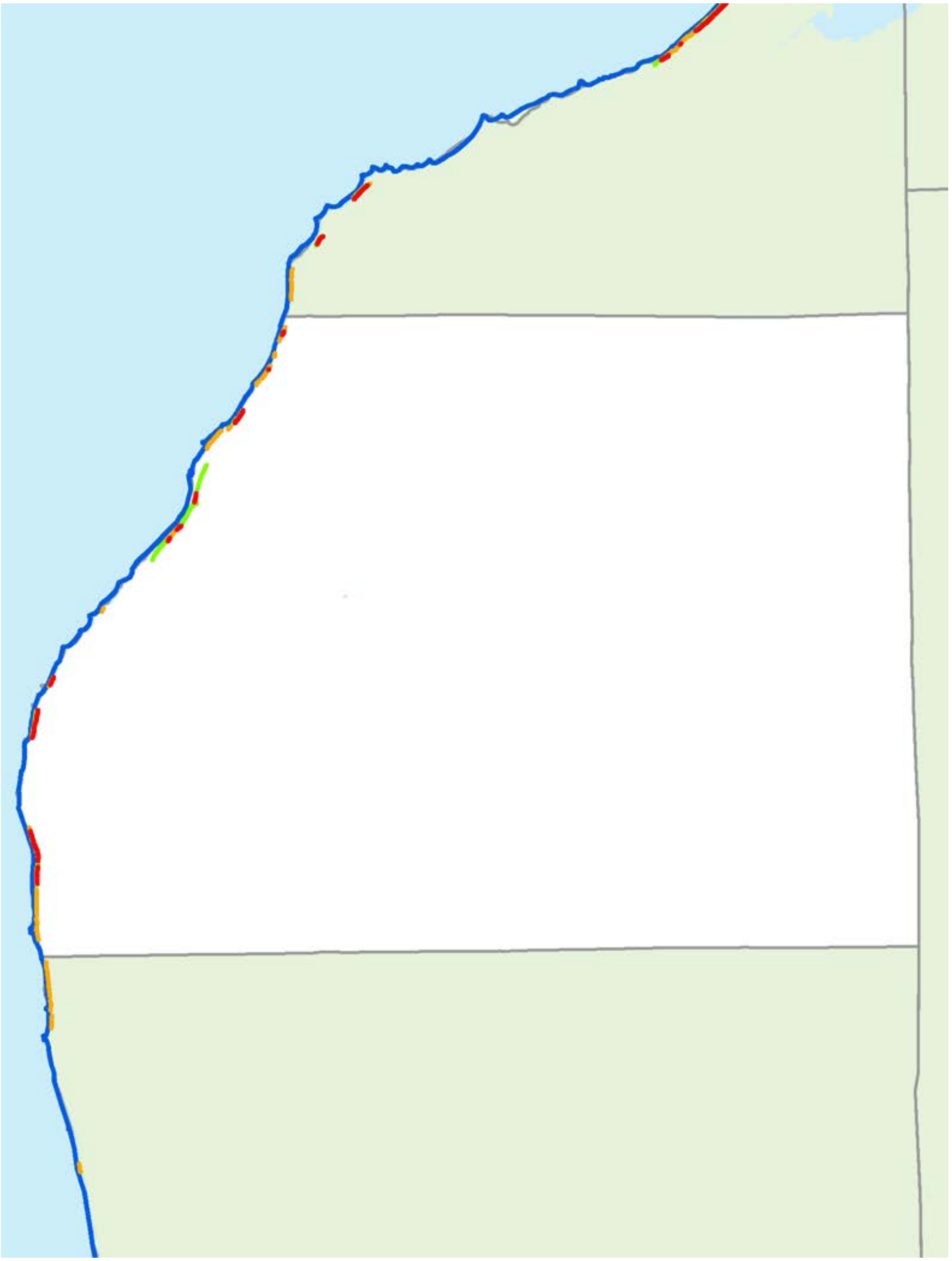


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

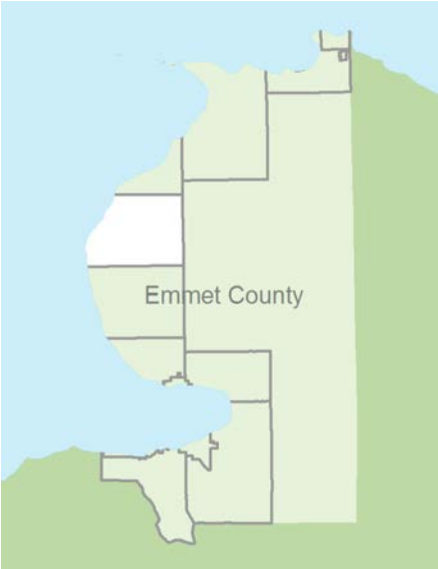

19
20
21
22
23
24
25
Cross Village Twp
Readmond Twp


Emmet County

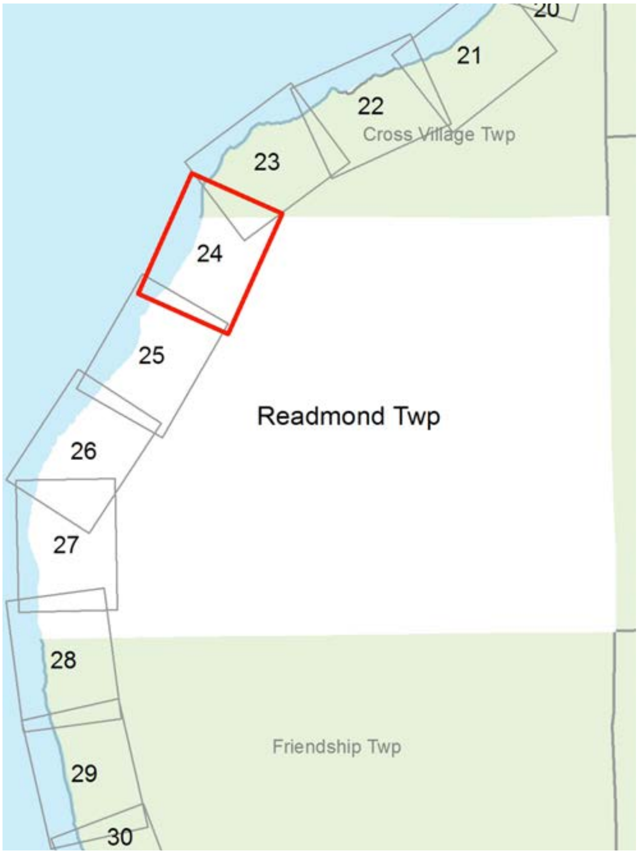

Panel #24
Shoreline Recession
N
Cross Village Twp
Readmond Twp
Division
Gully
Lake Shore
Pike
Wilkinson
Island View
Vorce
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Readmond Twp.

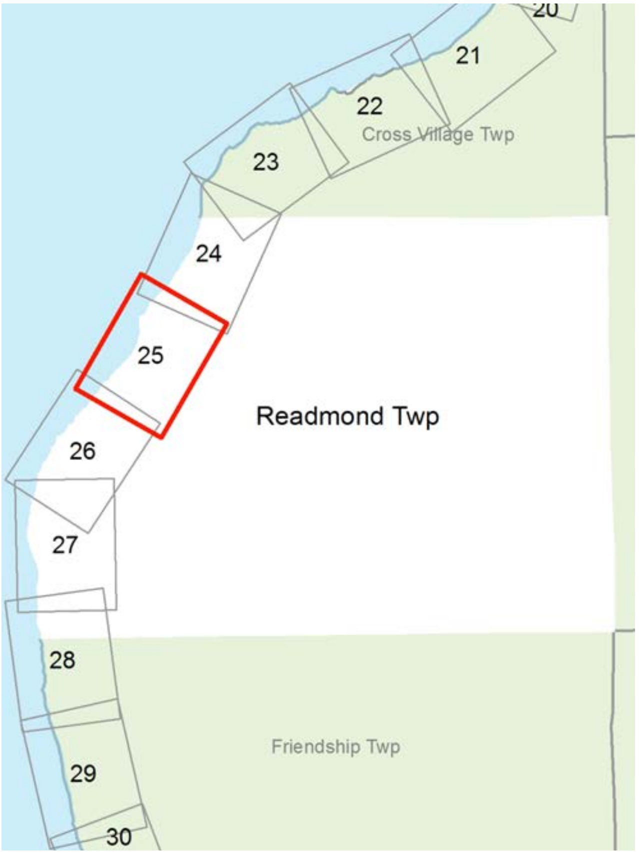


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

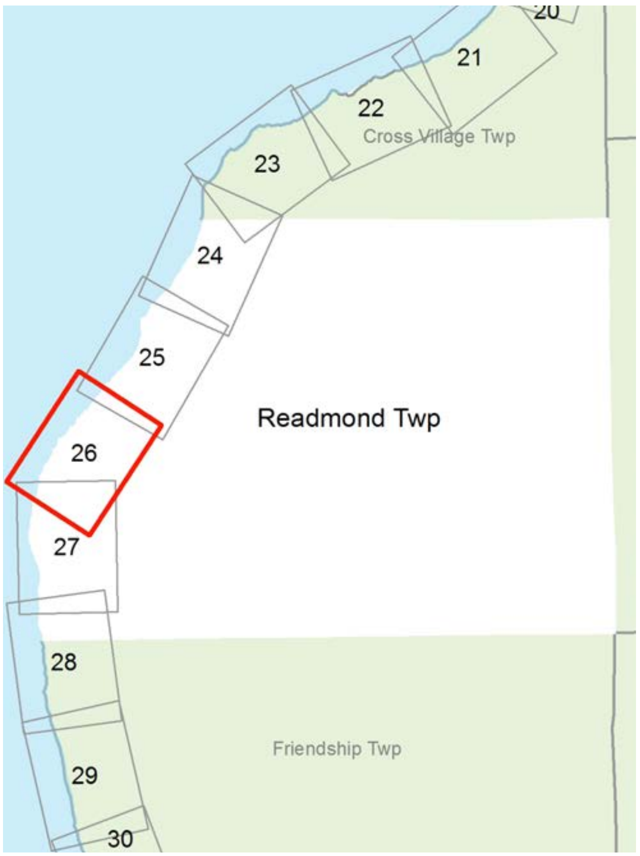

20
21
22
Cross Village Twp
23
24
25
Readmond Twp
26
27
28
Friendship Twp
29
30


Emmet County


Panel #24
Shoreline Recession
N
Cross Village Twp
Readmond Twp
Division
Gully
Lake Shore
Pike
Wilkinson
Island View
Vorce
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


20
21
22
Cross Village Twp
23
24
25
Readmond Twp
26
27
28
29
Friendship Twp
30

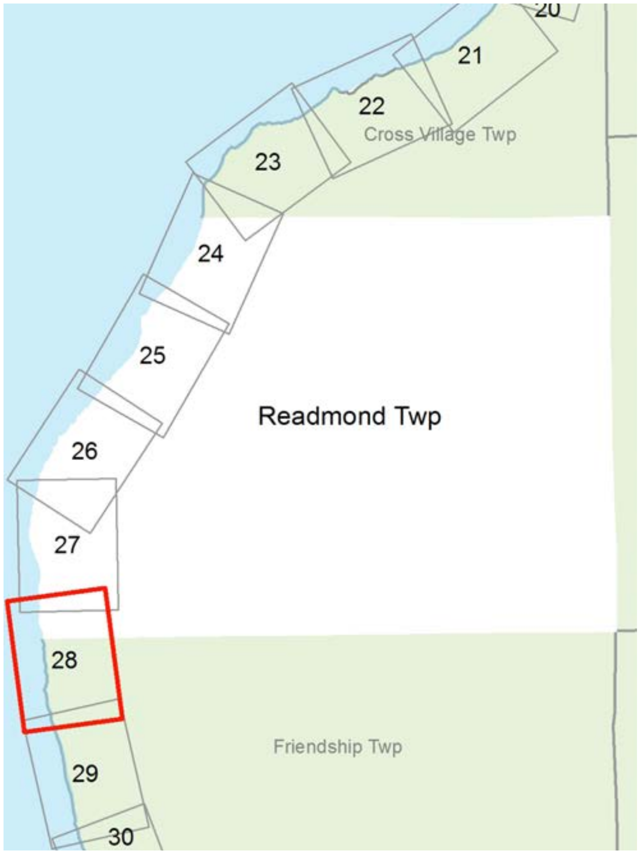

Emmet County

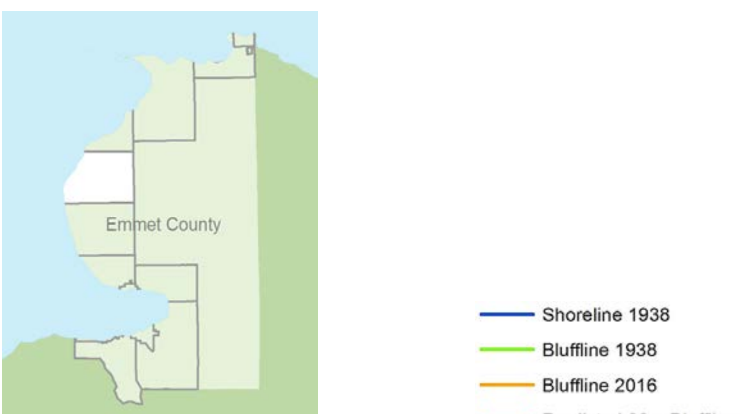

Panel #26
Shoreline Recession
N
Wormwood
Old
Ivan
Marquette
Ivan
Lake Shore
Timber Lake
Buff Side
Maple
Hemlock
Birch
Oak
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #27
Shoreline Recession
N
Bluff Side
Birch
Hemlock
Maple
Oak
Goodhart
Lake Shore
Lamkin
Robinson
Church

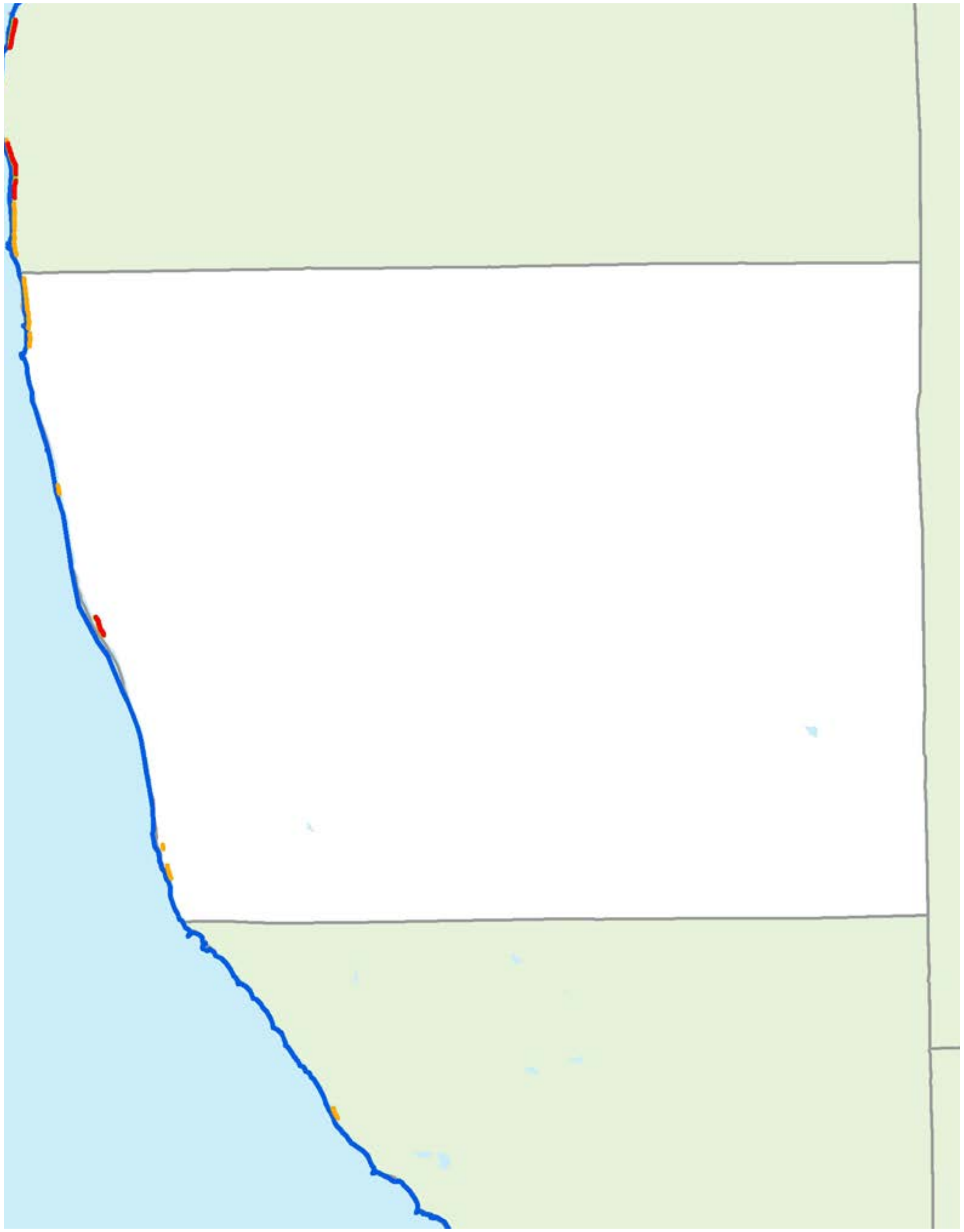

20
21
22
Cross Village Twp
23
24
25
Readmond Twp
26
27
28
Friendship Twp
29
30
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Emmet County

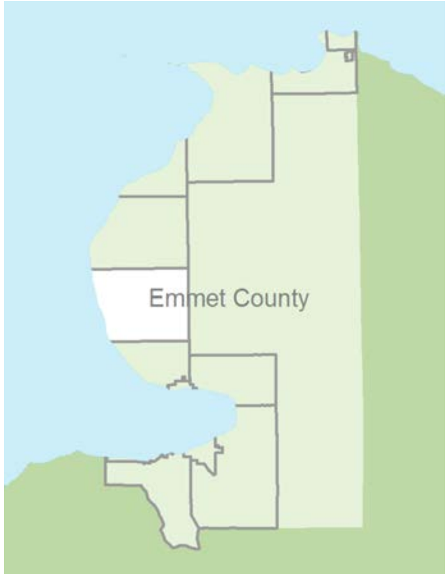

20
21
22
Cross Village Twp
23
24
25
Readmond Twp
26
27
28
29
Friendship Twp
30


Emmet County
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

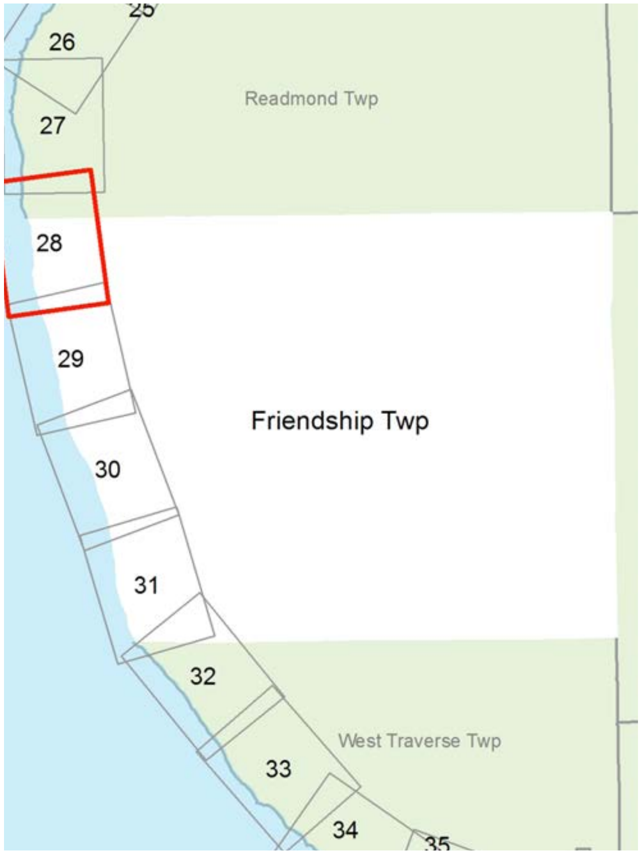

Panel #28
Shoreline Recession
N
Readmond Twp
Friendship Twp
Middle Village
Lamkin
Lake Shore
Townline



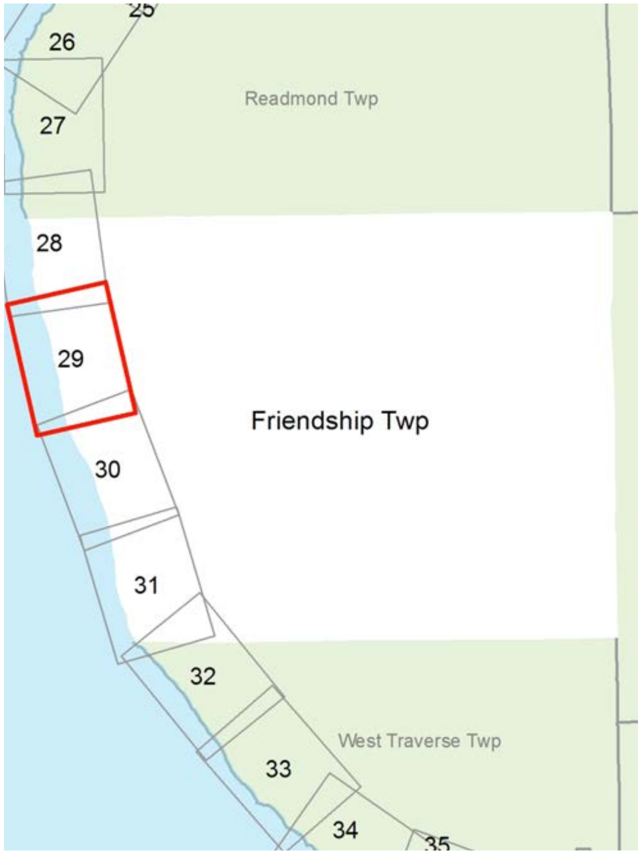
Friendship Twp.



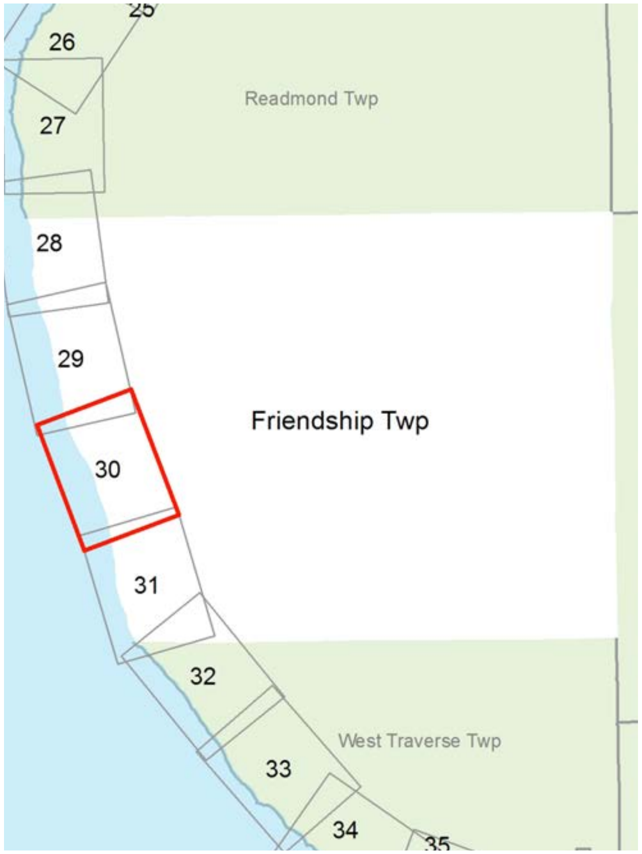
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

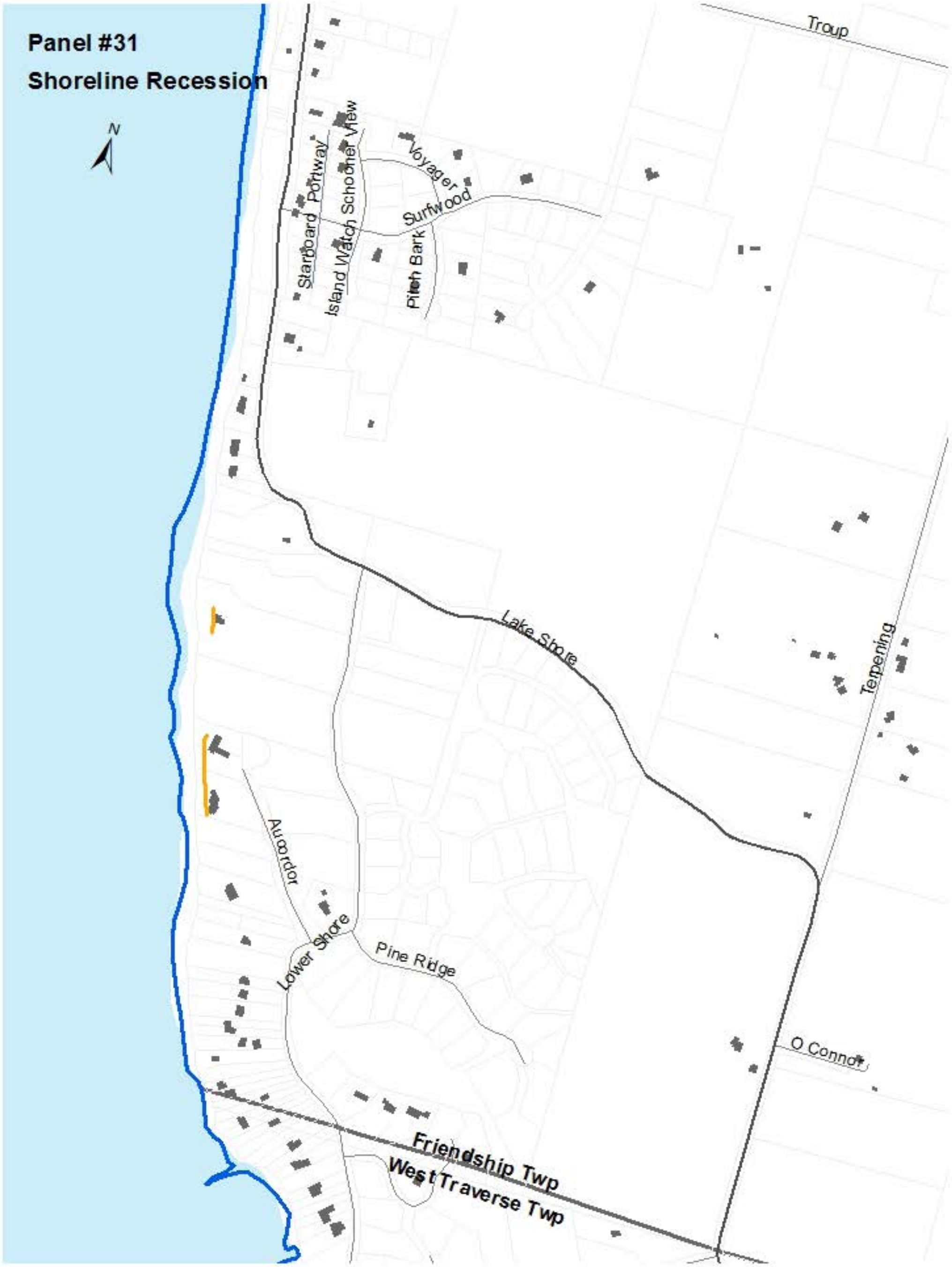


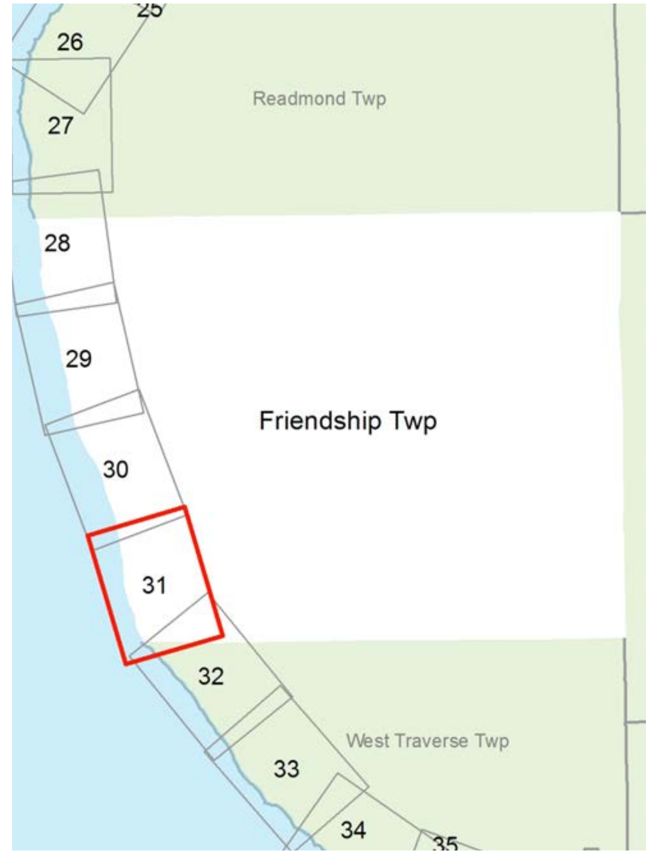
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


25
26
27
Readmond Twp
28
29
Friendship Twp
30
31
32
West Traverse Twp
33
34
35

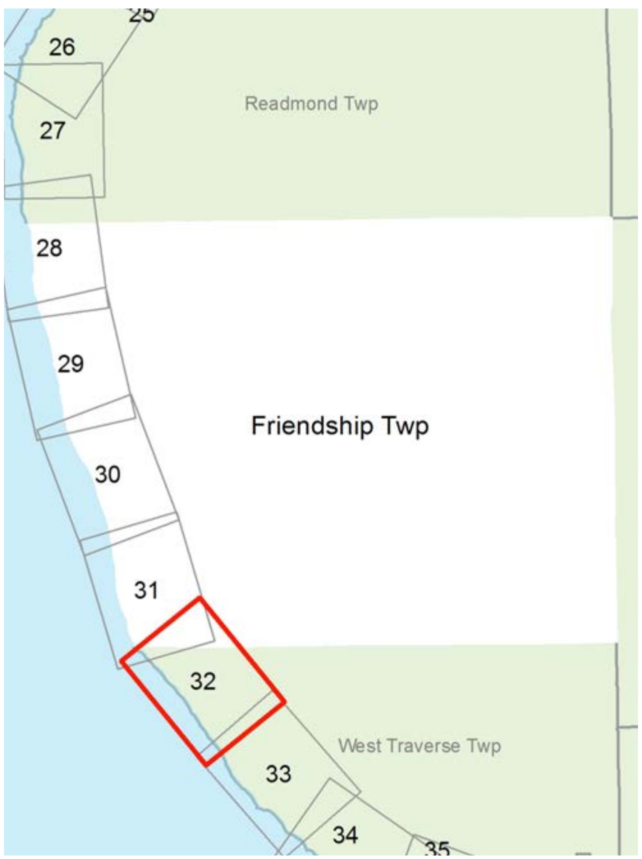

Emmet County


Panel #30
Shoreline Recession
N
Townline
Lake Shore
Stutsmanville
Troup
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


25
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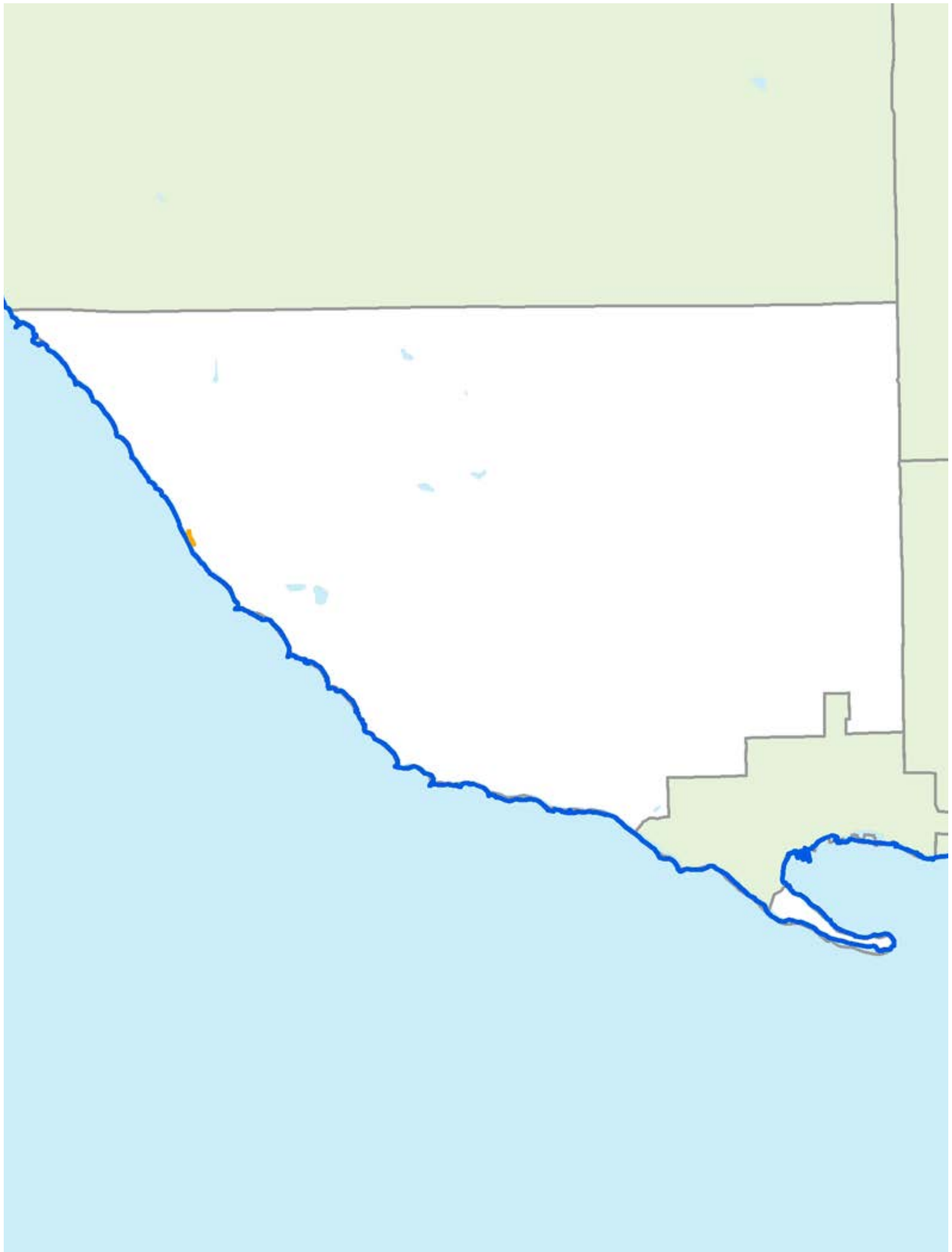
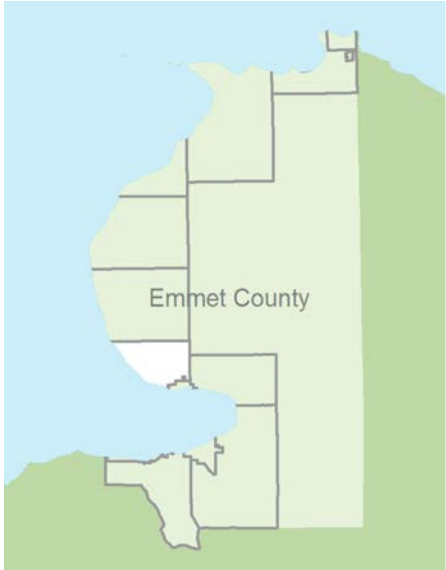
34
35
Readmond Twp
Friendship Twp
West Traverse Twp

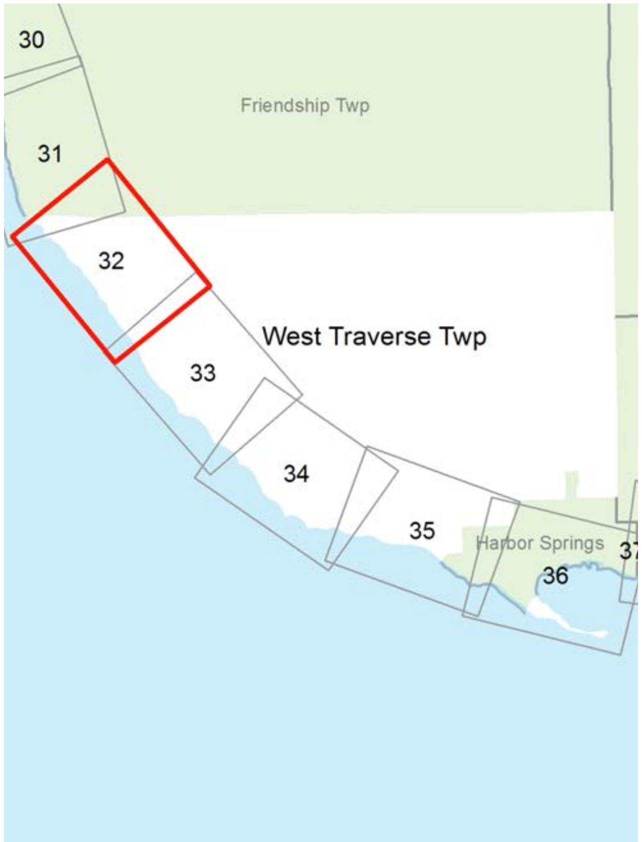

Emmet County


Panel #32
Shoreline Recession
O Connor
Thorne Swift
Friendship Twp
West Traverse Twp
7 Mile Pointe Ridge
Lake Shore
Bluffside
Lower Shore
Cummings
Five Mile Creek
Five Mile Lake
Five Mile Lake
Trillium
Middle
Lake Shore
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

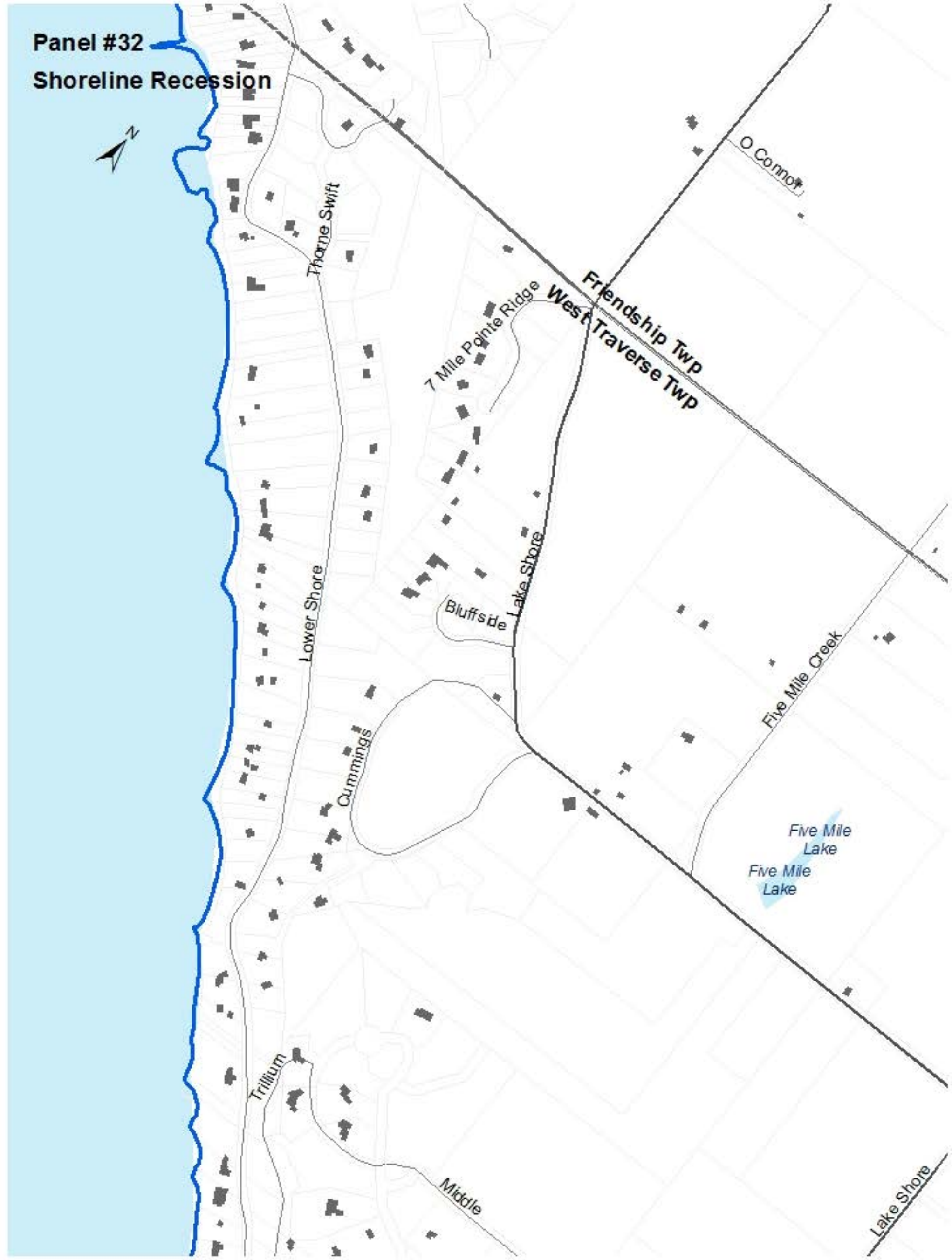


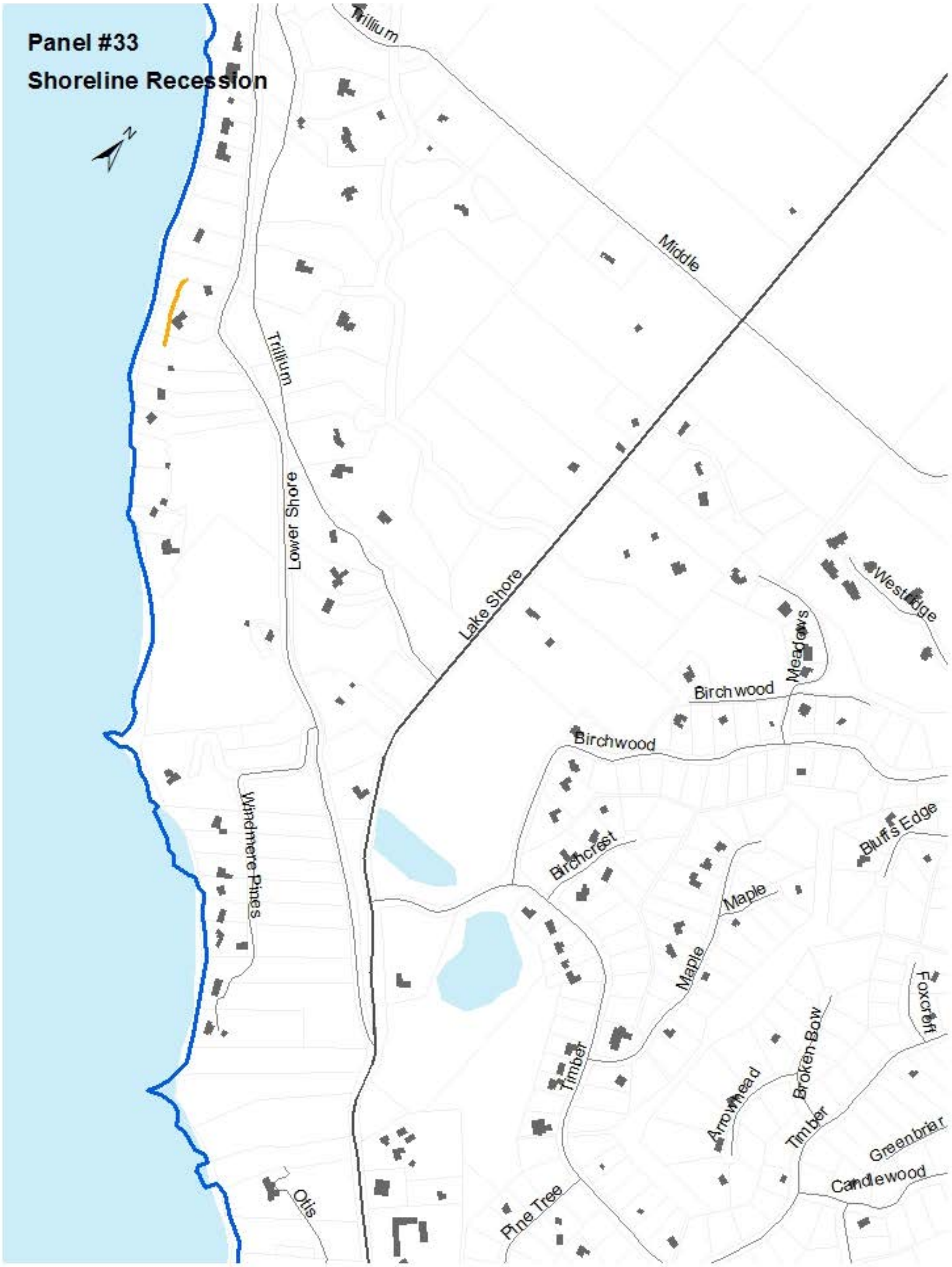
West Traverse Twp.



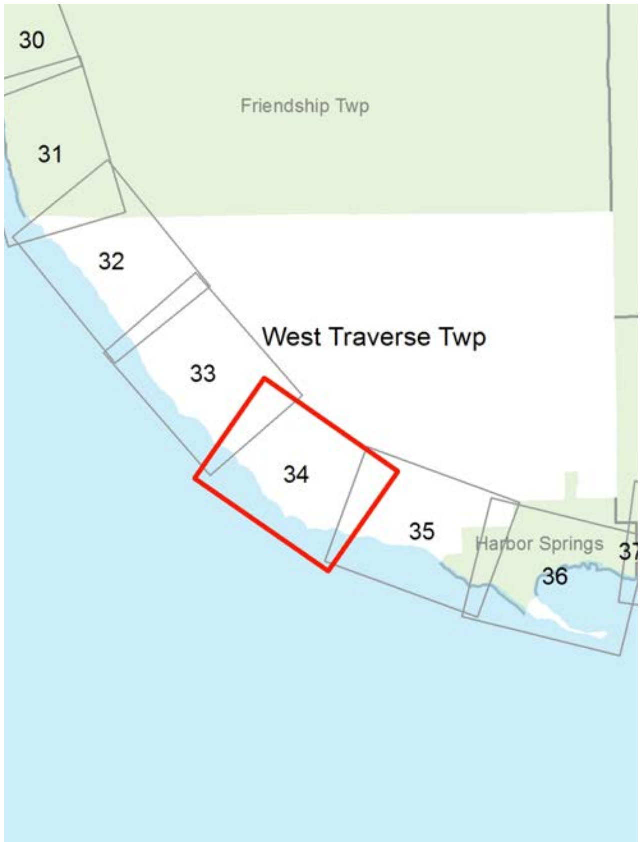


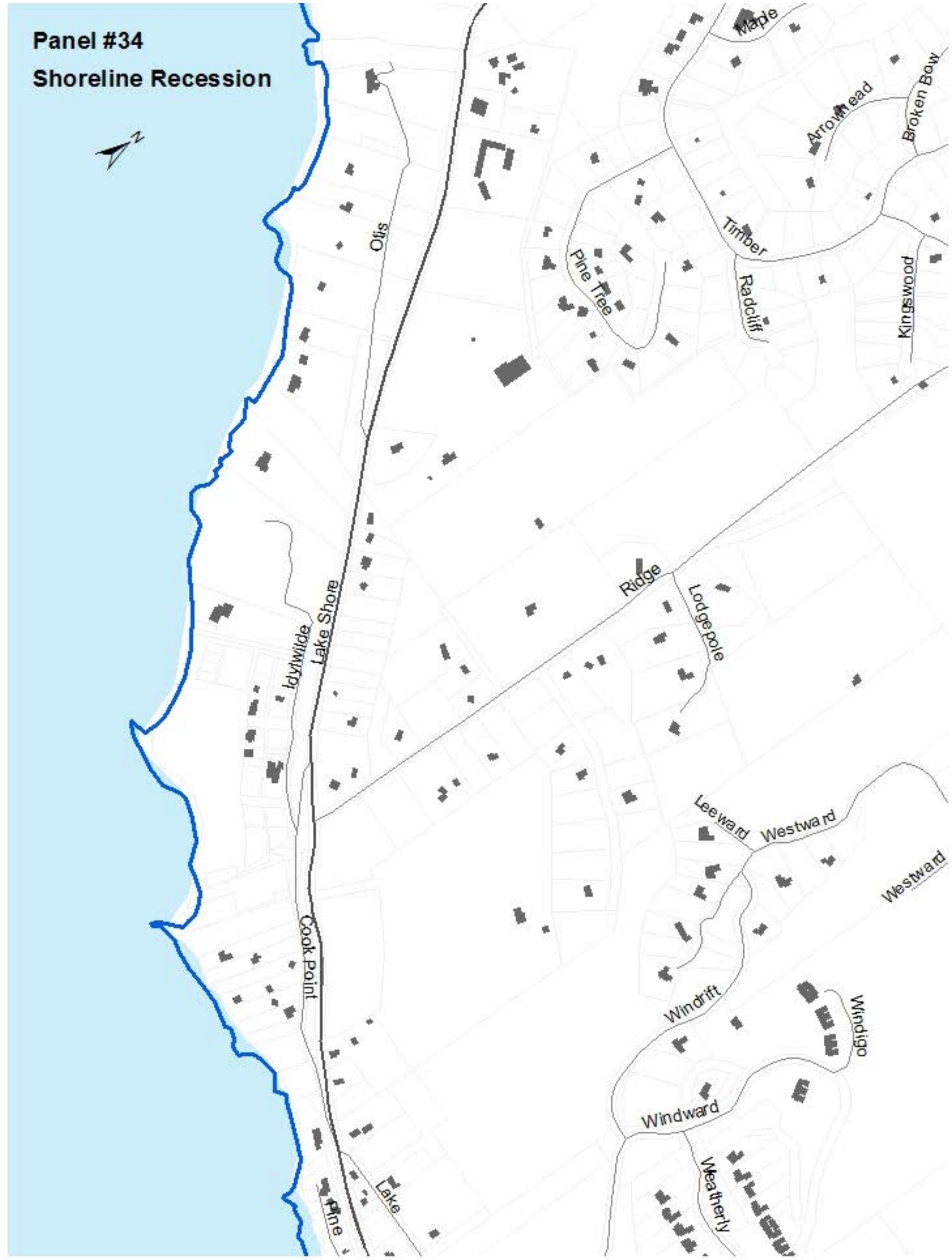
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



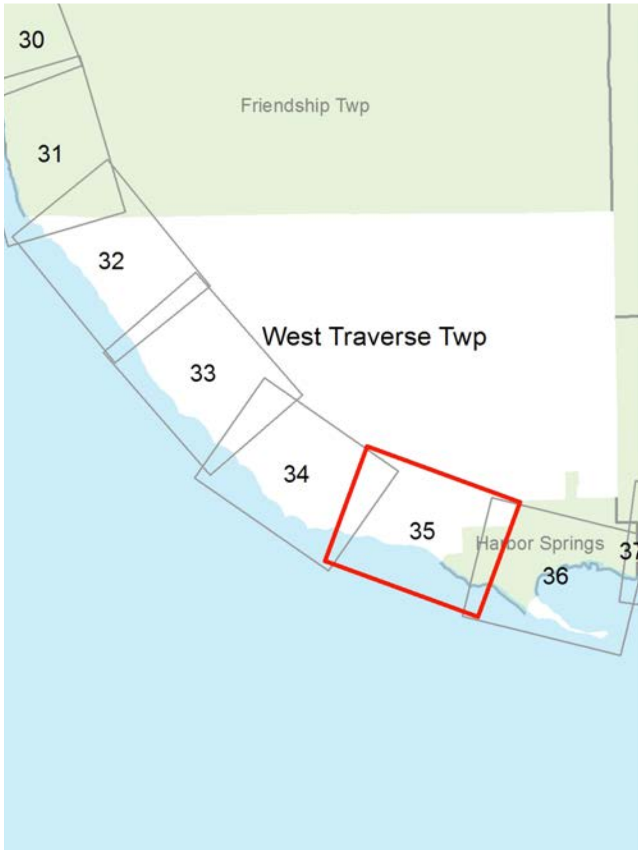


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

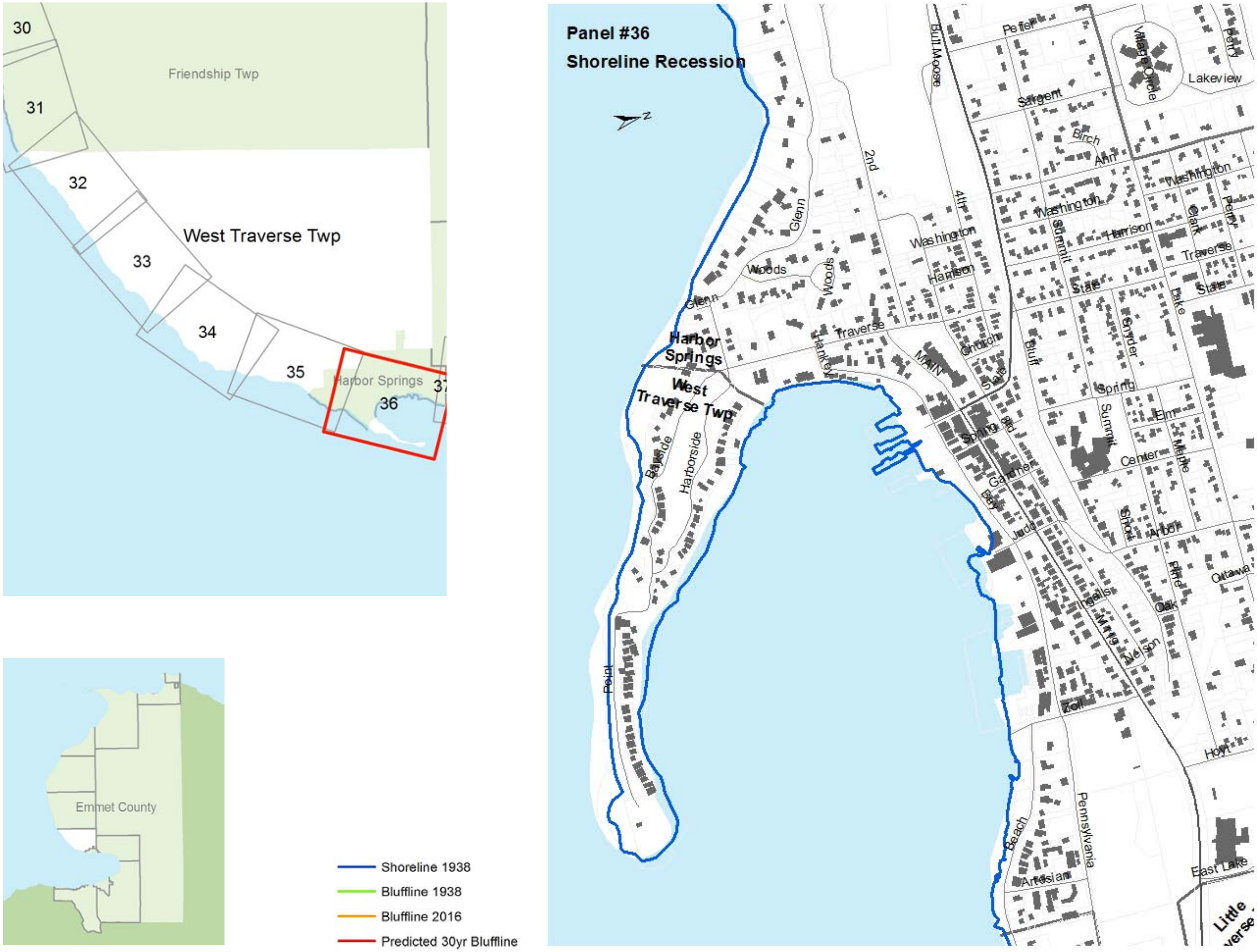




Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #36
Shoreline Recession
Friendship Twp
West Traverse Twp
30
31
32
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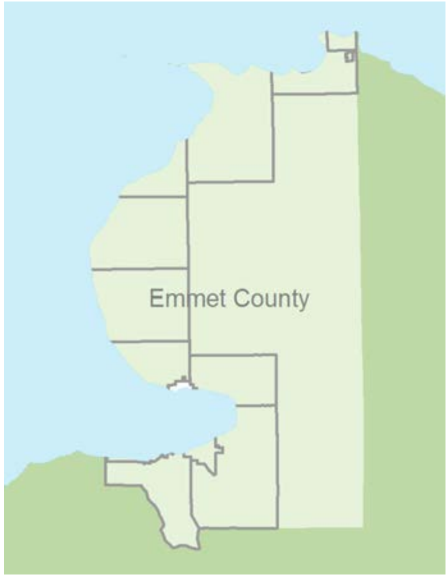
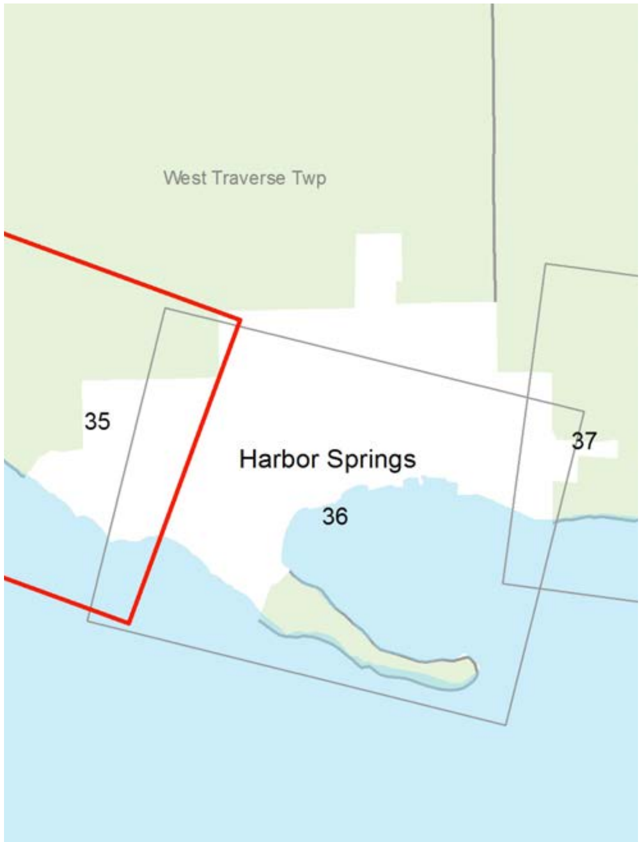
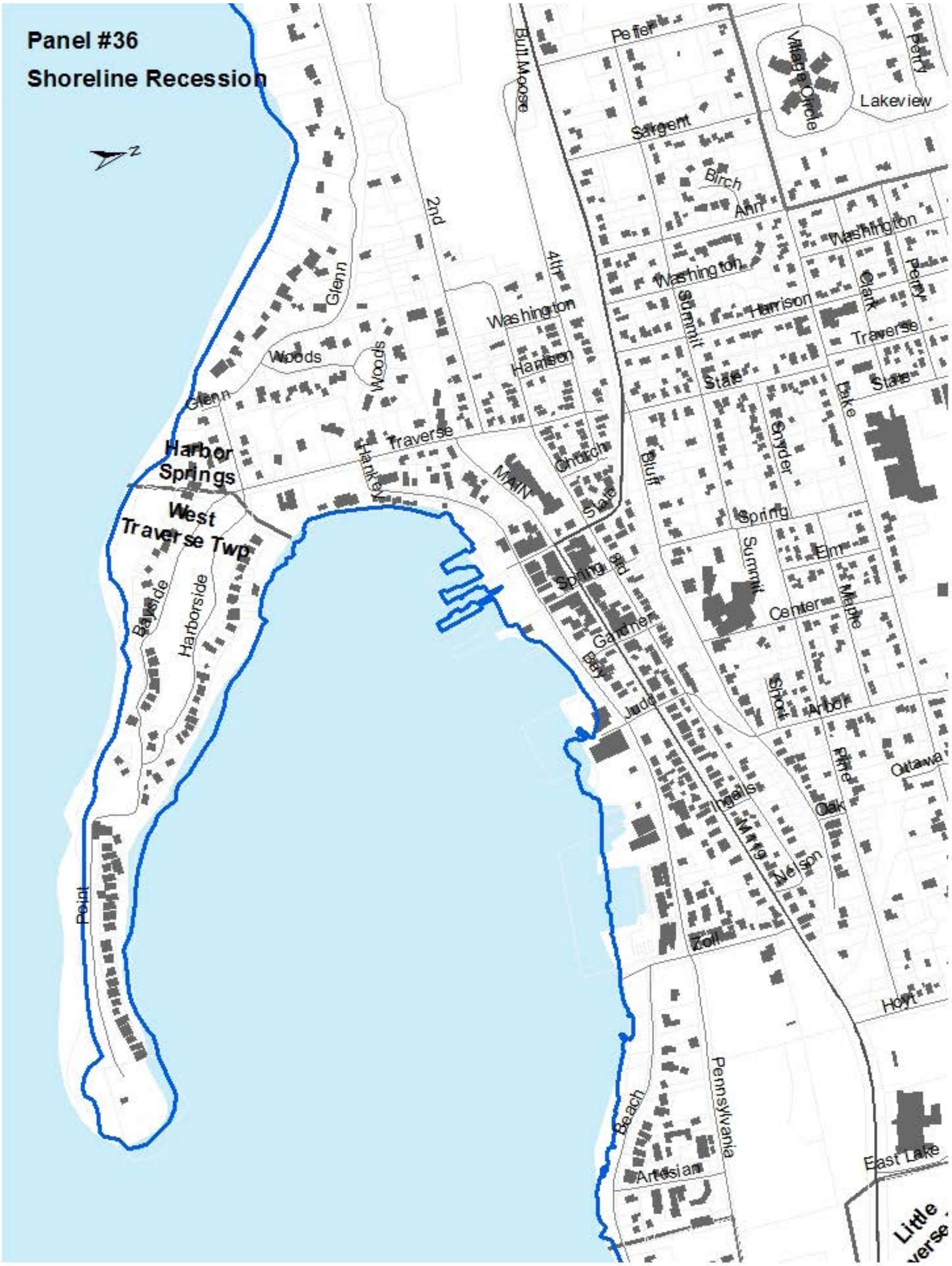
37
Harbor Springs
Emmet County
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline
Harbor Springs
West Traverse Twp
Little Traverse

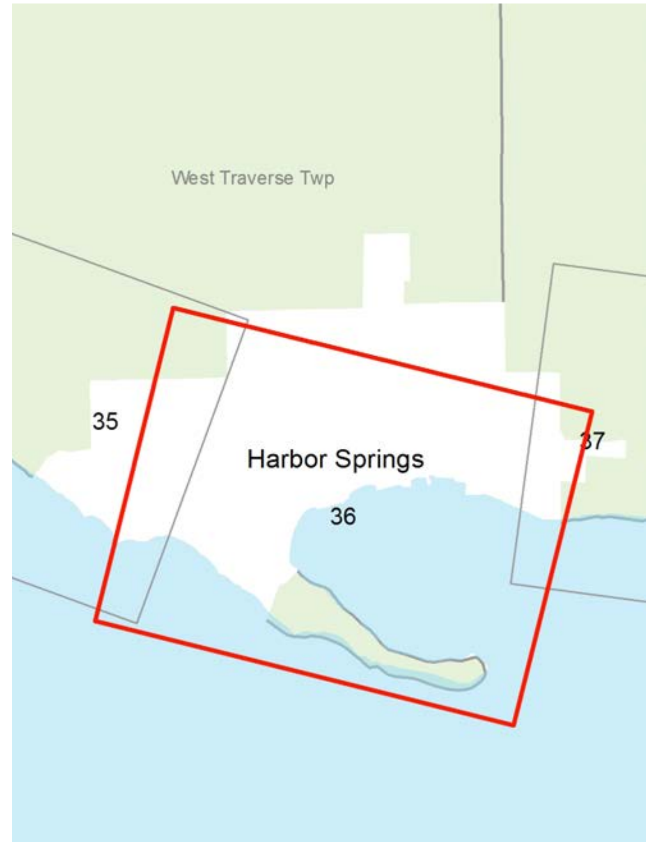
Harbor Springs





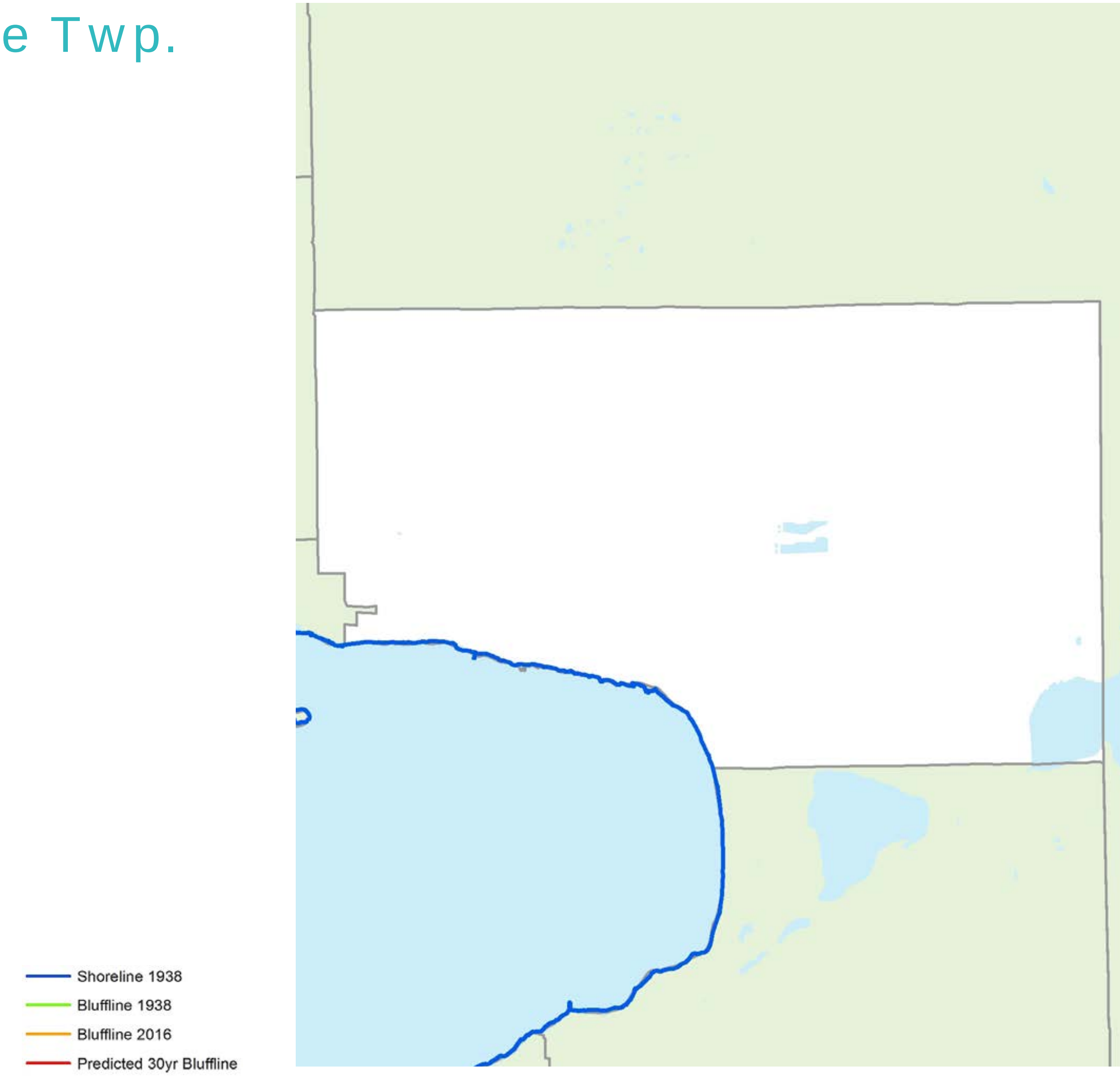
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Little Traverse Twp.

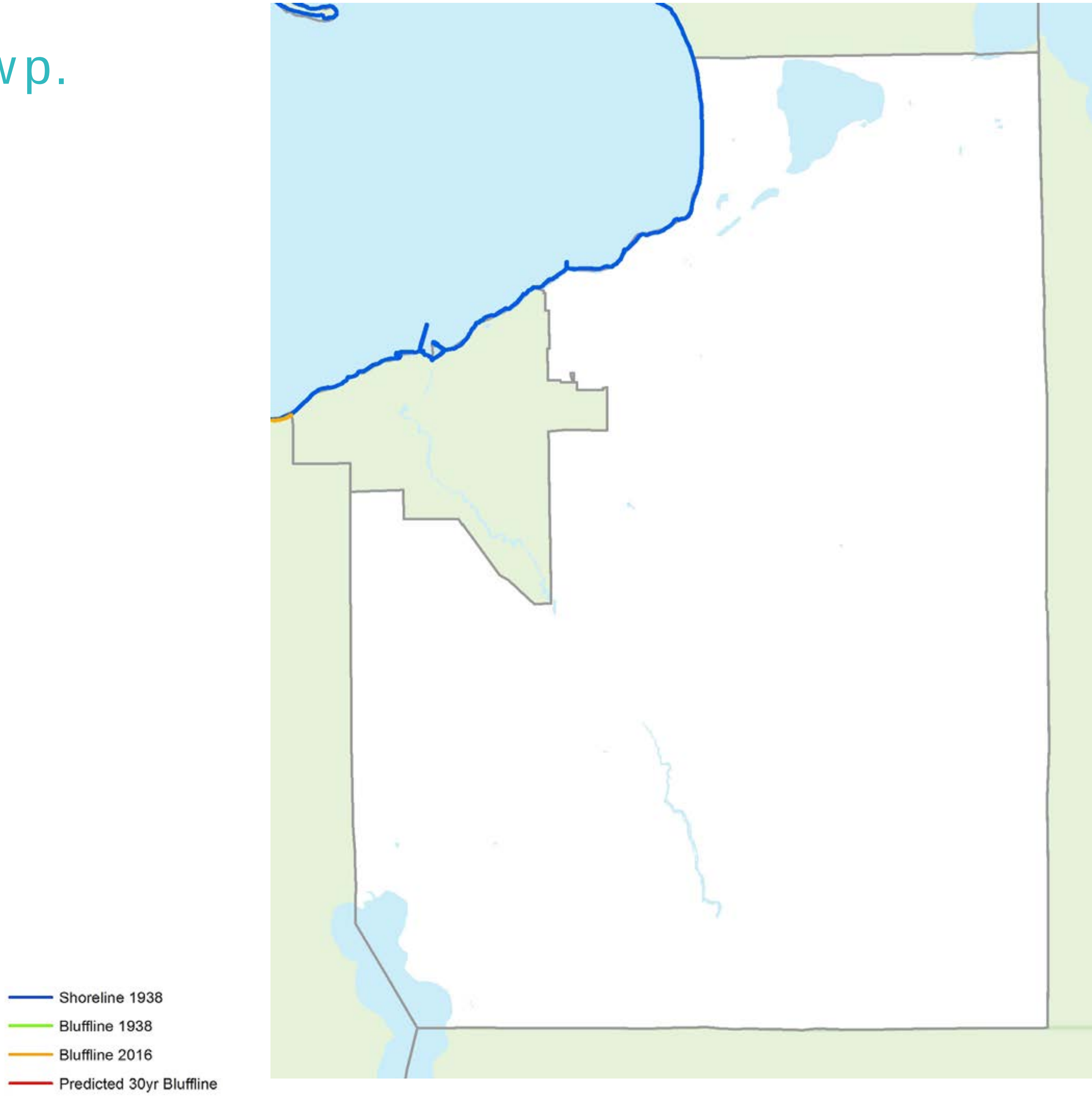


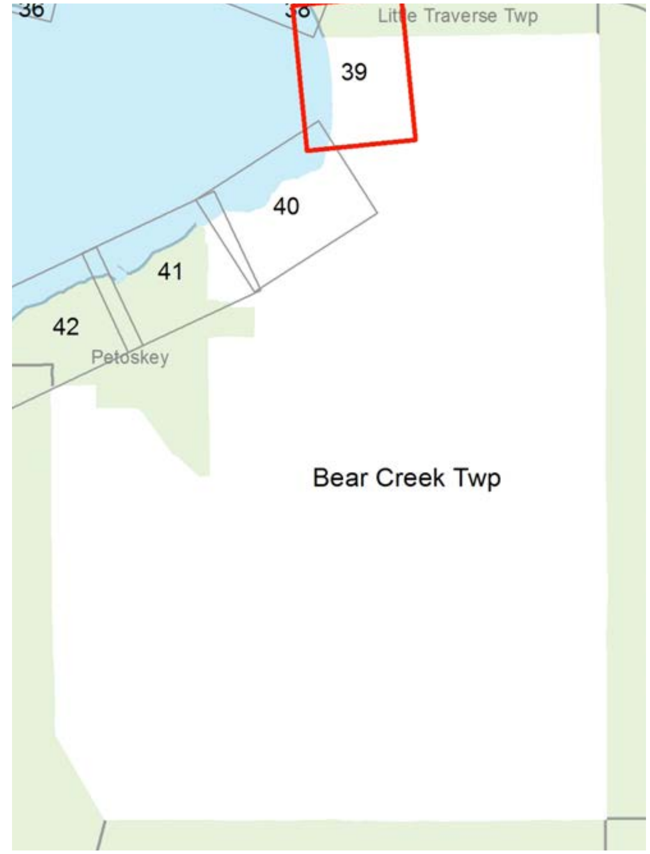
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

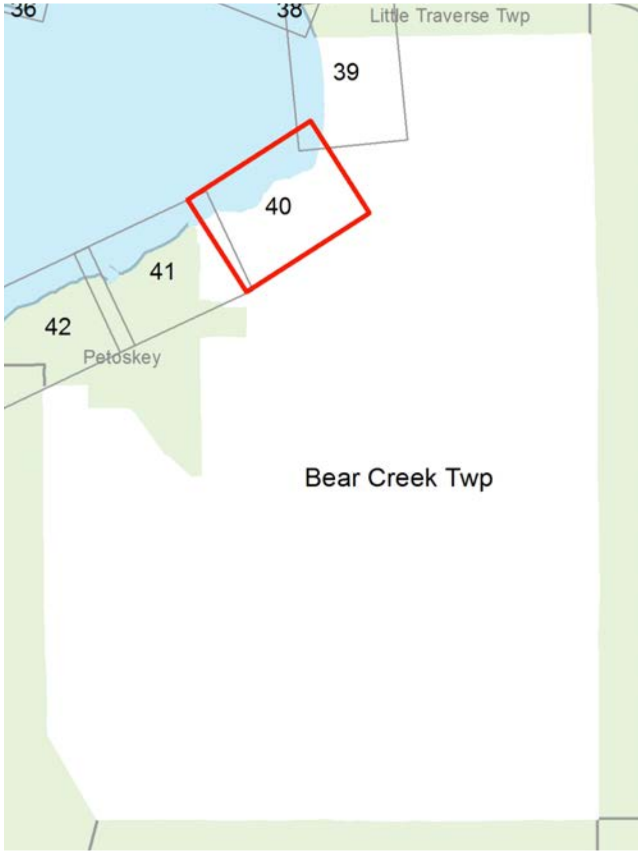
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

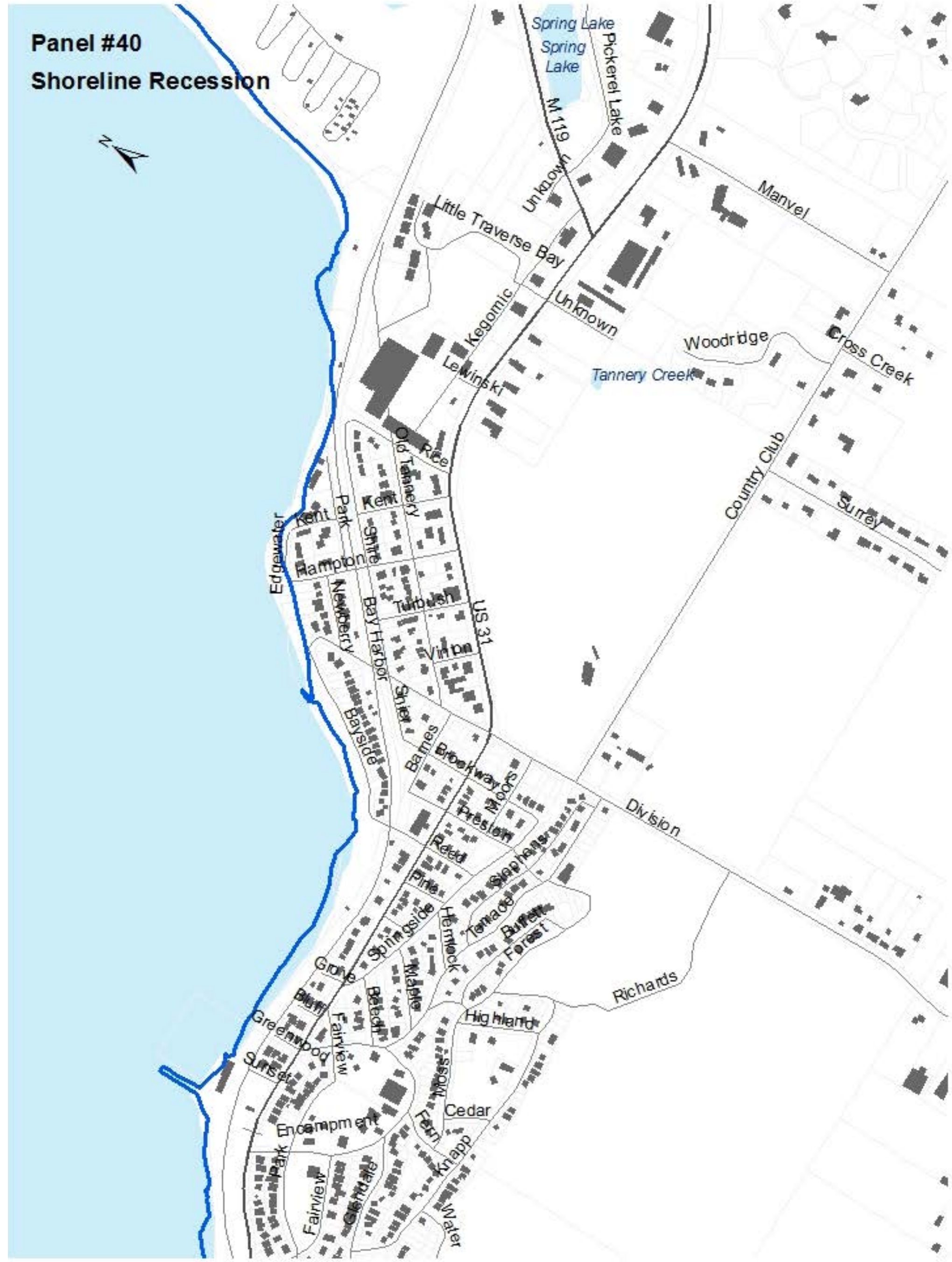
Bear Creek Twp.



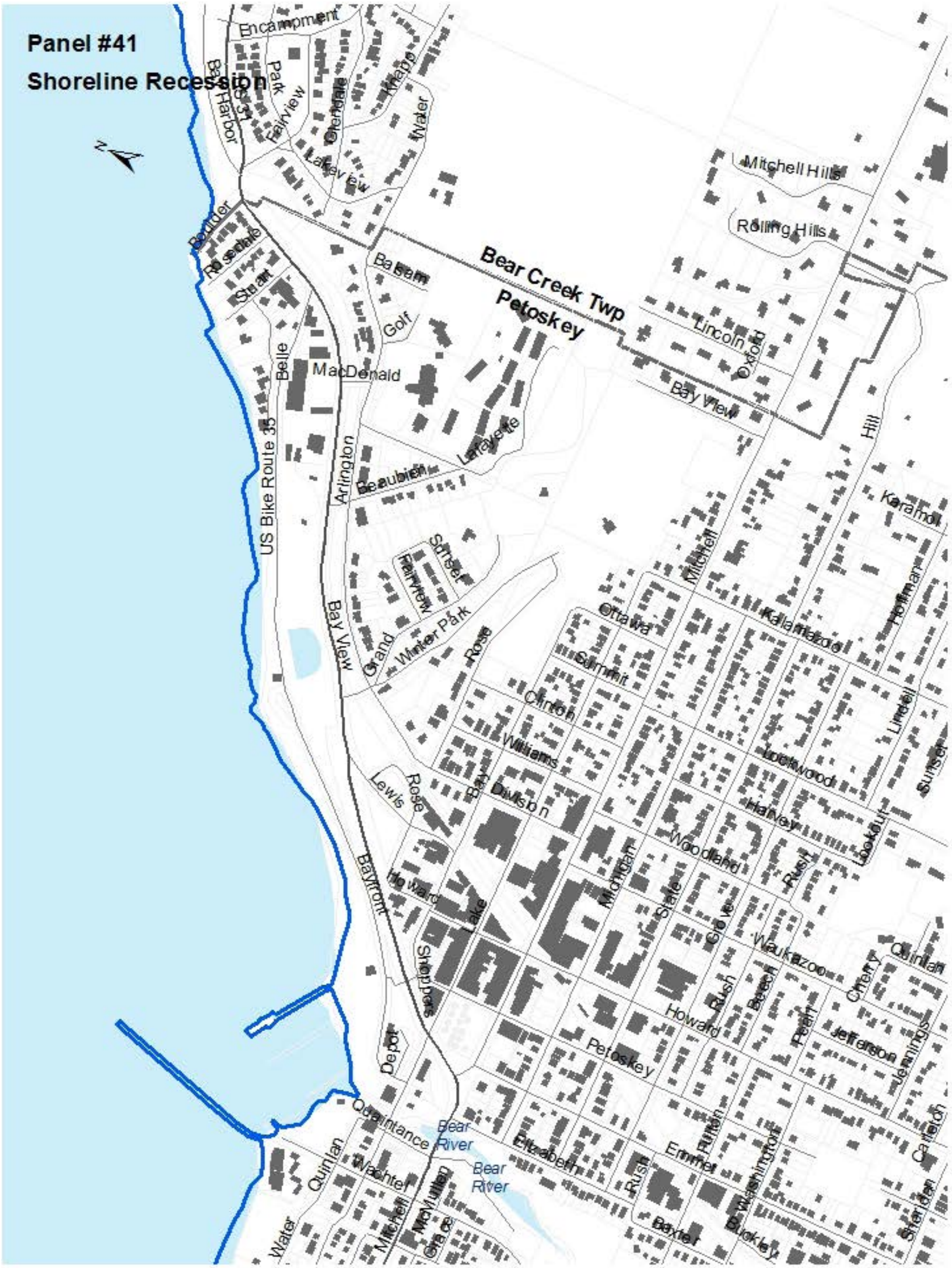


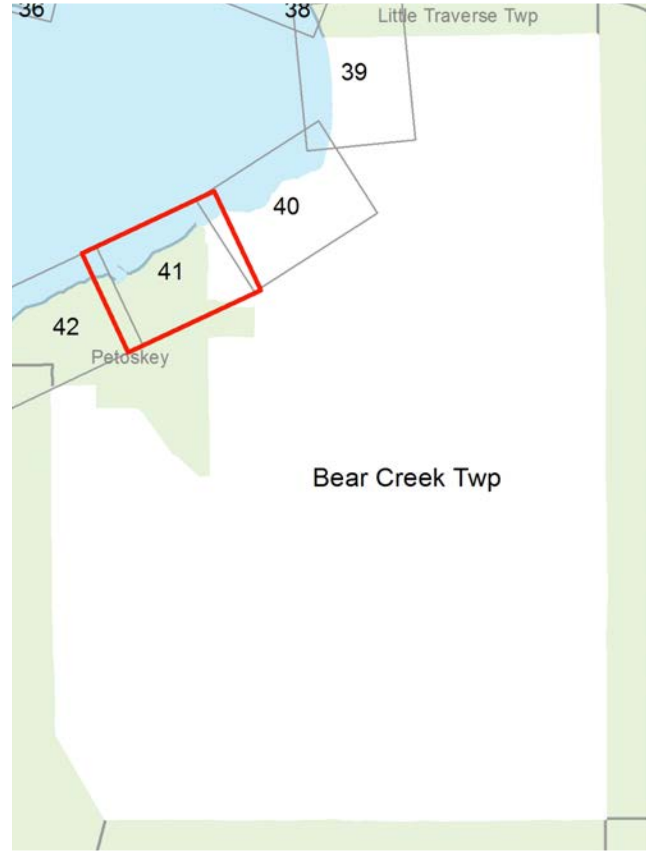
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline

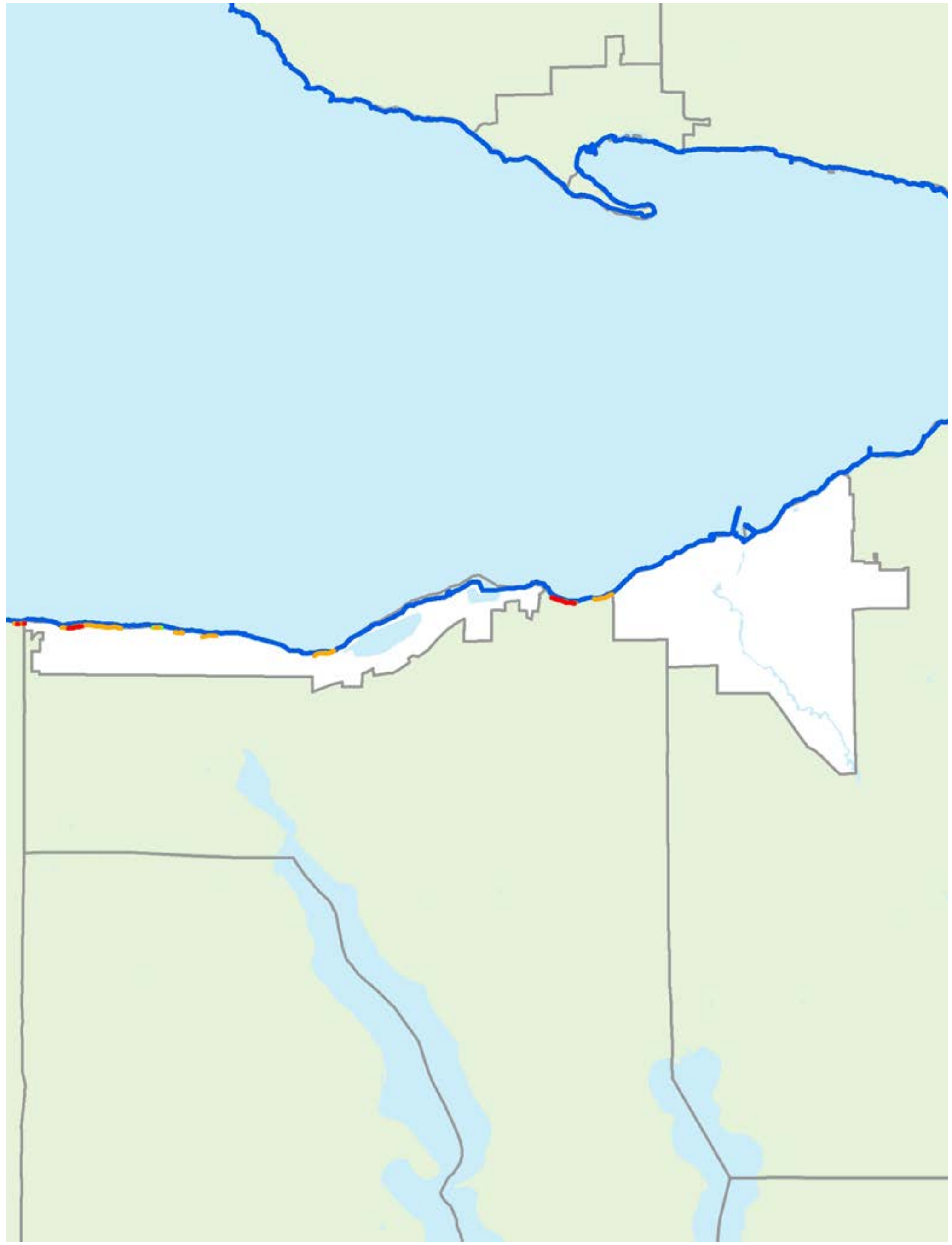




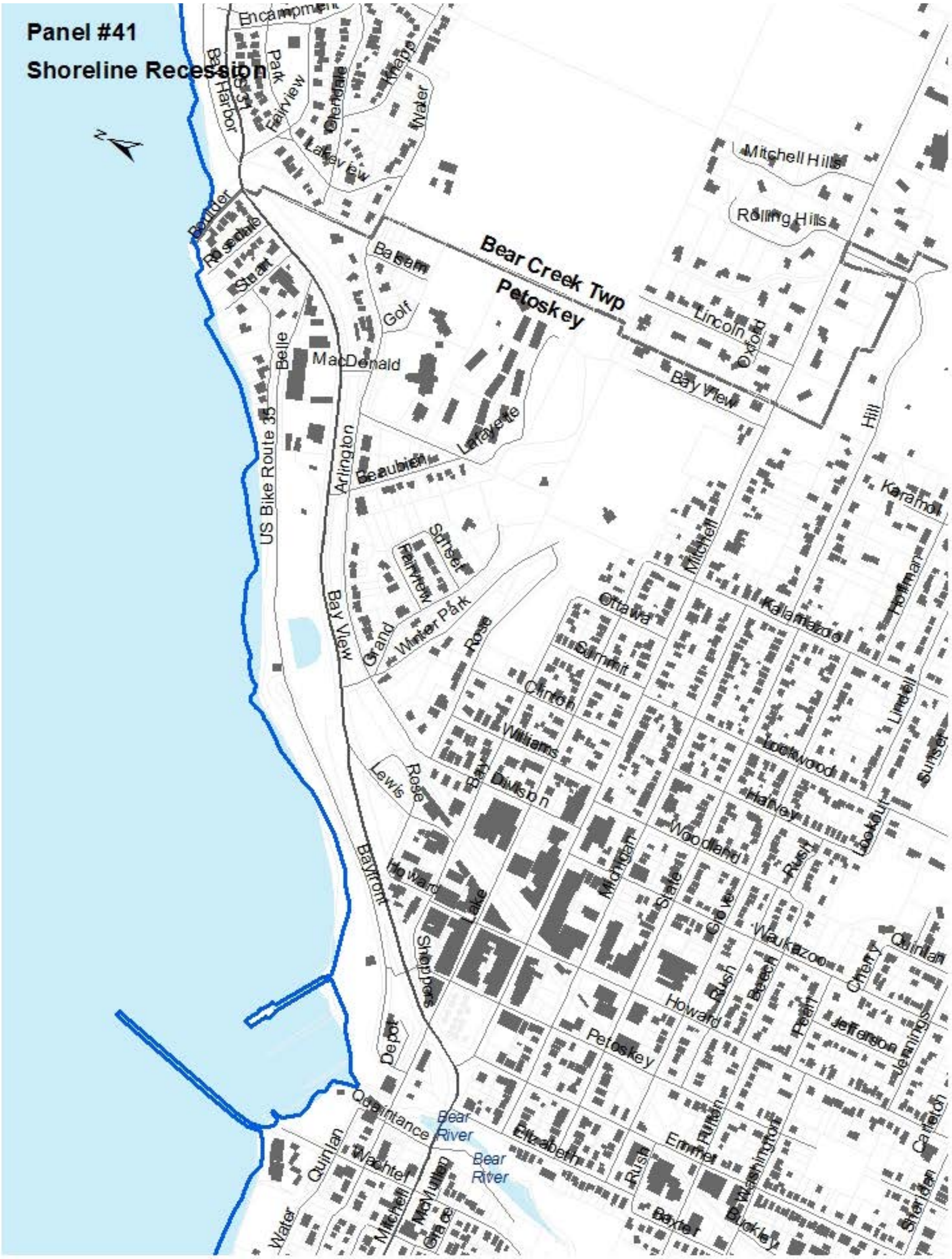
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

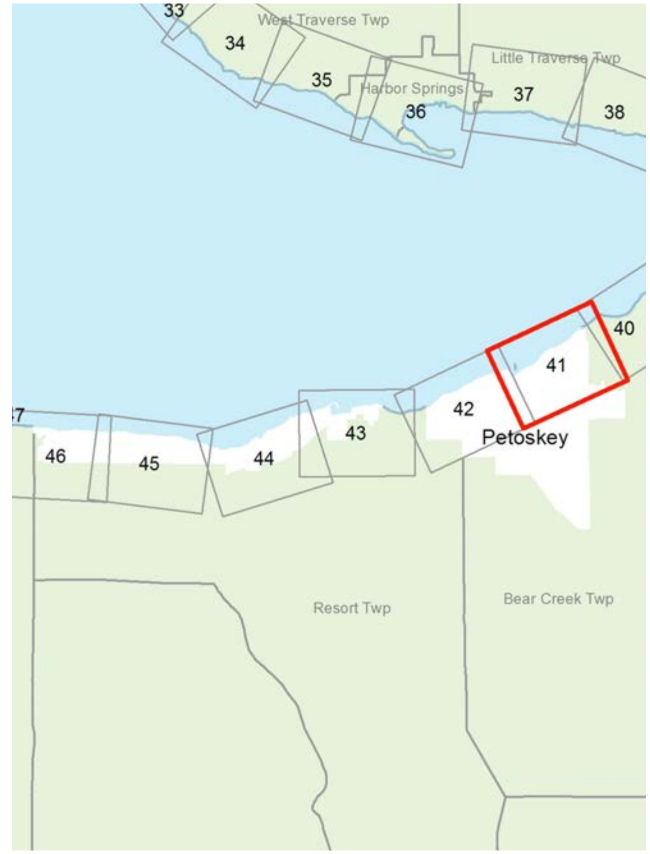
Petoskey


Emmet County

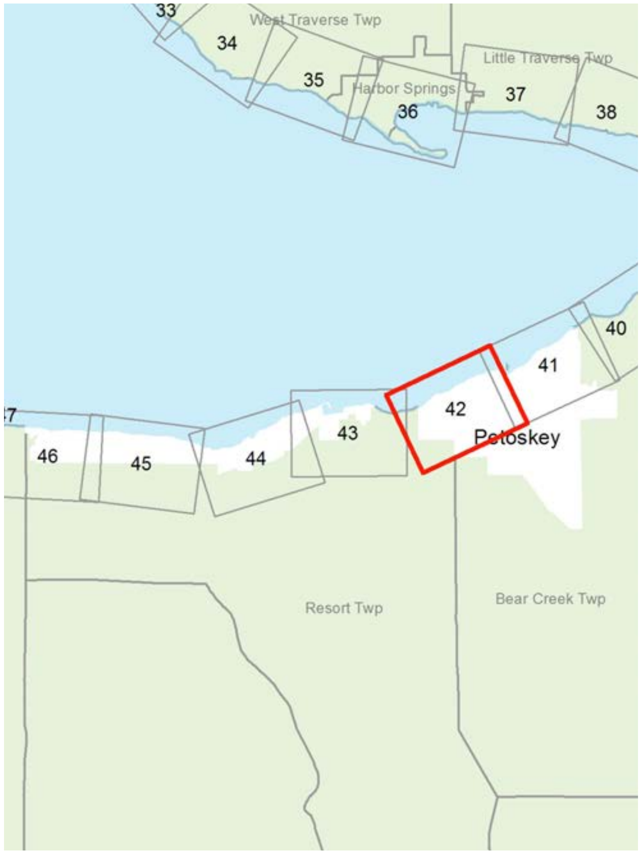


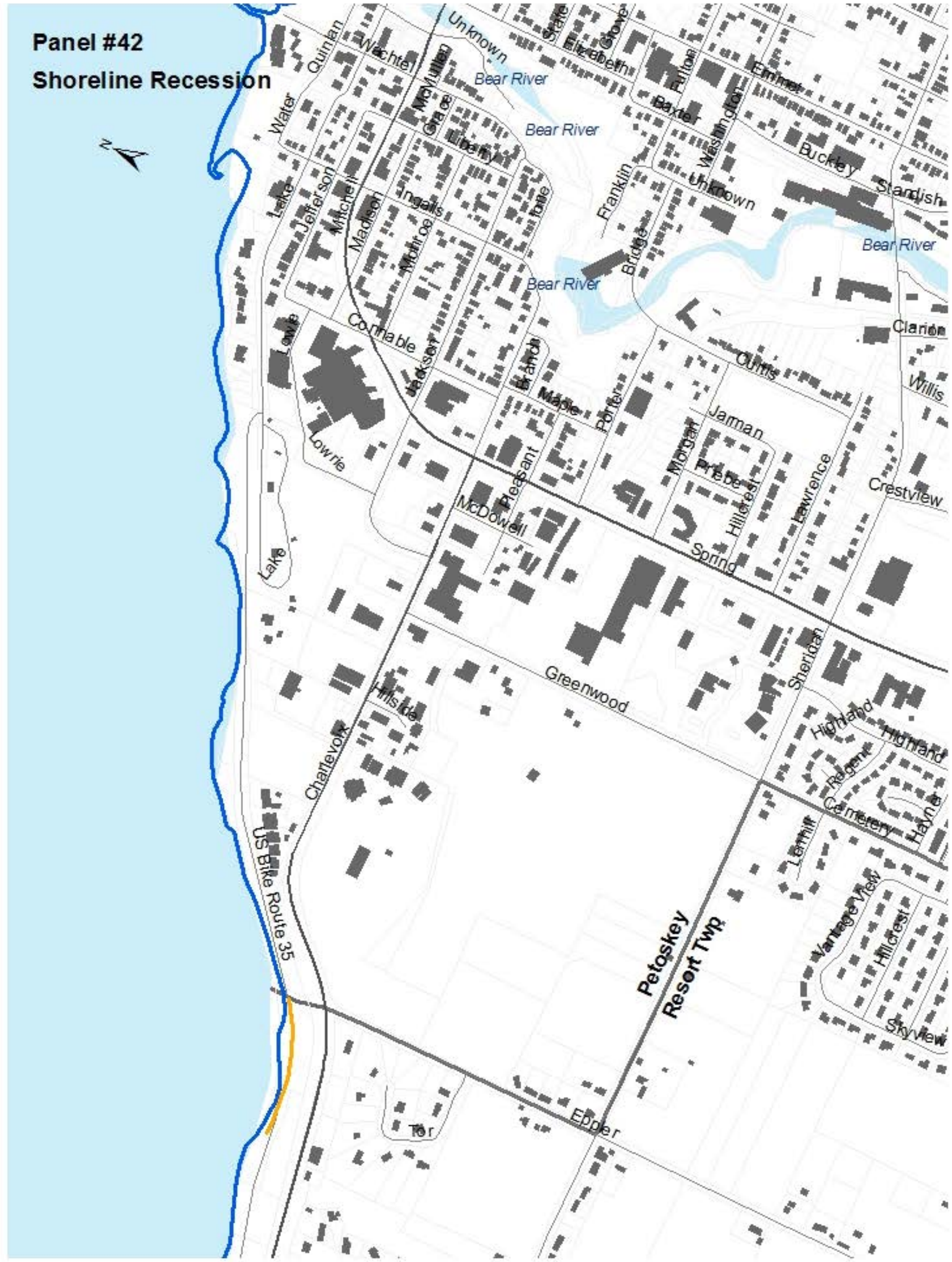
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



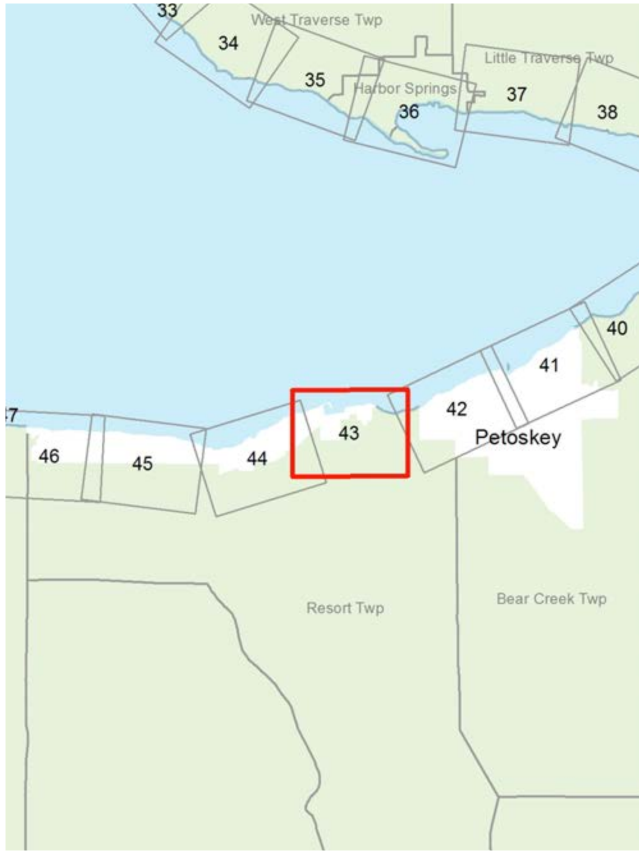


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

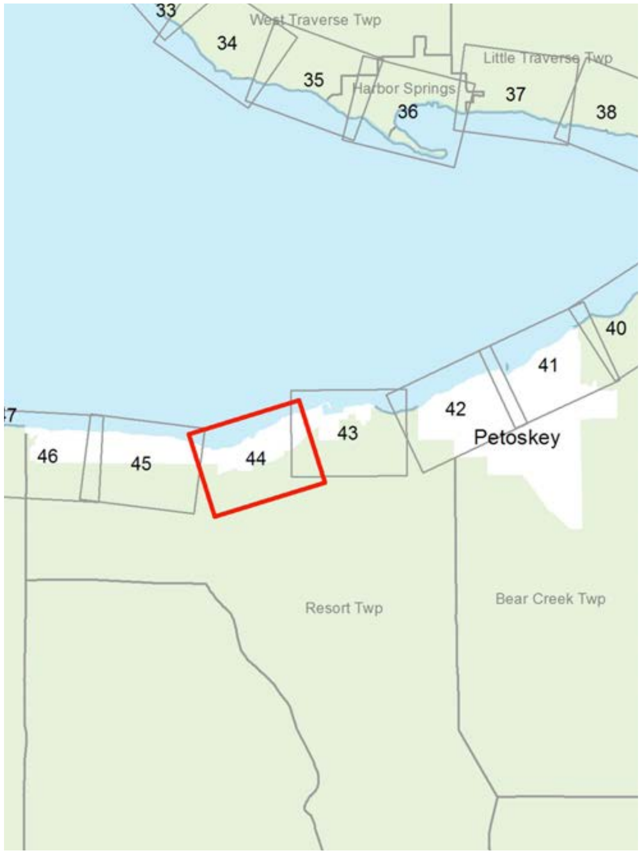




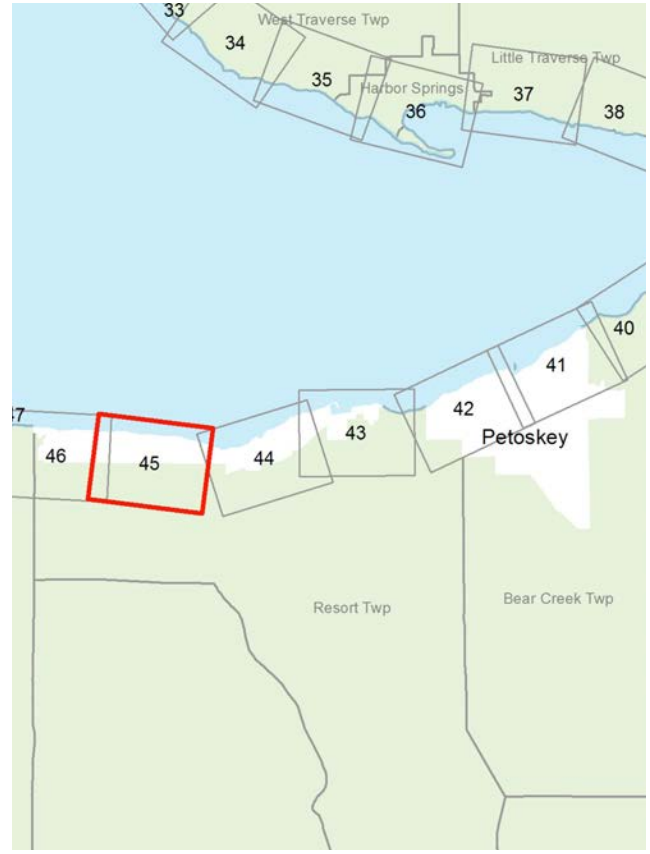
- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



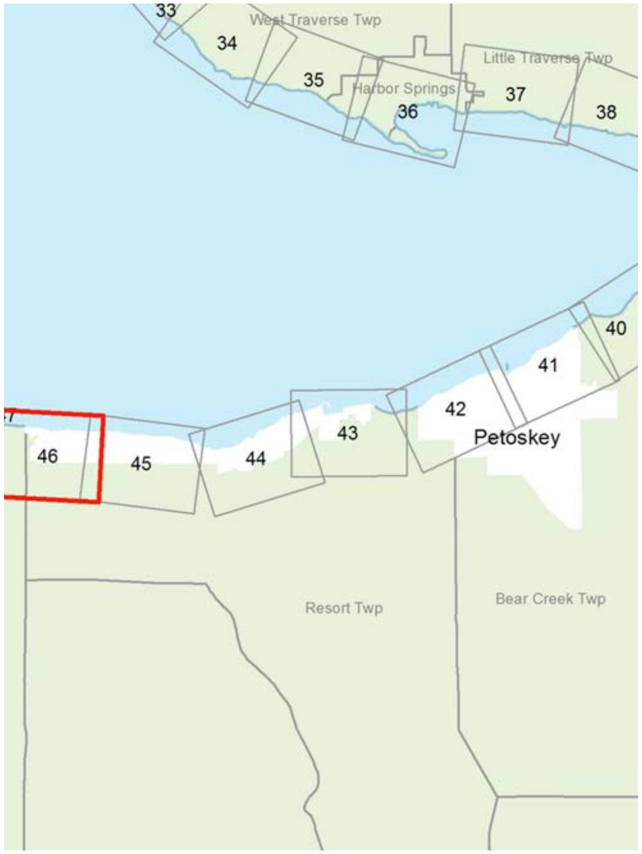
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

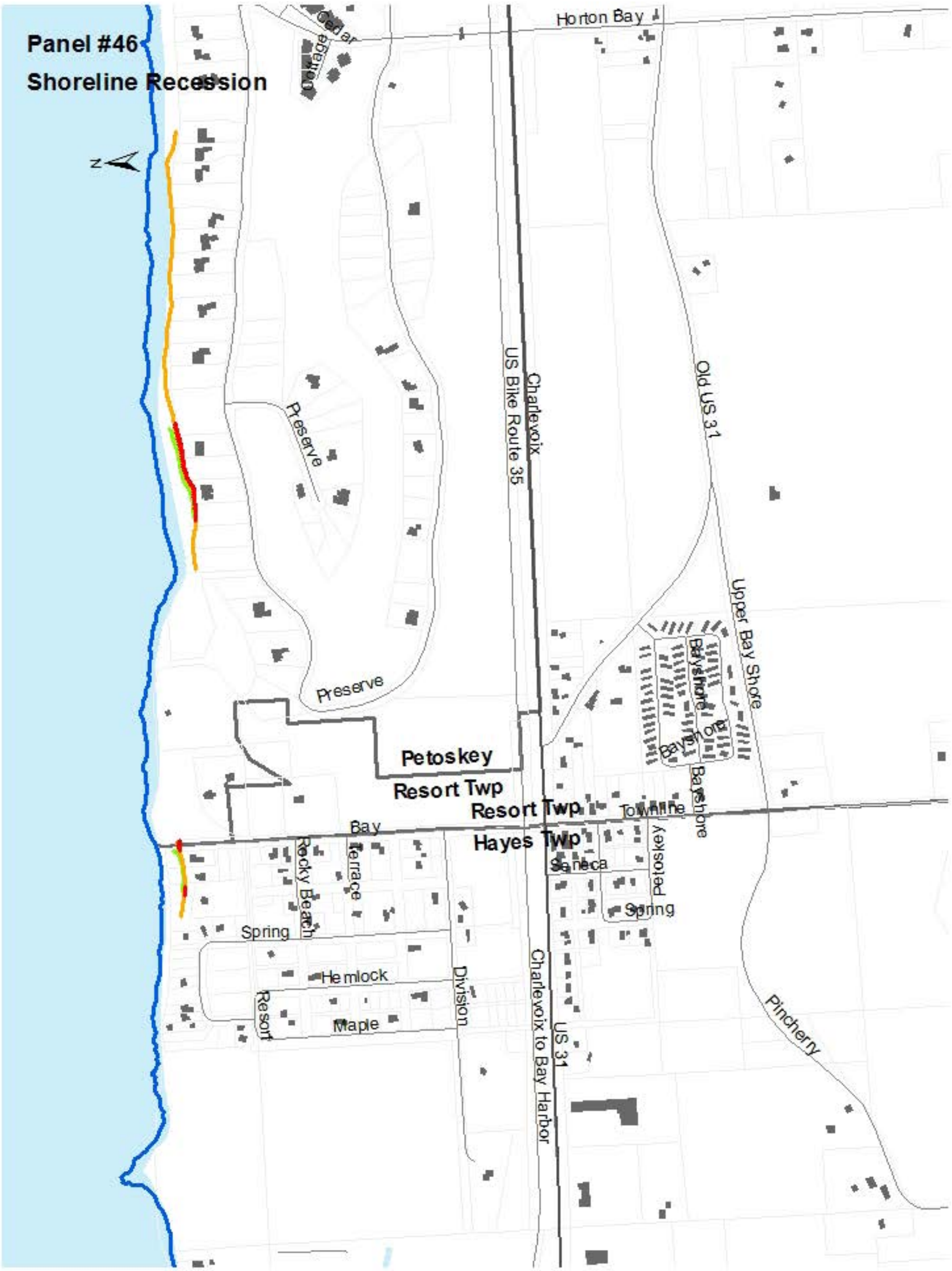


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



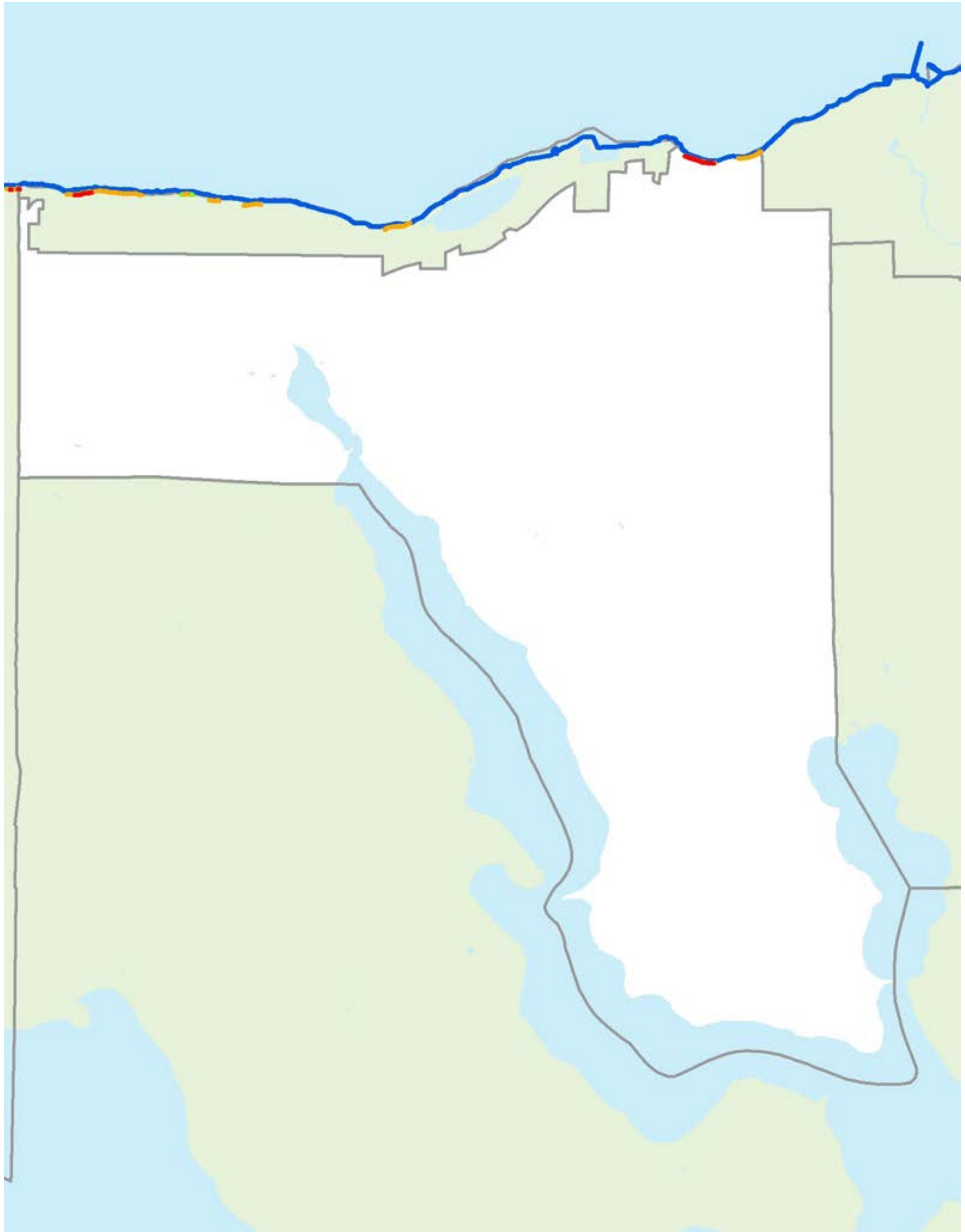
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





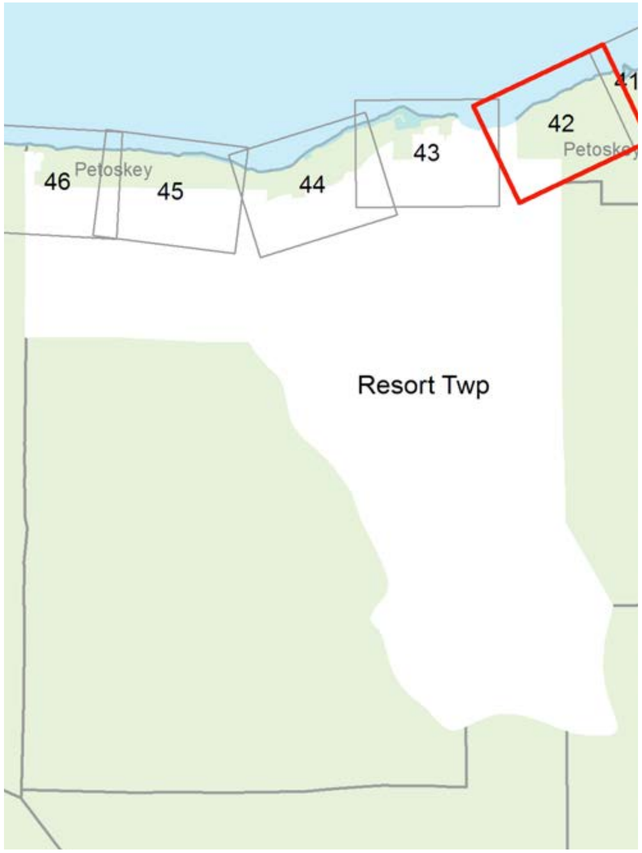
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

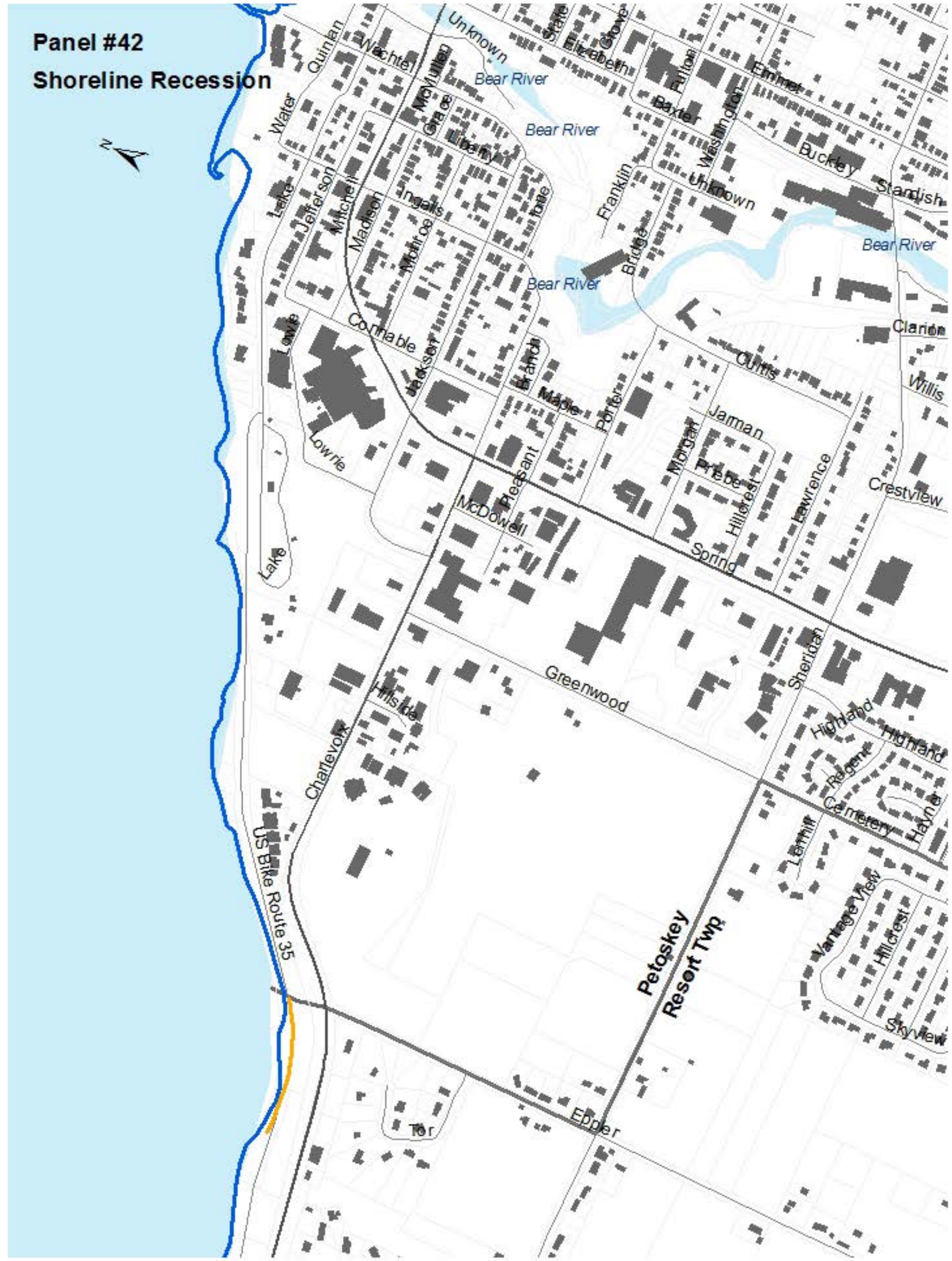
Resort Twp.



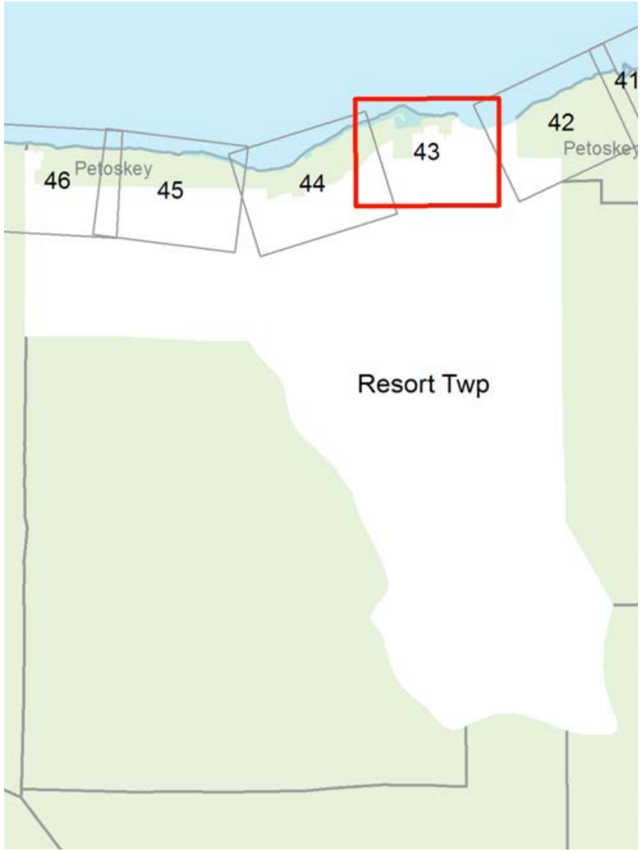

Emmet County

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



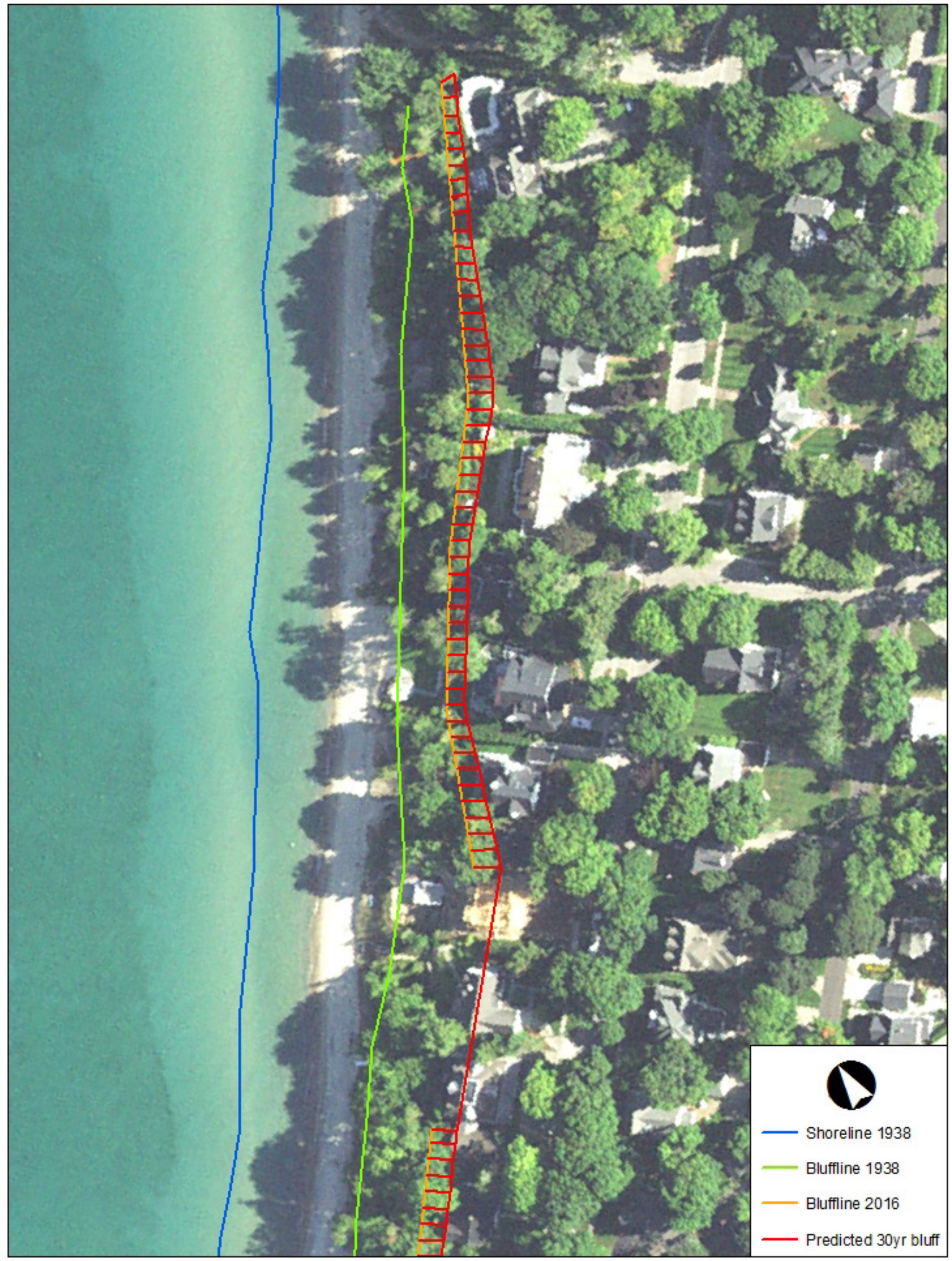
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Charlevoix County

BLUFF RECESSION DETAIL

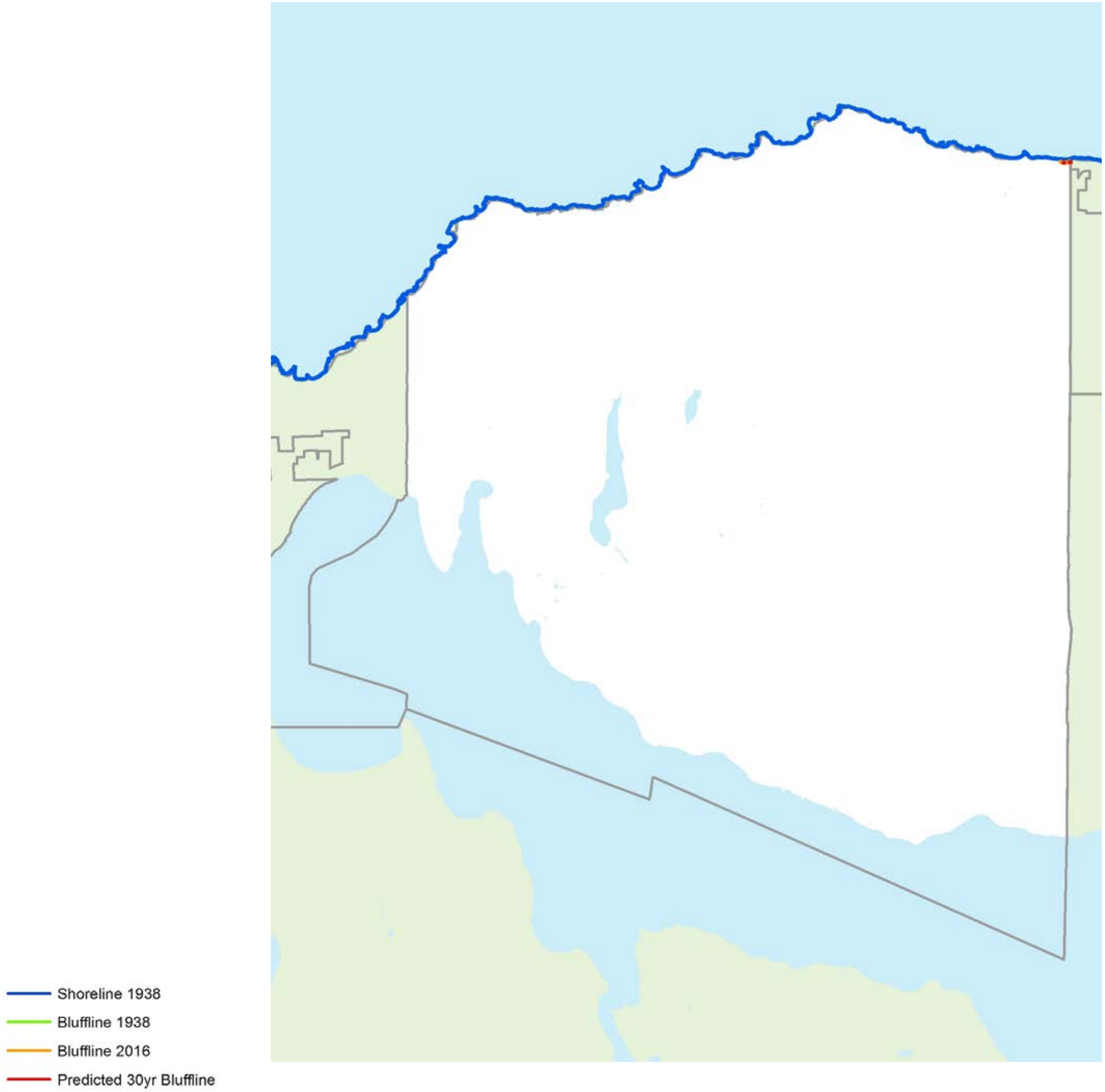
At least one "zoomed in" detail example of historic bluffline recession and future projections is provided at the beginning of each county section of this chapter. Shoreline and bluffline recession data can be viewed in greater detail online at http://geospatialresearch.mtu.edu/czmp.

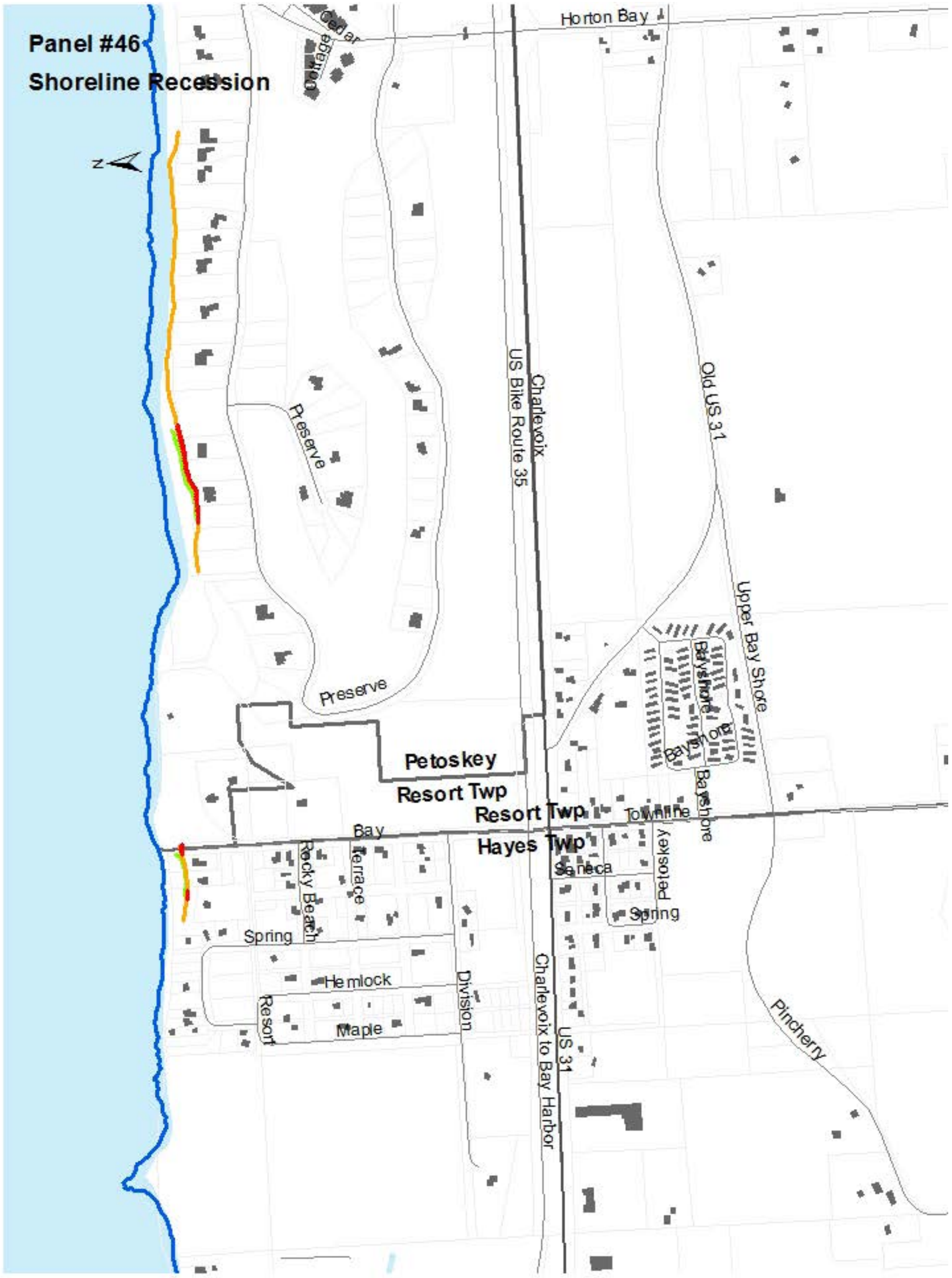
Bluff Detail, Panel 53, Charlevoix

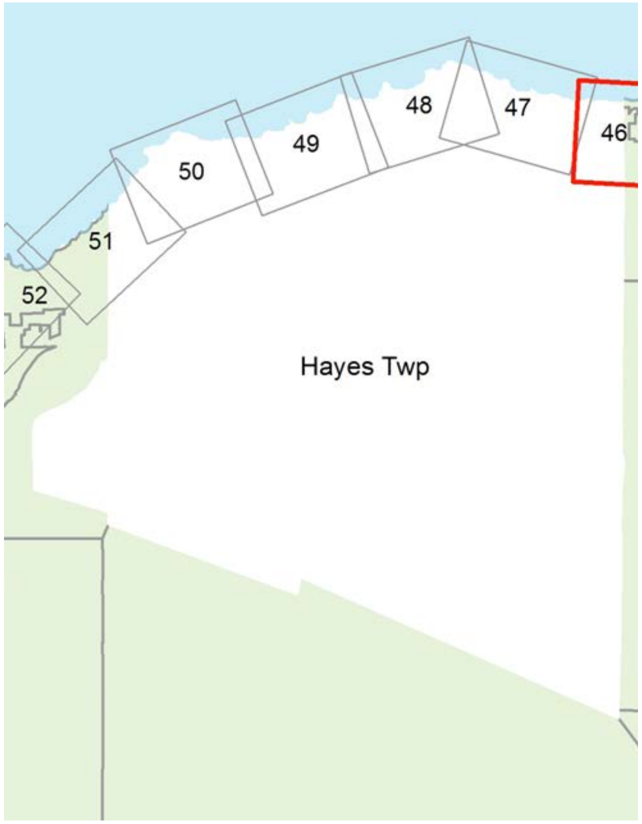


Hayes Twp.

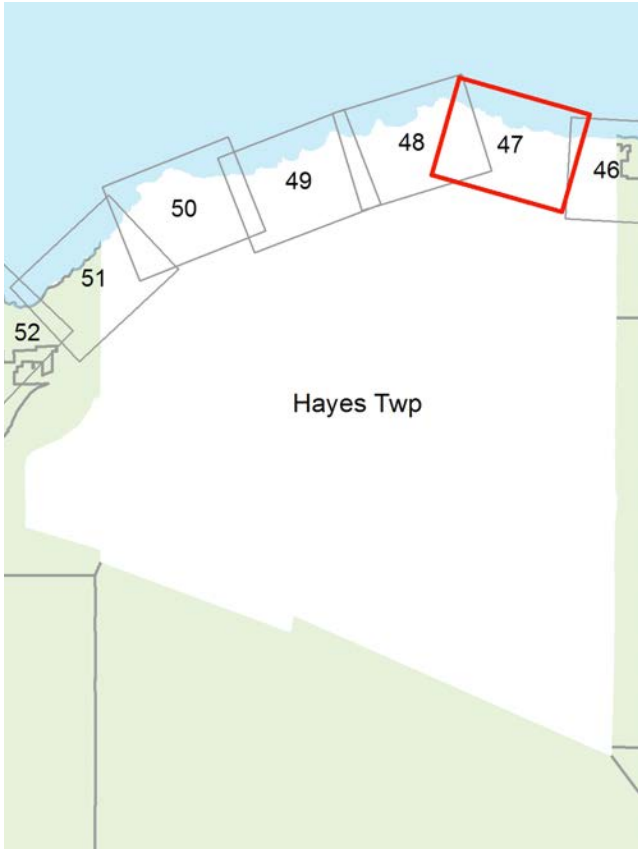

Charlevoix County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

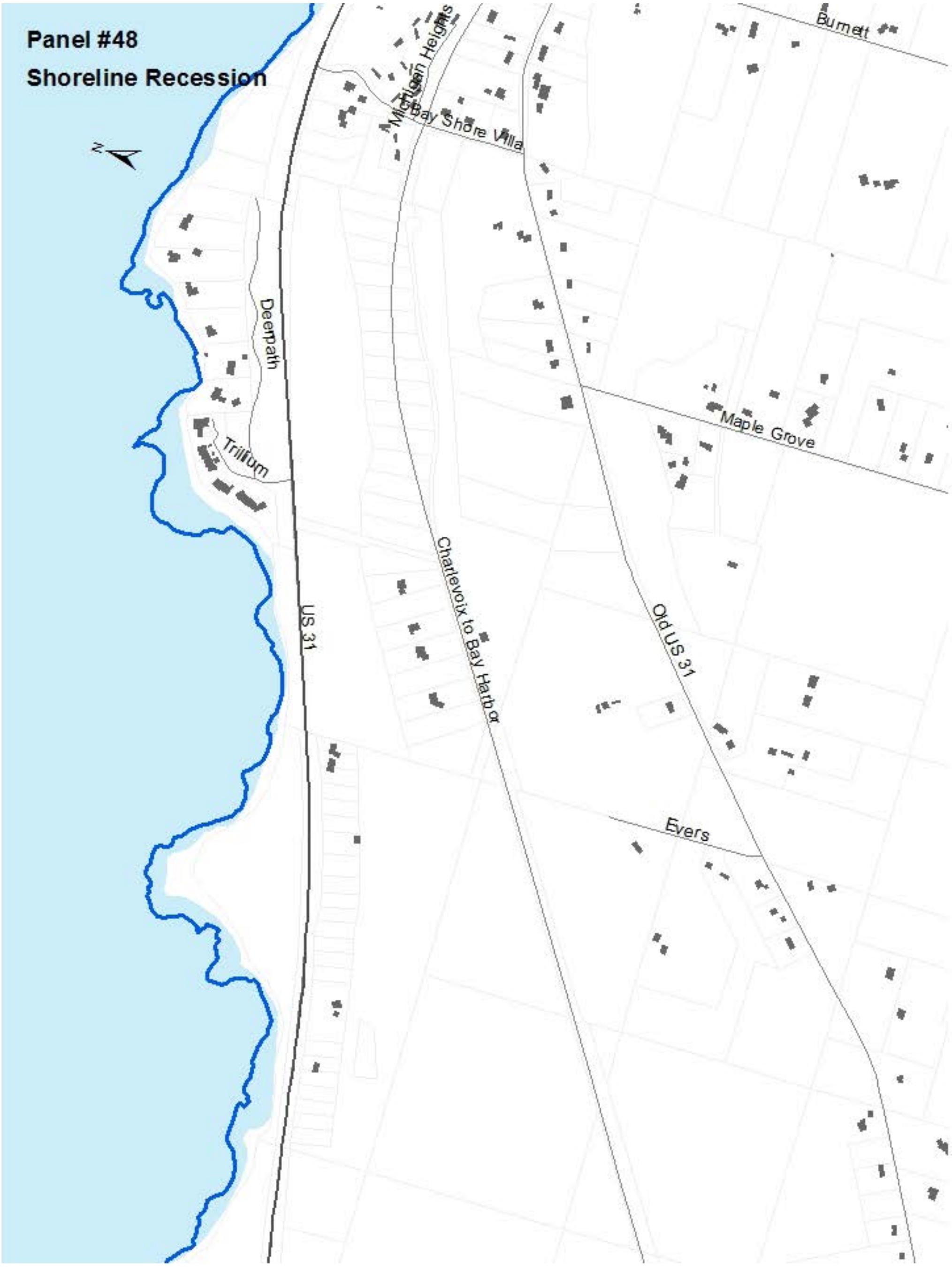


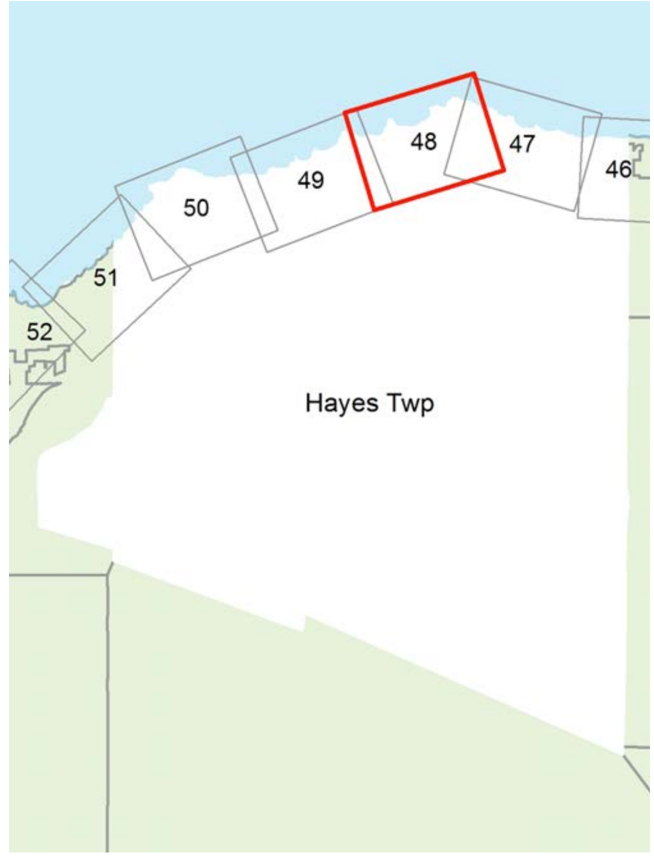


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

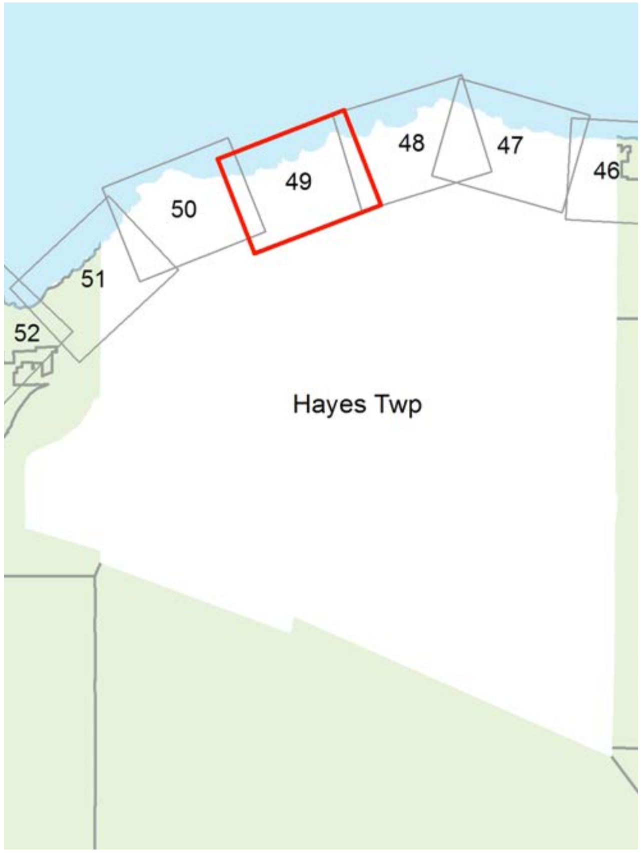


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



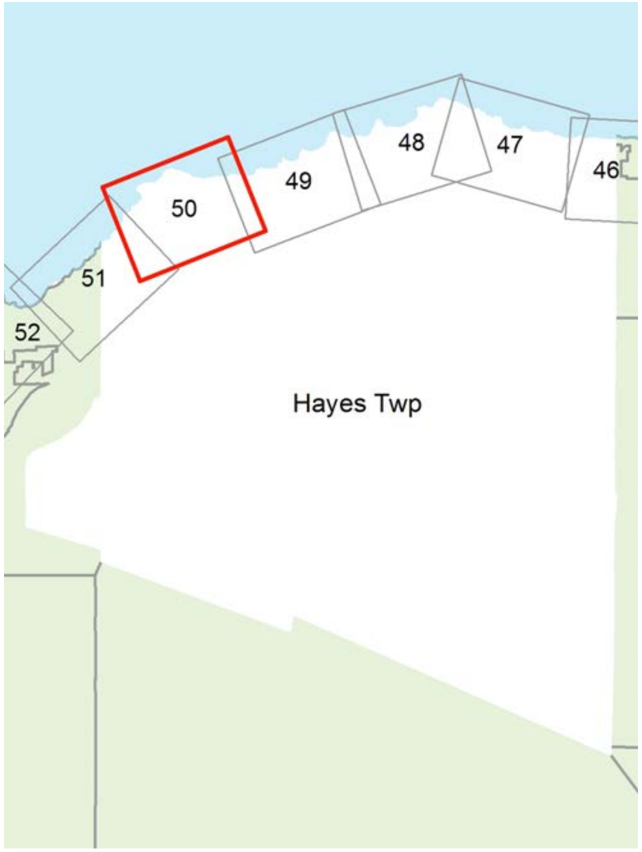


- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline

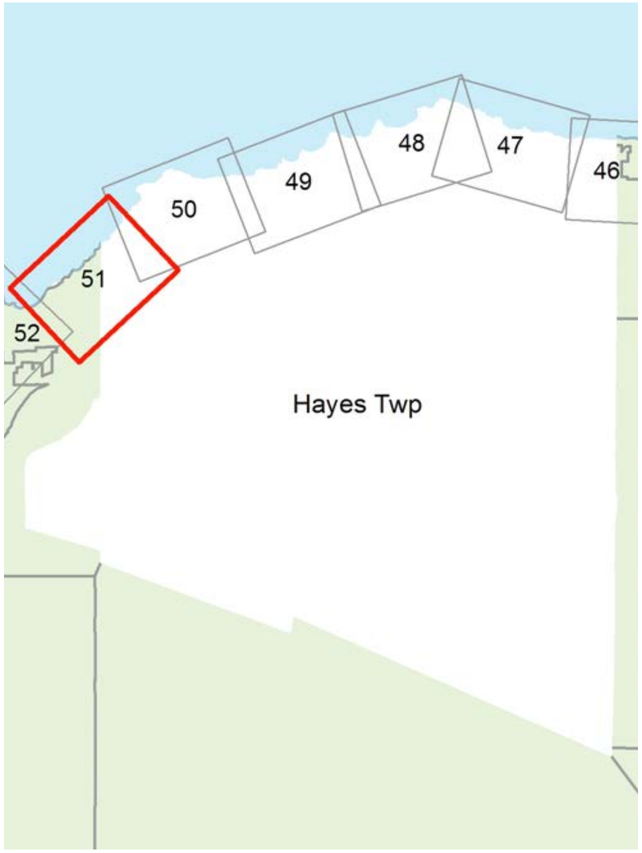

48
47
46
49
50
51
52
Hayes Twp

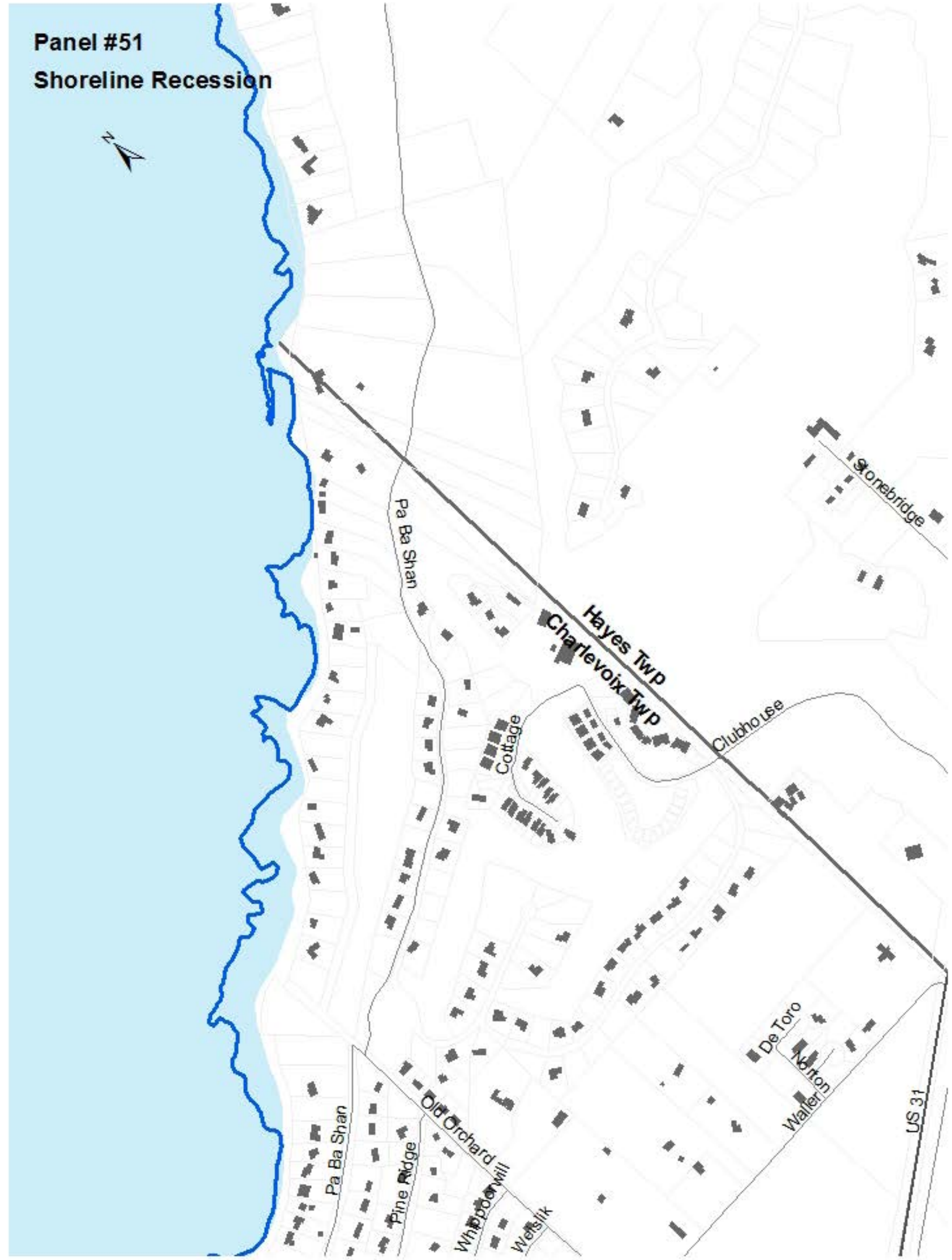

Charlevoix County


Panel #49
Shoreline Recession
N
Old US 31
Burgess
Charlevoix to Bay Harbor
US 31
Susan Creek
Susan Creek
Struthers
Big Rock
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





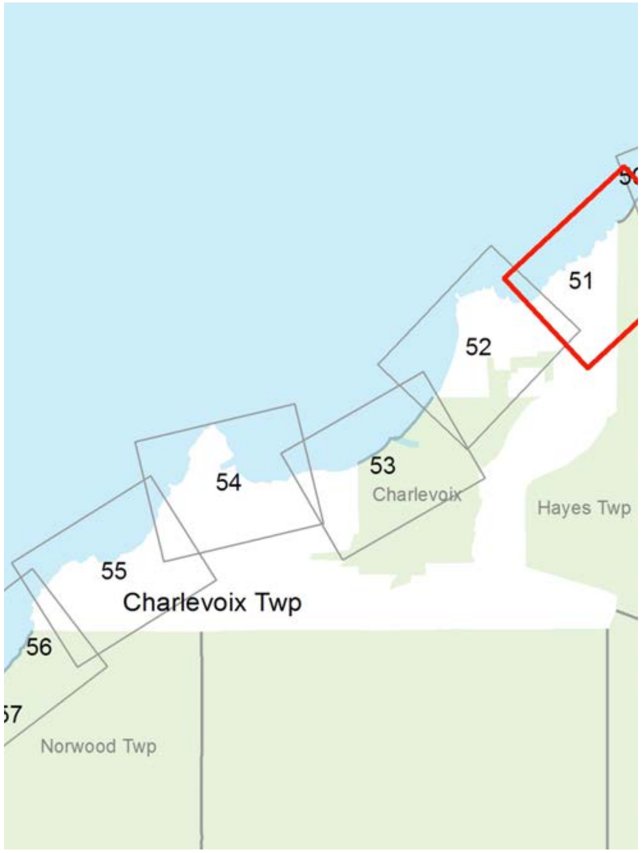
Shoreline 1938

Bluffline 1938

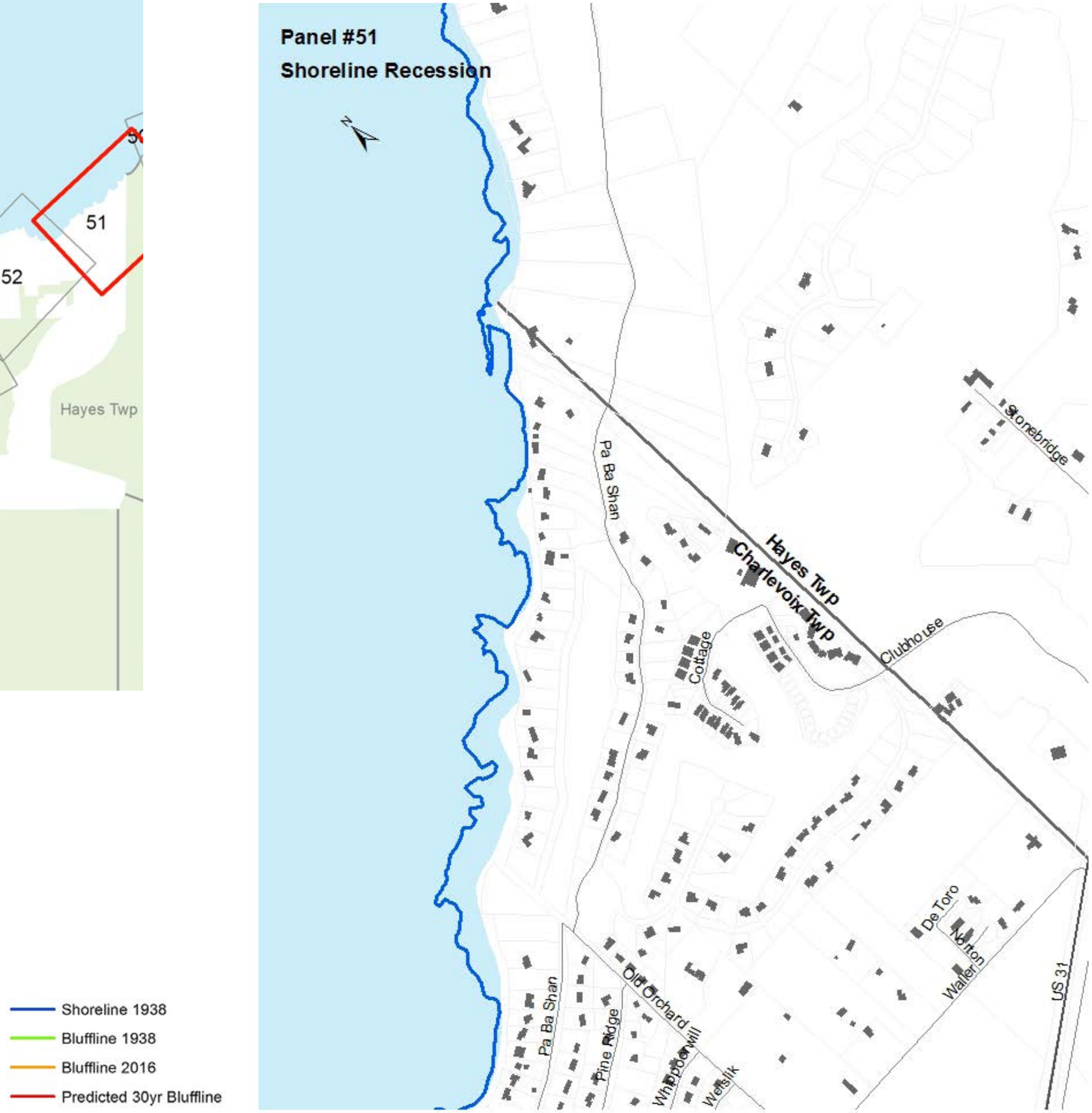
Bluffline 2016

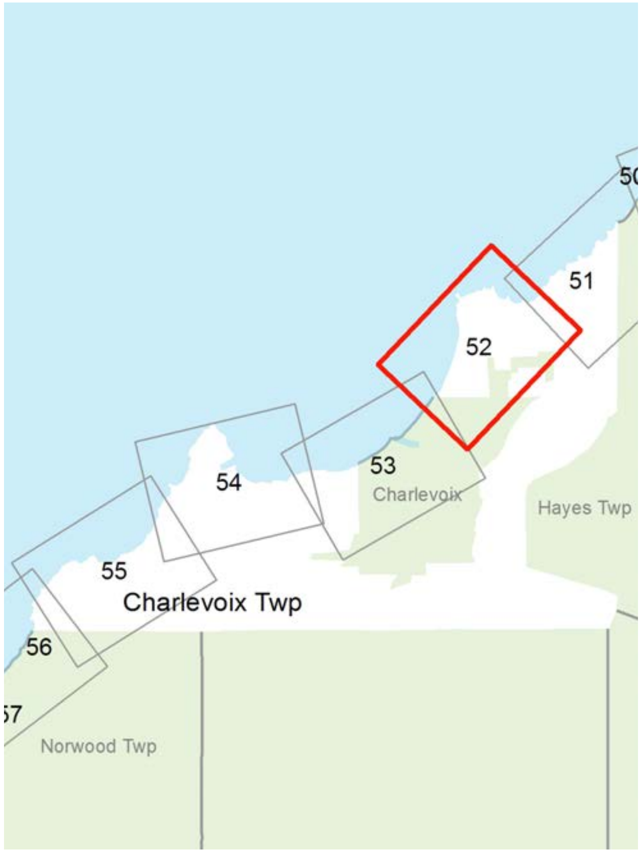
Predicted 30yr Bluffline

Charlevoix Twp.

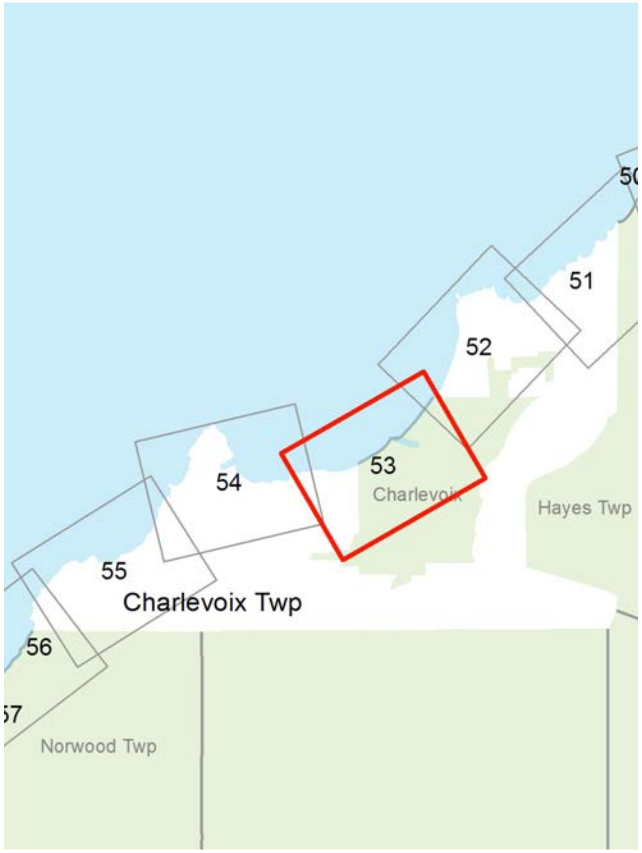

51
52
53
54
55
56
Charlevoix
Hayes Twp
Charlevoix Twp
Norwood Twp

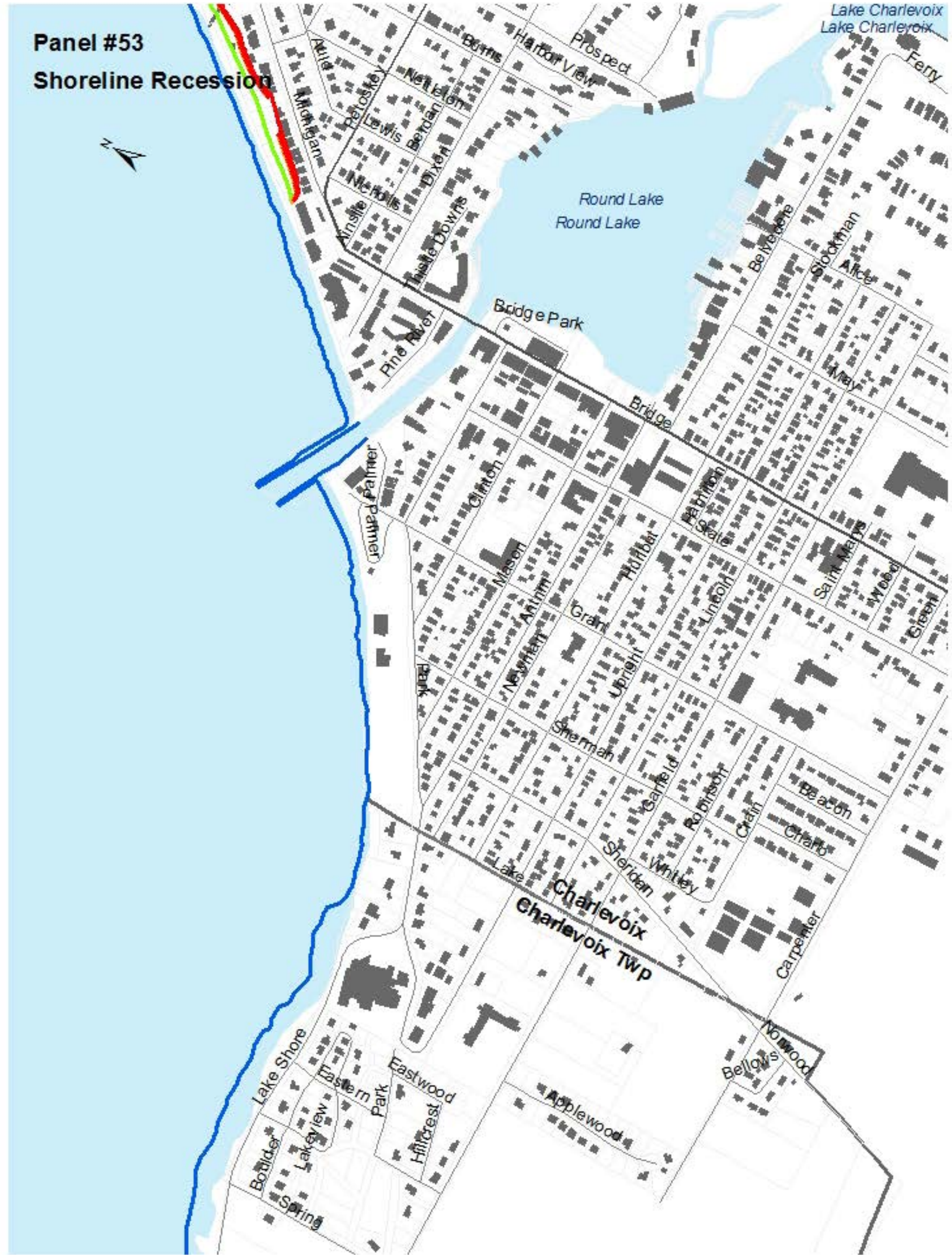

Charlevoix County


Panel #51
Shoreline Recession
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline
Pa Ba Shan
Hayes Twp
Charlevoix Twp
Stonebridge
Clubhouse
Cottage
Old Orchard
Pine Ridge
Whippoorwill
Weitslik
De Toro
Norton
Walter
US 31

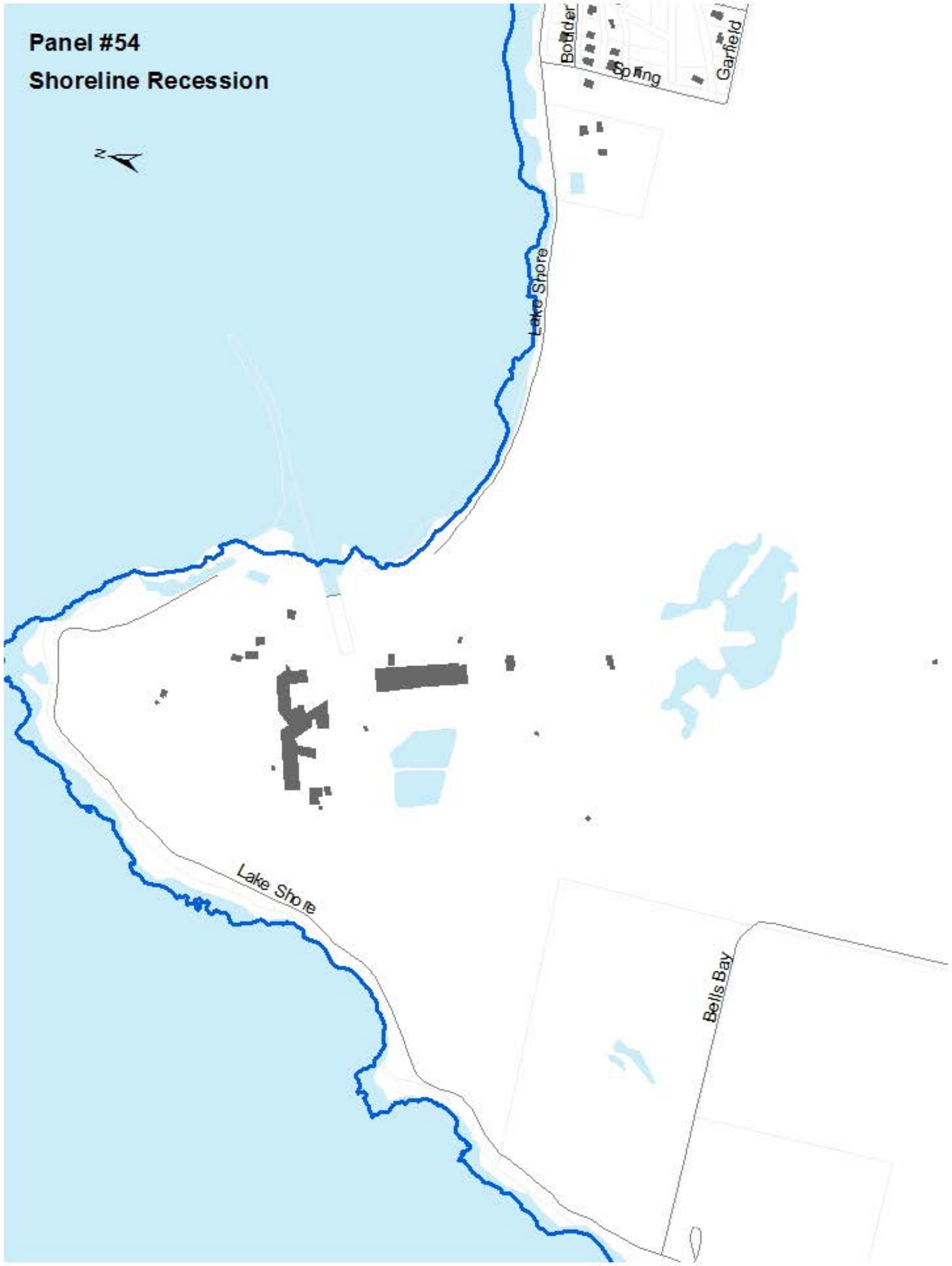


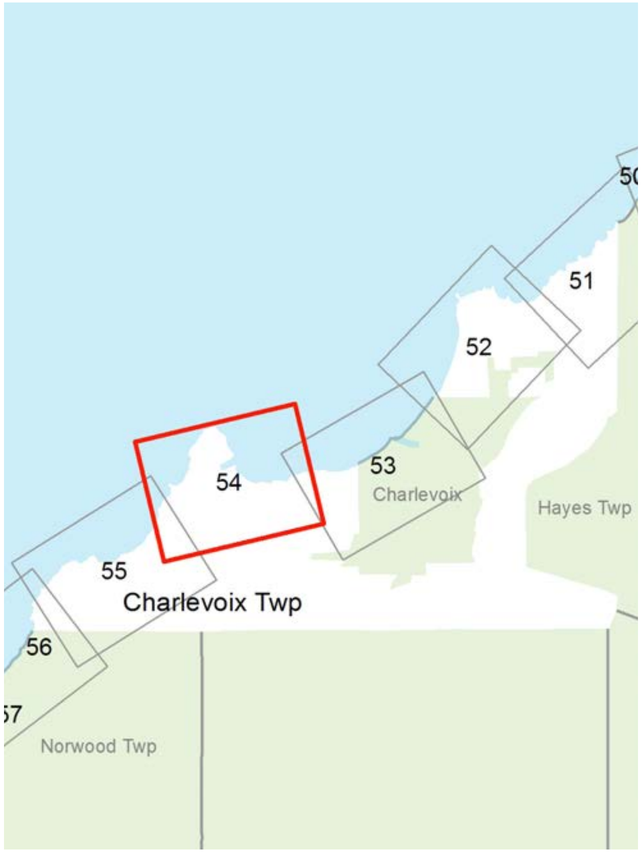
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



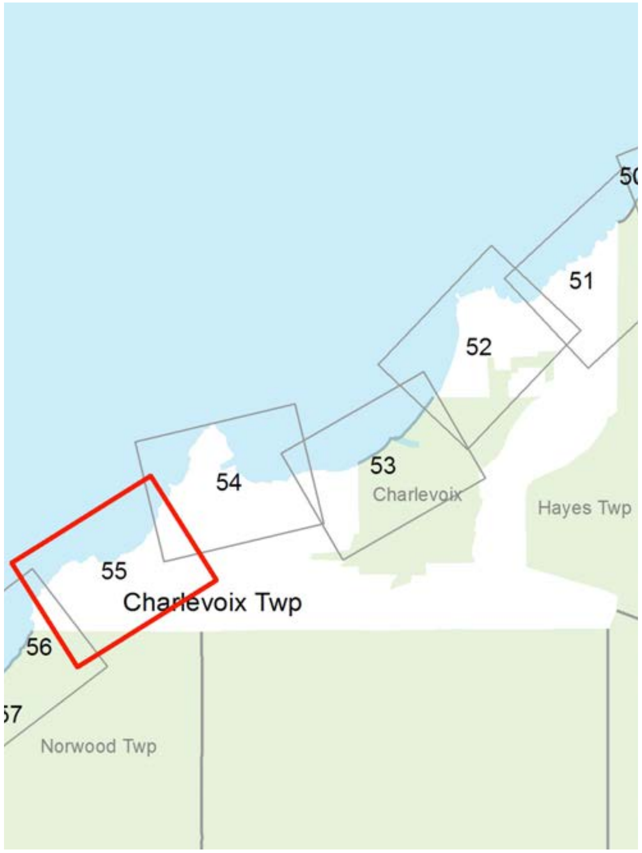


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

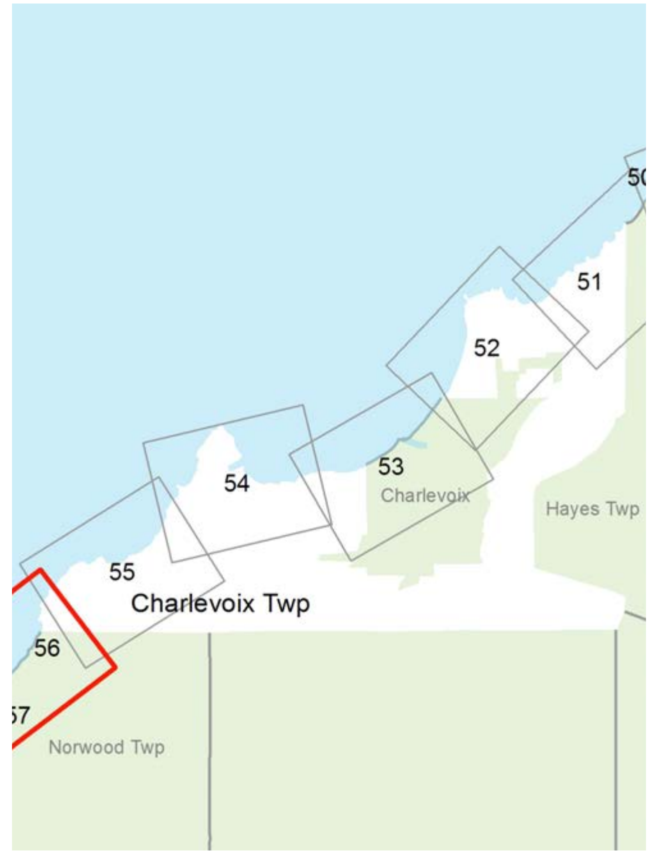




Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

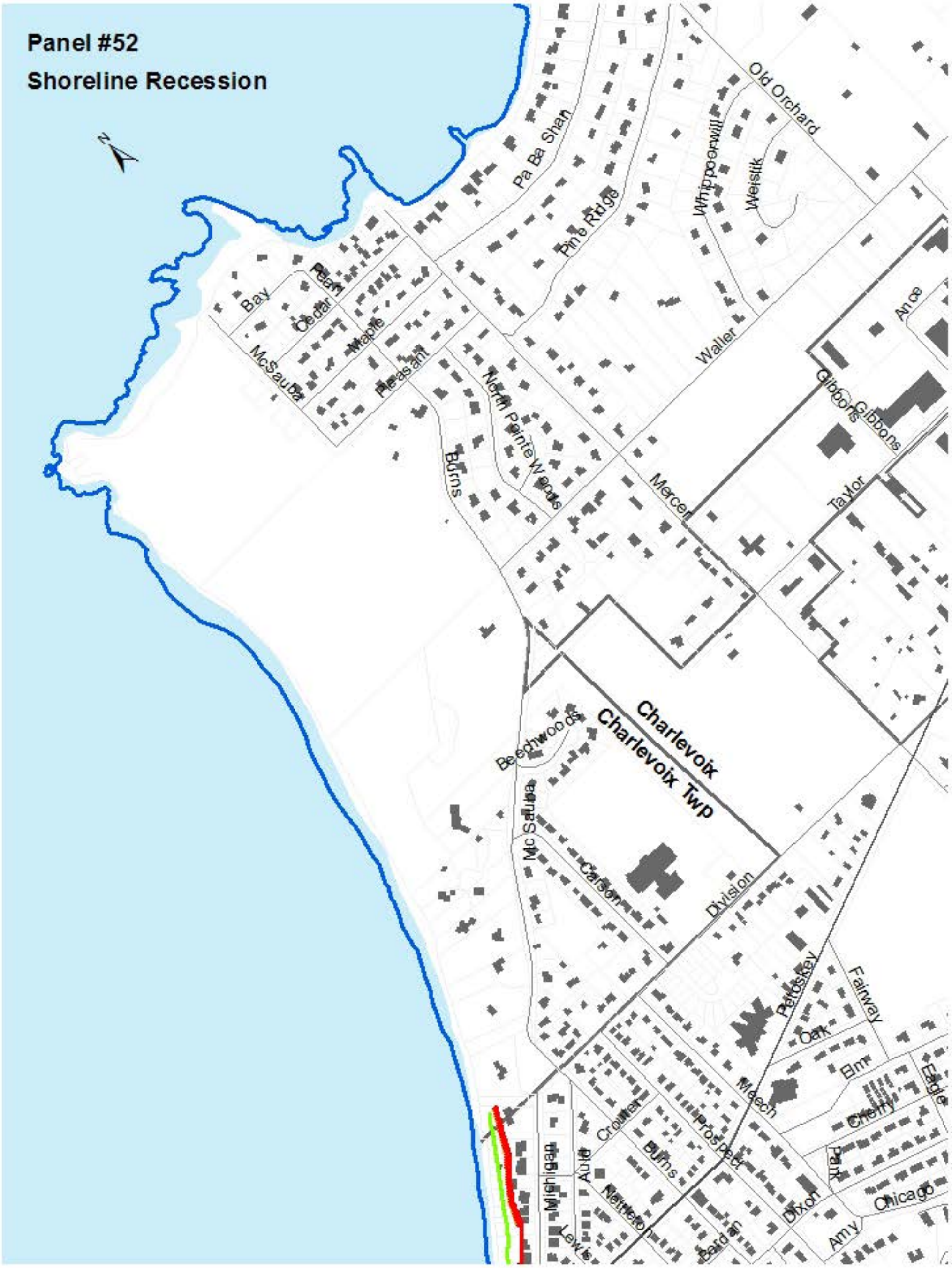


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

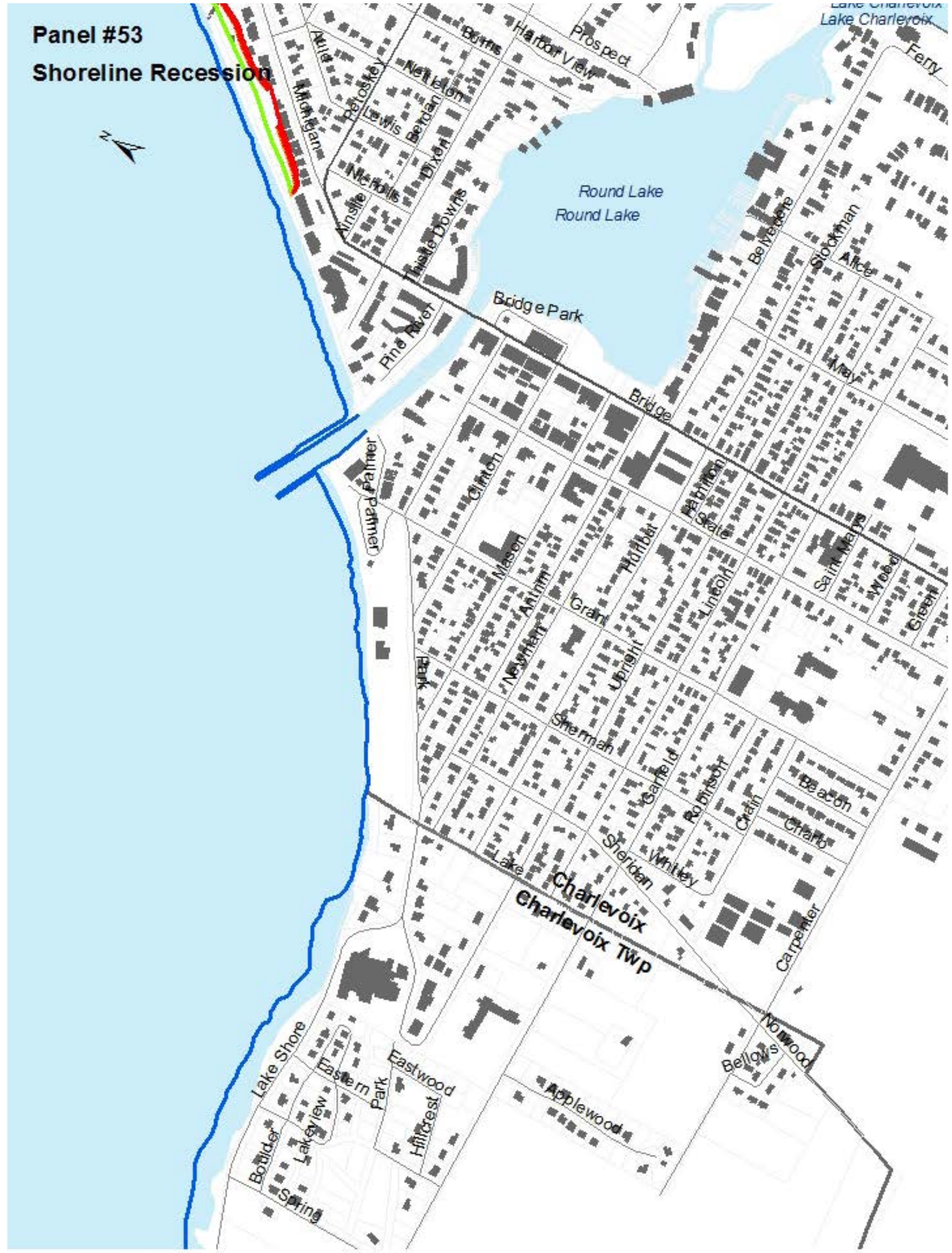
Charlevoix


Charlevoix County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

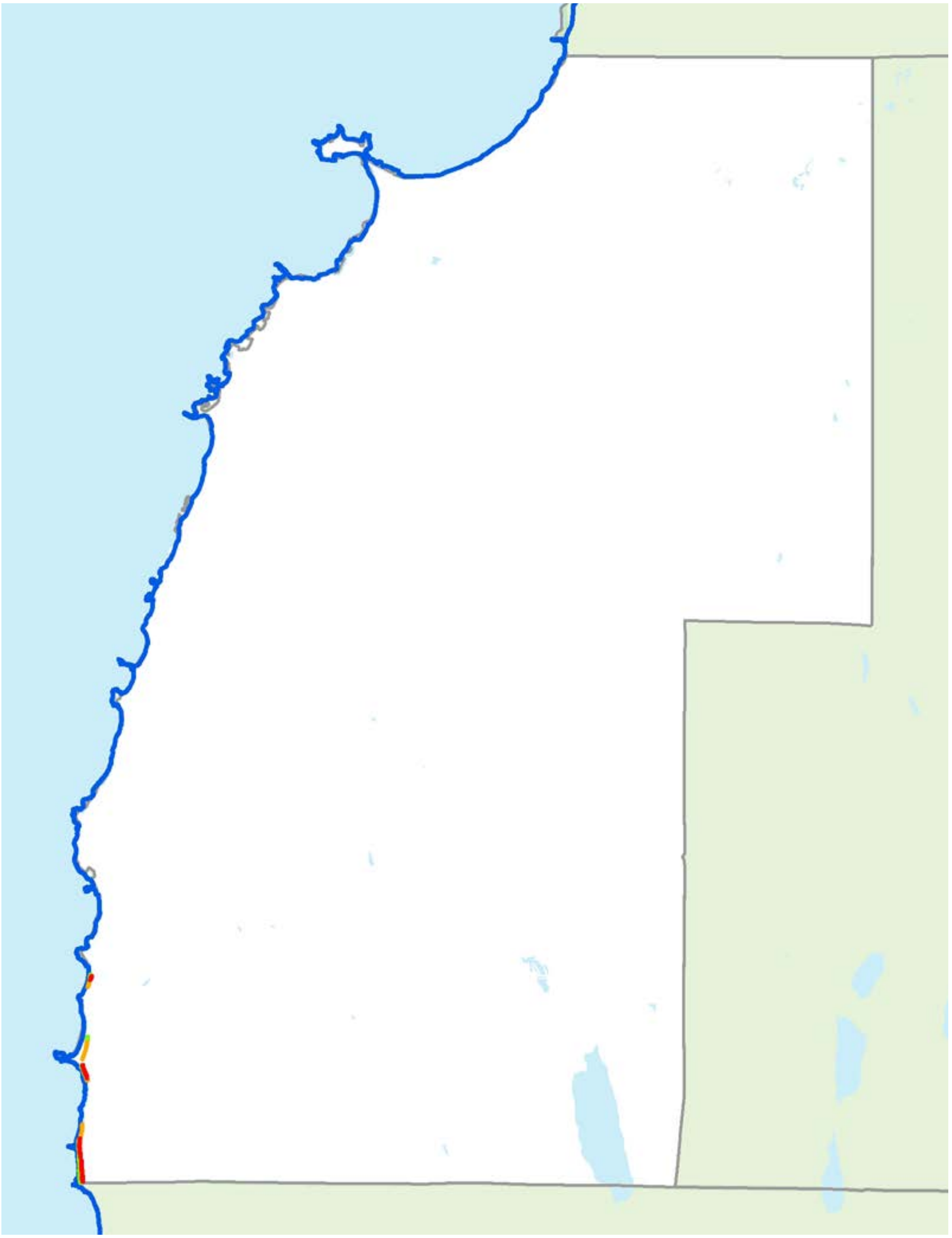


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



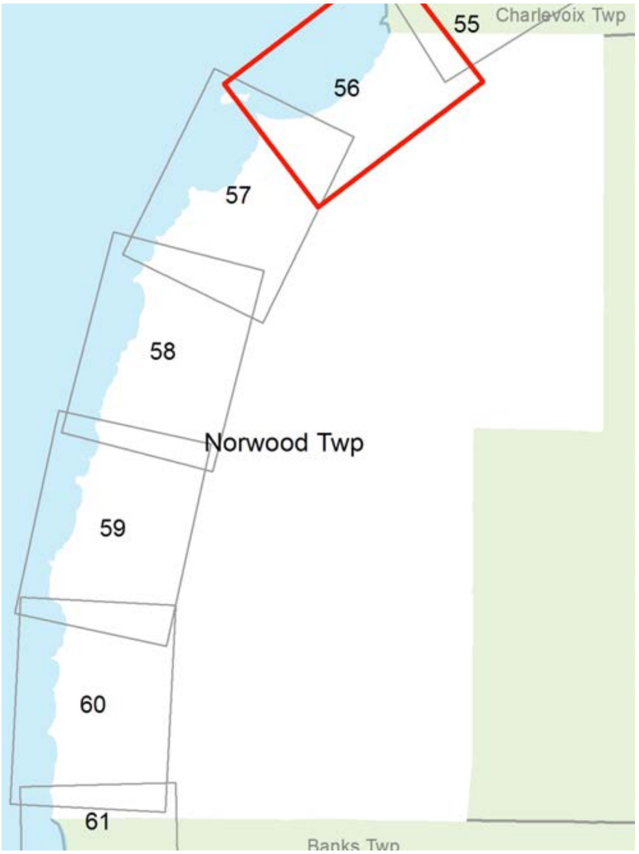
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Norwood Twp.



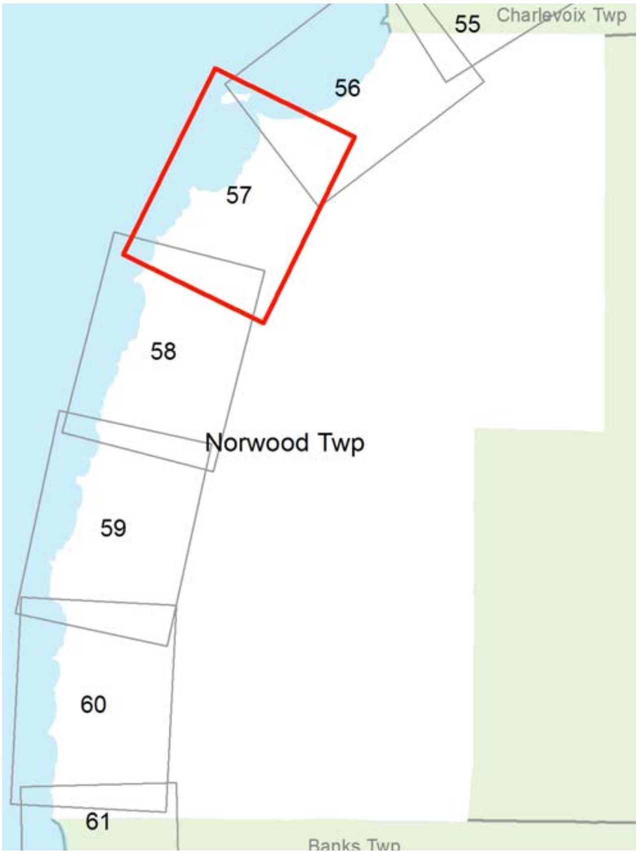

Charlevoix County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

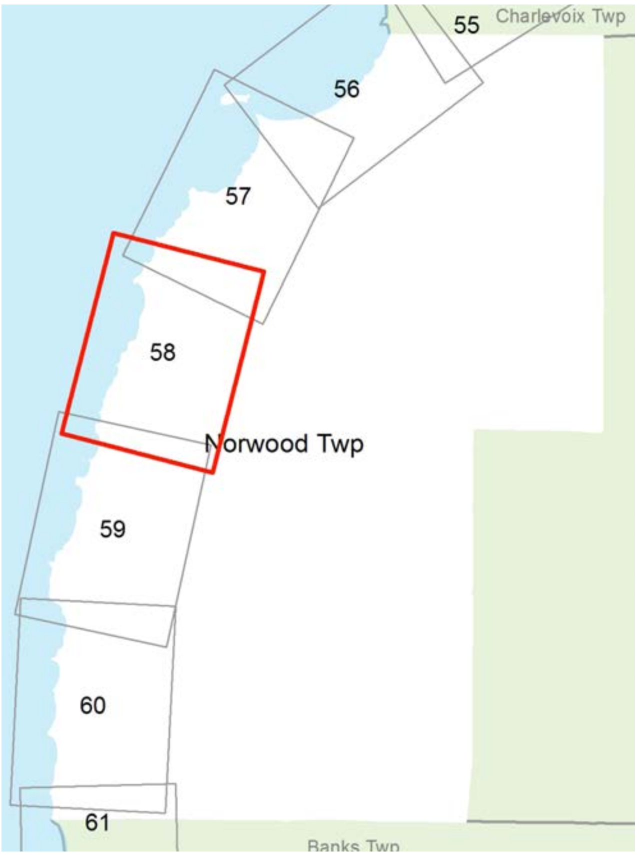

55
Charlevoix Twp
56
57
58
Norwood Twp
59
60
61
Banks Twp


Charlevoix County


Panel #56
Shoreline Recession
Charlevoix Twp
Norwood Twp
Fishermans Island SP Cmpgrnd
Fishermans Island SP Access
Clipperview
Witmere
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

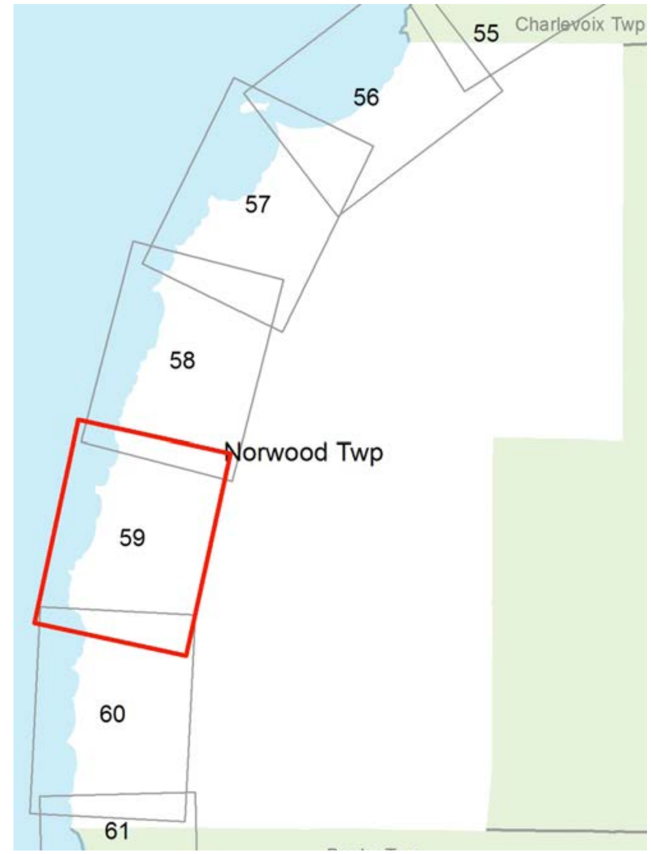


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



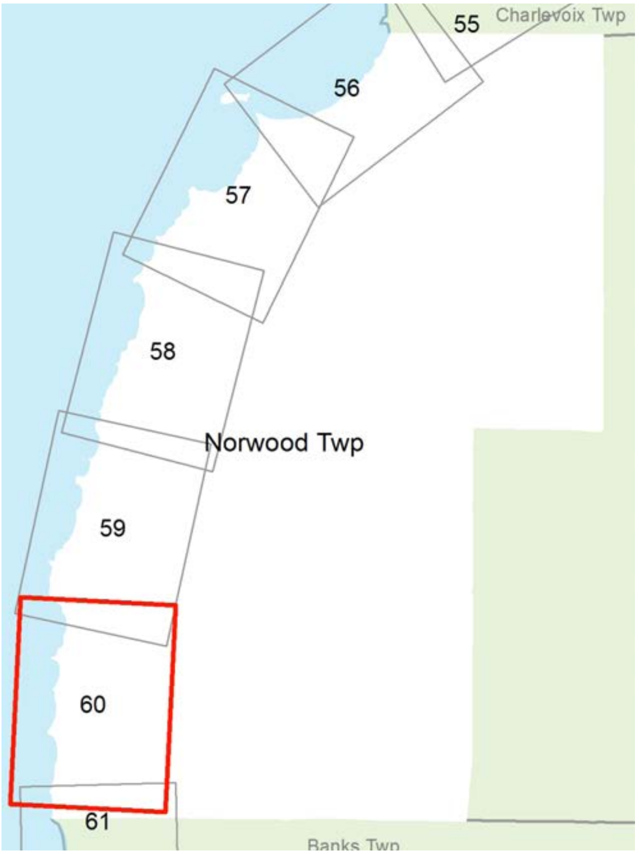
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #59
Shoreline Recession
N
Norwood


55
Charlevoix Twp
56
57
58
Norwood Twp
59
60
61

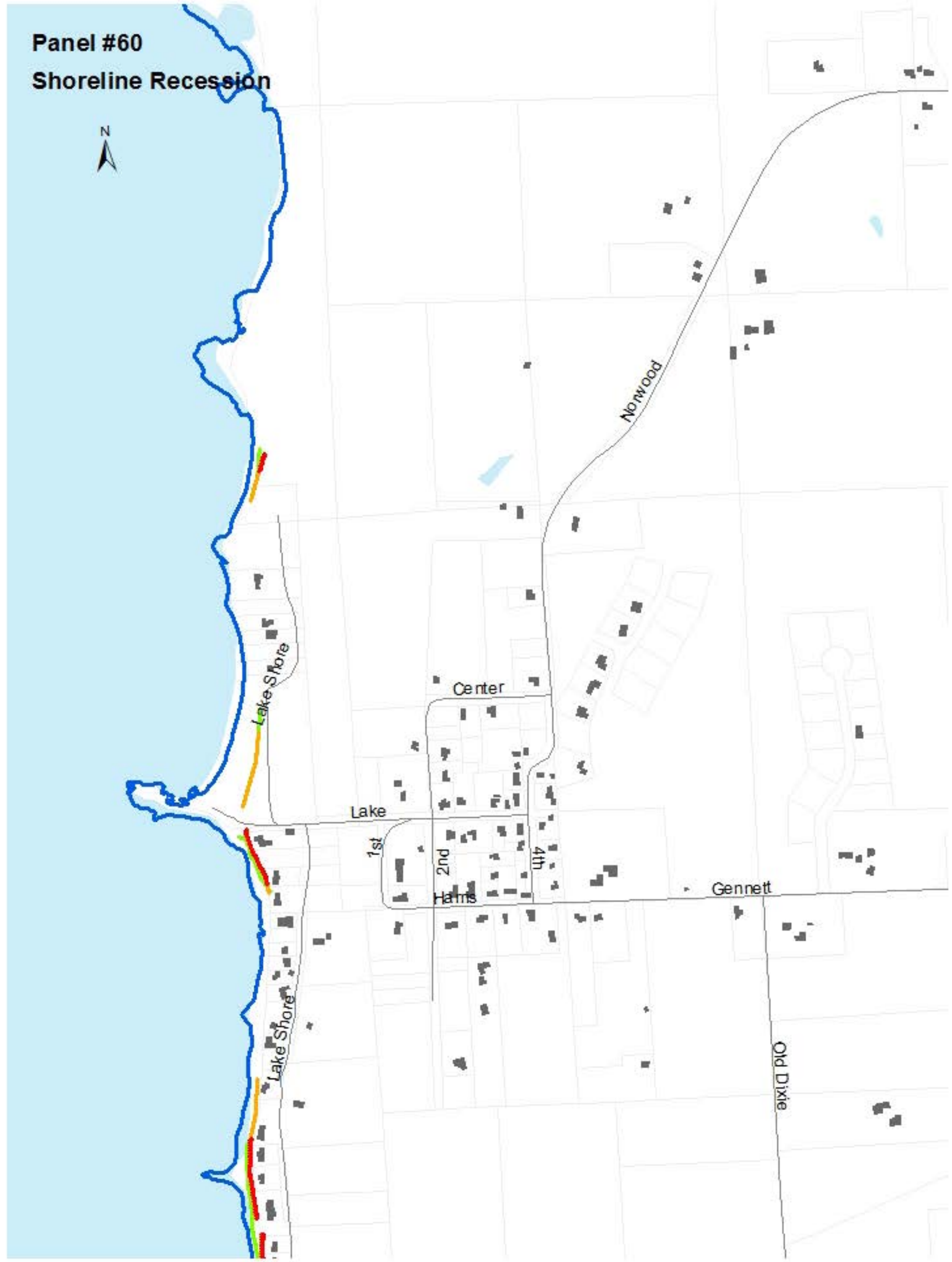

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

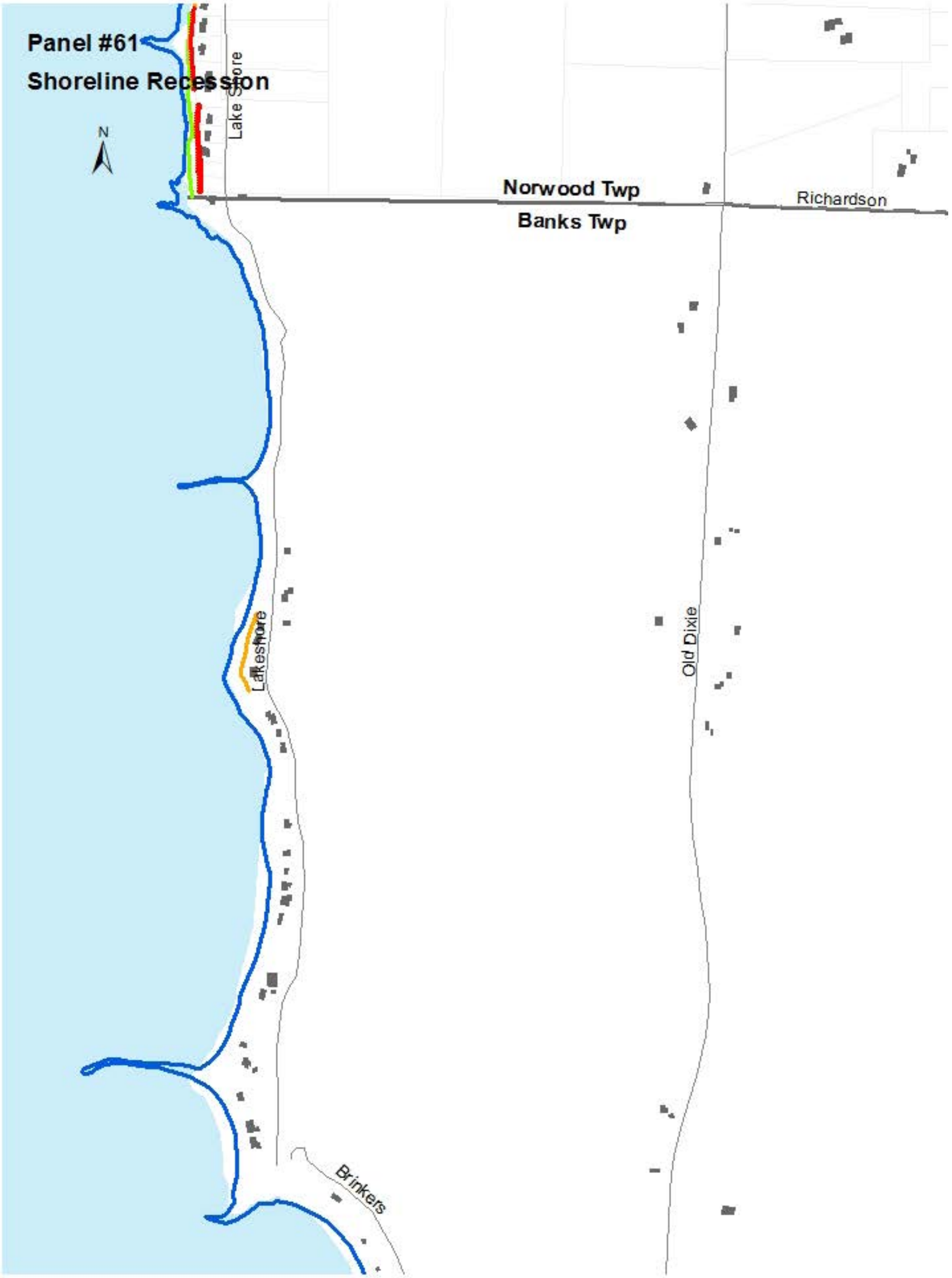

Charlevoix County

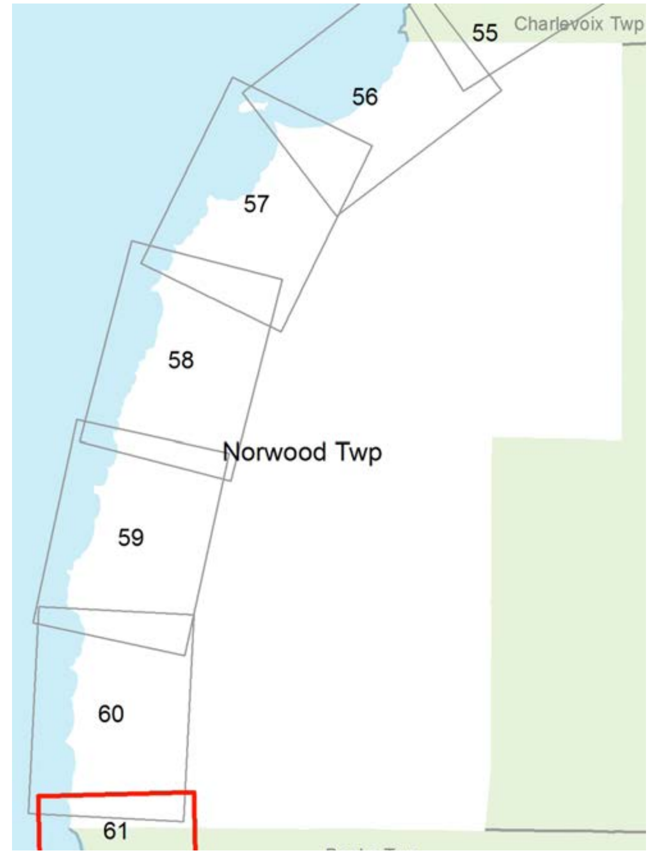

55
Charlevoix Twp
56
57
58
Norwood Twp
59
60
61
Banks Twp


Charlevoix County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #60
Shoreline Recession
N
Norwood
Center
Lake Shore
Lake
1st
2nd
4th
Harris
Gennett
Lake Shore
Old Dixie





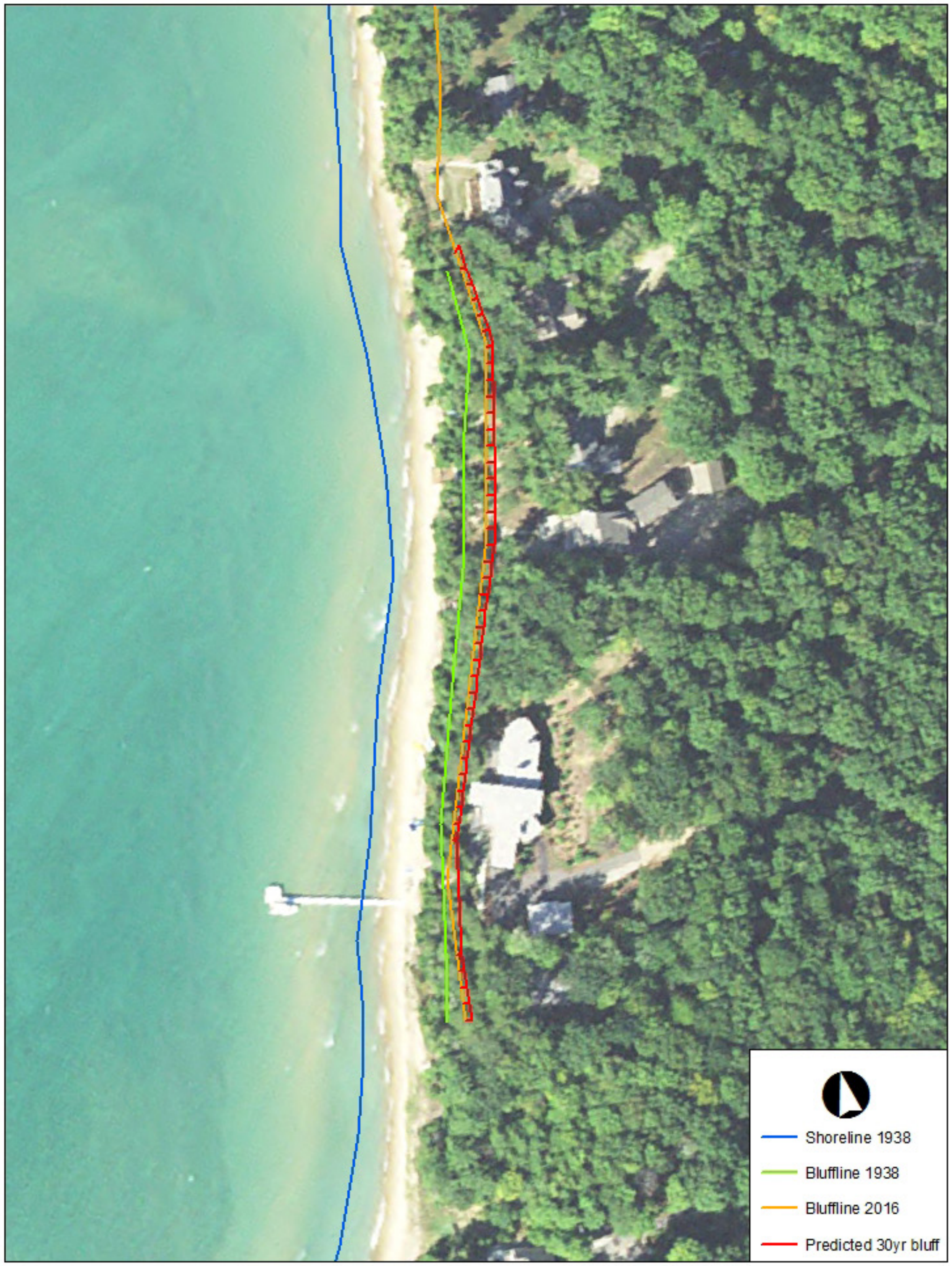
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Antrim County

BLUFF RECESSION DETAIL

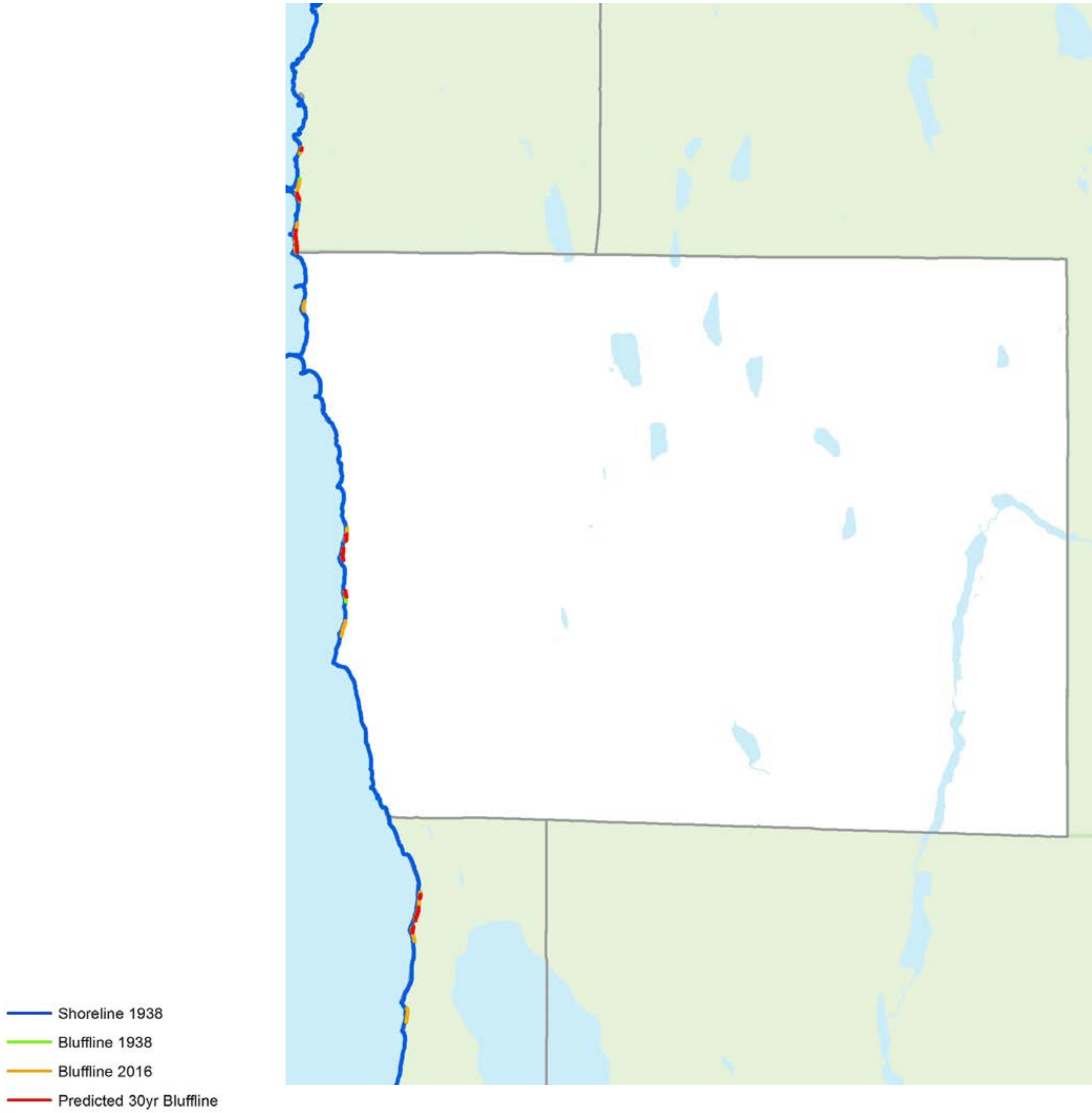
At least one "zoomed in" detail example of historic bluffline recession and future projections is provided at the beginning of each county section of this chapter. Shoreline and bluffline recession data can be viewed in greater detail online at http://geospatialresearch.mtu.edu/czmp.

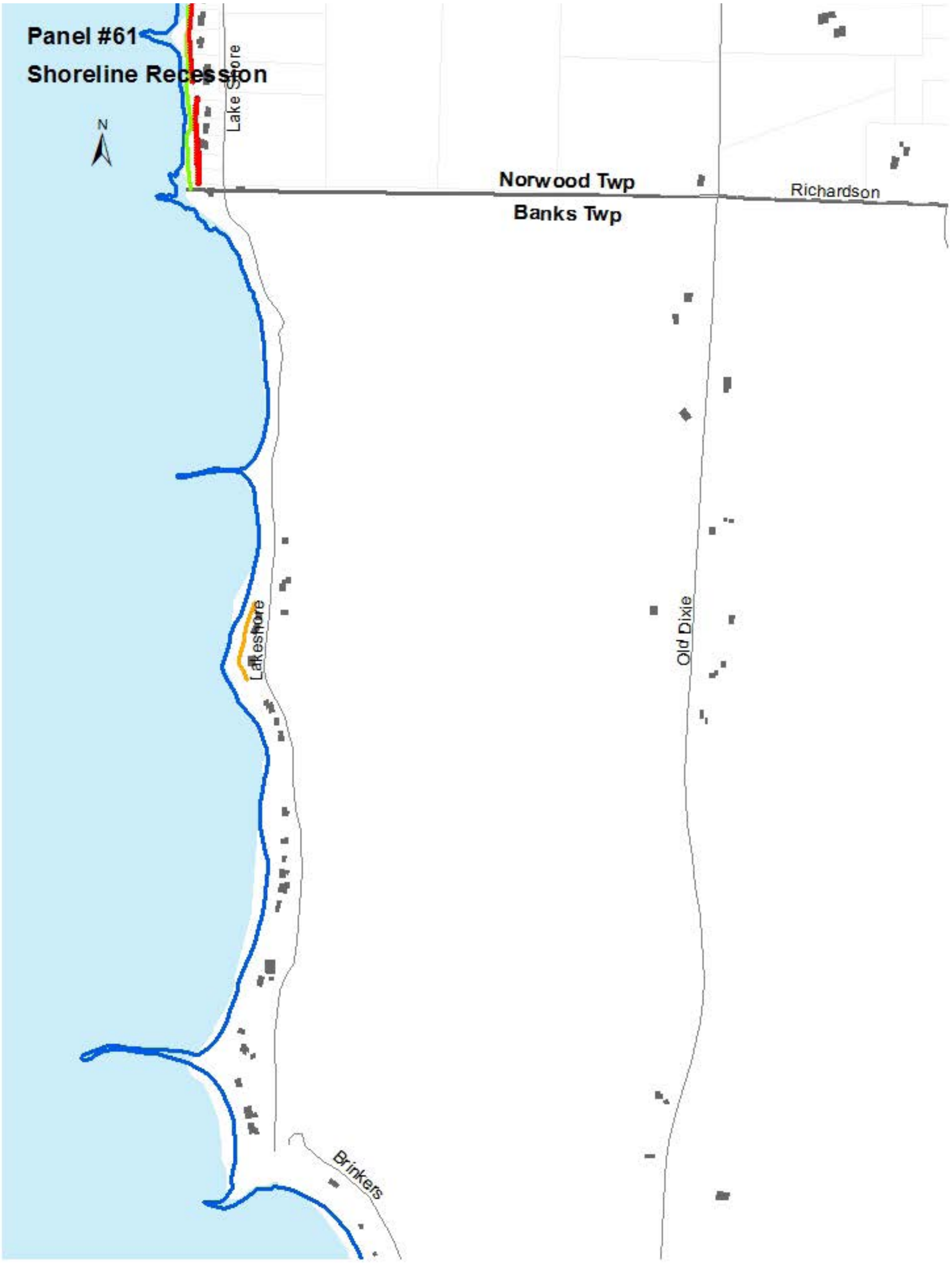
Bluff Detail, Panel 66, Torch Lake Twp.

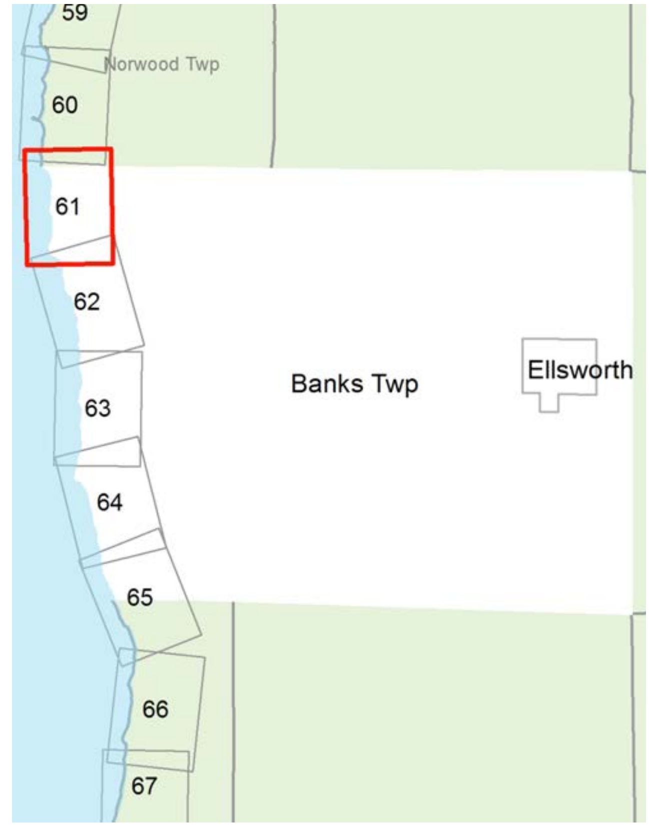


Banks Twp.

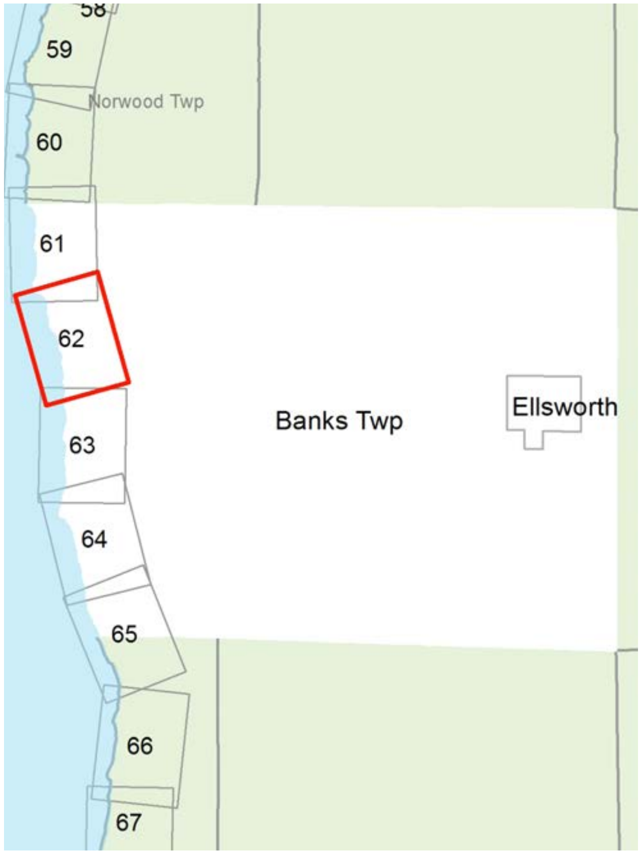

Antrim County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





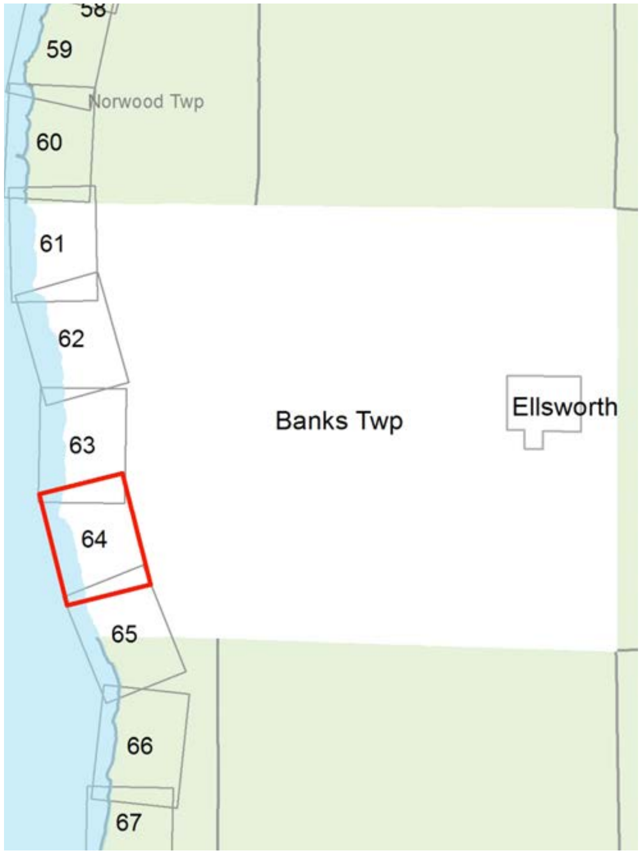
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


58
59
Norwood Twp
60
61
62
63
Banks Twp
Ellsworth
64
65
66
67


Antrim County

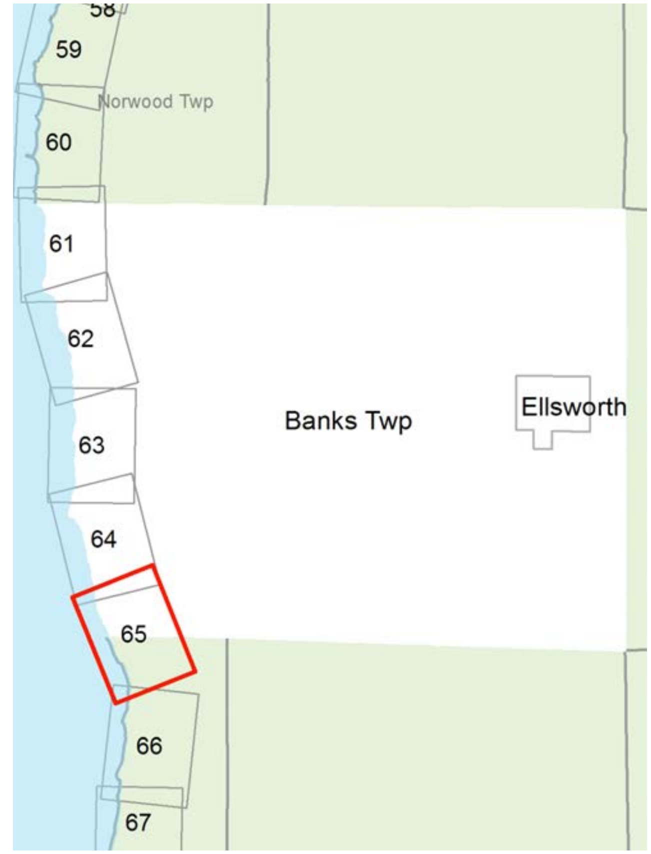

Panel #62
Shoreline Recession
N
Brinkers
Banks Twp Park
Old Dixie
Rex Beach
Brant
Brant
Tyrell Beach
Antrim
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #63
Shoreline Recession
N
Antrim
Simmons Bluff
Old Dixie
Antrim
Shannon
East
Glenbeigh
Forest
Galway
Timberlane
58
59
Norwood Twp
60
61
62
63
64
65
66
67
Banks Twp
Ellsworth
Antrim County
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


58
59
Norwood Twp
60
61
62
63
Banks Twp
Ellsworth
64
65
66
67

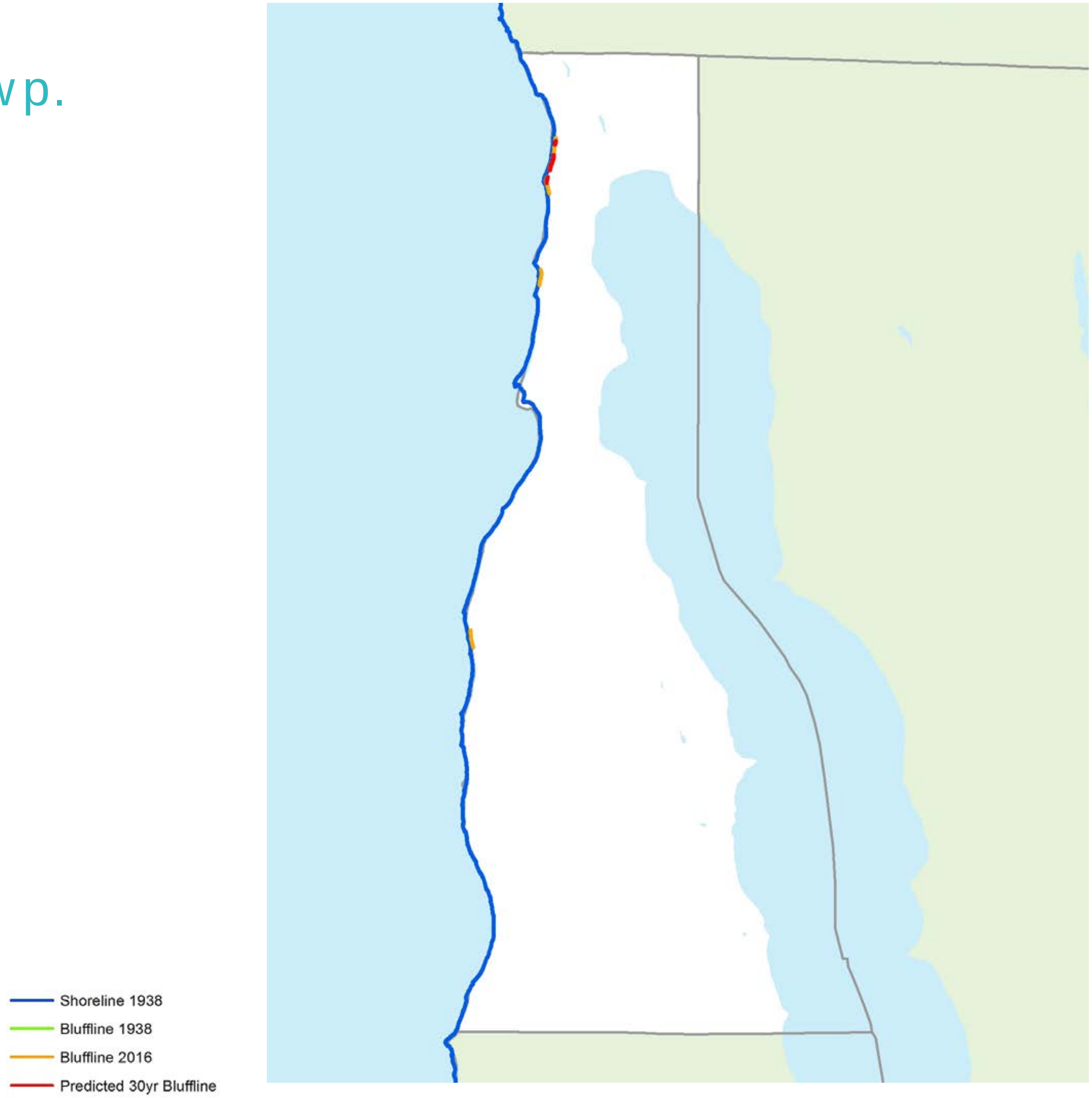

Antrim County


Panel #64
Shoreline Recession
N
Timberlane
White Pine
Glenleigh
Forest
Galway
Old Dixie
Timberlake
Timber Lake
Scott
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

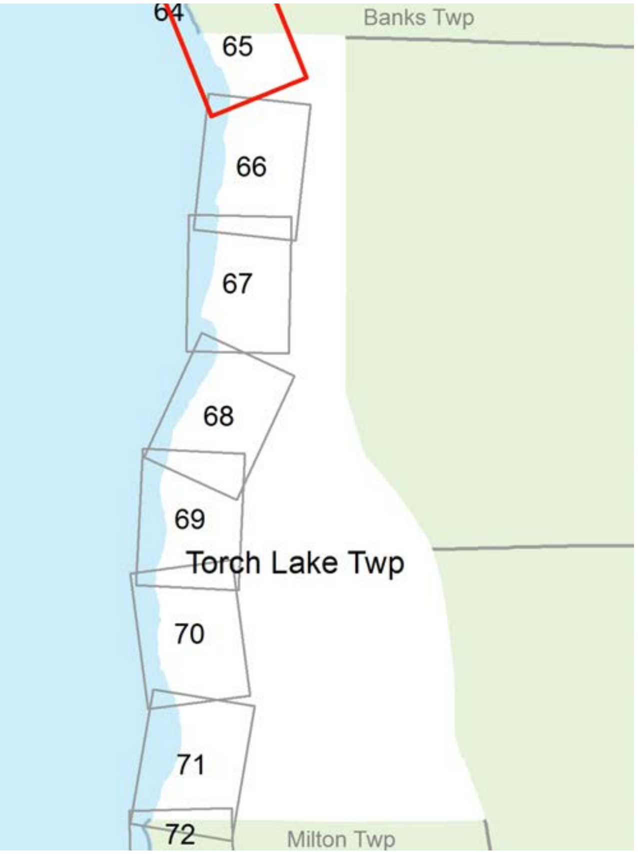


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Torch Lake Twp.

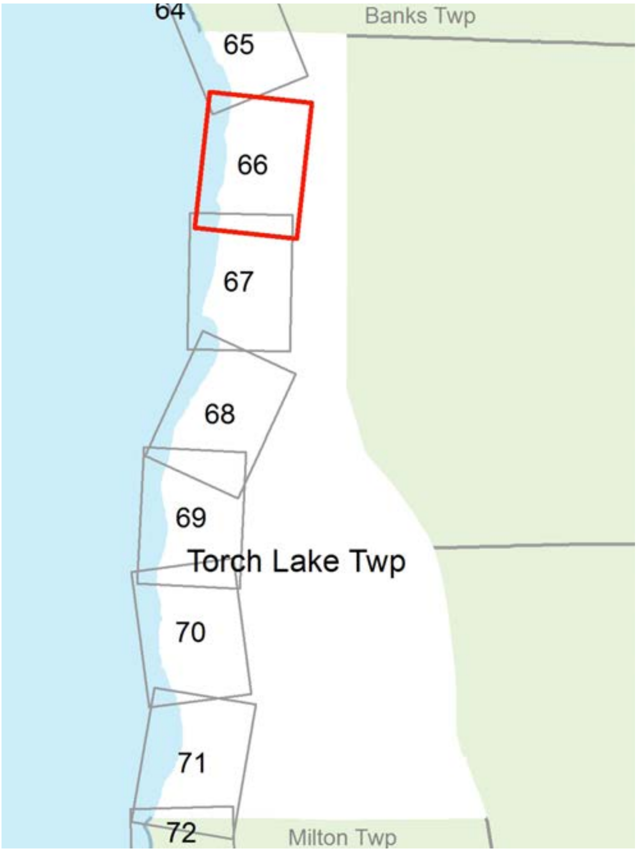



Panel #65
Shoreline Recession
N
Timberlake
Pachakee
Lore
Lore
Lore
Old Dixie
Banks Twp
Torch Lake Twp
Bayshore
US 31
Old Park
Birch
Birch
Birch


64
65
Banks Twp
66
67
68
69
Torch Lake Twp
70
71
72
Milton Twp

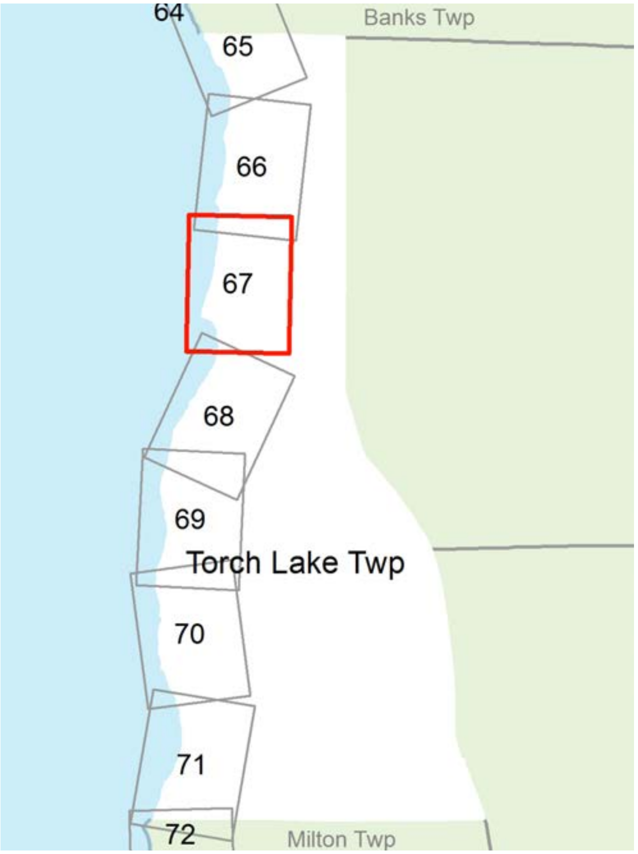

Antrim County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

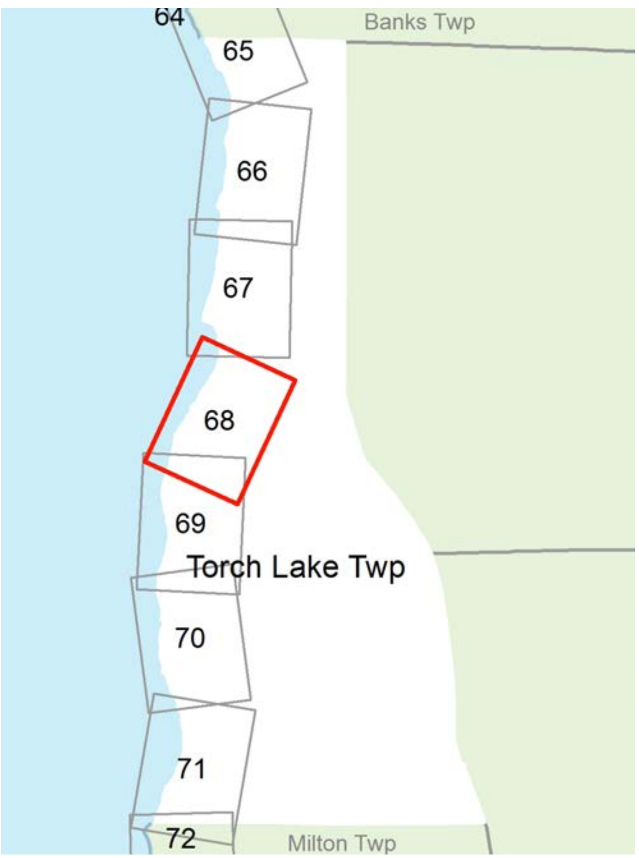

64
65
66
67
68
69
70
71
72
Banks Twp
Torch Lake Twp
Milton Twp

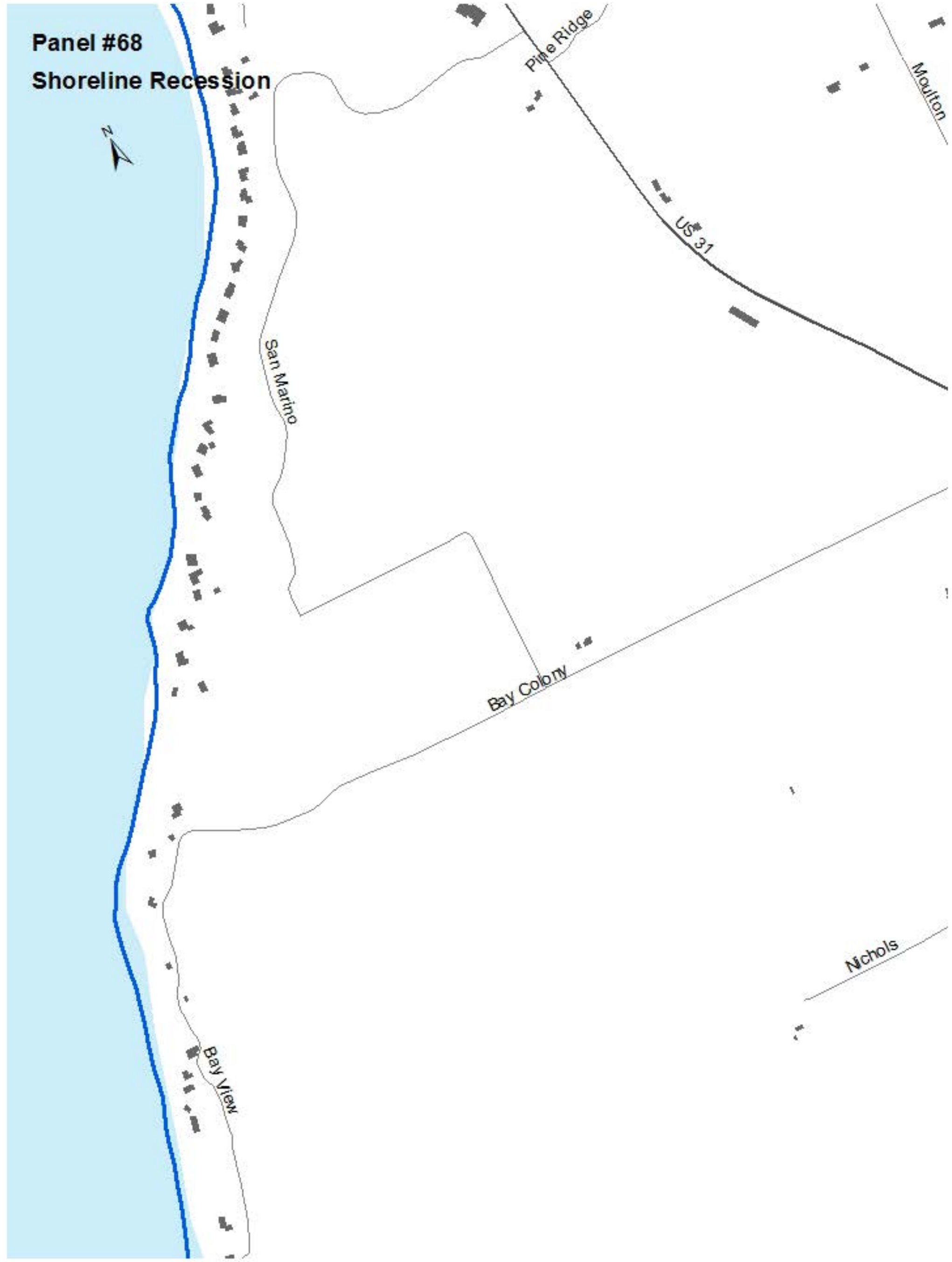

Antrim County


Panel #66
Shoreline Recession
N
Old Park
Barnes Park
Arrow Head
Baker
Pearl
M 88
Pearl
Eastport Bay S
Harris Beach
Hopkins
US 31
Michigan
Torch Lake
Torch Lake
Ojibway
Blue Haven
Wildwood
Manitou
Forest Beach
Thierry
Waters Edge
Kessler
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

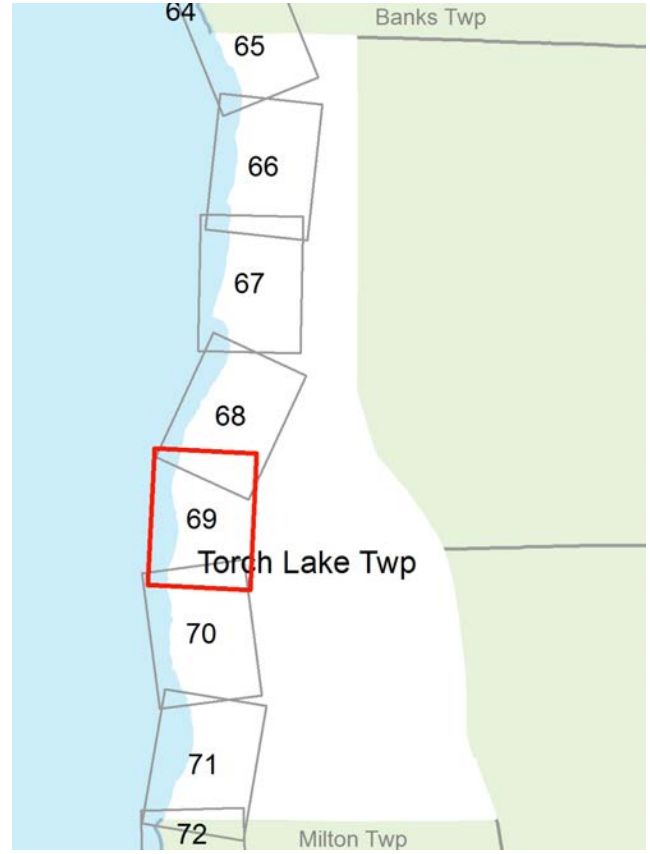


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

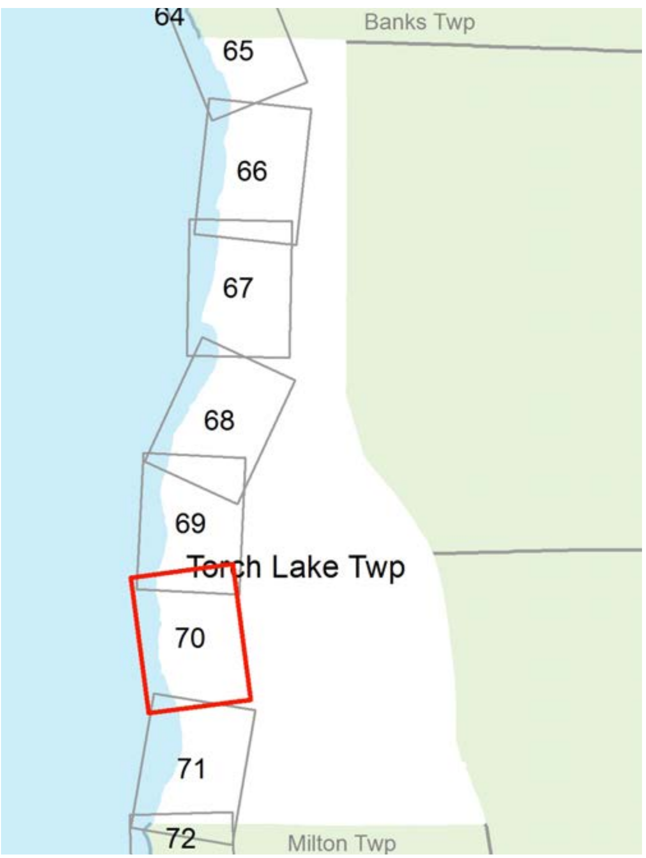




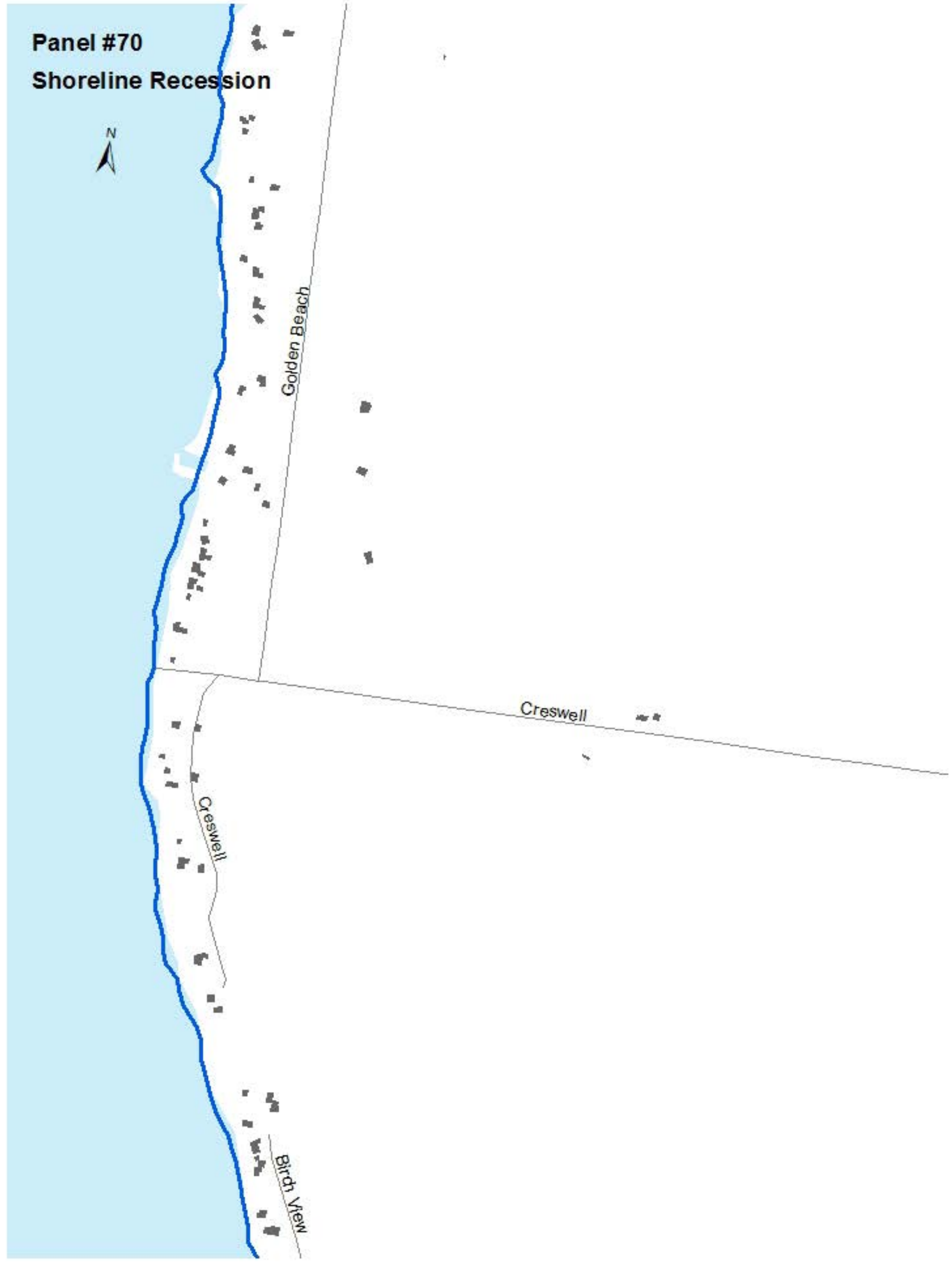
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



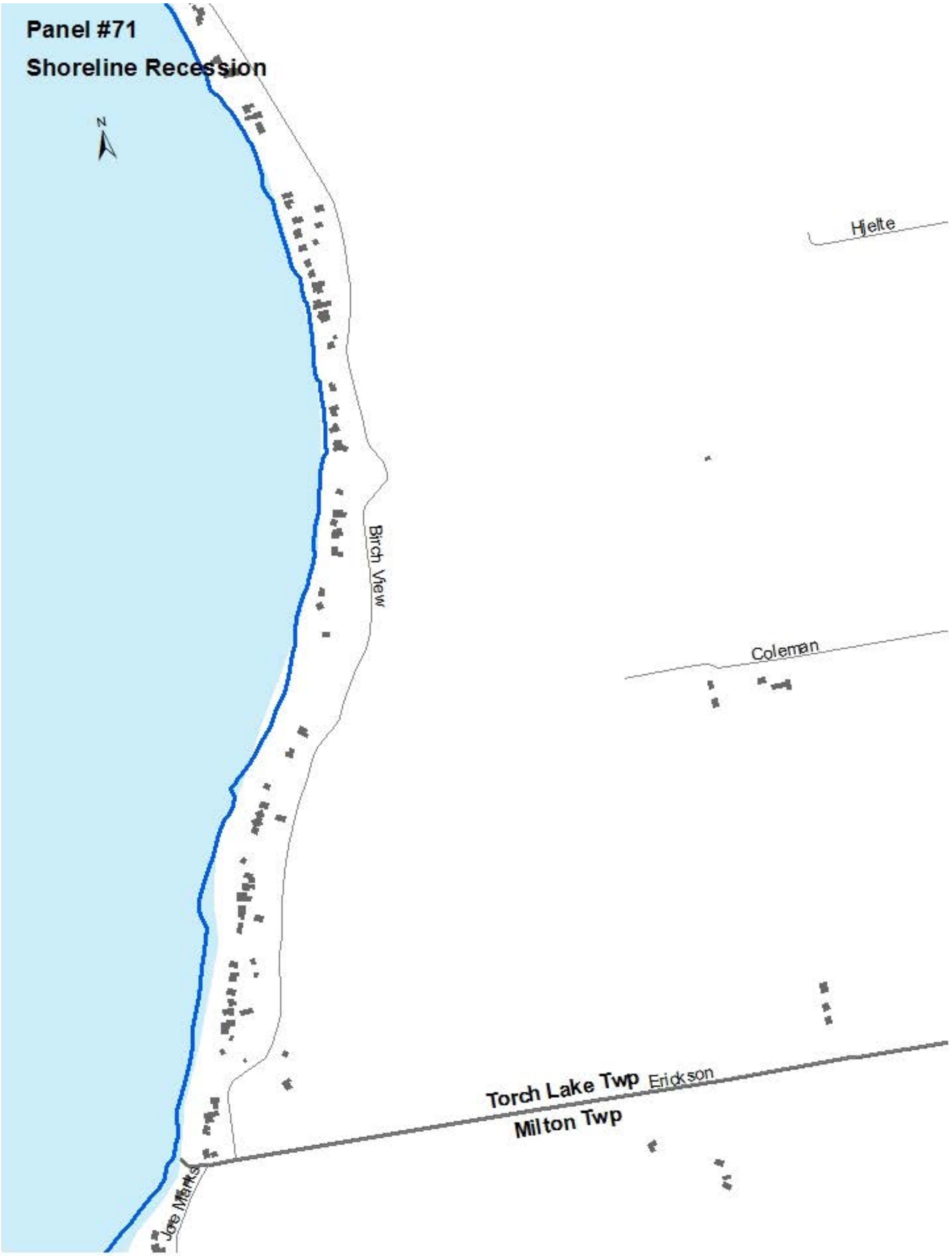
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

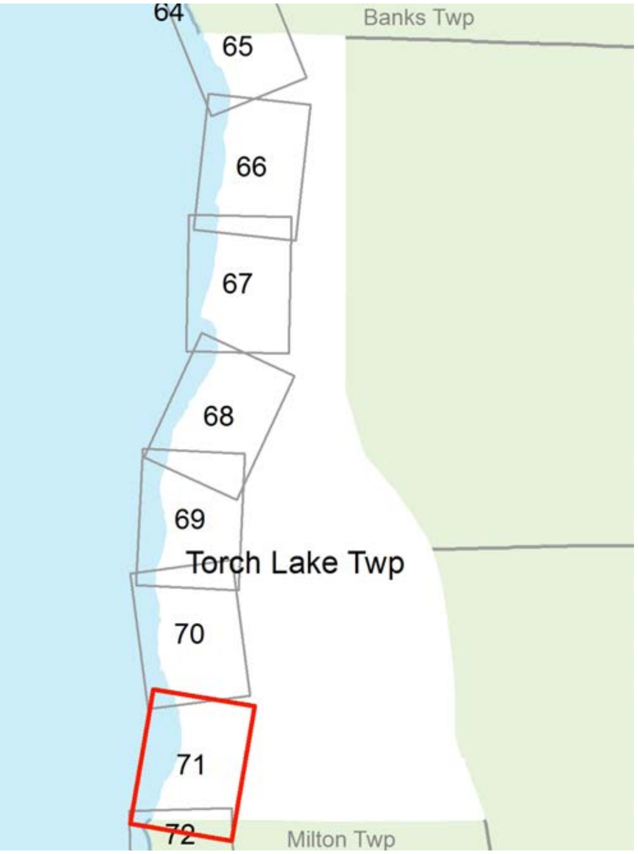

64
65
Banks Twp
66
67
68
69
Torch Lake Twp
70
71
72
Milton Twp


Antrim County


Panel #70
Shoreline Recession
N
Golden Beach
Creswell
Creswell
Birch View


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

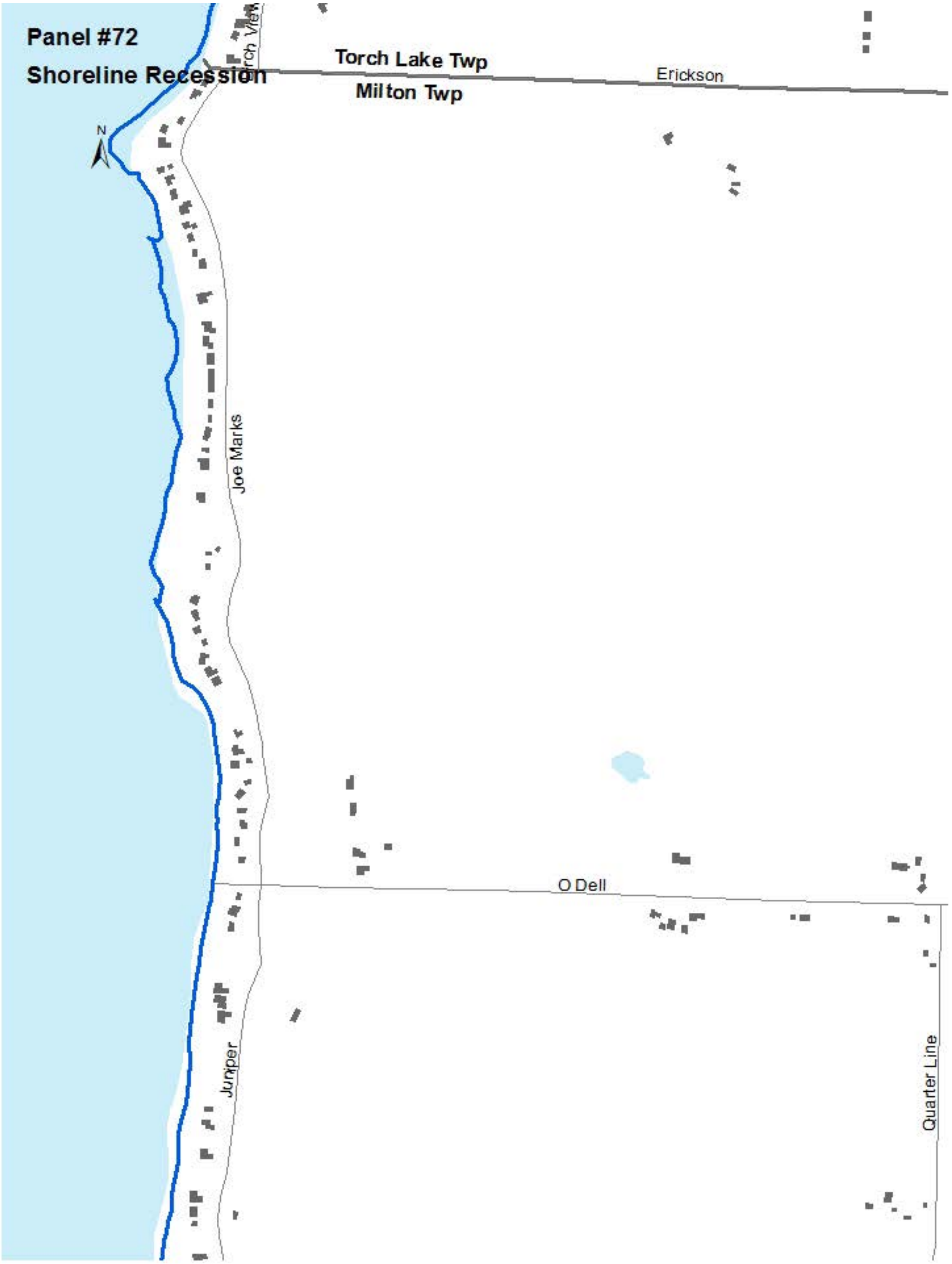


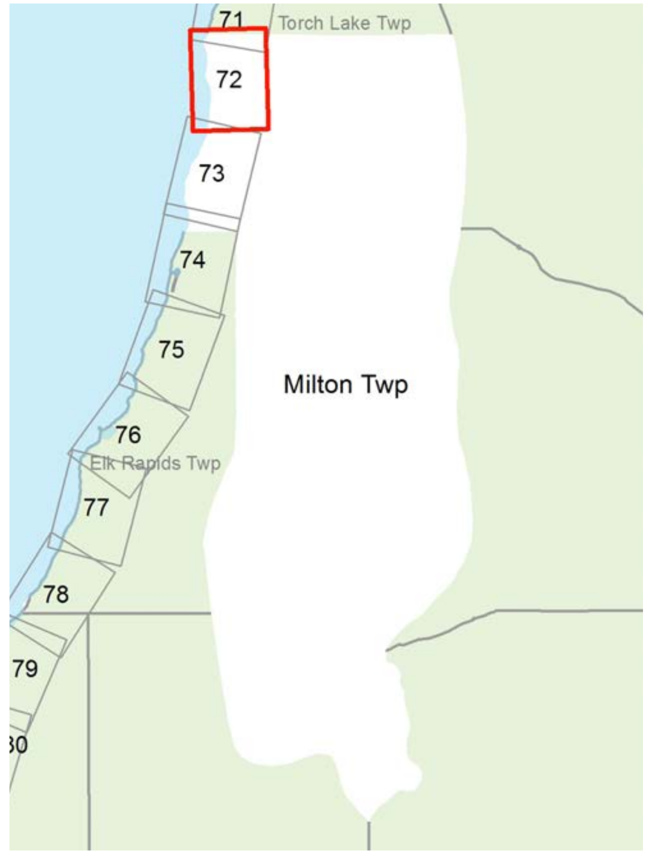


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

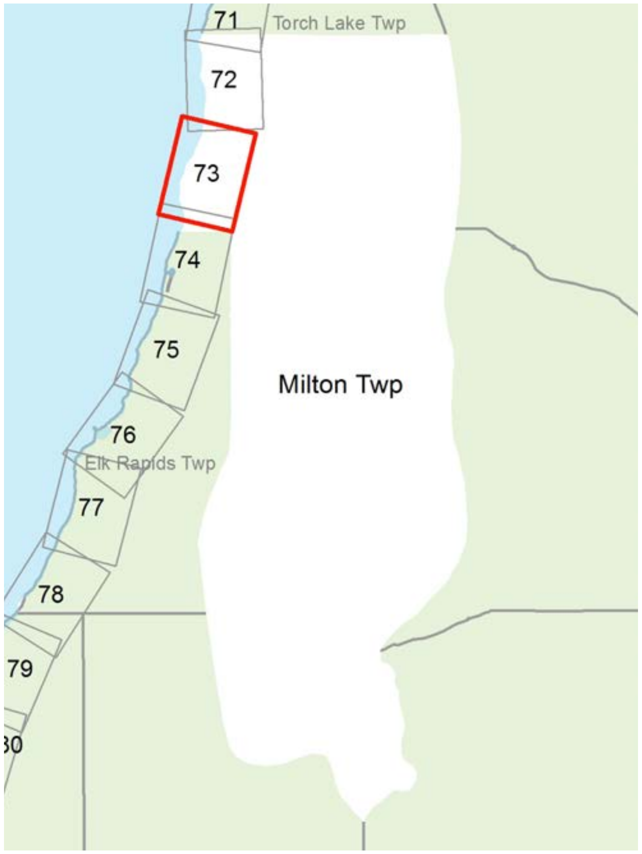
Milton Twp.

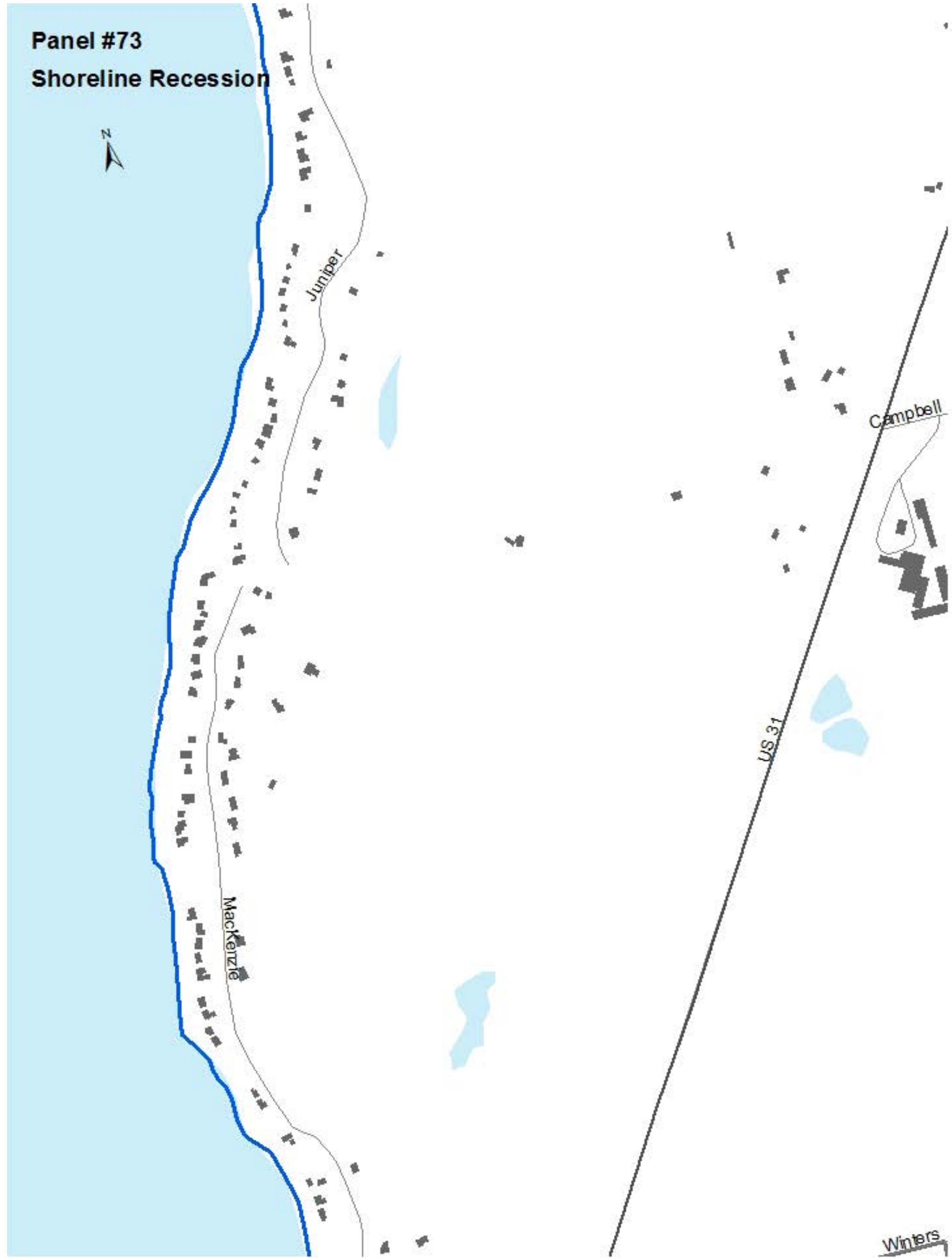
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



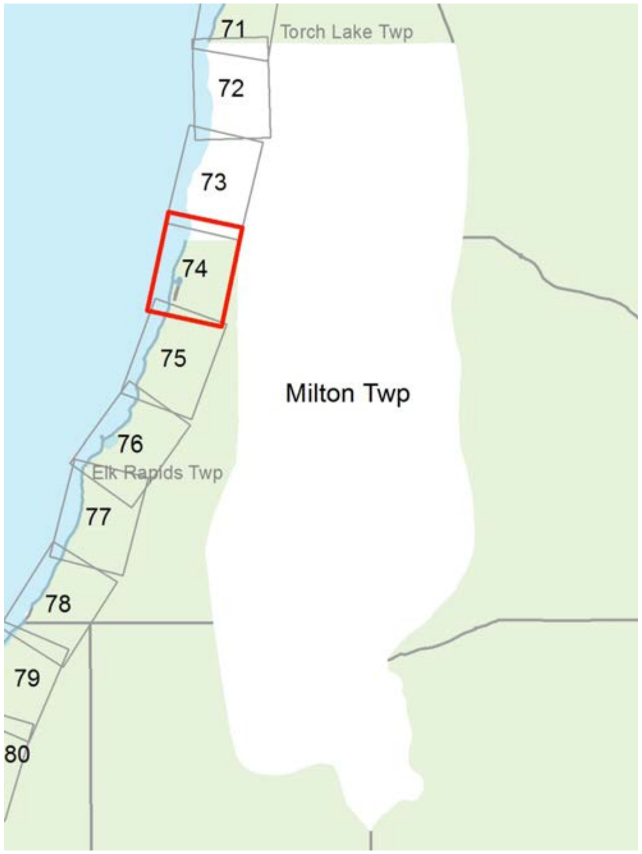


- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



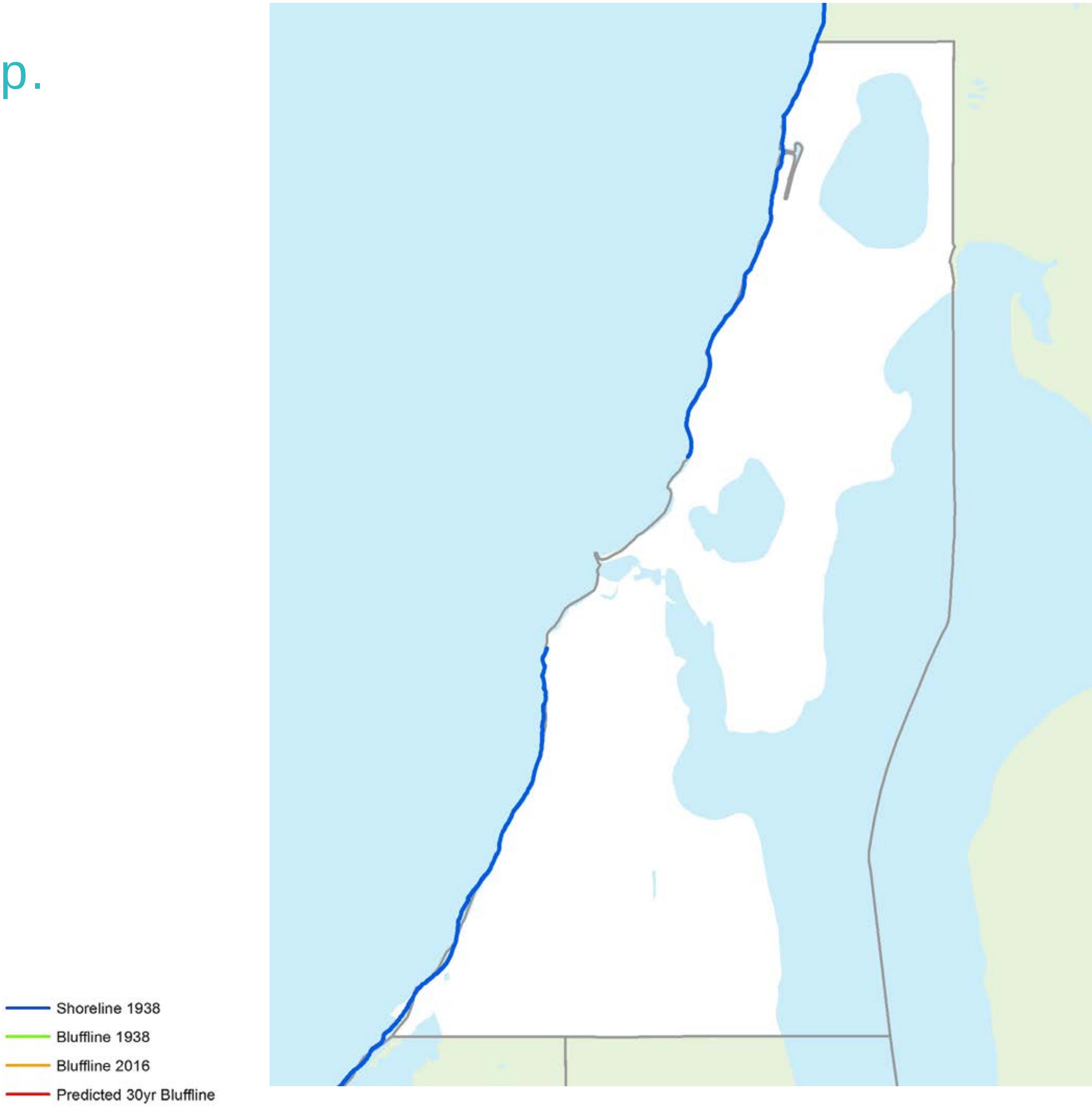


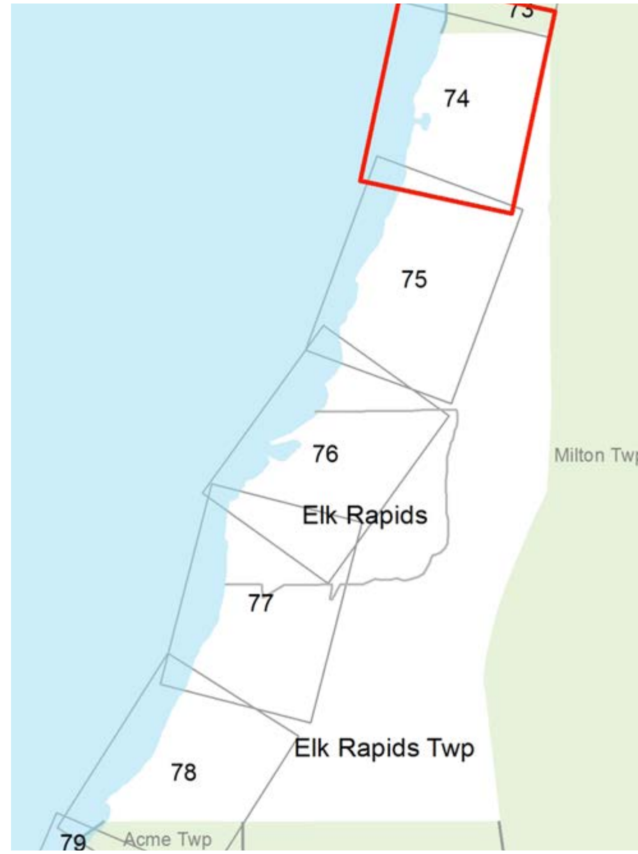
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



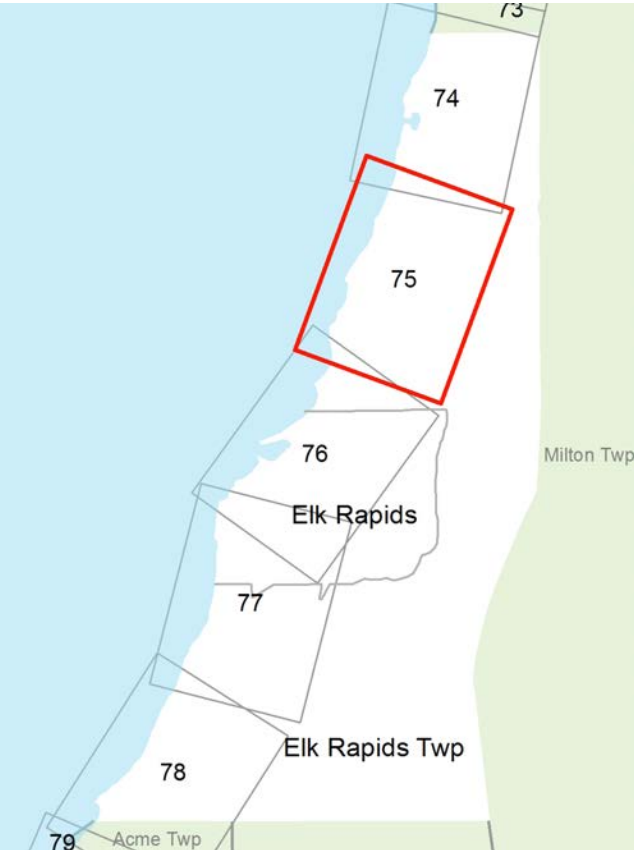
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Elk Rapids Twp.



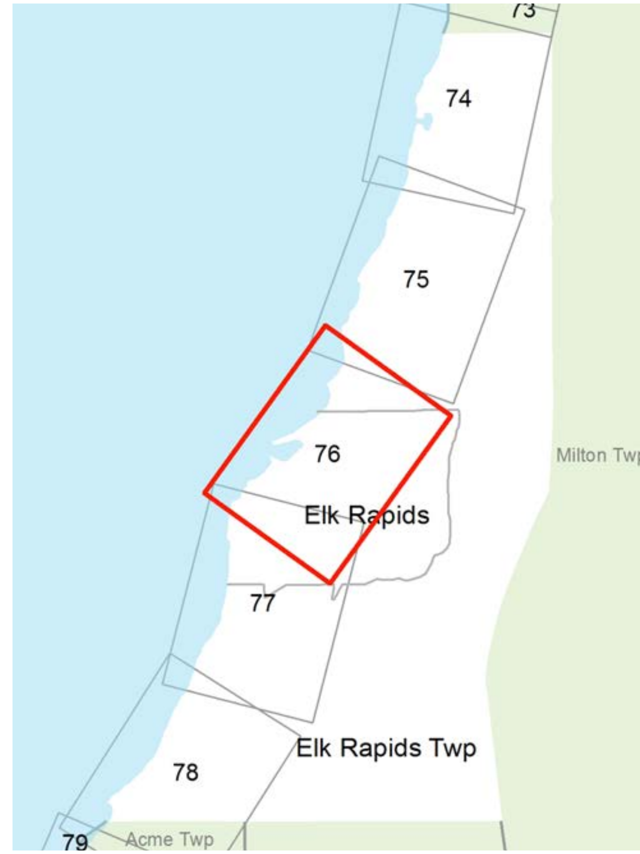


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

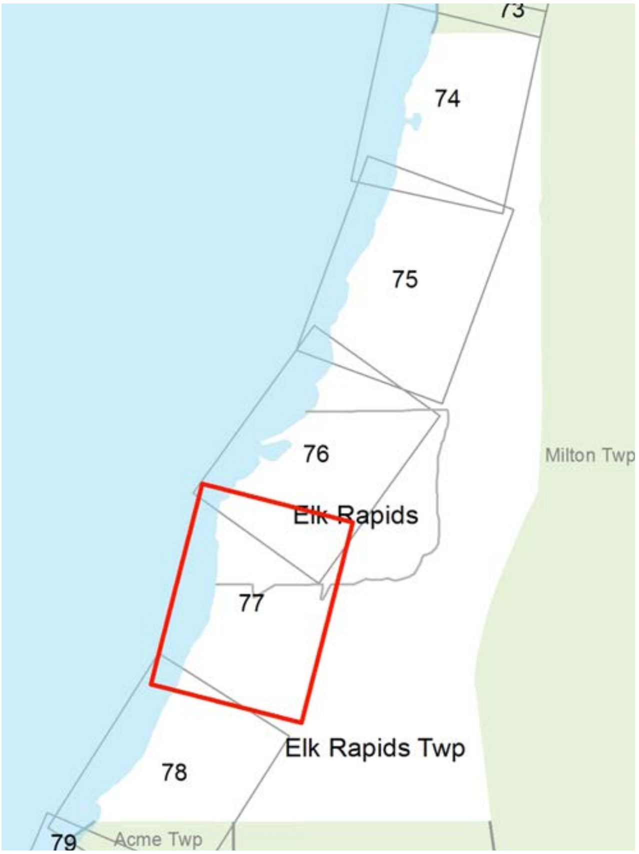

73
74
75
76
Elk Rapids
Milton Twp
77
78
Elk Rapids Twp
79
Acme Twp


Antrim County

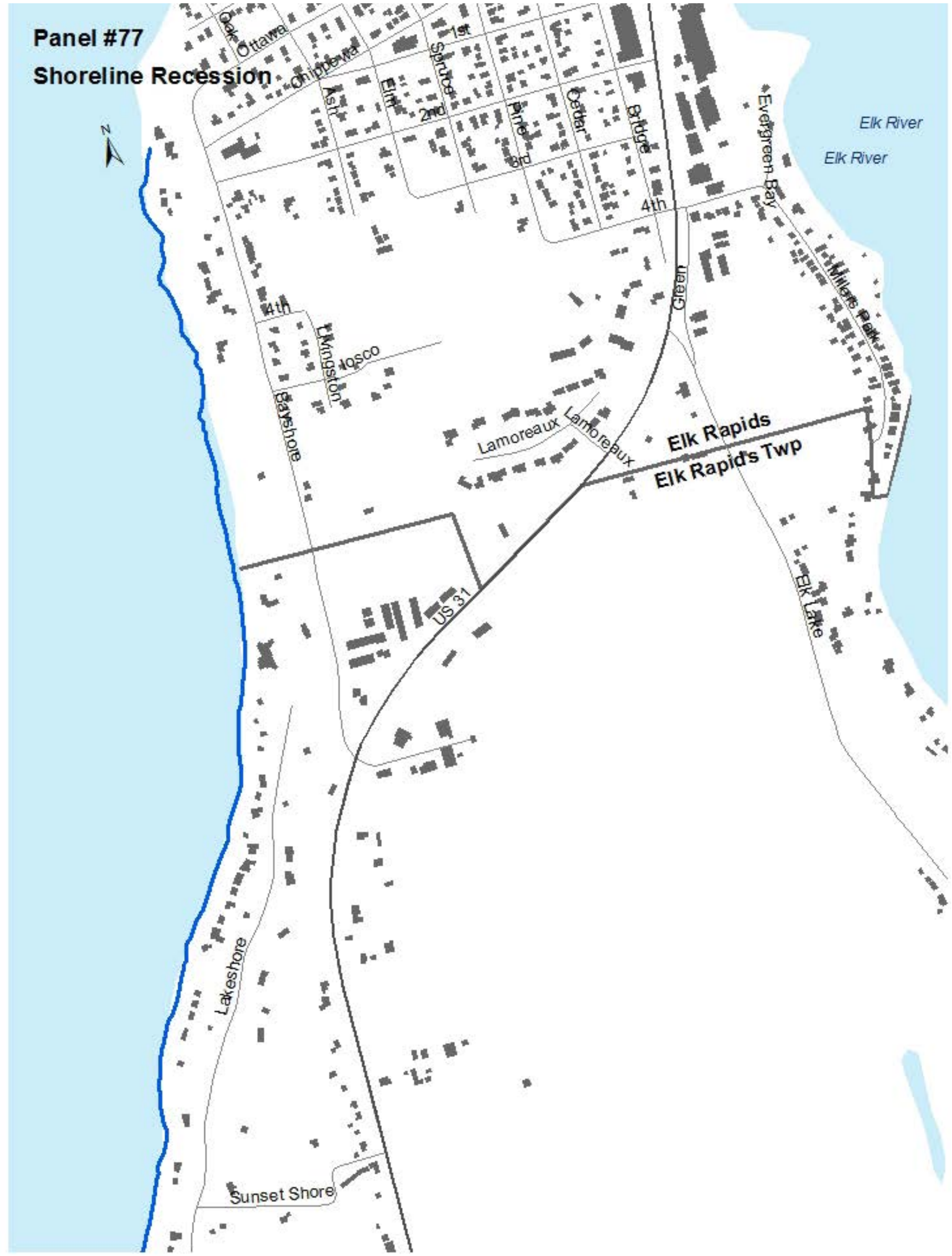

Panel #75
Shoreline Recession
Birch Lake
Williams
Cairn
Bayshore
US 31
Herrman
Partridge
Bass Lake
Bass Lake
Cairn
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

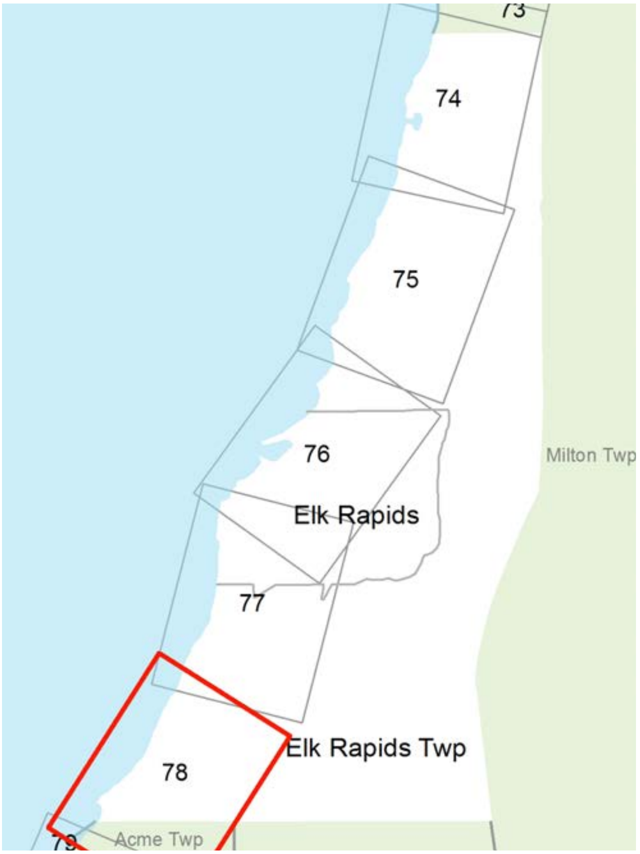


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





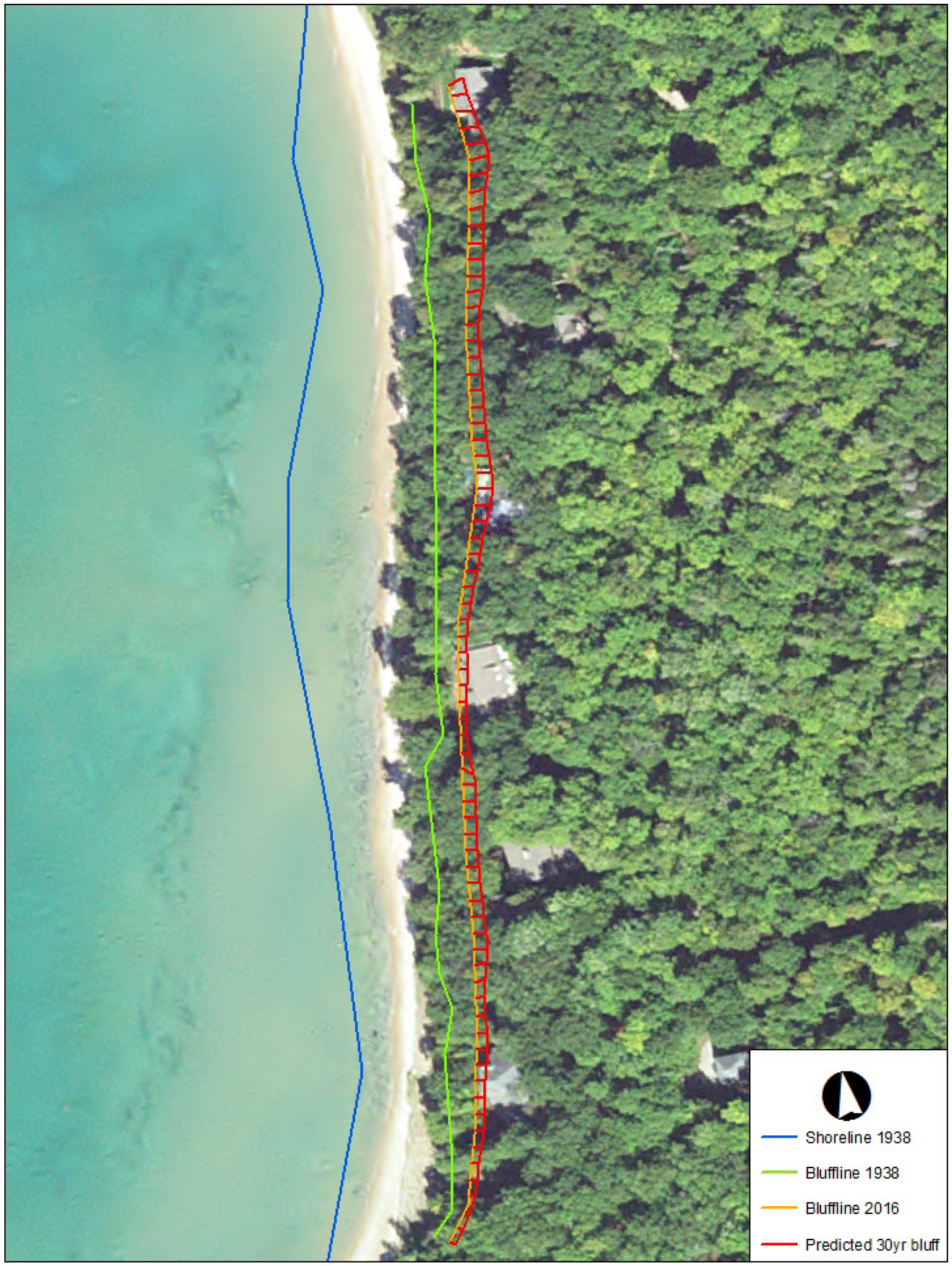
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Grand Traverse County

BLUFF RECESSION DETAIL

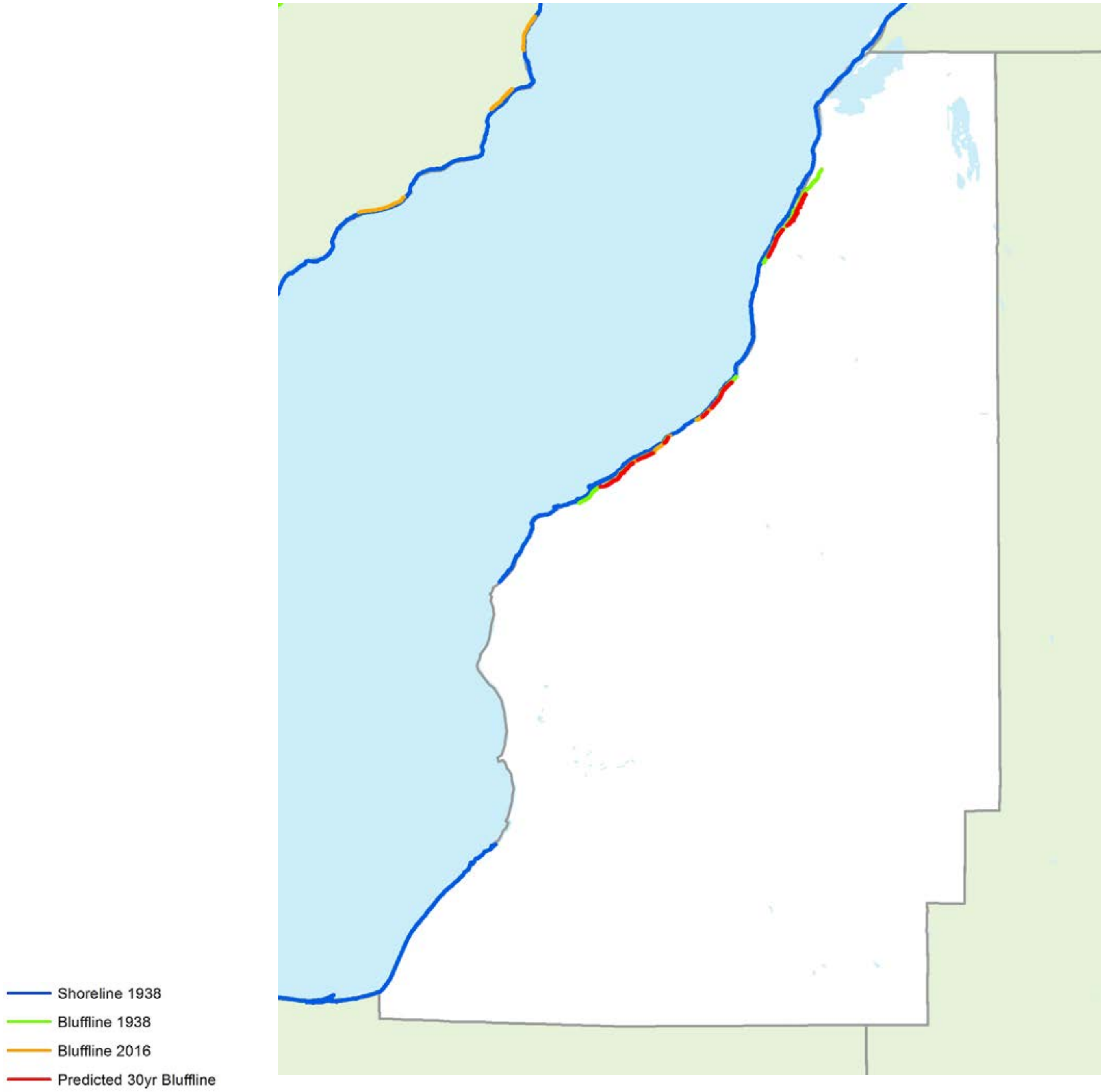
At least one "zoomed in" detail example of historic bluffline recession and future projections is provided at the beginning of each county section of this chapter. Shoreline and bluffline recession data can be viewed in greater detail online at http://geospatialresearch.mtu.edu/czmp.

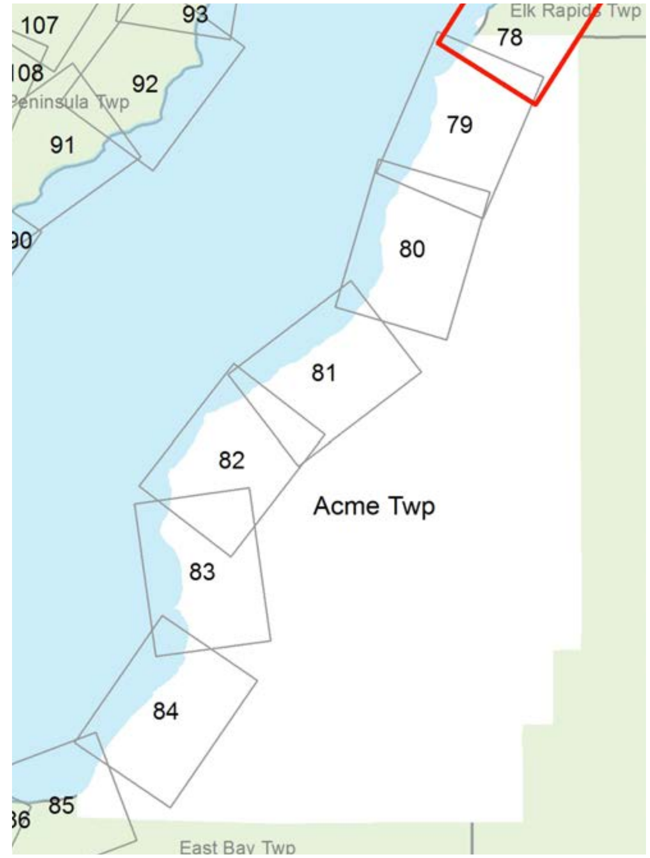
Bluff Detail, Panel 81, Acme Twp.



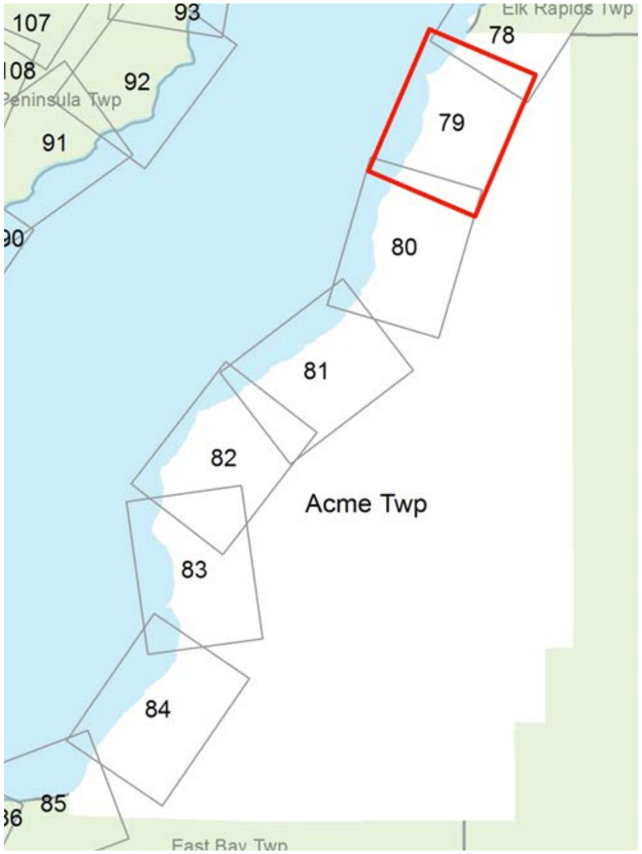
Acme Twp.


Grand Traverse County

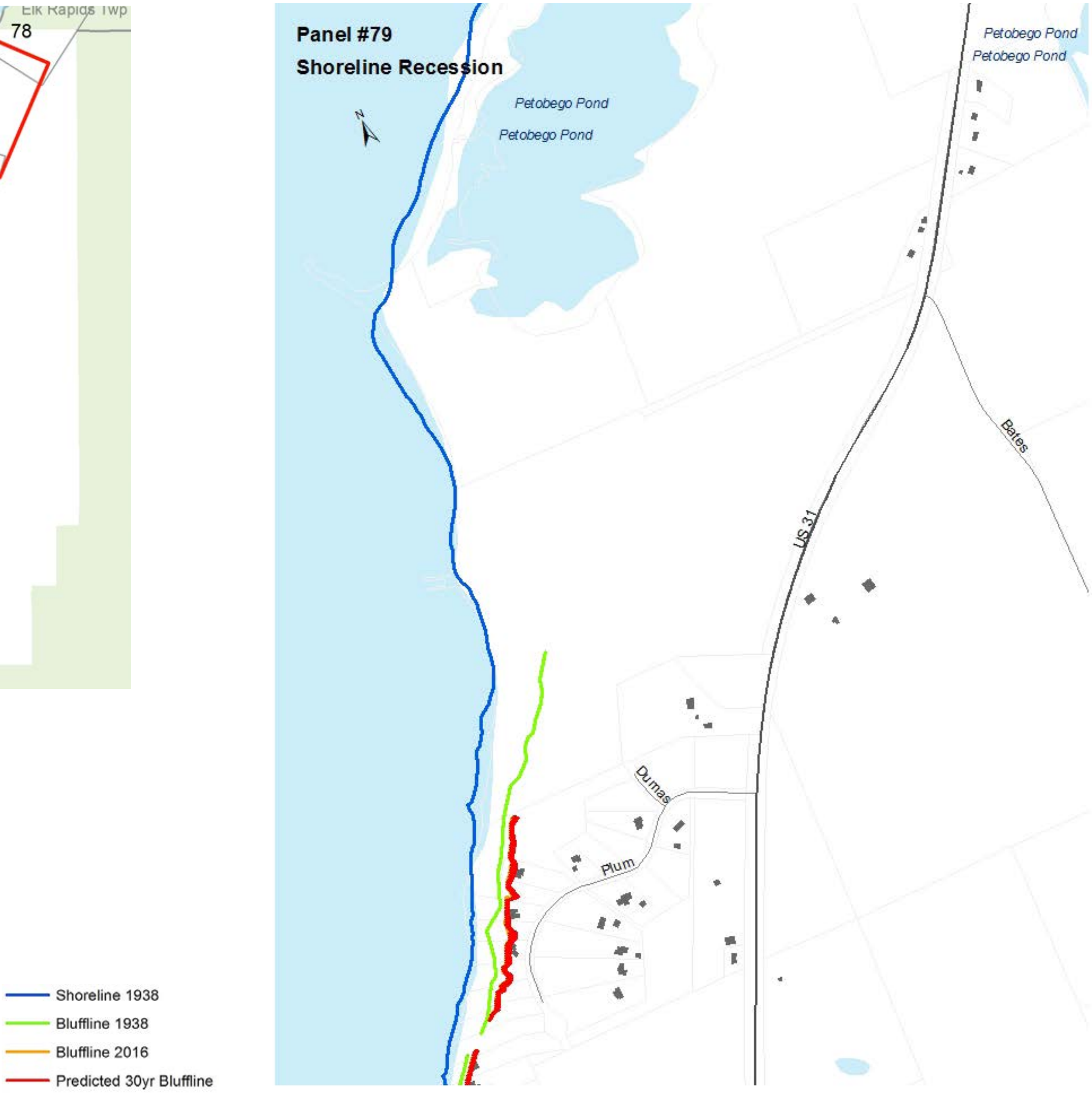

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

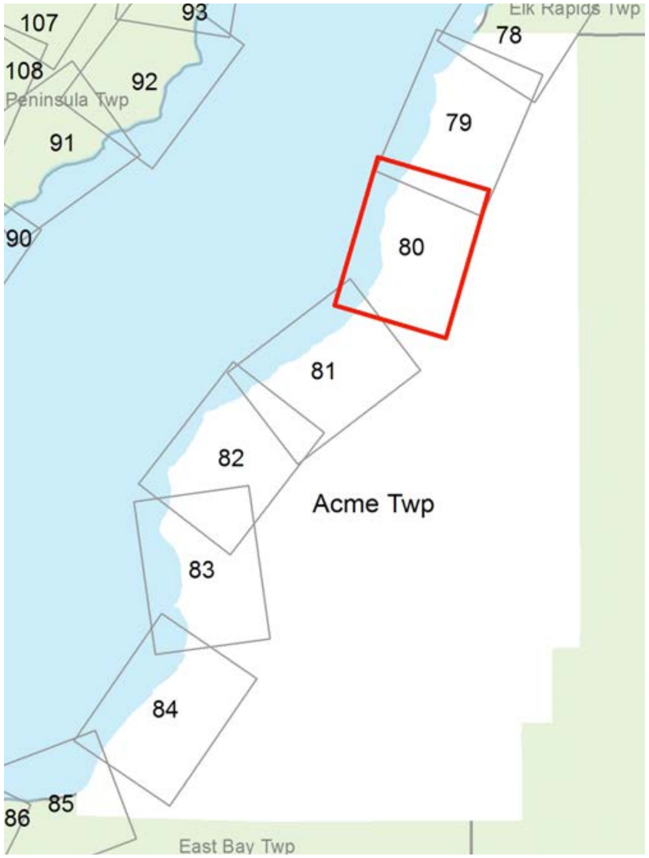


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

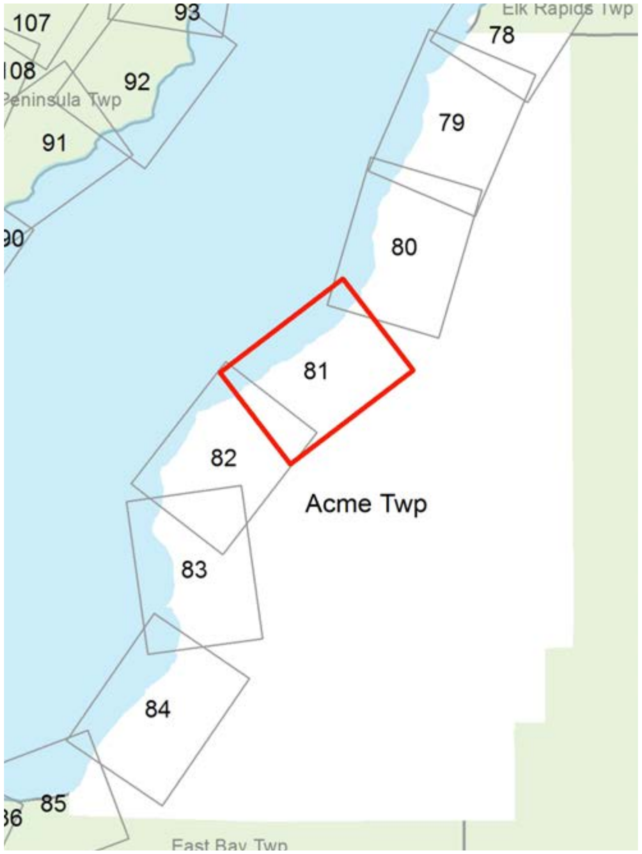

107
93
Elk Rapids Twp
78
108
92
Peninsula Twp
79
91
90
80
81
82
Acme Twp
83
84
85
86
East Bay Twp


Grand Traverse County


Panel #79
Shoreline Recession
Petobego Pond
Petobego Pond
Petobego Pond
Petobego Pond
Bates
US 31
Dumas
Plum
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

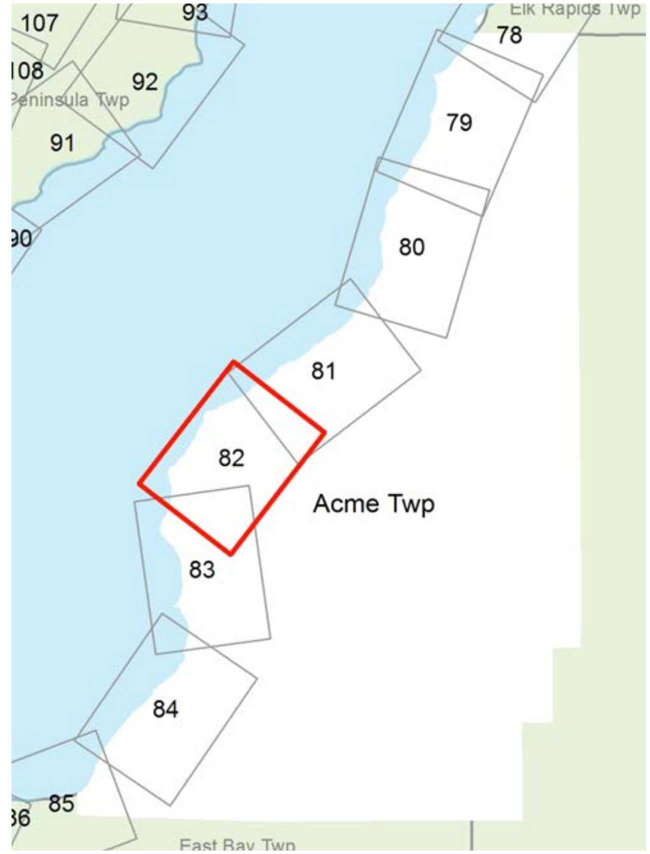


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

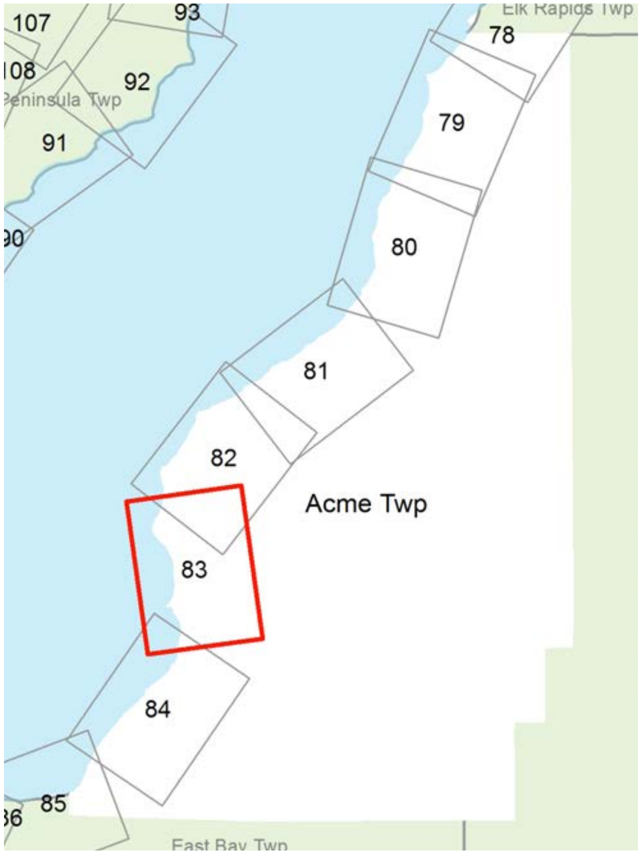

107
93
Elk Rapids Twp
78
108
92
Peninsula Twp
79
91
80
90
81
82
Acme Twp
83
84
85
86
East Bay Twp


Grand Traverse County

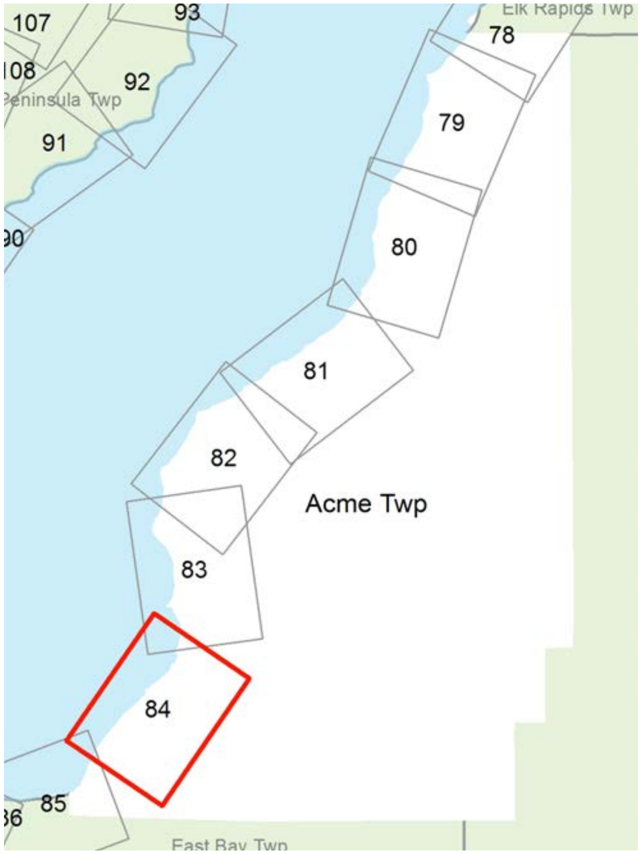

Panel #81
Shoreline Recession
Bayridge
Bayridge
Crockett
Birchview
Sun Bay
Woodridge
US 31
Bethesda
Prestwick
Prestwick
Campustie
Kesner
Maitland
Lochenheath
Maitland
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



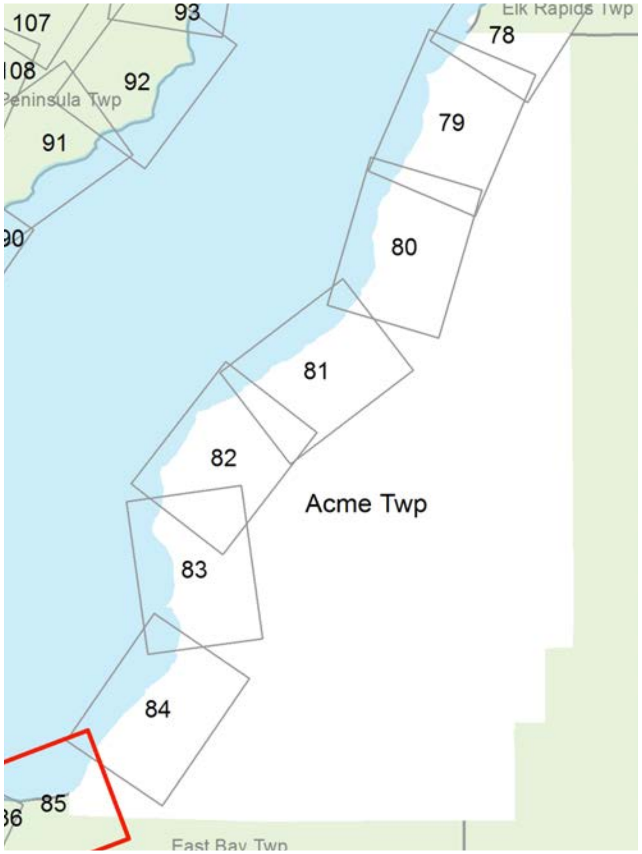
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

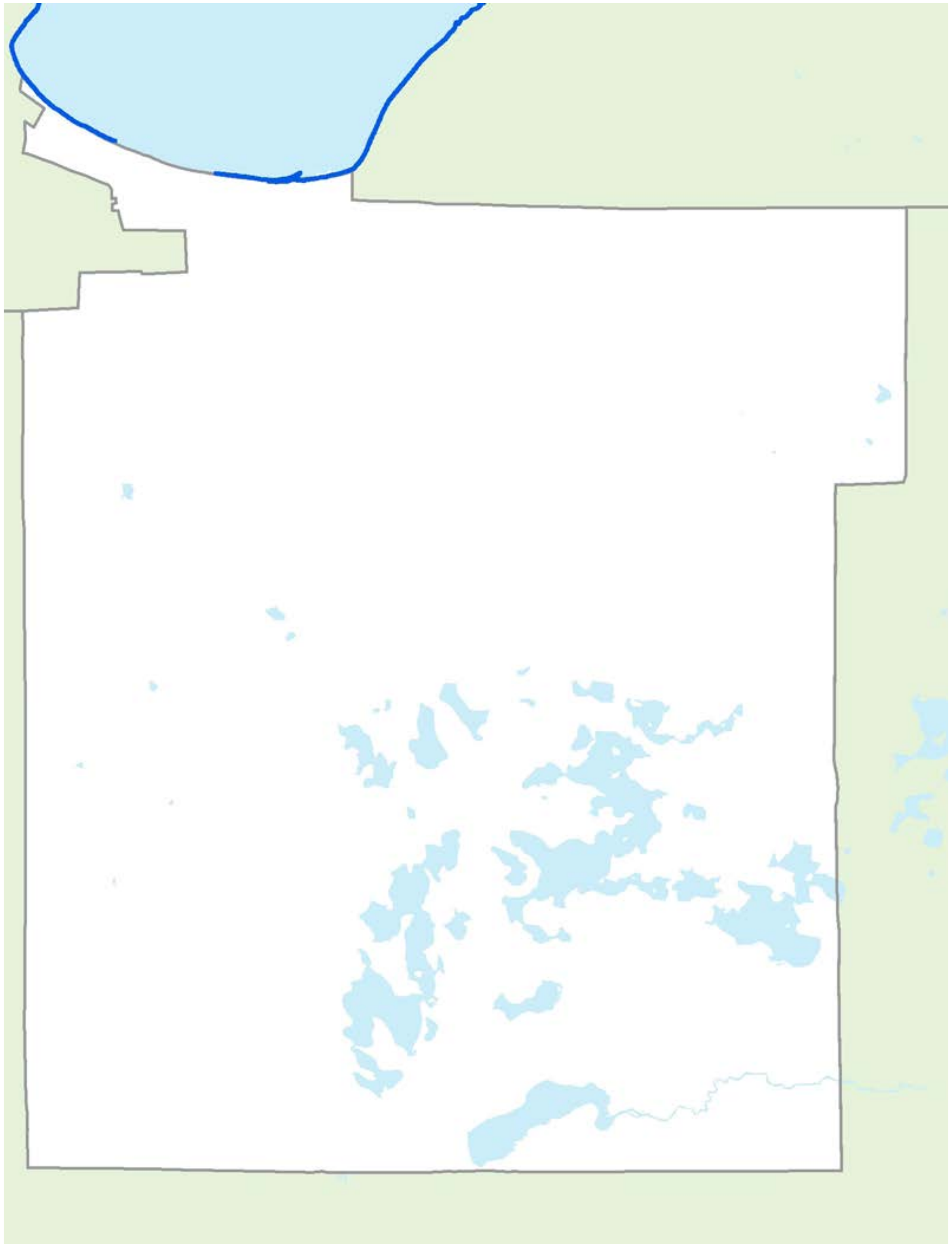

107
93
Elk Rapids Twp
78
108
92
Peninsula Twp
79
91
80
90
81
82
Acme Twp
83
84
85
86
East Bay Twp


Grand Traverse County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #85
Shoreline Recession
Holiday
Holiday Pines
Sherwood
Ridge Run
5 Mile
Acme Twp
East Bay Twp
Holiday
Park
Evelyn
Pinebrook
US 31
Tart Trail
4 Mile
East
Oak
Maple
Pine
West
Finnila
Traverse City SP Campground
Business Park
International

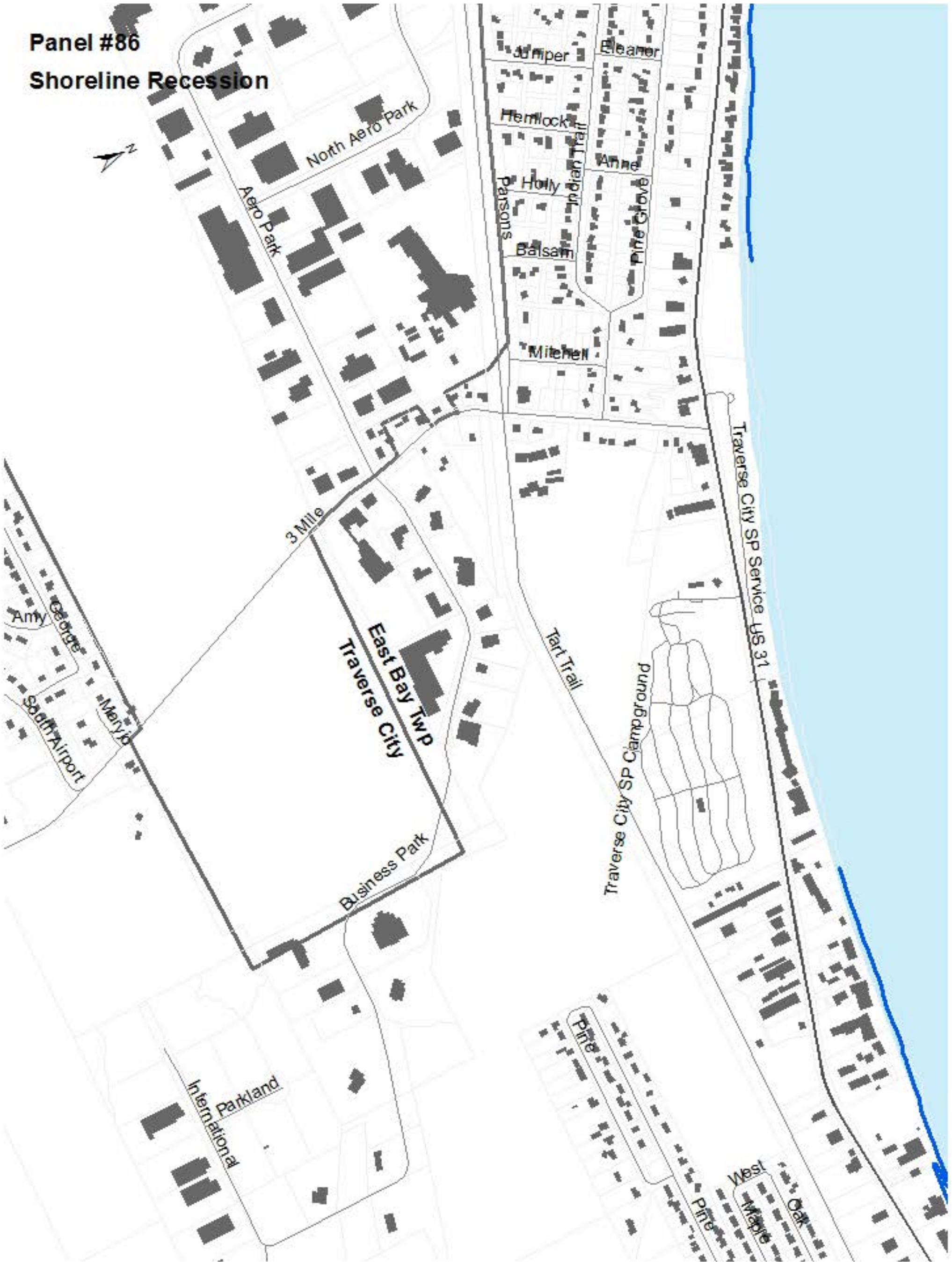
East Bay Twp.



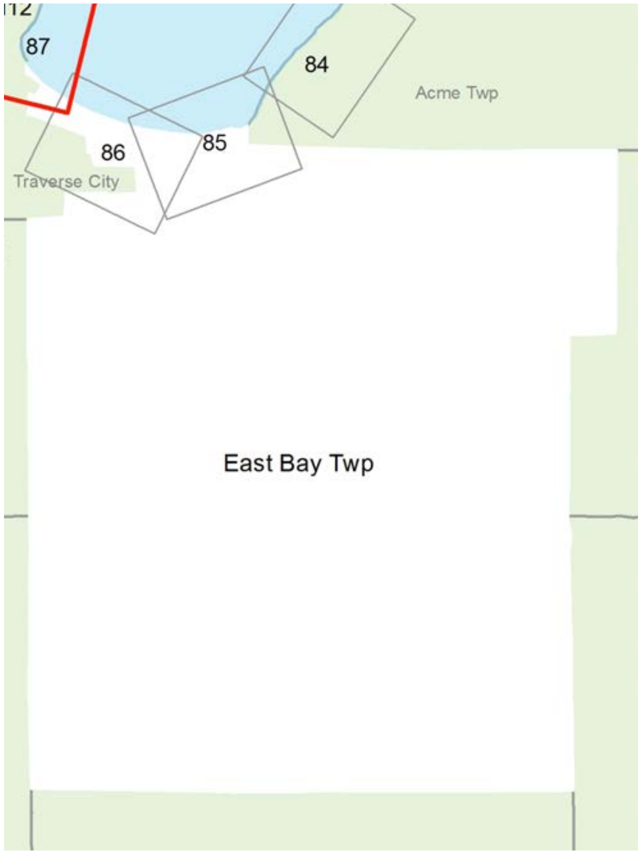

Grand Traverse County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



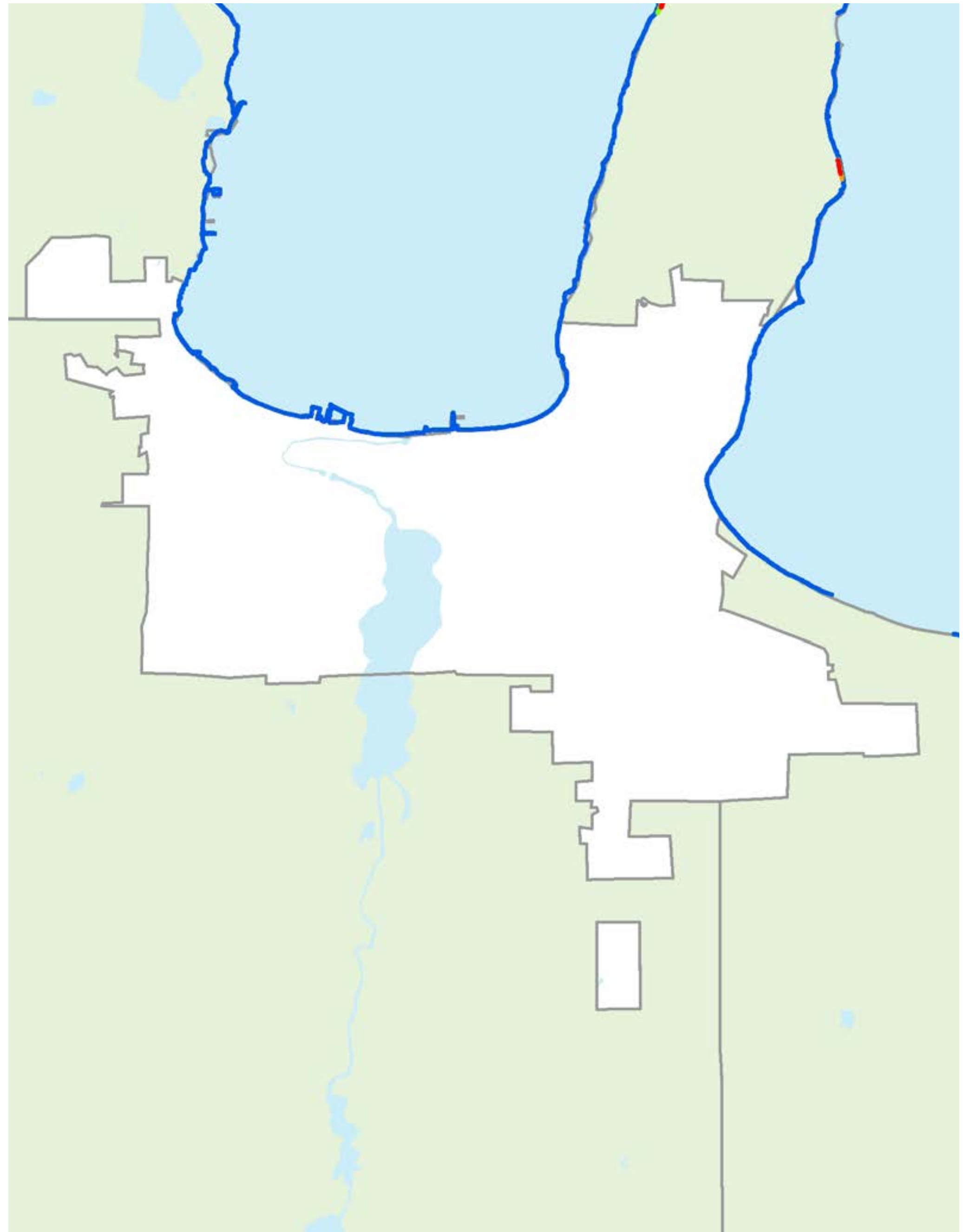
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

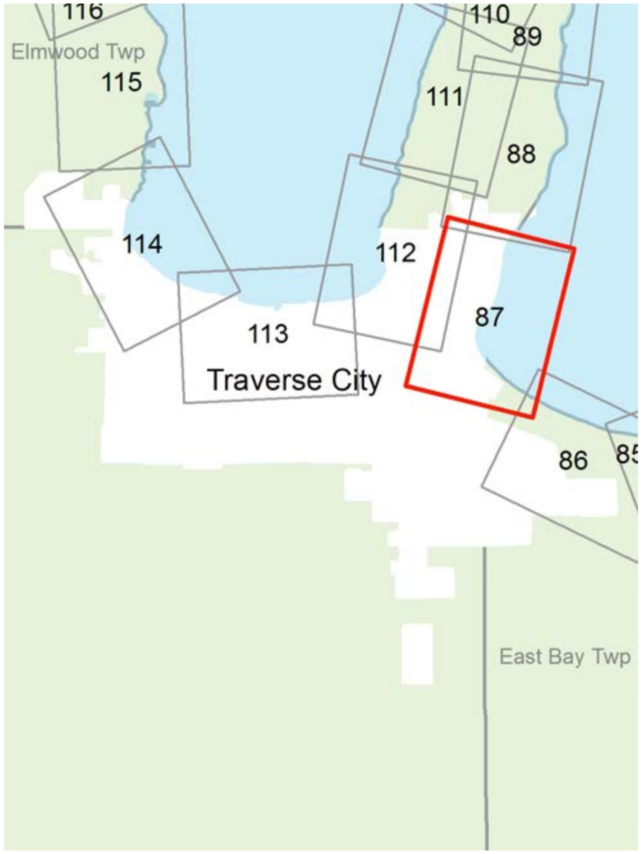

87
84
86
85
Acme Twp
Traverse City
East Bay Twp


Grand Traverse County

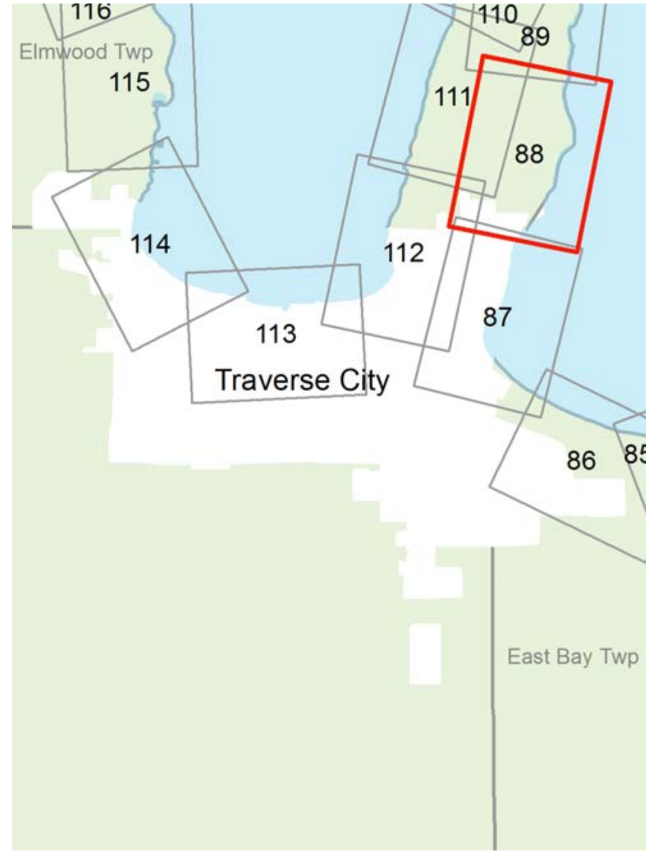

Panel #87
Shoreline Recession
Kewaunee
Birchwood
Aspen
North Quail
South Quail
Eastern
College
Leeward
East Bay
Western
Apache
Front
Shawnee
Comanche
Indian Woods
Iroquois
Sequoia
Seneca
Chippewa
Munson
8th
Hannah
Airport Access
East Bay Twp
Traverse City
US 31
Indian Trail
Pine Grove
Calvin
Westminster
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Traverse City

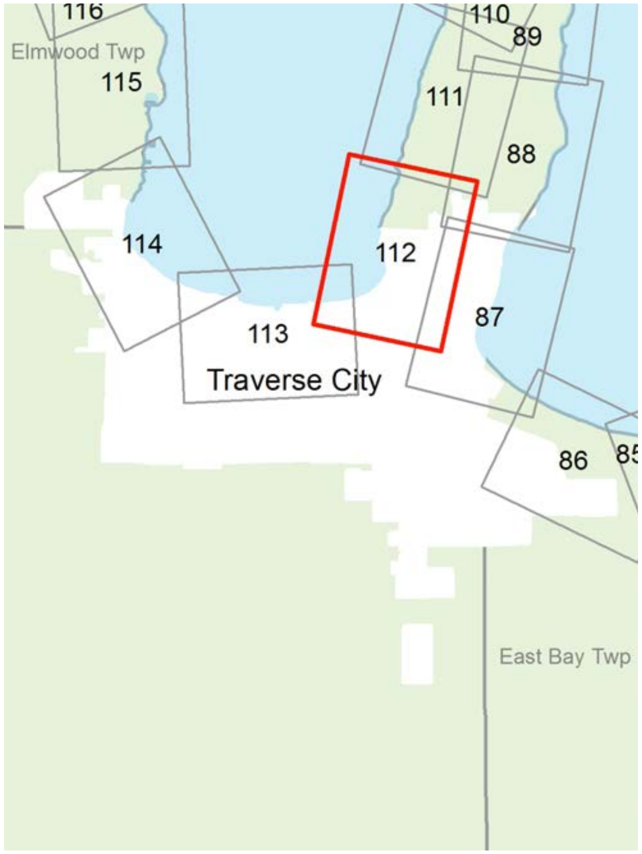


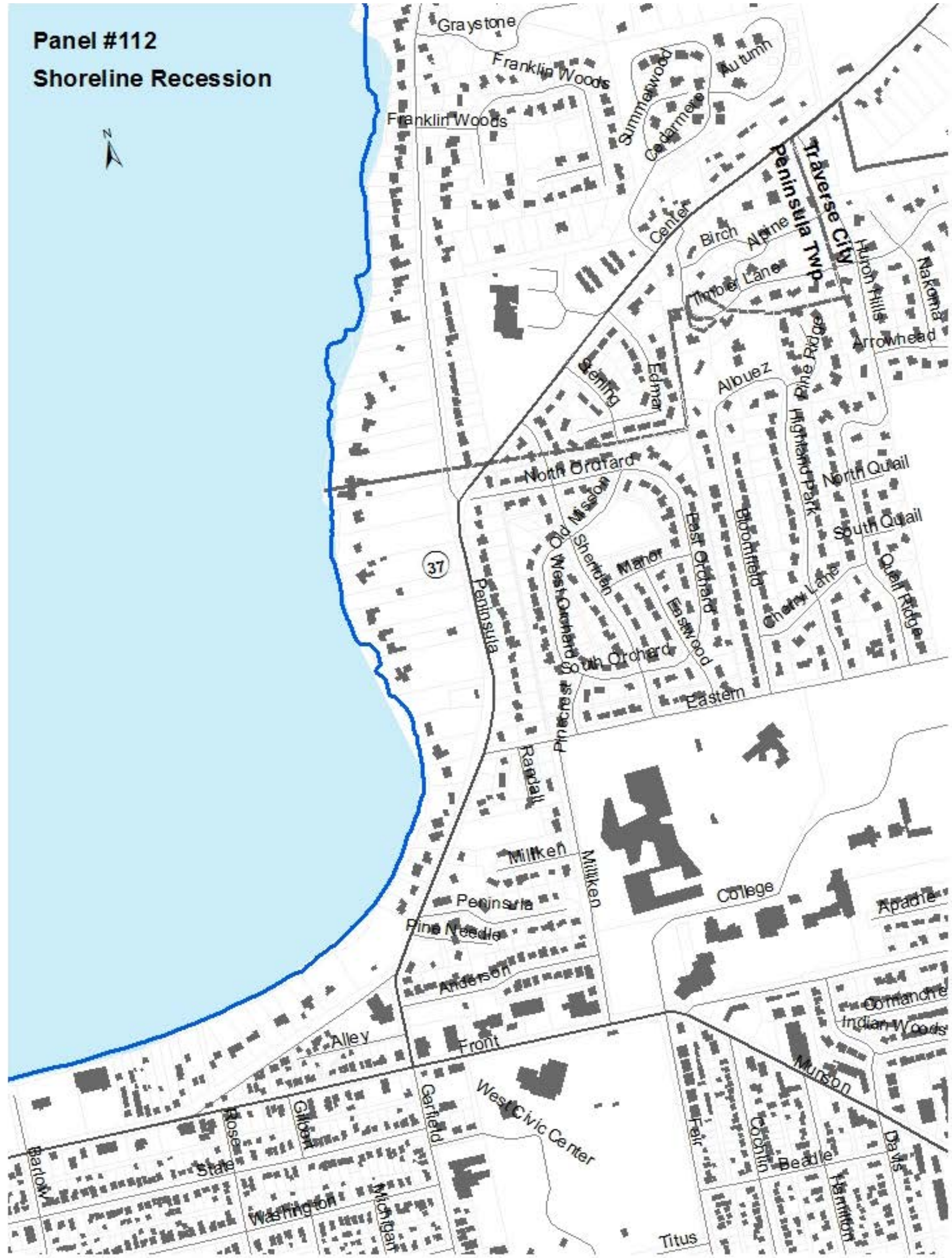


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

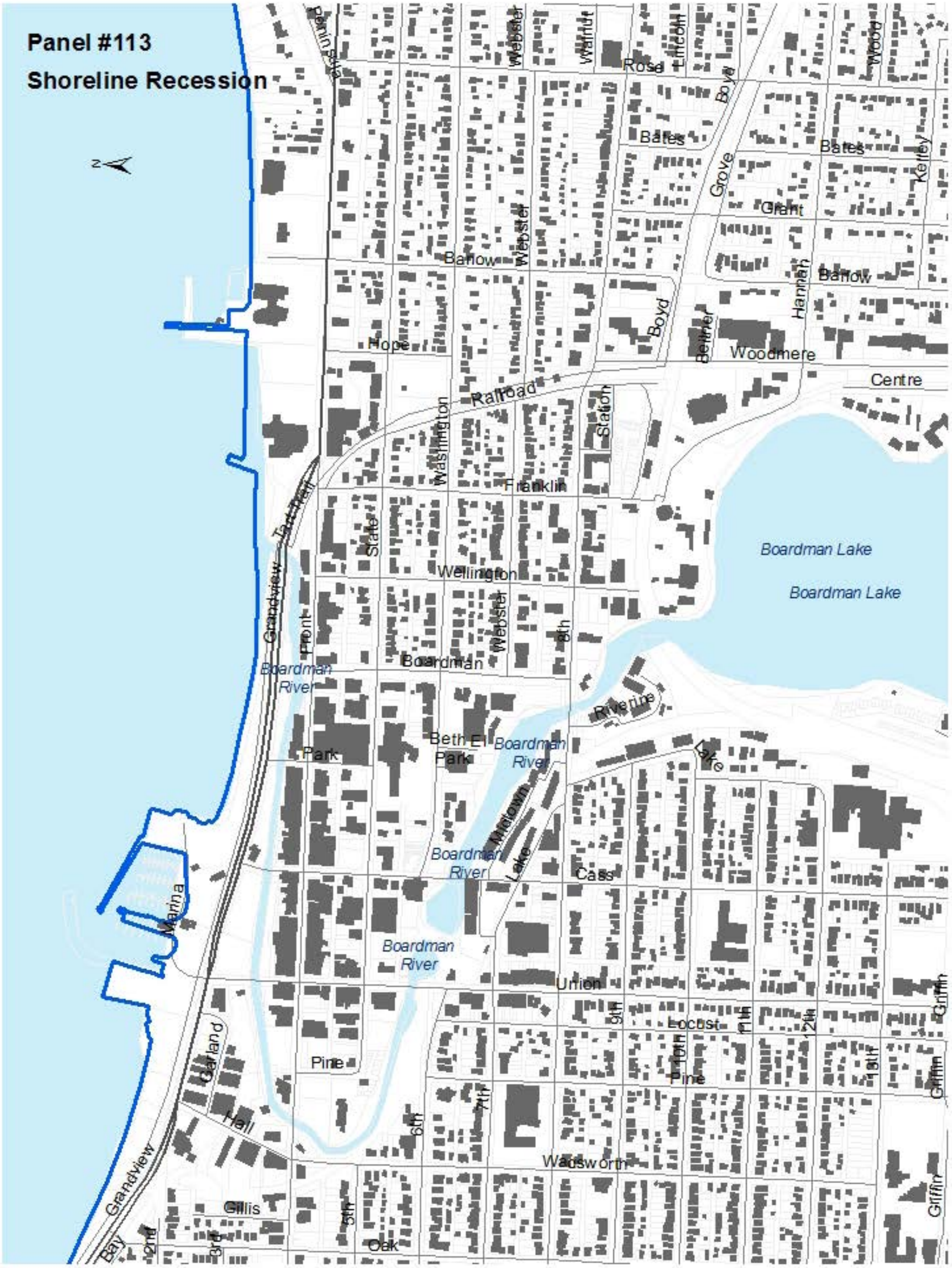


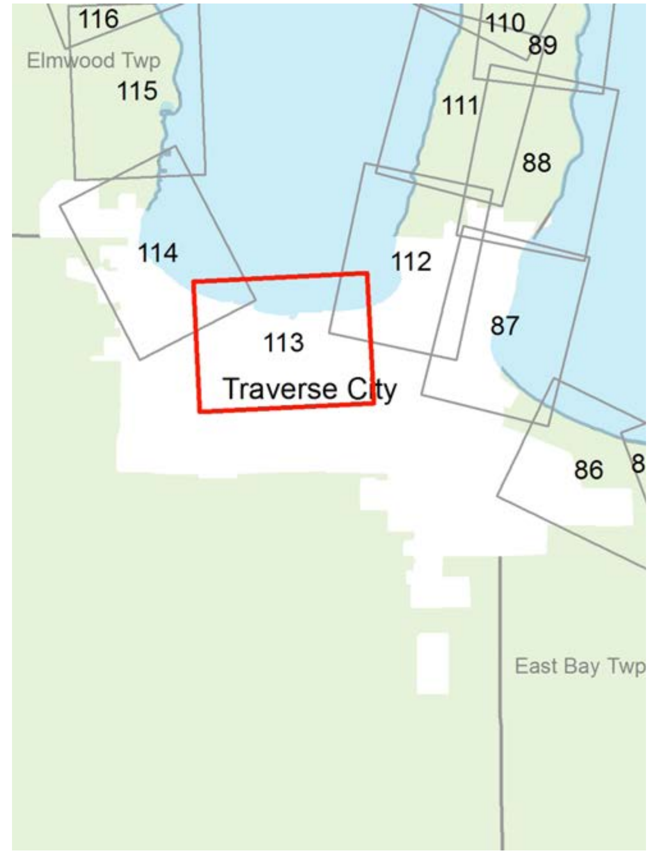
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



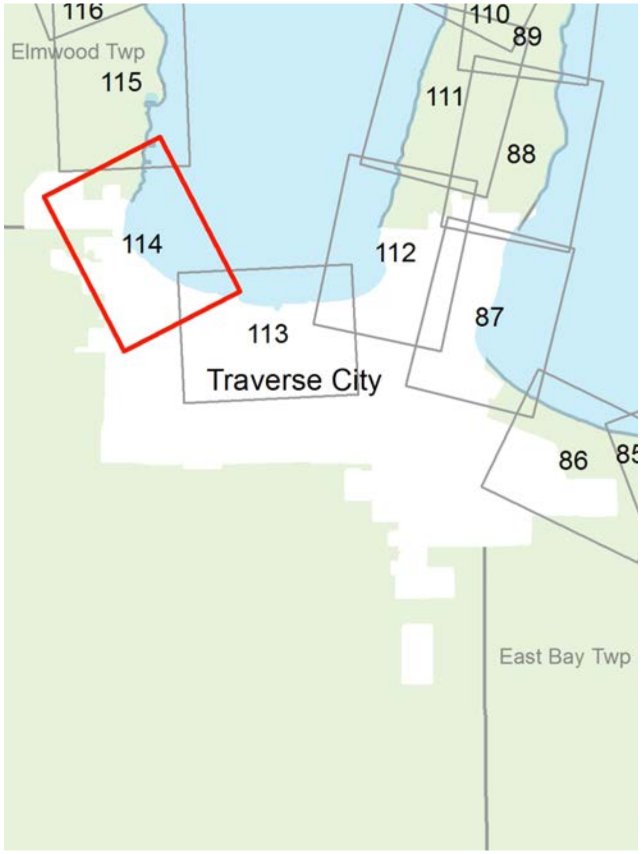


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

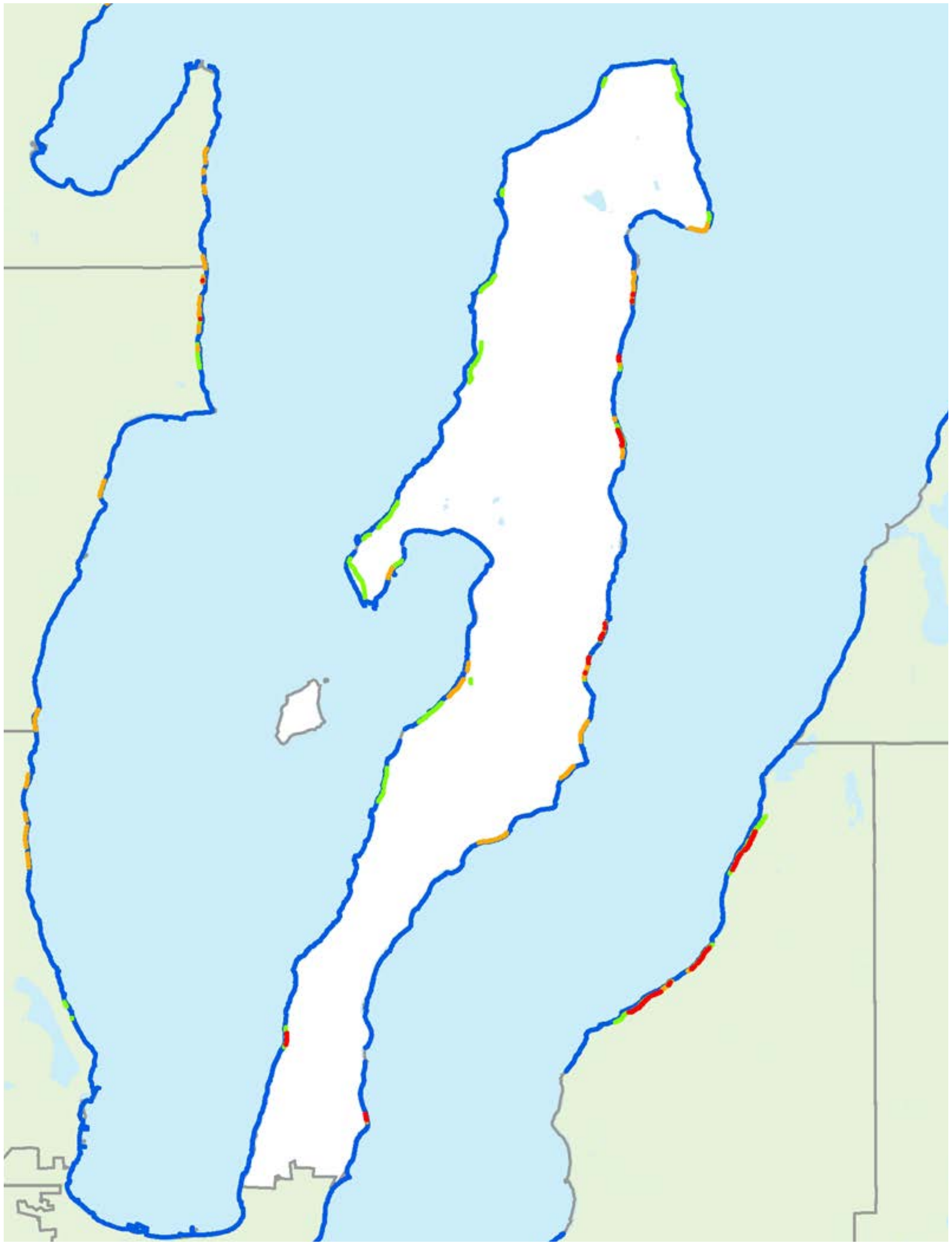




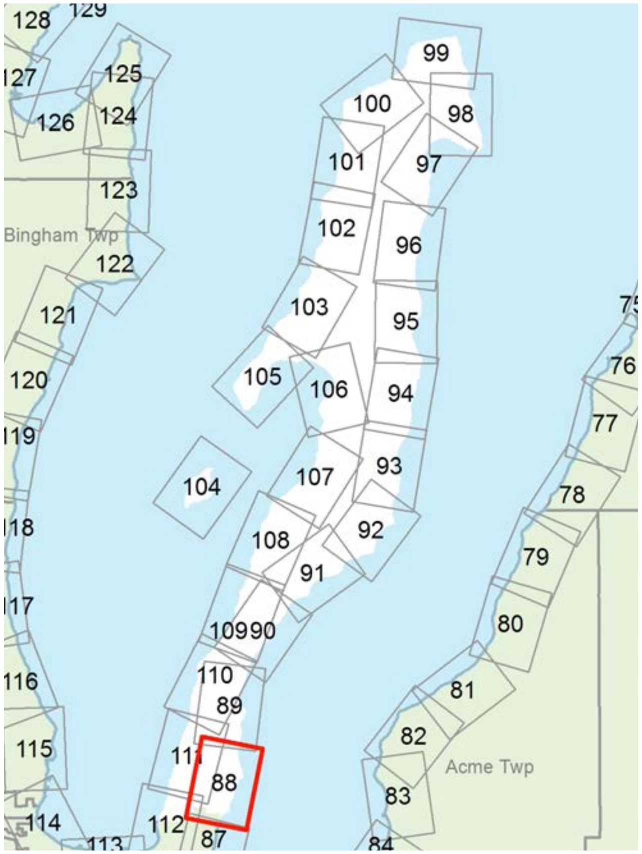
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



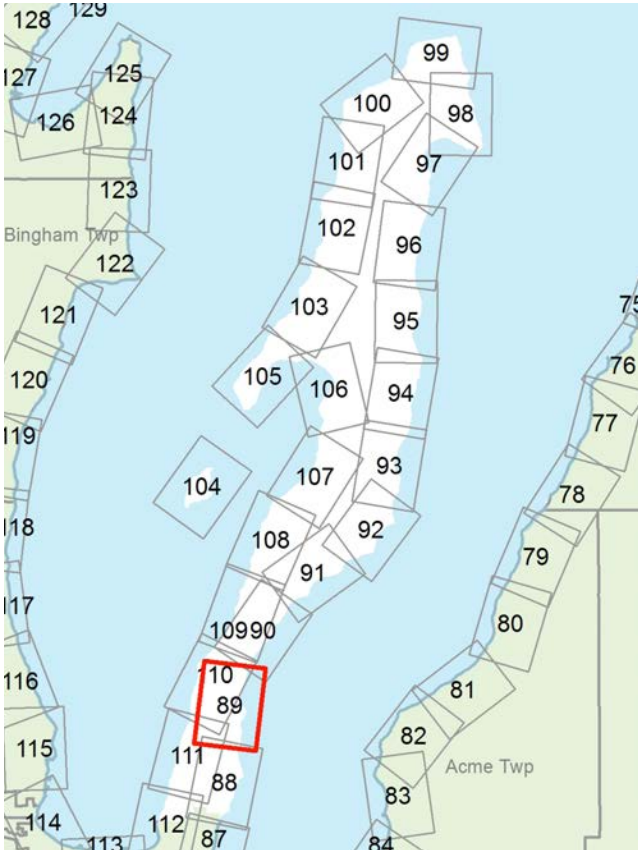
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



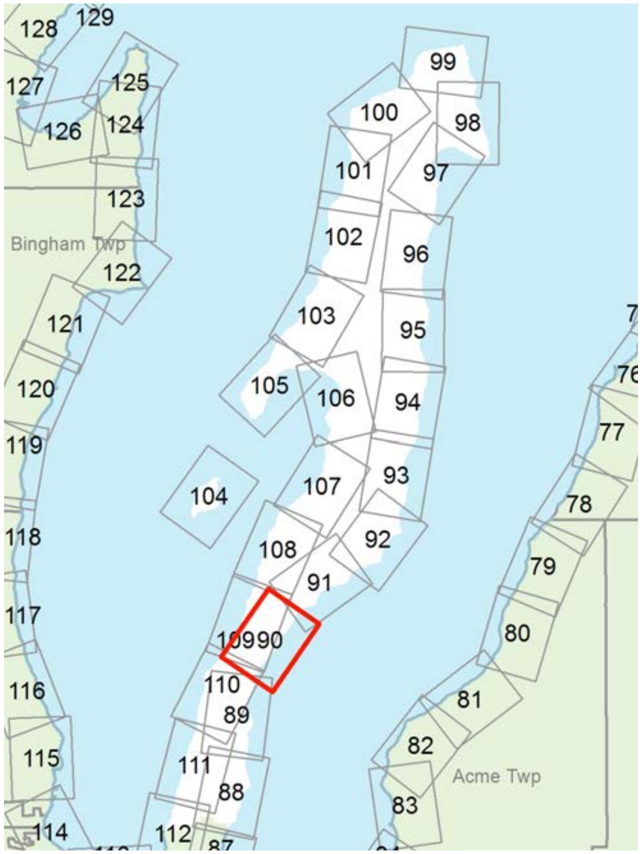
Peninsula Twp.



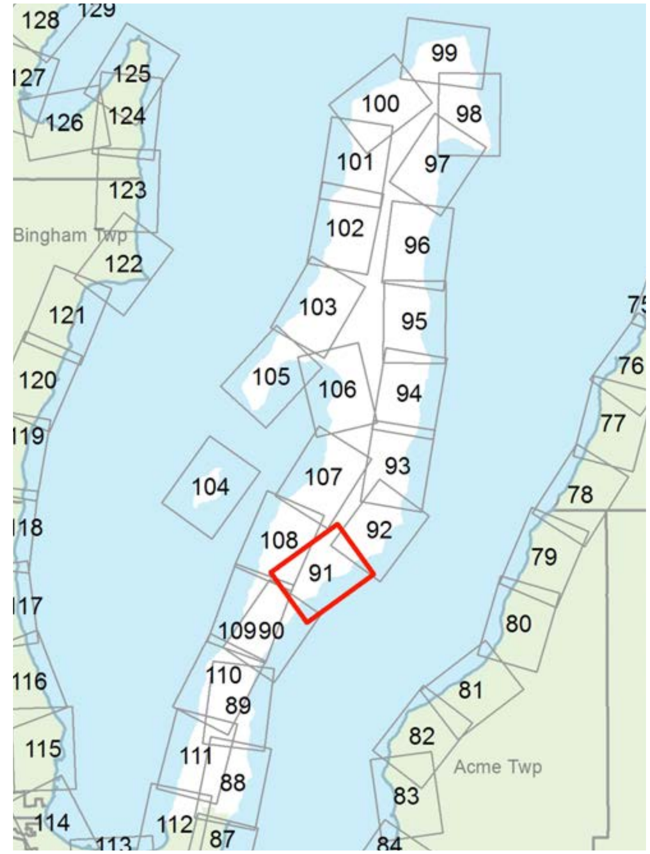
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



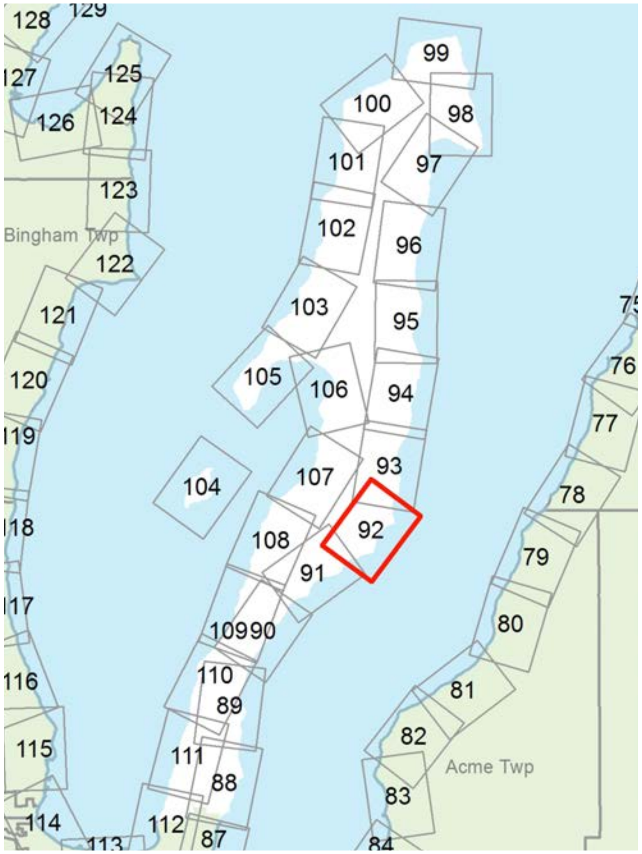
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

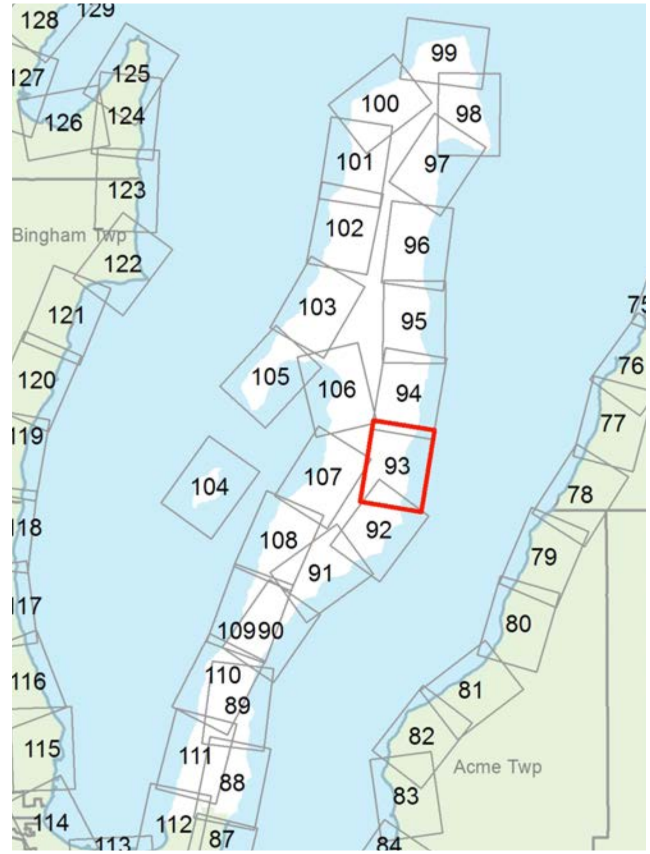


Shoreline 1938

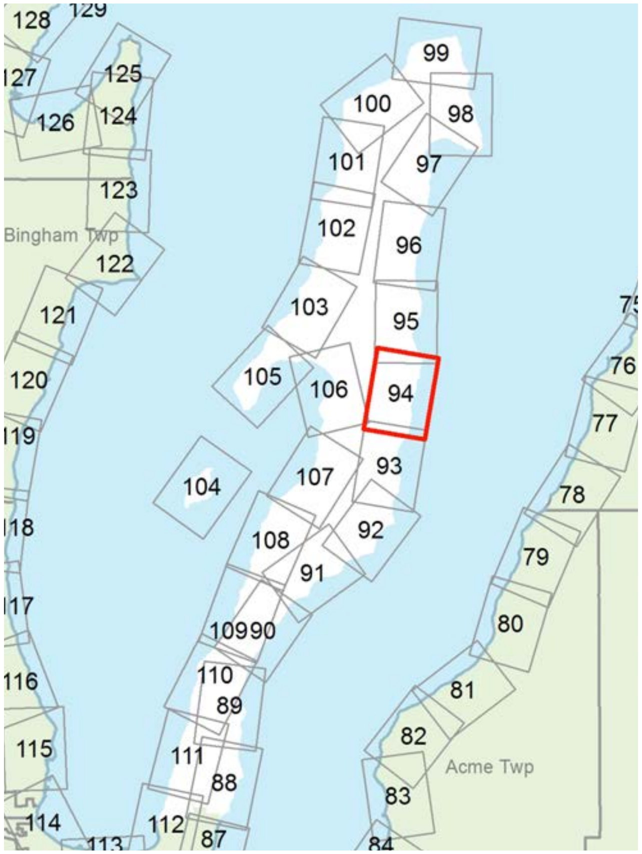
Bluffline 1938

Bluffline 2016

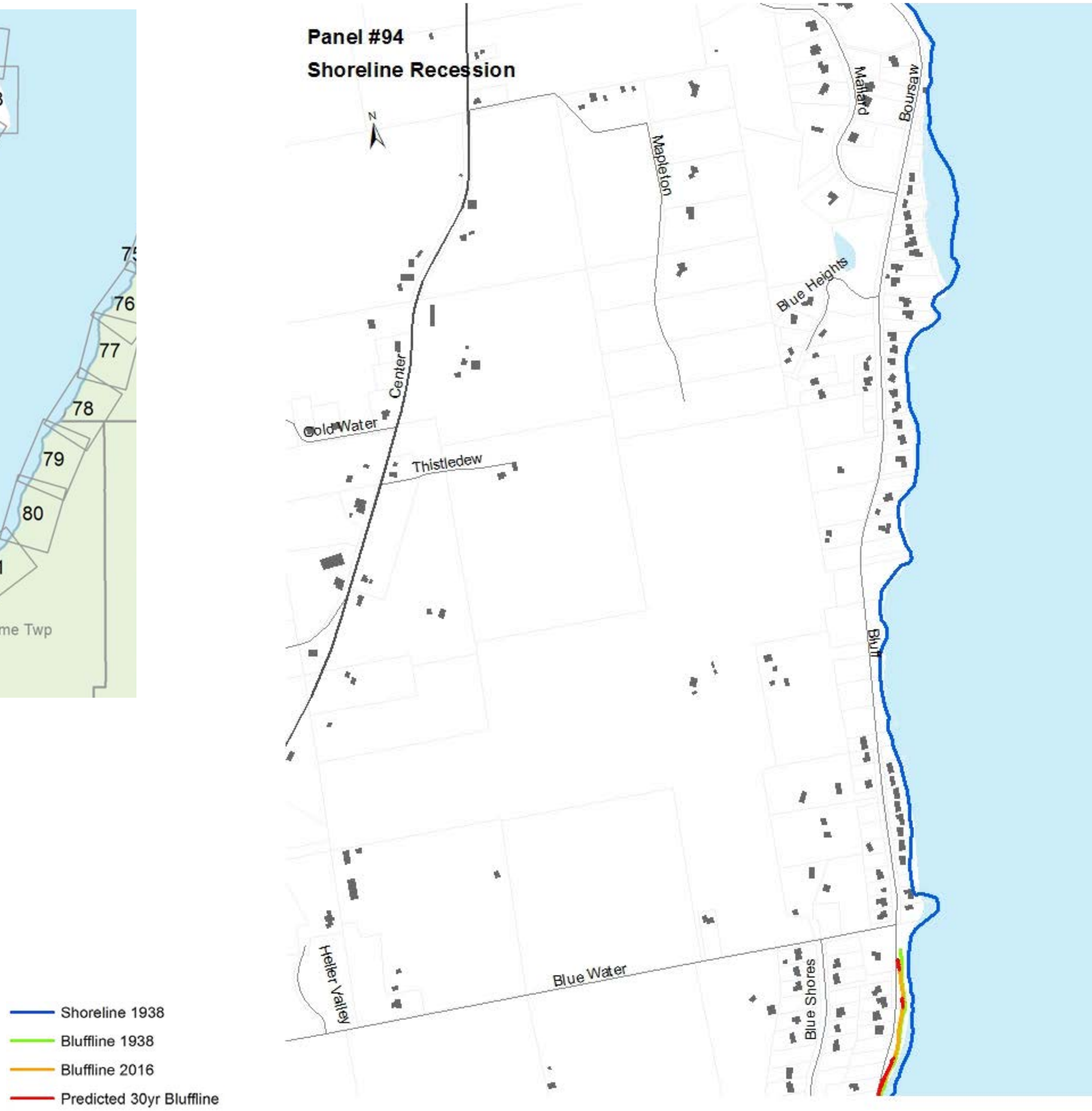
Predicted 30yr Bluffline

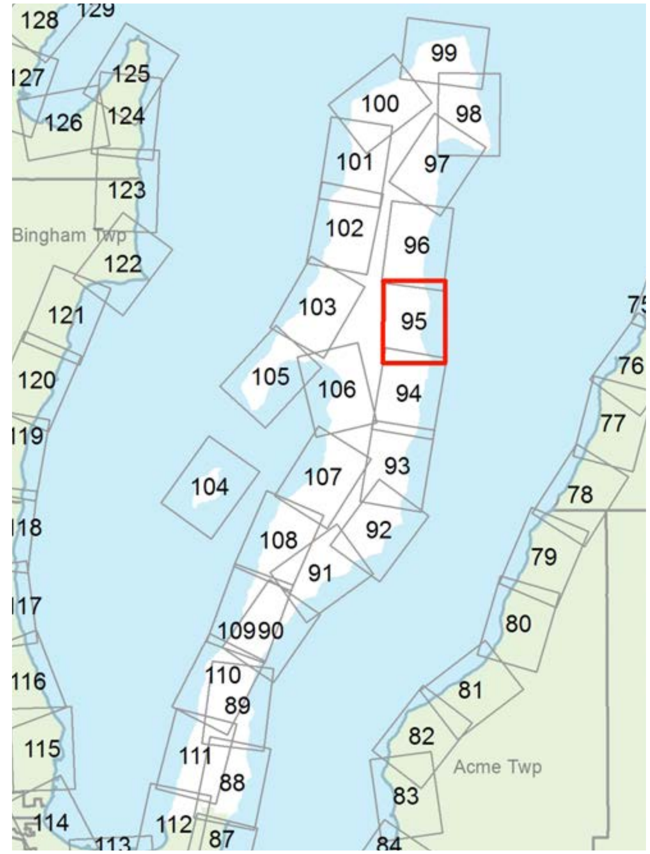


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

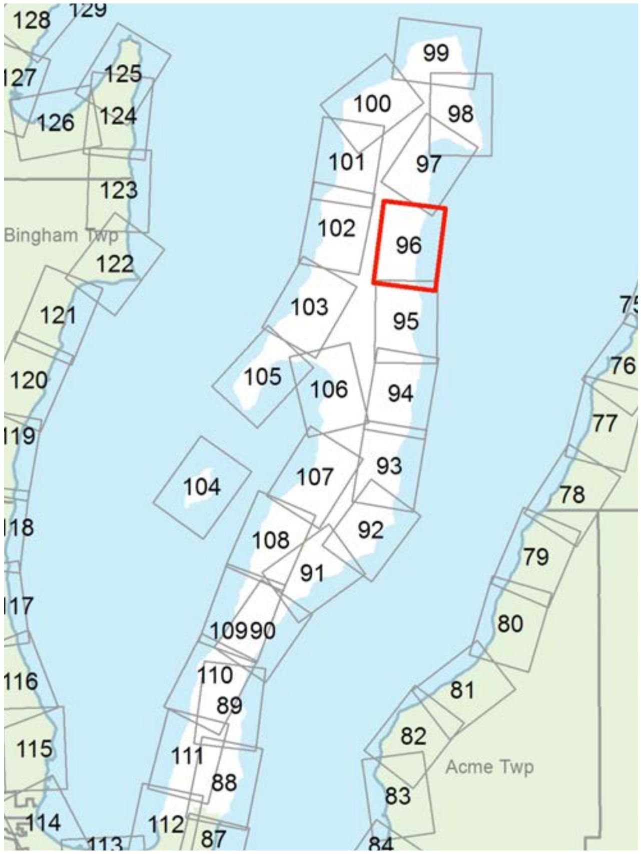

Bingham Twp
Acme Twp


Grand Traverse County


Panel #94
Shoreline Recession
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline
Mallard
Boursaw
Mapleton
Blue Heights
Center
Cold Water
Thistledew
Bluff
Heller Valley
Blue Water
Blue Shores



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


128
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Bingham Twp
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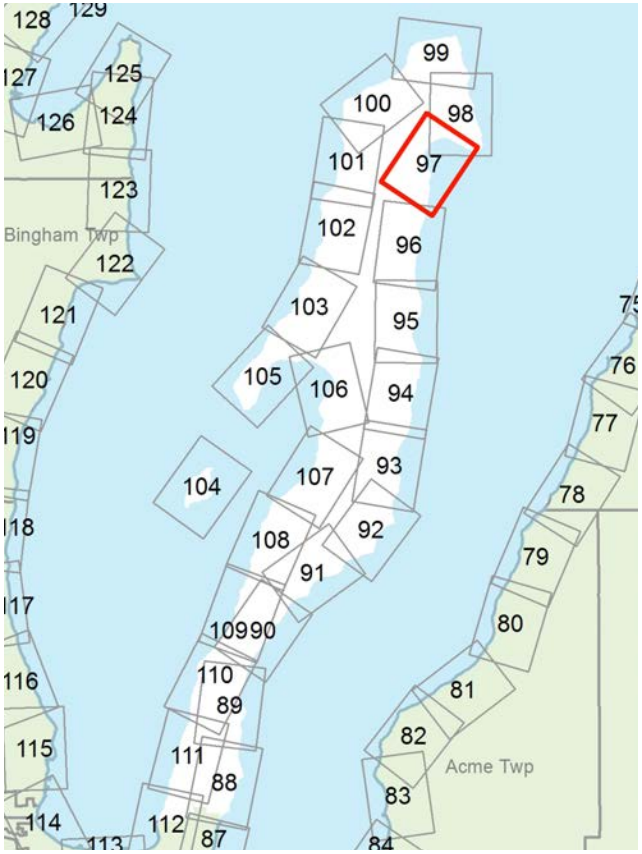
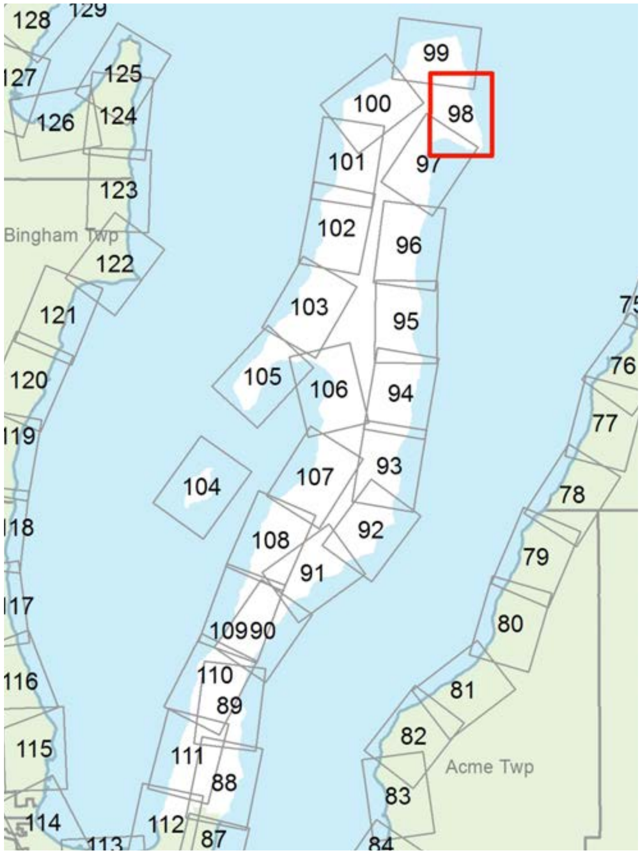
84
Acme Twp


Grand Traverse County


Panel #96
Shoreline Recession
N
Smokey Hollow
Whispering Pines
Wrightwood Terrace
Center
Vineyard
Smokey Ridge
Ladd
Woodhill
Trevor
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



128
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Bingham Twp
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10990
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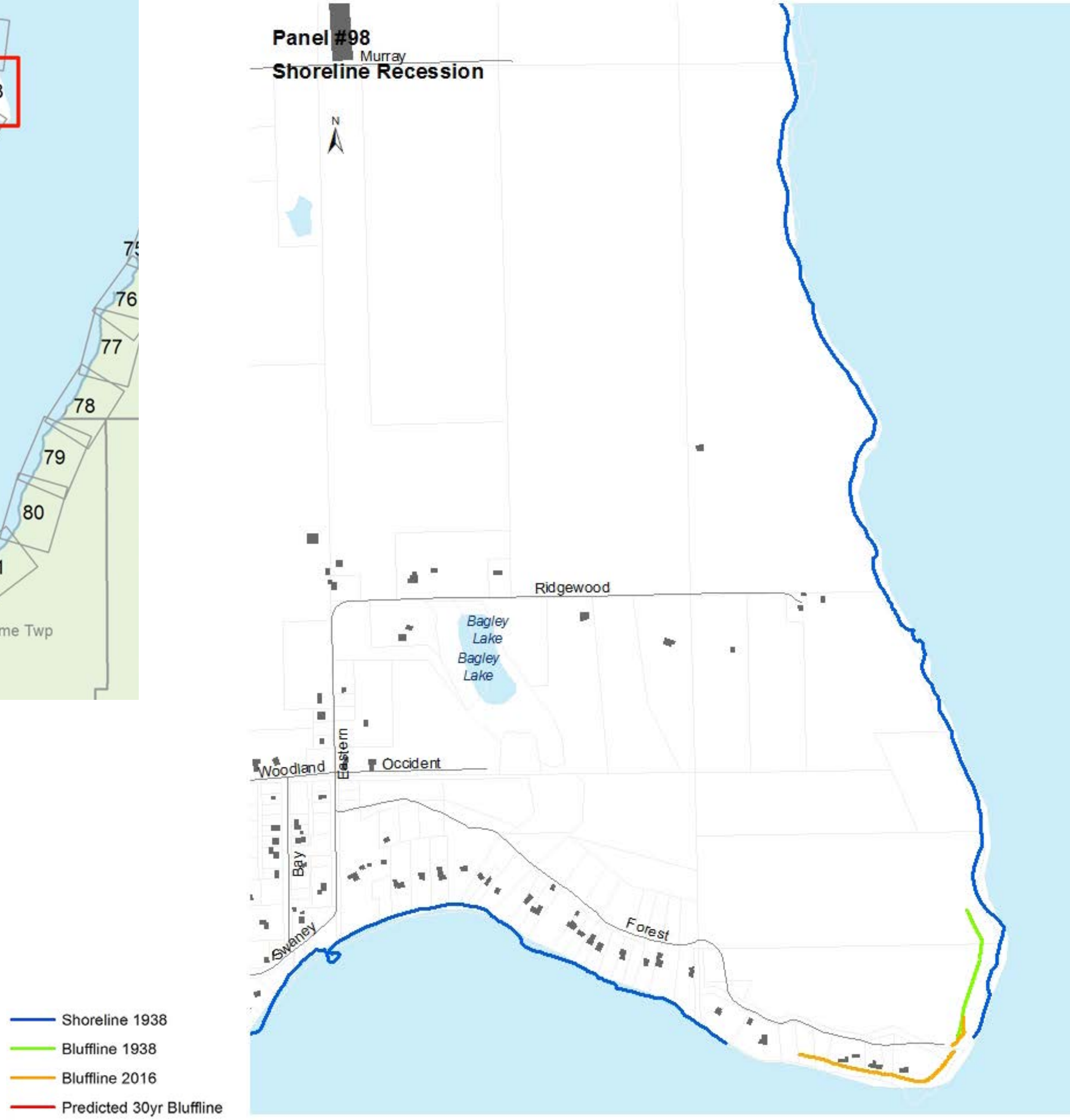
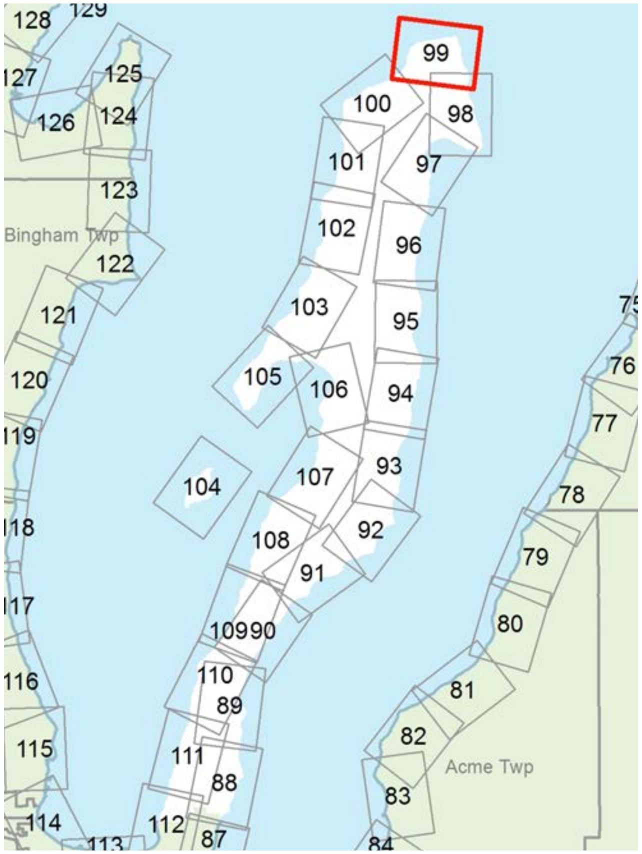
Acme Twp
83
84

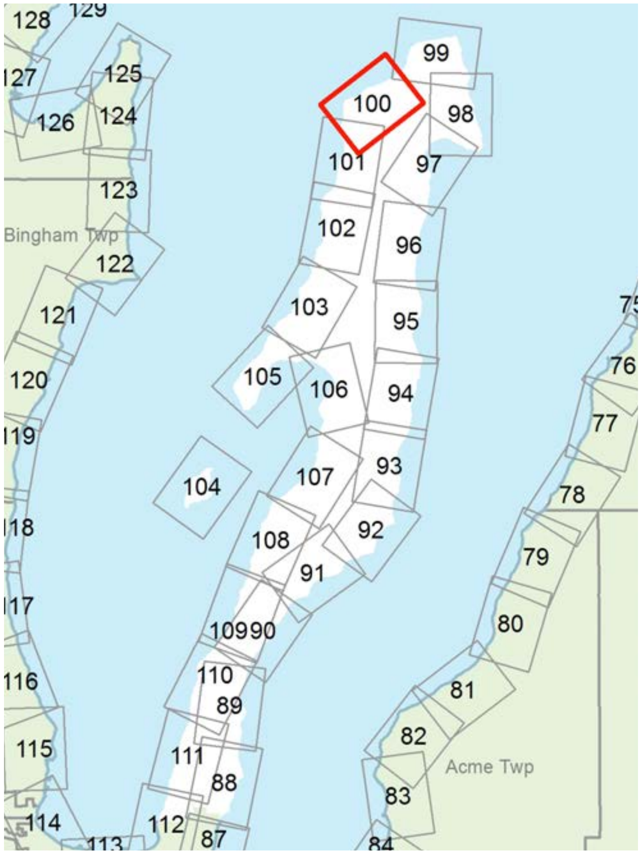
Grand Traverse County



Panel #98
Shoreline Recession
N
Murray
Ridgewood
Bagley Lake
Bagley Lake
Woodland
Eastern
Occident
Bay
Forest
Swaney
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Bingham Twp
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119
104
107
93
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118
108
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10990
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Acme Twp
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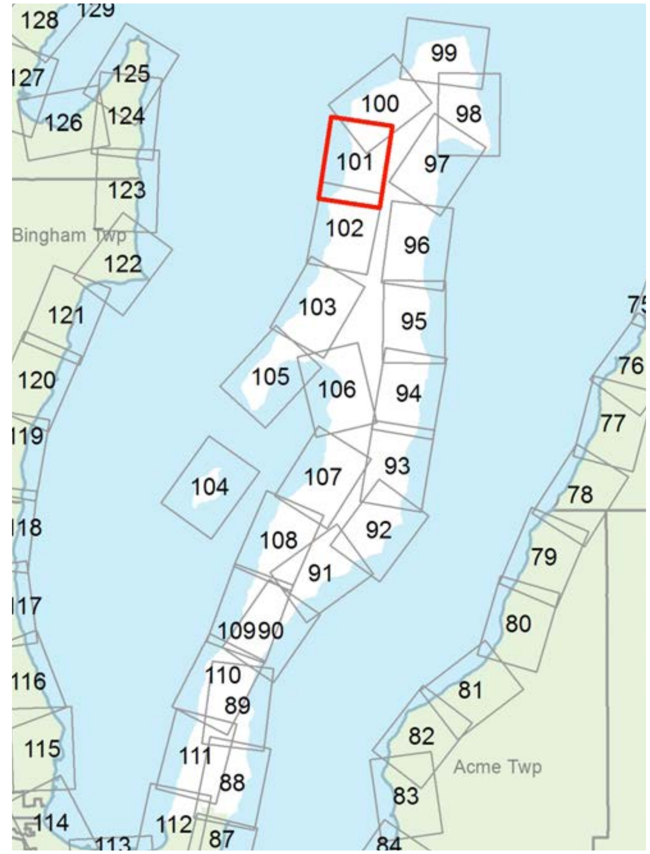
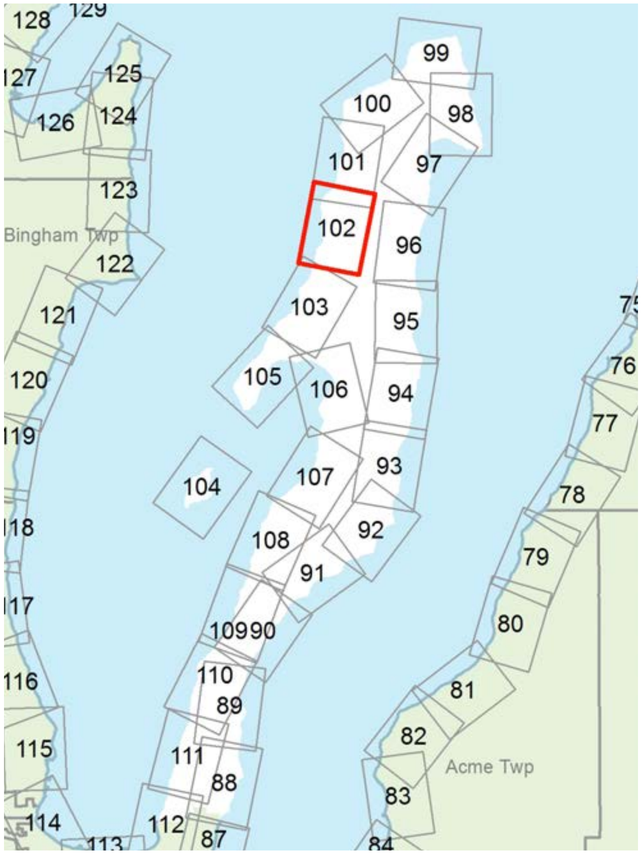
113
84


Grand Traverse County


Panel #100
Shoreline Recession
Eagle Rise
Tompkins
Center
Shore Wood
Swaney
Whispering
Peninsula
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Bingham Twp
Acme Twp
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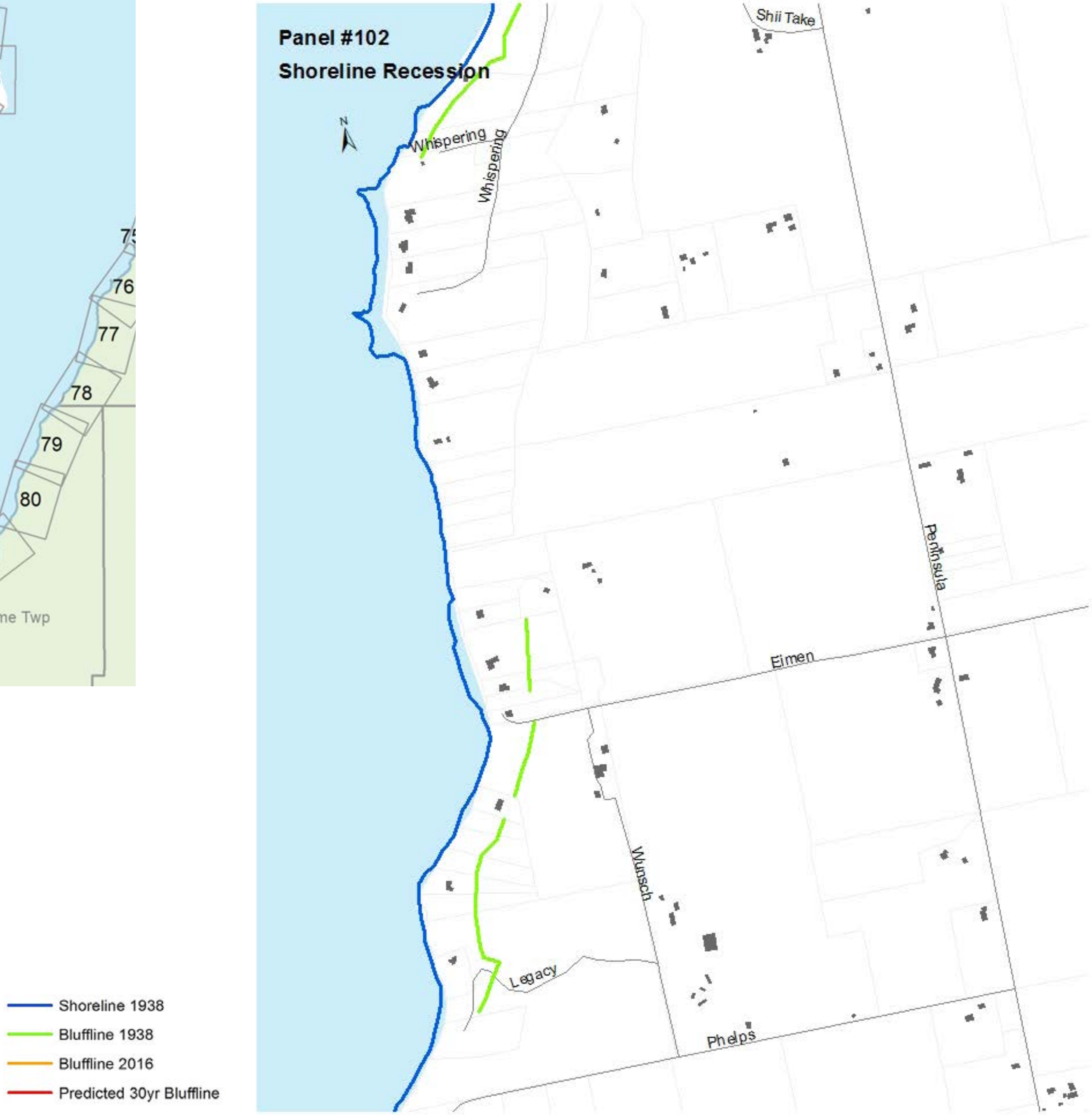
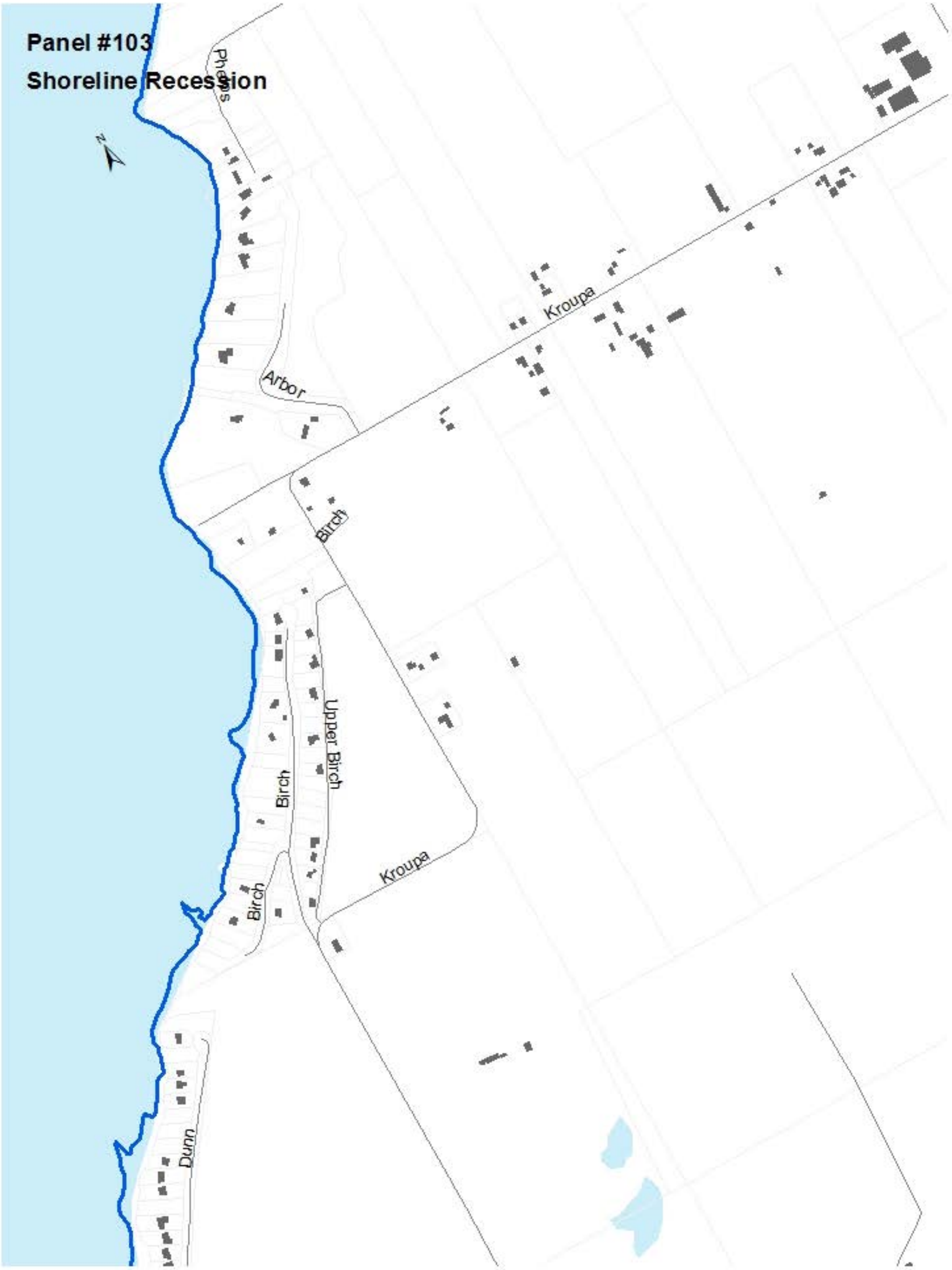
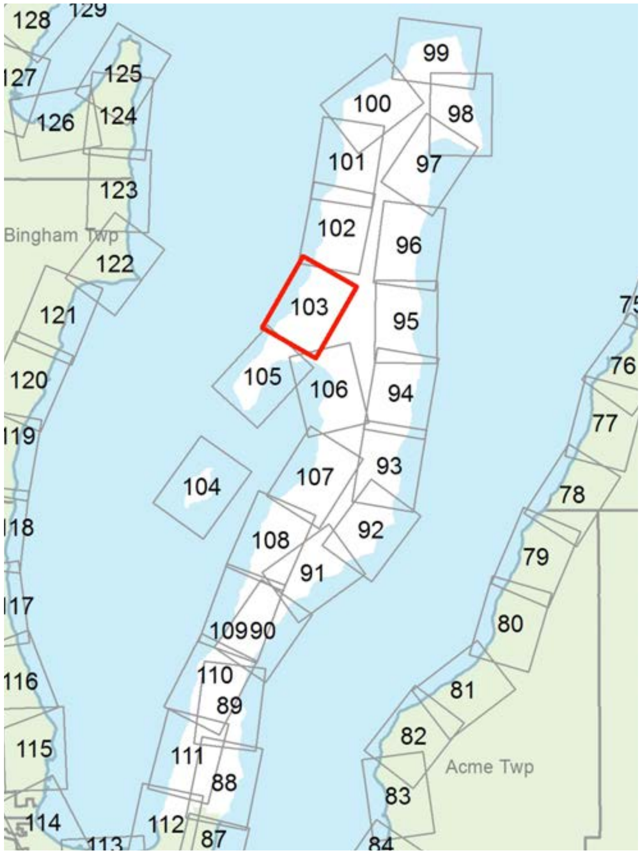
Grand Traverse County

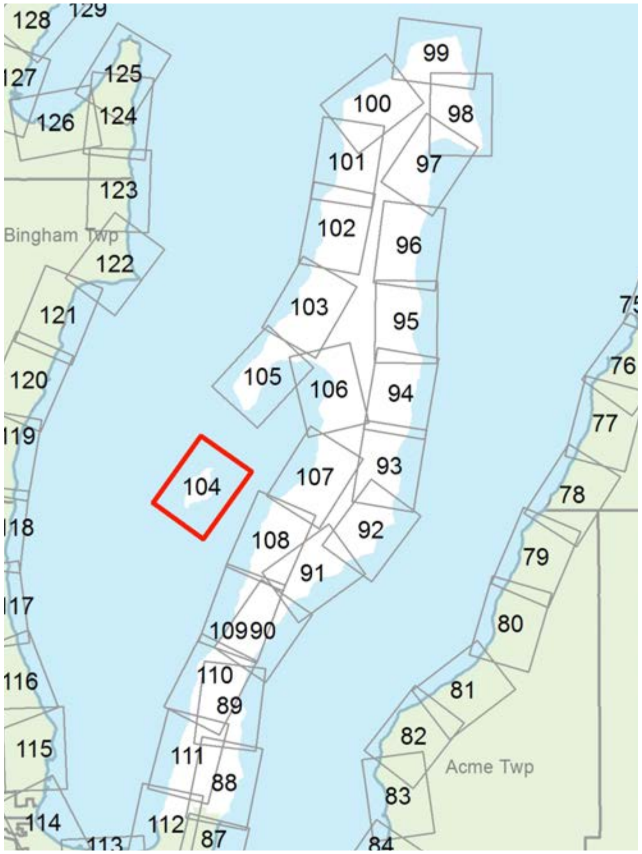


Panel #102
Shoreline Recession
N
Whispering
Whispering
Shii Take
Peninsula
Eimen
Wunsch
Legacy
Phelps
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

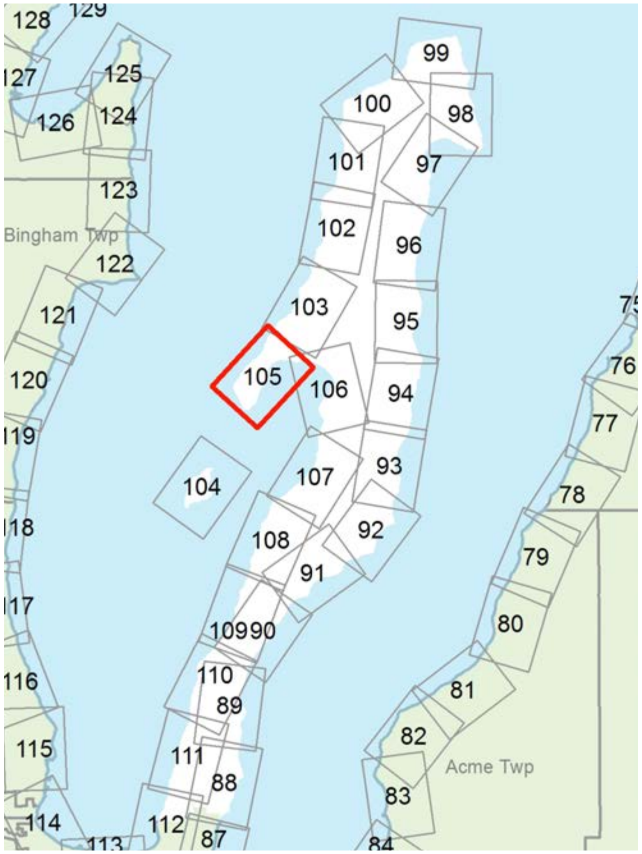




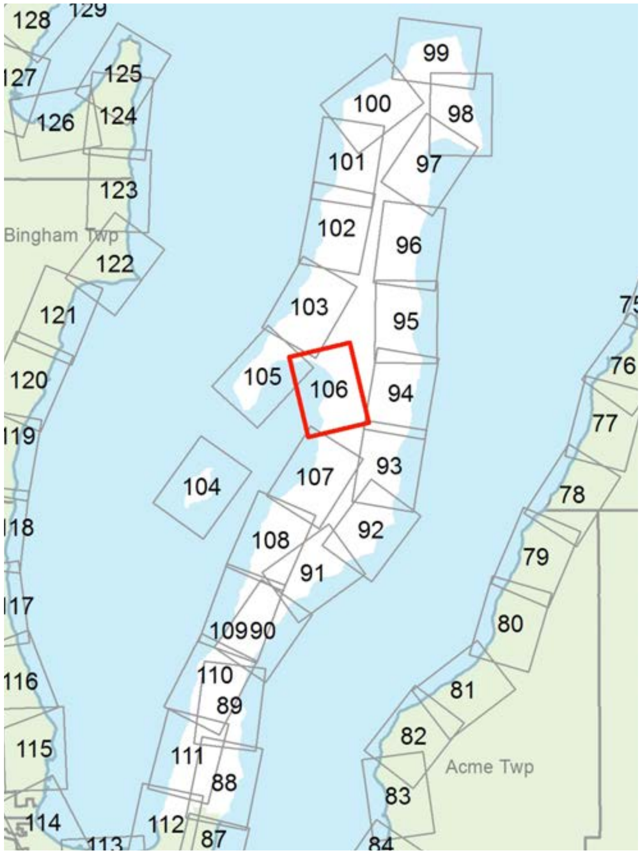
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



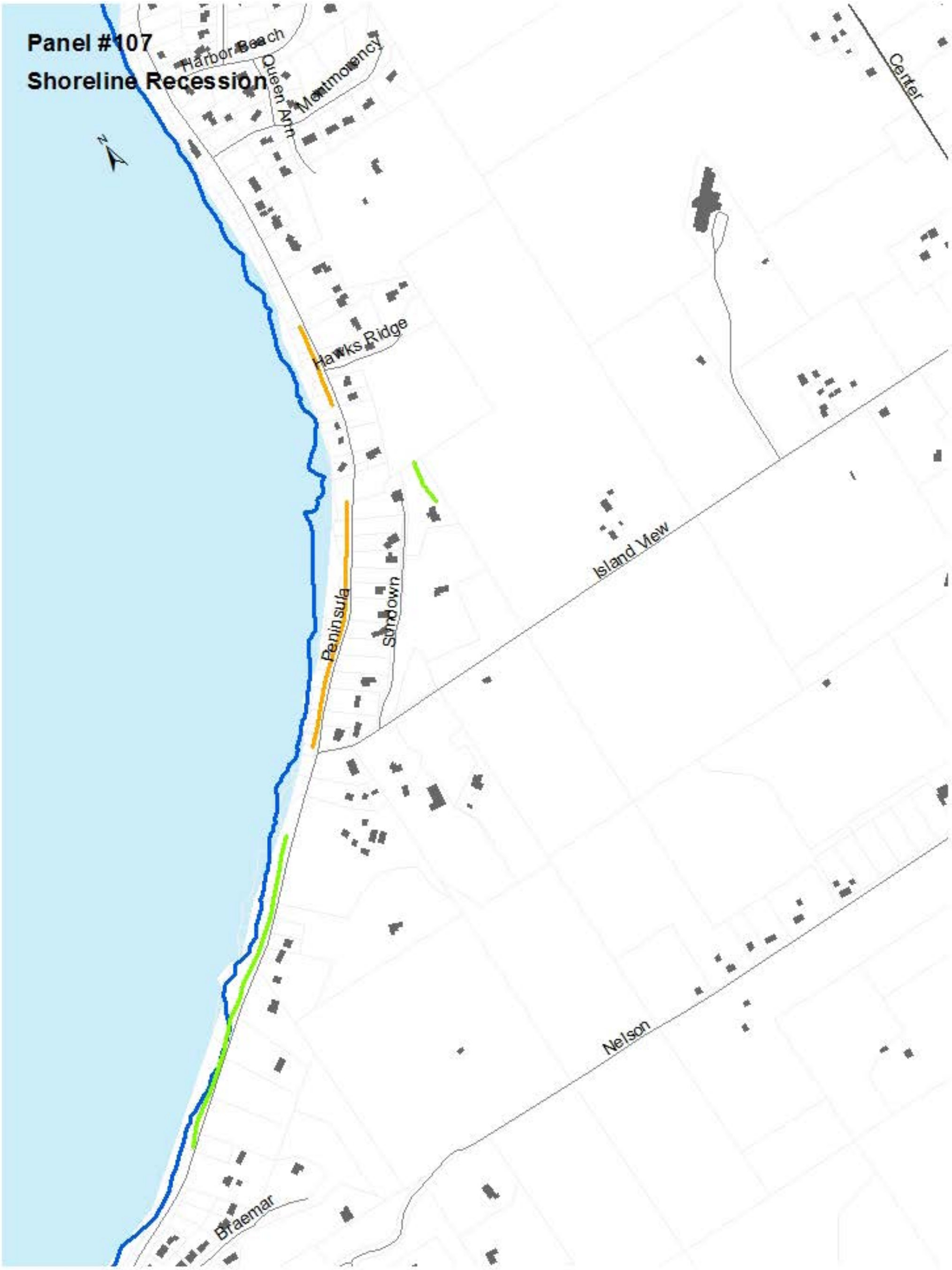
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

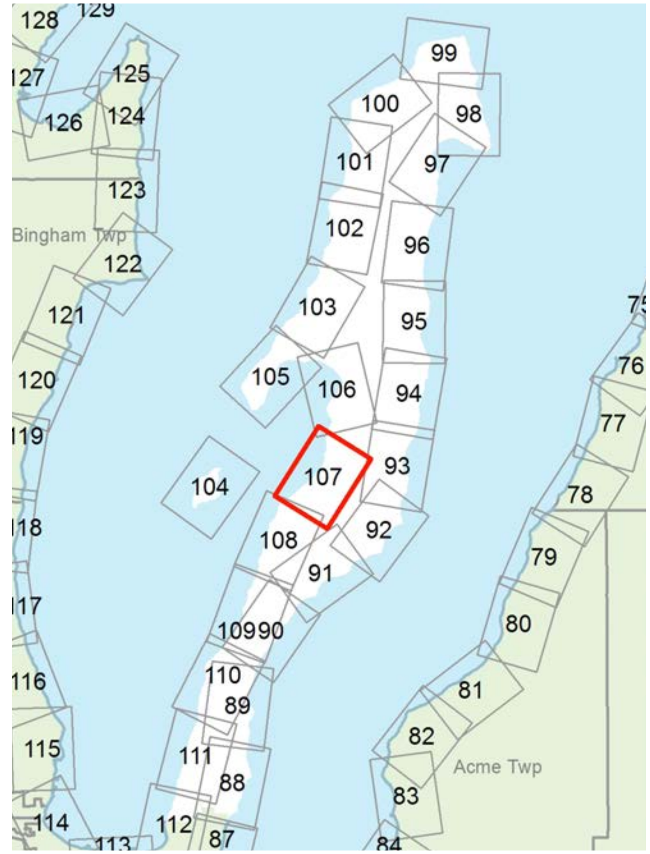

Bingham Twp
Acme Twp
128 129 127 125 126 124 123 122 121 120 119 118 117 116 115 114 113 112 111 110 109 108 107 106 105 104 103 102 101 100 99 98 97 96 95 94 93 92 91 90 89 88 87 84 83 82 81 80 79 78 77 76


Grand Traverse County

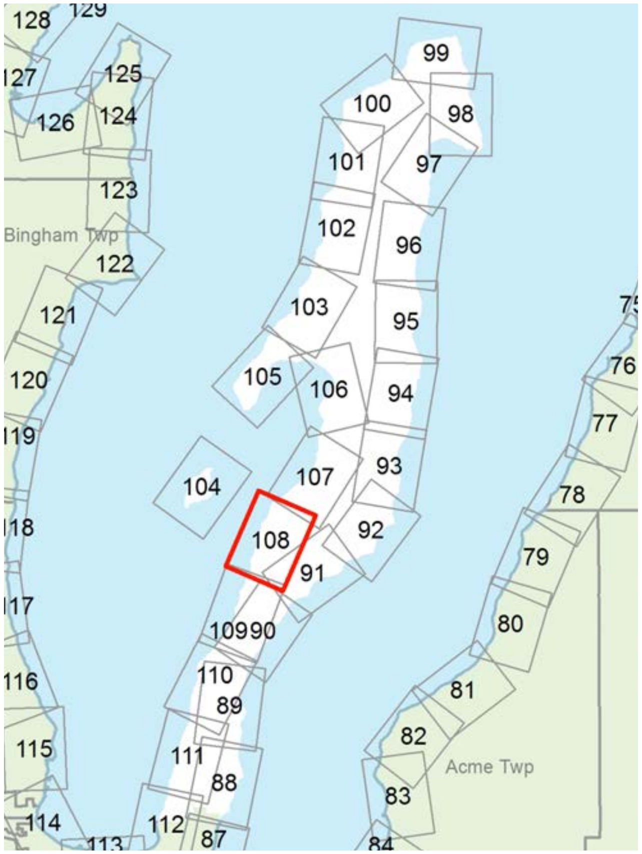

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #106
Shoreline Recession
Ne ah Ta Wanta
Peterson
Pyatt
Woburn
Bowers Harbor
Bowers Harbor
Peninsula
Seven Hills
Devils Dive
Hedeen
Centennial
Center
Heller Valley

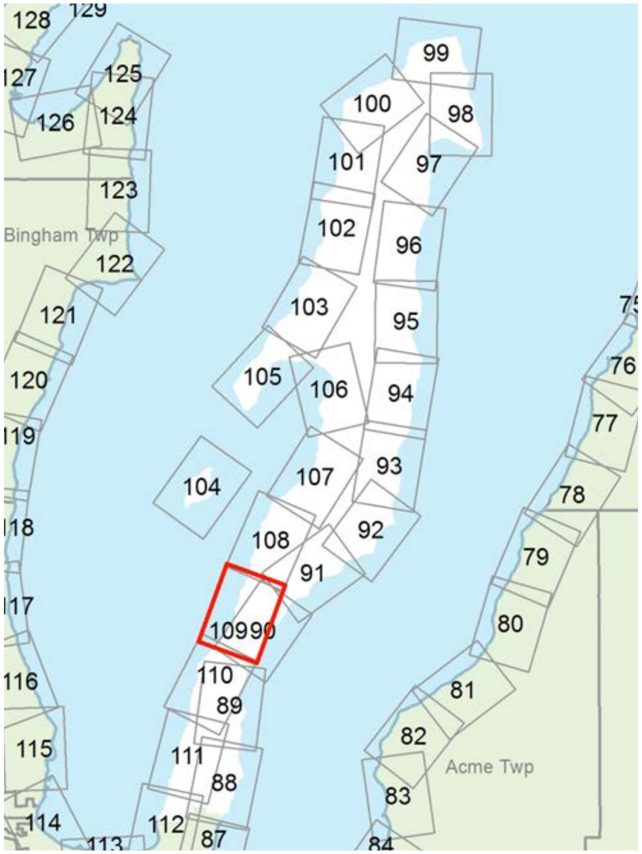




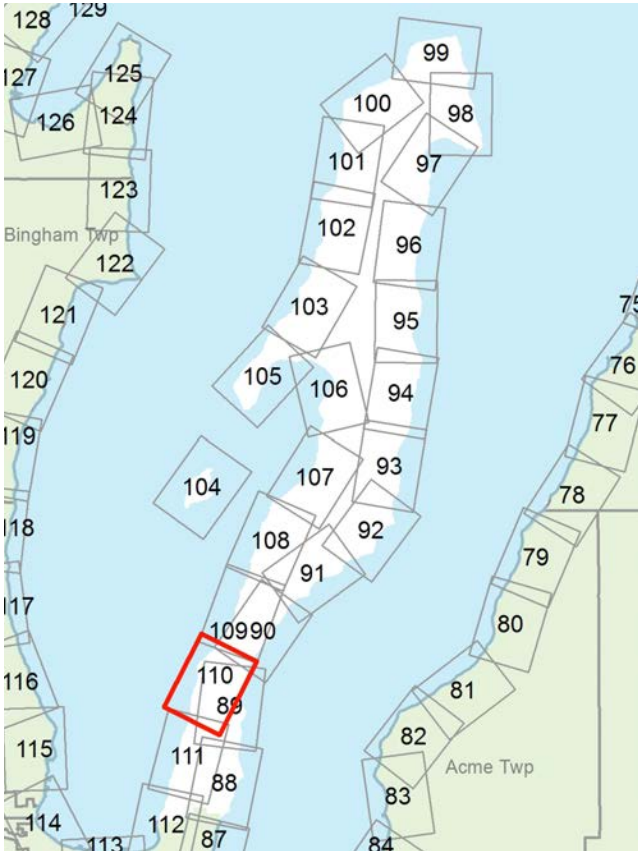
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

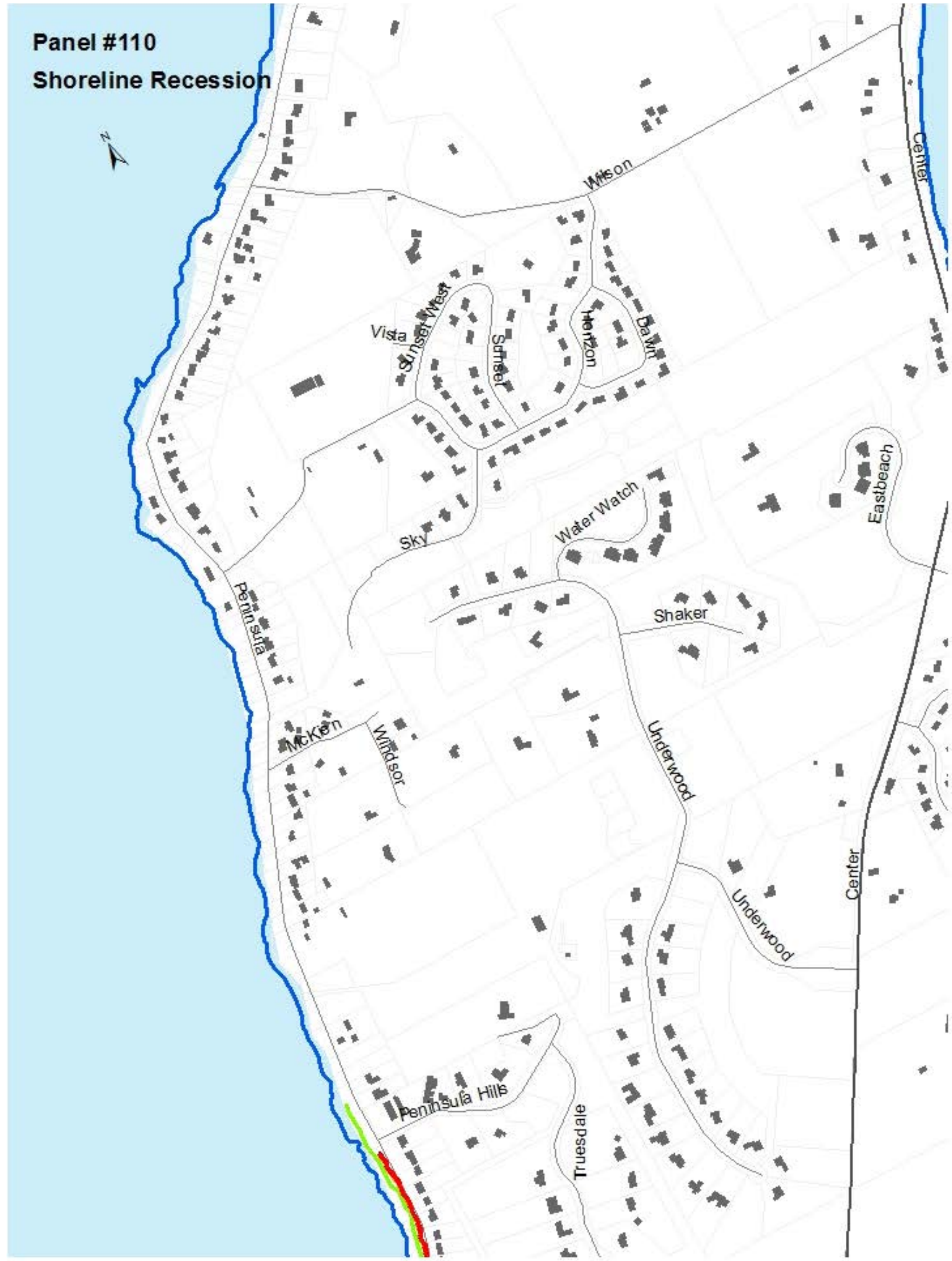


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

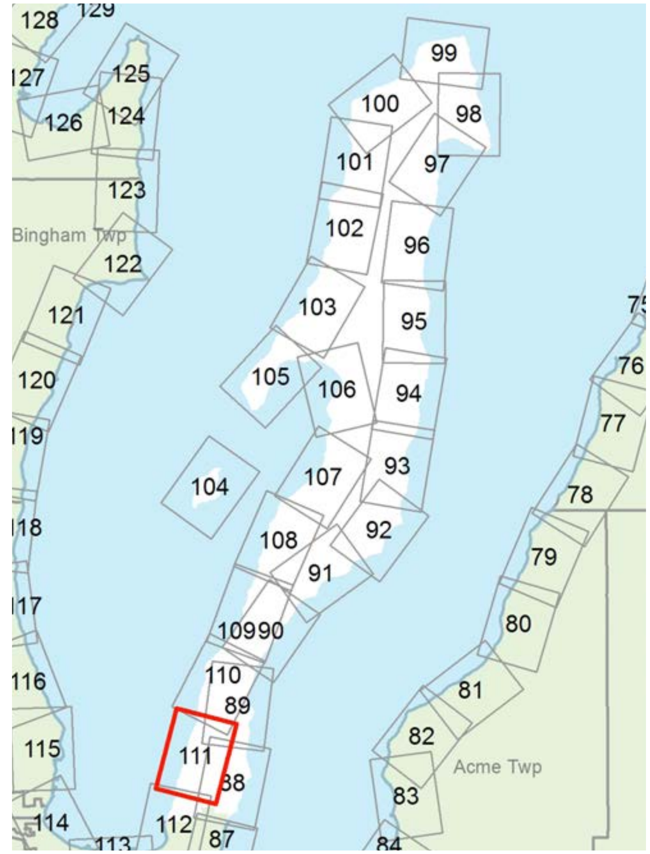

Bingham Twp
Acme Twp
110


Grand Traverse County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #110
Shoreline Recession
Wilson
Vista
Sunset West
Sunset
Horizon
Dawn
Sky
Water Watch
Eastbeach
Shaker
Peninsula
McKean
Windsor
Underwood
Center
Peninsula Hills
Truesdale


Panel #111
Shoreline Recession
N
Truesdale
McKinley
Lauren
Westwind
Maple Terrace
Maple
Ironwood
Peninsula
Wahl
Kidder
Logan
Hilltop
Cherrywood
Center
Carpenter Hill
Leorie Taylor
Mathison
Hidden Forest Trl
Timber Crest
Homestead
Wakulat
Grand Cru
Knollwood
Pine Knolls
Graystone
Cedarmere
Autumn
Port Mission


128
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Bingham Twp
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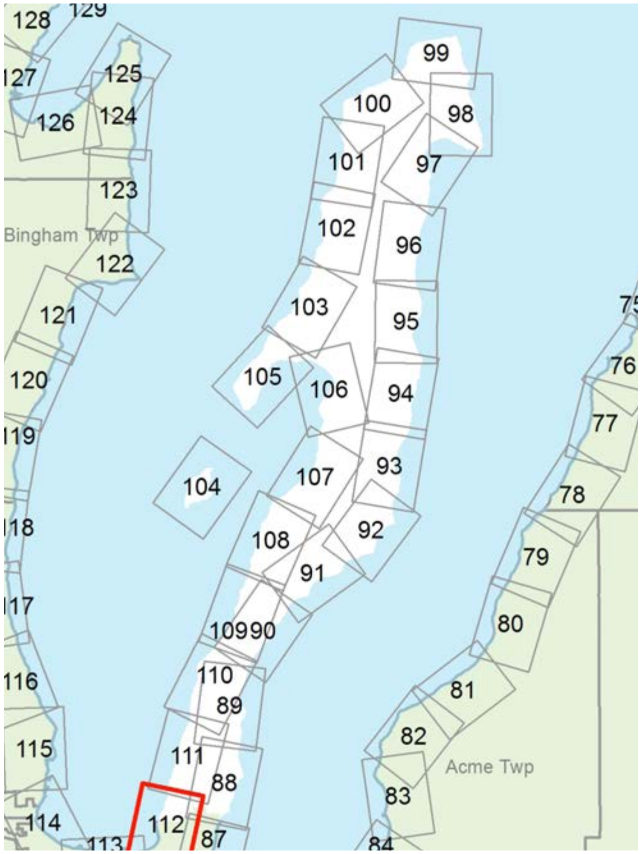
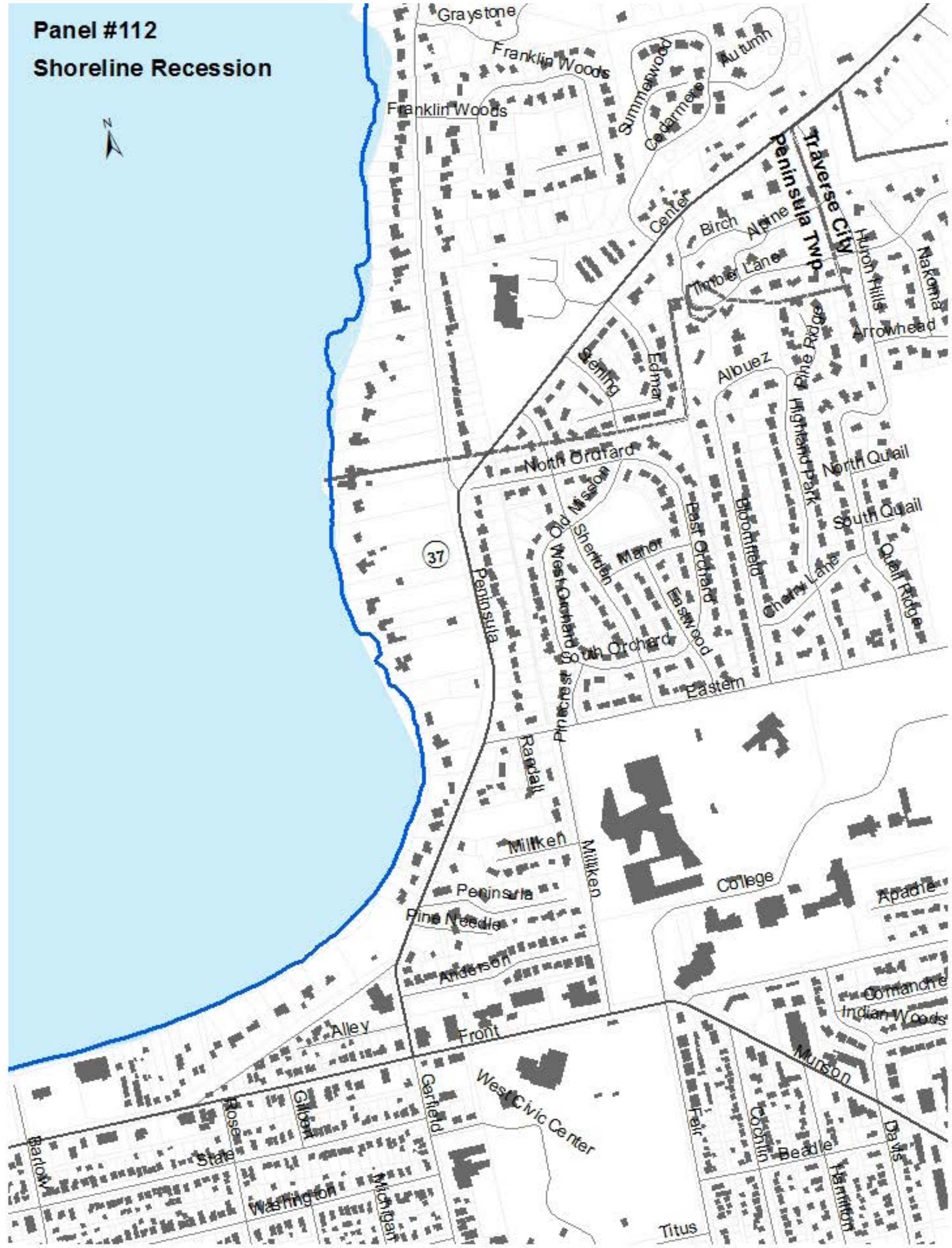
Acme Twp


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Grand Traverse County





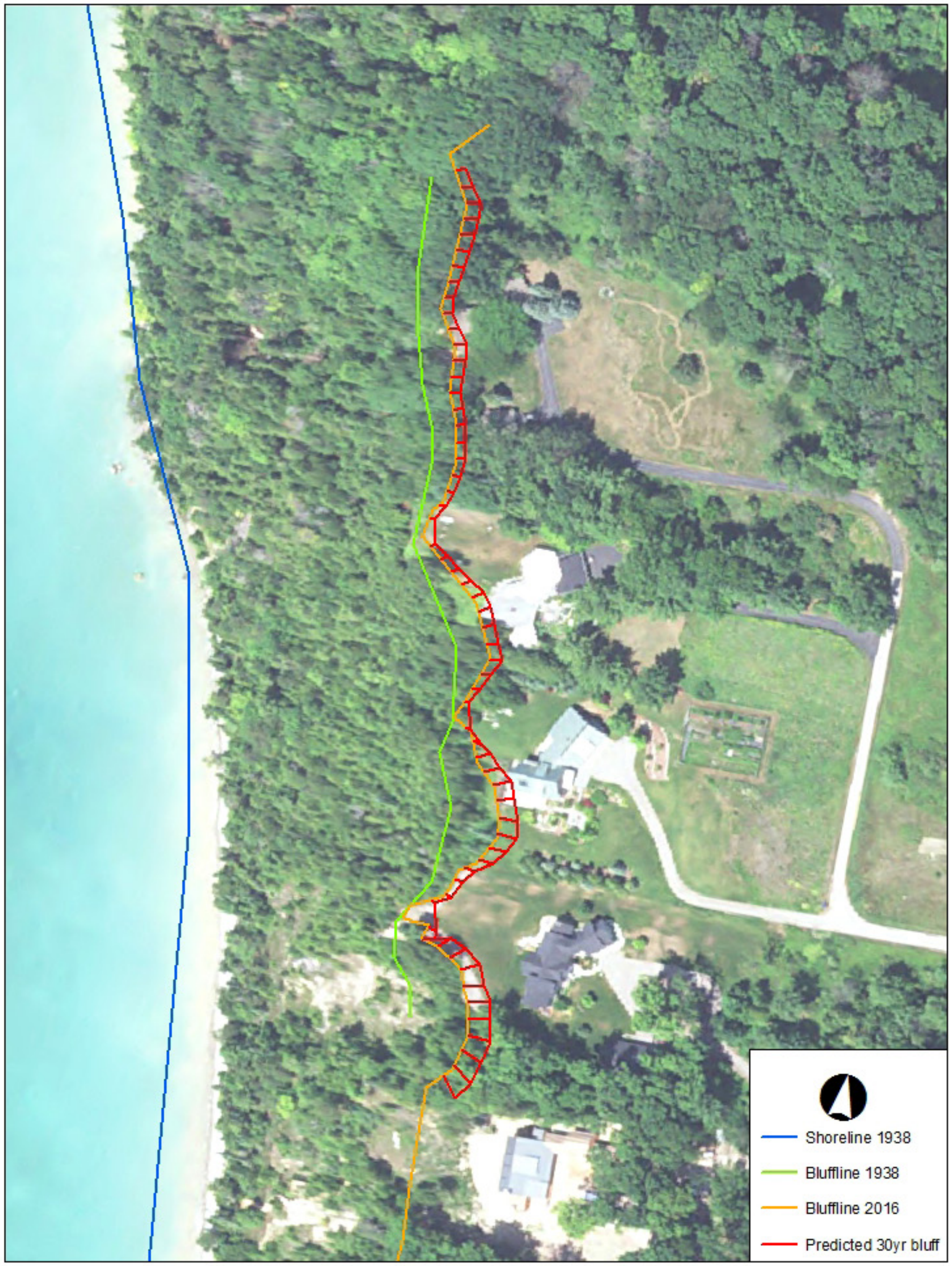
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Leelanau County

BLUFF RECESSION DETAIL

At least one "zoomed in" detail example of historic bluffline recession and future projections is provided at the beginning of each county section of this chapter. Shoreline and bluffline recession data can be viewed in greater detail online at http://geospatialresearch.mtu.edu/czmp.

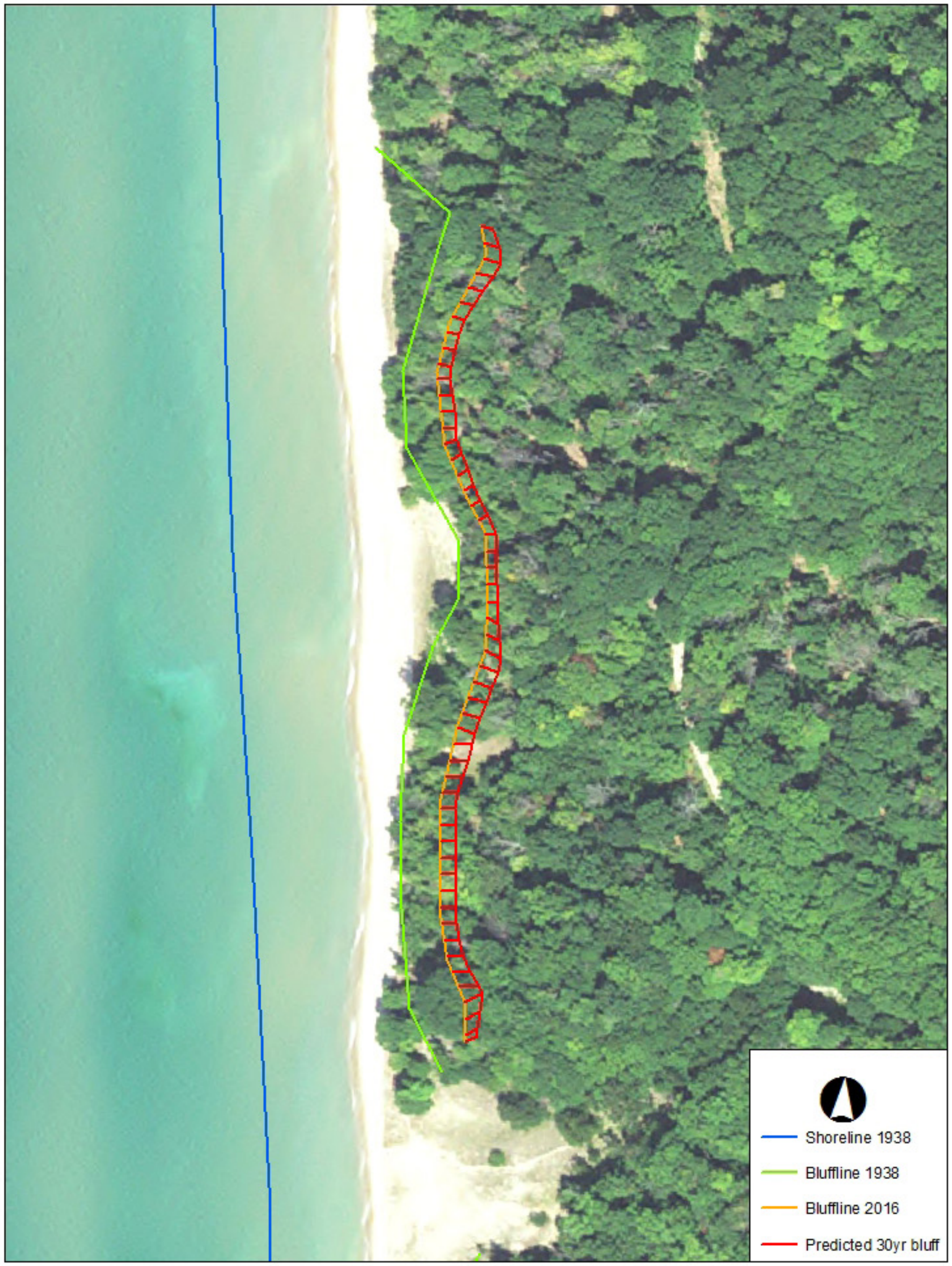
Bluff Detail, Panel 156, Leland Twp.



Bluff Detail, Panel 157, Leland Twp.

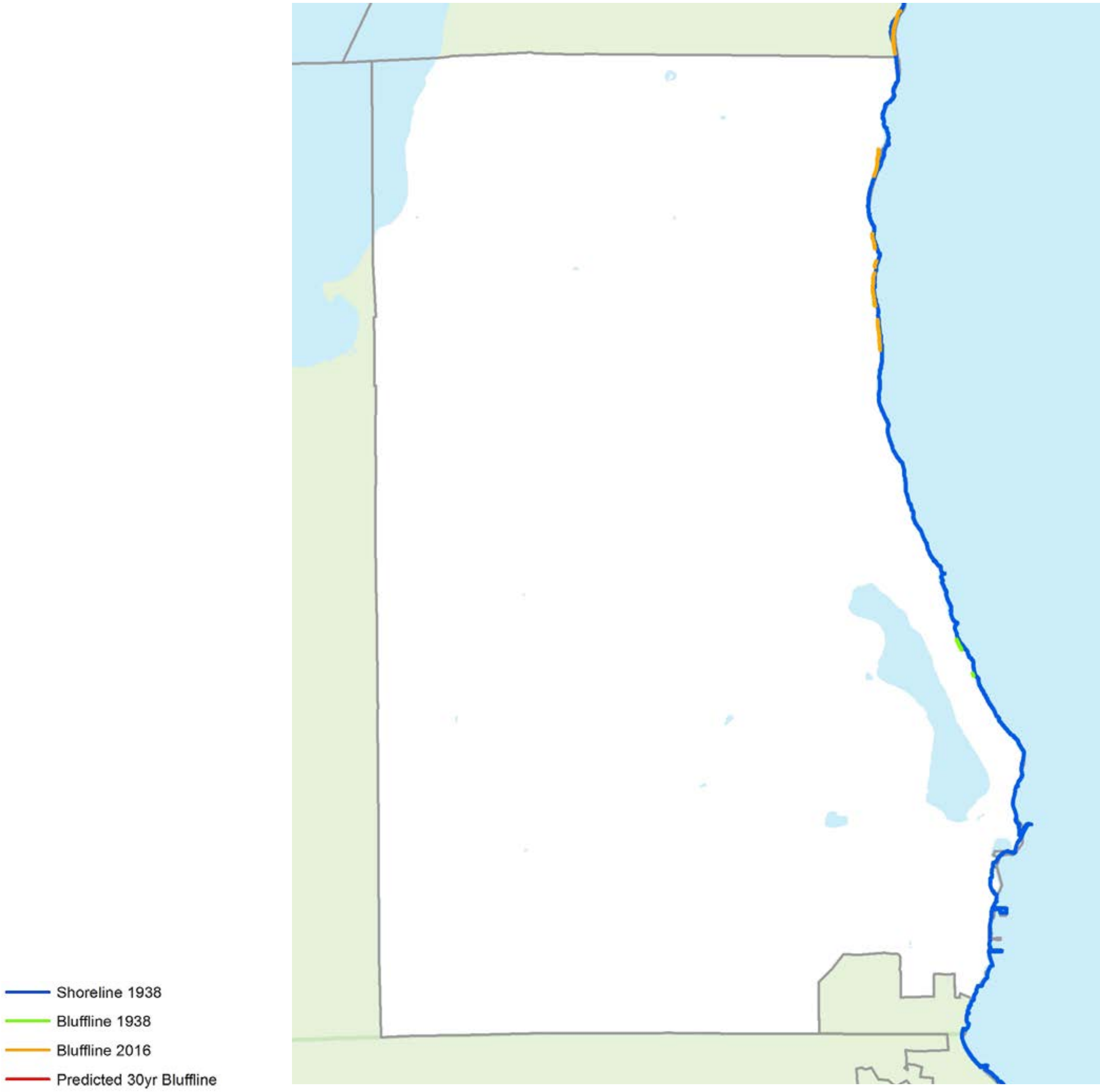
Bluff Detail, Panel 174, Empire Twp.

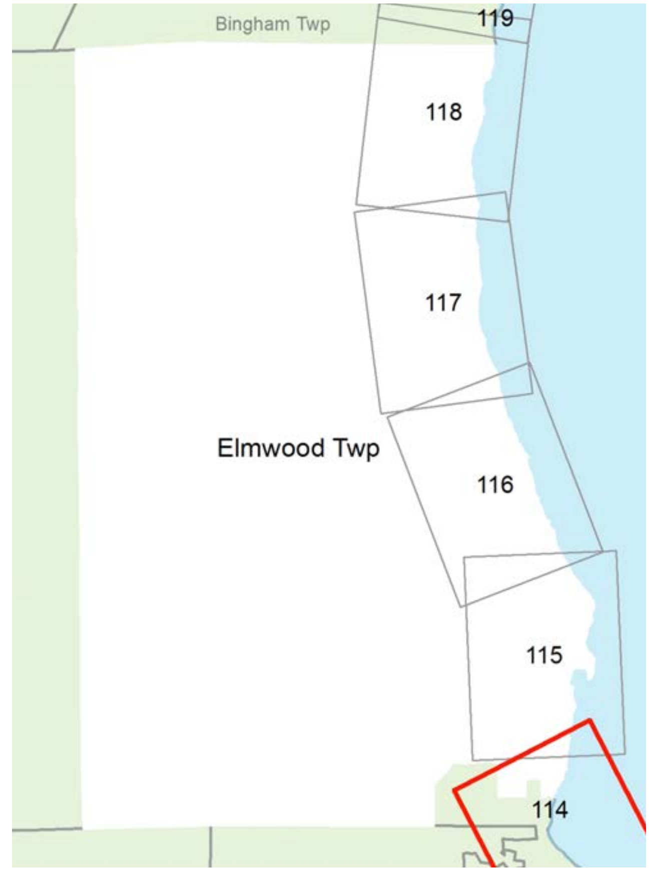
Bluff Detail, Panel 174, Empire Twp.



Elmwood Twp.

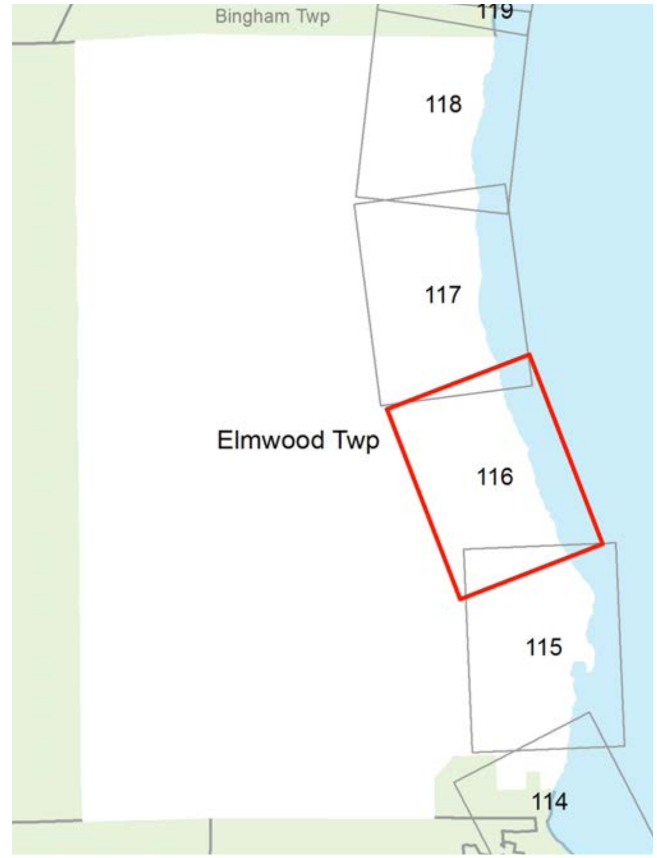

Leelanau County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

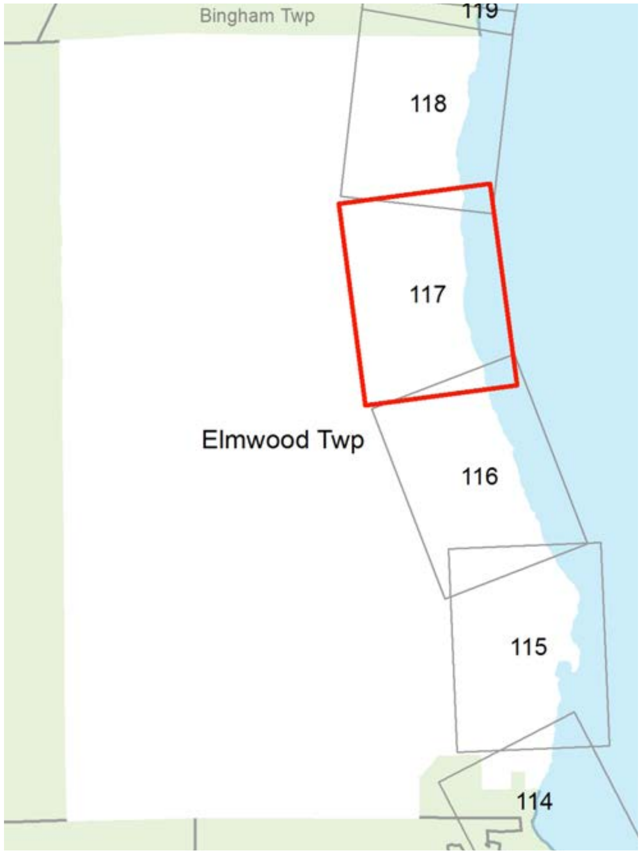


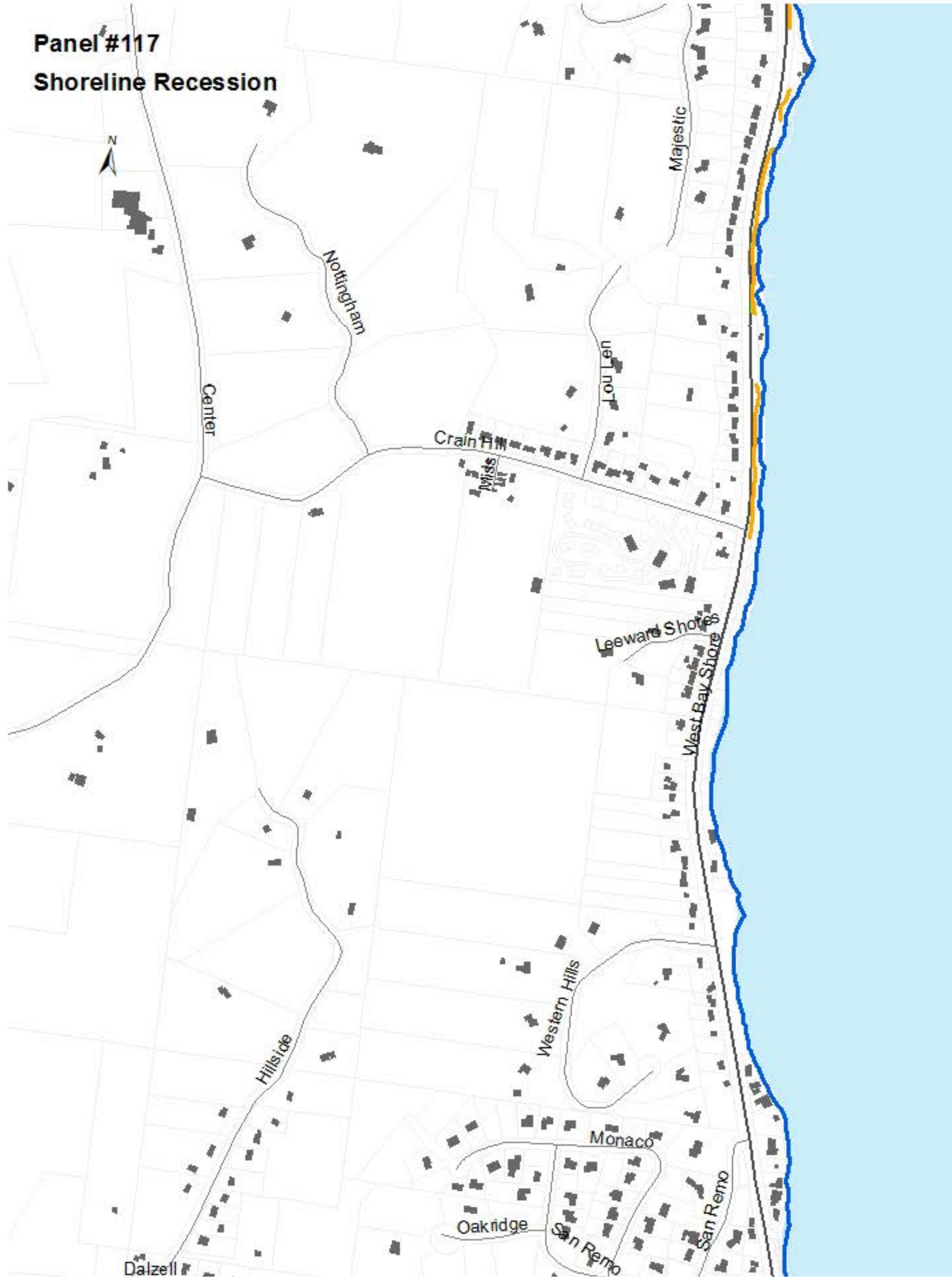
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





Shoreline 1938

Bluffline 1938

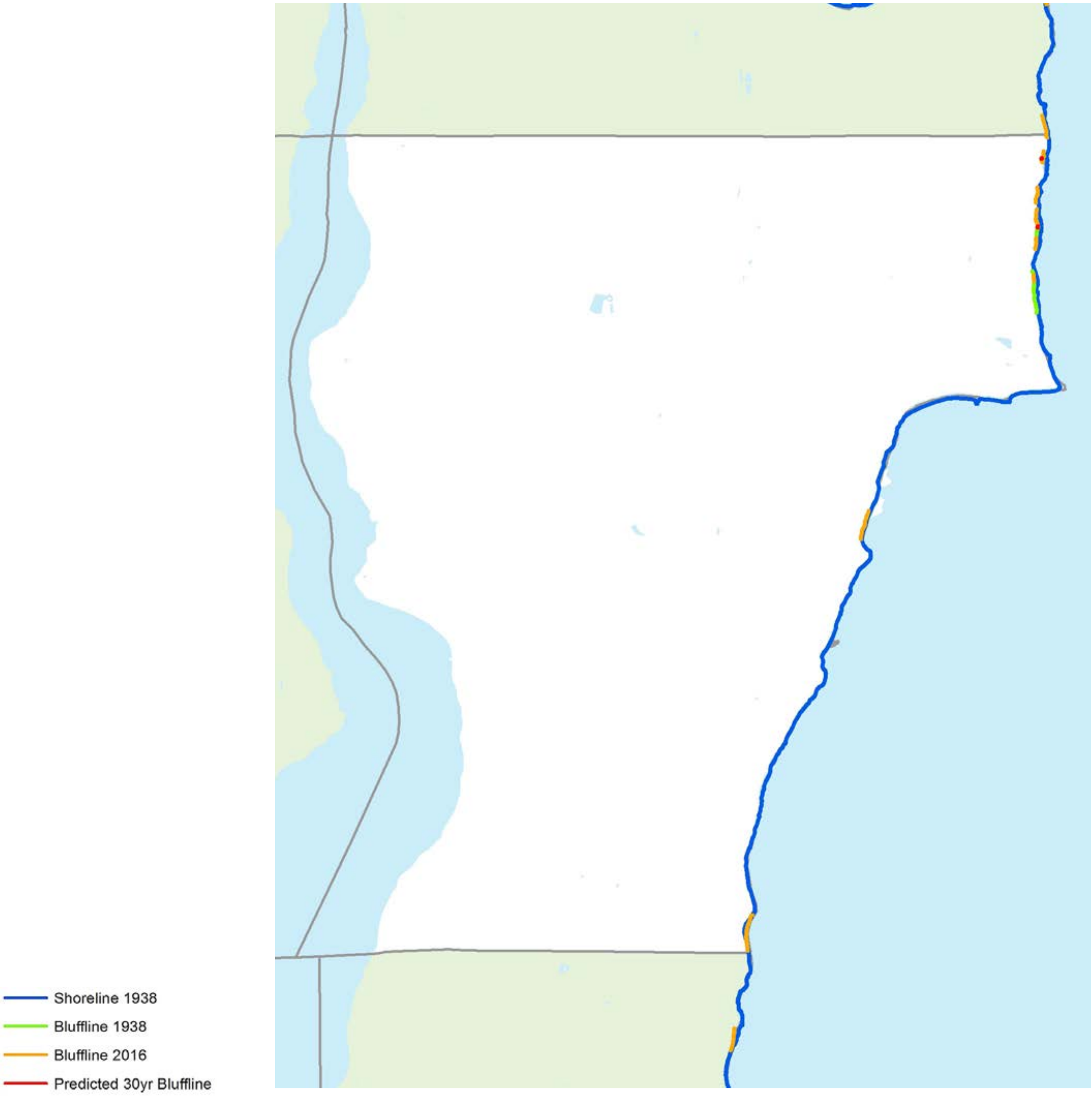
Bluffline 2016

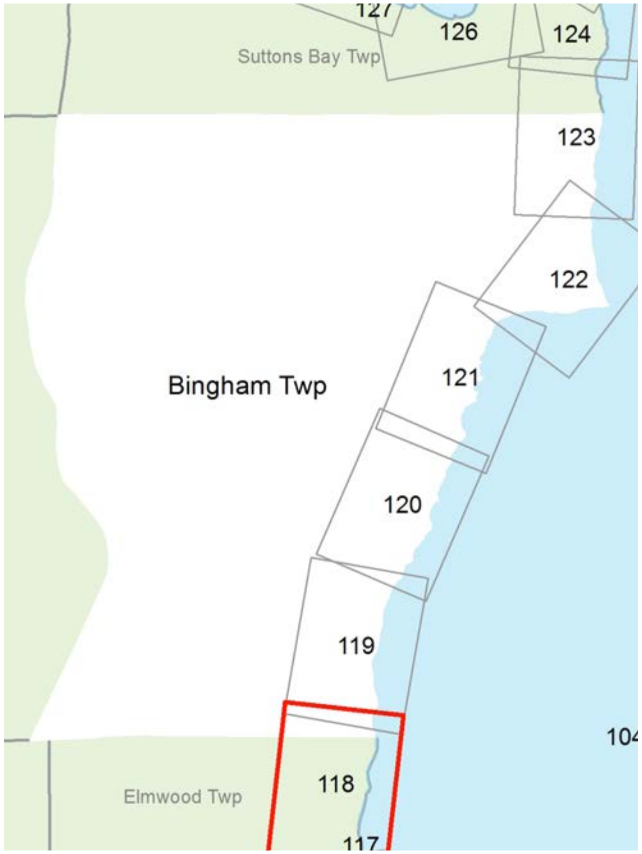
Predicted 30yr Bluffline

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

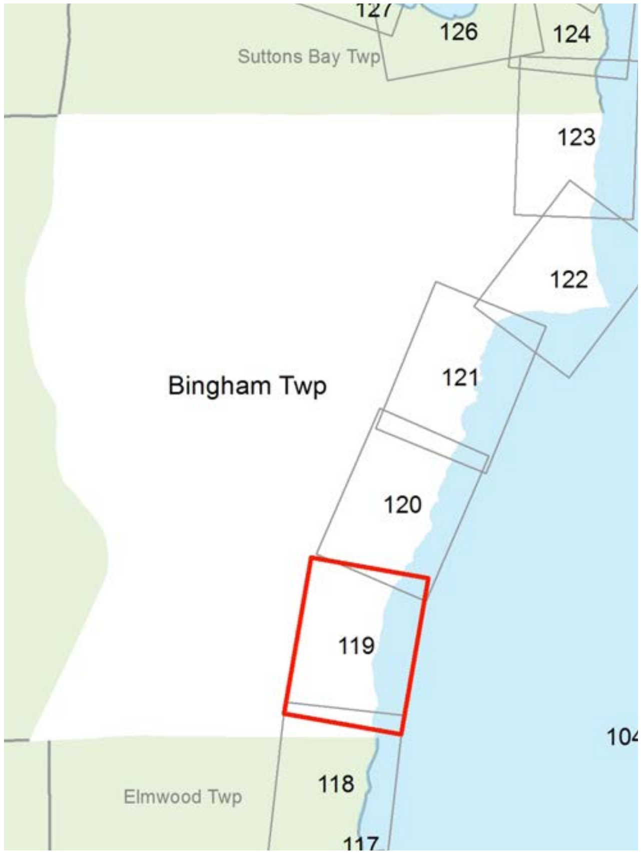
Bingham Twp.


Leelanau County

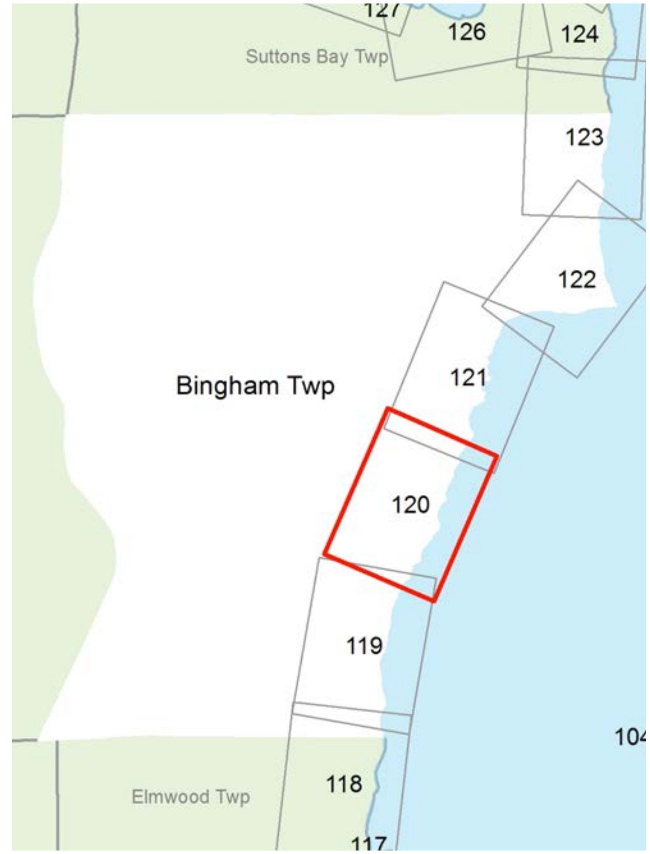

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



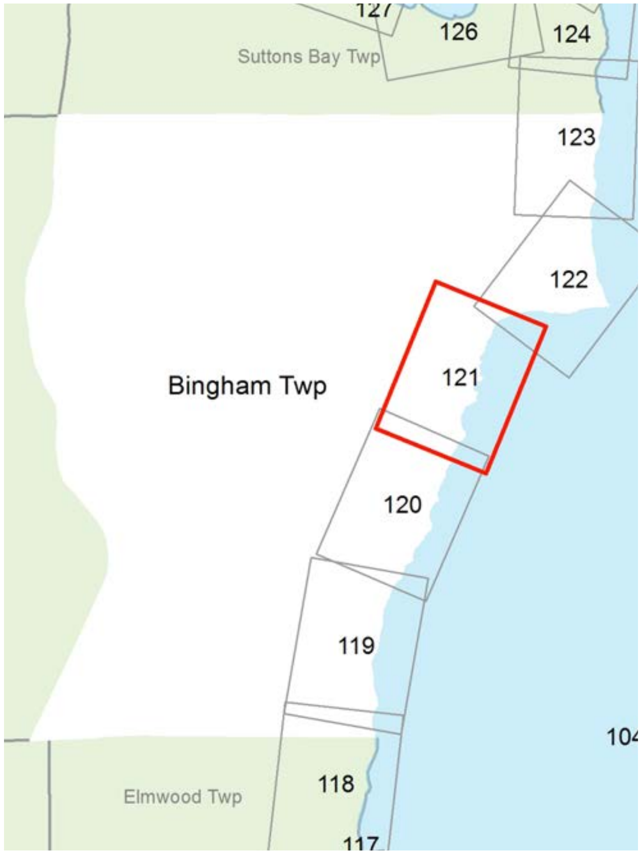
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


127
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124
Suttons Bay Twp
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Bingham Twp
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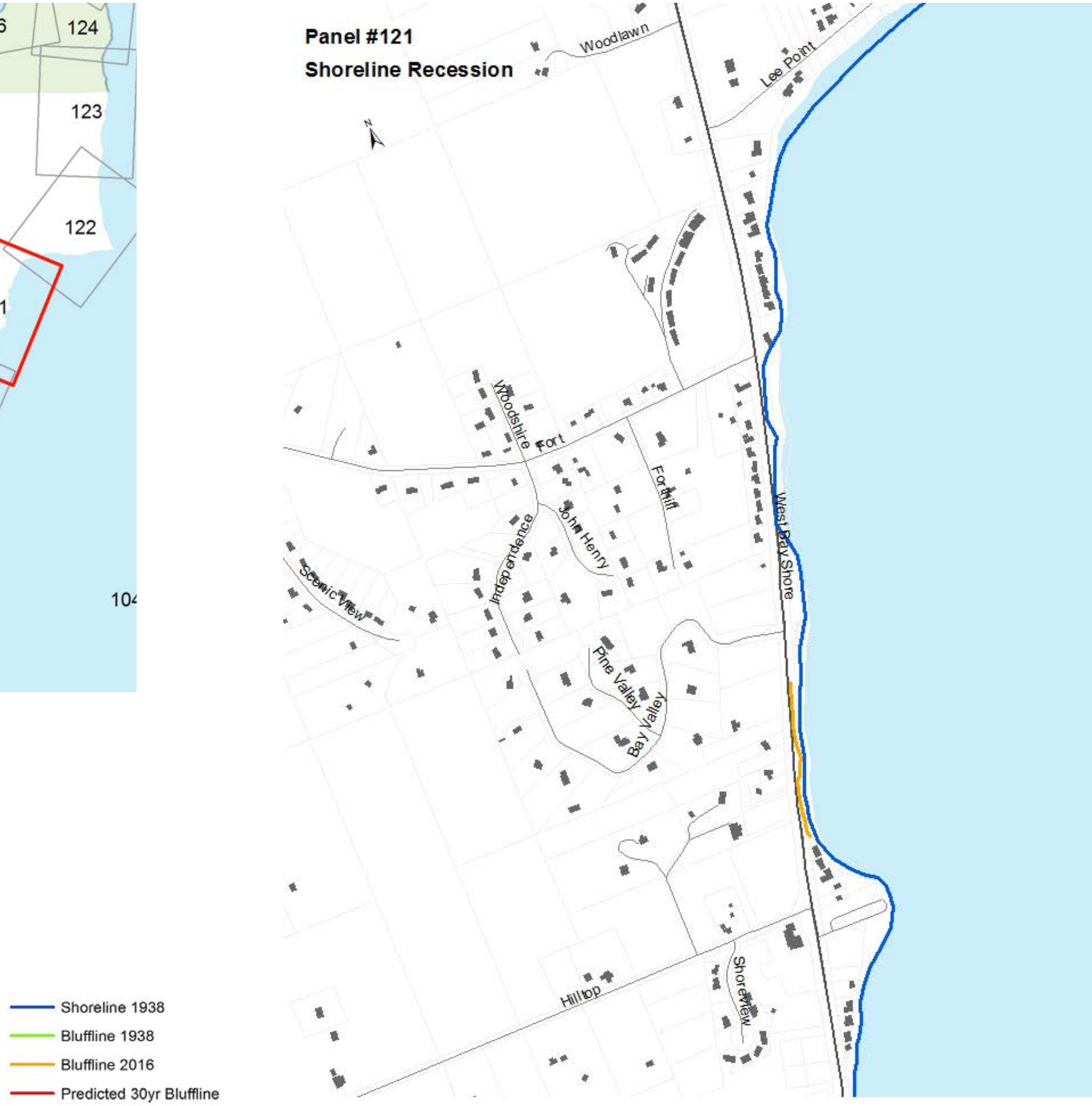
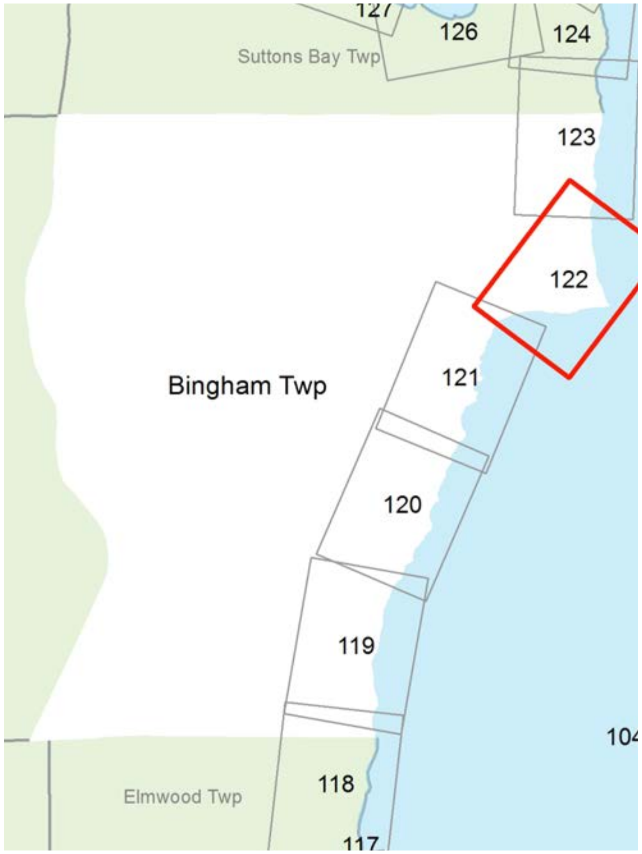
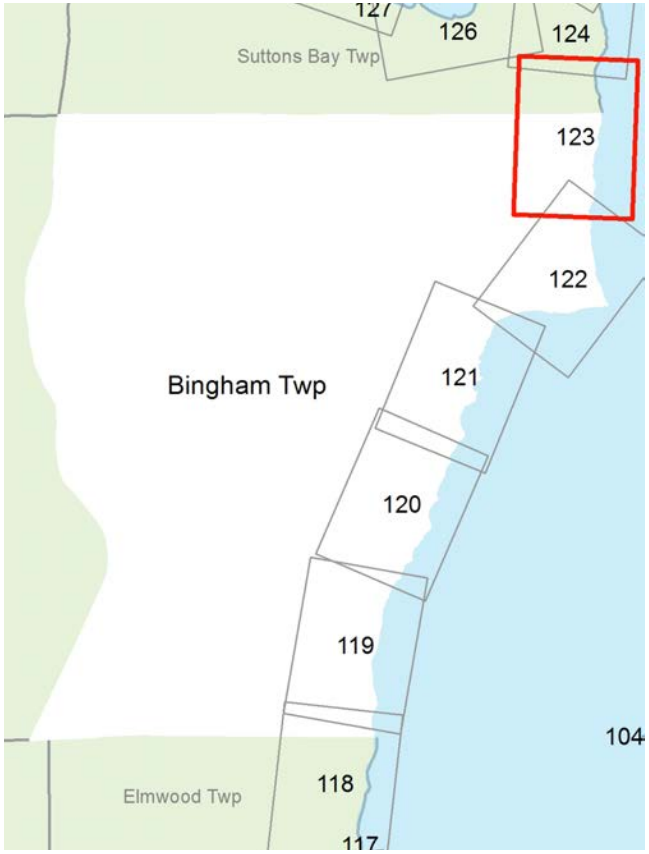
104
118
Elmwood Twp
117

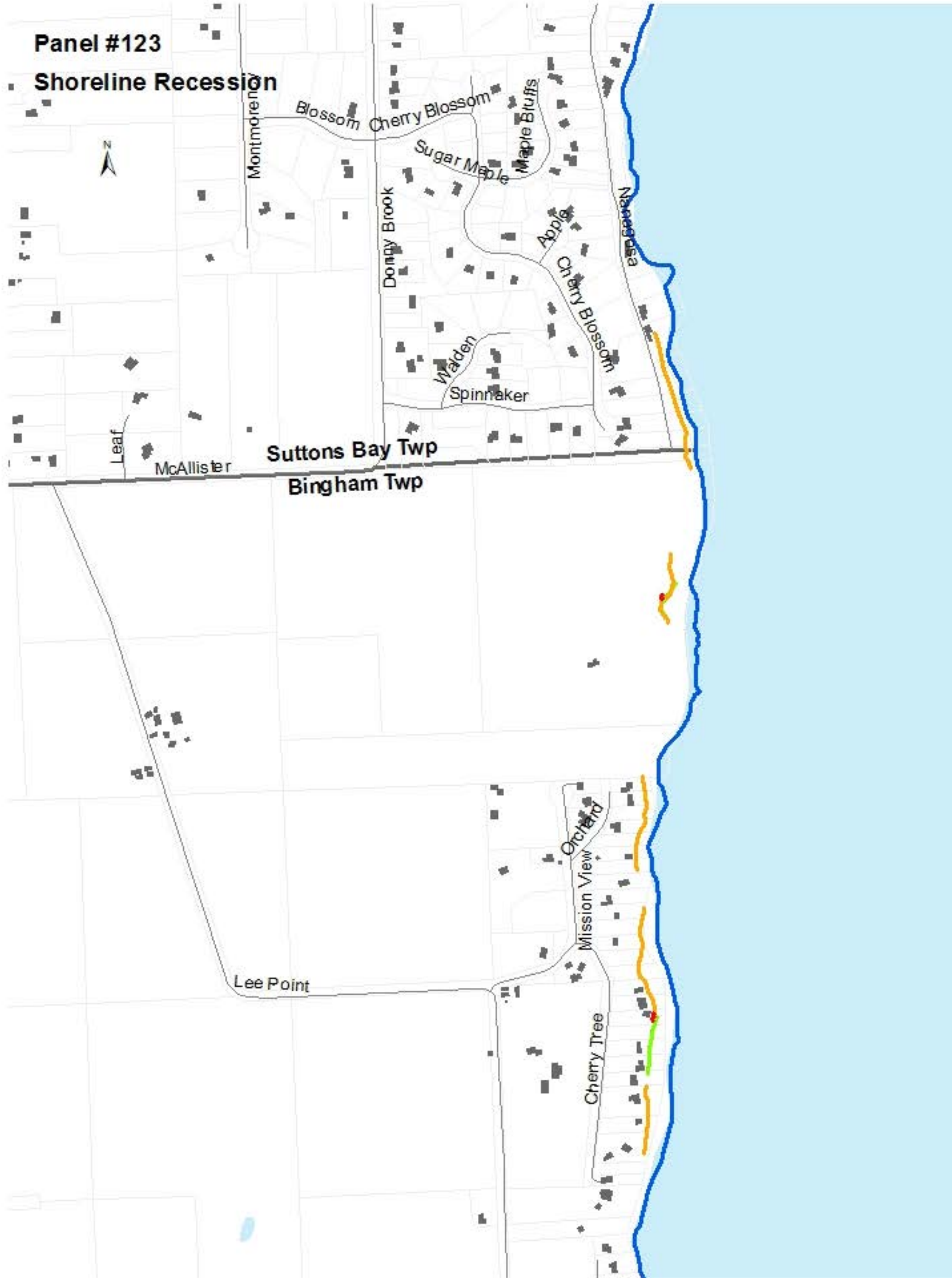

Leelanau County


Panel #121
Shoreline Recession
Woodlawn
Lee Point
Woodshire
Fort
Fort Hill
John Henry
Independence
Scenic View
West Bay Shore
Pine Valley
Bay Valley
Hilltop
Shoreview
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



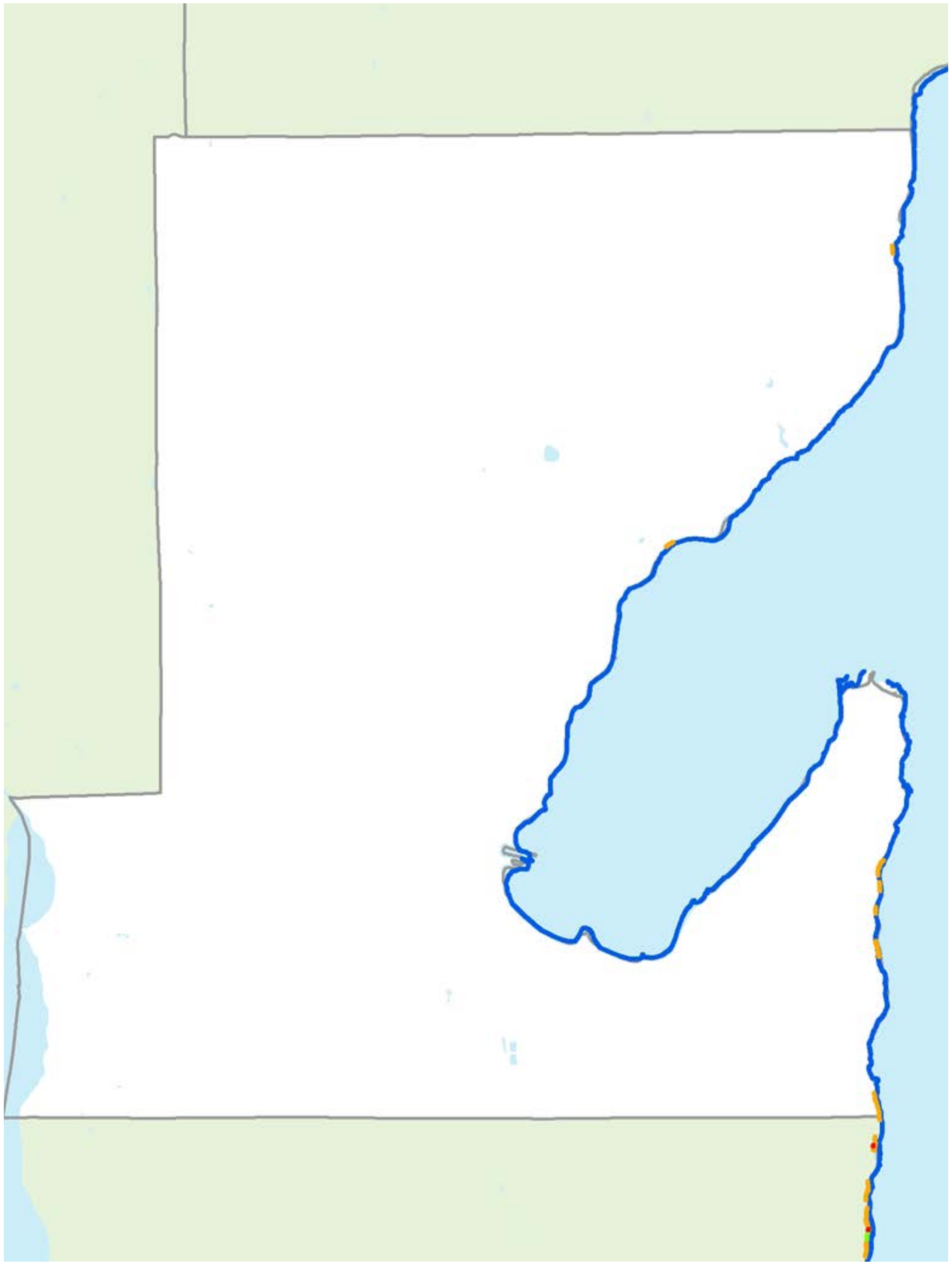
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



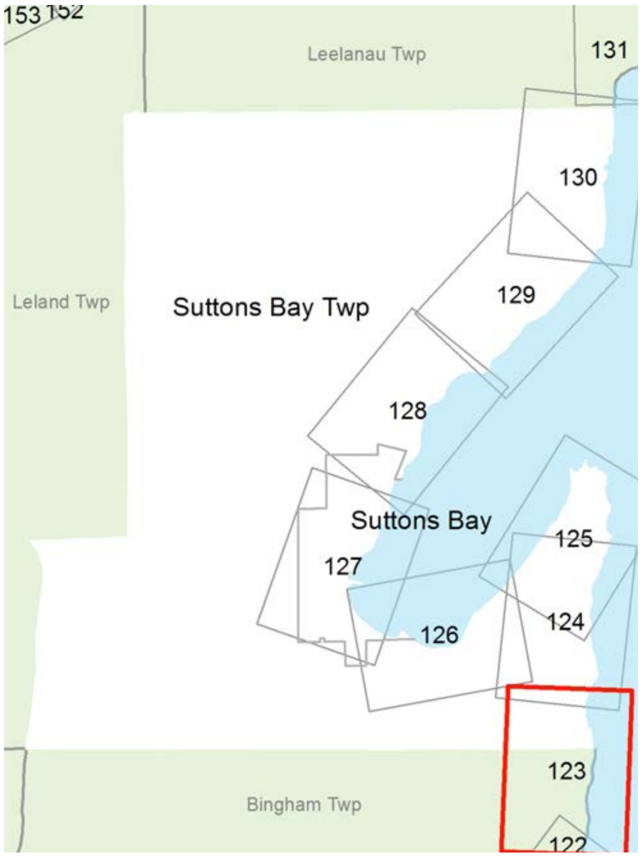


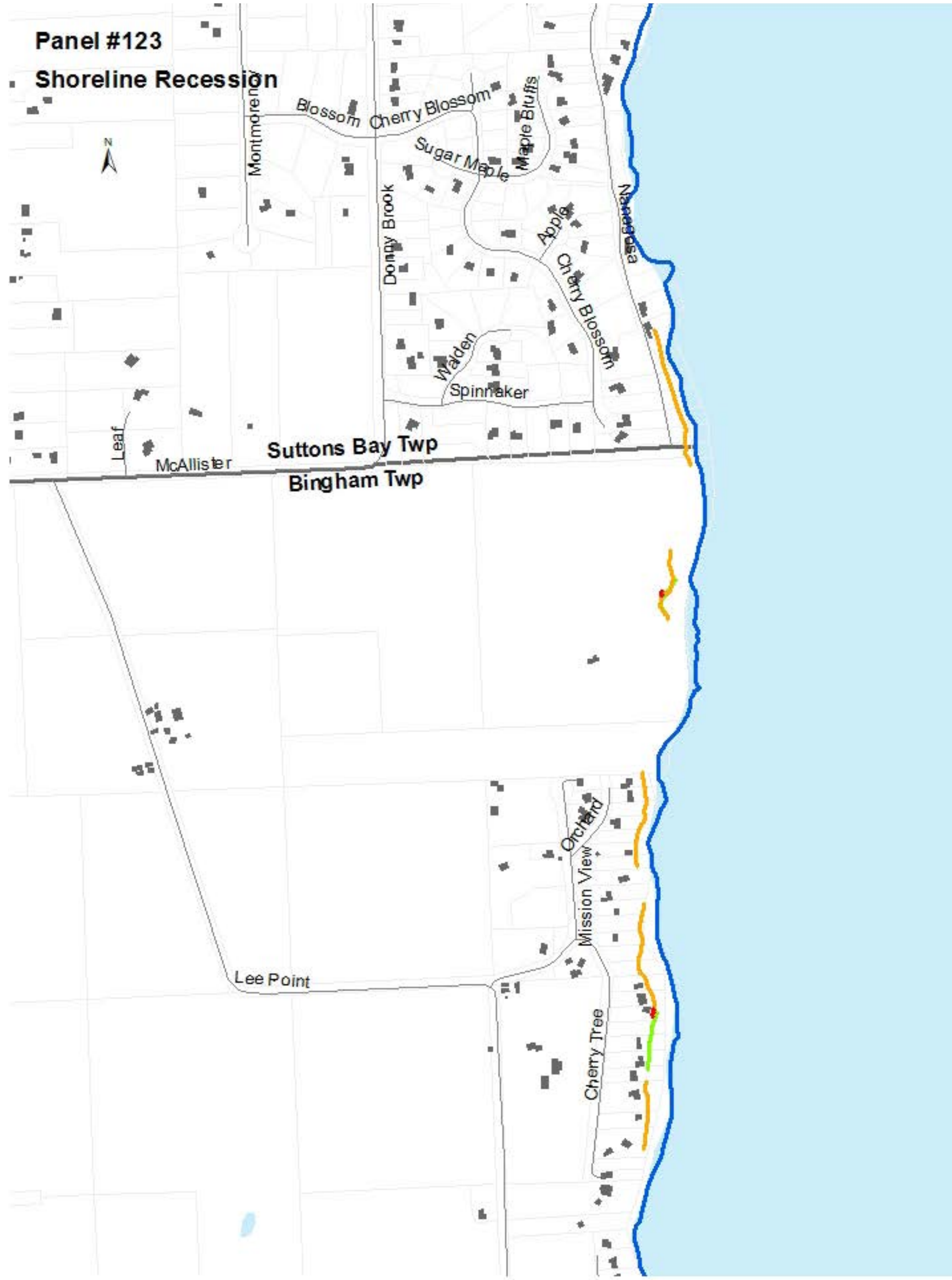
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Suttons Bay Twp./ Suttons Bay

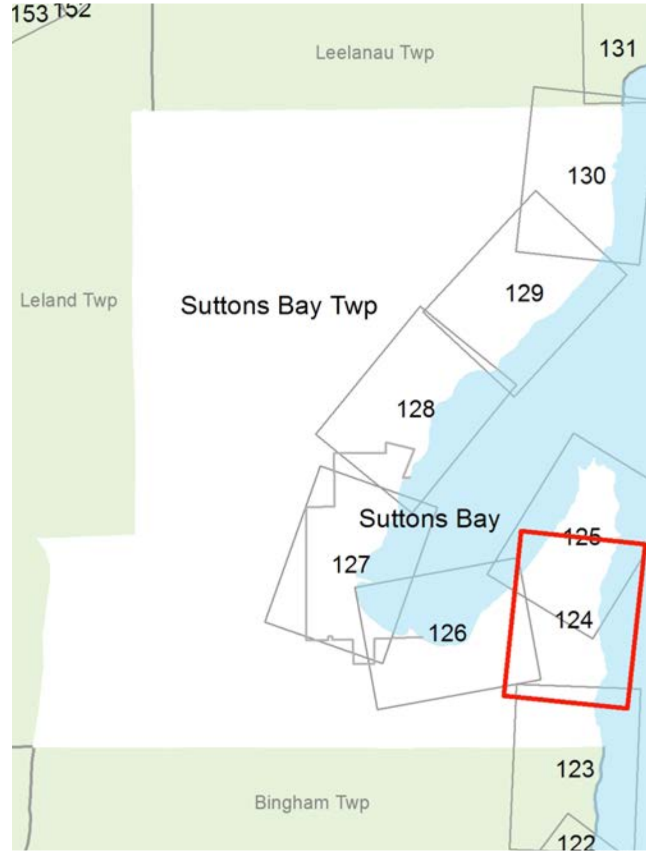


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

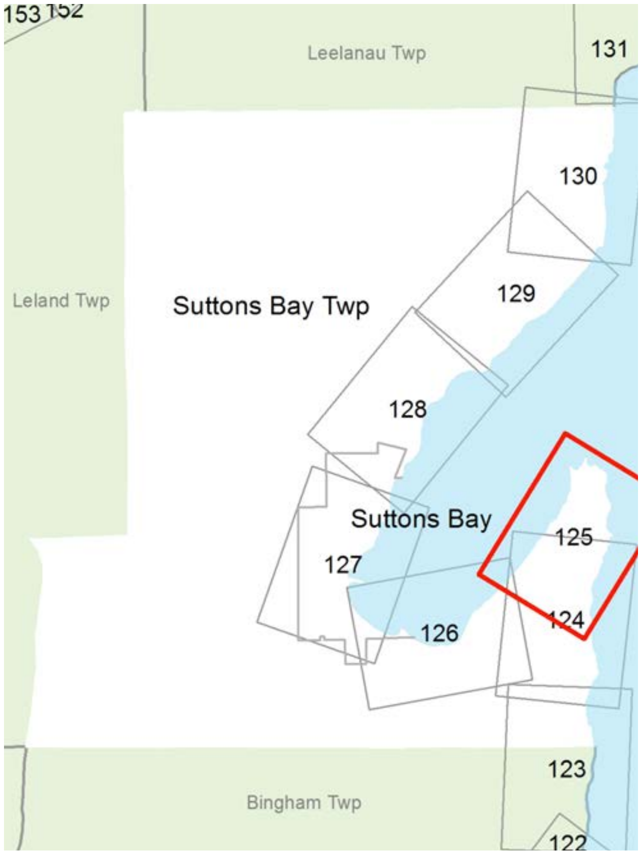




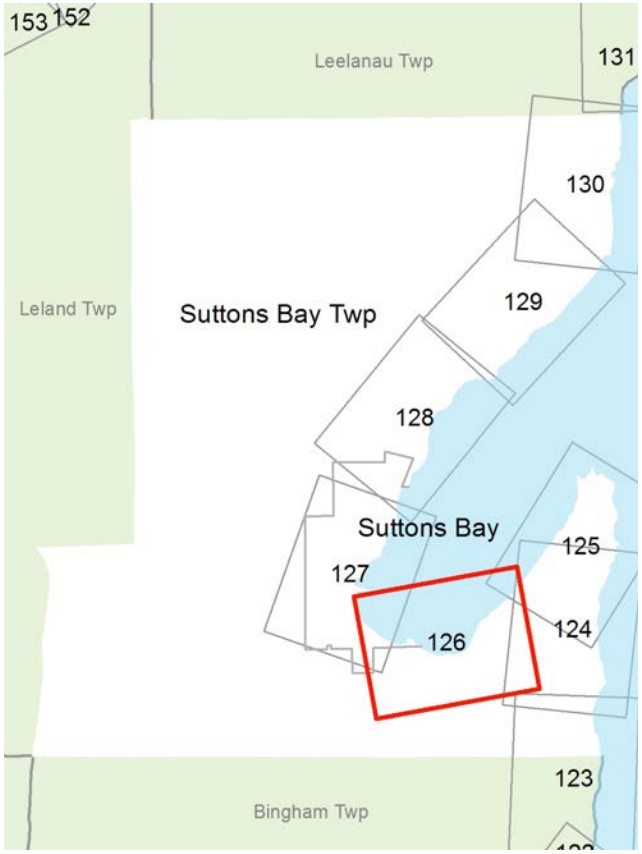
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



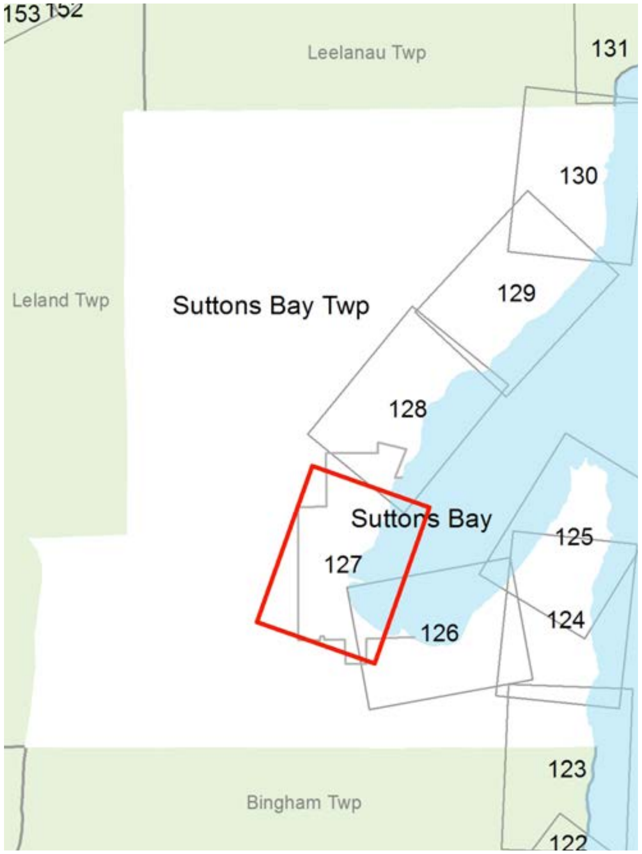
- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline

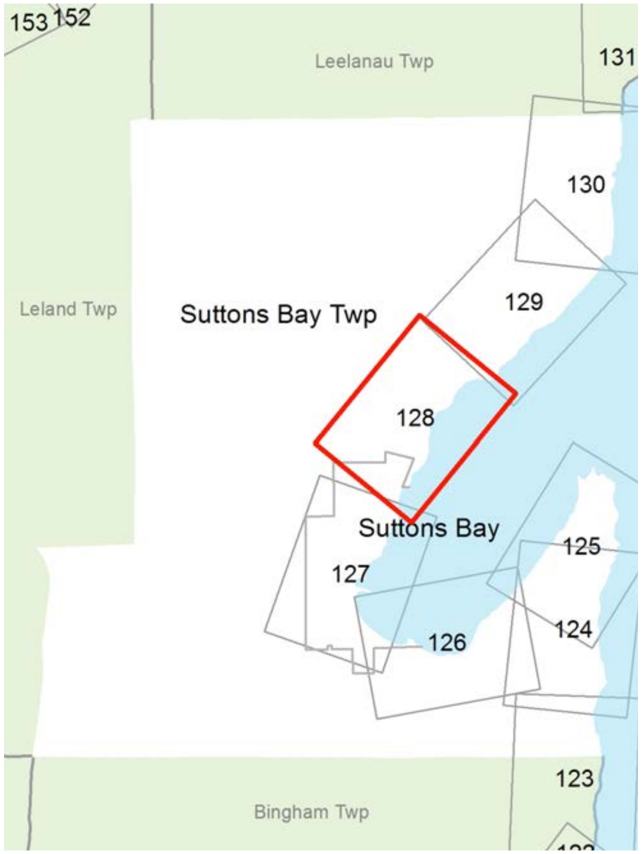


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



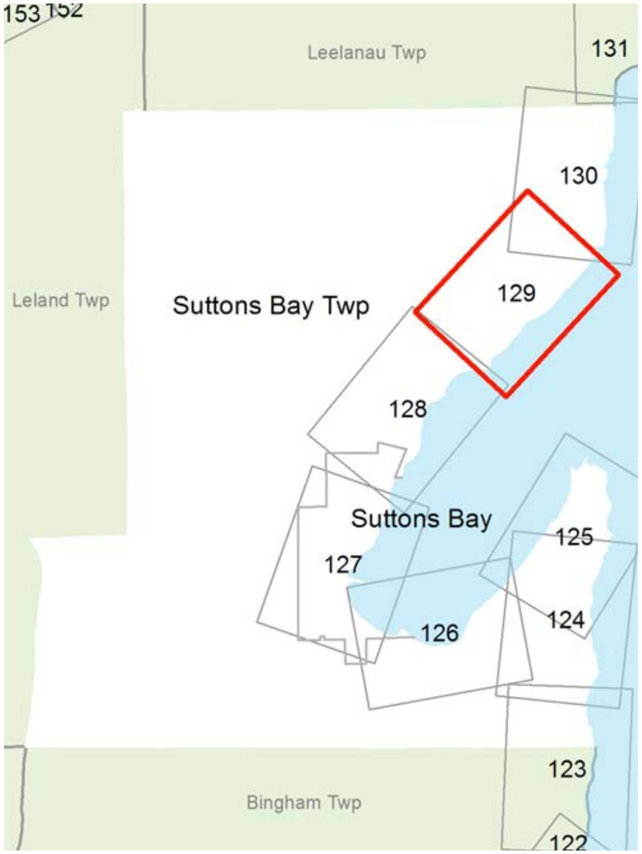
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #128
Shoreline Recession
Jacobson
Blue Water
Pebble Beach
Setterbo
West Bay Shore
Suttons Bay Twp
Suttons Bay
Dumas
Windward

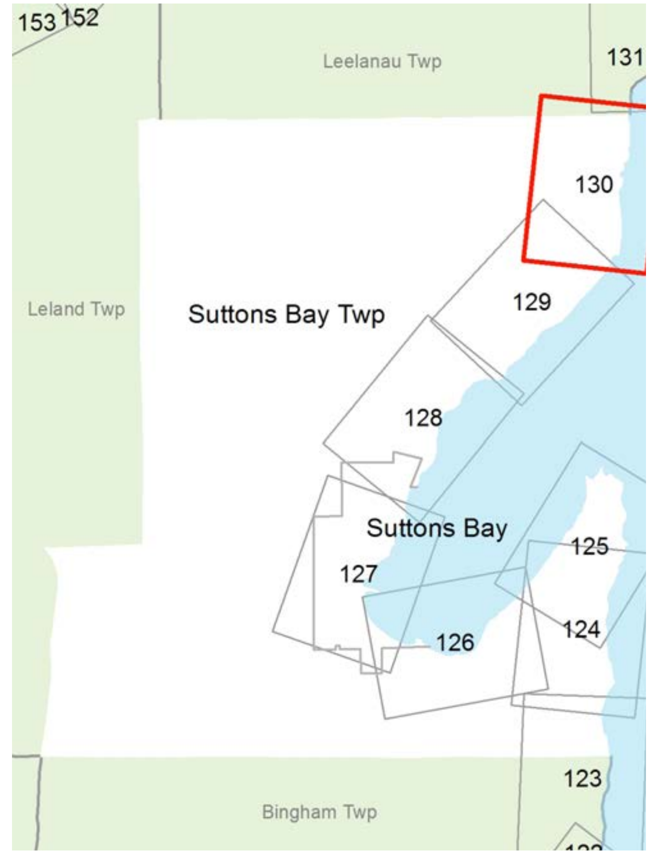

153
152
Leelanau Twp
131
130
129
Leland Twp
Suttons Bay Twp
128
Suttons Bay
125
127
124
126
123
Bingham Twp


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Leelanau County

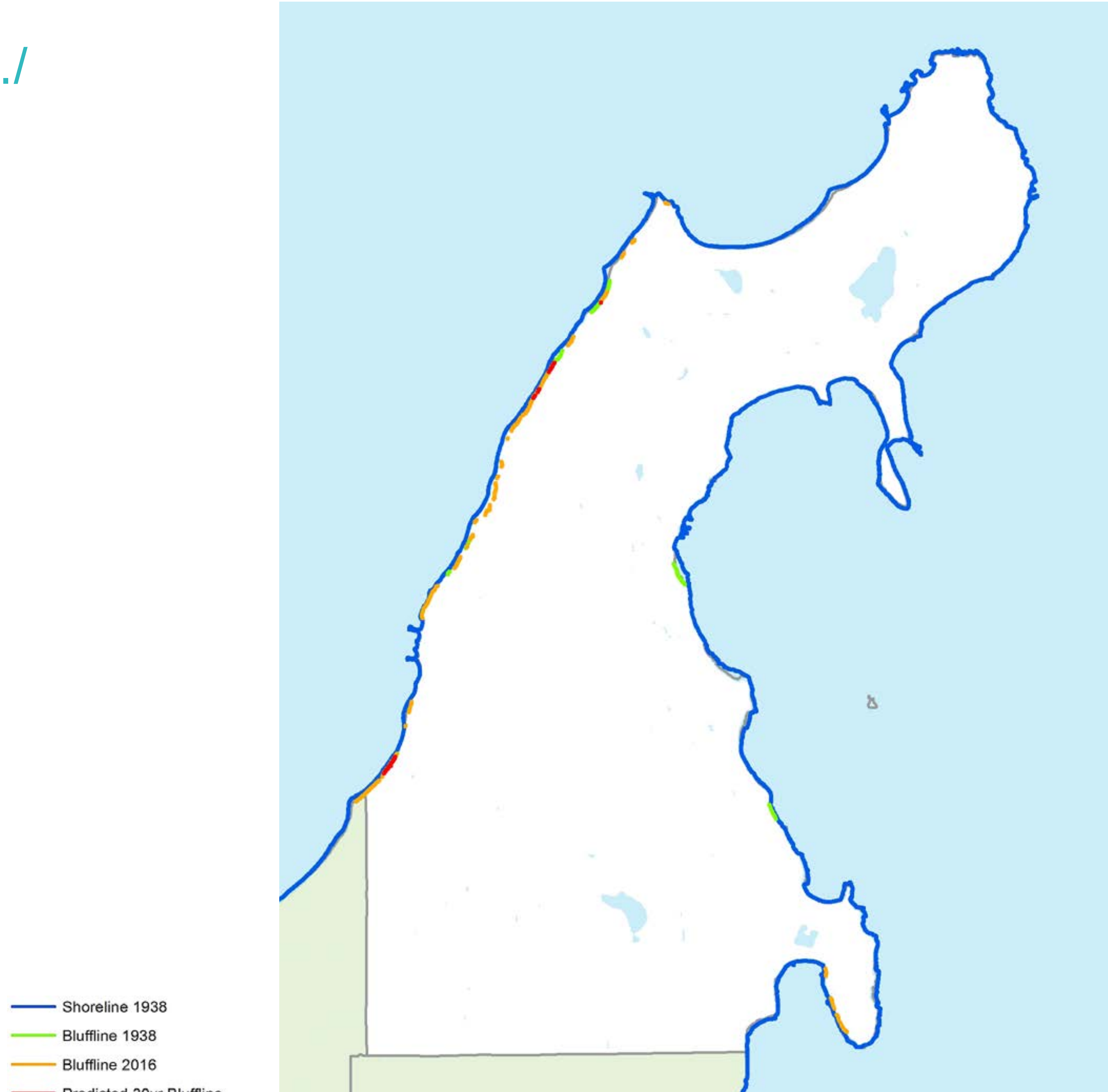


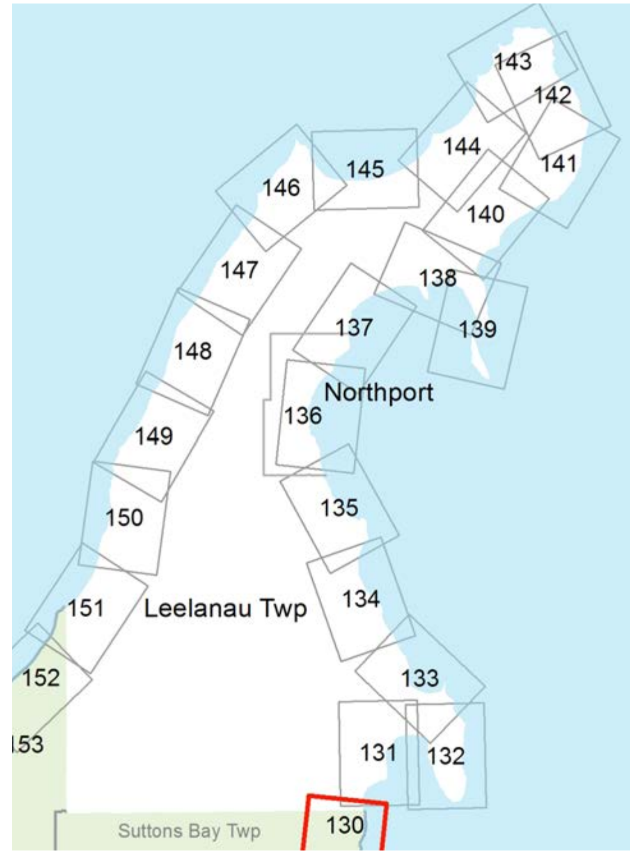
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



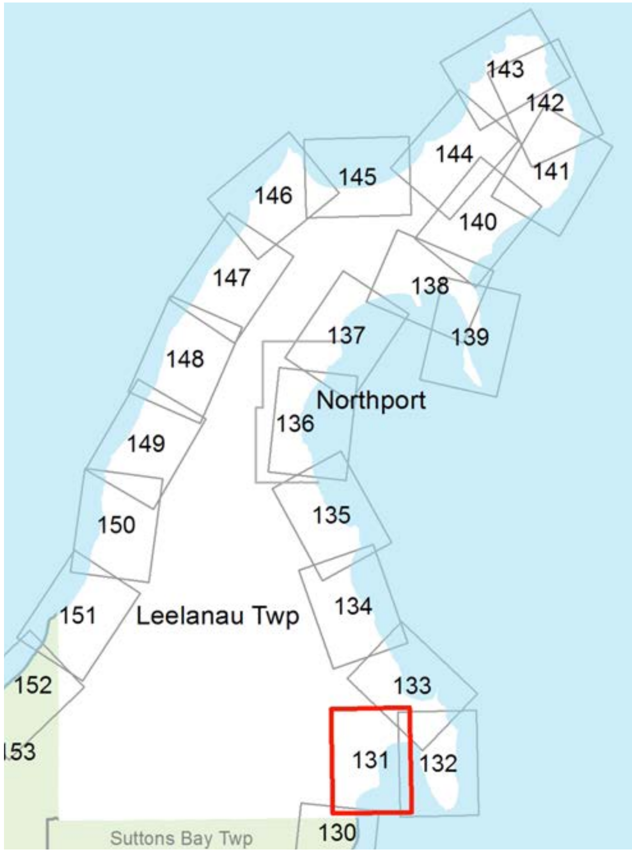
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Leelanau Twp./ Northport





Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Northport
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Leelanau Twp
134
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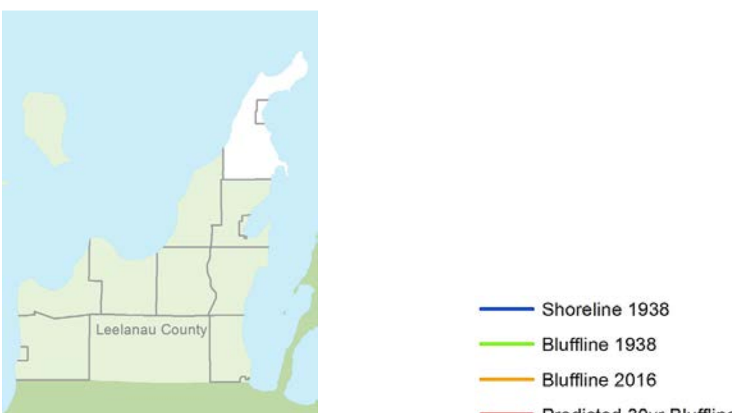
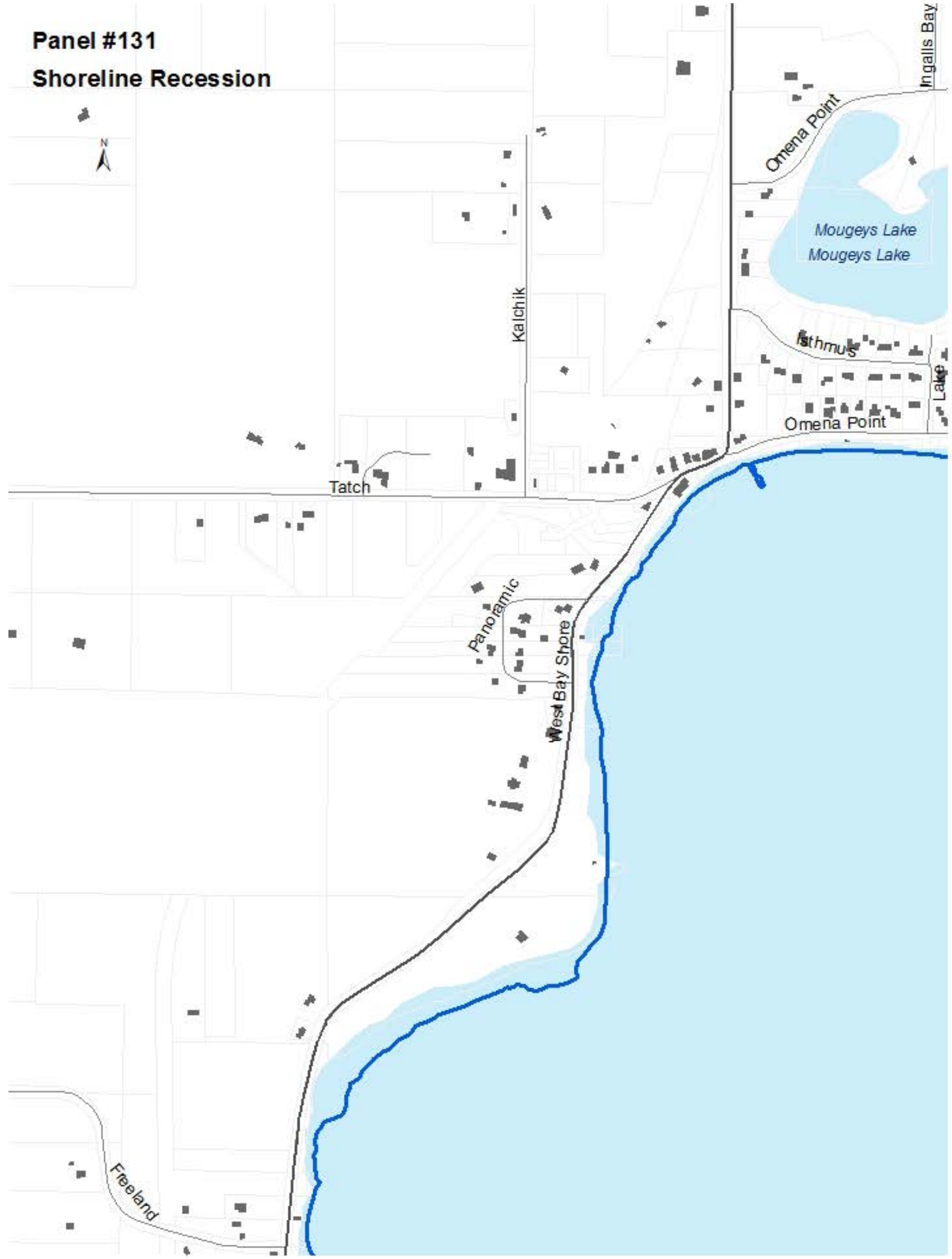
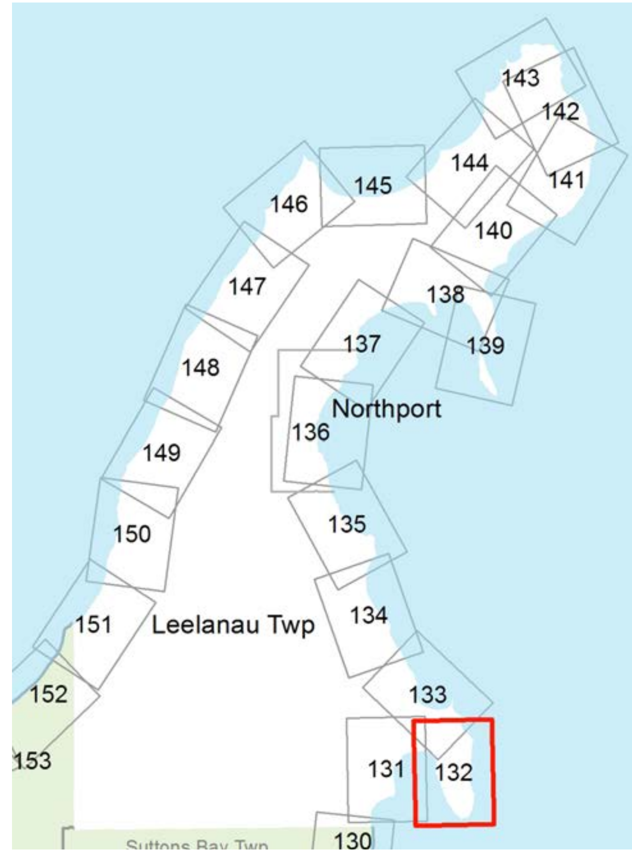
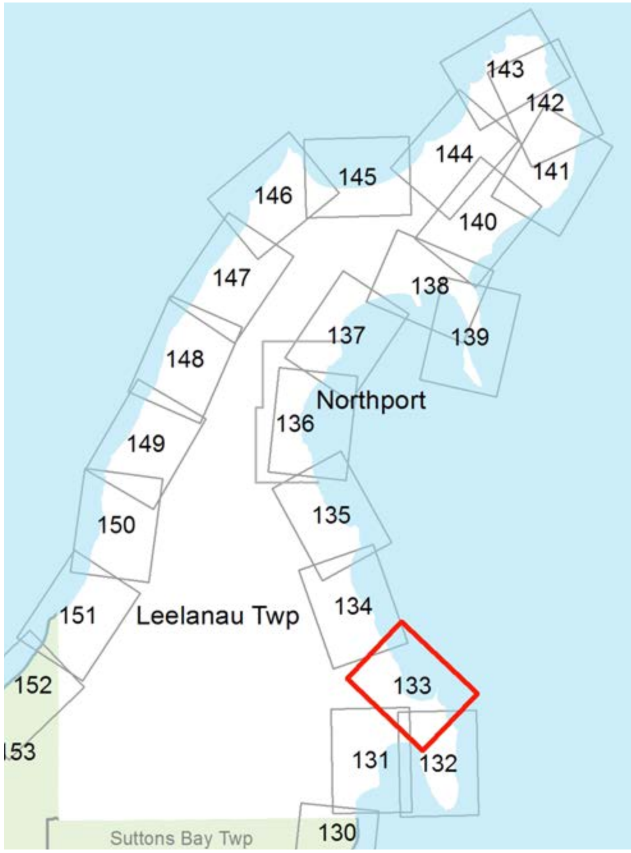
153
131
132
Suttons Bay Twp
130


Leelanau County
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #131
Shoreline Recession
N
Ingalls Bay
Omena Point
Mougeys Lake
Mougeys Lake
Kalchik
Isthmus
Lake
Omena Point
Tatch
Panoramic
West Bay Shore
Freeland



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Northport
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Leelanau Twp
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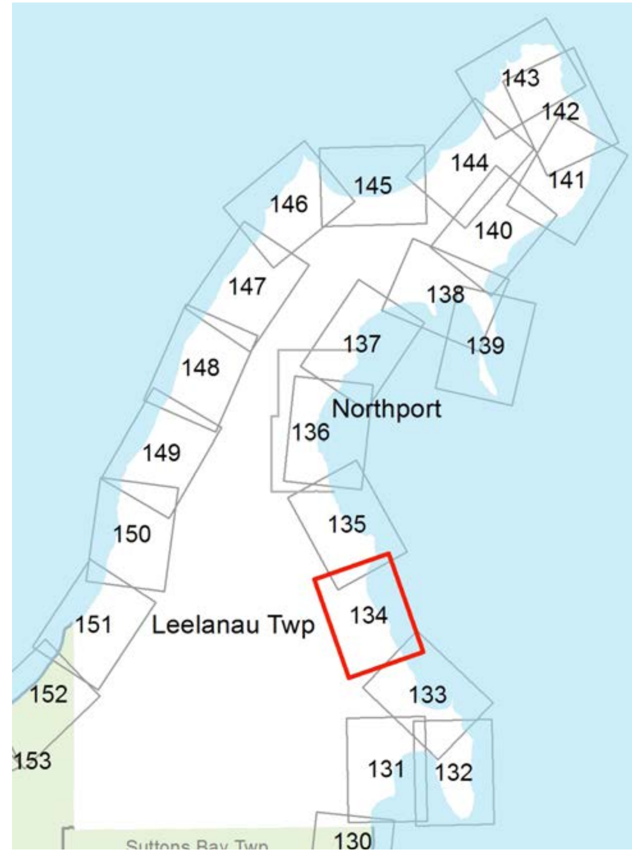
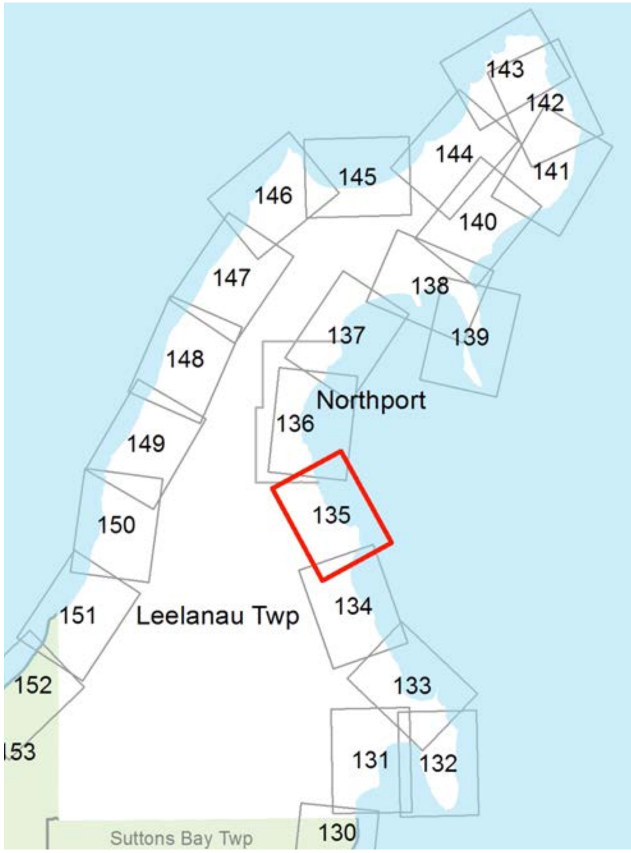
Suttons Bay Twp
130


Leelanau County

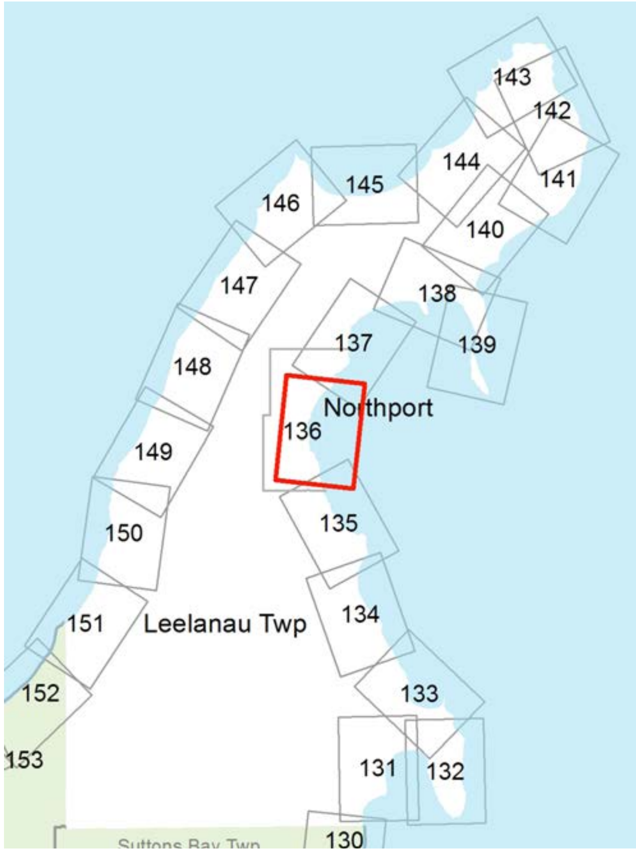

Panel #133
Shoreline Recession
Craker
Northstar
West Bay Shore
Anderson
Ingalls Bay
Ingalls Bay
Omena Point
Pine
Mougeys Lake
Mougeys Lake
Omena Point
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



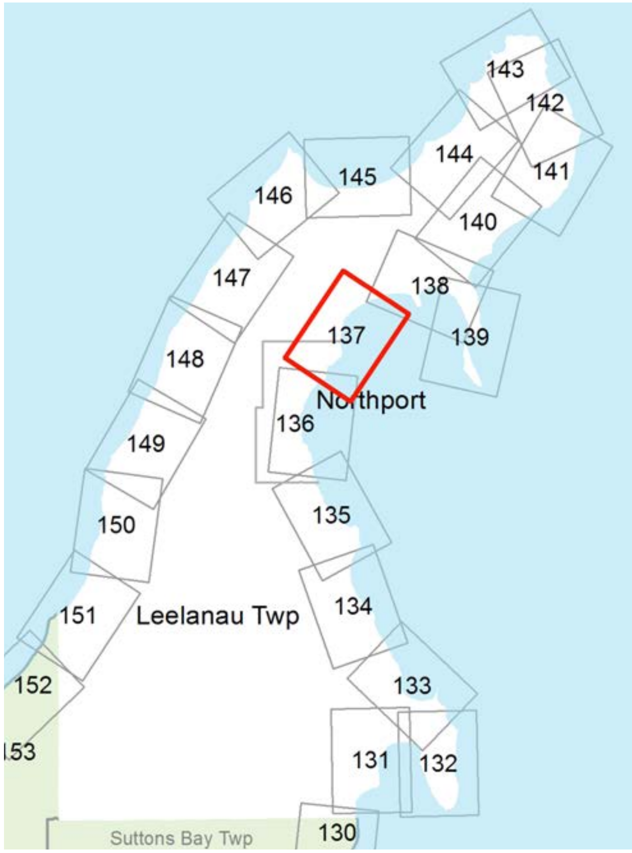
- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

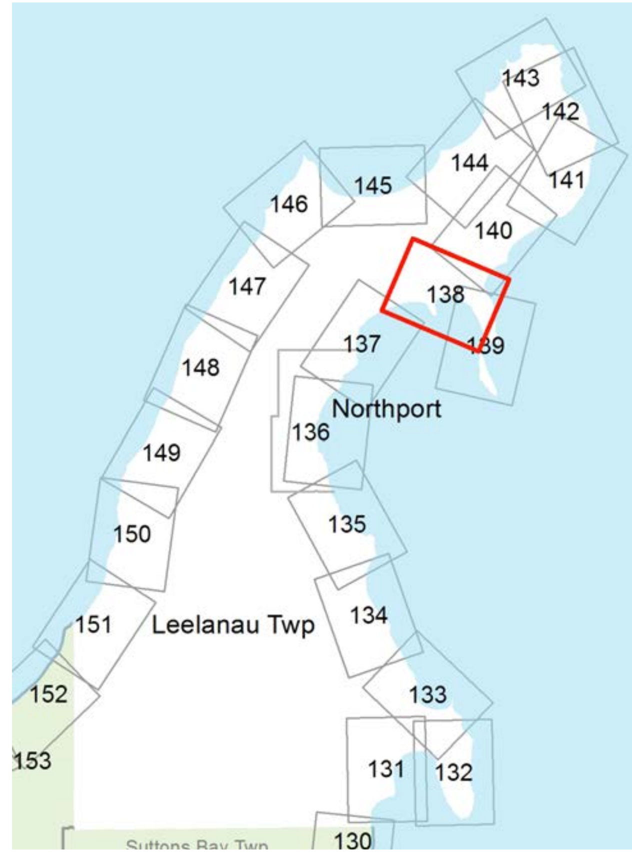


- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #138
Shoreline Recession
Orchard
Northcott
Seven Pines
Northport Point
Paradesia
Circle
Woolsey Lake
Howell
Sugar Bush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Northport
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Leelanau Twp
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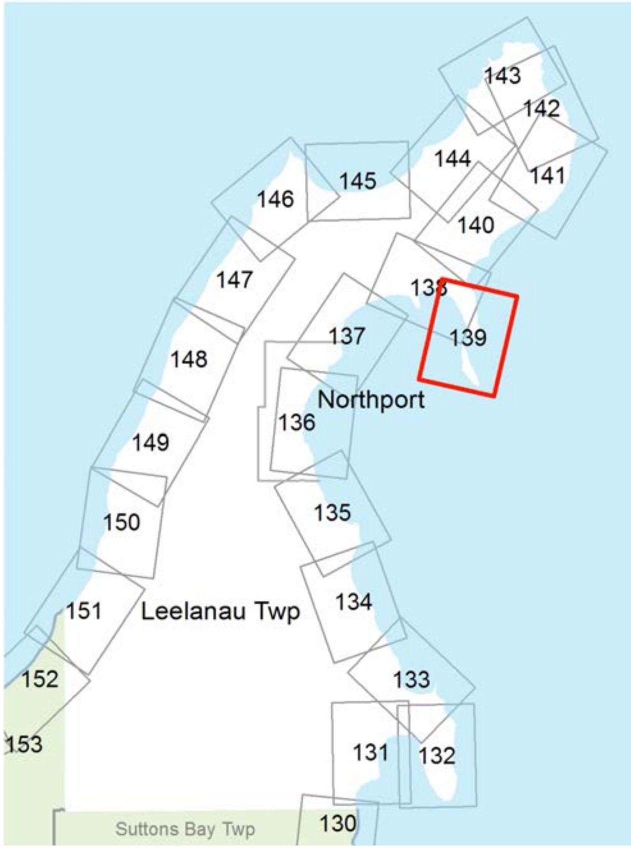
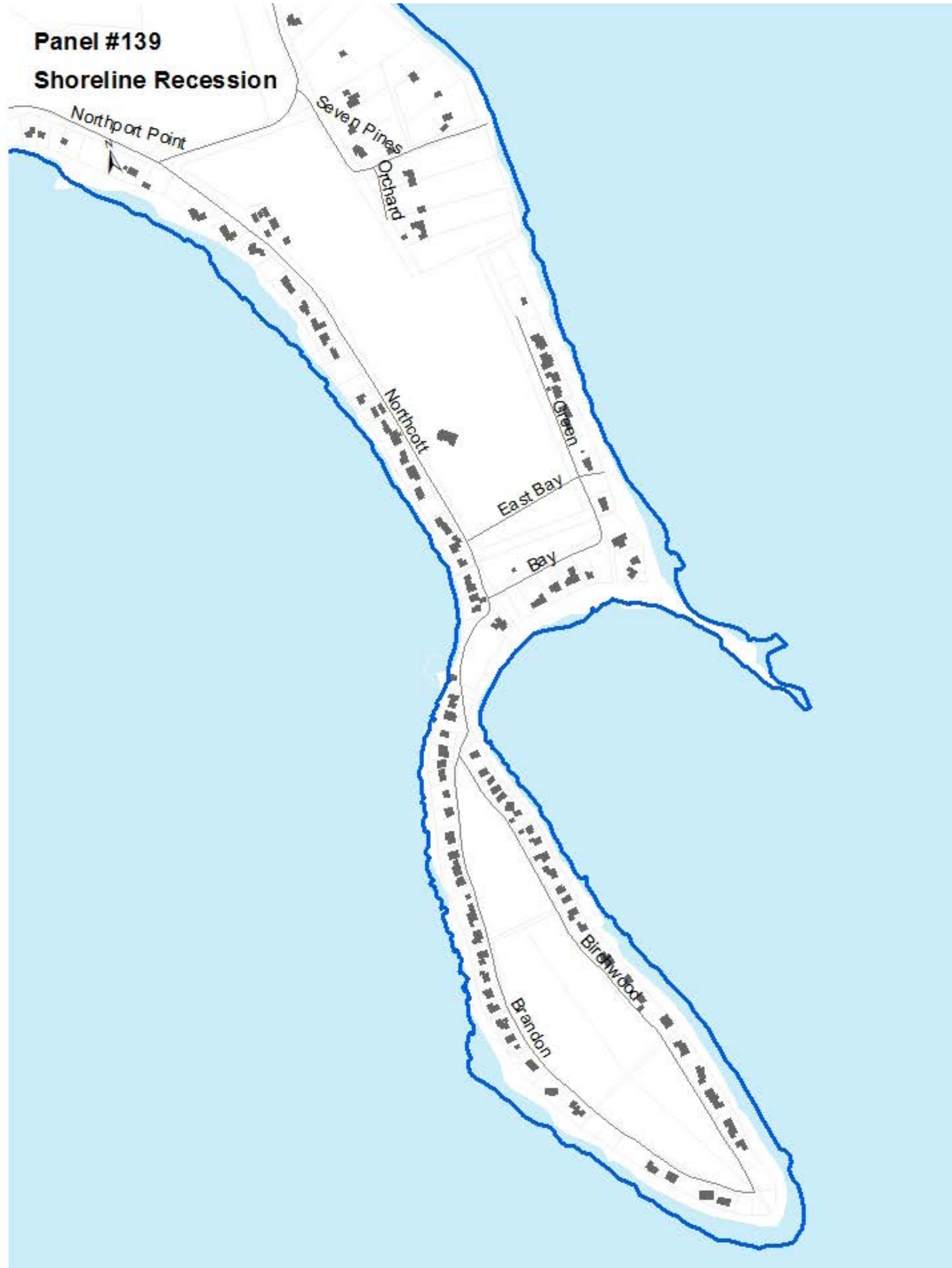
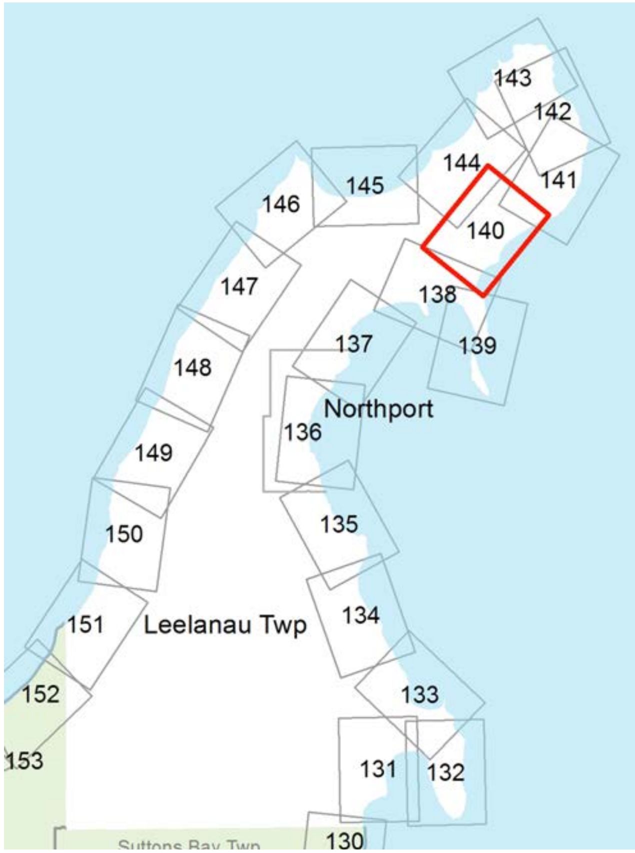
Suttons Bay Twp
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Leelanau County

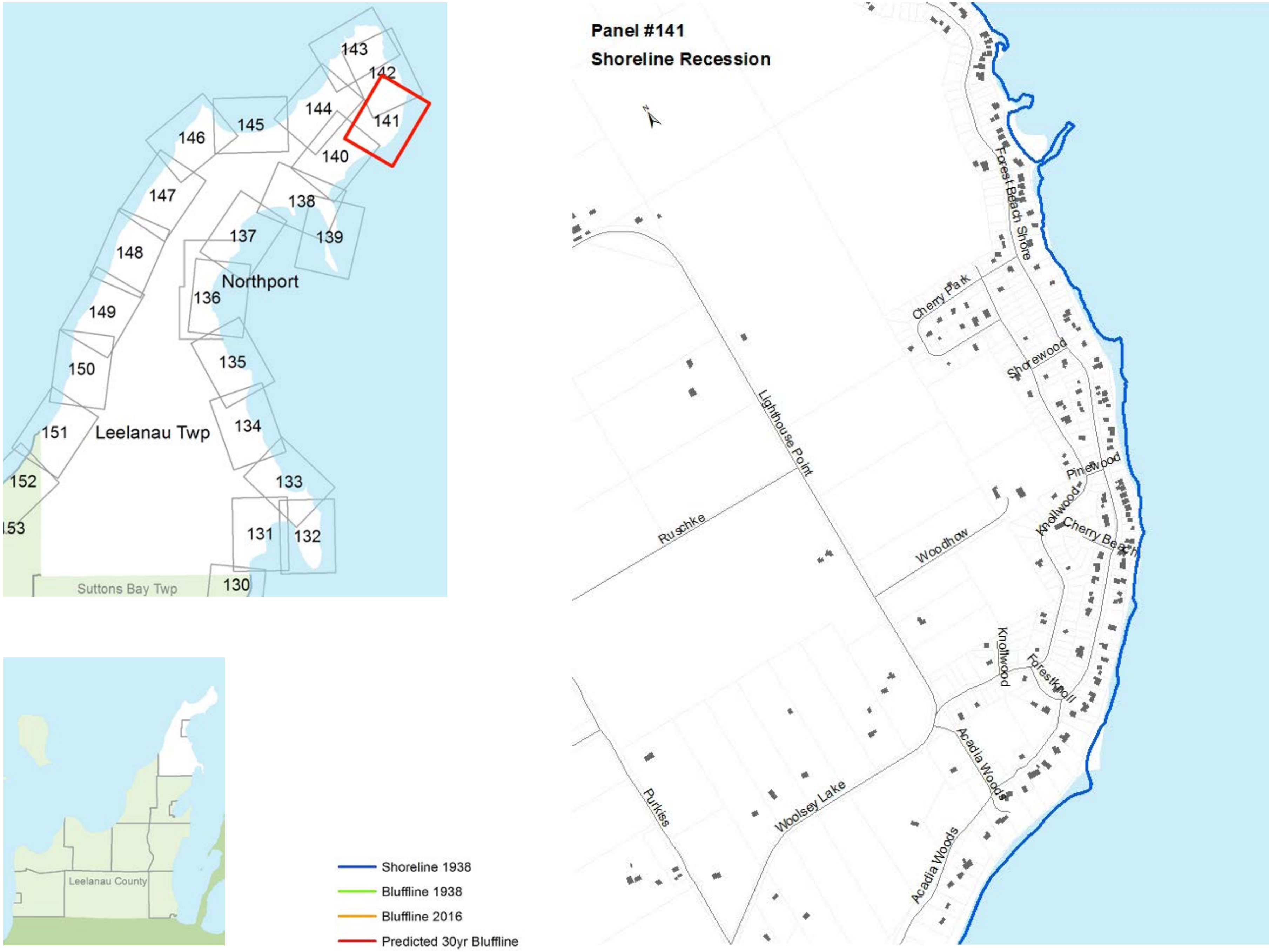




Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #141
Shoreline Recession
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Northport
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Leelanau Twp
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Suttons Bay Twp
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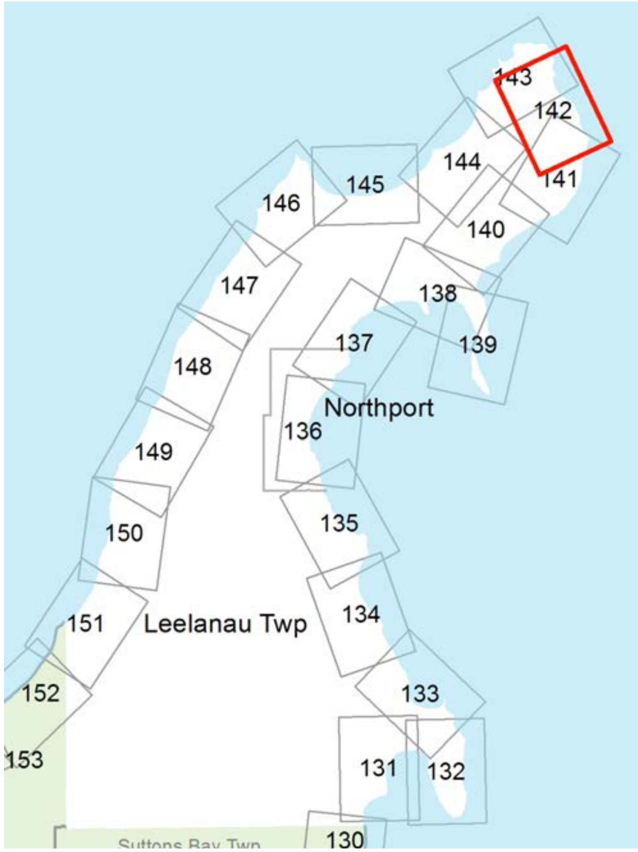
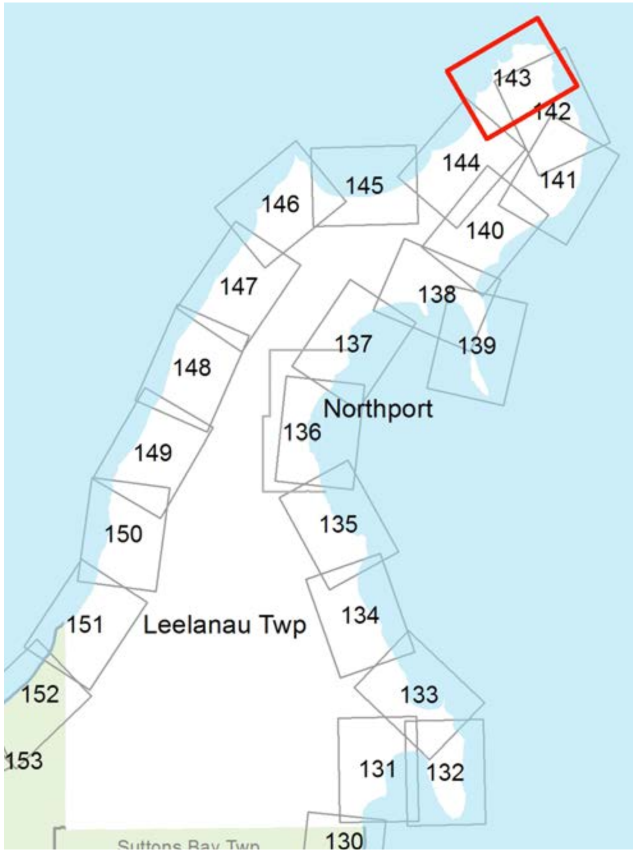
Leelanau County
Forest Beach Shore
Cherry Park
Shorewood
Pinewood
Knollwood
Cherry Beach
Lighthouse Point
Ruschke
Woodhow
Knollwood
Forestknoll
Acadia Woods
Woolsey Lake
Purkiss
Acadia Woods
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Leelanau Twp
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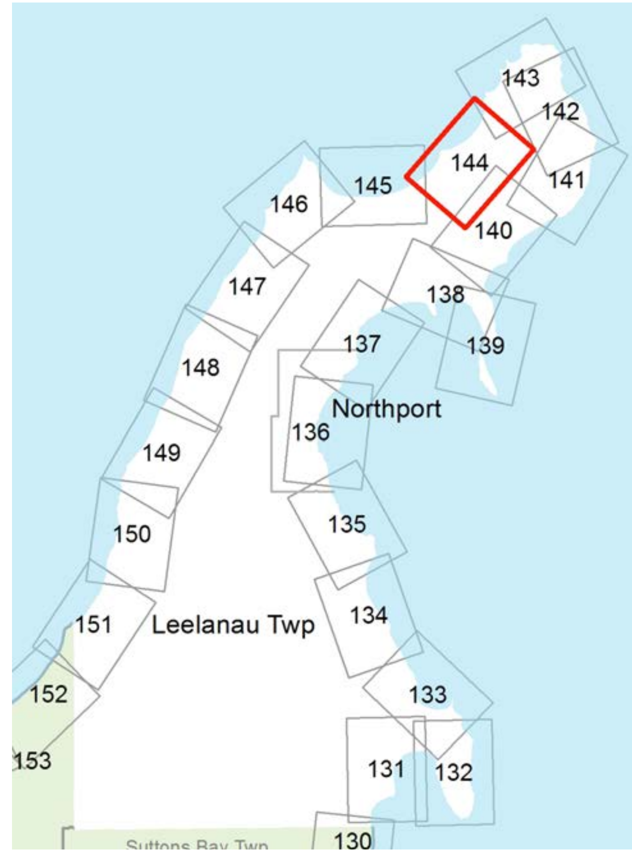
Suttons Bay Twp

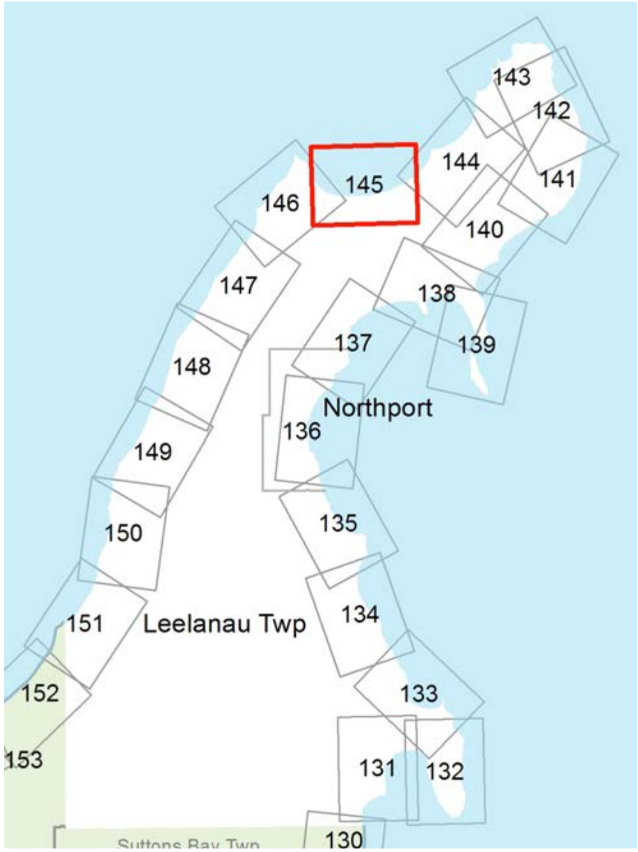

Leelanau County


Panel #143
Shoreline Recession
Leelanau SP Campground
Cathead Bay
Lighthouse Point
Cathead Bay


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Northport
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Leelanau Twp
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Suttons Bay Twp
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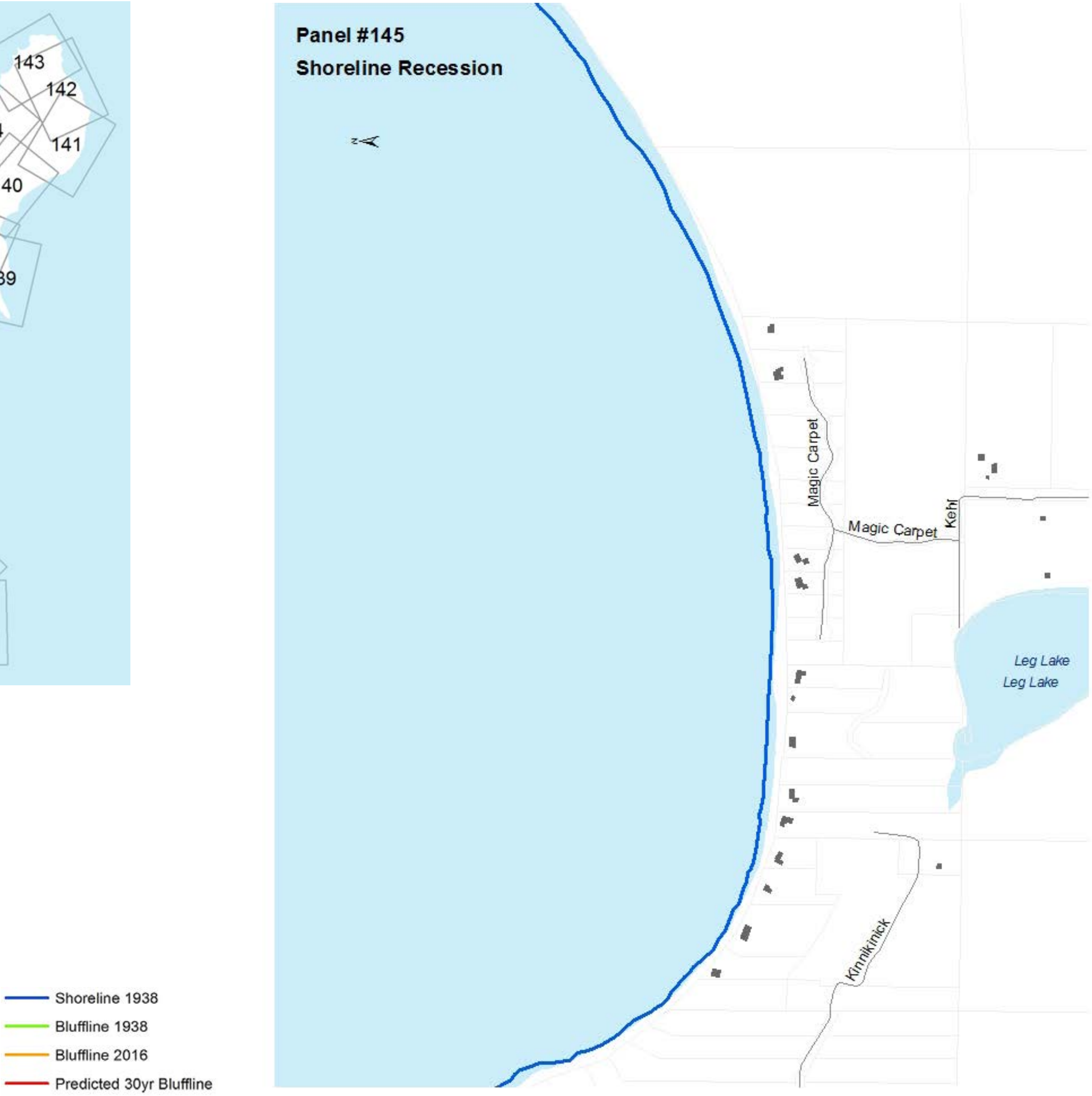
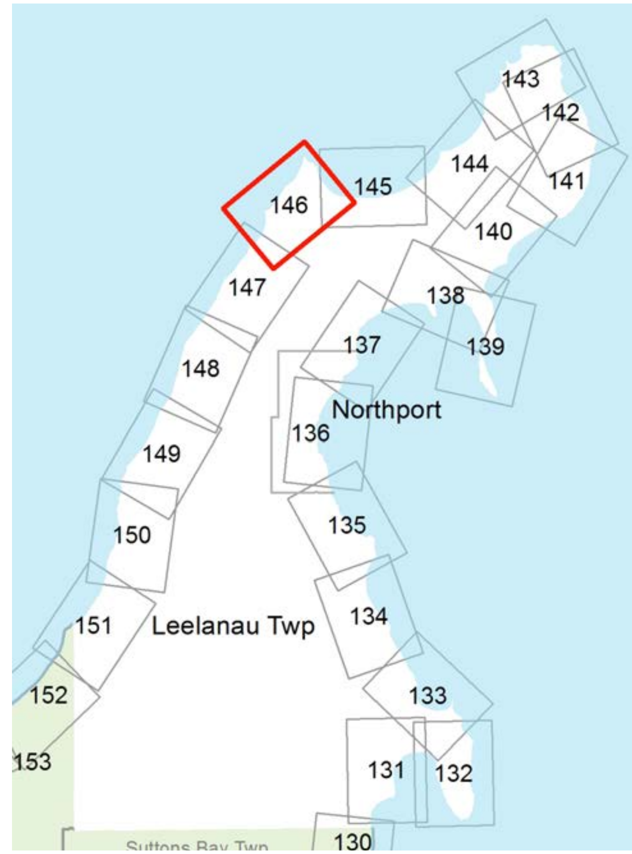
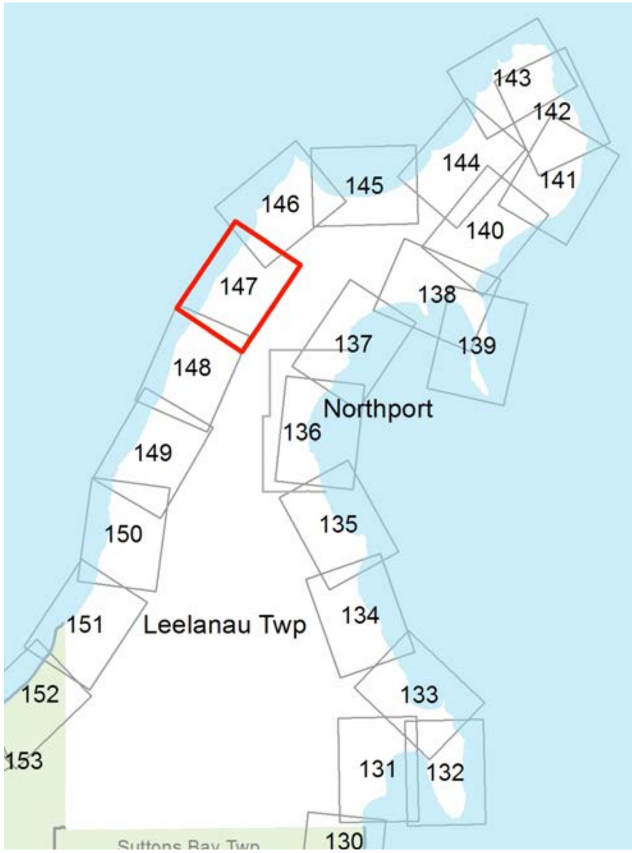
Leelanau County


Panel #145
Shoreline Recession
Magic Carpet
Magic Carpet
Kehl
Leg Lake
Leg Lake
Kinnikinick
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Northport
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Leelanau Twp
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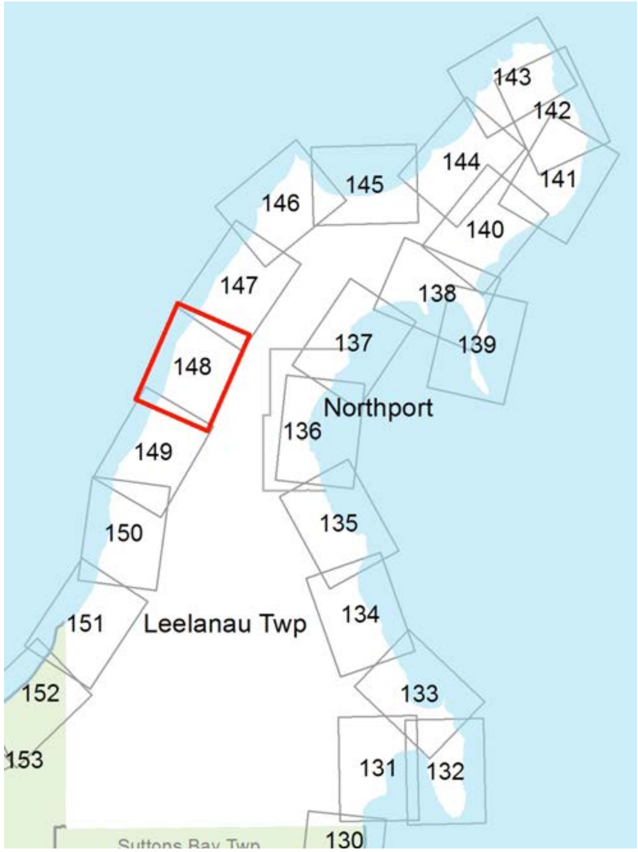
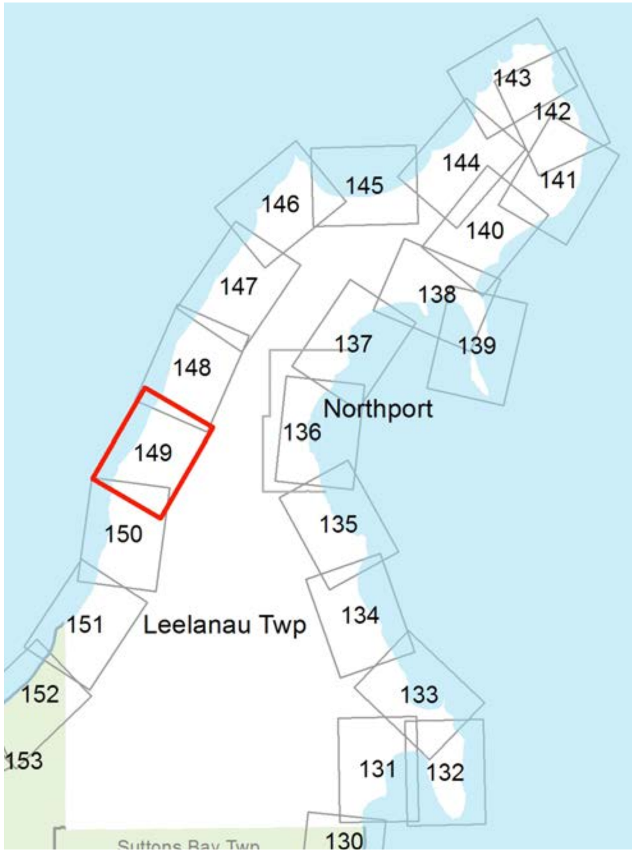
Suttons Bay Twp


Leelanau County


Panel #147
Shoreline Recession
Christmas Cove
Island View
Shores
Scott
Foxview
Monique
Peterson Park
Foxview
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Northport
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Leelanau Twp
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Suttons Bay Twp
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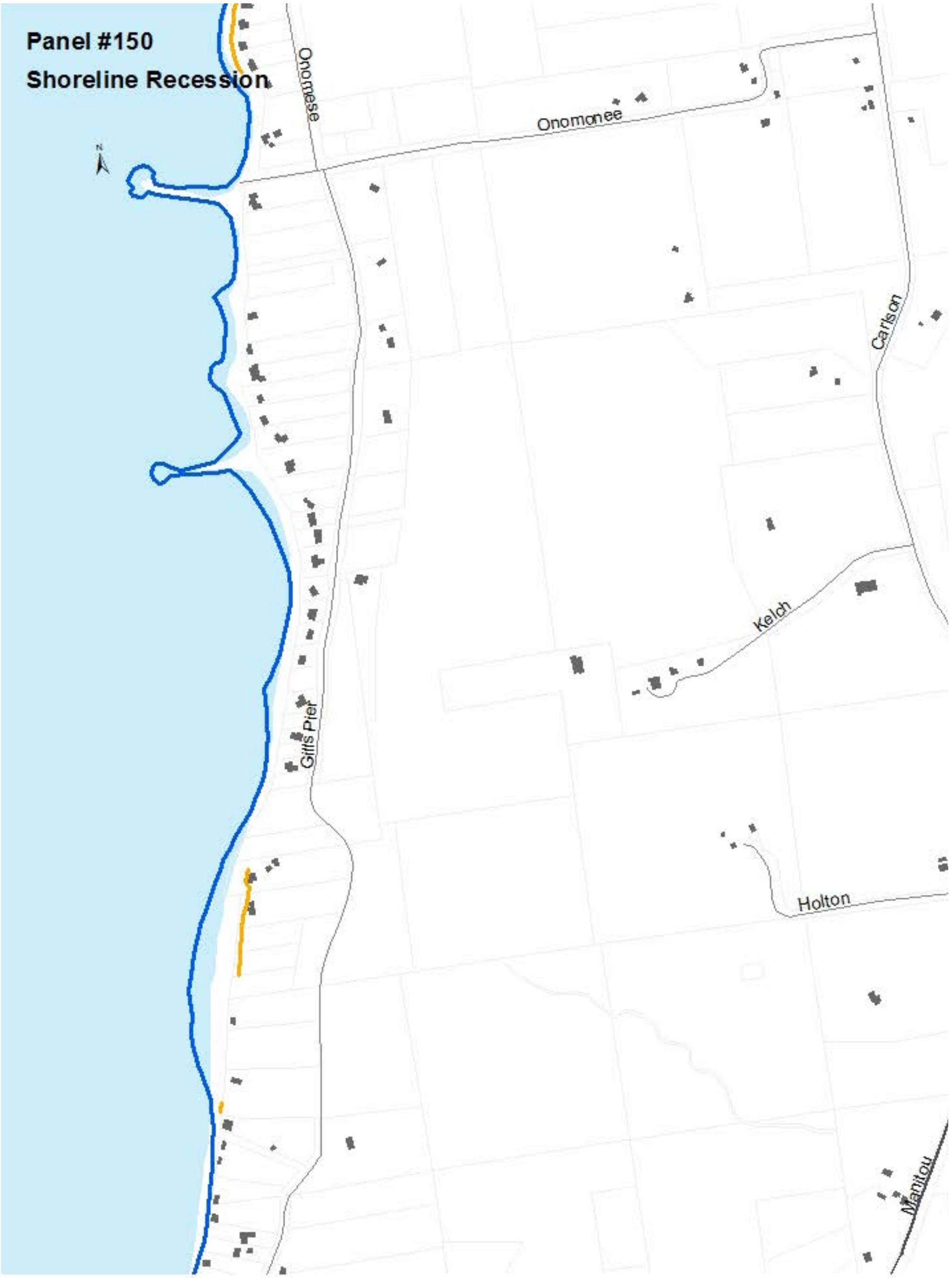
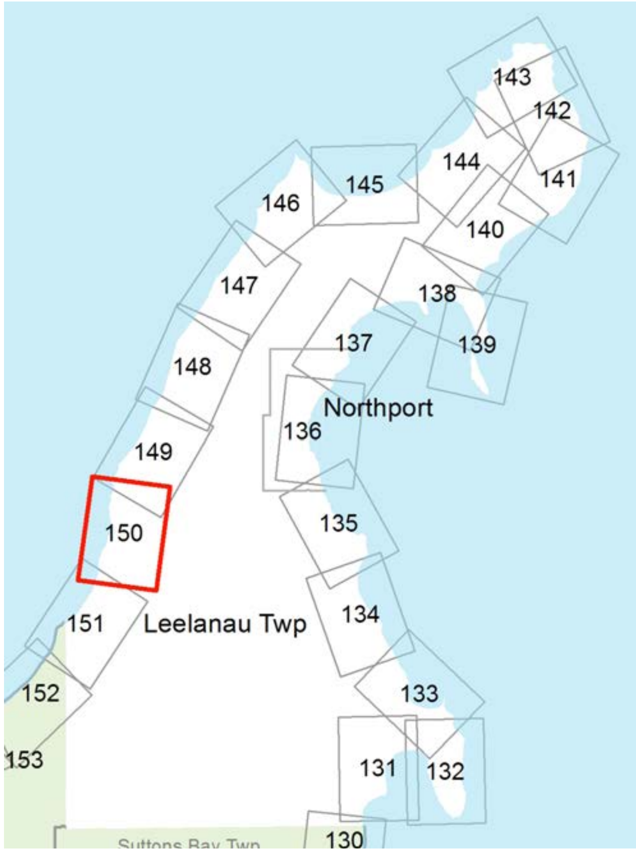
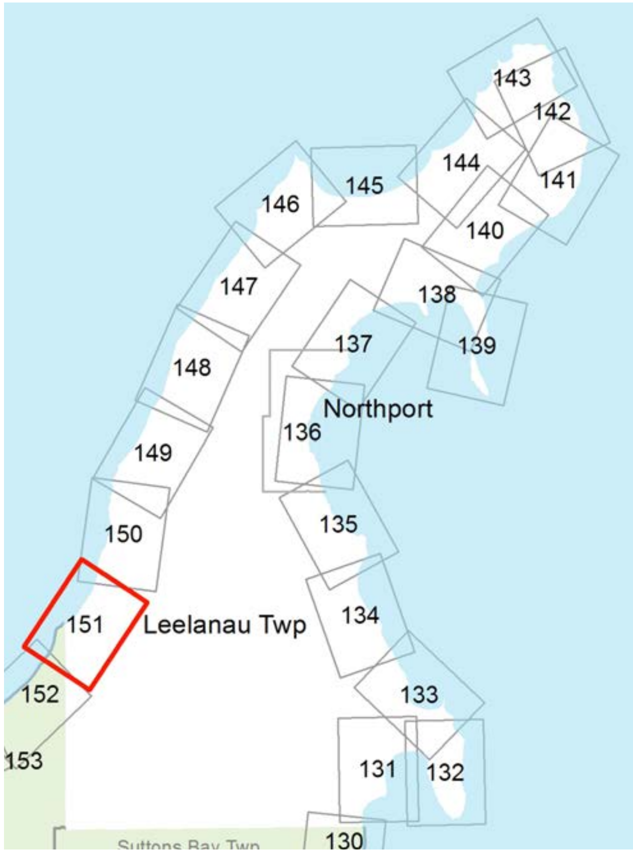
Leelanau County


Panel #149
Shoreline Recession
Old Farm
Johnson
Onominese
Indian Cemetery
Carlson
Onomonee
Onominese
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Northport
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Leelanau Twp
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Suttons Bay Twp
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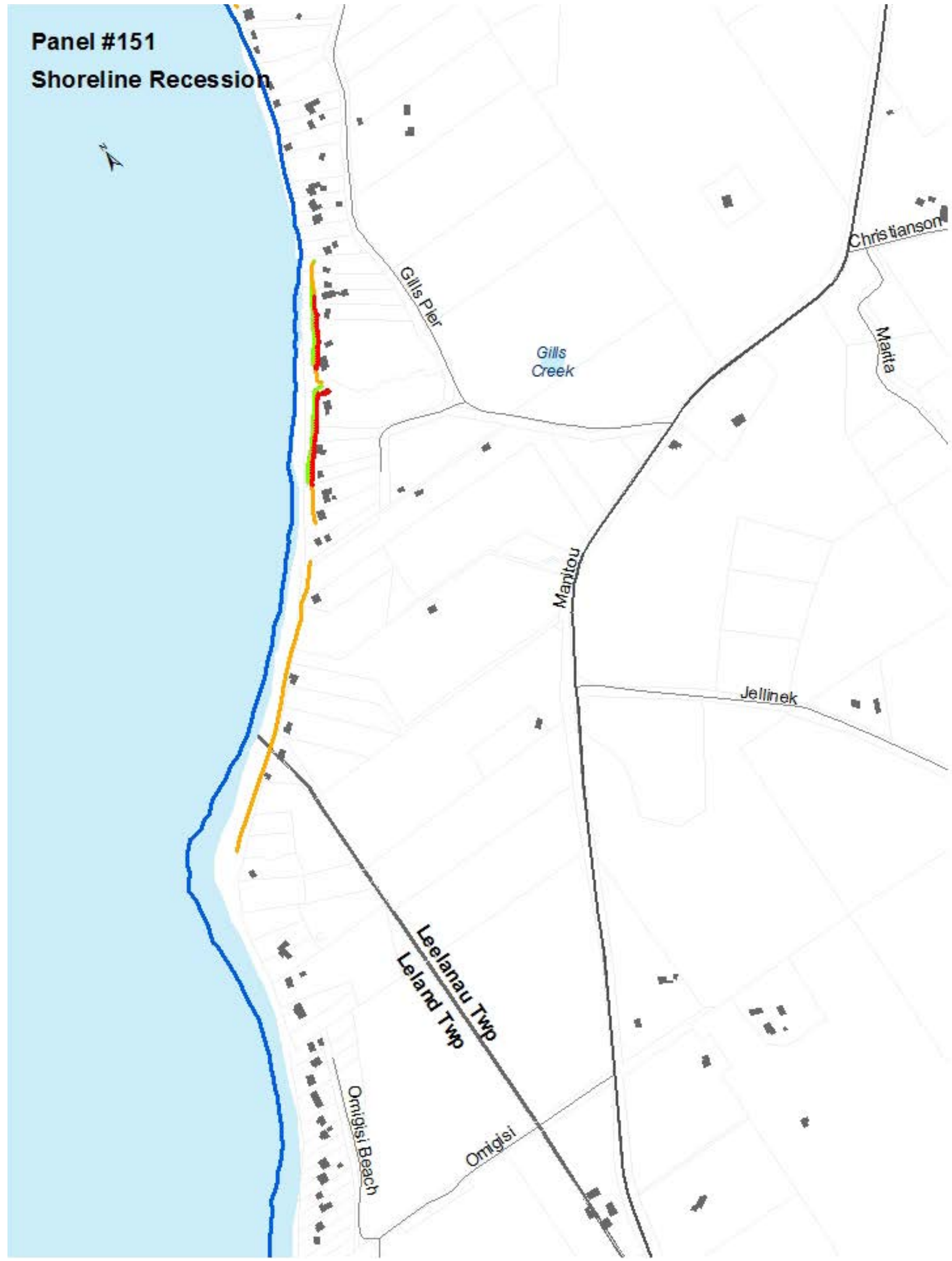
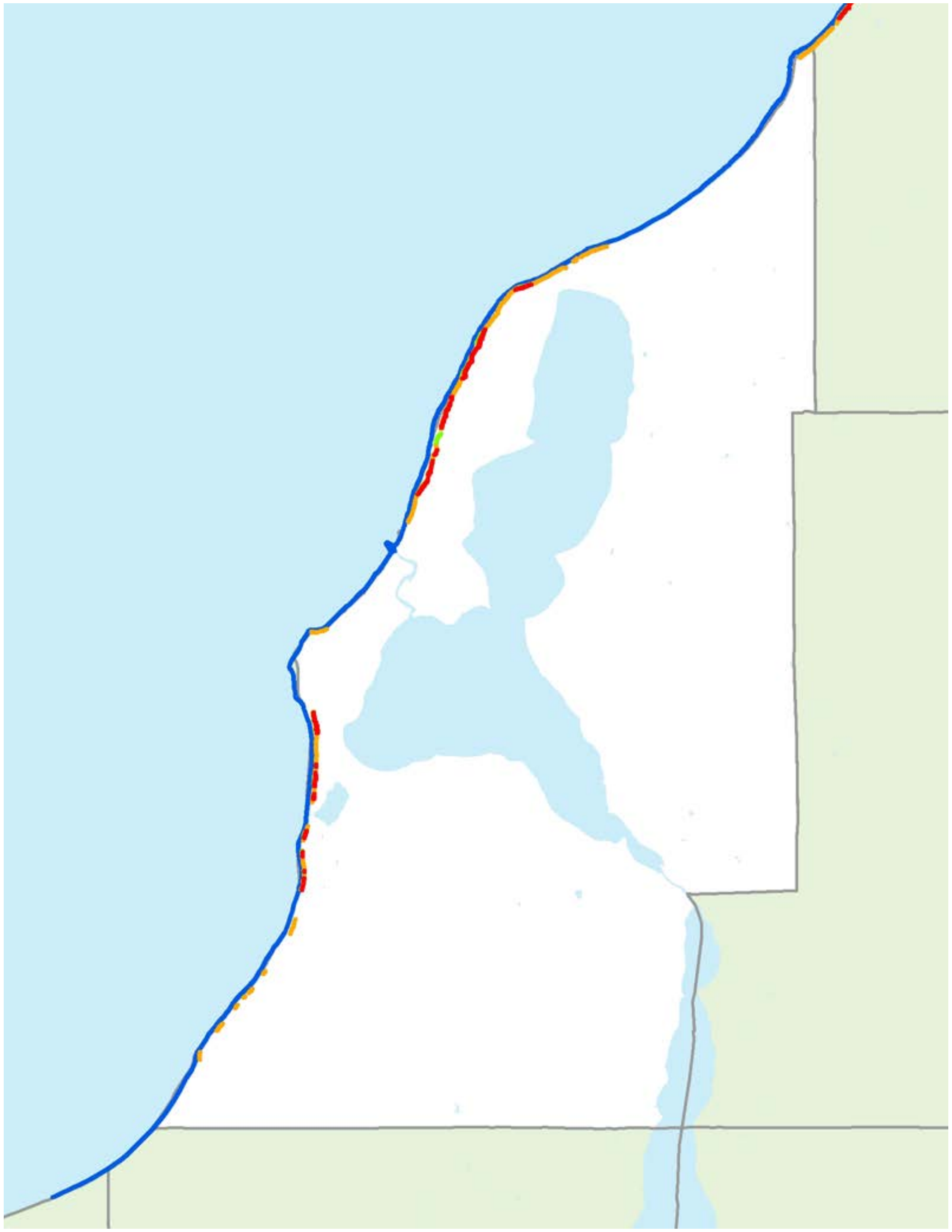
Leelanau County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

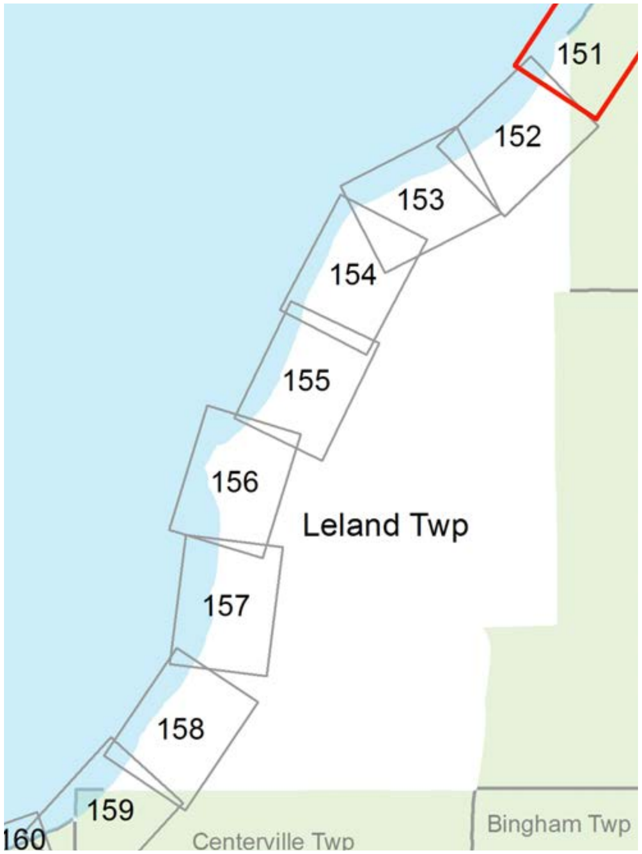

Panel #151
Shoreline Recession
Christianson
Gills Pier
Gills Creek
Marita
Manitou
Jellinek
Leelanau Twp
Leland Twp
Omigisi Beach
Omigisi

Leland Twp.




Leelanau County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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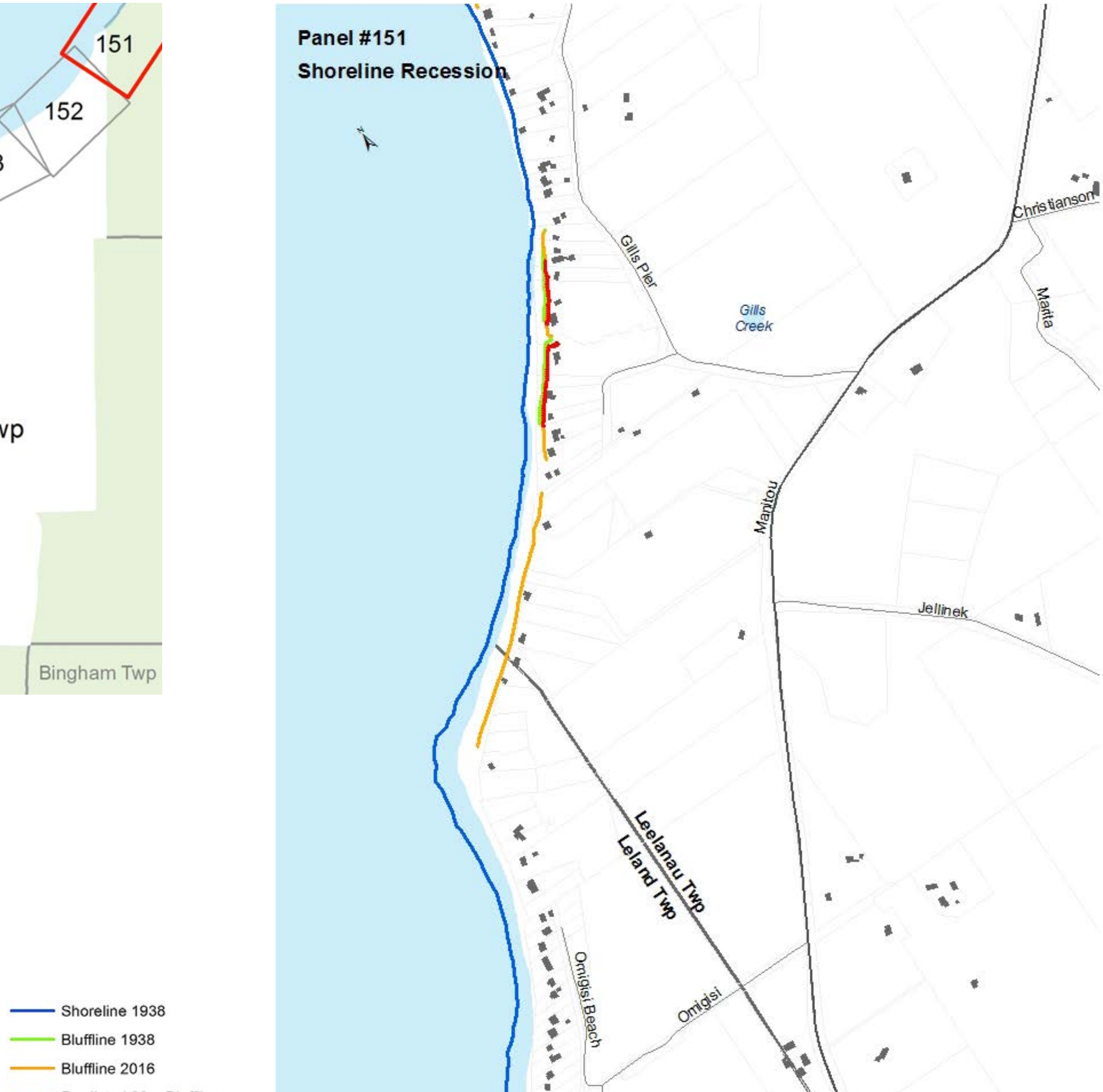
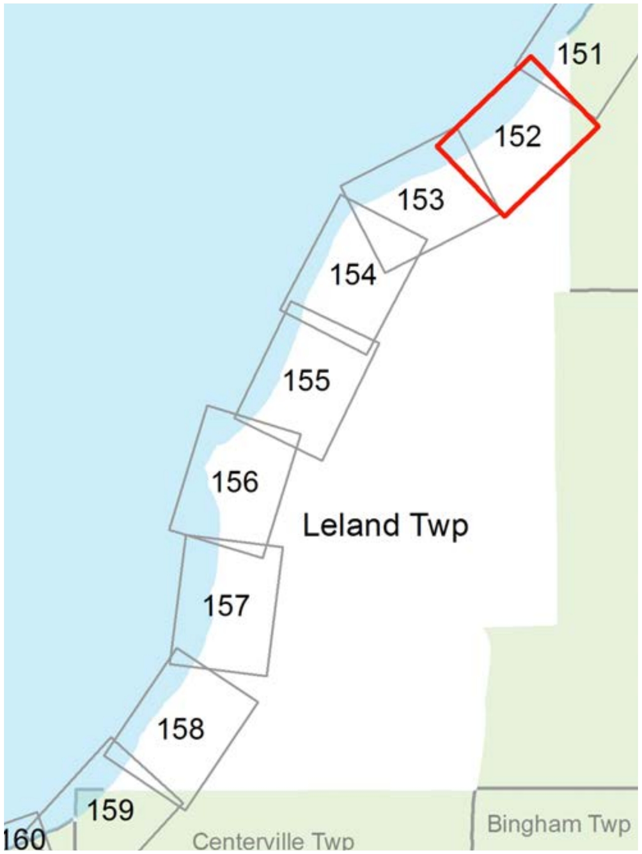
Leland Twp
Centerville Twp
Bingham Twp


Leelanau County


Panel #151
Shoreline Recession
Gills Pier
Gills Creek
Christianson
Marta
Manitou
Jellinek
Leelanau Twp
Leland Twp
Omigisi Beach
Omigisi
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #152
Shoreline Recession
Omigisi
Omigisi Beach
Kovarik
Leelanau Twp
Leland Twp
Novotny
Manitou
Birchwood Shores
Eagle
Leland Woods
Kolarik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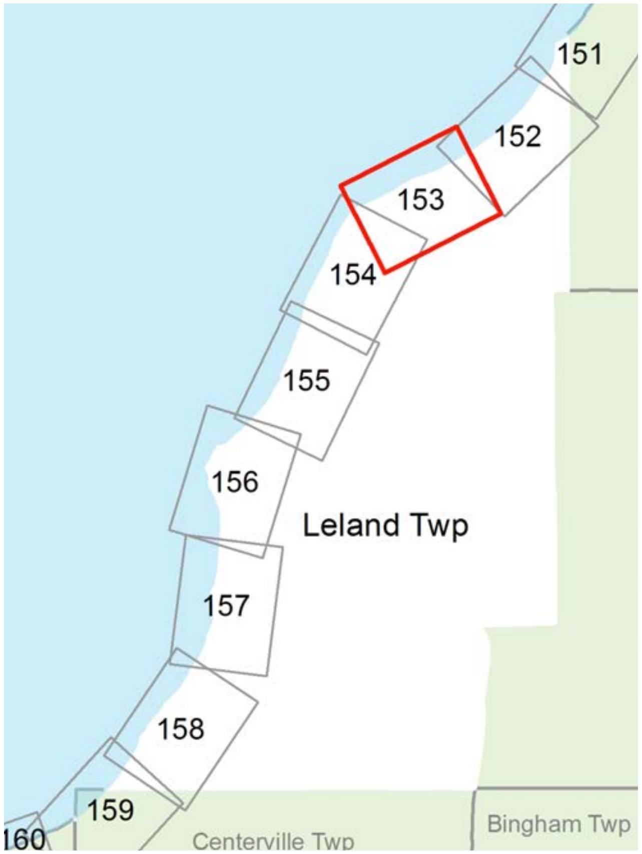
Leland Twp
Centerville Twp
Bingham Twp


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Leelanau County



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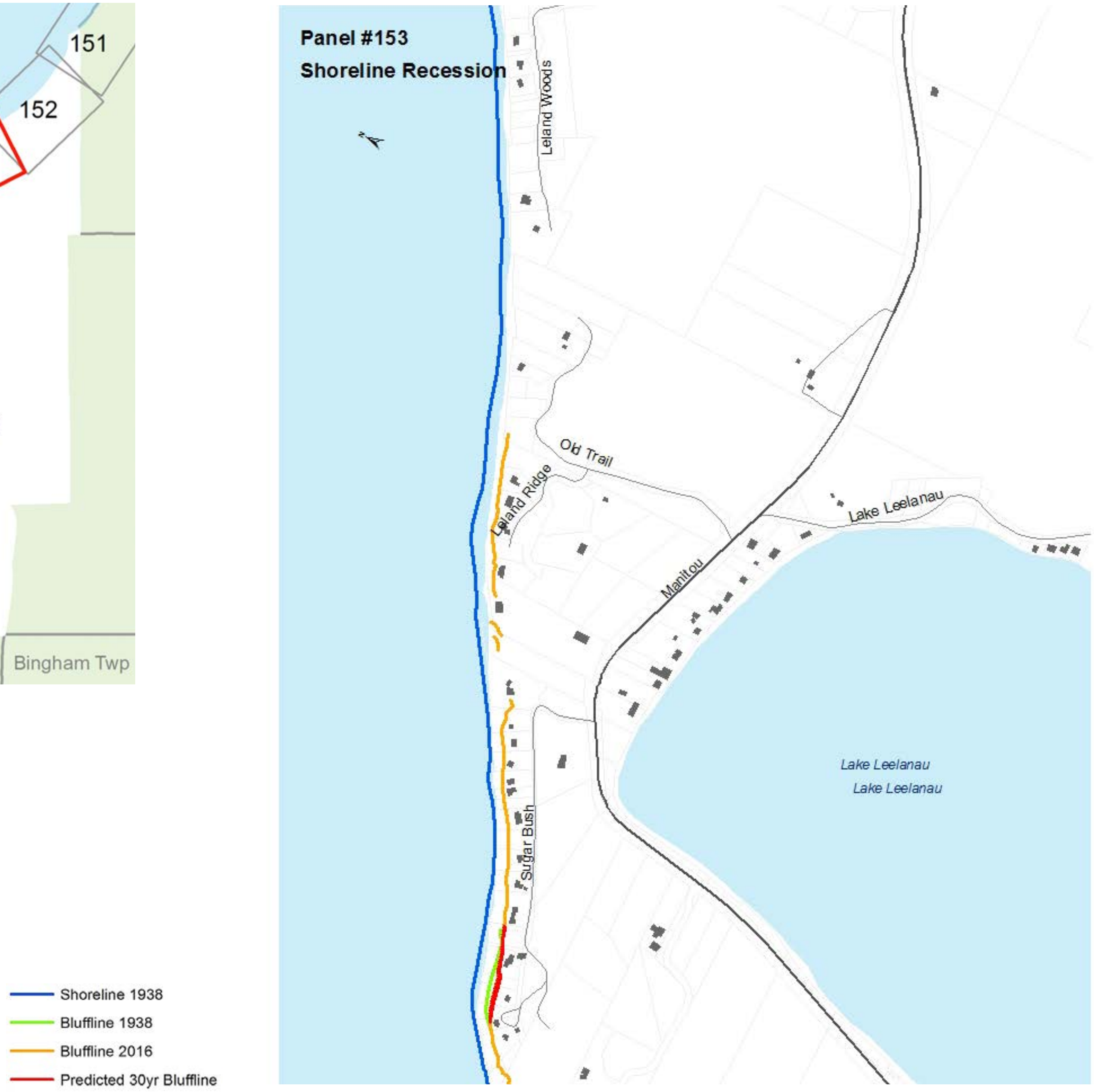
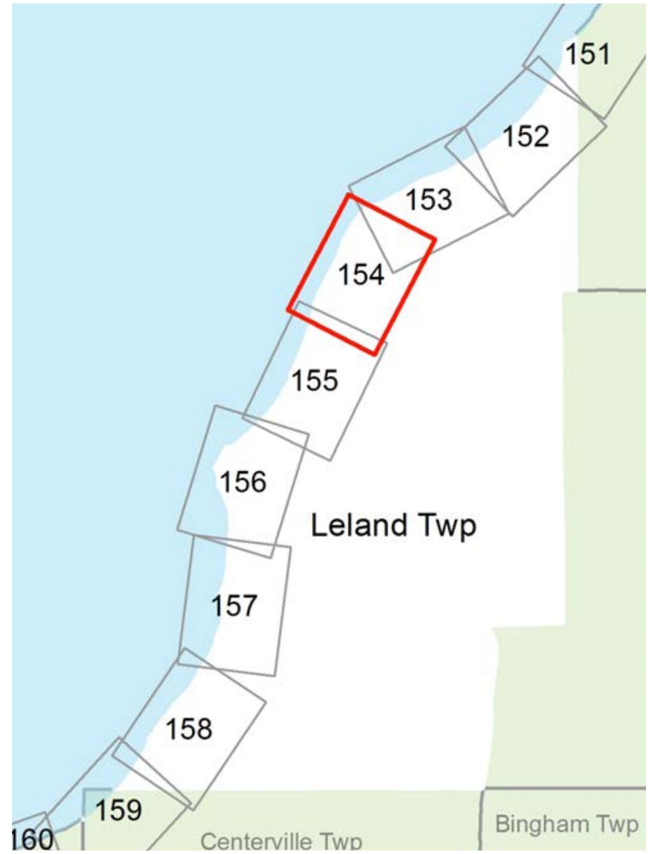
Leland Twp
Centerville Twp
Bingham Twp

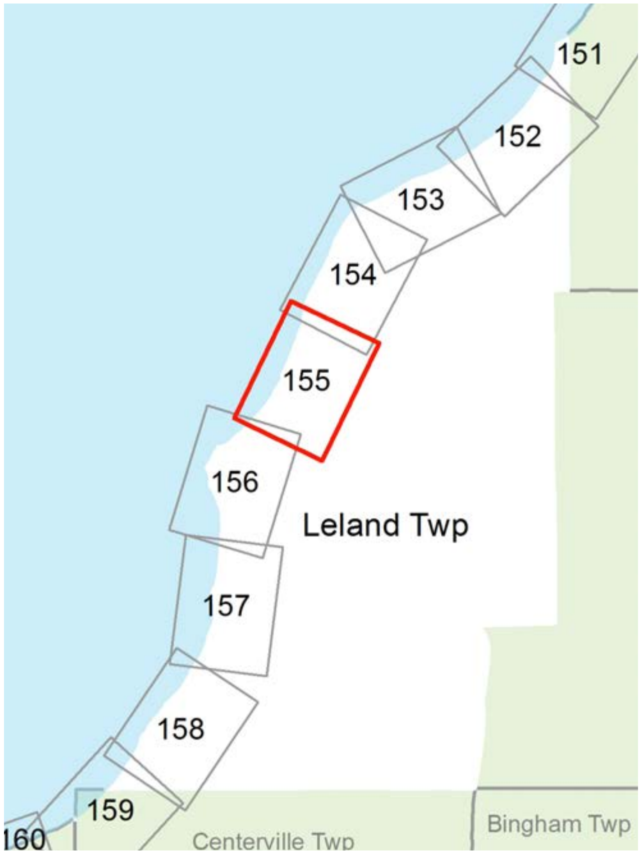
Leelanau County



Panel #153
Shoreline Recession
Leland Woods
Old Trail
Leland Ridge
Lake Leelanau
Manitou
Sugar Bush
Lake Leelanau
Lake Leelanau
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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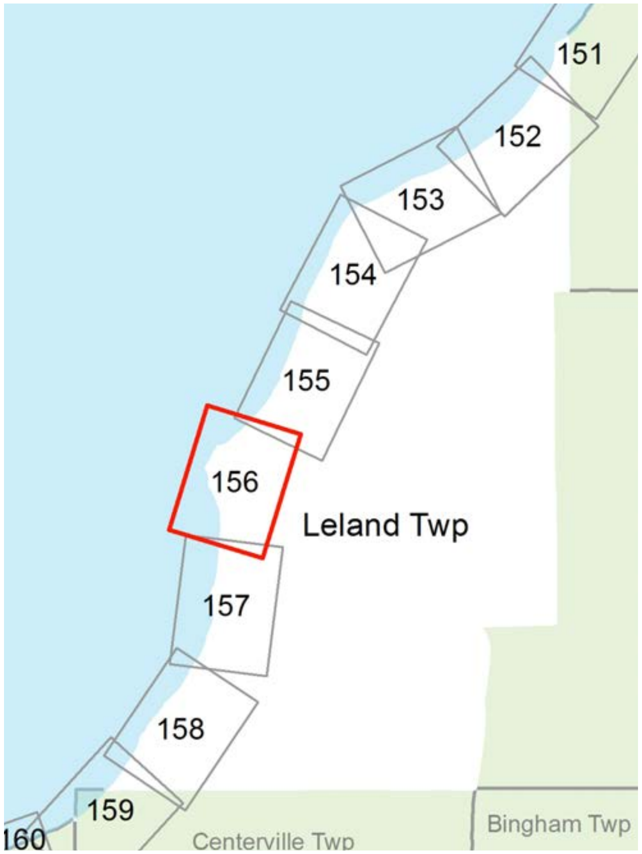
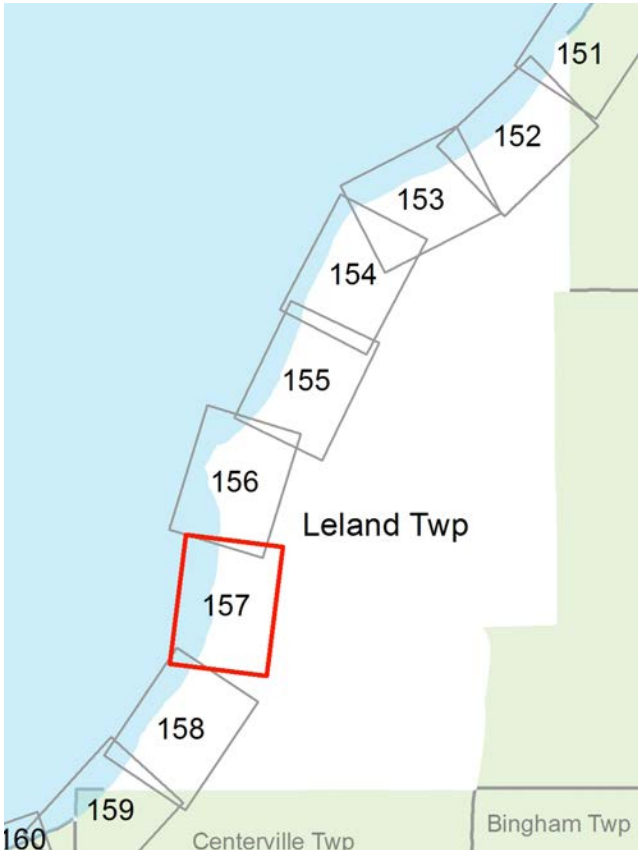
Leland Twp
Centerville Twp
Bingham Twp

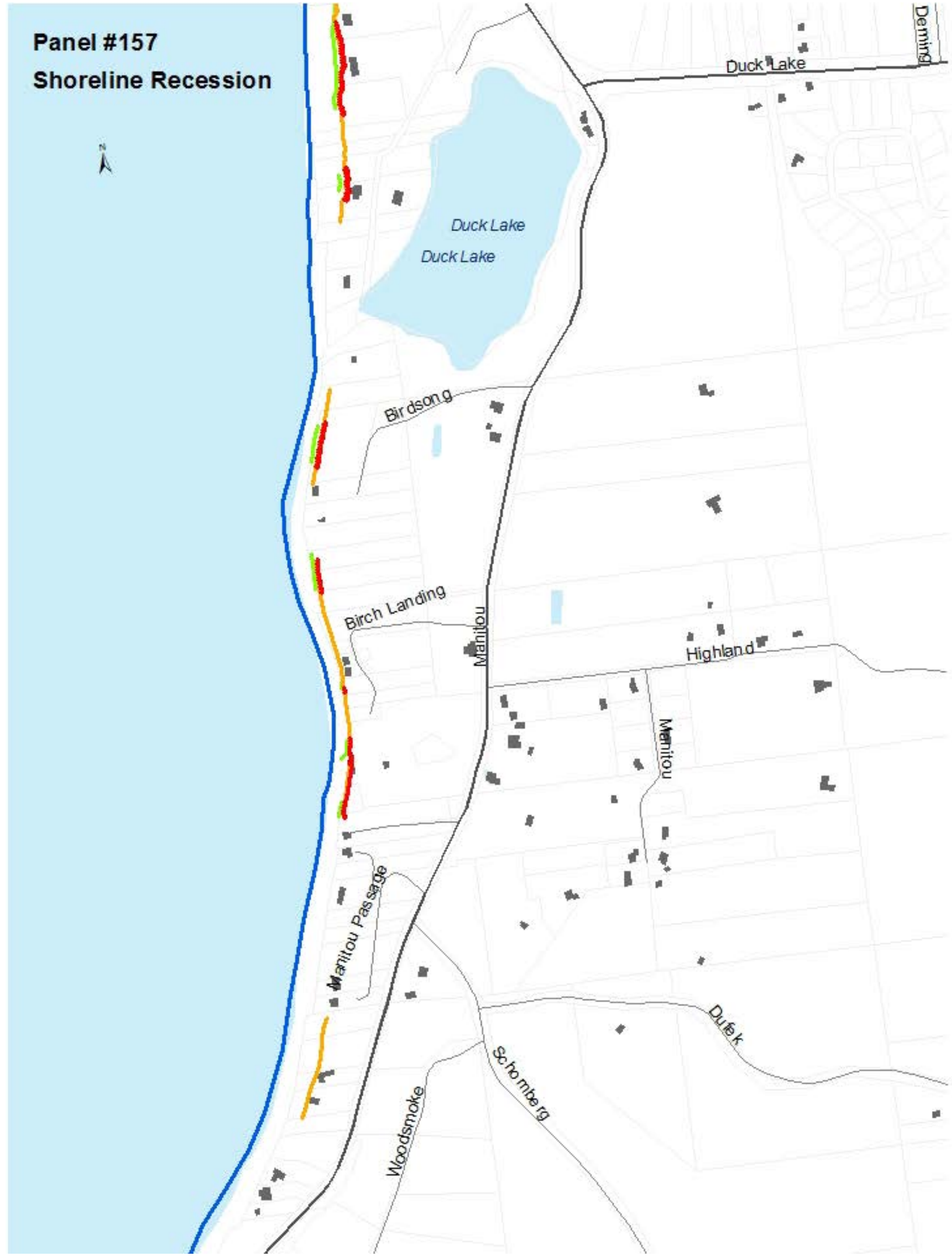

Leelanau County


Panel #155
Shoreline Recession
Lake Leelanau
Lake Leelanau
Lake Leelanau
Lake Leelanau
Leland River
Leland River
Manitou
Shorewood
Golfview
Brooks
Lake
Terrace
Cherry
North
William
William
Church
Main
1st
2nd
Pearl
River
Cedar
Cedar
Grand
5th
Union
Oak
Pine
South
Boulevard
Chandler
Oak
Cummings
Juniper
Edward
Thompson
Matheson
Mill
Reynolds
West
Manitou
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

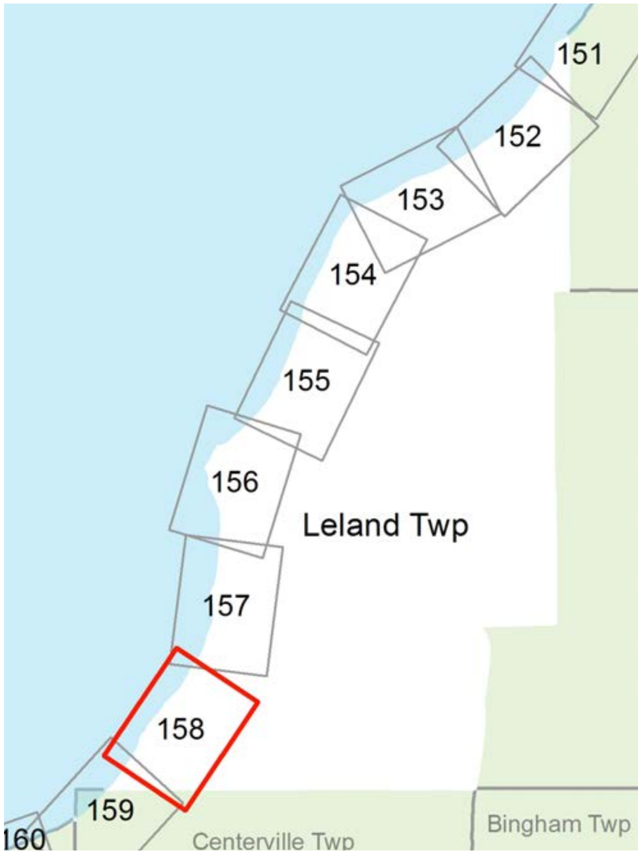


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

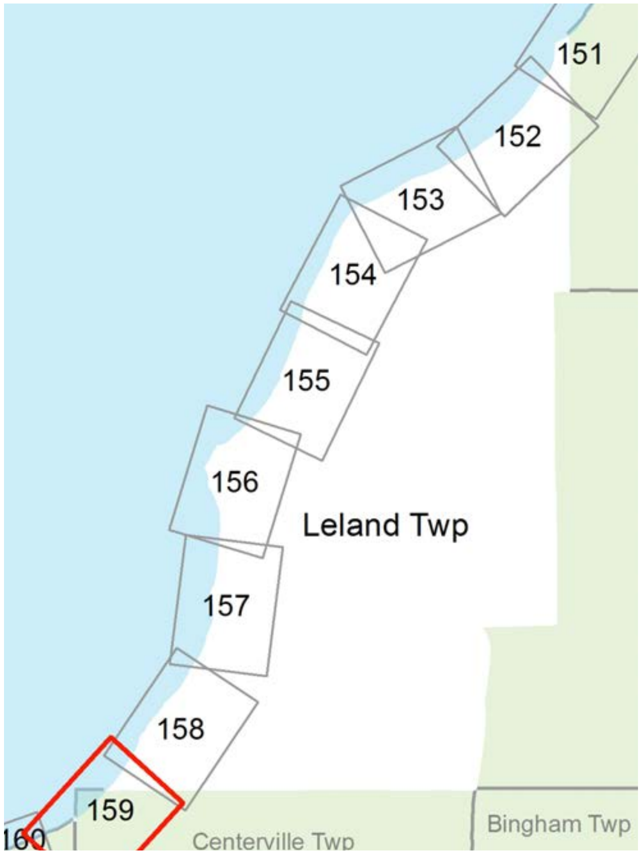




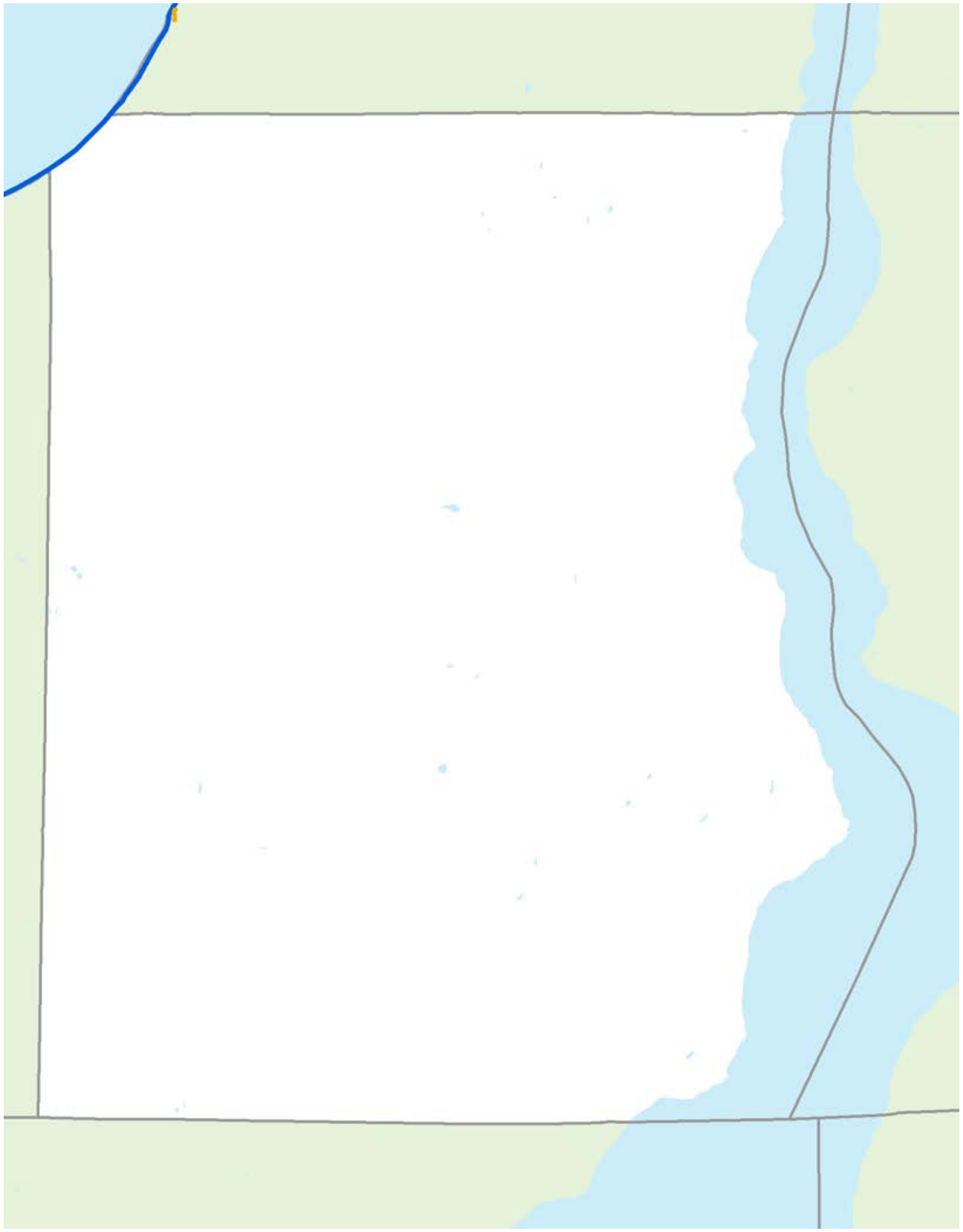
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

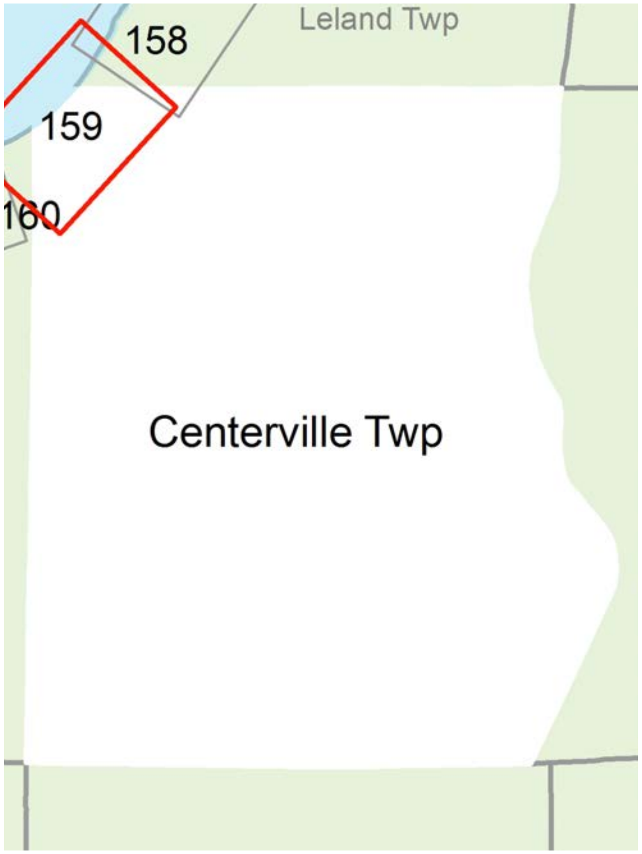


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



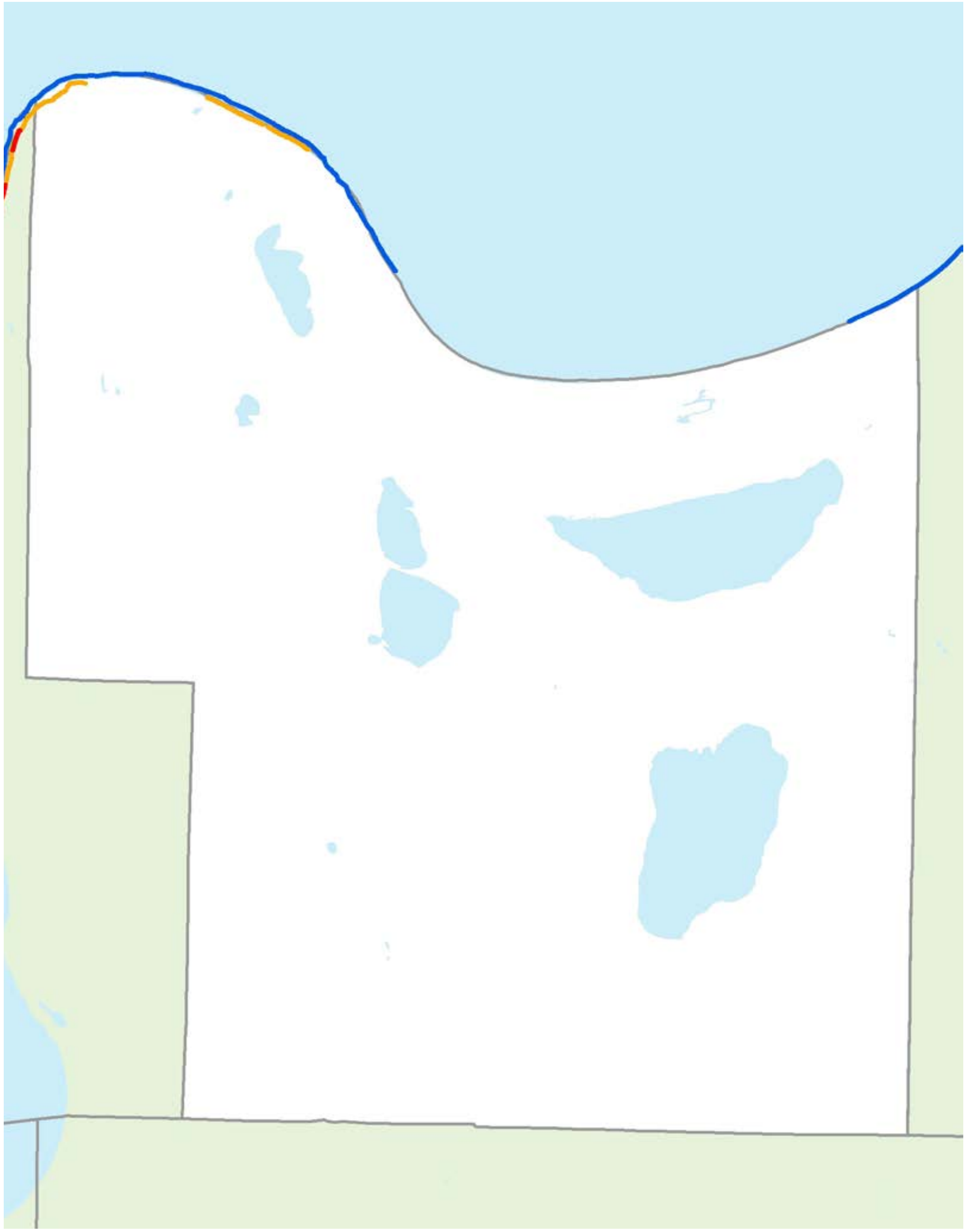
Centerville Twp.

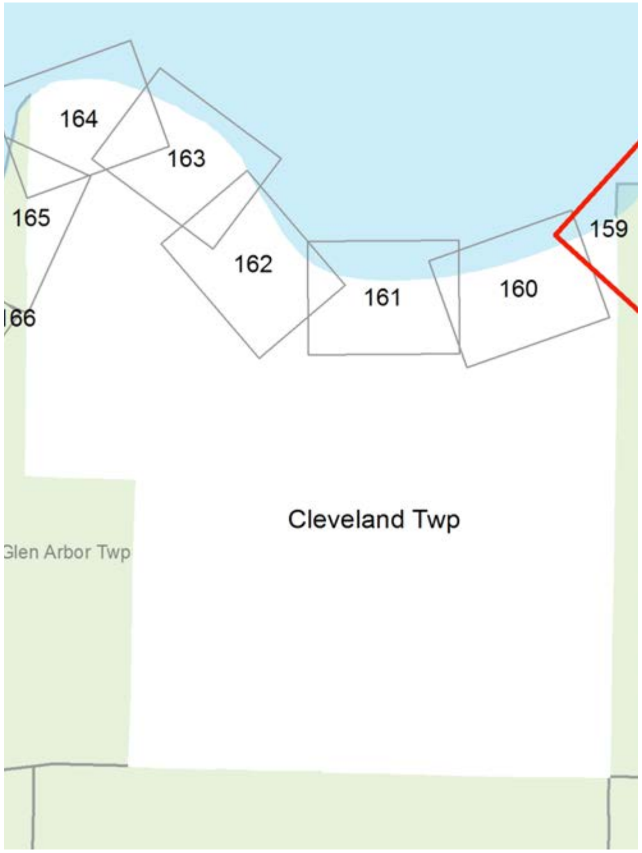
- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline



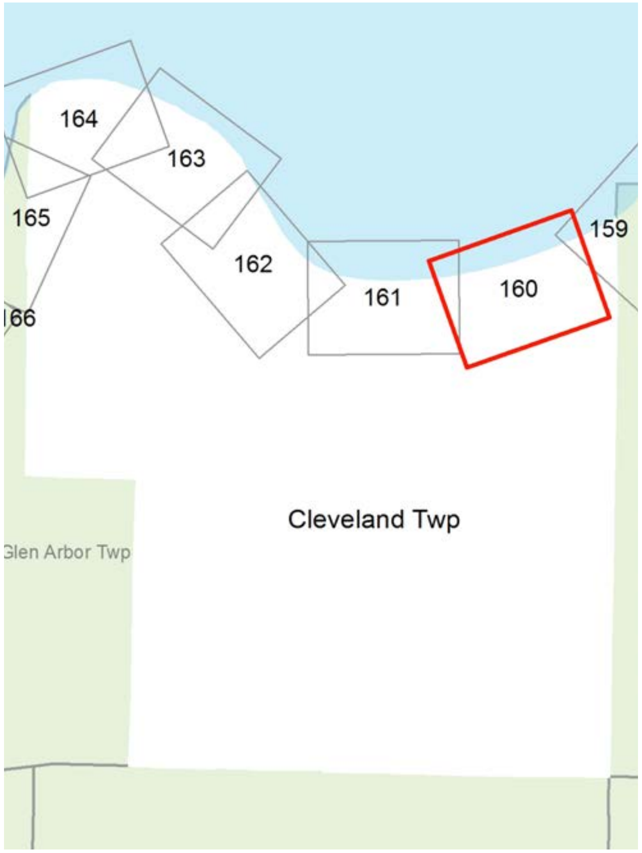
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Cleveland Twp.

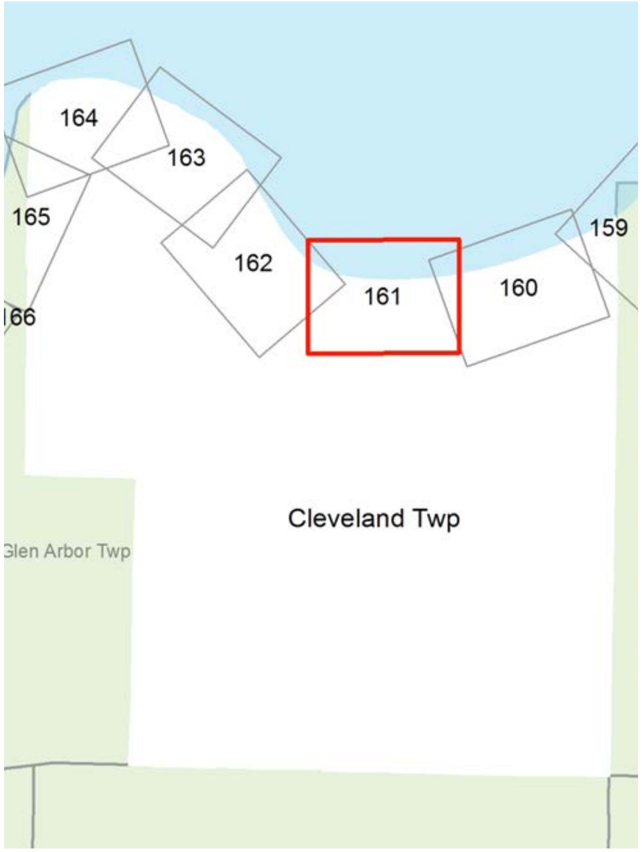




Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


164
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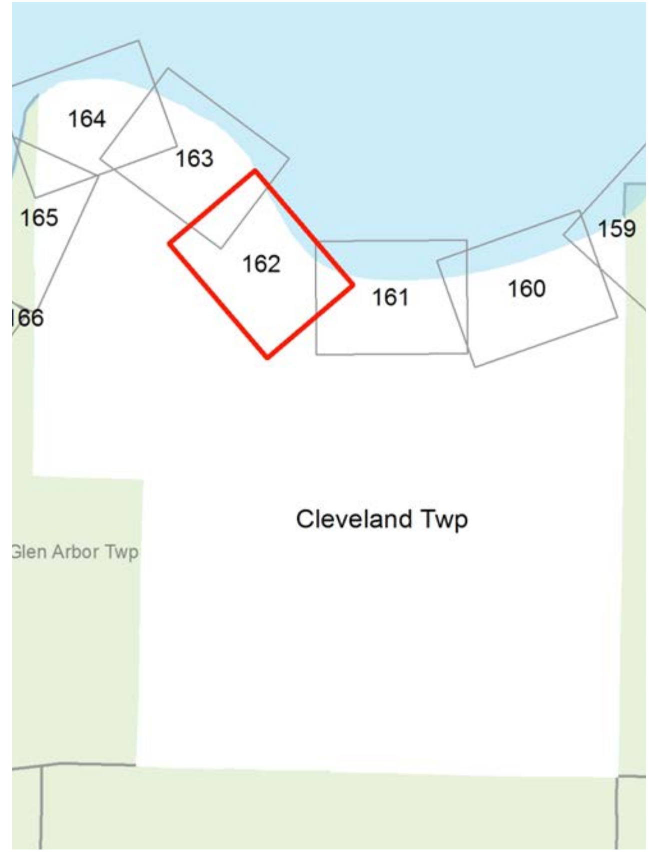
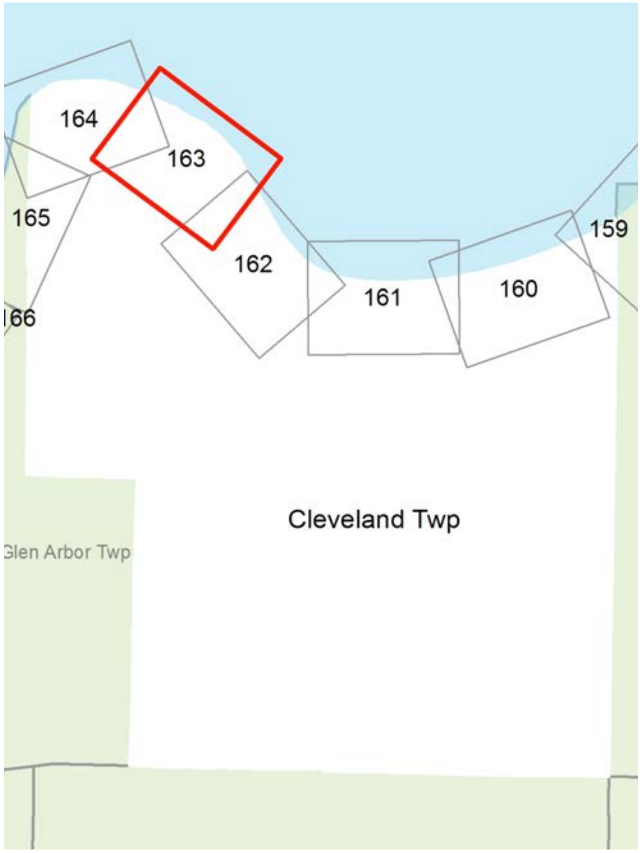
166
Cleveland Twp
Glen Arbor Twp


Leelanau County


Panel #161
Shoreline Recession
Traverse Lake
Lake Michigan
Bohemian
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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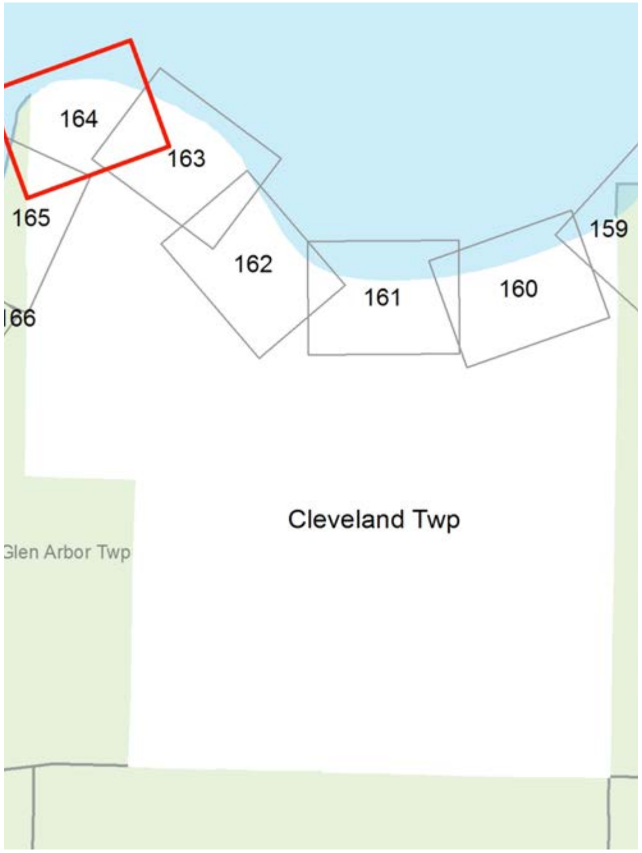
166
Cleveland Twp
Glen Arbor Twp


Leelanau County


Panel #163
Shoreline Recession
Stanz
Elliot
Elliott
Shell Lake
Shell Lake
Lake Michigan
Good Harbor
Hatt Pond
Hatt Pond
Basch
Hidden Lake
Hidden Lake
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #164
Shoreline Recession
Hidden Lake
Hidden Lake
Basch
Cleveland Twp
Glen Arbor Twp
Port Oneida
Baker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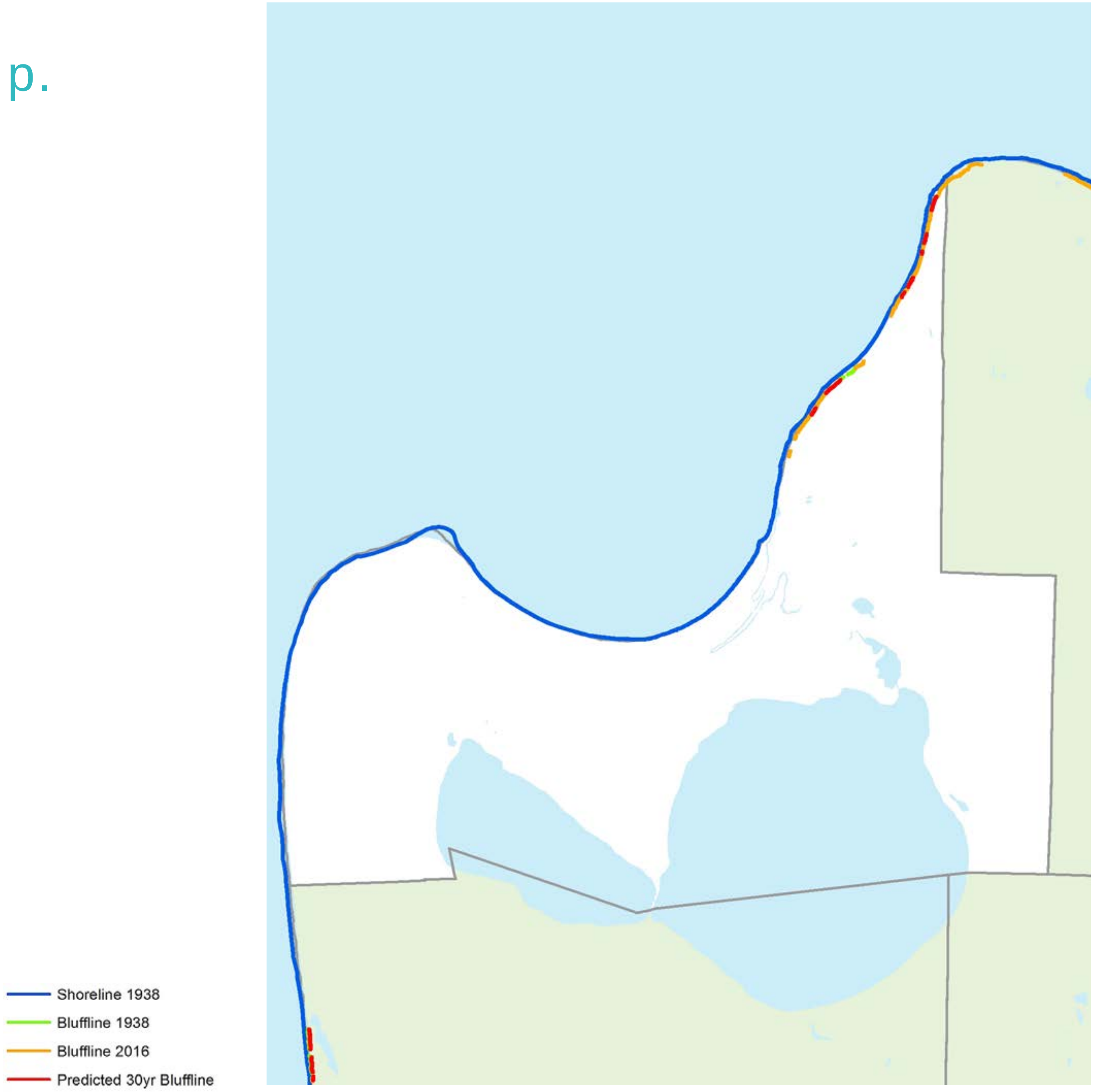
166
Cleveland Twp
Glen Arbor Twp

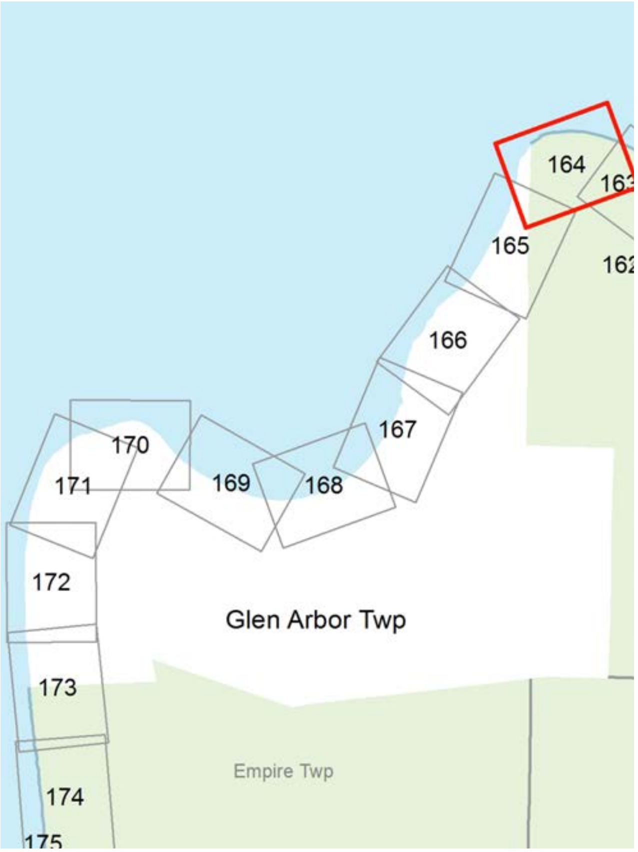

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Leelanau County

Glen Arbor Twp.




Panel #164
Shoreline Recession
Hidden Lake
Hidden Lake
Basch
Cleveland Twp
Glen Arbor Twp
Port Oneida
Baker


164
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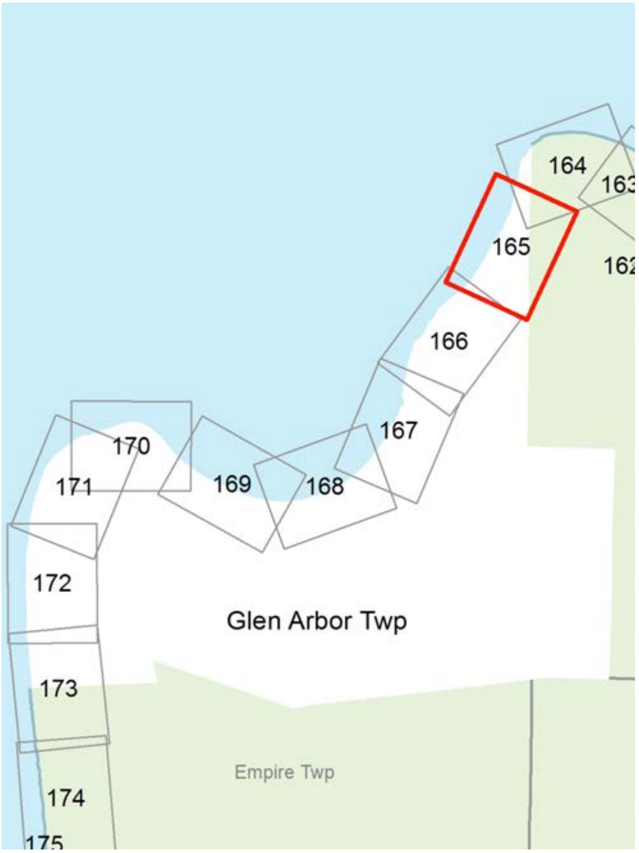
175
Glen Arbor Twp
Empire Twp


Leelanau County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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Glen Arbor Twp
173
Empire Twp
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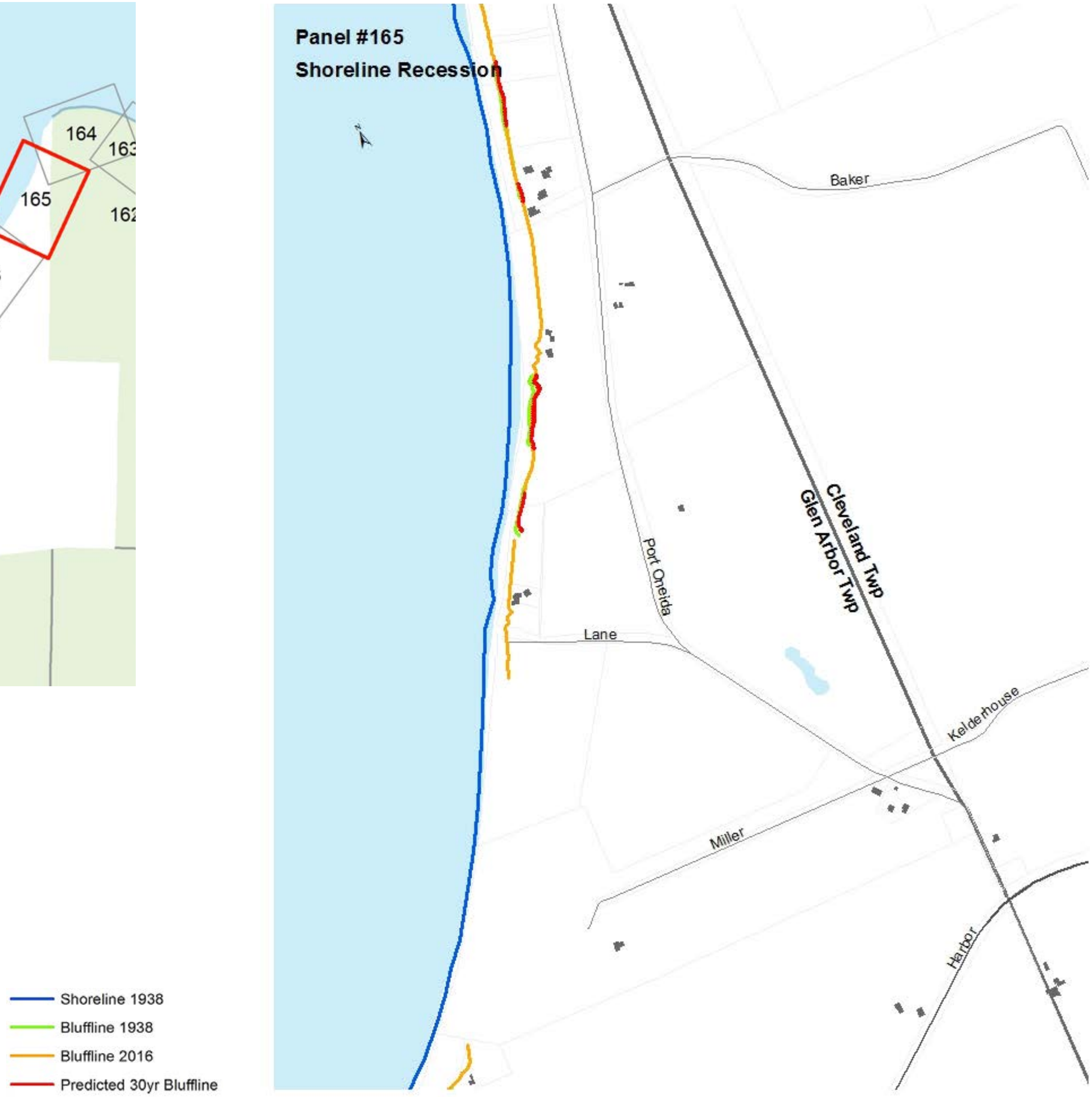
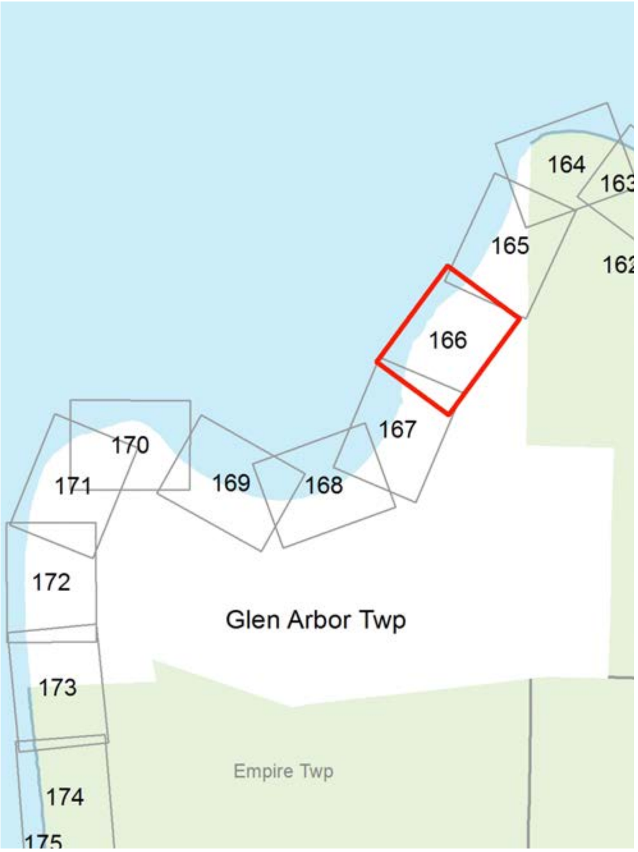
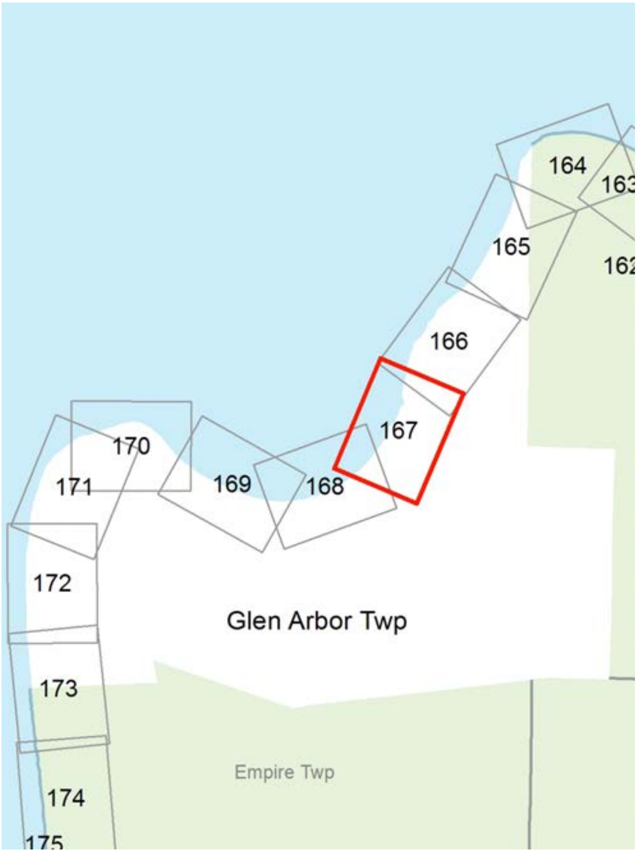
175


Leelanau County

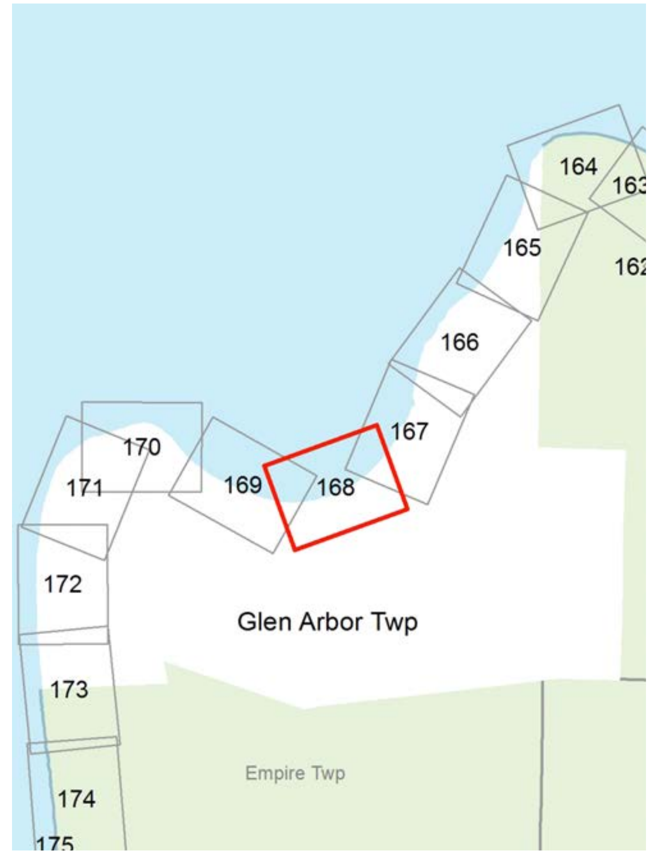

Panel #165
Shoreline Recession
Baker
Port Oneida
Lane
Cleveland Twp
Glen Arbor Twp
Kelderhouse
Miller
Harbor
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



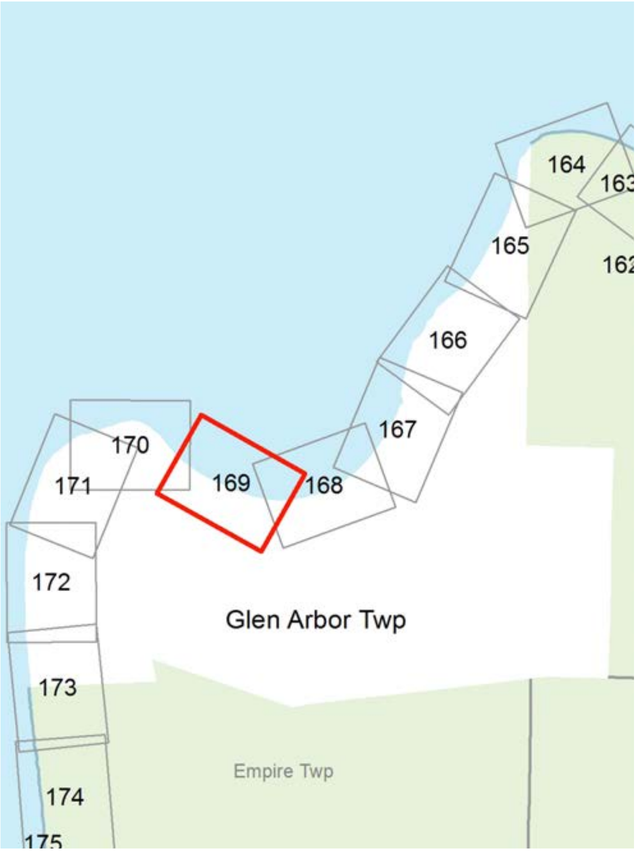
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



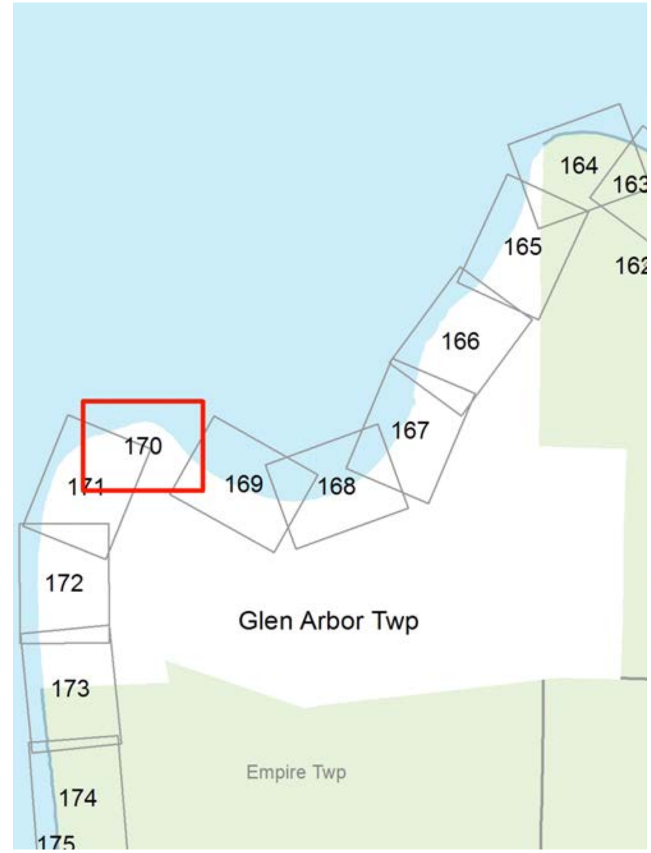
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



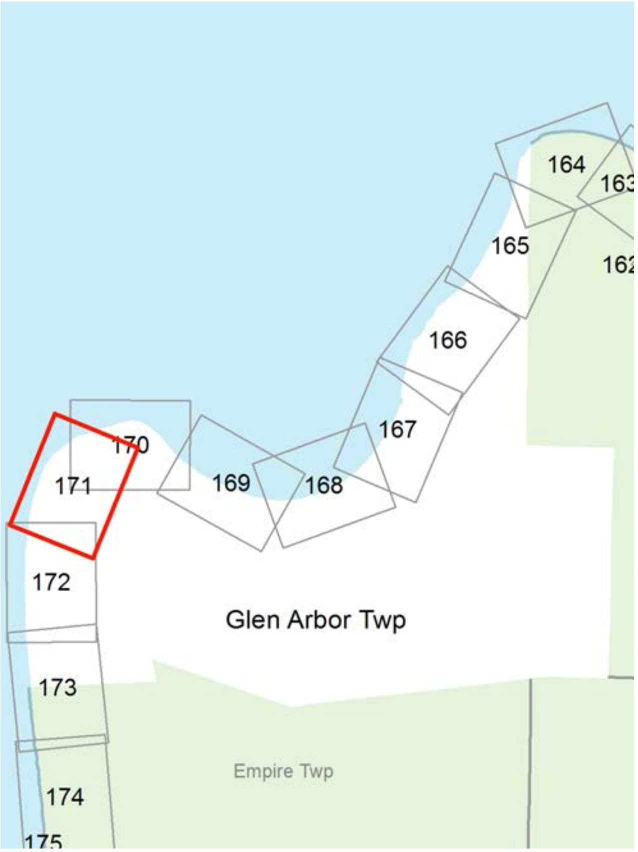
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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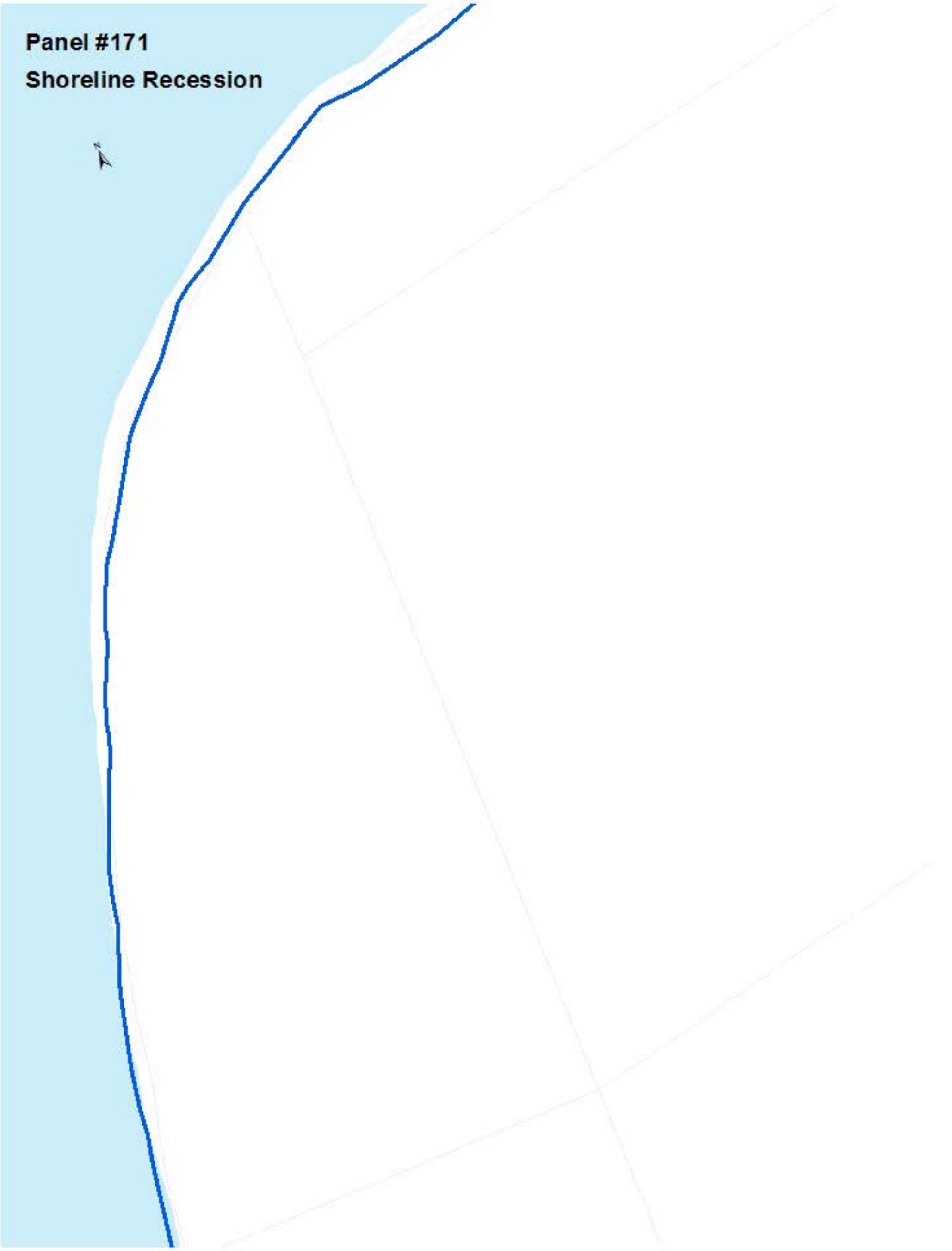
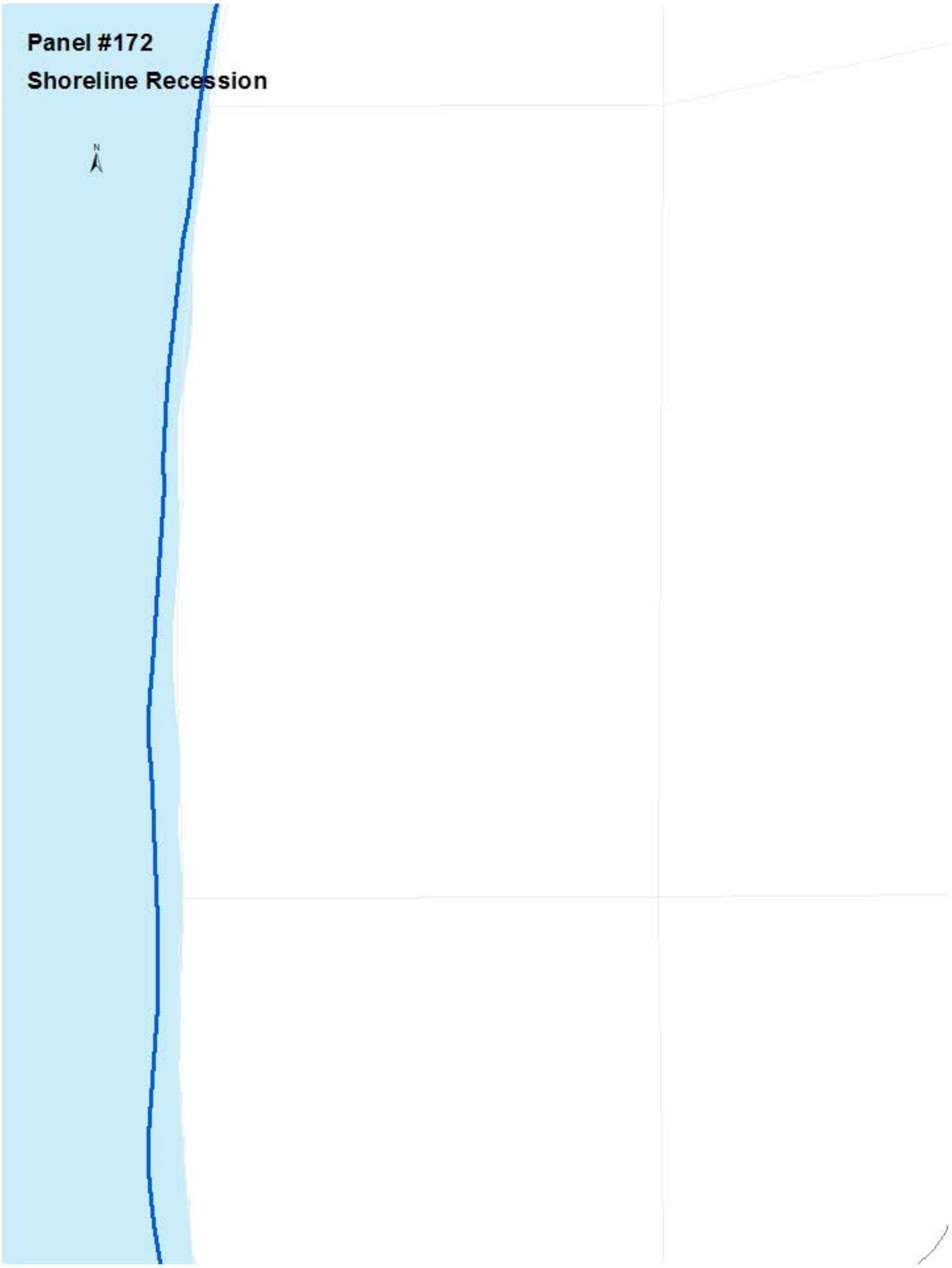
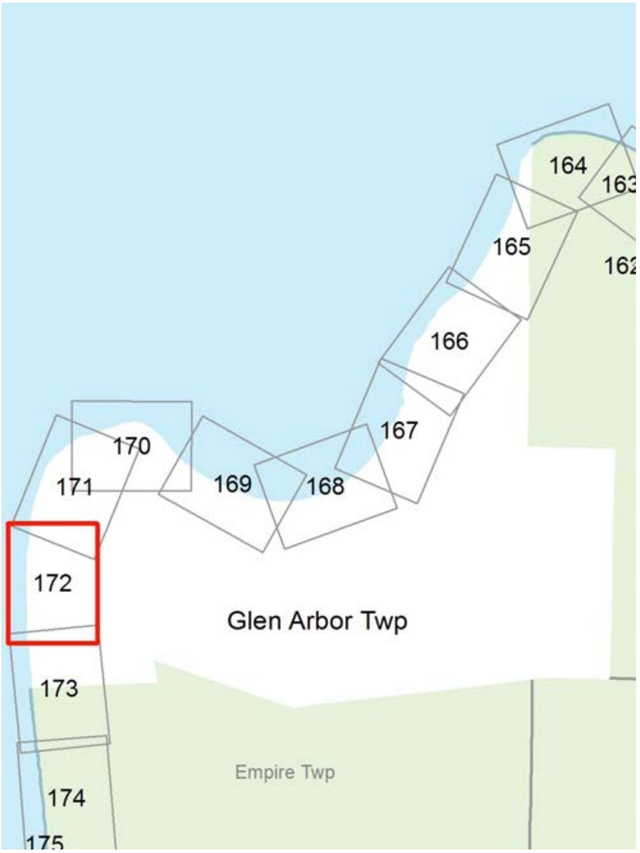
168
172
Glen Arbor Twp
173
Empire Twp
174
175


Leelanau County

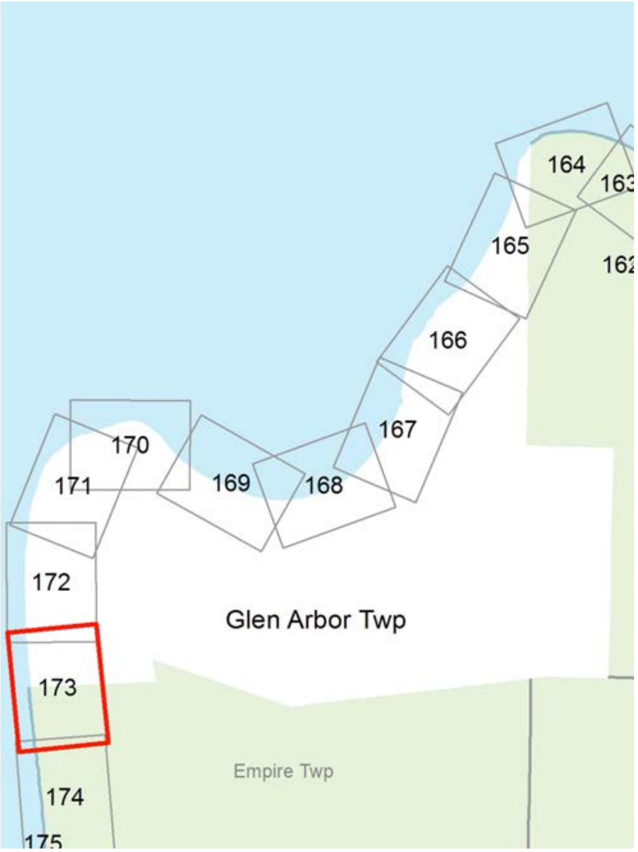

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #171
Shoreline Recession





Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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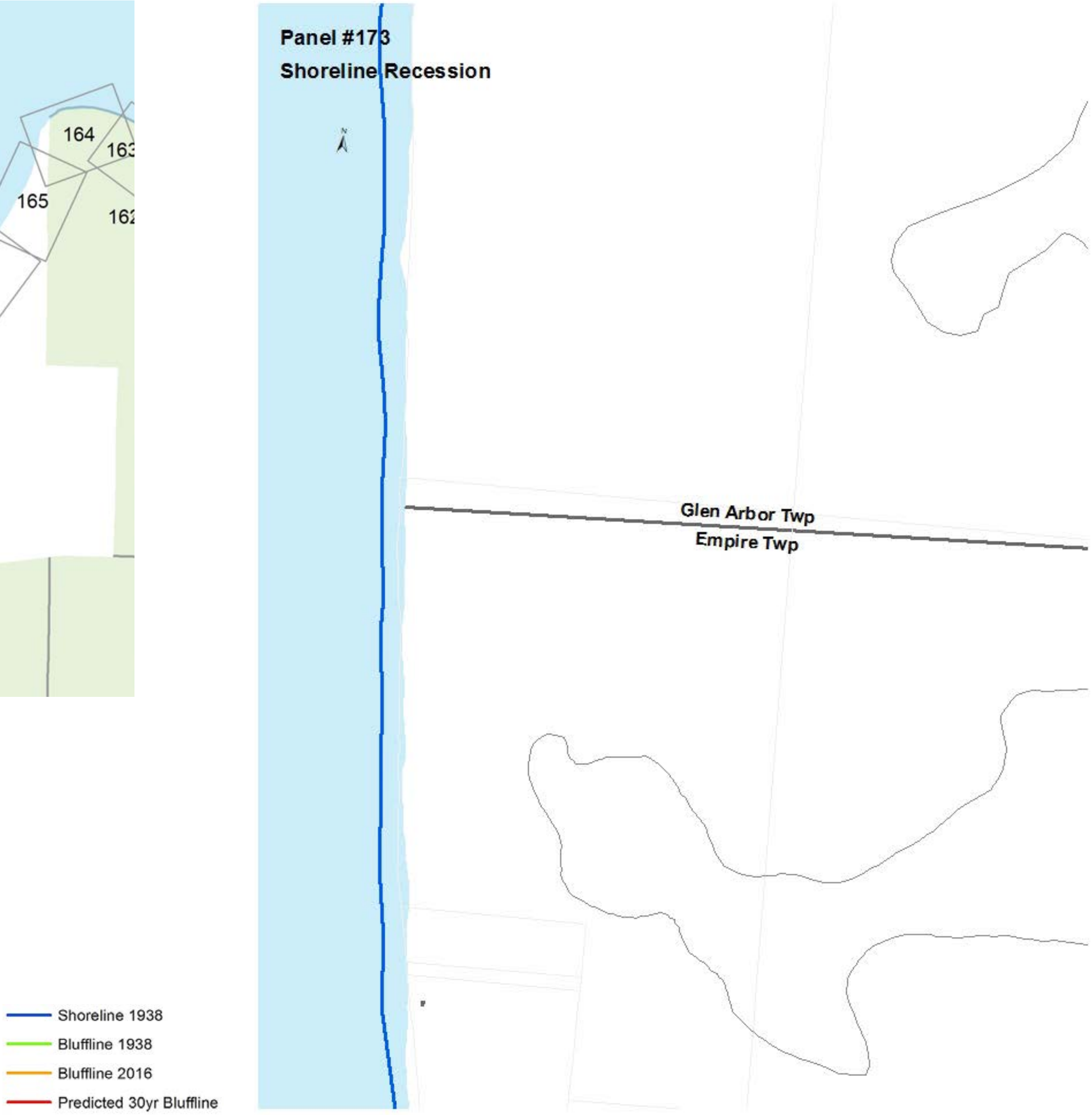
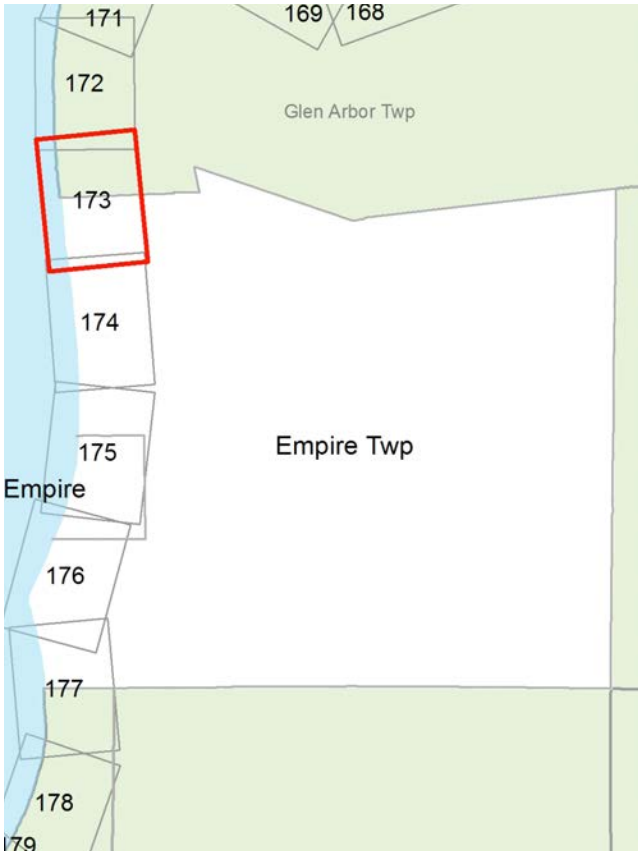
168
172
Glen Arbor Twp
173
Empire Twp
174
175

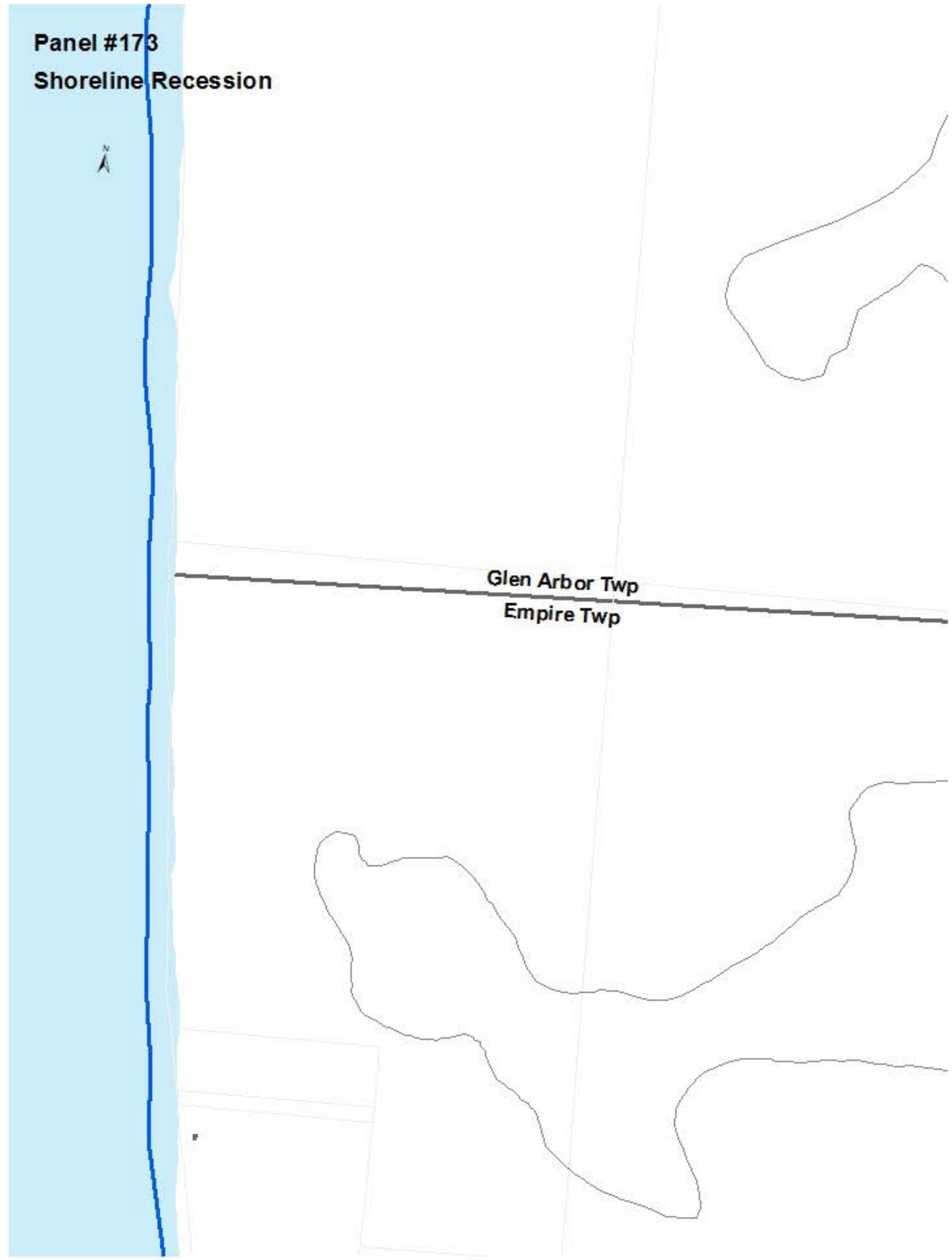

Leelanau County


Panel #173
Shoreline Recession
Glen Arbor Twp
Empire Twp
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

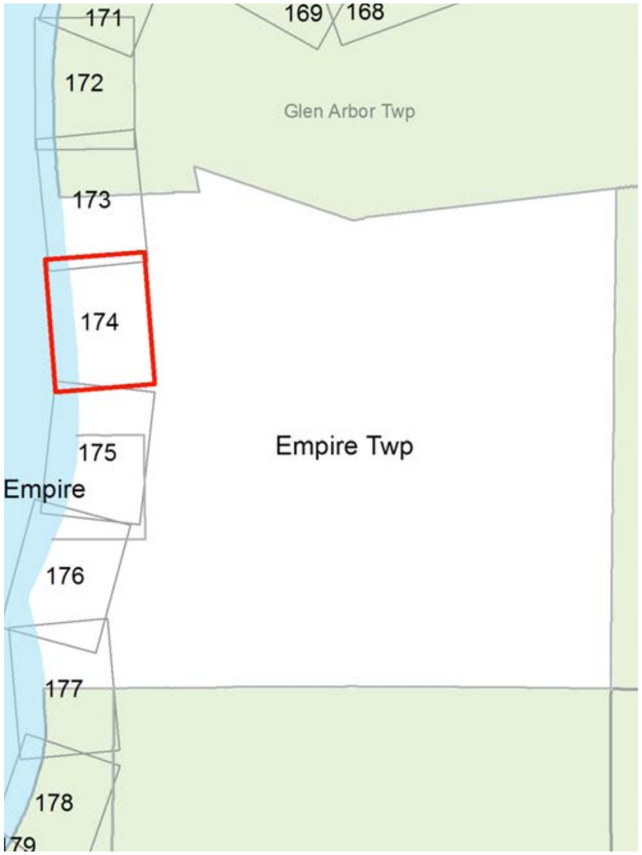
Empire Twp./Empire

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





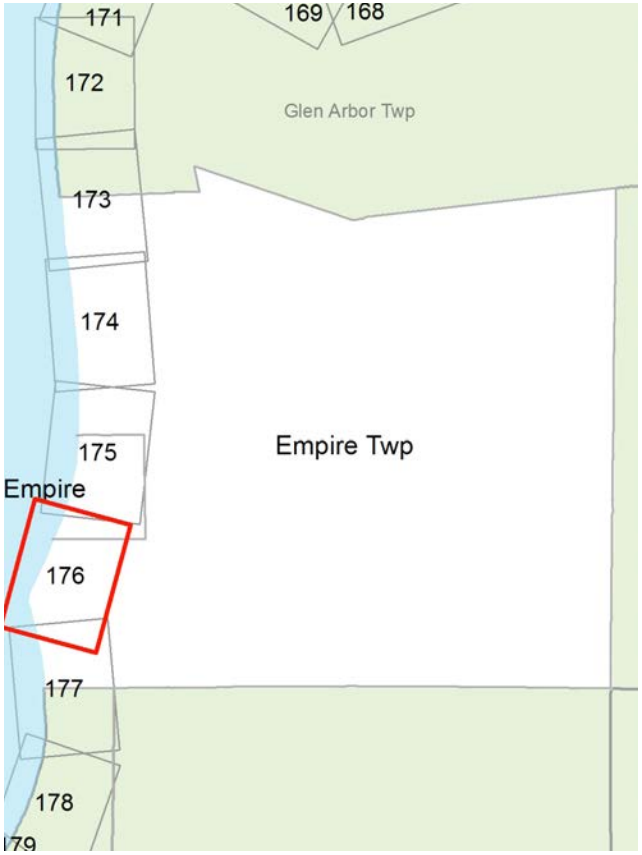
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

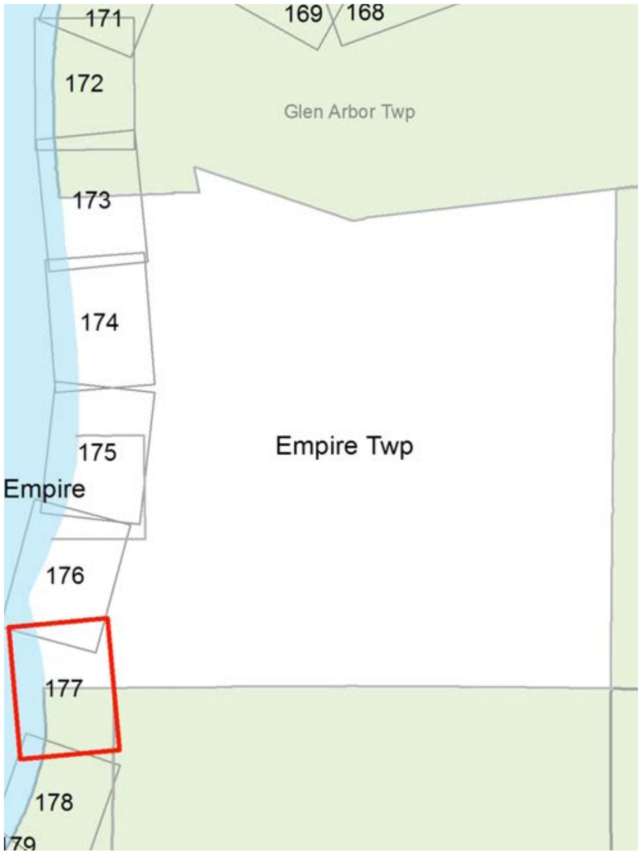
171
169
168
172
Glen Arbor Twp
173
174
175
Empire
Empire Twp
176
177
178
179
Leelanau County
Panel #175
Shoreline Recession
Voice
Windsong
La Core
Friend
Roberts
Empire Twp
Empire
Florence
Lake Michigan
South Bar Lake
South Bar Lake
Park
Fisher
Ottawa
Reynolds
Salisbury
Phillip
Leelanau
Sunset
Crescent
Lambkin
Union
Niagara
Niagara
Niagara
LaRue
Front
Empire
Wilce
Pokagon
Erie
Fillby
Watch Hill
Storm Hill
Lake
Wilce
Michigan
Michigan
Ontario
Roen
LaCore
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #176
Shoreline Recession
Storm Hill
Orchard Hill
Aylsworth
Washington
Wood LaCore
Pitch Apple
Lake
Empire
Empire Twp
Wilco
Wisniewski
Treat


171
169
168
172
Glen Arbor Twp
173
174
175
Empire Twp
Empire
176
177
178
179


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Leelanau County


171
169
168
172
Glen Arbor Twp
173
174
175
Empire Twp
Empire
176
177
178
179

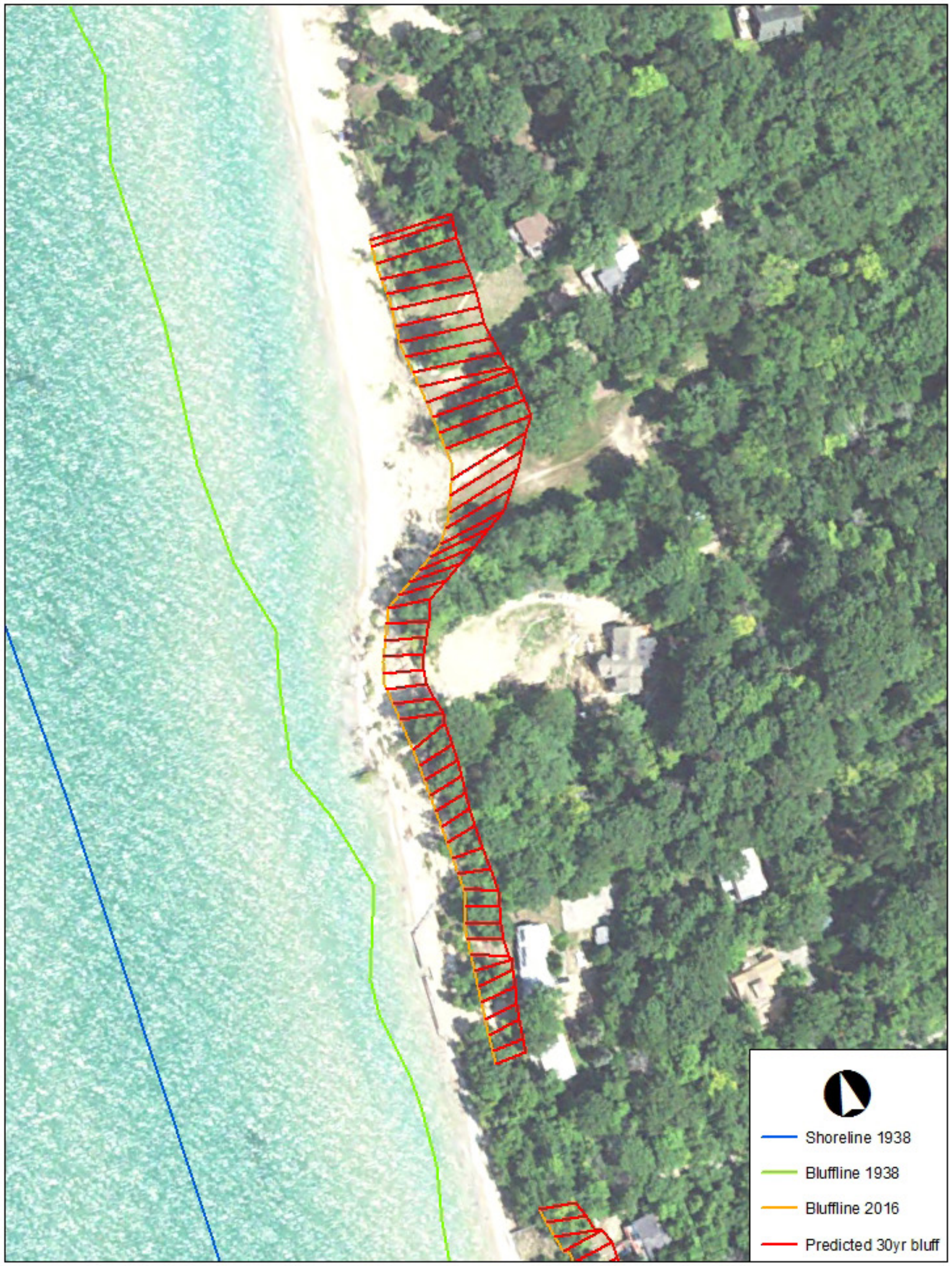

Leelanau County


Panel #177
Shoreline Recession
Empire Twp
Lake Twp
Aral Hills
Aral
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Benzie County

Bluff Detail, Panel 185, Lake Twp.

Bluff Detail, Panel 187, Crystal Lake Twp.

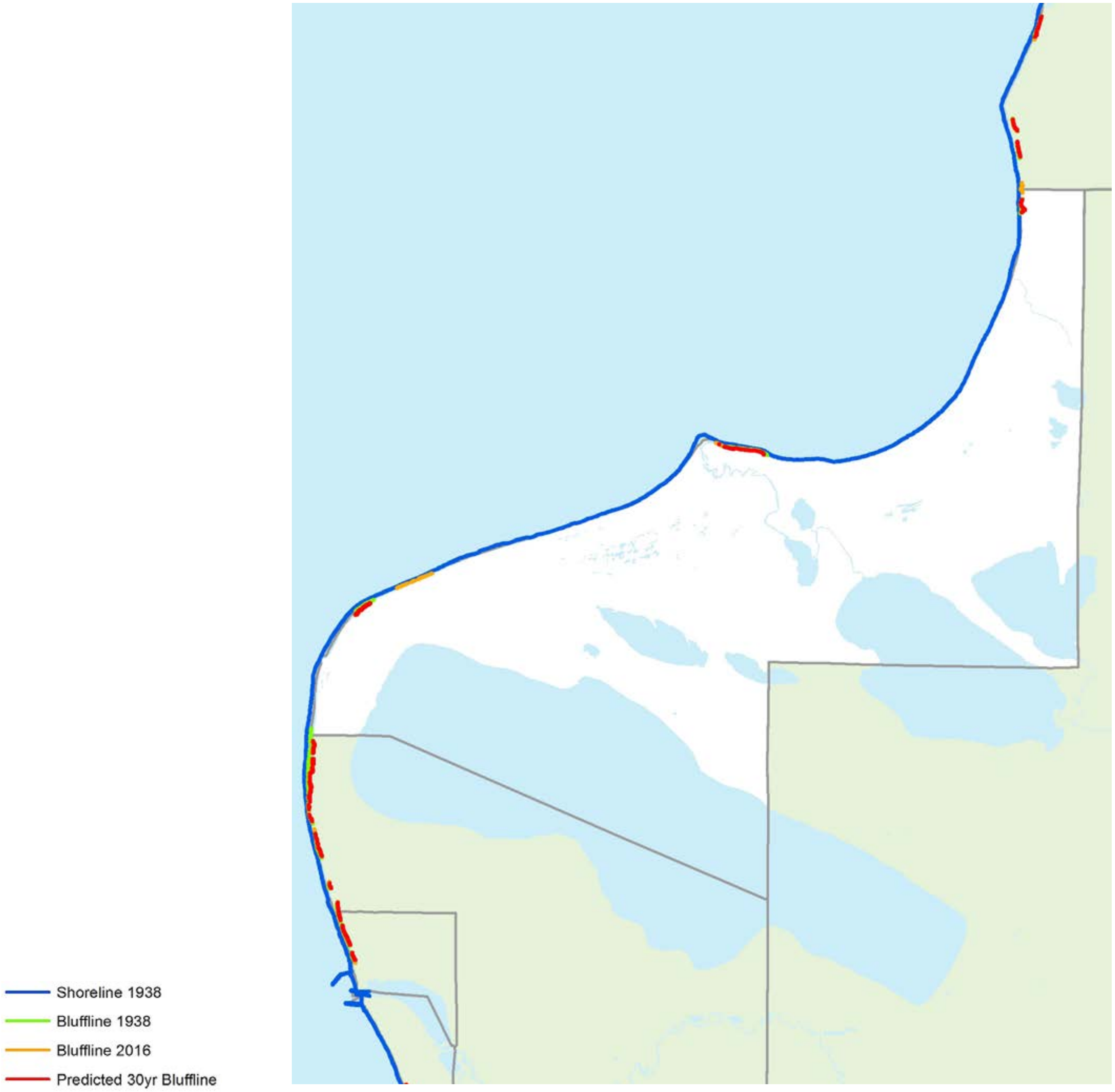


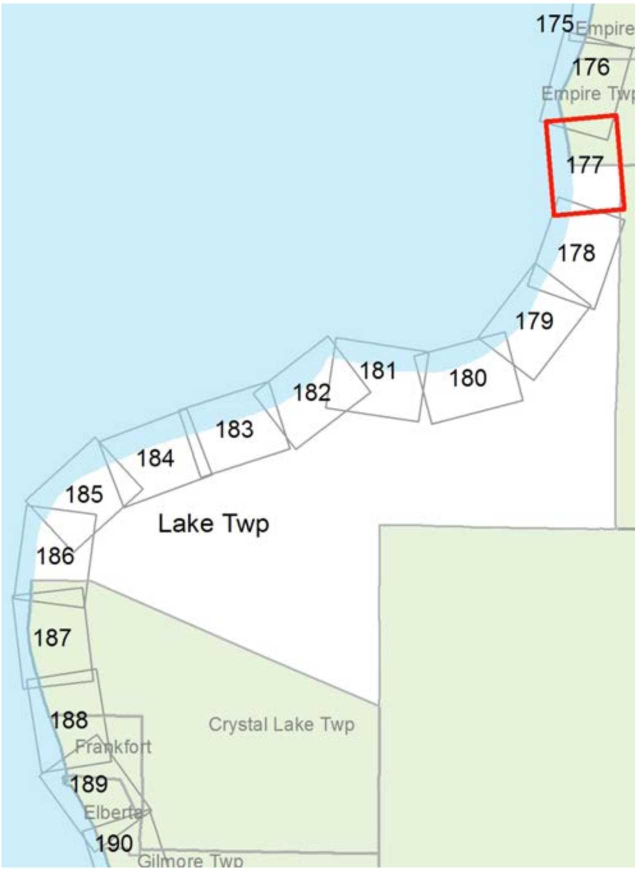
Bluff Detail, Panel 187, Crystal Lake Twp.

Bluff Detail, Panel 188, Frankfort

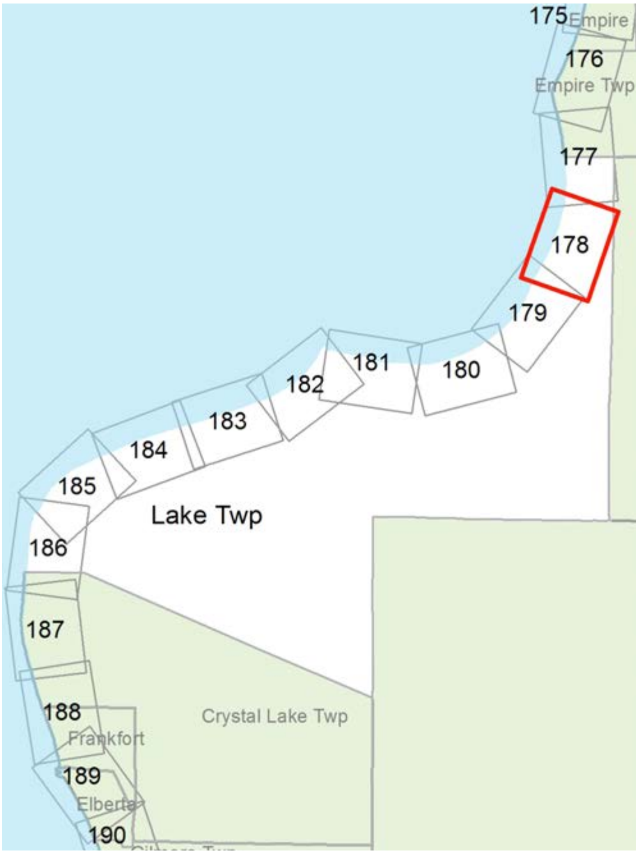
Lake Twp.


Benzie County

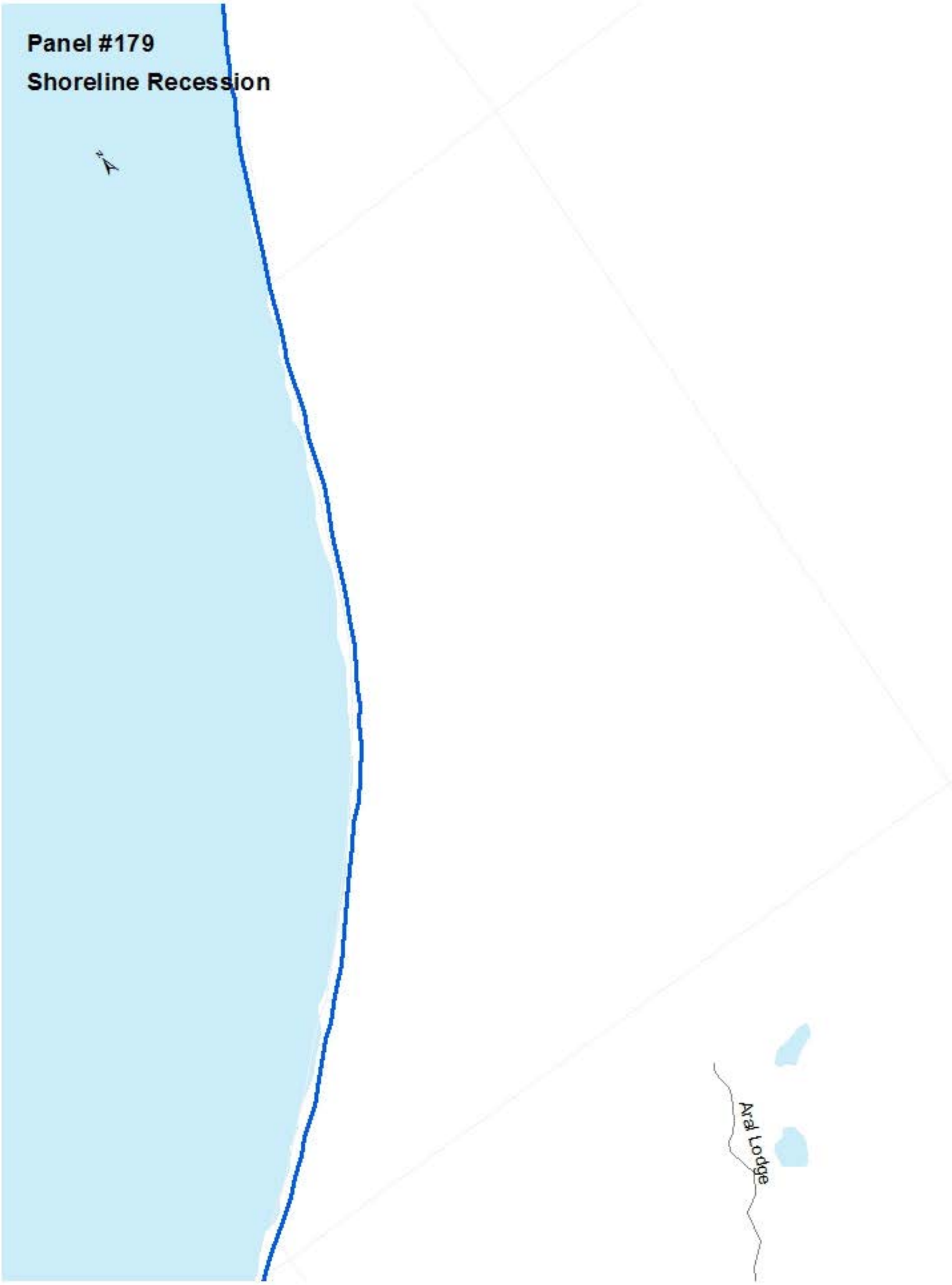

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

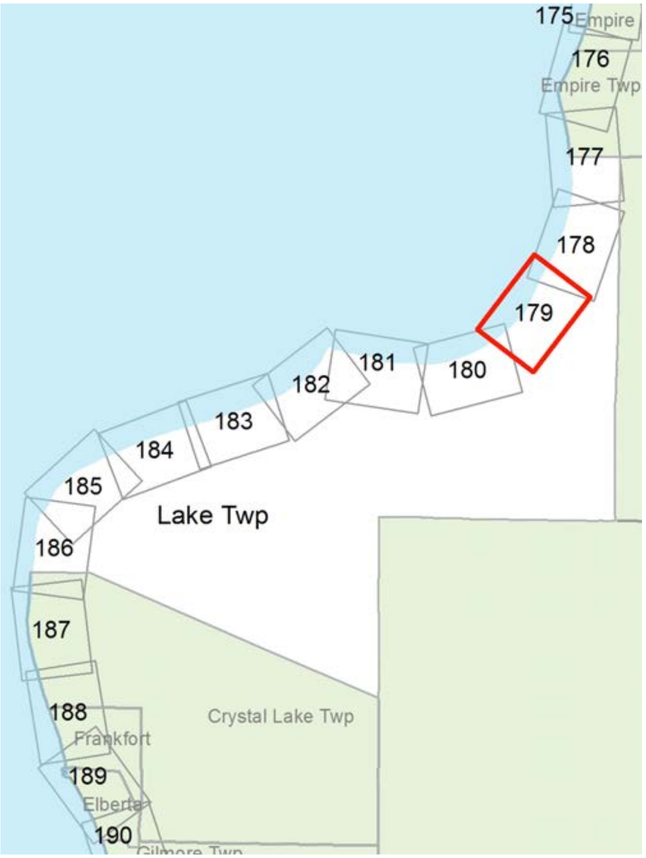


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

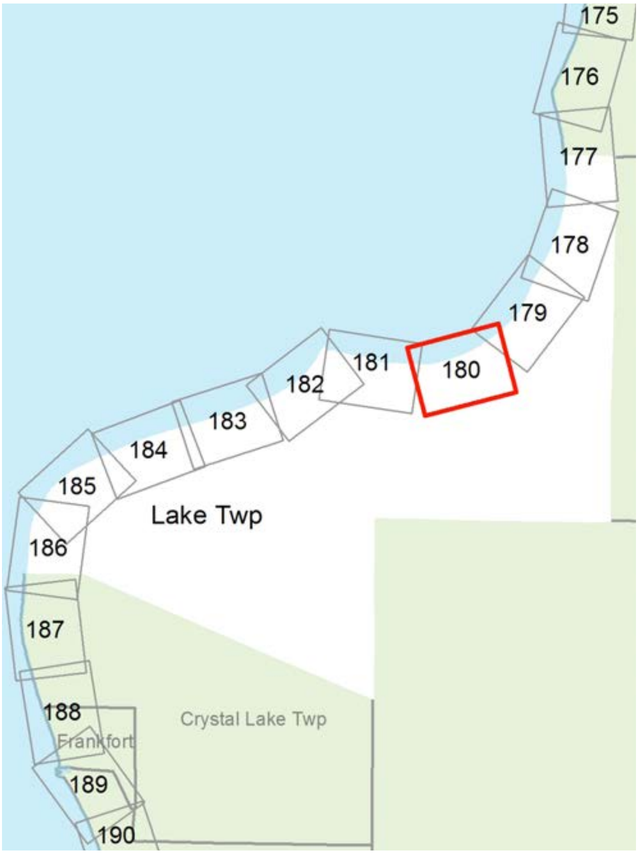


- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline

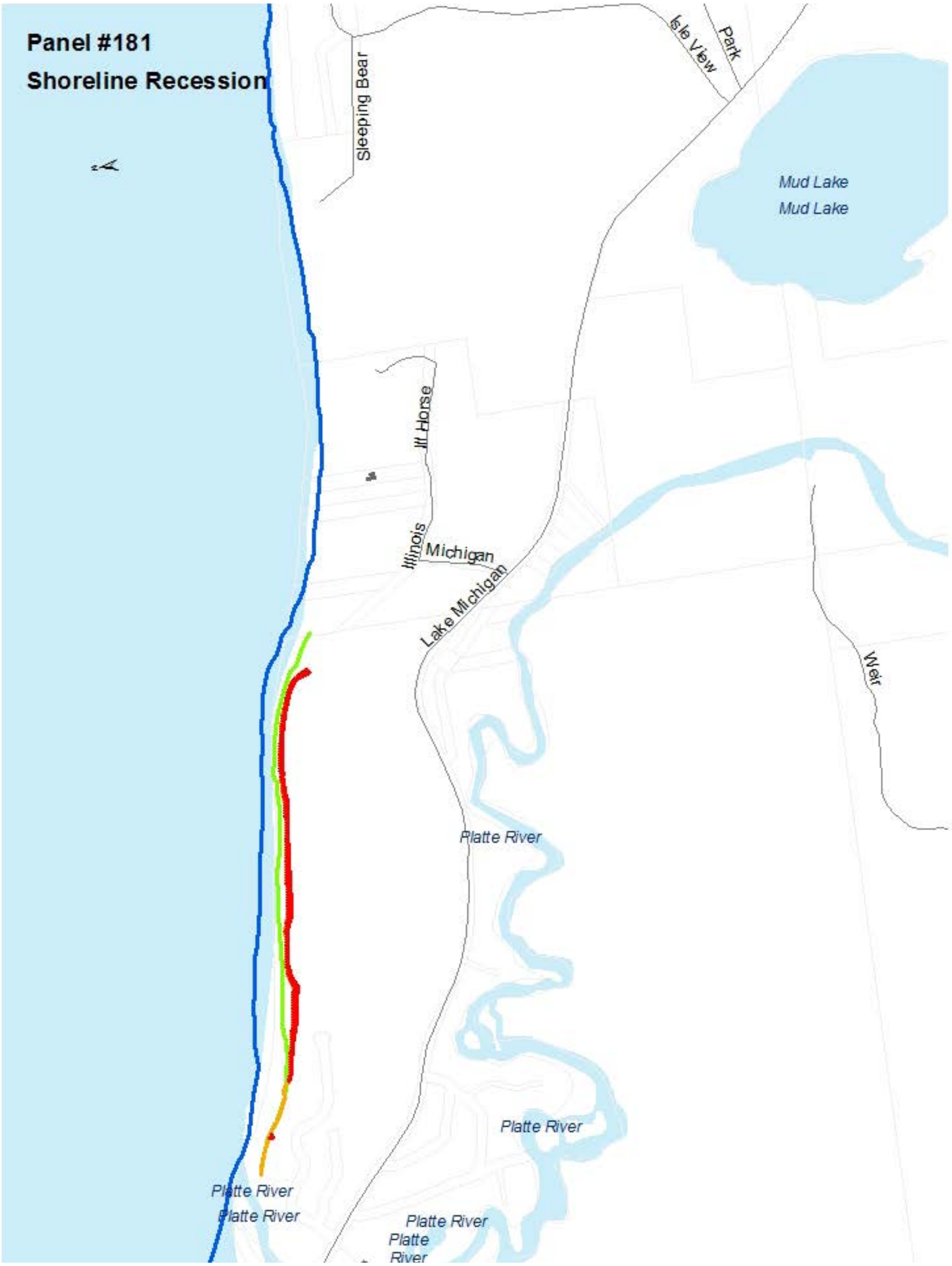


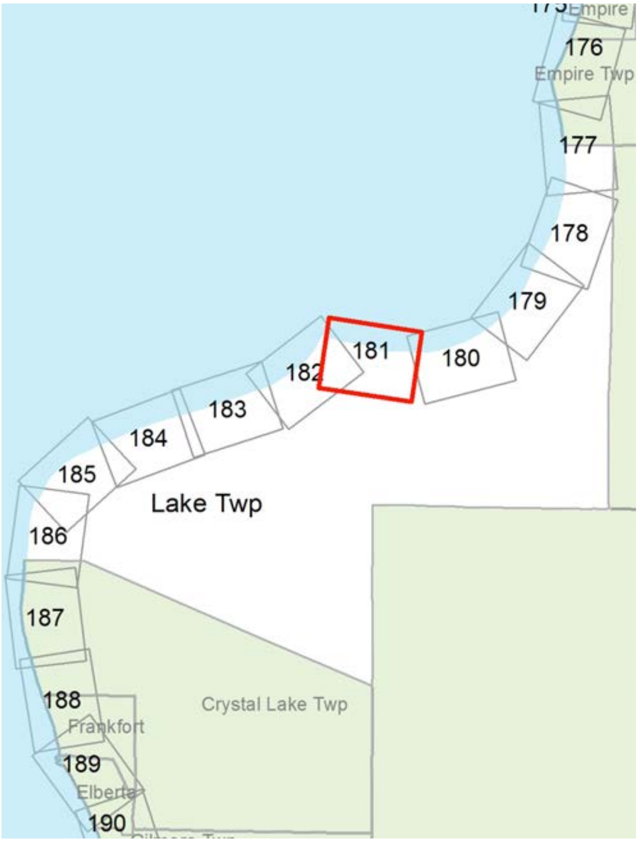


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

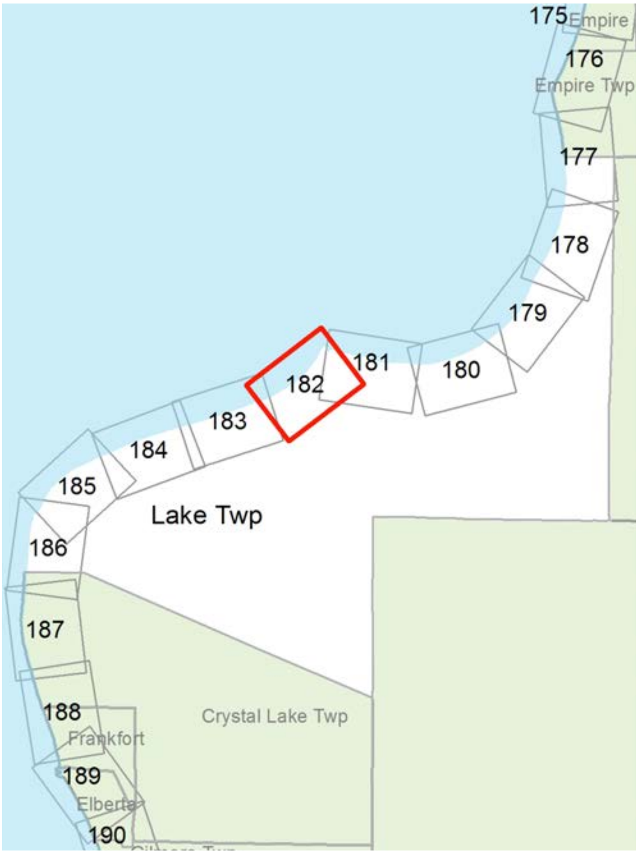


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

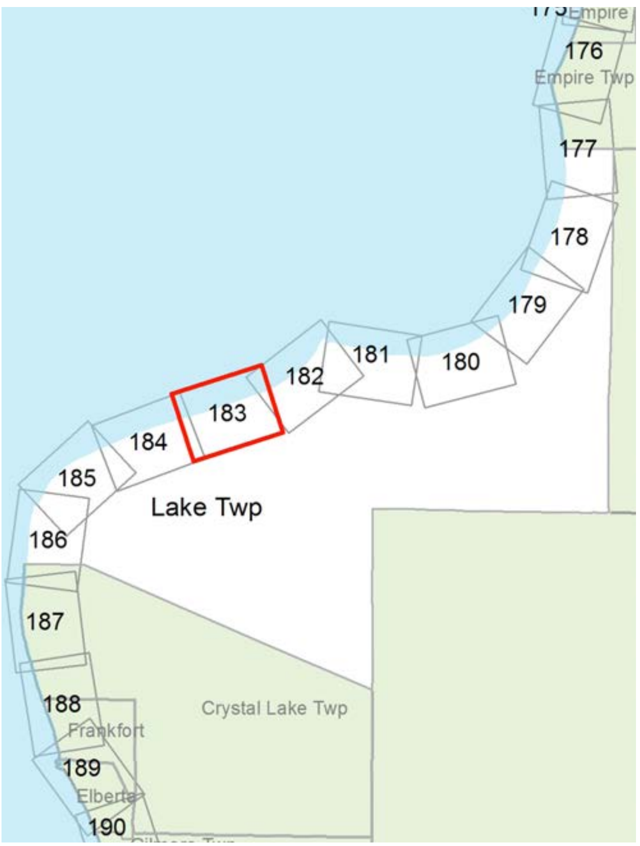




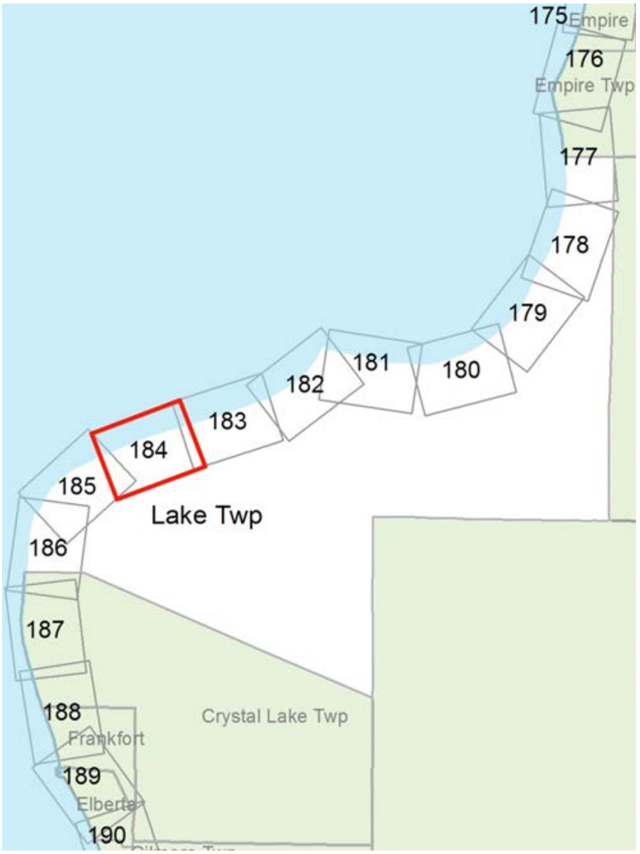
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


175
Empire
176
Empire Twp
177
178
179
180
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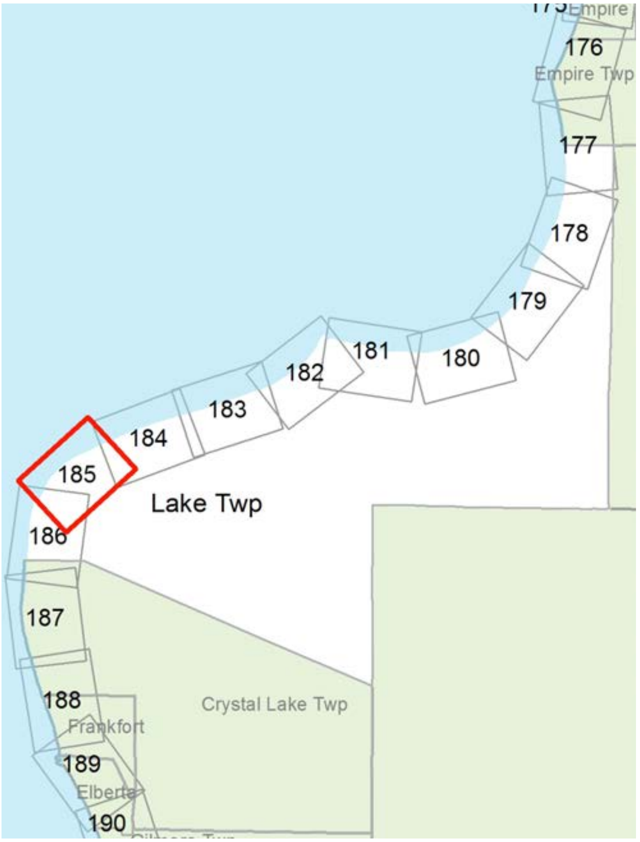
182
183
184
185
Lake Twp
186
187
188
Frankfort
Crystal Lake Twp
189
Elberta
190


Benzie County

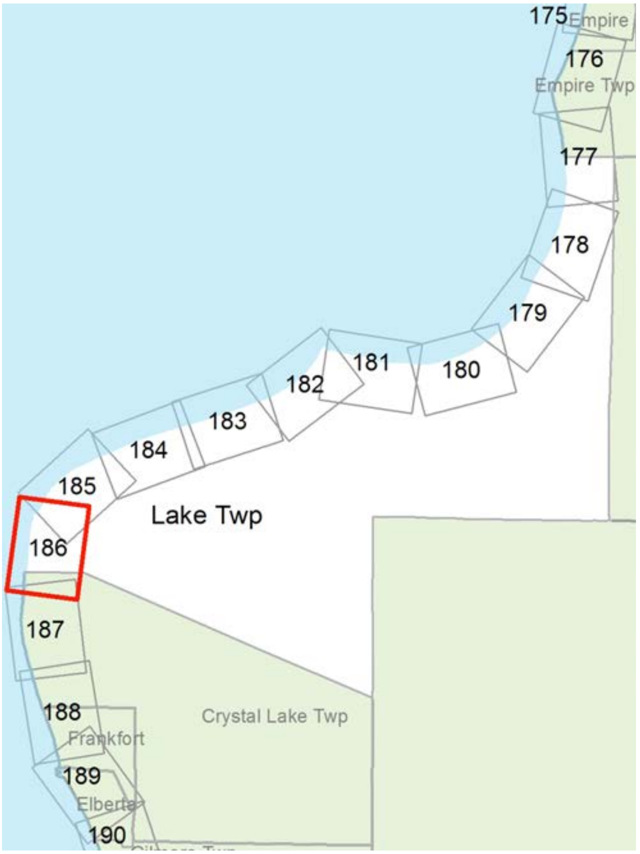

Panel #184
Shoreline Recession
Hill Valley
Michabou Shores
Tiba
Sutter
Taquaka
Logging
Beach
Crystal Downs
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

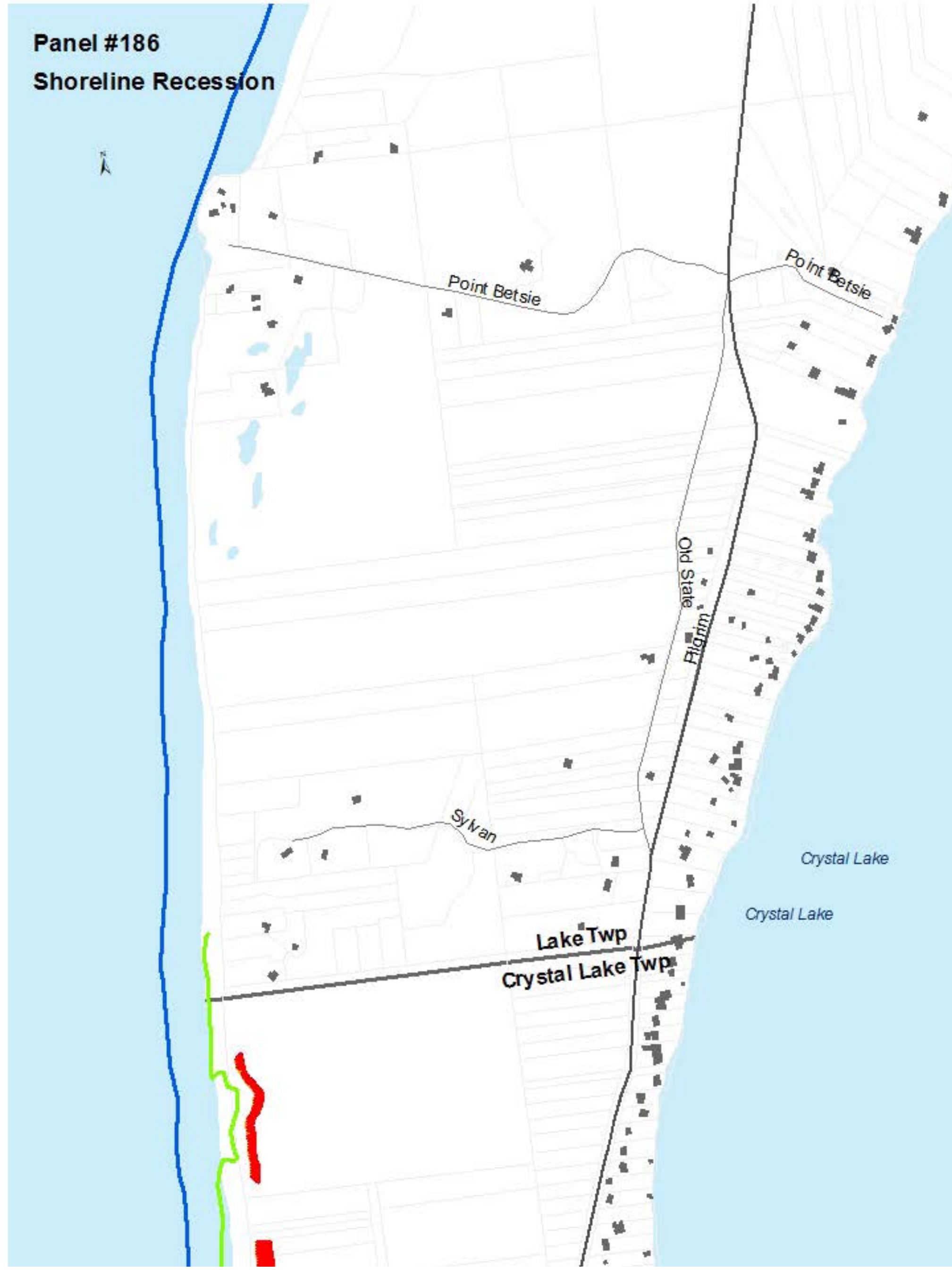

Panel #185
Shoreline Recession
Beach
Crystal Downs
Sutter
Crystal
Crystal Lake
Crystal Lake
Pilgrim
Point Betsie
Point Betsie
Old State


Empire
176
Empire Twp
177
178
179
180
181
182
183
184
185
Lake Twp
186
187
188
Frankfort
Crystal Lake Twp
189
Elberta
190


Benzie County

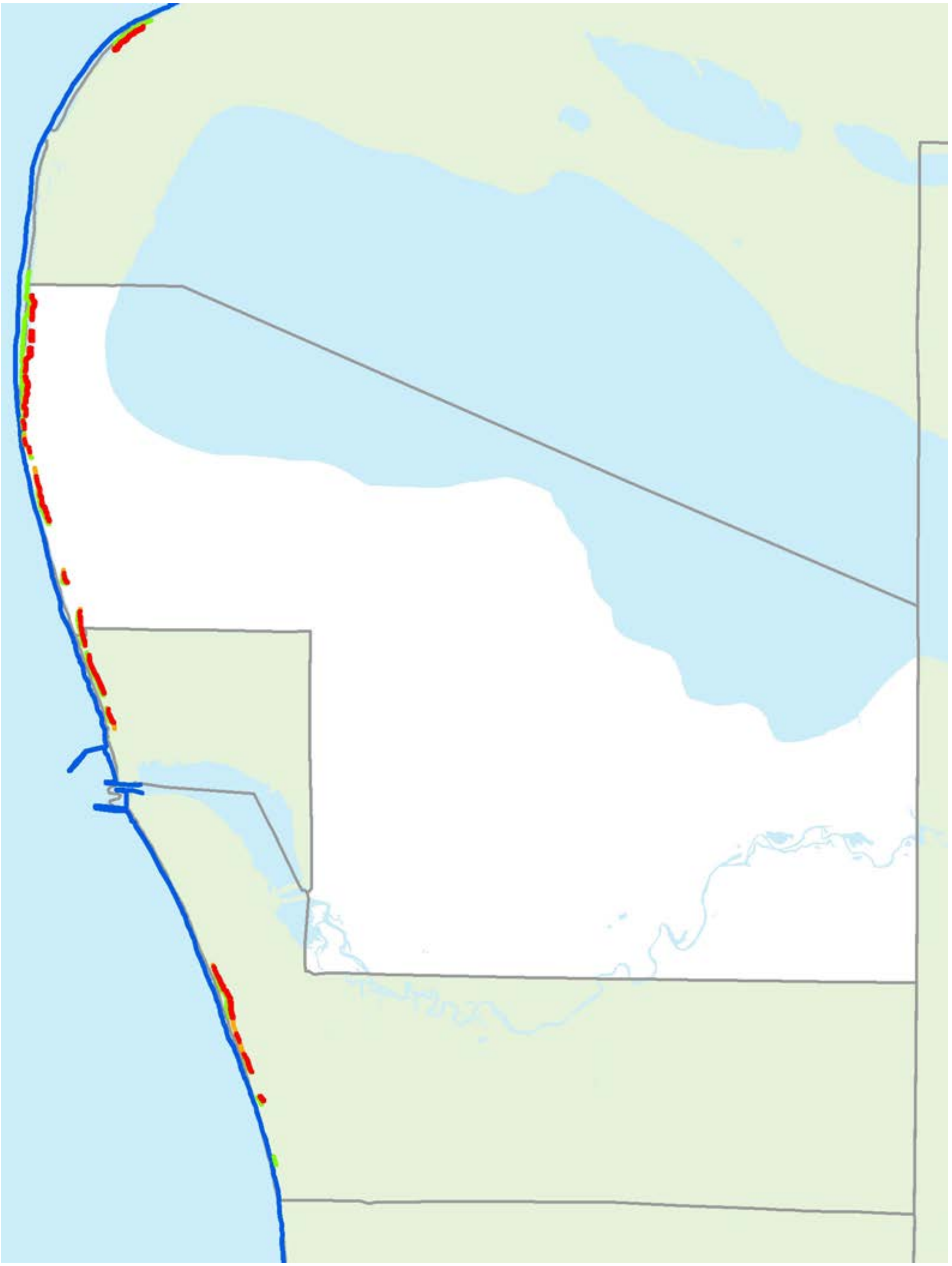

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



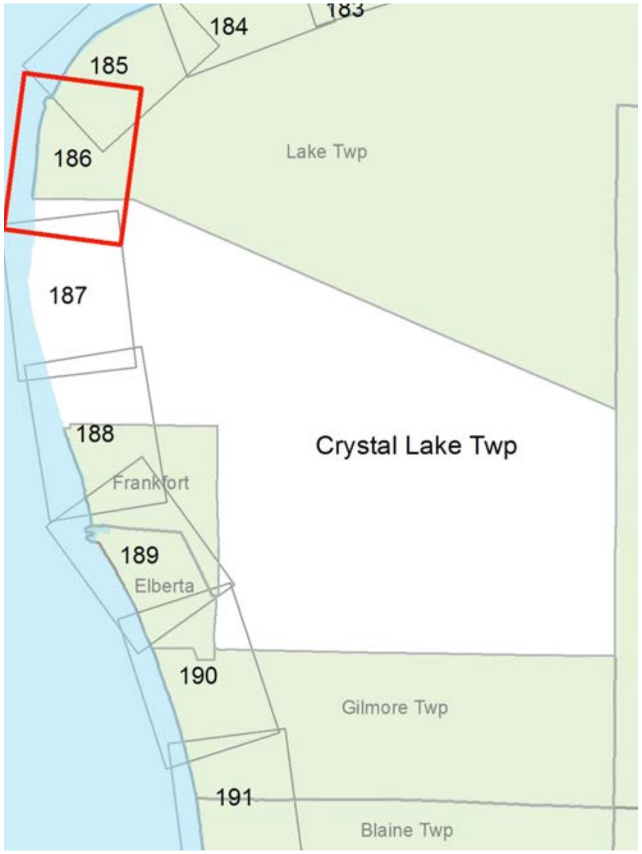


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Crystal Lake Twp.

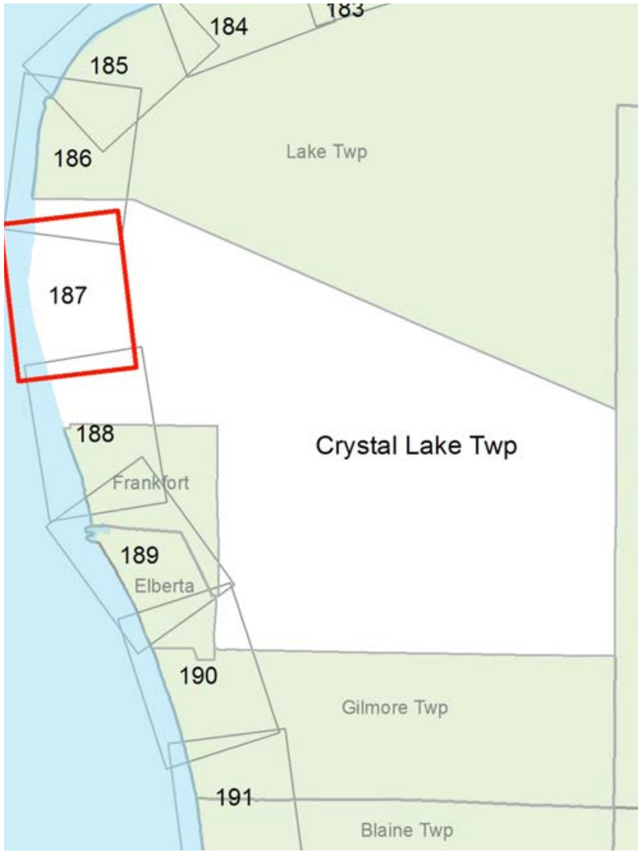


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

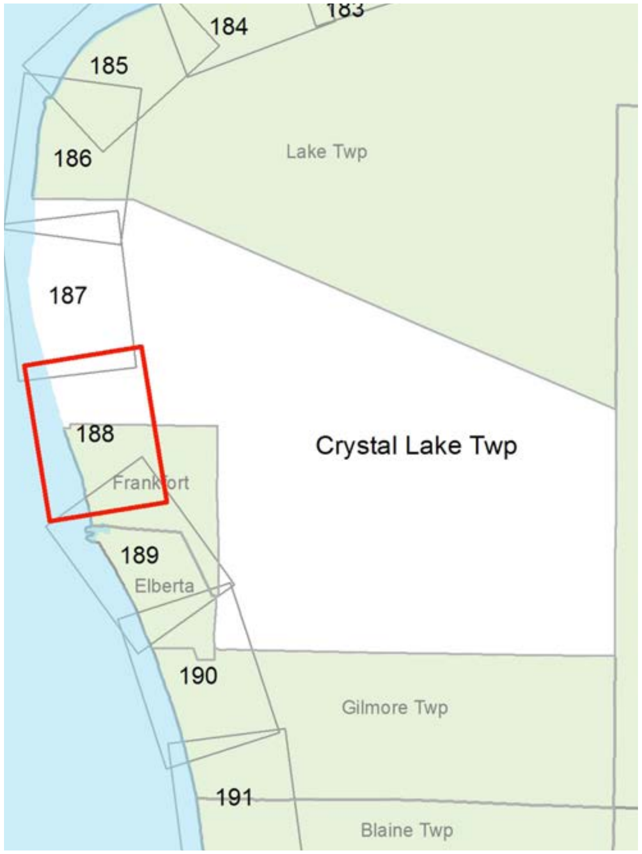

183
184
185
186
Lake Twp
187
Crystal Lake Twp
188
Frankfort
189
Elberta
190
Gilmore Twp
191
Blaine Twp

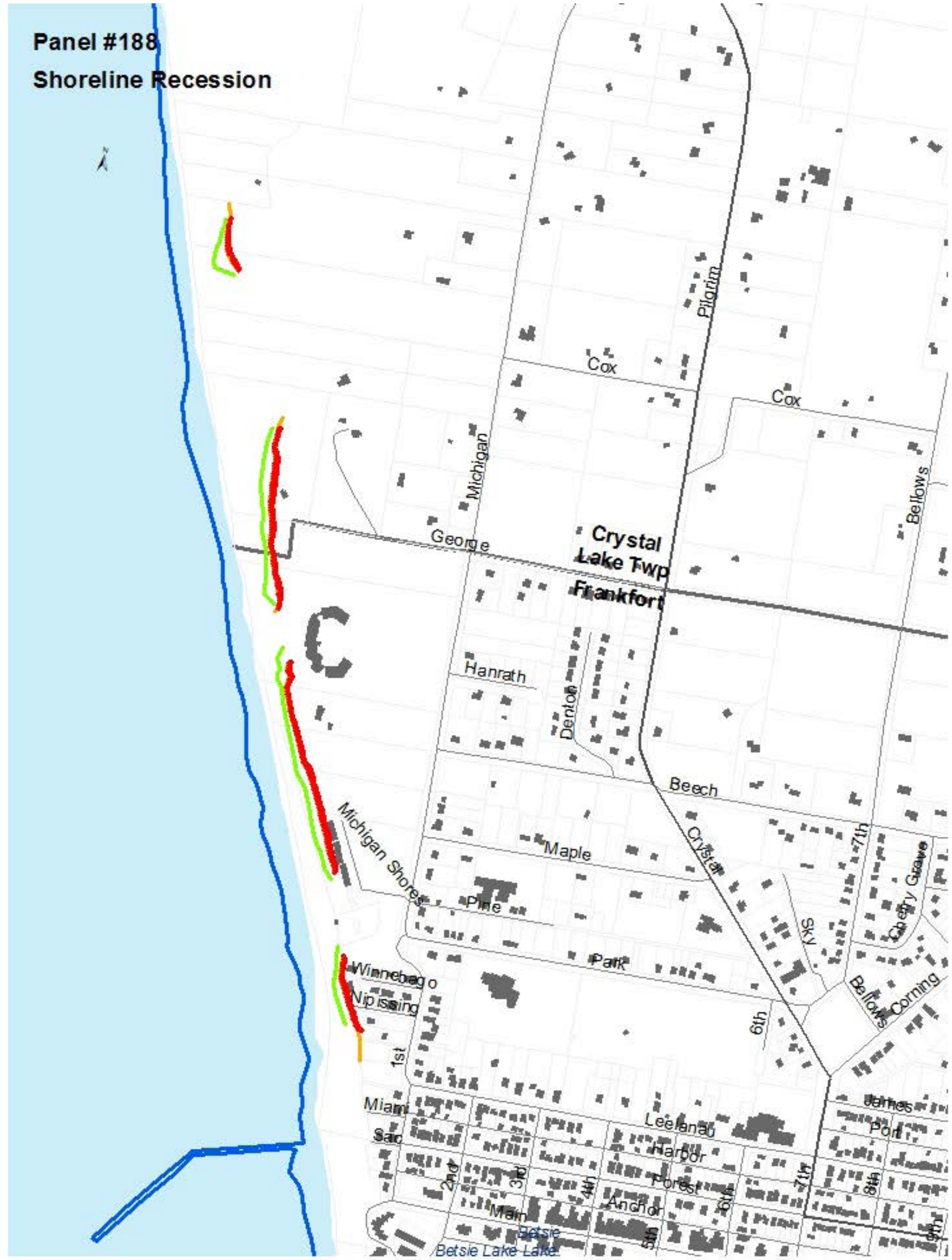

Benzie County


Panel #186
Shoreline Recession
Point Betsie
Point Betsie
Old State
Pilgrim
Sylvan
Lake Twp
Crystal Lake Twp
Crystal Lake
Crystal Lake
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



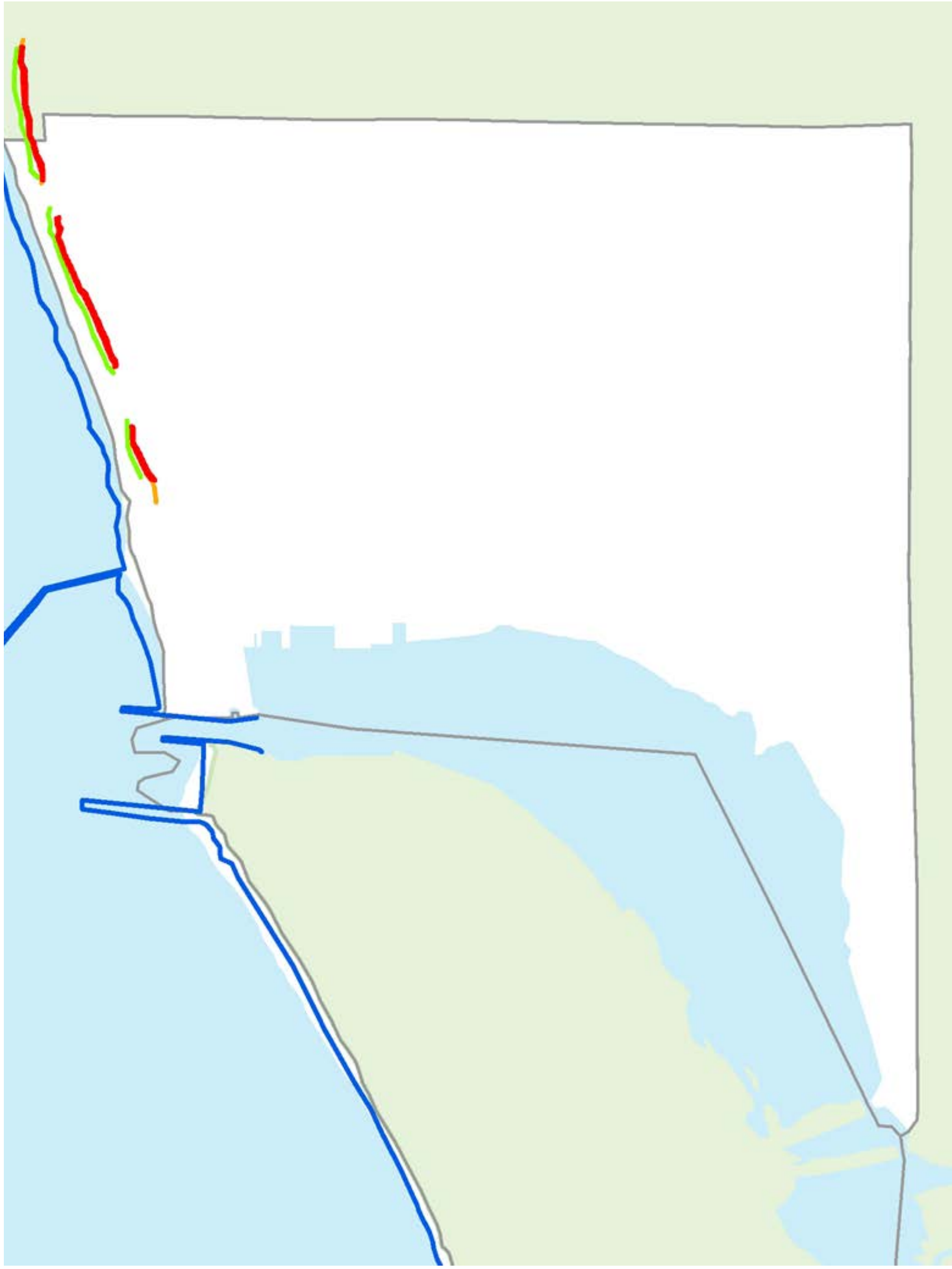
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





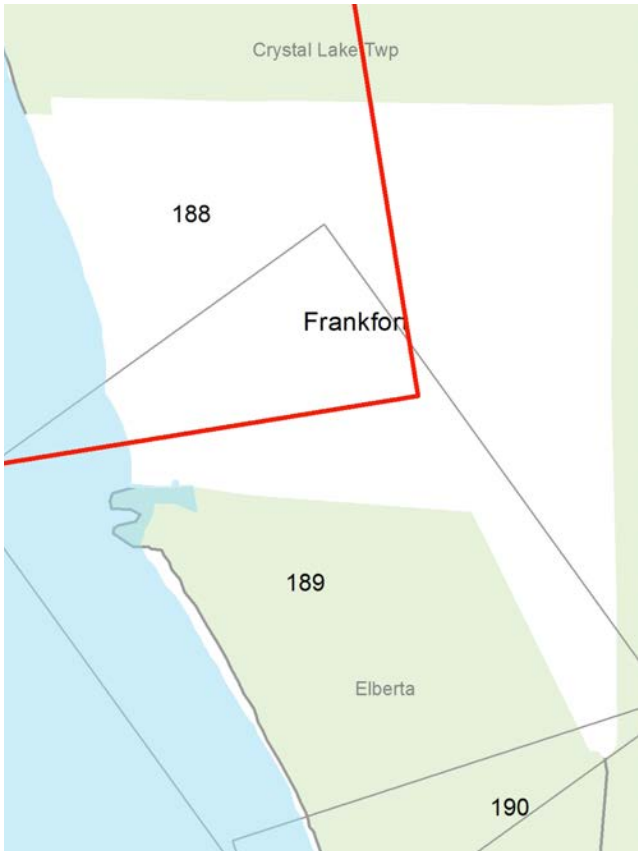
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

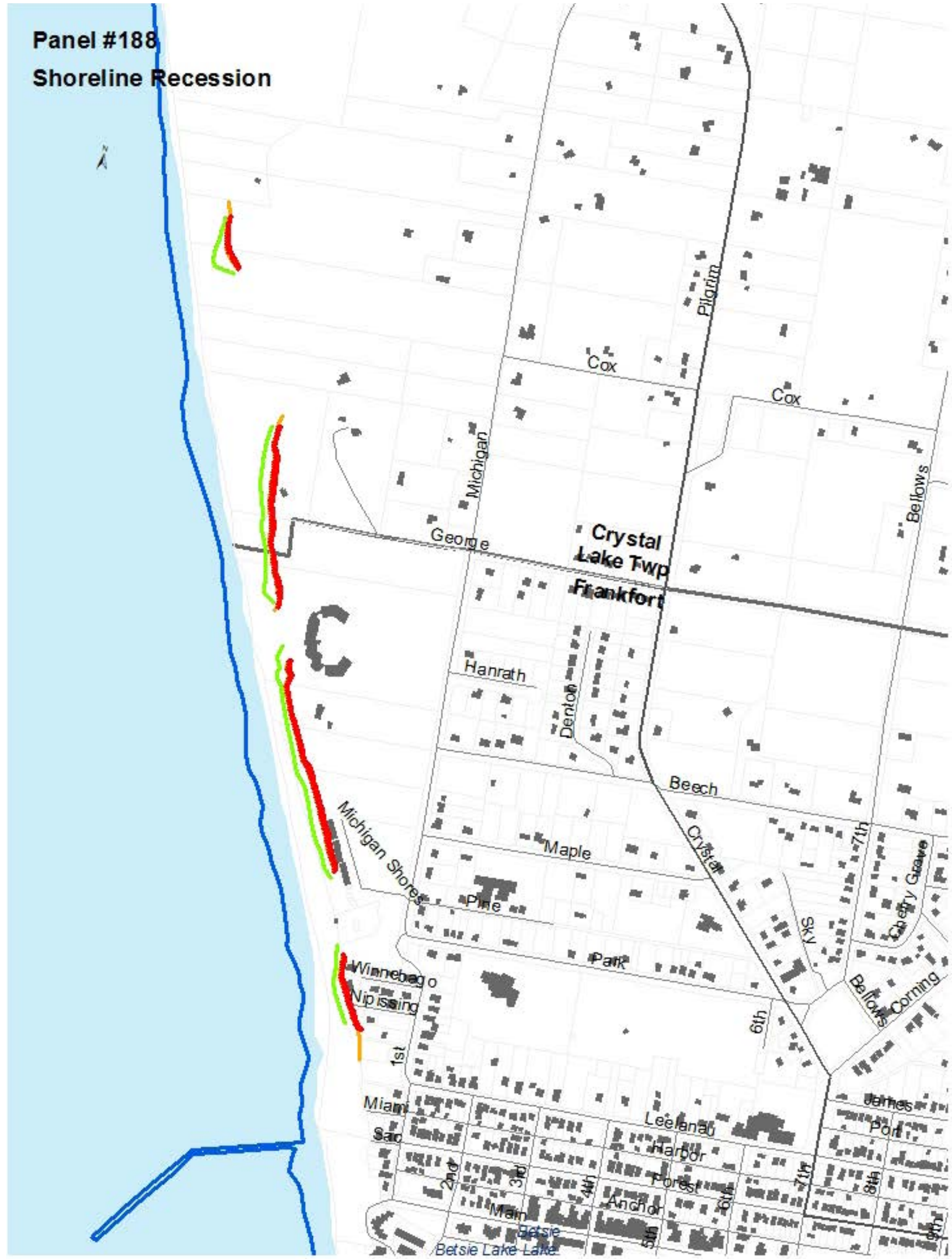
Frankfort



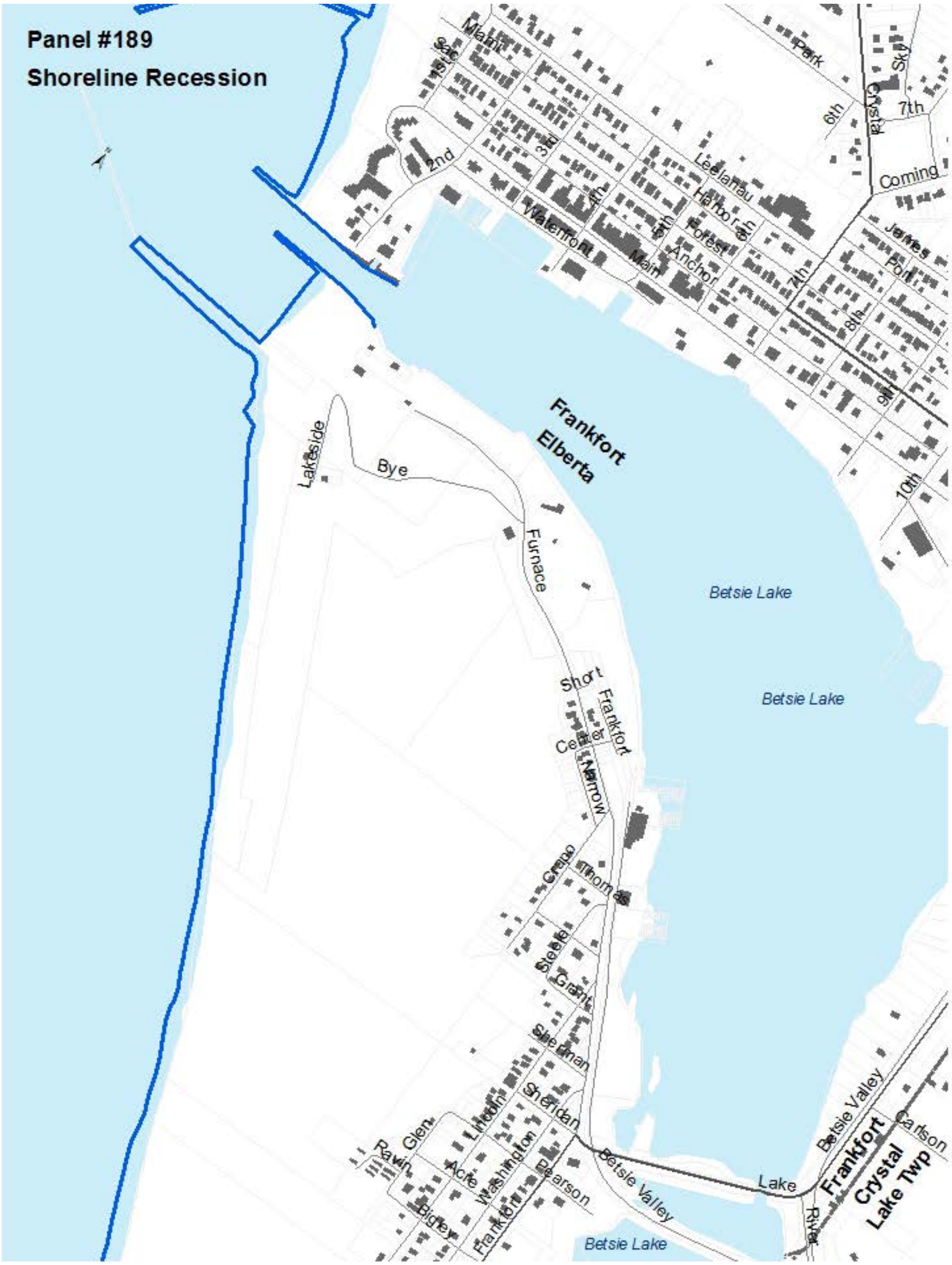

Benzie County

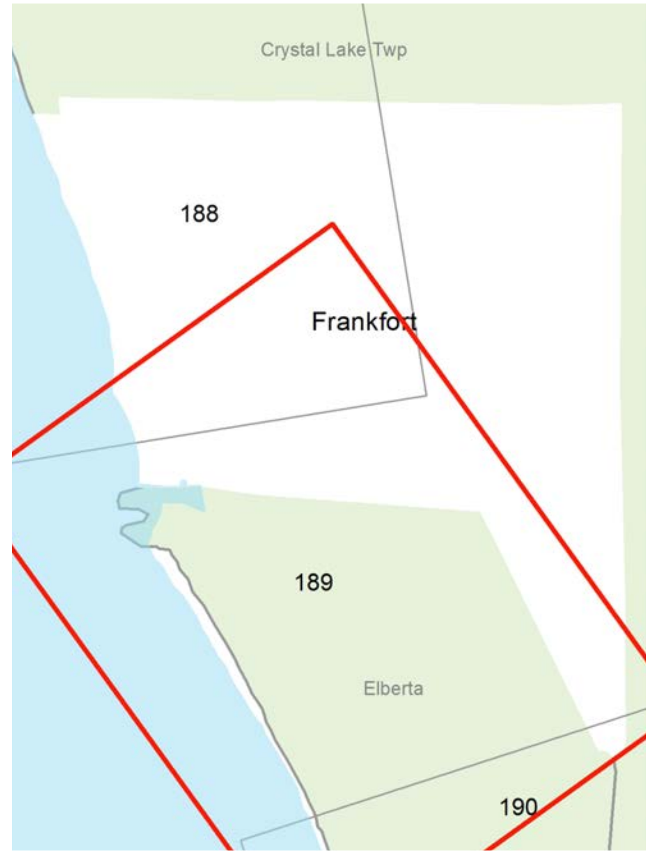

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline





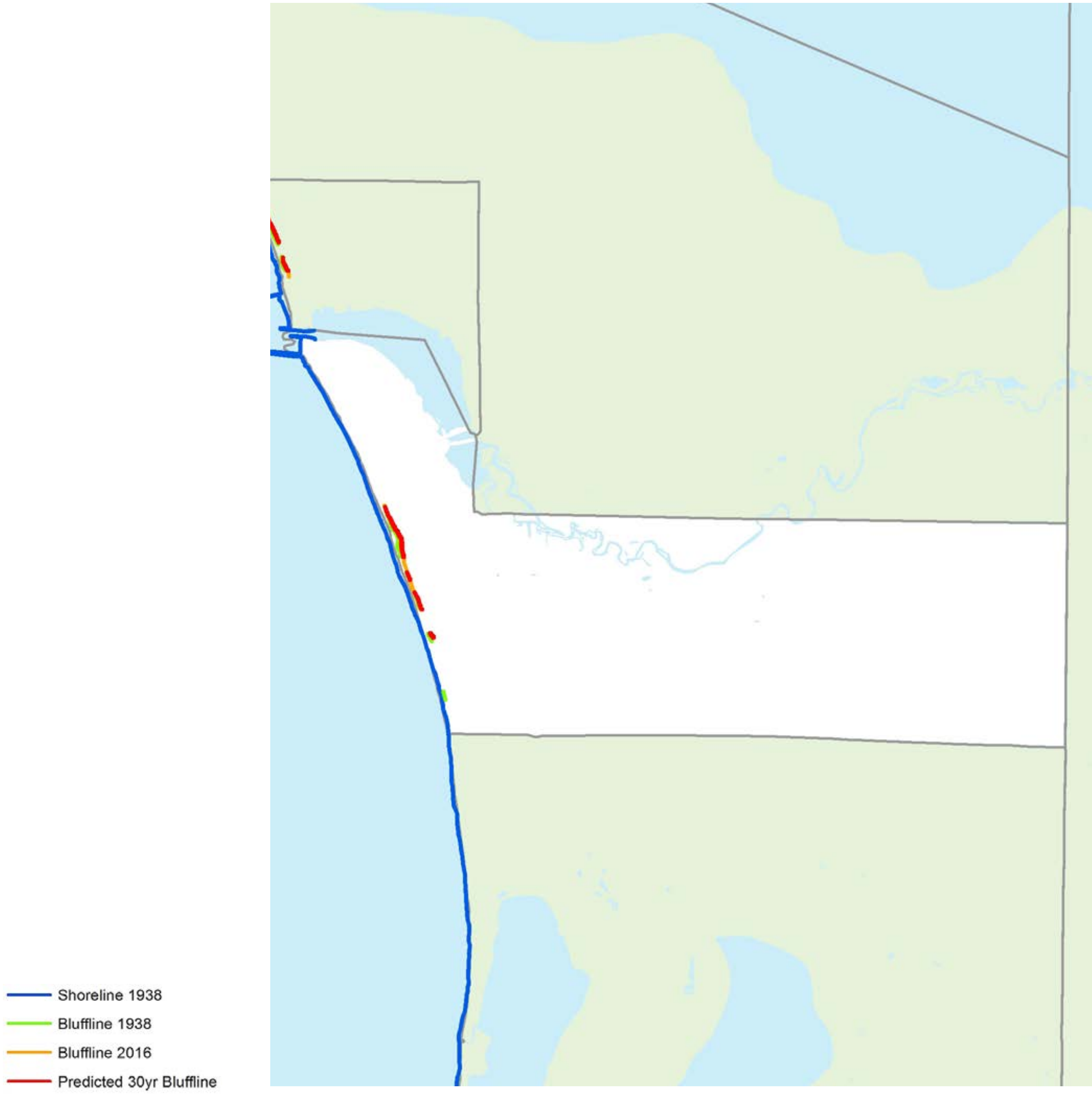
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

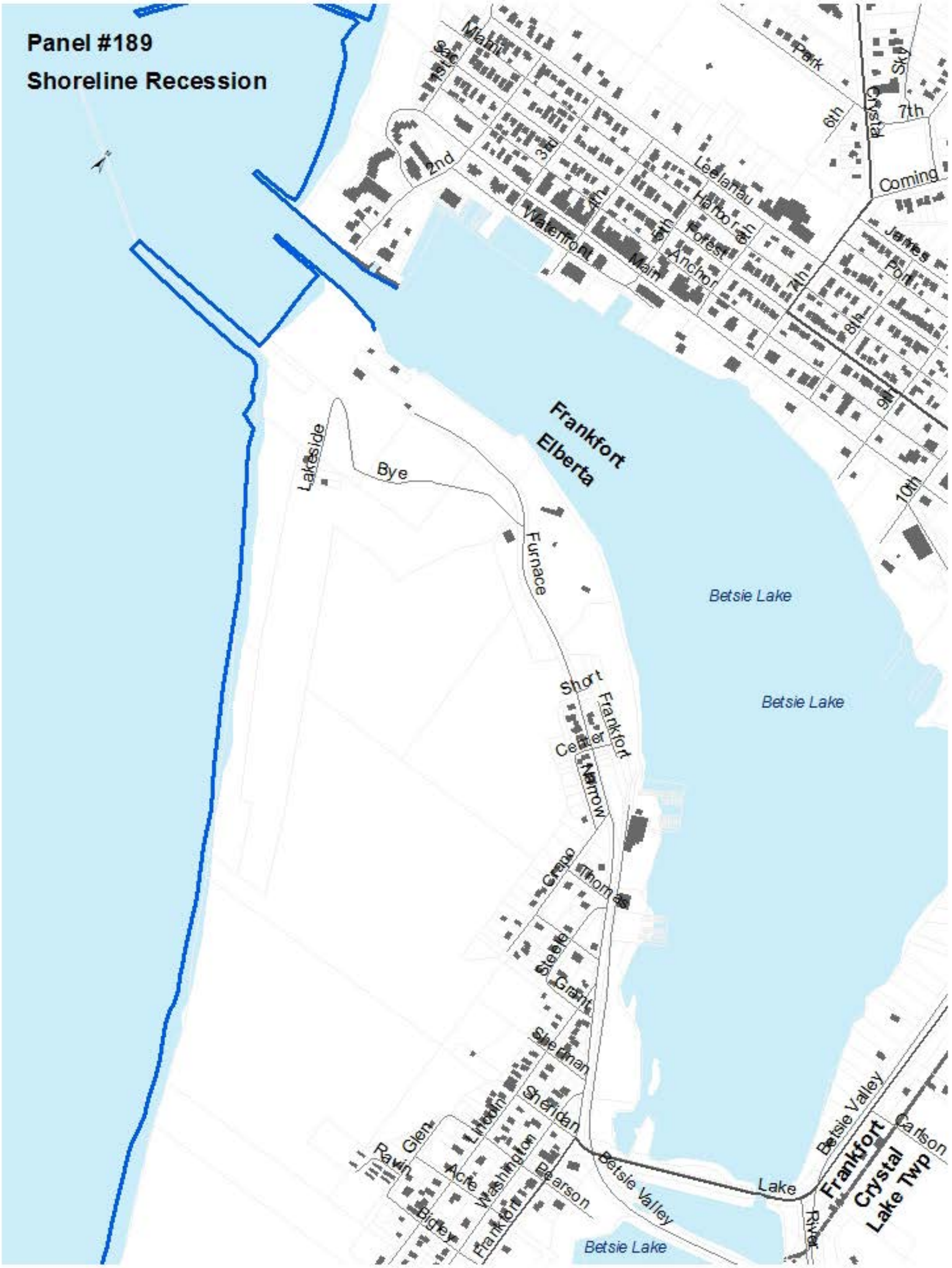


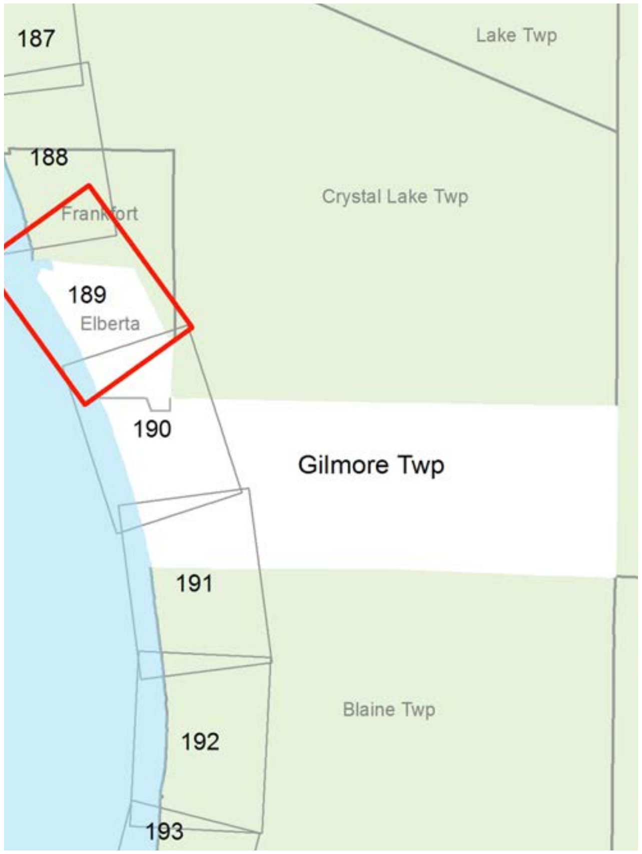


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

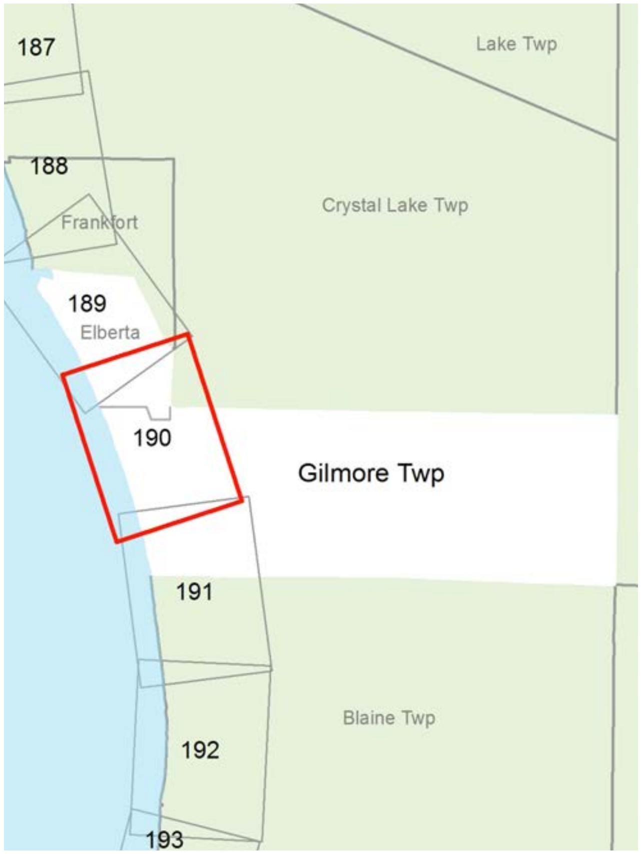
Gilmore Twp./ Elberta

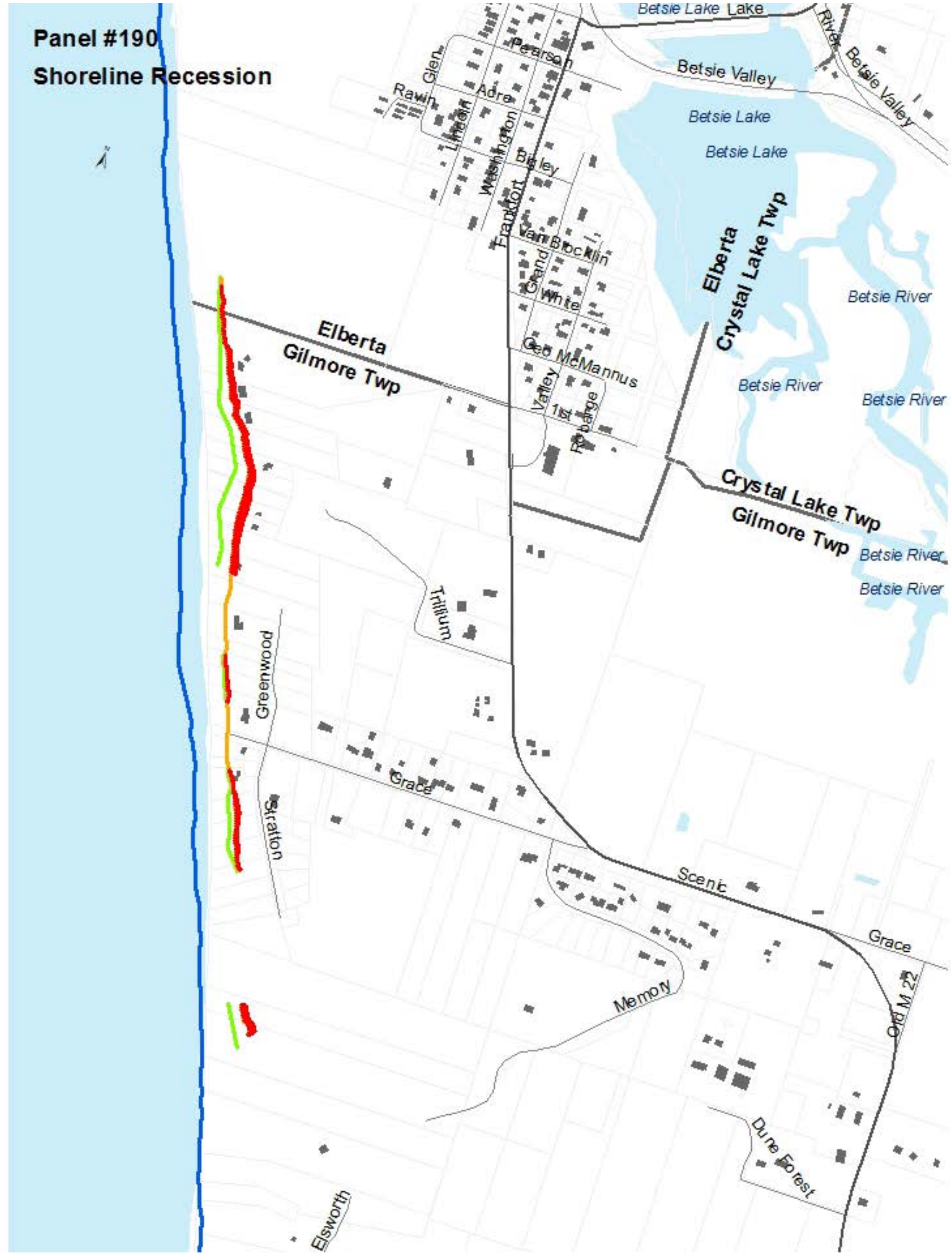



Panel #189
Shoreline Recession
Frankfort
Elberta
Betsie Lake
Betsie Lake
Betsie Lake
Lakeside
Bye
Furnace
Short
Frankfort
Center
Marrow
Crane
Thomas
Steele
Grant
Sherman
Sheridan
Lincoln
Washington
Pearson
Betsie Valley
Lake
River
Frankfort
Crystal Lake Twp
Carson
Glen
Ravin
Acre
Bigley
Frankfort
2nd
3rd
4th
Main
Waterfront
Leelanau
Forest
Anchor
6th
7th
8th
9th
10th
Park
Crystal
Coming
James
Point
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

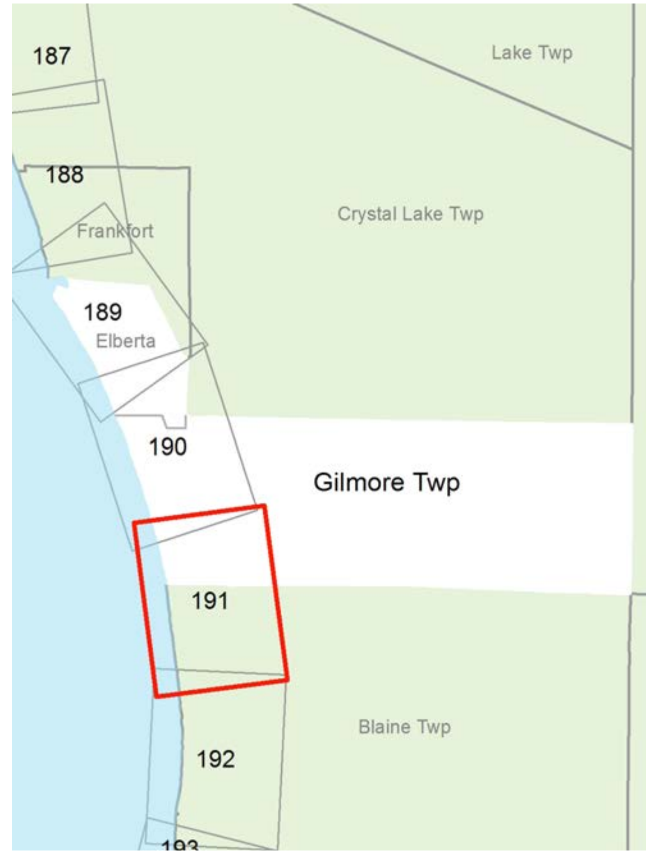

187
188
189
190
191
192
193
Frankfort
Elberta
Lake Twp
Crystal Lake Twp
Gilmore Twp
Blaine Twp


Benzie County





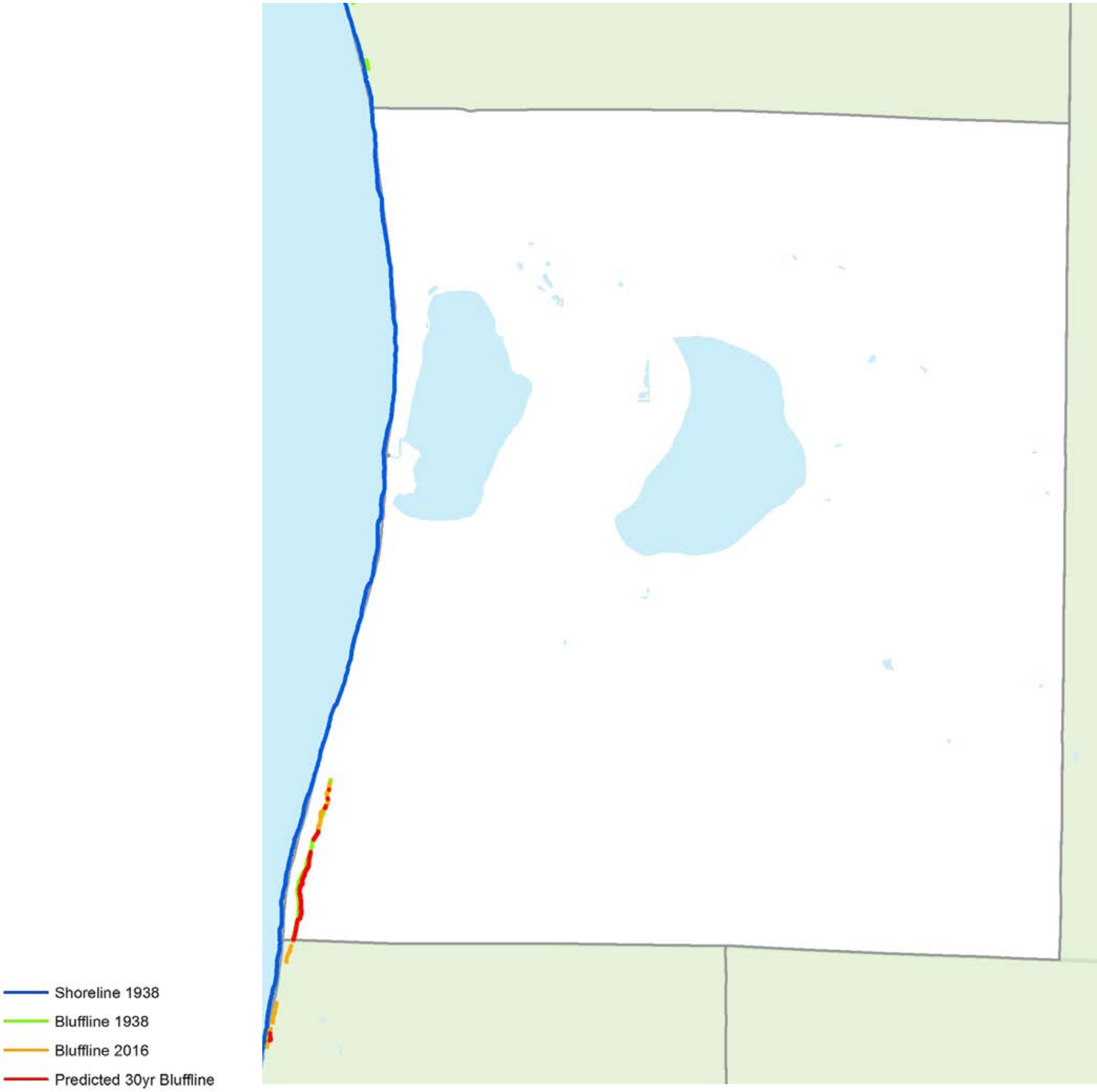
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Blaine Twp.


Benzie County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #193
Shoreline Recession
Lower Herring Lake
Lower Herring Lake
Watervale
Elveretta
Dolph
Howard
Scenic


190
Gilmore Twp
191
192
Blaine Twp
193
194
Arcadia Twp
195


Benzie County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


190
Gilmore Twp
191
192
Blaine Twp
193
194
Arcadia Twp
195


Benzie County

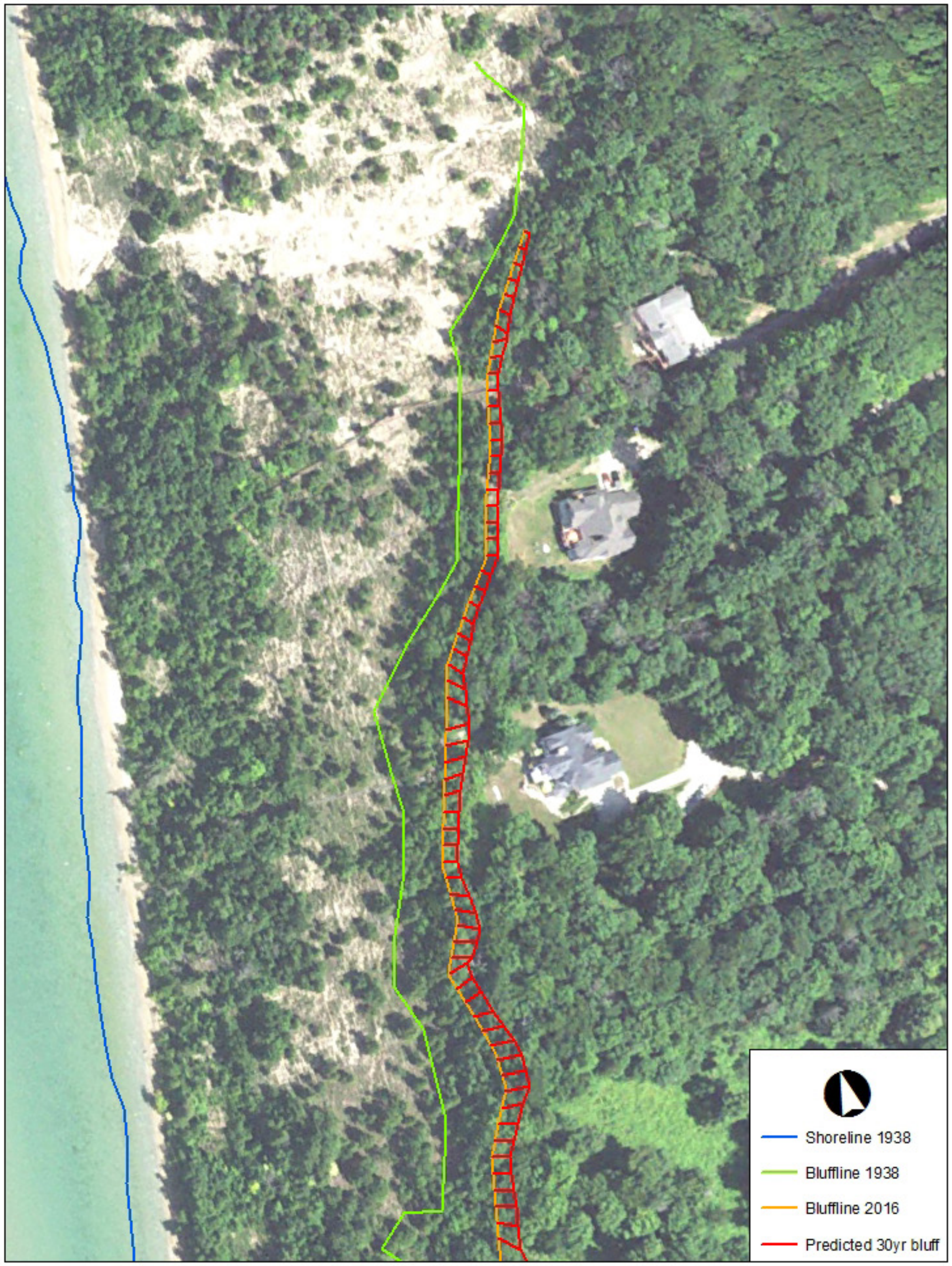

Panel #194
Shoreline Recession
Matzinger
Scenic
Saint Pierre
Blaine Twp
Taylor
Arcadia Twp
Northwood
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

Manistee County

BLUFF RECESSION DETAIL

At least one "zoomed in" detail example of historic bluffline recession and future projections is provided at the beginning of each county section of this chapter. Shoreline and bluffline recession data can be viewed in greater detail online at http://geospatialresearch.mtu.edu/czmp.

Bluff Detail, Panel 200, Onekama Twp.



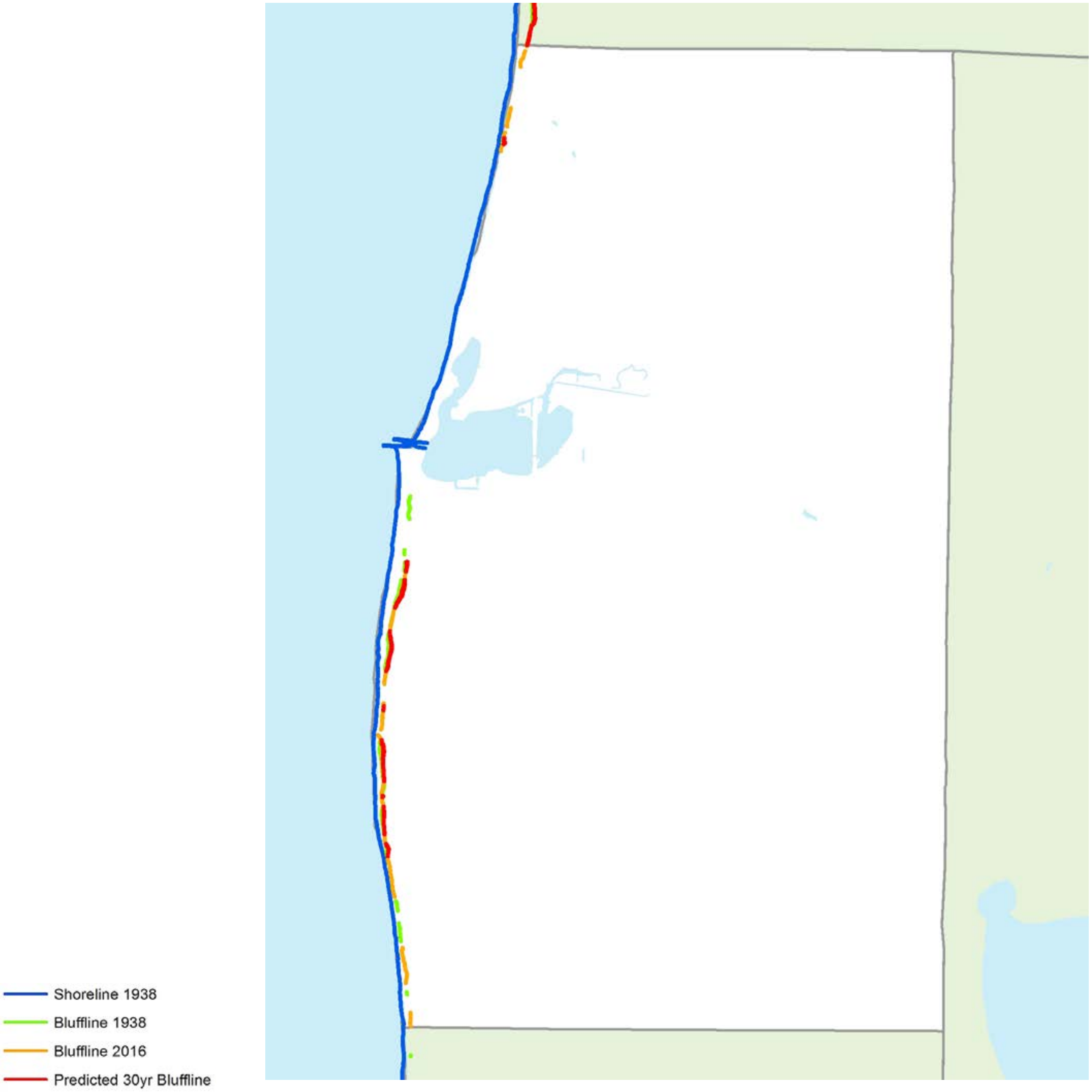
Bluff Detail, Panel 206, Manistee Twp.

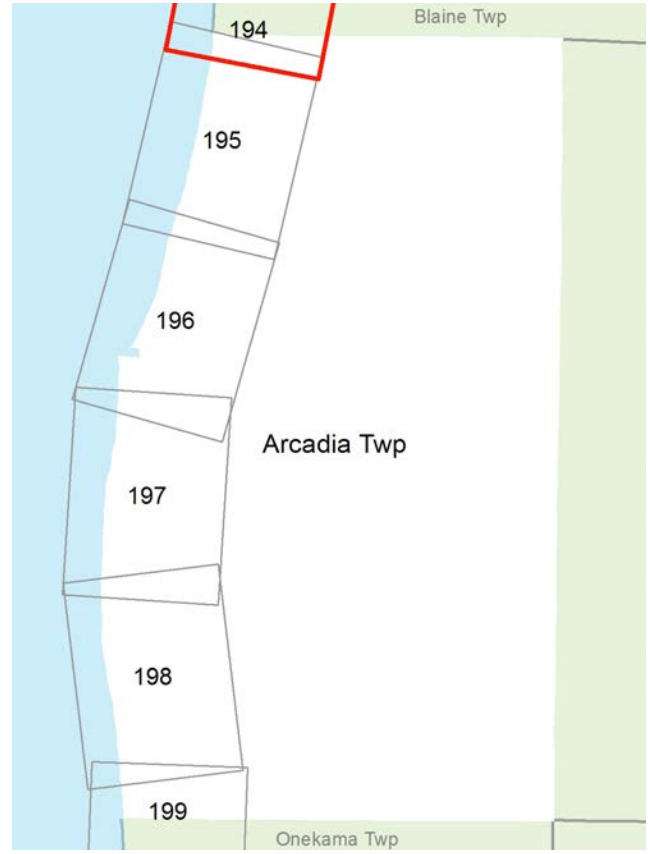
Bluff Detail, Panel 207, Manistee Twp.

Bluff Detail, Panel 207, Manistee Twp.

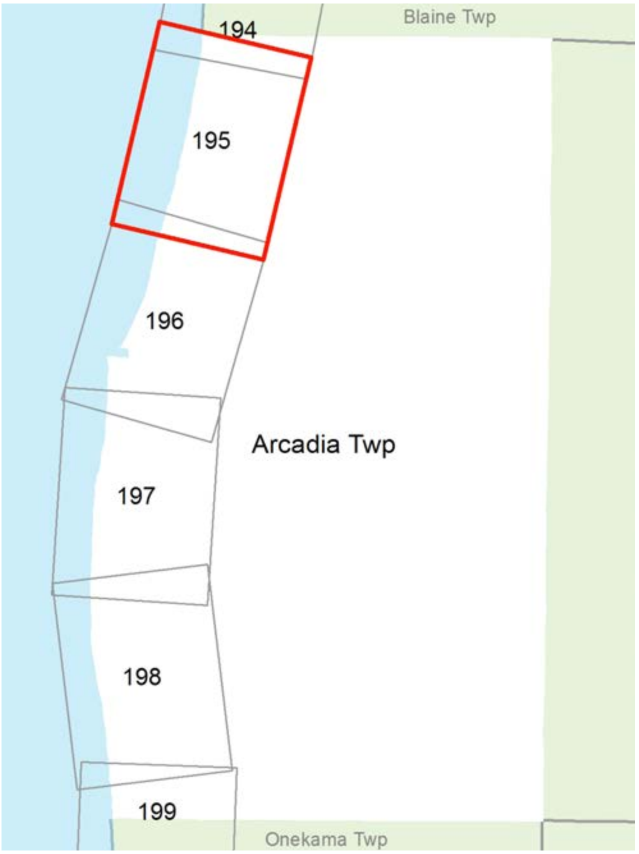
Arcadia Twp.


Manistee County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

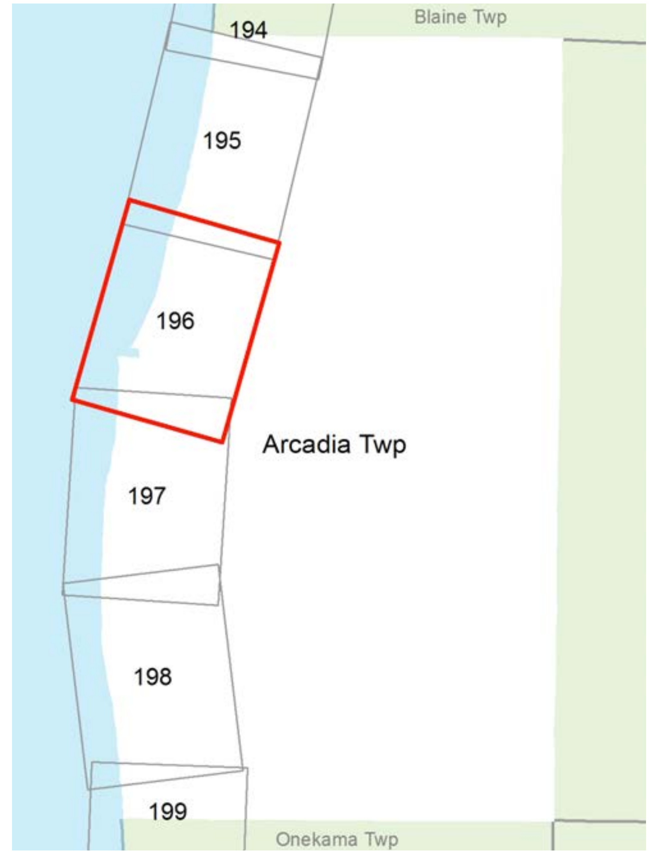


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

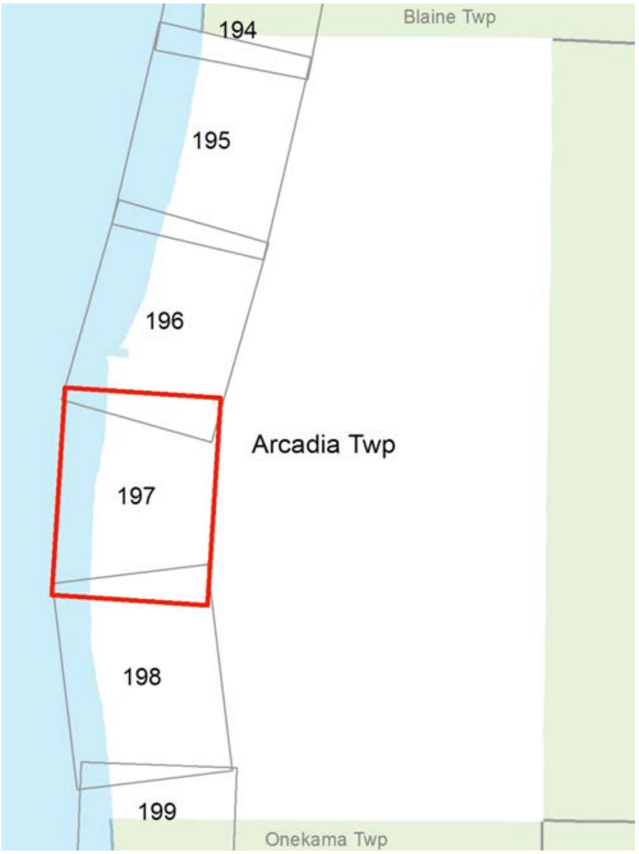

Blaine Twp
194
195
196
197
198
199
Arcadia Twp
Onekama Twp


Manistee County


Panel #195
Shoreline Recession
Arcadia Twp
Taylor
Burnham
Norman
Jungle Inn
Northwood
Sorrenson
Jass
Forestview
South Ridgewood
Spruce
2nd
3rd
4th
5th
6th
7th
Oak
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

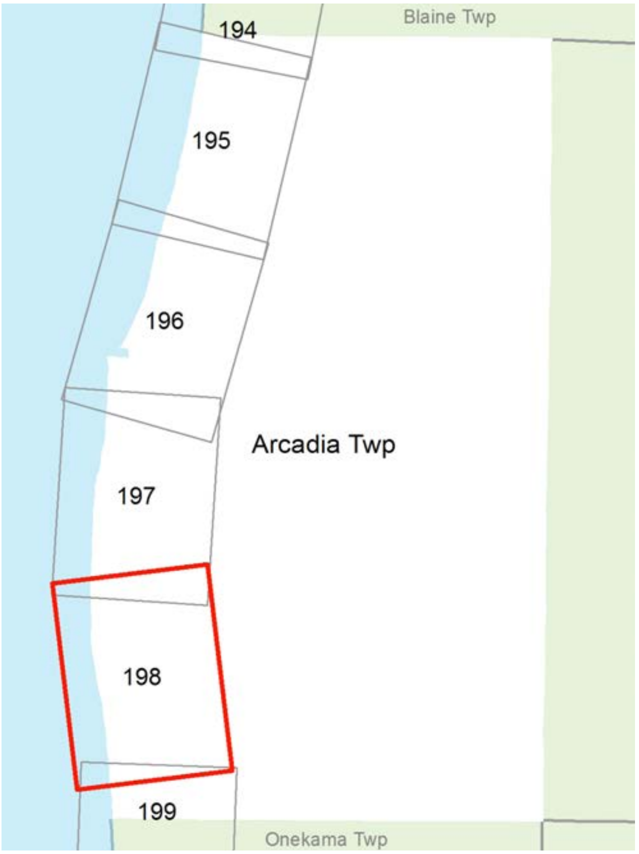


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

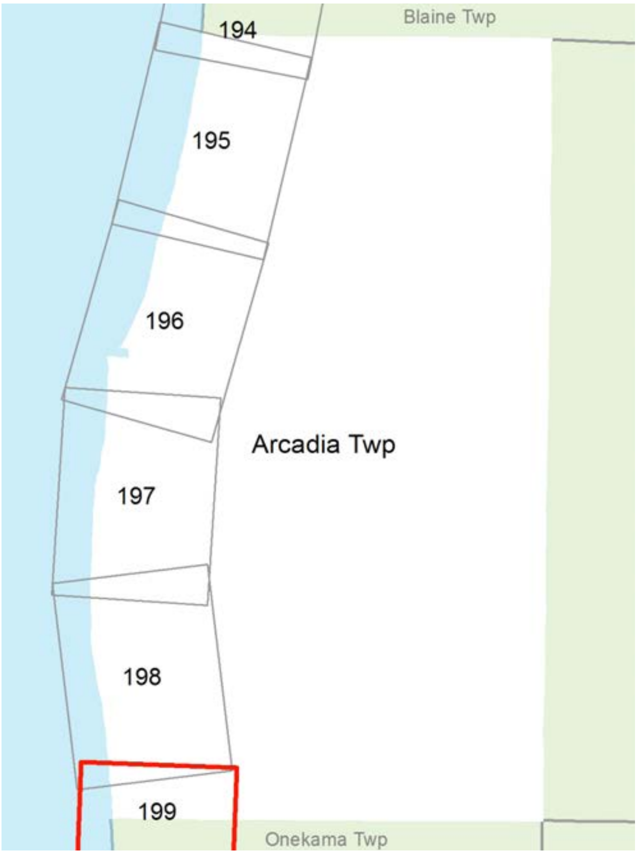

Blaine Twp
194
195
196
197
Arcadia Twp
198
199
Onekama Twp


Manistee County


Panel #197
Shoreline Recession
Northwood
Lake Bluff
Maxey
Paluszny
Bischoff
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

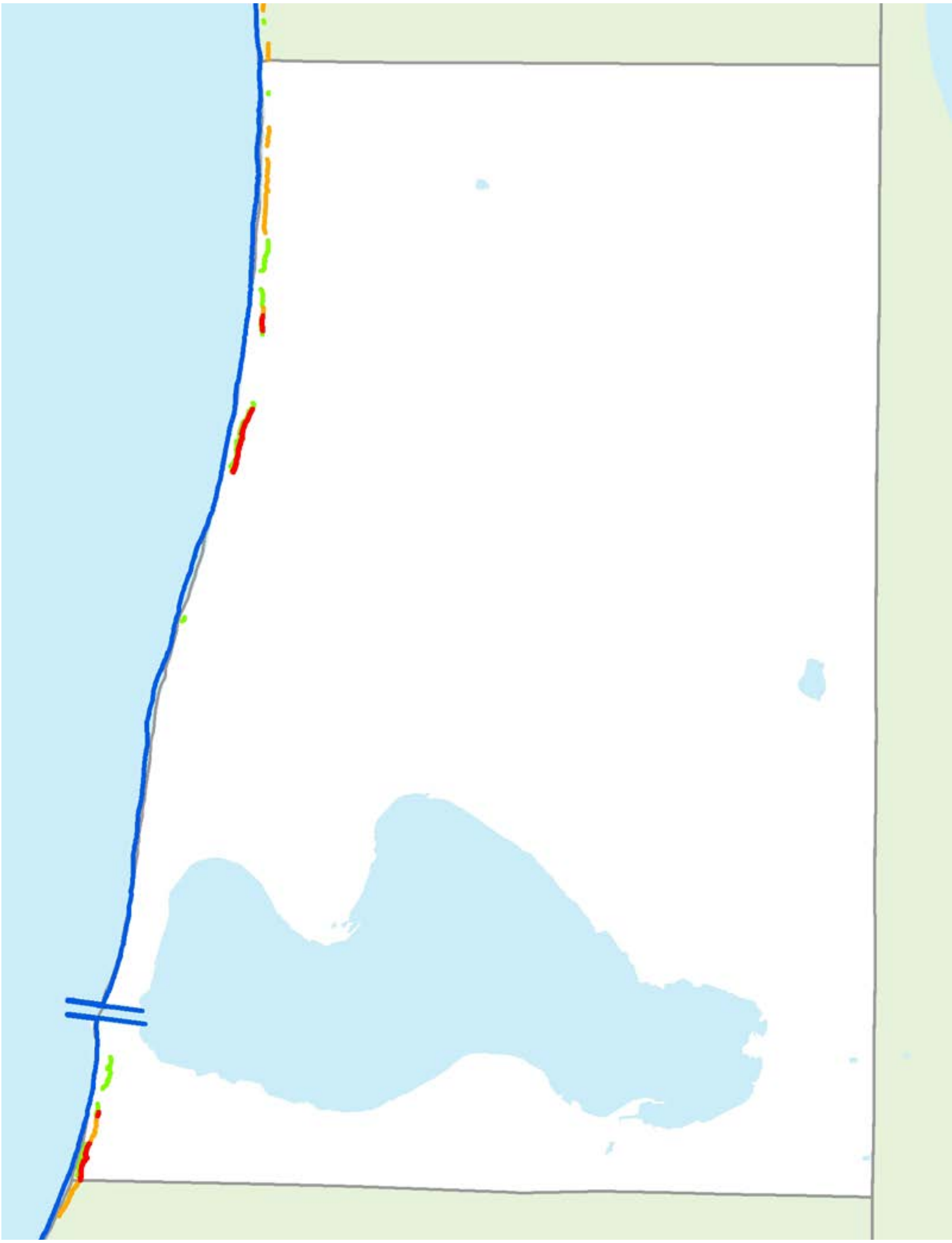

Blaine Twp
194
195
196
Arcadia Twp
197
198
199
Onekama Twp


Manistee County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

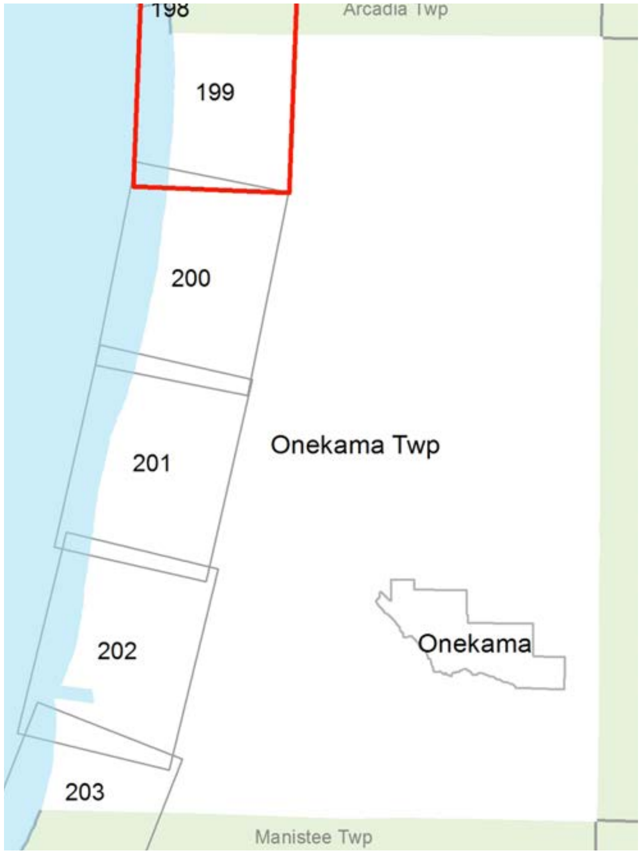

Panel #199
Shoreline Recession
Leos
Szerlong
Gear
Arcadia Twp
Onekama Twp
Unknown
Lakeview
Mill
Perry
13 Mile
Burtker
Lost Cabin
Potter
Herkelrath

Onekama Twp.



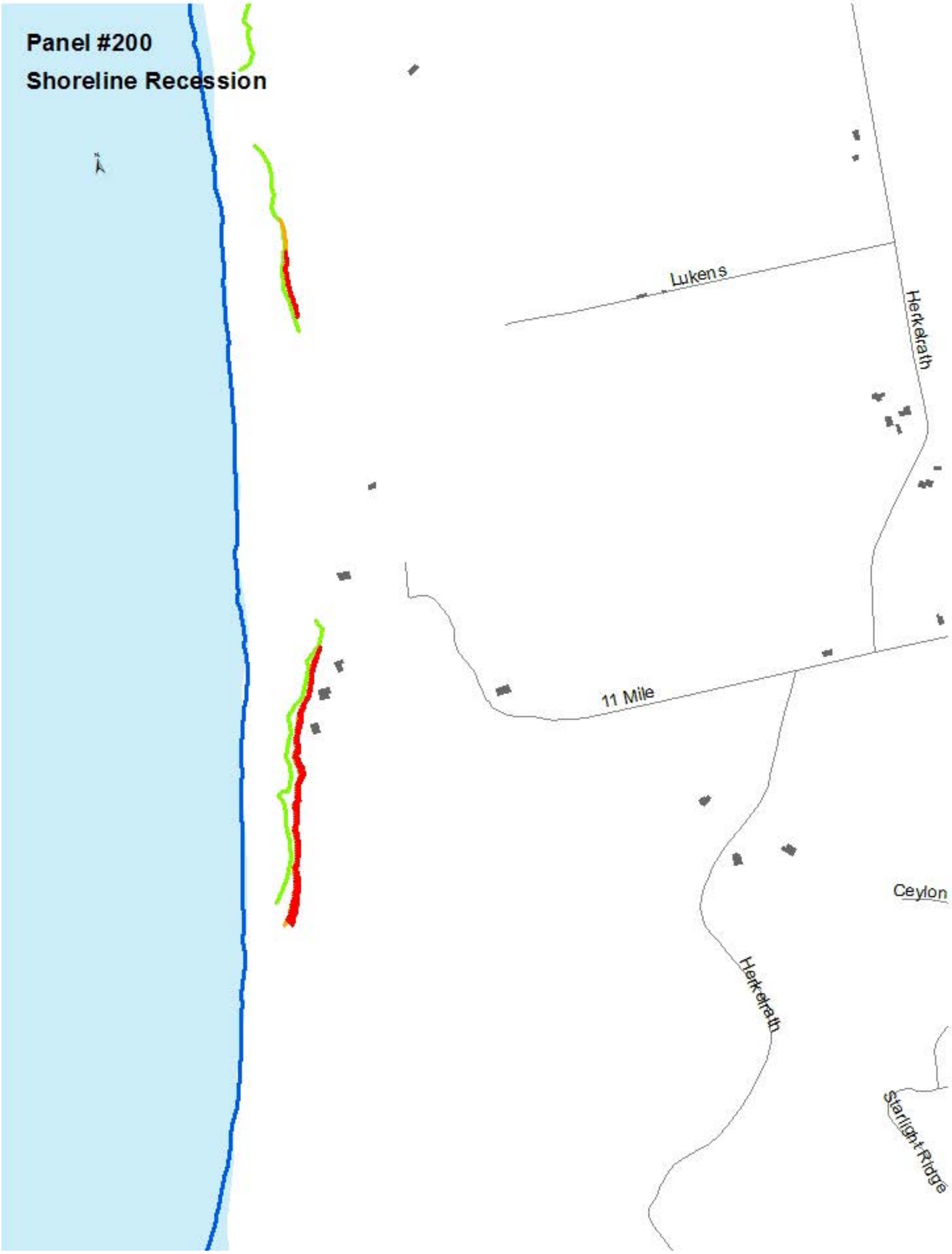

Manistee County

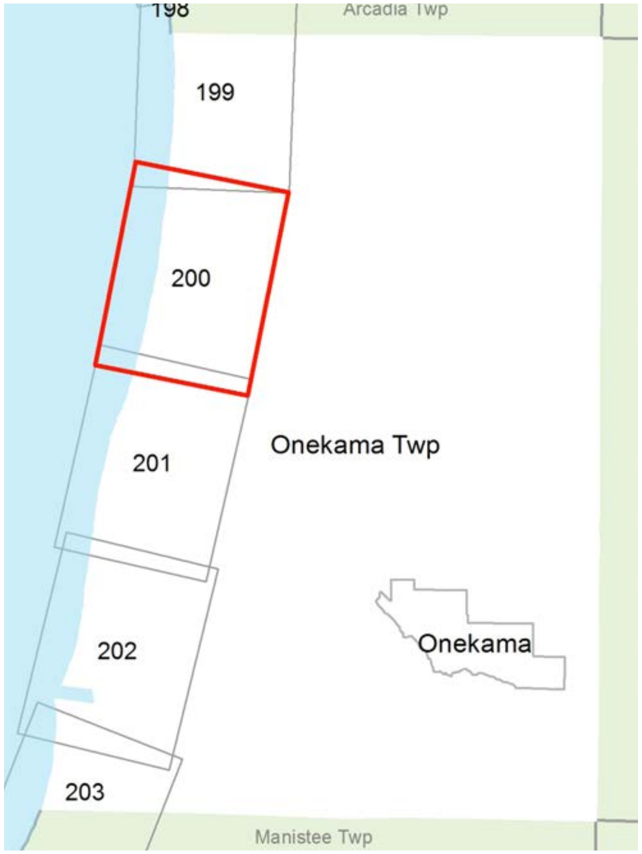

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


198
Arcadia Twp
199
200
201
202
203
Onekama Twp
Onekama
Manistee Twp

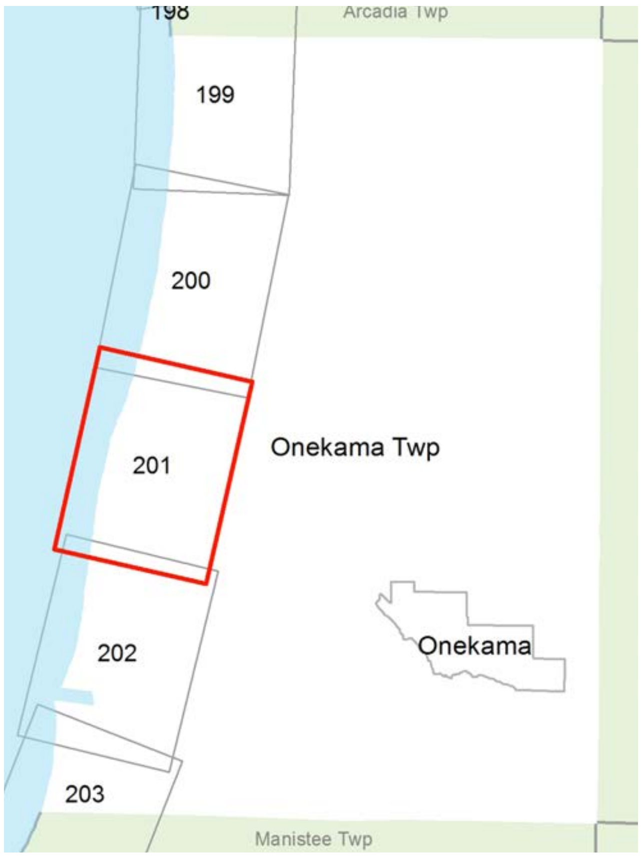

Manistee County


Panel #199
Shoreline Recession
Leos
Szerlong
Gear
Arcadia Twp
Onekama Twp
Unknown
Lakeview
Mill
Perry
13 Mile
Burtker
Lost Cabin
Potter
Herkelrath
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

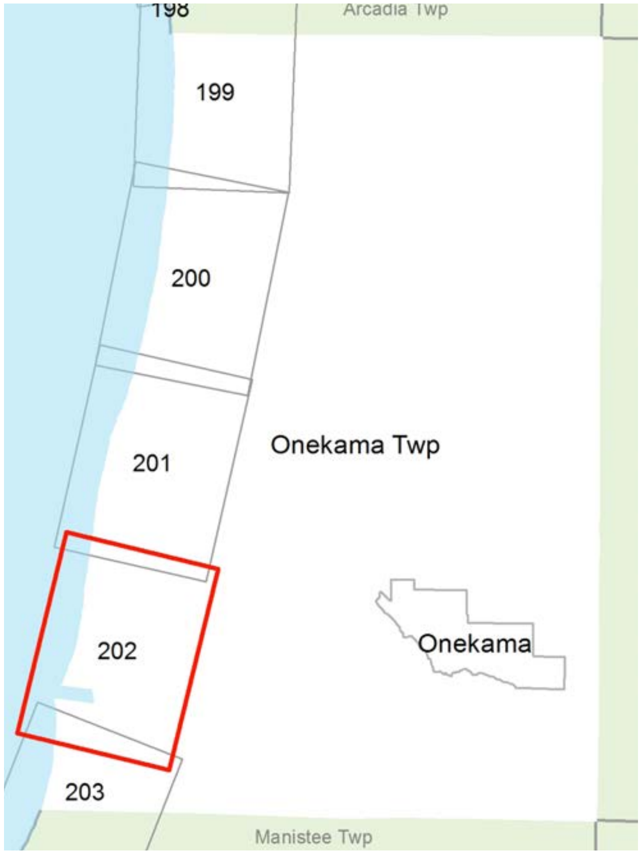




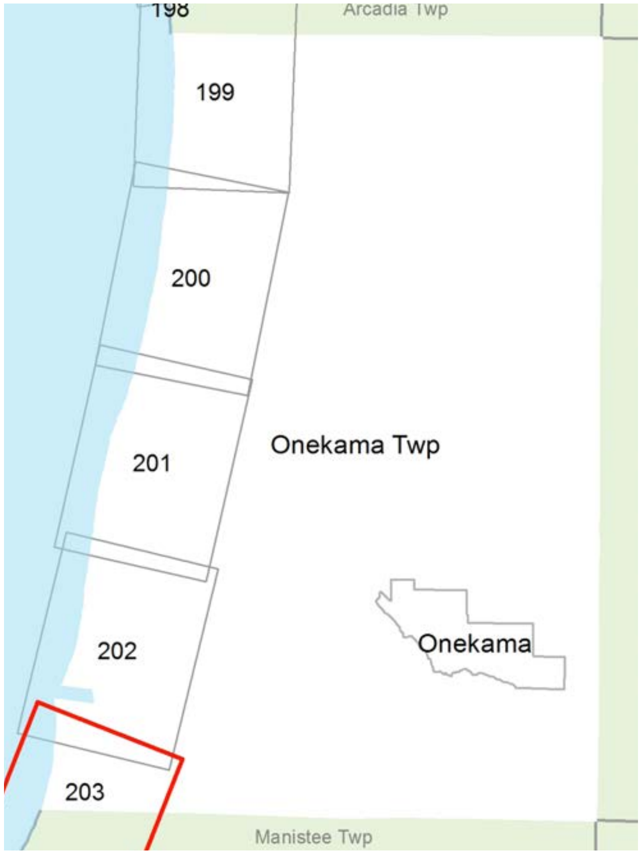
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

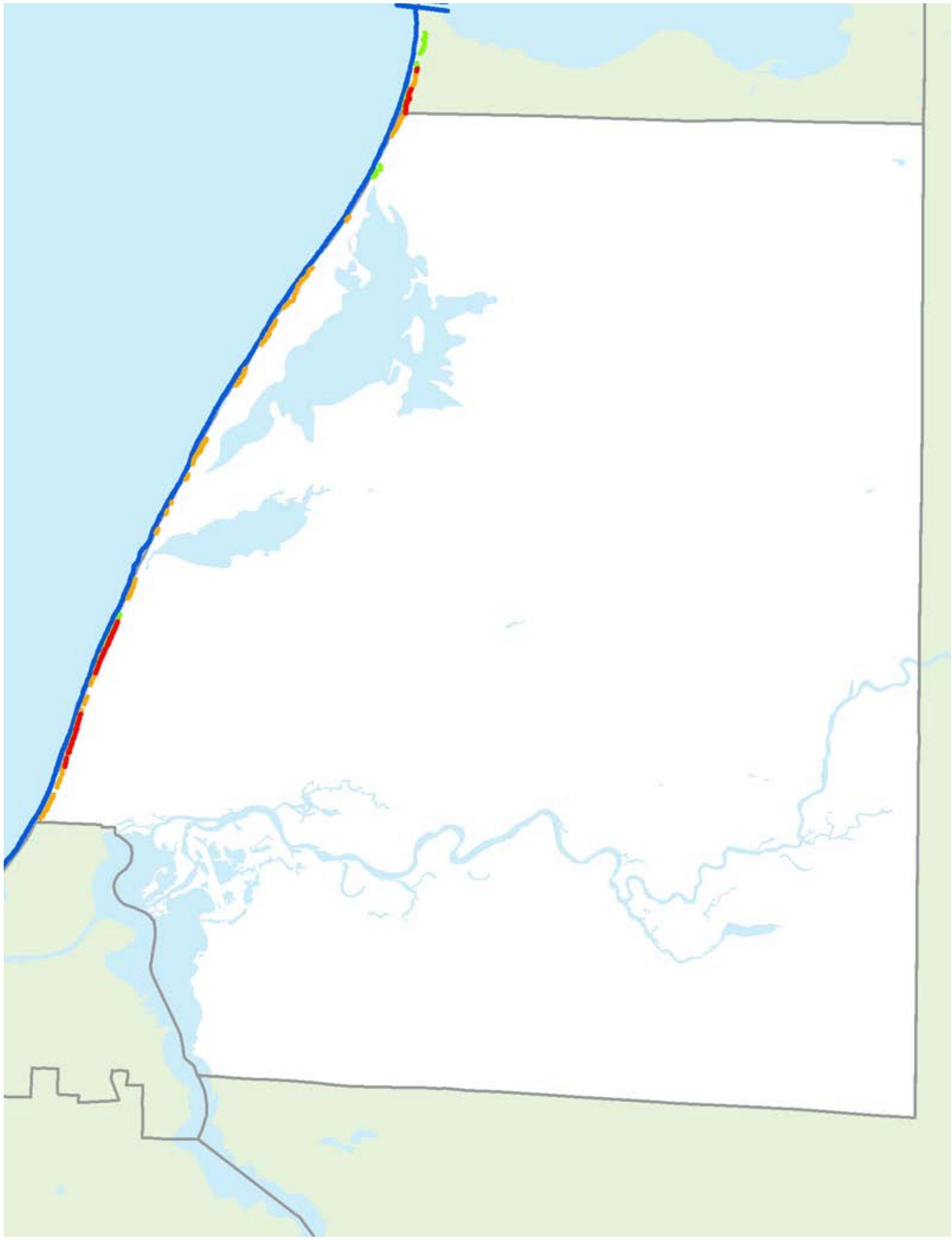

198
Arcadia Twp
199
200
201
202
203
Onekama Twp
Onekama
Manistee Twp


Manistee County

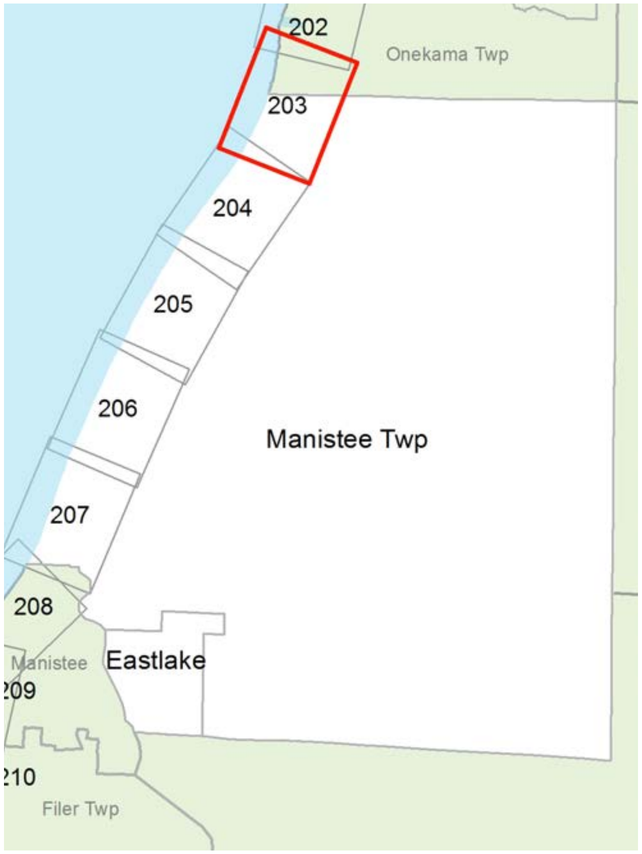

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #203
Shoreline Recession
Crescent Beach
Beech Knolls
Onekama Twp
Manistee Twp
Lakeshore
Bar Lake
Falk
Bar Lake Swamp
Bar Lake Swamp
Bar Lake Swamp
Bar Lake Swamp

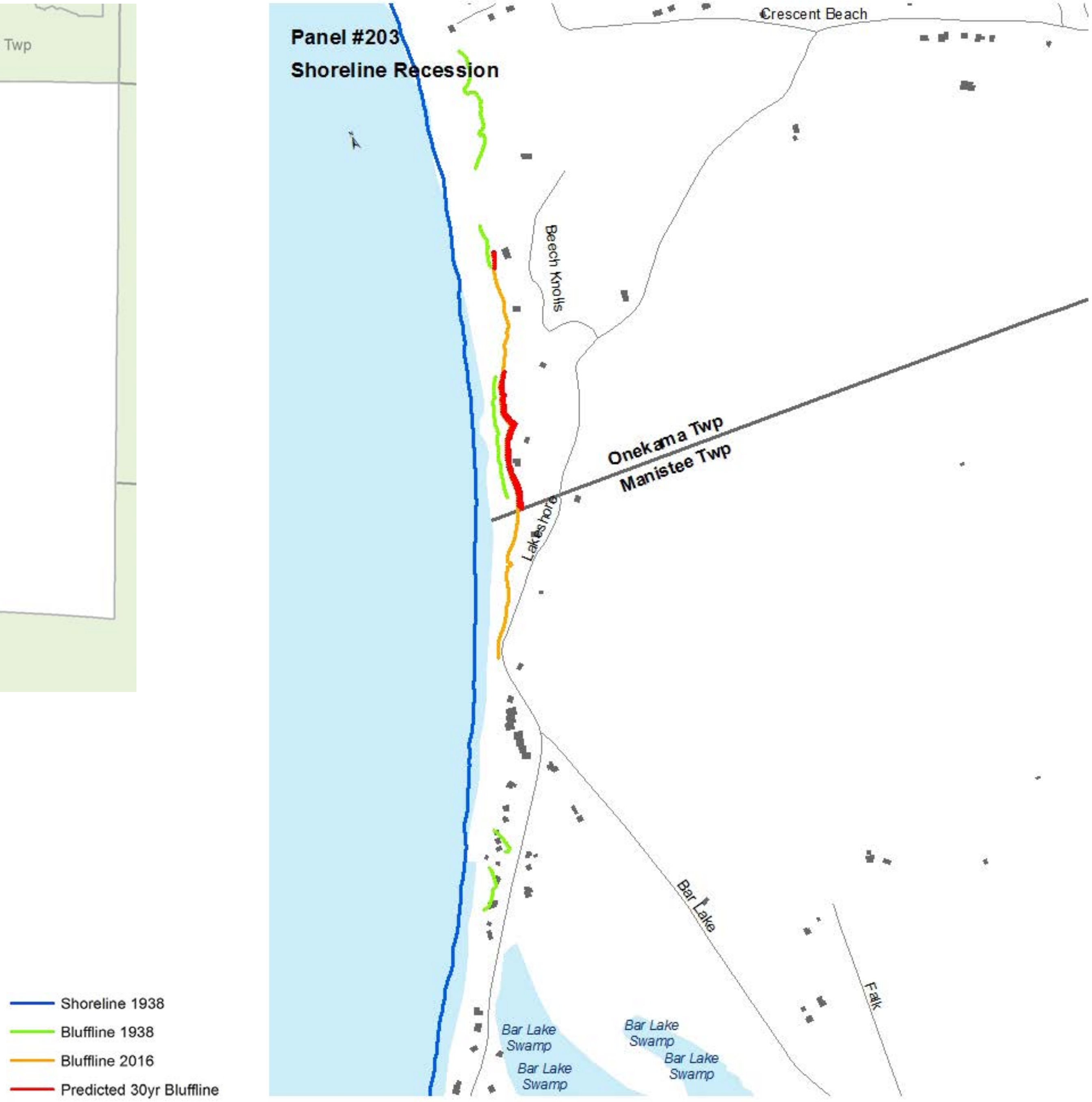
Manistee Twp.

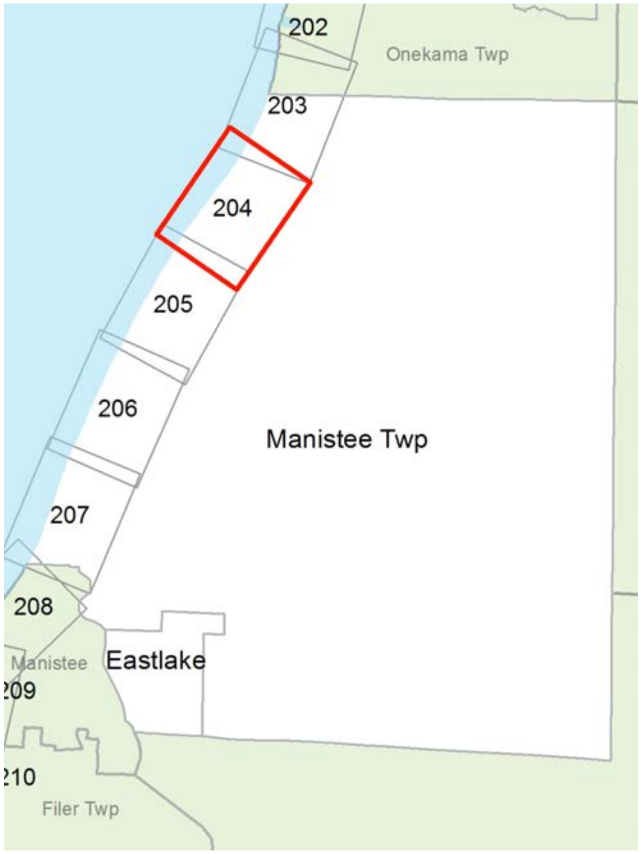


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

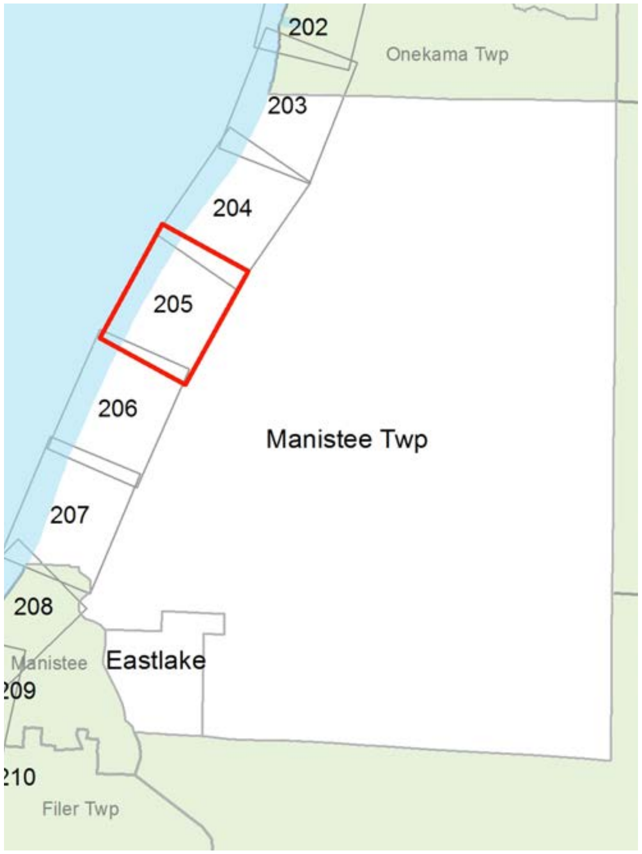

202
Onekama Twp
203
204
205
206
Manistee Twp
207
208
Manistee
Eastlake
209
210
Filer Twp


Manistee County


Panel #203
Shoreline Recession
Crescent Beach
Beech Knolls
Onekama Twp
Manistee Twp
Lakeshore
Bar Lake
Falk
Bar Lake Swamp
Bar Lake Swamp
Bar Lake Swamp
Bar Lake Swamp
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

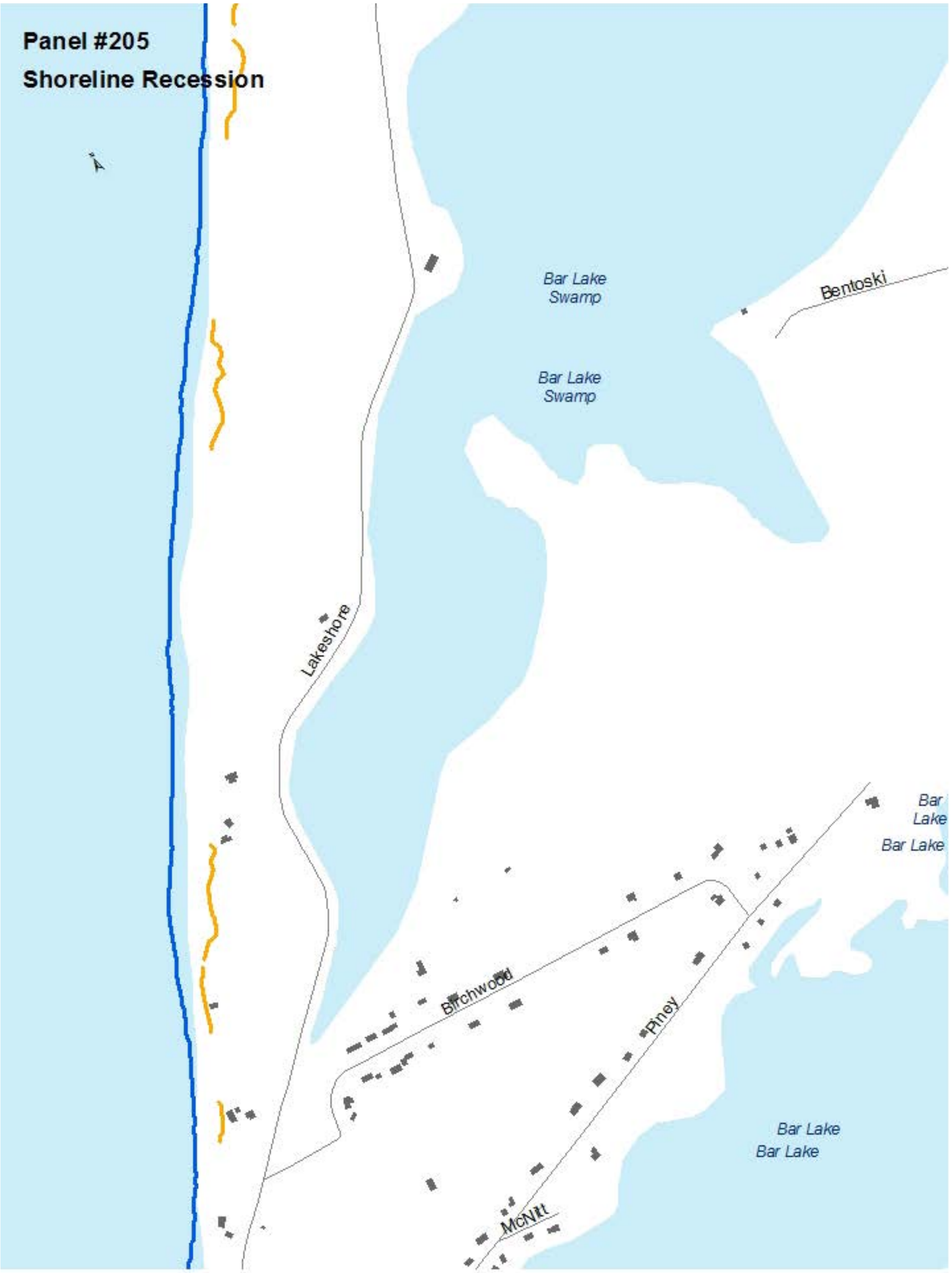


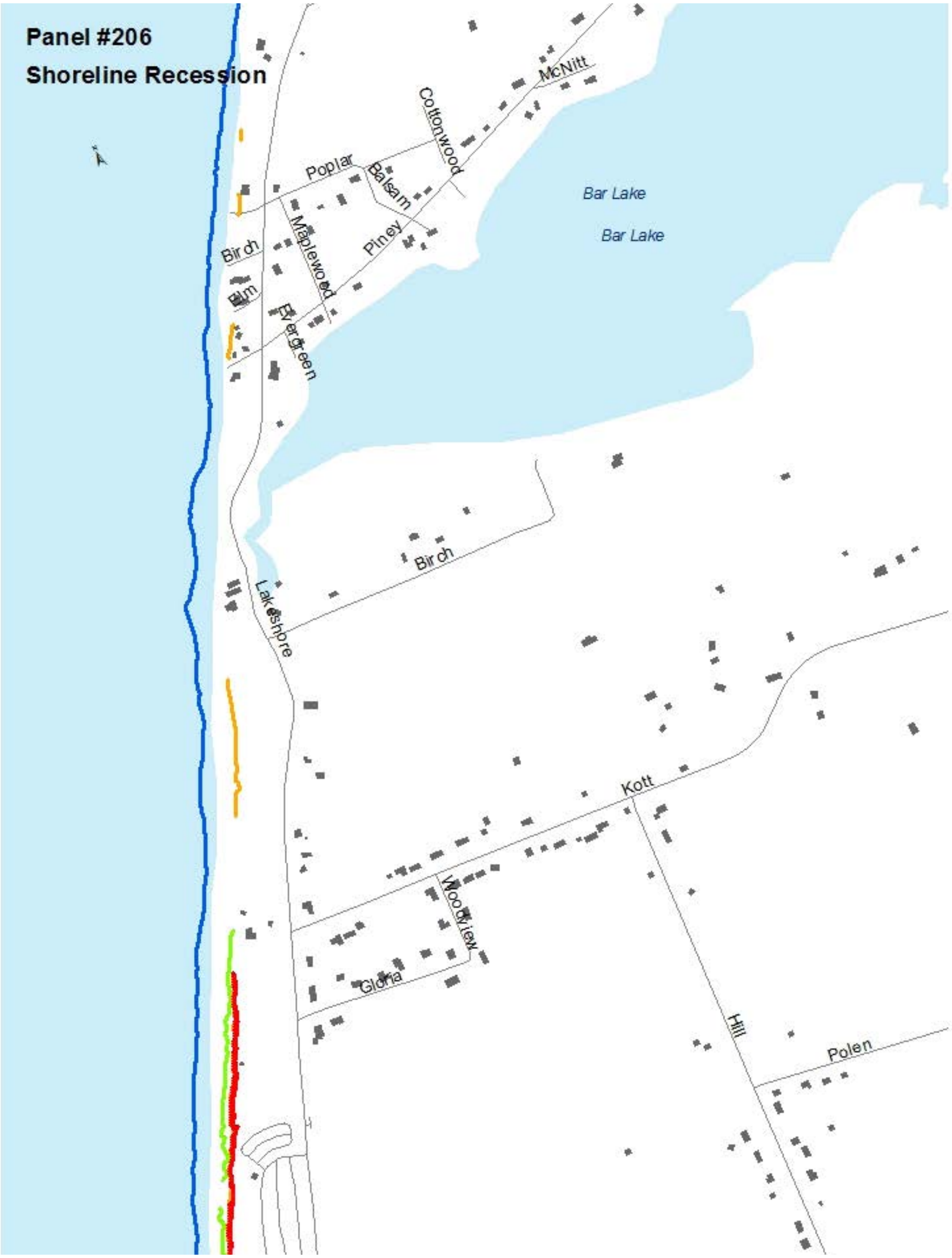
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

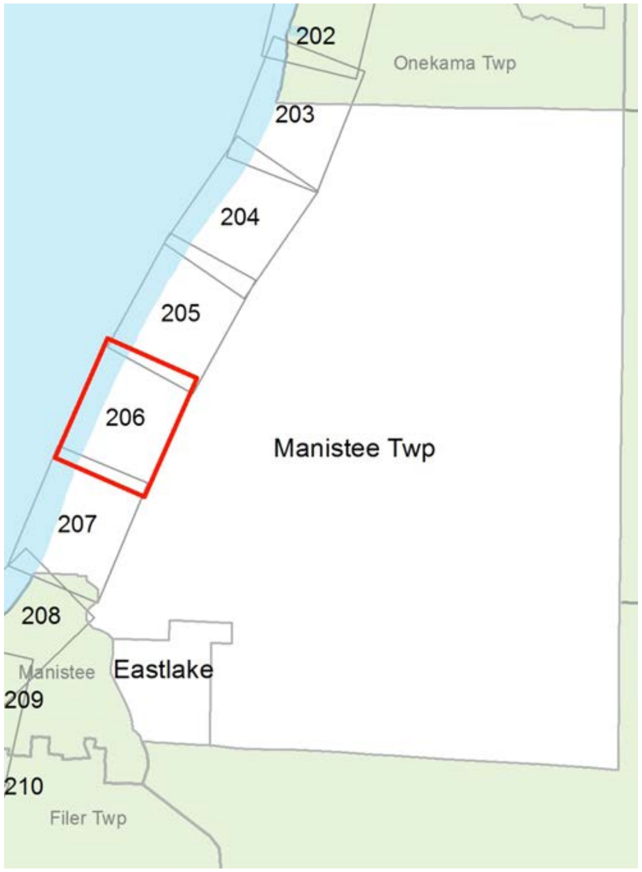

202
Onekama Twp
203
204
205
206
Manistee Twp
207
208
Manistee
Eastlake
209
210
Filer Twp


Manistee County

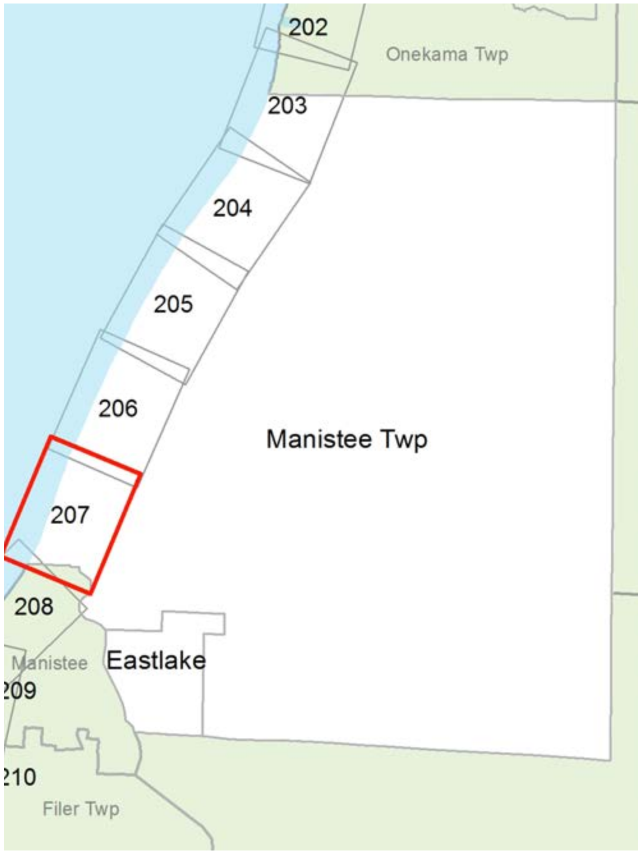

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


Panel #205
Shoreline Recession
Bar Lake Swamp
Bar Lake Swamp
Bentoski
Lakeshore
Bar Lake
Bar Lake
Birchwood
Piney
Bar Lake
Bar Lake
McNitt

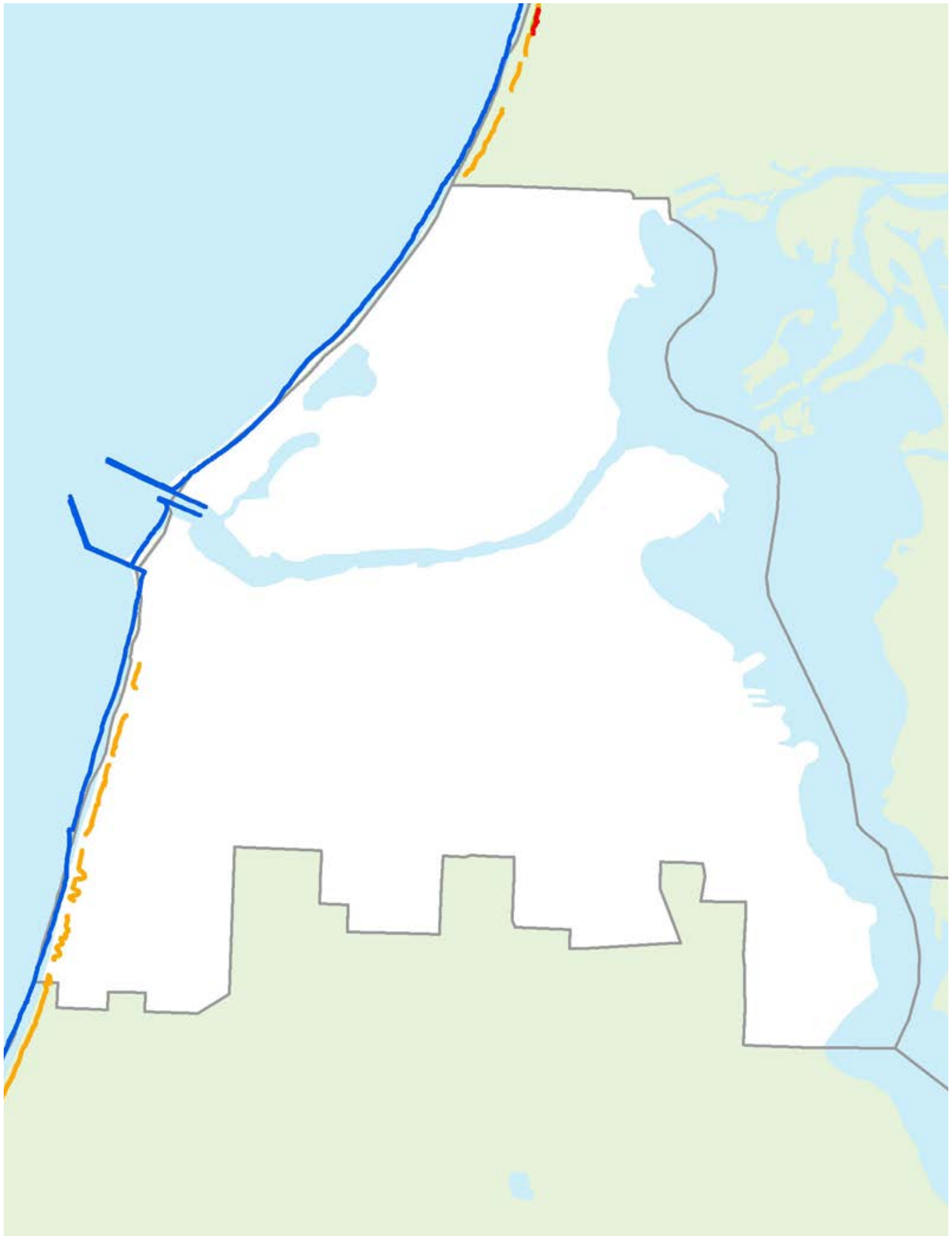




Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



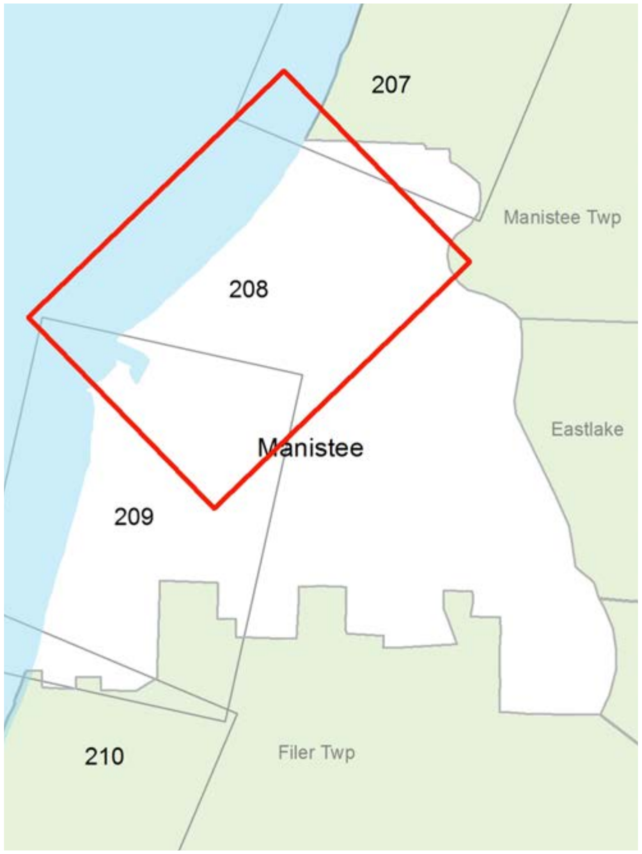
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



Manistee

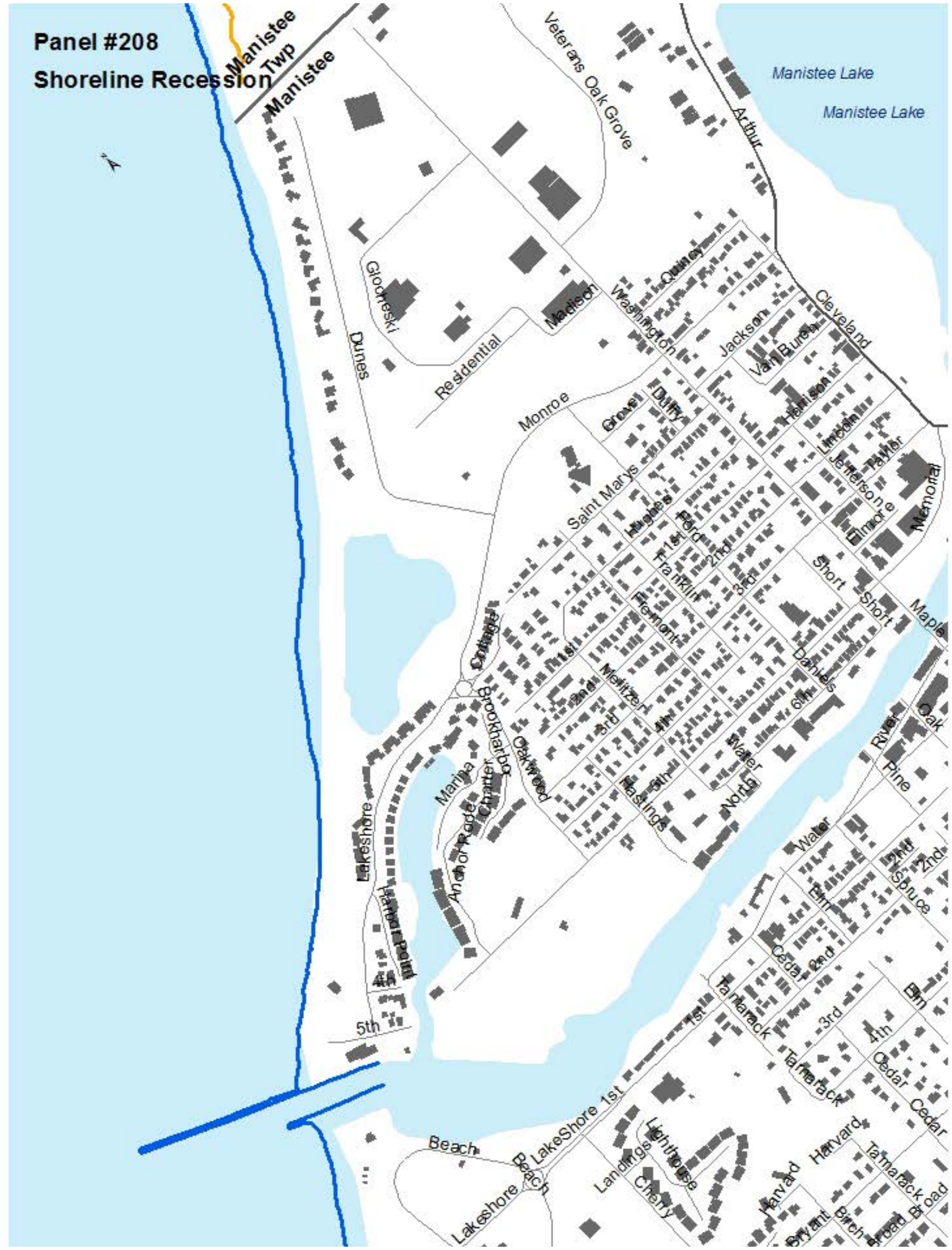

Manistee County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


207
208
209
210
Manistee Twp
Eastlake
Manistee
Filer Twp


Manistee County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline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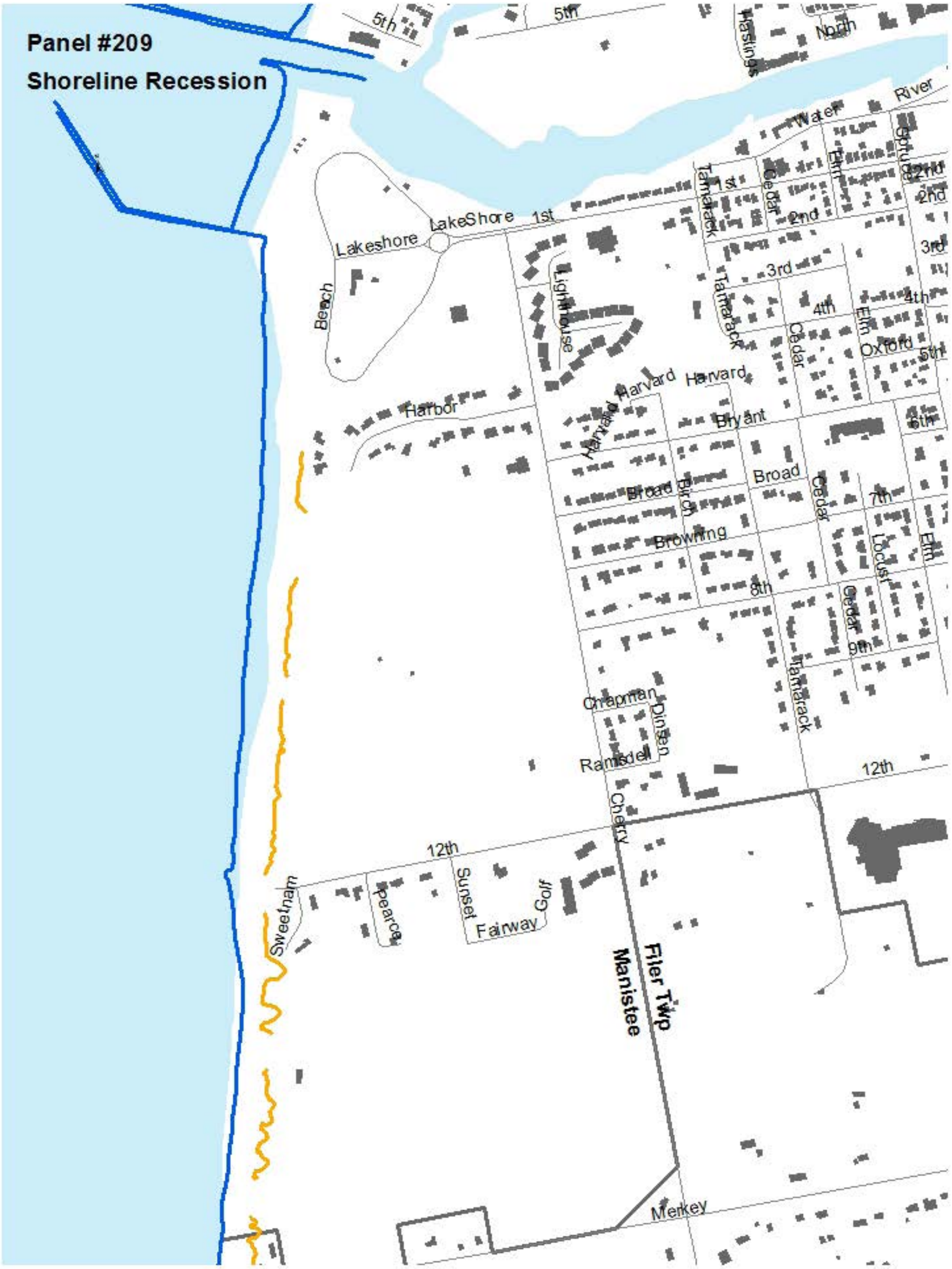
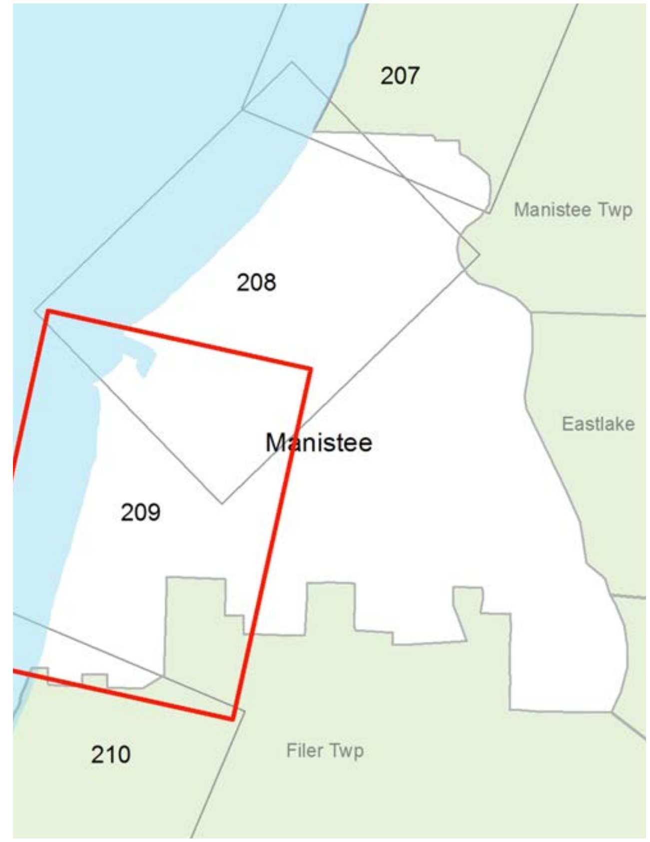
Shoreline Recession
Manistee Twp
Manistee
Manistee Lake
Manistee Lake



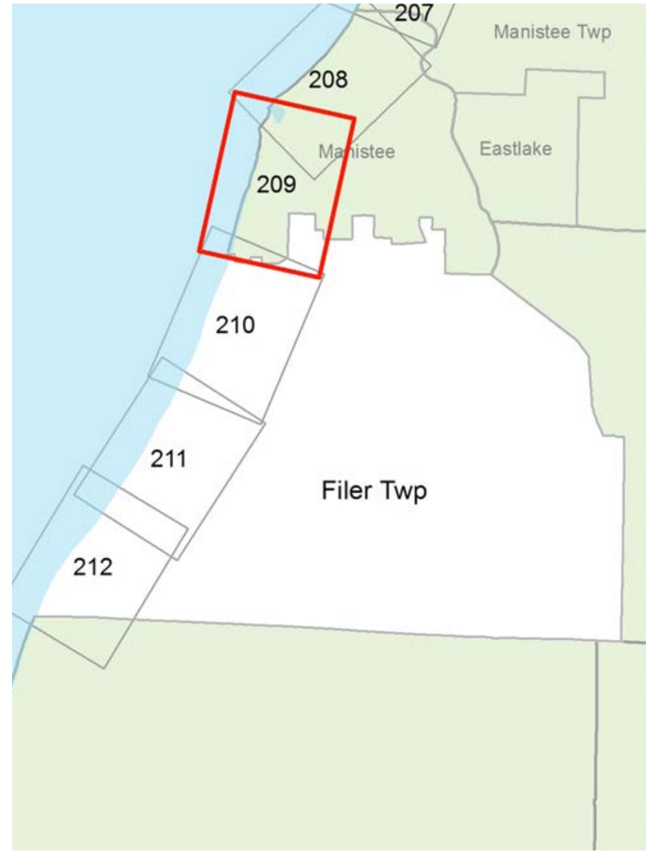


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

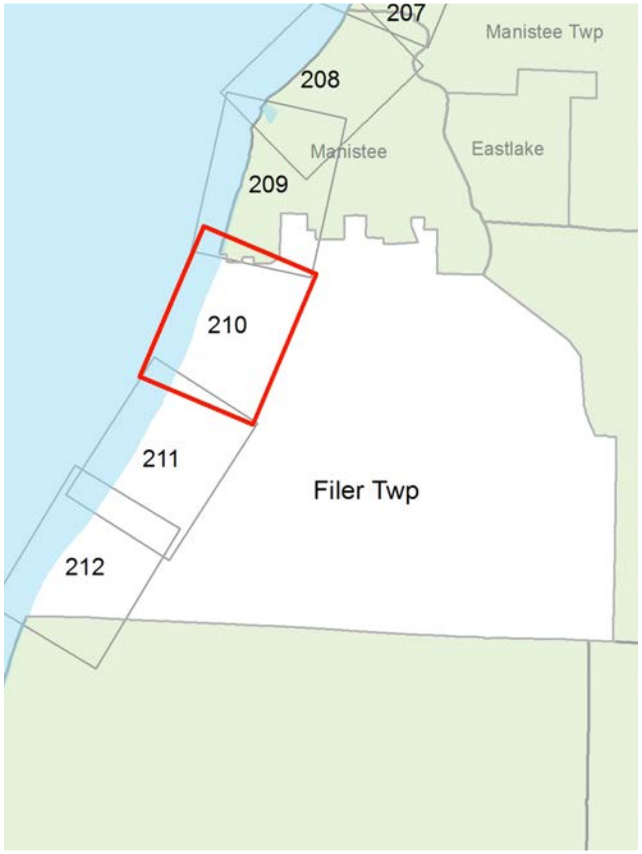
Filer Twp.


Manistee County


Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



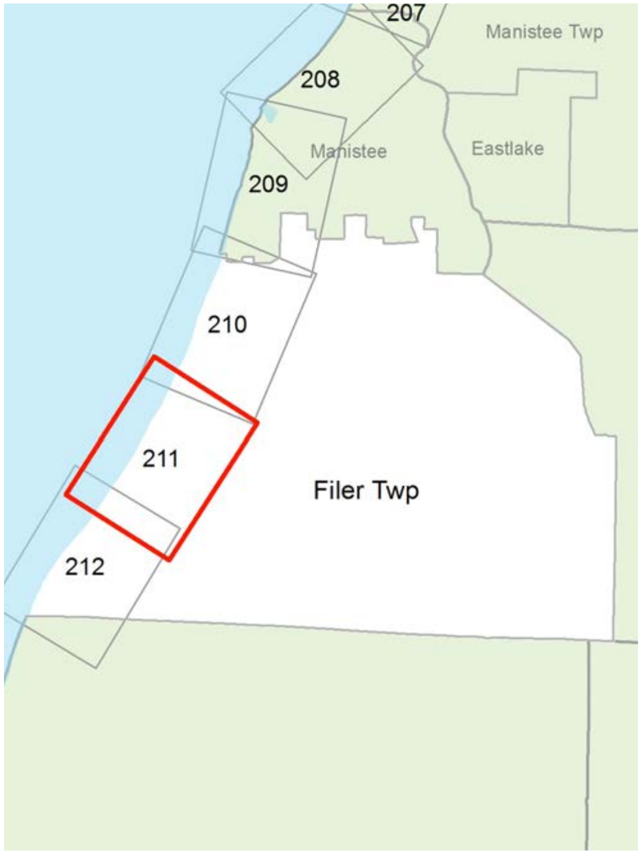
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline


207
Manistee Twp
208
Manistee
Eastlake
209
210
211
Filer Twp
212

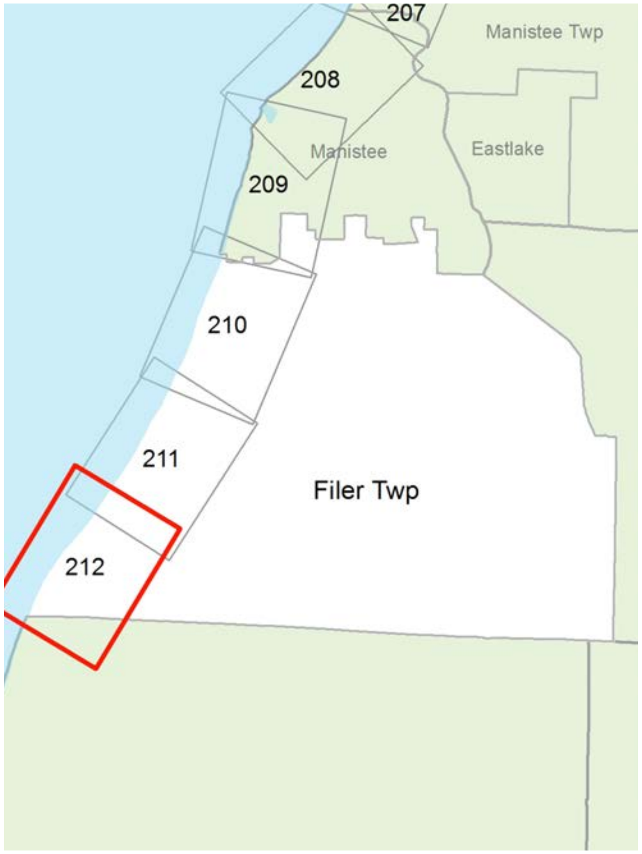

Panel #210
Shoreline Recession
Manistee
Filer Twp
Merkey
Snow Trails
Blossom
Cherry
Fruit
Anthony
Red Apple
Old Red Apple
Wildwood


Manistee County

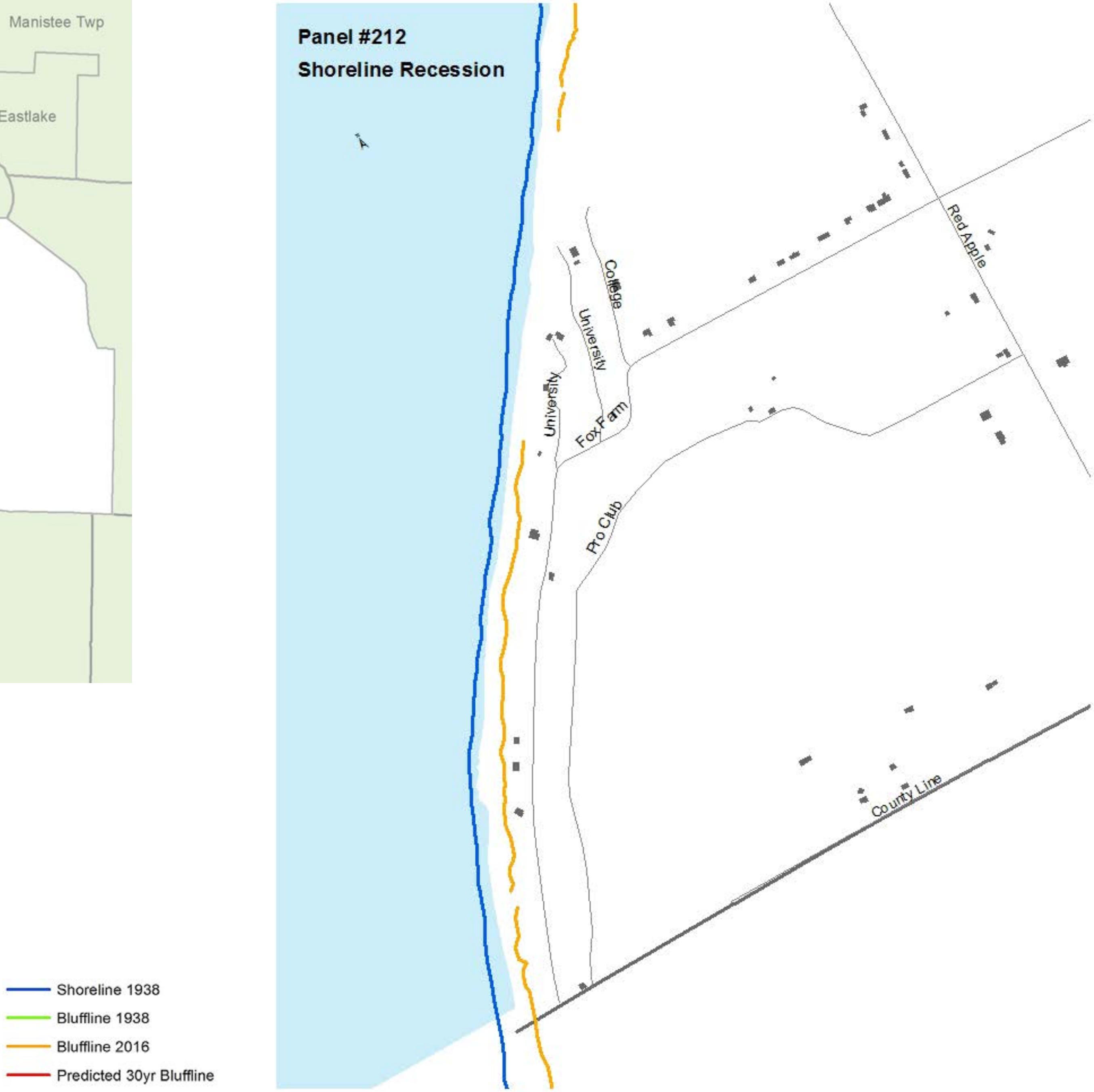

Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline



- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline


207
Manistee Twp
208
Manistee
Eastlake
209
210
211
Filer Twp
212


Manistee County


Panel #212
Shoreline Recession
College
University
University
Fox Farm
Pro Club
Red Apple
County Line
Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30yr Bluffline

CHAPTER 5
Heat Vulnerability

Communities interested in becoming more resilient assess their vulnerabilities and make action plans to reduce their sensitivities and exposures to hazards of all kinds. While extreme heat events have been relatively rare in northwest Lower Michigan, climate models indicate the region will experience an increase in the frequency and length of severe heat events. This Heat Vulnerability Assessment has been compiled for local officials who are looking to address their community's vulnerability to heat.

Vulnerability = Exposure + Sensitivity

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. "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 is used in a variety of studies such as equity and adaptation assessments conducted by the NAACP, research on vulnerability and its relationship to adaptation, and hazard-specific vulnerability assessments aimed at measuring exposure, sensitivity, and resilience.

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 areas of vulnerability lie and why the vulnerability exists.

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 county equalization departments. Building footprint data was obtained through the USBuildingFootprints database licensed by Microsoft under the Open Data Commons Open Database License (ODbL). Tree canopy cover and impervious surface data was obtained through the Michigan Tech Research Institute (MTRI) of Michigan Technological University.

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. One study found that neighborhoods with the highest temperatures and the least amount of open space and vegetation were also likely to be the most socioeconomically disadvantaged. 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 and described in a 2012 report.

To conduct the heat sensitivity assessment of each coastal 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 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 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 2 depicts the high concentrations of people living alone.

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. Census Blocks were used to map the relative percentages of non-white populations in the each community (see Map 3).

Two socioeconomic factors associated with increased heat-related morbidity and mortality are the percentage of people living in poverty and the 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 observed communities (please see Map 4).

Similarly, University of Michigan researchers found studies that demonstrate a direct link between low education attainment and poor health. 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 studied municipalities (see Map 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.

Each Community Sensitivity to Excessive Heat Map (Map 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 for this analysis likely double-counts some people, such as in cases where a person is both a minority and over 65; this may overestimate the severity of the sensitivities in some locations. On the other hand, 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 each community looks to better understand its 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.

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 when temperatures begin to fall. 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.

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. Increasing the tree canopy cover can also reduce air temperatures 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.

To complete a heat exposure assessment, the project team focused on the Urban Heat Island Effect. 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). 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.

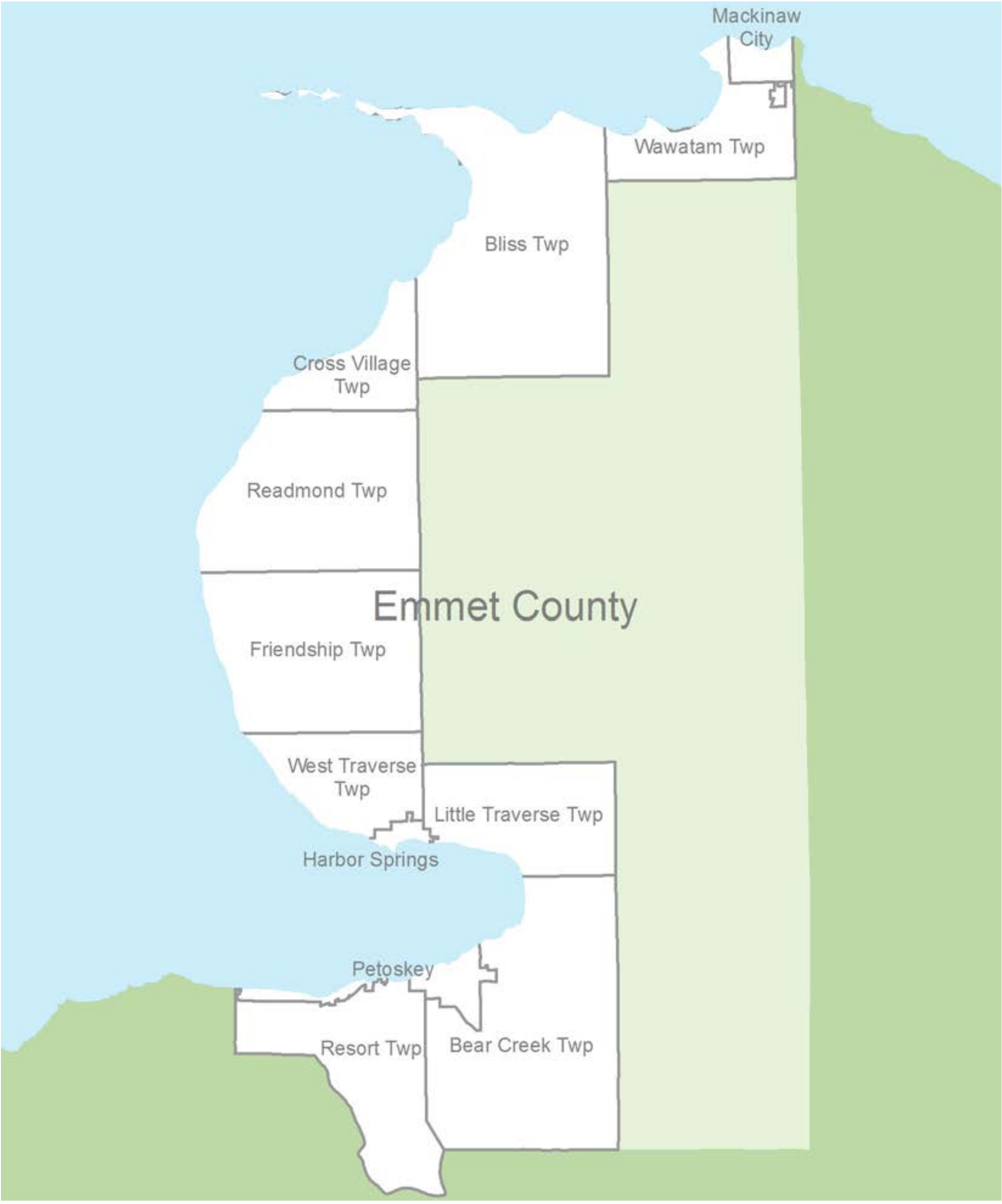
The second exposure factor is percentage of tree canopy. Here tree canopy is mapped within each Census Block and scored using a similar five-category process (Map 8). The project team combined the results of the two exposure maps to provide a single Community Excessive Heat Exposure Map (Map 9), which provides a reliable depiction of where the Urban Heat Island Effect would be most or least intense during a heat wave. Local officials in each community can use these maps to better assess where new vegetation and tree canopy would be helpful to reduce heat impact.

COMPOSITE HEAT VULNERABILITY

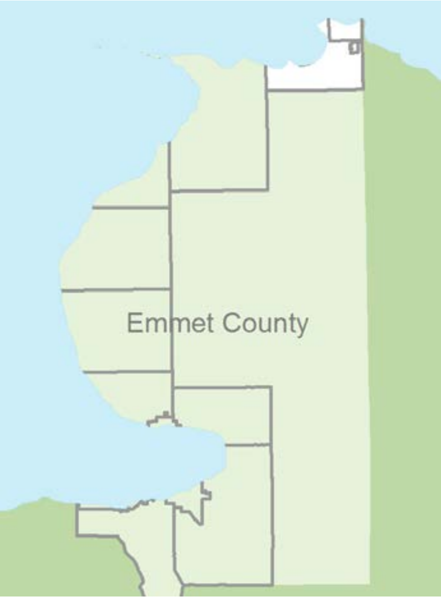
The Community Heat Vulnerability Map (Map 10) is a simple additive combination of the overall sensitivity map and the overall exposures map. The resulting vulnerability index depicts where concentrations of exposures and sensitive populations create a higher risk for community residents. In general, those areas with a composite score of 22 to 27 (red) have residential populations that may be particularly vulnerable to extreme heat events.

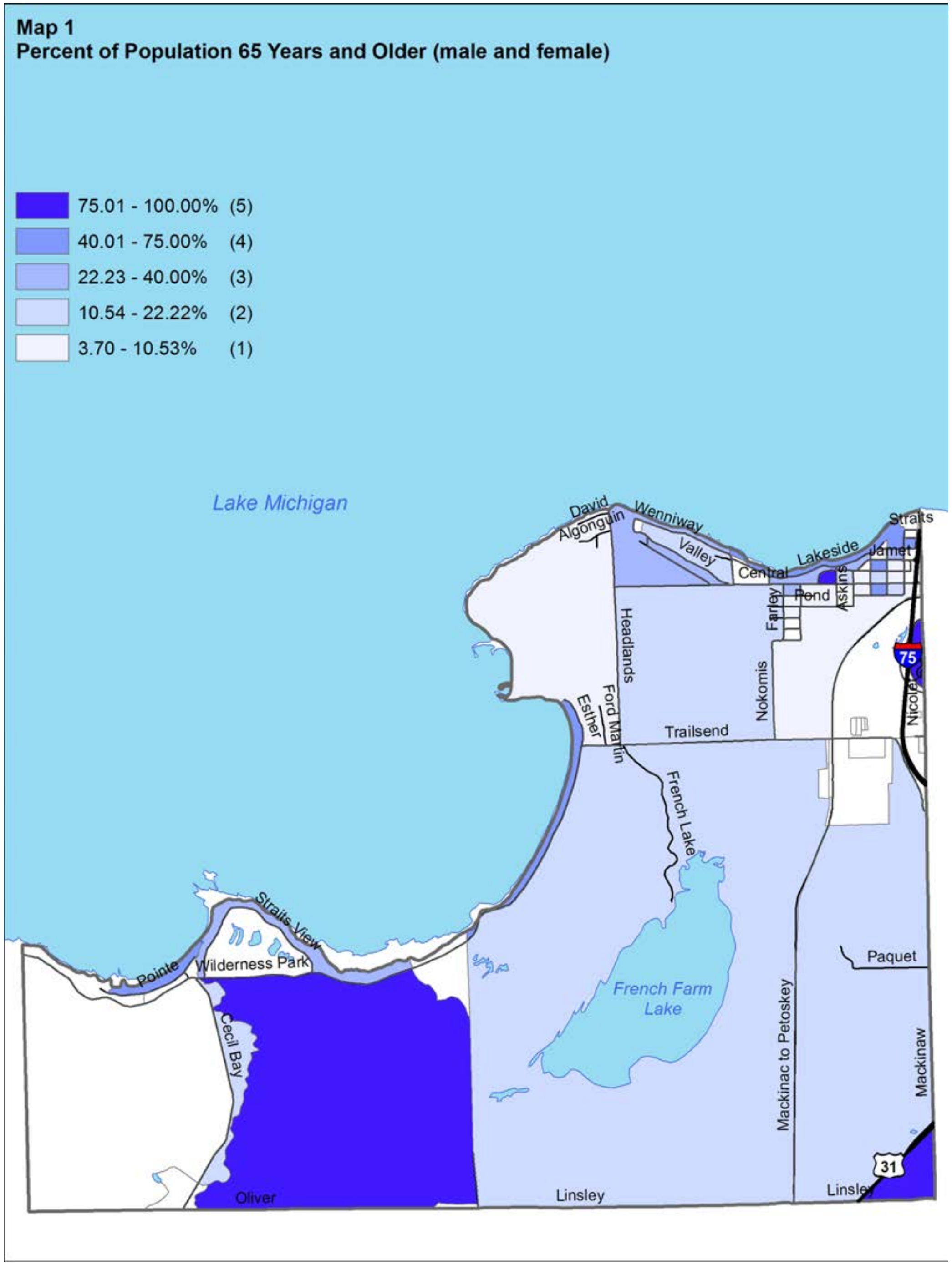
For this Atlas, Heat Vulnerability Assessments were conducted for each coastal community. The following sections are organized first by county, then by each local jurisdiction within that county. It is important to note that the U.S. Census data sets used to calculate heat vulnerability incorporate village data into an adjacent township, which is noted in each occurrence.

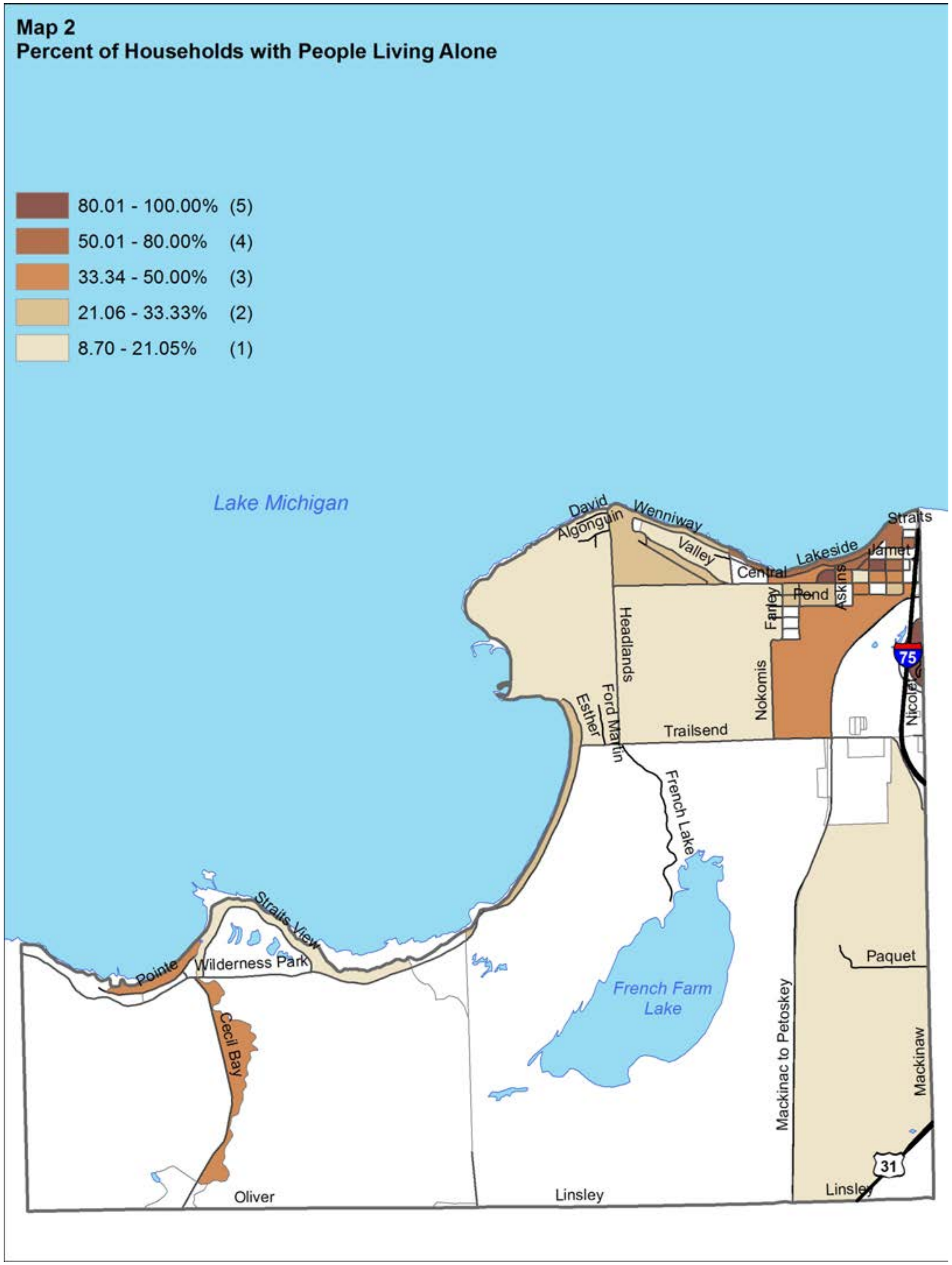
Emmet County

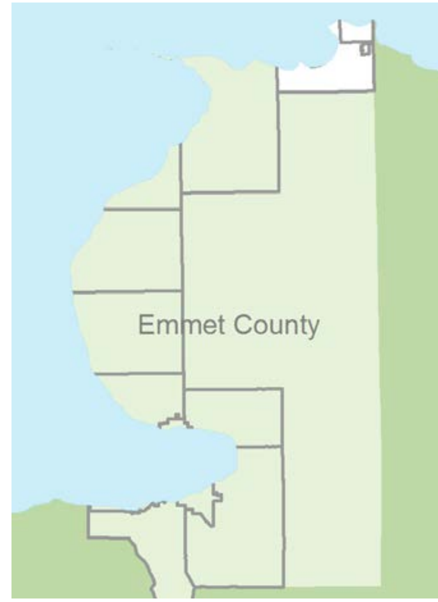


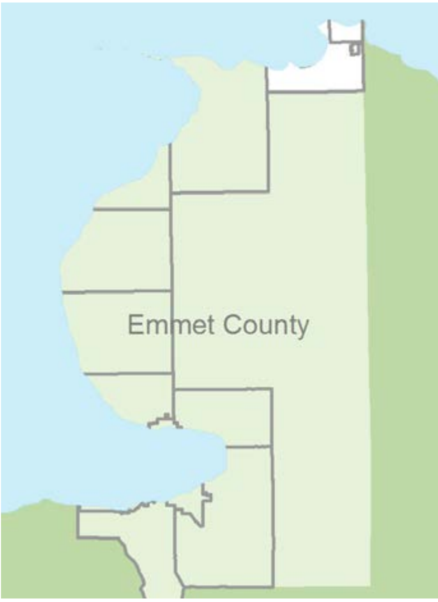
Wawatam Twp./ Mackinaw City

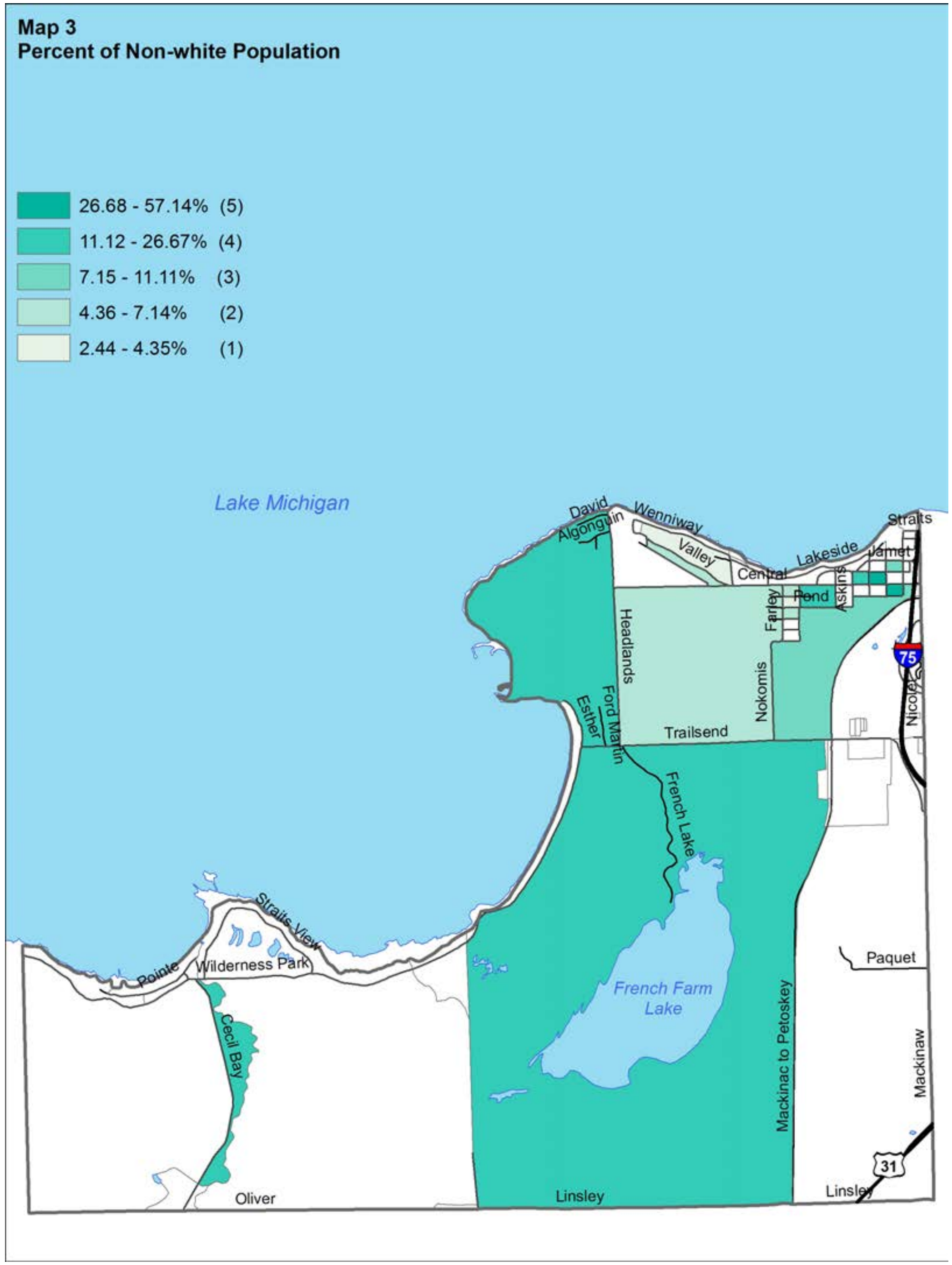


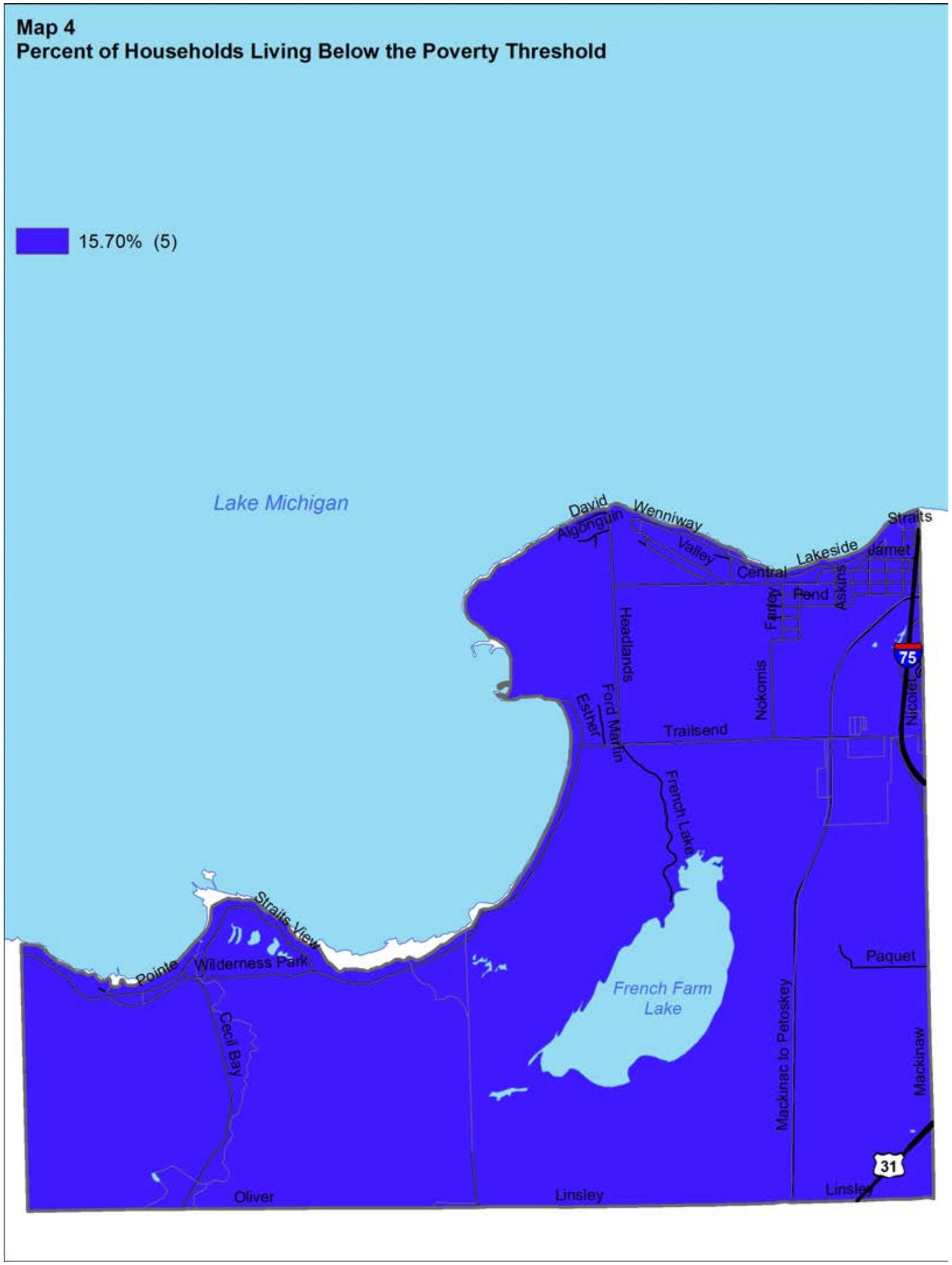


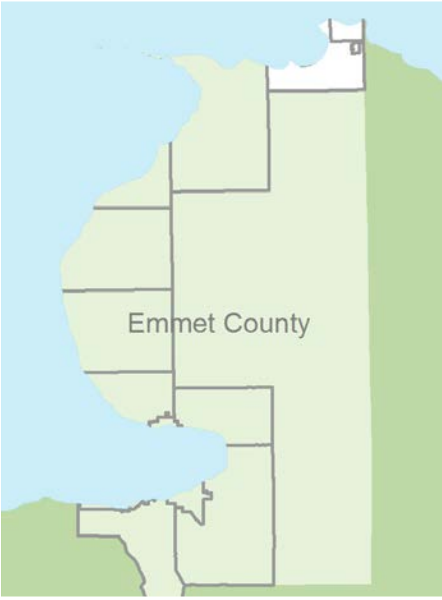

Map 2
Percent of Households with People Living Alone
80.01 - 100.00% (5)
50.01 - 80.00% (4)
33.34 - 50.00% (3)
21.06 - 33.33% (2)
8.70 - 21.05% (1)
Lake Michigan
David
Algonguin
Wenniway
Valley
Central
Lakeside
Straits
Jamet
Pond
Askins
Farley
Headlands
Nokomis
Nicolet
75
Esther
Ford Martin
Trailsend
French Lake
Straits View
Wilderness Park
Pointe
Cecil Bay
French Farm Lake
Mackinac to Petoskey
Paquet
Mackinaw
31
Oliver
Linsley
Linsley

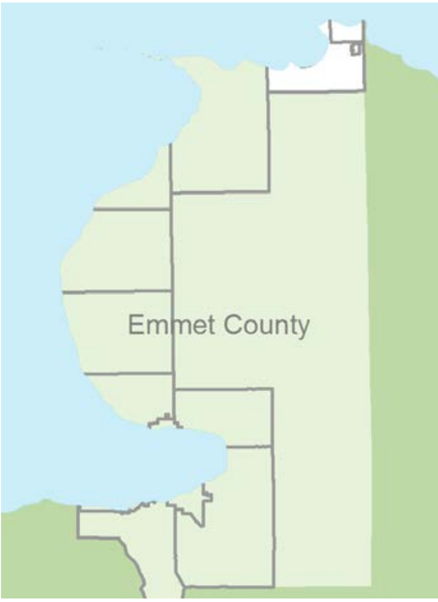

Emmet County

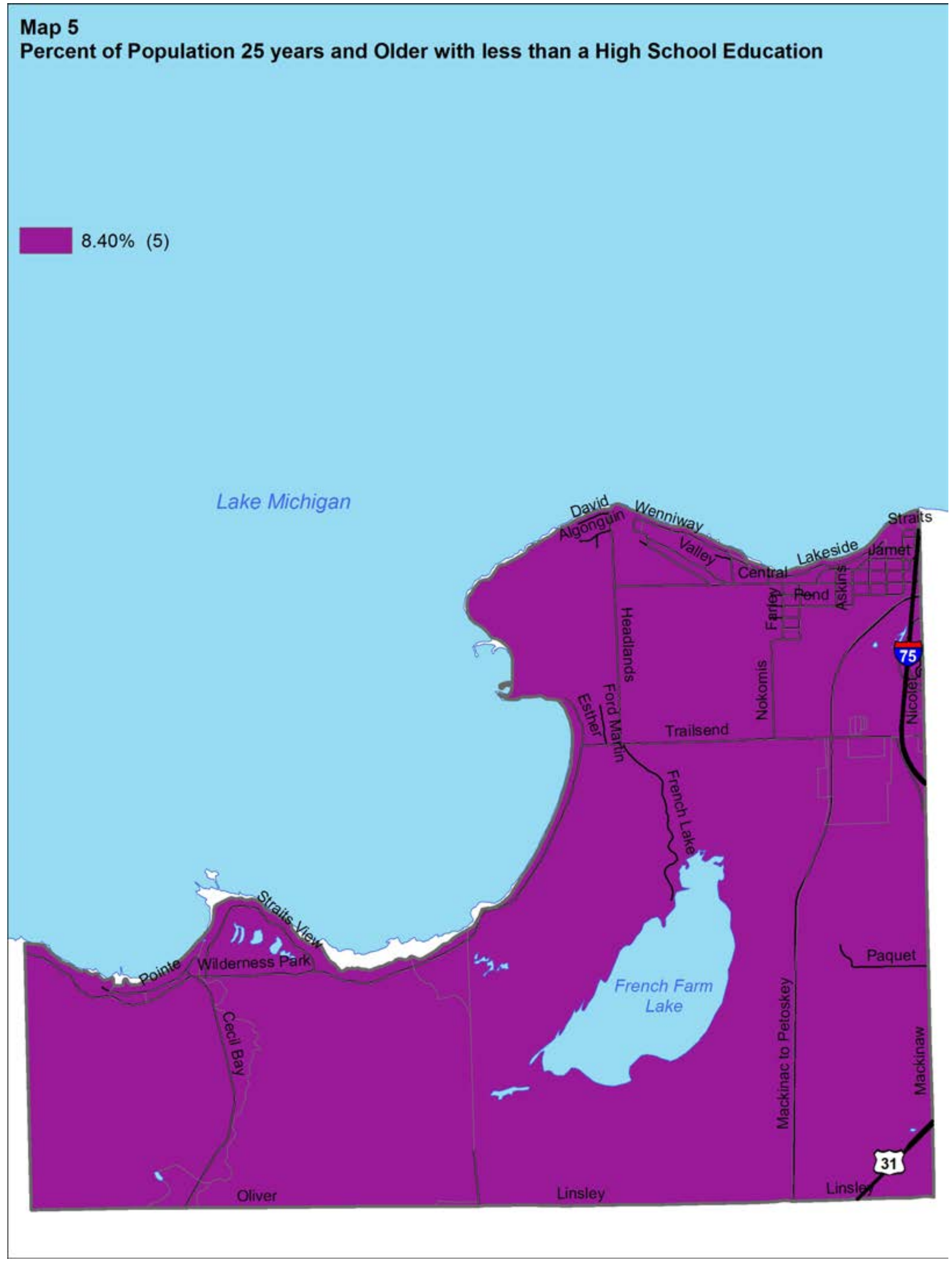

Emmet County

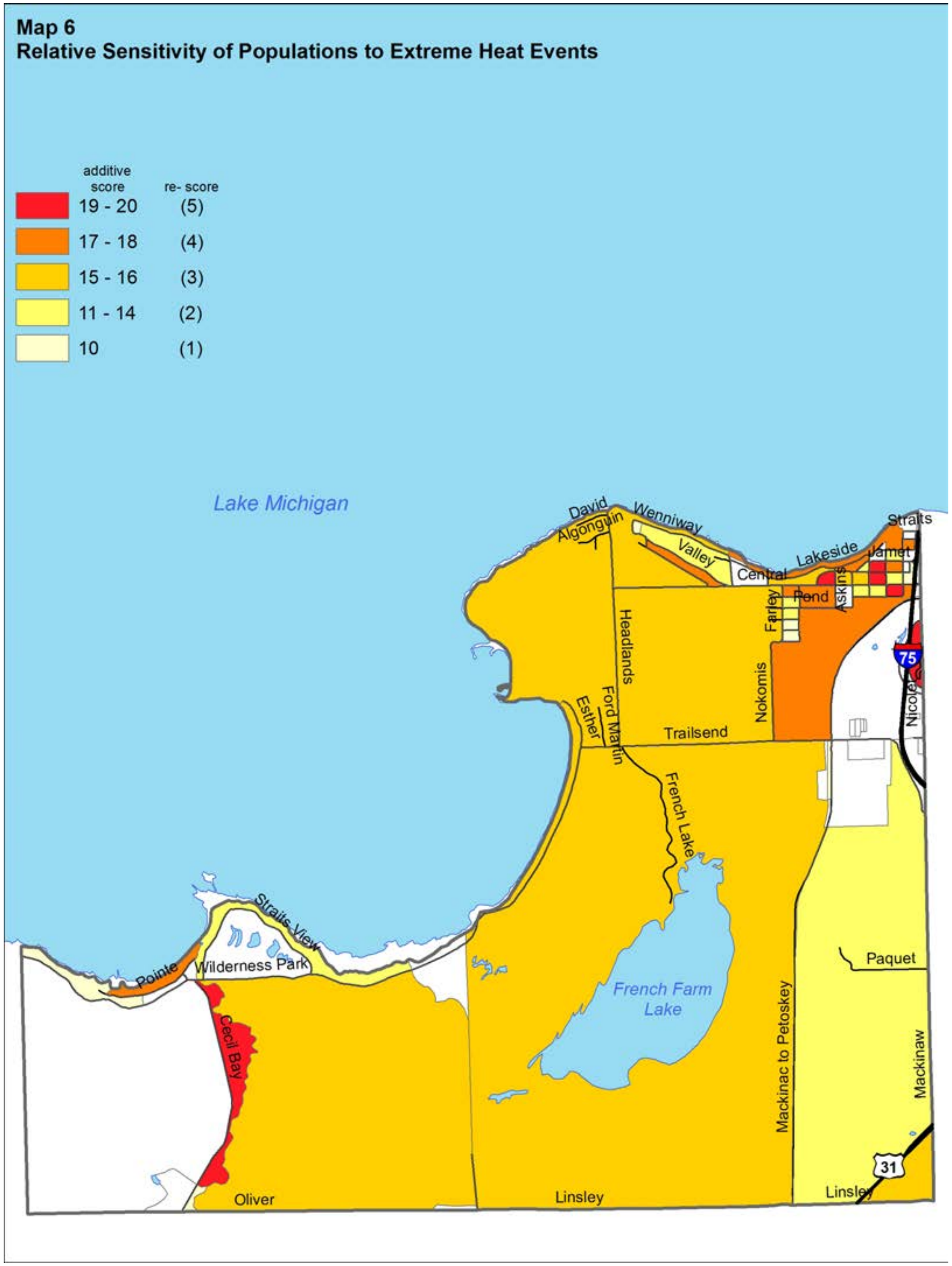

Map 3
Percent of Non-white Population
26.68 - 57.14% (5)
11.12 - 26.67% (4)
7.15 - 11.11% (3)
4.36 - 7.14% (2)
2.44 - 4.35% (1)
Lake Michigan
David
Algonquin
Wenniway
Valley
Central
Lakeside
Straits
Jamet
Pond
Askins
Farley
Headlands
Nokomis
Ford Martin
Esther
Trailsend
75
Nicolet
French Lake
French Farm Lake
Mackinac to Petoskey
Paquet
Mackinaw
31
Linsley
Straits View
Wilderness Park
Pointe
Cecil Bay
Oliver
Linsley

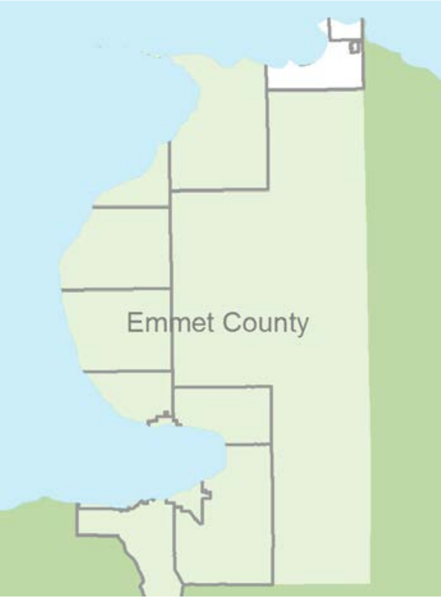

Map 4
Percent of Households Living Below the Poverty Threshold
15.70% (5)
Lake Michigan
David
Algonquin
Wenniway
Valley
Central
Lakeside
Straits
Jamet
Pond
Askins
Farley
Headlands
Nokomis
75
Nicolet
Ford Martin
Esther
Trailsend
French Lake
French Farm Lake
Straits View
Pointe
Wilderness Park
Cecil Bay
Paquet
Mackinac to Petoskey
Mackinaw
31
Oliver
Linsley
Linsley

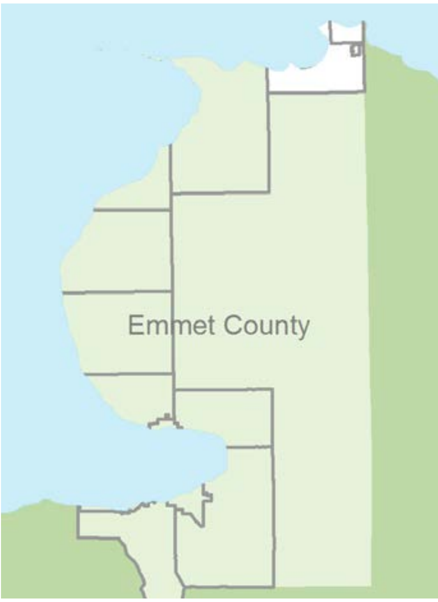

Emmet County

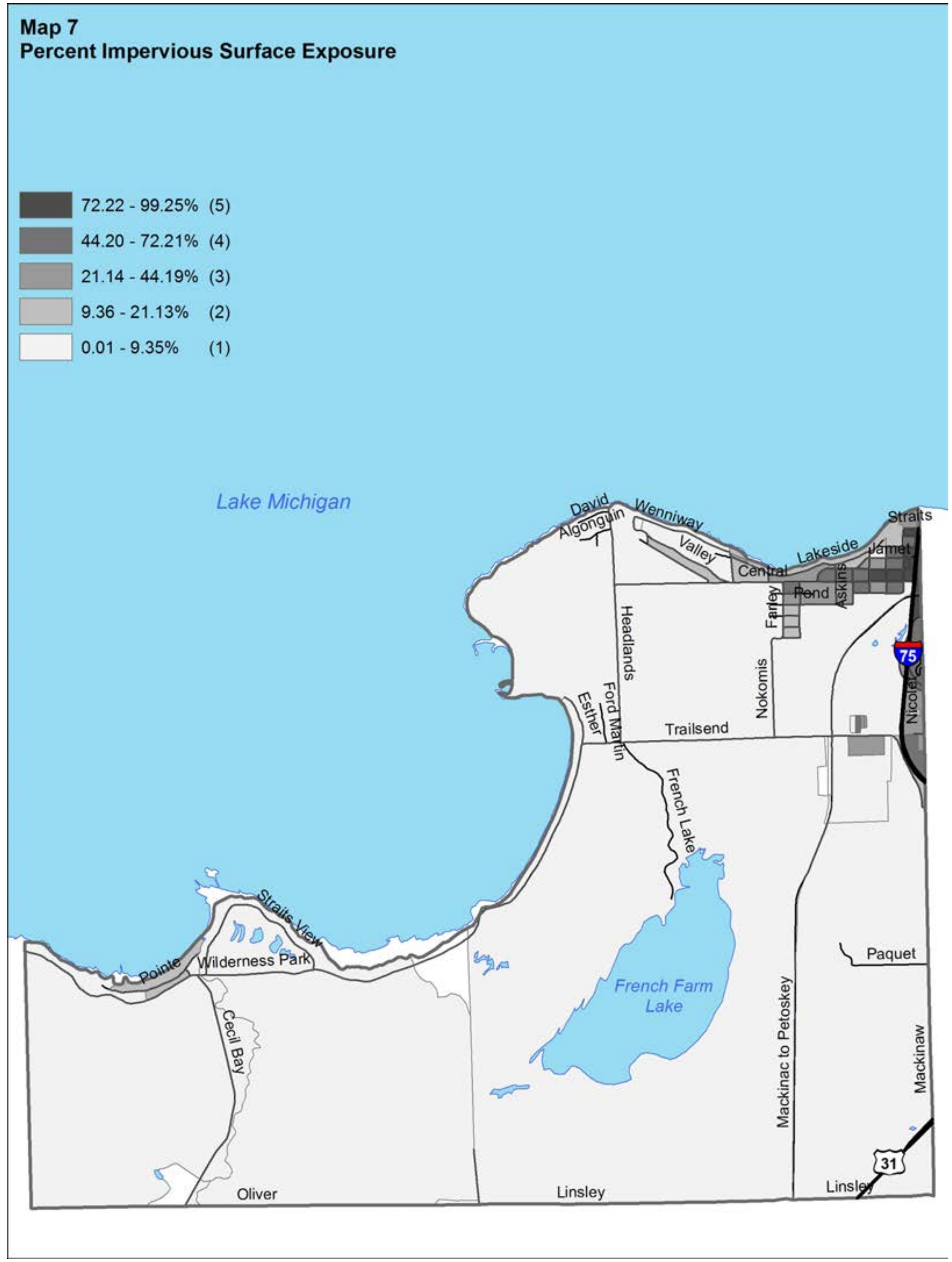

Emmet County

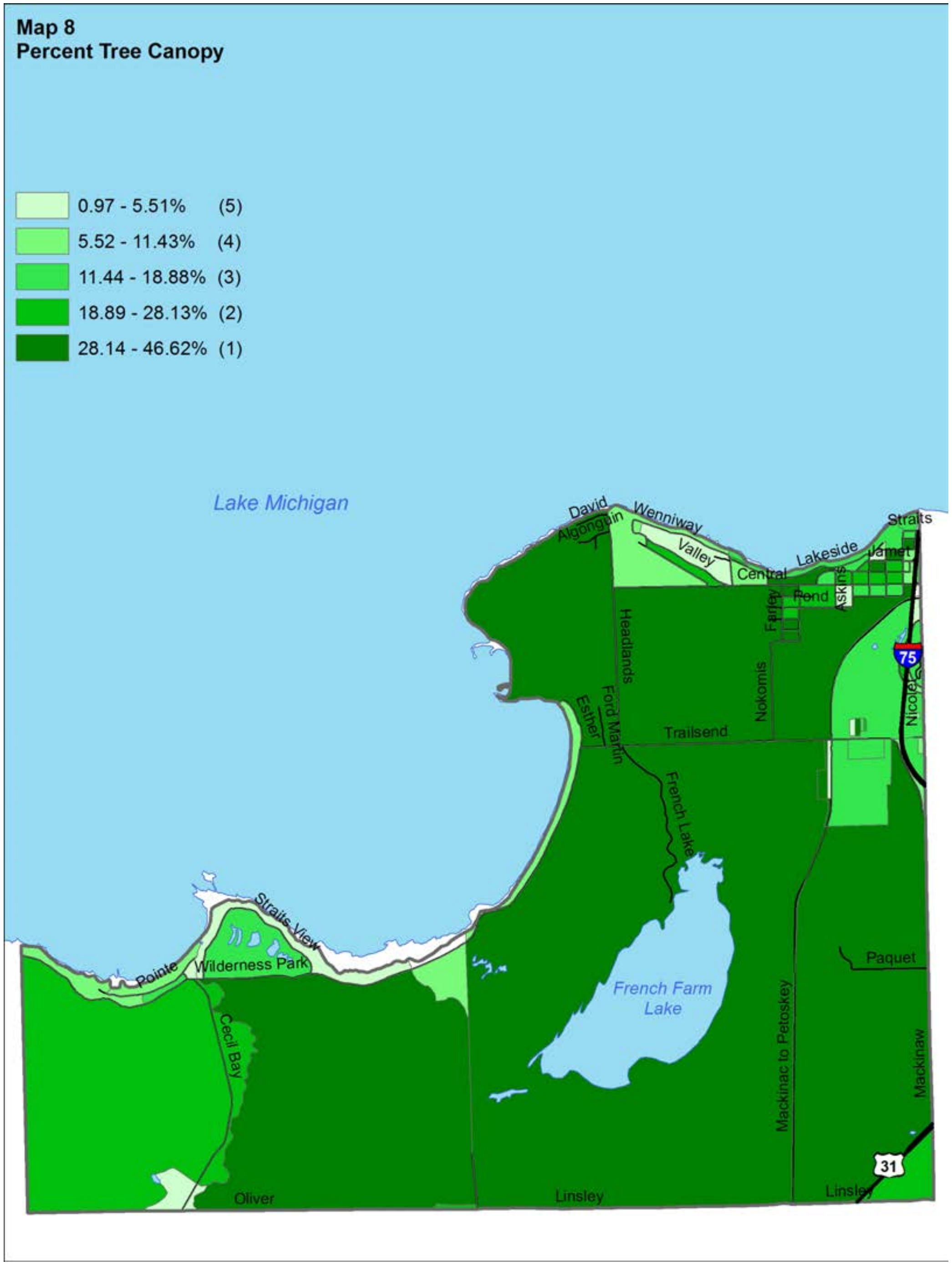

Map 5
Percent of Population 25 years and Older with less than a High School Education
8.40% (5)
Lake Michigan
David
Algonquin
Wenniway
Valley
Central
Lakeside
Straits
Jamet
Pond
Askins
Farley
Headlands
Nokomis
Esther
Ford Martin
Trailsend
Nicolet
75
French Lake
French Farm Lake
Straits View
Wilderness Park
Pointe
Cecil Bay
Paquet
Mackinac to Petoskey
Mackinaw
31
Oliver
Linsley
Linsley

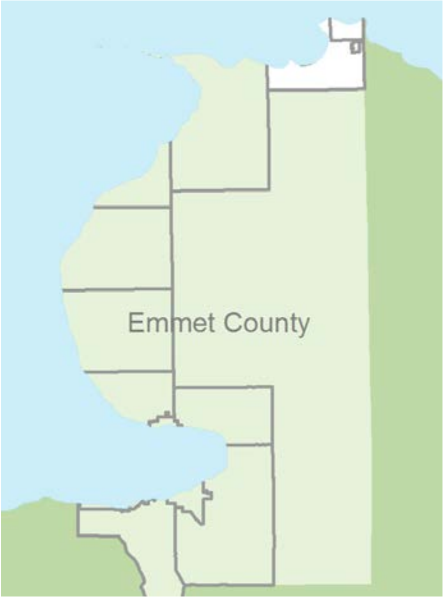

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
additive score
re- score
19 - 20 (5)
17 - 18 (4)
15 - 16 (3)
11 - 14 (2)
10 (1)
Lake Michigan
David
Algonquin
Wenniway
Valley
Central
Lakeside
Straits
Jamet
Askins
Pond
Farley
Headlands
Nokomis
Esther
Ford Martin
Trailsend
Nicolet
75
French Lake
Straits View
Wilderness Park
Pointe
Cecil Bay
French Farm Lake
Mackinac to Petoskey
Paquet
Mackinaw
31
Oliver
Linsley
Linsley

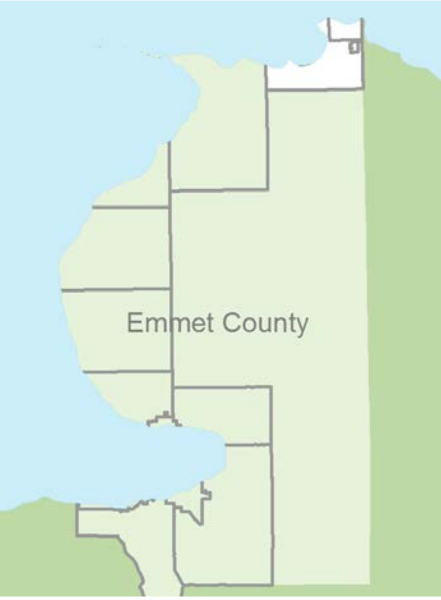

Emmet County

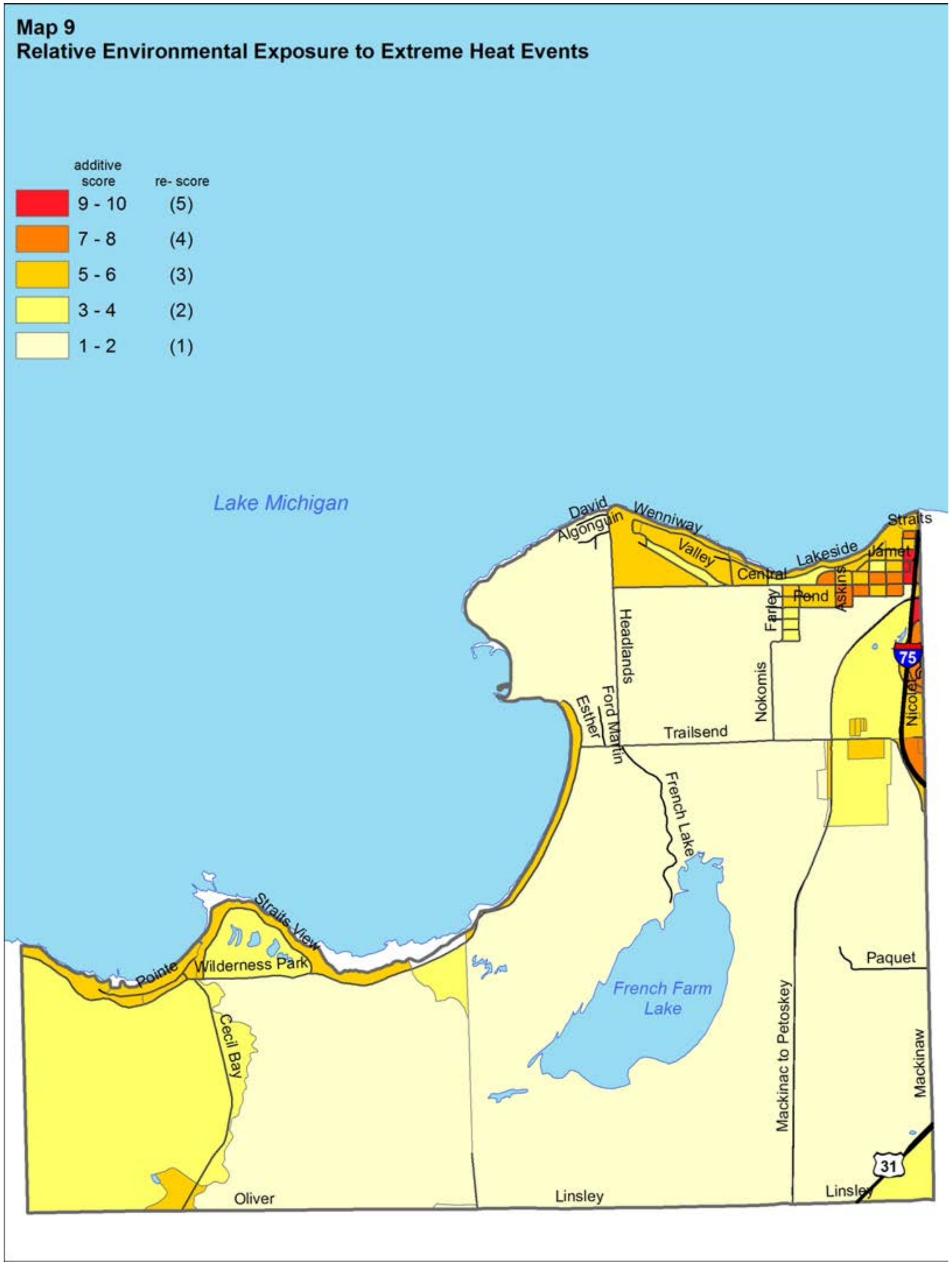

Emmet County

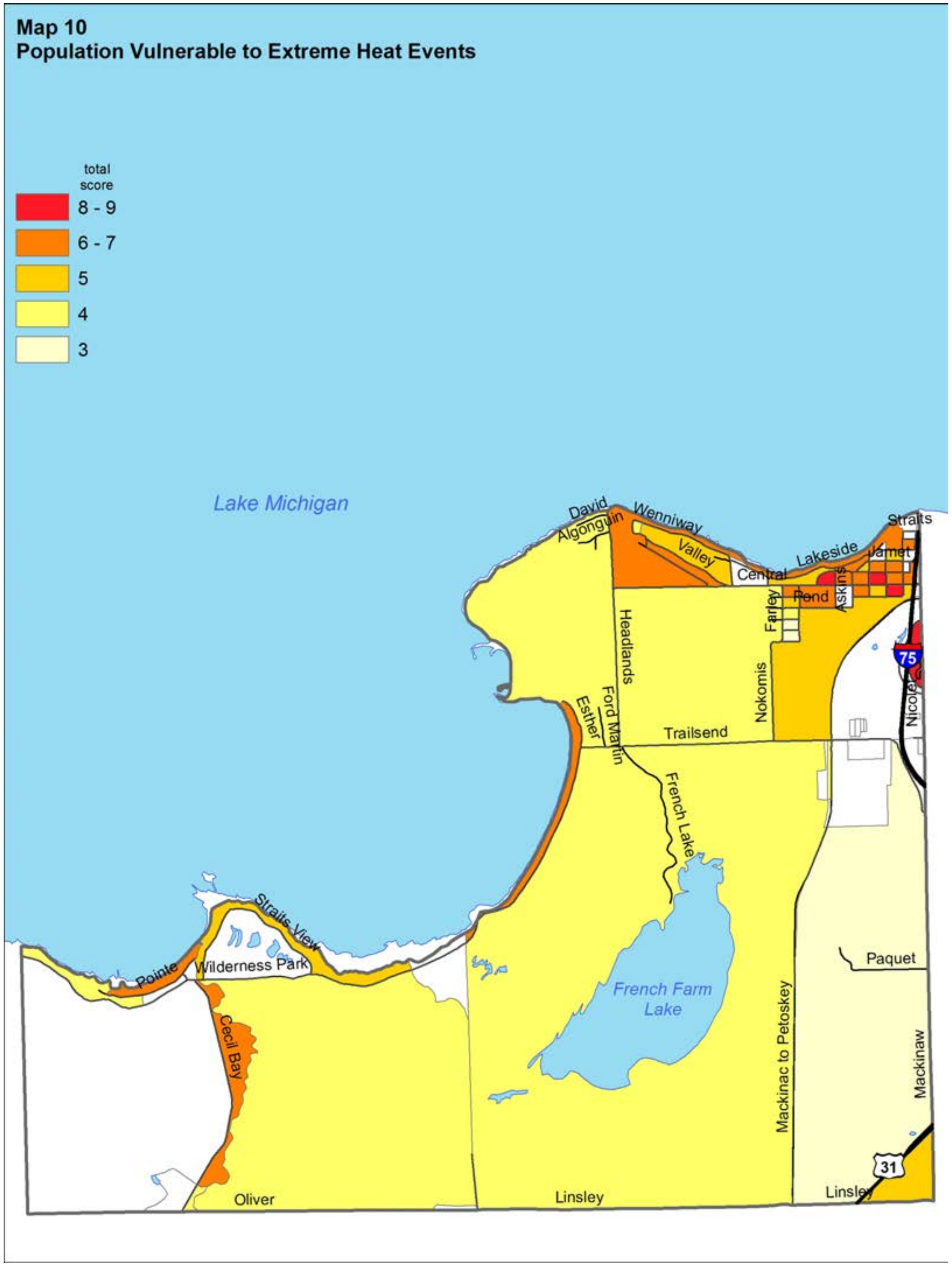

Map 7
Percent Impervious Surface Exposure
72.22 - 99.25% (5)
44.20 - 72.21% (4)
21.14 - 44.19% (3)
9.36 - 21.13% (2)
0.01 - 9.35% (1)
Lake Michigan
David
Algonquin
Wenniway
Valley
Central
Lakeside
Jamet
Straits
Pond
Askins
Farley
Headlands
Nokomis
Nicolet
75
Ford Martin
Esther
Trailsend
French Lake
Straits View
Wilderness Park
Pointe
Cecil Bay
French Farm Lake
Paquet
Mackinac to Petoskey
Mackinaw
31
Oliver
Linsley
Linsley

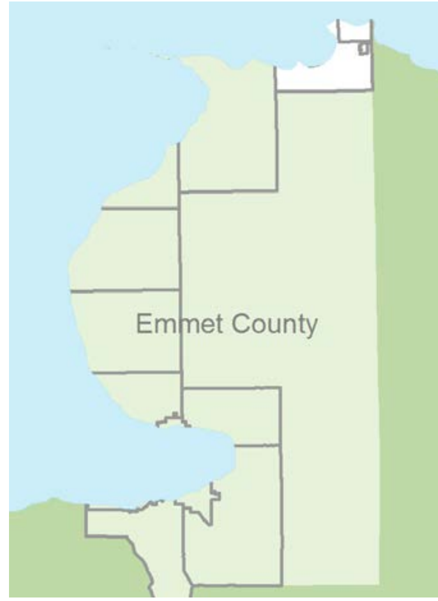

Map 8
Percent Tree Canopy
0.97 - 5.51% (5)
5.52 - 11.43% (4)
11.44 - 18.88% (3)
18.89 - 28.13% (2)
28.14 - 46.62% (1)
Lake Michigan
David
Algonquin
Wenniway
Valley
Central
Lakeside
Jamet
Straits
Pond
Askins
Fairley
Headlands
Nokomis
Esther
Ford Martin
Trailsend
75
Nicolet
French Lake
French Farm
Lake
Straits View
Wilderness Park
Pointe
Cecil Bay
Paquet
Mackinac to Petoskey
Mackinaw
31
Oliver
Linsley
Linsley


Emmet County


Emmet County

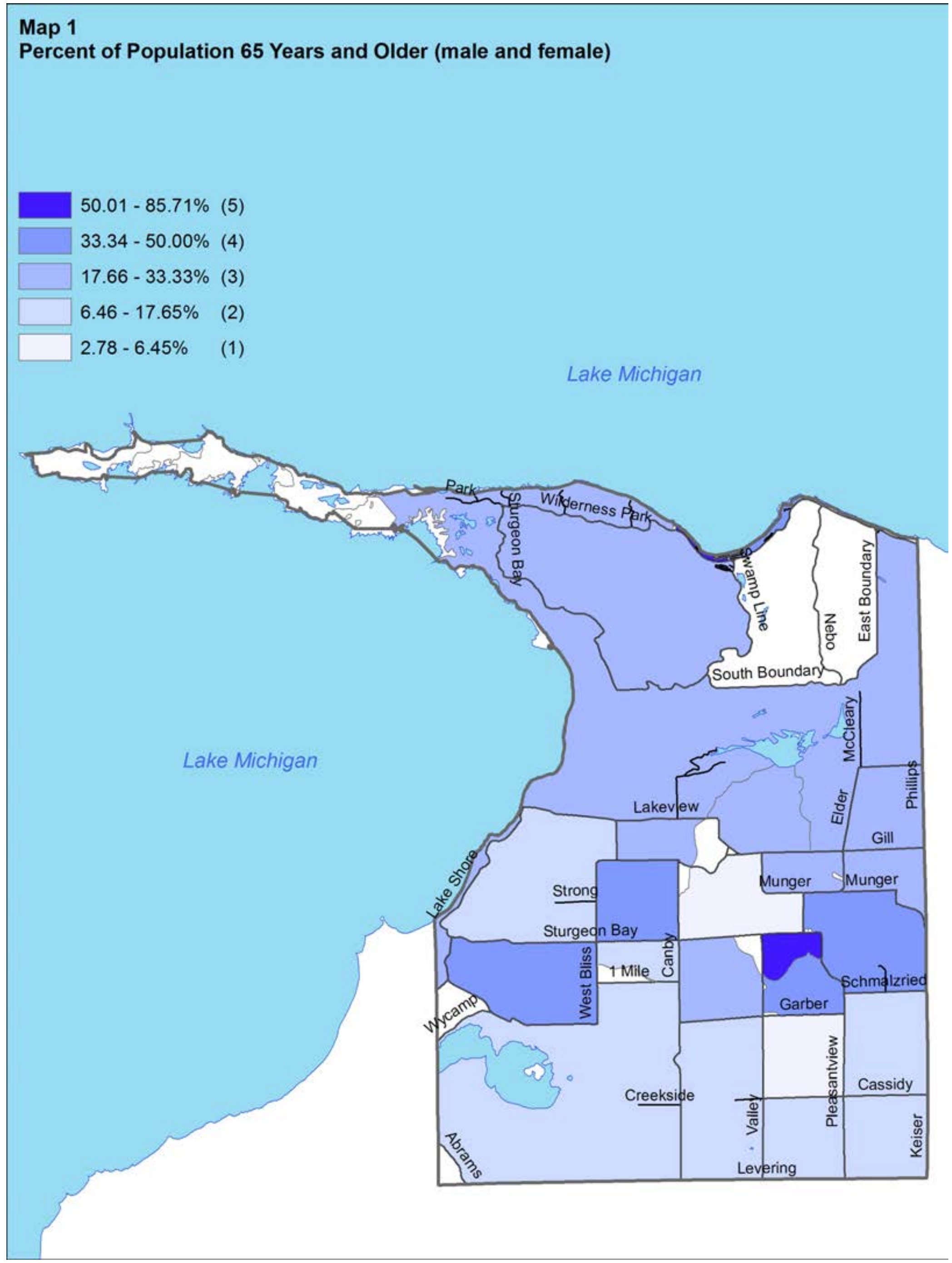

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re- score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
David
Algonquin
Wenniway
Valley
Central
Lakeside
Straits
Pond
Headlands
Esther
Ford Martin
Trailsend
Nokomis
French Lake
Straits View
Wilderness Park
Pointe
Cecil Bay
French Farm Lake
Mackinac to Petoskey
Paquet
Mackinaw
Oliver
Linsley
Linsley
75
31

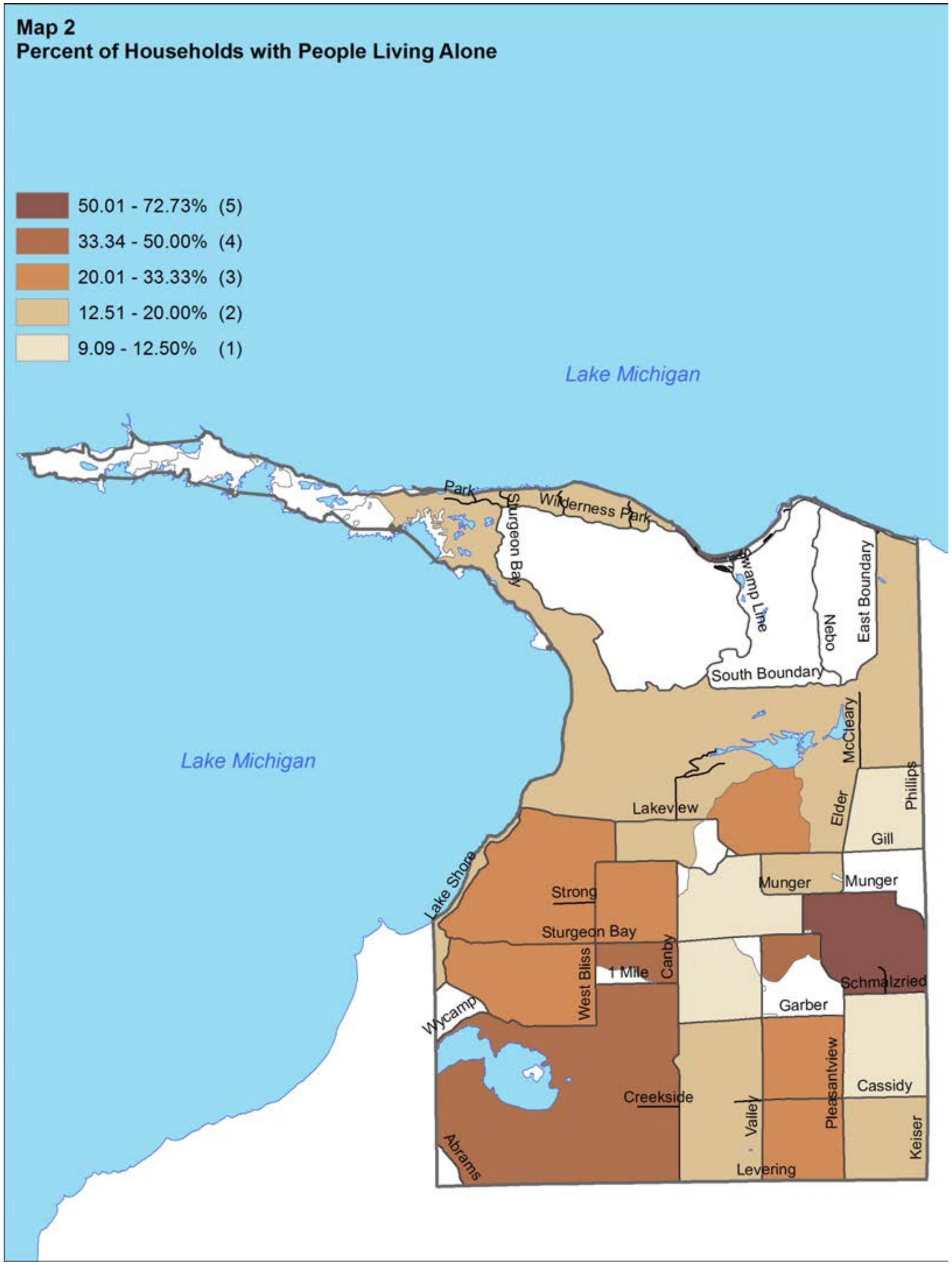

Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
6 - 7
5
4
3
Lake Michigan
David
Algonguin
Wenniway
Valley
Central
Lakeside
Jamet
Straits
Pond
Askins
Farley
Headlands
Nokomis
Nicolet
75
Ford Martin
Esther
Trailsend
French Lake
French Farm Lake
Straits View
Wilderness Park
Pointe
Cecil Bay
Paquet
Mackinac to Petoskey
Mackinaw
31
Oliver
Linsley
Linsley

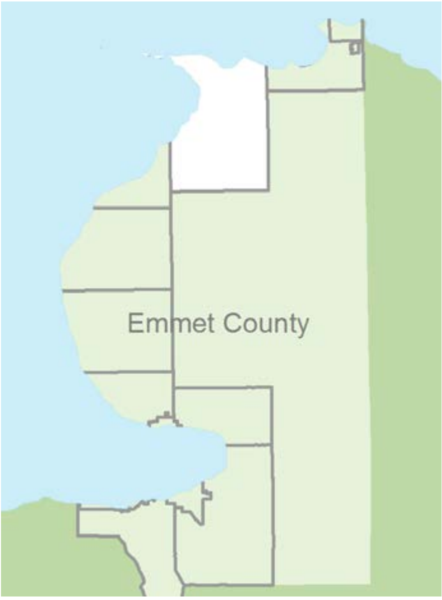

Emmet County

Bliss Twp.

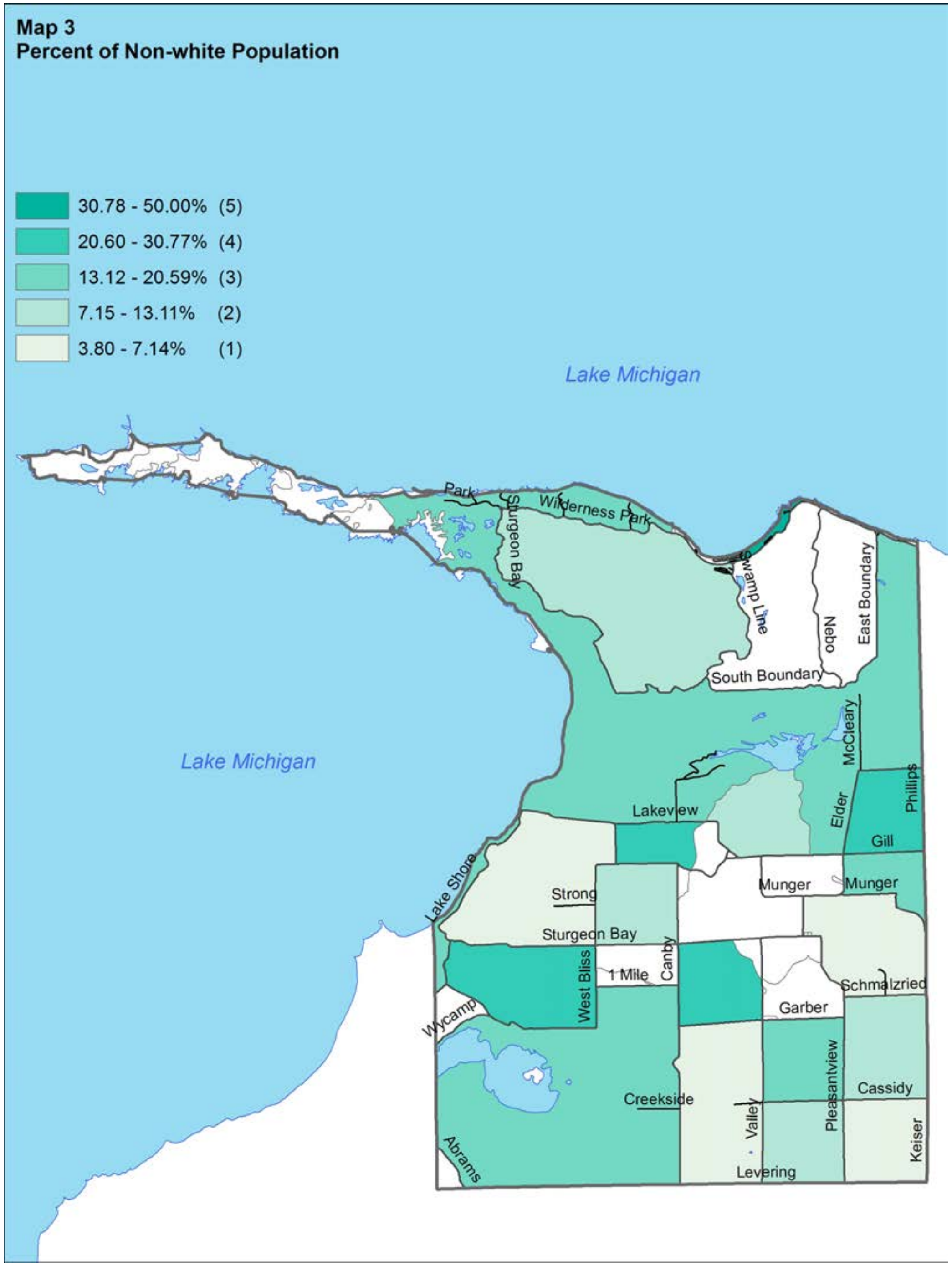

Emmet County

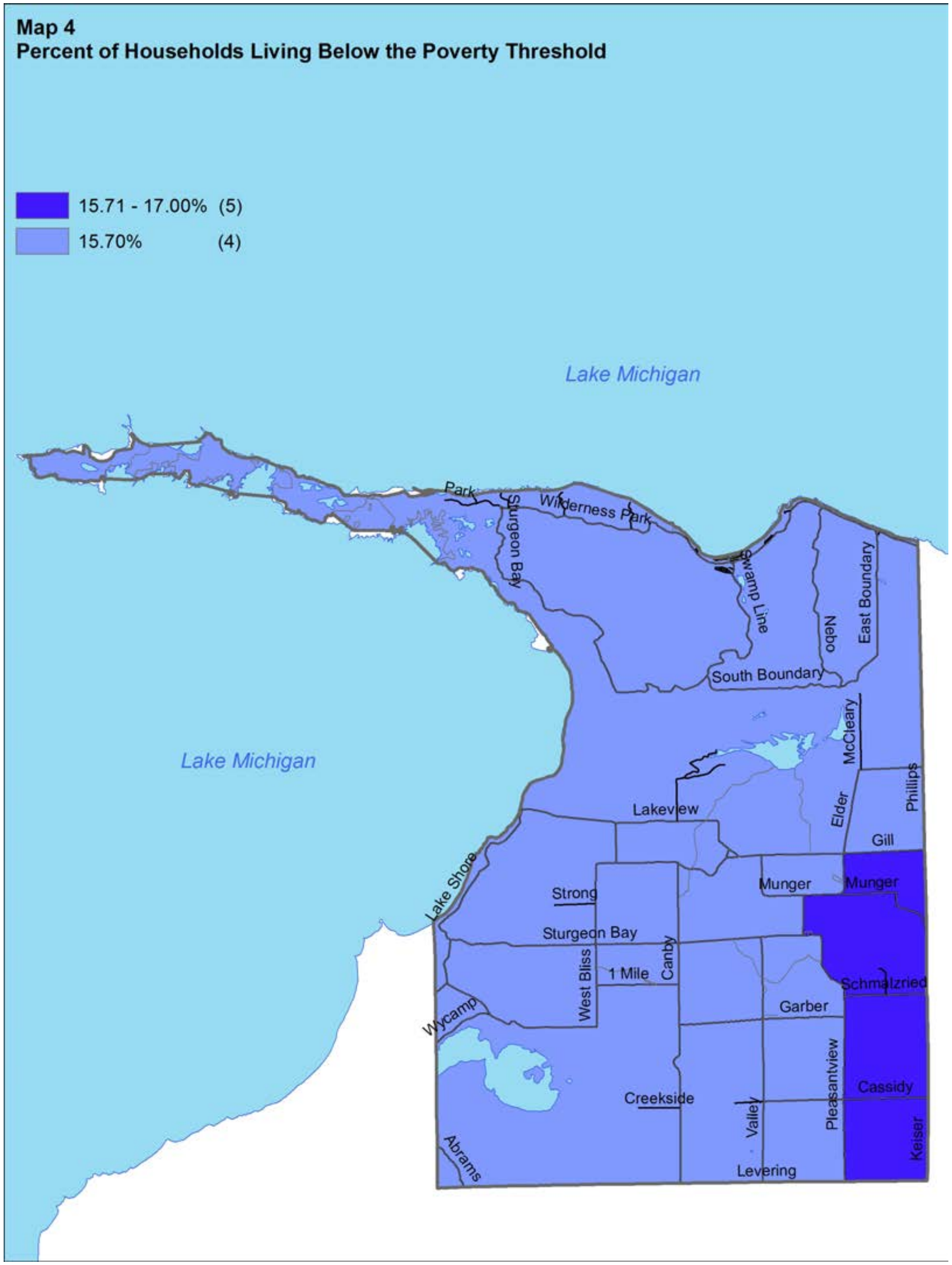

Map 1
Percent of Population 65 Years and Older (male and female)
50.01 - 85.71% (5)
33.34 - 50.00% (4)
17.66 - 33.33% (3)
6.46 - 17.65% (2)
2.78 - 6.45% (1)
Lake Michigan
Lake Michigan
Park
Wilderness Park
Sturgeon Bay
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Lakeview
Elder
Phillips
Gill
Lake Shore
Strong
Munger
Munger
Sturgeon Bay
Canby
1 Mile
West Bliss
Schmalzried
Garber
Wycamp
Pleasantview
Cassidy
Creekside
Valley
Abrams
Levering
Keiser

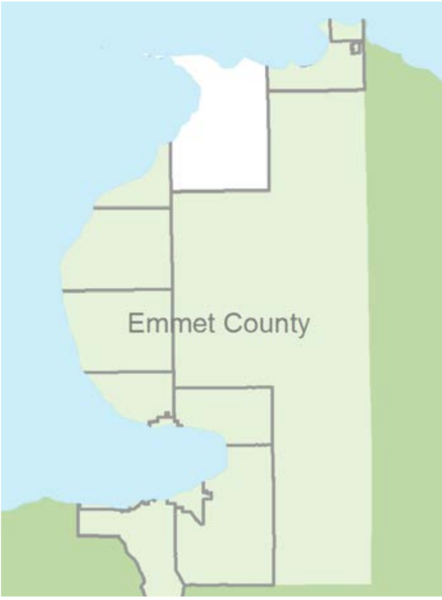

Map 2
Percent of Households with People Living Alone
50.01 - 72.73% (5)
33.34 - 50.00% (4)
20.01 - 33.33% (3)
12.51 - 20.00% (2)
9.09 - 12.50% (1)
Lake Michigan
Lake Michigan
Park
Wilderness Park
Sturgeon Bay
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Phillips
Elder
Lakeview
Gill
Munger
Munger
Lake Shore
Strong
Sturgeon Bay
Canby
1 Mile
West Bliss
Schmalzried
Garber
Wycamp
Creekside
Pleasantview
Cassidy
Valley
Keiser
Levering
Abrams

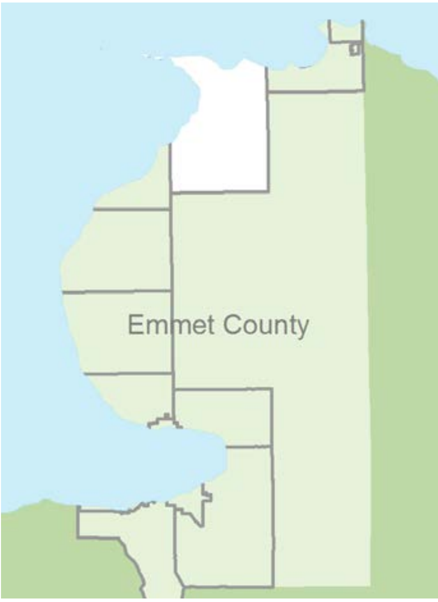

Emmet County

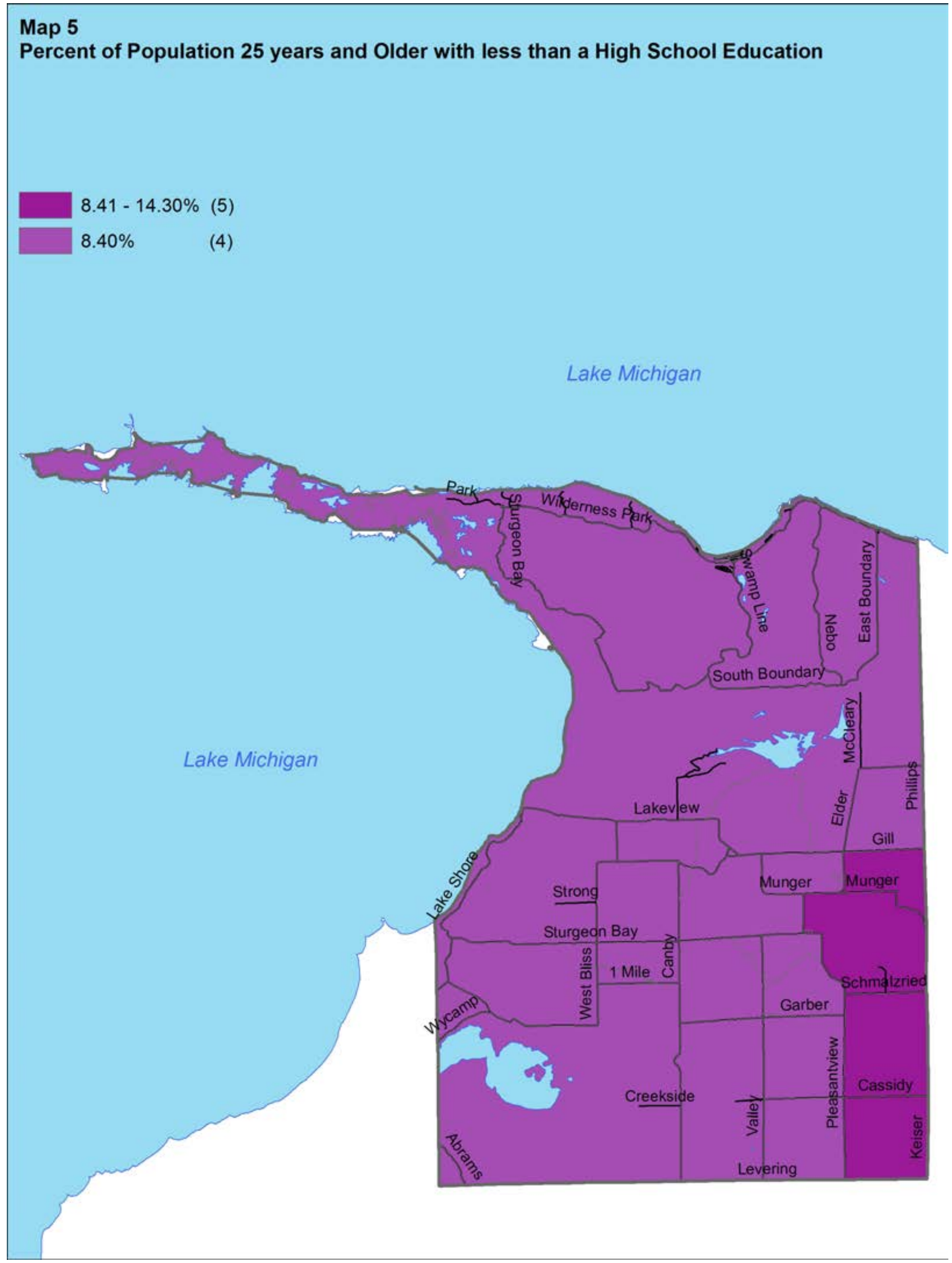

Emmet County

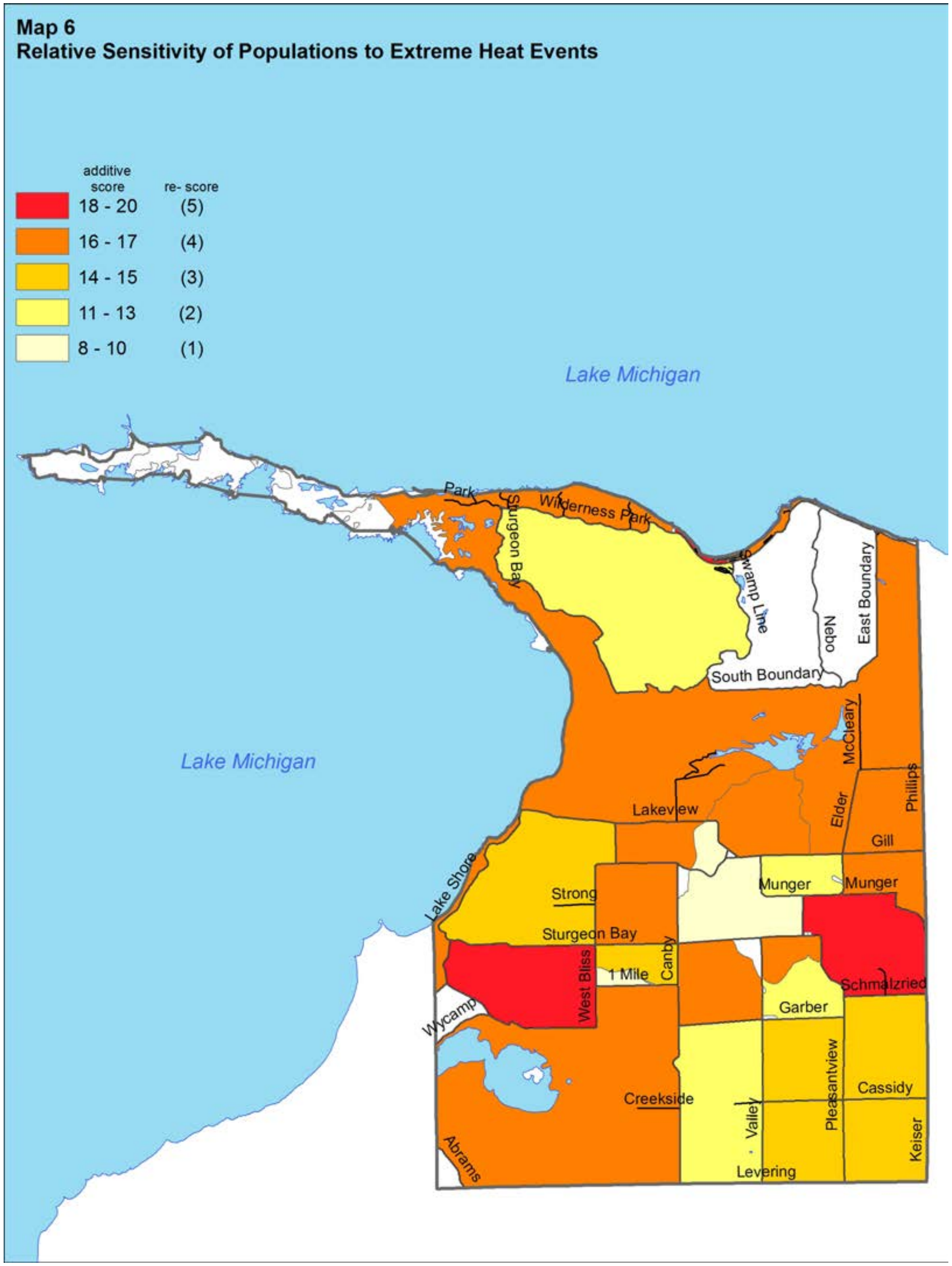

Map 3
Percent of Non-white Population
30.78 - 50.00% (5)
20.60 - 30.77% (4)
13.12 - 20.59% (3)
7.15 - 13.11% (2)
3.80 - 7.14% (1)
Lake Michigan
Lake Michigan
Park
Sturgeon Bay
Wilderness Park
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Phillips
Elder
Lakeview
Gill
Lake Shore
Strong
Munger
Munger
Sturgeon Bay
West Bliss
1 Mile
Canby
Schmalzried
Wycamp
Garber
Pleasantview
Cassidy
Creekside
Valley
Abrams
Levering
Keiser

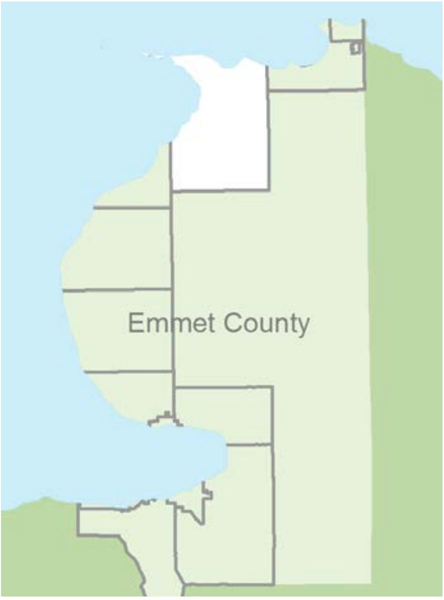

Map 4
Percent of Households Living Below the Poverty Threshold
15.71 - 17.00% (5)
15.70% (4)
Lake Michigan
Lake Michigan
Park
Wilderness Park
Sturgeon Bay
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Phillips
Elder
Lakeview
Gill
Munger
Munger
Strong
Lake Shore
Sturgeon Bay
Canby
1 Mile
West Bliss
Schmalzried
Garber
Wycamp
Pleasantview
Cassidy
Creekside
Valley
Keiser
Abrams
Levering

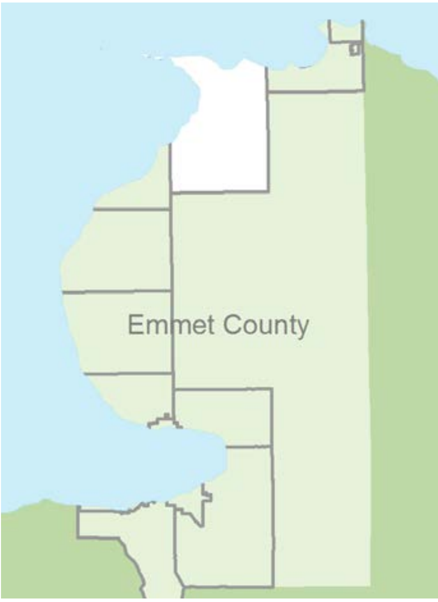

Emmet County

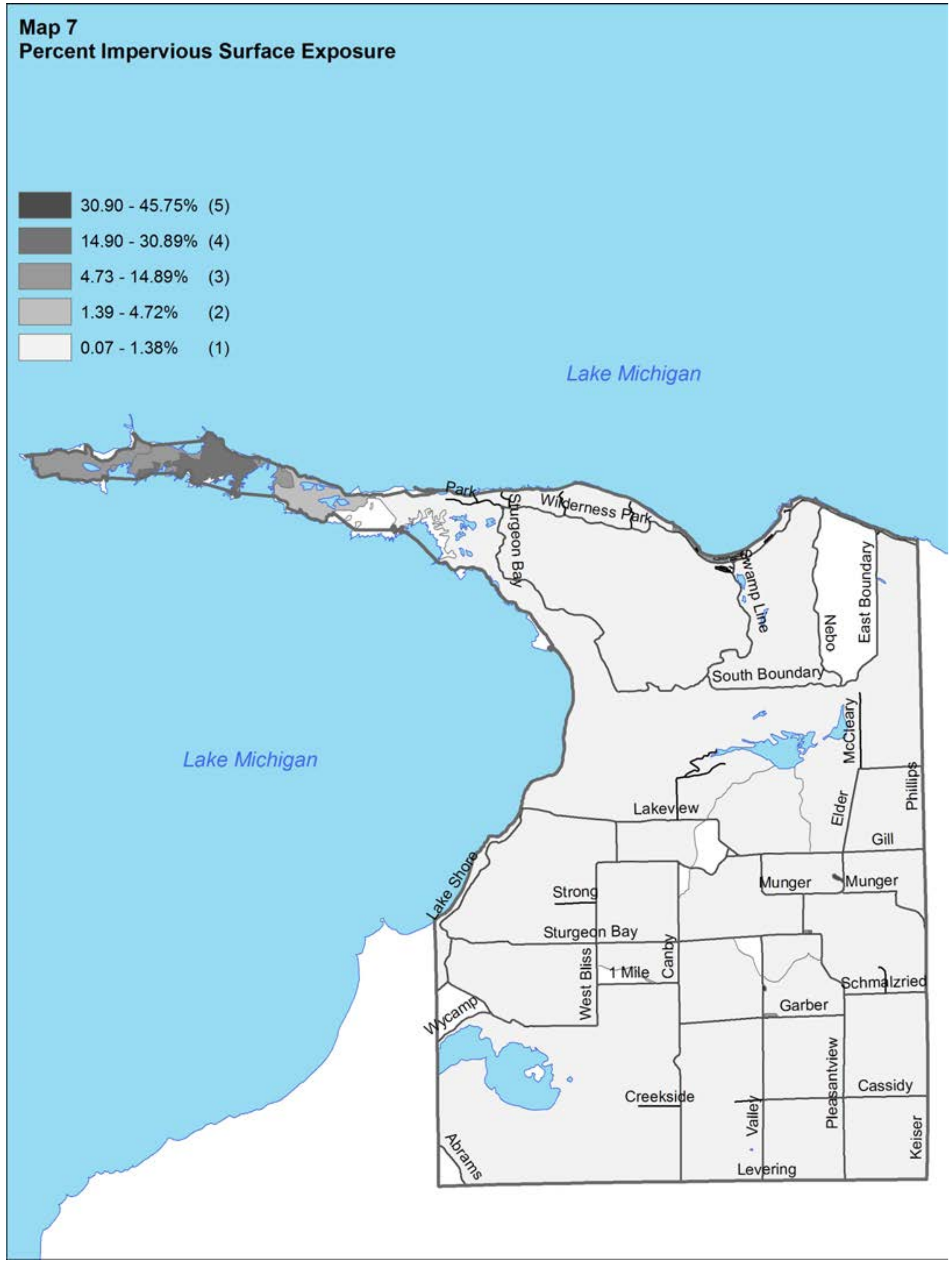

Emmet County

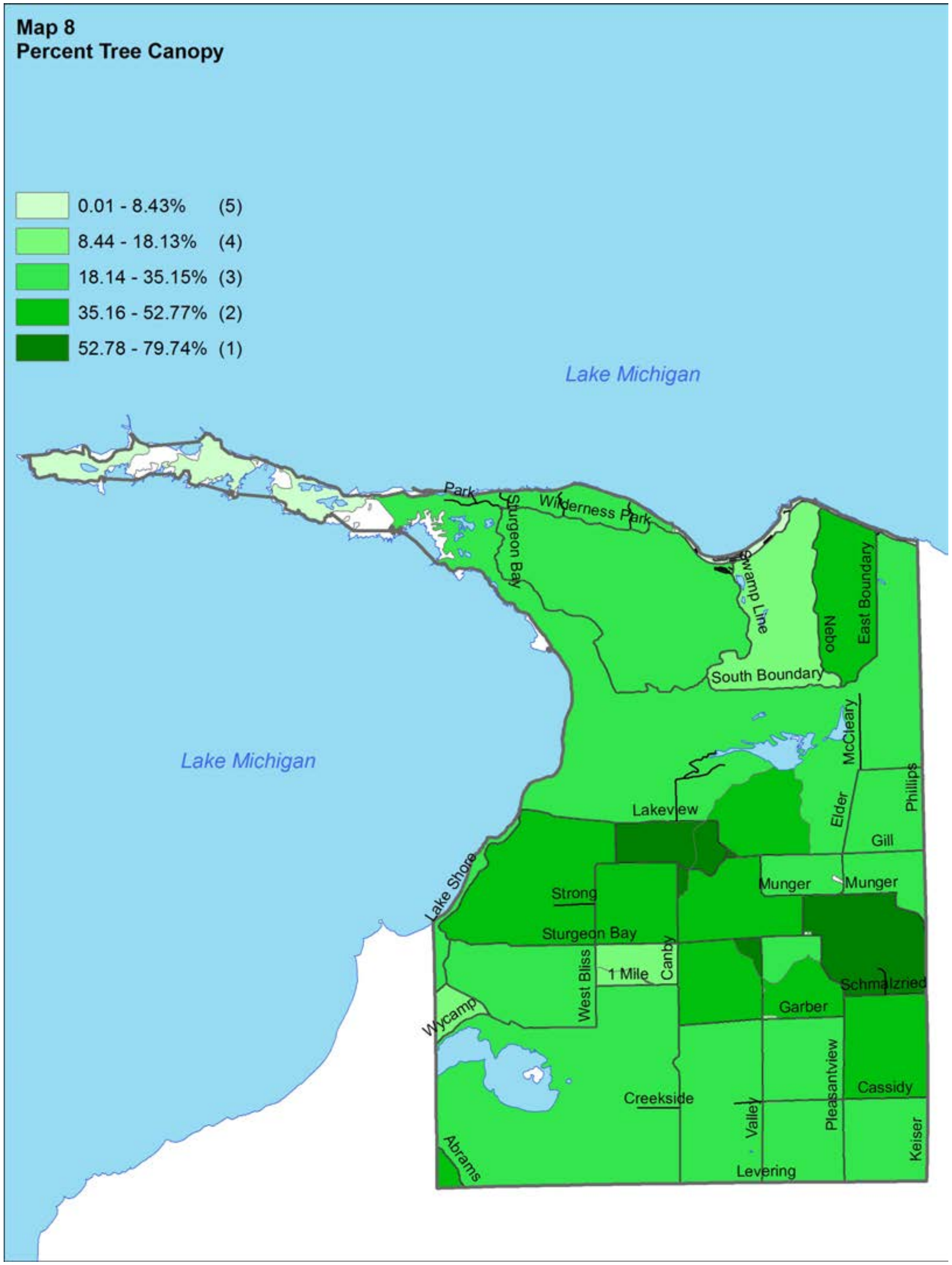

Map 5
Percent of Population 25 years and Older with less than a High School Education
8.41 - 14.30% (5)
8.40% (4)
Lake Michigan
Lake Michigan
Park
Wilderness Park
Sturgeon Bay
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Lakeview
Elder
Phillips
Gill
Lake Shore
Munger
Munger
Strong
Sturgeon Bay
Canby
West Biss
1 Mile
Schmalzried
Garber
Wycamp
Creekside
Pleasantview
Cassidy
Valley
Keiser
Abrams
Levering

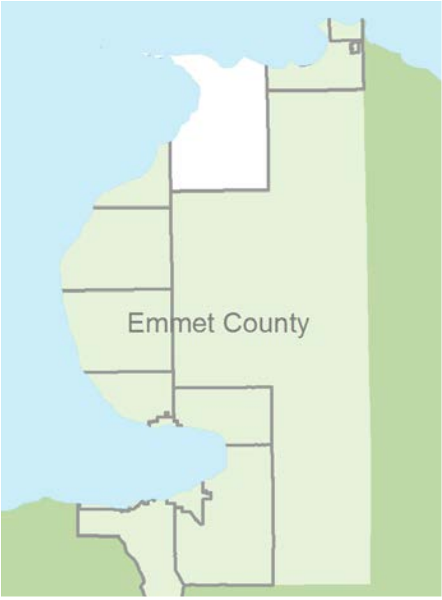

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
additive score
re- score
18 - 20 (5)
16 - 17 (4)
14 - 15 (3)
11 - 13 (2)
8 - 10 (1)
Lake Michigan
Lake Michigan
Park
Sturgeon Bay
Wilderness Park
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Phillips
Elder
Lakeview
Gill
Munger
Munger
Lake Shore
Strong
Sturgeon Bay
West Bliss
1 Mile
Canby
Schmalzried
Garber
Wycamp
Creekside
Pleasantview
Cassidy
Valley
Levering
Keiser
Abrams


Emmet County

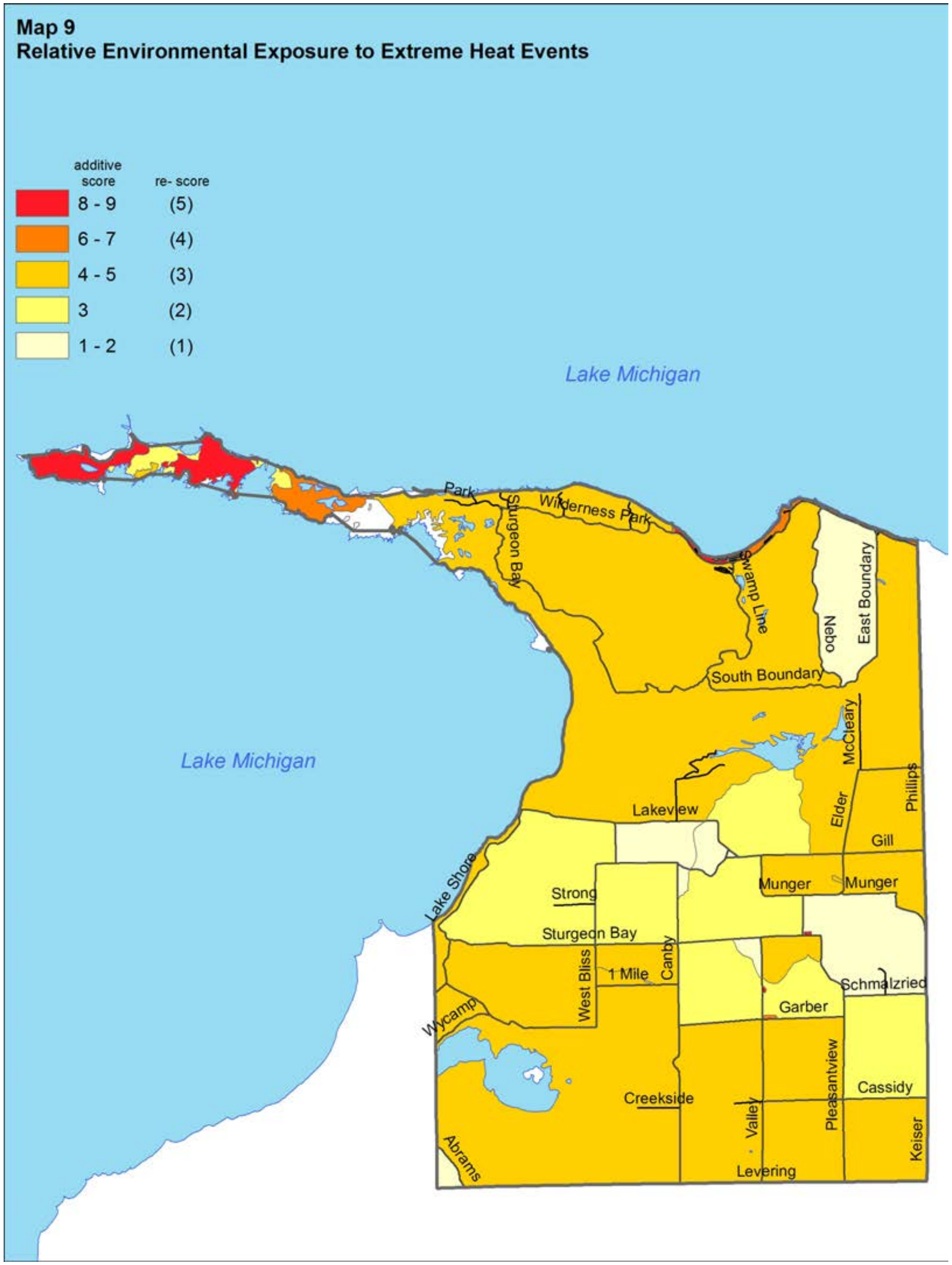

Emmet County

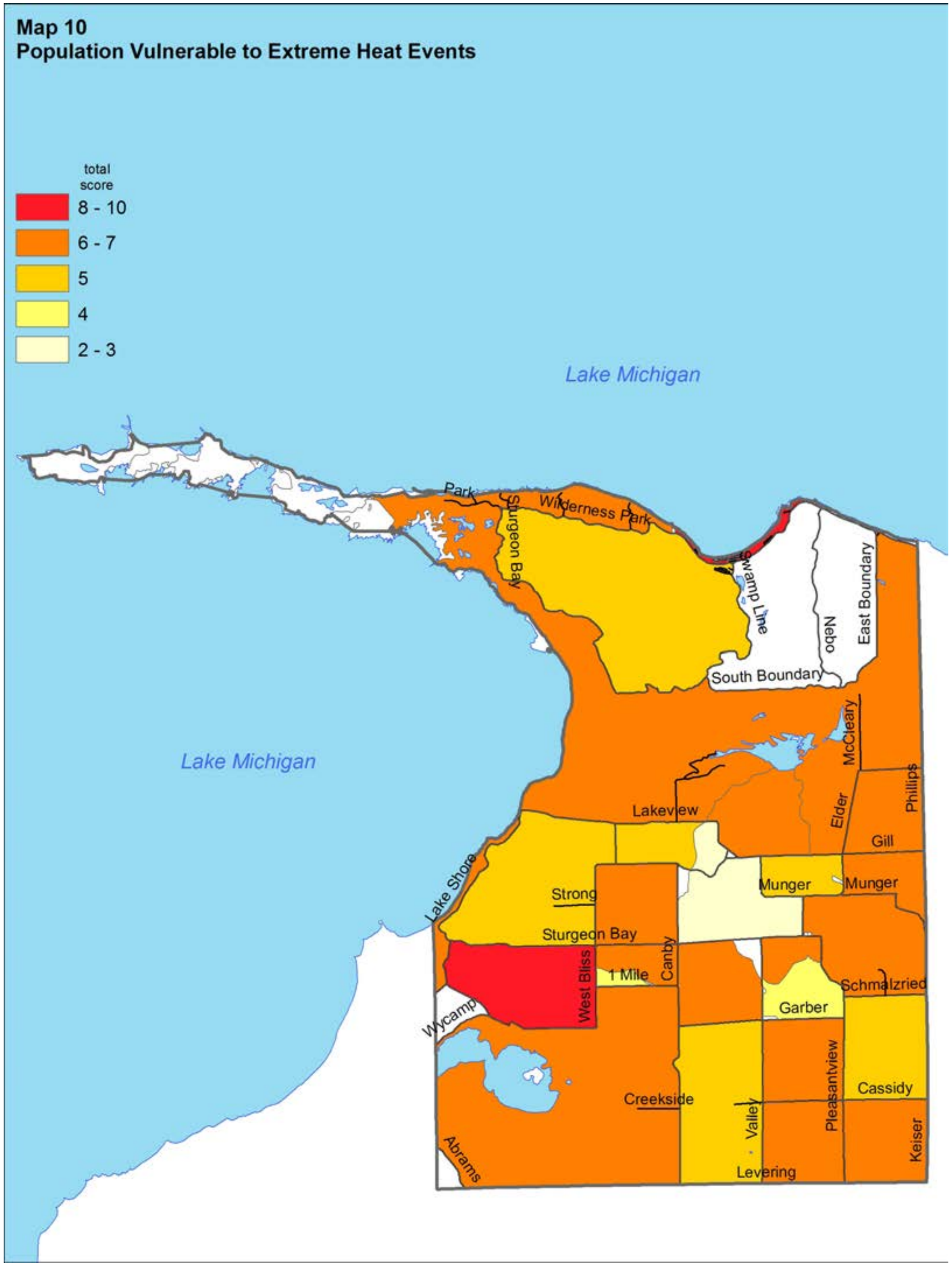

Map 7
Percent Impervious Surface Exposure
30.90 - 45.75% (5)
14.90 - 30.89% (4)
4.73 - 14.89% (3)
1.39 - 4.72% (2)
0.07 - 1.38% (1)
Lake Michigan
Lake Michigan
Park
Wilderness Park
Sturgeon Bay
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Lakeview
Elder
Phillips
Gill
Munger
Munger
Strong
Lake Shore
Sturgeon Bay
West Bliss
1 Mile
Canby
Schmalzried
Garber
Wycamp
Creekside
Pleasantview
Cassidy
Valley
Abrams
Levering
Keiser


Map 8
Percent Tree Canopy
0.01 - 8.43% (5)
8.44 - 18.13% (4)
18.14 - 35.15% (3)
35.16 - 52.77% (2)
52.78 - 79.74% (1)
Lake Michigan
Lake Michigan
Park
Wilderness Park
Sturgeon Bay
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Lakeview
Elder
Phillips
Gill
Munger
Munger
Lake Shore
Strong
Sturgeon Bay
West Bliss
1 Mile
Canby
Schmalzried
Garber
Wycamp
Creekside
Valley
Pleasantview
Cassidy
Keiser
Levering
Abrams


Emmet County

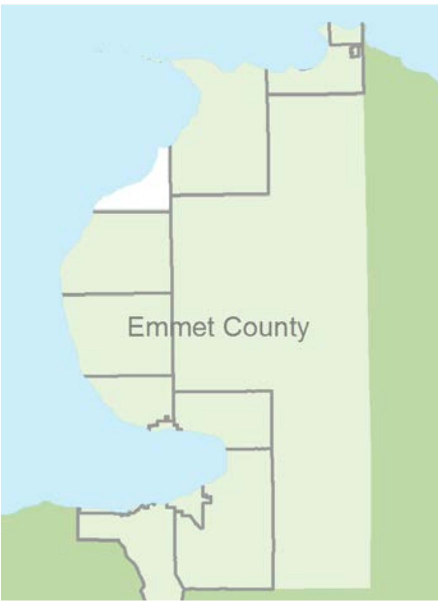

Emmet County

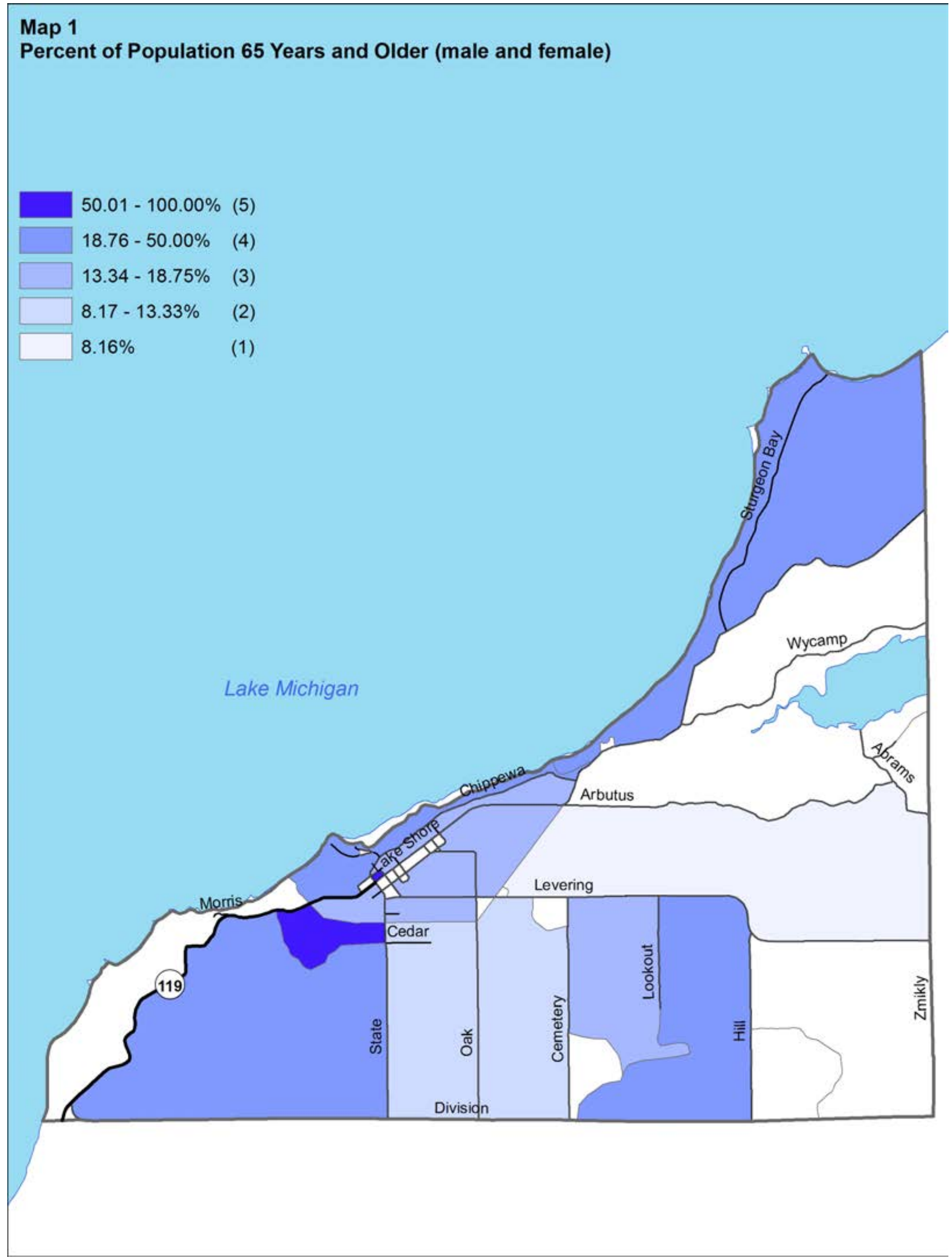

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re- score
8 - 9 (5)
6 - 7 (4)
4 - 5 (3)
3 (2)
1 - 2 (1)
Lake Michigan
Lake Michigan
Park
Wilderness Park
Sturgeon Bay
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Lakeview
Elder
Phillips
Gill
Munger
Munger
Lake Shore
Strong
Sturgeon Bay
Canby
West Bliss
1 Mile
Schmalzried
Garber
Wycamp
Creekside
Cassidy
Pleasantview
Valley
Levering
Keiser
Abrams

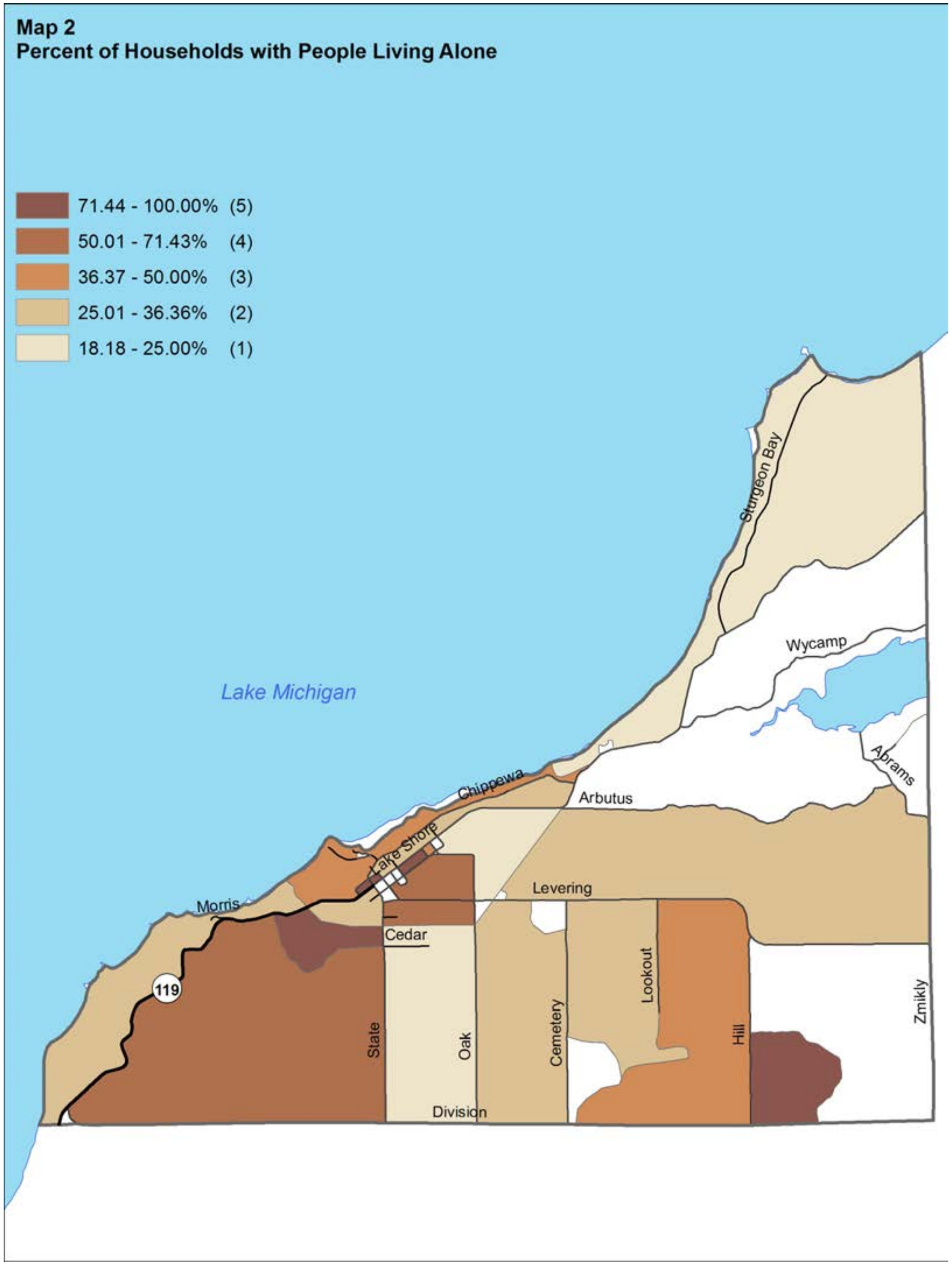

Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 10
6 - 7
5
4
2 - 3
Lake Michigan
Lake Michigan
Park
Sturgeon Bay
Wilderness Park
Swamp Line
Nebo
East Boundary
South Boundary
McCleary
Phillips
Lakeview
Elder
Gill
Munger
Munger
Lake Shore
Strong
Sturgeon Bay
West Bliss
1 Mile
Canby
Schmalzried
Garber
Wycamp
Creekside
Pleasantview
Cassidy
Valley
Keiser
Abrams
Levering

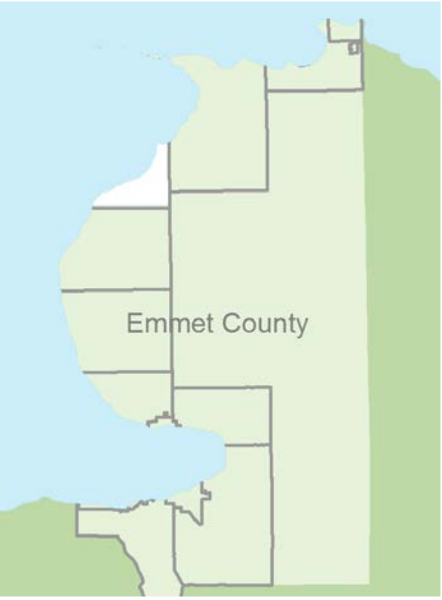

Emmet County

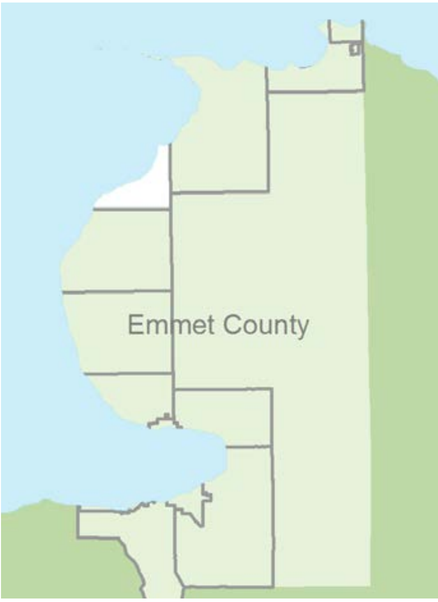
Cross Village Twp.

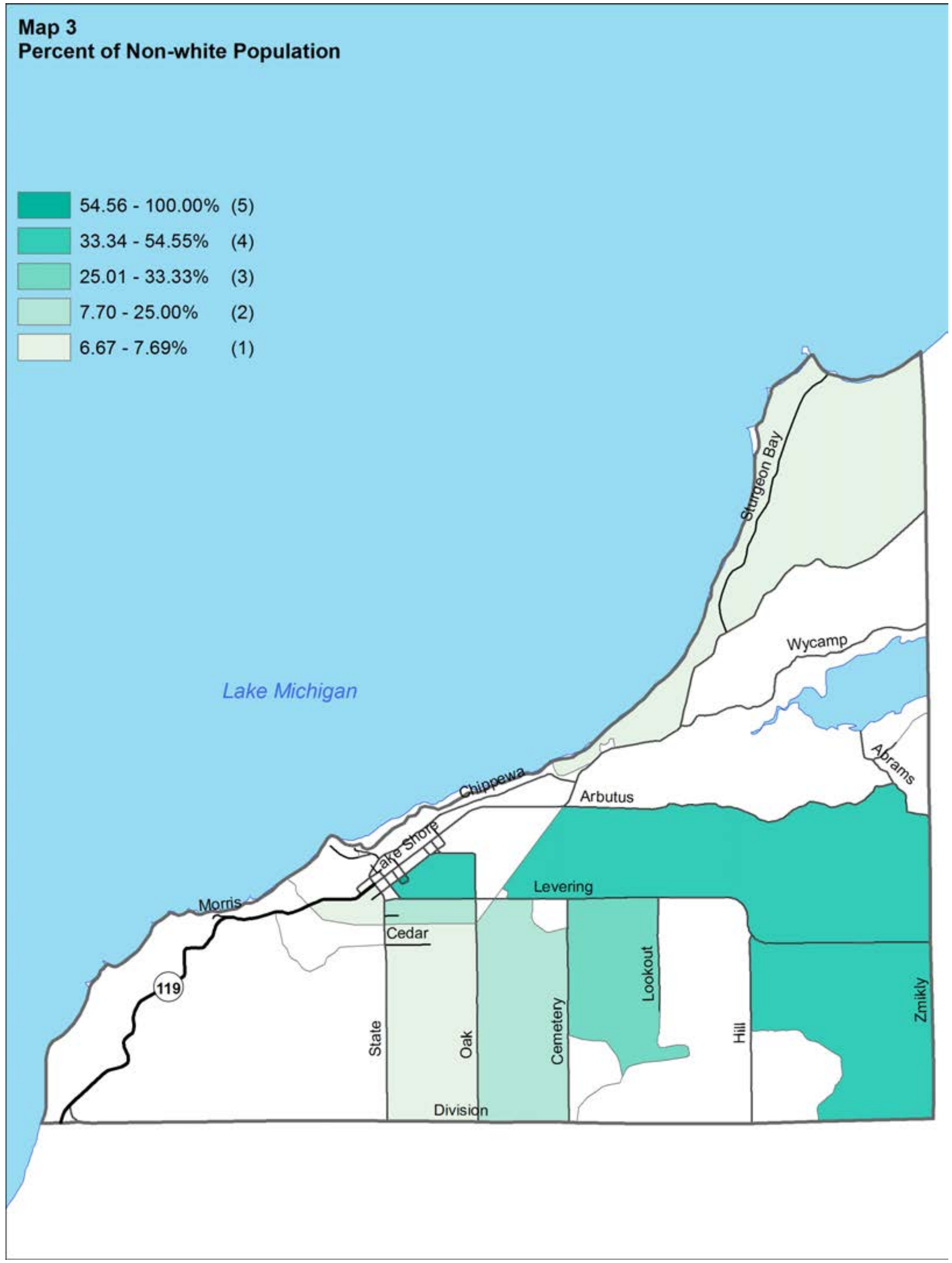


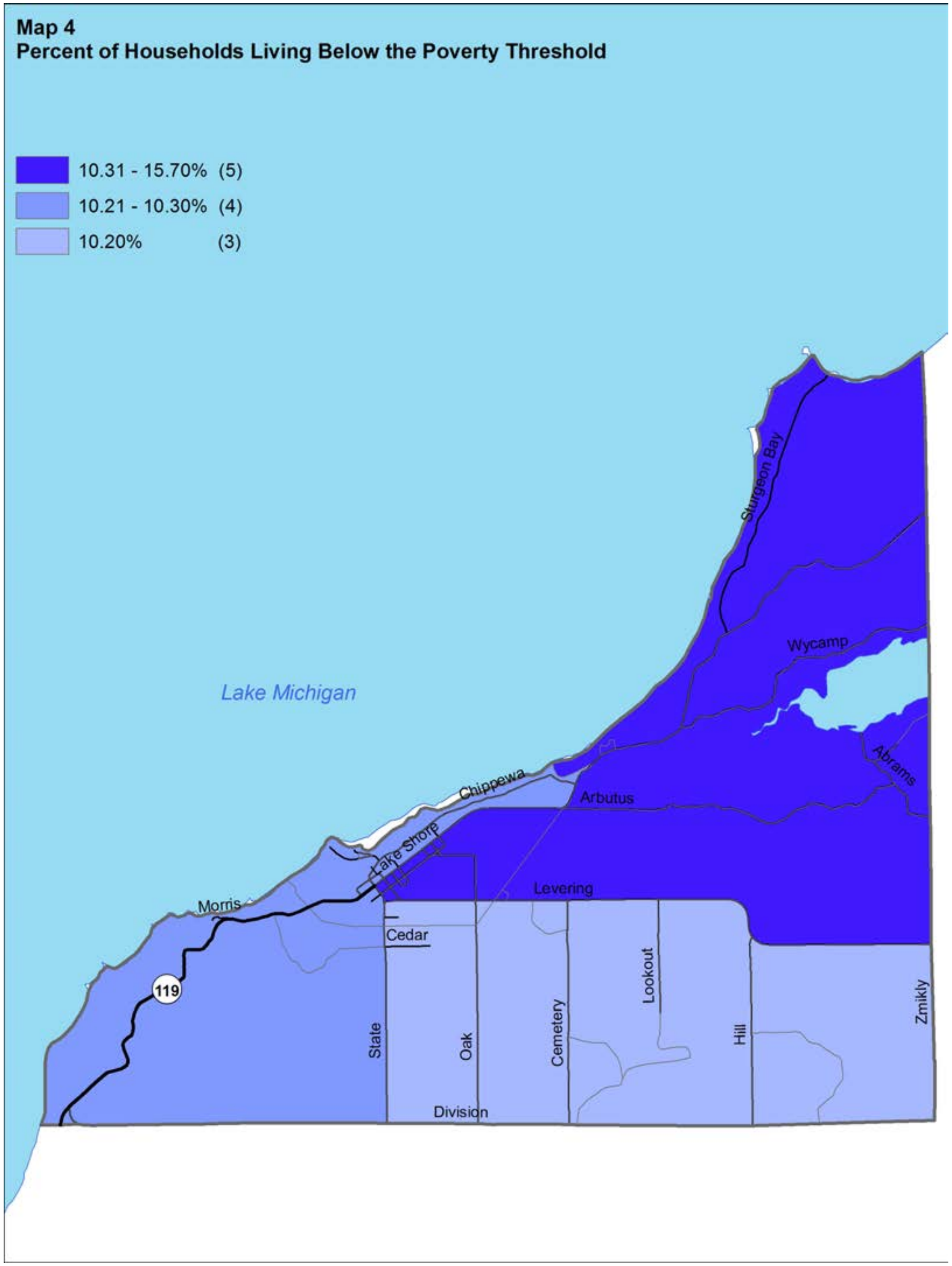


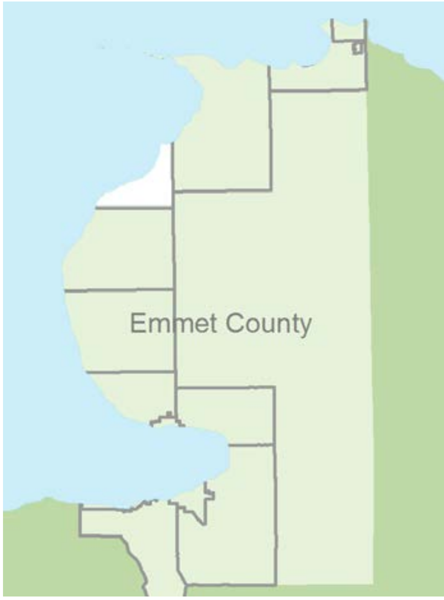

Map 2
Percent of Households with People Living Alone
71.44 - 100.00% (5)
50.01 - 71.43% (4)
36.37 - 50.00% (3)
25.01 - 36.36% (2)
18.18 - 25.00% (1)
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Chippewa
Arbutus
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division

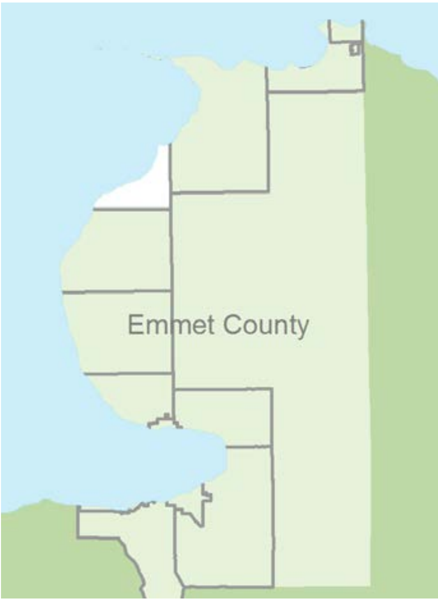

Emmet County


Emmet County


Map 3
Percent of Non-white Population
54.56 - 100.00% (5)
33.34 - 54.55% (4)
25.01 - 33.33% (3)
7.70 - 25.00% (2)
6.67 - 7.69% (1)
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Chippewa
Arbutus
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division


Map 4
Percent of Households Living Below the Poverty Threshold
10.31 - 15.70% (5)
10.21 - 10.30% (4)
10.20% (3)
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Chippewa
Arbutus
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division


Emmet County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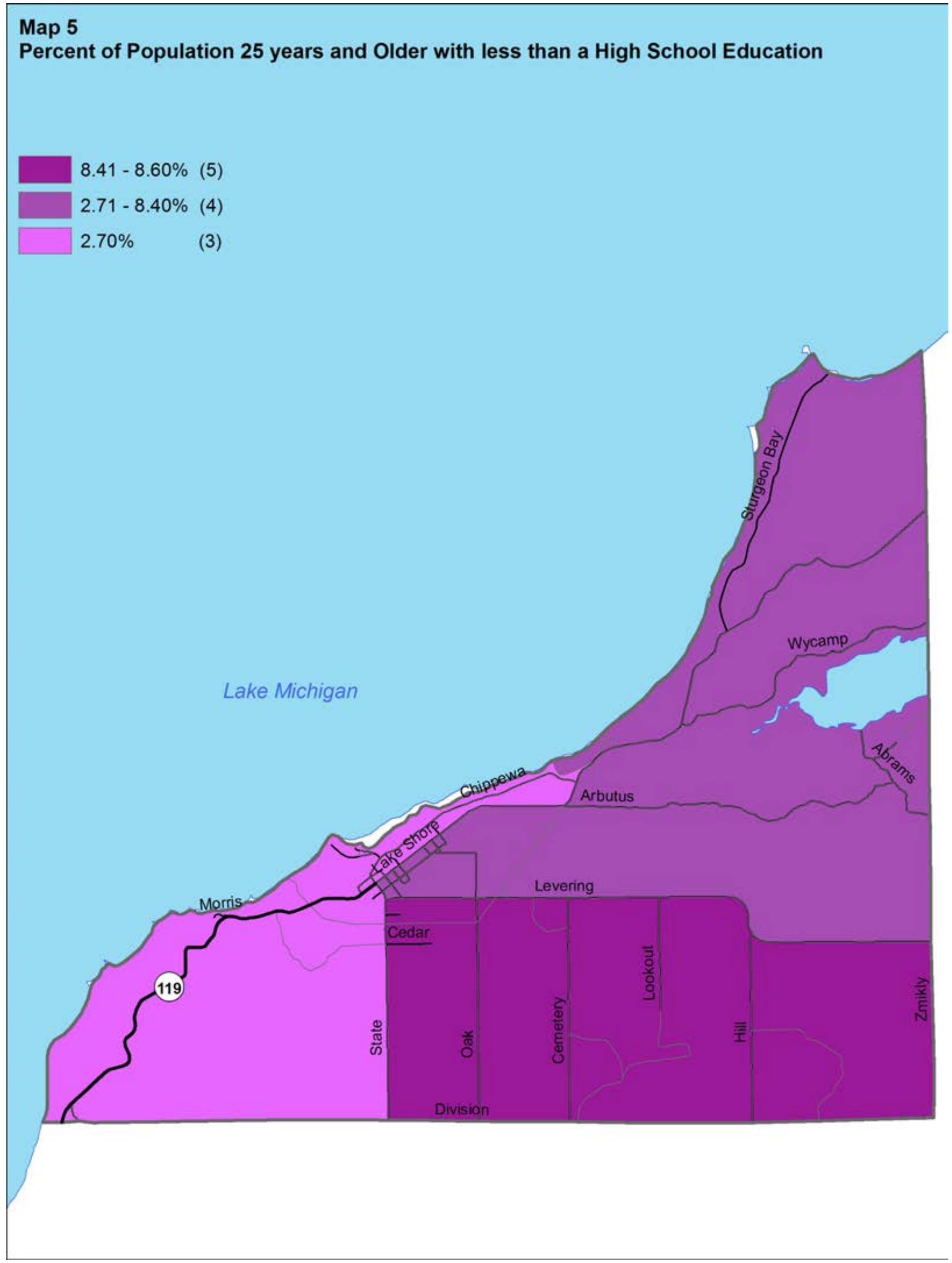
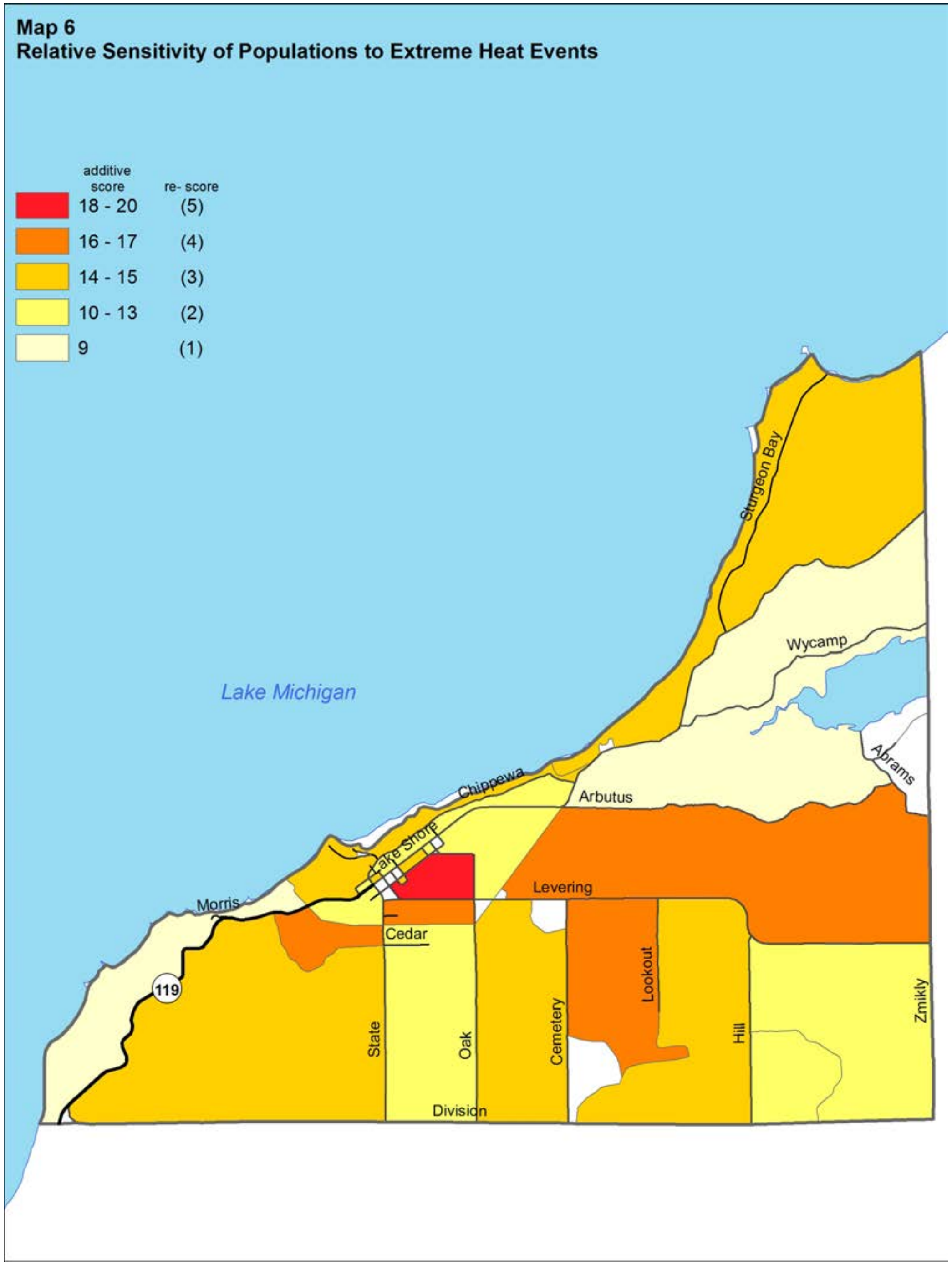
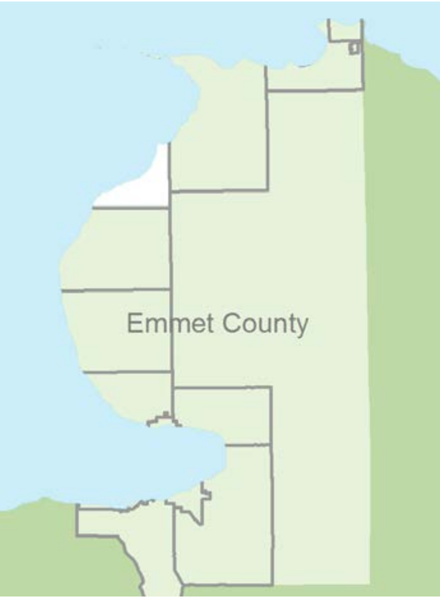
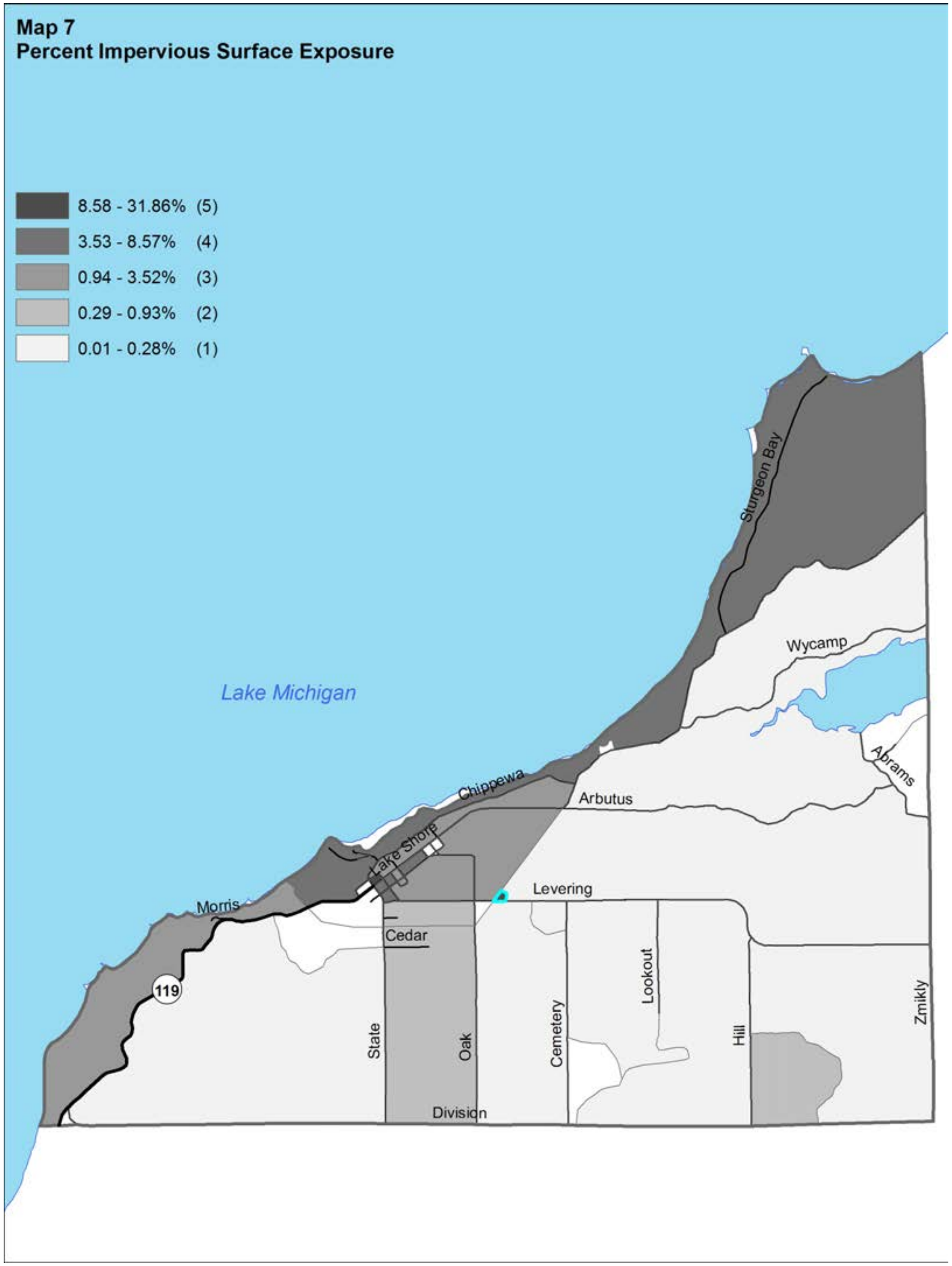
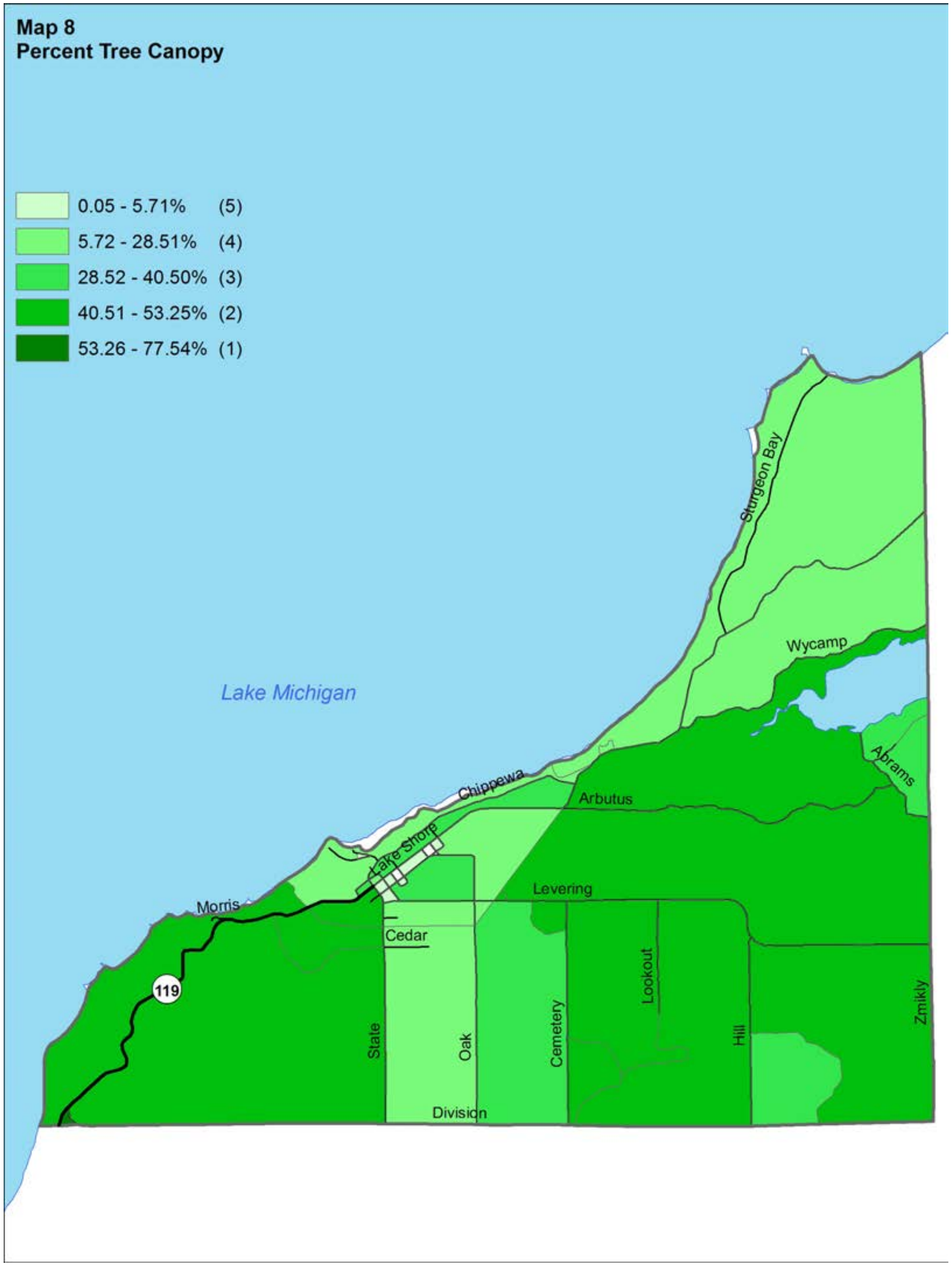

Map 5
Percent of Population 25 years and Older with less than a High School Education
8.41 - 8.60% (5)
2.71 - 8.40% (4)
2.70% (3)
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Arbutus
Chippewa
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division

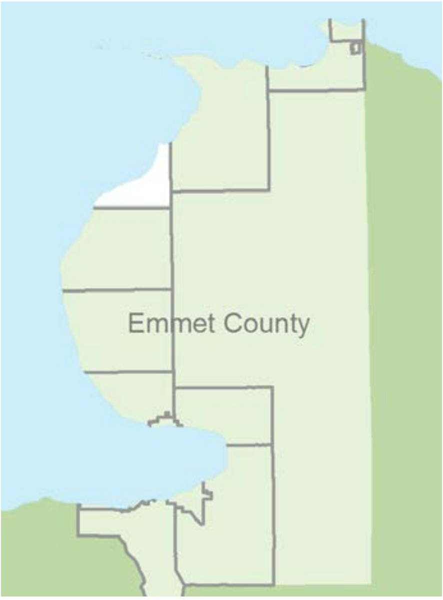

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
additive score
re- score
18 - 20 (5)
16 - 17 (4)
14 - 15 (3)
10 - 13 (2)
9 (1)
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Arbutus
Chippewa
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division


Emmet County

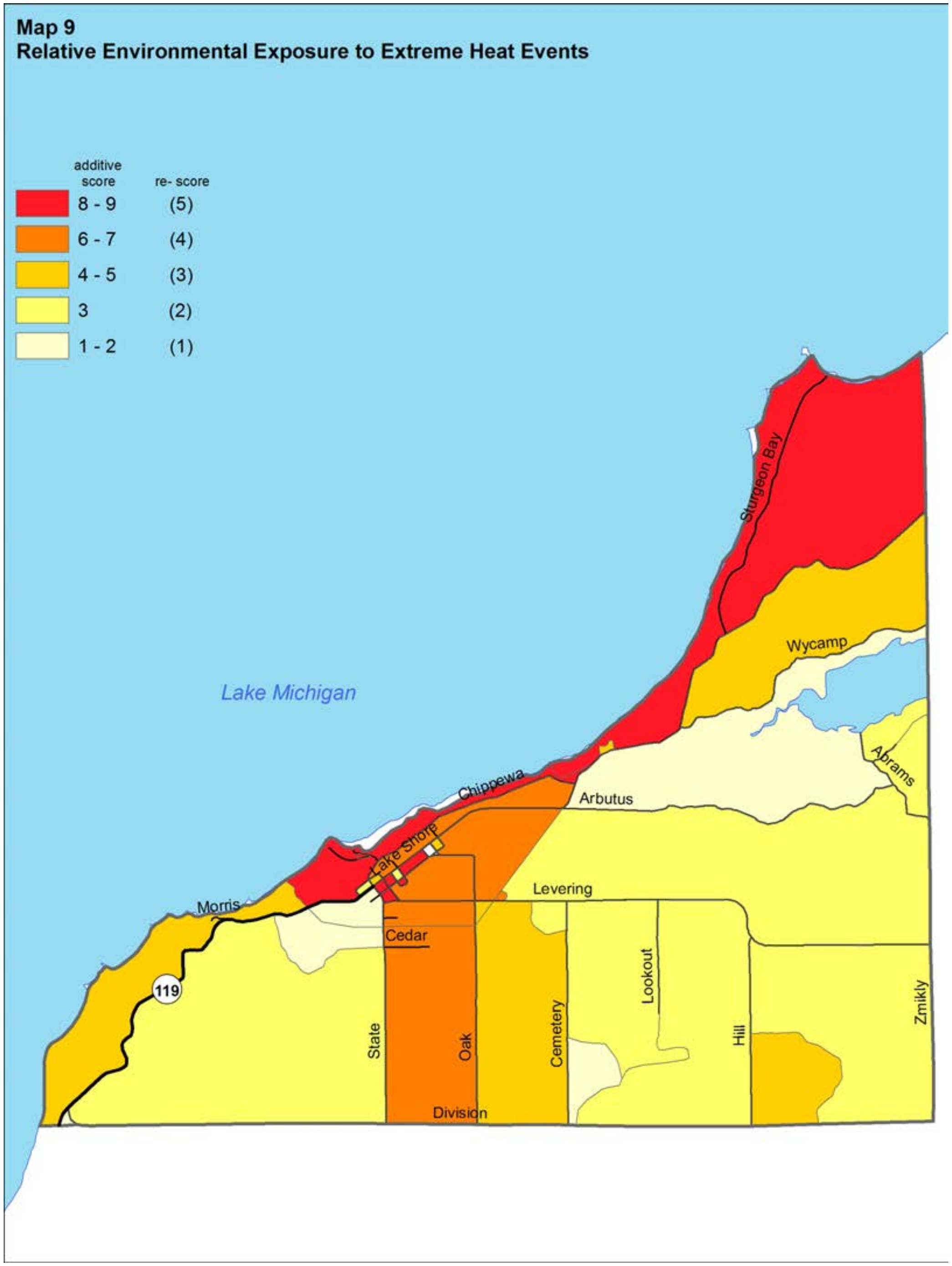

Emmet County

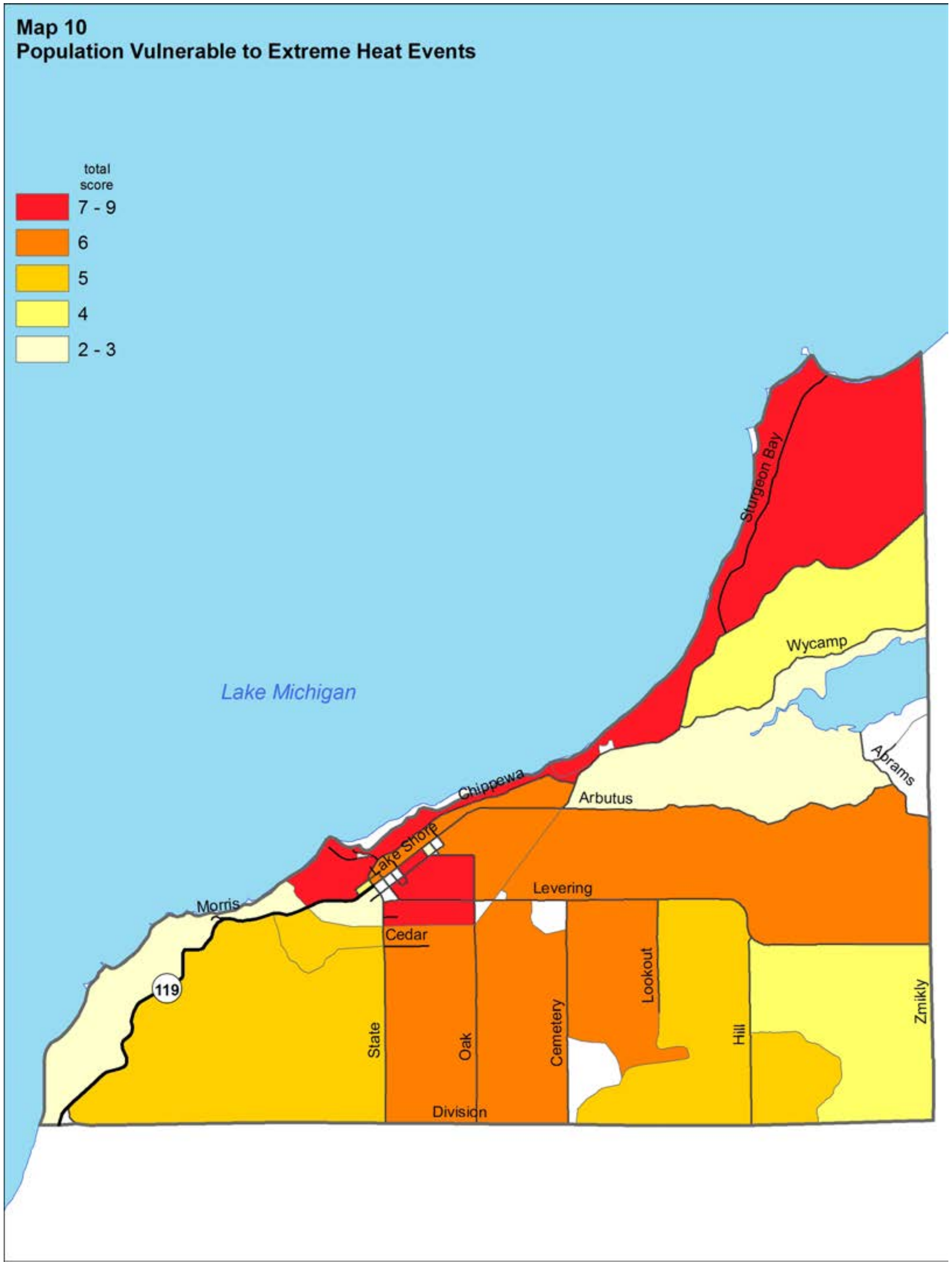

Map 7
Percent Impervious Surface Exposure
8.58 - 31.86% (5)
3.53 - 8.57% (4)
0.94 - 3.52% (3)
0.29 - 0.93% (2)
0.01 - 0.28% (1)
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Chippewa
Arbutus
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division

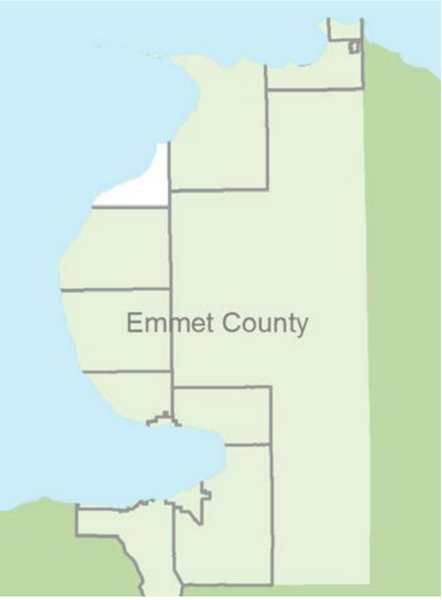

Map 8
Percent Tree Canopy
0.05 - 5.71% (5)
5.72 - 28.51% (4)
28.52 - 40.50% (3)
40.51 - 53.25% (2)
53.26 - 77.54% (1)
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Chippewa
Arbutus
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division


Emmet County

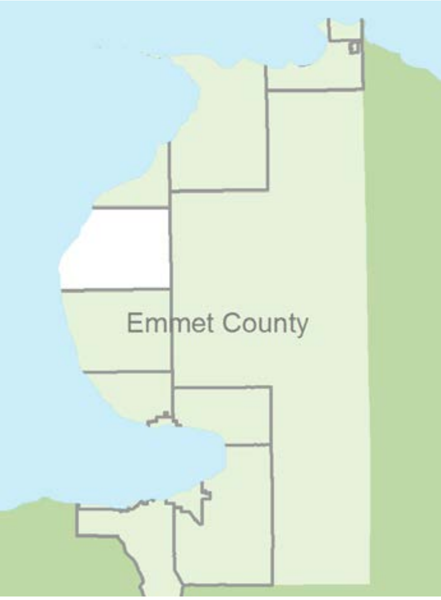

Emmet County

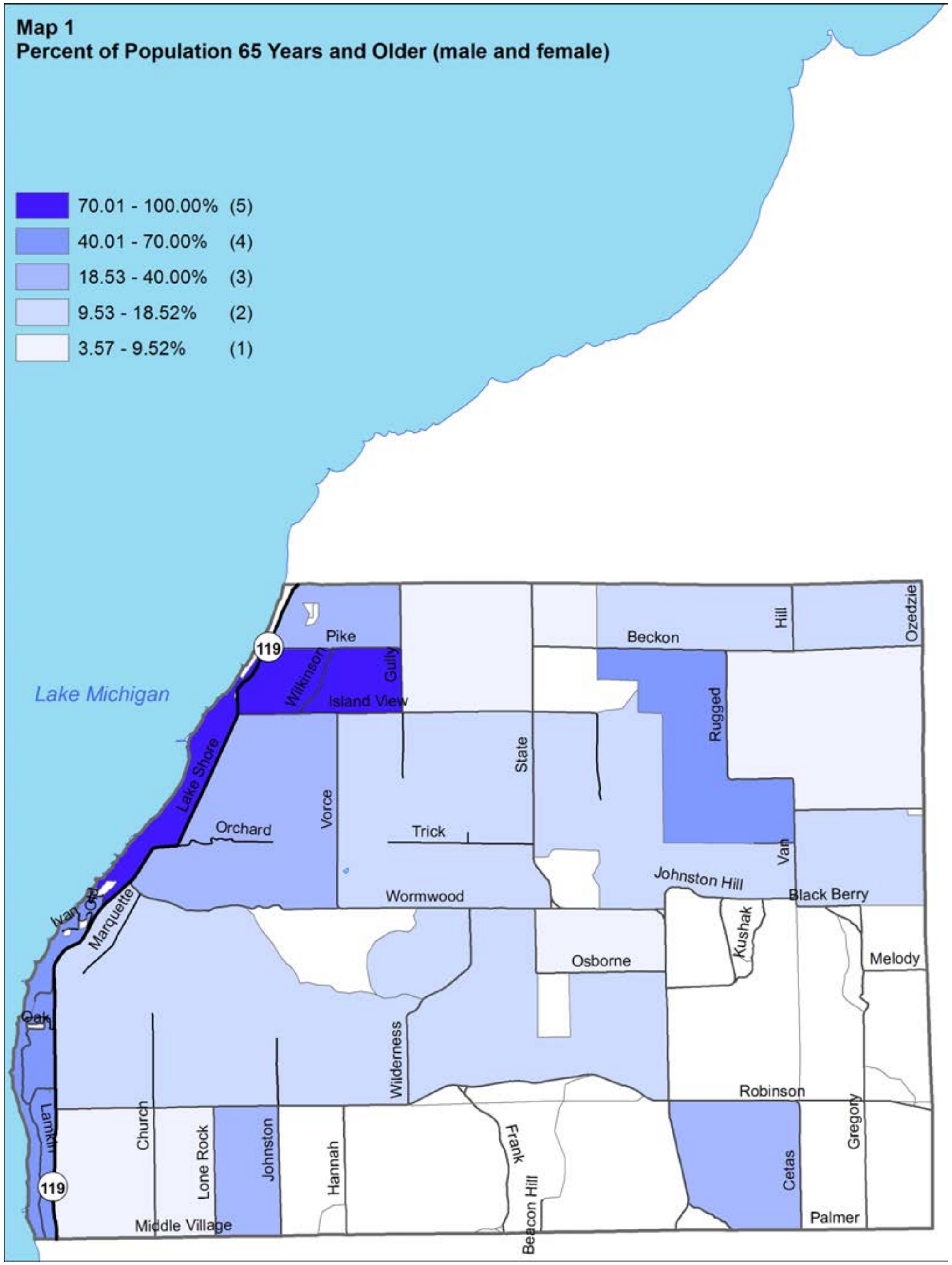

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re- score
8 - 9 (5)
6 - 7 (4)
4 - 5 (3)
3 (2)
1 - 2 (1)
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Chippewa
Arbutus
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division

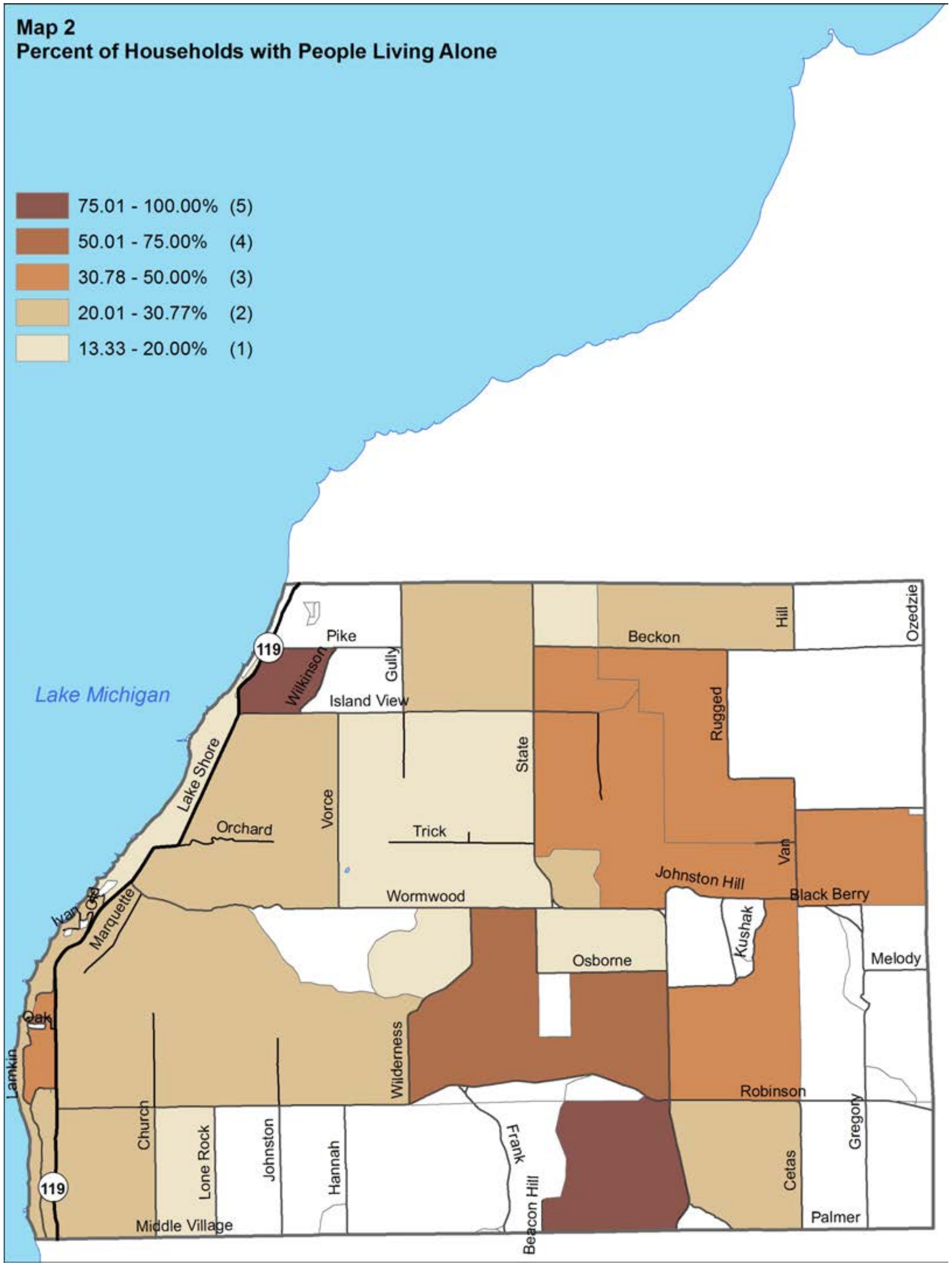

Map 10
Population Vulnerable to Extreme Heat Events
total score
7 - 9
6
5
4
2 - 3
Lake Michigan
Sturgeon Bay
Wycamp
Abrams
Chippewa
Arbutus
Lake Shore
Levering
Morris
Cedar
119
State
Oak
Cemetery
Lookout
Hill
Zmikly
Division

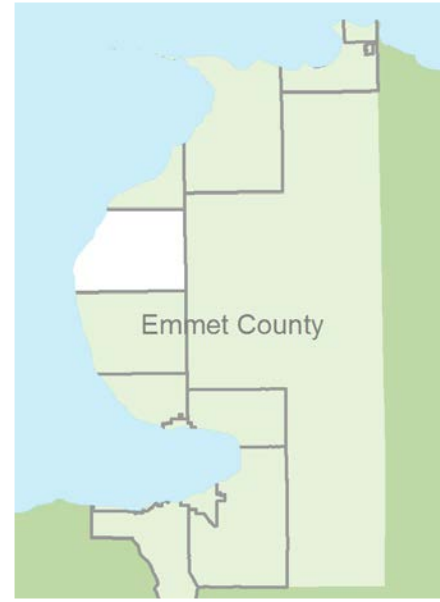

Emmet County

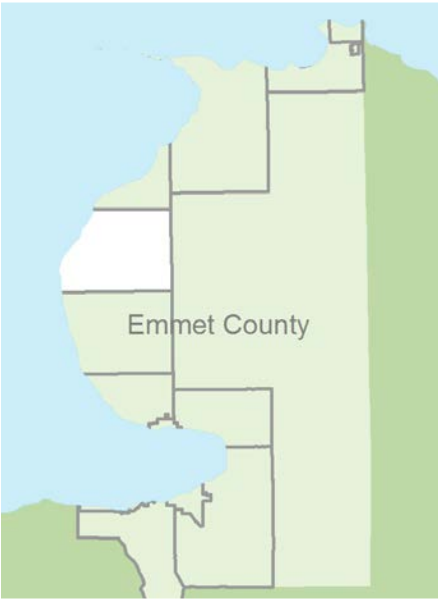
Readmond Twp.

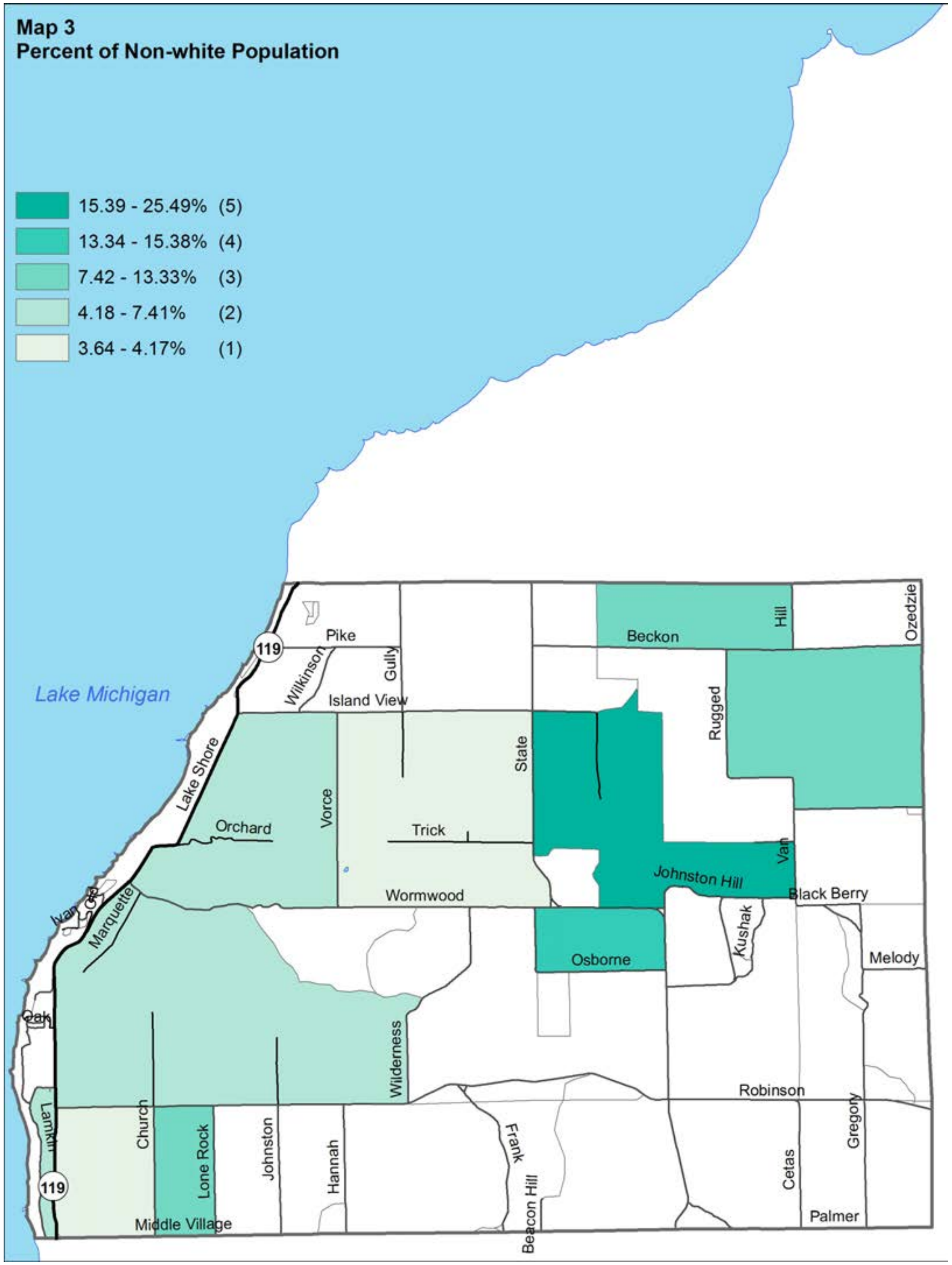


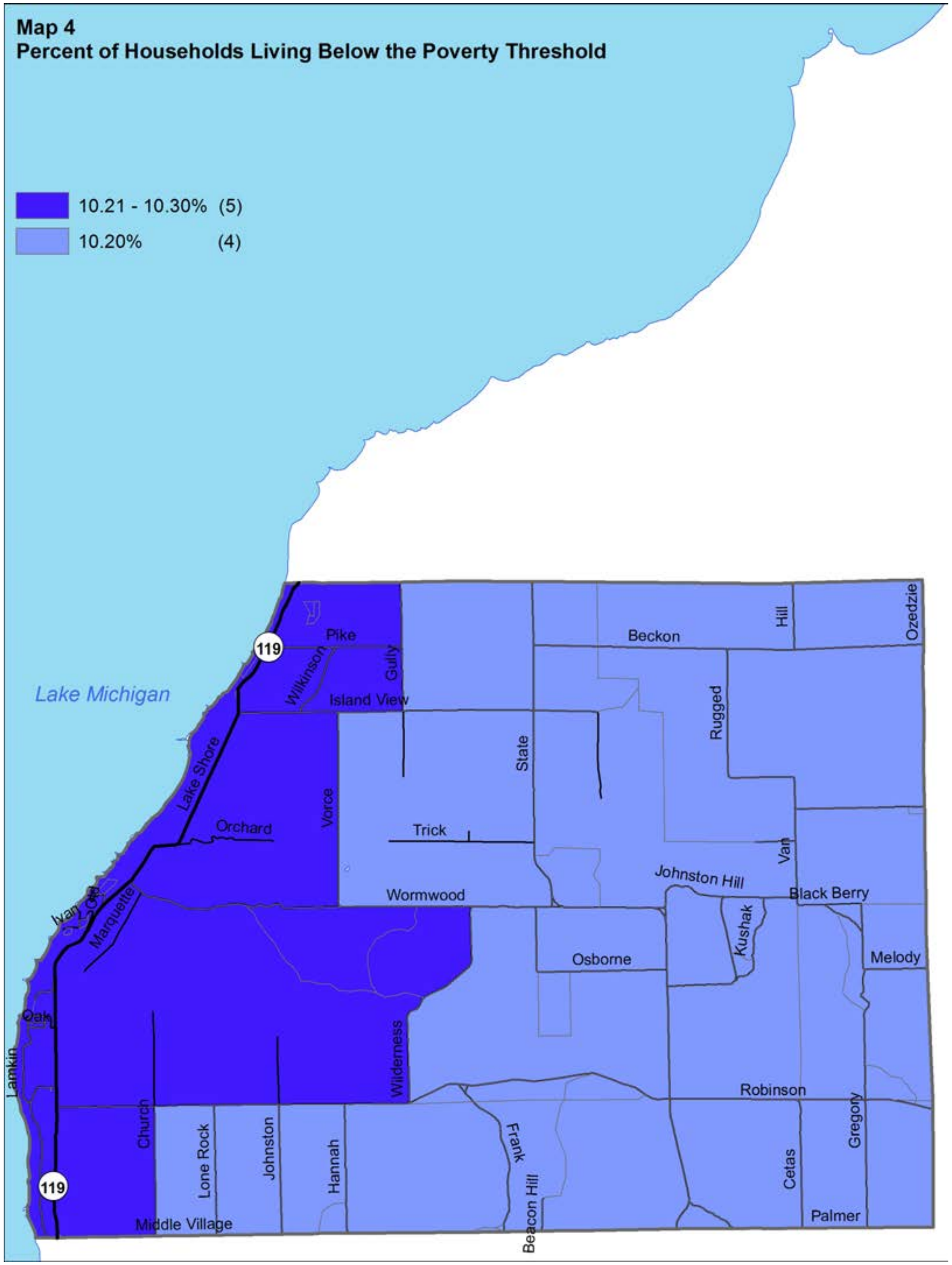


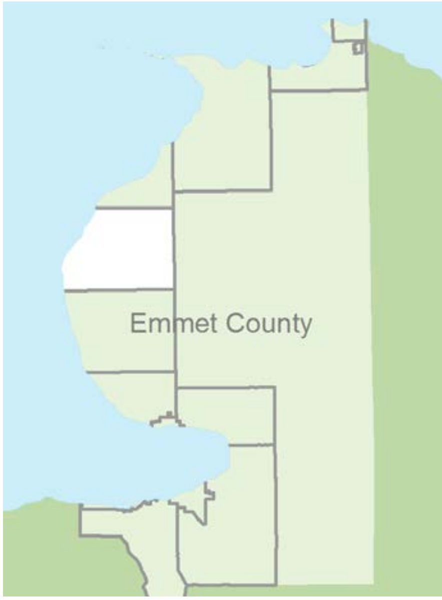

Map 2
Percent of Households with People Living Alone
75.01 - 100.00% (5)
50.01 - 75.00% (4)
30.78 - 50.00% (3)
20.01 - 30.77% (2)
13.33 - 20.00% (1)
Lake Michigan
Pike
Beckon
Hill
Ozedzie
Wilkinson
Gully
Island View
Rugged
State
Lake Shore
Vorce
Orchard
Trick
Van
Johnston Hill
Black Berry
Wormwood
Kushak
Marquette
Osborne
Melody
Oak
Lamkin
Wilderness
Robinson
Church
Lone Rock
Johnston
Hannah
Frank
Beacon Hill
Cetas
Gregory
Middle Village
Palmer
119

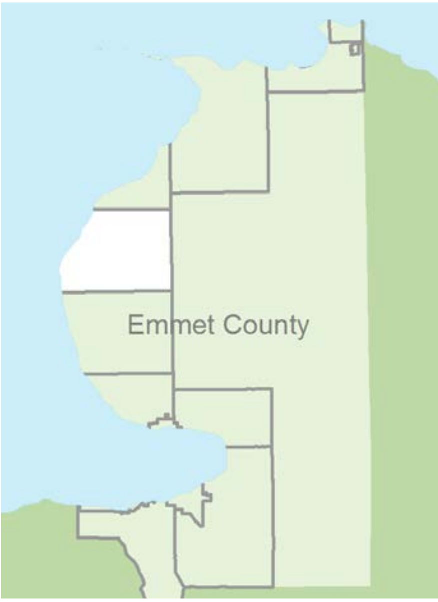

Emmet County

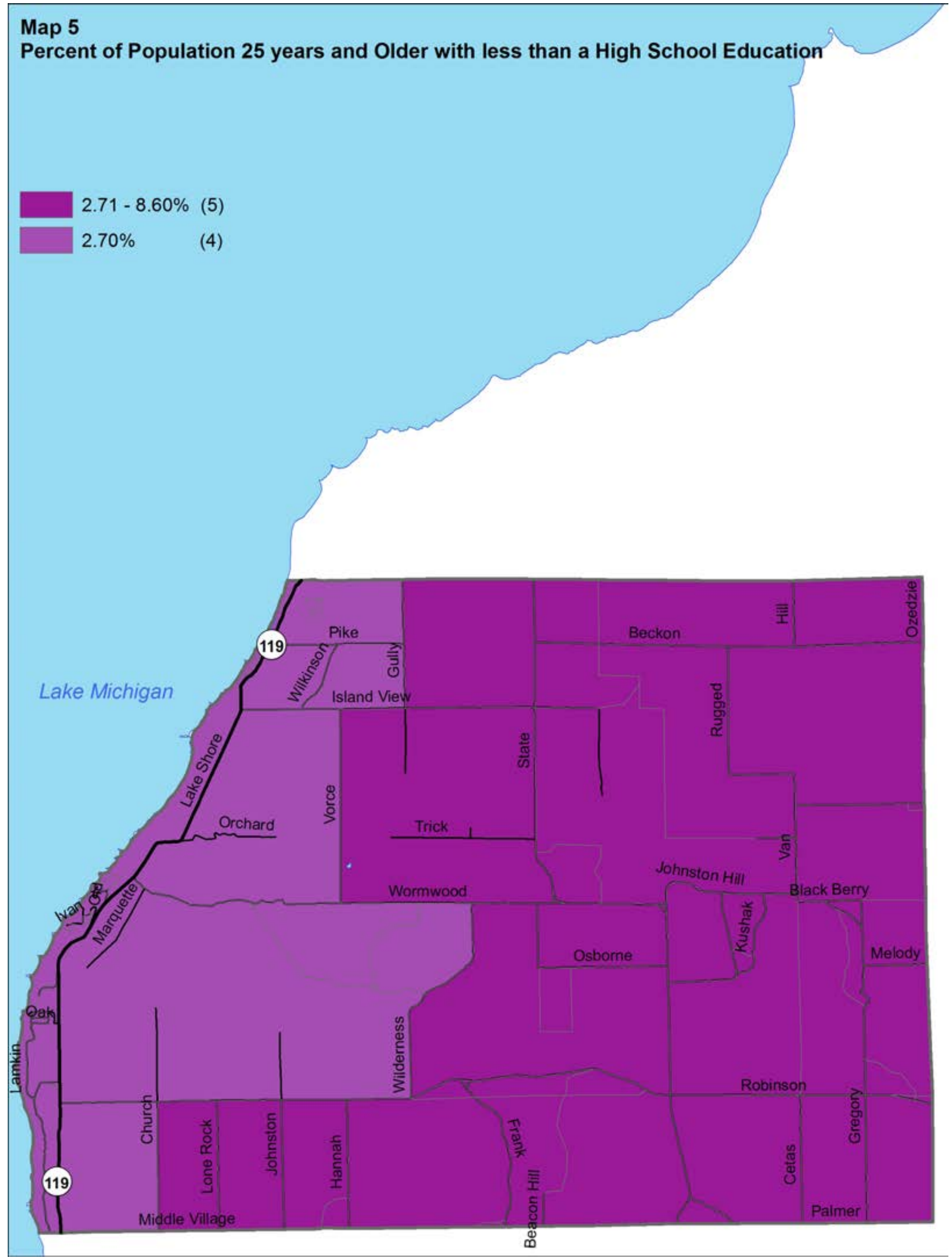

Emmet County

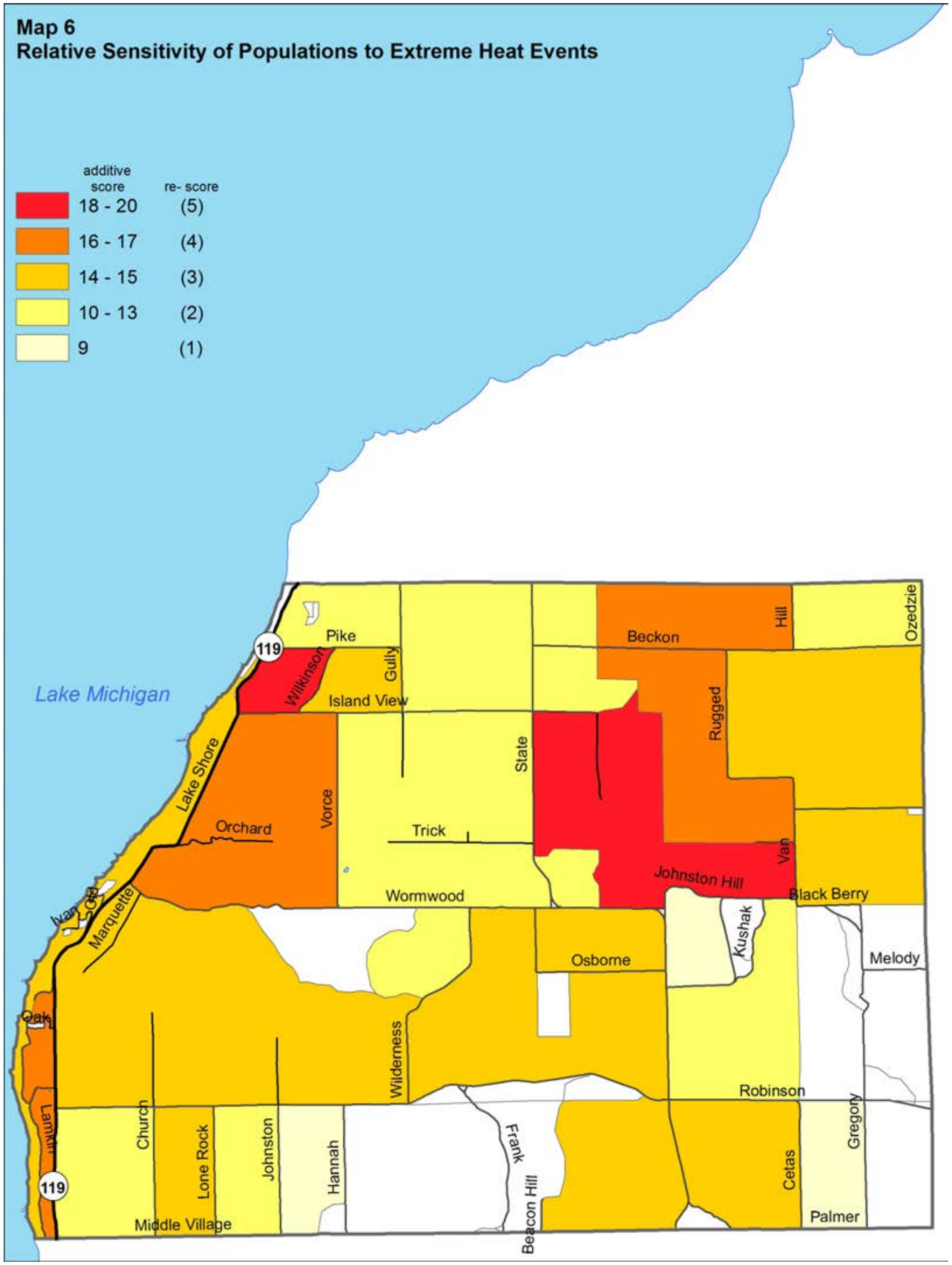

Map 3
Percent of Non-white Population
15.39 - 25.49% (5)
13.34 - 15.38% (4)
7.42 - 13.33% (3)
4.18 - 7.41% (2)
3.64 - 4.17% (1)
Lake Michigan
Pike
Island View
Beckon
Hill
Ozedzie
Rugged
State
Lake Shore
Orchard
Vorce
Trick
Wormwood
Johnston Hill
Van
Black Berry
Kushak
Melody
Osborne
Marquette
Wilderness
Robinson
Church
Lone Rock
Johnston
Hannah
Frank
Beacon Hill
Cetas
Gregory
Palmer
Middle Village
119

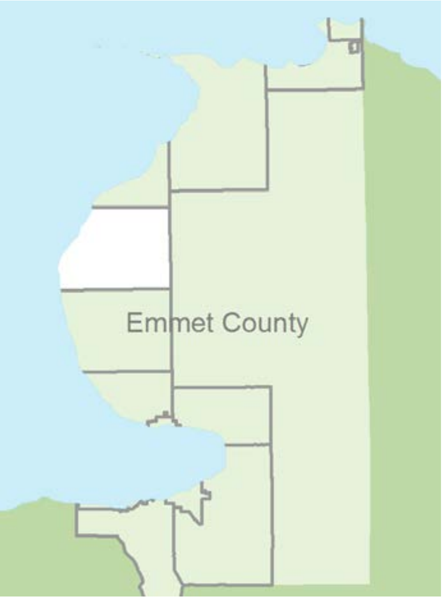

Map 4
Percent of Households Living Below the Poverty Threshold
10.21 - 10.30% (5)
10.20% (4)
Lake Michigan
119
Pike
Wilkinson
Gully
Island View
Lake Shore
Orchard
Vorce
Trick
State
Beckon
Hill
Ozedzie
Rugged
Van
Johnston Hill
Black Berry
Wormwood
Osborne
Kushak
Melody
Marquette
Oak
Lamkin
Church
Lone Rock
Johnston
Hannah
Wilderness
Frank
Beacon Hill
Robinson
Cetas
Gregory
Palmer
Middle Village

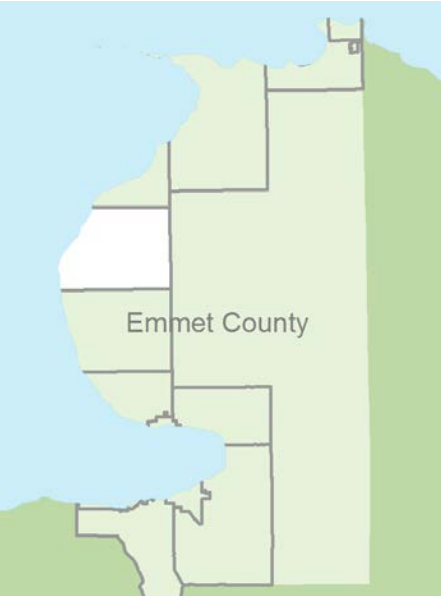

Emmet County

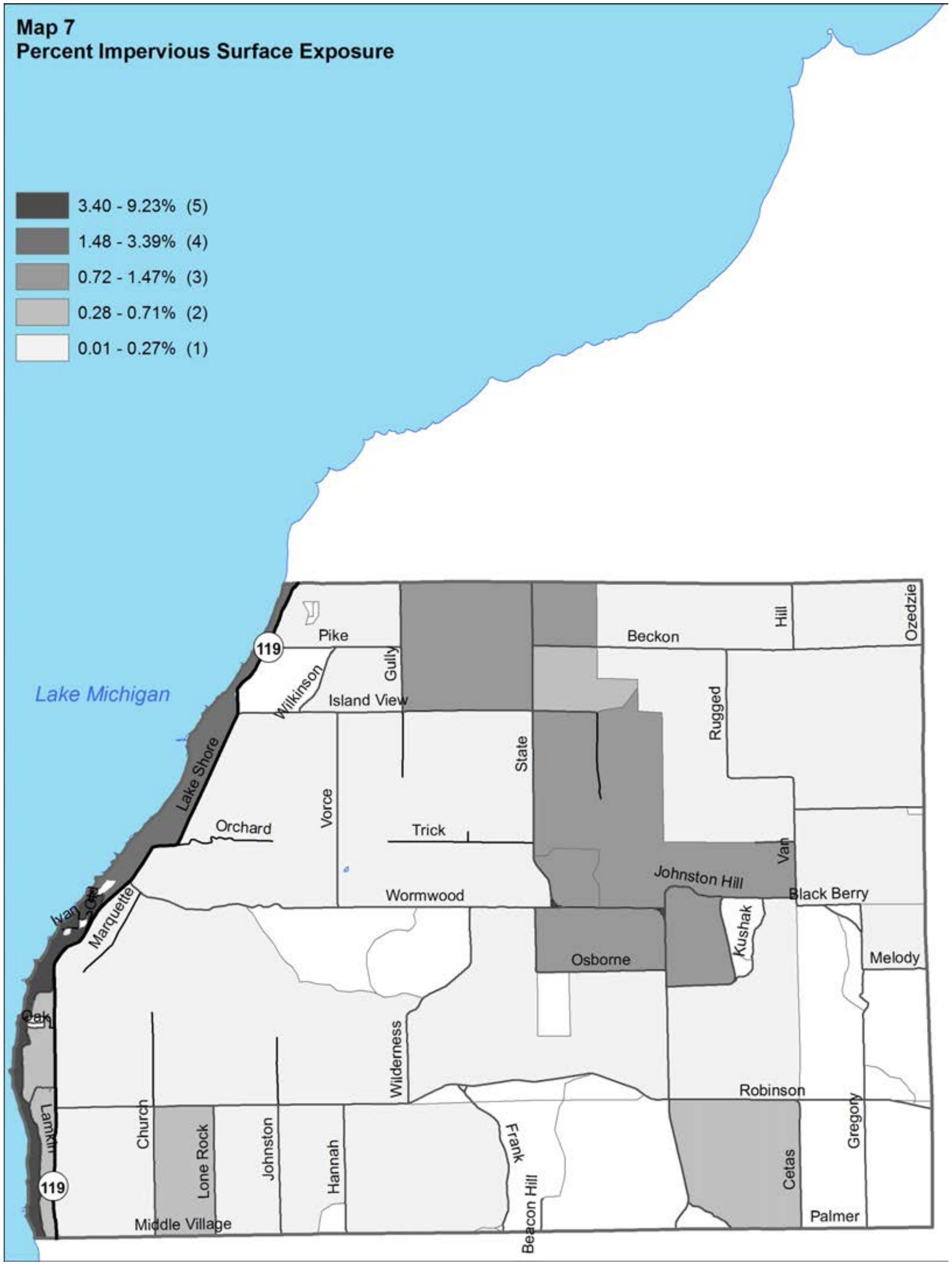

Emmet County

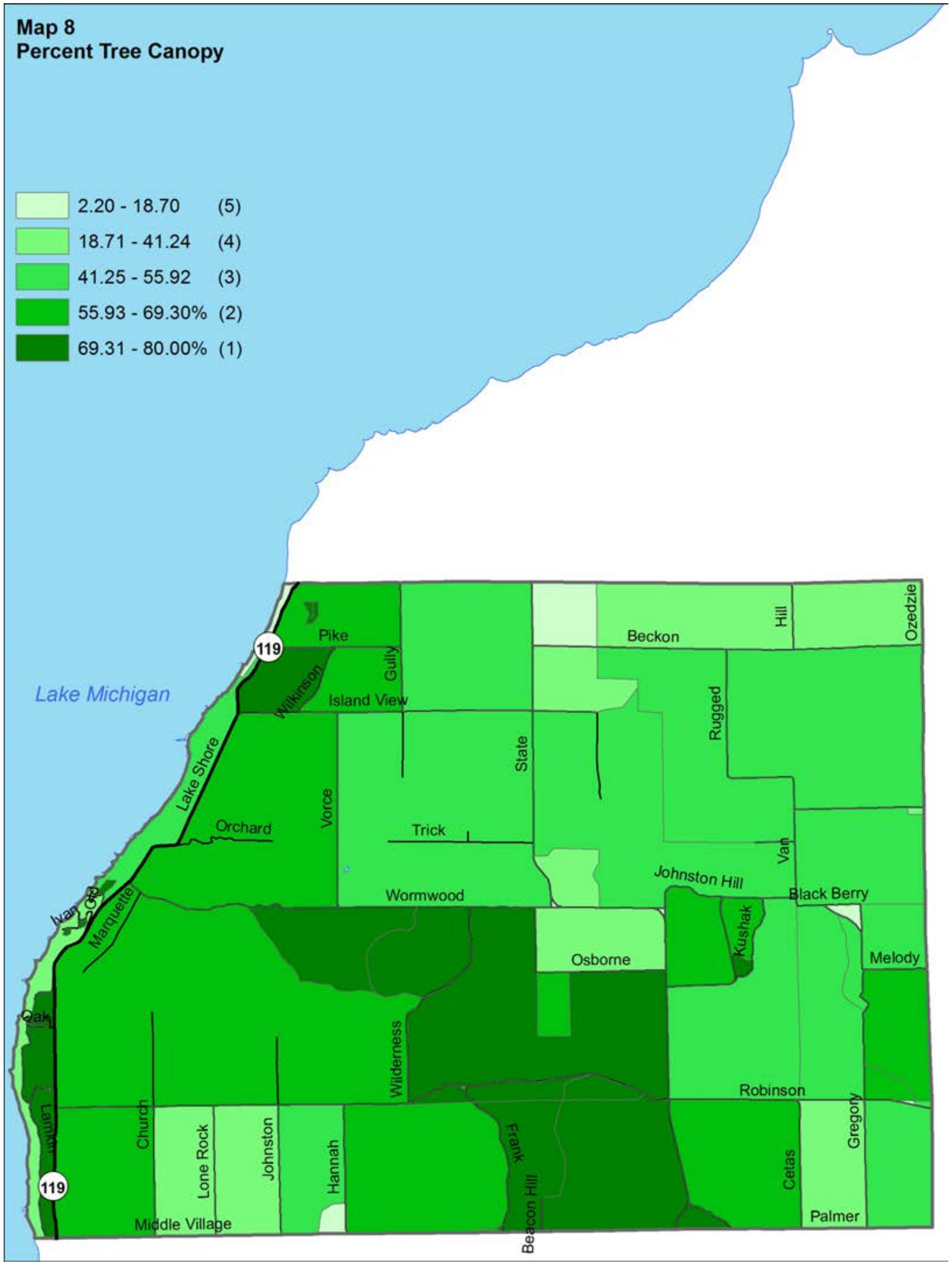

Map 5
Percent of Population 25 years and Older with less than a High School Education
2.71 - 8.60% (5)
2.70% (4)
Lake Michigan
119
Pike
Wilkinson
Gully
Island View
Beckon
Hill
Ozedzie
Rugged
State
Lake Shore
Vorce
Orchard
Trick
Van
Johnston Hill
Wormwood
Black Berry
Marquette
Kushak
Osborne
Melody
Oak
Lamkin
Wilderness
Robinson
Church
Lone Rock
Johnston
Hannah
Frank
Beacon Hill
Cetas
Gregory
Middle Village
Palmer

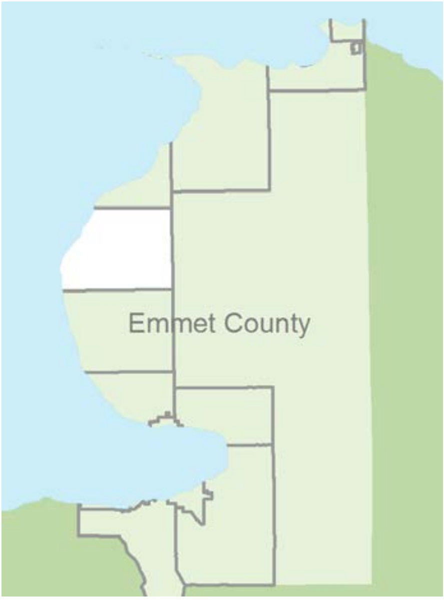

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
additive score
re- score
18 - 20 (5)
16 - 17 (4)
14 - 15 (3)
10 - 13 (2)
9 (1)
Lake Michigan
119
Pike
Wilkinson
Gully
Island View
Beckon
Hill
Ozedzie
Rugged
State
Lake Shore
Orchard
Vorce
Trick
Wormwood
Johnston Hill
Van
Black Berry
Kushak
Melody
Osborne
Marquette
Wilderness
Robinson
Gregory
Church
Lone Rock
Johnston
Hannah
Frank
Beacon Hill
Cetas
Palmer
Middle Village
Lamkin
Oak

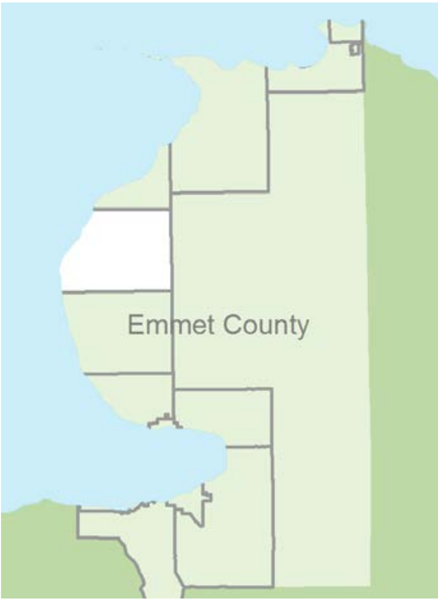

Emmet County

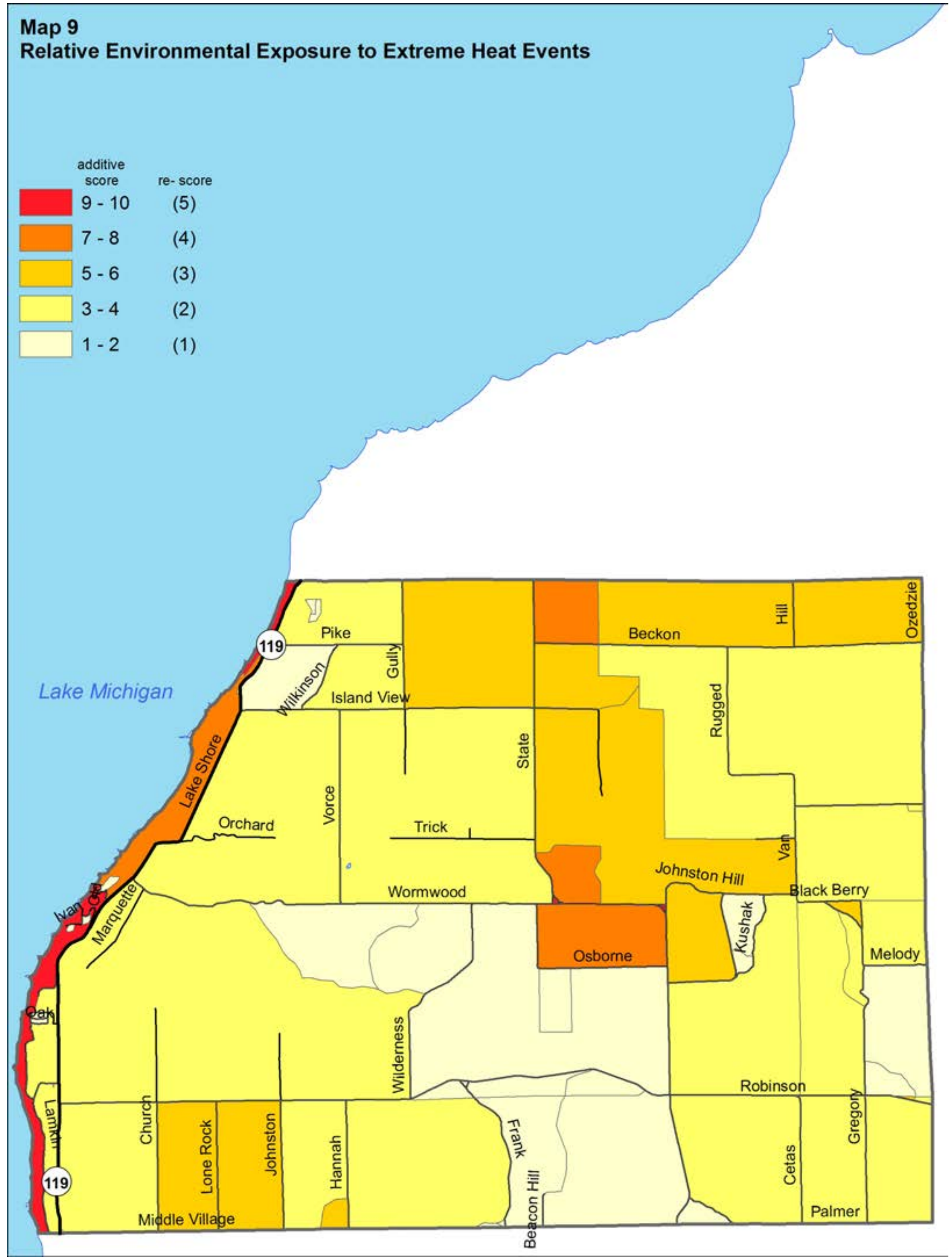

Emmet County

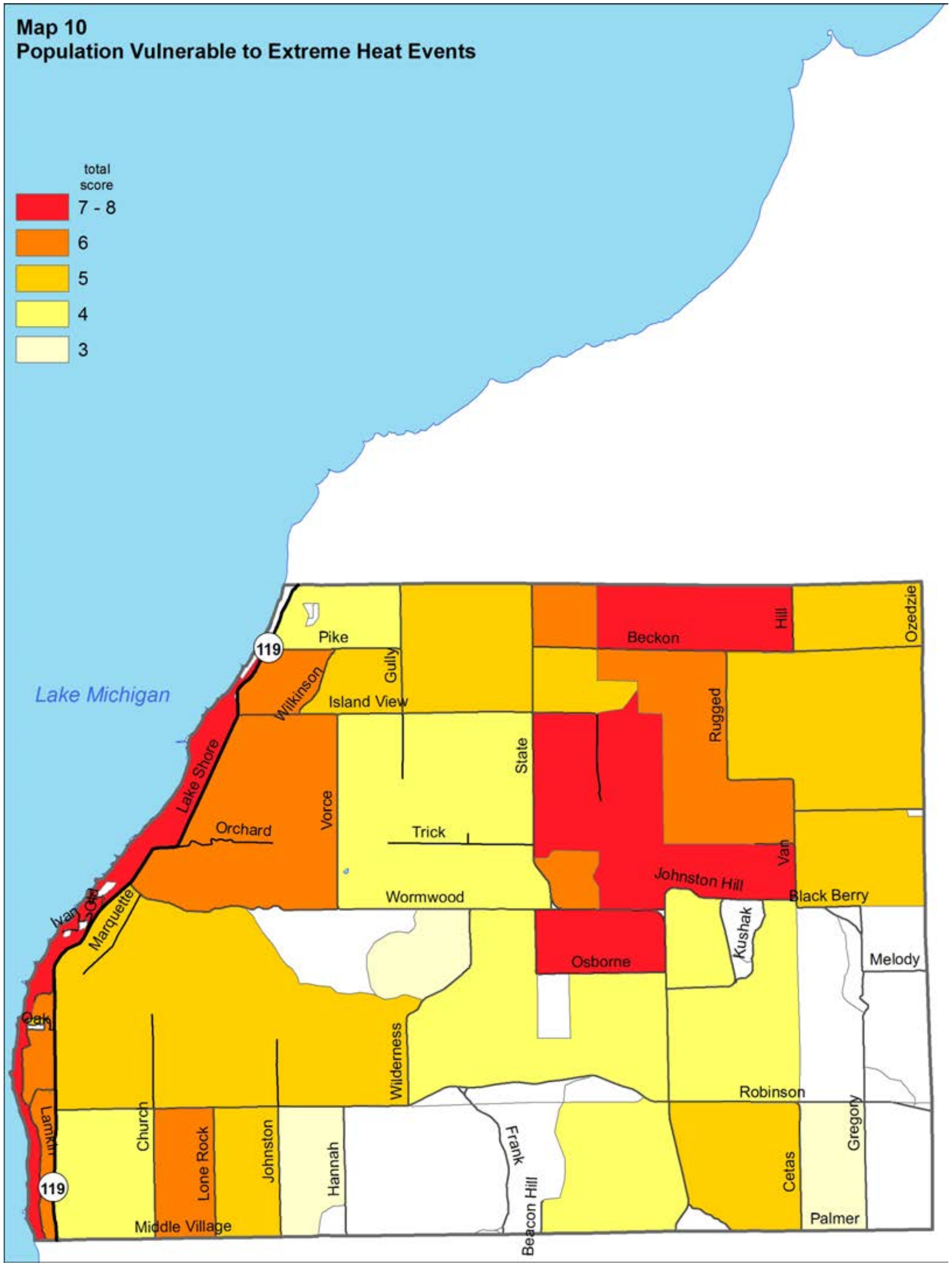

Map 7
Percent Impervious Surface Exposure
3.40 - 9.23% (5)
1.48 - 3.39% (4)
0.72 - 1.47% (3)
0.28 - 0.71% (2)
0.01 - 0.27% (1)
Lake Michigan
119
Pike
Beckon
Hill
Ozedzie
Gully
Wilkinson
Island View
Rugged
State
Lake Shore
Vorce
Orchard
Trick
Van
Johnston Hill
Wormwood
Black Berry
Marquette
Kushak
Osborne
Melody
Oak
Wilderness
Robinson
Church
Lone Rock
Johnston
Hannah
Frank
Beacon Hill
Gregory
Cetas
Palmer
Middle Village

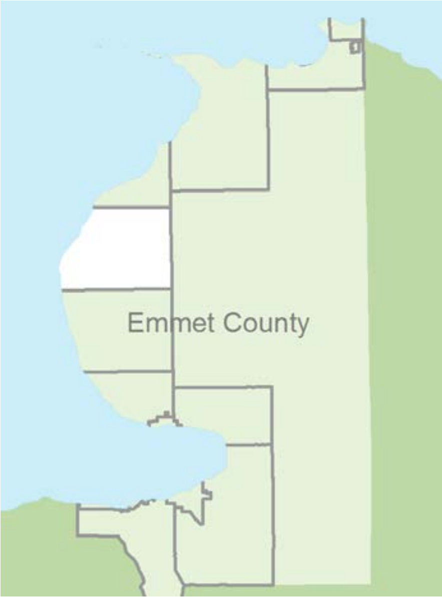

Map 8
Percent Tree Canopy
2.20 - 18.70 (5)
18.71 - 41.24 (4)
41.25 - 55.92 (3)
55.93 - 69.30% (2)
69.31 - 80.00% (1)
Lake Michigan
119
Pike
Gully
Wilkinson
Island View
Beckon
Hill
Ozedzie
Rugged
State
Lake Shore
Vorce
Orchard
Trick
Van
Johnston Hill
Black Berry
Wormwood
Marquette
Ivan
Osborne
Kushak
Melody
Oak
Wilderness
Robinson
Lamb
Church
Lone Rock
Johnston
Hannah
Frank
Beacon Hill
Cetas
Gregory
Palmer
Middle Village


Emmet County

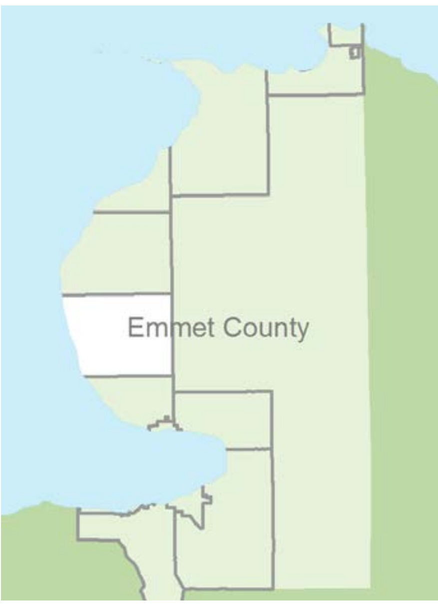

Emmet County

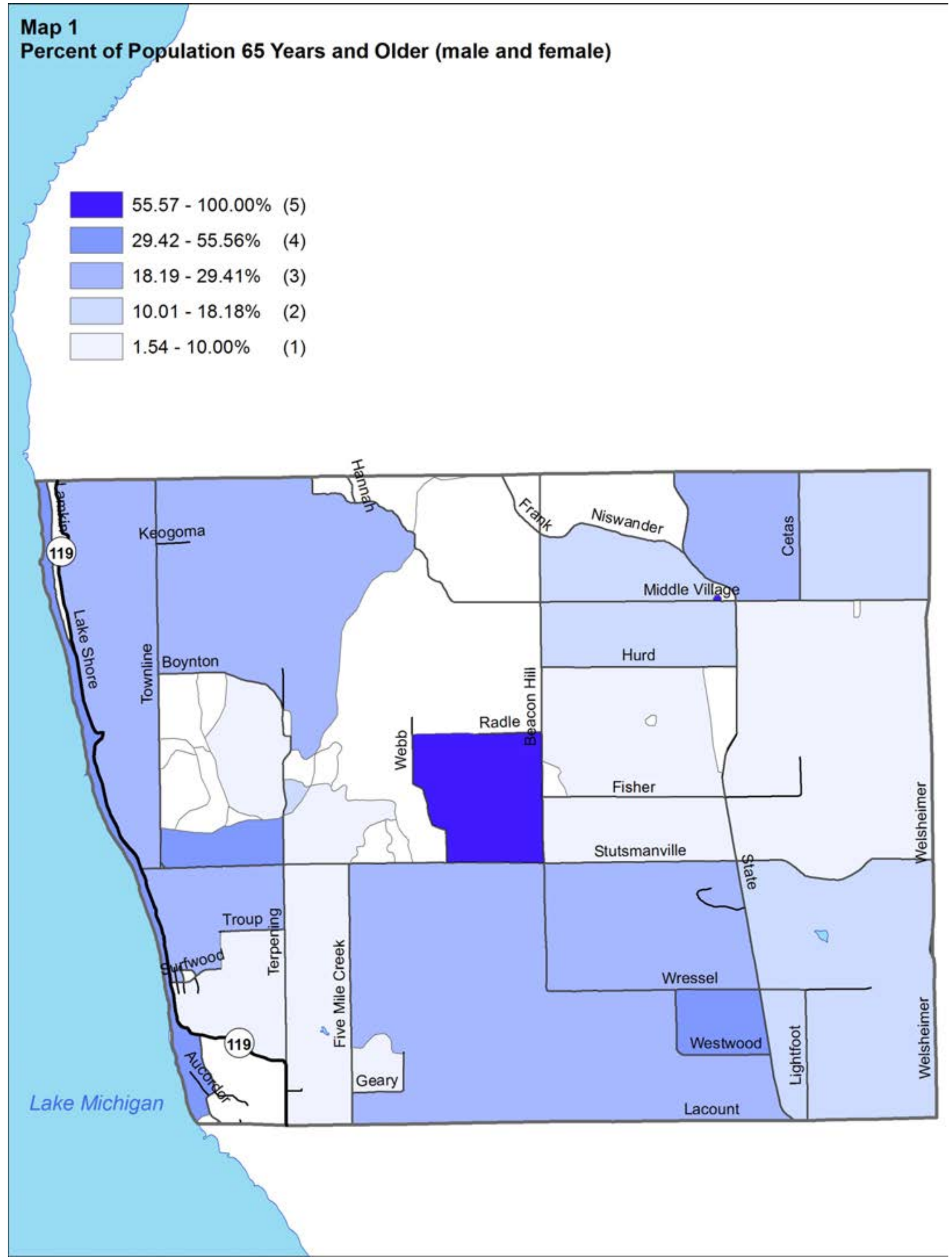

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re- score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
119
Pike
Wilkinson
Gully
Island View
Beckon
Hill
Ozedzie
Rugged
State
Lake Shore
Orchard
Vorce
Trick
Van
Johnston Hill
Black Berry
Wormwood
Marquette
Ivan
Kushak
Osborne
Melody
Oak
Wilderness
Robinson
Church
Lone Rock
Johnston
Hannah
Frank
Gregory
Lamkin
Beacon Hill
Cetas
Middle Village
Palmer

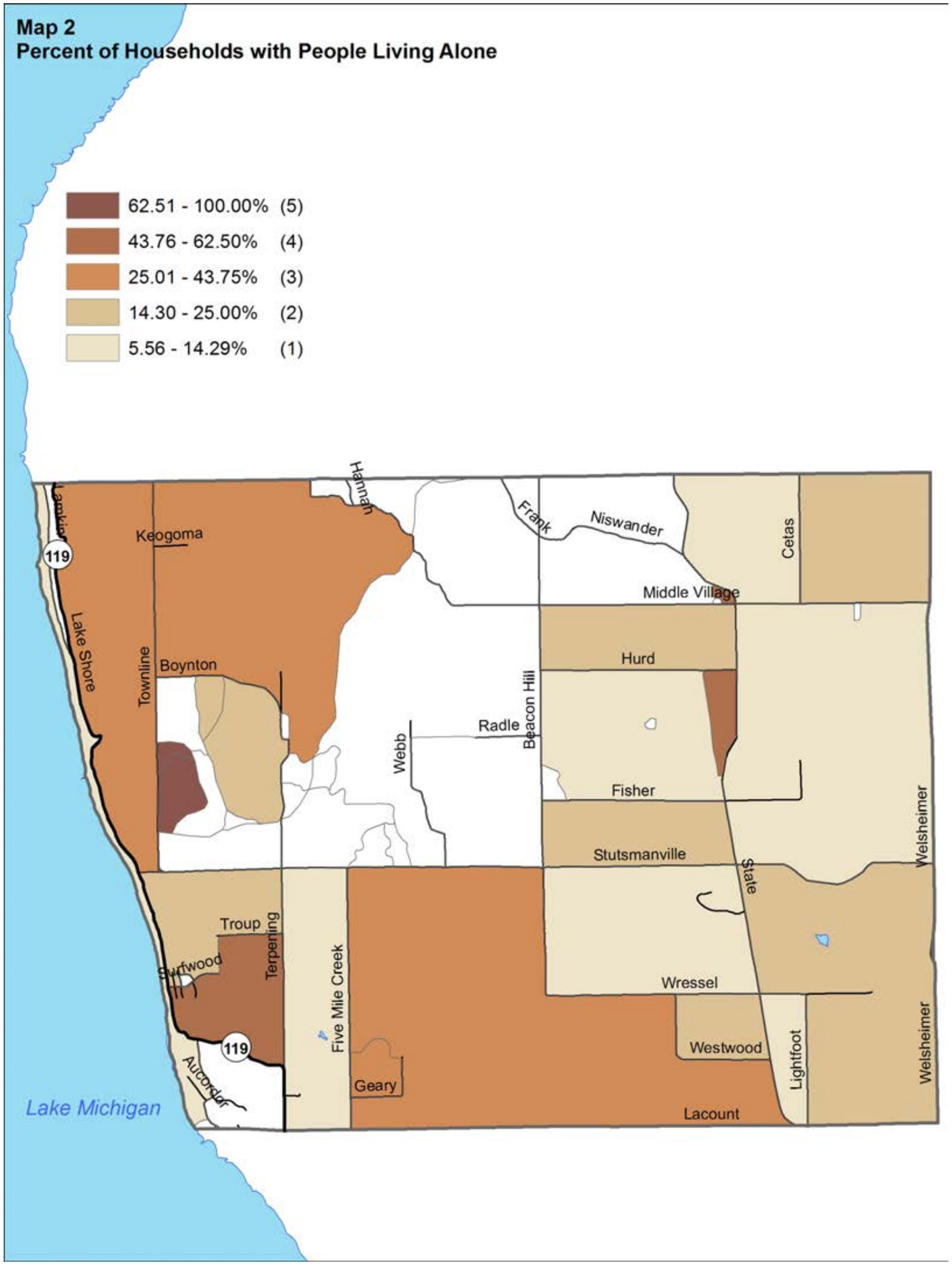

Map 10
Population Vulnerable to Extreme Heat Events
total score
7 - 8
6
5
4
3
Lake Michigan
Pike
119
Wilkinson
Gully
Island View
Beckon
Hill
Ozedzie
Rugged
State
Lake Shore
Orchard
Vorce
Trick
Van
Johnston Hill
Black Berry
Wormwood
Ivan
Marquette
Kushak
Osborne
Melody
Oak
Wilderness
Robinson
Lamkin
Church
Lone Rock
Johnston
Hannah
Frank
Beacon Hill
Cetas
Gregory
Palmer
Middle Village

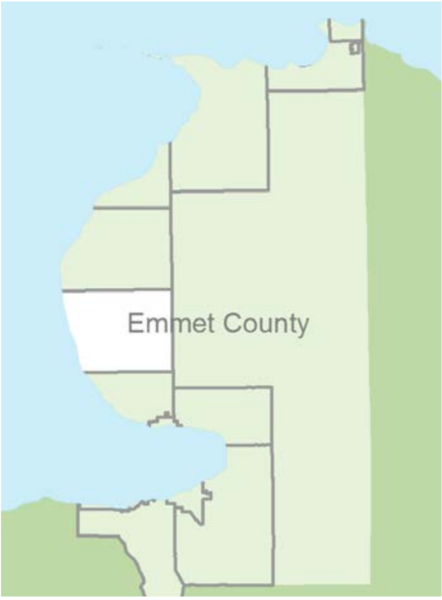

Emmet County

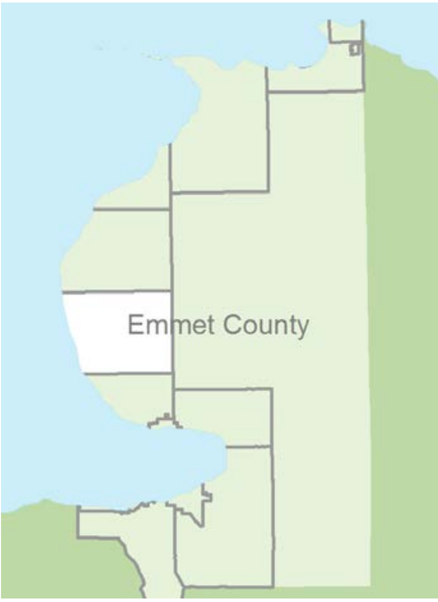
Friendship Twp.

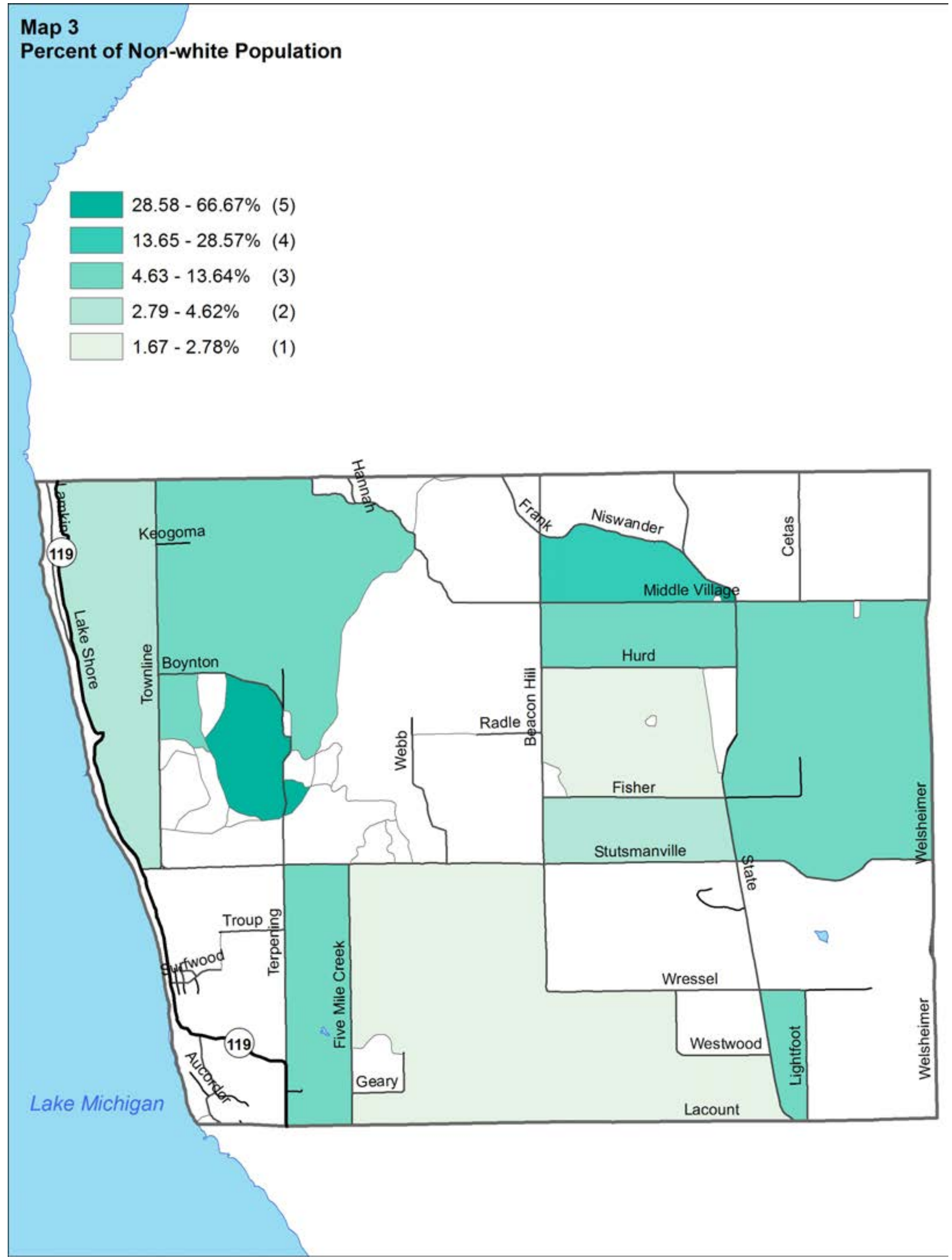


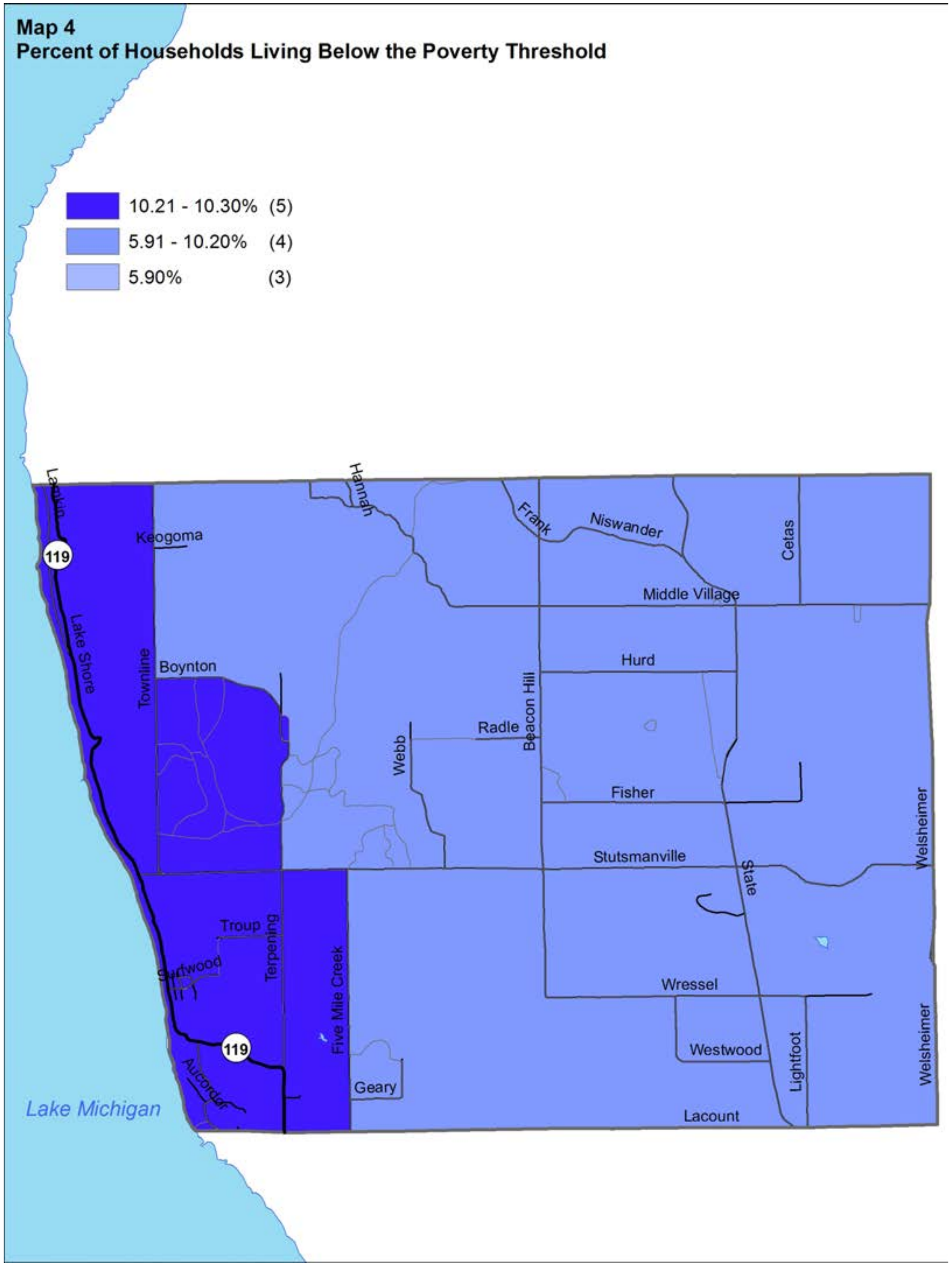



Map 2
Percent of Households with People Living Alone
62.51 - 100.00% (5)
43.76 - 62.50% (4)
25.01 - 43.75% (3)
14.30 - 25.00% (2)
5.56 - 14.29% (1)
Hannah
Lamkin
Keogoma
119
Frank
Niswander
Cetas
Middle Village
Lake Shore
Townline
Boynton
Hurd
Beacon Hill
Radle
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Terpening
Surfwood
Five Mile Creek
Wressel
Westwood
Lightfoot
Geary
Lacount
Autocular
Lake Michigan

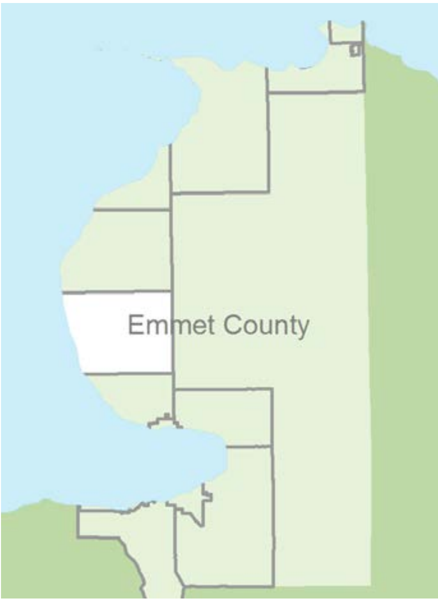

Emmet County

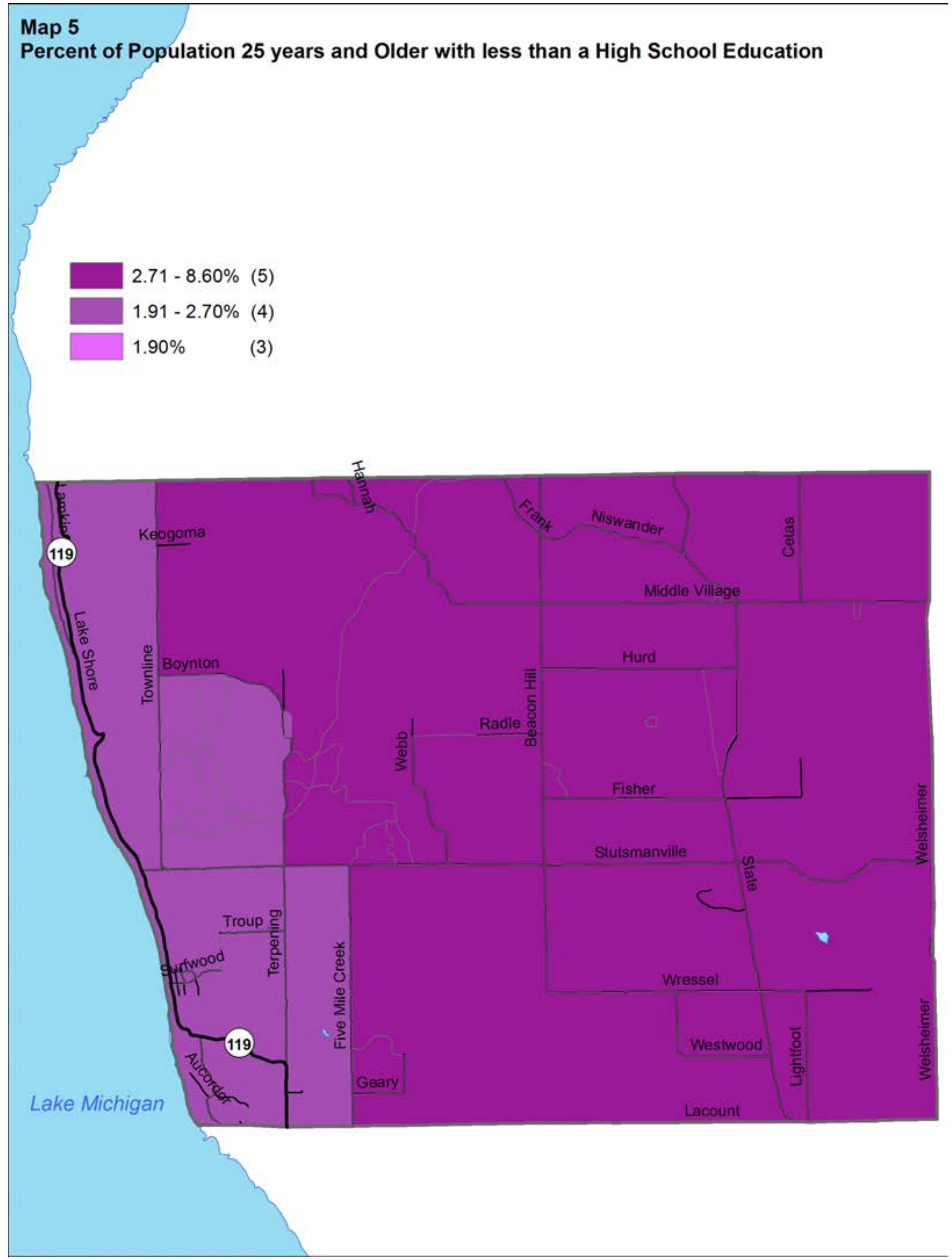

Emmet County

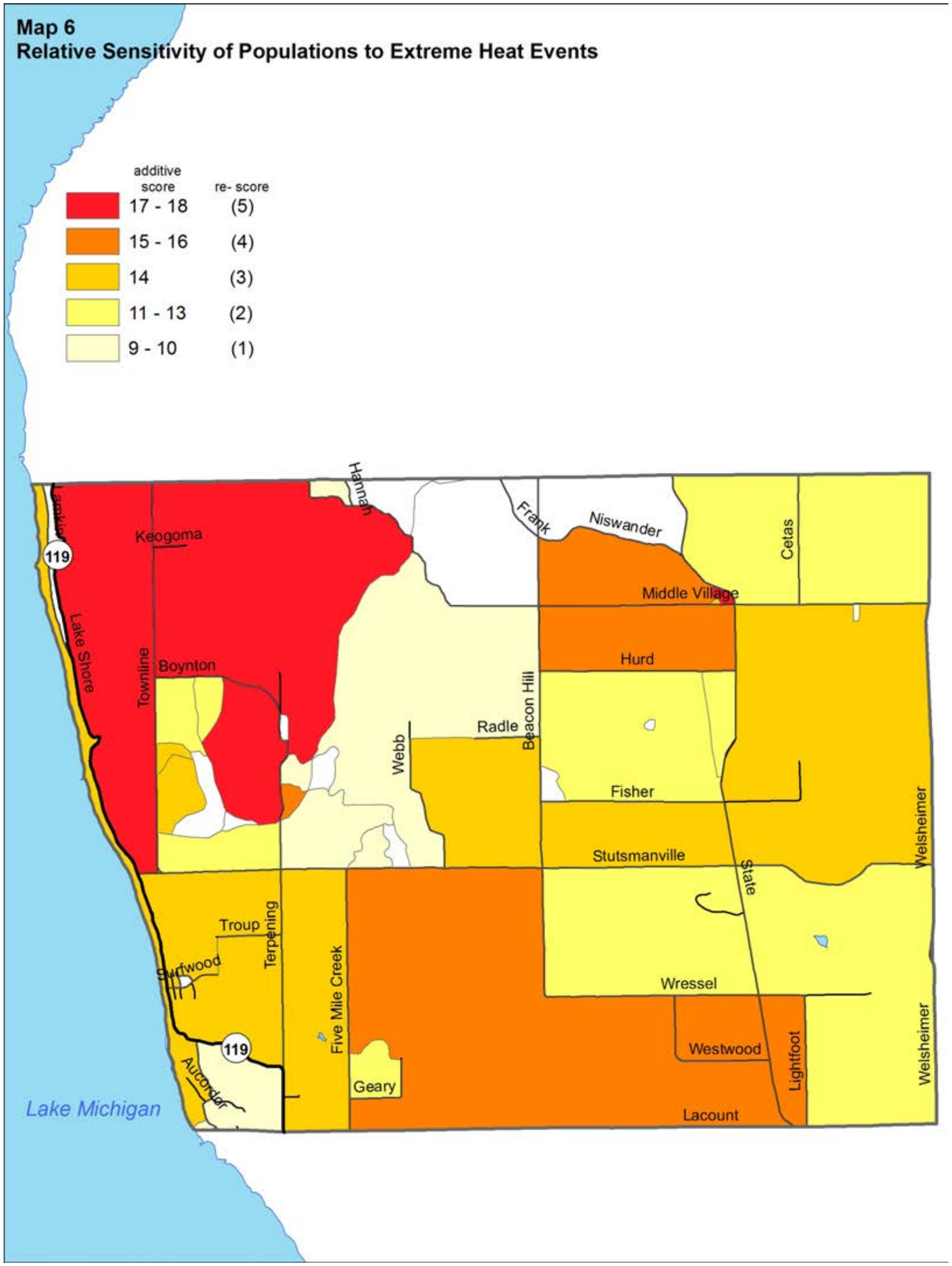

Map 3
Percent of Non-white Population
28.58 - 66.67% (5)
13.65 - 28.57% (4)
4.63 - 13.64% (3)
2.79 - 4.62% (2)
1.67 - 2.78% (1)
Hannah
Frank
Niswander
Cetas
Keogoma
119
Middle Village
Lake Shore
Townline
Boynton
Hurd
Beacon Hill
Radle
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Terpening
Surfwood
Five Mile Creek
Wressel
Westwood
Lightfoot
Geary
Lacount
Lake Michigan


Map 4
Percent of Households Living Below the Poverty Threshold
10.21 - 10.30% (5)
5.91 - 10.20% (4)
5.90% (3)
Lake Michigan
Keogoma
Boynton
Lake Shore
Townline
Hannah
Frank
Niswander
Cetas
Middle Village
Hurd
Radle
Beacon Hill
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Terpening
Five Mile Creek
Wressel
Westwood
Lightfoot
Geary
Lacount
119

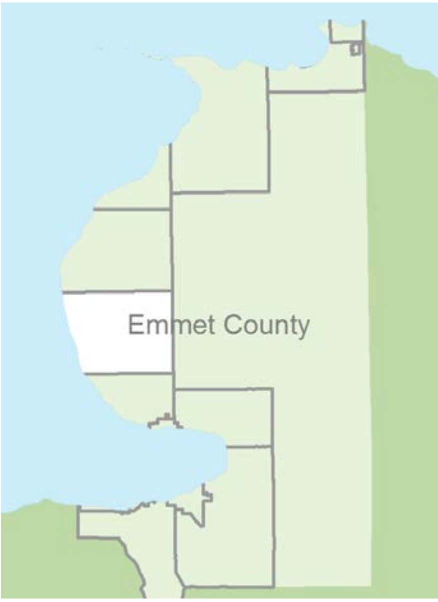

Emmet County

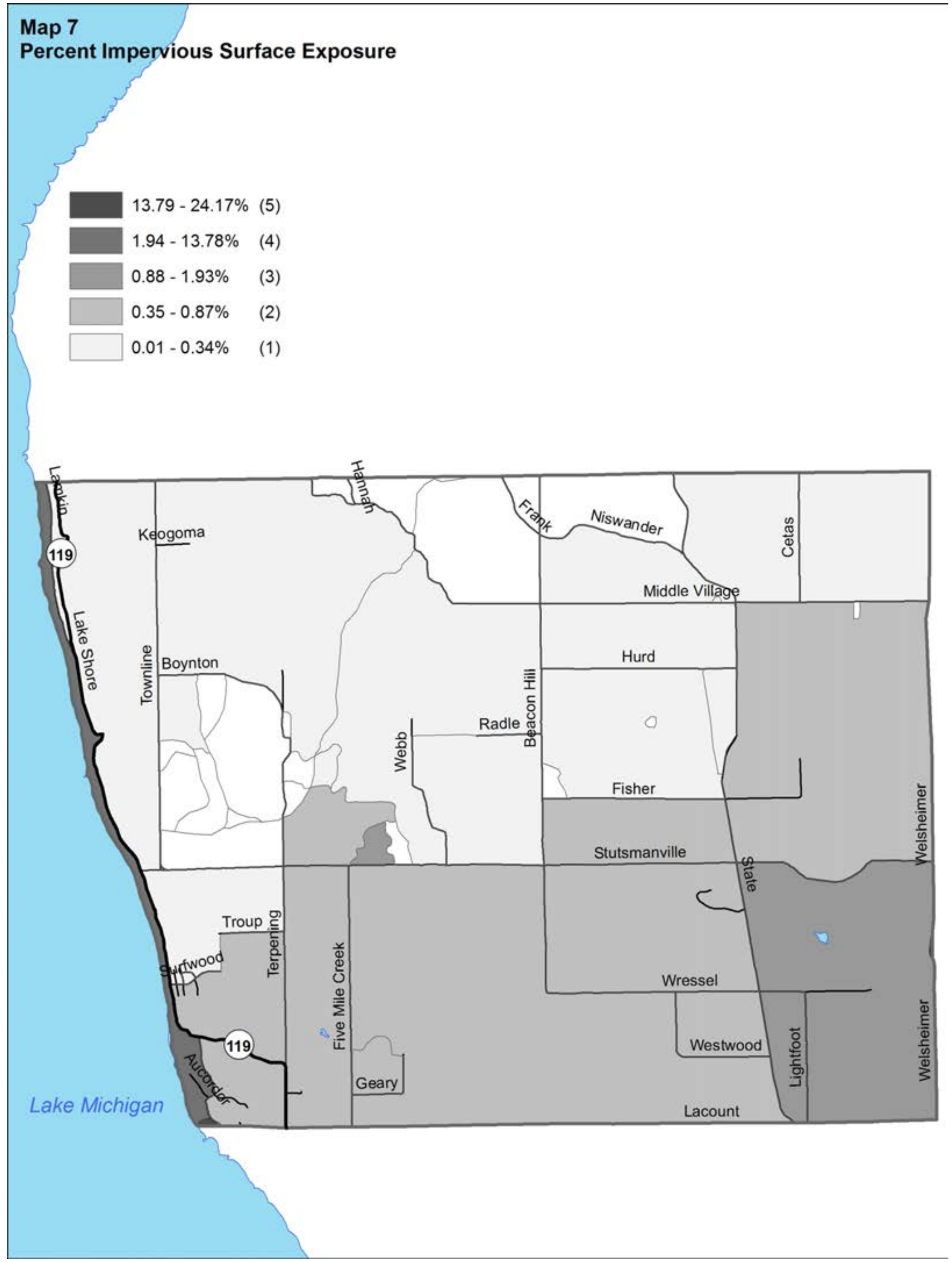

Emmet County

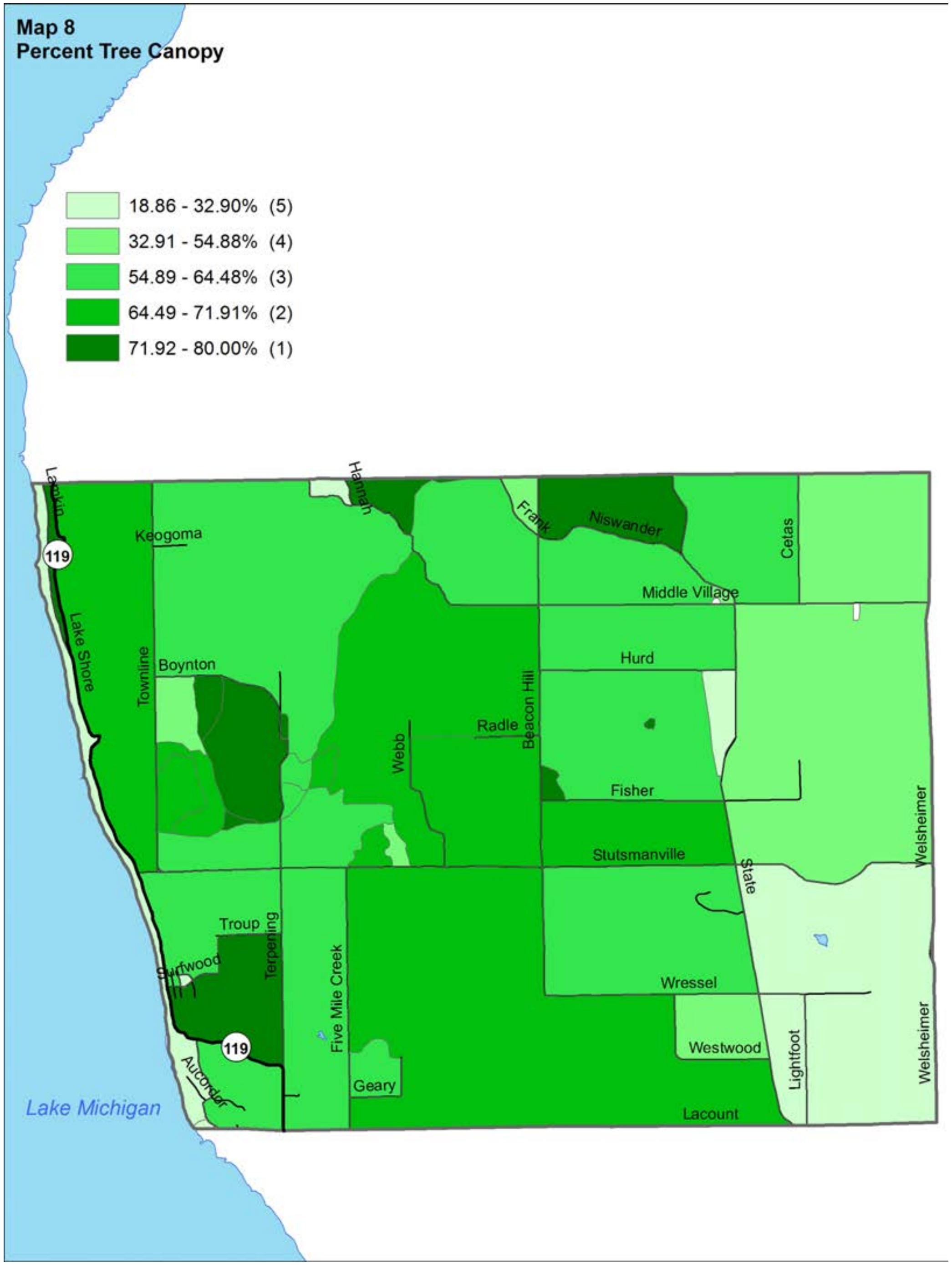

Map 5
Percent of Population 25 years and Older with less than a High School Education
2.71 - 8.60% (5)
1.91 - 2.70% (4)
1.90% (3)
Lake Michigan
Lake Shore
Townline
Keogoma
Boynton
Hannah
Frank
Niswander
Cetas
Middle Village
Hurd
Radle
Beacon Hill
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Terpening
Five Mile Creek
Wressel
Westwood
Lightfoot
Geary
Lacount
119

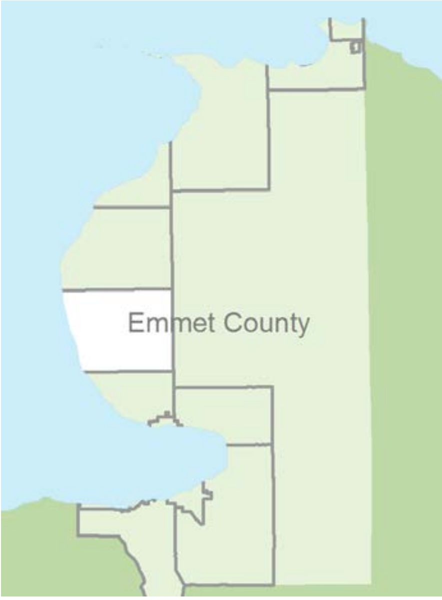

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
additive score
re- score
17 - 18 (5)
15 - 16 (4)
14 (3)
11 - 13 (2)
9 - 10 (1)
Keogoma
Hannah
Frank
Niswander
Cetas
Middle Village
Lake Shore
Townline
Boynton
Hurd
Radle
Beacon Hill
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Terpening
Surfwood
Five Mile Creek
Wressel
Westwood
Lightfoot
Geary
Aucordor
Lacount
119
Lake Michigan

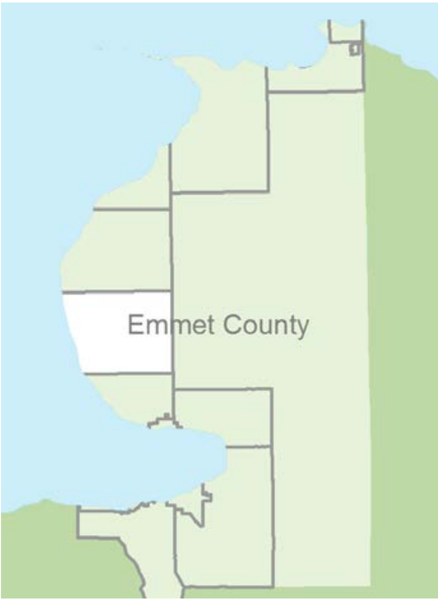

Emmet County

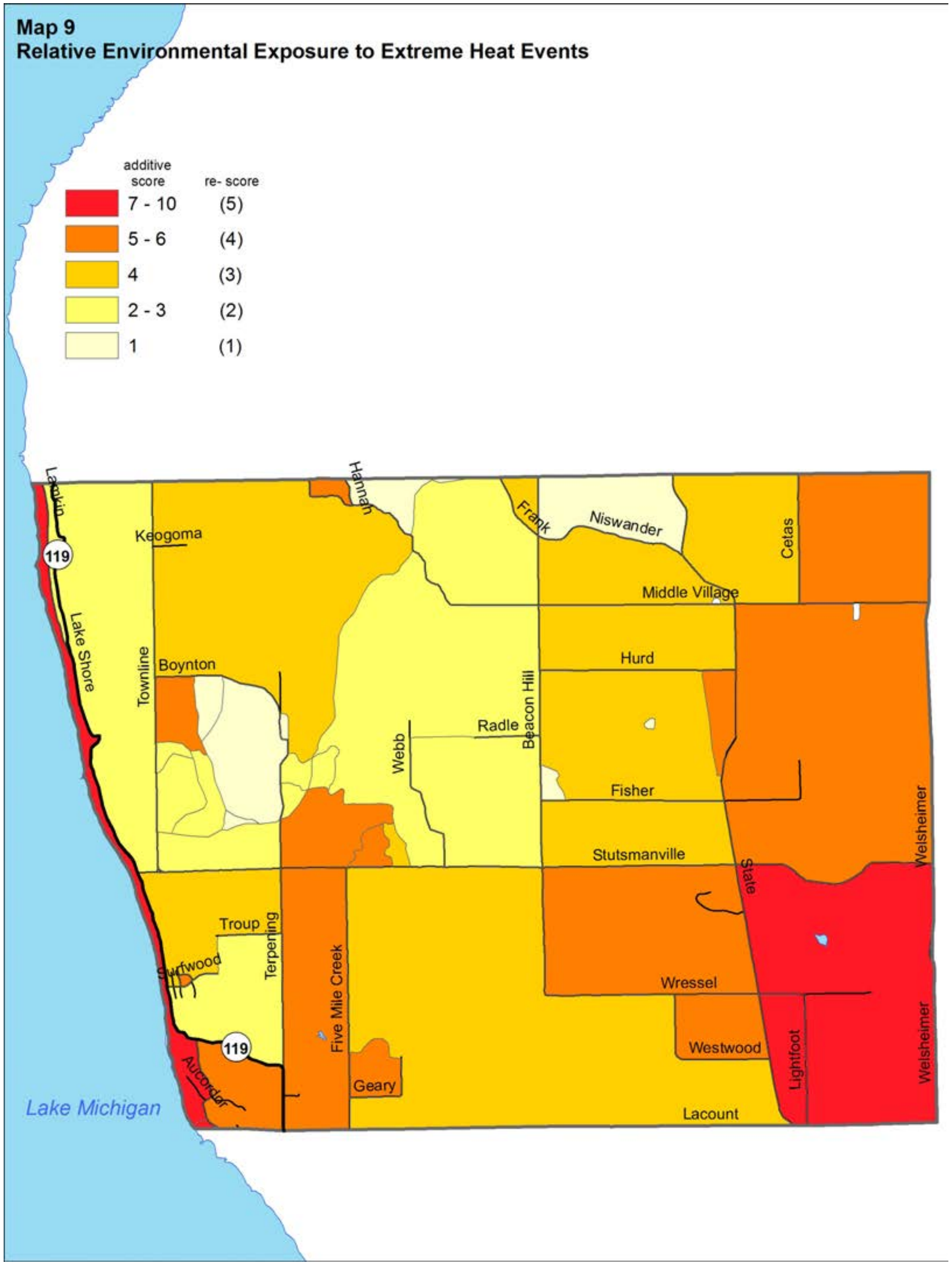

Emmet County

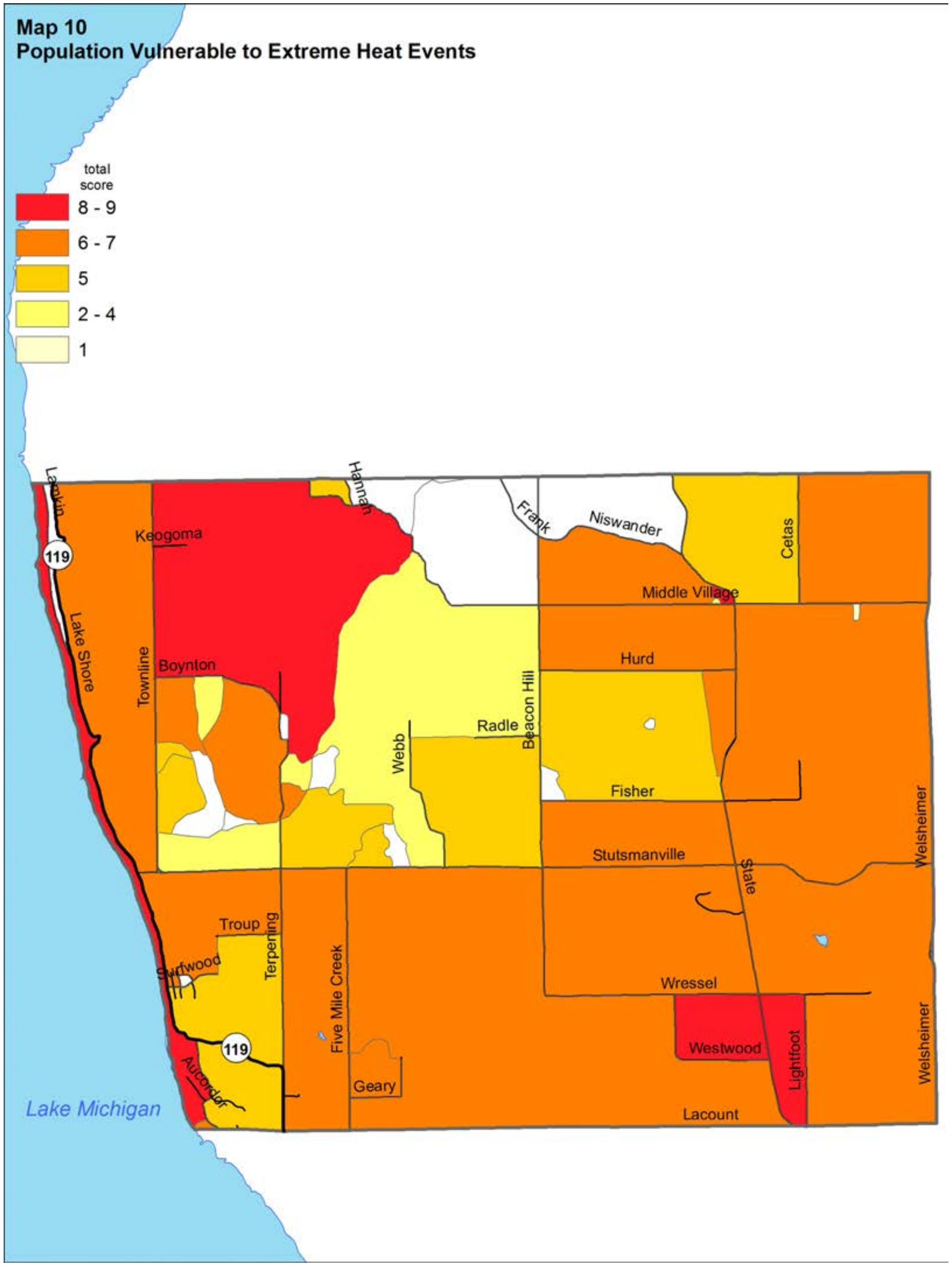

Map 7
Percent Impervious Surface Exposure
13.79 - 24.17% (5)
1.94 - 13.78% (4)
0.88 - 1.93% (3)
0.35 - 0.87% (2)
0.01 - 0.34% (1)
Lake Michigan
Keogoma
Hannah
Frank
Niswander
Cetas
Middle Village
Lake Shore
Townline
Boynton
Hurd
Radle
Beacon Hill
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Surfwood
Terpening
Five Mile Creek
Wressel
Westwood
Geary
Lightfoot
Lacount
Aucordor
119


Map 8
Percent Tree Canopy
18.86 - 32.90% (5)
32.91 - 54.88% (4)
54.89 - 64.48% (3)
64.49 - 71.91% (2)
71.92 - 80.00% (1)
Lake Michigan
Keogoma
Boynton
Townline
Lake Shore
Hannah
Frank
Niswander
Cetas
Middle Village
Hurd
Radle
Beacon Hill
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Terpening
Surfwood
Five Mile Creek
Geary
Wressel
Westwood
Lightfoot
Lacount
Aucordor
119


Emmet County

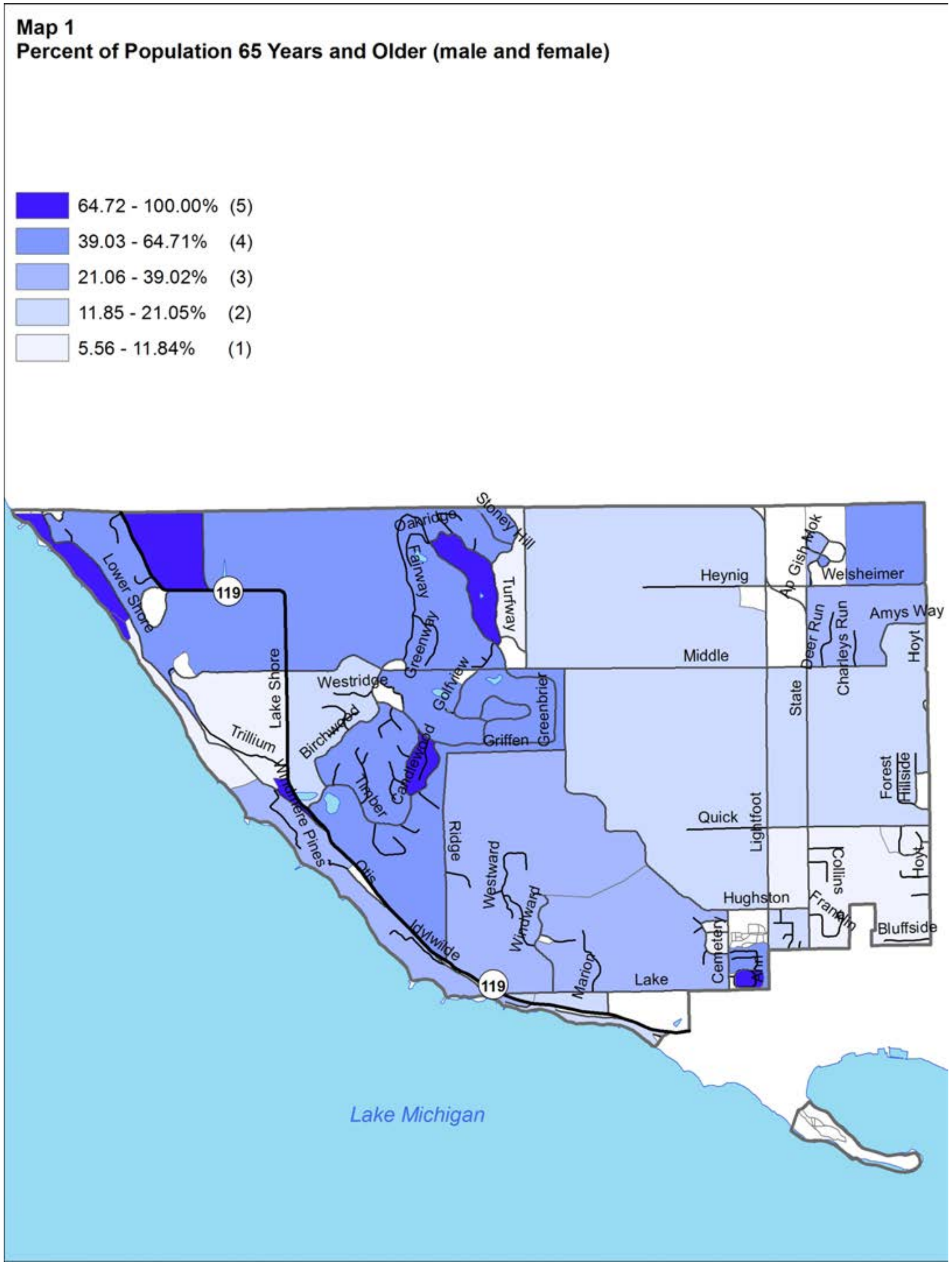

Emmet County


Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re- score
7 - 10 (5)
5 - 6 (4)
4 (3)
2 - 3 (2)
1 (1)
Larkin
Hannah
Frank
Niswander
Cetas
Keogoma
119
Middle Village
Lake Shore
Townline
Boynton
Hurd
Beacon Hill
Radle
Webb
Fisher
Stutsmanville
Welsheimer
State
Troup
Terpening
Surfwood
Five Mile Creek
Wressel
119
Westwood
Lightfoot
Welsheimer
Aucordar
Geary
Lake Michigan
Lacount

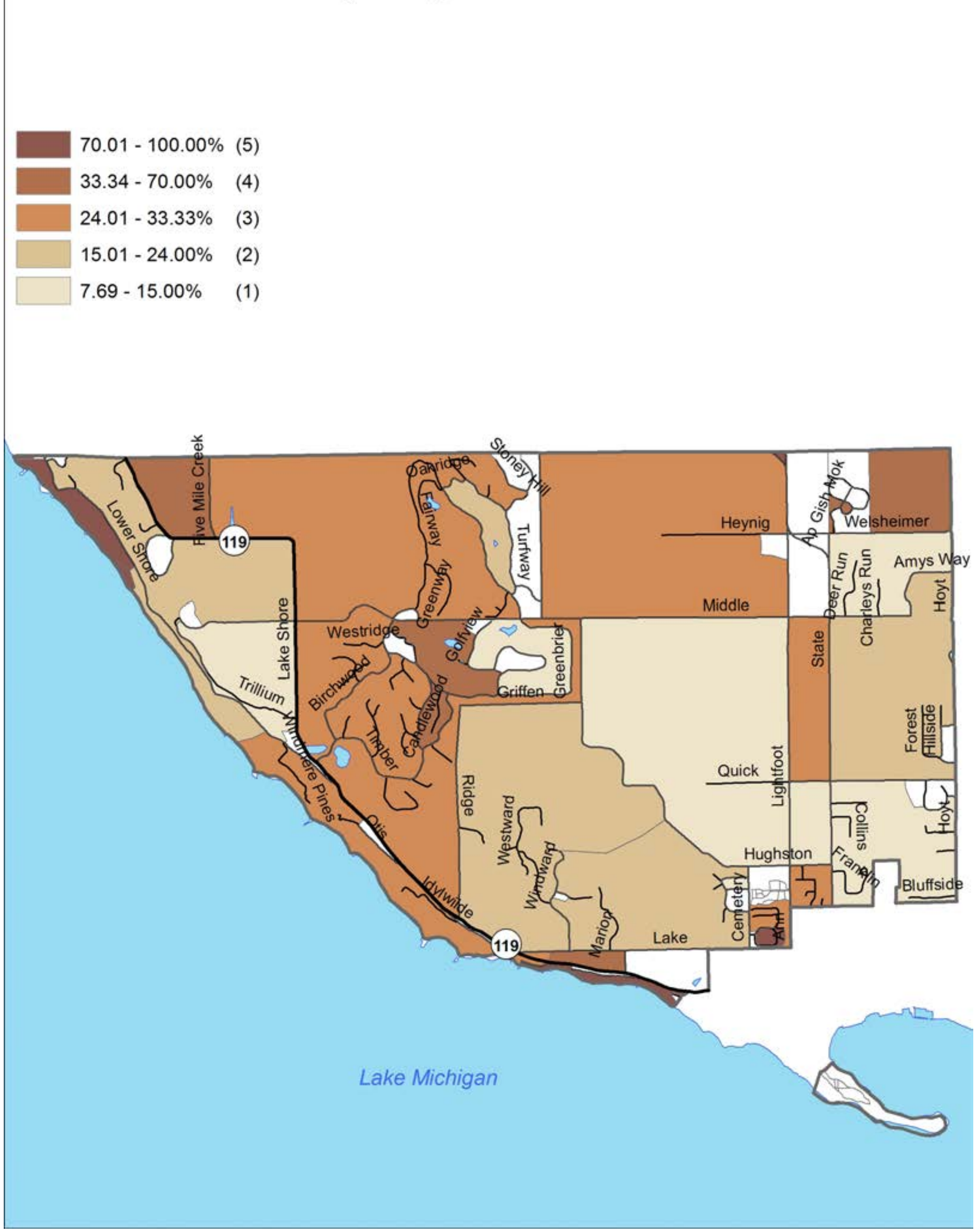

Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
6 - 7
5
2 - 4
1
Larkin
Hannah
Frank
Niswander
Cetas
Keogoma
119
Middle Village
Lake Shore
Townline
Boynton
Hurd
Beacon Hill
Radle
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Terpening
Surfwood
Five Mile Creek
Wressel
Westwood
Lightfoot
Geary
Lacount
Lake Michigan

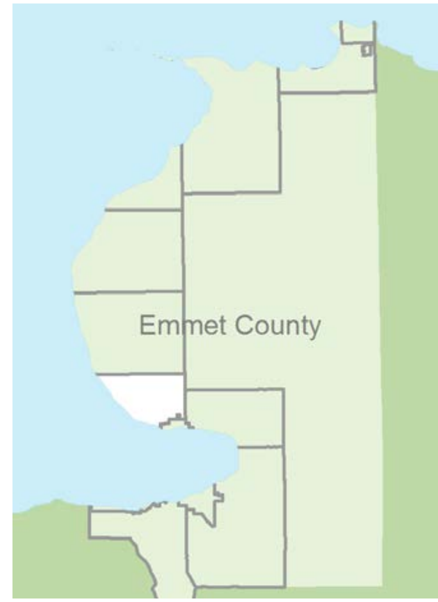

Emmet County

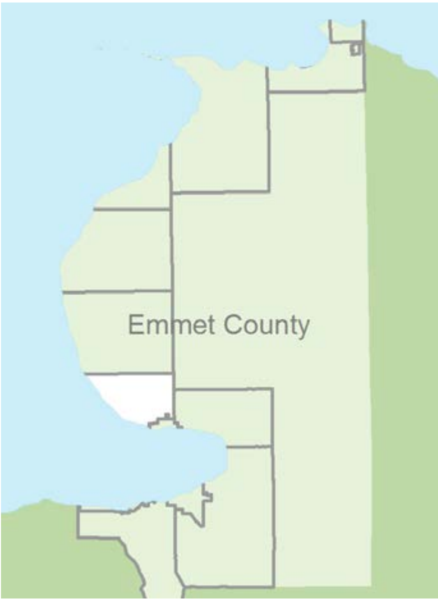
West Traverse Twp.

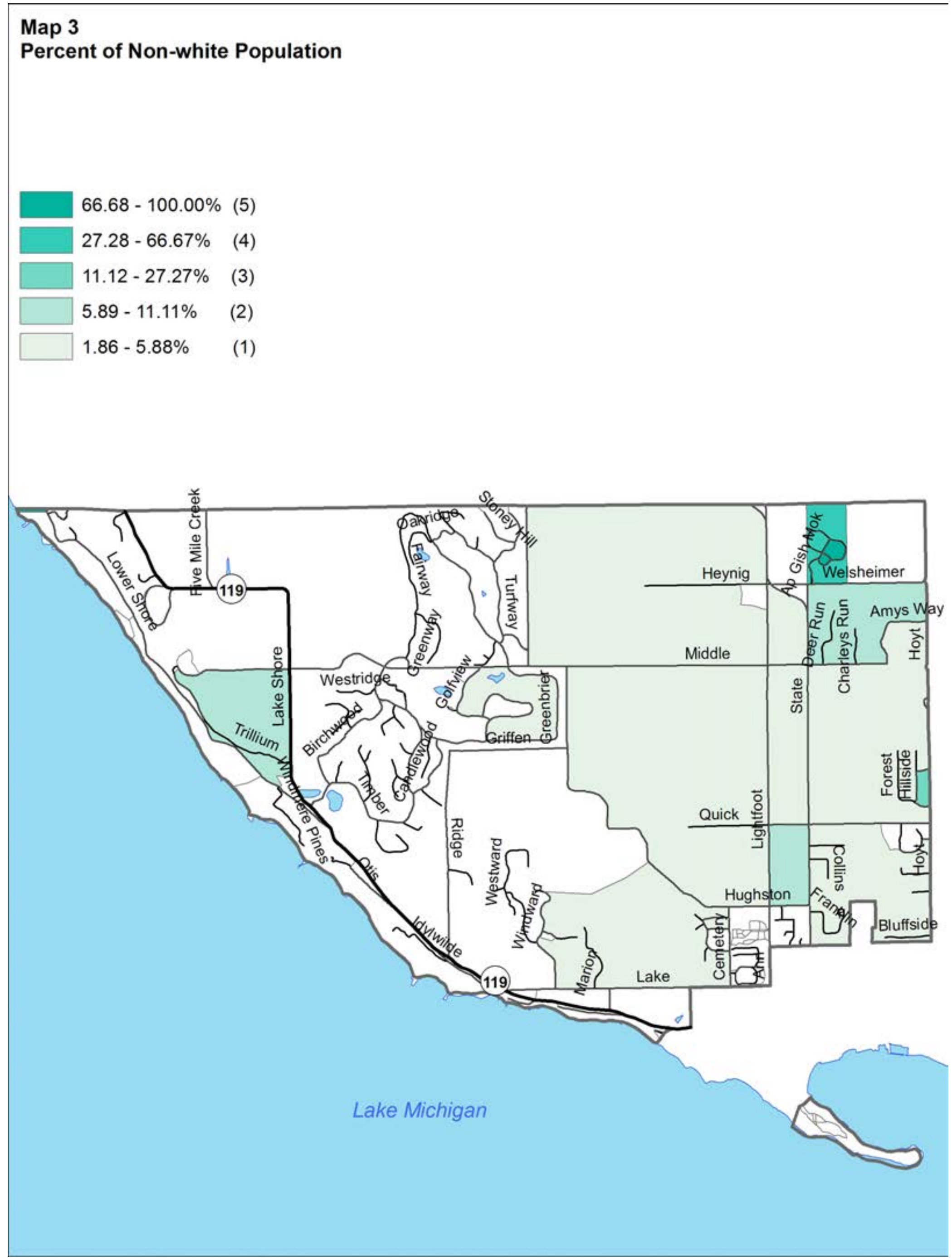


Map 2
Percent of Households with People Living Alone

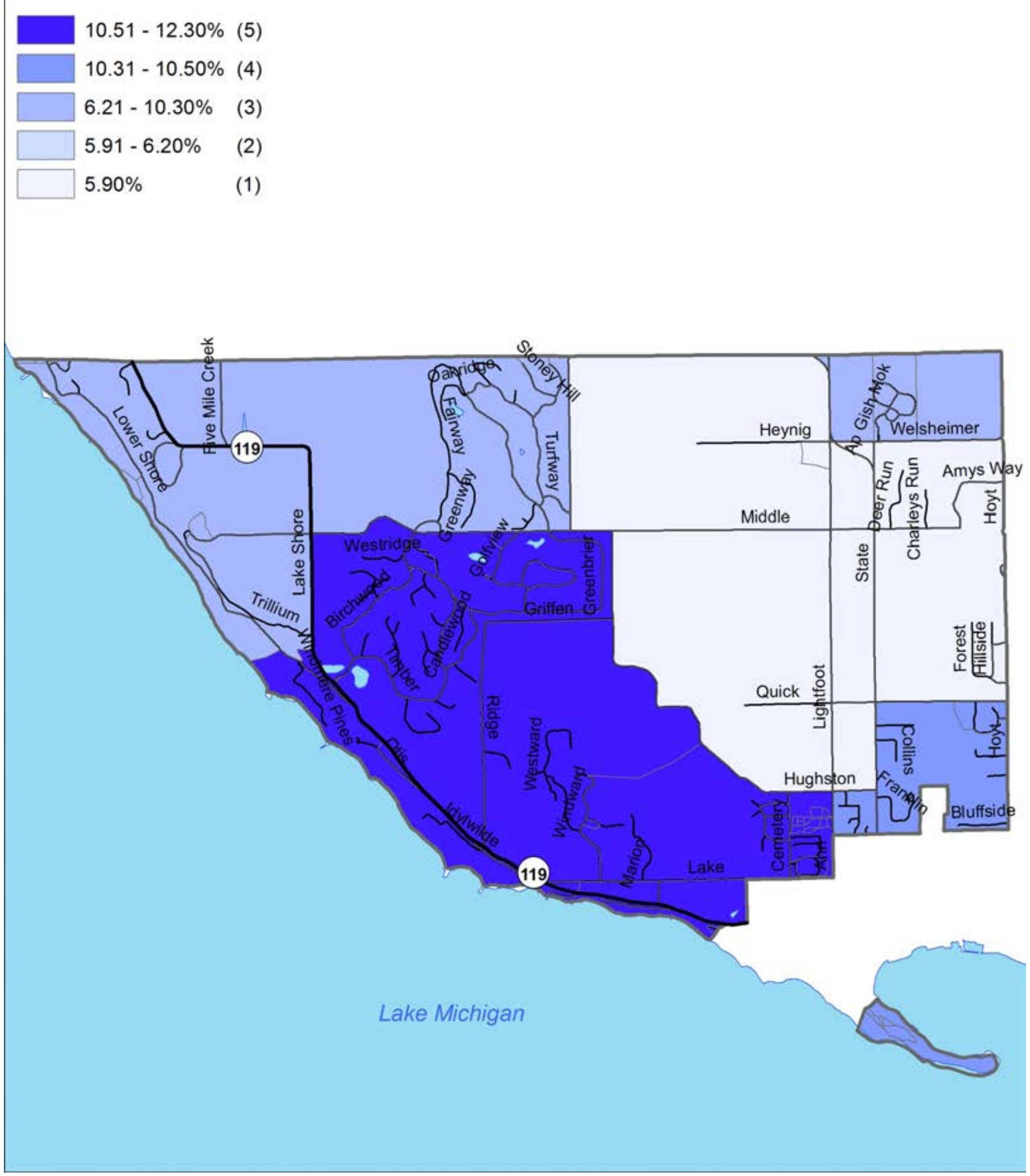


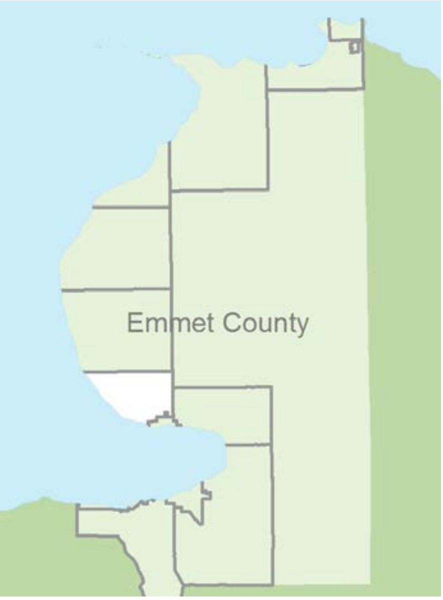


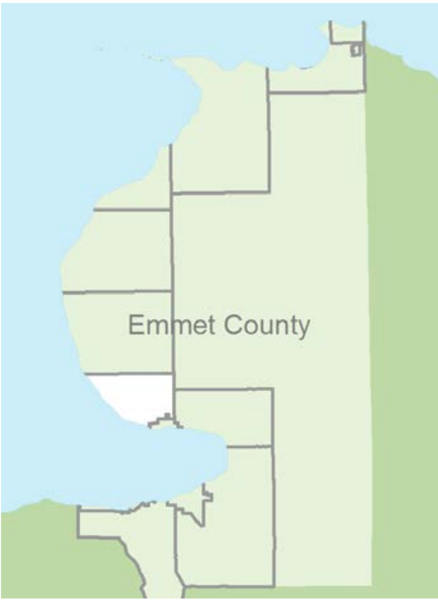



Map 3
Percent of Non-white Population

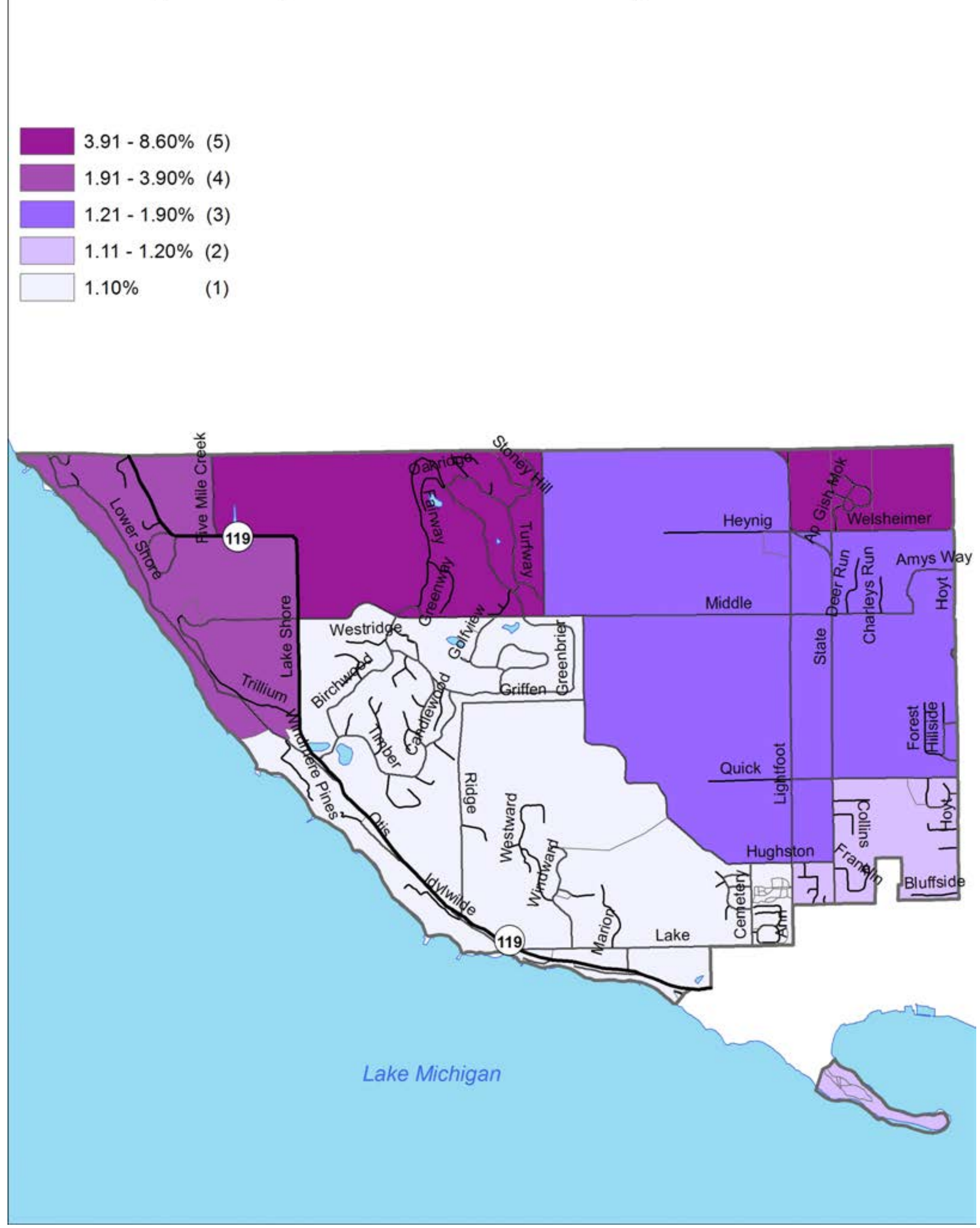
Map 4
Percent of Households Living Below the Poverty Threshold

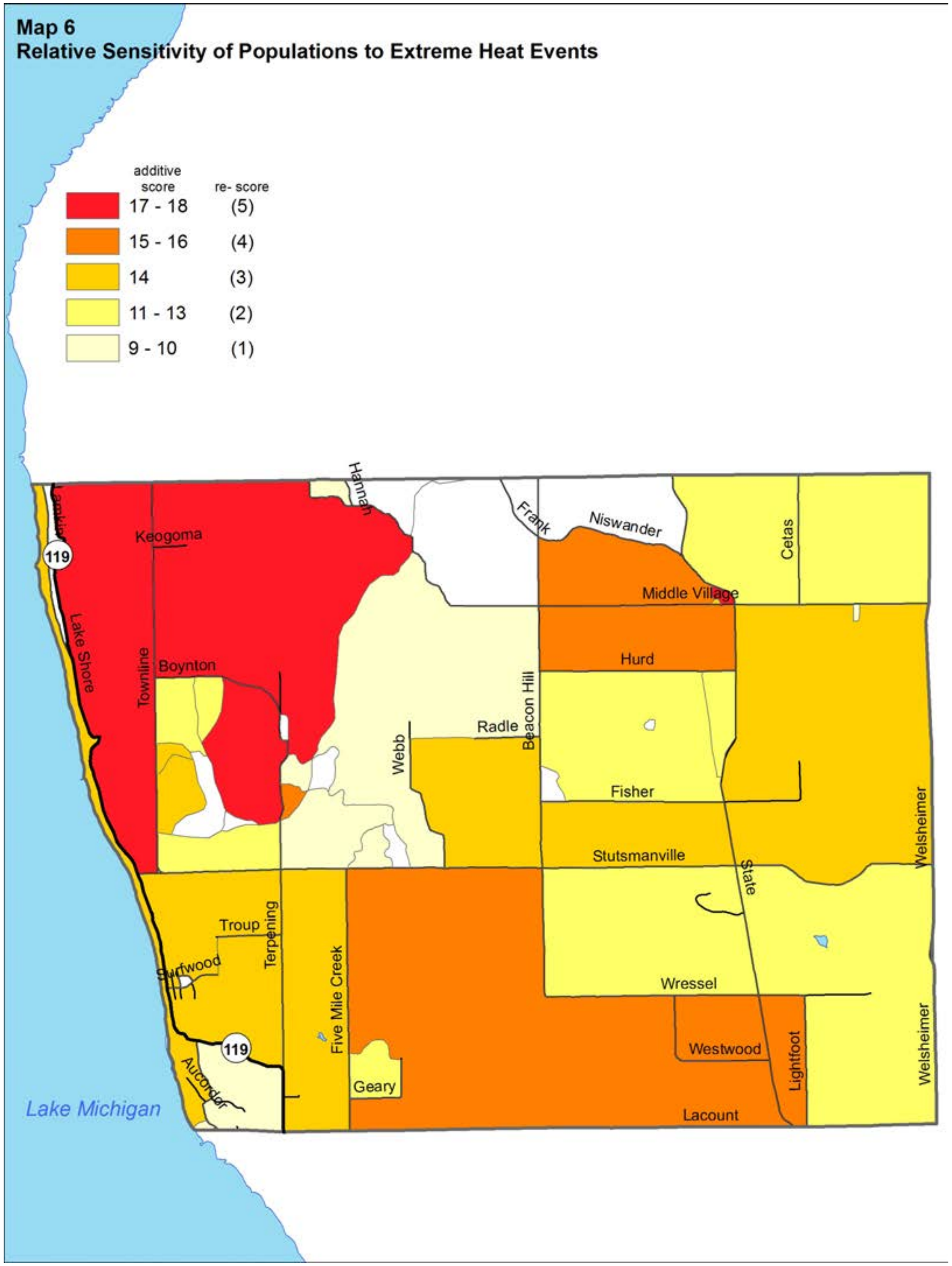


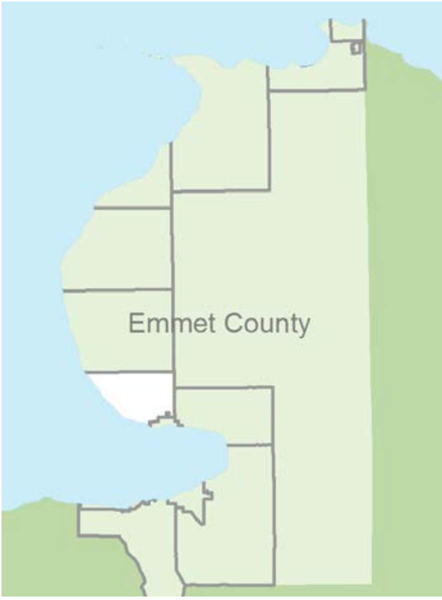


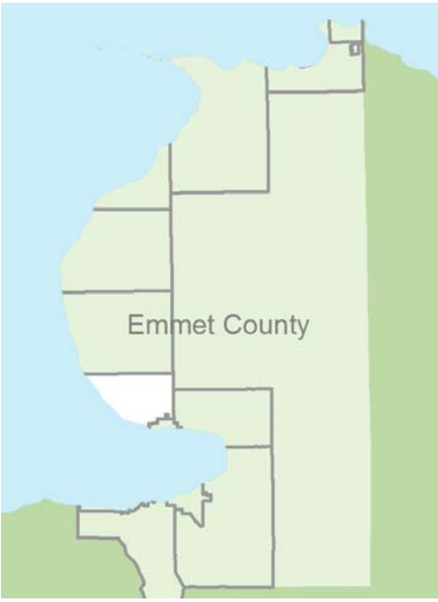


Map 5
Percent of Population 25 years and Older with less than a High School Education

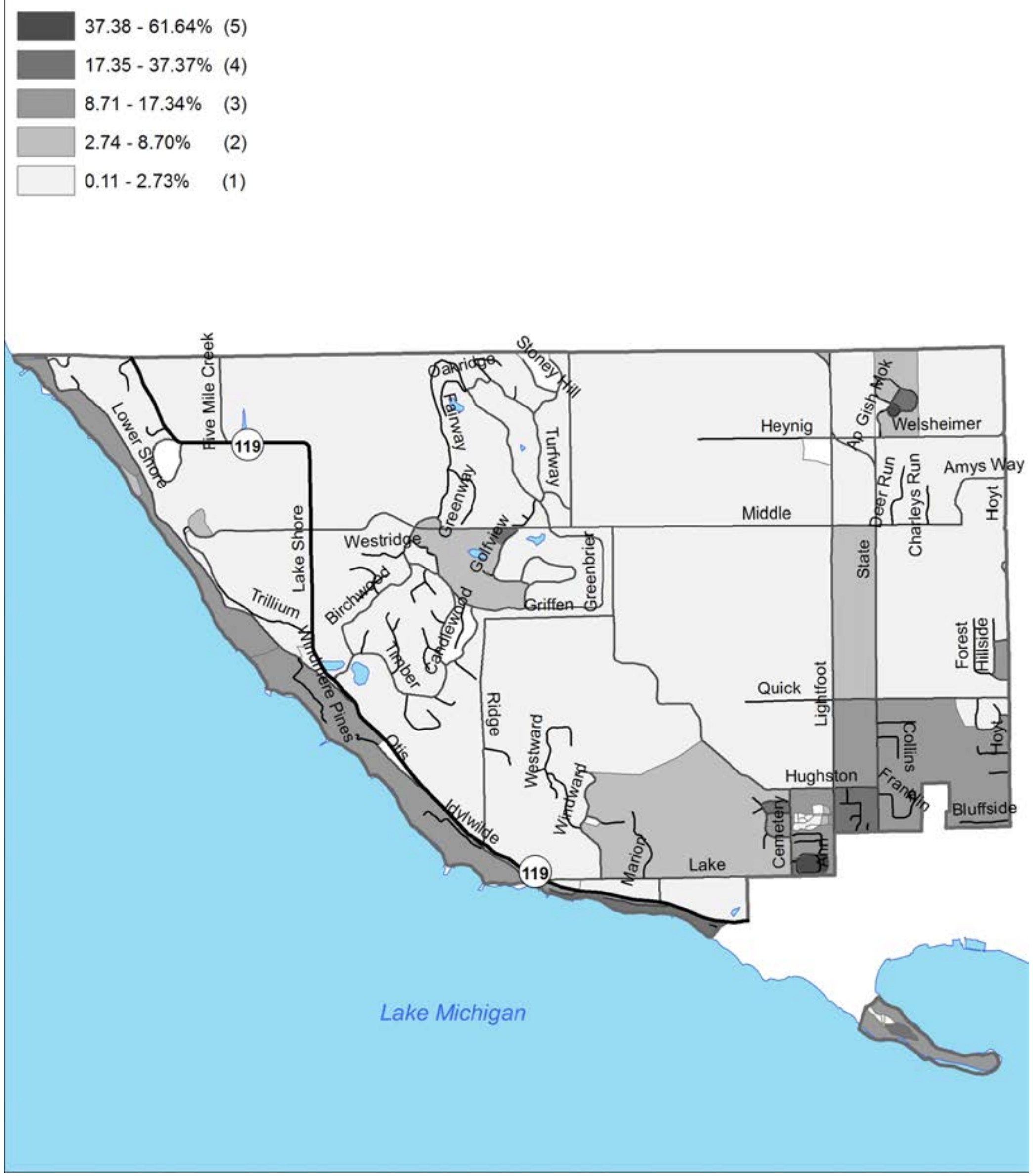


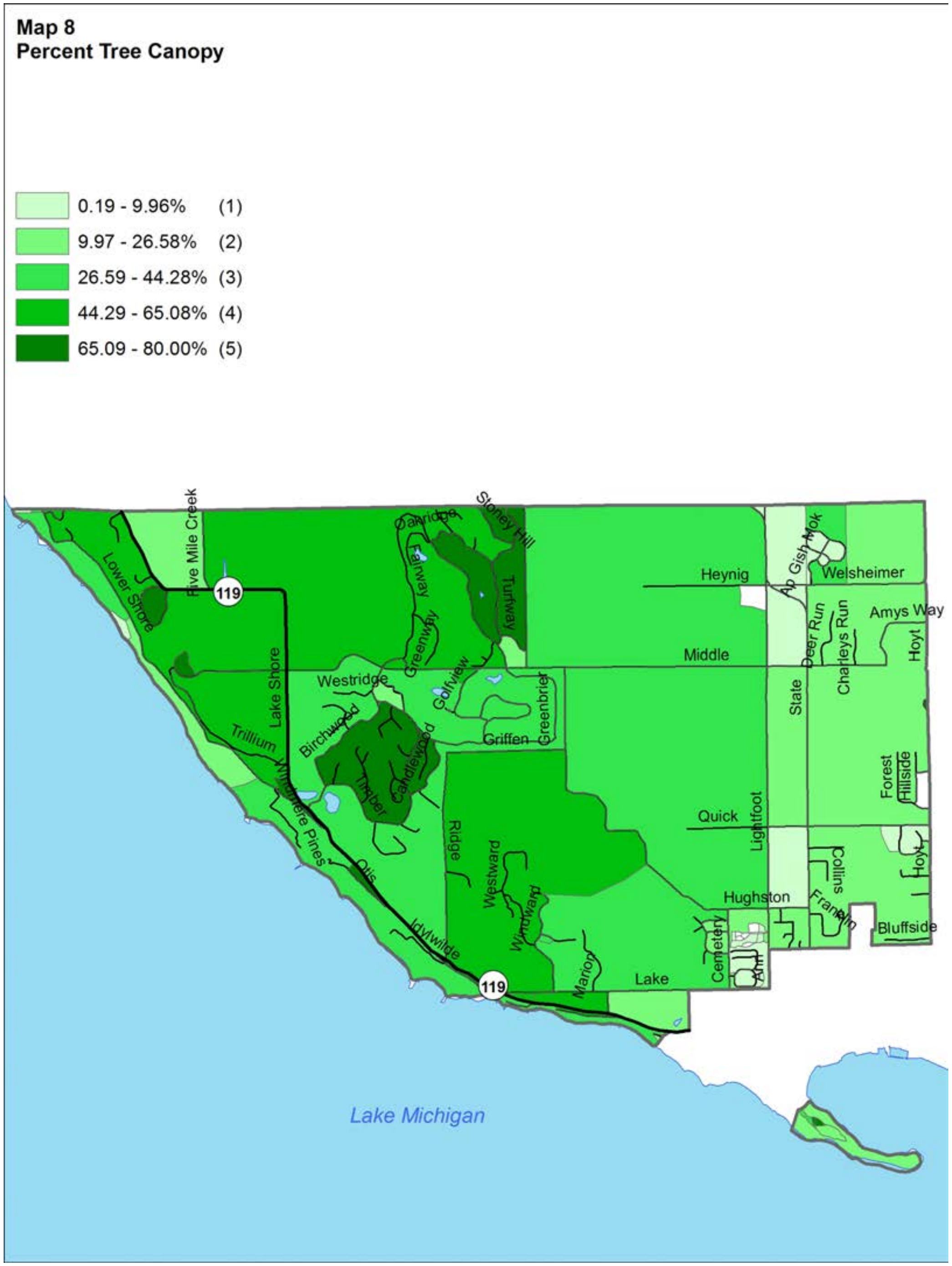

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
additive score
re- score
17 - 18 (5)
15 - 16 (4)
14 (3)
11 - 13 (2)
9 - 10 (1)
Hannah
Frank
Niswander
Cetas
Keogoma
119
Middle Village
Lake Shore
Townline
Boynton
Hurd
Radle
Beacon Hill
Webb
Fisher
Stutsmanville
State
Welsheimer
Troup
Terpening
Five Mile Creek
Wressel
Westwood
Lightfoot
Geary
Lacount
Lake Michigan

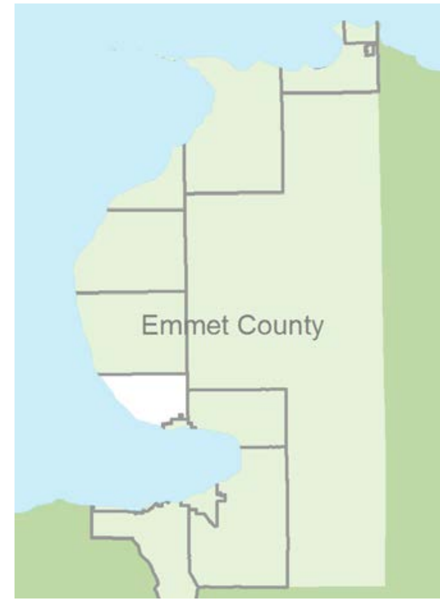

Emmet County



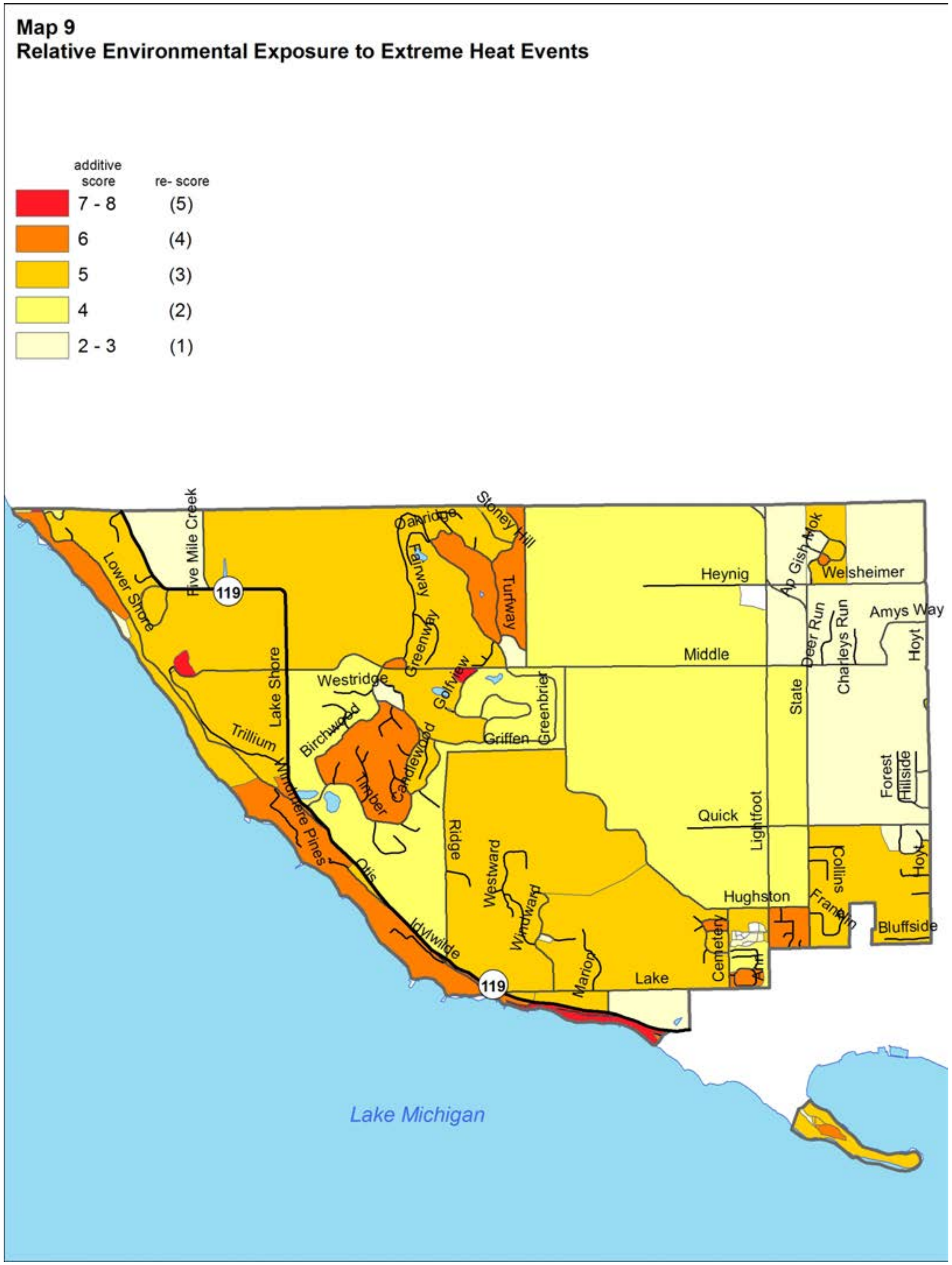
Map 7
Percent Impervious Surface Exposure



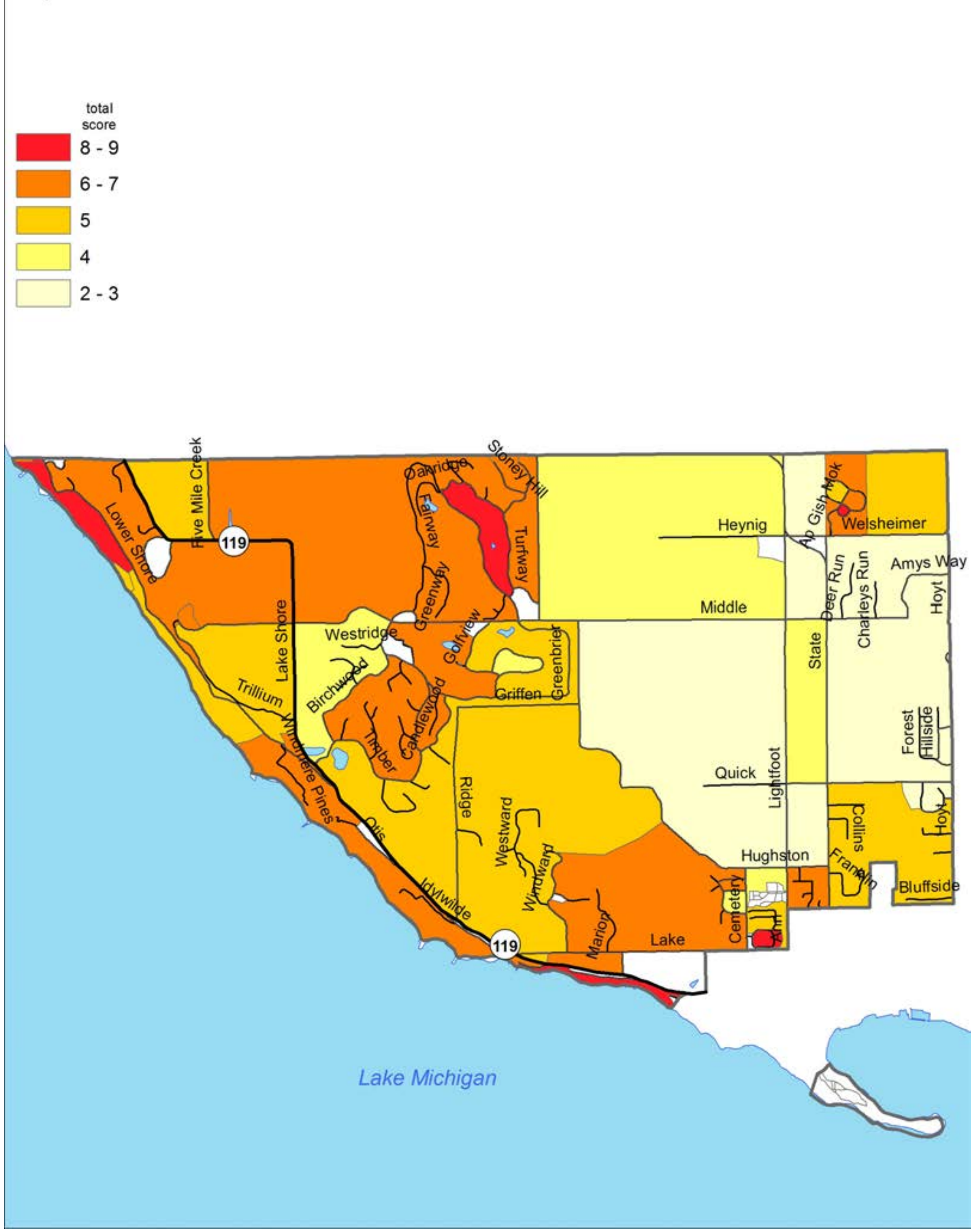

Map 8
Percent Tree Canopy
0.19 - 9.96% (1)
9.97 - 26.58% (2)
26.59 - 44.28% (3)
44.29 - 65.08% (4)
65.09 - 80.00% (5)
Lower Shore
Five Mile Creek
119
Oakridge
Stoney Hill
Fairway
Turfway
Greenway
Golfview
Heynig
Ab Gish Mok
Welsheimer
Amys Way
Deer Run
Charleys Run
Hoyt
Middle
Lake Shore
Westridge
Greenbrier
Griffen
State
Birchwood
Trillium
Candlewood
Timber
Windemere Pines
Forest
Hillside
Quick
Lightfoot
Ridge
Westward
Otis
Collins
Hoyt
Hughston
Franklin
Windward
Idylwilde
Bluffside
Cemetery
Marion
Lake
119
Lake Michigan

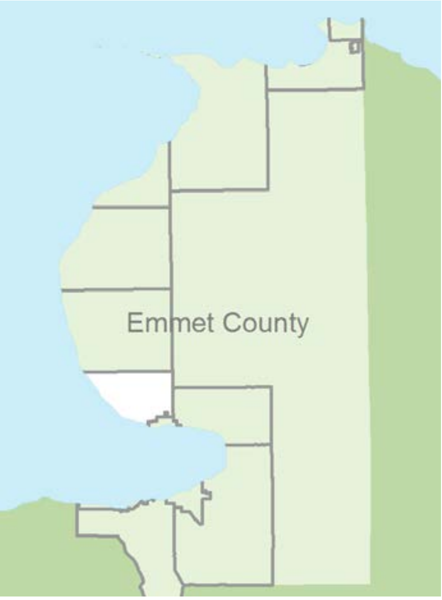

Emmet County


Emmet County

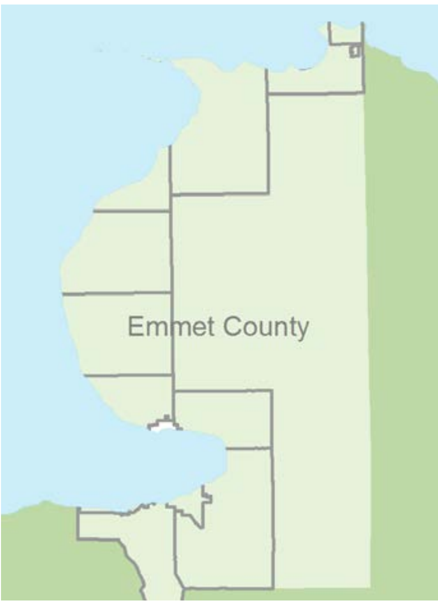

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re- score
7 - 8 (5)
6 (4)
5 (3)
4 (2)
2 - 3 (1)
Lake Michigan
119
Lower Shore
Five Mile Creek
Lake Shore
Trillium
Westridge
Birchwood
Timber
Candlewood
Greenway
Fairway
Oakridge
Stoney Hill
Turfway
Golfview
Greenbrier
Griffen
Ridge
Westward
Windward
Marion
Lake
Idylwilde
Otis
Heynig
Middle
Quick
Lightfoot
Hughston
Cemetery
State
Deer Run
Charleys Run
Amys Way
Hoyt
Welsheimer
Forest
Hillside
Collins
Franklin
Bluffside

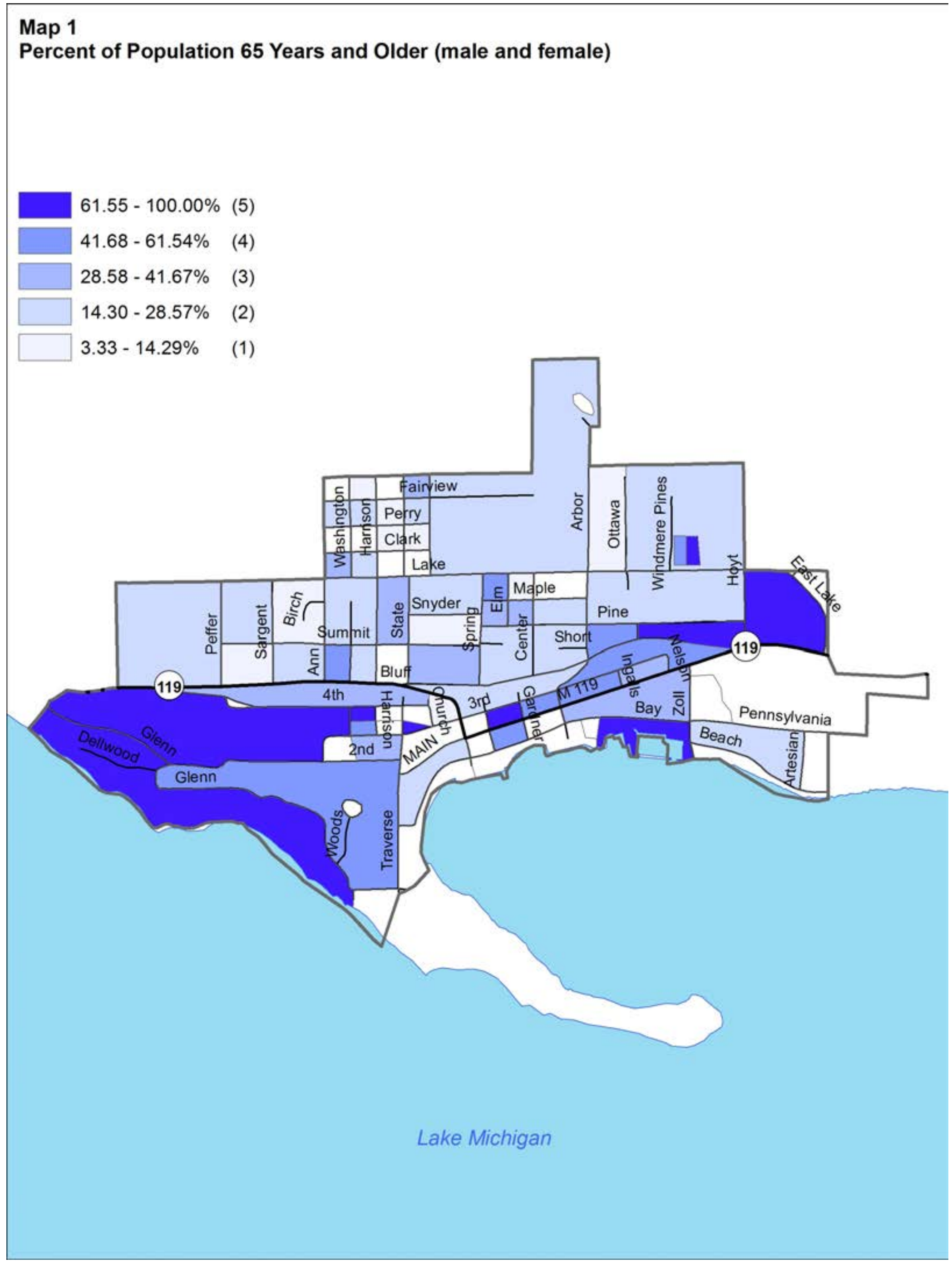
Map 10
Population Vulnerable to Extreme Heat Events

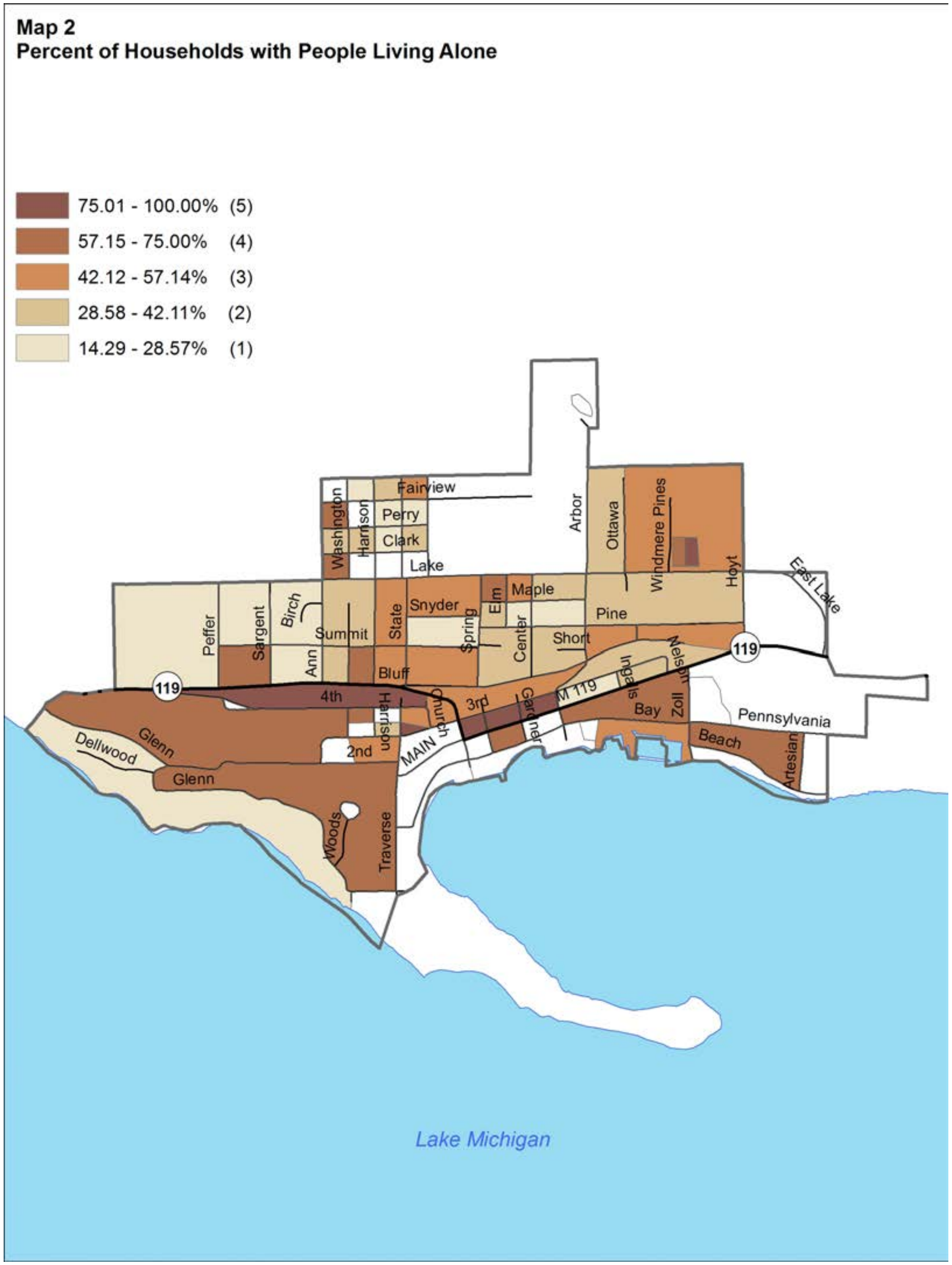


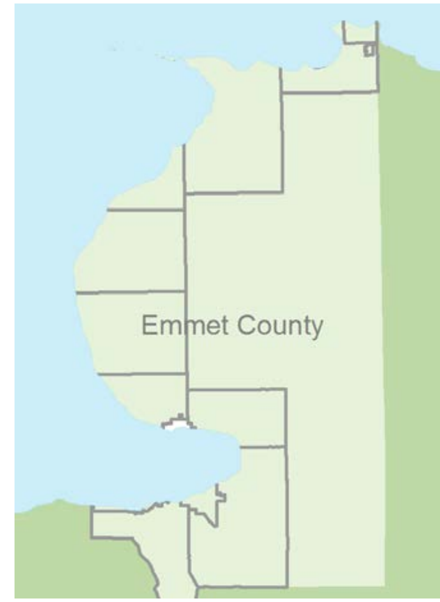


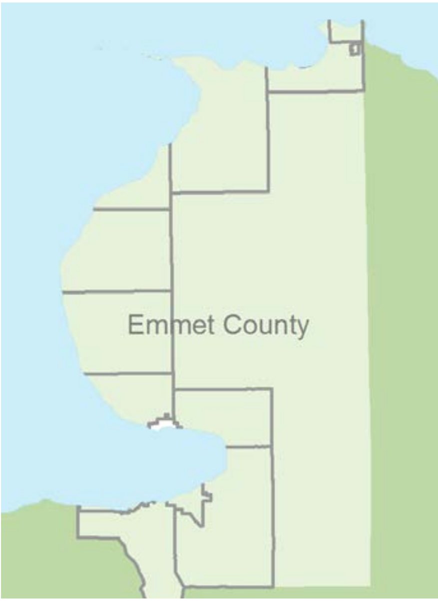
Harbor Springs



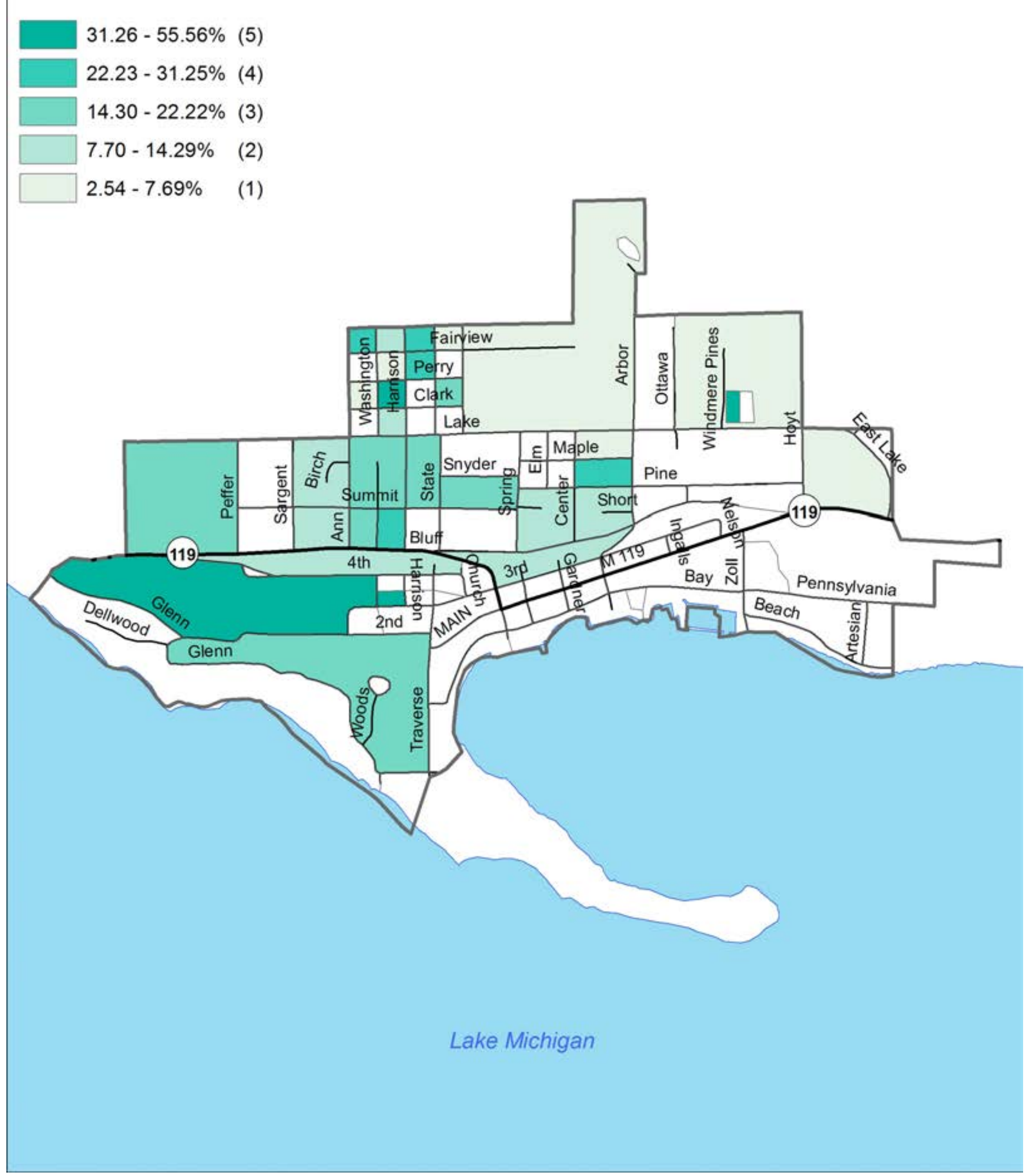



Map 2
Percent of Households with People Living Alone
75.01 - 100.00% (5)
57.15 - 75.00% (4)
42.12 - 57.14% (3)
28.58 - 42.11% (2)
14.29 - 28.57% (1)
Fairview
Perry
Clark
Lake
Washington
Harrison
Arbor
Ottawa
Windmere Pines
Hoyt
East Lake
Maple
Elm
Snyder
Pine
Short
Center
Spring
State
Summit
Birch
Sargent
Peffer
Ann
Bluff
4th
3rd
119
M 119
Church
Gardner
Ingalls
Nelson
Bay
Zoll
Pennsylvania
Beach
Artesian
MAIN
2nd
Glenn
Dellwood
Woods
Traverse
Lake Michigan

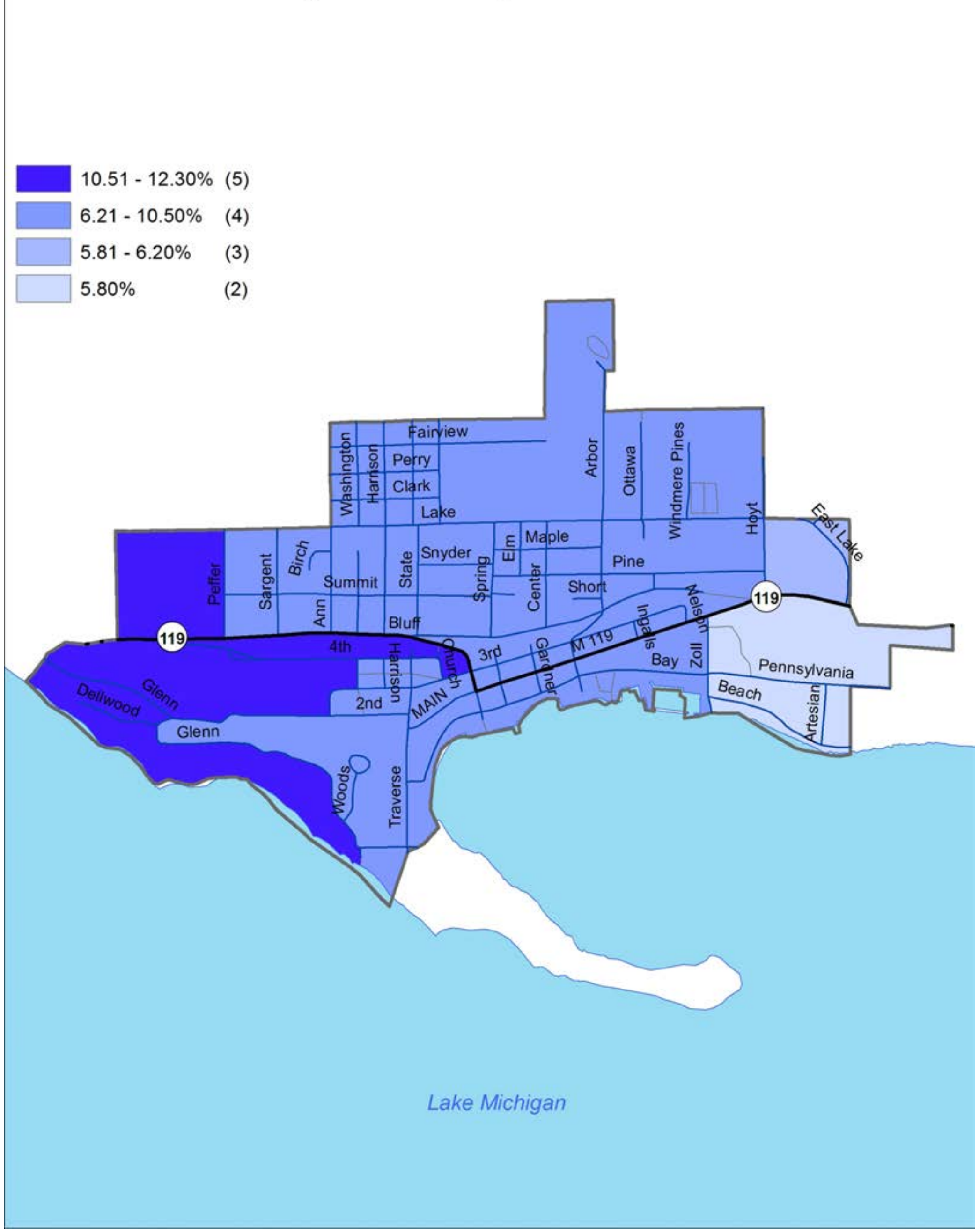

Emmet County

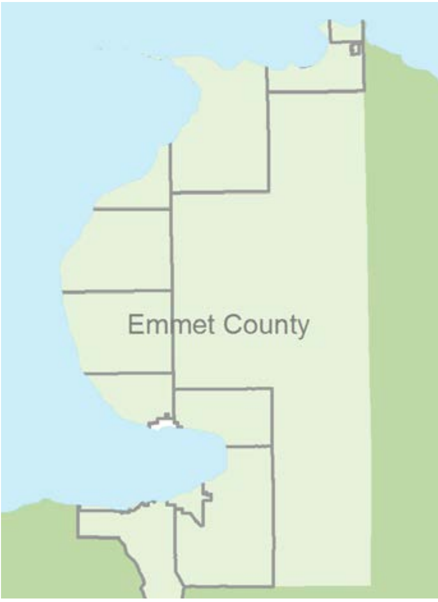


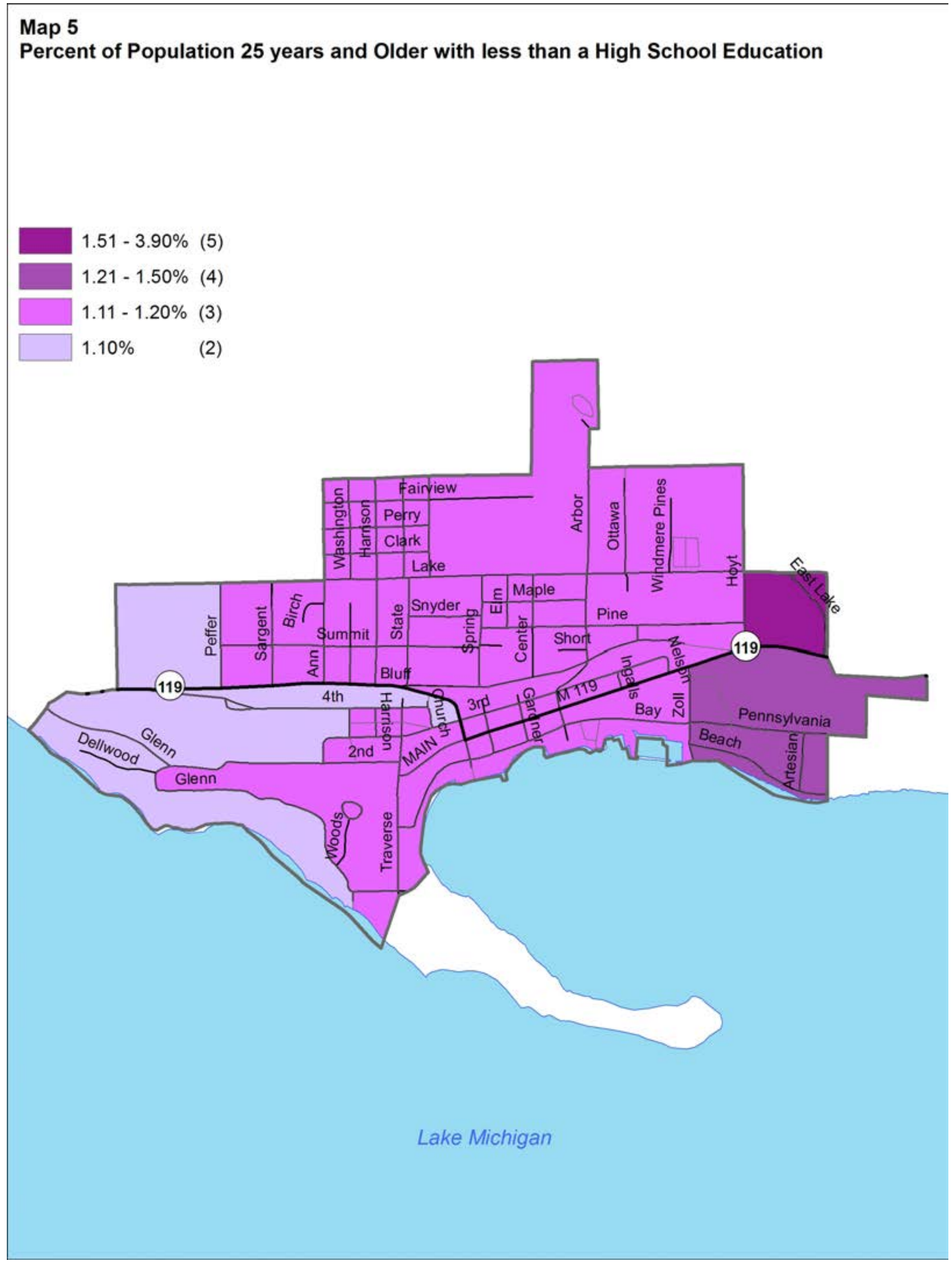
Map 3
Percent of Non-white Population



Map 4
Percent of Households Living Below the Poverty Threshold

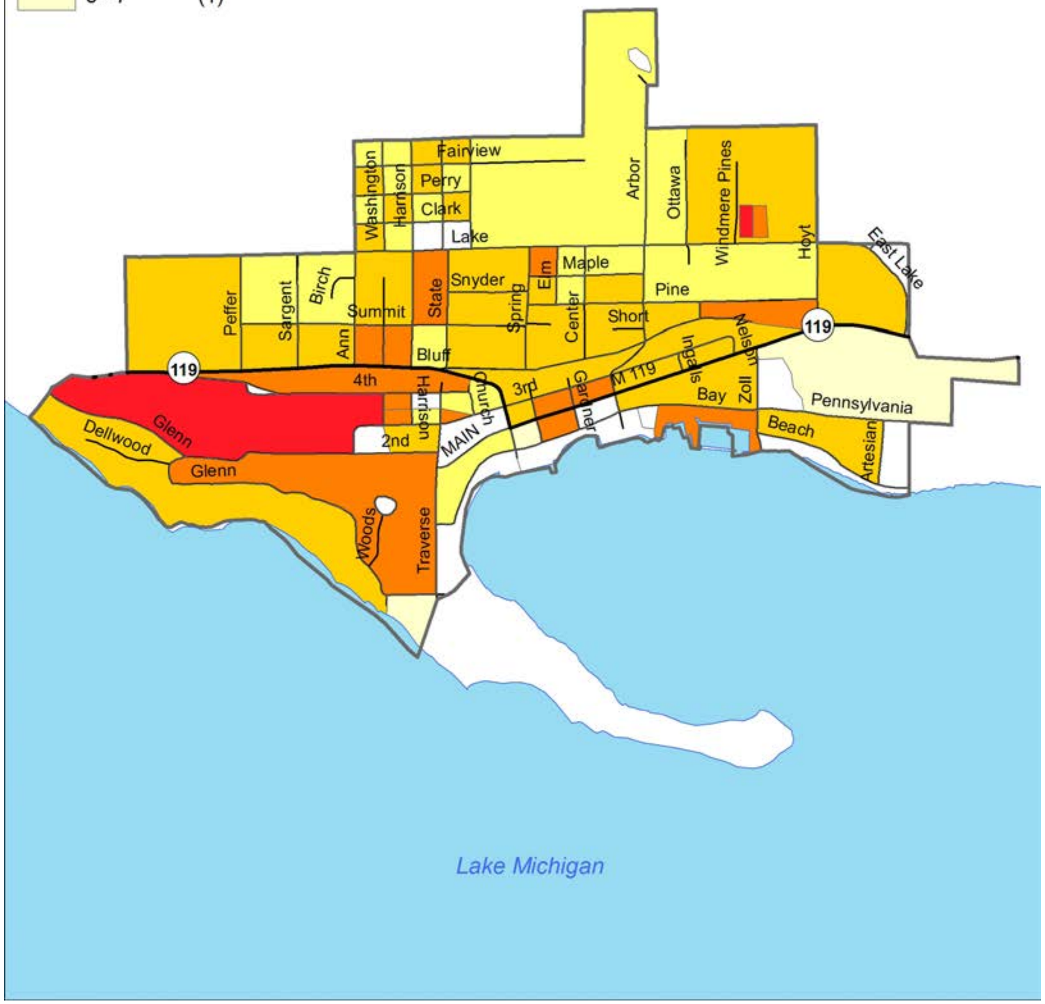


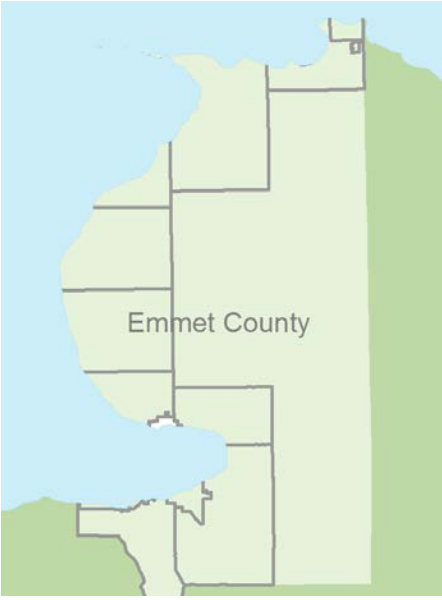

Emmet County

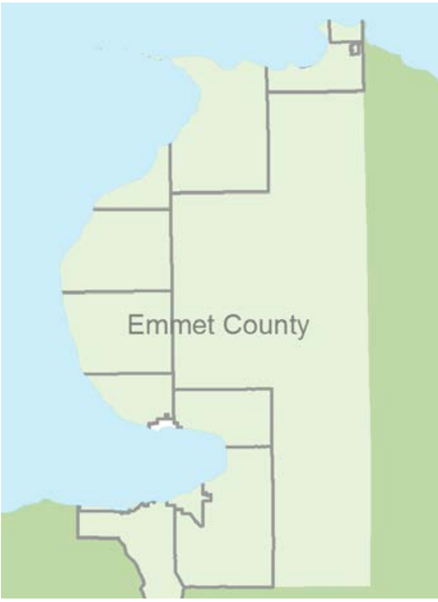

Map 5
Percent of Population 25 years and Older with less than a High School Education
1.51 - 3.90% (5)
1.21 - 1.50% (4)
1.11 - 1.20% (3)
1.10% (2)
Fairview
Perry
Clark
Lake
Washington
Harrison
Arbor
Ottawa
Windmere Pines
Hoyt
East Lake
Maple
Snyder
Elm
Pine
Short
Peffer
Sargent
Birch
Summit
State
Spring
Center
Ann
Bluff
4th
3rd
2nd
Church
Gardner
M 119
Ingalls
Nelson
Zoll
Bay
Pennsylvania
Beach
Artesian
MAIN
Glenn
Dellwood
Woods
Traverse
119
Lake Michigan

Map 6
Relative Sensitivity of Populations to Extreme Heat Events

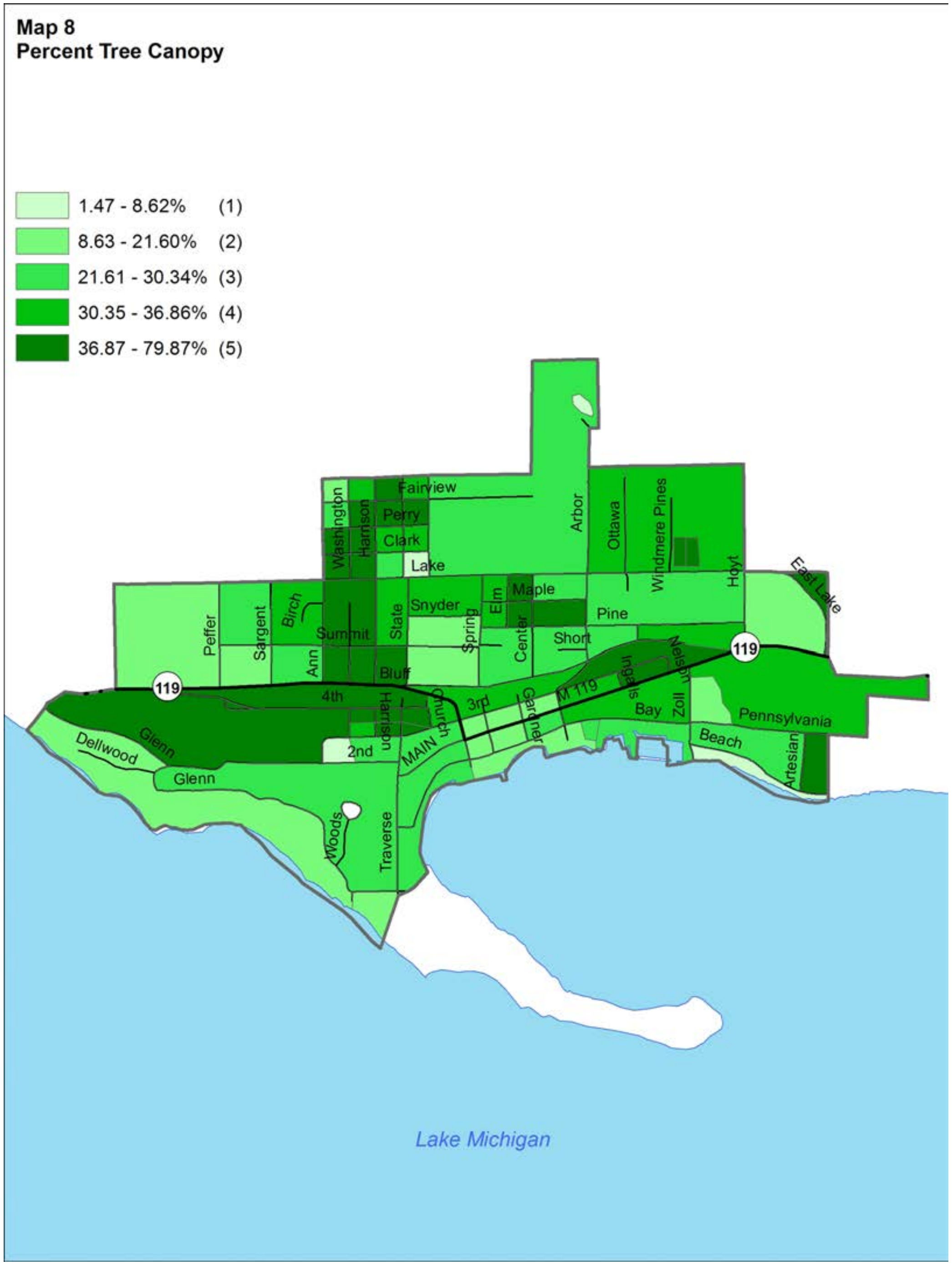
additive score	re- score
19 - 21	(5)
15 - 18	(4)
12 - 14	(3)
8 - 11	(2)
6 - 7	(1)



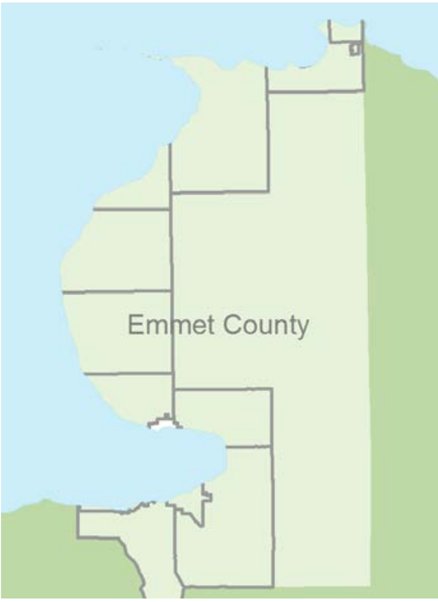



Emmet County

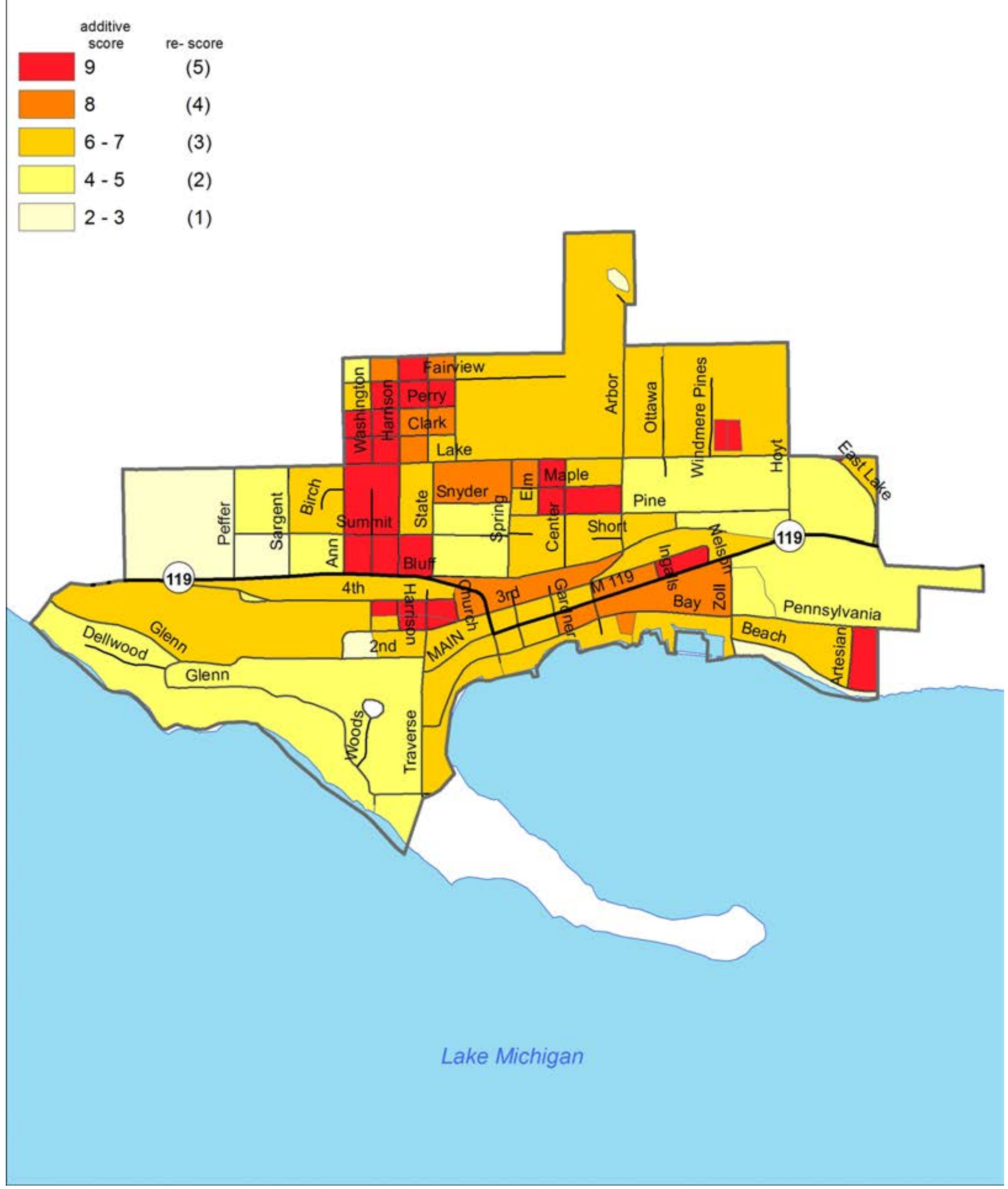

Map 7
Percent Impervious Surface Exposure
69.67 - 85.00% (5)
52.99 - 69.66% (4)
35.70 - 52.98% (3)
18.65 - 35.69% (2)
1.09 - 18.64% (1)
Fairview
Perry
Clark
Lake
Washington
Harrison
Arbor
Ottawa
Windmere Pines
Hoyt
East Lake
Maple
Pine
Snyder
Elm
Short
Center
Spring
State
Summit
Birch
Sargent
Peffer
Ann
Bluff
119
4th
3rd
M 119
Ingalls
Nelson
Bay
Zoll
Pennsylvania
Beach
Artesian
Gardner
Church
MAIN
2nd
Glenn
Dellwood
Woods
Traverse
Lake Michigan

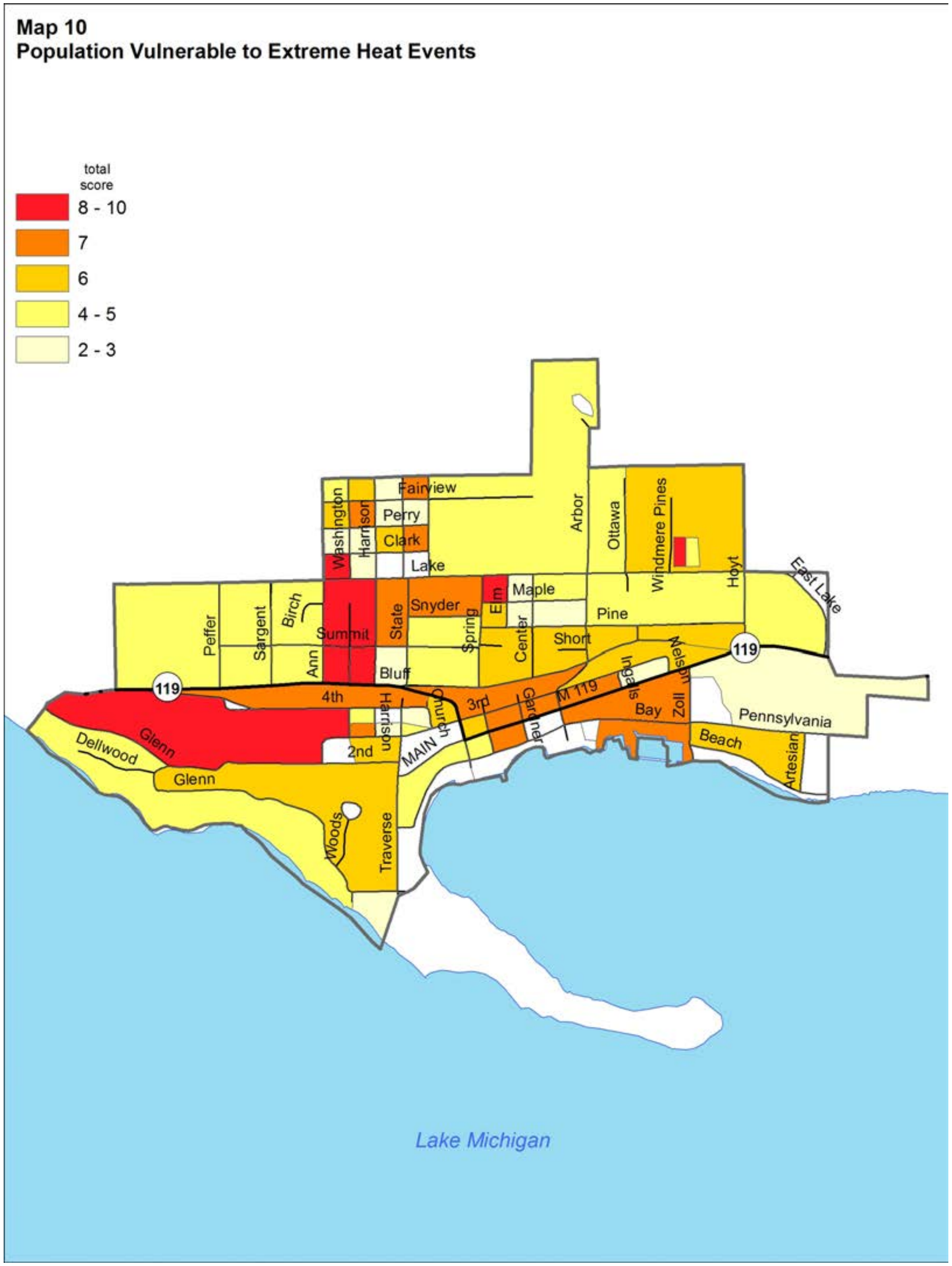

Map 8
Percent Tree Canopy
1.47 - 8.62% (1)
8.63 - 21.60% (2)
21.61 - 30.34% (3)
30.35 - 36.86% (4)
36.87 - 79.87% (5)
Fairview
Perry
Clark
Lake
Washington
Harrison
Arbor
Ottawa
Windmere Pines
Hoyt
East Lake
Maple
Pine
Snyder
Elm
Spring
Center
Short
Peffer
Sargent
Birch
Summit
State
Ann
Bluff
119
4th
Harrison
Church
3rd
Gardner
M 119
Ingalls
Nelson
Zoll
Bay
Pennsylvania
Beach
Artesian
Dellwood
Glenn
2nd
MAIN
Woods
Traverse
Lake Michigan

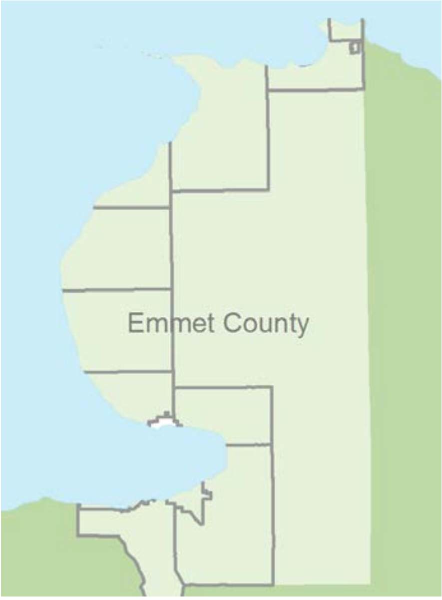

Emmet County



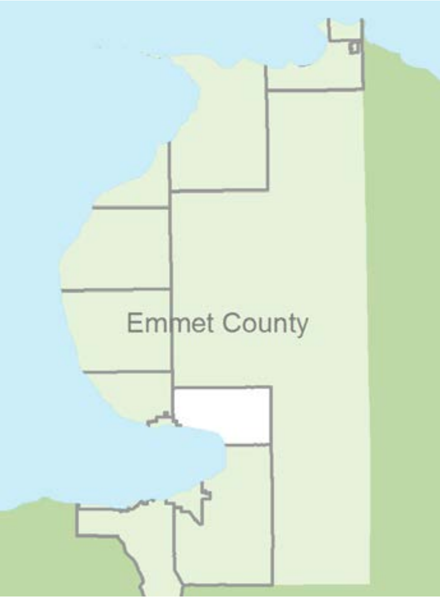
Map 9
Relative Environmental Exposure to Extreme Heat Events



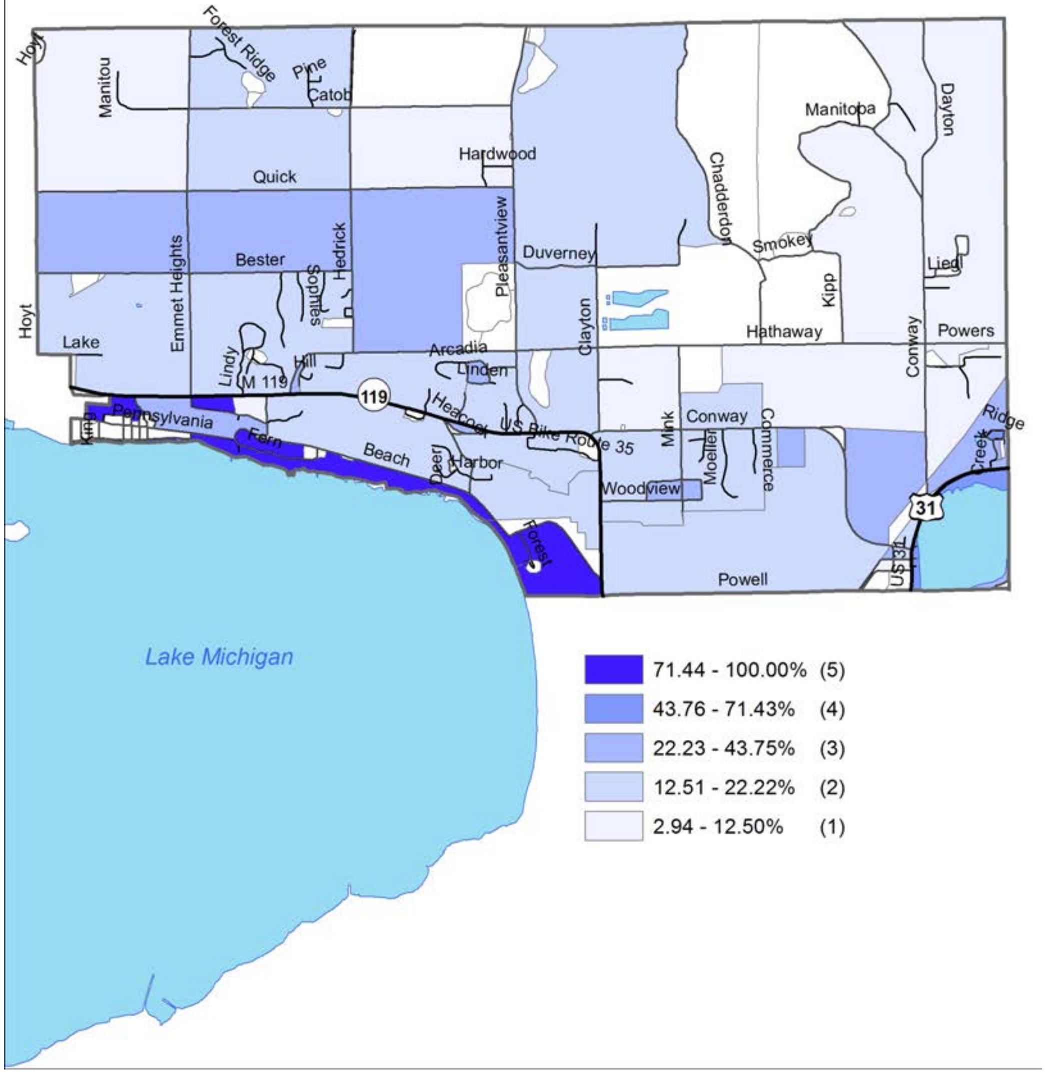

Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 10
7
6
4 - 5
2 - 3
Fairview
Perry
Clark
Lake
Washington
Harrison
Arbor
Ottawa
Windmere Pines
Hoyt
East Lake
Maple
Pine
Snyder
Elm
Peffer
Sargent
Birch
Summit
State
Spring
Center
Short
Ann
Bluff
119
4th
Church
3rd
M 119
Ingalls
Nelson
Bay
Zoll
Pennsylvania
Beach
Artesian
Gardner
MAIN
2nd
Dellwood
Glenn
Woods
Traverse
Lake Michigan


Emmet County

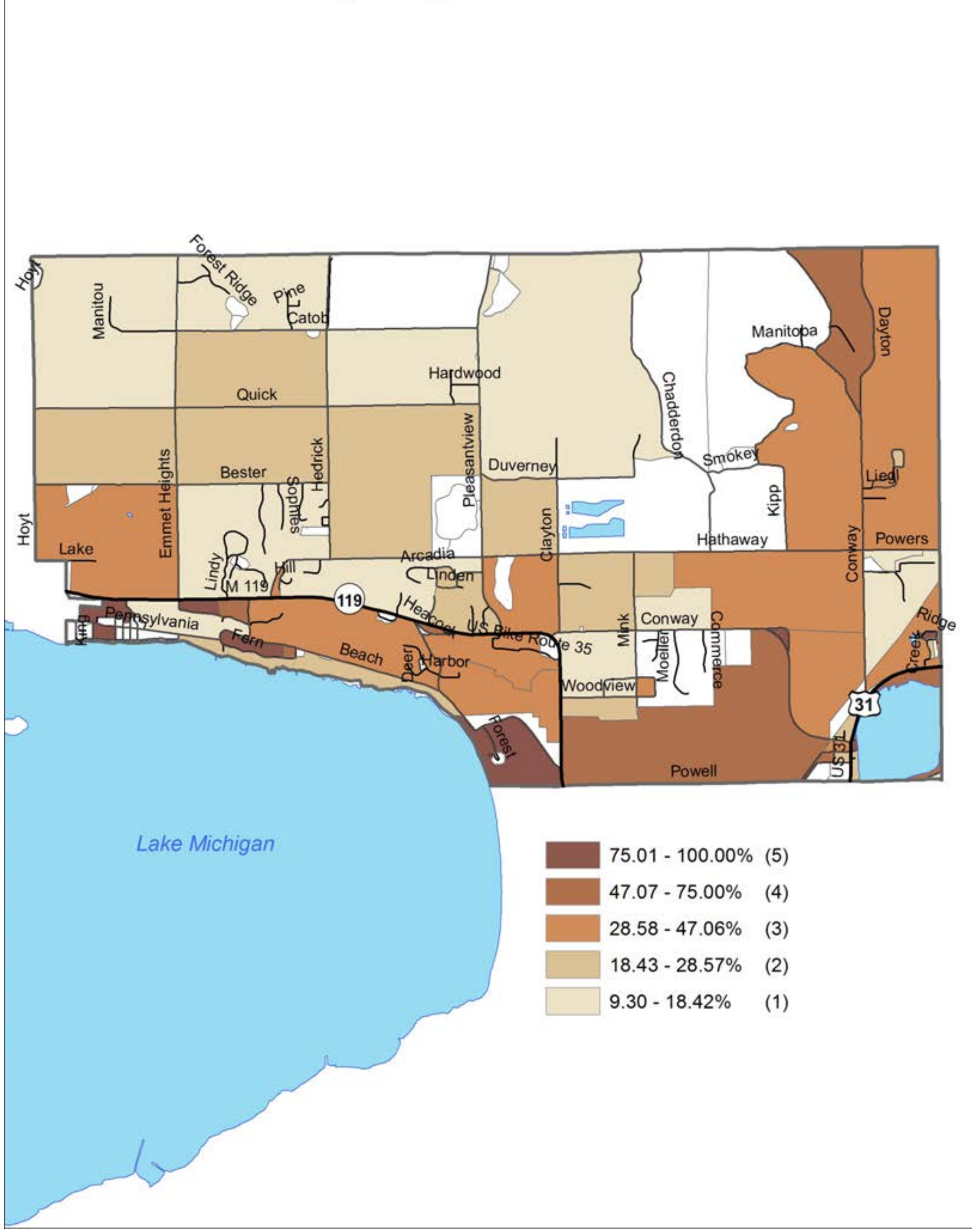
Little Traverse Twp.

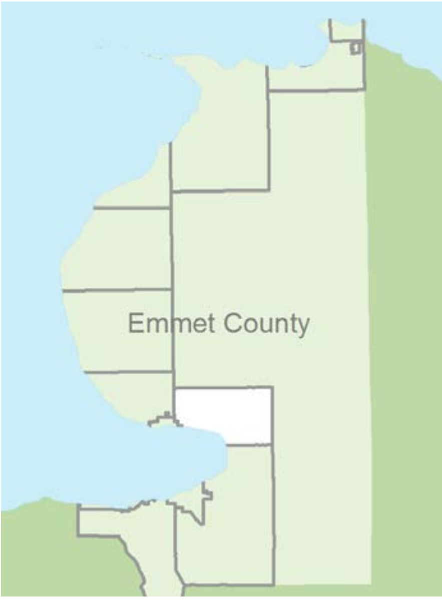


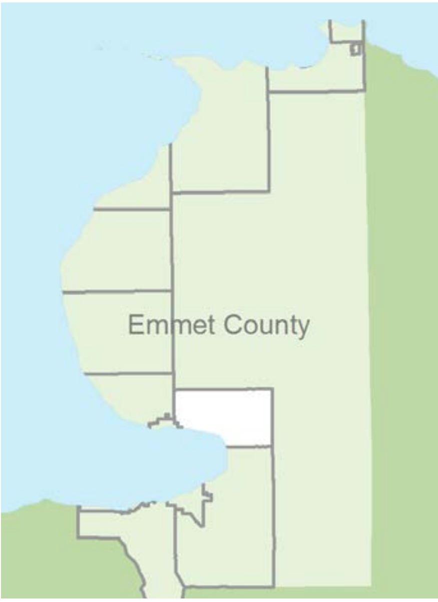
Map 1
Percent of Population 65 Years and Older (male and female)



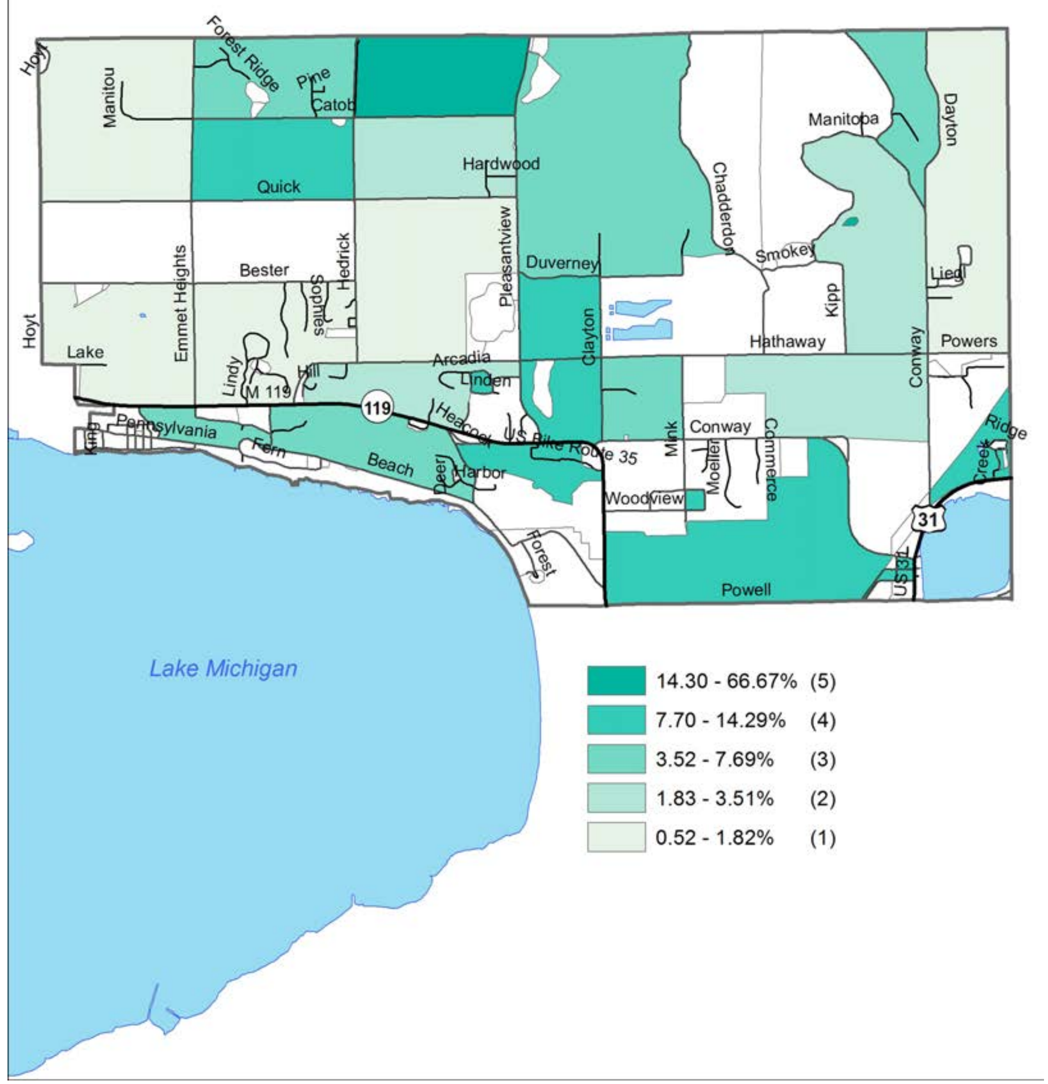
Map 2
Percent of Households with People Living Alone



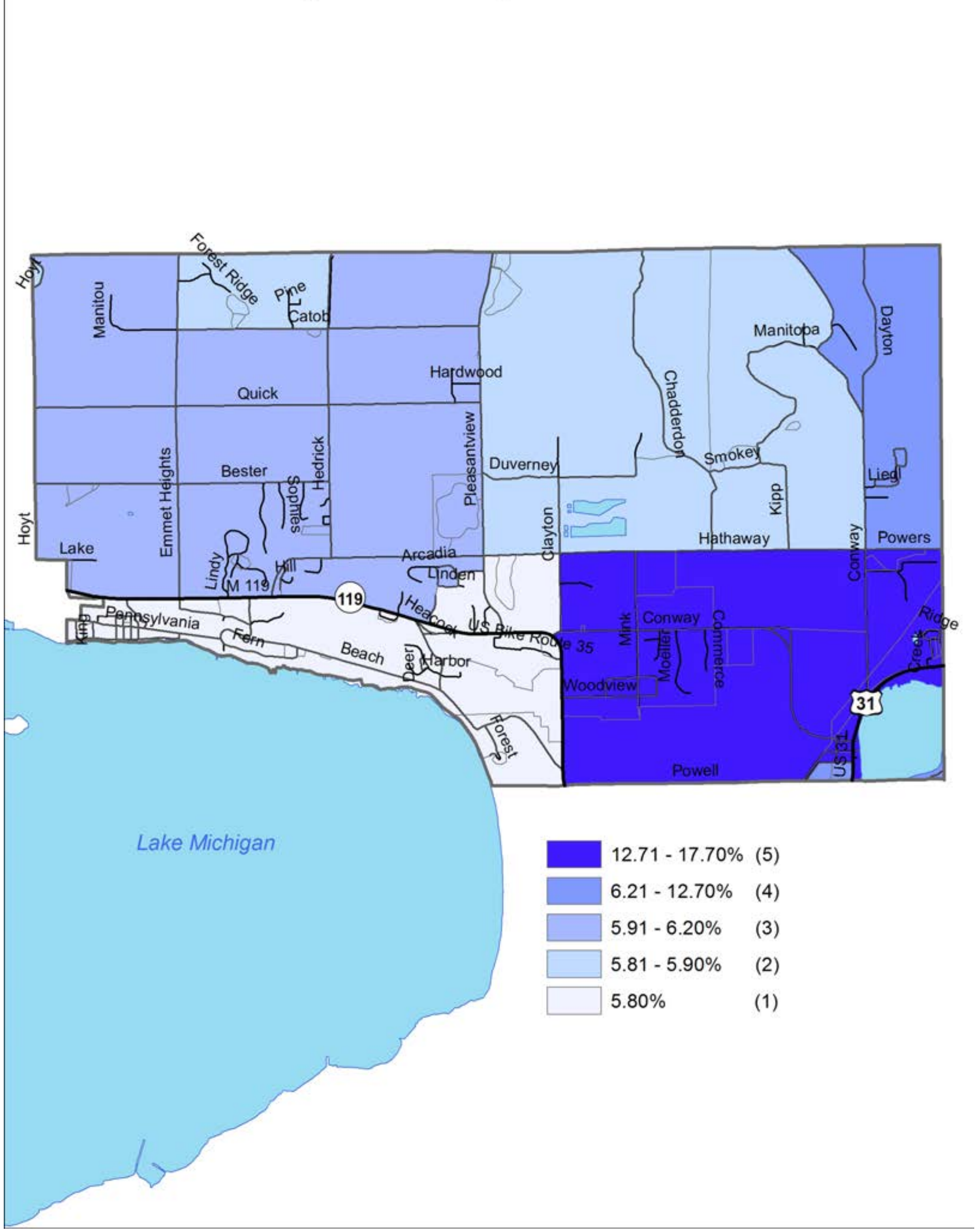


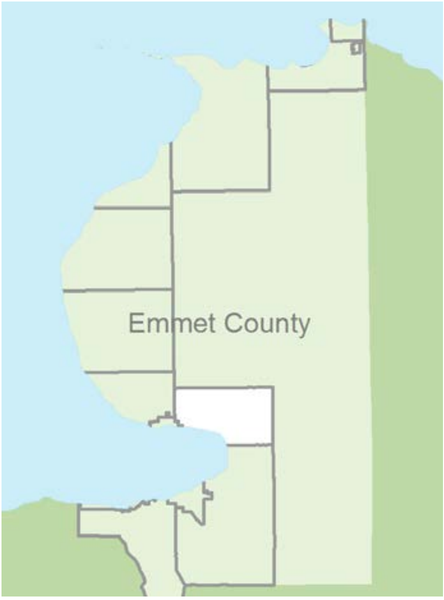


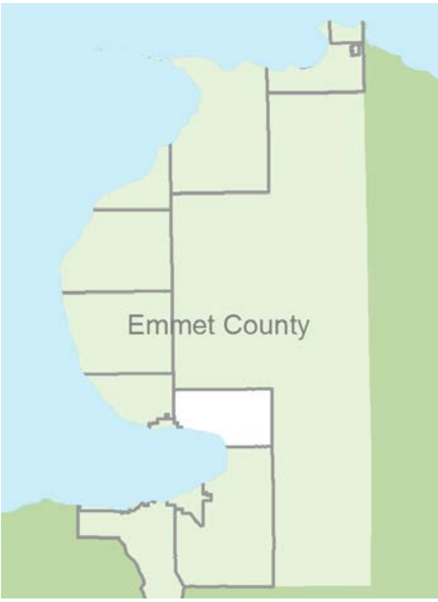
Map 3
Percent of Non-white Population

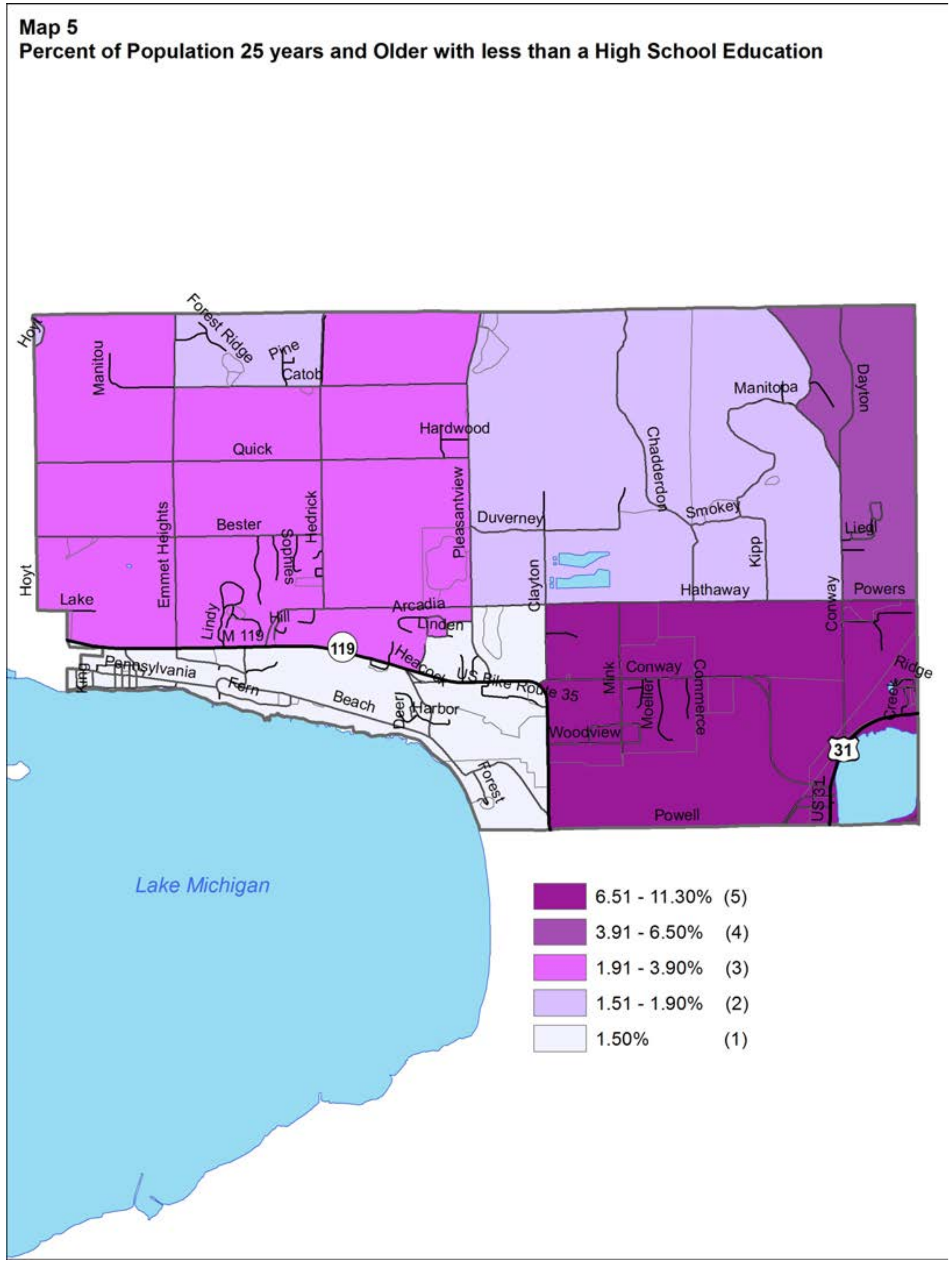


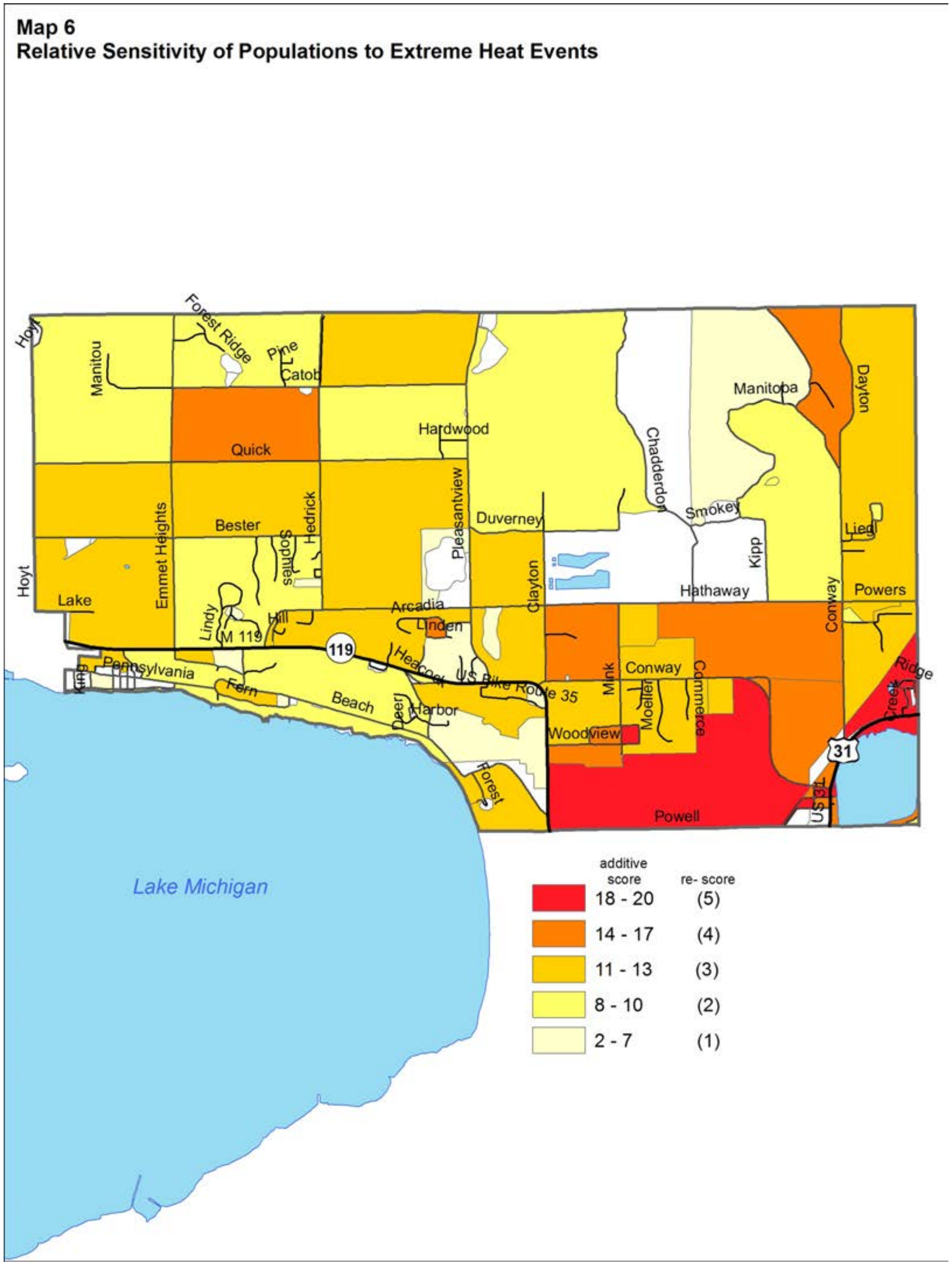
Map 4
Percent of Households Living Below the Poverty Threshold



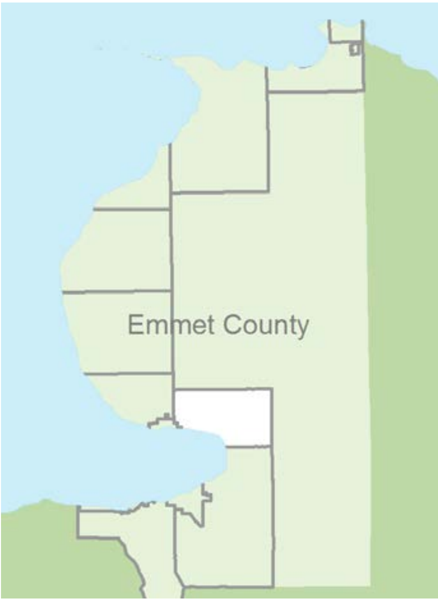


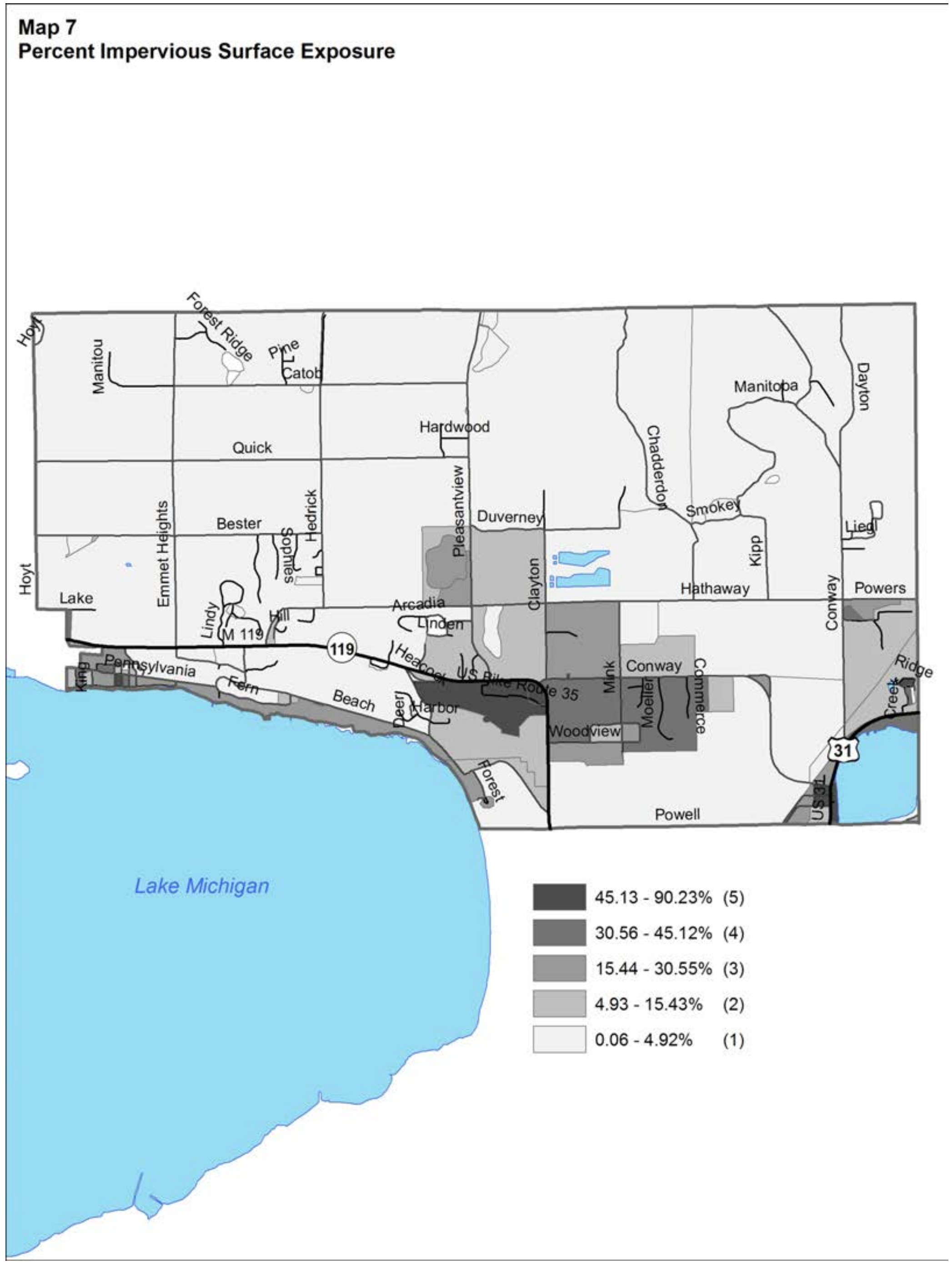

Emmet County

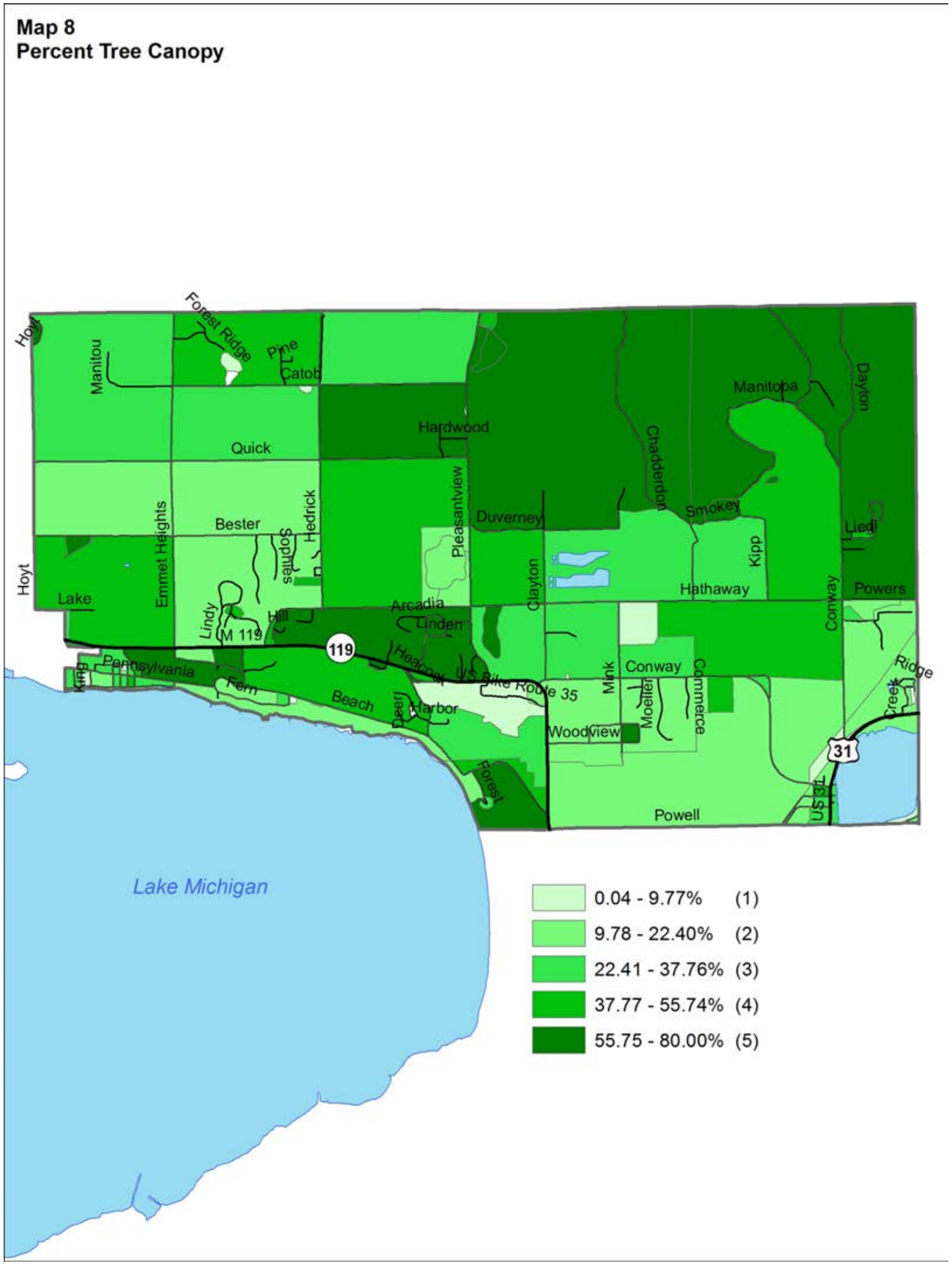

Map 5
Percent of Population 25 years and Older with less than a High School Education
Lake Michigan
6.51 - 11.30% (5)
3.91 - 6.50% (4)
1.91 - 3.90% (3)
1.51 - 1.90% (2)
1.50% (1)
Quick
Bester
Lake
Manitou
Emmet Heights
Hardwood
Duverney
Pleasantview
Manitoba
Chadderdon
Smokey
Hathaway
Powers
Dayton
Conway
Powell
Pennsylvania
Beach
Harbor
Arcadia
Linden
Woodview
Commerce
Mink
Hoyt
Kipp
Clayton
119
31


Map 6
Relative Sensitivity of Populations to Extreme Heat Events
Lake Michigan
additive score
re- score
18 - 20 (5)
14 - 17 (4)
11 - 13 (3)
8 - 10 (2)
2 - 7 (1)
Manitou
Forest Ridge
Pine
Catob
Quick
Hardwood
Bester
Emmet Heights
Hedrick
Sophies
Pleasantview
Duverney
Clayton
Chadderdon
Manitoba
Dayton
Smokey
Kipp
Hathaway
Lied
Powers
Conway
Hoyt
Lake
Lindy
M 119
Hill
Arcadia
Linden
119
Pennsylvania
Fern
Beach
Deer
Harbor
Heacock
US Bike Route 35
Mink
Moeller
Commerce
Woodview
Forest
Powell
Ridge
Creek
31
US 31

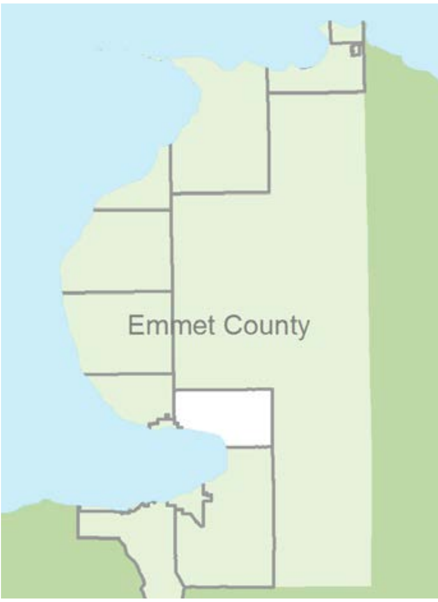

Emmet County


Emmet County

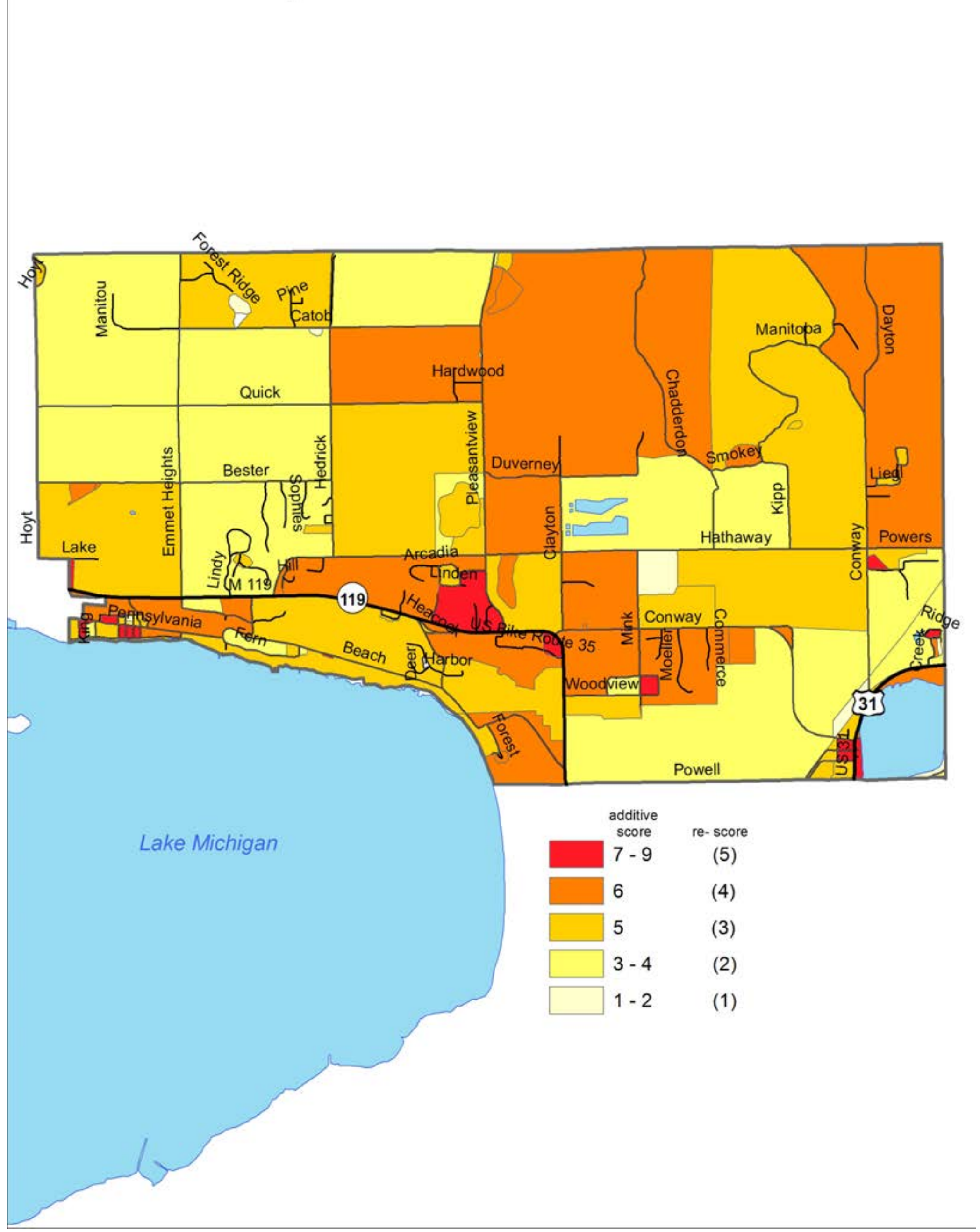

Map 7
Percent Impervious Surface Exposure
Lake Michigan
45.13 - 90.23% (5)
30.56 - 45.12% (4)
15.44 - 30.55% (3)
4.93 - 15.43% (2)
0.06 - 4.92% (1)
Quick
Bester
Hardwood
Duverney
Manitoba
Hathaway
Powers
Powell
Conway
Woodview
Beach
Pennsylvania
Lake
Hoyt
Manitou
Emmet Heights
Pleasantview
Clayton
Chadderdon
Dayton
Arcadia
Harbor
Forest
119
31

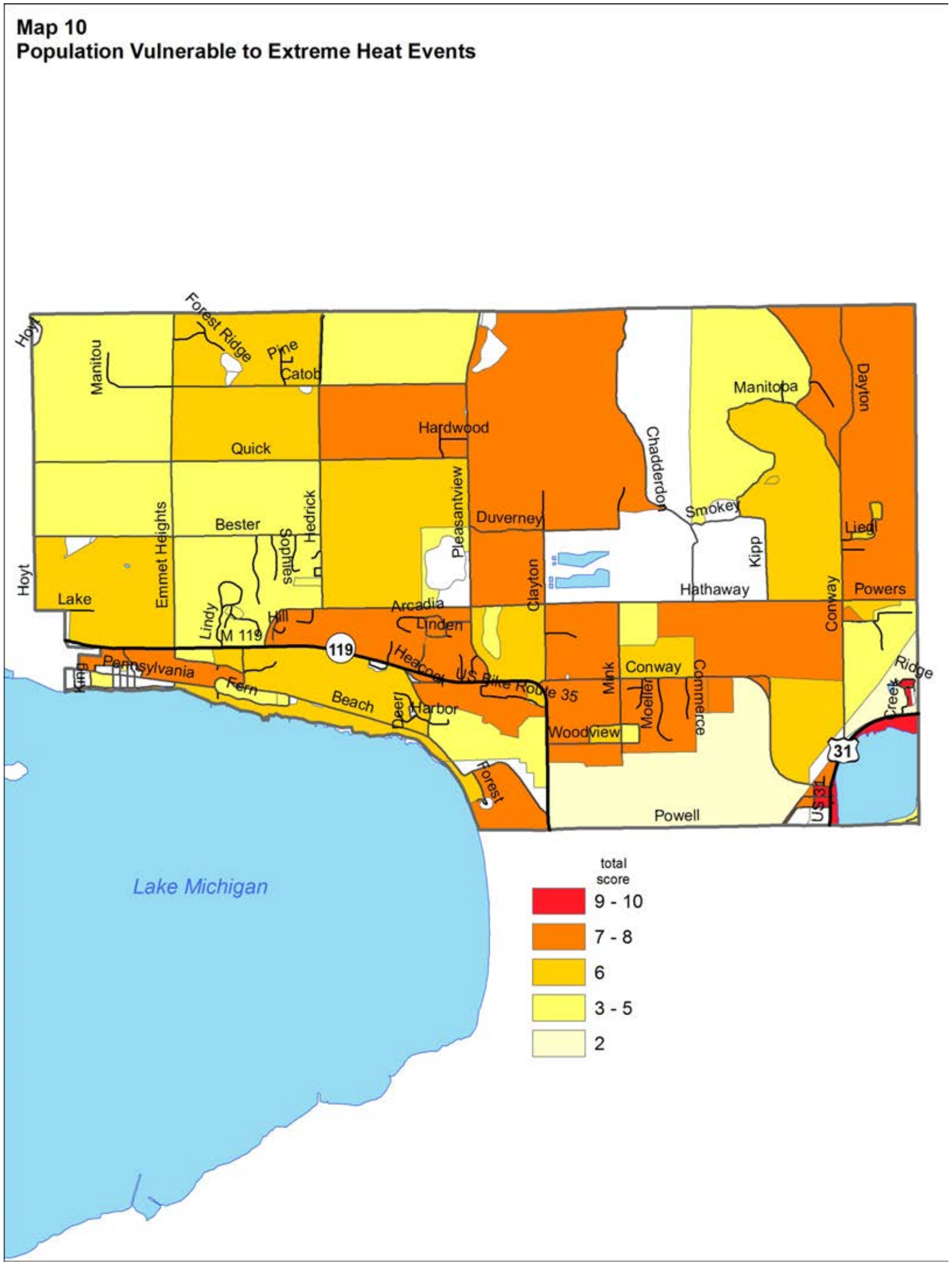

Map 8
Percent Tree Canopy
Lake Michigan
0.04 - 9.77% (1)
9.78 - 22.40% (2)
22.41 - 37.76% (3)
37.77 - 55.74% (4)
55.75 - 80.00% (5)
Forest Ridge
Pine
Catob
Manitou
Quick
Hardwood
Manitoba
Dayton
Chadderdon
Smokey
Duverney
Pleasantview
Bester
Hedrick
Emmet Heights
Lake
Hoyt
Kipp
Liedl
Hathaway
Powers
Clayton
Conway
Arcadia
Linden
Lindy
Hill
M 119
119
Pennsylvania
Fern
Beach
Harbor
Mink
Moeller
Commerce
Woodview
Ridge
Creek
31
Forest
Powell
US 31

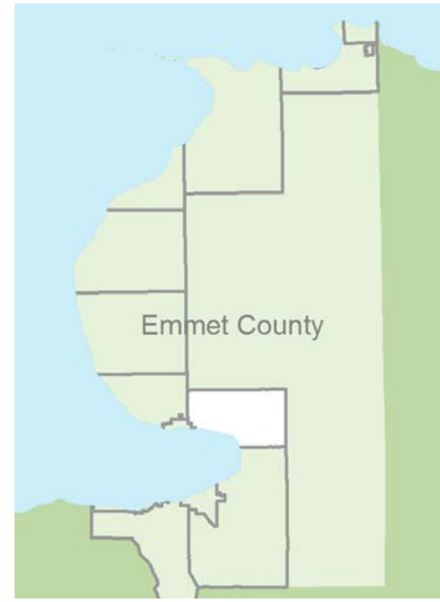

Emmet County



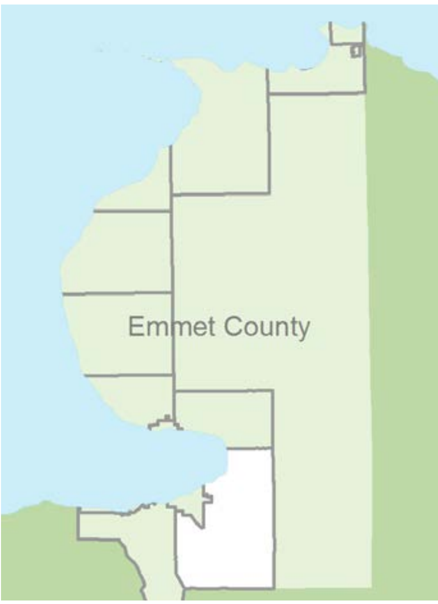
Map 9
Relative Environmental Exposure to Extreme Heat Events

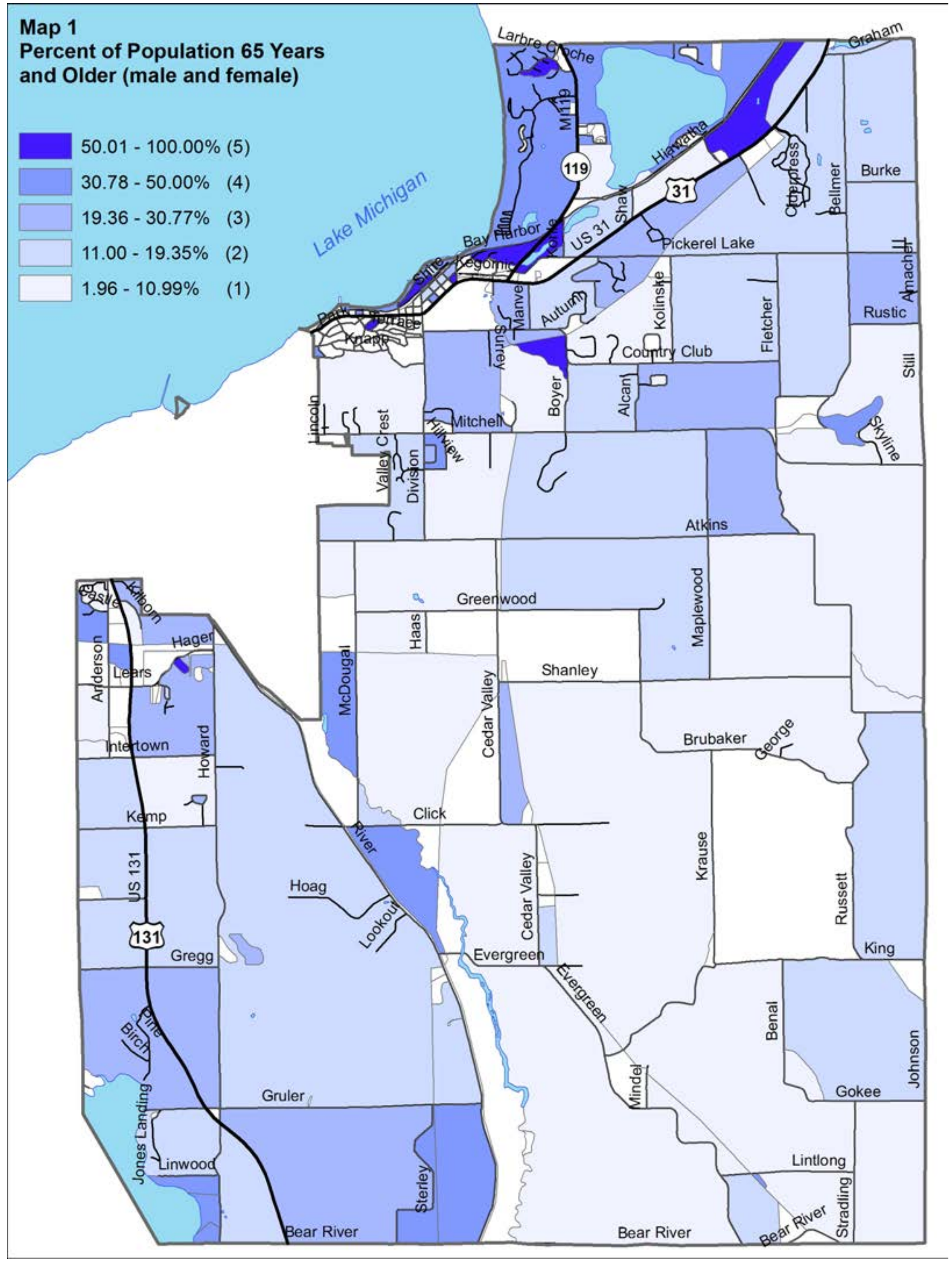


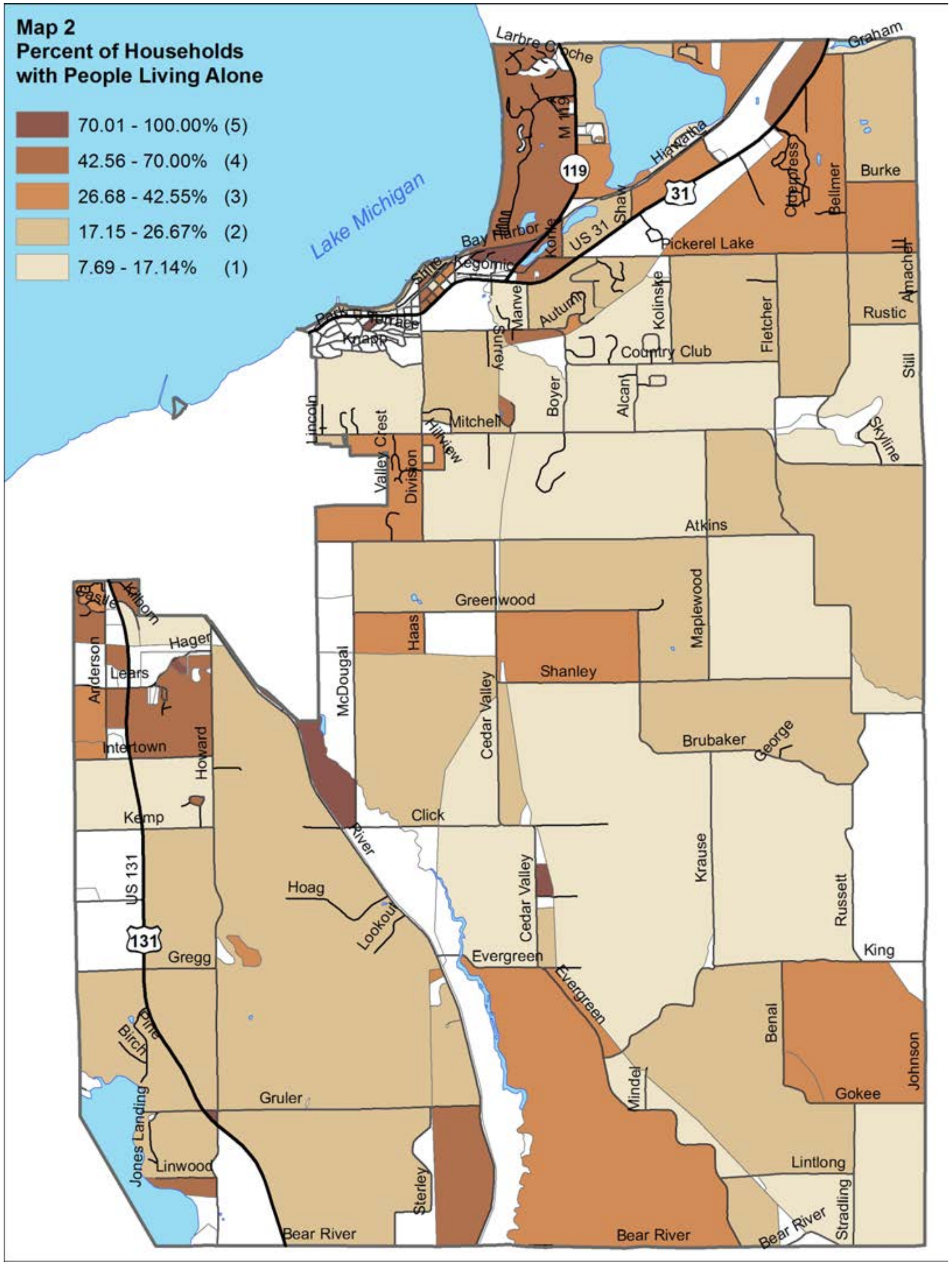

Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
total score
9 - 10
7 - 8
6
3 - 5
2

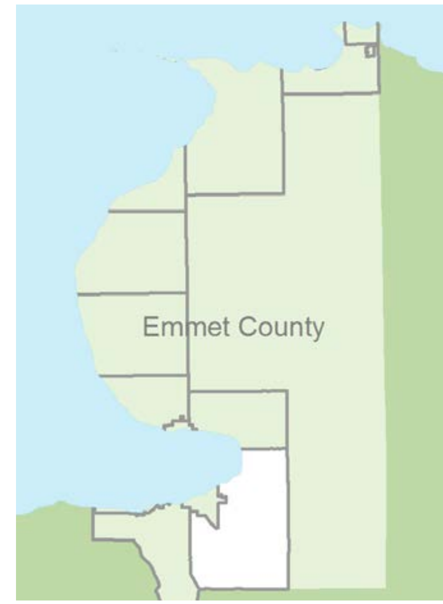

Emmet County

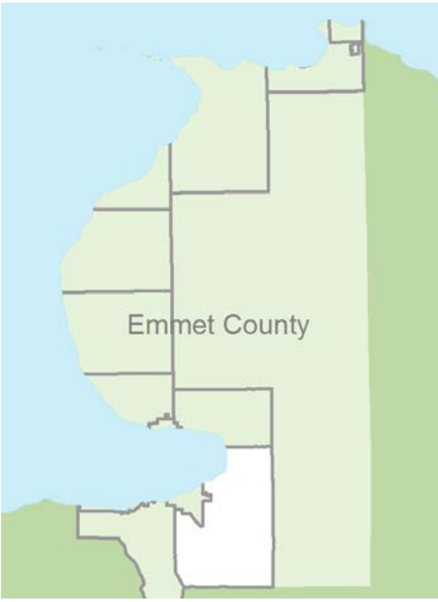
Bear Creek Twp.

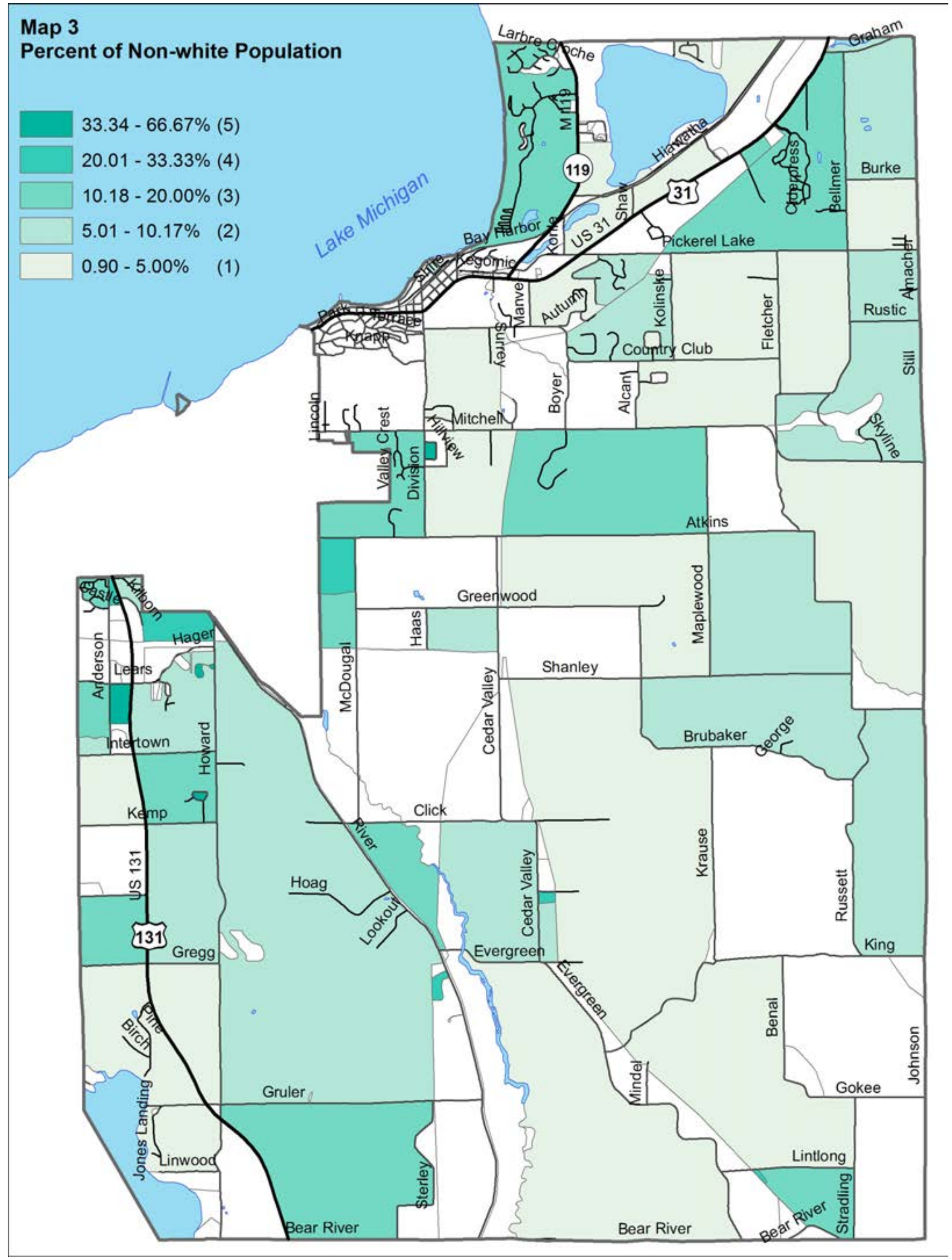


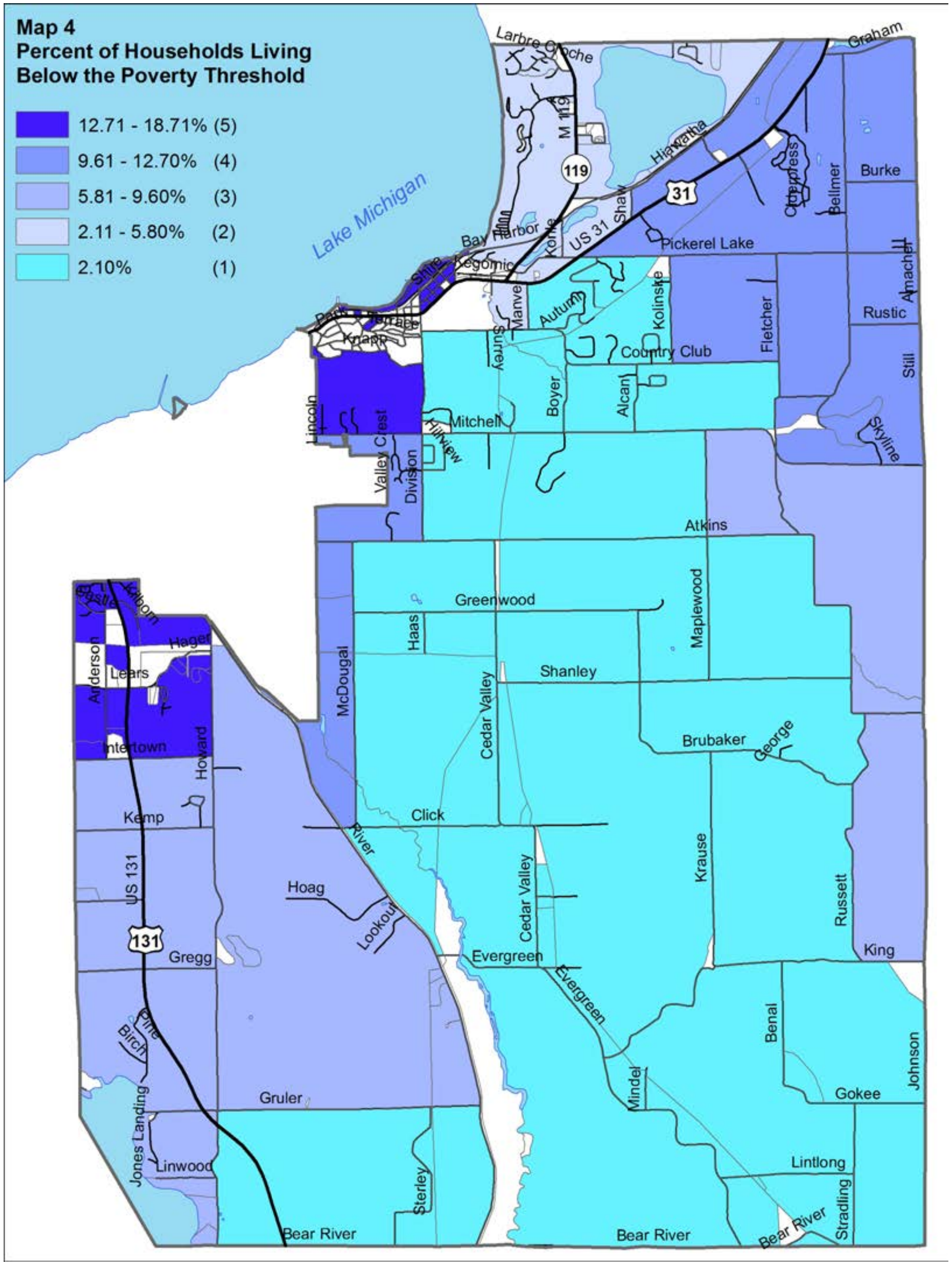


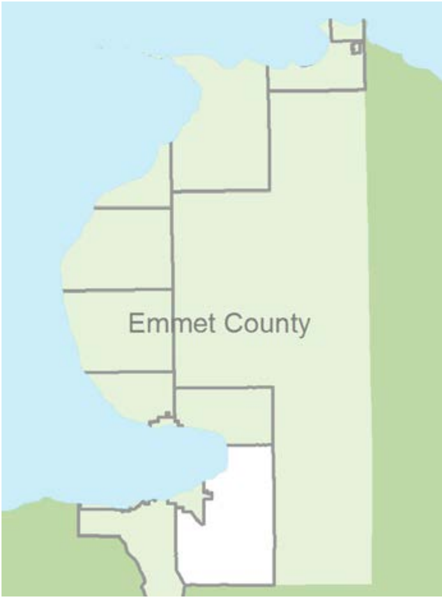

Map 2
Percent of Households with People Living Alone
70.01 - 100.00% (5)
42.56 - 70.00% (4)
26.68 - 42.55% (3)
17.15 - 26.67% (2)
7.69 - 17.14% (1)
Lake Michigan
Larbre Croche
Graham
M 119
119
Hiawatha
31
Shaw
US 31
Bay Harbor
Kegomic
Pickerel Lake
Bellmer
Burke
Rustic
Amacher
Still
Skyline
Manvel
Autumn
Kolinske
Country Club
Fletcher
Surrey
Boyer
Alcan
Mitchell
Hillview
Lincoln
Valley Crest
Division
Atkins
Greenwood
Maplewood
Haas
McDougal
Shanley
Cedar Valley
Brubaker
George
Click
River
Krause
Russett
King
Anderson
Hager
Lears
Intertown
Howard
Kemp
US 131
131
Gregg
Hoag
Lookout
Evergreen
Benal
Johnson
Gokee
Birch
Pine
Gruler
Mindel
Lintlong
Jones Landing
Linwood
Sterley
Bear River
Stradling

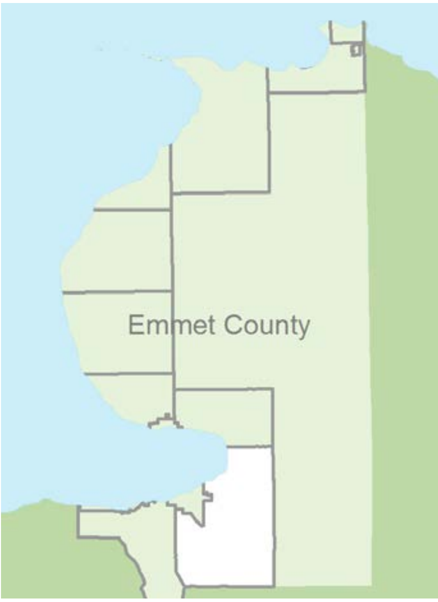

Emmet County

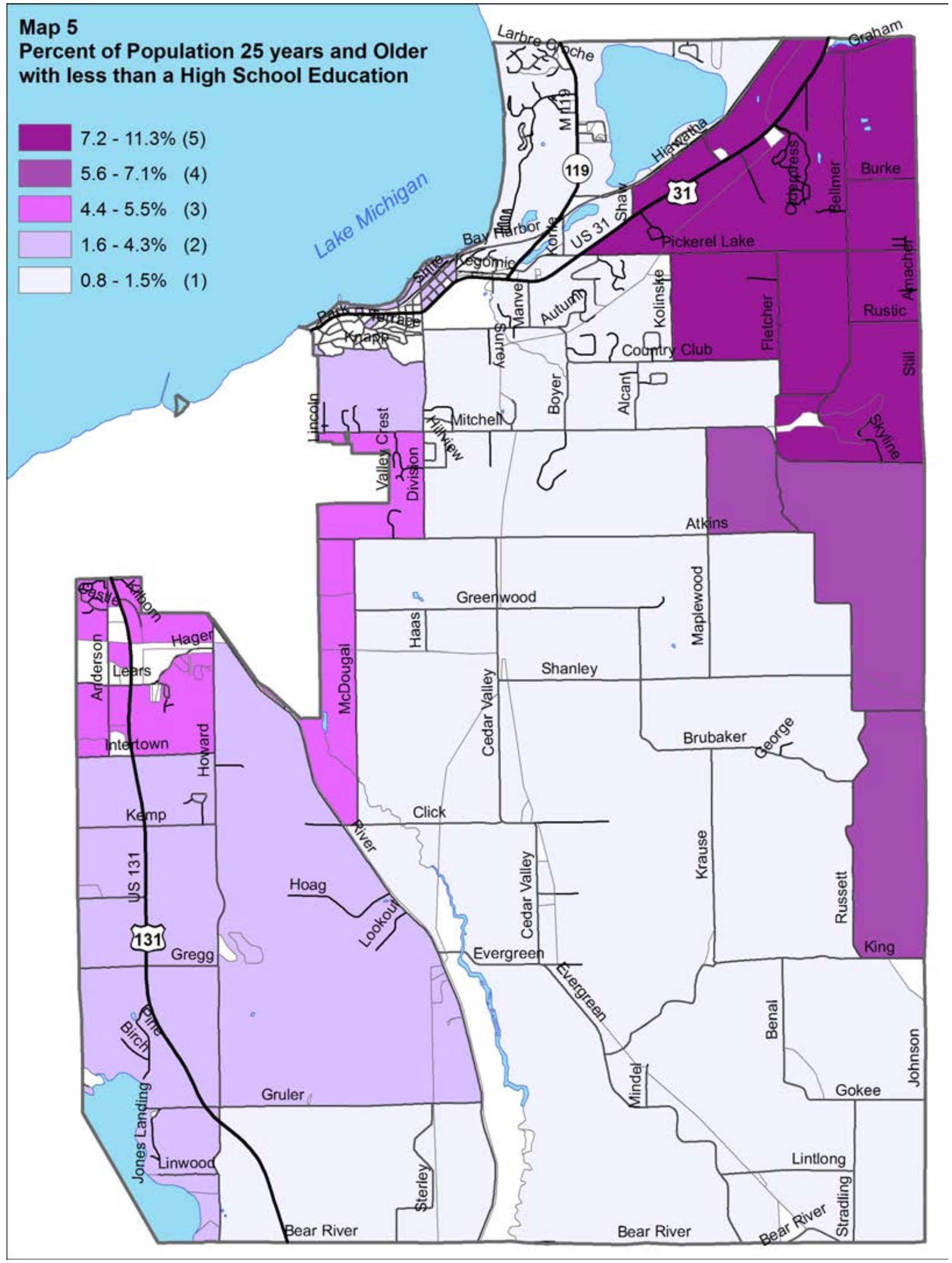

Emmet County

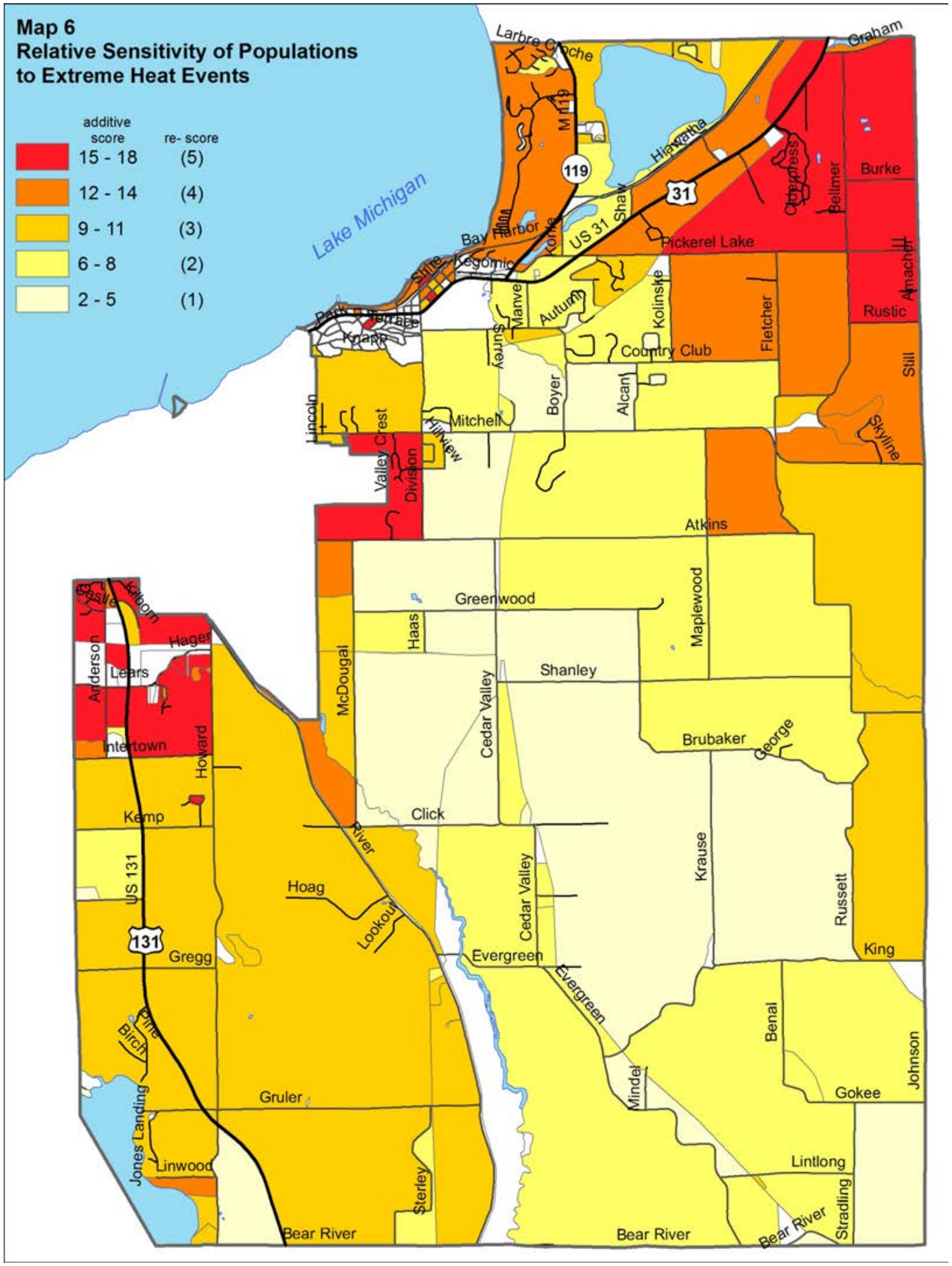

Map 3
Percent of Non-white Population
33.34 - 66.67% (5)
20.01 - 33.33% (4)
10.18 - 20.00% (3)
5.01 - 10.17% (2)
0.90 - 5.00% (1)
Lake Michigan


Map 4
Percent of Households Living Below the Poverty Threshold
12.71 - 18.71% (5)
9.61 - 12.70% (4)
5.81 - 9.60% (3)
2.11 - 5.80% (2)
2.10% (1)
Lake Michigan
Larbre Croche
Graham
M 119
119
Hiawatha
31
US 31
Shaw
Bay Harbor
Pickerel Lake
Burke
Bellmer
Rustic
Still
Skyline
Country Club
Fletcher
Kolinske
Autumn
Manvel
Surrey
Boyer
Alcan
Mitchell
Hillview
Lincoln
Valley Crest
Division
Atkins
Greenwood
Haas
Maplewood
Shanley
McDougal
Cedar Valley
Brubaker
George
Click
River
Krause
Russett
King
Hoag
Lookout
Evergreen
Benal
Johnson
Gokee
Mindel
Lintlong
Stradling
Bear River
Gruler
Sterley
Linwood
Jones Landing
Birch
Gregg
131
US 131
Kemp
Howard
Intertown
Lears
Anderson
Hager
Calhoun

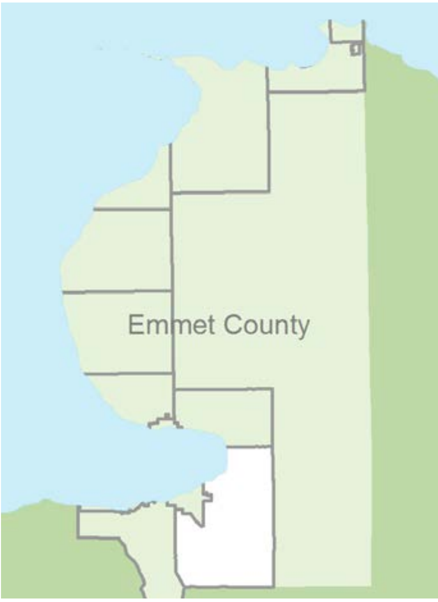

Emmet County

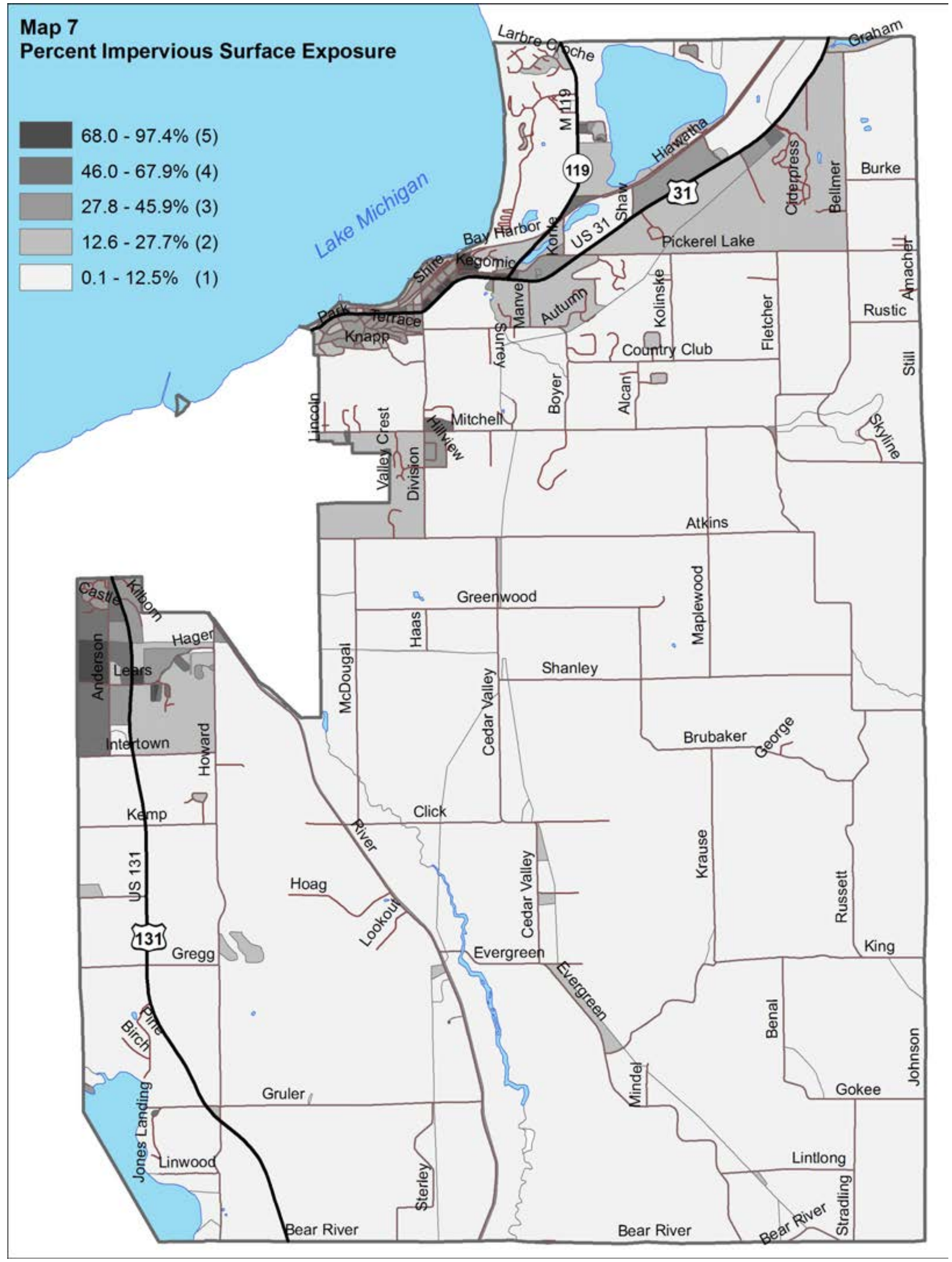

Emmet County

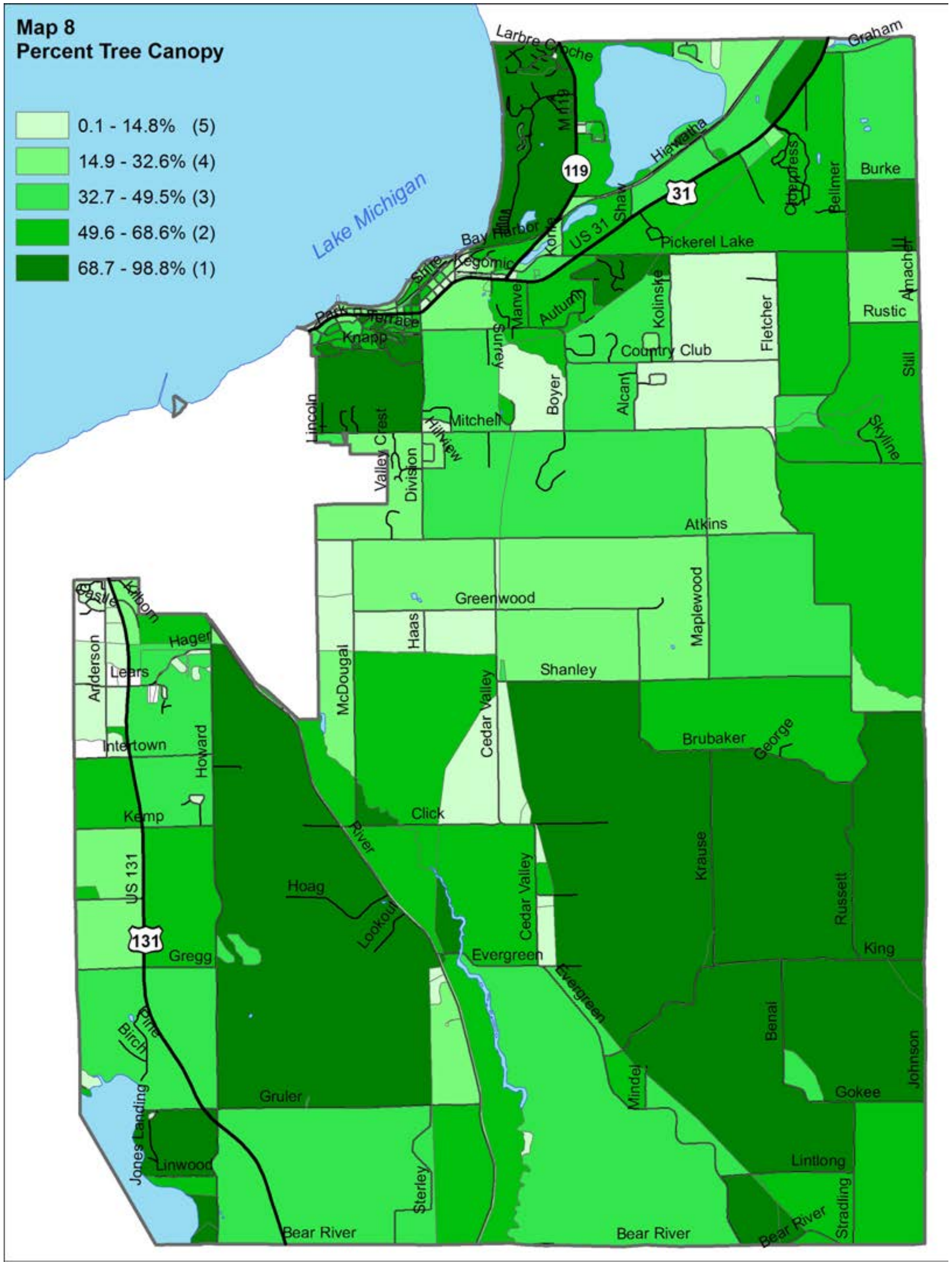

Map 5
Percent of Population 25 years and Older with less than a High School Education
7.2 - 11.3% (5)
5.6 - 7.1% (4)
4.4 - 5.5% (3)
1.6 - 4.3% (2)
0.8 - 1.5% (1)
Lake Michigan
Larbre Croche
Graham
Hiawatha
Burke
Bellmer
Pickerel Lake
Bay Harbor
US 31
Rustic
Fletcher
Country Club
Still
Skyline
Mitchell
Boyer
Alcan
Atkins
Greenwood
Maplewood
Shanley
Brubaker
George
Click
Cedar Valley
Krause
Russett
King
Evergreen
Benal
Gokee
Johnson
Lintlong
Stradling
Bear River
Mindel
Sterley
Gruler
Hoag
Lookout
River
McDougal
Haas
Gregg
Kemp
US 131
131
Intertown
Howard
Lears
Anderson
Hager
Linwood
Jones Landing
Birch
Division
Valley Crest
Lincoln
Knapp
Surrey
Kolinske
119
31

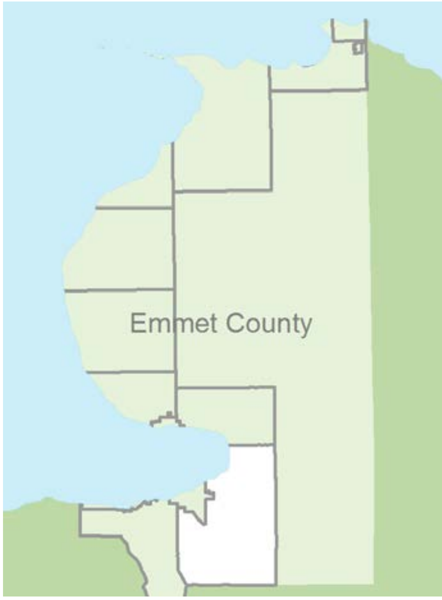

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
additive score
re- score
15 - 18 (5)
12 - 14 (4)
9 - 11 (3)
6 - 8 (2)
2 - 5 (1)
Lake Michigan
Larbre Croche
Graham
M 119
119
Hiawatha
Shaw
31
US 31
Cypress
Bellmer
Burke
Bay Harbor
Pickerel Lake
Kegomic
Amacher
Rustic
Manvel
Autumn
Kolinske
Fletcher
Surrey
Country Club
Still
Knapp
Lincoln
Crest
Mitchell
Boyer
Alcan
Skyline
Valley
Division
Hillview
Atkins
Greenwood
Haas
Maplewood
McDougal
Shanley
Hager
Anderson
Lears
Cedar Valley
Brubaker
George
Intertown
Howard
Kemp
Click
River
Krause
Hoag
US 131
131
Lookout
Cedar Valley
Russett
Gregg
Evergreen
King
Evergreen
Birch
Benal
Johnson
Mindel
Gruler
Gokee
Jones Landing
Linwood
Lintlong
Sterley
Stradling
Bear River
Bear River
Bear River

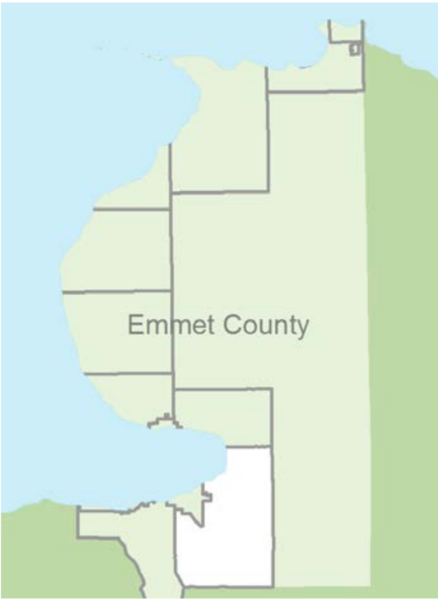

Emmet County

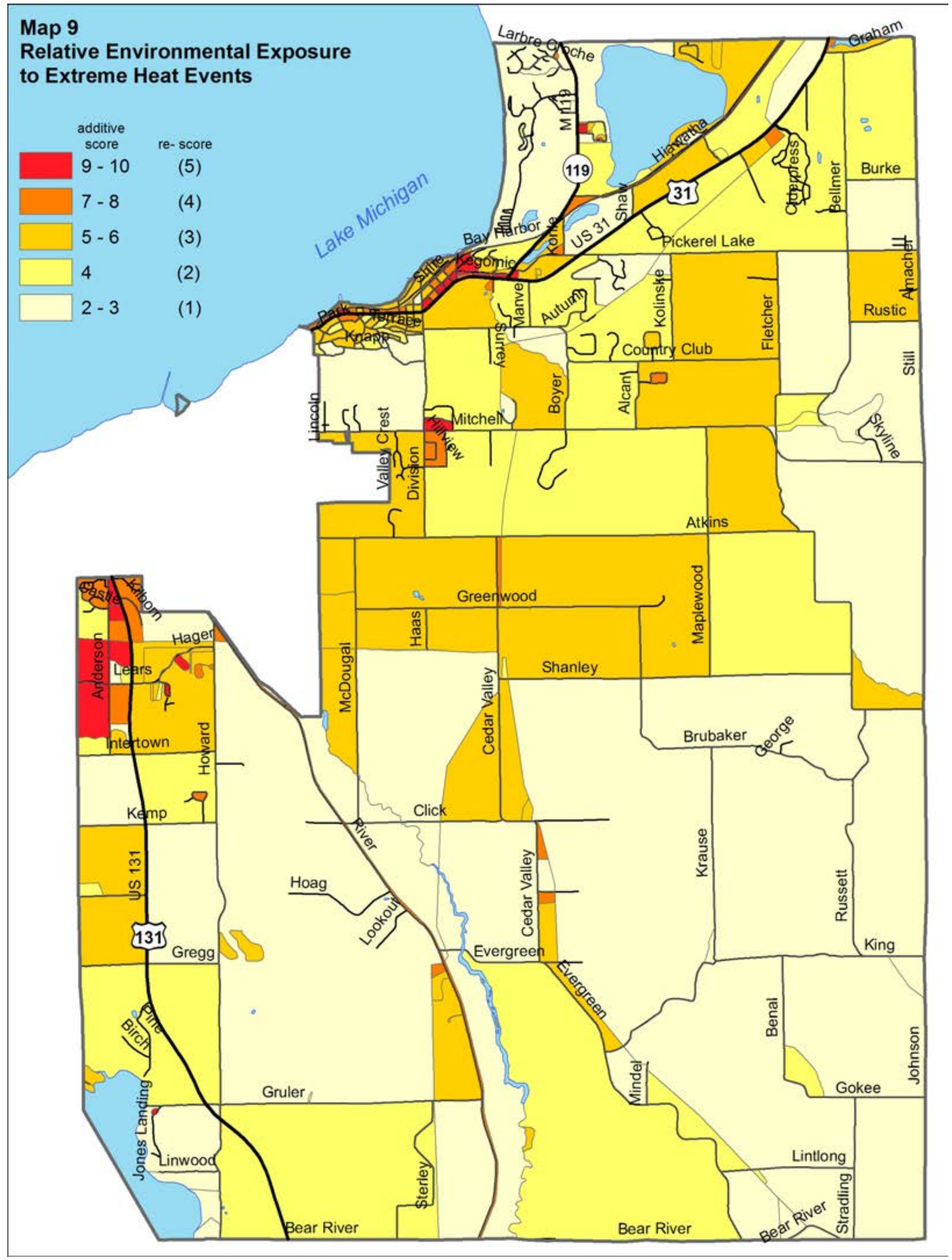

Emmet County

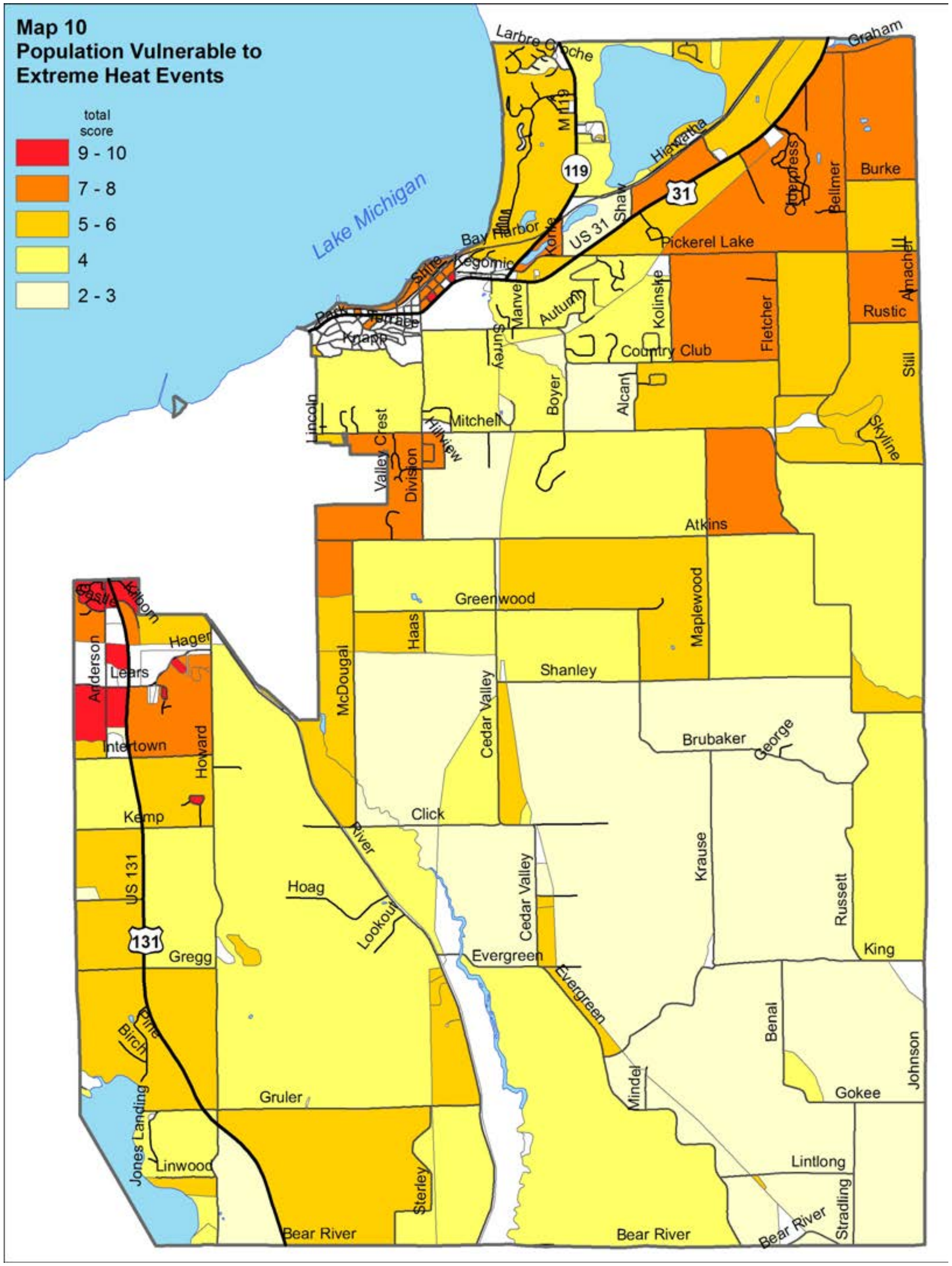

Map 7
Percent Impervious Surface Exposure
68.0 - 97.4% (5)
46.0 - 67.9% (4)
27.8 - 45.9% (3)
12.6 - 27.7% (2)
0.1 - 12.5% (1)
Lake Michigan
Larbre Croche
Graham
M 119
119
Hiawatha
31
US 31
Shaw
Bay Harbor
Kegomic
Shire
Park
Terrace
Knapp
Pickerel Lake
Burke
Bellmer
Cedar Press
Amacher
Rustic
Still
Skyline
Manvel
Autumn
Kolinske
Fletcher
Surrey
Country Club
Boyer
Alcan
Lincoln
Mitchell
Hillview
Valley Crest
Division
Atkins
Greenwood
Maplewood
Haas
Castle
Kilborn
Hager
Anderson
Lears
McDougal
Shanley
Cedar Valley
Brubaker
George
Intertown
Howard
Click
Kemp
River
US 131
131
Hoag
Lookout
Cedar Valley
Krause
Russett
King
Gregg
Evergreen
Evergreen
Pine
Birch
Benal
Johnson
Mindel
Gokee
Gruler
Jones Landing
Linwood
Sterley
Lintlong
Stradling
Bear River
Bear River
Bear River


Map 8
Percent Tree Canopy
0.1 - 14.8% (5)
14.9 - 32.6% (4)
32.7 - 49.5% (3)
49.6 - 68.6% (2)
68.7 - 98.8% (1)
Lake Michigan
Larbre Croche
Graham
Hiawatha
Burke
Bellmer
Pickerel Lake
Bay Harbor
Kegomic
Rustic
Kolinske
Fletcher
Country Club
Surrey
Boyer
Alcan
Mitchell
Skyline
Still
Lincoln
Valley Crest
Division
Hillview
Atkins
Greenwood
Maplewood
Haas
Shanley
McDougal
Cedar Valley
Brubaker
George
Anderson
Lears
Hager
Intertown
Howard
Kemp
Click
River
Krause
Russell
Hoag
Lookout
US 131
131
Gregg
Evergreen
King
Birch
Pine
Benai
Johnson
Gruler
Mindel
Gokee
Jones Landing
Linwood
Sterley
Lintlong
Stradling
Bear River


Emmet County

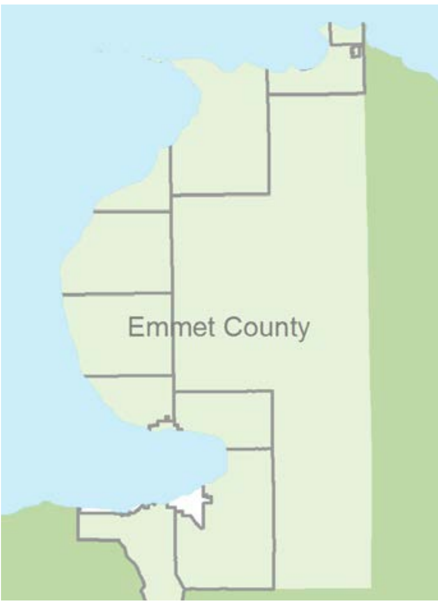

Emmet County

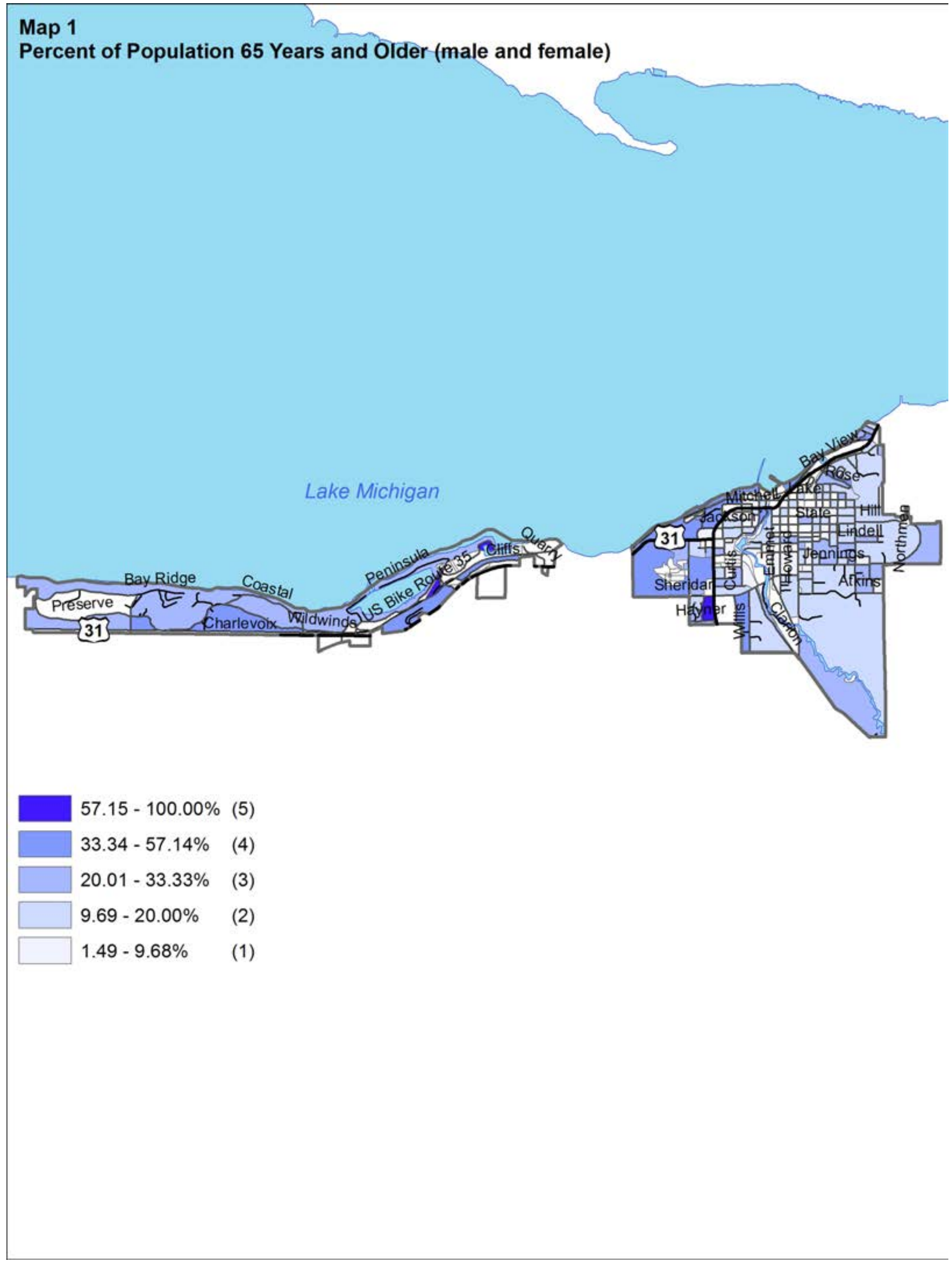

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re- score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
4 (2)
2 - 3 (1)
Lake Michigan
Larbre Croche
Graham
M 119
119
Hiawatha
31
US 31
Shaw
Bay Harbor
Pickerel Lake
Burke
Bellmer
Cypress
Rustic
Amacher
Still
Skyline
Kolinske
Country Club
Fletcher
Autumn
Manvel
Surrey
Terrace
Knapp
Lincoln
Crest
Valley
Division
Hillview
Mitchell
Boyer
Alcan
Atkins
Greenwood
Haas
McDougal
Maplewood
Shanley
Cedar Valley
Brubaker
George
Click
River
Hoag
Lookout
Evergreen
Krause
Russett
King
Benal
Johnson
Gokee
Lintlong
Stradling
Bear River
Mindel
Sterley
Gruler
Linwood
Jones Landing
Birch
Pine
131
US 131
Gregg
Kemp
Howard
Intertown
Lears
Anderson
Hager
Castle
Kilborn

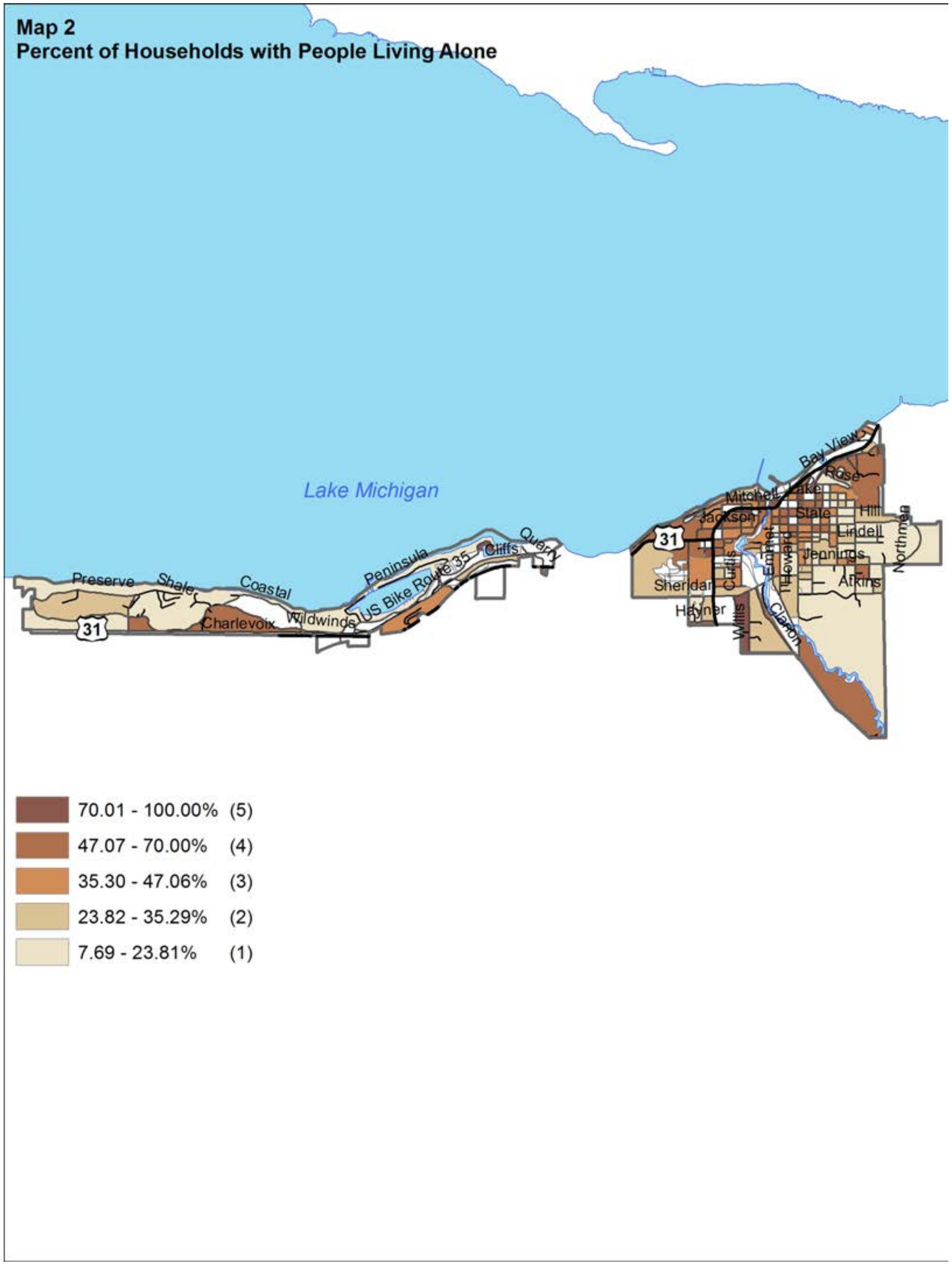

Map 10
Population Vulnerable to Extreme Heat Events
total score
9 - 10
7 - 8
5 - 6
4
2 - 3
Lake Michigan
Larbre Croche
Graham
M 119
119
Hiawatha
31
Burke
Bellmer
Bay Harbor
US 31
Shaw
Pickerel Lake
Kegomic
Rustic
Surrey
Country Club
Kolinske
Fletcher
Still
Lincoln
Mitchell
Boyer
Alcan
Skyline
Valley Crest
Division
Atkins
Greenwood
Haas
Maplewood
Hager
Anderson
Lears
McDougal
Cedar Valley
Shanley
Brubaker
George
Intertown
Howard
Click
Kemp
River
US 131
Hoag
Krause
Russett
131
Gregg
Lookout
Cedar Valley
Evergreen
Evergreen
King
Birch
Benal
Johnson
Gruler
Mindel
Gokee
Jones Landing
Linwood
Lintlong
Sterley
Stradling
Bear River
Bear River
Bear River


Emmet County

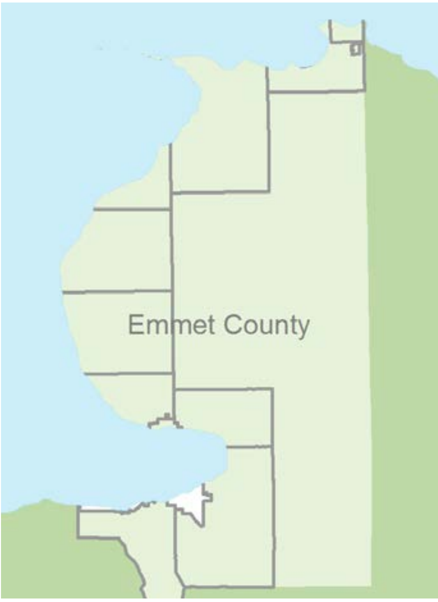
Petoskey

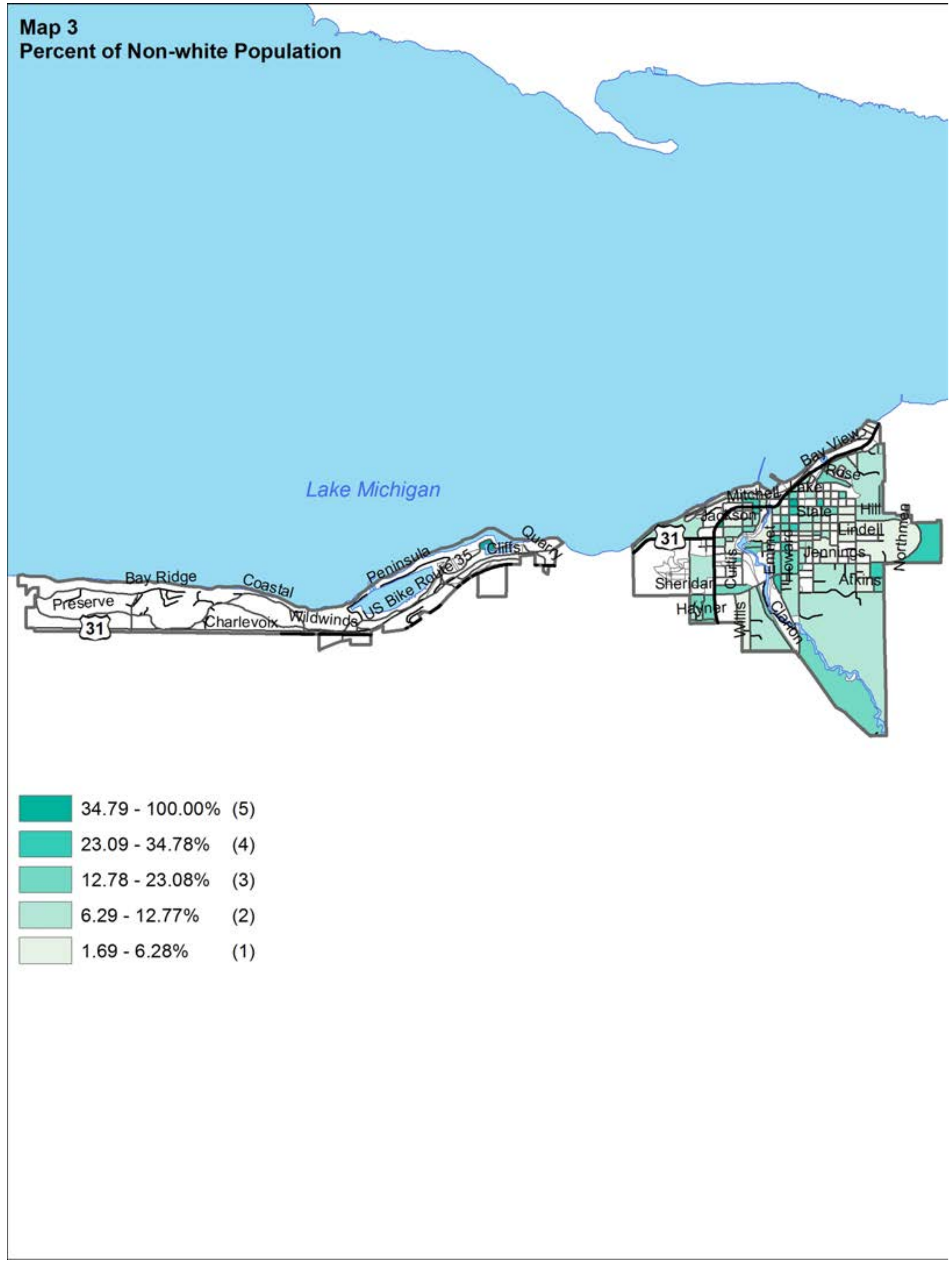

Emmet County

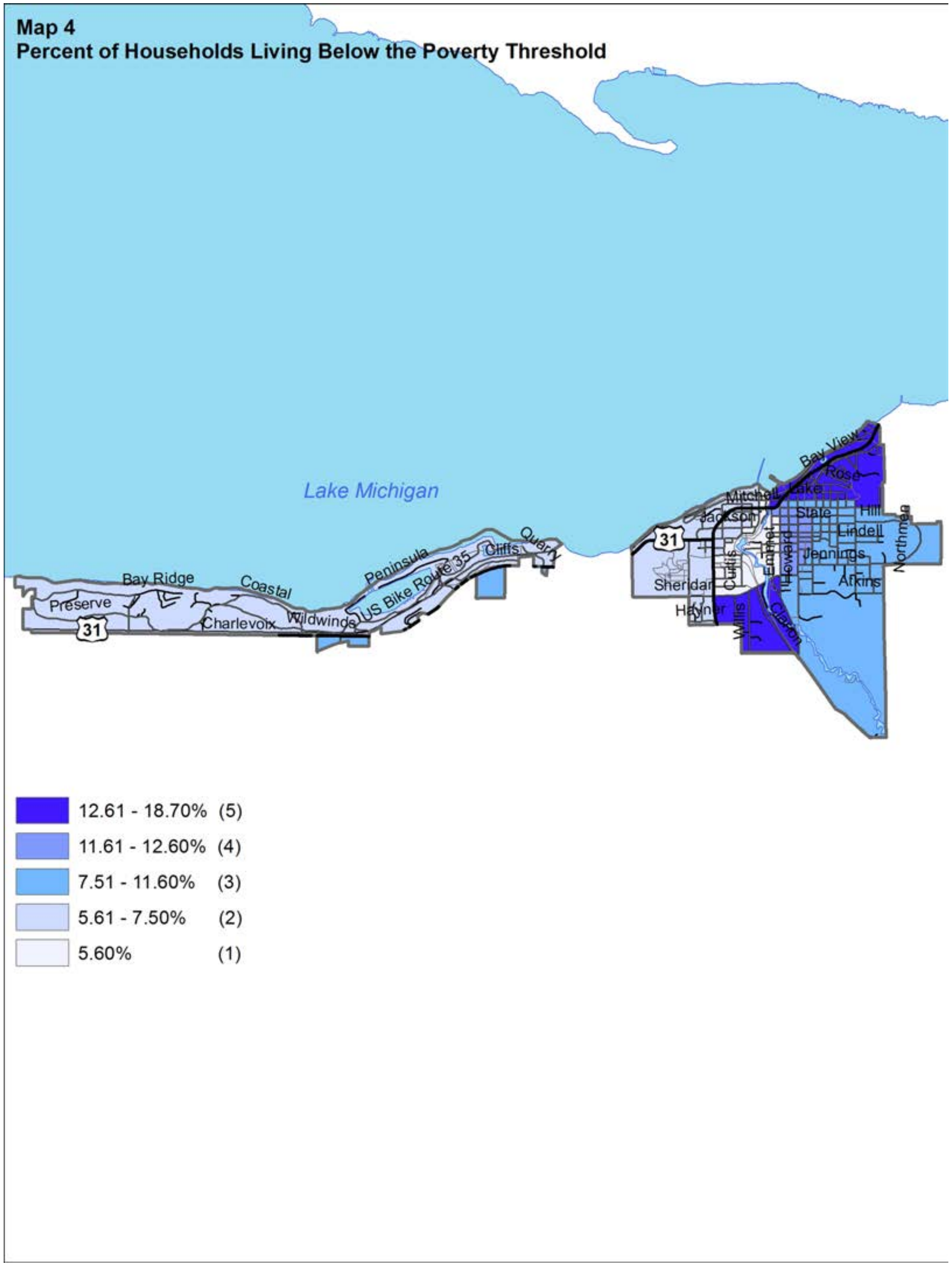

Map 1
Percent of Population 65 Years and Older (male and female)
Lake Michigan
Bay Ridge
Coastal
Preserve
Charlevoix
Wildwinds
Peninsula
US Bike Route 35
Cliffs
Quarry
31
Bay View
Rose
Lake
Mitchell
Jackson
State
Hill
Lindell
Jennings
Atkins
Sheridan
Hayner
Curtis
Willis
Clarion
57.15 - 100.00% (5)
33.34 - 57.14% (4)
20.01 - 33.33% (3)
9.69 - 20.00% (2)
1.49 - 9.68% (1)


Map 2
Percent of Households with People Living Alone
Lake Michigan
Preserve
Shale
Coastal
Charlevoix
Wildwinds
Peninsula
US Bike Route 35
Cliffs
Quarry
31
Bay View
Rose
Mitchell
Lake
Jackson
State
Hill
Lindell
Jennings
Atkins
Northmen
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clarion
70.01 - 100.00% (5)
47.07 - 70.00% (4)
35.30 - 47.06% (3)
23.82 - 35.29% (2)
7.69 - 23.81% (1)

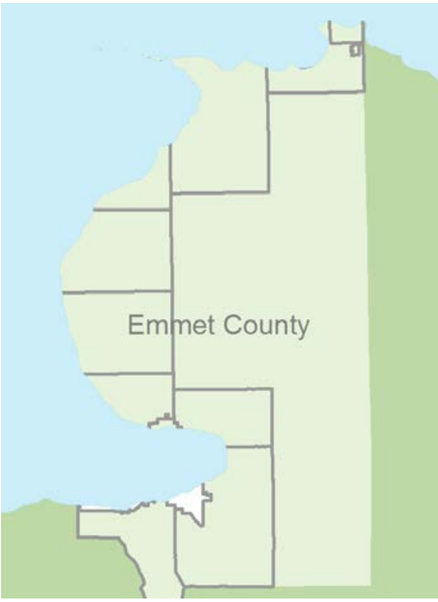

Emmet County

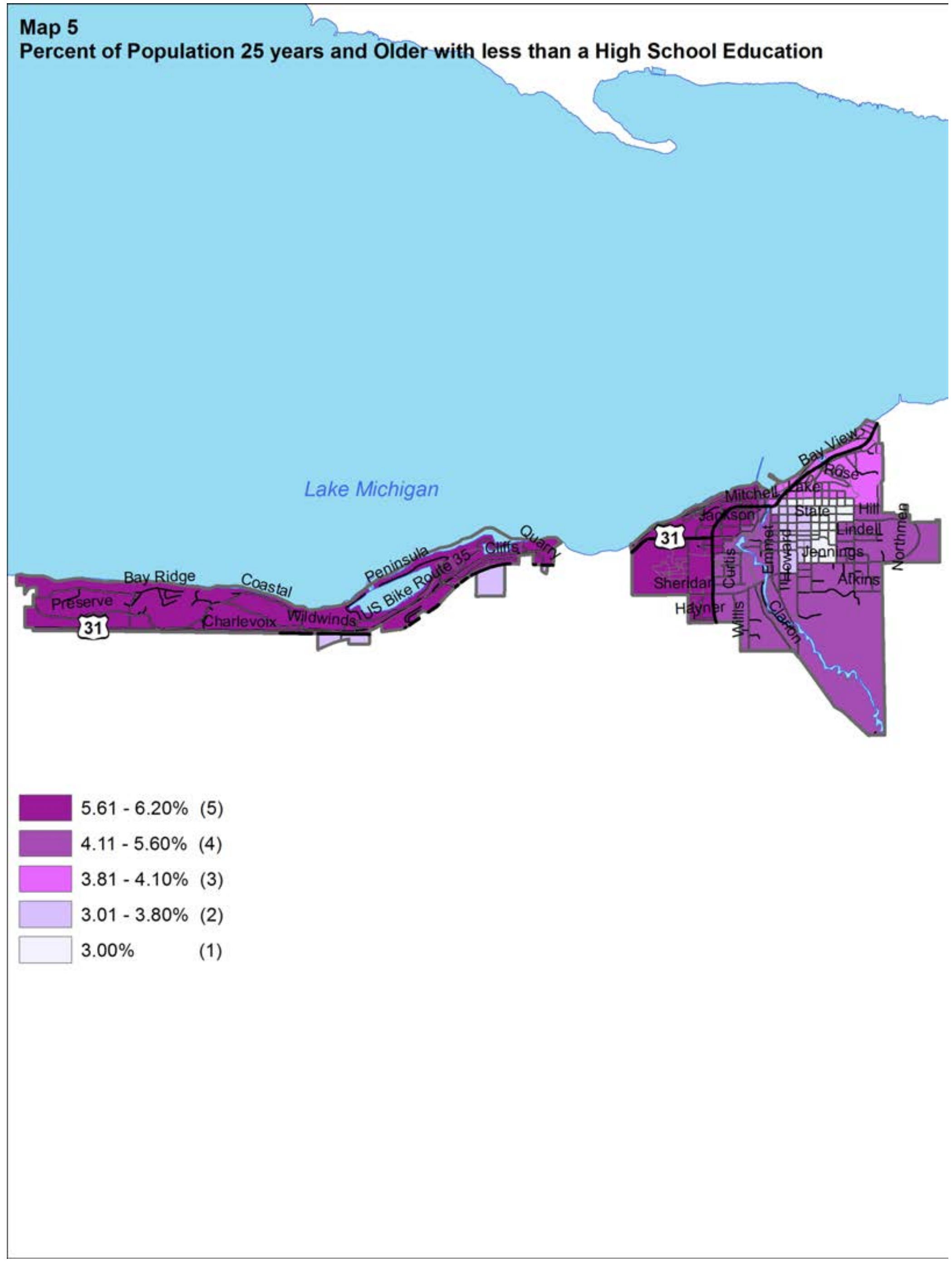

Emmet County

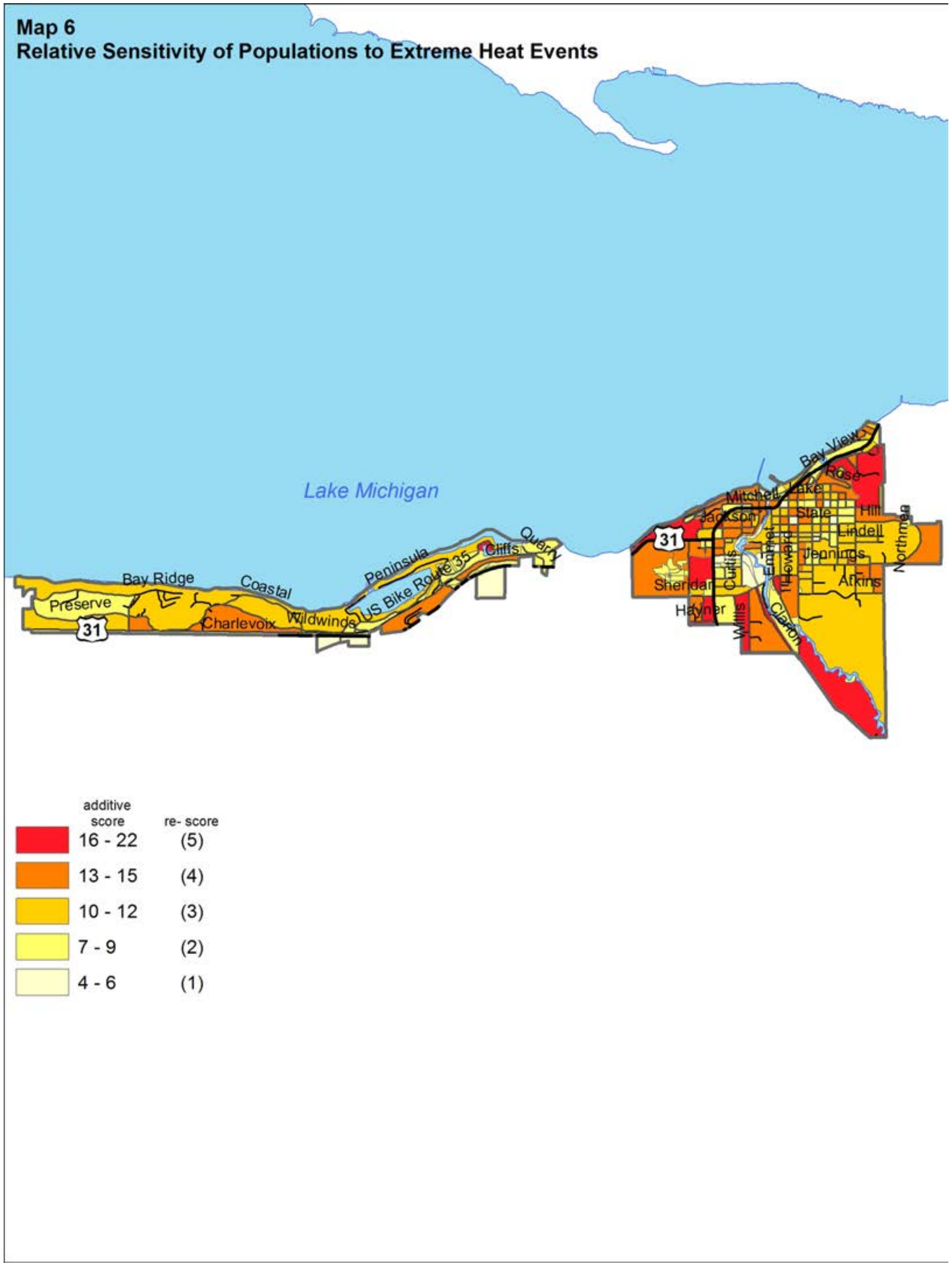

Map 3
Percent of Non-white Population
Lake Michigan
Bay View
Rose
Lake
Mitchell
Jackson
State
Hill
Lindell
Jennings
Atkins
Northmen
31
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clarion
Bay Ridge
Coastal
Preserve
Charlevoix
Wildwinds
Peninsula
US Bike Route 35
Cliffs
Quarry
34.79 - 100.00% (5)
23.09 - 34.78% (4)
12.78 - 23.08% (3)
6.29 - 12.77% (2)
1.69 - 6.28% (1)

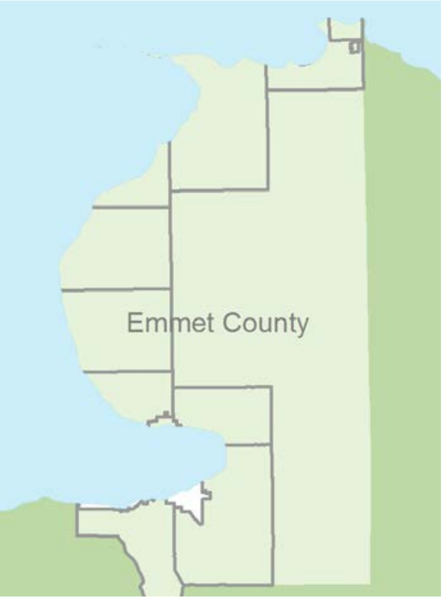

Map 4
Percent of Households Living Below the Poverty Threshold
Lake Michigan
Bay View
Rose
Lake
Mitchell
Jackson
State
Hill
Lindell
Jennings
Atkins
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clarion
Bay Ridge
Coastal
Preserve
Charlevoix
Wildwinds
US Bike Route 35
Peninsula
Cliffs
31
12.61 - 18.70% (5)
11.61 - 12.60% (4)
7.51 - 11.60% (3)
5.61 - 7.50% (2)
5.60% (1)

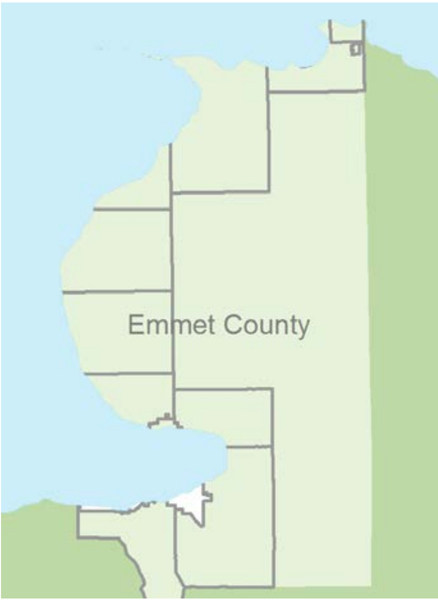

Emmet County

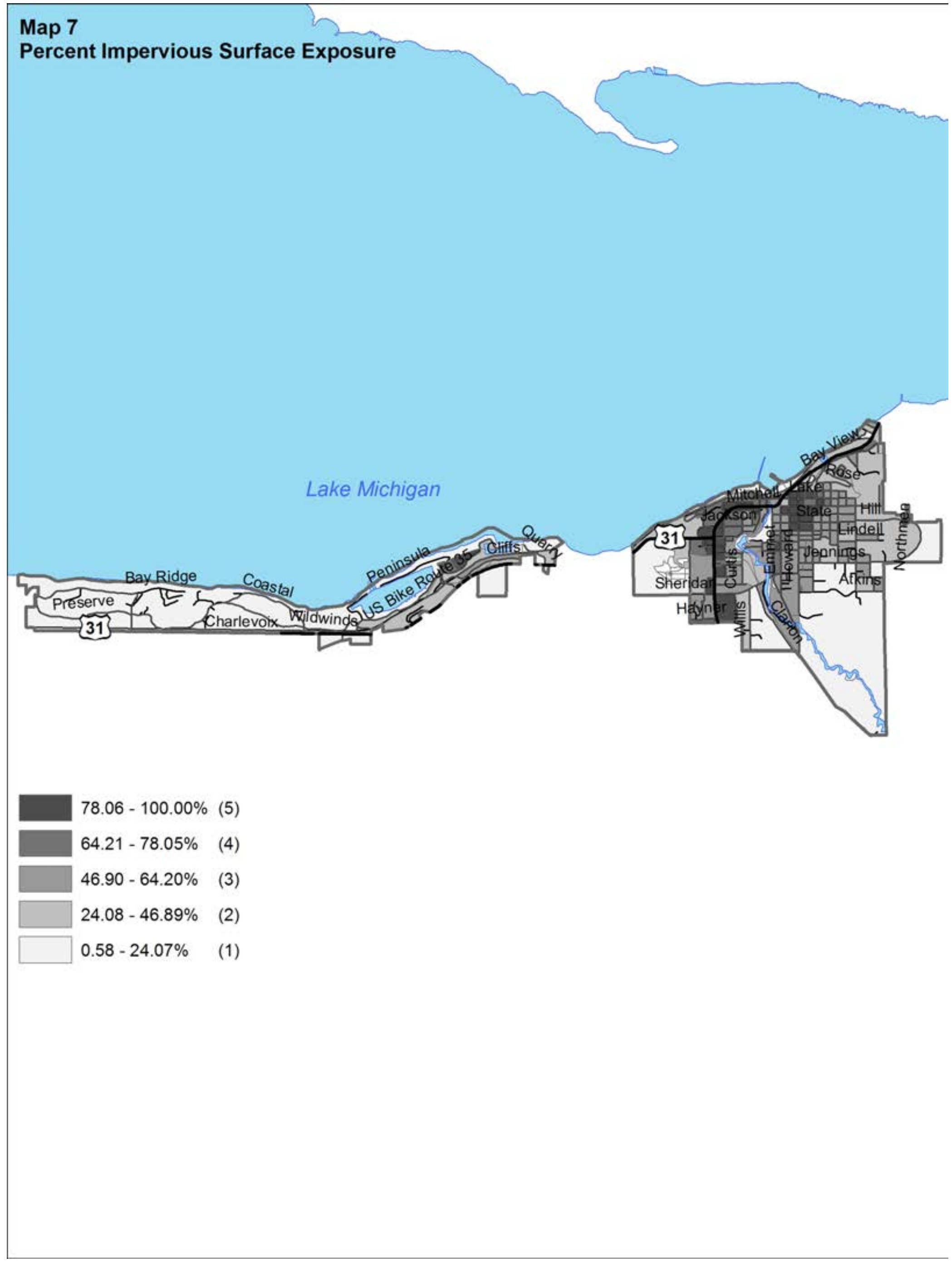

Emmet County

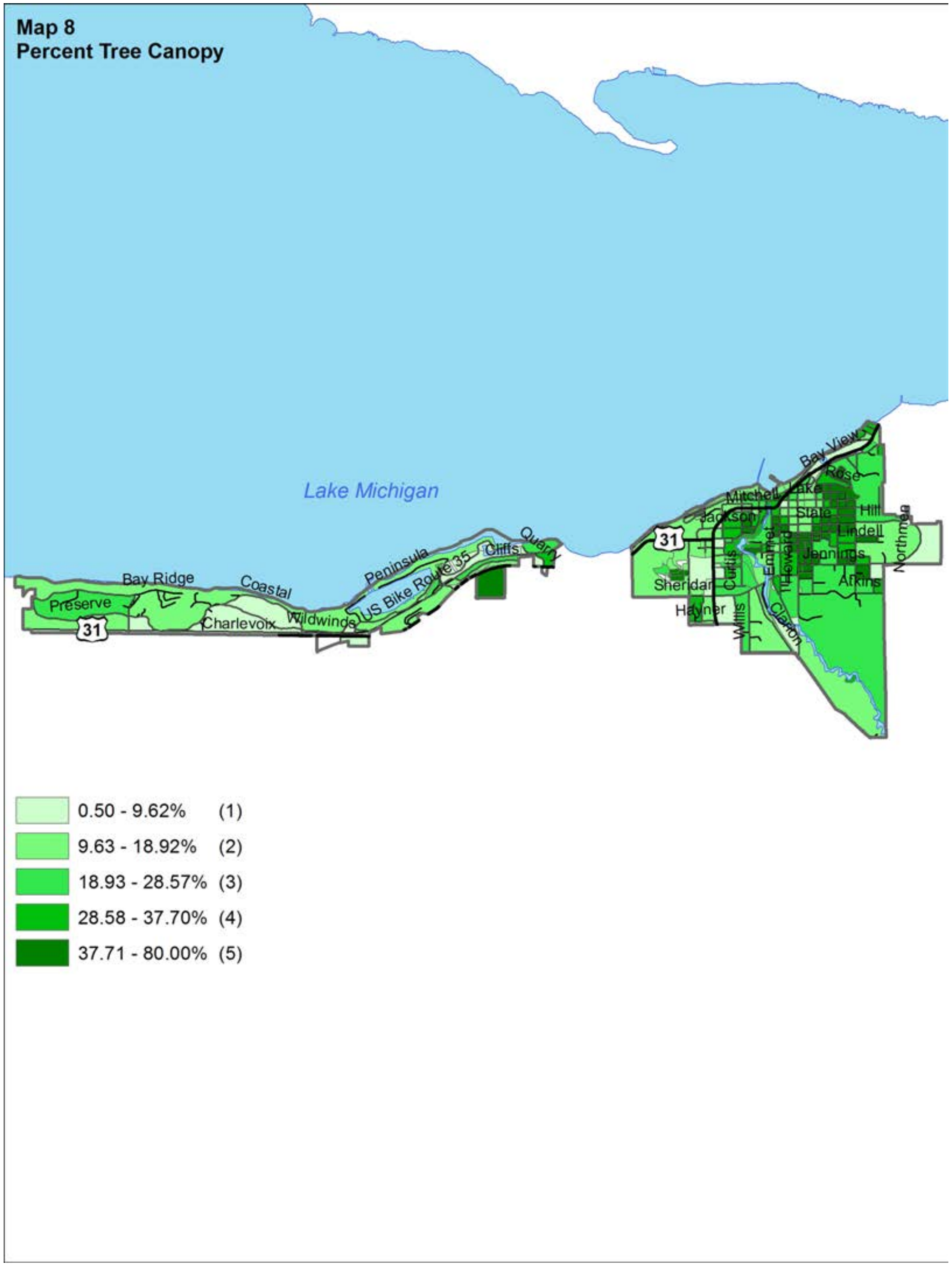

Map 5
Percent of Population 25 years and Older with less than a High School Education
Lake Michigan
Bay View
Rose
Mitchell
Lake
Jackson
State
Hill
Lindell
Jennings
Atkins
Northmen
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clarion
31
Quarry
Cliffs
Peninsula
US Bike Route 35
Coastal
Bay Ridge
Preserve
Charlevoix
Wildwinds
5.61 - 6.20% (5)
4.11 - 5.60% (4)
3.81 - 4.10% (3)
3.01 - 3.80% (2)
3.00% (1)

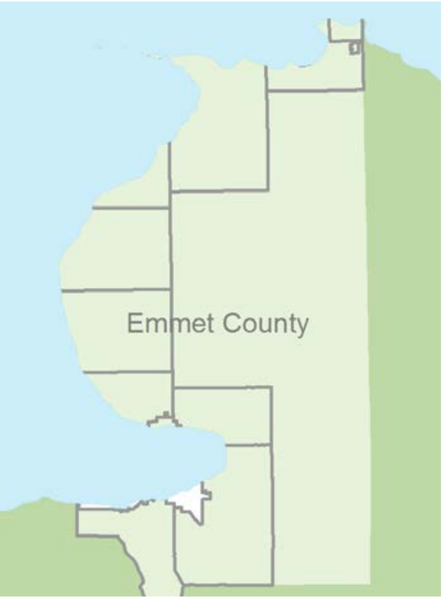

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
Lake Michigan
Bay Ridge
Coastal
Preserve
Charlevoix
Wildwinds
Peninsula
US Bike Route 35
Cliffs
Quarry
Bay View
Rose
Mitchell
Lake
Jackson
State
Hill
Lindell
Jennings
Atkins
Northmen
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clayton
31
additive score
re- score
16 - 22 (5)
13 - 15 (4)
10 - 12 (3)
7 - 9 (2)
4 - 6 (1)

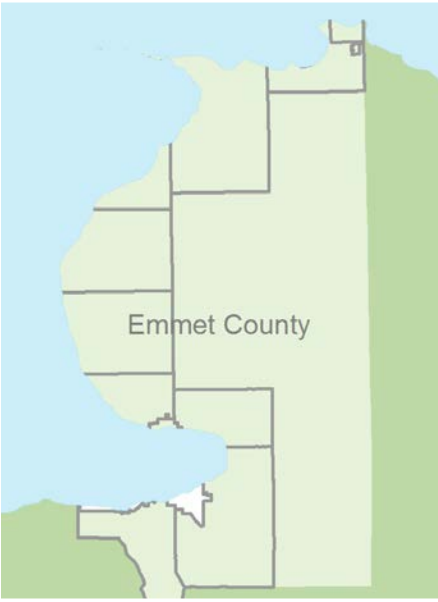

Emmet County

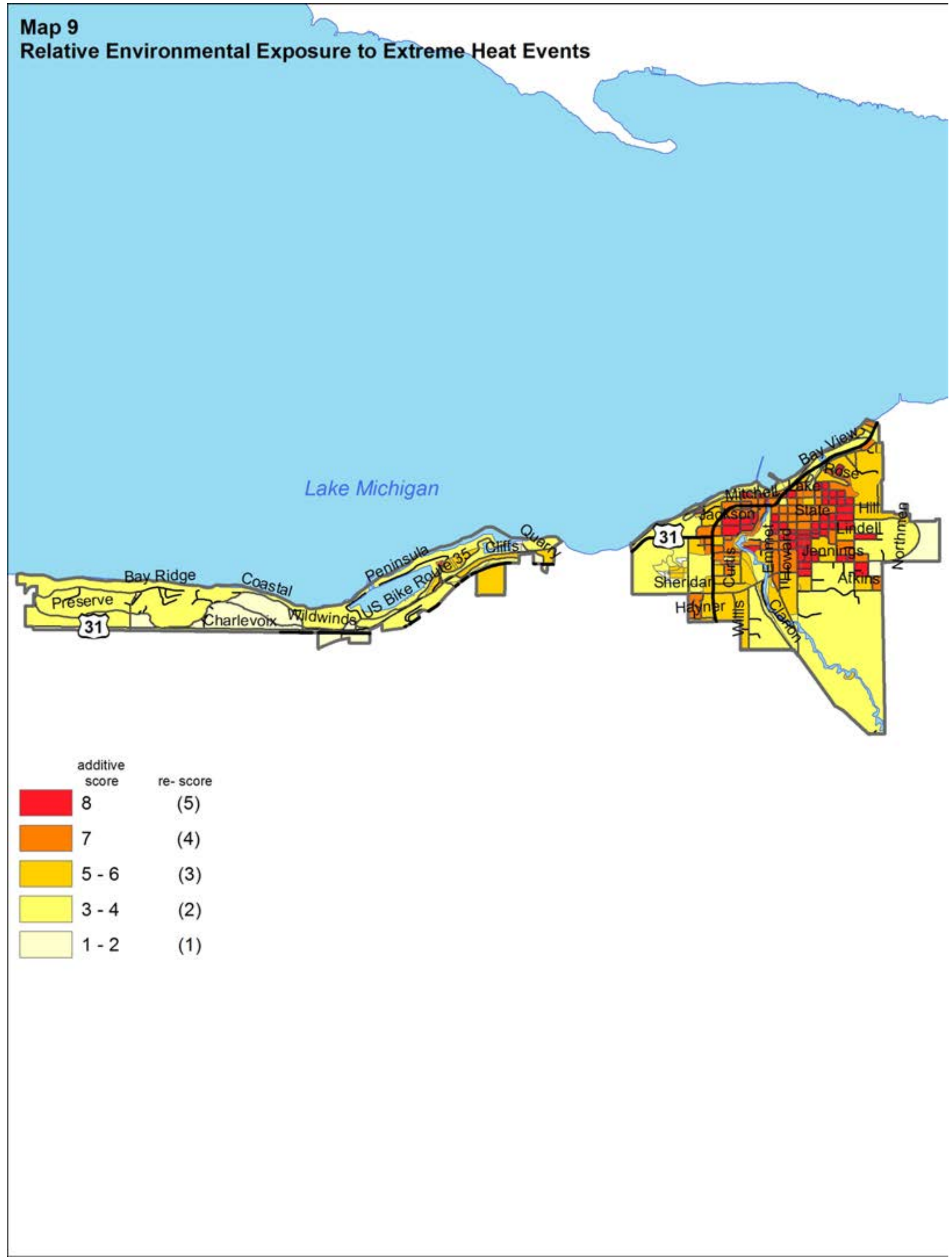

Emmet County

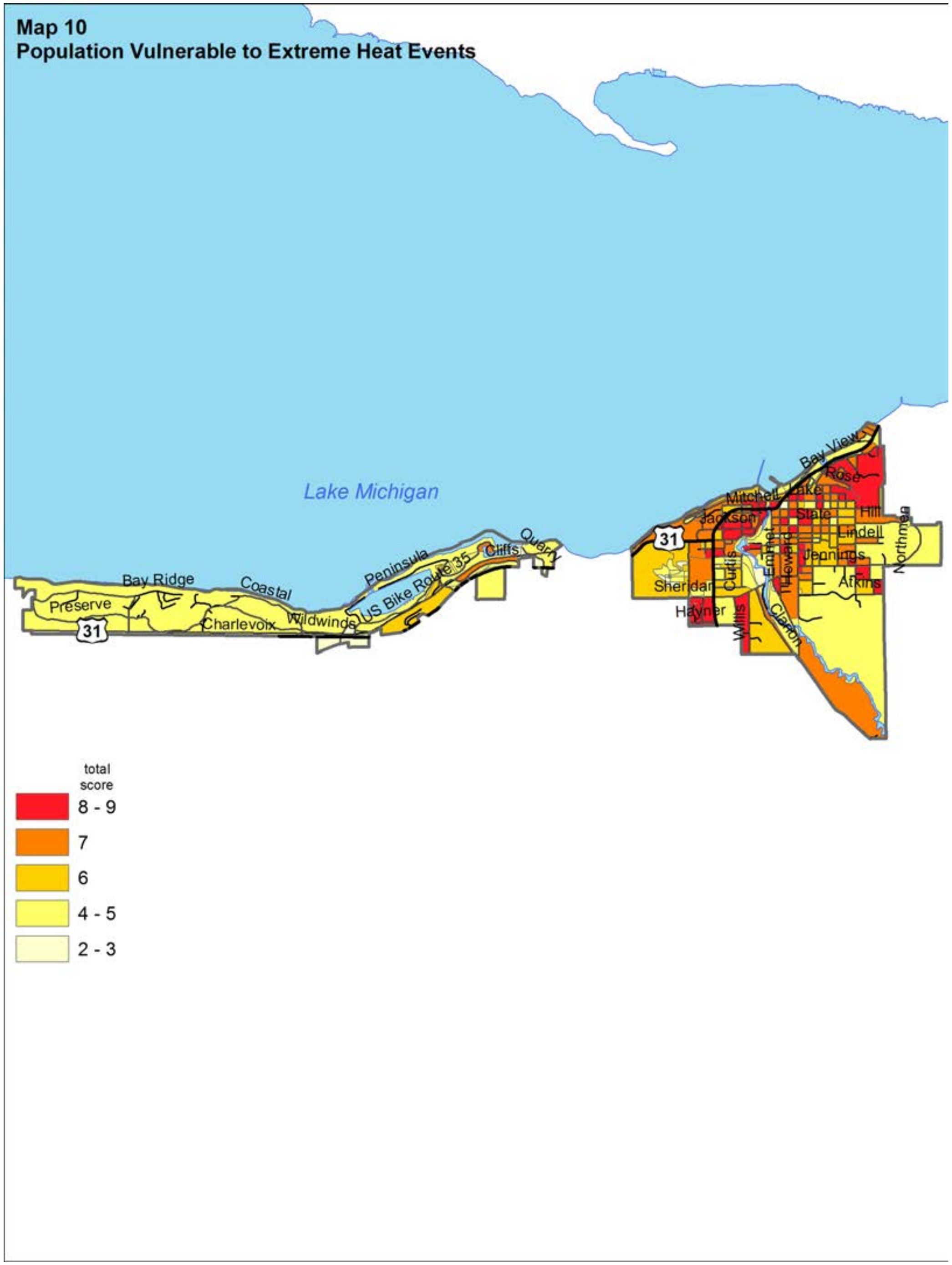

Map 7
Percent Impervious Surface Exposure
Lake Michigan
Bay Ridge
Preserve
Coastal
Charlevoix
Wildwinds
Peninsula
US Bike Route 35
Cliffs
Quarry
31
Bay View
Rose
Mitchell
Lake
Jackson
State
Hill
Lindell
Jennings
Atkins
Northmere
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clarion
78.06 - 100.00% (5)
64.21 - 78.05% (4)
46.90 - 64.20% (3)
24.08 - 46.89% (2)
0.58 - 24.07% (1)

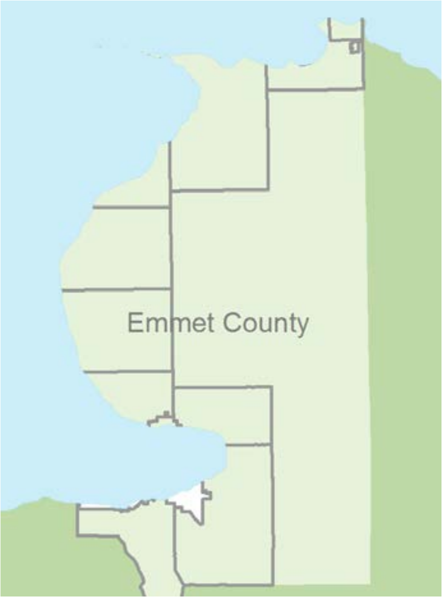

Map 8
Percent Tree Canopy
Lake Michigan
Bay View
Rose
Mitchell
Lake
Jackson
State
Hill
Lindell
Jennings
Atkins
Northmen
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clarion
Bay Ridge
Coastal
Peninsula
US Bike Route 35
Cliffs
Quarry
Preserve
Charlevoix
Wildwinds
31
0.50 - 9.62% (1)
9.63 - 18.92% (2)
18.93 - 28.57% (3)
28.58 - 37.70% (4)
37.71 - 80.00% (5)


Emmet County

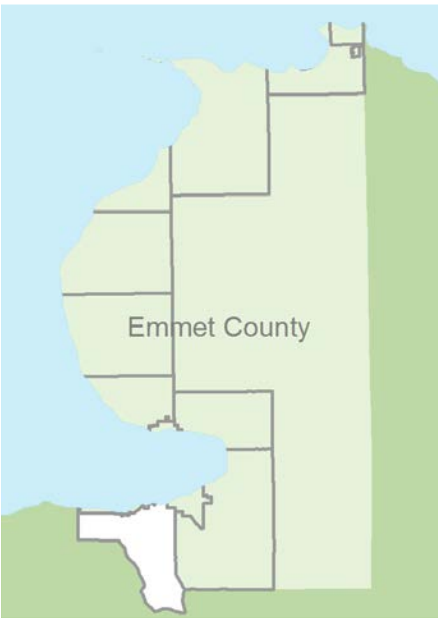

Emmet County

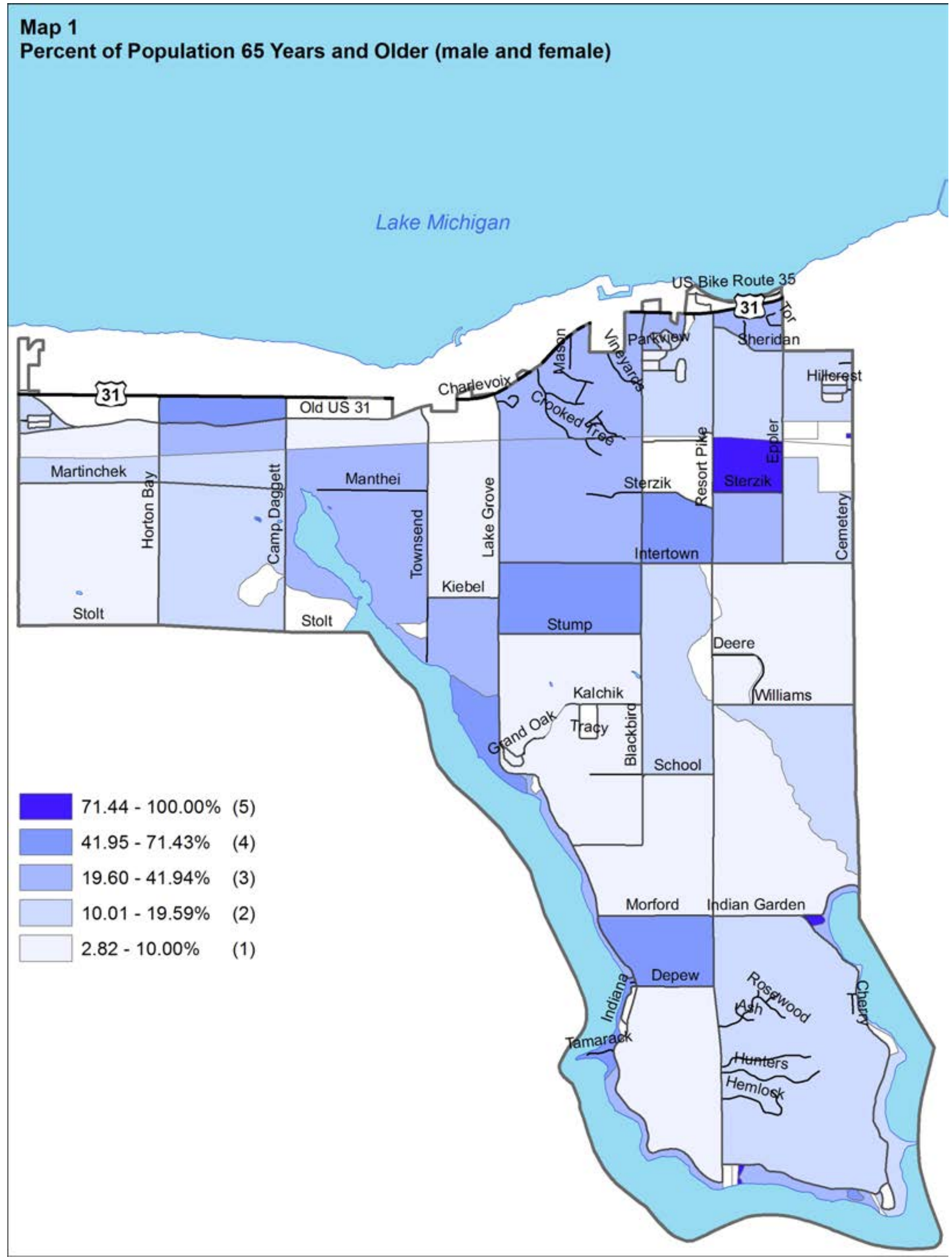

Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
Bay Ridge
Coastal
Preserve
Charlevoix
Wildwinds
Peninsula
US Bike Route 35
Cliffs
Quarry
31
Bay View
Rose
Mitchell
Lake
Jackson
State
Hill
Lindell
Jennings
Atkins
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clarion
Northmoor
additive score
re- score
8 (5)
7 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)

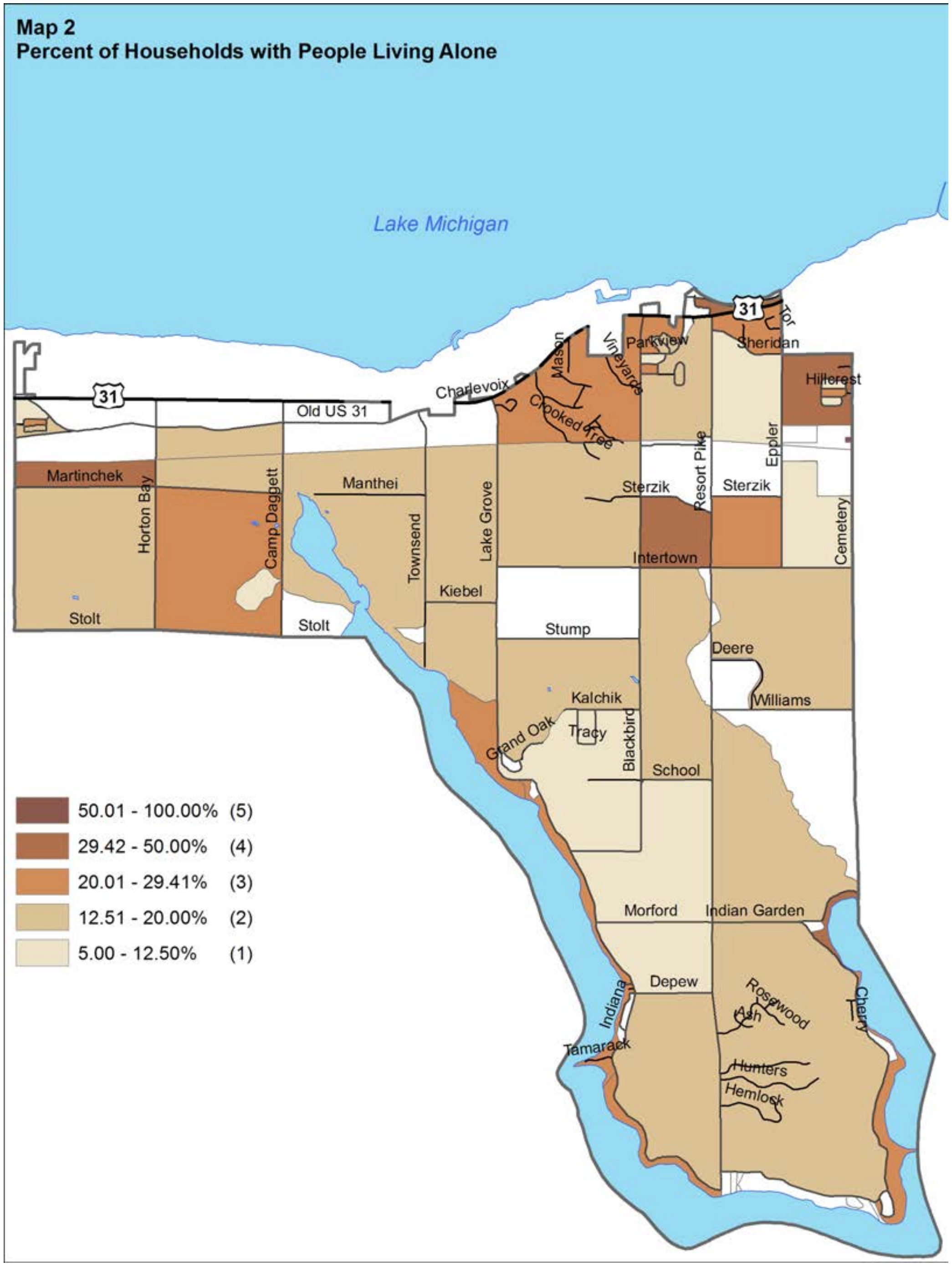

Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
Bay Ridge
Coastal
Preserve
31
Charlevoix
Wildwinds
US Bike Route 35
Peninsula
Cliffs
Quarry
Bay View
Rose
Mitchell
Lake
Jackson
State
Hill
Lindell
Jennings
Atkins
Sheridan
Curtis
Emmet
Howard
Hayner
Willis
Clarion
Northmen
total
score
8 - 9
7
6
4 - 5
2 - 3

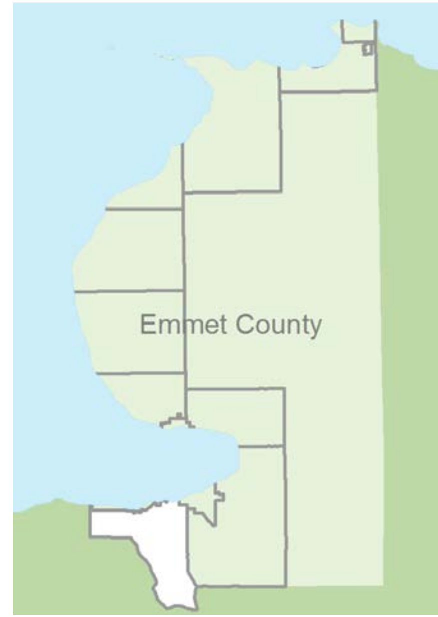

Emmet County

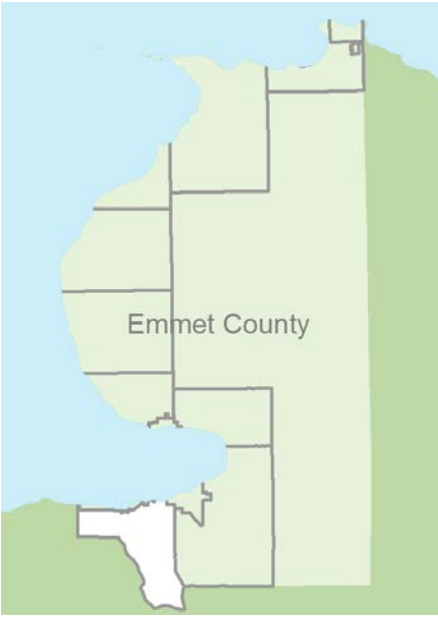
Resort Twp.

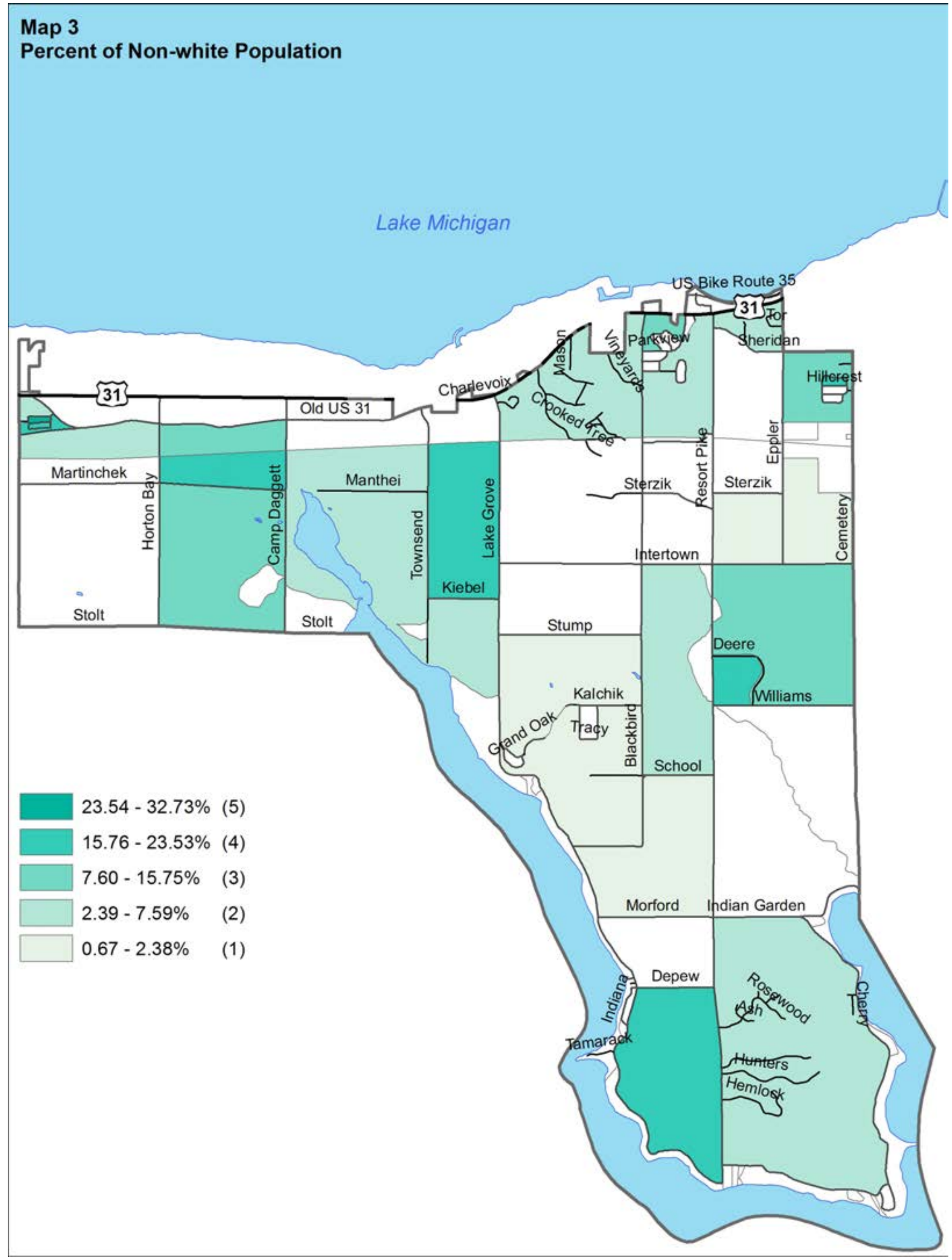

Emmet County

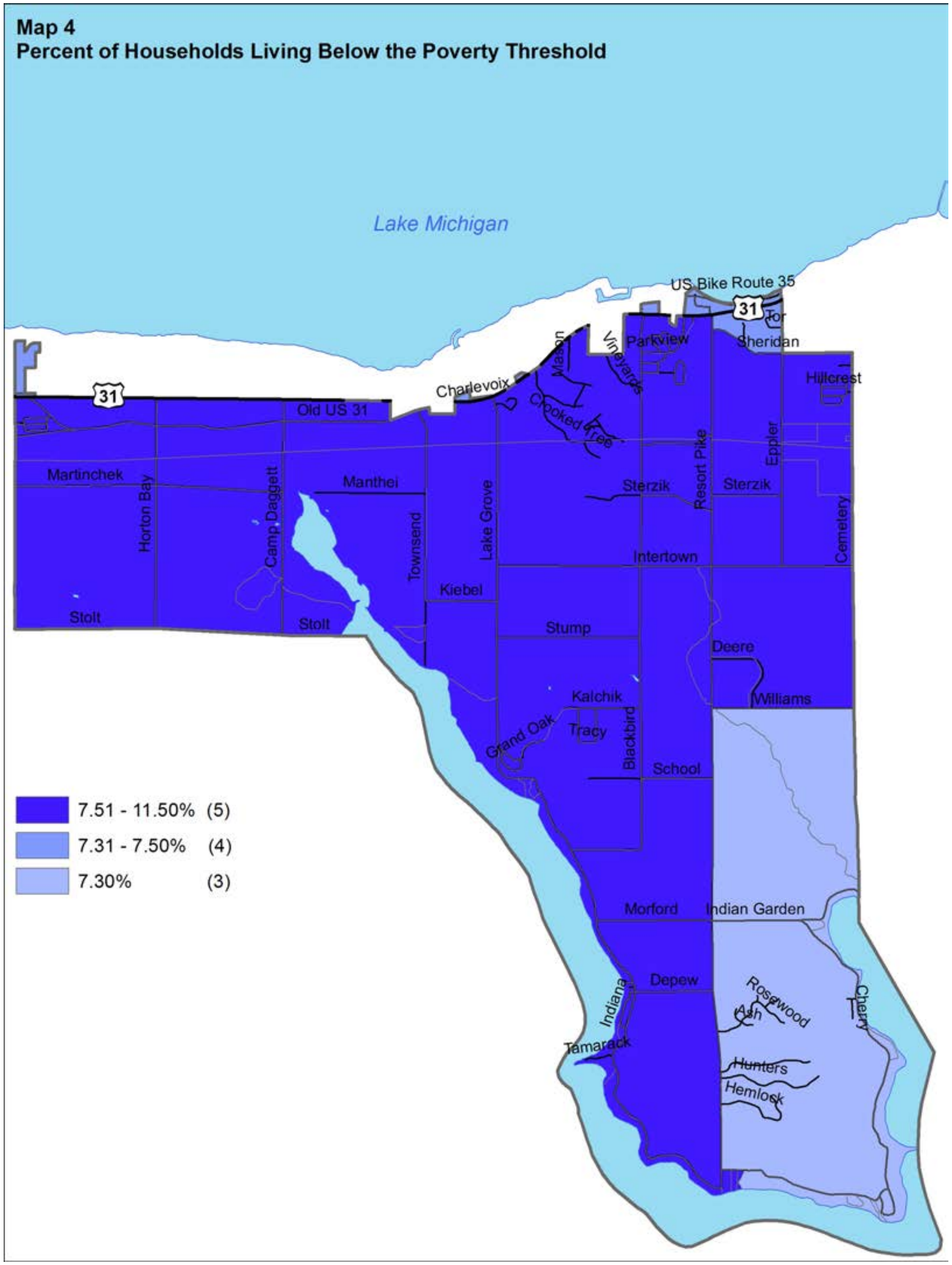

Map 1
Percent of Population 65 Years and Older (male and female)
Lake Michigan
US Bike Route 35
31
Old US 31
Charlevoix
Parkview
Sheridan
Hillcrest
Mason
Vineyards
Crooked Tree
Martinchek
Horton Bay
Camp Daggett
Manthei
Townsend
Lake Grove
Sterzik
Resort Pike
Eppler
Cemetery
Intertown
Kiebel
Stolt
Stump
Deere
Williams
Kalchik
Grand Oak
Tracy
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
71.44 - 100.00% (5)
41.95 - 71.43% (4)
19.60 - 41.94% (3)
10.01 - 19.59% (2)
2.82 - 10.00% (1)

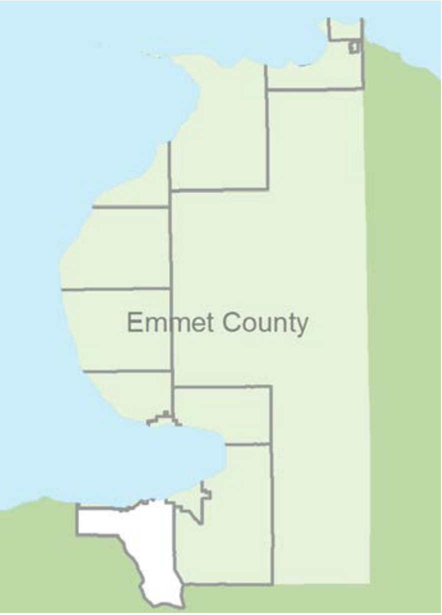

Map 2
Percent of Households with People Living Alone
Lake Michigan
31
Old US 31
Charlevoix
Mason
Vineyards
Parkview
Sheridan
Tor
Hillcrest
Crooked Tree
Martinchek
Horton Bay
Camp Daggett
Manthei
Townsend
Lake Grove
Sterzik
Resort Pike
Eppler
Intertown
Cemetery
Kiebel
Stolt
Stump
Deere
Williams
Kalchik
Grand Oak
Tracy
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
50.01 - 100.00% (5)
29.42 - 50.00% (4)
20.01 - 29.41% (3)
12.51 - 20.00% (2)
5.00 - 12.50% (1)

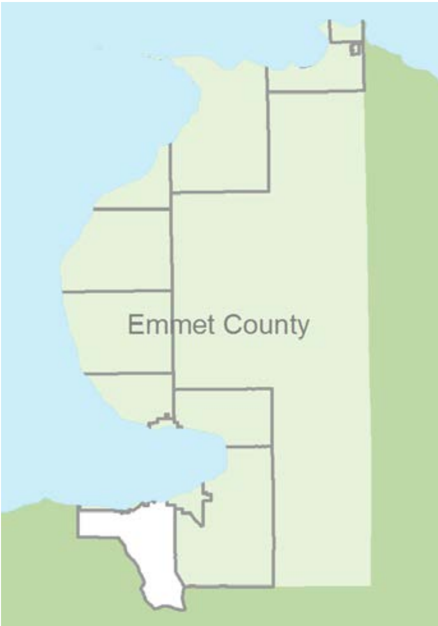

Emmet County

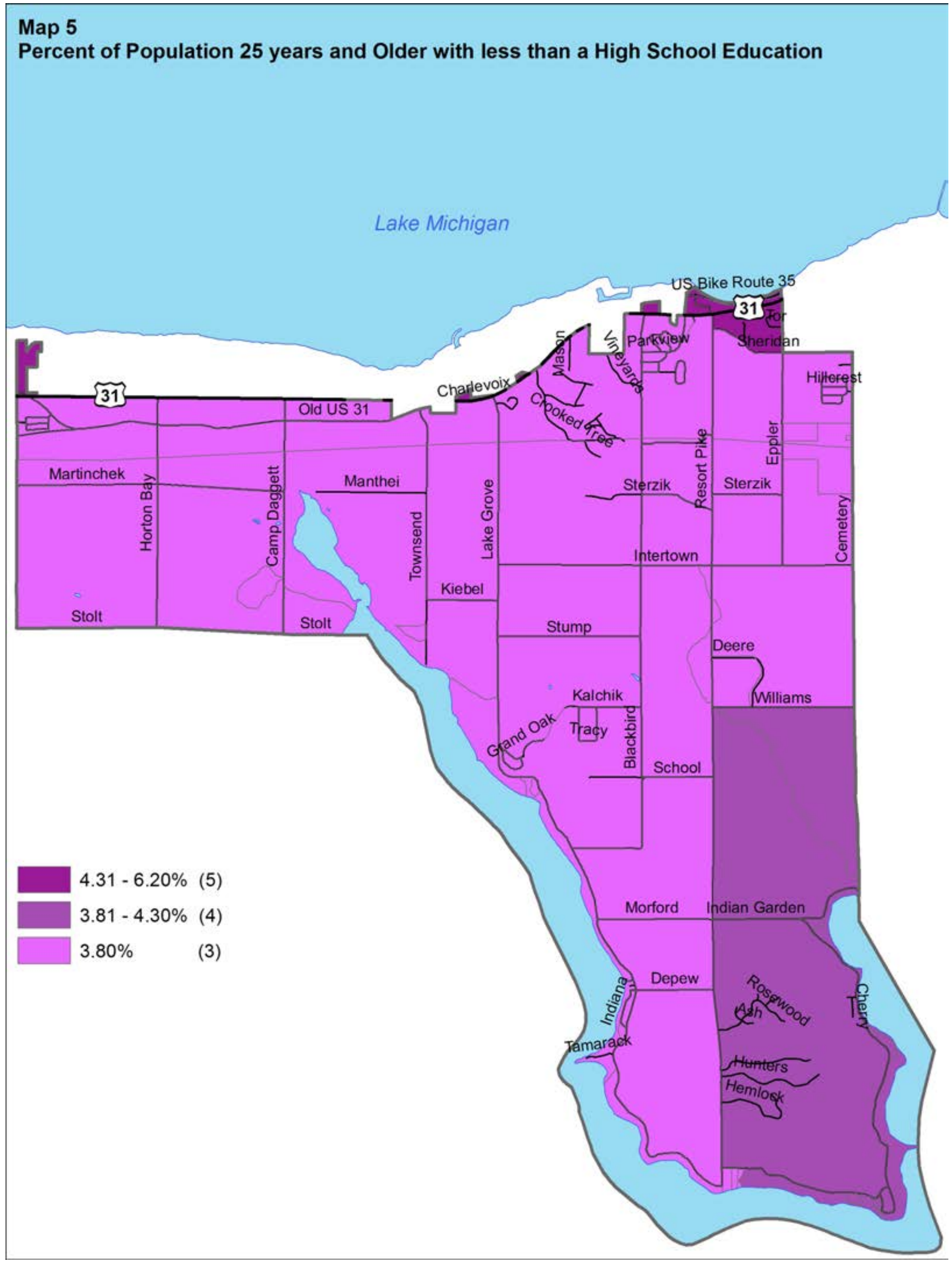

Emmet County

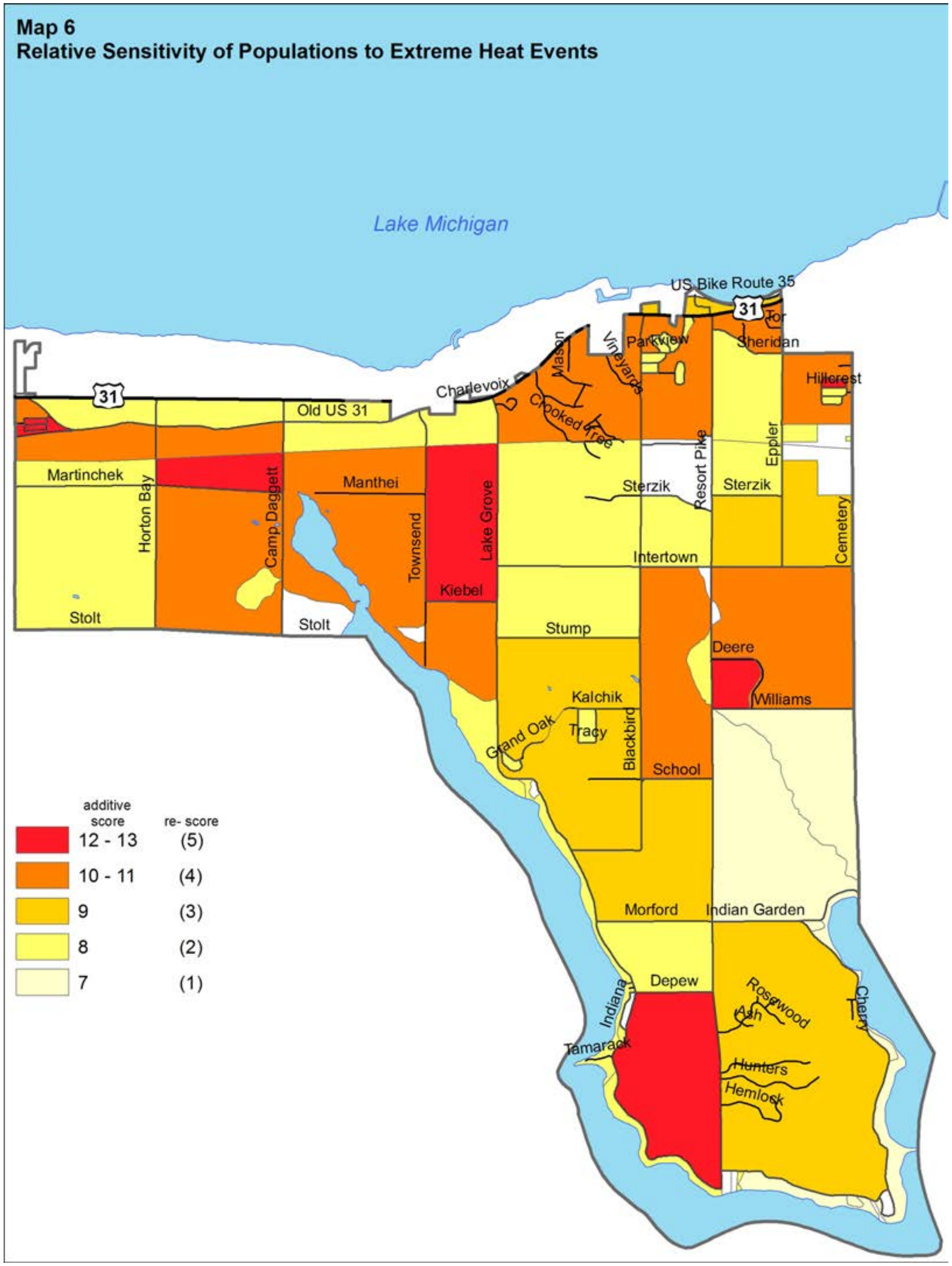

Map 3
Percent of Non-white Population
Lake Michigan
US Bike Route 35
31
Tor
Parkview
Sheridan
Hillcrest
Mason
Vineyards
Charlevoix
Crooked Tree
Old US 31
Martinchek
Horton Bay
Camp Daggett
Manthei
Townsend
Lake Grove
Kiebel
Sterzik
Resort Pike
Eppler
Cemetery
Intertown
Stolt
Stump
Deere
Williams
Kalchik
Grand Oak
Tracy
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
23.54 - 32.73% (5)
15.76 - 23.53% (4)
7.60 - 15.75% (3)
2.39 - 7.59% (2)
0.67 - 2.38% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
Lake Michigan
US Bike Route 35
31
Tor
Sheridan
Parkview
Vineyards
Mason
Charlevoix
Crooked Tree
Hillcrest
Old US 31
Martinchek
Horton Bay
Camp Daggett
Manthei
Townsend
Lake Grove
Sterzik
Resort Pike
Eppler
Cemetery
Intertown
Kiebel
Stolt
Stump
Deere
Williams
Kalchik
Grand Oak
Tracy
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
7.51 - 11.50% (5)
7.31 - 7.50% (4)
7.30% (3)

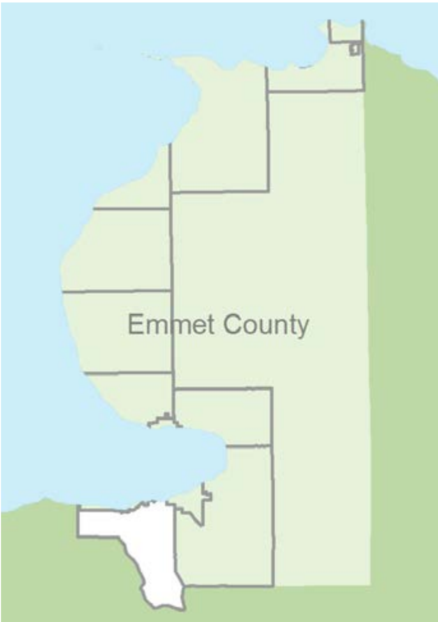

Emmet County

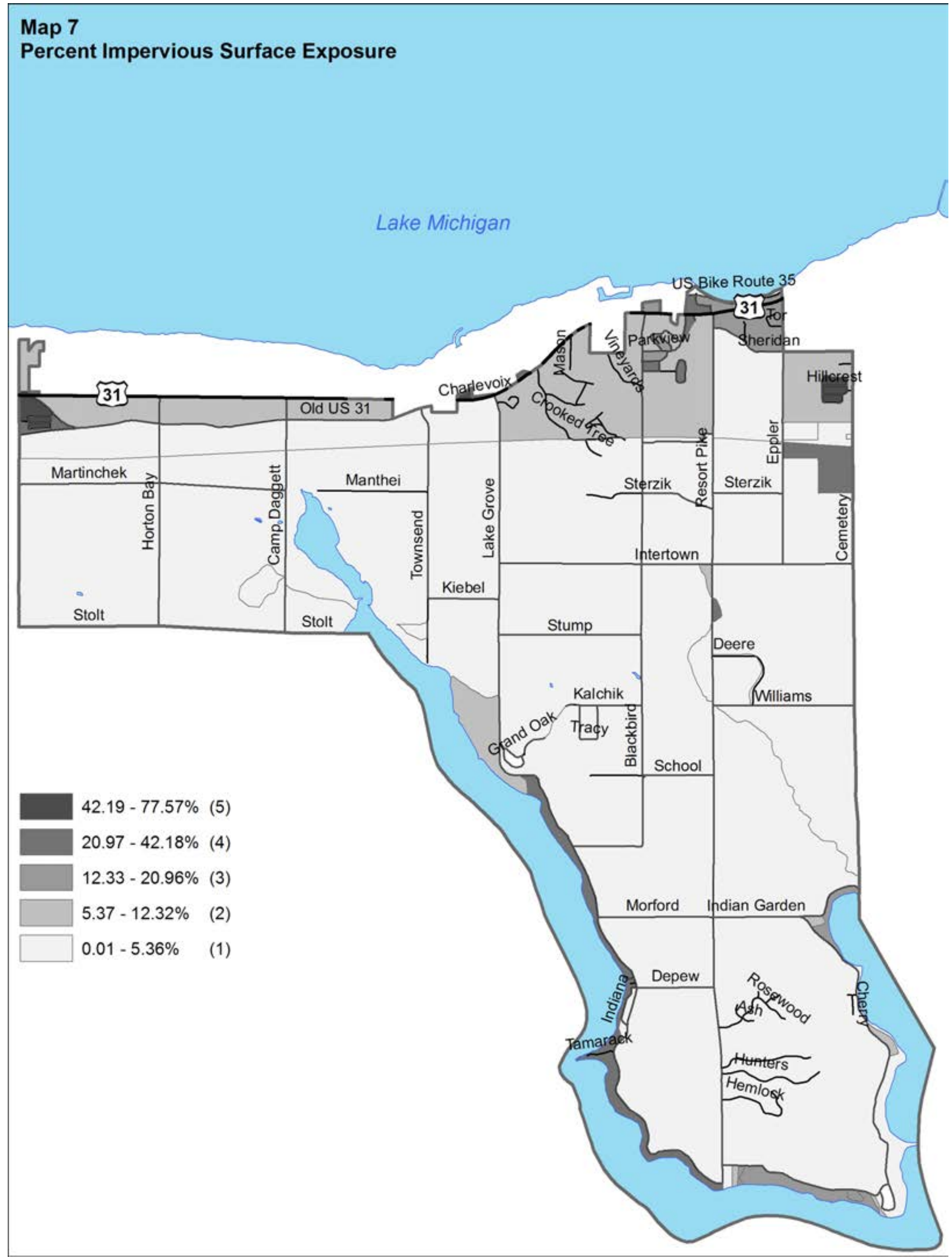

Emmet County

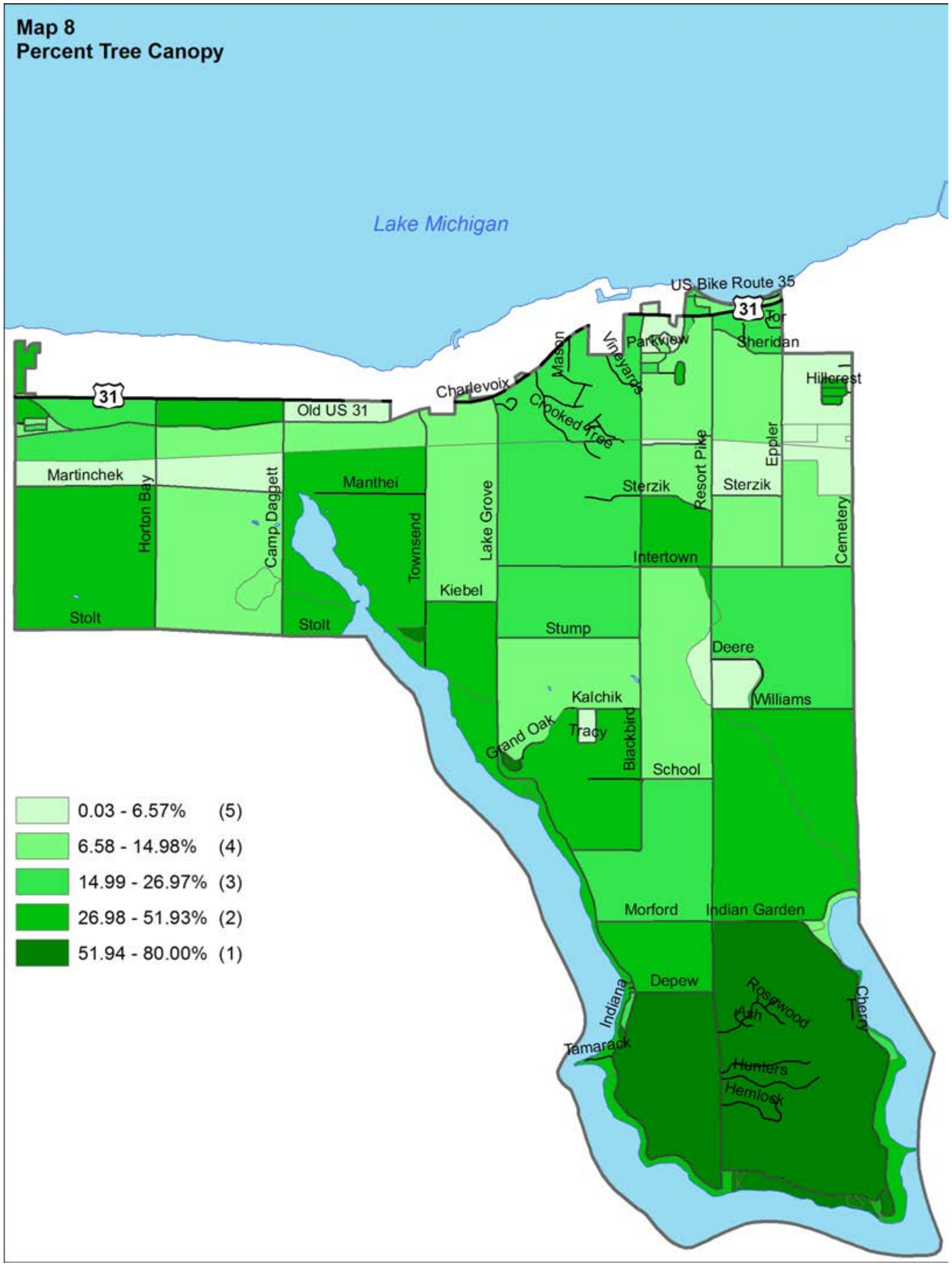

Map 5
Percent of Population 25 years and Older with less than a High School Education
Lake Michigan
US Bike Route 35
31
Old US 31
Charlevoix
Parkview
Sheridan
Hillcrest
Mason
Vineyards
Crooked Tree
Martinchek
Manthei
Sterzik
Resort Pike
Eppler
Horton Bay
Camp Daggett
Townsend
Lake Grove
Intertown
Cemetery
Kiebel
Stolt
Stump
Deere
Williams
Kalchik
Tracy
Grand Oak
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
4.31 - 6.20% (5)
3.81 - 4.30% (4)
3.80% (3)

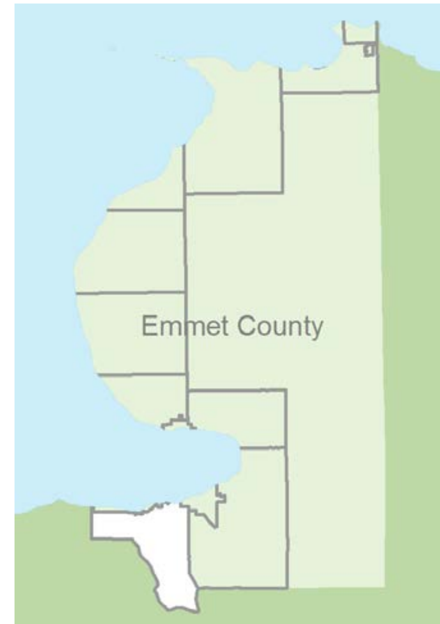

Map 6
Relative Sensitivity of Populations to Extreme Heat Events
Lake Michigan
US Bike Route 35
31
Charlevoix
Old US 31
Mason
Vineyards
Parkview
Tor
Sheridan
Hillcrest
Crooked Tree
Martinchek
Horton Bay
Camp Daggett
Manthei
Townsend
Lake Grove
Sterzik
Resort Pike
Eppler
Intertown
Cemetery
Kiebel
Stolt
Stump
Deere
Williams
Kalchik
Grand Oak
Tracy
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
additive score
re- score
12 - 13 (5)
10 - 11 (4)
9 (3)
8 (2)
7 (1)

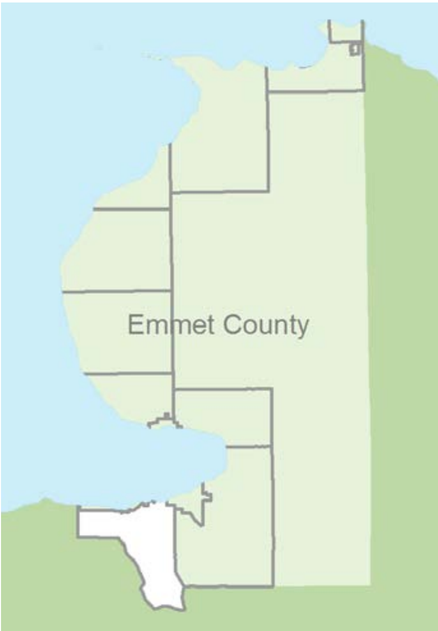

Emmet County

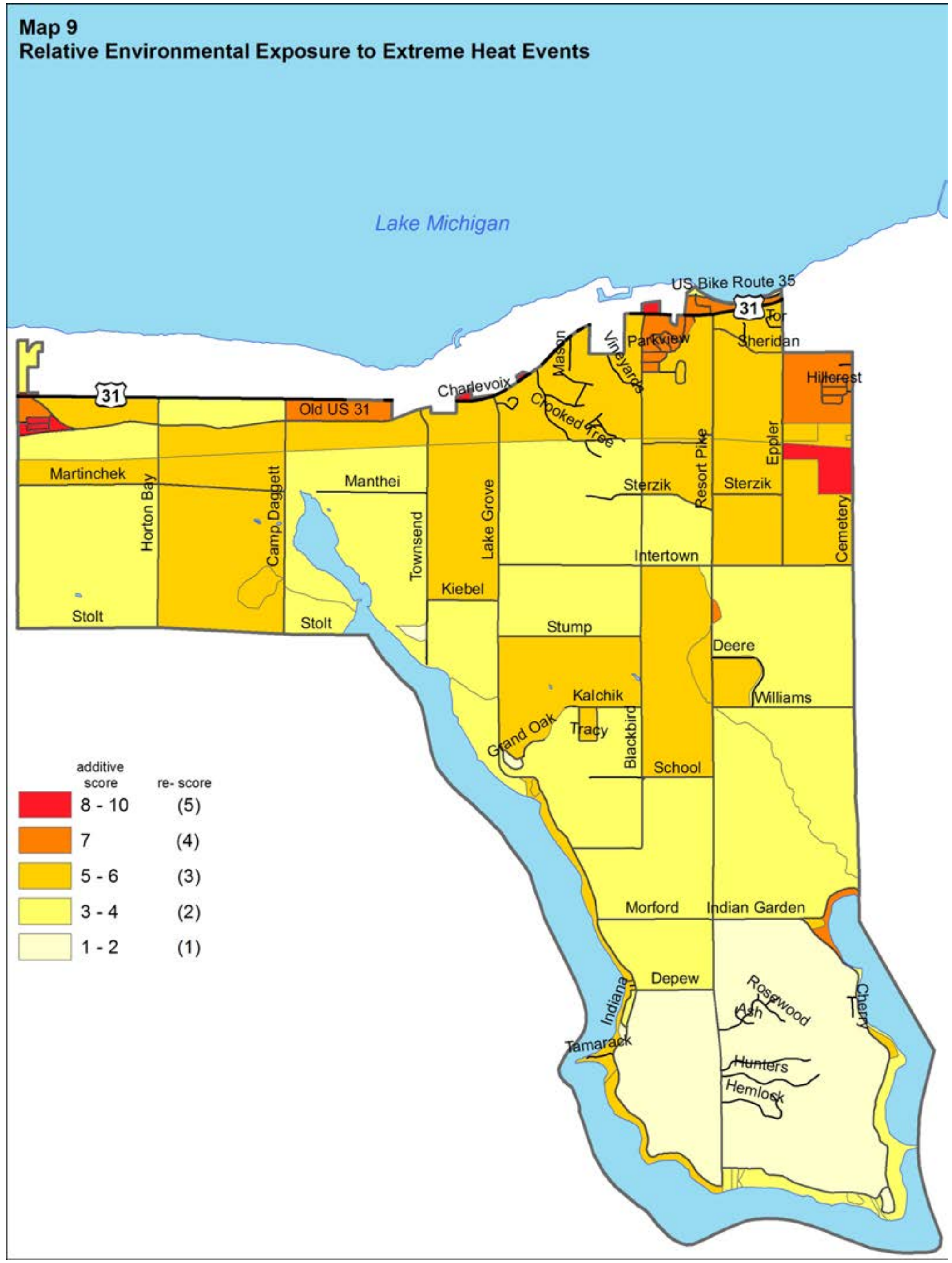

Emmet County

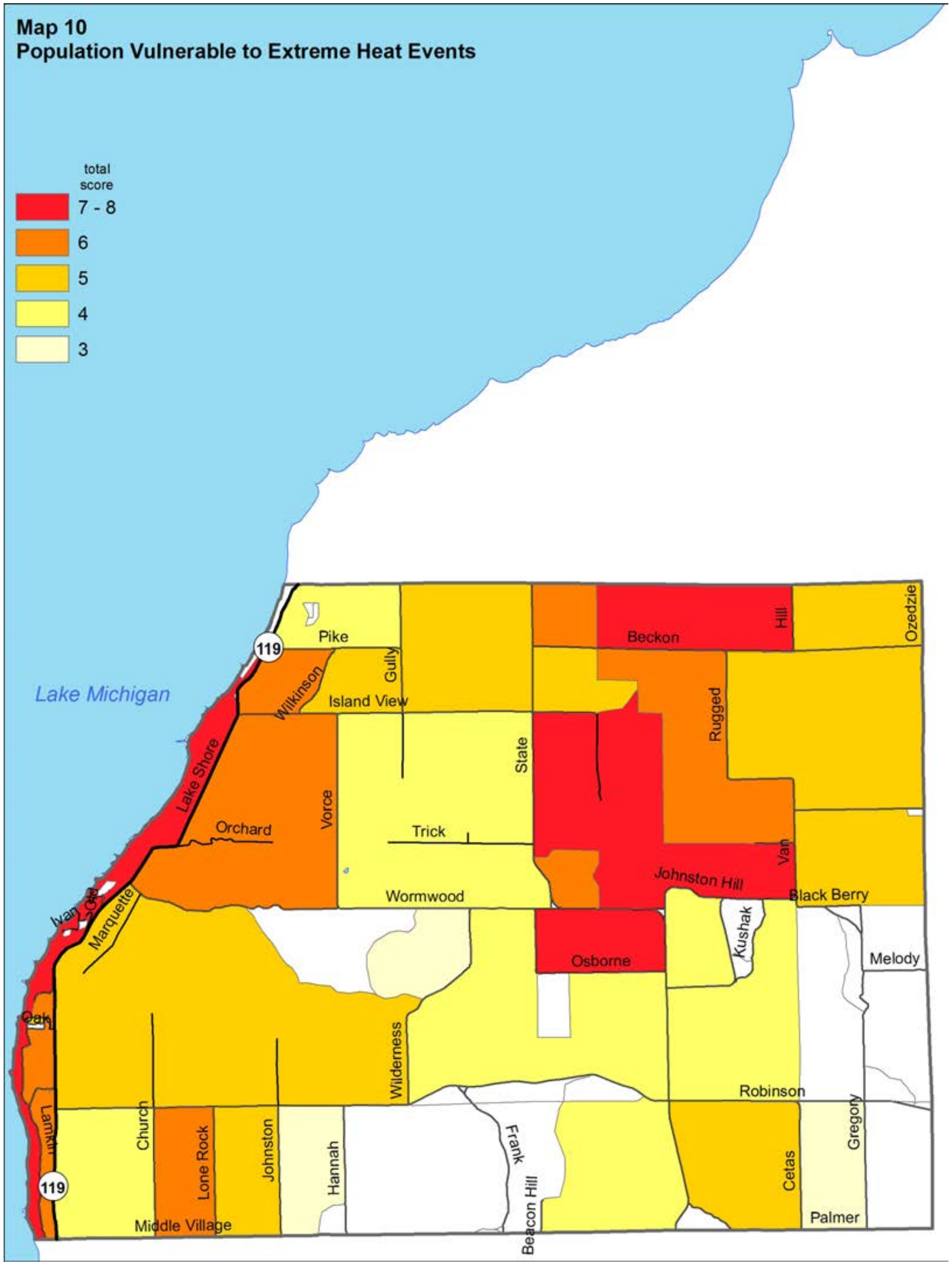

Map 7
Percent Impervious Surface Exposure
Lake Michigan
US Bike Route 35
31
Old US 31
Charlevoix
Parkview
Sheridan
Hillcrest
Vineyards
Mason
Crooked Tree
Martinchek
Horton Bay
Camp Daggett
Manthei
Townsend
Lake Grove
Sterzik
Resort Pike
Eppler
Cemetery
Intertown
Kiebel
Stolt
Stump
Deere
Williams
Kalchik
Grand Oak
Tracy
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
42.19 - 77.57% (5)
20.97 - 42.18% (4)
12.33 - 20.96% (3)
5.37 - 12.32% (2)
0.01 - 5.36% (1)


Map 8
Percent Tree Canopy
Lake Michigan
US Bike Route 35
31
Tor
Sheridan
Parkview
Vineyards
Mason
Hillcrest
Charlevoix
Crooked Tree
Old US 31
Martinchek
Horton Bay
Camp Daggett
Manthei
Townsend
Lake Grove
Sterzik
Resort Pike
Eppler
Cemetery
Intertown
Kiebel
Stolt
Stump
Deere
Williams
Kalchik
Tracy
Grand Oak
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
0.03 - 6.57% (5)
6.58 - 14.98% (4)
14.99 - 26.97% (3)
26.98 - 51.93% (2)
51.94 - 80.00% (1)


Emmet County


Emmet County


Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
US Bike Route 35
31
Old US 31
Charlevoix
Parkview
Sheridan
Hillcrest
Mason
Vineyards
Crooked Tree
Martinchek
Horton Bay
Camp Daggett
Manthei
Townsend
Lake Grove
Sterzik
Resort Pike
Eppler
Cemetery
Intertown
Kiebel
Stolt
Stump
Deere
Williams
Kalchik
Grand Oak
Tracy
Blackbird
School
Morford
Indian Garden
Depew
Indiana
Tamarack
Rosewood
Ash
Cherry
Hunters
Hemlock
additive score
re- score
8 - 10 (5)
7 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)



Map 10
Population Vulnerable to Extreme Heat Events

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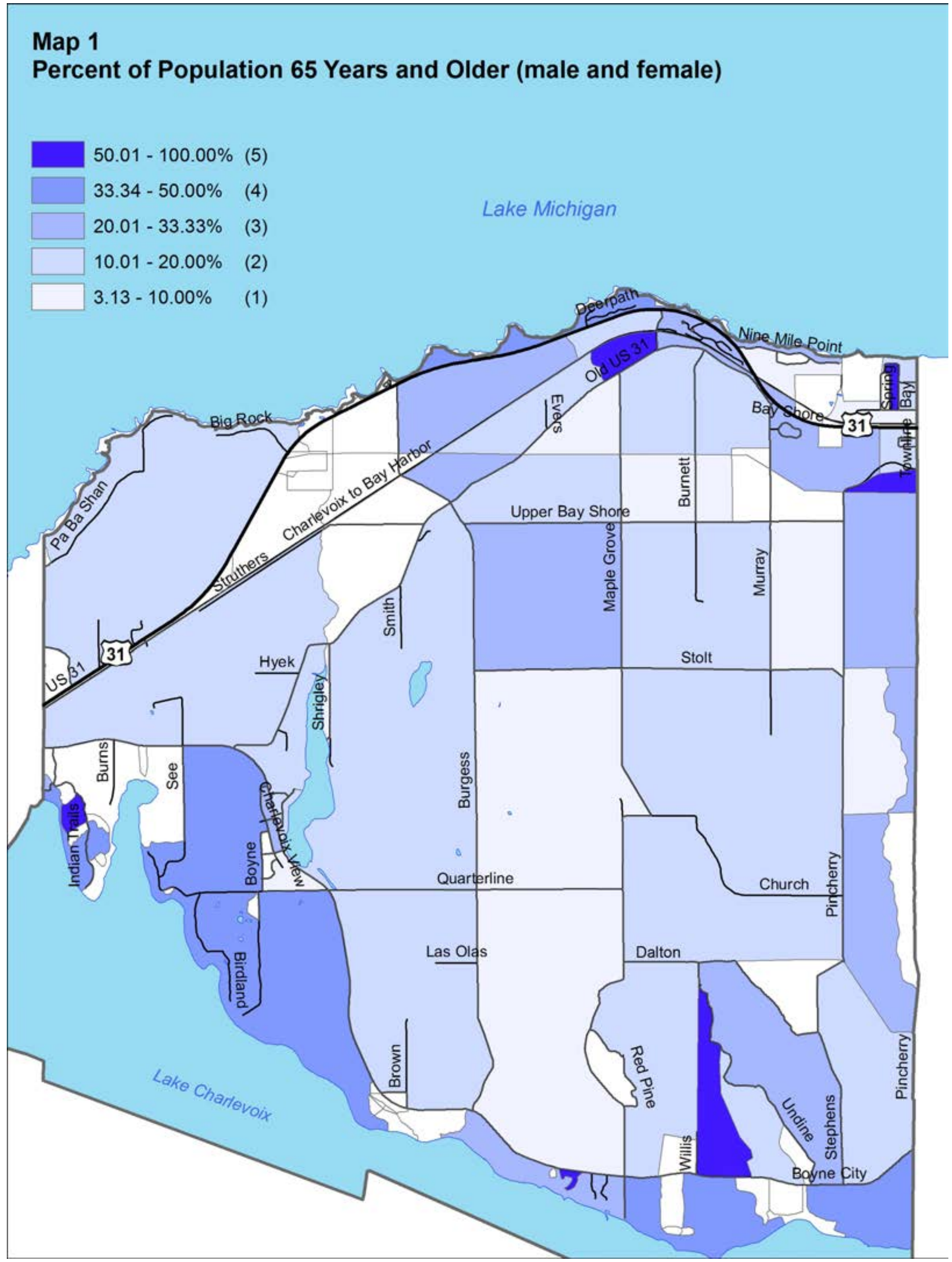
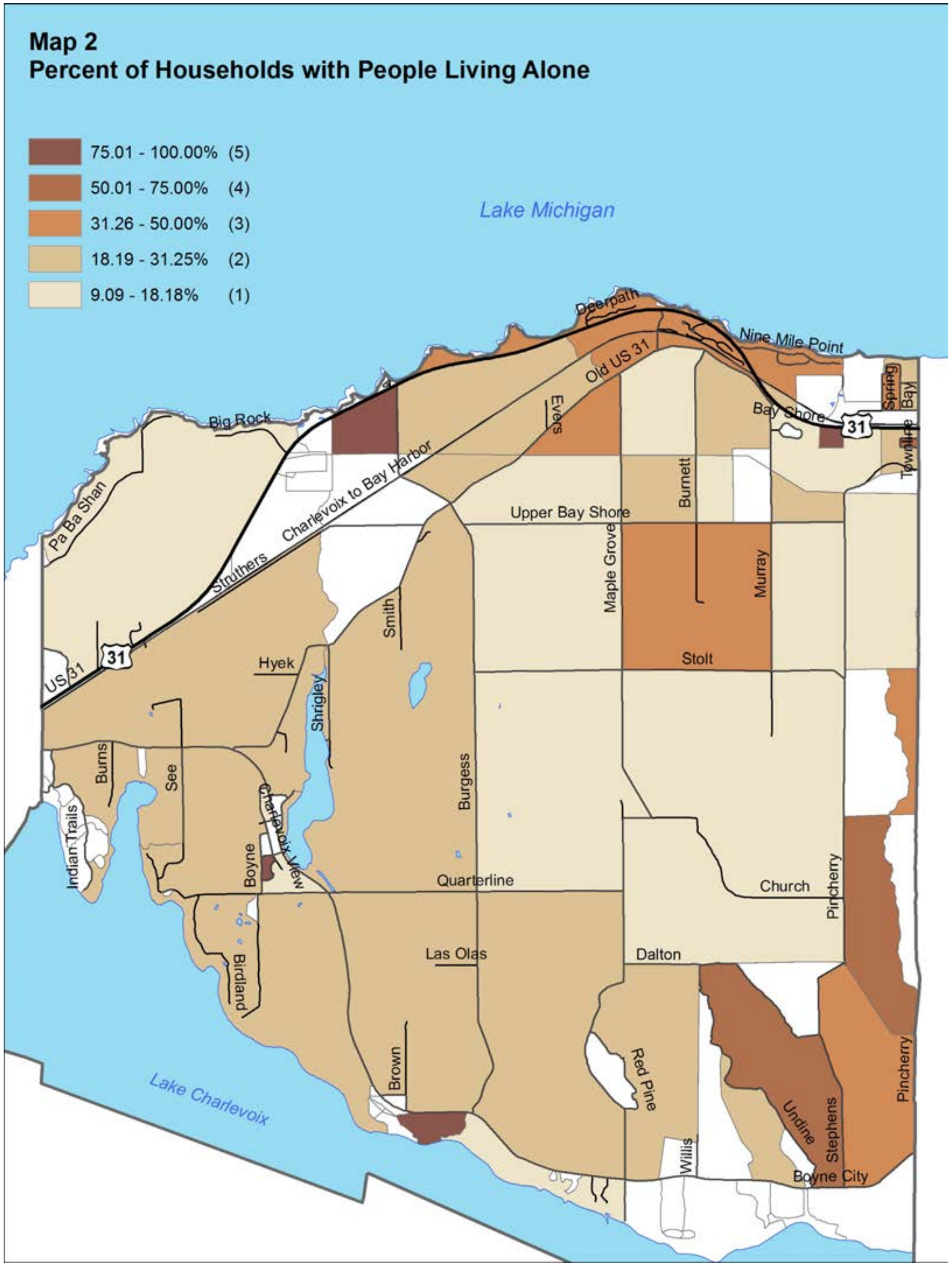
Charlevoix County

Hayes Twp.

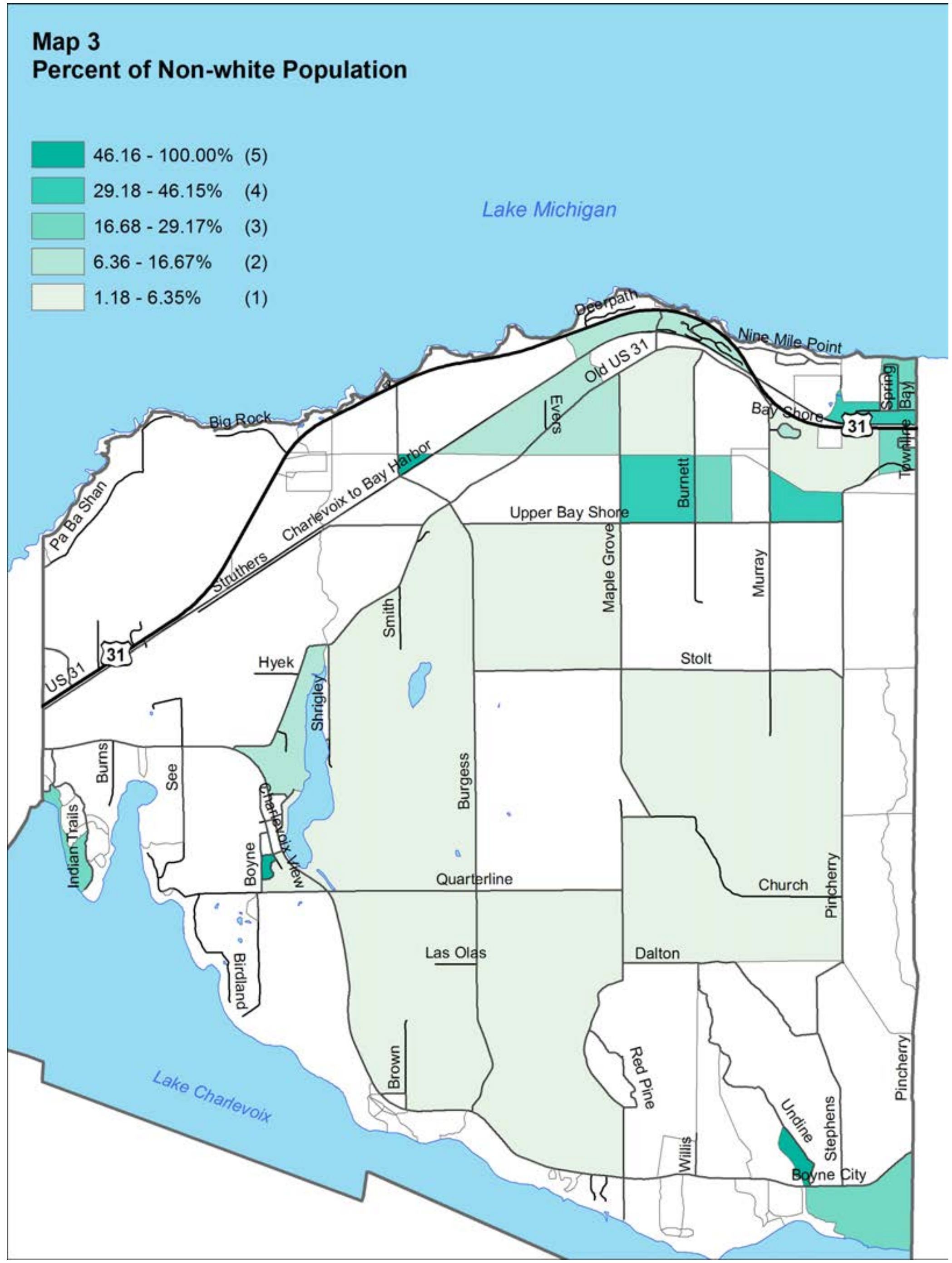

Charlevoix County

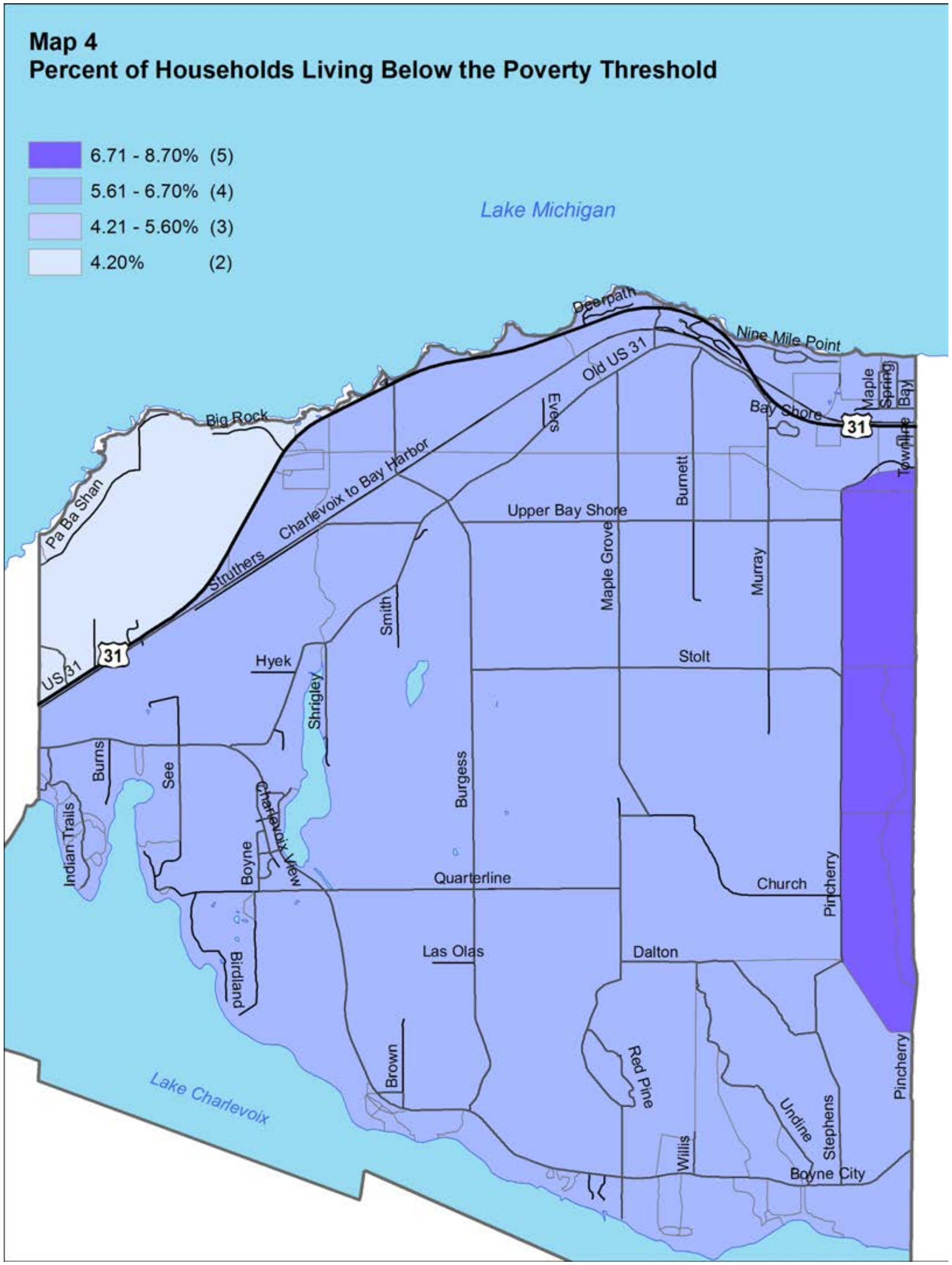

Map 1
Percent of Population 65 Years and Older (male and female)
50.01 - 100.00% (5)
33.34 - 50.00% (4)
20.01 - 33.33% (3)
10.01 - 20.00% (2)
3.13 - 10.00% (1)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Big Rock
Evers
Bay Shore
Spring
Bay
Townline
31
Pa Ba Shan
Charlevoix to Bay Harbor
Burnett
Upper Bay Shore
Struthers
Maple Grove
Murray
Smith
US 31
Hyek
Stolt
Shrigley
Burns
See
Burgess
Charlevoix View
Indian Trails
Boyne
Quarterline
Church
Pincherry
Las Olas
Dalton
Birdland
Red Pine
Brown
Undine
Stephens
Willis
Boyne City


Map 2
Percent of Households with People Living Alone
75.01 - 100.00% (5)
50.01 - 75.00% (4)
31.26 - 50.00% (3)
18.19 - 31.25% (2)
9.09 - 18.18% (1)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Big Rock
Evers
Bay Shore
Spring
Bay
Townline
31
Pa Ba Shan
Charlevoix to Bay Harbor
Upper Bay Shore
Burnett
Struthers
Maple Grove
Murray
Smith
Stolt
US 31
Hyek
Shrigley
Burns
See
Burgess
Indian Trails
Boyne
Charlevoix View
Quarterline
Church
Pincherry
Las Olas
Dalton
Birdland
Brown
Red Pine
Undine
Stephens
Willis
Boyne City


Charlevoix County

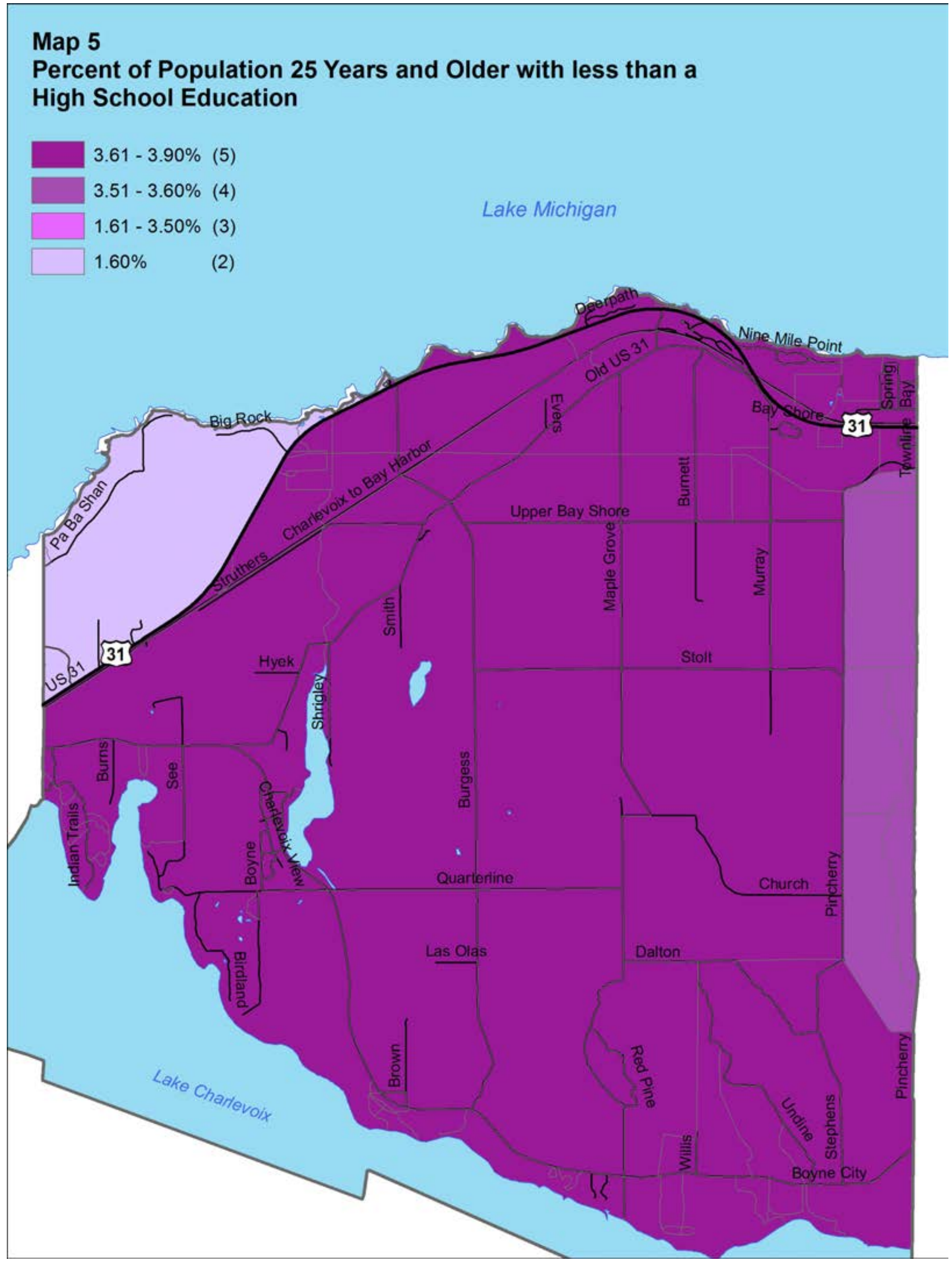

Charlevoix County

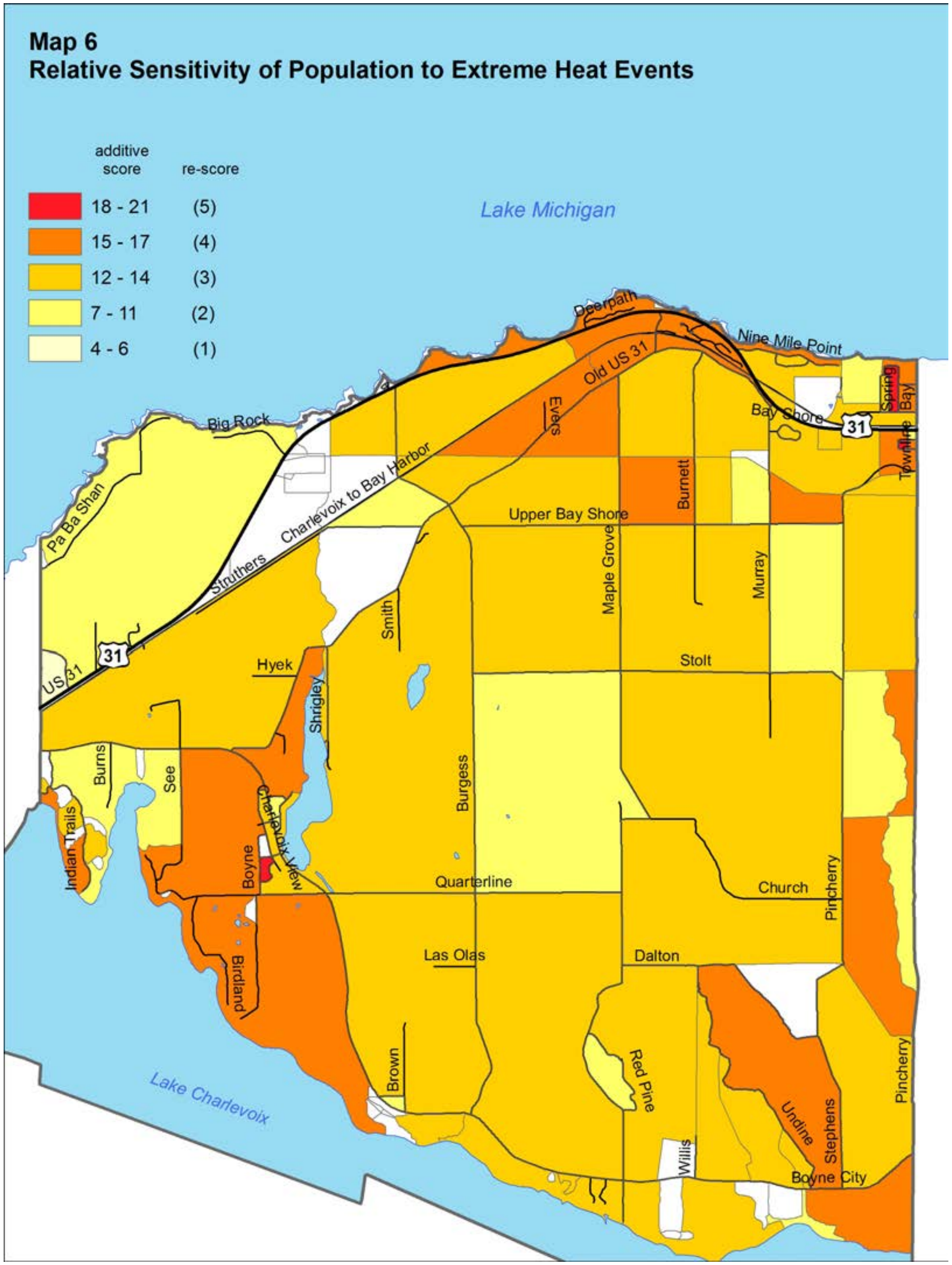

Map 3
Percent of Non-white Population
46.16 - 100.00% (5)
29.18 - 46.15% (4)
16.68 - 29.17% (3)
6.36 - 16.67% (2)
1.18 - 6.35% (1)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Evers
Bay Shore
31
Spring
Bay
Townline
Big Rock
Charlevoix to Bay Harbor
Pa Ba Shan
Struthers
Upper Bay Shore
Burnett
Maple Grove
Murray
Smith
Stolt
US 31
Hyek
Shrigley
Burns
See
Indian Trails
Charlevoix View
Boyne
Burgess
Quarterline
Church
Pincherry
Las Olas
Dalton
Birdland
Brown
Red Pine
Willis
Undine
Stephens
Boyne City


Map 4
Percent of Households Living Below the Poverty Threshold
6.71 - 8.70% (5)
5.61 - 6.70% (4)
4.21 - 5.60% (3)
4.20% (2)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Big Rock
Pa Ba Shan
Charlevoix to Bay Harbor
Struthers
US 31
31
Evers
Bay Shore
Maple
Spring
Bay
Townline
Upper Bay Shore
Burnett
Maple Grove
Murray
Smith
Hyek
Shrigley
Stolt
Burns
See
Indian Trails
Boyne
Charlevoix View
Burgess
Quarterline
Church
Pincherry
Las Olas
Dalton
Birdland
Brown
Red Pine
Undine
Stephens
Willis
Boyne City


Charlevoix County

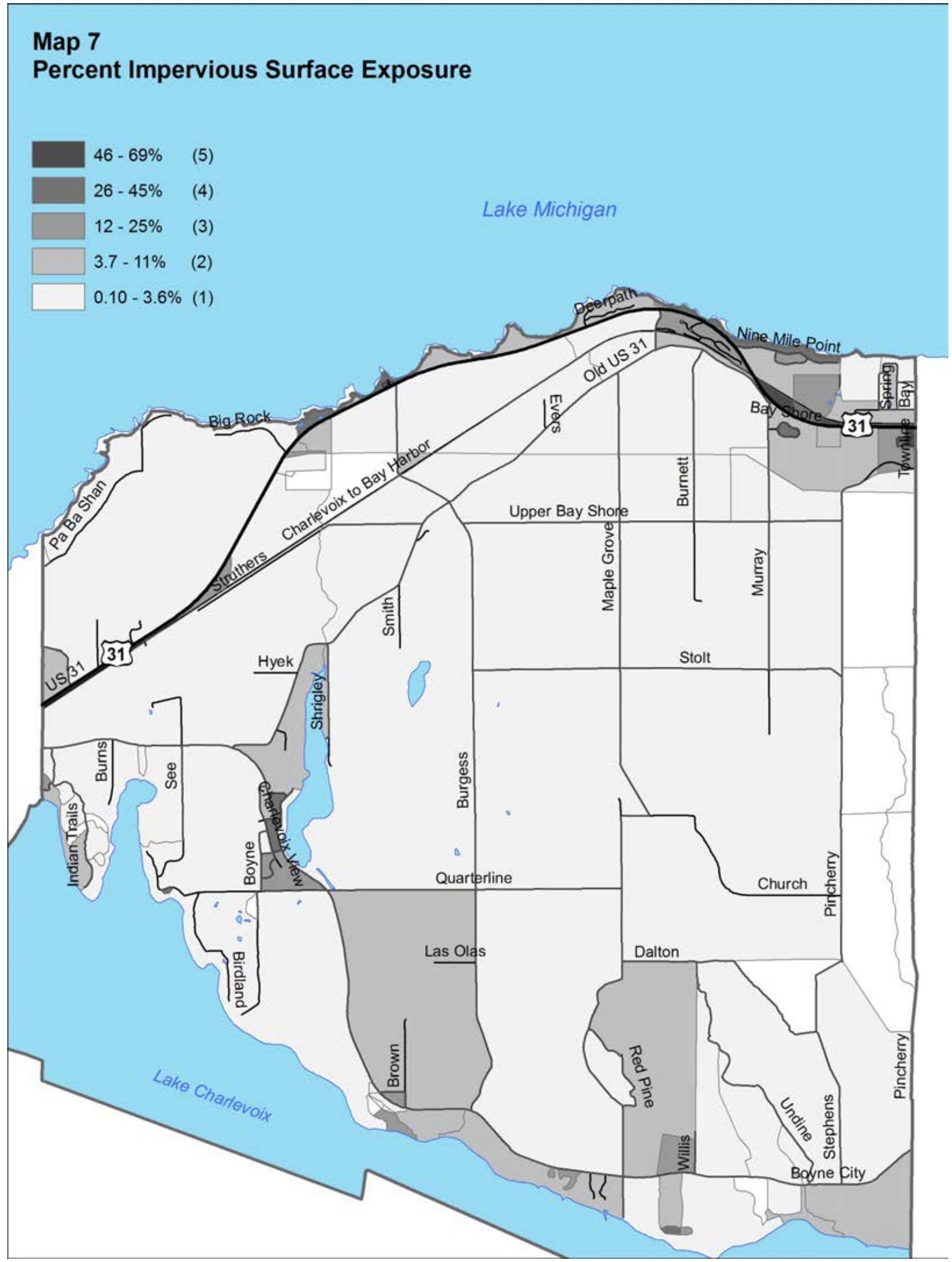

Charlevoix County

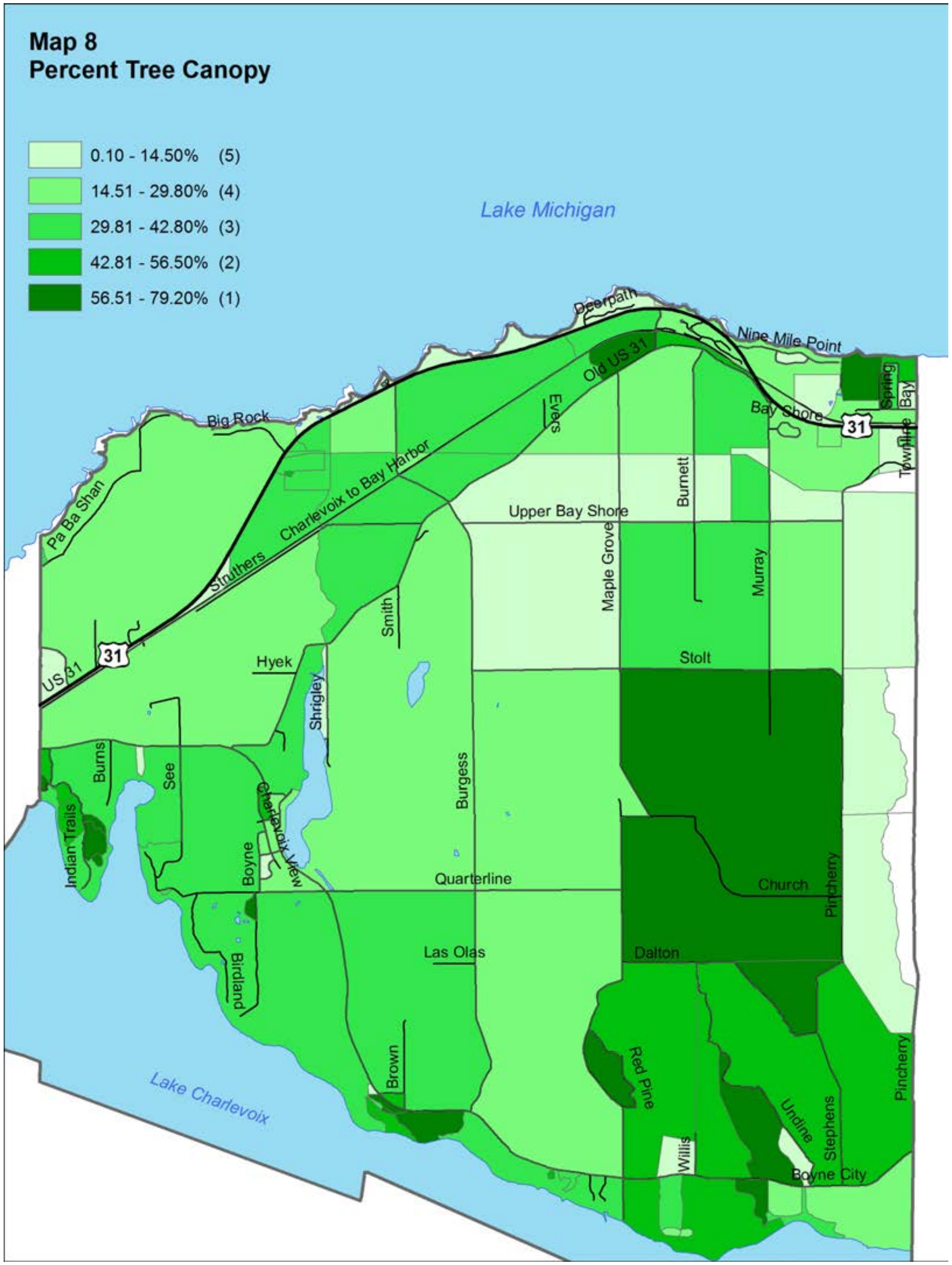

Map 5
Percent of Population 25 Years and Older with less than a High School Education
3.61 - 3.90% (5)
3.51 - 3.60% (4)
1.61 - 3.50% (3)
1.60% (2)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Evers
Big Rock
Bay Shore
31
Spring
Bay
Townline
Pa Ba Shan
Charlevoix to Bay Harbor
Burnett
Upper Bay Shore
Struthers
Maple Grove
Murray
Smith
US 31
Hyek
Stolt
Shrigley
Burns
See
Burgess
Indian Trails
Charlevoix View
Boyne
Quarterline
Church
Pincherry
Birdland
Las Olas
Dalton
Brown
Red Pine
Undine
Stephens
Willis
Boyne City


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
18 - 21 (5)
15 - 17 (4)
12 - 14 (3)
7 - 11 (2)
4 - 6 (1)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Big Rock
Pa Ba Shan
Charlevoix to Bay Harbor
Struthers
Evers
Bay Shore
31
Spring
Bay
Townline
Upper Bay Shore
Burnett
Maple Grove
Murray
Smith
Stolt
Hyek
US 31
Shrigley
Burns
See
Burgess
Indian Trails
Boyne
Charlevoix View
Quarterline
Church
Pincherry
Las Olas
Dalton
Birdland
Brown
Red Pine
Undine
Stephens
Willis
Boyne City


Charlevoix County

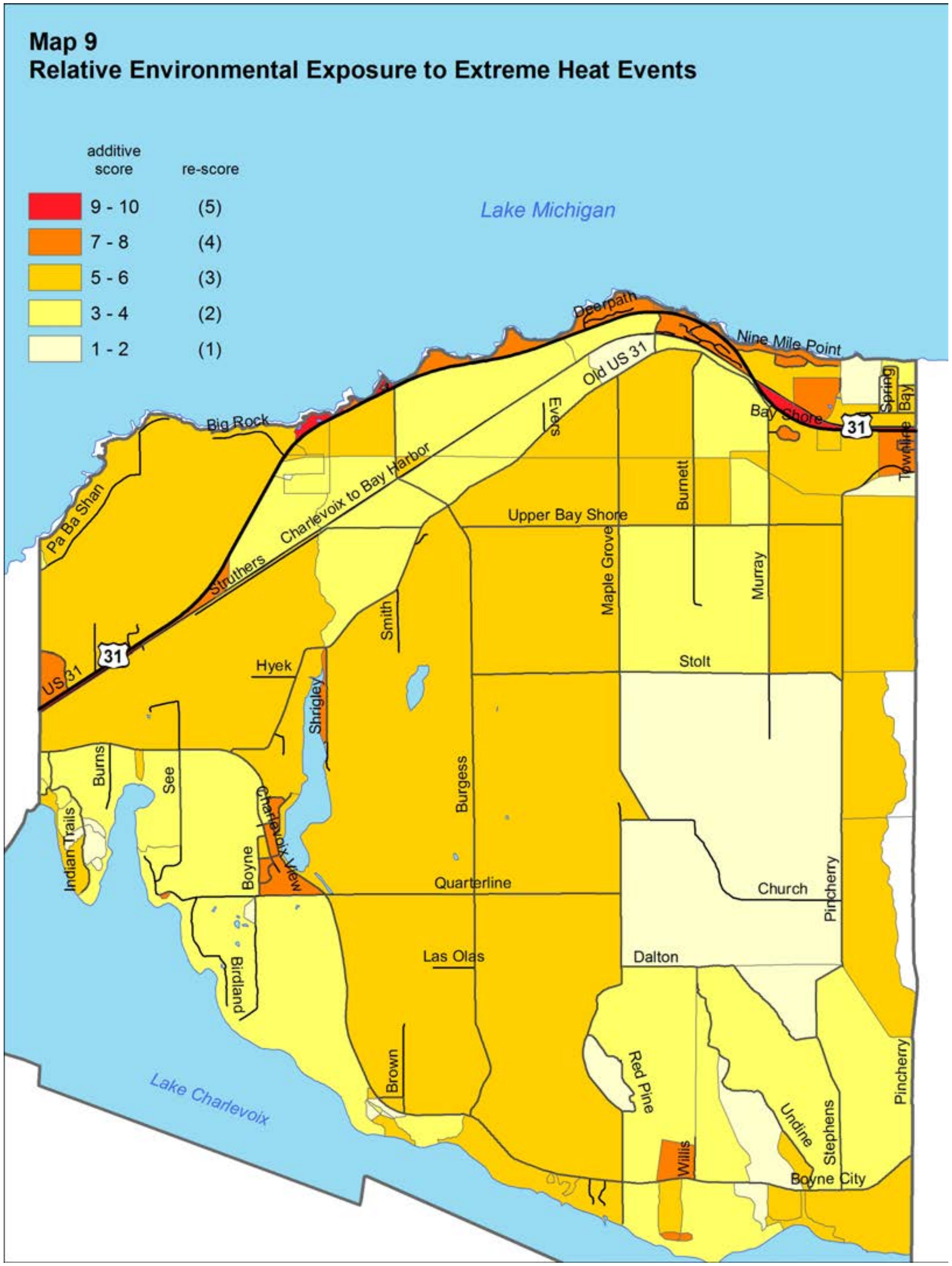

Charlevoix County

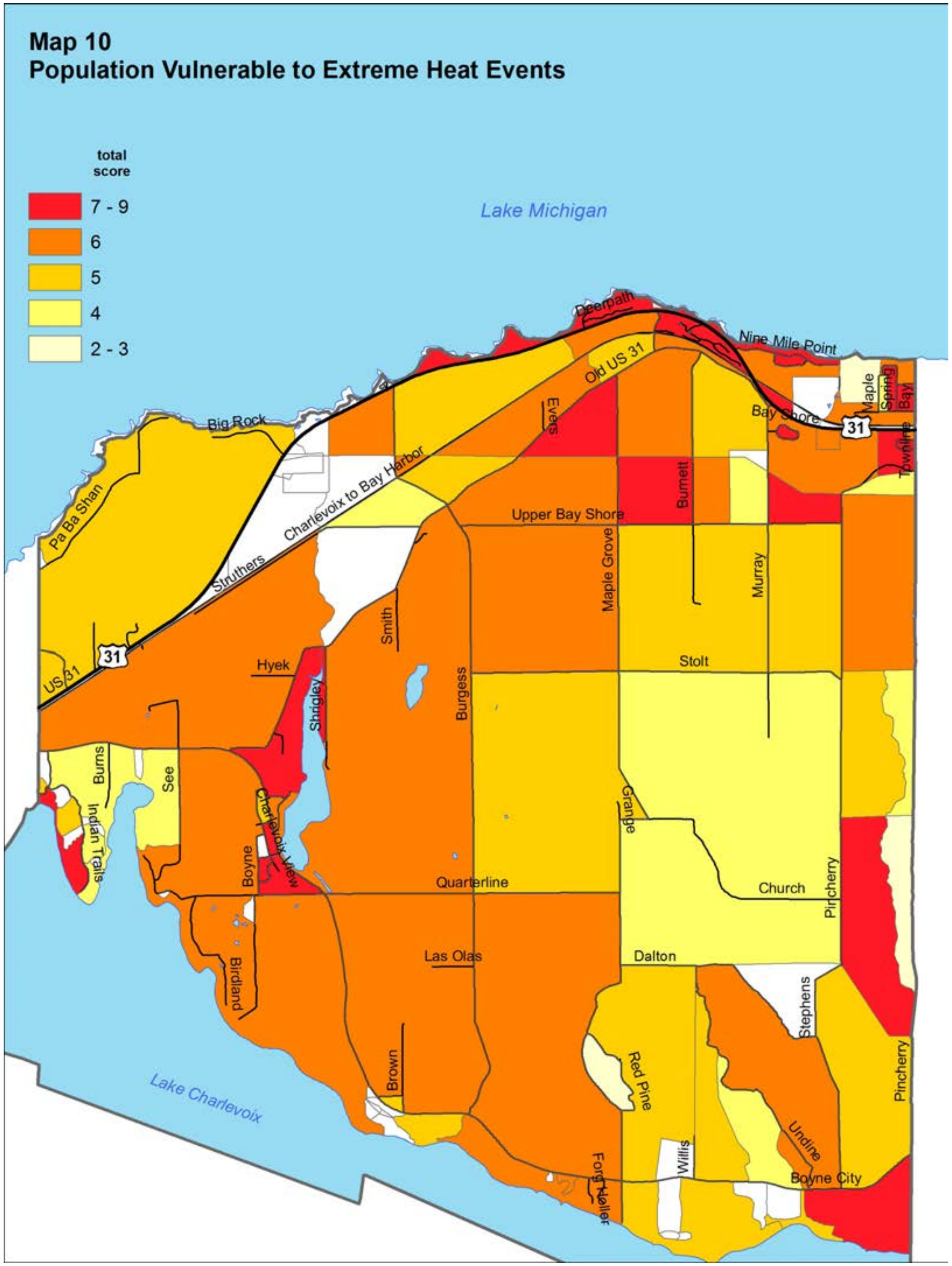

Map 7
Percent Impervious Surface Exposure
46 - 69% (5)
26 - 45% (4)
12 - 25% (3)
3.7 - 11% (2)
0.10 - 3.6% (1)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Big Rock
Pa Ba Shan
Charlevoix to Bay Harbor
Struthers
Evers
Burnett
Upper Bay Shore
Bay Shore
Spring
Bay
Townline
Maple Grove
Murray
Smith
US 31
31
Hyek
Shrigley
Stolt
Burns
See
Burgess
Indian Trails
Boyne
Charlevoix View
Quarterline
Church
Pinchery
Las Olas
Dalton
Birdland
Brown
Red Pine
Willis
Undine
Stephens
Boyne City


Map 8
Percent Tree Canopy
0.10 - 14.50% (5)
14.51 - 29.80% (4)
29.81 - 42.80% (3)
42.81 - 56.50% (2)
56.51 - 79.20% (1)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Bay Shore
31
Spring
Bay
Townline
Big Rock
Evers
Pa Ba Shan
Charlevoix to Bay Harbor
Upper Bay Shore
Burnett
Struthers
Maple Grove
Murray
Smith
Stolt
US 31
Hyek
Shrigley
Burns
See
Burgess
Indian Trails
Boyne
Charlevoix View
Quarterline
Church
Pincherry
Birdland
Las Olas
Dalton
Brown
Red Pine
Undine
Stephens
Willis
Boyne City


Charlevoix County

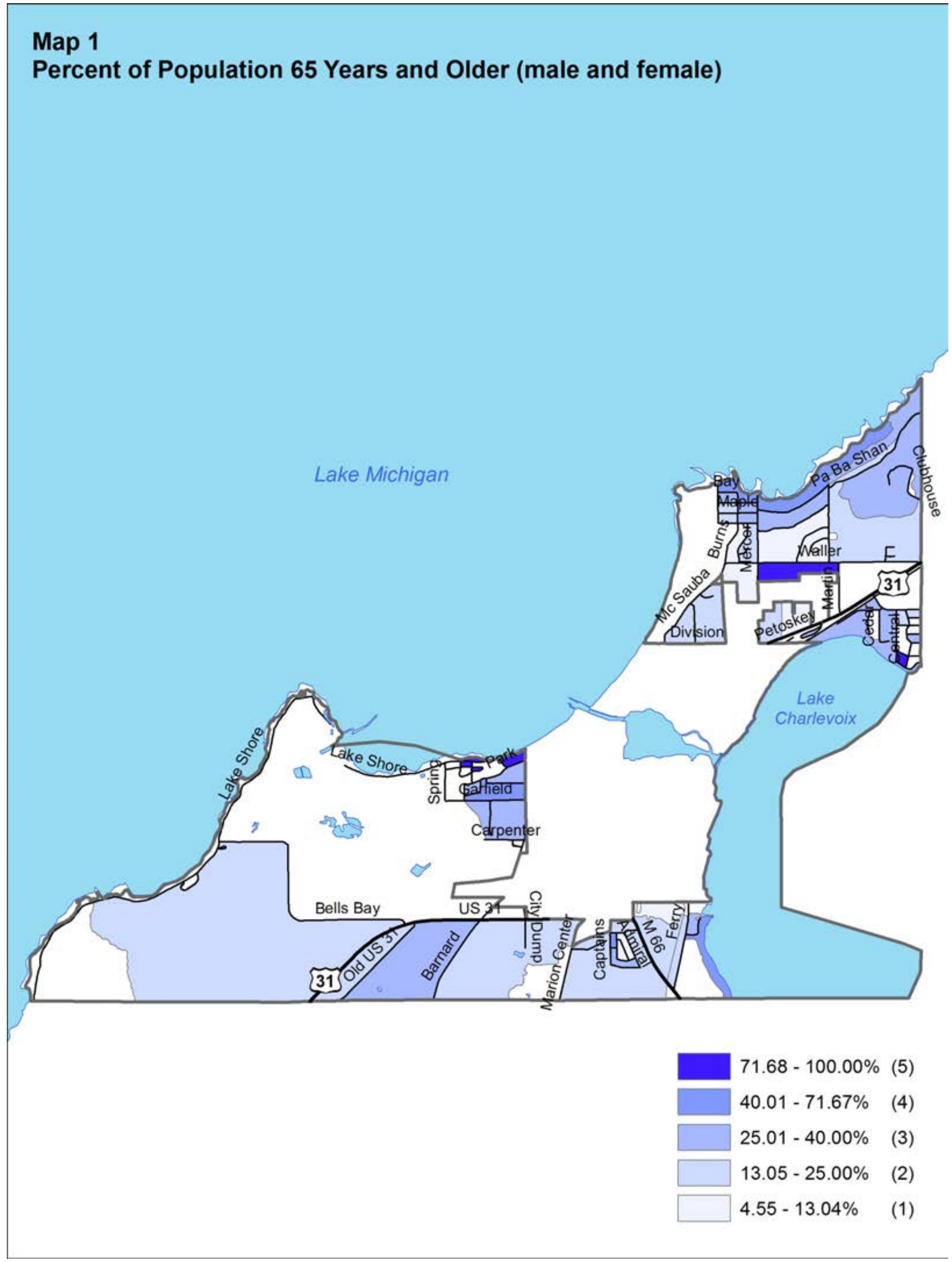

Charlevoix County

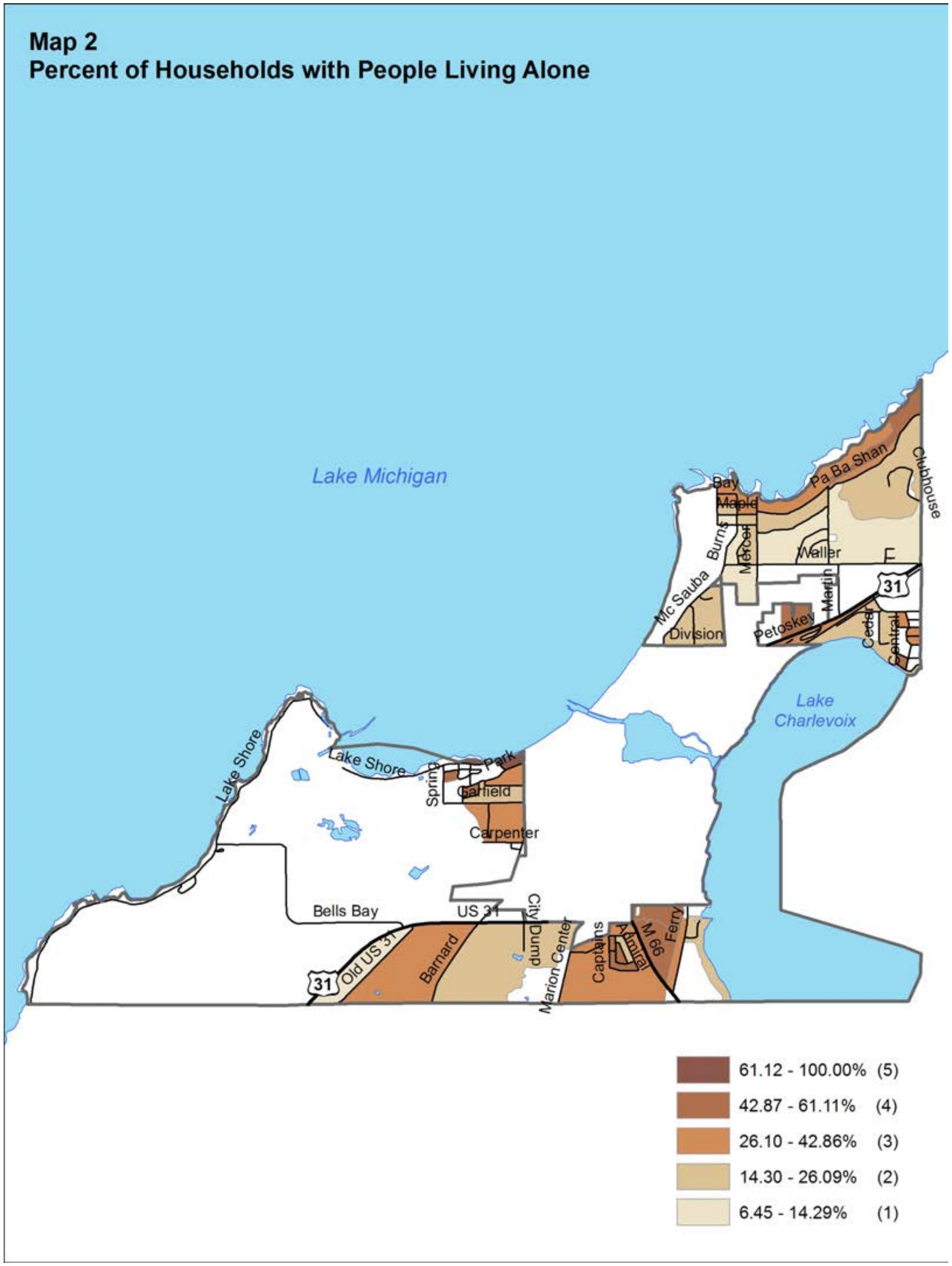

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Big Rock
Pa Ba Shan
Charlevoix to Bay Harbor
Struthers
Evers
Burnett
Bay Shore
Upper Bay Shore
Maple Grove
Murray
Smith
Hyek
Shrigley
Stolt
US 31
31
Burns
See
Indian Trails
Boyne
Charlevoix View
Burgess
Quarterline
Church
Pincherry
Birdland
Las Olas
Dalton
Brown
Red Pine
Undine
Stephens
Willis
Boyne City
Spring
Bay
Townline


Map 10
Population Vulnerable to Extreme Heat Events
total score
7 - 9
6
5
4
2 - 3
Lake Michigan
Lake Charlevoix
Deerpath
Nine Mile Point
Old US 31
Big Rock
Pa Ba Shan
Charlevoix to Bay Harbor
Struthers
Evers
Bay Shore
Maple
Spring
Bay
Townline
31
Upper Bay Shore
Burnett
Maple Grove
Murray
Smith
US 31
Hyek
Shrigley
Burgess
Stolt
Burns
See
Indian Trails
Charlevoix View
Boyne
Grange
Quarterline
Church
Pincherry
Birdland
Las Olas
Dalton
Stephens
Brown
Red Pine
Undine
Willis
Boyne City
Fort Holler


Charlevoix County

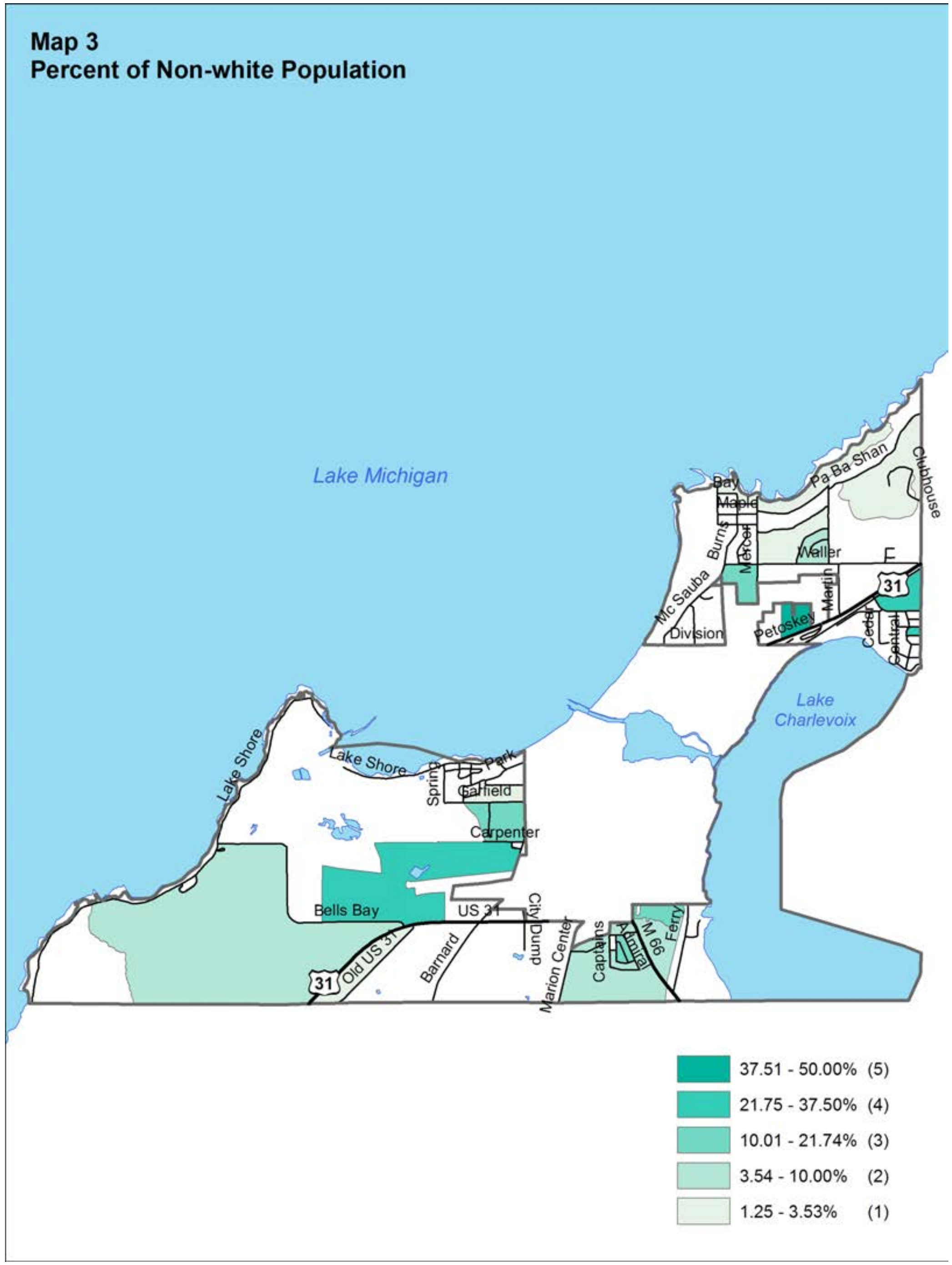
Charlevoix Twp.

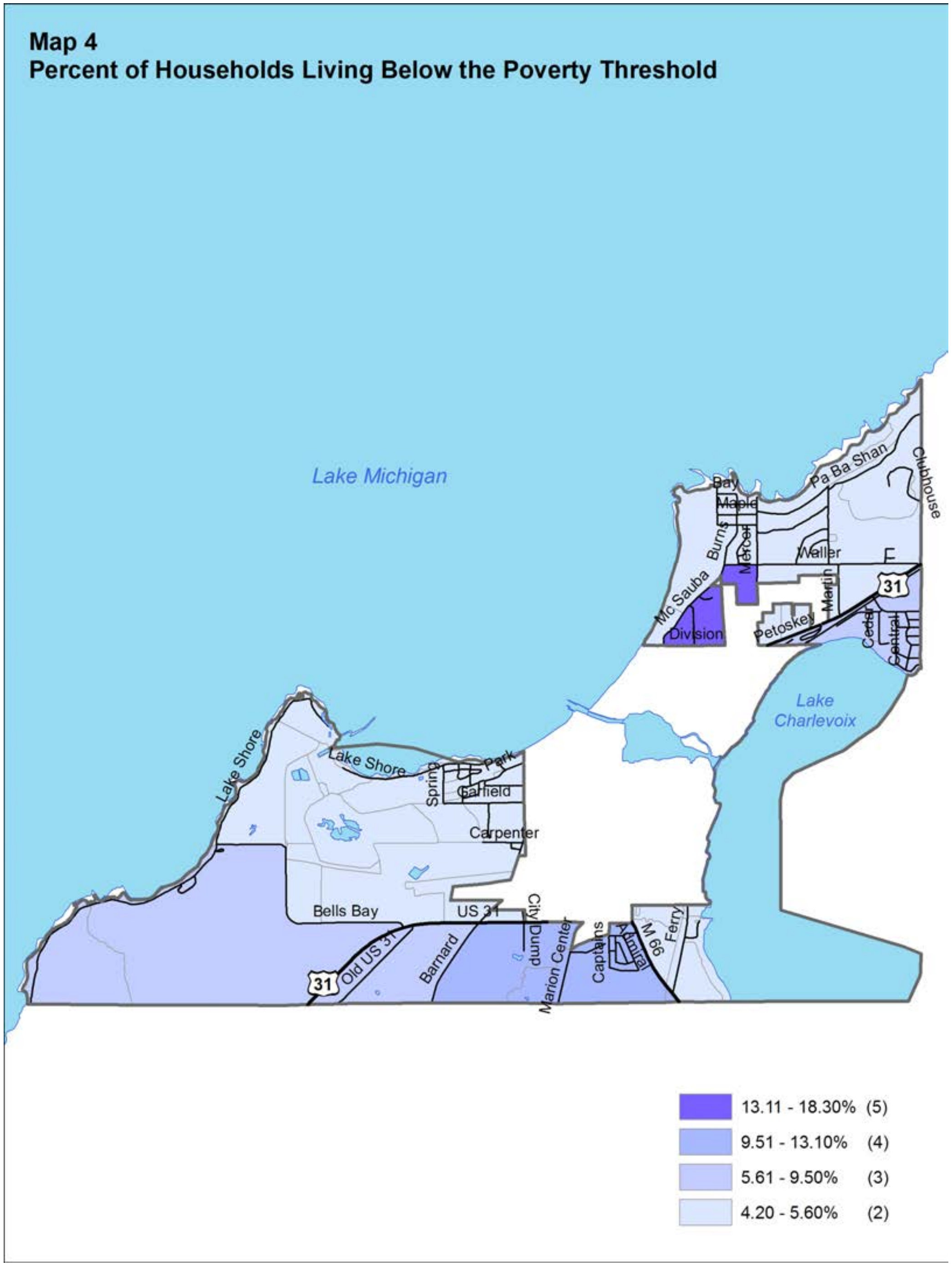



Map 2
Percent of Households with People Living Alone
Lake Michigan
Lake Charlevoix
Pa Ba Shan
Clubhouse
Bay
Maple
Burns
Mercer
Waller
Mc Sauba
Division
Petoskey
Martin
Cedar
Central
31
Lake Shore
Park
Spring
Garfield
Carpenter
Bells Bay
US 31
Old US 31
Barnard
City Dump
Marion Center
Captains
Admiral
M 66
Ferry
61.12 - 100.00% (5)
42.87 - 61.11% (4)
26.10 - 42.86% (3)
14.30 - 26.09% (2)
6.45 - 14.29% (1)

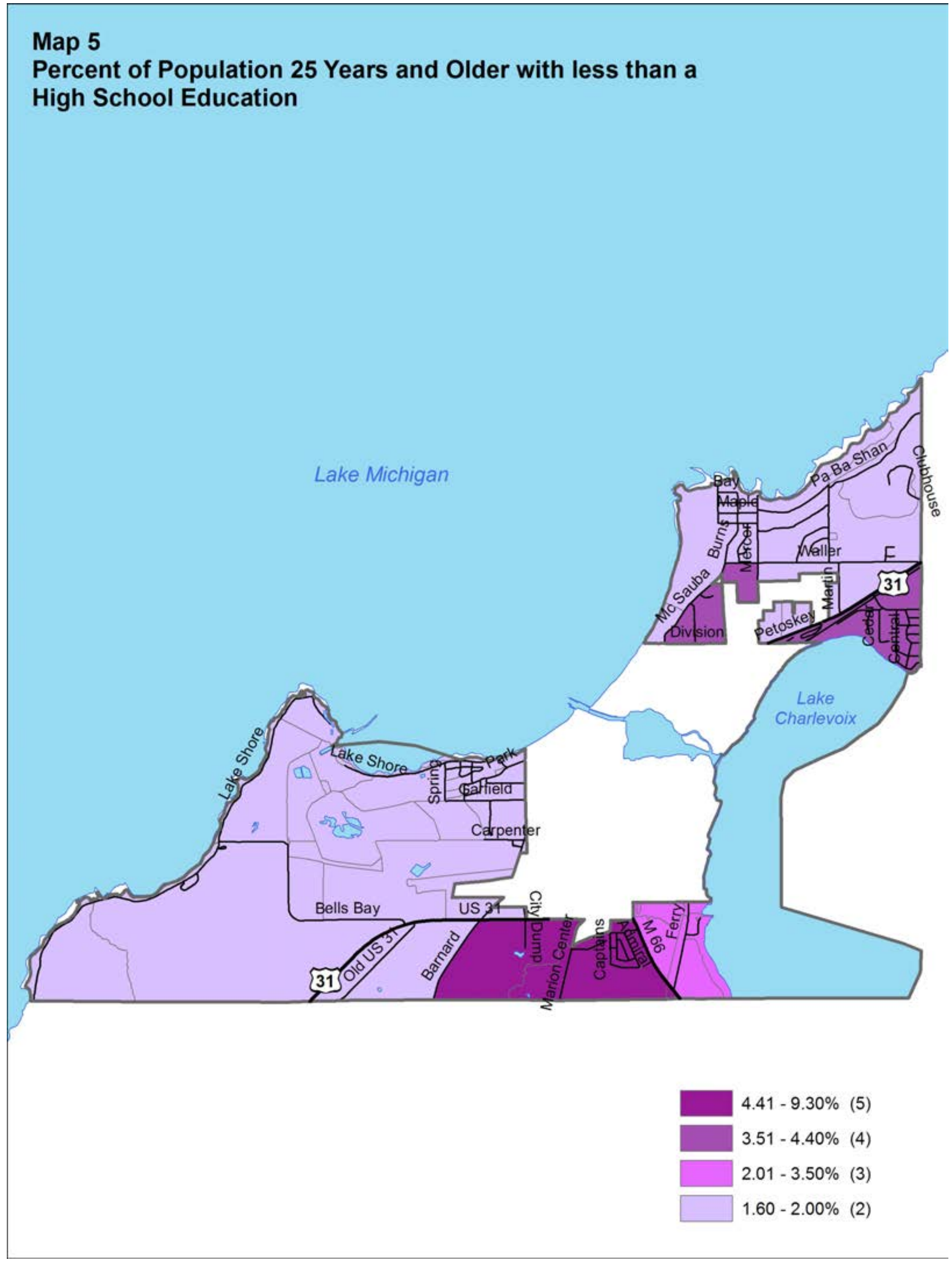

Charlevoix County


Charlevoix County

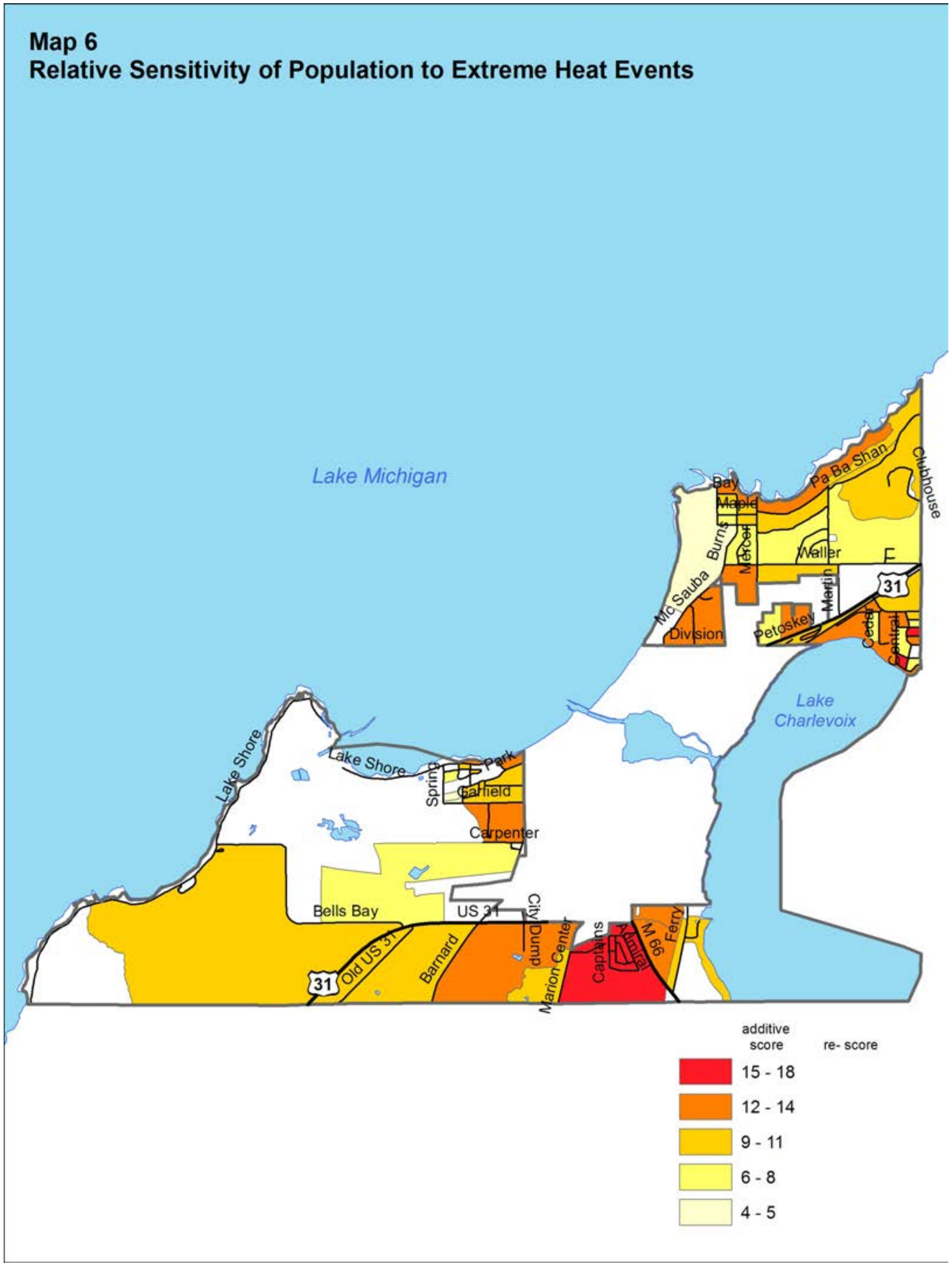

Map 3
Percent of Non-white Population
Lake Michigan
Lake Charlevoix
Pa Ba Shan
Clubhouse
Bay
Maple
Burns
Mercer
Waller
Mc Sauba
Division
Petoskey
Martin
31
Cedar
Central
Lake Shore
Lake Shore
Park
Spring
Garfield
Carpenter
Bells Bay
US 31
City Dump
Old US 31
Barnard
Marion Center
Captains
Admiral
M 66
Ferry
37.51 - 50.00% (5)
21.75 - 37.50% (4)
10.01 - 21.74% (3)
3.54 - 10.00% (2)
1.25 - 3.53% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
Lake Michigan
Lake Charlevoix
Bay
Maple
Pa Ba Shan
Clubhouse
Burns
Mercer
Waller
Mc Sauba
Division
Petoskey
Martin
31
Cedar
Central
Lake Shore
Lake Shore
Park
Spring
Garfield
Carpenter
Bells Bay
US 31
City Dump
31
Old US 31
Barnard
Marion Center
Captains
Admiral
M 66
Ferry
13.11 - 18.30% (5)
9.51 - 13.10% (4)
5.61 - 9.50% (3)
4.20 - 5.60% (2)


Charlevoix County

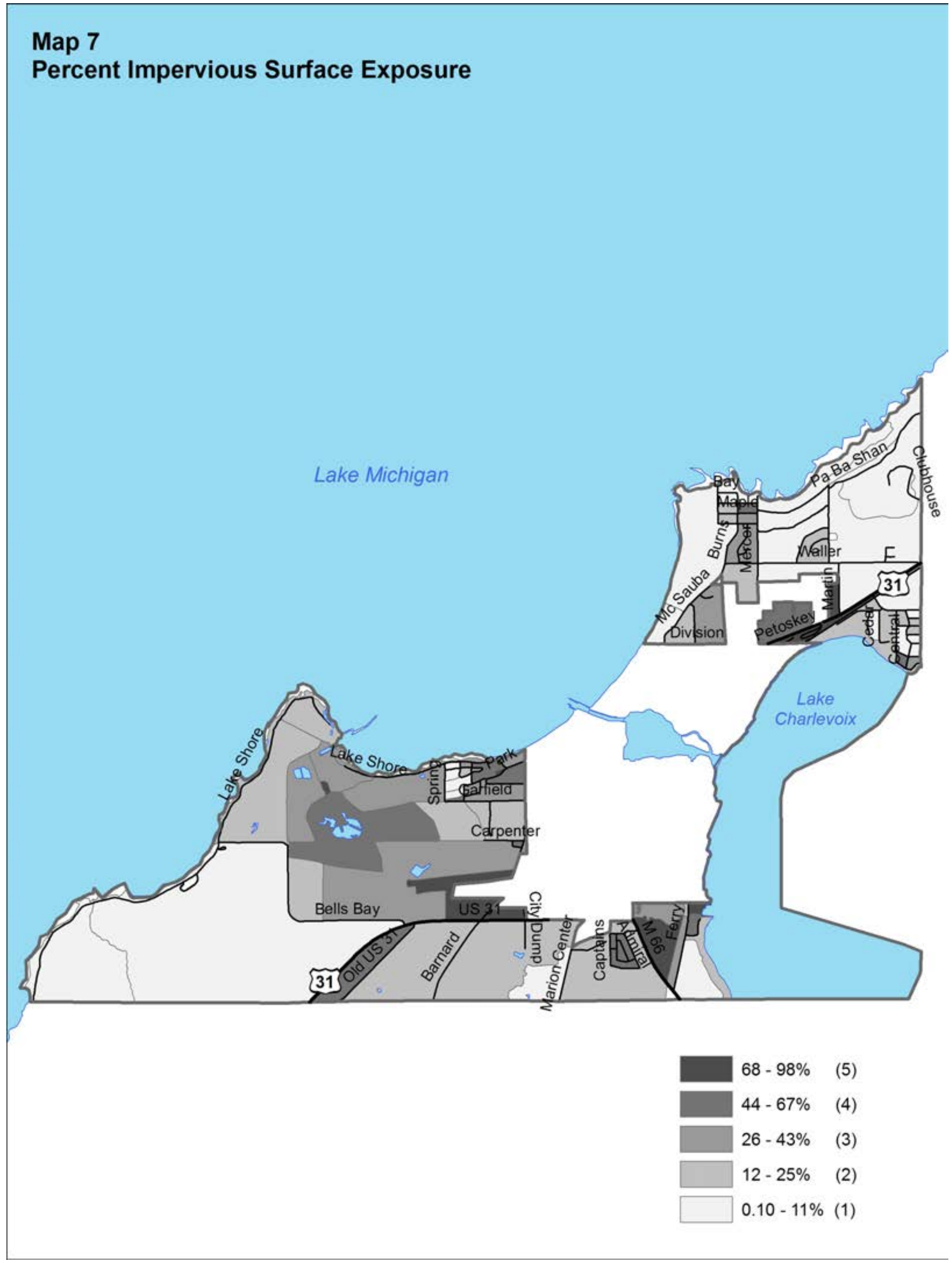


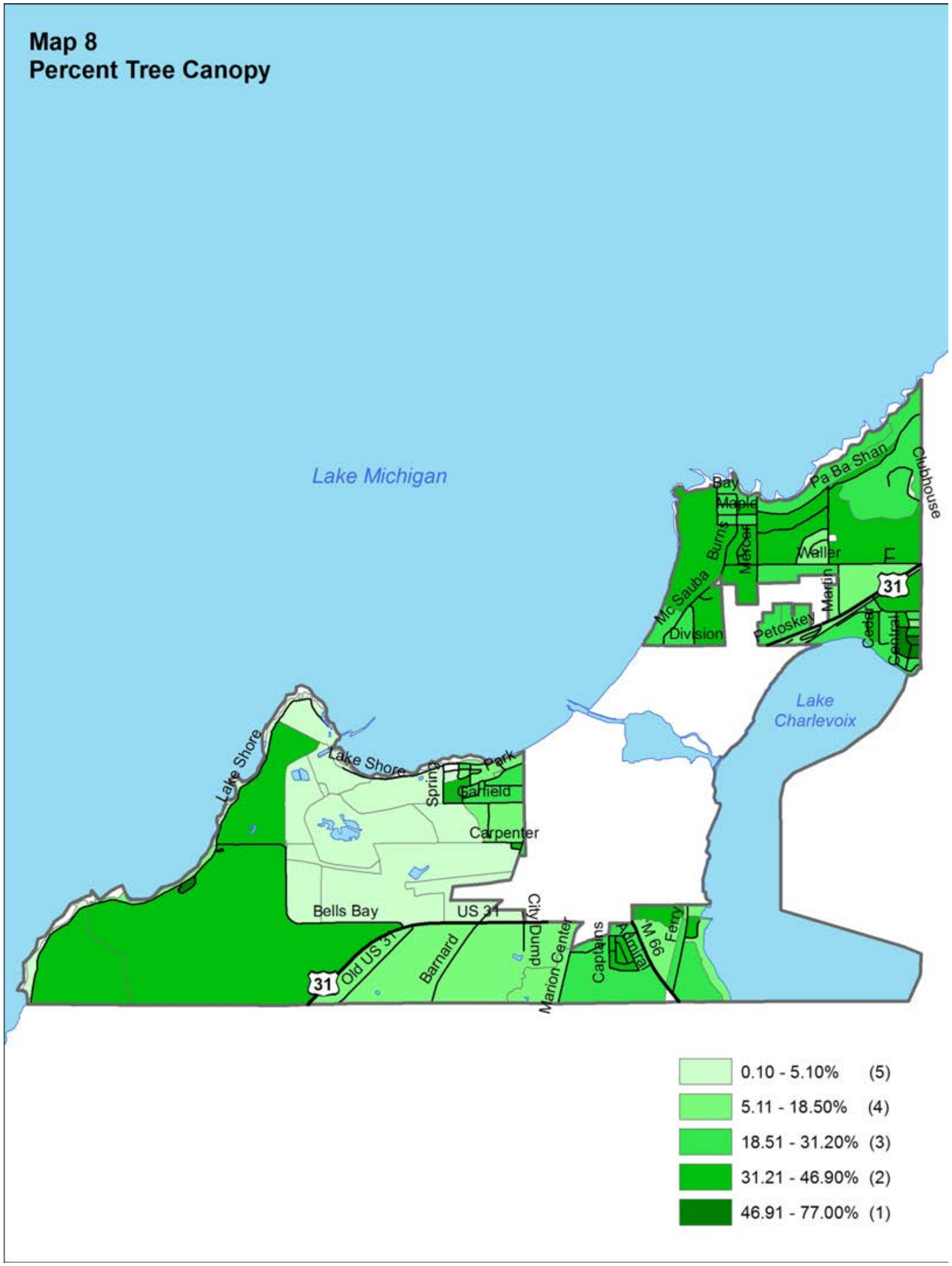
Map 5
Percent of Population 25 Years and Older with less than a High School Education


Map 6
Relative Sensitivity of Population to Extreme Heat Events
Lake Michigan
Lake Charlevoix
Pa Ba Shan
Clubhouse
Bay
Maple
Burns
Mercer
Waller
Mc Sauba
Martin
Division
Petoskey
31
Cedar
Central
Lake Shore
Lake Shore
Park
Spring
Garfield
Carpenter
Bells Bay
US 31
City Dump
Old US 31
Barnard
Marion Center
Captains
Admiral
M 66
Ferry
additive score
re- score
15 - 18
12 - 14
9 - 11
6 - 8
4 - 5


Charlevoix County

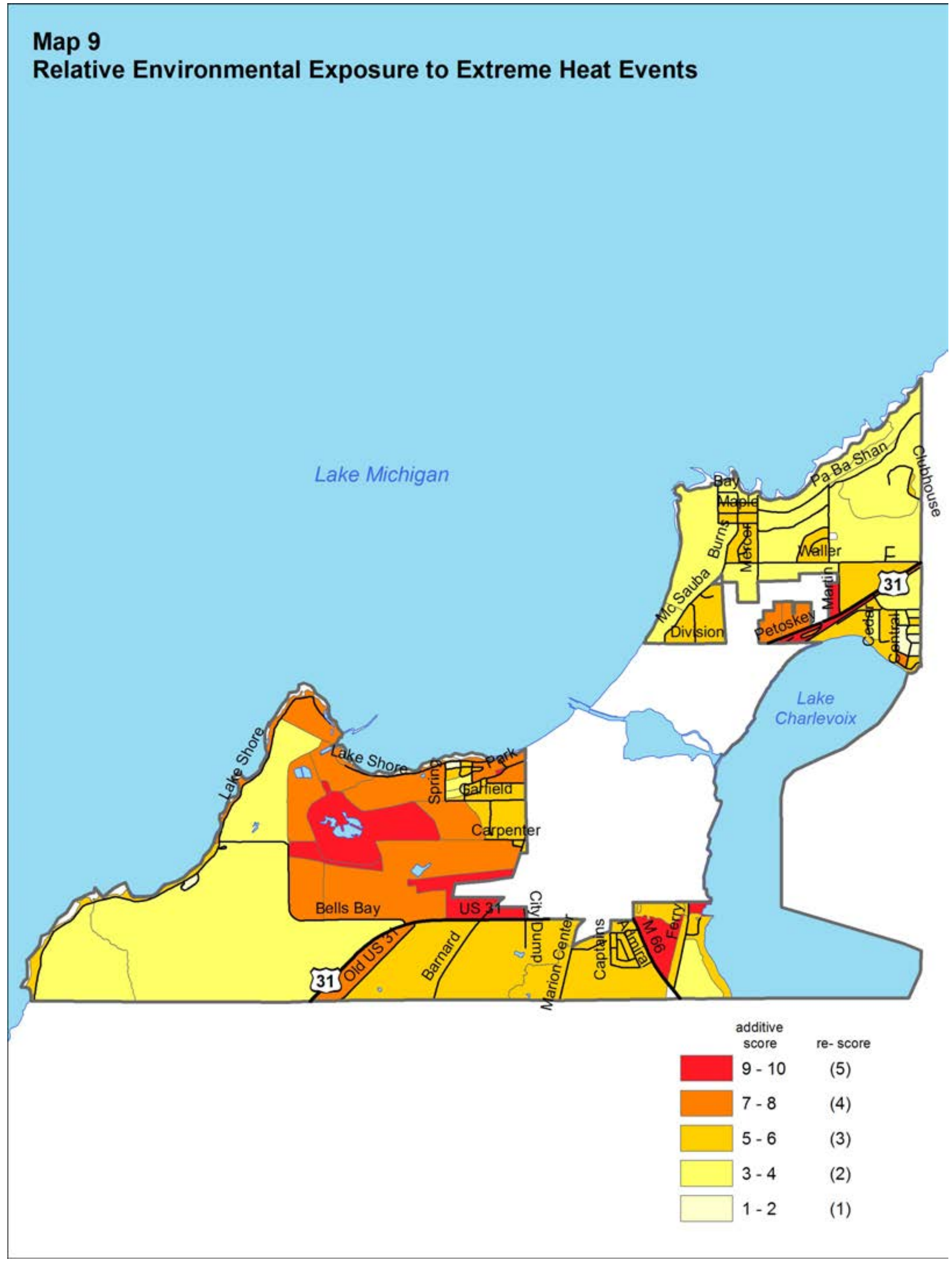

Charlevoix County

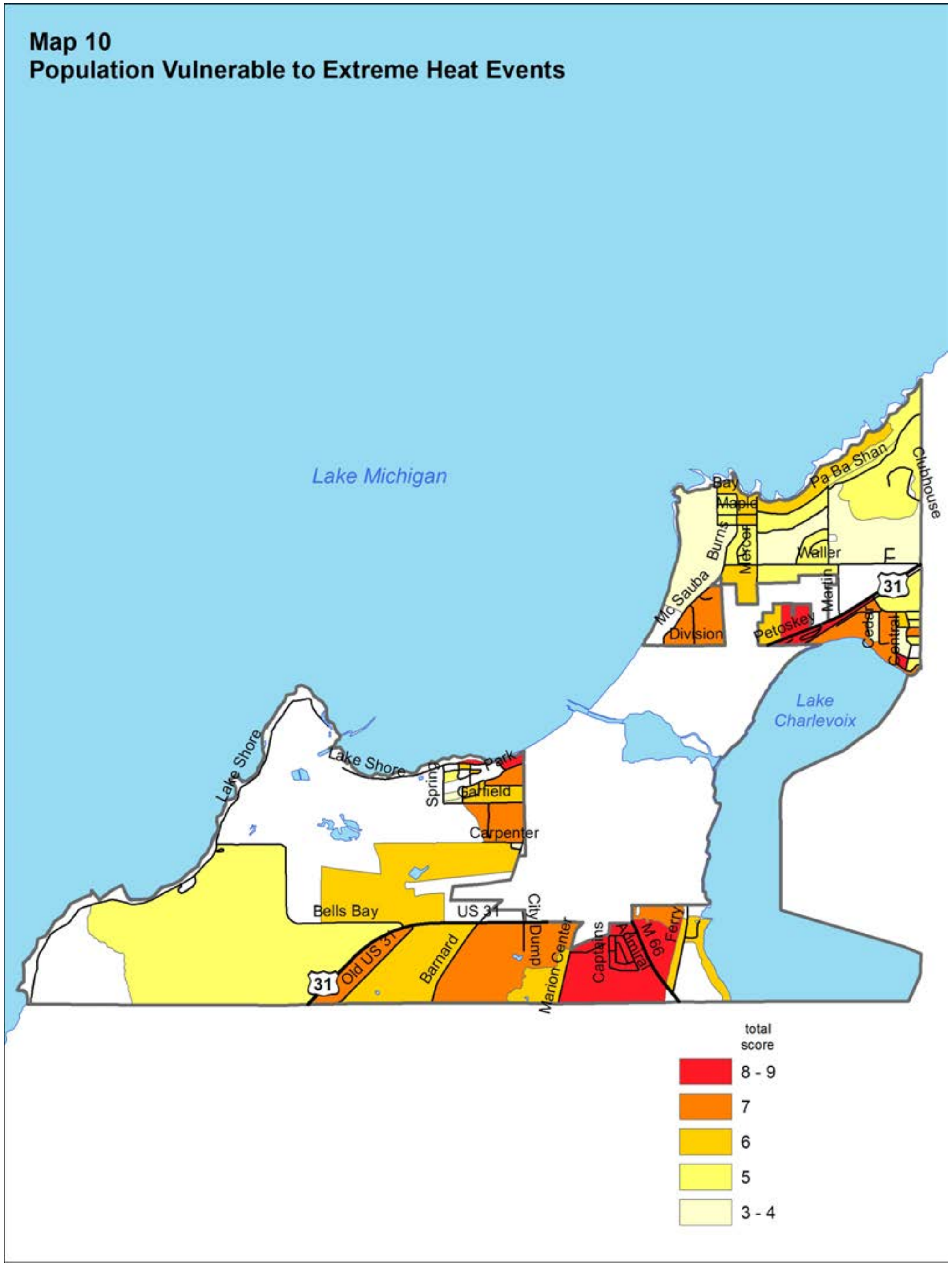

Map 7
Percent Impervious Surface Exposure
Lake Michigan
Lake Charlevoix
Lake Shore
Park
Garfield
Spring
Carpenter
Bells Bay
US 31
Old US 31
Barnard
City Dump
Marion Center
Captains
Admiral
M 66
Ferry
Bay
Maple
Burns
Mercer
McSauba
Division
Weller
Martin
Petoskey
Pa Ba Shan
Clubhouse
Cedar
Central
31
68 - 98% (5)
44 - 67% (4)
26 - 43% (3)
12 - 25% (2)
0.10 - 11% (1)


Map 8
Percent Tree Canopy
Lake Michigan
Lake Charlevoix
Pa Ba Shan
Clubhouse
Bay
Maple
Burns
Mercer
Mc Sauba
Waller
Martin
31
Division
Petoskey
Cedar
Central
Lake Shore
Lake Shore
Park
Spring
Garfield
Carpenter
Bells Bay
US 31
City Dump
Old US 31
Barnard
Marion Center
Captains
Admiral
M 66
Ferry
0.10 - 5.10% (5)
5.11 - 18.50% (4)
18.51 - 31.20% (3)
31.21 - 46.90% (2)
46.91 - 77.00% (1)


Charlevoix County


Charlevoix County

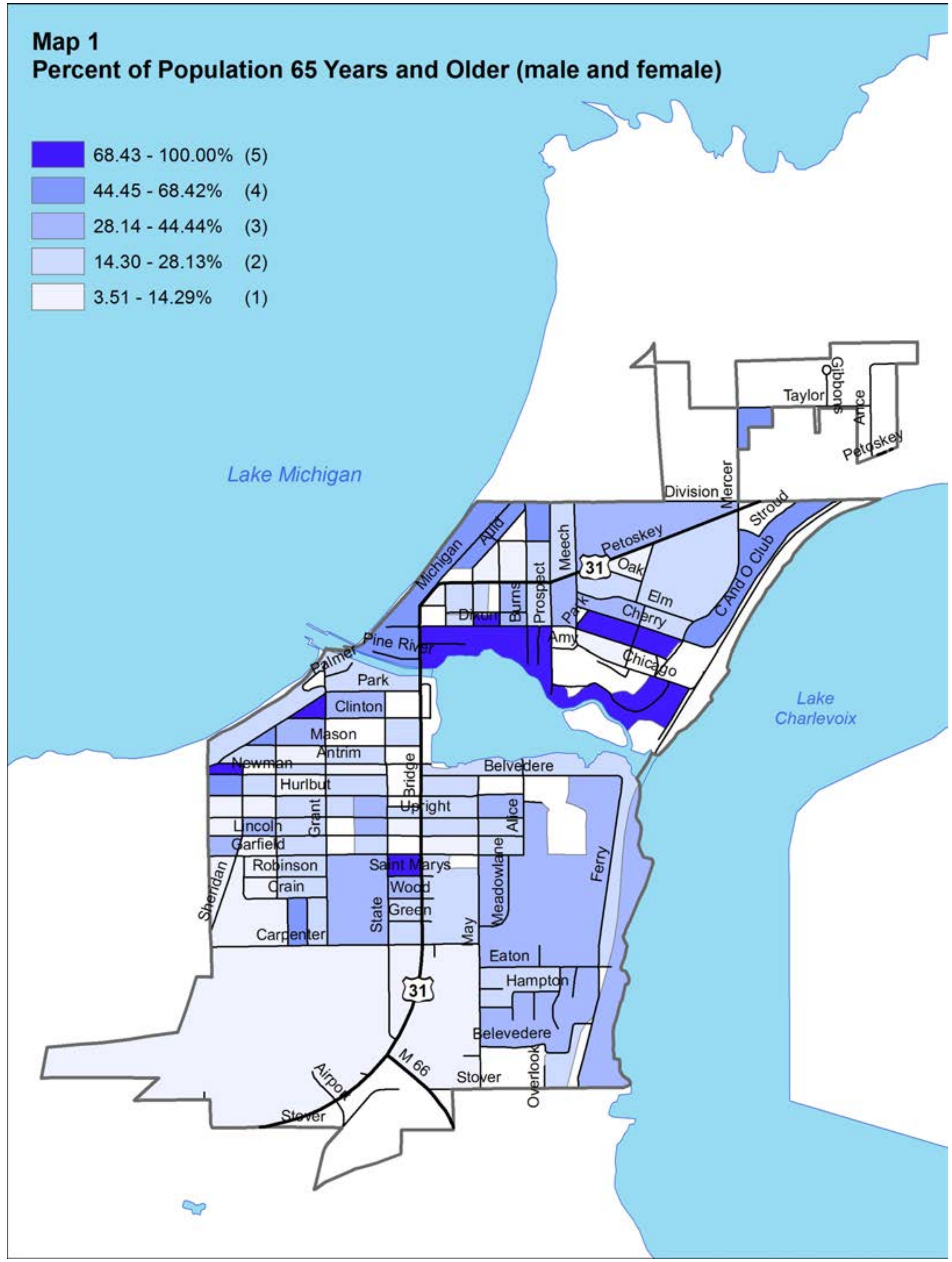

Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
Lake Charlevoix
Pa Ba Shan
Clubhouse
Bay
Maple
Burns
Mercer
Waller
Mc Sauba
Division
Petoskey
Martin
31
Cedar
Central
Lake Shore
Park
Spring
Garfield
Carpenter
Bells Bay
US 31
Old US 31
Barnard
City Dump
Marion Center
Captains
Aurora
M 66
Ferry
additive score
re- score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)

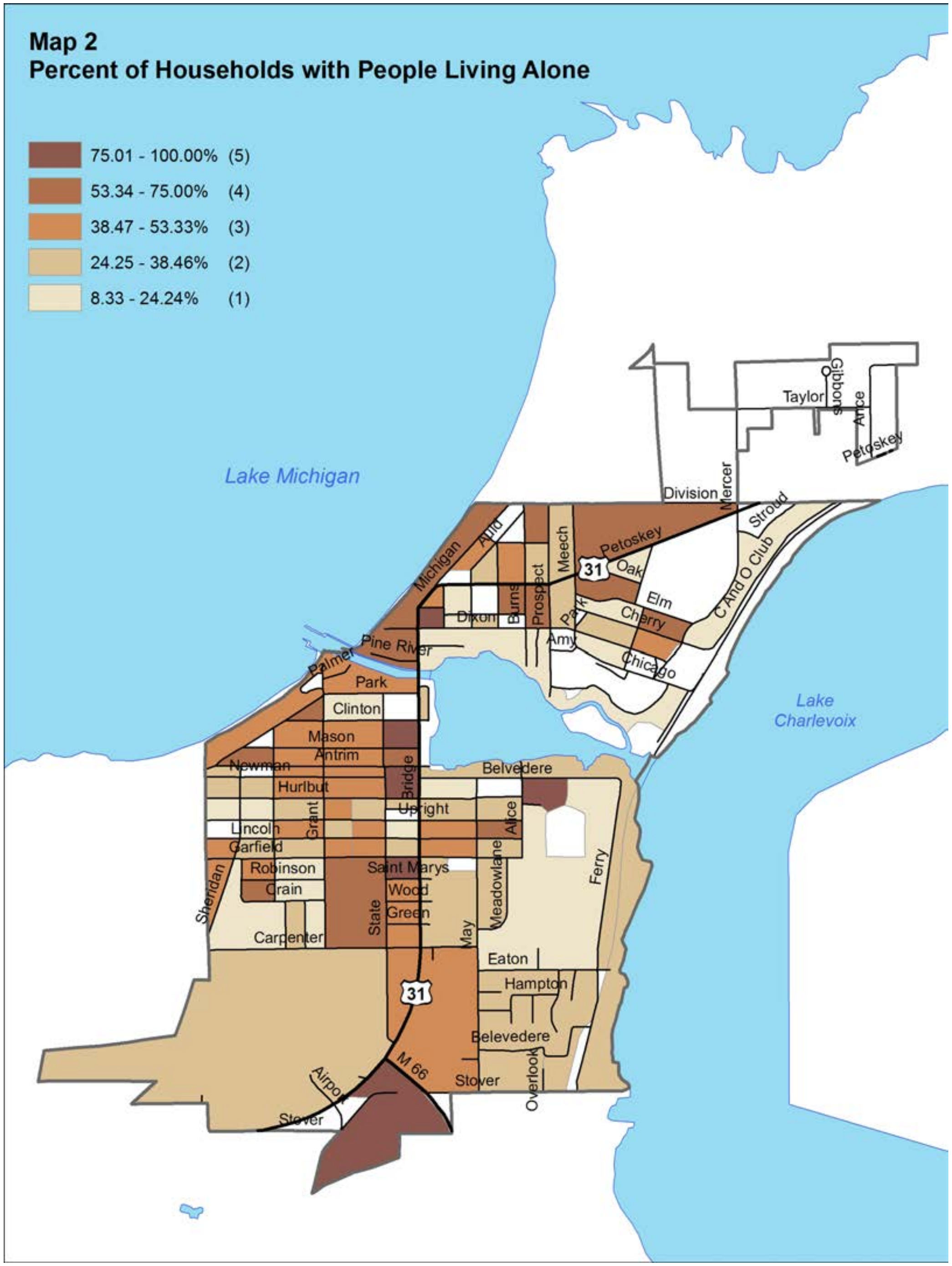

Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
Lake Charlevoix
Pa Ba Shan
Clubhouse
Bay
Maple
Burns
Mercer
Waller
Mc Sauba
Division
Petoskey
Merlin
31
Cedar
Central
Lake Shore
Lake Shore
Park
Spring
Garfield
Carpenter
Bells Bay
US 31
City Dump
Old US 31
Barnard
Marion Center
Captains
M 66
Ferry
total score
8 - 9
7
6
5
3 - 4


Charlevoix County

Charlevoix

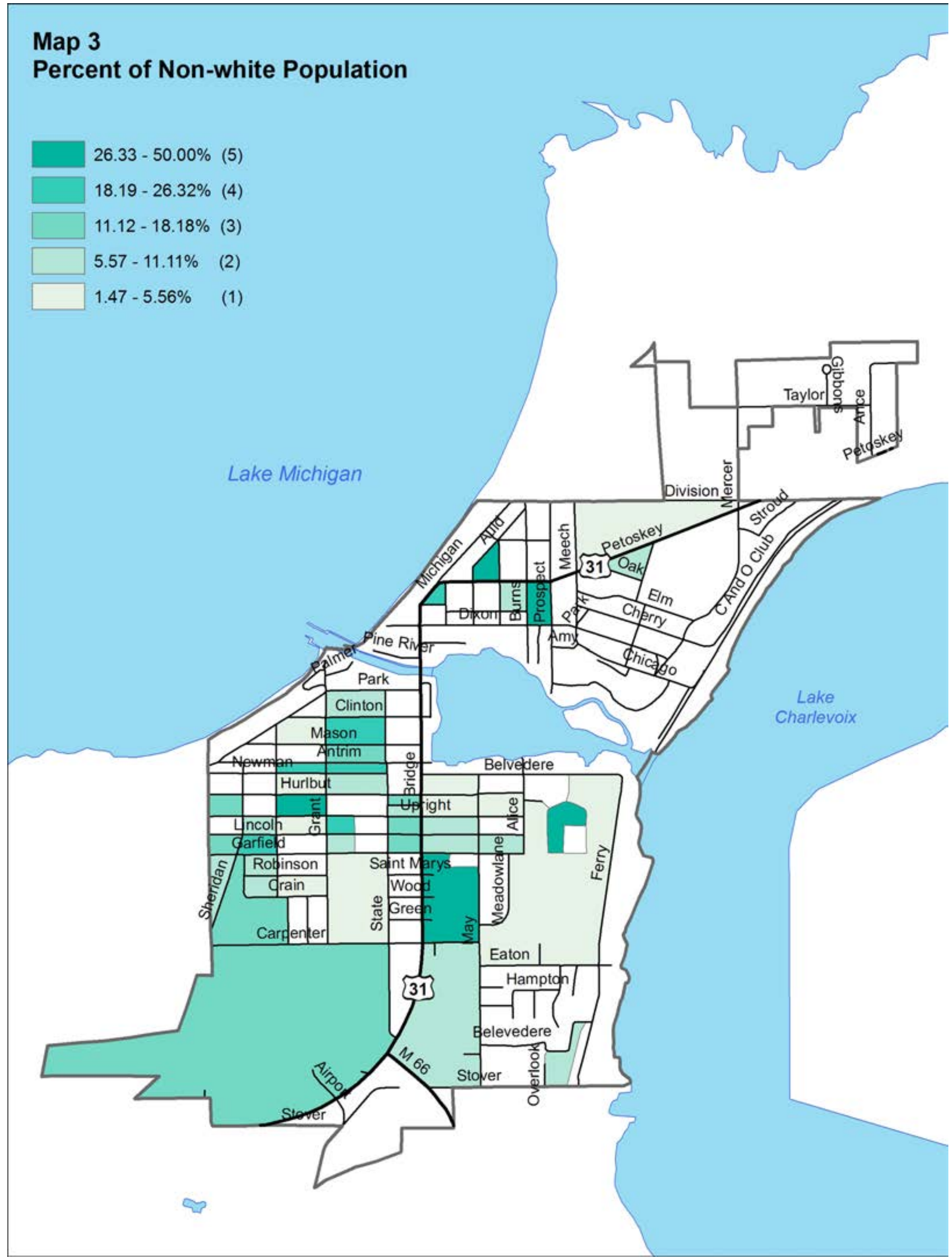

Charlevoix County

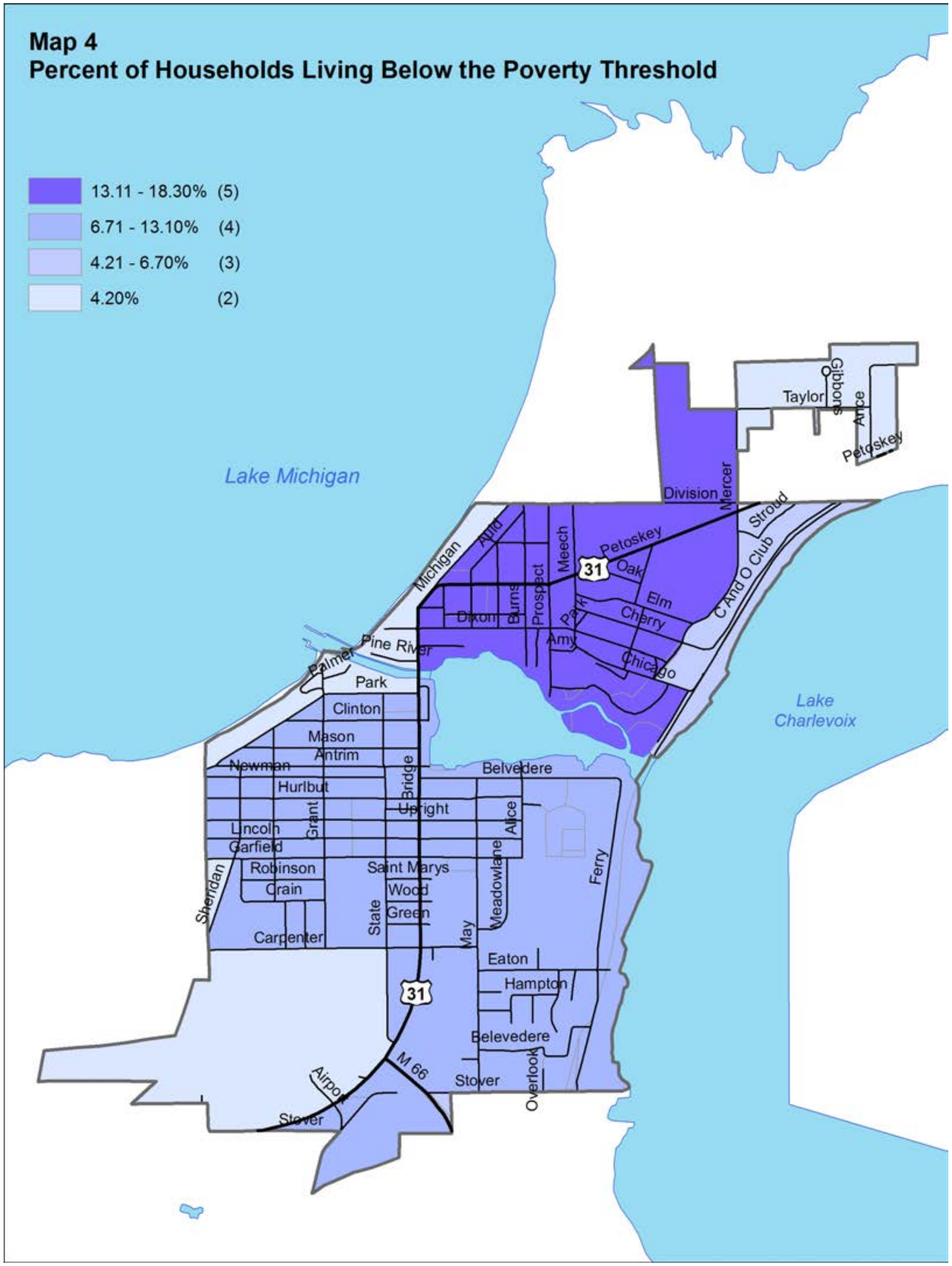

Map 1
Percent of Population 65 Years and Older (male and female)
68.43 - 100.00% (5)
44.45 - 68.42% (4)
28.14 - 44.44% (3)
14.30 - 28.13% (2)
3.51 - 14.29% (1)
Lake Michigan
Lake Charlevoix
Taylor
Gibbons
Antce
Petoskey
Division
Mercer
Stroud
C And O Club
Michigan
Antd
Meech
Petoskey
31
Oak
Elm
Cherry
Dixon
Burns
Prospect
Park
Amy
Chicago
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Belvedere
Upright
Alice
Lincoln
Grant
Garfield
Robinson
Crain
Saint Marys
Wood
Green
Meadowlane
Ferry
Sheridan
Carpenter
State
May
Eaton
Hampton
Belevedere
31
M 66
Airport
Stover
Stover
Overlook


Map 2
Percent of Households with People Living Alone
75.01 - 100.00% (5)
53.34 - 75.00% (4)
38.47 - 53.33% (3)
24.25 - 38.46% (2)
8.33 - 24.24% (1)
Lake Michigan
Lake Charlevoix
Division
Mercer
Taylor
Gibbons
Alice
Petoskey
Stroud
C And O Club
Michigan
Petoskey
Oak
Elm
Cherry
Chicago
Amy
Park
Meech
Prospect
Burns
Dixon
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Belvedere
Upright
Alice
Lincoln
Garfield
Grant
Robinson
Crain
Saint Marys
Wood
Green
State
Sheridan
Carpenter
Meadowlane
Ferry
May
Eaton
Hampton
Belevedere
Overlook
Stover
M 66
Airport
Stover
31


Charlevoix County

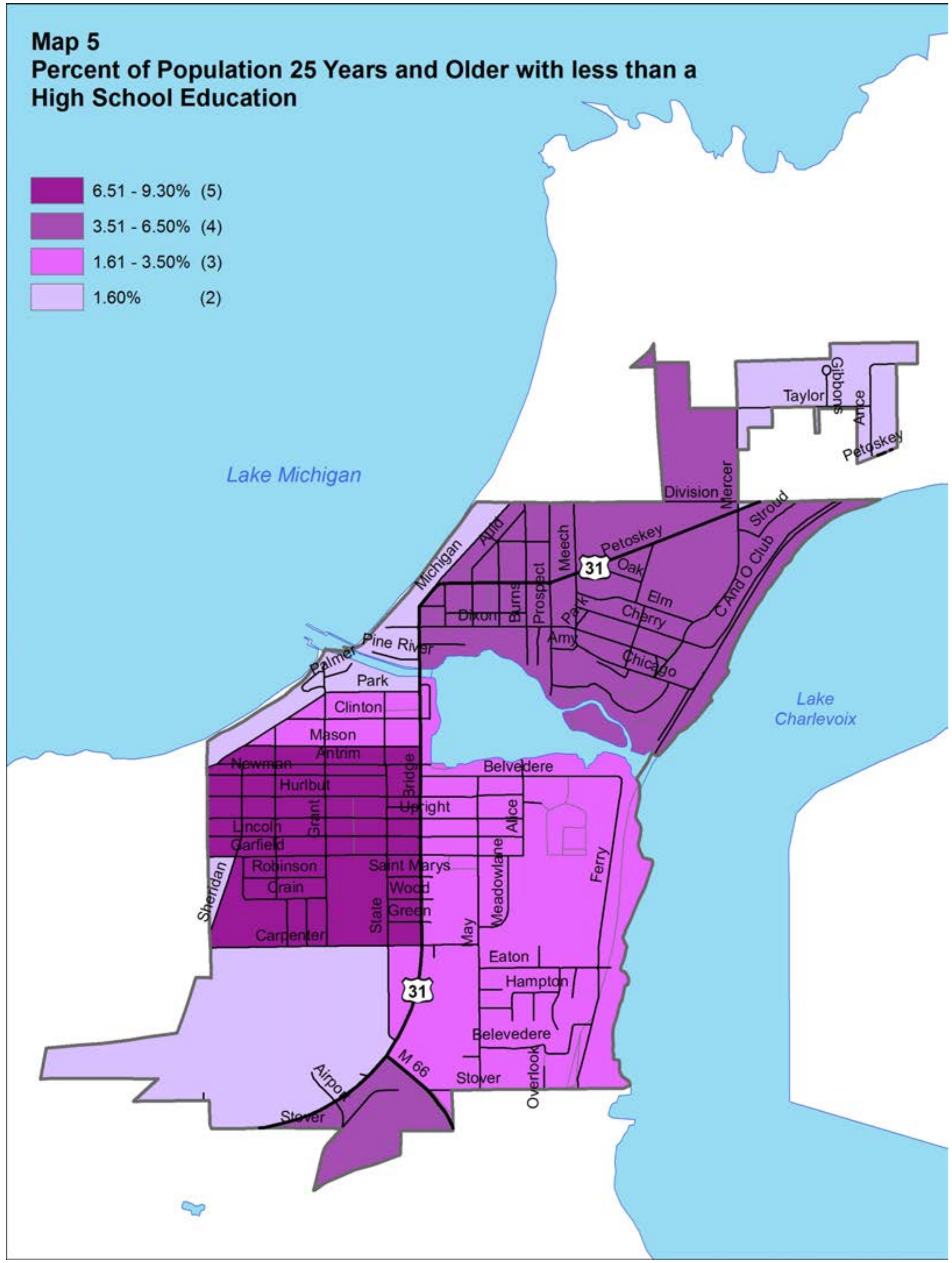

Charlevoix County

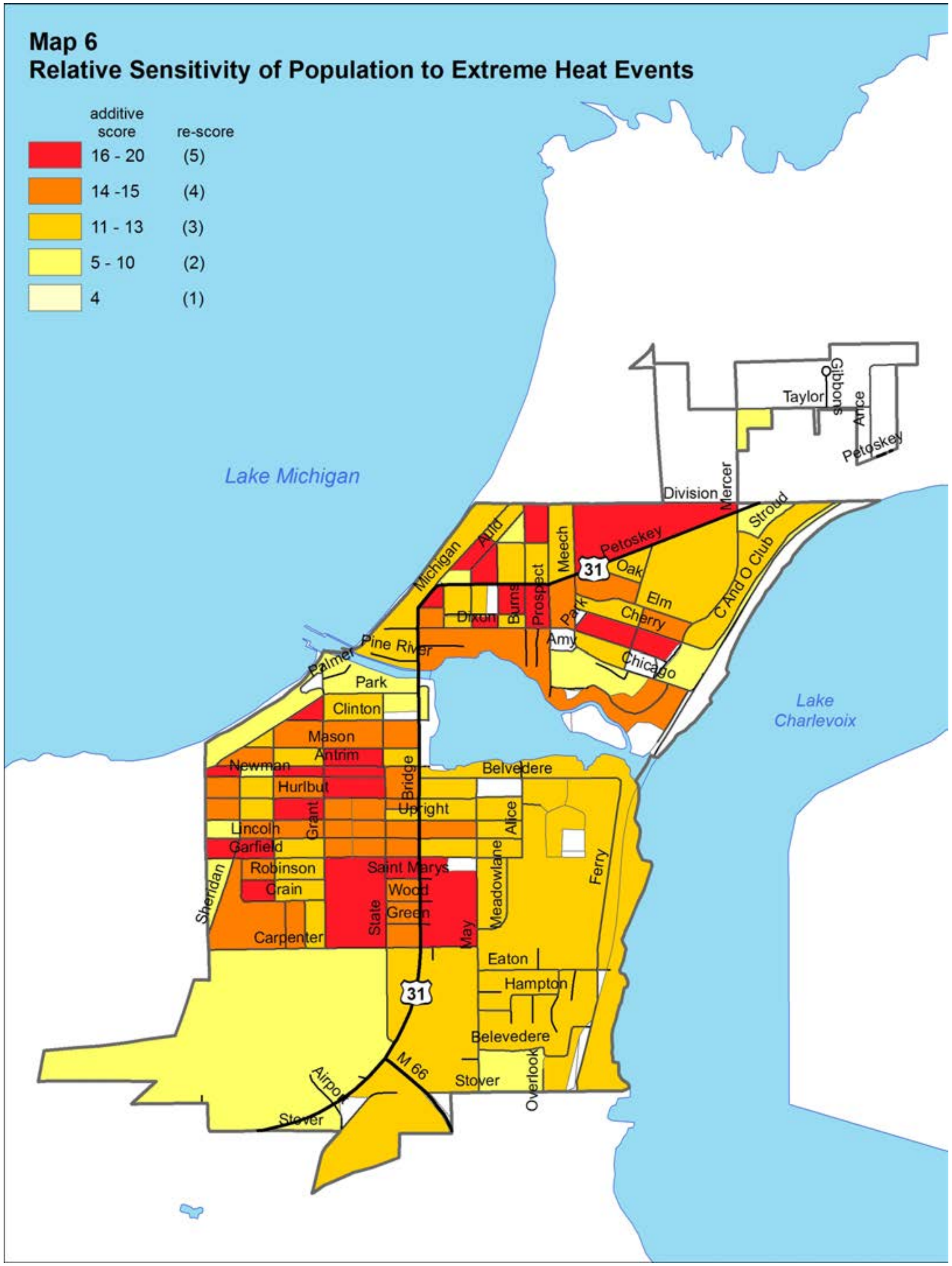

Map 3
Percent of Non-white Population
26.33 - 50.00% (5)
18.19 - 26.32% (4)
11.12 - 18.18% (3)
5.57 - 11.11% (2)
1.47 - 5.56% (1)
Lake Michigan
Lake Charlevoix
Division
Mercer
Taylor
Gibbons
Petoskey
Stroud
Michigan
Petoskey
Oak
Elm
Cherry
Chicago
Dixon
Burns
Prospect
Meech
Amy
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Belvedere
Upright
Alice
Lincoln
Garfield
Grant
Robinson
Crain
Sheridan
Saint Marys
Wood
Green
State
Meadowlane
Ferry
Carpenter
May
Eaton
Hampton
Belevedere
Stover
Overlook
M 66
Stover
31
31


Map 4
Percent of Households Living Below the Poverty Threshold
13.11 - 18.30% (5)
6.71 - 13.10% (4)
4.21 - 6.70% (3)
4.20% (2)
Lake Michigan
Lake Charlevoix
Division
Mercer
Taylor
Gibbons
Petoskey
Stroud
C And O Club
Michigan
Antid
Meech
Prospect
Burns
Dixon
Oak
Elm
Cherry
Park
Amy
Chicago
Pine River
Palmer
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Belvedere
Upright
Alice
Lincoln
Grant
Garfield
Robinson
Crain
Sheridan
Saint Marys
Wood
Green
State
Meadowlane
Ferry
Carpenter
May
Eaton
Hampton
Belevedere
Stover
Overlook
M 66
Airport
31


Charlevoix County

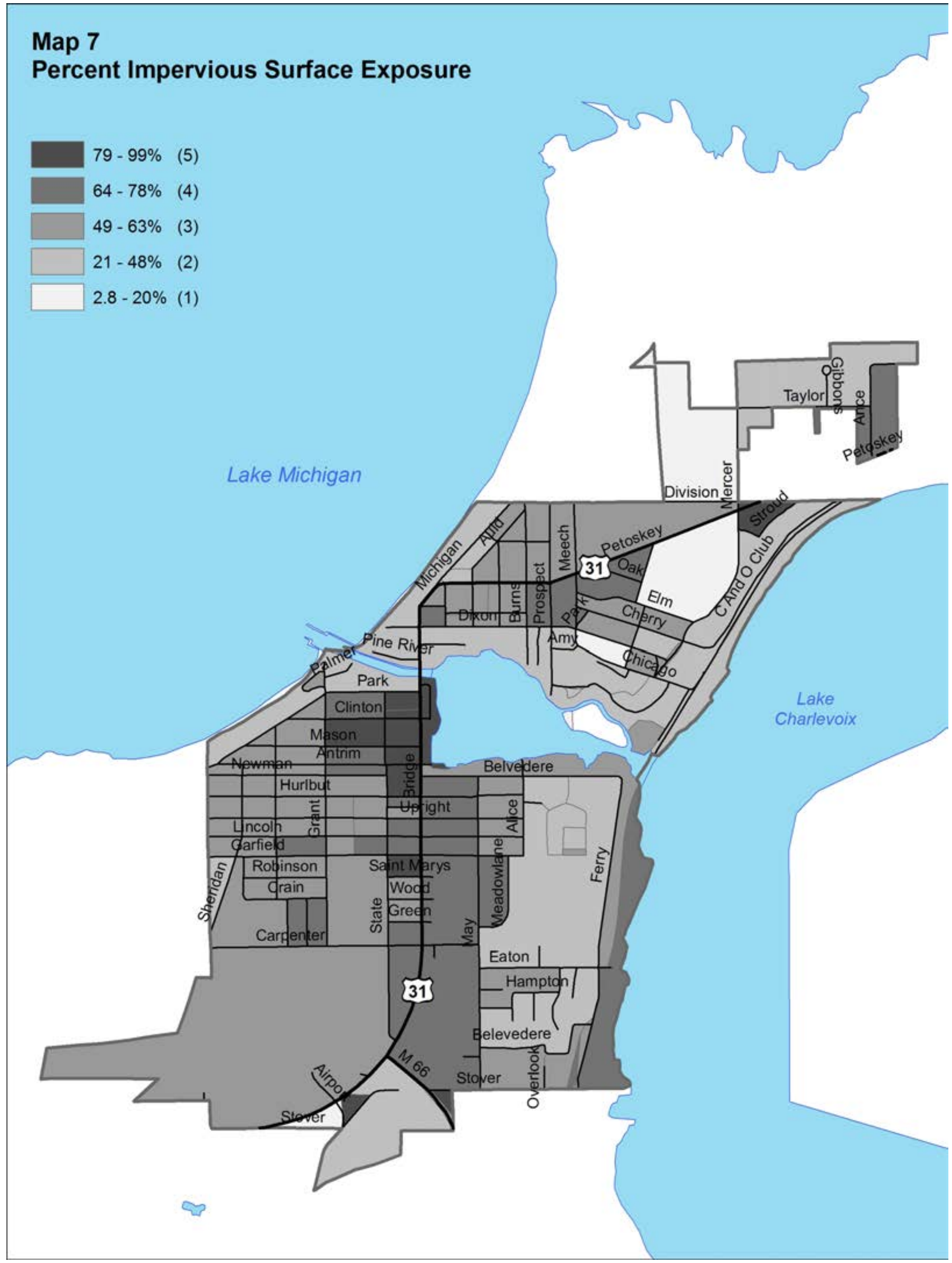

Charlevoix County

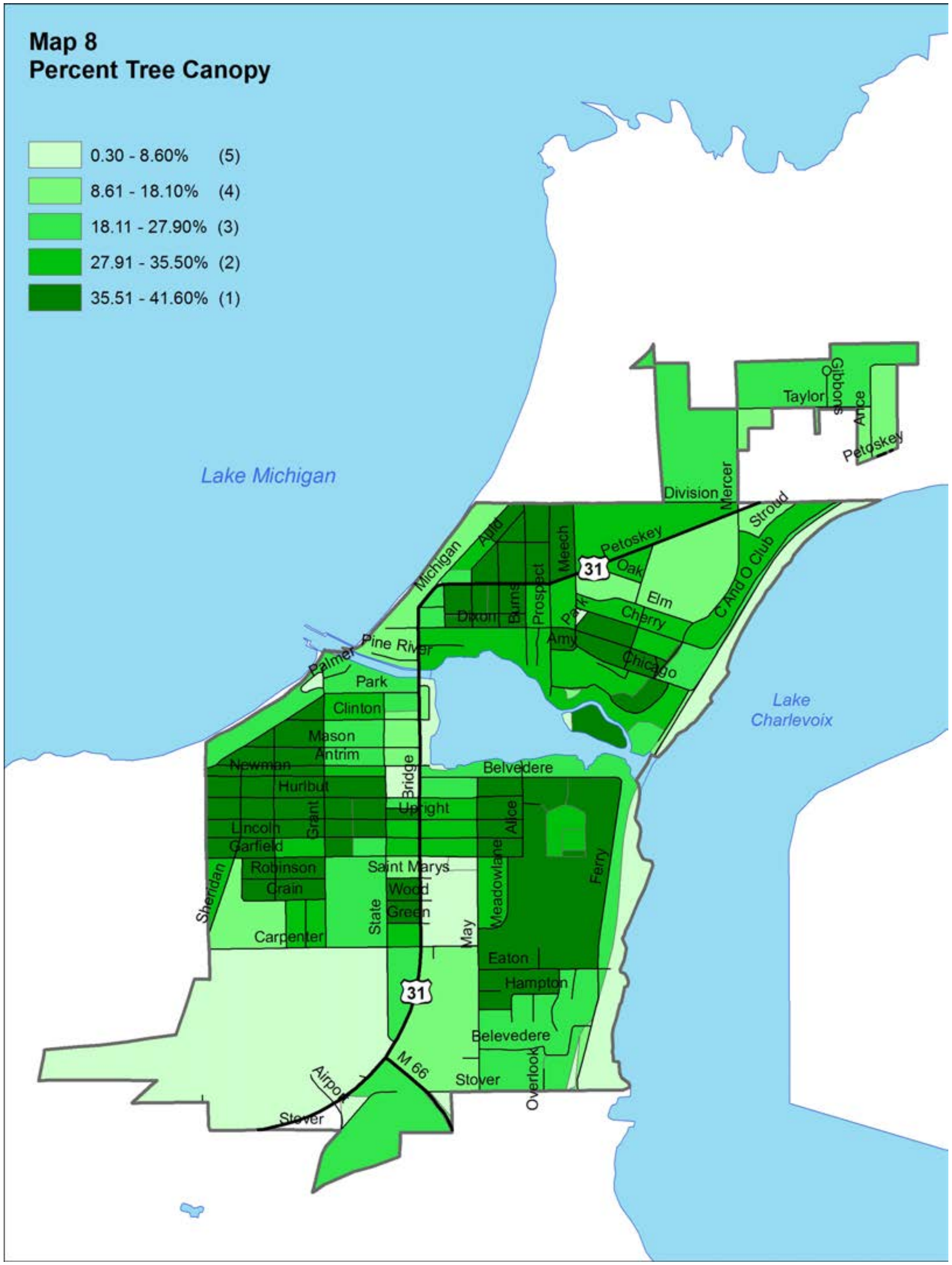

Map 5
Percent of Population 25 Years and Older with less than a High School Education
6.51 - 9.30% (5)
3.51 - 6.50% (4)
1.61 - 3.50% (3)
1.60% (2)
Lake Michigan
Lake Charlevoix
Taylor
Gibbons
Arrice
Petoskey
Division
Mercer
Stroud
Michigan
Antrim
Meech
Petoskey
31
Oak
C And O Club
Dixon
Burns
Prospect
Elm
Cherry
Park
Amy
Chicago
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Belvedere
Upright
Alice
Lincoln
Garfield
Grant
Robinson
Crain
Saint Marys
Wood
Green
Meadowlane
Ferry
Sheridan
State
May
Carpenter
Eaton
Hampton
31
Belevedere
M 66
Airport
Stover
Overlook
Stover


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
16 - 20 (5)
14 -15 (4)
11 - 13 (3)
5 - 10 (2)
4 (1)
Lake Michigan
Lake Charlevoix
Division
Mercer
Taylor
Gibbons
Arnce
Petoskey
Stroud
C And O Club
Michigan
Auld
Meech
Prospect
Burns
Dixon
31
Oak
Elm
Cherry
Park
Amy
Chicago
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Upright
Belvedere
Alice
Grant
Lincoln
Garfield
Robinson
Crain
Saint Marys
Wood
Green
State
May
Meadowlane
Ferry
Sheridan
Carpenter
Eaton
Hampton
Belevedere
M 66
Airport
Stover
Overlook


Charlevoix County

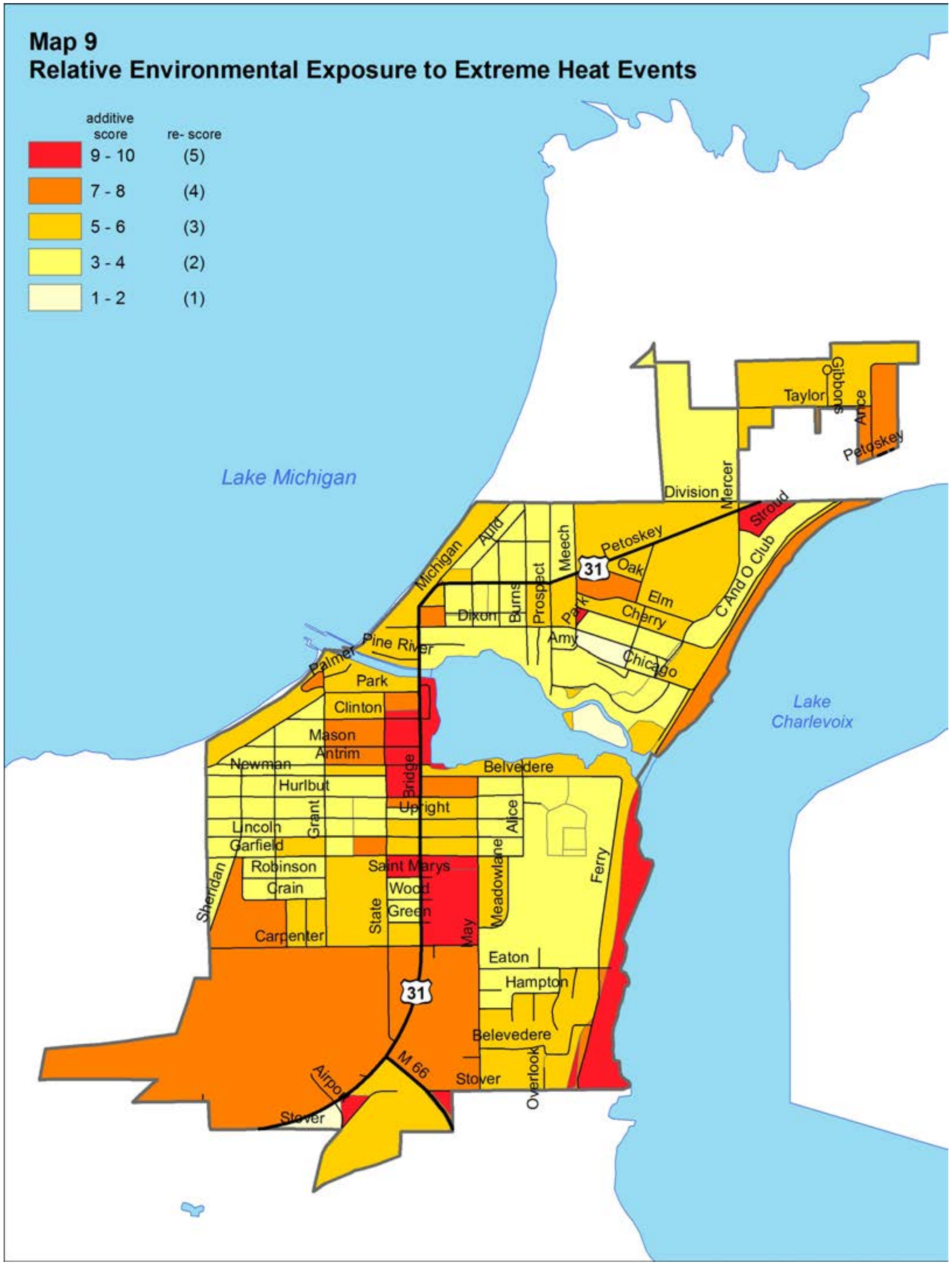

Charlevoix County

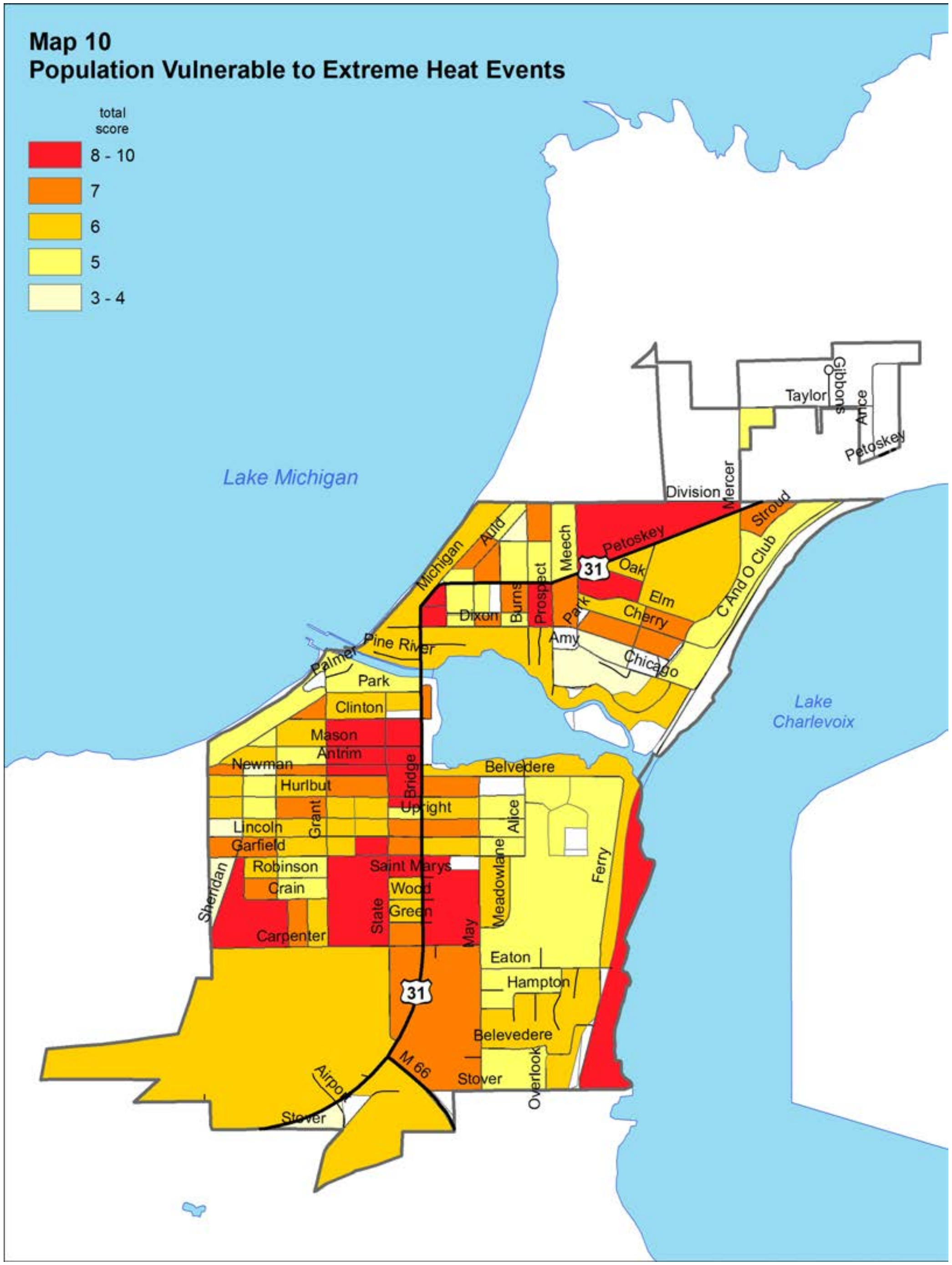

Map 7
Percent Impervious Surface Exposure
79 - 99% (5)
64 - 78% (4)
49 - 63% (3)
21 - 48% (2)
2.8 - 20% (1)
Lake Michigan
Lake Charlevoix
Division
Mercer
Taylor
Gibbons
Alice
Petoskey
Stroud
C And O Club
Michigan
Antrim
Burns
Prospect
Meech
Oak
Elm
Cherry
Park
Amy
Chicago
Dixon
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Upright
Belvedere
Alice
Lincoln
Garfield
Grant
Robinson
Crain
Sheridan
Saint Marys
Wood
Green
State
Meadowlane
Ferry
Carpenter
May
Eaton
Hampton
Belevedere
Overlook
Stover
M 66
31
Airport
Stover


Map 8
Percent Tree Canopy
0.30 - 8.60% (5)
8.61 - 18.10% (4)
18.11 - 27.90% (3)
27.91 - 35.50% (2)
35.51 - 41.60% (1)
Lake Michigan
Lake Charlevoix
Division
Mercer
Taylor
Gibbons
Petoskey
Stroud
Michigan
Meech
Prospect
Burns
Dixon
Oak
Elm
Cherry
Park
Amy
Chicago
C And O Club
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Belvedere
Upright
Alice
Lincoln
Garfield
Grant
Robinson
Crain
Sheridan
Saint Marys
Wood
Green
State
May
Meadowlane
Ferry
Carpenter
Eaton
Hampton
31
Belevedere
M 66
Stover
Overlook
Stover


Charlevoix County


Charlevoix County

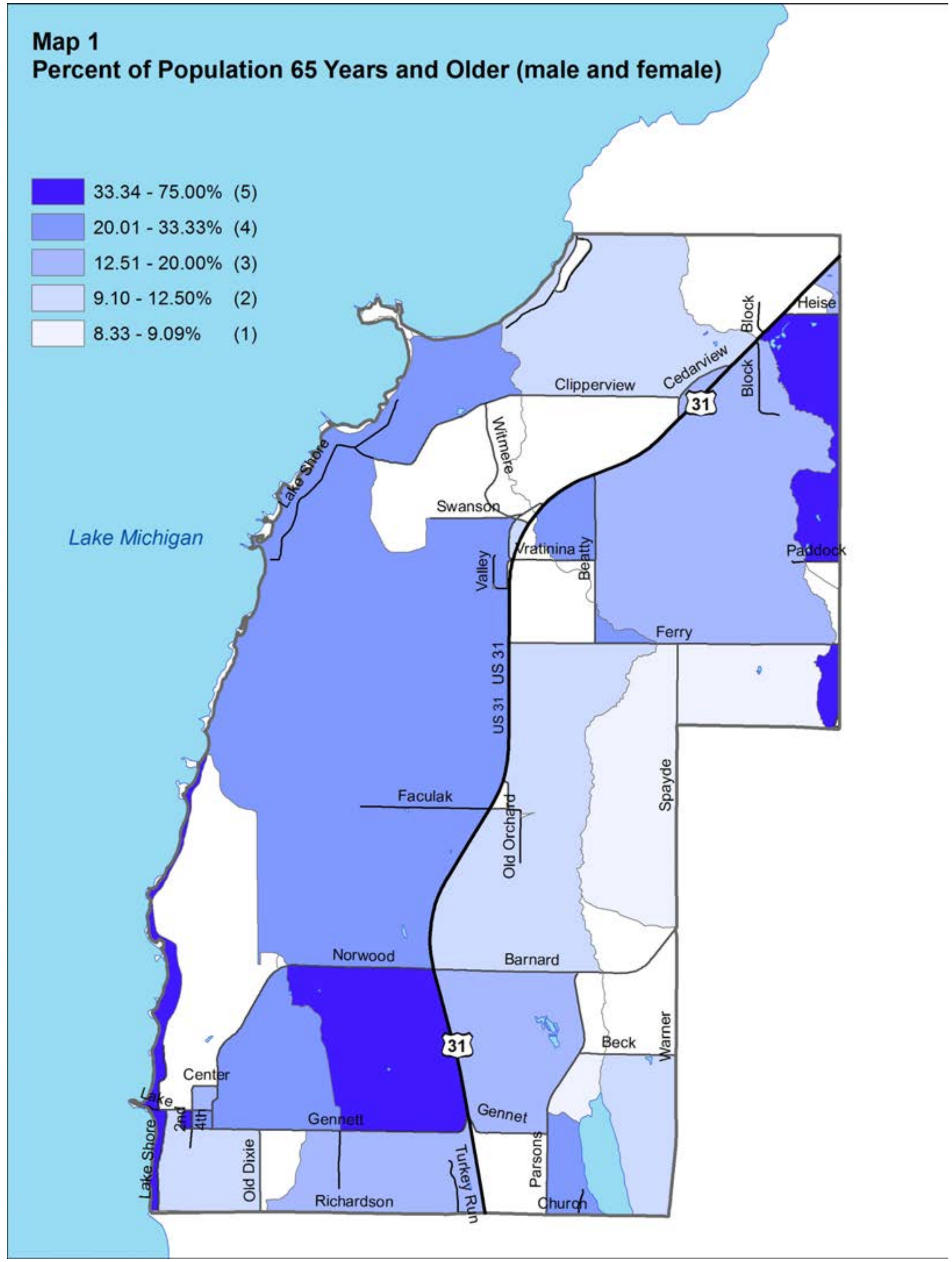

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re- score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
Lake Charlevoix
Taylor
Division
Mercer
Stroud
Petoskey
C And O Club
Michigan
Meech
Oak
Elm
Cherry
Dixon
Burns
Prospect
Amy
Chicago
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Upright
Belvedere
Lincoln
Garfield
Grant
Alice
Robinson
Crain
Saint Marys
Wood
Green
Meadowlane
Ferry
Sheridan
State
Carpenter
May
Eaton
Hampton
Belevedere
Stover
Overlook
M 66
31

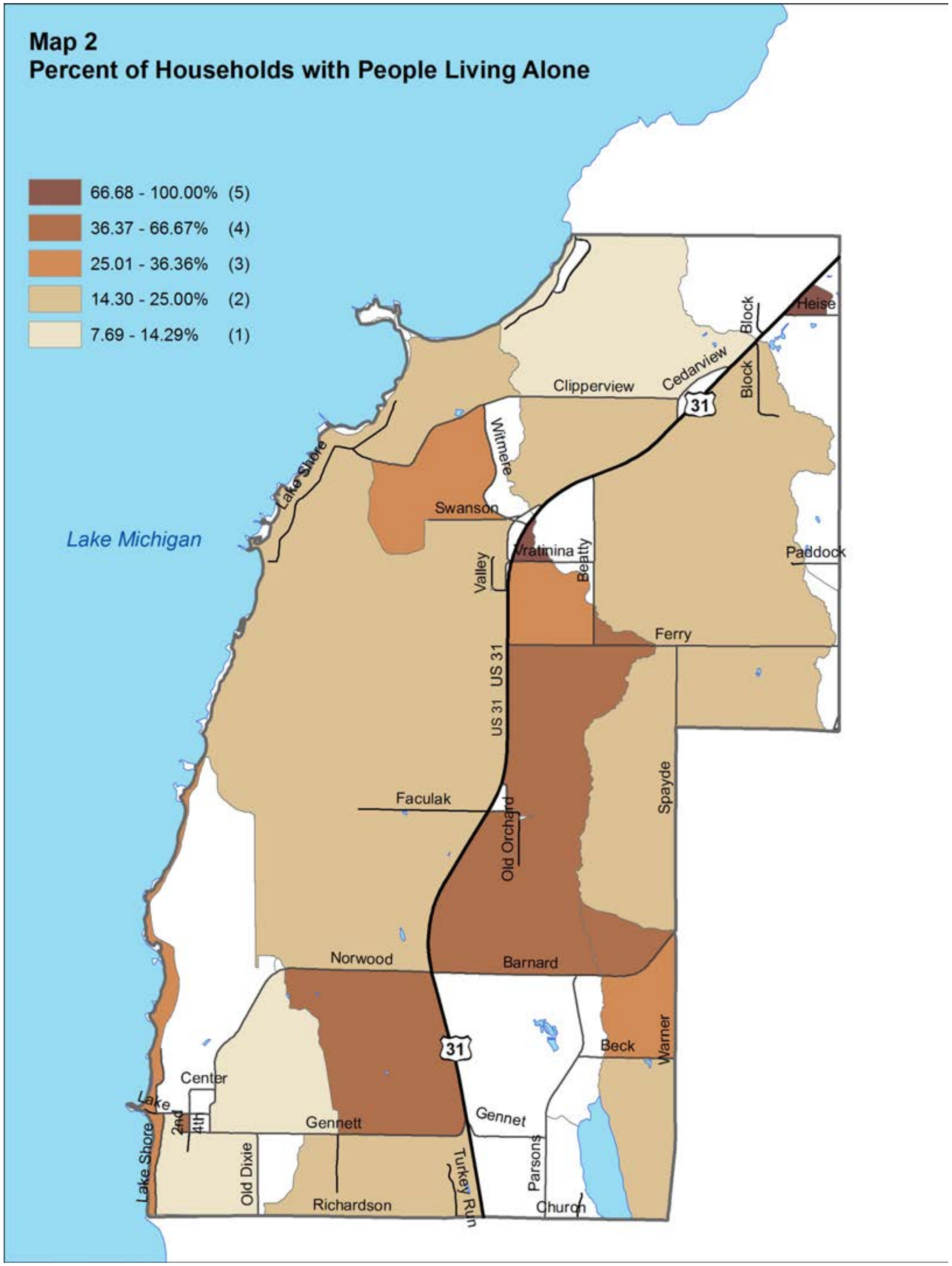

Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 10
7
6
5
3 - 4
Lake Michigan
Lake Charlevoix
Division
Mercer
Taylor
Gibbons
Arice
Petoskey
Stroud
C And O Club
Michigan
Auld
Meech
Prospect
Burns
Dixon
Oak
Elm
Cherry
Park
Amy
Chicago
Pine River
Palmer
Park
Clinton
Mason
Antrim
Newman
Hurlbut
Bridge
Upright
Belvedere
Alice
Lincoln
Grant
Garfield
Robinson
Crain
Saint Marys
Wood
Green
Sheridan
State
Carpenter
May
Meadowlane
Ferry
Eaton
Hampton
Belevedere
Overlook
Stover
M 66
Airport
Stover
31


Charlevoix County

Norwood Twp.

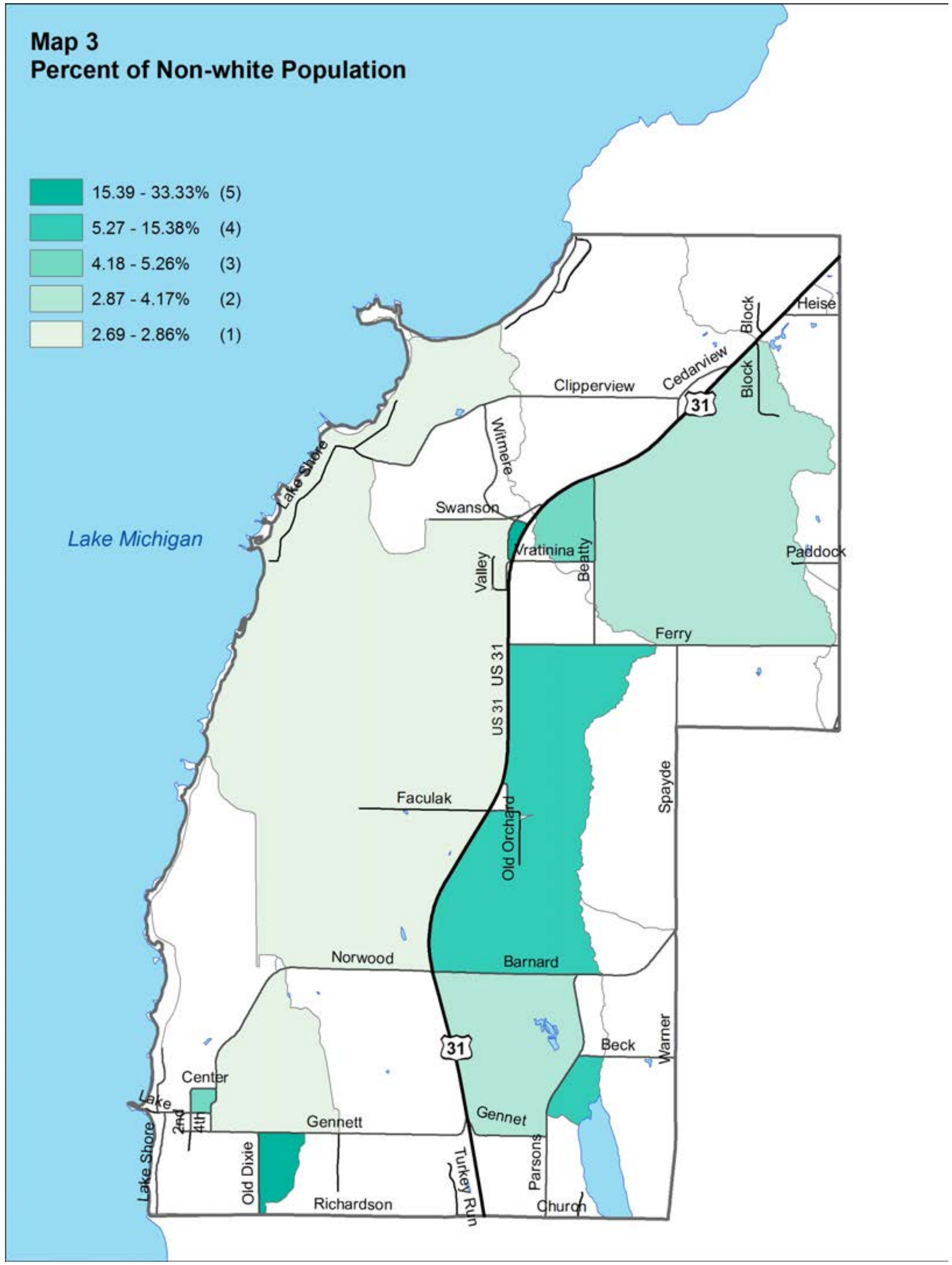

Charlevoix County

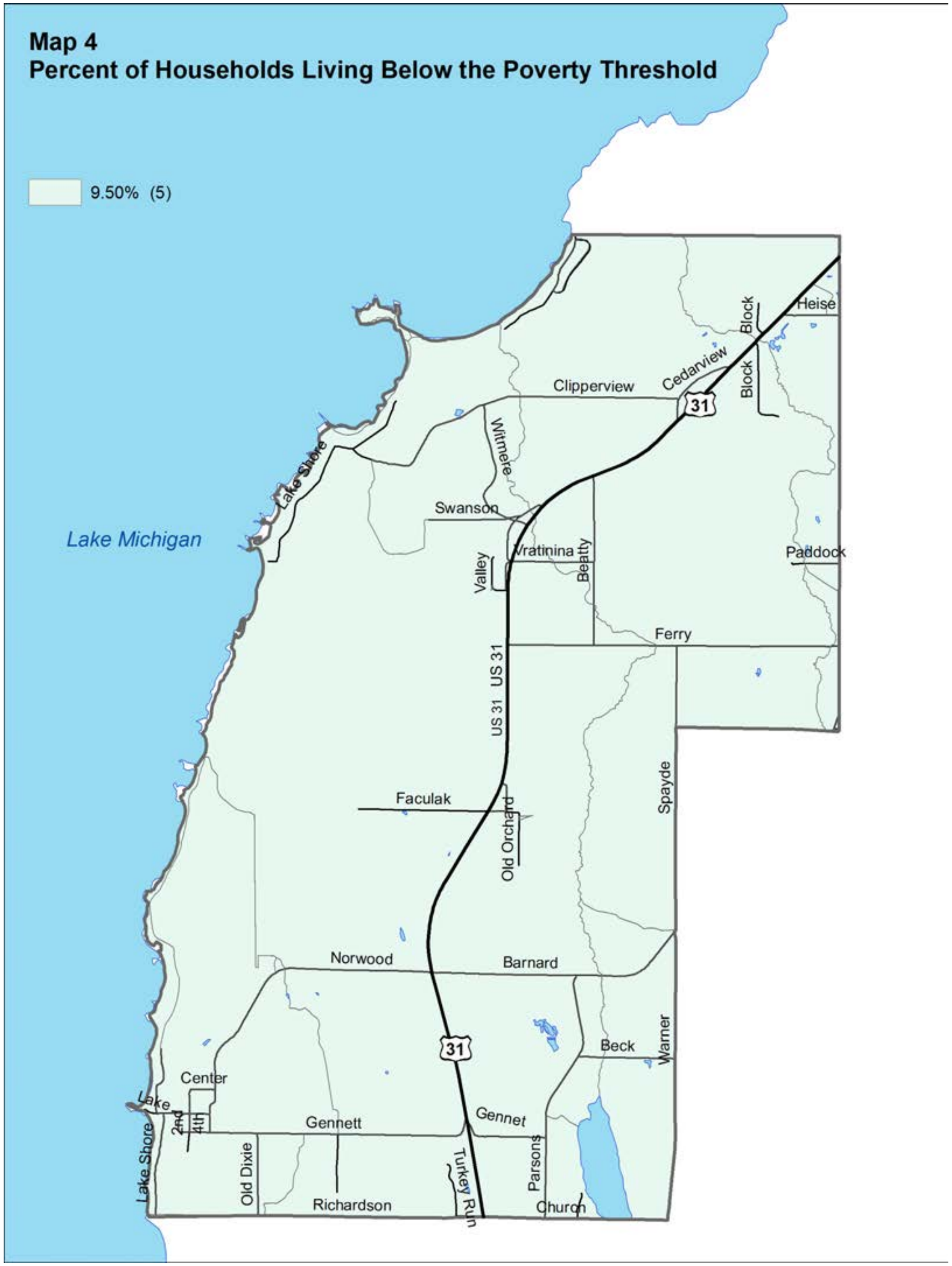

Map 1
Percent of Population 65 Years and Older (male and female)
33.34 - 75.00% (5)
20.01 - 33.33% (4)
12.51 - 20.00% (3)
9.10 - 12.50% (2)
8.33 - 9.09% (1)
Lake Michigan
Lake Shore
Clipperview
Cedarview
Block
Heise
31
Witmere
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
Faculak
Old Orchard
Spayde
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Old Dixie
Richardson
Turkey Run
Parsons
Church


Map 2
Percent of Households with People Living Alone
66.68 - 100.00% (5)
36.37 - 66.67% (4)
25.01 - 36.36% (3)
14.30 - 25.00% (2)
7.69 - 14.29% (1)
Lake Michigan
Lake Shore
Clipperview
Cedarview
Block
Block
Heise
31
Witmere
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
US 31
Spayde
Faculak
Old Orchard
Norwood
Barnard
31
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Lake Shore
Old Dixie
Richardson
Turkey Run
Parsons
Church


Charlevoix County

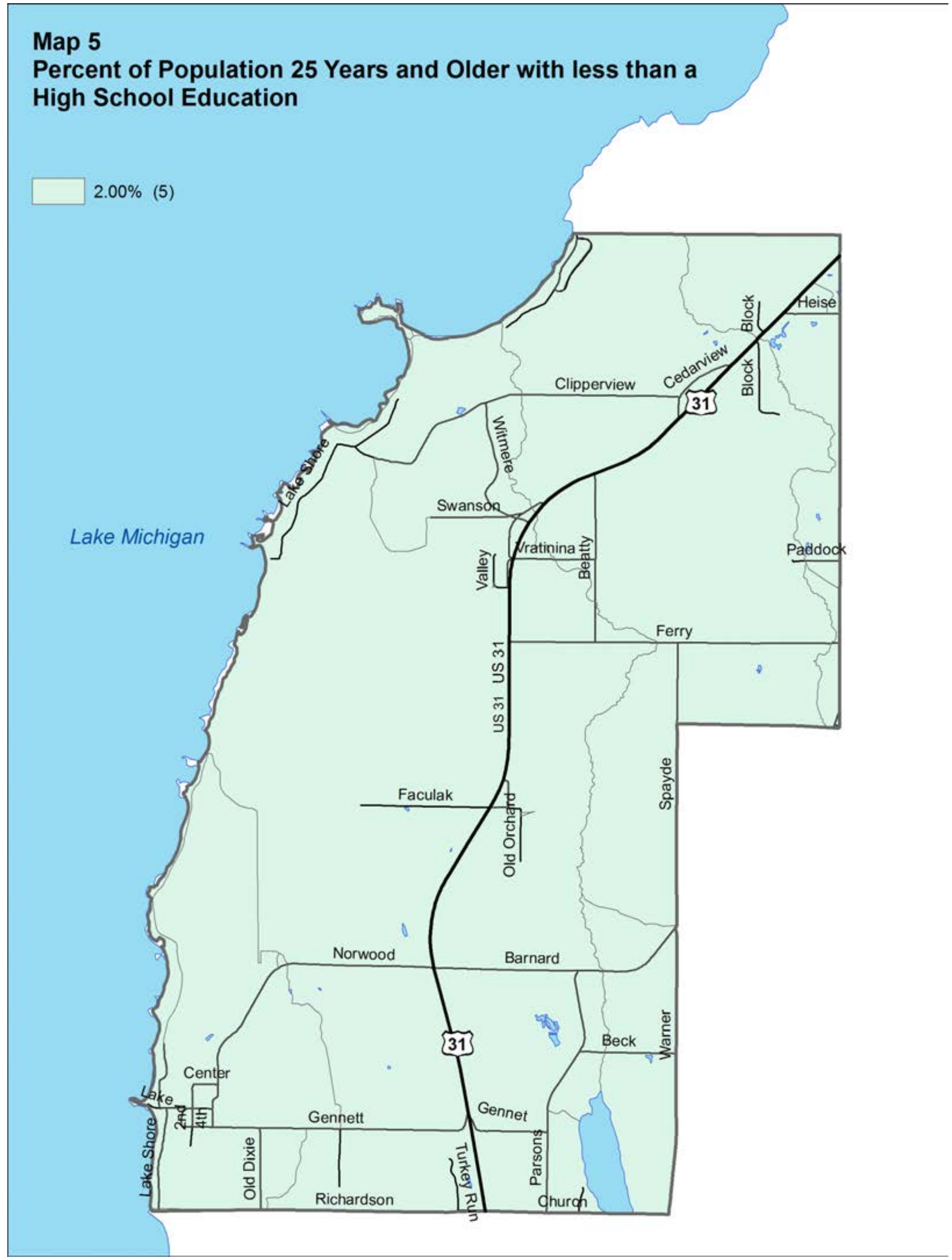

Charlevoix County

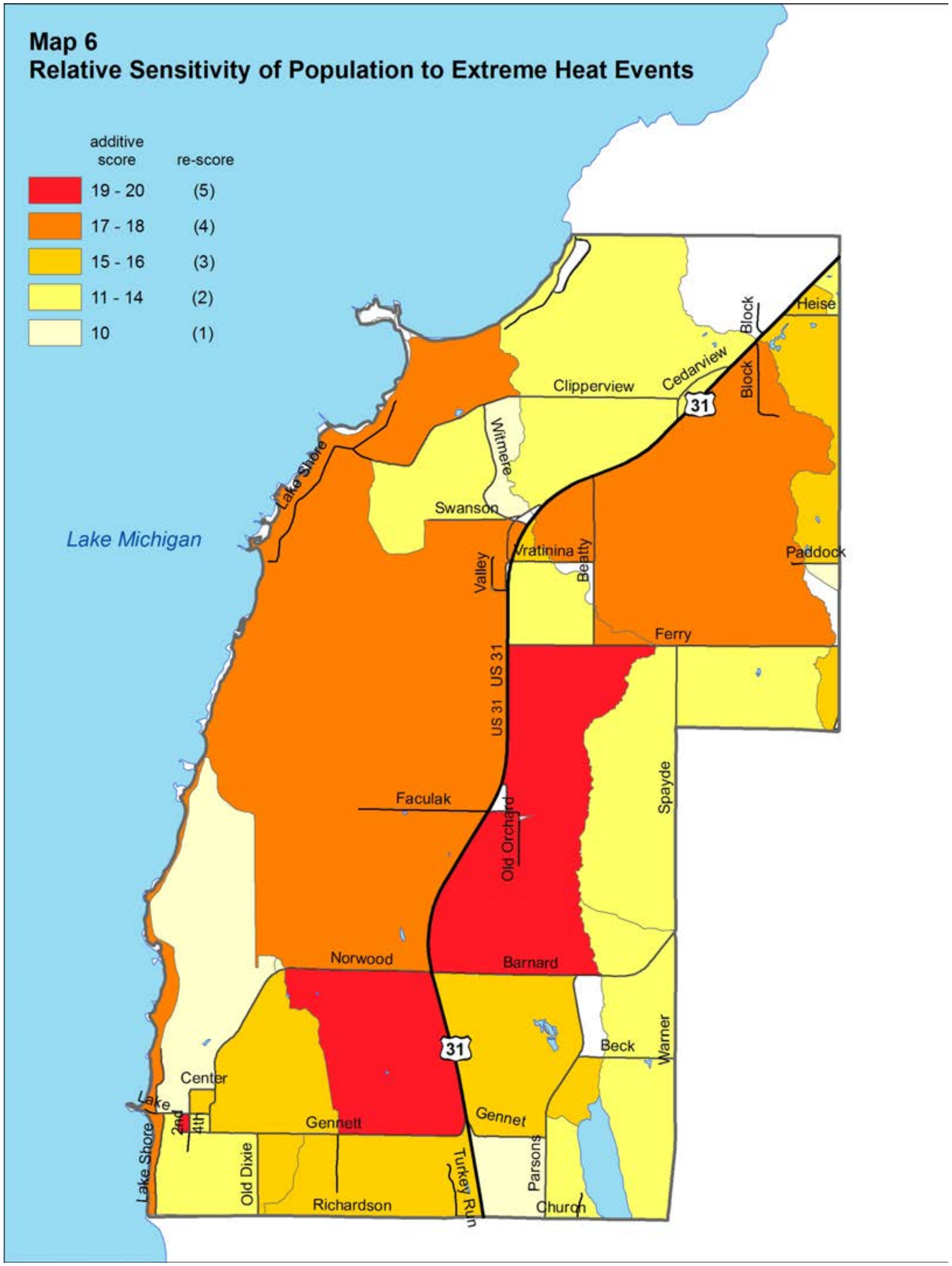

Map 3
Percent of Non-white Population
15.39 - 33.33% (5)
5.27 - 15.38% (4)
4.18 - 5.26% (3)
2.87 - 4.17% (2)
2.69 - 2.86% (1)
Lake Michigan
Lake Shore
Clipperview
Cedarview
Block
Heise
31
Witmere
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
Faculak
Old Orchard
Spayde
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Old Dixie
Richardson
Turkey Run
Parsons
Church


Map 4
Percent of Households Living Below the Poverty Threshold
9.50% (5)
Lake Michigan
Lake Shore
Clipperview
Cedarview
Block
Heise
Witmere
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
31
Faculak
Old Orchard
Spayde
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Old Dixie
Richardson
Turkey Run
Parsons
Church


Charlevoix County

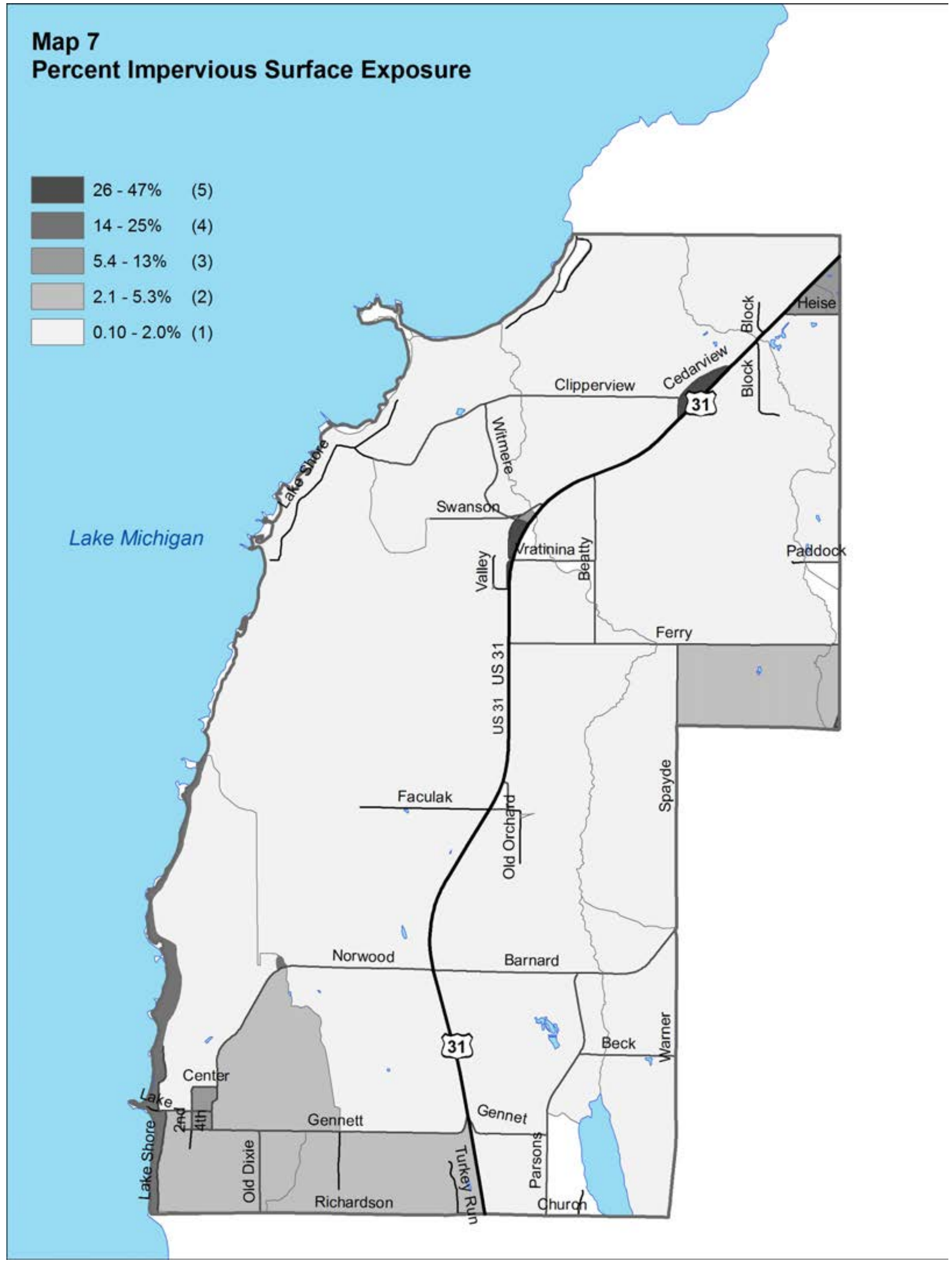

Charlevoix County

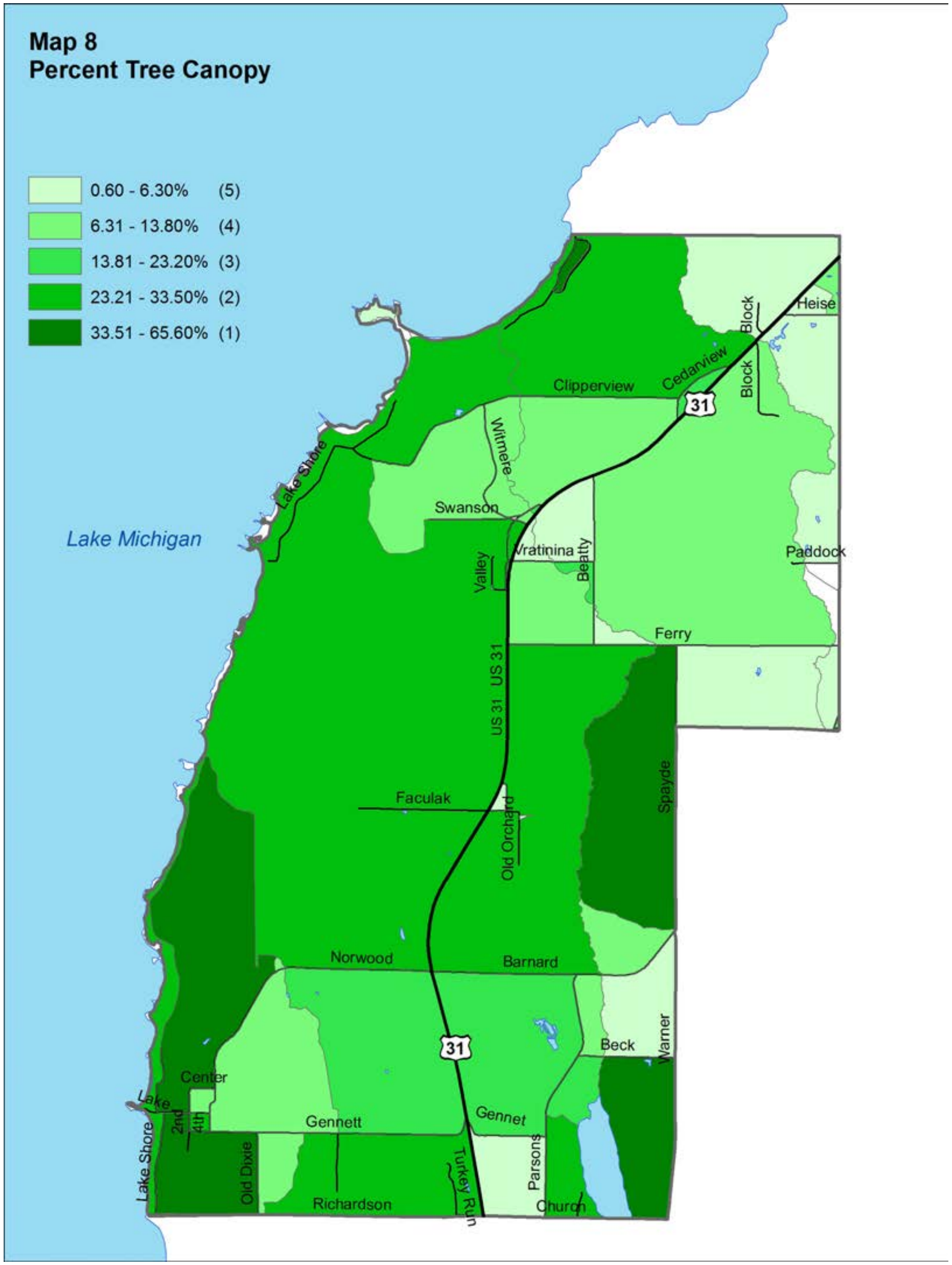

Map 5
Percent of Population 25 Years and Older with less than a High School Education
2.00% (5)
Lake Michigan
Lake Shore
Clipperview
Cedarview
Block
Heise
31
Witmere
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
Faculak
Old Orchard
Spayde
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Old Dixie
Richardson
Turkey Run
Parsons
Church


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
19 - 20 (5)
17 - 18 (4)
15 - 16 (3)
11 - 14 (2)
10 (1)
Lake Michigan
Clipperview
Cedarview
Block
Heise
31
Lake Shore
Witmere
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
Spayde
Faculak
Old Orchard
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Lake Shore
Old Dixie
Richardson
Turkey Run
Parsons
Church


Charlevoix County

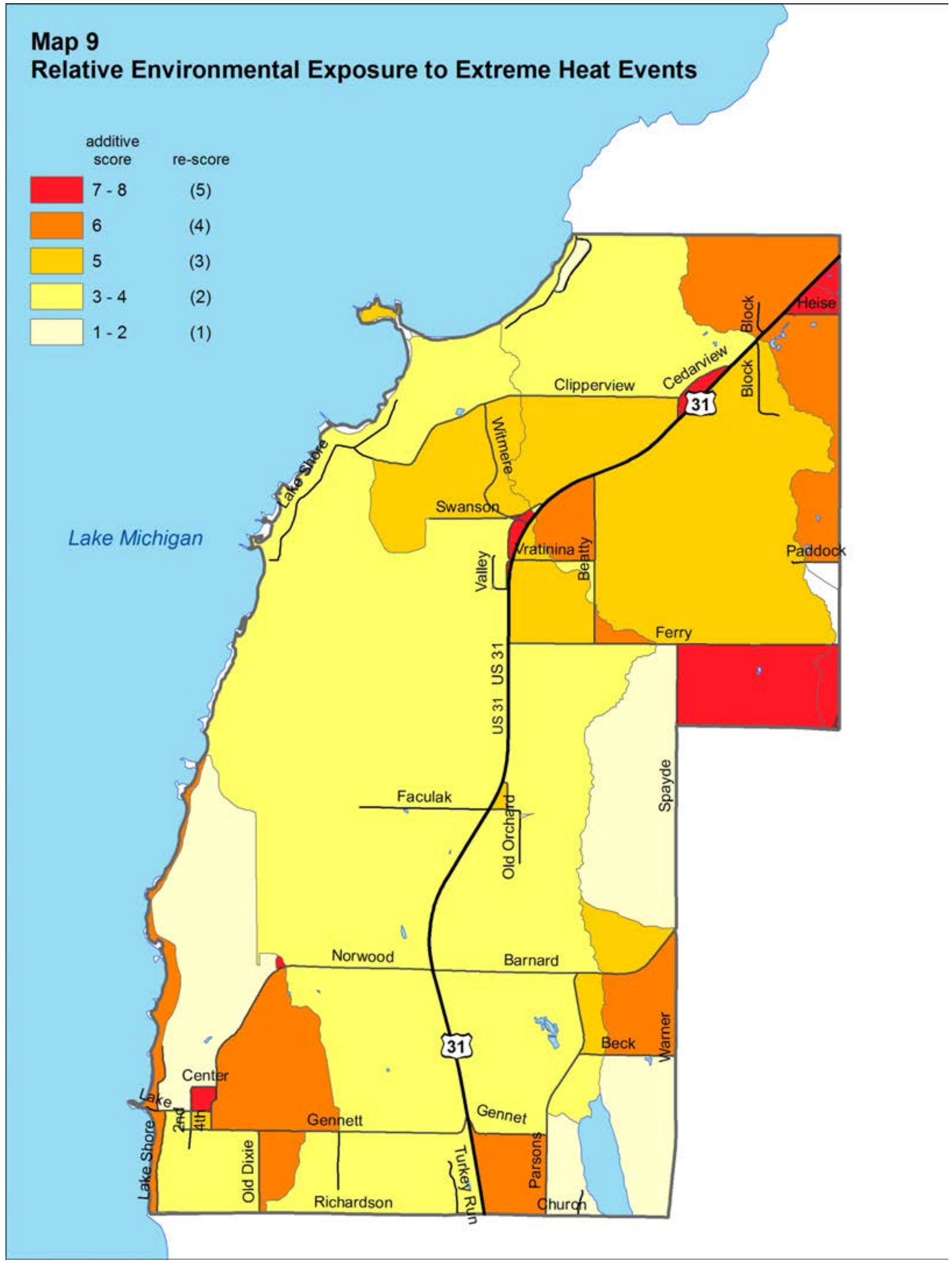

Charlevoix County

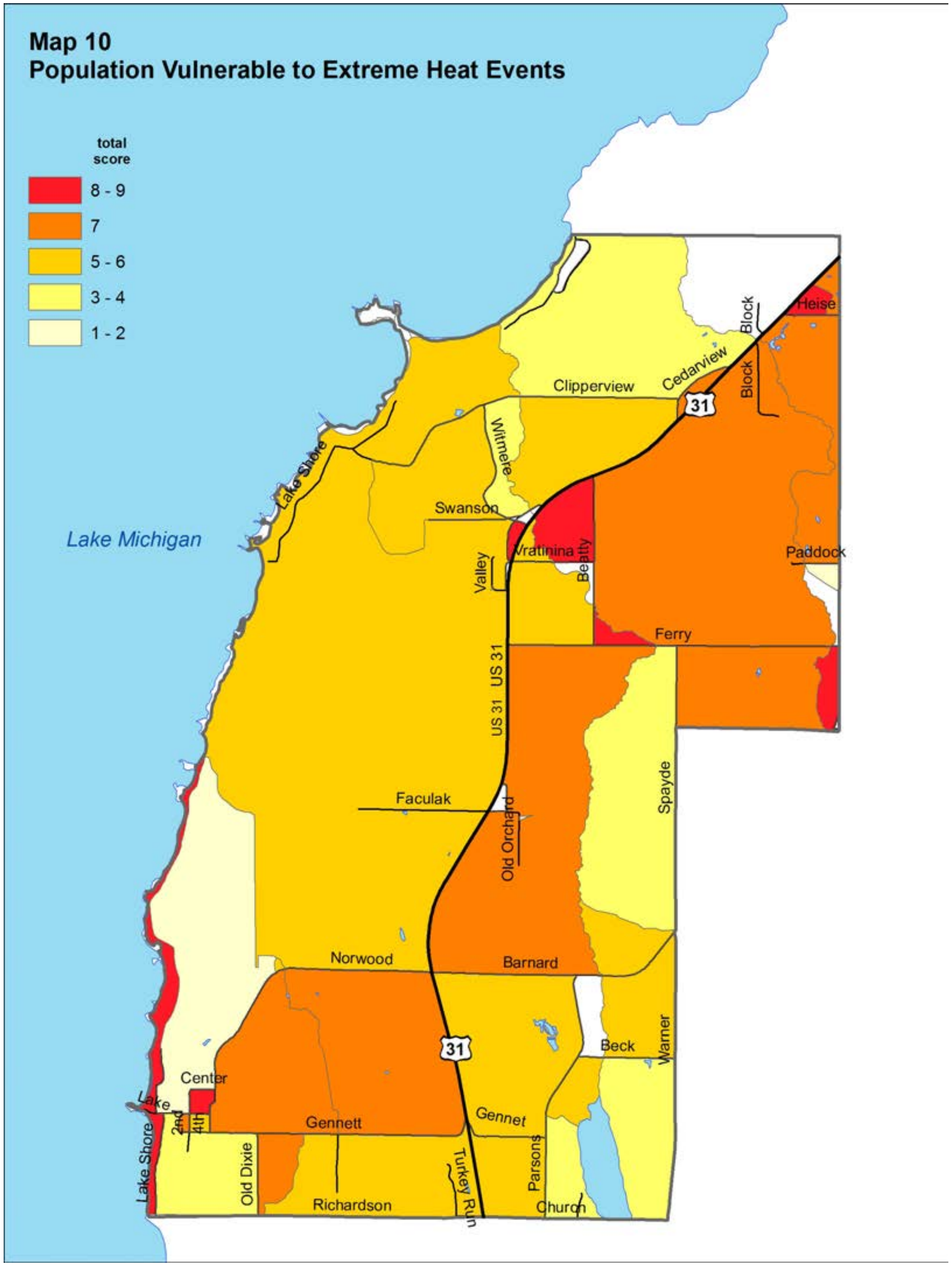

Map 7
Percent Impervious Surface Exposure
26 - 47% (5)
14 - 25% (4)
5.4 - 13% (3)
2.1 - 5.3% (2)
0.10 - 2.0% (1)
Lake Michigan
Clipperview
Cedarview
Block
Heise
Witmere
Lake Shore
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
Faculak
Old Orchard
Spayde
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Lake Shore
Old Dixie
Richardson
Turkey Run
Parsons
Church
31


Map 8
Percent Tree Canopy
0.60 - 6.30% (5)
6.31 - 13.80% (4)
13.81 - 23.20% (3)
23.21 - 33.50% (2)
33.51 - 65.60% (1)
Lake Michigan
Lake Shore
Clipperview
Cedarview
Block
Heise
31
Witmere
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
Faculak
Old Orchard
Spayde
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Old Dixie
Richardson
Turkey Run
Parsons
Church


Charlevoix County


Charlevoix County

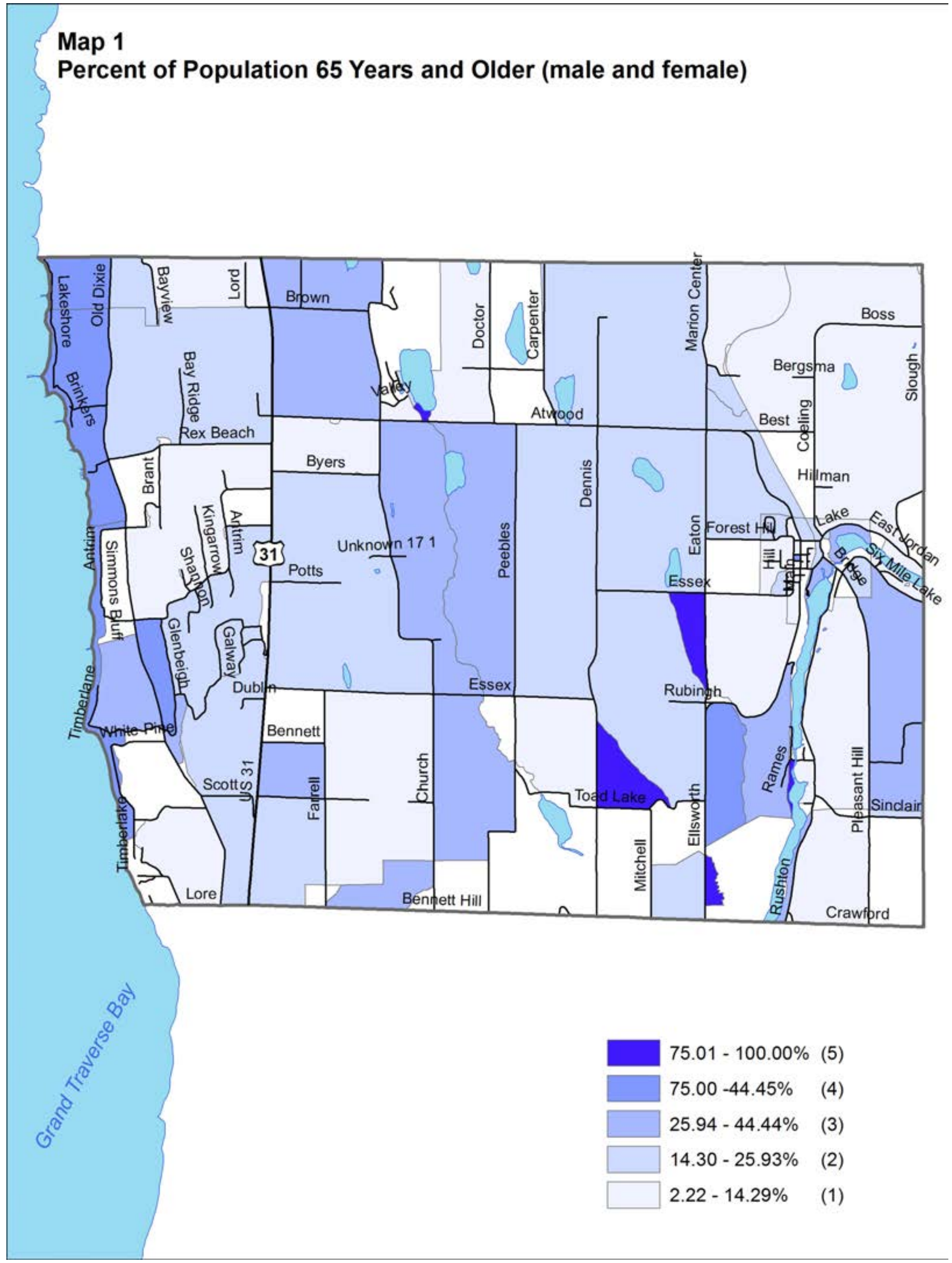

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
7 - 8 (5)
6 (4)
5 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
Clipperview
Cedarview
Block
Heise
31
Witmere
Lake Shore
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
Faculak
Old Orchard
Spayde
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Old Dixie
Richardson
Turkey Run
Parsons
Church

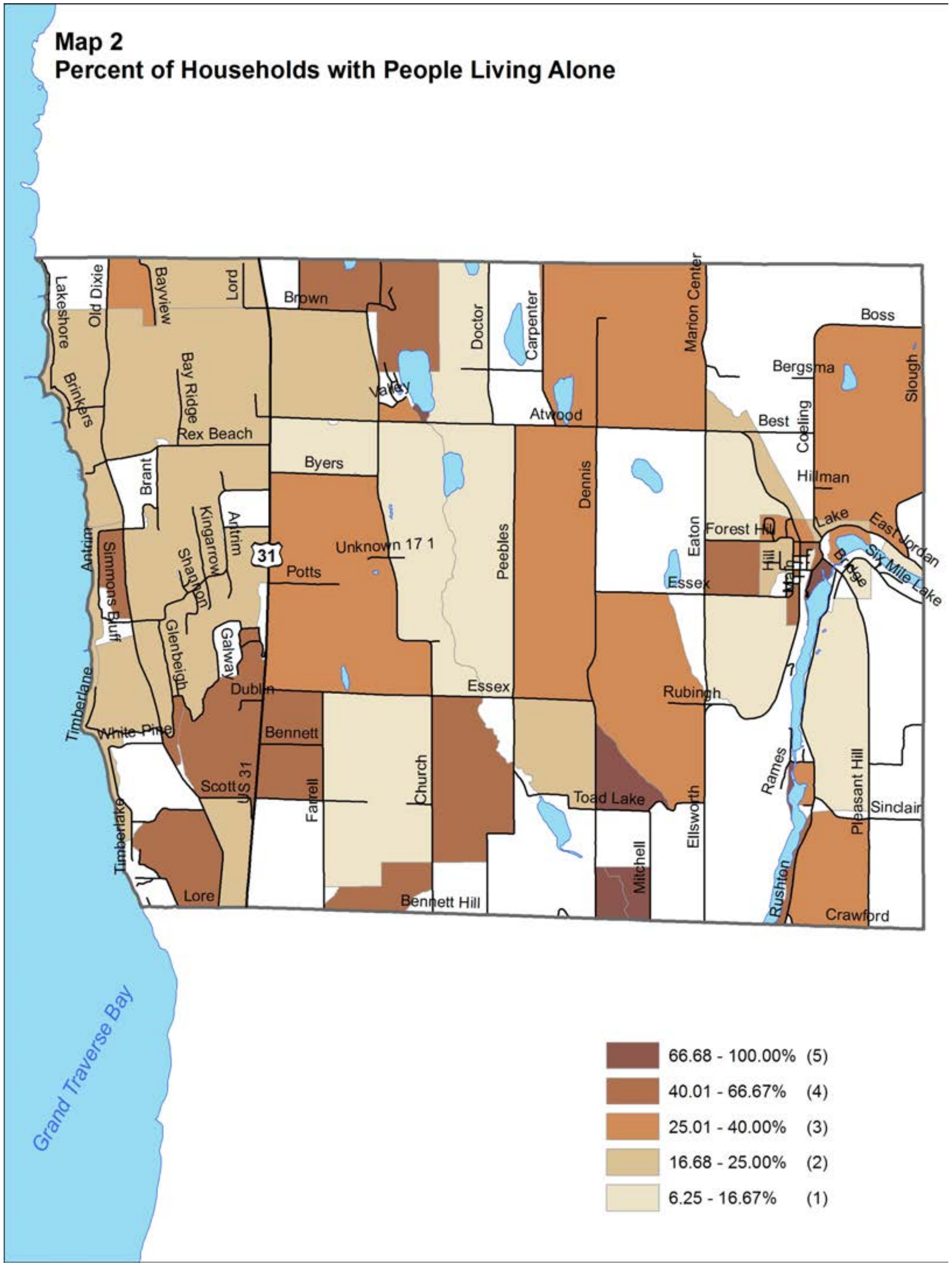

Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
7
5 - 6
3 - 4
1 - 2
Lake Michigan
Lake Shore
Clipperview
Cedarview
Block
Heise
Witmere
Swanson
Vratinina
Beatty
Valley
Paddock
Ferry
US 31
31
Faculak
Old Orchard
Spayde
Norwood
Barnard
Beck
Warner
Center
Lake
2nd
4th
Gennett
Gennet
Old Dixie
Richardson
Turkey Run
Parsons
Church


Charlevoix County

Antrim County

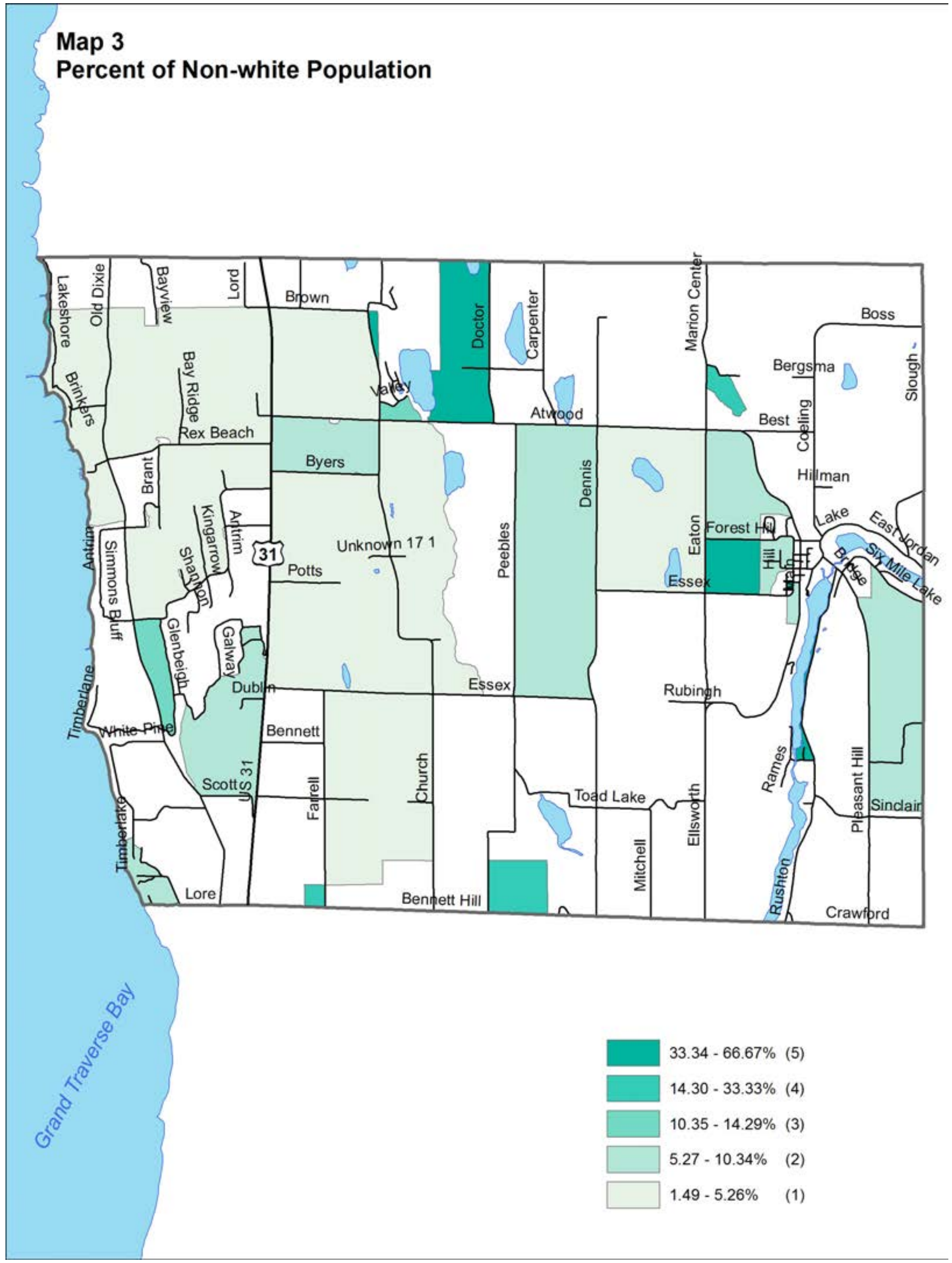
Banks Twp./Ellsworth

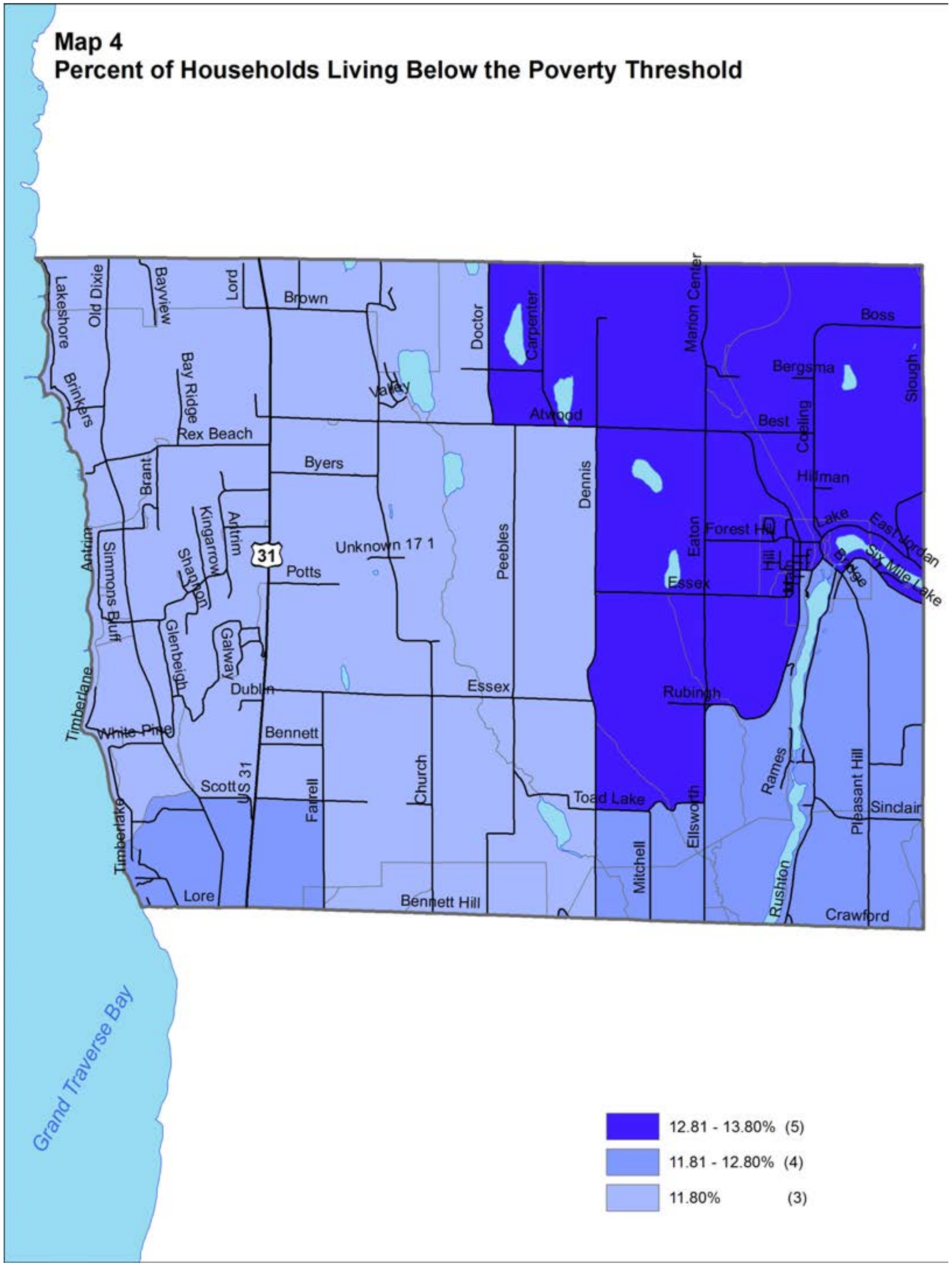



Map 2
Percent of Households with People Living Alone
Grand Traverse Bay
66.68 - 100.00% (5)
40.01 - 66.67% (4)
25.01 - 40.00% (3)
16.68 - 25.00% (2)
6.25 - 16.67% (1)


Antrim County

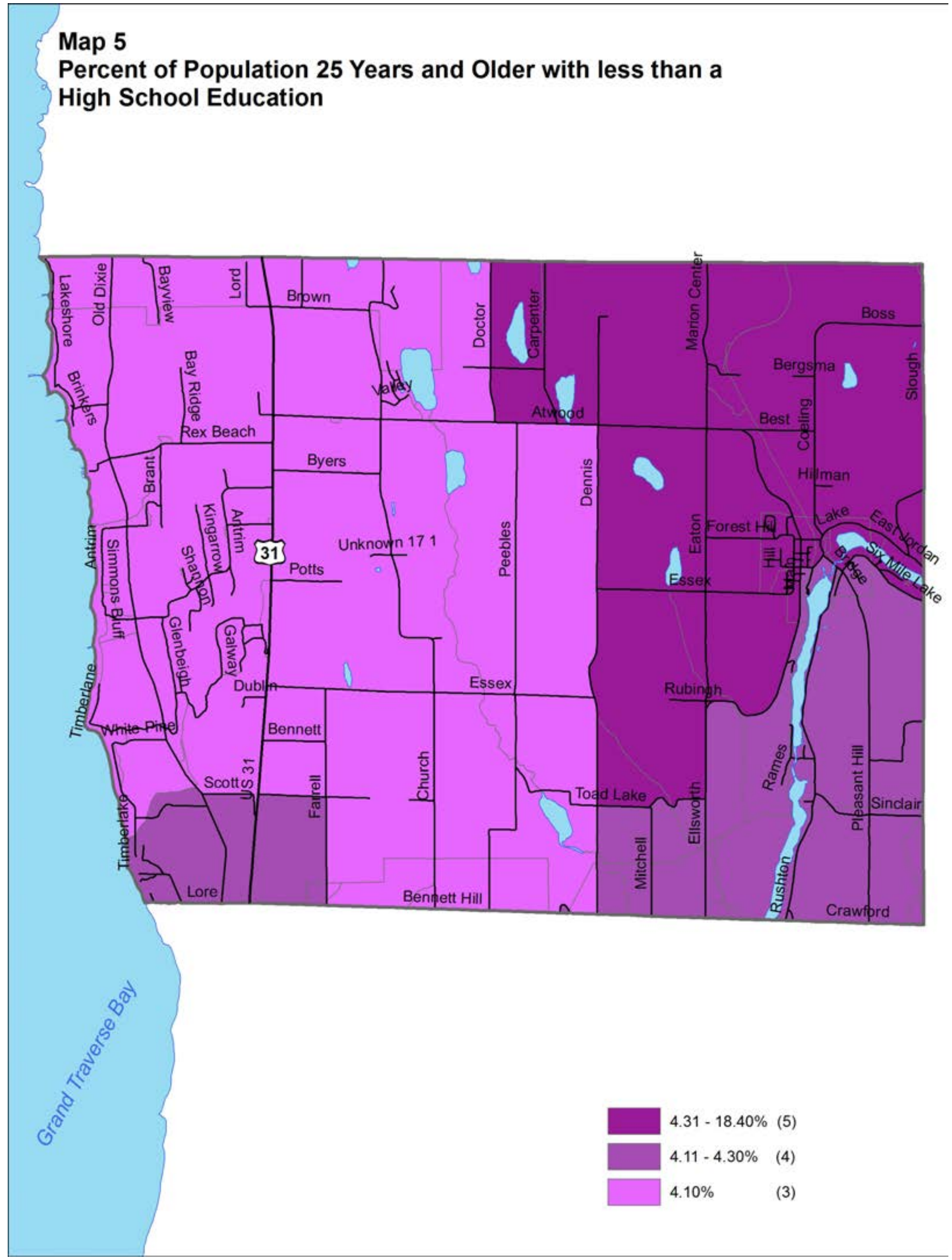

Antrim County


Map 3
Percent of Non-white Population
Grand Traverse Bay
33.34 - 66.67% (5)
14.30 - 33.33% (4)
10.35 - 14.29% (3)
5.27 - 10.34% (2)
1.49 - 5.26% (1)

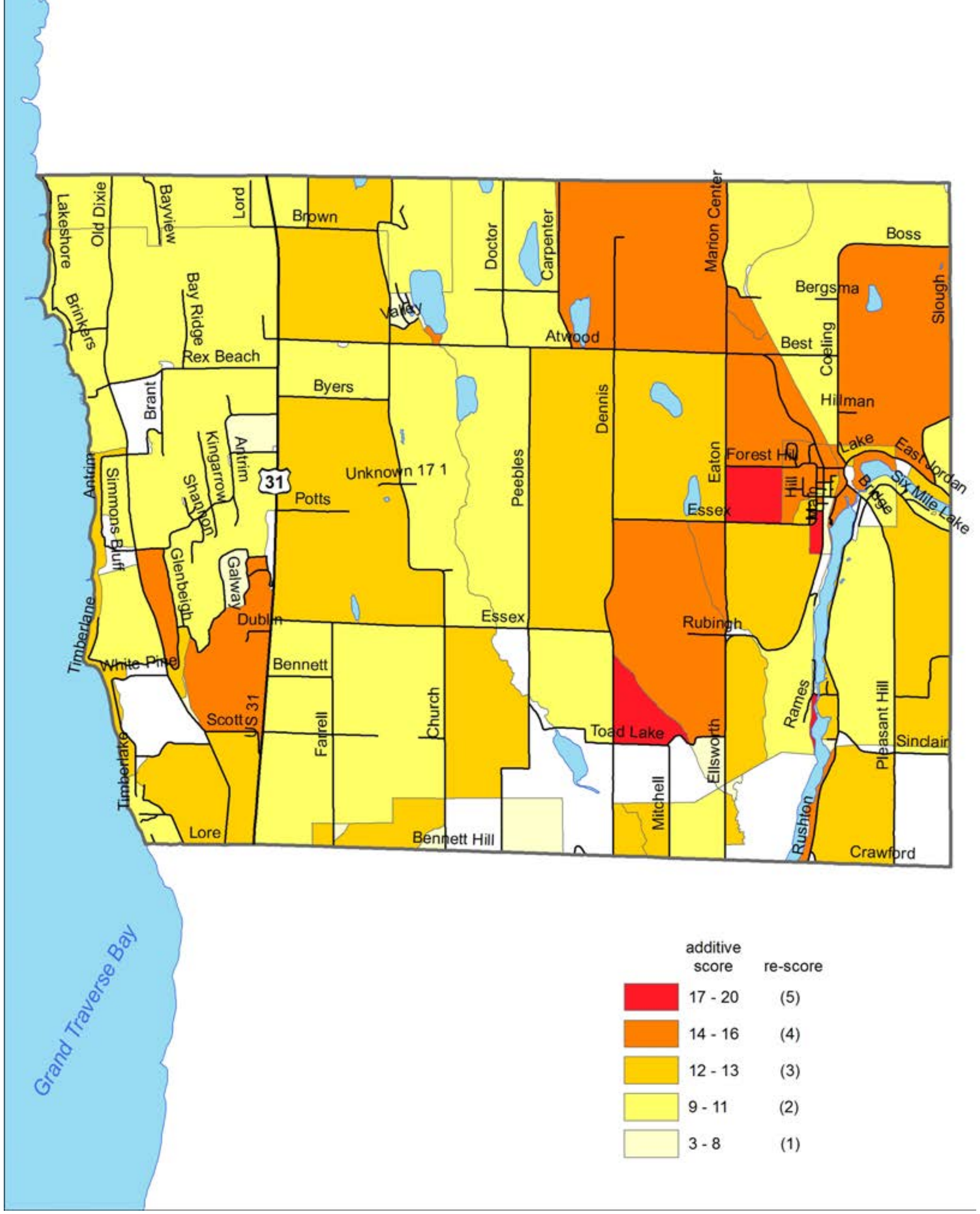

Map 4
Percent of Households Living Below the Poverty Threshold
Grand Traverse Bay
12.81 - 13.80% (5)
11.81 - 12.80% (4)
11.80% (3)

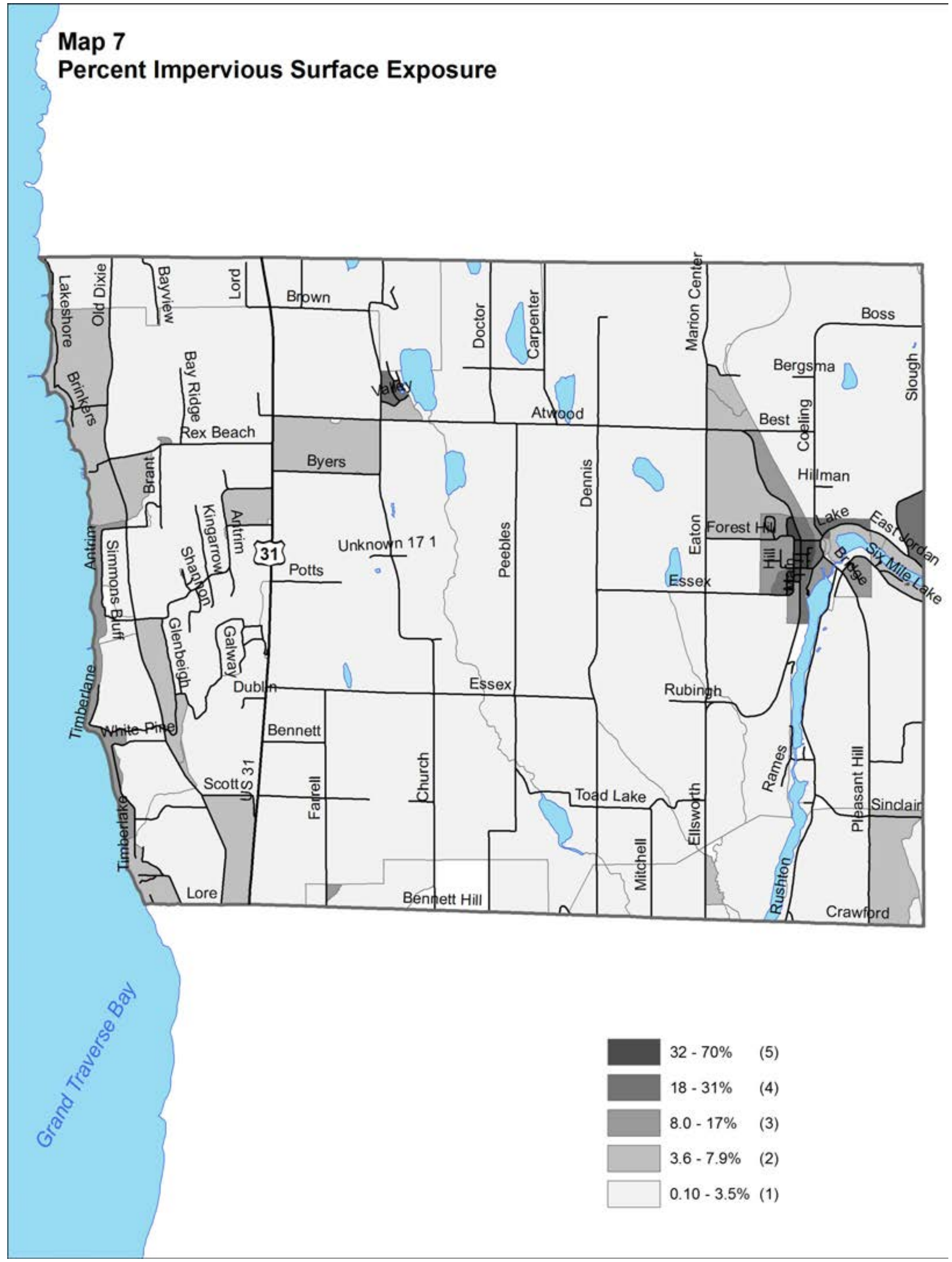

Antrim County


Antrim County

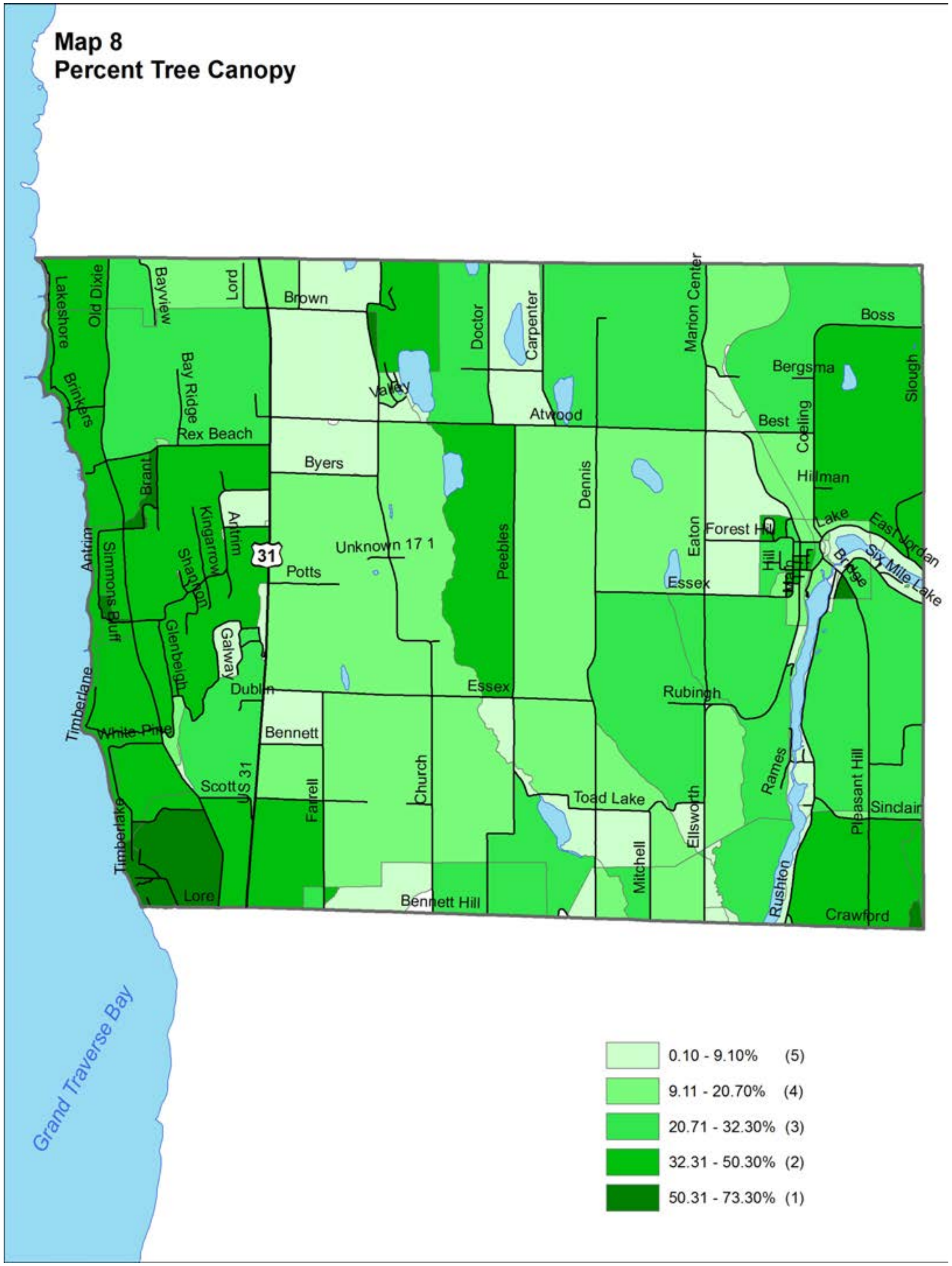

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Grand Traverse Bay
4.31 - 18.40% (5)
4.11 - 4.30% (4)
4.10% (3)

Map 6
Relative Sensitivity of Population to Extreme Heat Events



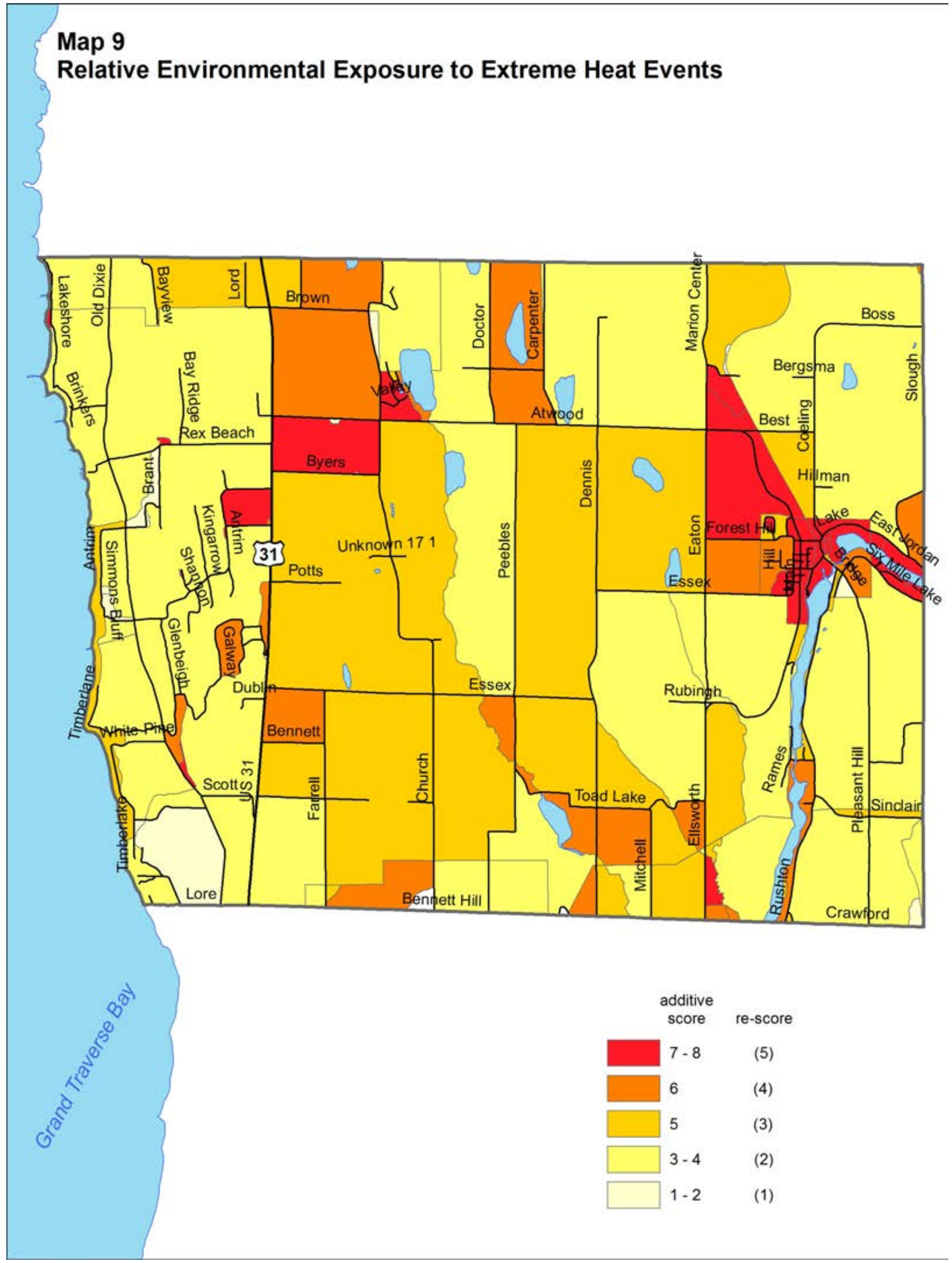


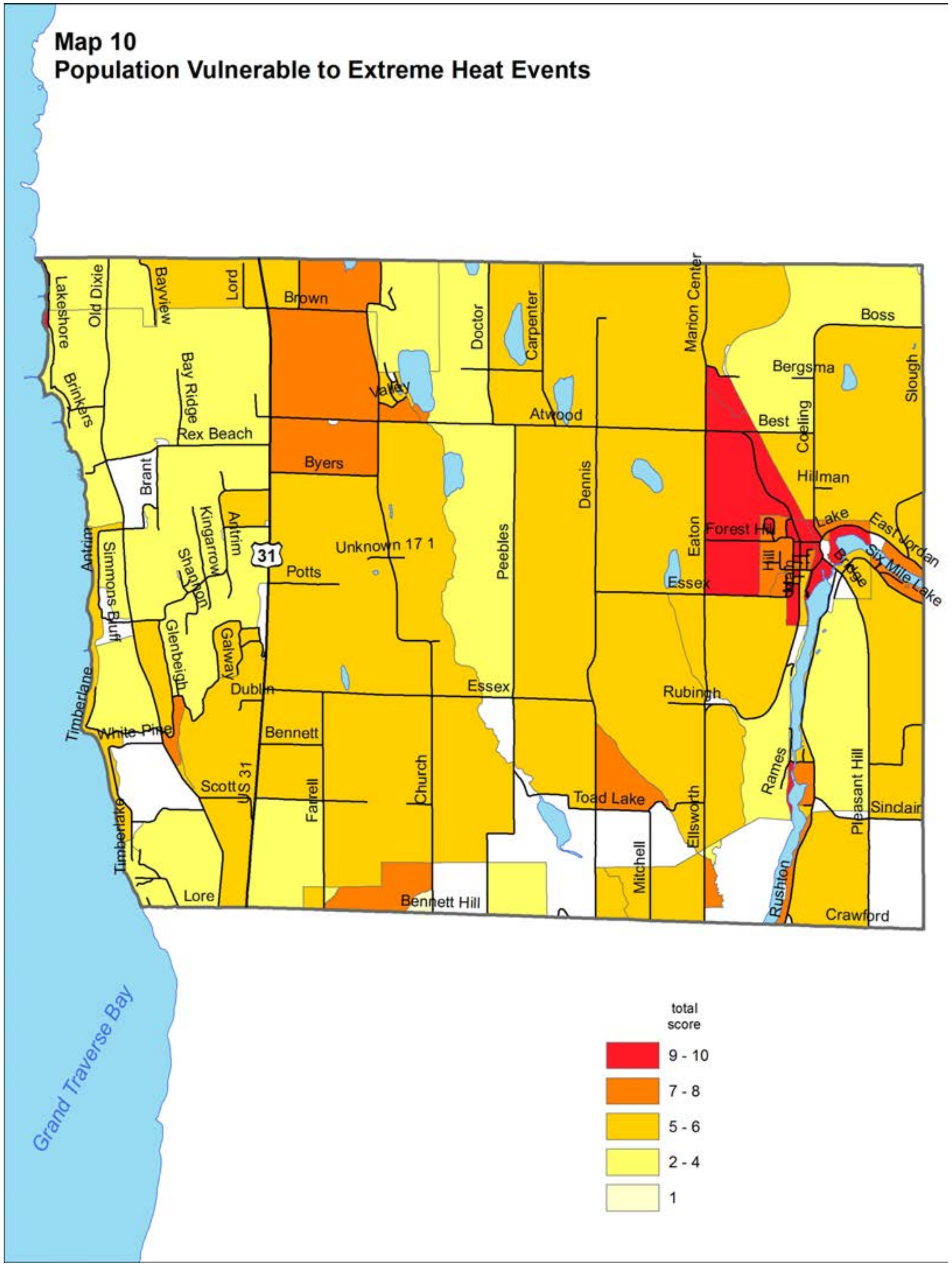
Map 7
Percent Impervious Surface Exposure


Map 8
Percent Tree Canopy
Lakeshore
Old Dixie
Bayview
Lord
Brown
Doctor
Carpenter
Marion Center
Boss
Brinkers
Bay Ridge
Valley
Atwood
Bergsma
Slough
Rex Beach
Best
Cooling
Byers
Brant
Hillman
Dennis
Antrim
Kingarrow
Antrim
31
Unknown 17 1
Peebles
Eaton
Forest Hill
Lake
East Jordan
Six Mile Lake
Bridge
Simmons Bluff
Shagton
Potts
Essex
Hill
Glenbeigh
Galway
Timberlane
Dublin
Essex
Rubingh
White Pine
Bennett
Scott
US 31
Farrell
Church
Rames
Pleasant Hill
Toad Lake
Ellsworth
Sinclair
Timberlake
Mitchell
Rushton
Lore
Bennett Hill
Crawford
Grand Traverse Bay
0.10 - 9.10% (5)
9.11 - 20.70% (4)
20.71 - 32.30% (3)
32.31 - 50.30% (2)
50.31 - 73.30% (1)


Antrim County

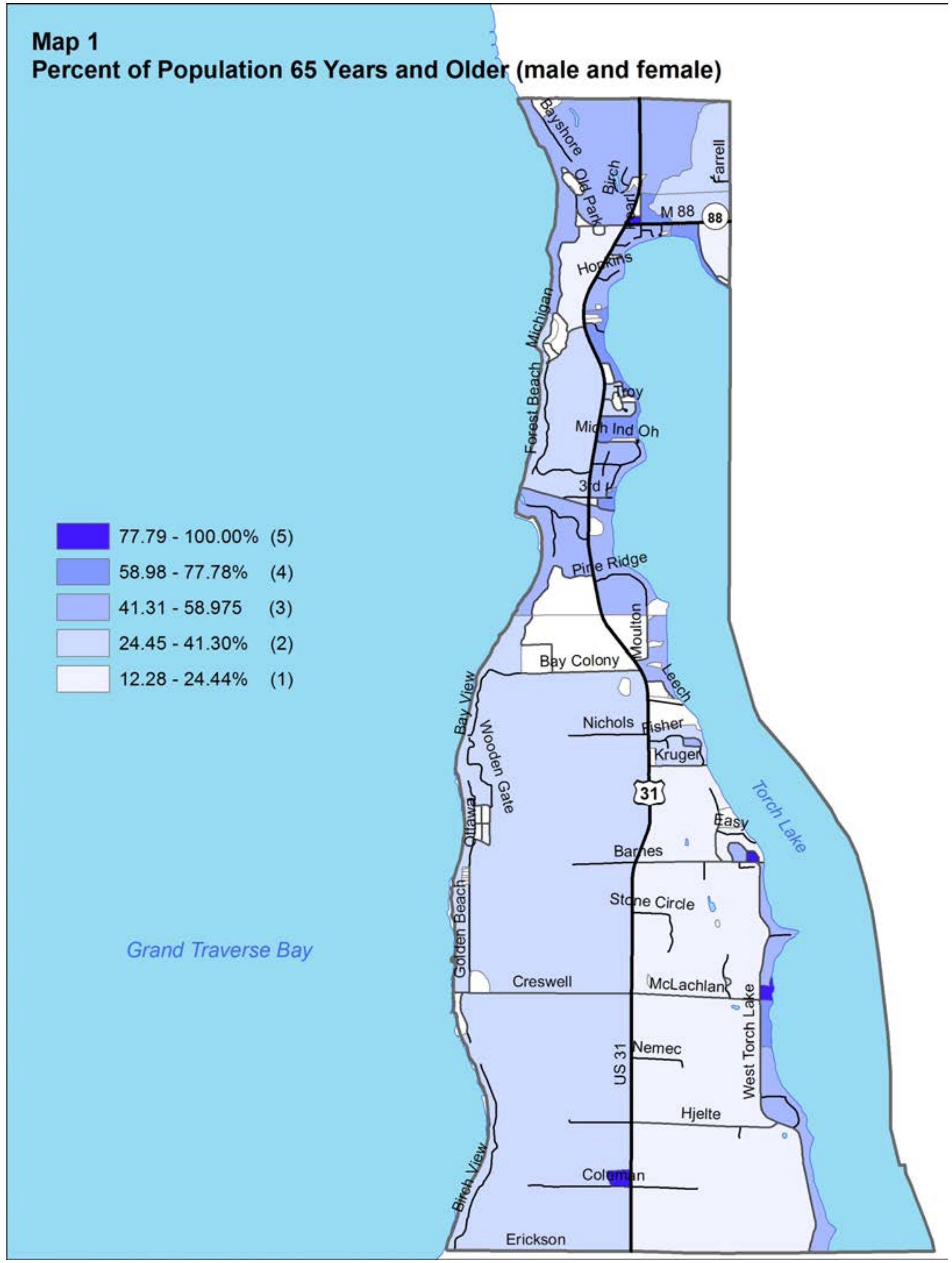

Antrim County

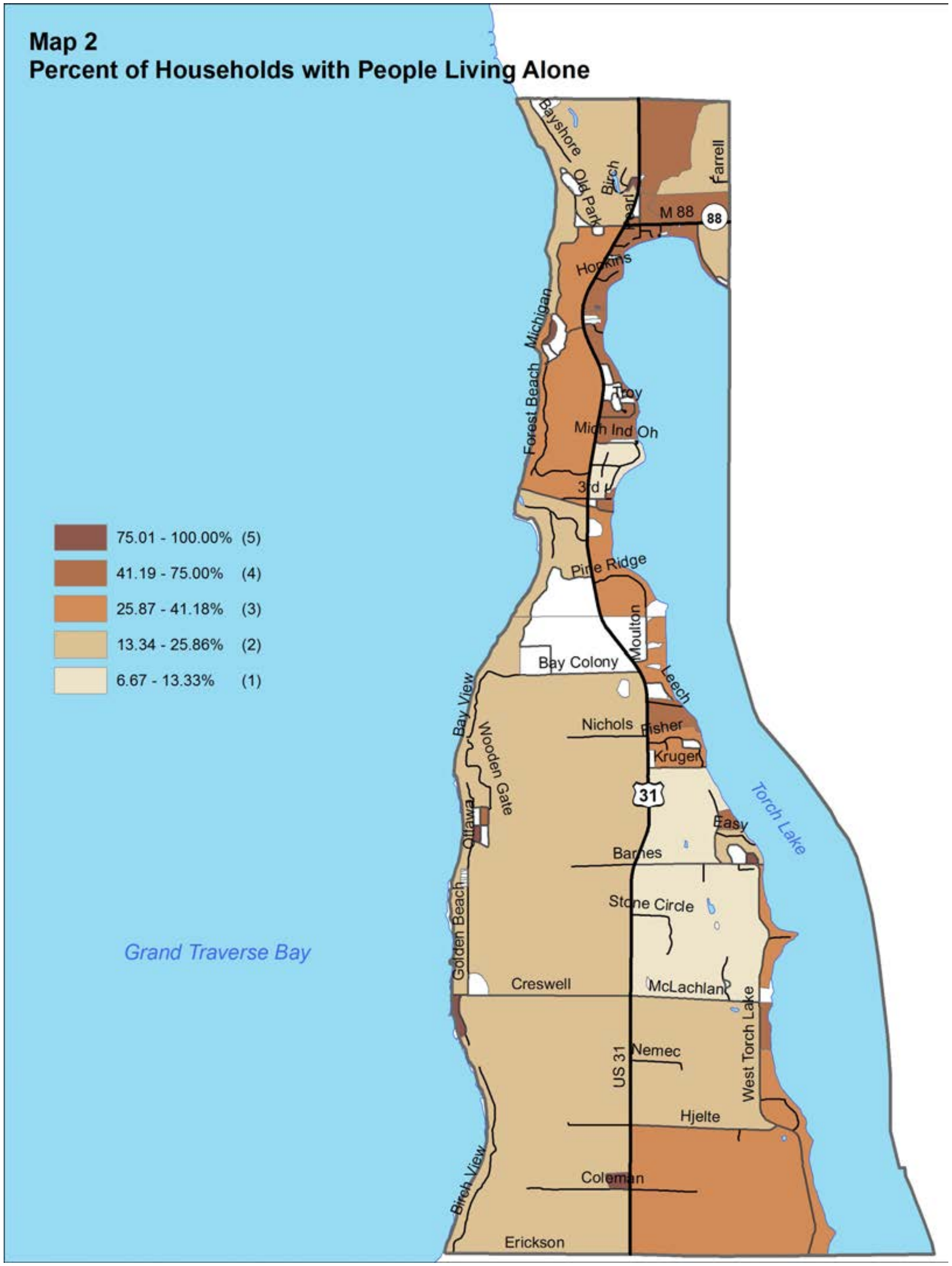

Map 9
Relative Environmental Exposure to Extreme Heat Events
Grand Traverse Bay
Lakeshore
Old Dixie
Bayview
Lord
Brown
Doctor
Carpenter
Marion Center
Boss
Bergsma
Slough
Brinkers
Bay Ridge
Rex Beach
Valley
Atwood
Best
Coeling
Hillman
Byers
Brant
Dennis
Forest Hill
Lake
East Jordan
Six Mile Lake
Bridge
Kingarrow
Antrim
Unknown 17 1
Potts
Peebles
Eaton
Essex
Simmons Bluff
Shannon
Glenbeigh
Galway
Dublin
Timberlane
White Pine
Bennett
Rubingh
Rames
Scott
US 31
31
Farrell
Church
Toad Lake
Ellsworth
Mitchell
Pleasant Hill
Sinclair
Lore
Bennett Hill
Rushton
Crawford
additive score
re-score
7 - 8 (5)
6 (4)
5 (3)
3 - 4 (2)
1 - 2 (1)


Map 10
Population Vulnerable to Extreme Heat Events
total score
9 - 10
7 - 8
5 - 6
2 - 4
1
Grand Traverse Bay


Antrim County

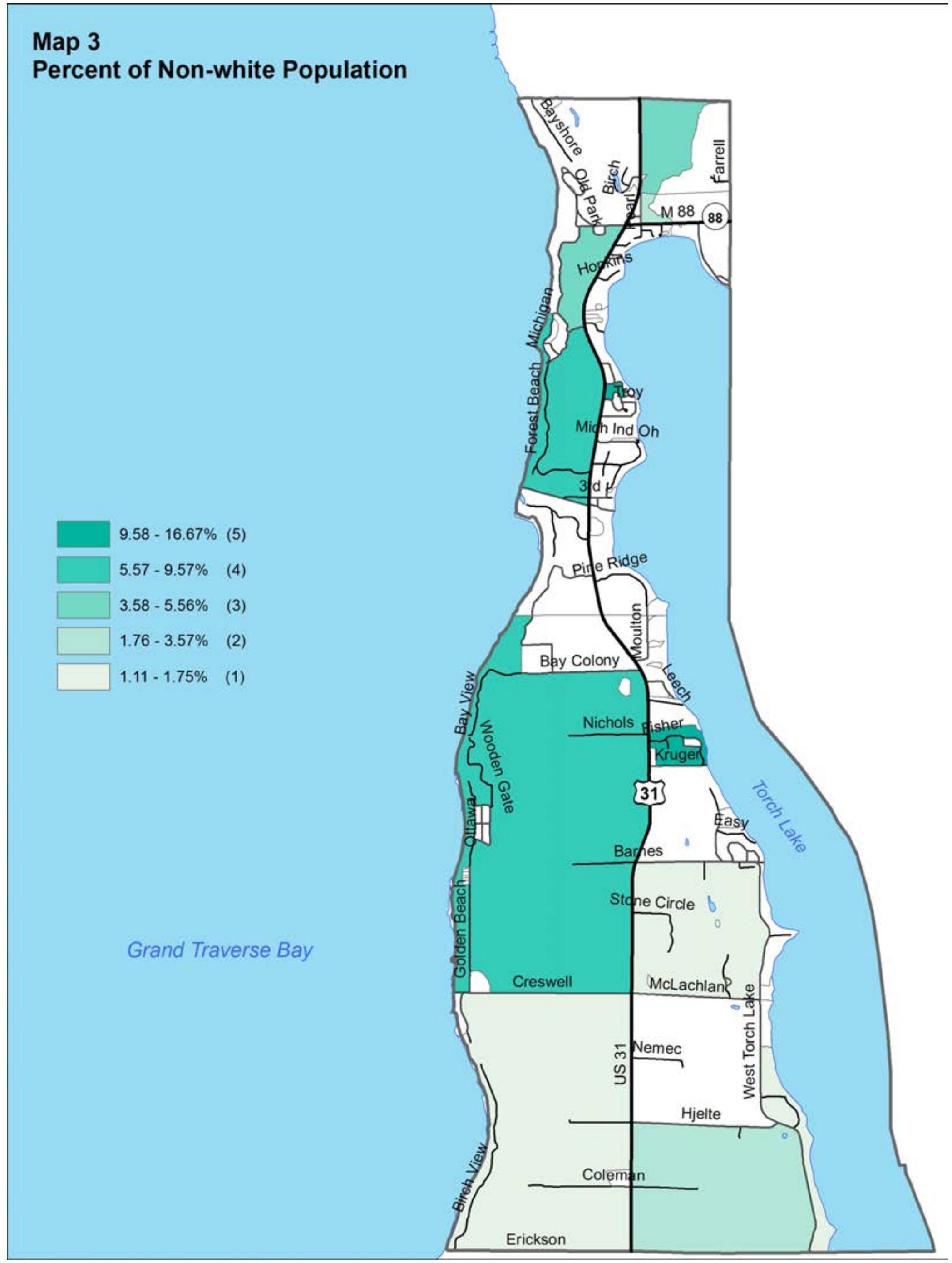
Torch Lake Twp.

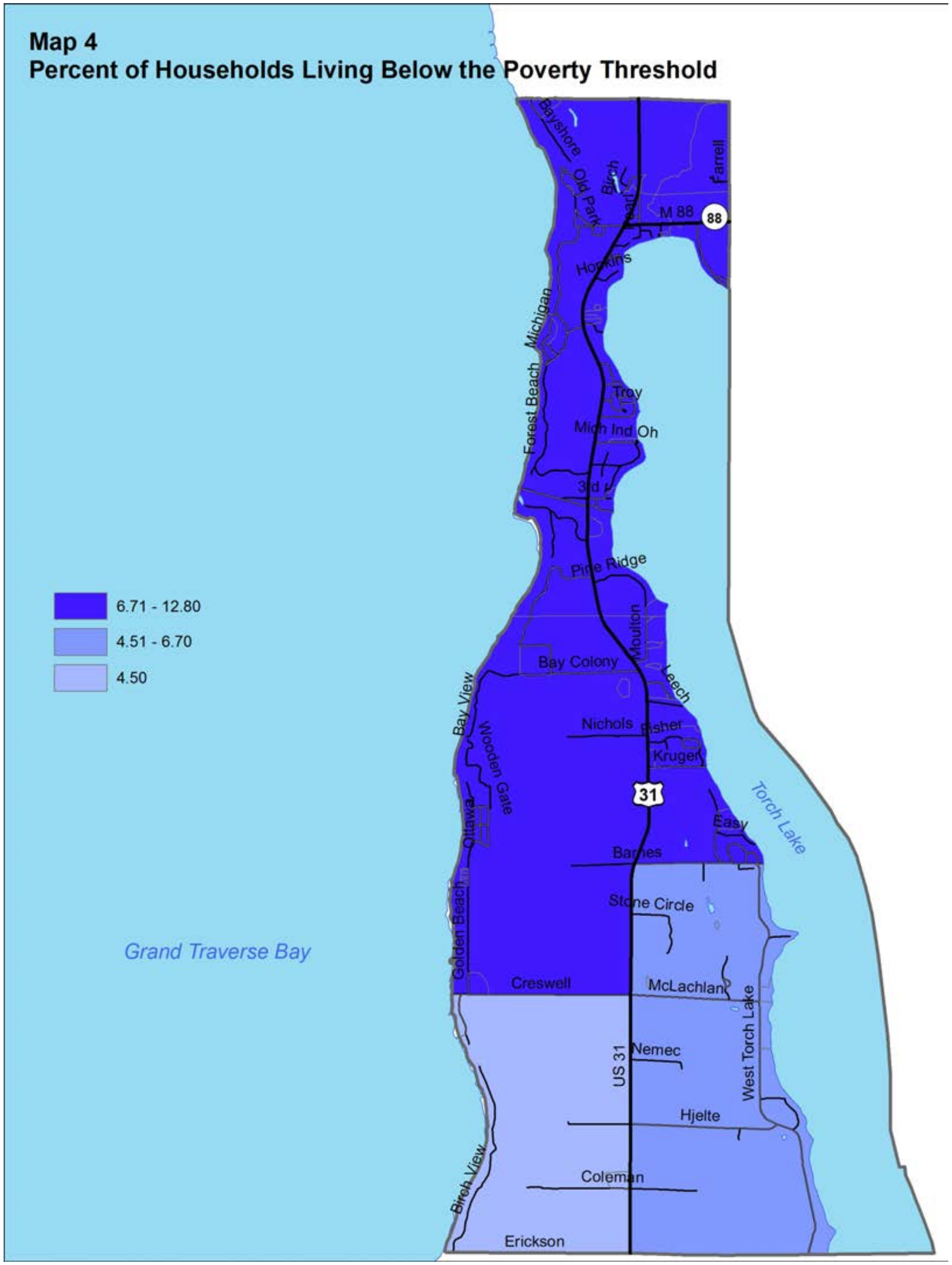



Map 2
Percent of Households with People Living Alone
75.01 - 100.00% (5)
41.19 - 75.00% (4)
25.87 - 41.18% (3)
13.34 - 25.86% (2)
6.67 - 13.33% (1)
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
Farrell
M 88
88
Hopkins
Forest Beach
Michigan
Troy
Mich Ind Oh
3rd
Pine Ridge
Moulton
Bay Colony
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Easy
Ottawa
Barnes
Stone Circle
Golden Beach
Creswell
McLachlan
West Torch Lake
Nemec
US 31
Hjelte
Birch View
Coleman
Erickson


Antrim County

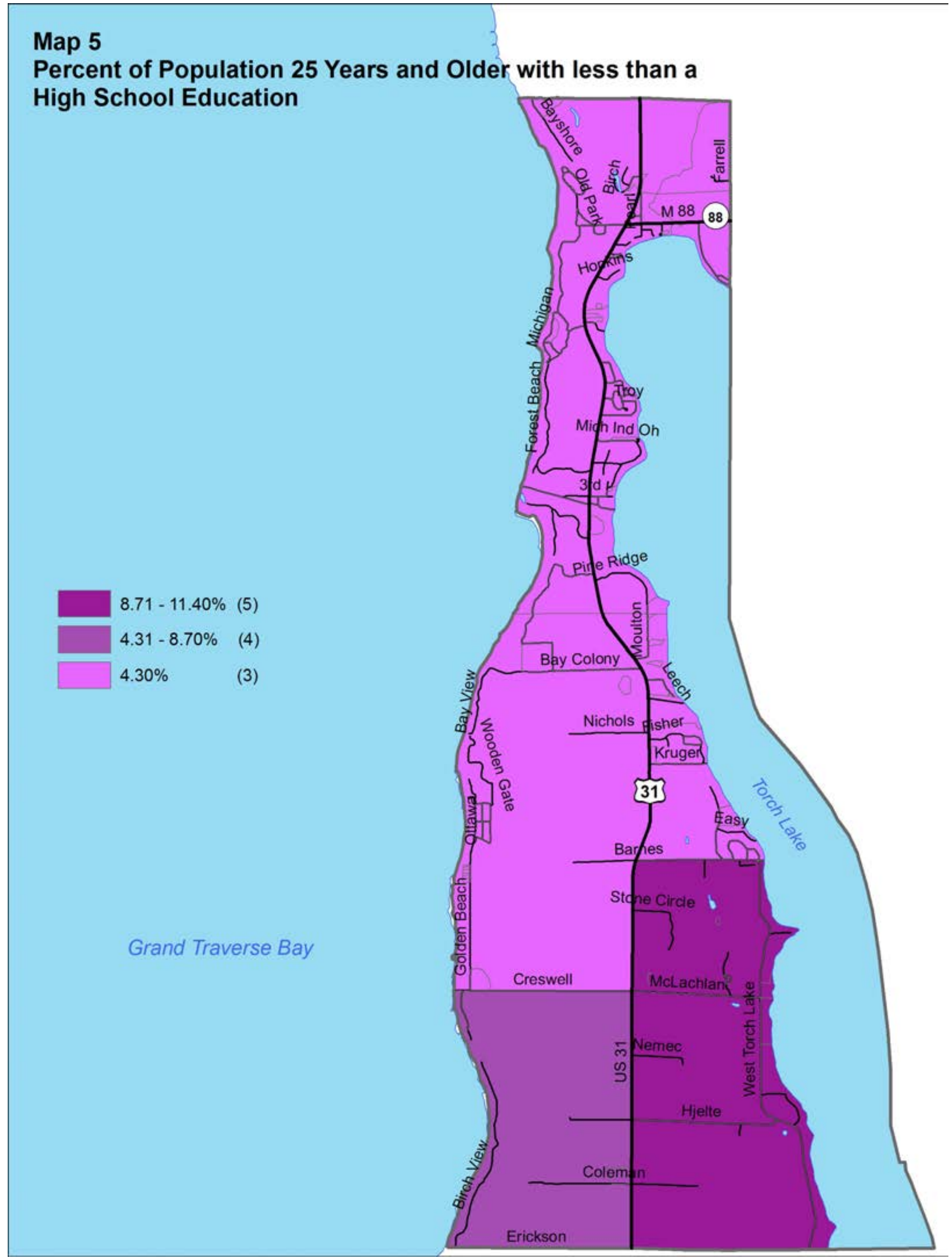

Antrim County

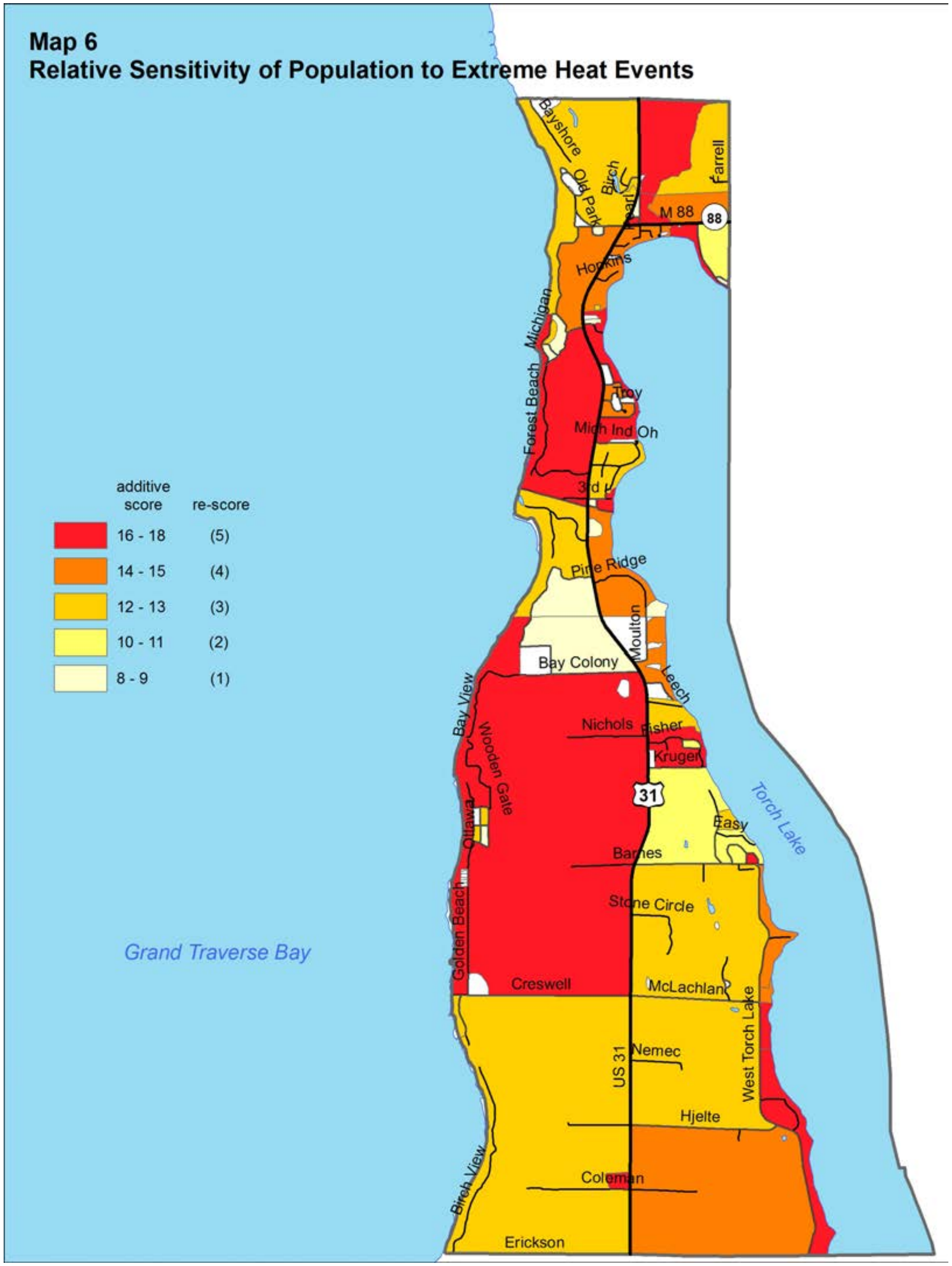

Map 3
Percent of Non-white Population
9.58 - 16.67% (5)
5.57 - 9.57% (4)
3.58 - 5.56% (3)
1.76 - 3.57% (2)
1.11 - 1.75% (1)
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
Farrell
M 88
88
Hopkins
Michigan
Forest Beach
Troy
Mich Ind Oh
3rd
Pine Ridge
Moulton
Bay Colony
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Ottawa
Easy
Barnes
Stone Circle
Golden Beach
Creswell
McLachlan
West Torch Lake
US 31
Nemec
Hjelte
Coleman
Birch View
Erickson


Map 4
Percent of Households Living Below the Poverty Threshold
6.71 - 12.80
4.51 - 6.70
4.50
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
Farrell
M 88
88
Hopkins
Michigan
Forest Beach
Troy
Mich Ind Oh
3rd
Pine Ridge
Moulton
Bay Colony
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Ottawa
Easy
Barnes
Golden Beach
Stone Circle
Creswell
McLachlan
West Torch Lake
Nemec
US 31
Hjelte
Birch View
Coleman
Erickson


Antrim County

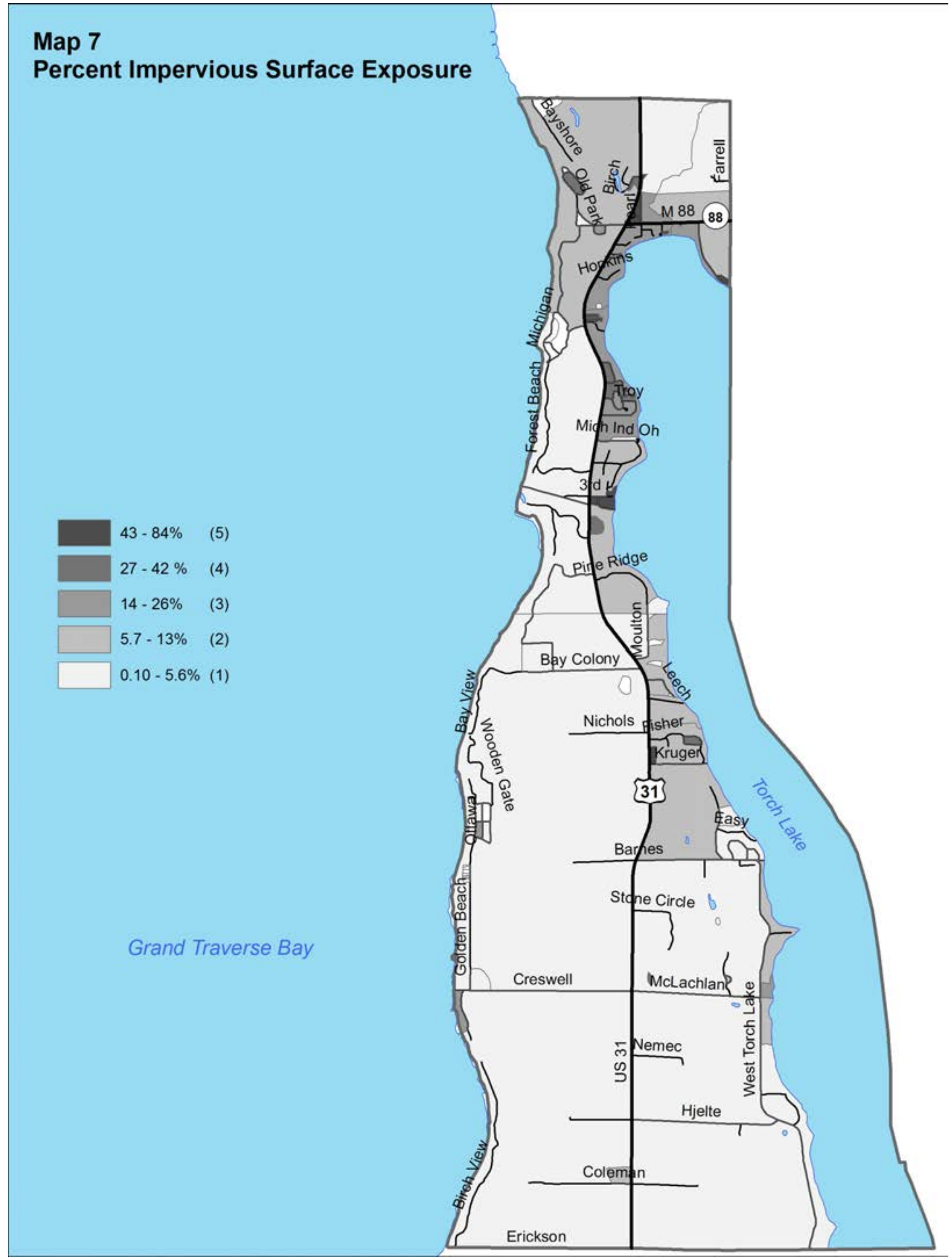

Antrim County

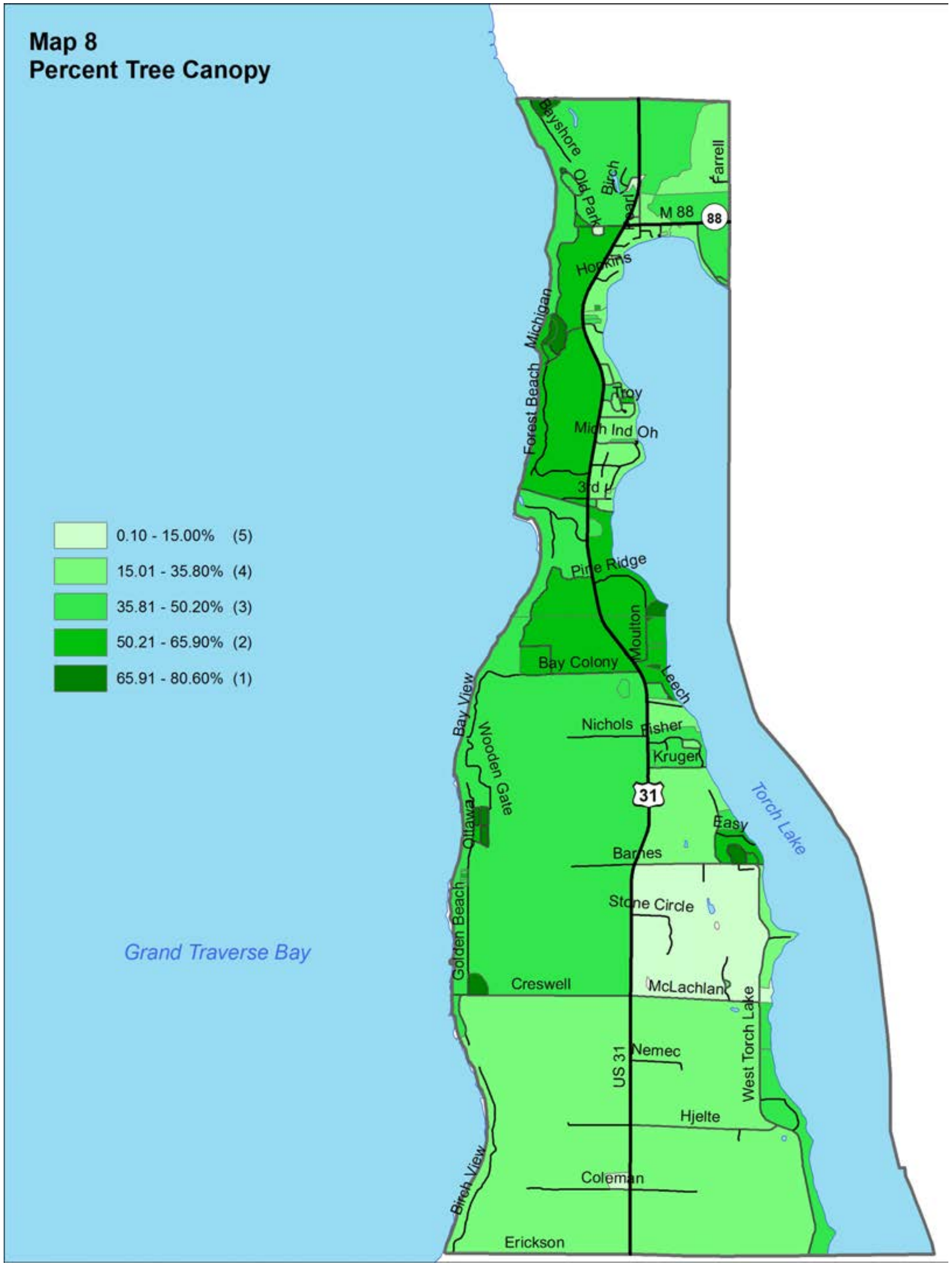

Map 5
Percent of Population 25 Years and Older with less than a High School Education
8.71 - 11.40% (5)
4.31 - 8.70% (4)
4.30% (3)
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
Pearl
Farrell
M 88
88
Hopkins
Michigan
Forest Beach
Troy
Mich Ind Oh
3rd
Pine Ridge
Moulton
Bay Colony
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Ottawa
Easy
Barnes
Stone Circle
Golden Beach
Creswell
McLachlan
West Torch Lake
Nemec
US 31
Hjelte
Birch View
Coleman
Erickson


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
16 - 18 (5)
14 - 15 (4)
12 - 13 (3)
10 - 11 (2)
8 - 9 (1)
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
Farrell
M 88
88
Hopkins
Michigan
Forest Beach
Troy
Mich Ind Oh
3rd
Pine Ridge
Moulton
Bay Colony
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Easy
Ottawa
Barnes
Stone Circle
Golden Beach
Creswell
McLachlan
West Torch Lake
US 31
Nemec
Hjelte
Birch View
Coleman
Erickson


Antrim County

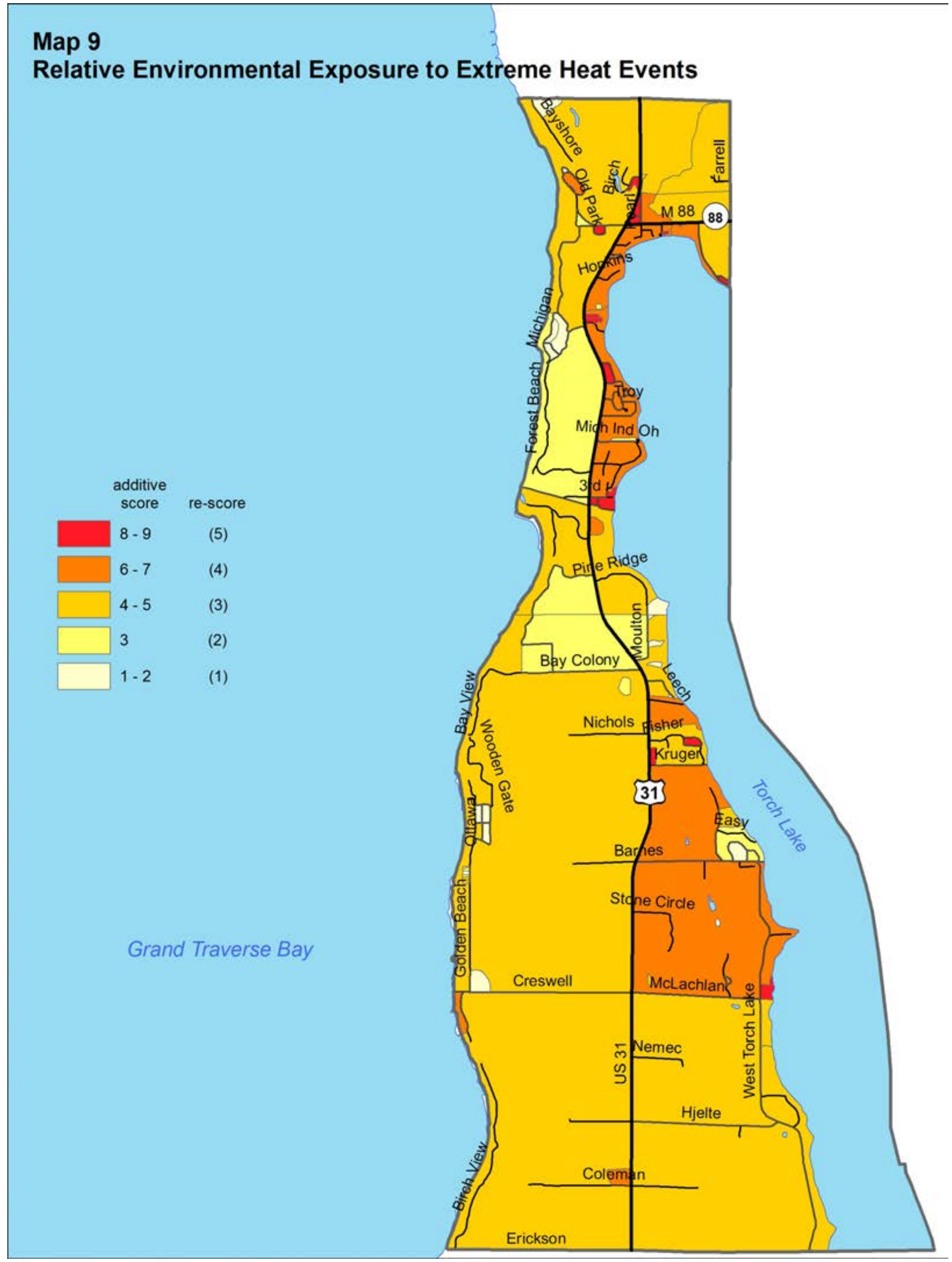

Antrim County

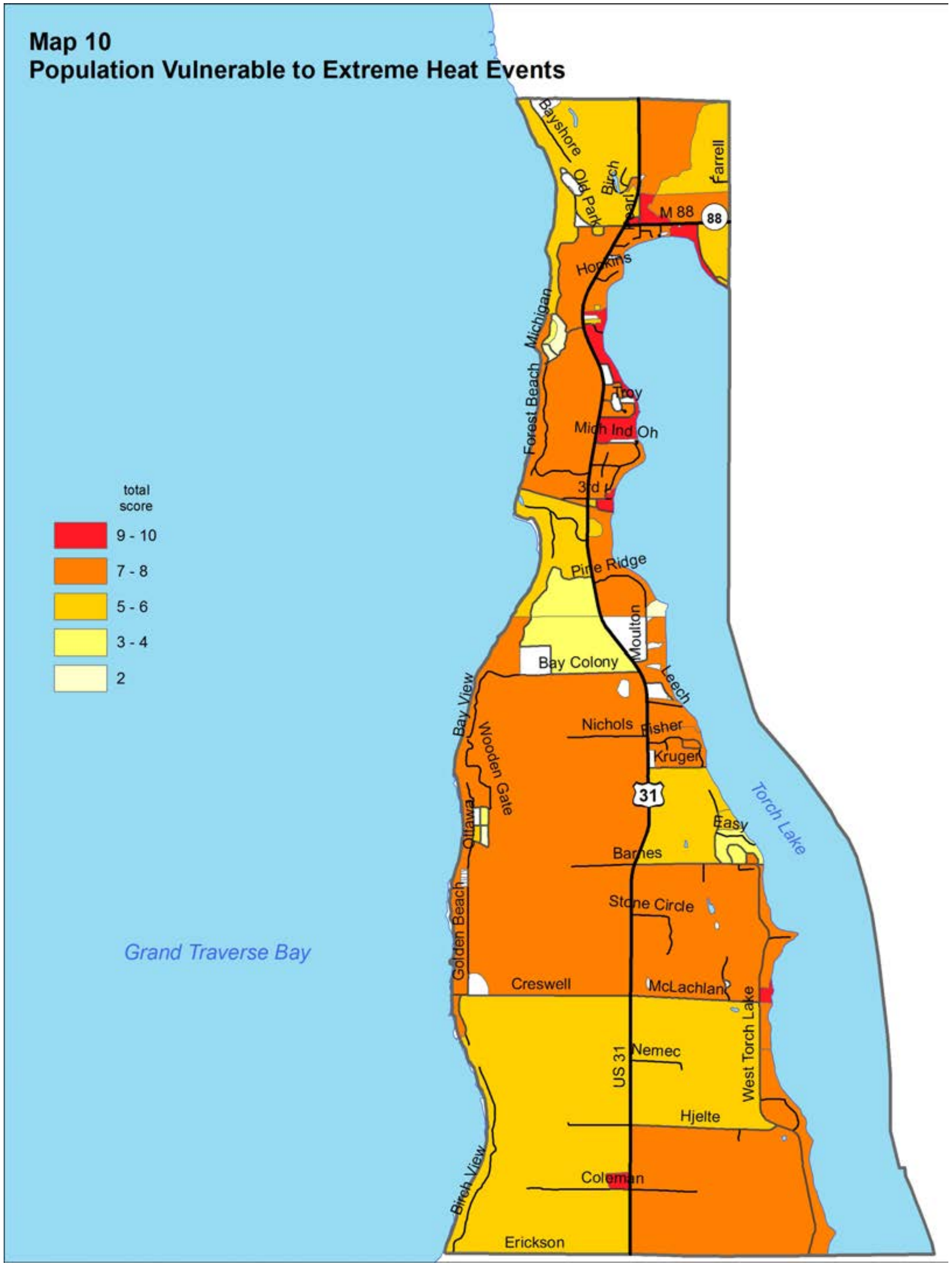

Map 7
Percent Impervious Surface Exposure
43 - 84% (5)
27 - 42 % (4)
14 - 26% (3)
5.7 - 13% (2)
0.10 - 5.6% (1)
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
Farrell
M 88
88
Hopkins
Michigan
Forest Beach
Troy
Mich Ind Oh
Pine Ridge
Bay Colony
Moulton
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Ottawa
Easy
Barnes
Stone Circle
Golden Beach
Creswell
McLachlan
West Torch Lake
US 31
Nemec
Hjelte
Birch View
Coleman
Erickson


Map 8
Percent Tree Canopy
0.10 - 15.00% (5)
15.01 - 35.80% (4)
35.81 - 50.20% (3)
50.21 - 65.90% (2)
65.91 - 80.60% (1)
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
Farrell
M 88
88
Hopkins
Michigan
Forest Beach
Troy
Mich Ind Oh
3rd
Pine Ridge
Moulton
Bay Colony
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Ottawa
Easy
Barnes
Stone Circle
Golden Beach
Creswell
McLachlan
West Torch Lake
US 31
Nemec
Hjelte
Coleman
Birch View
Erickson


Antrim County


Antrim County

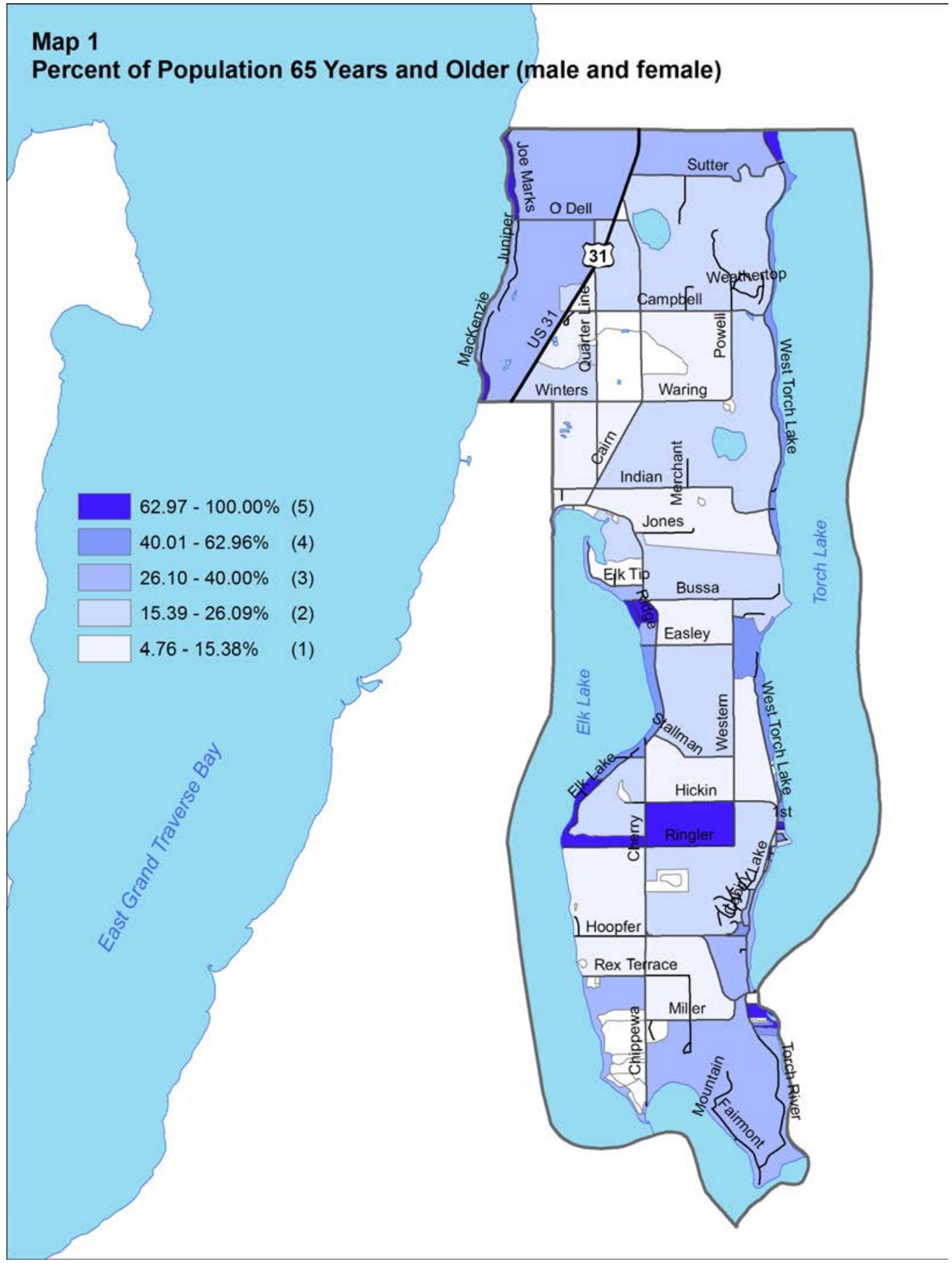

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
8 - 9 (5)
6 - 7 (4)
4 - 5 (3)
3 (2)
1 - 2 (1)
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
M 88
88
Farrell
Hopkins
Michigan
Forest Beach
Troy
Mich Ind Oh
Pine Ridge
Moulton
Bay Colony
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Ottawa
Easy
Barnes
Stone Circle
Golden Beach
Creswell
McLachlan
West Torch Lake
Nemec
US 31
Hjelte
Coleman
Birch View
Erickson

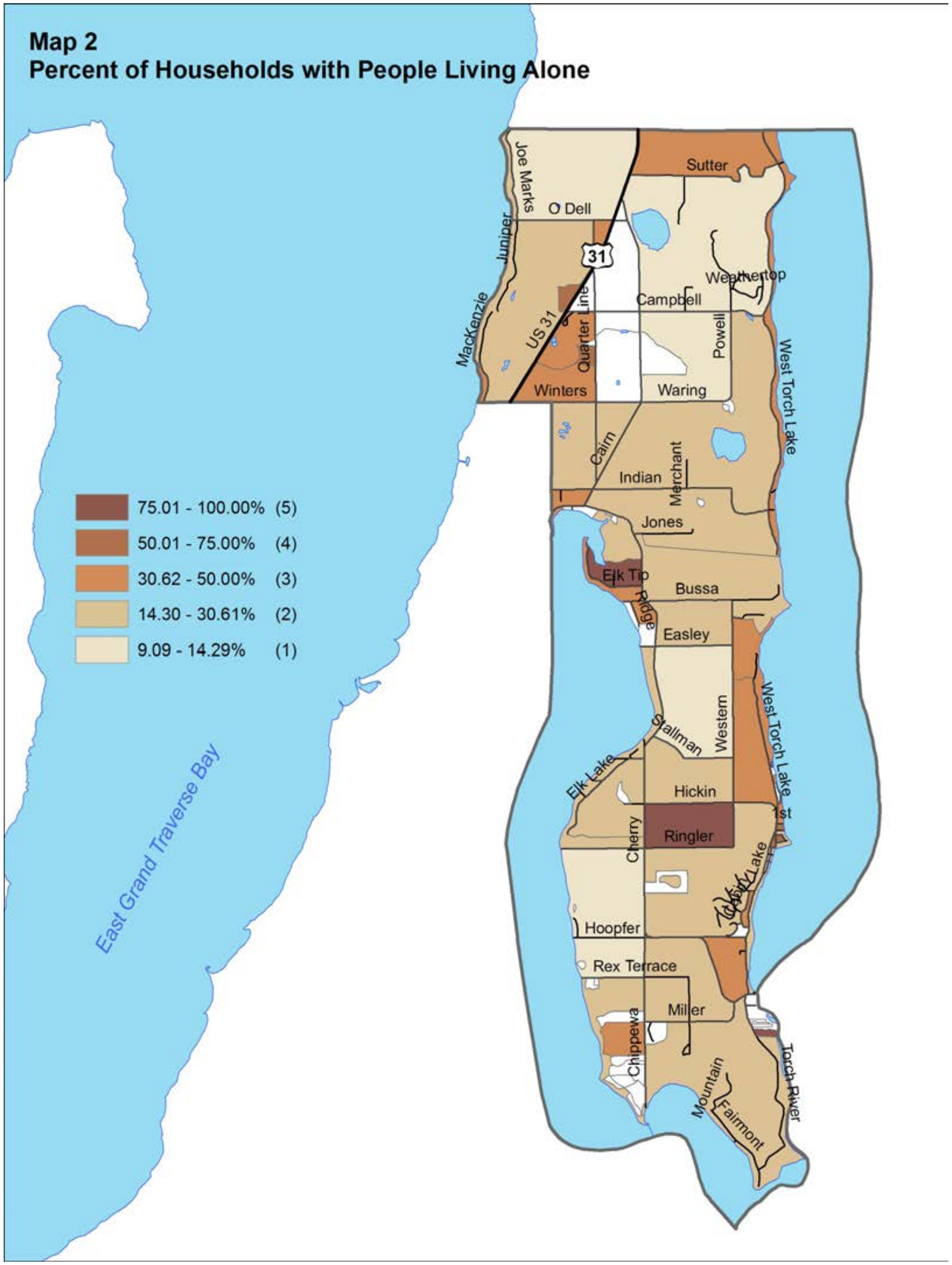

Map 10
Population Vulnerable to Extreme Heat Events
total score
9 - 10
7 - 8
5 - 6
3 - 4
2
Grand Traverse Bay
Torch Lake
Bayshore
Old Park
Birch
Farrell
M 88
88
Hopkins
Michigan
Forest Beach
Troy
Mich Ind Oh
3rd
Pine Ridge
Moulton
Bay Colony
Leech
Bay View
Wooden Gate
Nichols
Fisher
Kruger
31
Ottawa
Easy
Barnes
Stone Circle
Golden Beach
Creswell
McLachlan
West Torch Lake
Nemec
US 31
Hjelte
Birch View
Coleman
Erickson


Antrim County

Milton Twp.

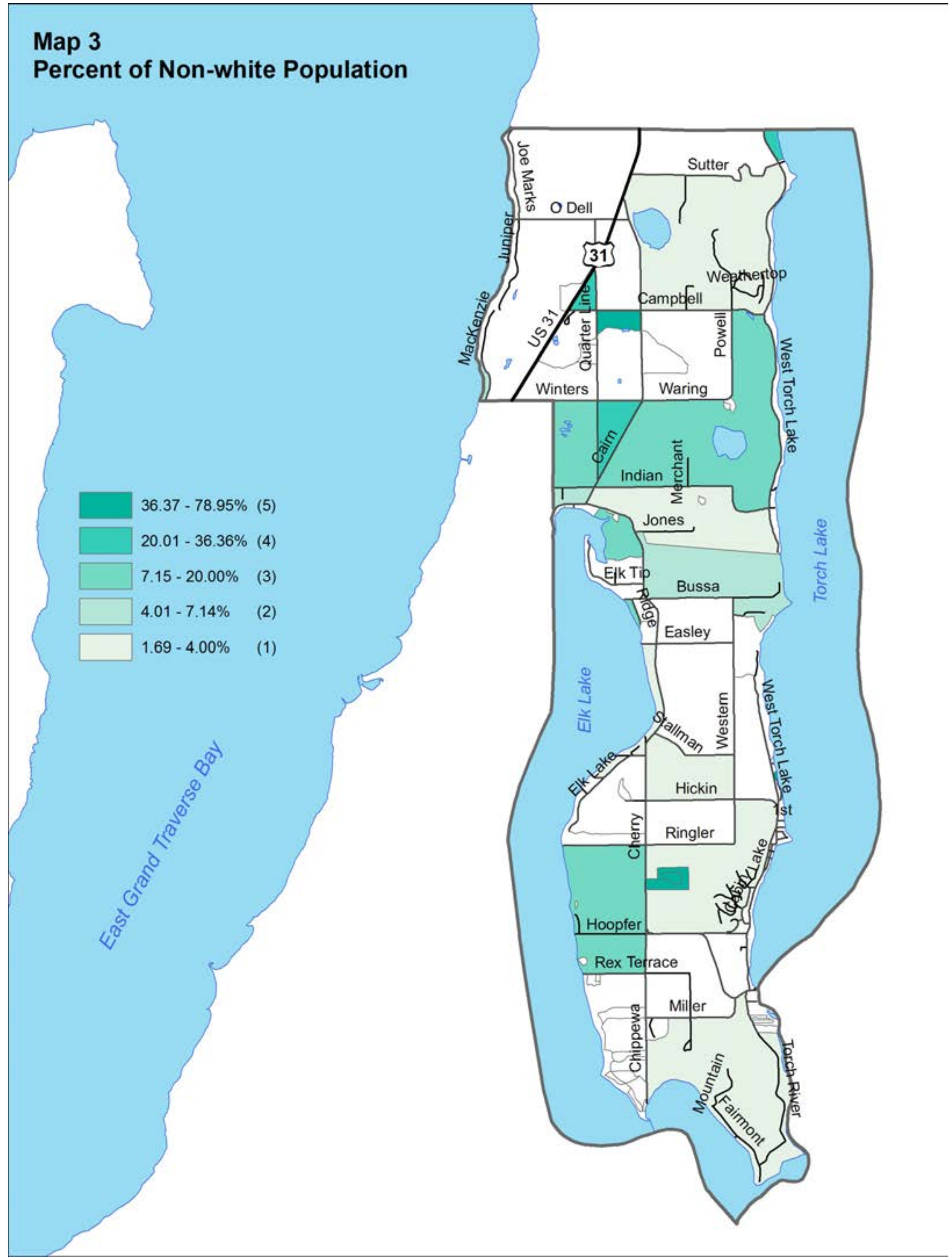

Antrim County

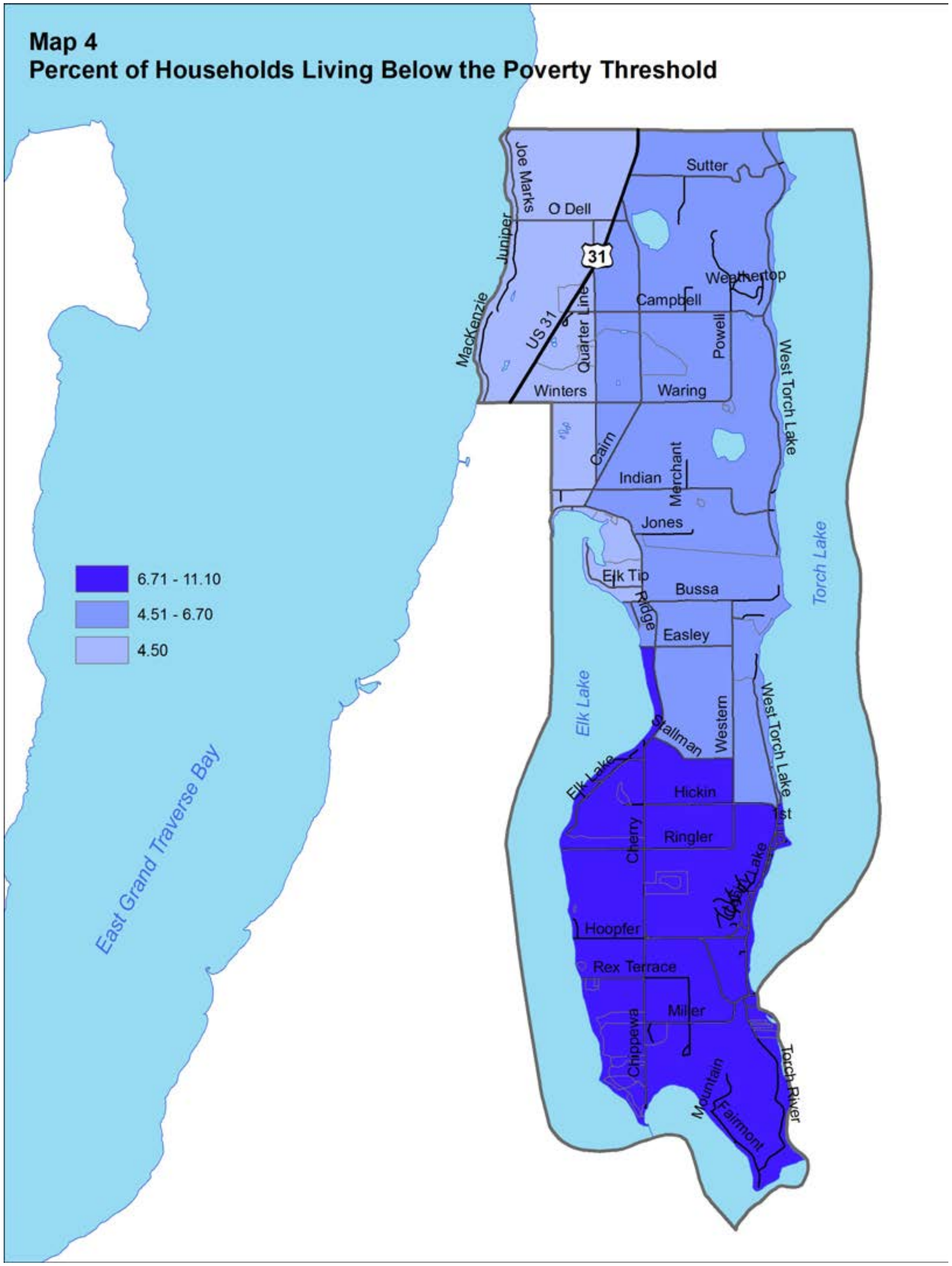

Map 1
Percent of Population 65 Years and Older (male and female)
62.97 - 100.00% (5)
40.01 - 62.96% (4)
26.10 - 40.00% (3)
15.39 - 26.09% (2)
4.76 - 15.38% (1)
East Grand Traverse Bay
Elk Lake
Torch Lake
West Torch Lake
Torch River
Joe Marks
O Dell
Sutter
Juniper
US 31
31
Quarter Line
Campbell
Weathertop
MacKenzie
Powell
Winters
Waring
Cairn
Merchant
Indian
Jones
Elk Tip
Ridge
Bussa
Easley
Western
Stallman
Elk Lake
Hickin
1st
Ringler
Cherry
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont


Map 2
Percent of Households with People Living Alone
75.01 - 100.00% (5)
50.01 - 75.00% (4)
30.62 - 50.00% (3)
14.30 - 30.61% (2)
9.09 - 14.29% (1)
East Grand Traverse Bay
Joe Marks
O Dell
Juniper
31
Sutter
Weathertop
Campbell
MacKenzie
US 31
Quarter Line
Powell
West Torch Lake
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Bussa
Ridge
Easley
Stallman
Western
Elk Lake
Hickin
Ringler
Cherry
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont
Torch River


Antrim County

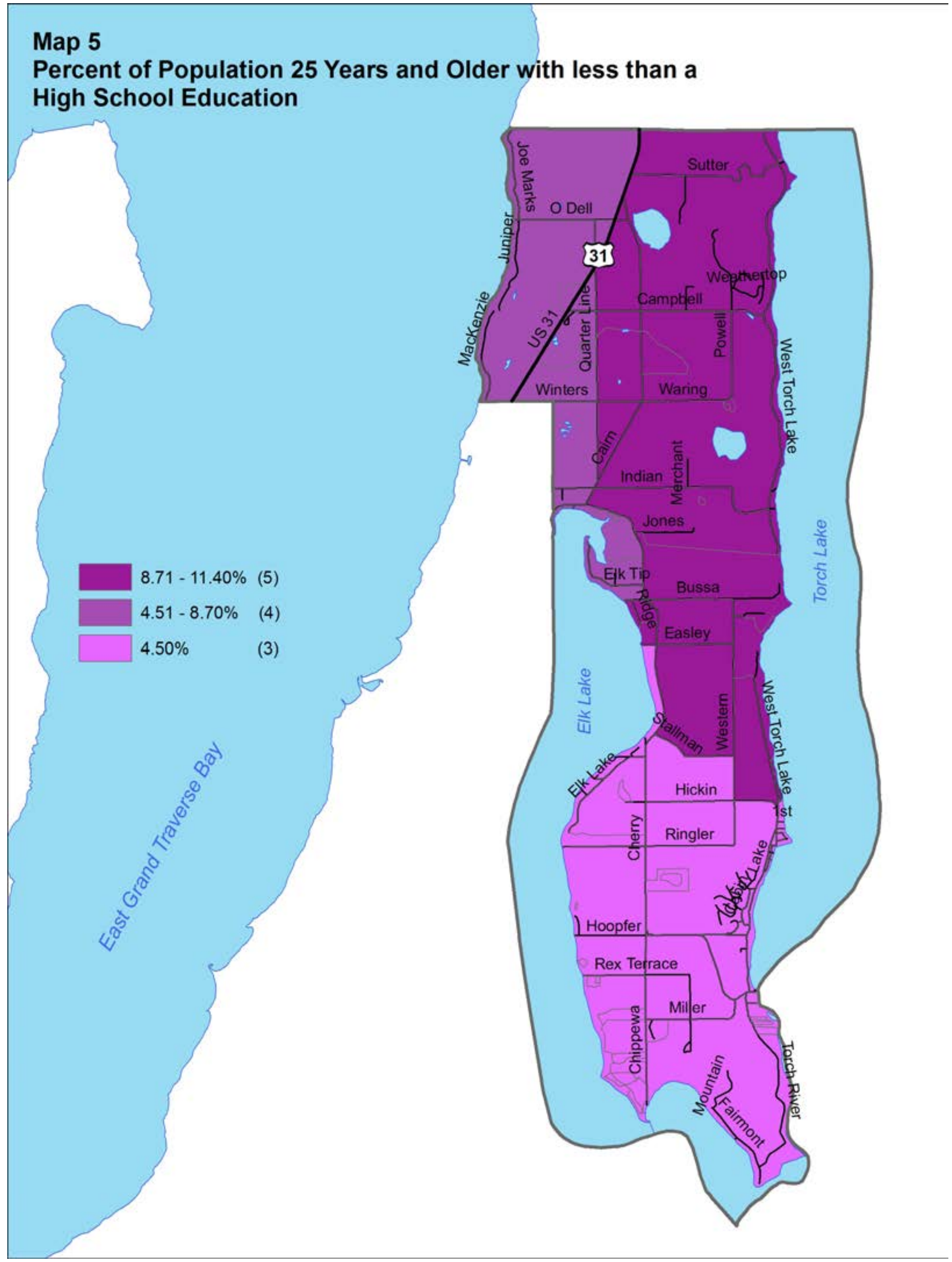

Antrim County

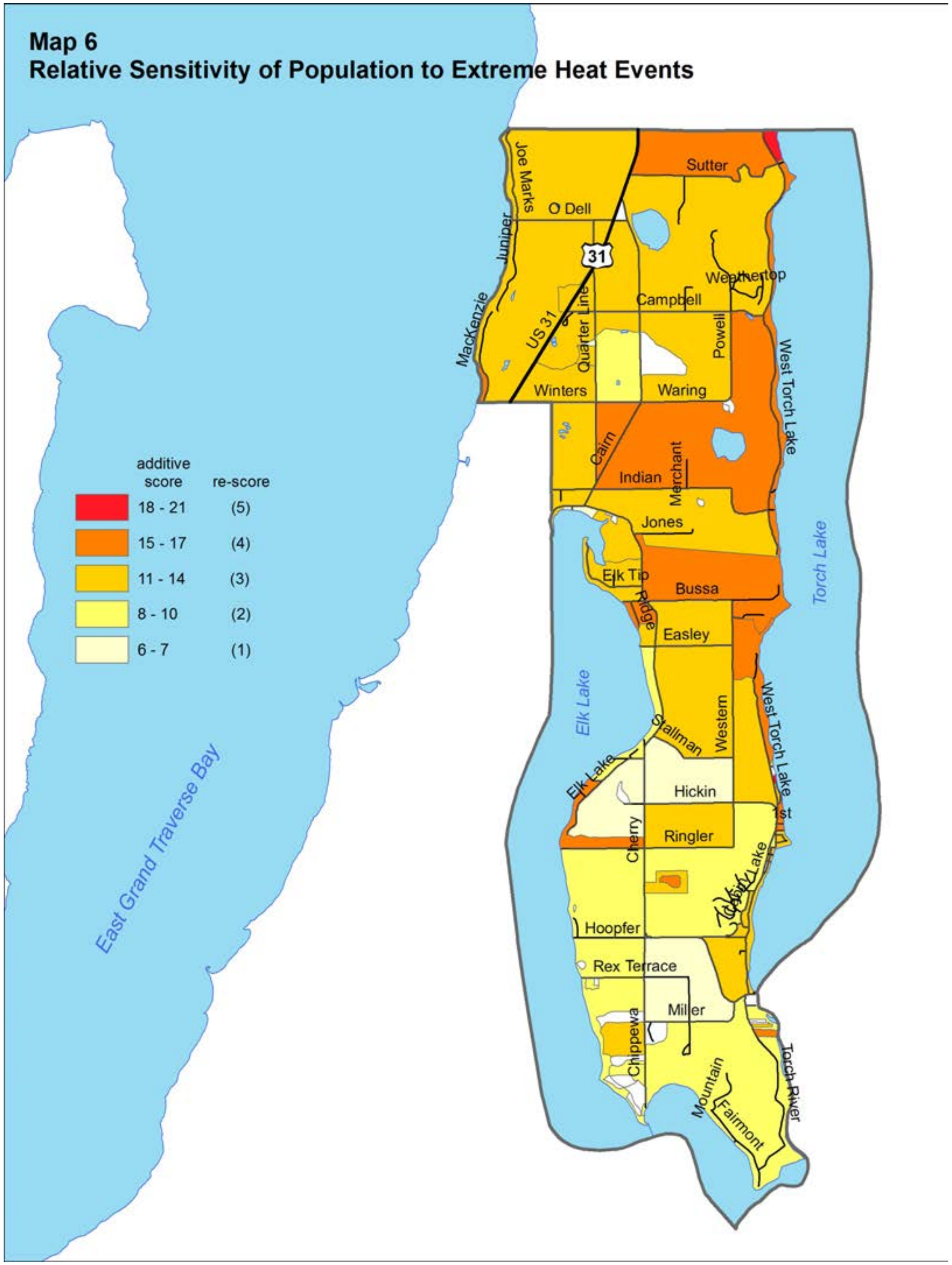

Map 3
Percent of Non-white Population
36.37 - 78.95% (5)
20.01 - 36.36% (4)
7.15 - 20.00% (3)
4.01 - 7.14% (2)
1.69 - 4.00% (1)
East Grand Traverse Bay
Elk Lake
Torch Lake
West Torch Lake
Torch River
US 31
31
Joe Marks
Dell
Juniper
MacKenzie
Sutter
Weathertop
Campbell
Quarter Line
Powell
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Bussa
Ridge
Easley
Stallman
Western
Elk Lake
Hickin
Cherry
Ringler
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont


Map 4
Percent of Households Living Below the Poverty Threshold
6.71 - 11.10
4.51 - 6.70
4.50
East Grand Traverse Bay
Elk Lake
Torch Lake
West Torch Lake
Sutter
O Dell
Joe Marks
Juniper
MacKenzie
US 31
31
Quarter Line
Campbell
Weathertop
Powell
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Bussa
Ridge
Easley
Stallman
Western
Hickin
Ringler
Cherry
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont
Torch River
1st


Antrim County

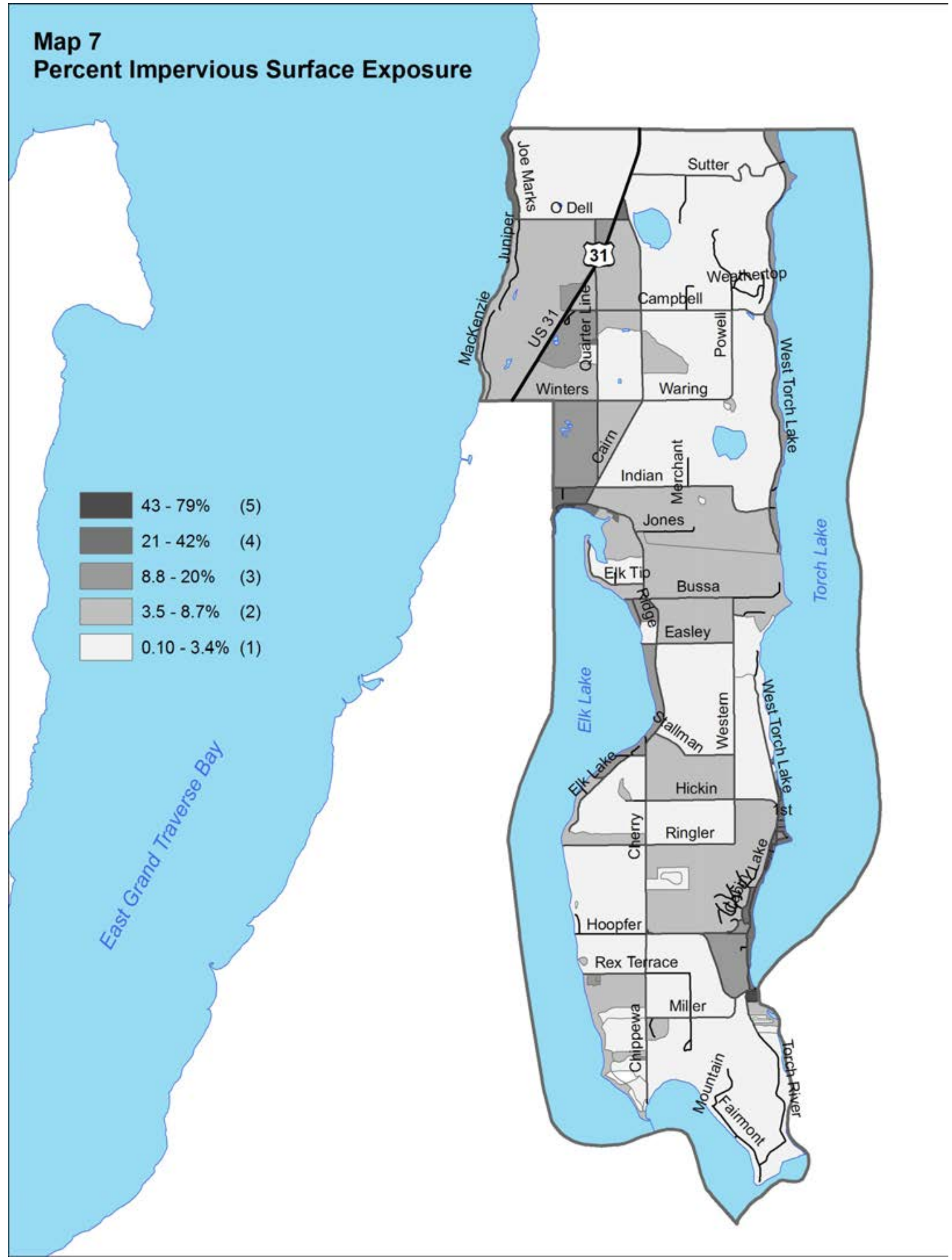

Antrim County

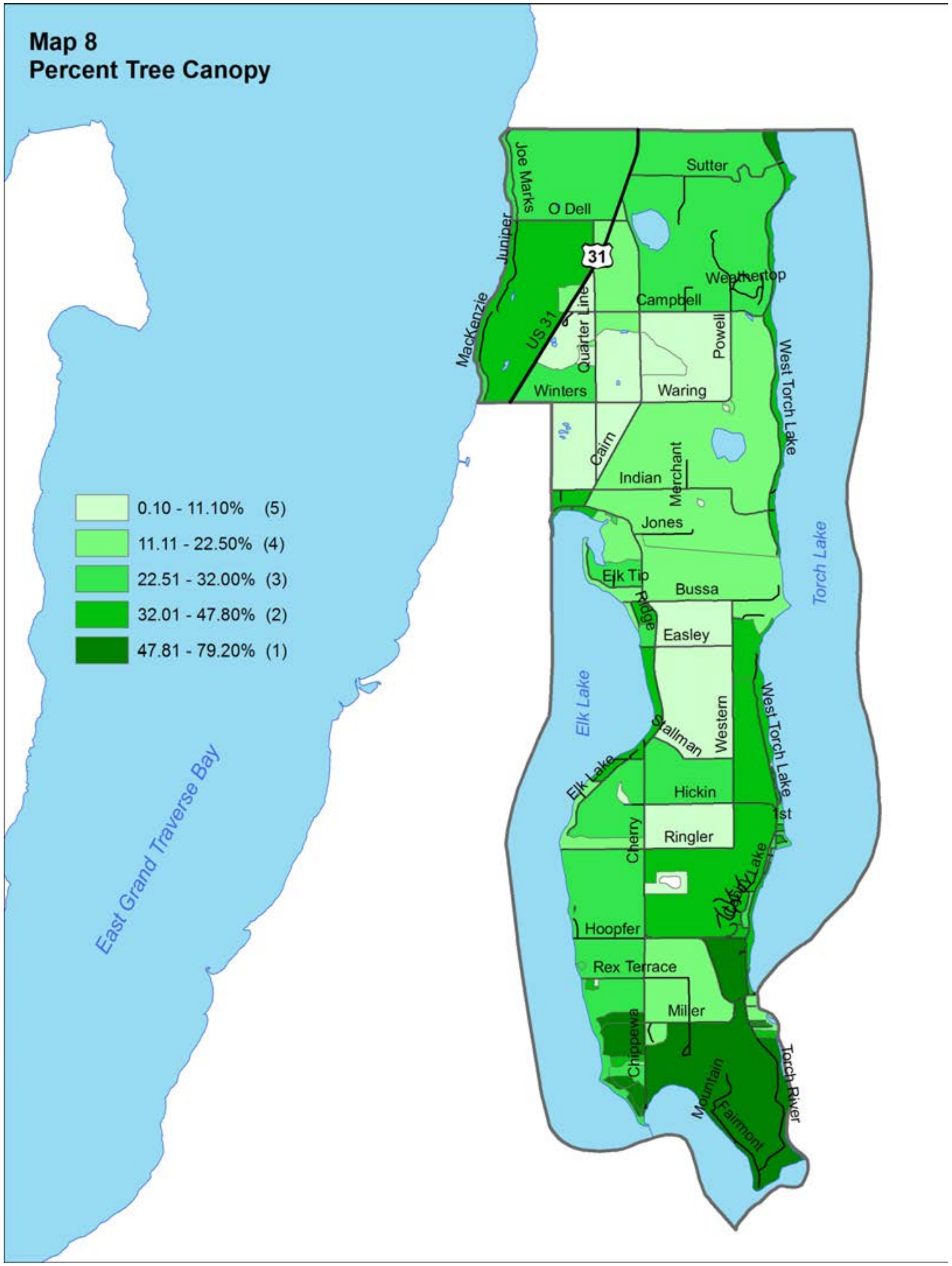

Map 5
Percent of Population 25 Years and Older with less than a High School Education
8.71 - 11.40% (5)
4.51 - 8.70% (4)
4.50% (3)
East Grand Traverse Bay
Elk Lake
Torch Lake
West Torch Lake
Sutter
O Dell
Joe Marks
Juniper
MacKenzie
US 31
31
Quarter Line
Campbell
Weatherstop
Powell
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Ridge
Bussa
Easley
Stallman
Western
Elk Lake
Hickin
Ringler
Cherry
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont
Torch River


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
18 - 21 (5)
15 - 17 (4)
11 - 14 (3)
8 - 10 (2)
6 - 7 (1)
East Grand Traverse Bay
Elk Lake
Torch Lake
West Torch Lake
Torch River
US 31
31
Joe Marks
O Dell
Juniper
MacKenzie
Quarter Line
Sutter
Weathertop
Campbell
Powell
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Ridge
Bussa
Easley
Stallman
Western
Elk Lake
Hickin
1st
Cherry
Ringler
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont


Antrim County

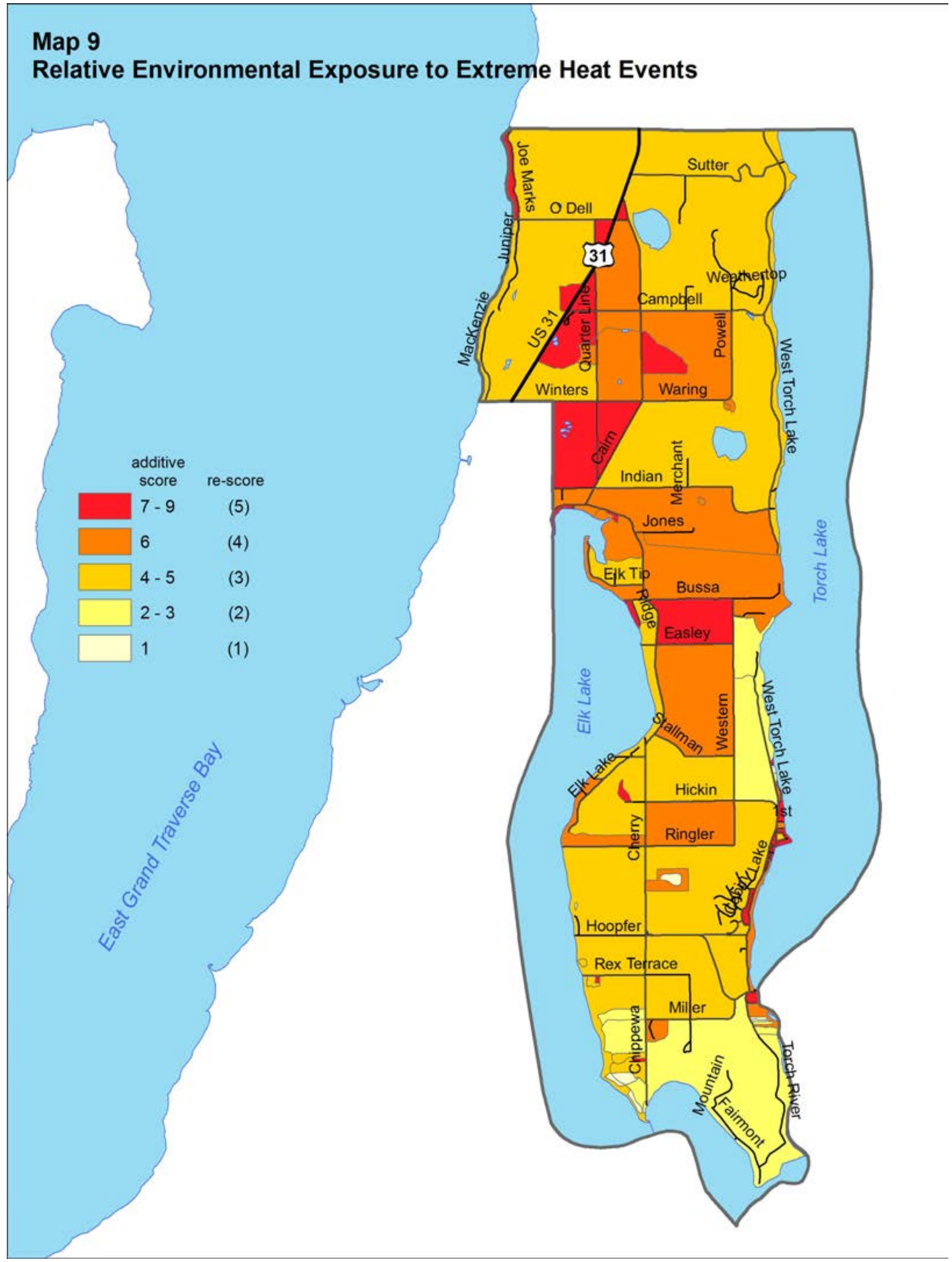

Antrim County

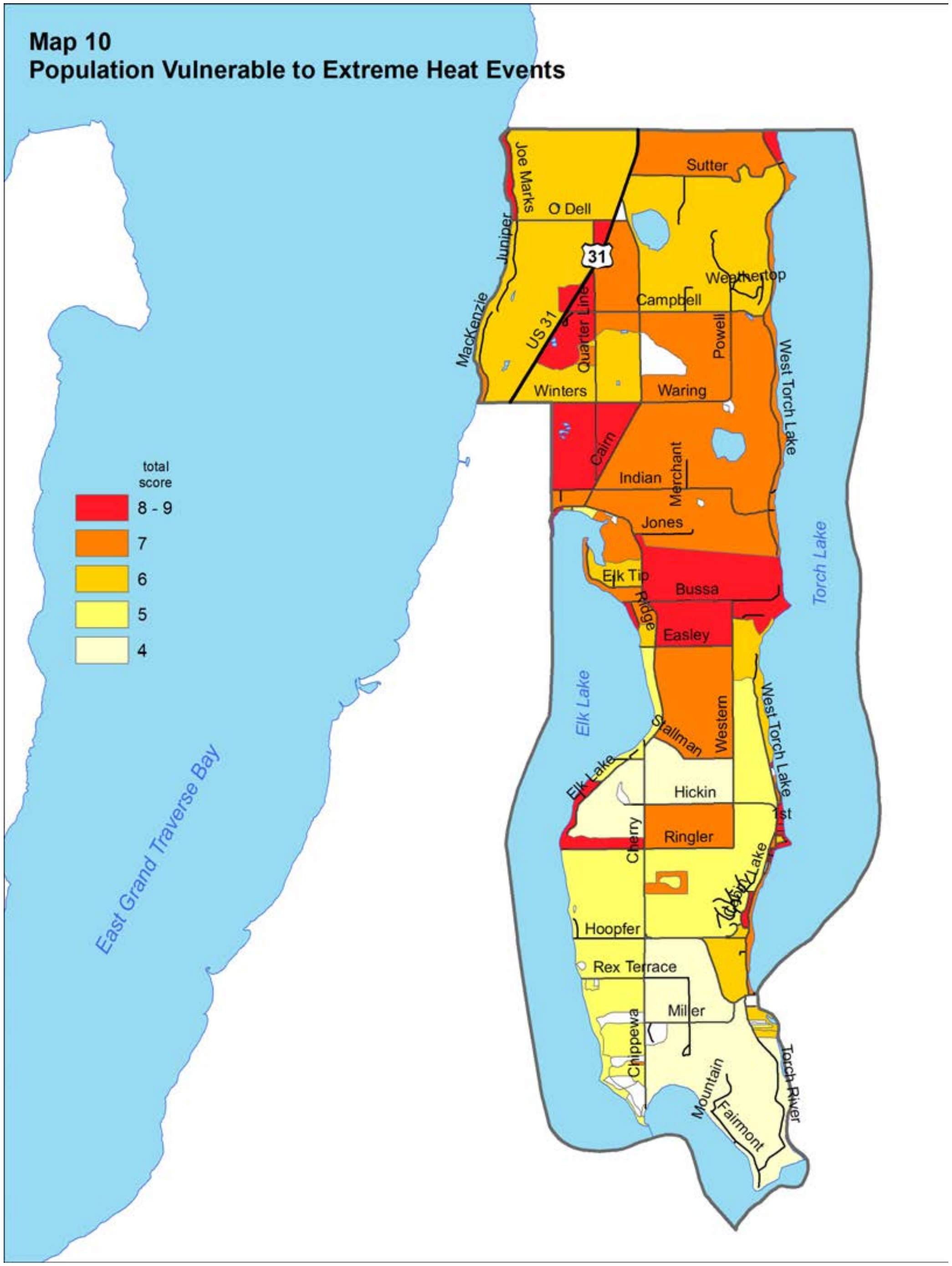

Map 7
Percent Impervious Surface Exposure
43 - 79% (5)
21 - 42% (4)
8.8 - 20% (3)
3.5 - 8.7% (2)
0.10 - 3.4% (1)
East Grand Traverse Bay
Elk Lake
Torch Lake
Joe Marks
O Dell
Sutter
Juniper
31
Weathertop
Campbell
MacKenzie
US 31
Quarter Line
Powell
West Torch Lake
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Bussa
Ridge
Easley
Stallman
Western
Elk Lake
Hickin
1st
Cherry
Ringler
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont
Torch River


Map 8
Percent Tree Canopy
0.10 - 11.10% (5)
11.11 - 22.50% (4)
22.51 - 32.00% (3)
32.01 - 47.80% (2)
47.81 - 79.20% (1)
East Grand Traverse Bay
Elk Lake
Torch Lake
Joe Marks
O Dell
Sutter
Juniper
31
Weathertop
Campbell
MacKenzie
US 31
Quarter Line
Powell
West Torch Lake
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Bussa
Ridge
Easley
Western
Stallman
Elk Lake
Hickin
Cherry
Ringler
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont
Torch River


Antrim County

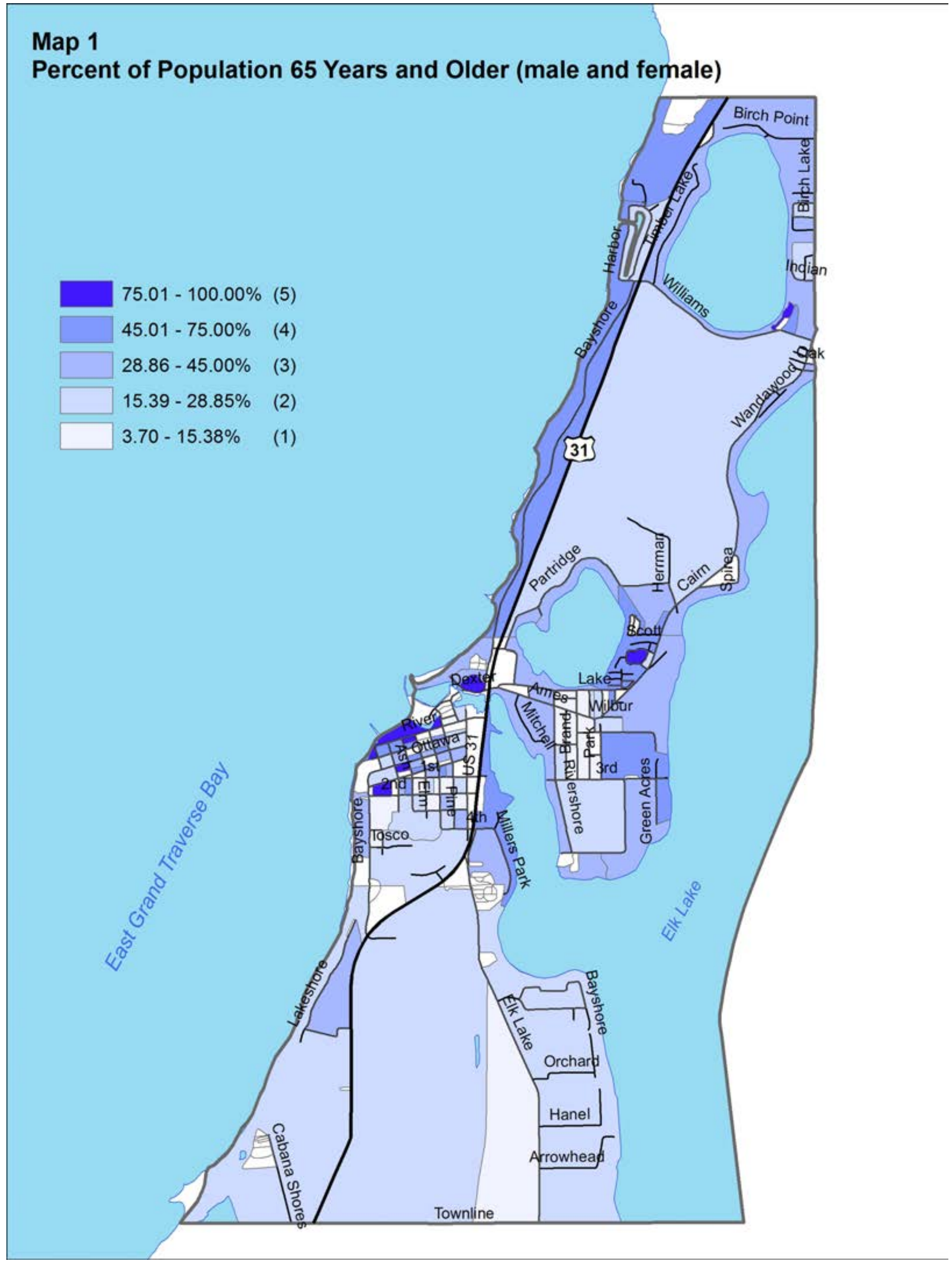

Antrim County

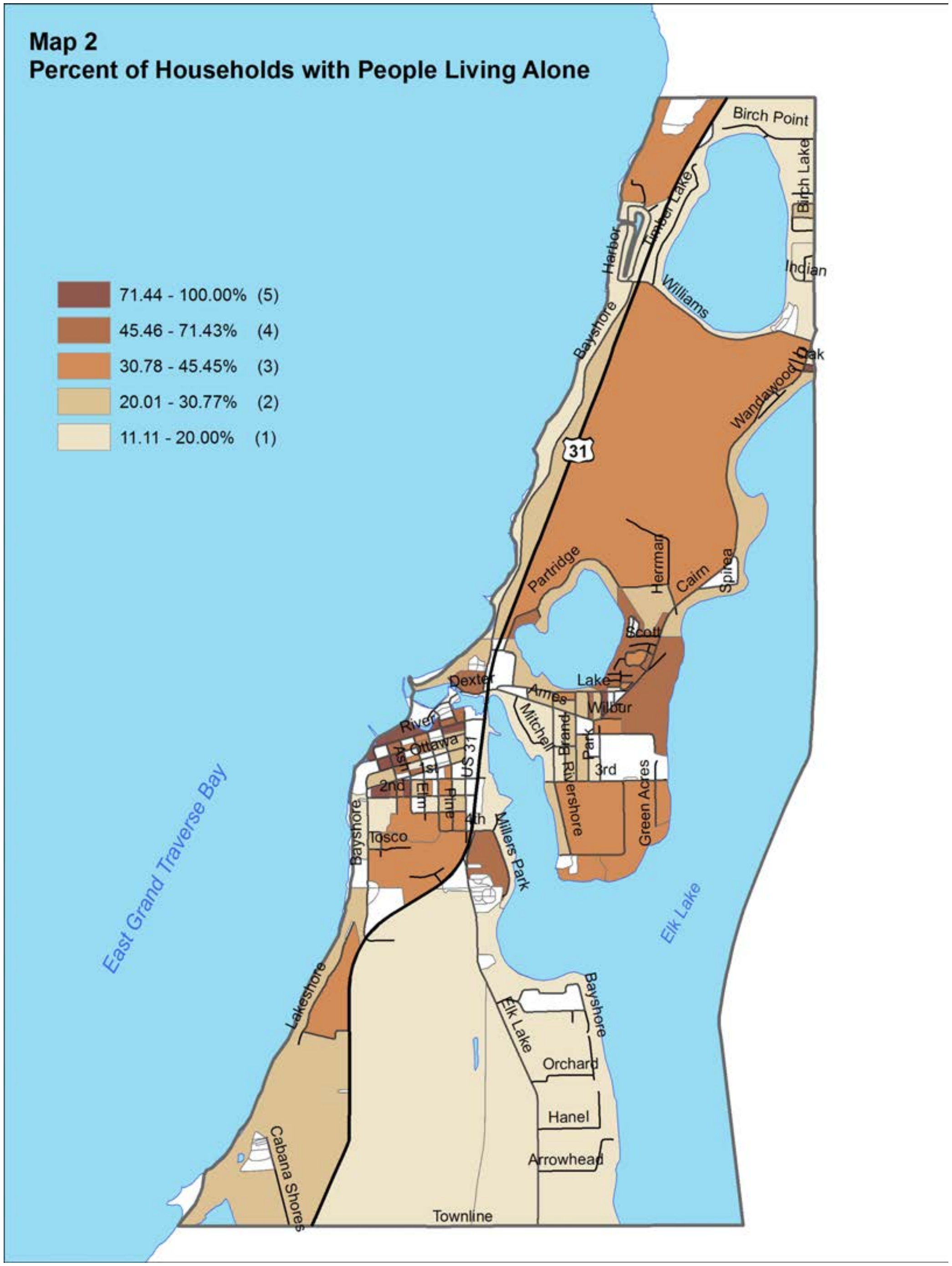

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
7 - 9 (5)
6 (4)
4 - 5 (3)
2 - 3 (2)
1 (1)
East Grand Traverse Bay
Elk Lake
Torch Lake
West Torch Lake
Joe Marks
O Dell
Sutter
Juniper
US 31
31
Quarter Line
Weathertop
Campbell
Powell
MacKenzie
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Ridge
Bussa
Easley
Stallman
Western
Elk Lake
Hickin
1st
Ringler
Cherry
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont
Torch River


Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
7
6
5
4
East Grand Traverse Bay
Elk Lake
Torch Lake
Joe Marks
O Dell
Sutter
Juniper
31
Weathertop
Campbell
MacKenzie
US 31
Quarter Line
Powell
West Torch Lake
Winters
Waring
Cairn
Indian
Merchant
Jones
Elk Tip
Bussa
Ridge
Easley
Stallman
Western
Elk Lake
Hickin
Cherry
Ringler
Hoopfer
Rex Terrace
Miller
Chippewa
Mountain
Fairmont
Torch River


Antrim County

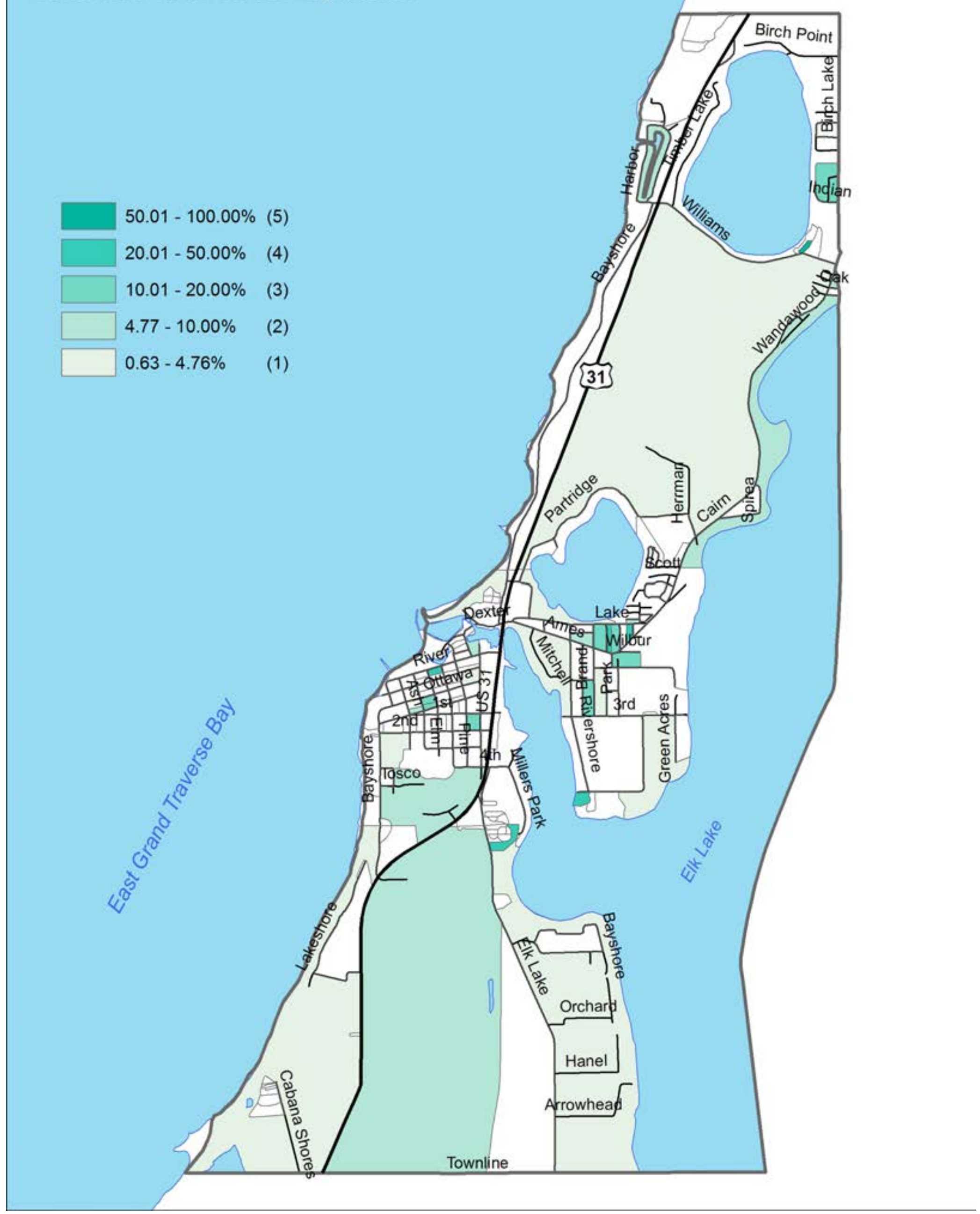
Elk Rapids Twp./ Elk Rapids

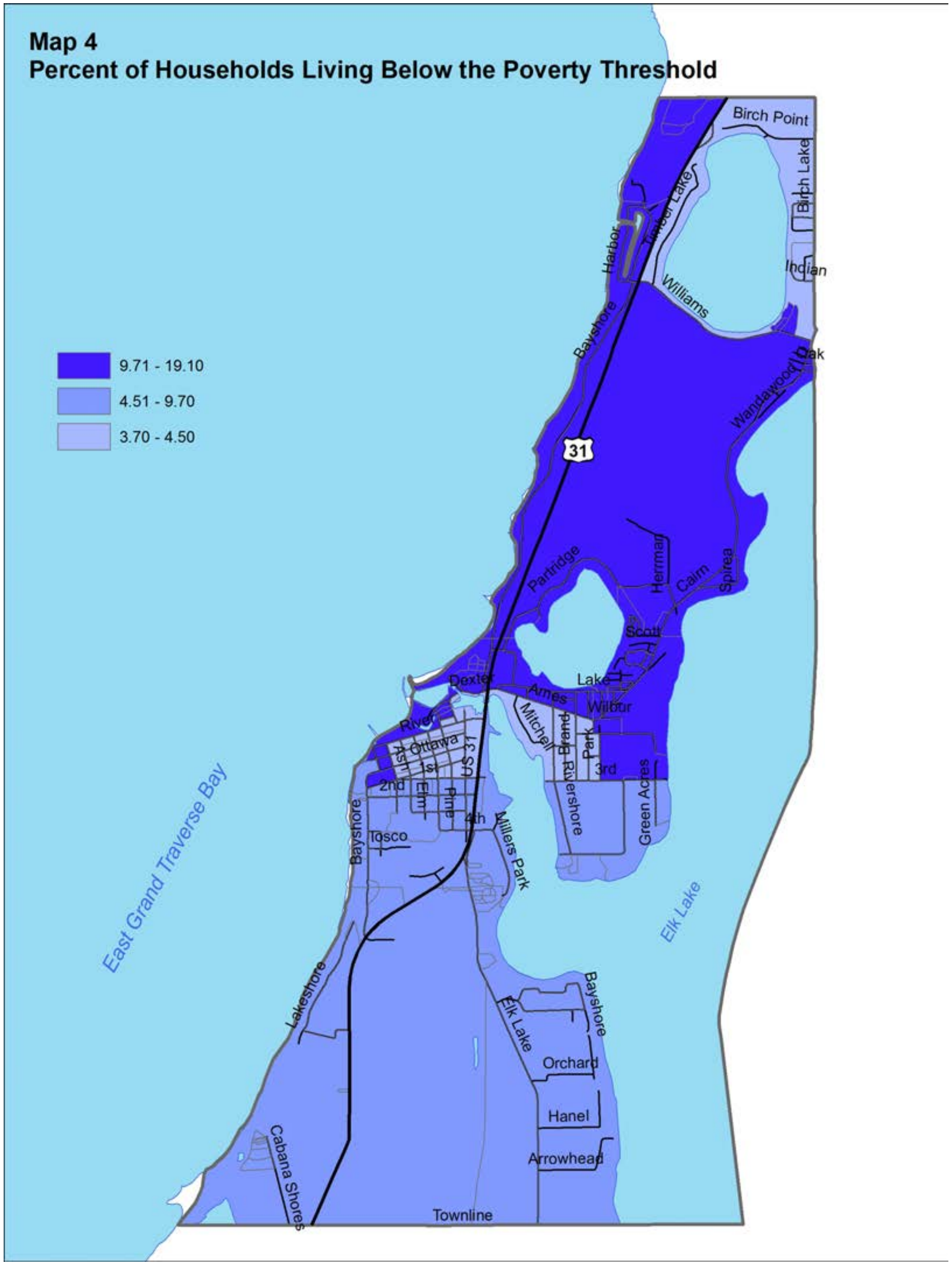



Map 2
Percent of Households with People Living Alone
71.44 - 100.00% (5)
45.46 - 71.43% (4)
30.78 - 45.45% (3)
20.01 - 30.77% (2)
11.11 - 20.00% (1)
East Grand Traverse Bay
Elk Lake
Birch Point
Birch Lake
Indian
Timber Lake
Harbor
Williams
Bayshore
Oak
Wandawood
31
Partridge
Herrman
Cairn
Spirea
Scott
Lake
Dexter
Ames
Wilbur
Mitchell
Brand
Park
River
Ottawa
Ash
1st
2nd
Elm
Pine
US 31
3rd
Rivershore
Green Acres
4th
Millers Park
Tosco
Lakeshore
Elk Lake
Orchard
Hanel
Arrowhead
Cabana Shores
Townline


Antrim County

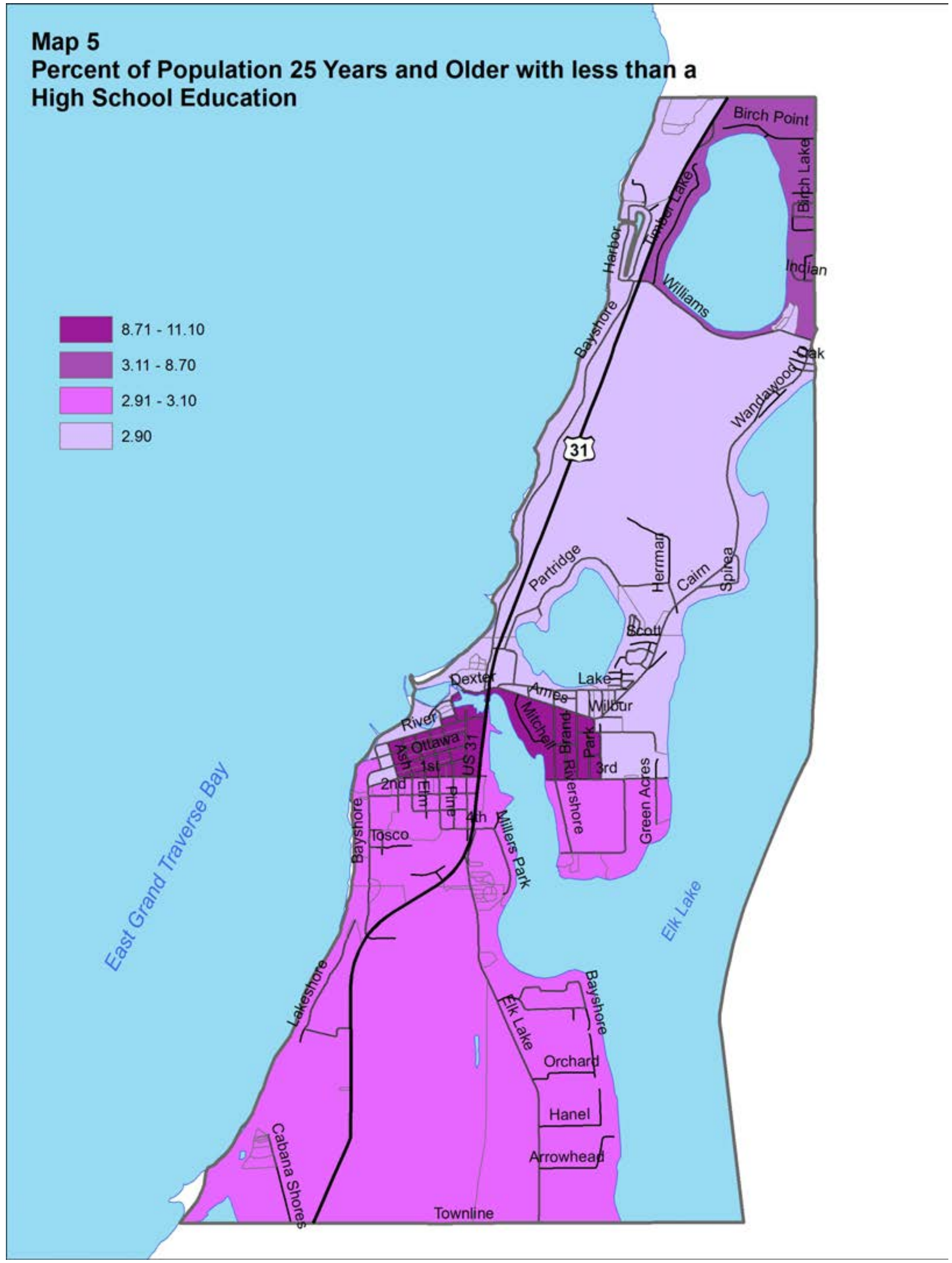
Map 3
Percent of Non-white Population

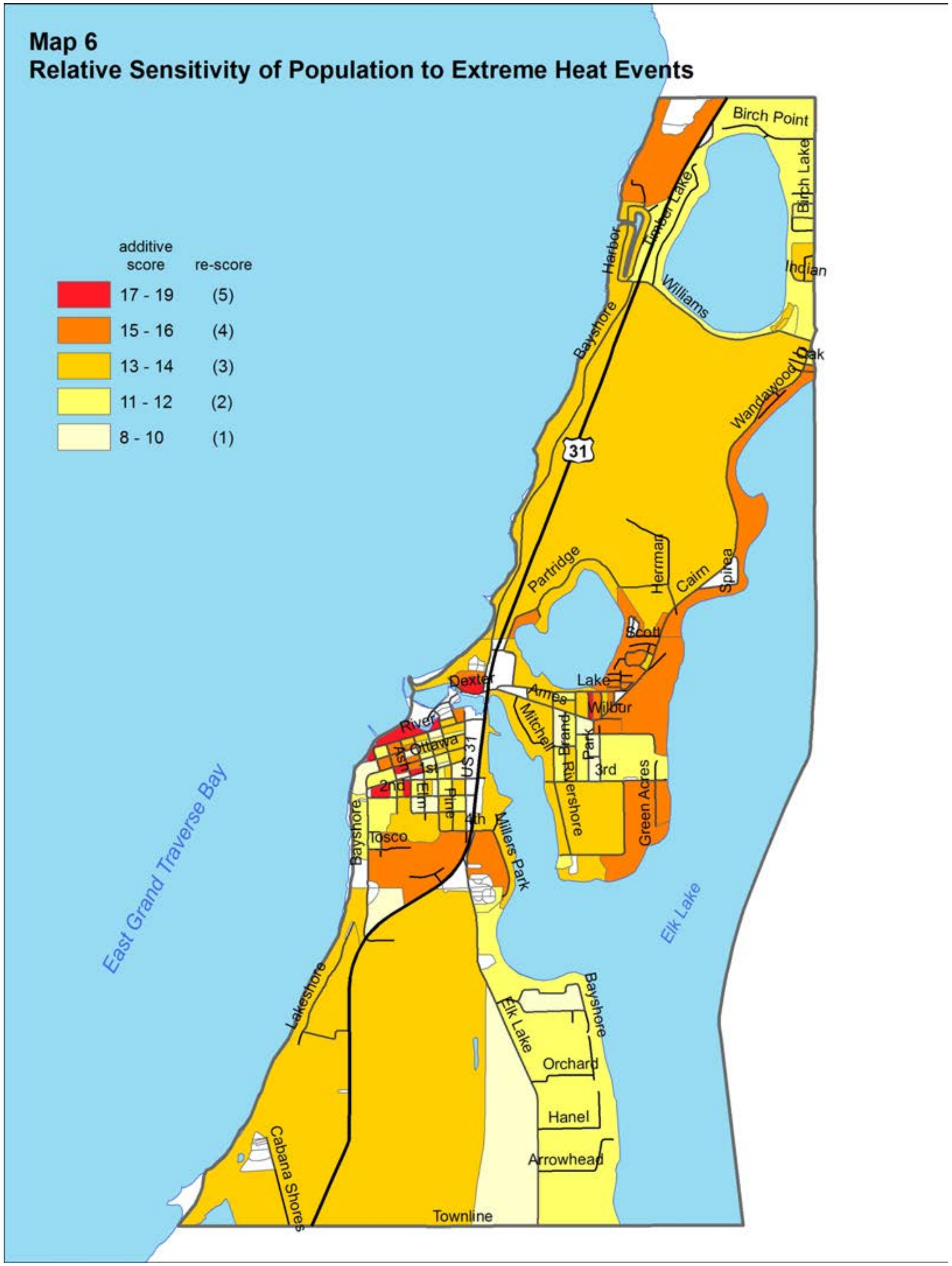



Map 4
Percent of Households Living Below the Poverty Threshold
9.71 - 19.10
4.51 - 9.70
3.70 - 4.50
Birch Point
Birch Lake
Indian
Williams
Oak
Wandawood
Harbor
Bayshore
31
Partridge
Herrman
Calm
Spirea
Scott
Lake
Dexter
Ames
Wilbur
River
Ottawa
Mitchell
Brand
Park
Ash
1st
US 31
2nd
Elm
Pine
3rd
Rivershore
Green Acres
4th
Millers Park
Bayshore
Tosco
East Grand Traverse Bay
Elk Lake
Lakeshore
Bayshore
Elk Lake
Orchard
Hanel
Arrowhead
Cabana Shores
Townline


Antrim County

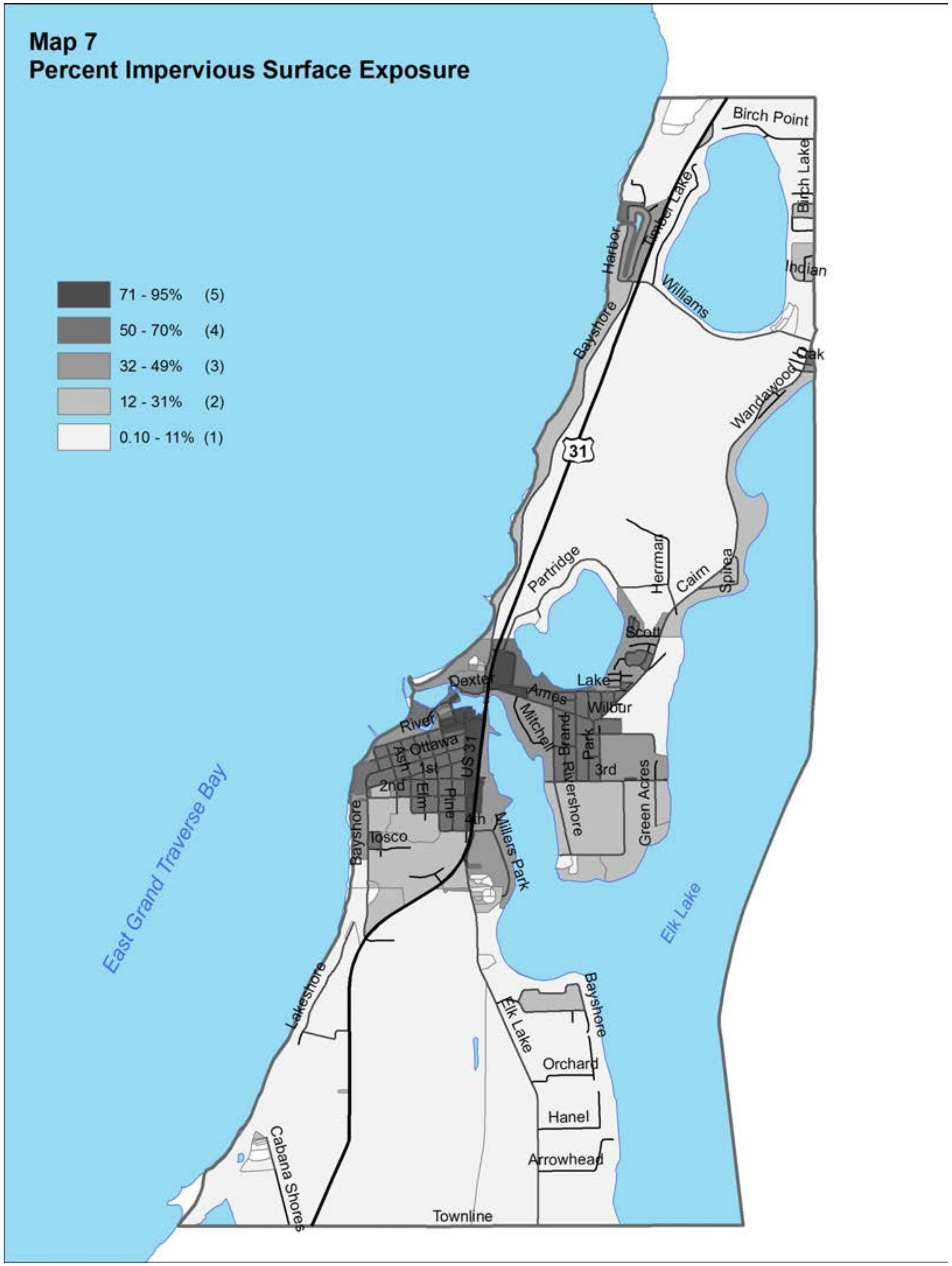

Antrim County

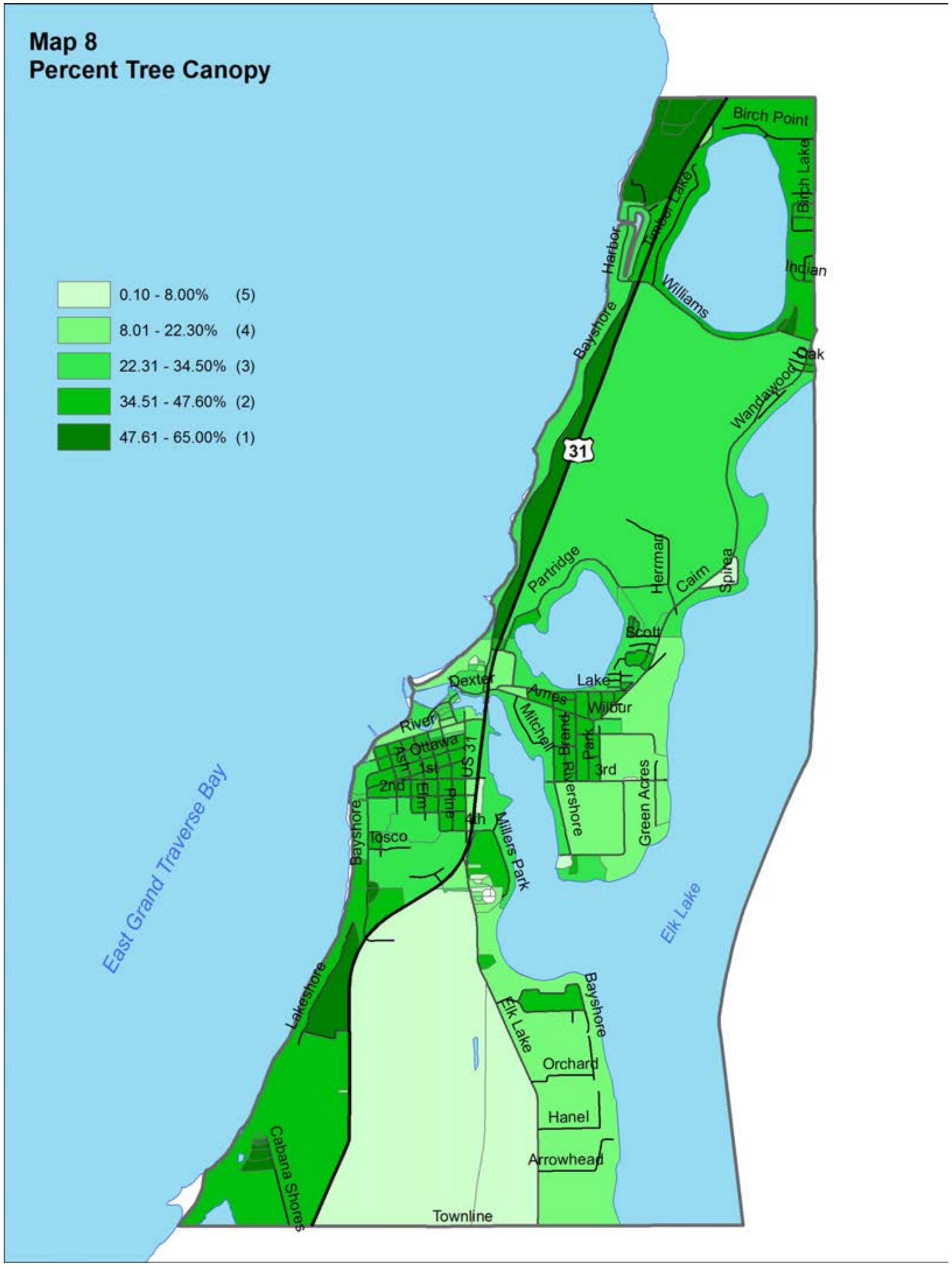

Map 5
Percent of Population 25 Years and Older with less than a High School Education
8.71 - 11.10
3.11 - 8.70
2.91 - 3.10
2.90
East Grand Traverse Bay
Elk Lake
Birch Point
Birch Lake
Indian
Williams
Timber Lake
Harbor
Bayshore
Oak
Wandawood
31
Partridge
Herrman
Cairn
Spirea
Scott
Lake
Dexter
Ames
Wilbur
River
Ottawa
Ash
1st
US 31
Mitchell
Brand
Park
Rivershore
3rd
Green Acres
2nd
Elm
Pine
4th
Millers Park
Tosco
Bayshore
Lakeshore
Elk Lake
Bayshore
Orchard
Hanel
Arrowhead
Cabana Shores
Townline


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
17 - 19 (5)
15 - 16 (4)
13 - 14 (3)
11 - 12 (2)
8 - 10 (1)
Birch Point
Birch Lake
Timber Lake
Harbor
Indian
Williams
Bayshore
Oak
Wandawood
31
Partridge
Herrman
Cairn
Spirea
Scott
Lake
Dexter
Ames
Wilbur
River
Ottawa
Mitchell
Brand
Park
Ash
1st
US 31
3rd
2nd
Elm
Pine
Rivershore
Green Acres
4th
Millers Park
Tosco
East Grand Traverse Bay
Elk Lake
Lakeshore
Elk Lake
Orchard
Hanel
Arrowhead
Cabana Shores
Townline

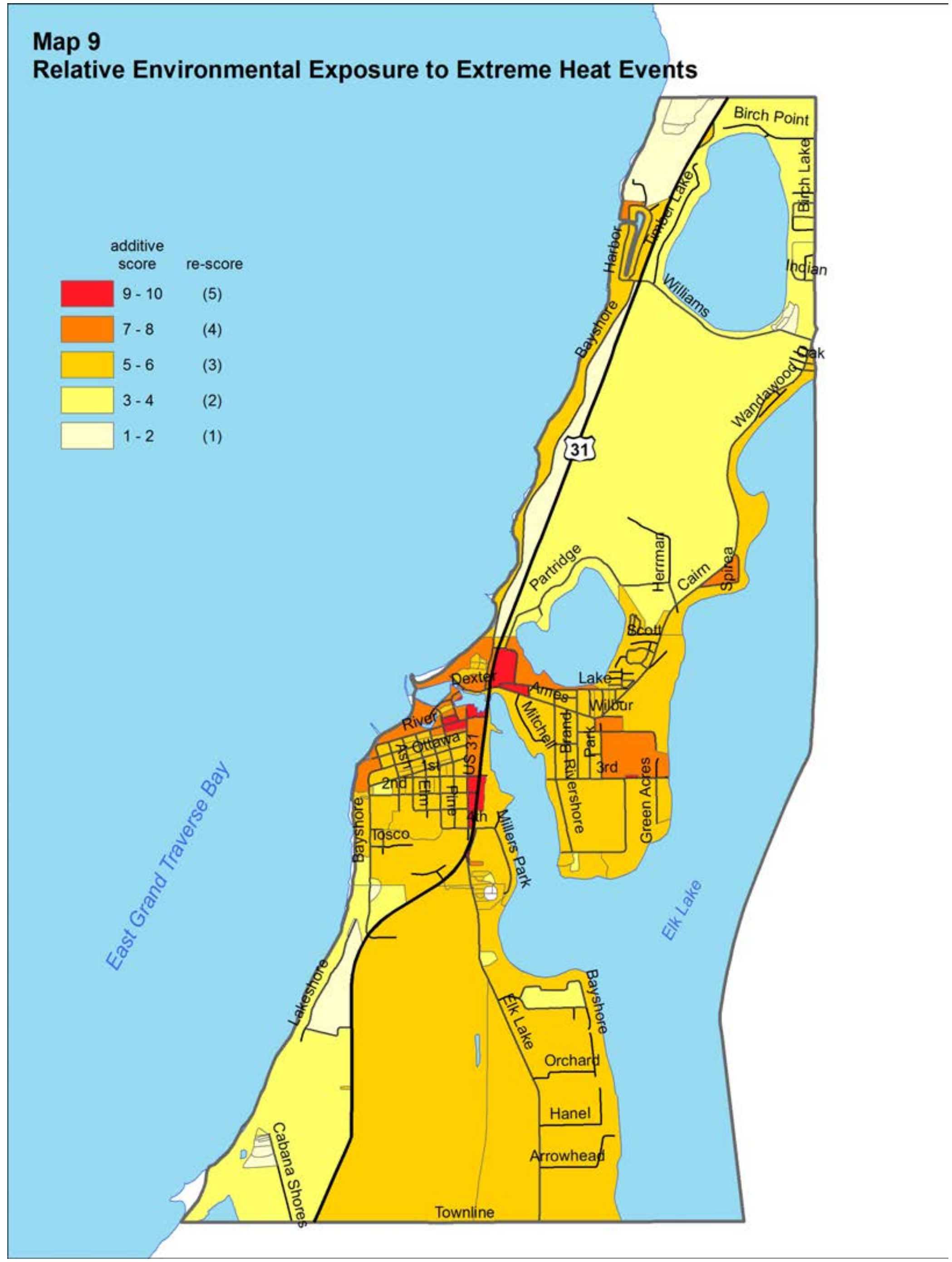

Antrim County


Antrim County

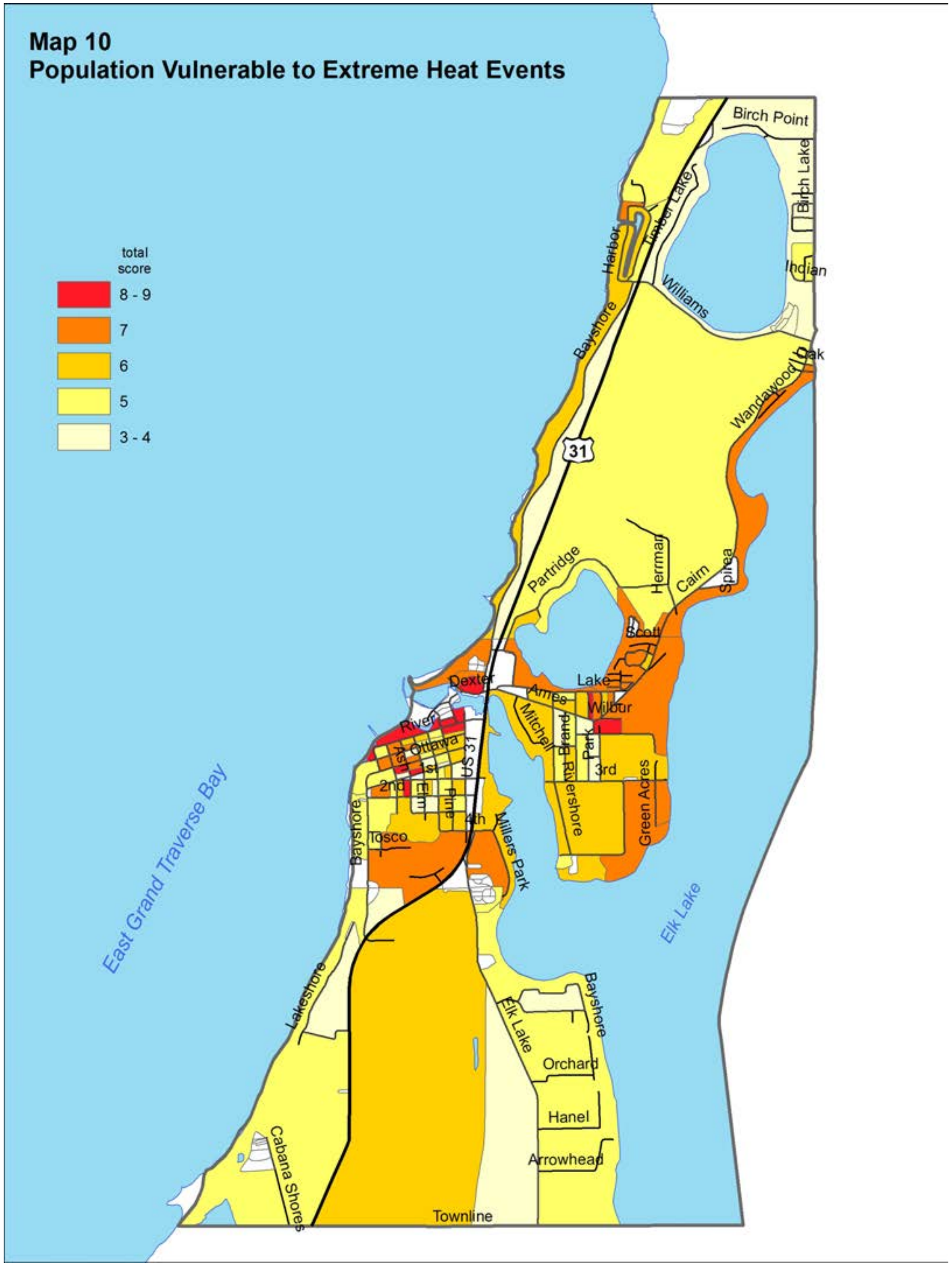

Map 7
Percent Impervious Surface Exposure
71 - 95% (5)
50 - 70% (4)
32 - 49% (3)
12 - 31% (2)
0.10 - 11% (1)
East Grand Traverse Bay
Elk Lake
Birch Point
Birch Lake
Indian
Williams
Harbor
Bayshore
Wandawood
31
Partridge
Herrman
Cairn
Spirea
Scott
Dexter
Lake
Ames
Wilbur
River
Ottawa
Mitchell
Brand
Park
3rd
Ash
1st
2nd
Elm
Pine
US 31
4th
Rivershore
Green Acres
Bayshore
Tosco
Millers Park
Lakeshore
Elk Lake
Bayshore
Orchard
Hanel
Arrowhead
Cabana Shores
Townline


Map 8
Percent Tree Canopy
0.10 - 8.00% (5)
8.01 - 22.30% (4)
22.31 - 34.50% (3)
34.51 - 47.60% (2)
47.61 - 65.00% (1)
East Grand Traverse Bay
Elk Lake
Birch Point
Birch Lake
Indian
Williams
Harbor
Bayshore
Oak
Wandawood
31
Partridge
Herrman
Cairn
Spirea
Scott
Lake
Dexter
Ames
Wilbur
River
Ottawa
Ash
1st
2nd
Elm
Pine
US 31
Mitchell
Brand
Park
3rd
Rivershore
Green Acres
4th
Millers Park
Tosco
Bayshore
Lakeshore
Elk Lake
Bayshore
Orchard
Hanel
Arrowhead
Cabana Shores
Townline


Antrim County



Map 9
Relative Environmental Exposure to Extreme Heat Events

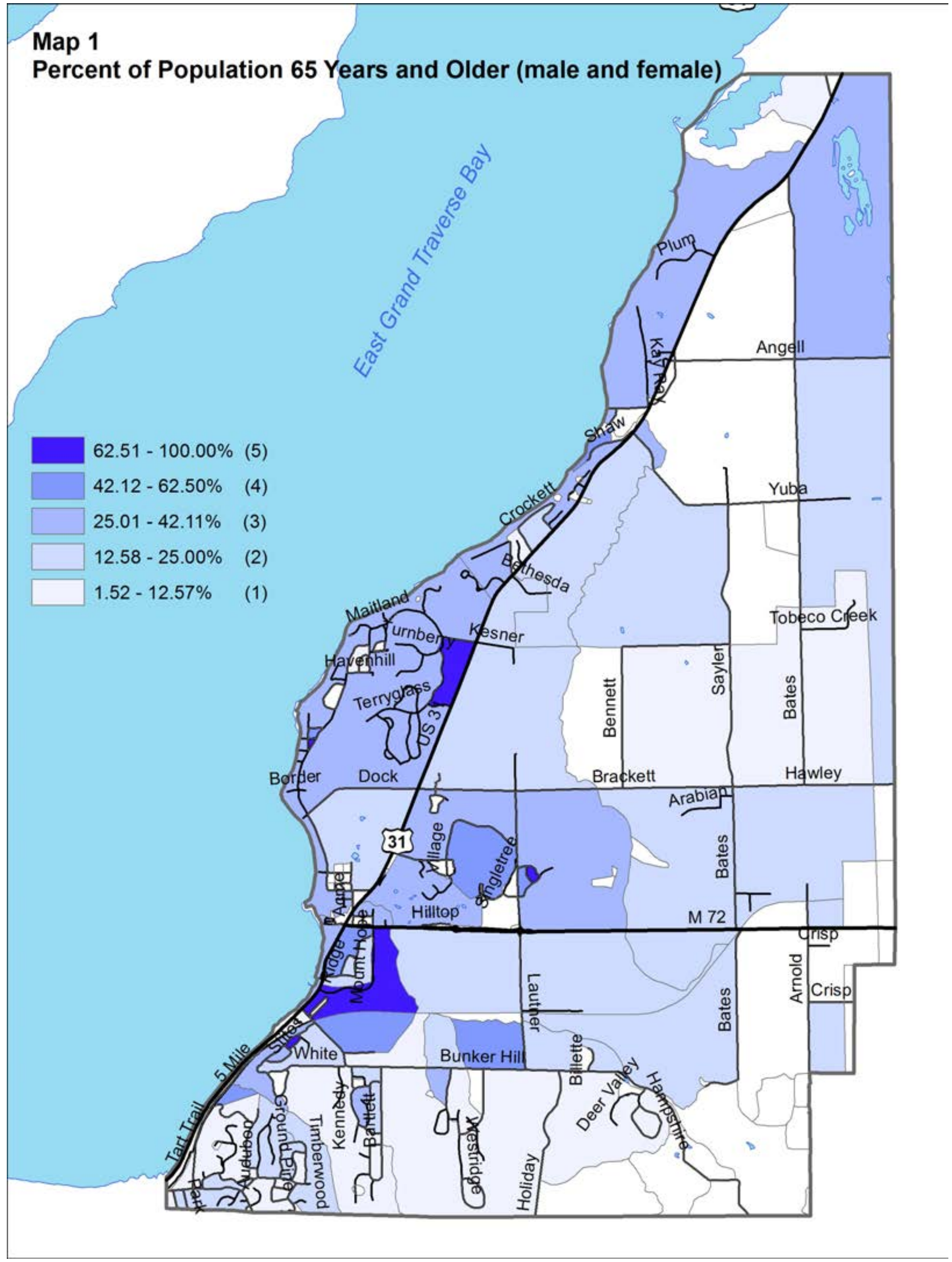

Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
7
6
5
3 - 4
East Grand Traverse Bay
Elk Lake
Birch Point
Birch Lake
Indian
Timber Lake
Harbor
Williams
Bayshore
Oak
Wandawood
31
Partridge
Herrman
Cairn
Spirea
Scott
Lake
Dexter
Ames
Wilbur
Mitchell
Brand
Park
3rd
River
Ottawa
Ash
1st
2nd
Elm
Pine
US 31
4th
Riverside
Green Acres
Bayshore
Tosco
Millers Park
Lakeshore
Bayshore
Elk Lake
Orchard
Hanel
Arrowhead
Cabana Shores
Townline

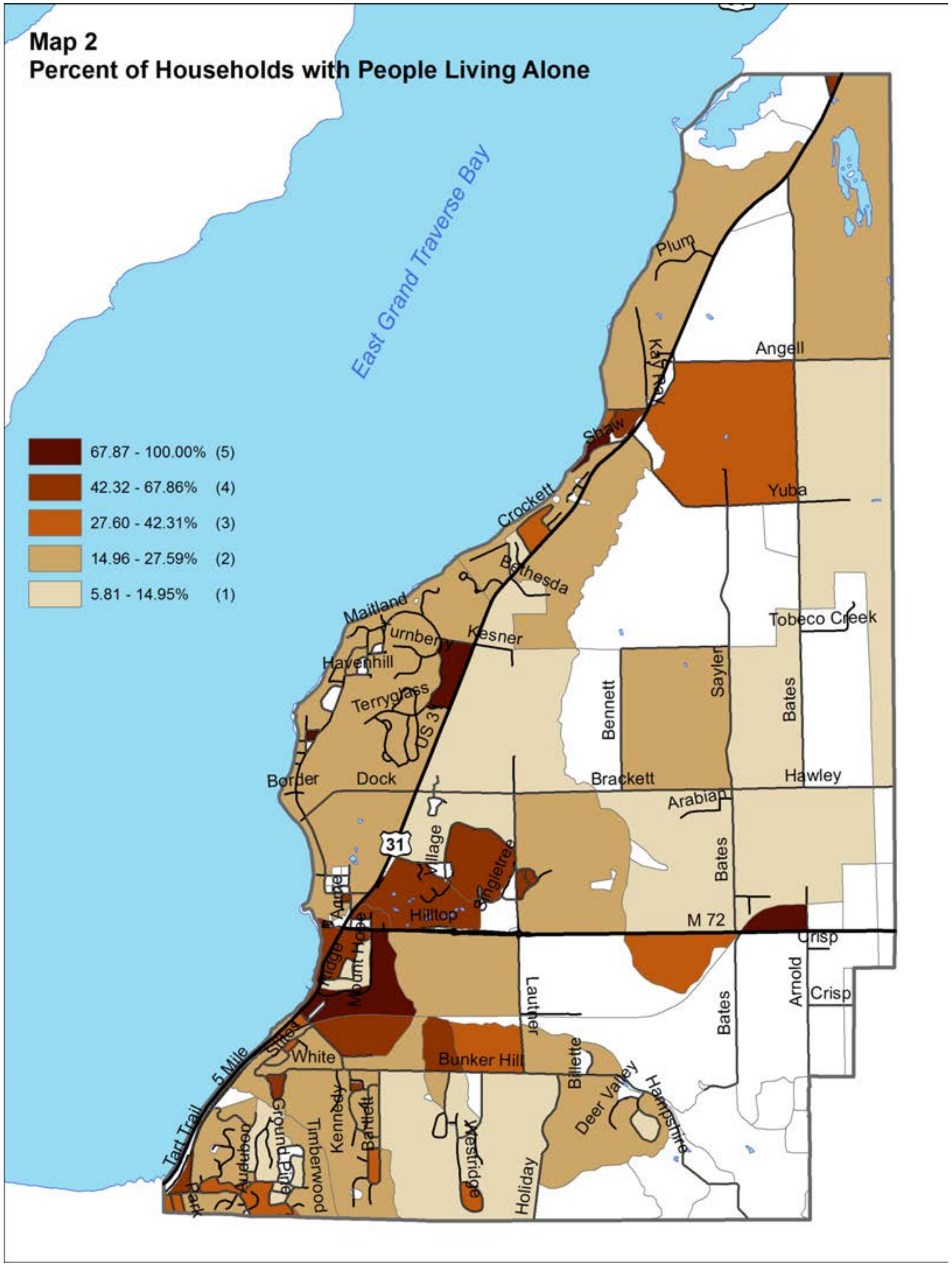

Antrim County

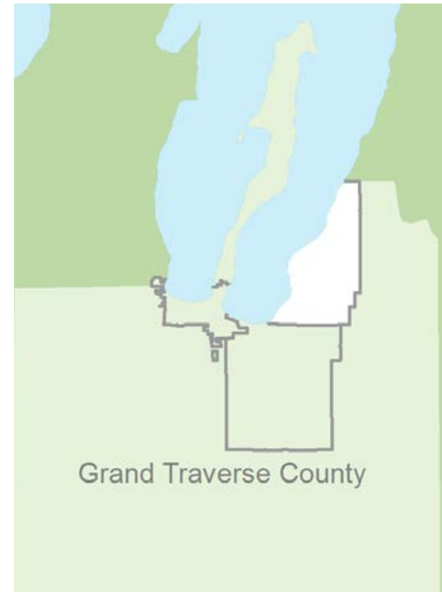
Grand Traverse County

Acme Twp.

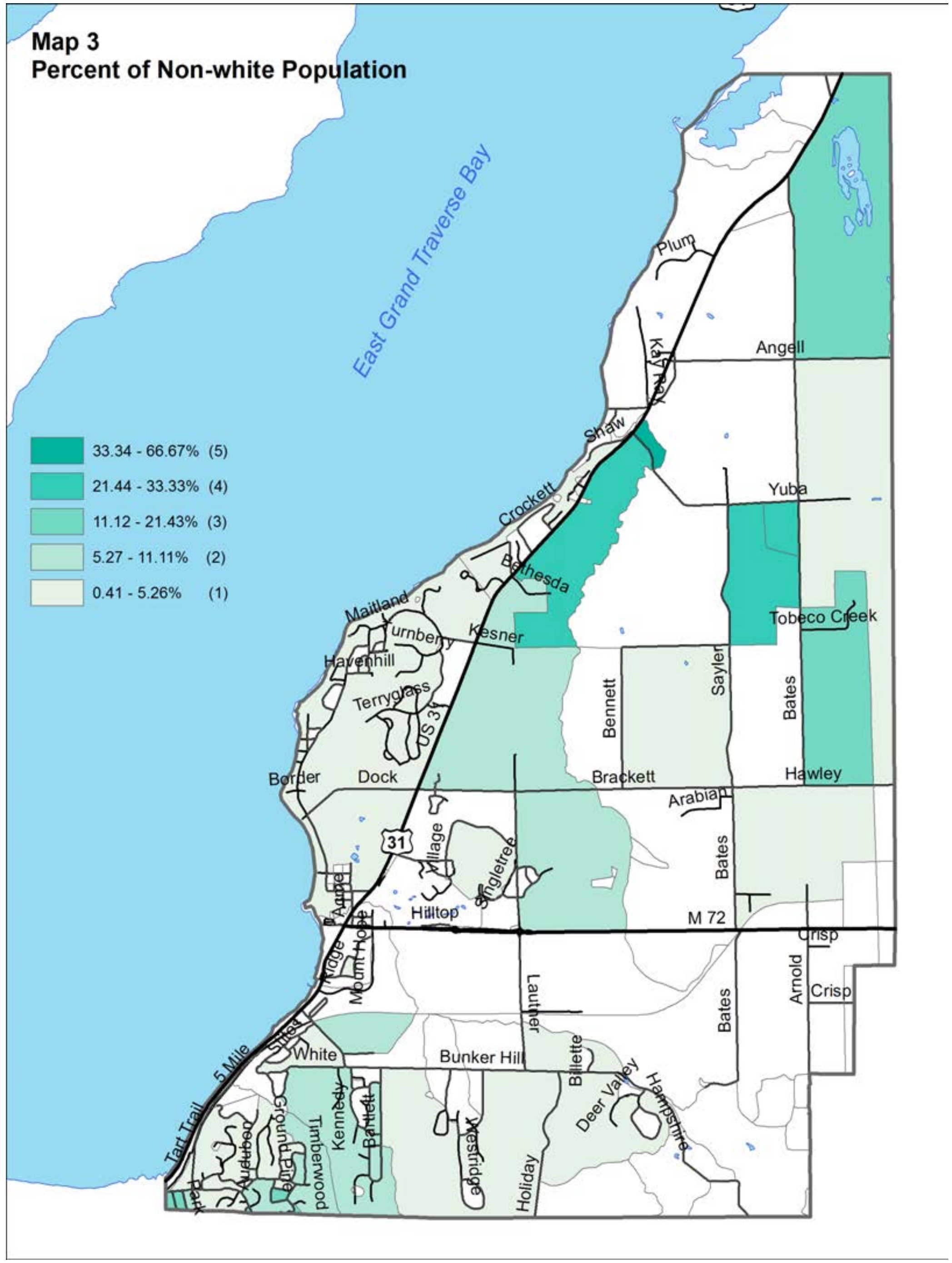

Grand Traverse County

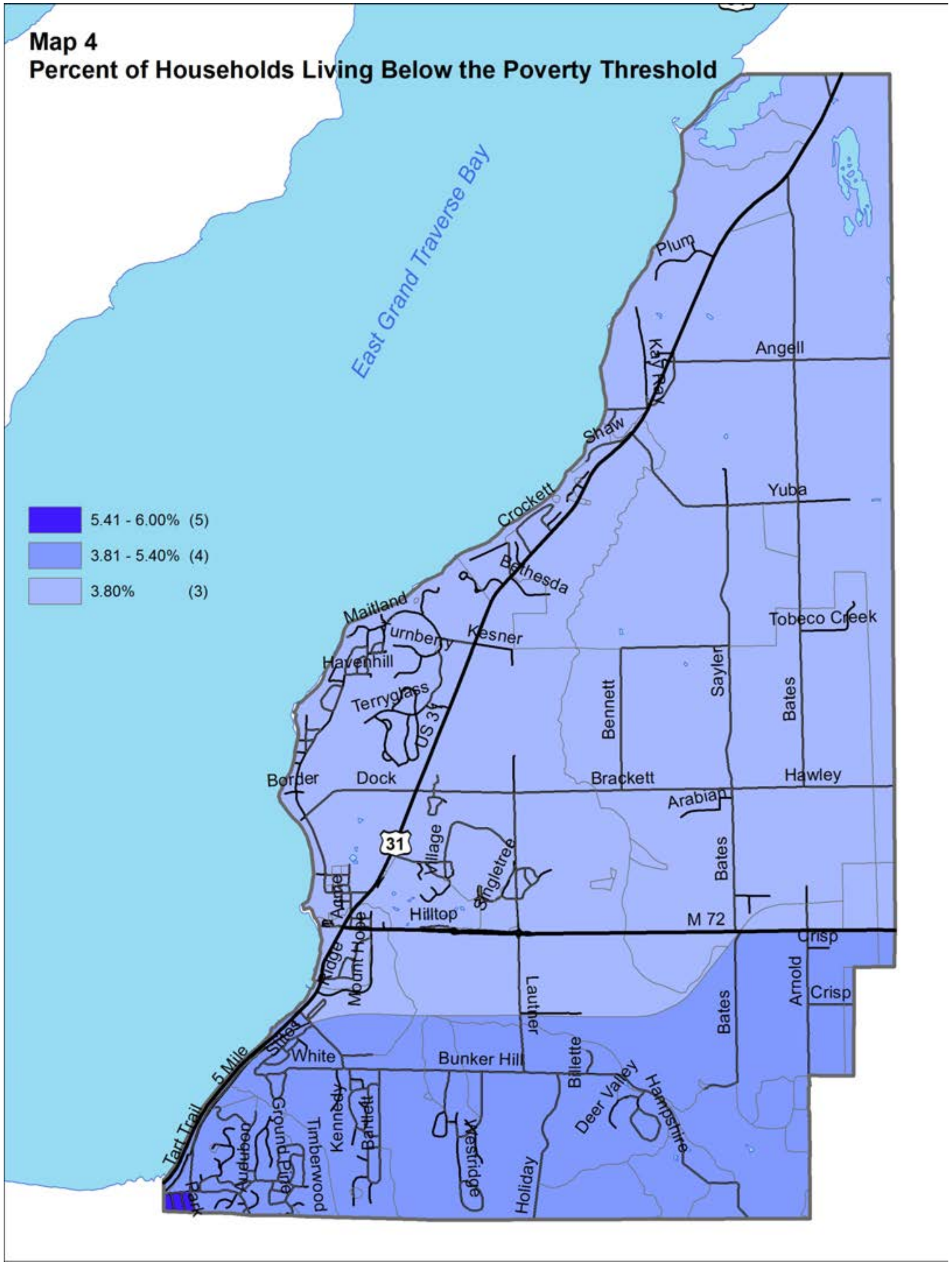

Map 1
Percent of Population 65 Years and Older (male and female)
62.51 - 100.00% (5)
42.12 - 62.50% (4)
25.01 - 42.11% (3)
12.58 - 25.00% (2)
1.52 - 12.57% (1)
East Grand Traverse Bay
Plum
Angell
Shaw
Yuba
Crockett
Bethesda
Tobeco Creek
Maitland
Kesner
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
31
Village
Hilltop
M 72
Crisp
Arnold
Lautner
White
Bunker Hill
5 Mile
Billette
Deer Valley
Hampshire
Tart Trail
Timberwood
Kennedy
Holiday
Westridge
Audubon
Park

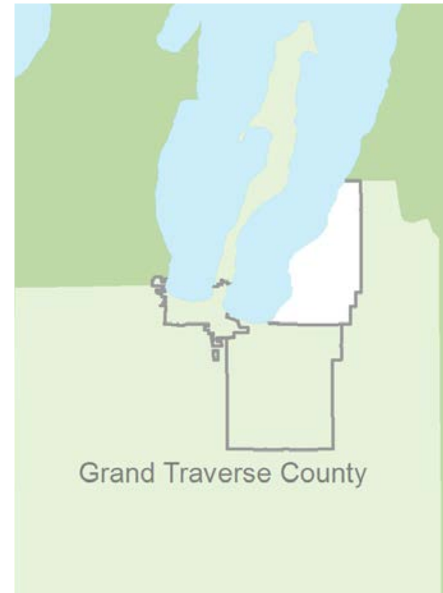

Map 2
Percent of Households with People Living Alone
67.87 - 100.00% (5)
42.32 - 67.86% (4)
27.60 - 42.31% (3)
14.96 - 27.59% (2)
5.81 - 14.95% (1)
East Grand Traverse Bay
Plum
Angell
Shaw
Yuba
Crockett
Bethesda
Maitland
Kesner
Tobeco Creek
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
Hilltop
M 72
Crisp
Lautner
Arnold
White
Bunker Hill
Billette
Deer Valley
Hampshire
5 Mile
Holiday
Timberwood


Grand Traverse County

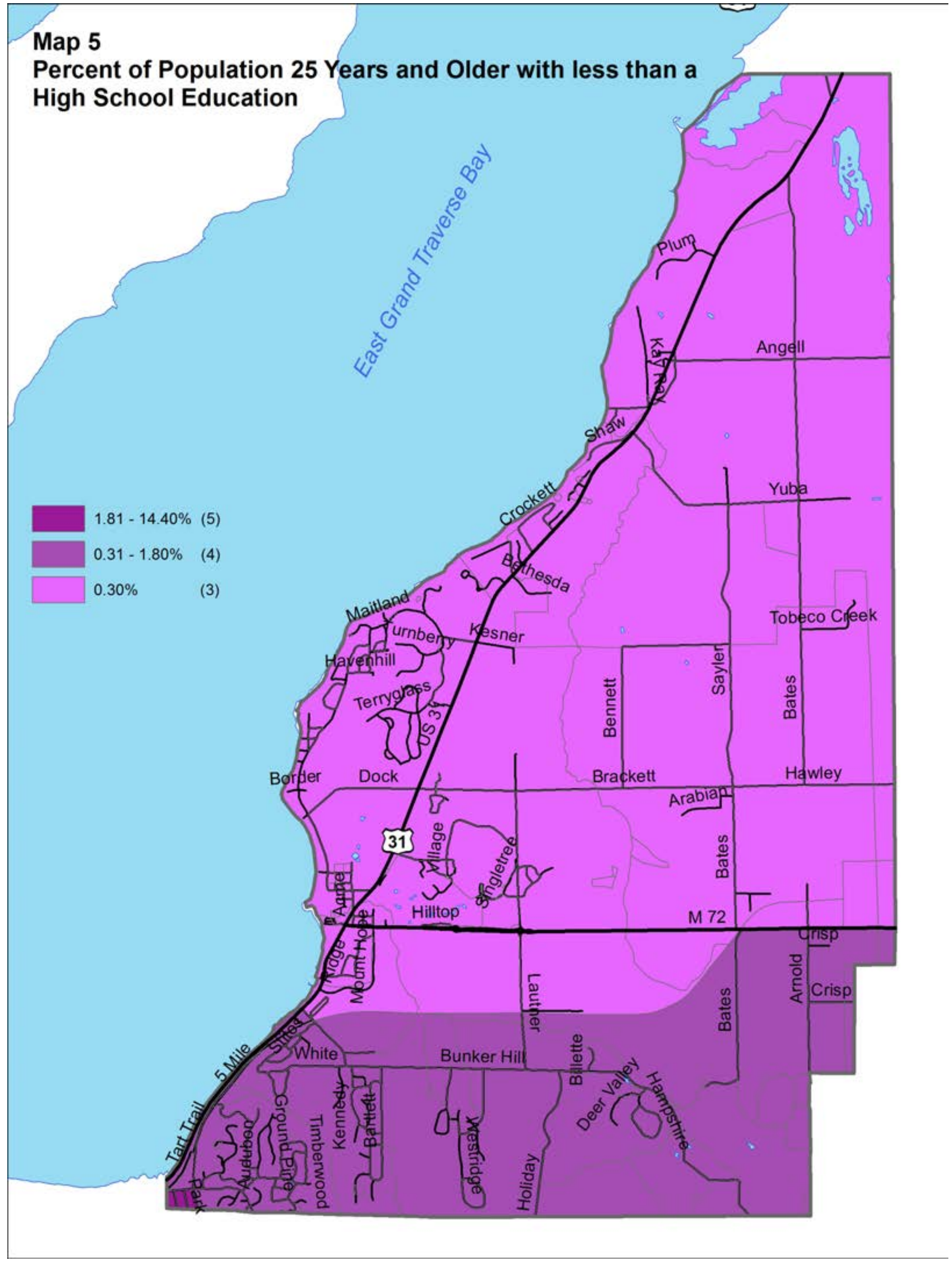

Grand Traverse County

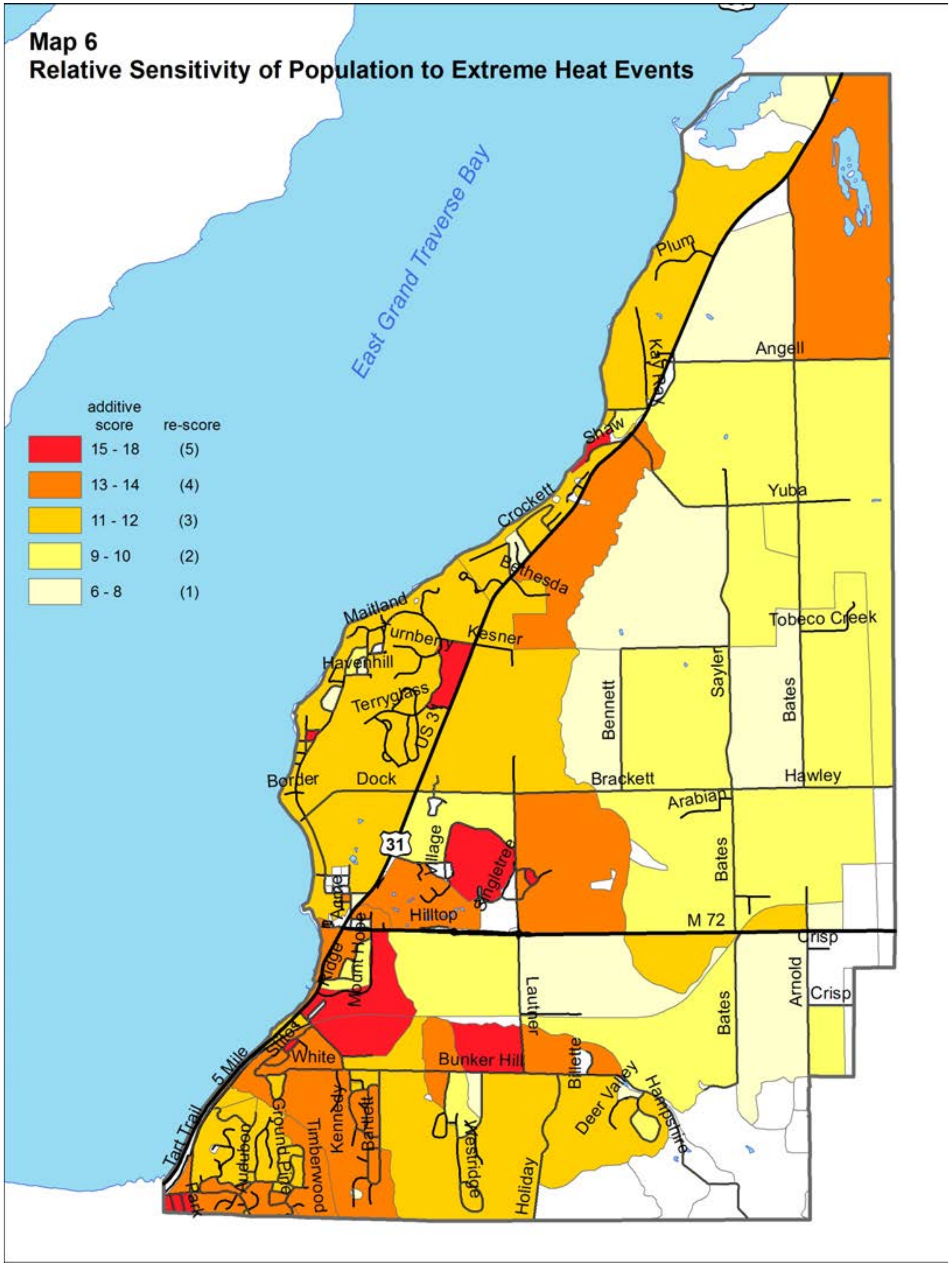

Map 3
Percent of Non-white Population
33.34 - 66.67% (5)
21.44 - 33.33% (4)
11.12 - 21.43% (3)
5.27 - 11.11% (2)
0.41 - 5.26% (1)
East Grand Traverse Bay
Plum
Angell
Shaw
Yuba
Crockett
Bethesda
Maitland
Kesner
Tobeco Creek
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabia
31
Hilltop
M 72
Crisp
Arnold
Lautner
White
Bunker Hill
Billette
Deer Valley
5 Mile
Tart Trail
Timberwood
Kennedy
Holiday


Map 4
Percent of Households Living Below the Poverty Threshold
5.41 - 6.00% (5)
3.81 - 5.40% (4)
3.80% (3)
East Grand Traverse Bay
Plum
Angell
Yuba
Shaw
Crockett
Bethesda
Maitland
Kesner
Havenhill
Terryglass
Tobeco Creek
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
Village
Singletree
Hilltop
M 72
Crisp
Arnold
Mount Hope
Lautner
White
Bunker Hill
Billette
Deer Valley
Hampshire
5 Mile
Tart Trail
Audubon
Timberwood
Kennedy
Westridge
Holiday
31


Grand Traverse County

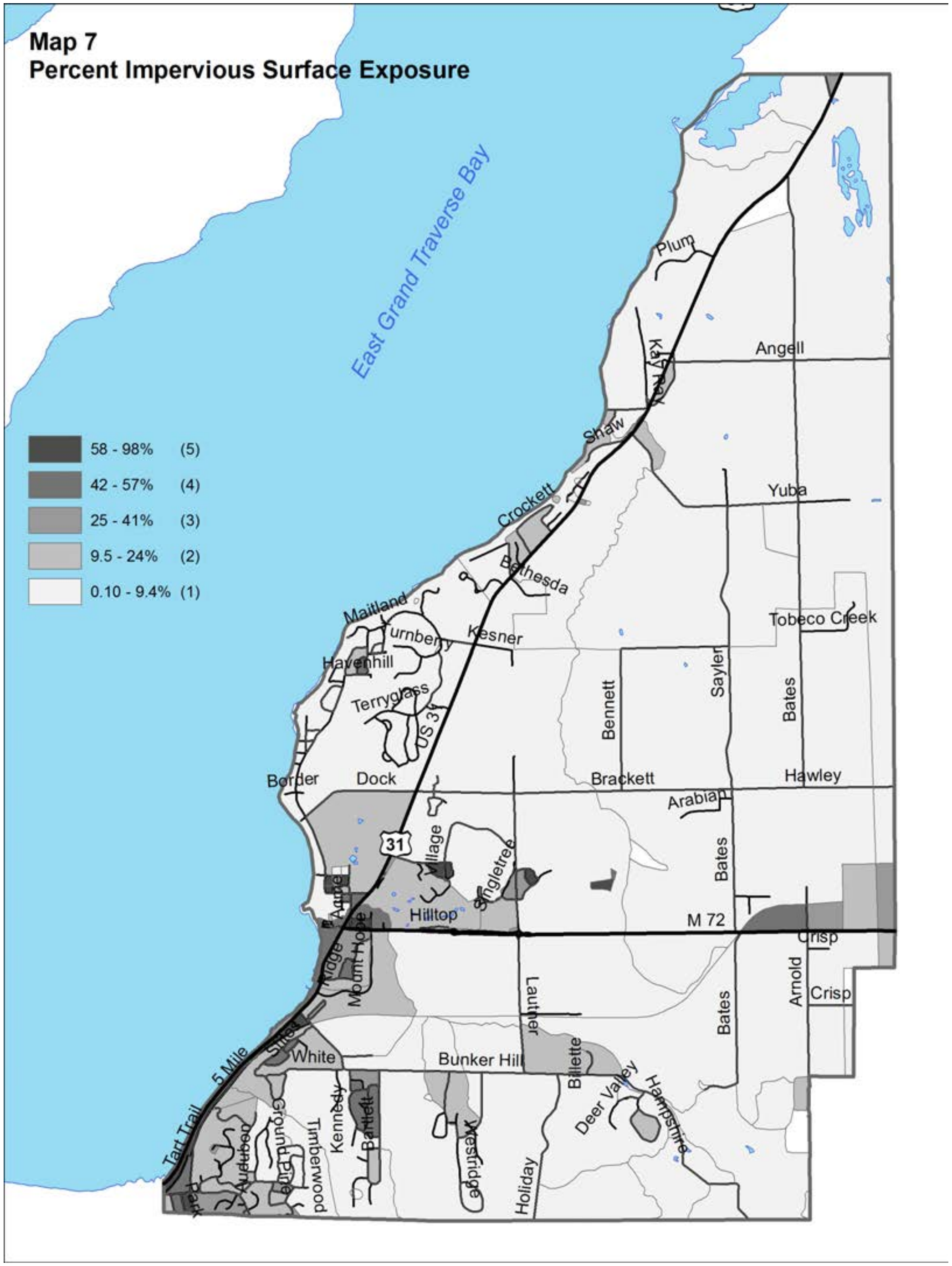

Grand Traverse County

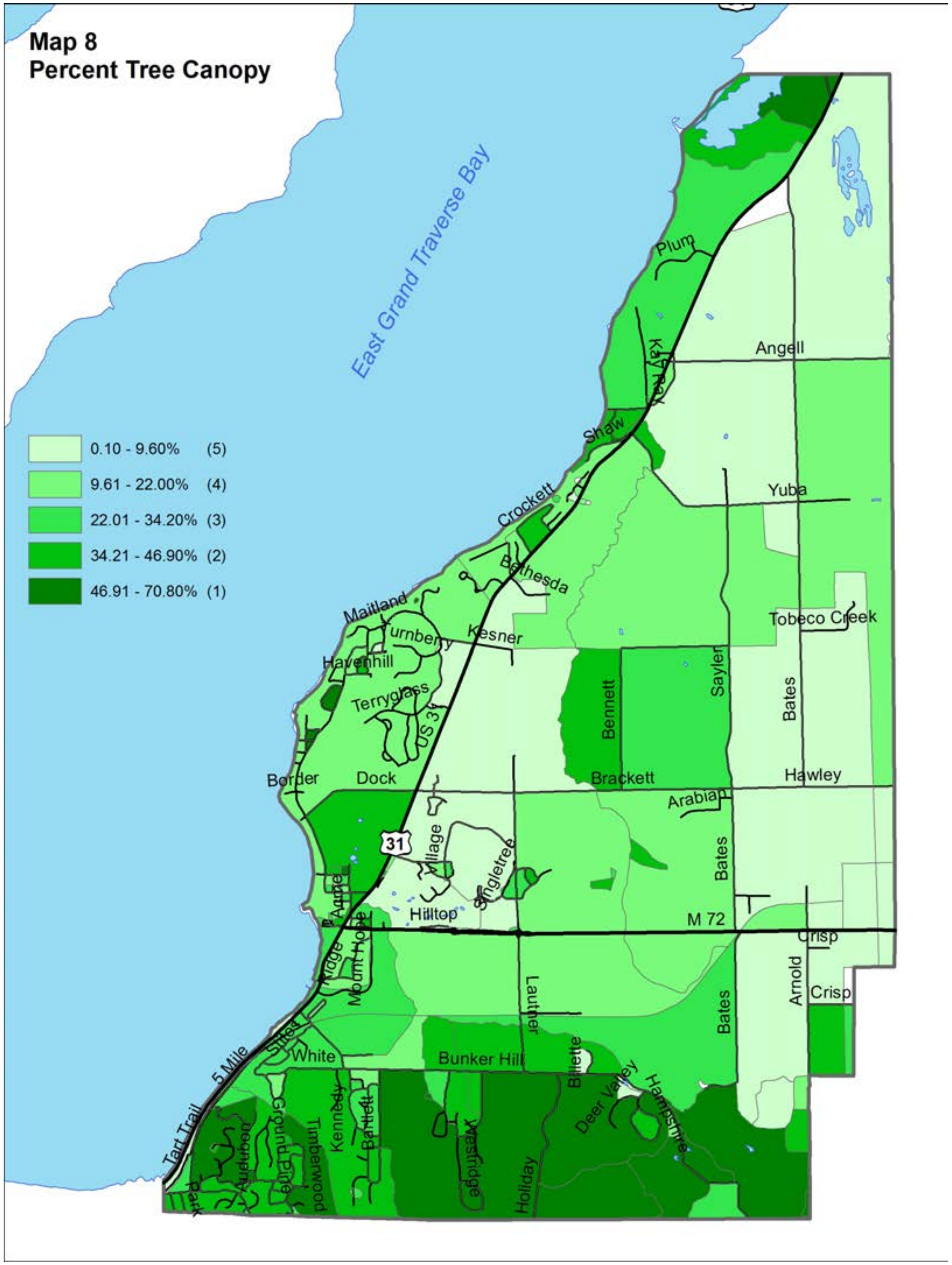

Map 5
Percent of Population 25 Years and Older with less than a High School Education
1.81 - 14.40% (5)
0.31 - 1.80% (4)
0.30% (3)
East Grand Traverse Bay
Plum
Angell
Shaw
Yuba
Crockett
Bethesda
Maitland
Kesner
Tobeco Creek
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
31
Village
Singletree
Hilltop
M 72
Crisp
Arnold
Lautner
Mount Hope
White
Bunker Hill
Billette
Deer Valley
Hampshire
5 Mile
Tart Trail
Audubon
Ground Pine
Timberwood
Kennedy
Bartlett
Westridge
Holiday
Park

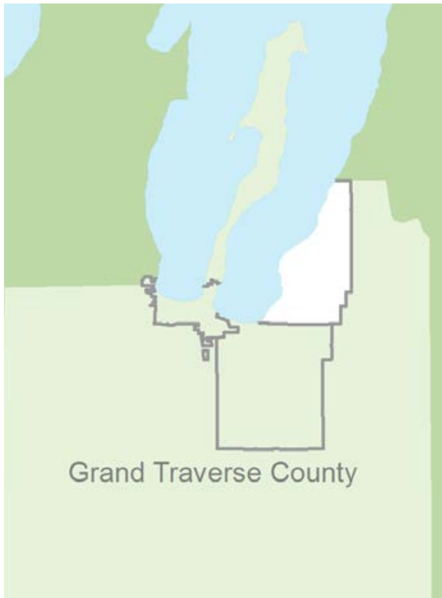

Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
15 - 18 (5)
13 - 14 (4)
11 - 12 (3)
9 - 10 (2)
6 - 8 (1)
East Grand Traverse Bay
Plum
Angell
Shaw
Yuba
Crockett
Bethesda
Maitland
Kesner
Tobeco Creek
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
Village
31
Hilltop
Singletree
M 72
Crisp
Arnold
Lautner
Mount Hope
White
Bunker Hill
Billette
Deer Valley
Hampshire
5 Mile
Tart Trail
Kennedy
Timberwood
Holiday

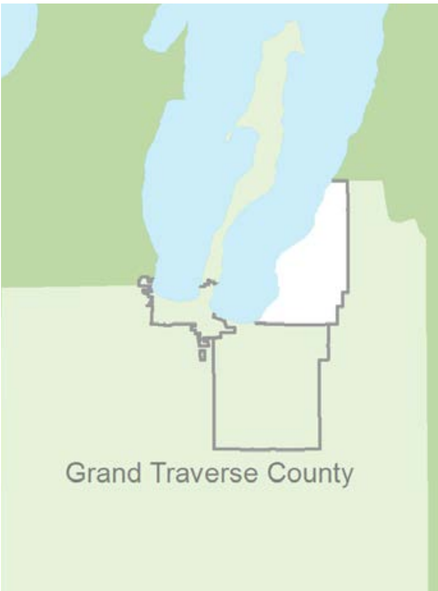

Grand Traverse County

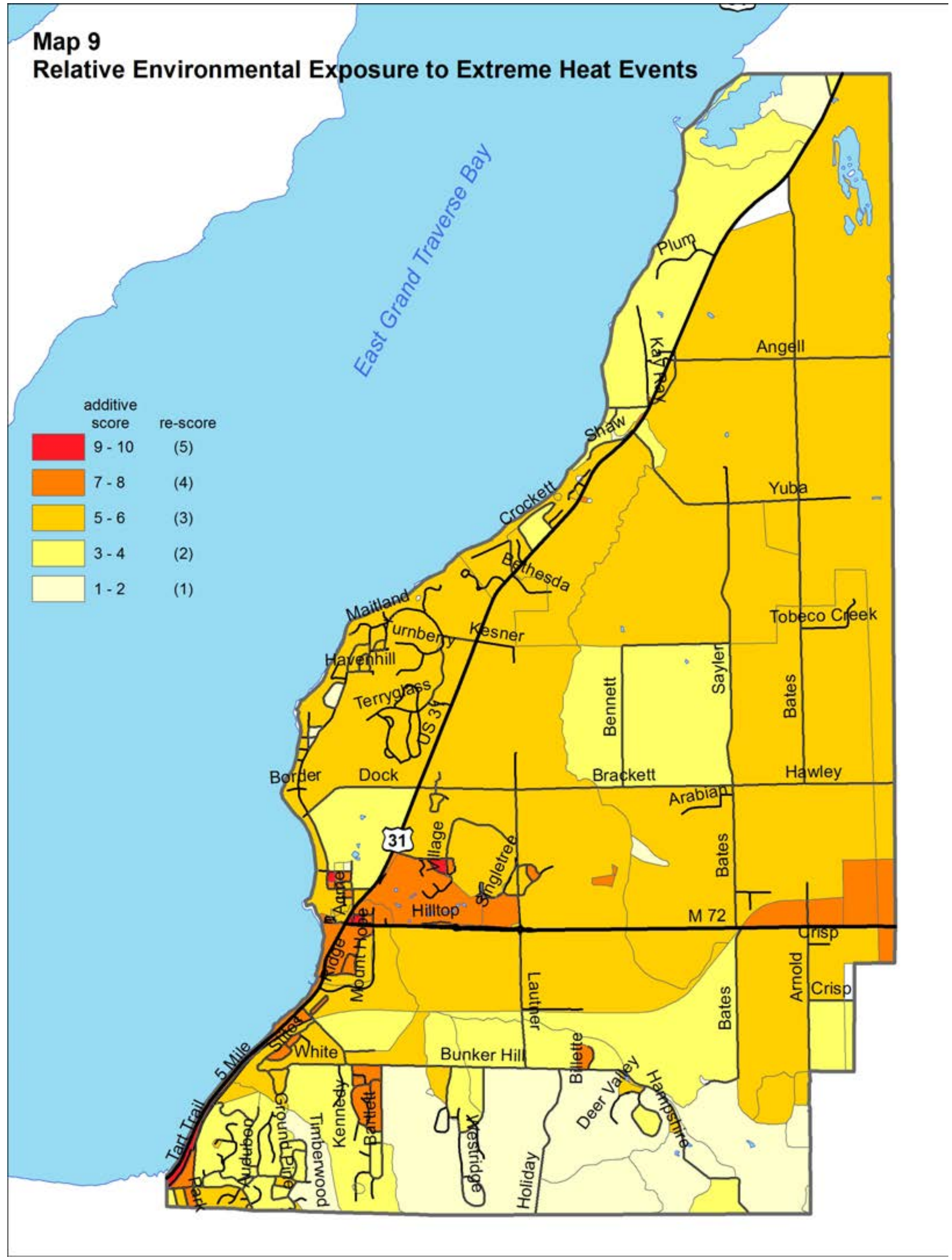

Grand Traverse County

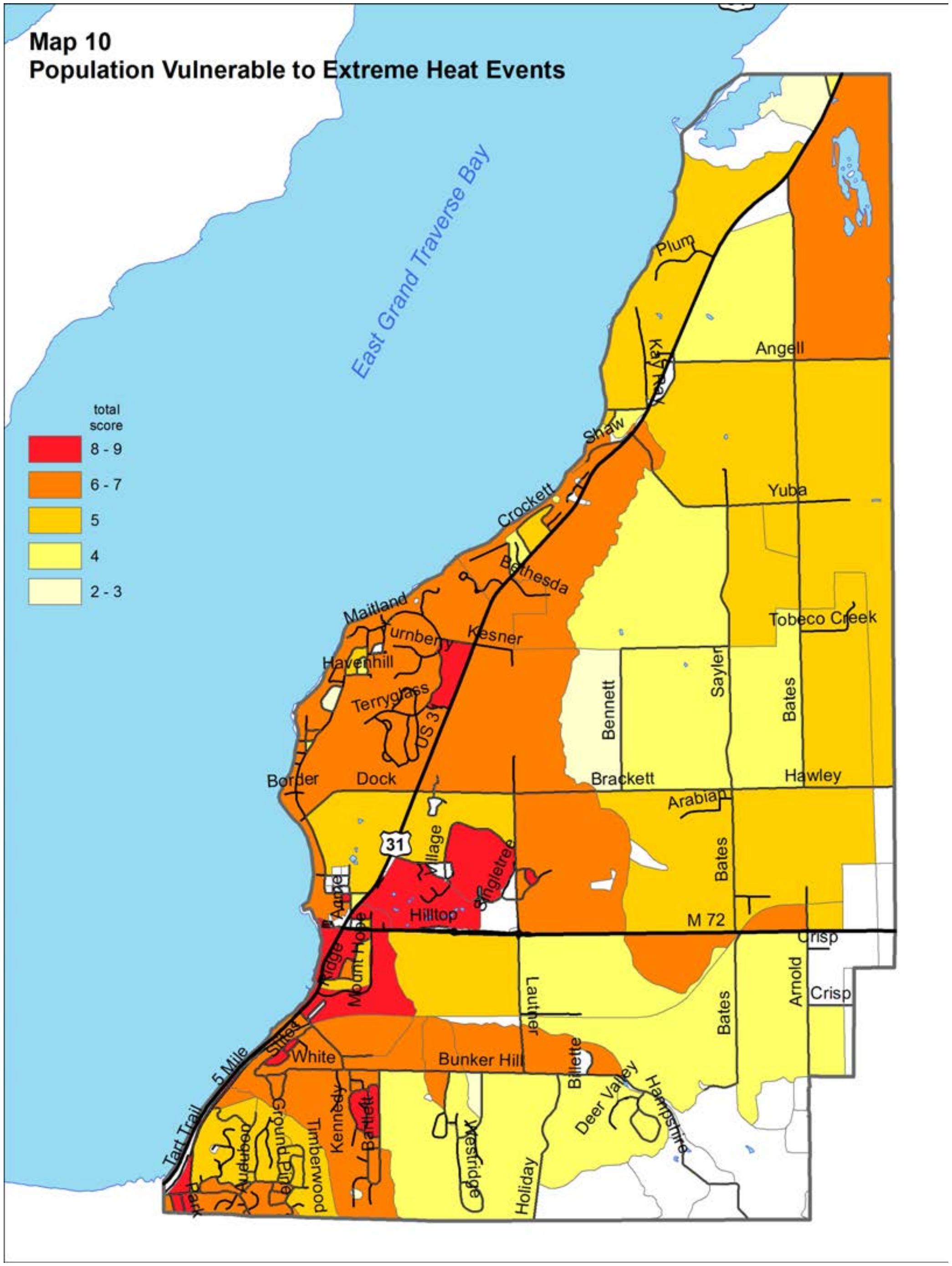

Map 7
Percent Impervious Surface Exposure
58 - 98% (5)
42 - 57% (4)
25 - 41% (3)
9.5 - 24% (2)
0.10 - 9.4% (1)
East Grand Traverse Bay
Plum
Angell
Shaw
Yuba
Crockett
Bethesda
Maitland
Kesner
Tobeco Creek
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
31
Village
Singletree
Hilltop
M 72
Crisp
Arnold
Ridge
Mount Hope
Lautner
White
Bunker Hill
Billette
Deer Valley
Hampshire
5 Mile
Tart Trail
Audubon
Timberwood
Kennedy
Bartlett
Holiday
Park

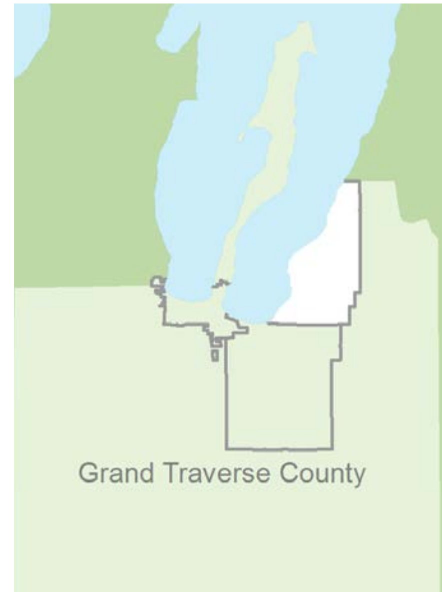

Map 8
Percent Tree Canopy
0.10 - 9.60% (5)
9.61 - 22.00% (4)
22.01 - 34.20% (3)
34.21 - 46.90% (2)
46.91 - 70.80% (1)
East Grand Traverse Bay
Plum
Angell
Shaw
Yuba
Crockett
Bethesda
Maitland
Kesner
Tobeco Creek
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
31
Village
Singletree
Hilltop
M 72
Crisp
Arnold
Lautner
Mount Hope
White
Bunker Hill
Billette
Deer Valley
Hampshire
5 Mile
Tart Trail
Audubon
Timberwood
Kennedy
Bartlett
Westridge
Holiday
Park


Grand Traverse County


Grand Traverse County

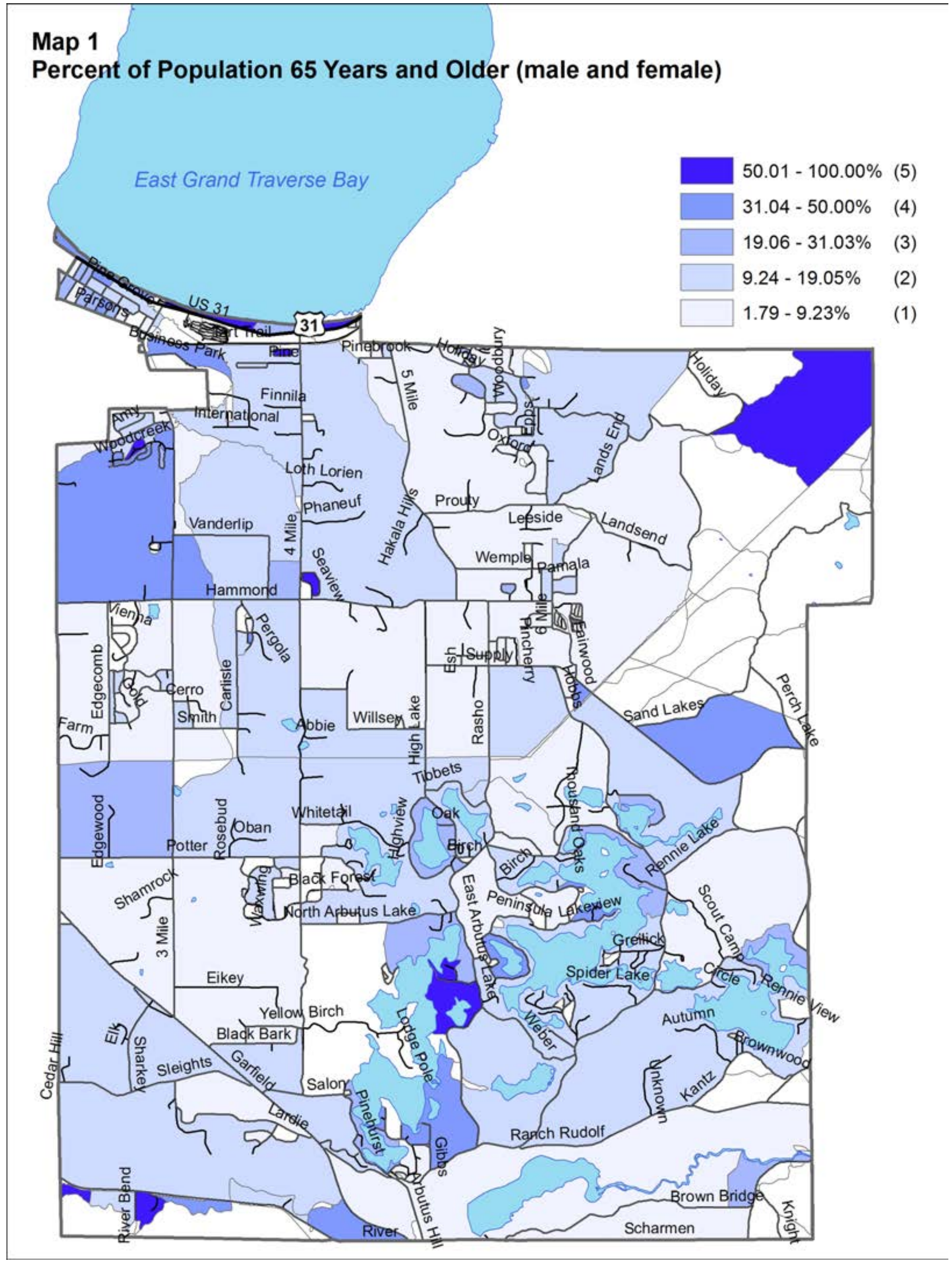

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
East Grand Traverse Bay
Plum
Angell
Shaw
Crockett
Yuba
Bethesda
Maitland
Kesner
Tobeco Creek
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
31
Village
Singletree
Hilltop
M 72
Crisp
Mount Hope
Lautner
Arnold
White
Bunker Hill
Billette
Deer Valley
Hampshire
5 Mile
Tart Trail
Audubon
Timberwood
Kennedy
Bartlett
Westridge
Holiday


Map 10
Population Vulnerable to Extreme Heat Events
East Grand Traverse Bay
total score
8 - 9
6 - 7
5
4
2 - 3
Plum
Angell
Shaw
Crockett
Yuba
Bethesda
Maitland
Kesner
Tobeco Creek
Havenhill
Terryglass
Bennett
Sayler
Bates
Border
Dock
Brackett
Hawley
Arabian
31
Village
Hilltop
M 72
Crisp
Mount Hope
Lautner
Arnold
White
Bunker Hill
Billette
Deer Valley
Hampshire
5 Mile
Tart Trail
Timberwood
Kennedy
Bartlett
Westridge
Holiday

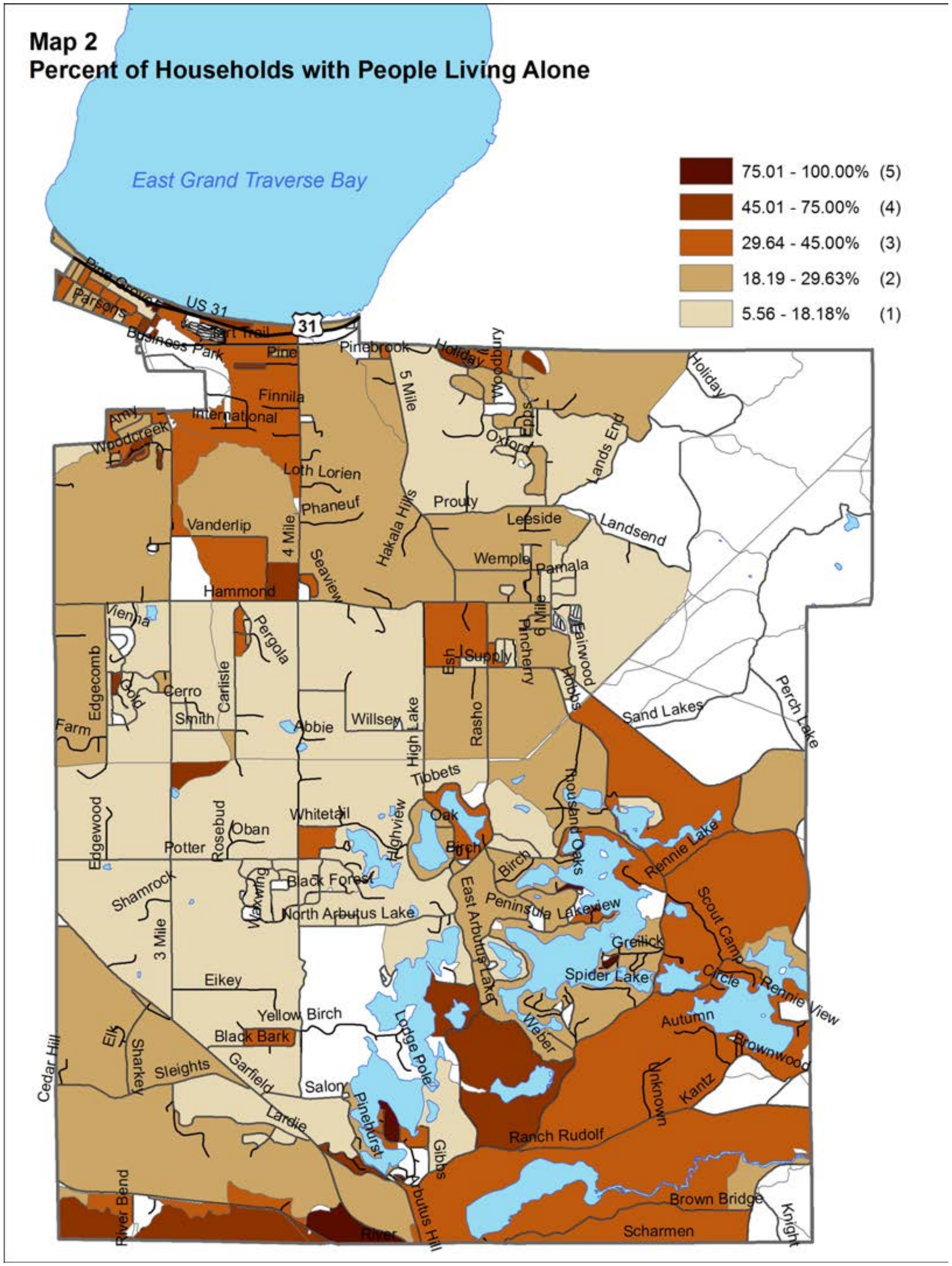

Grand Traverse County

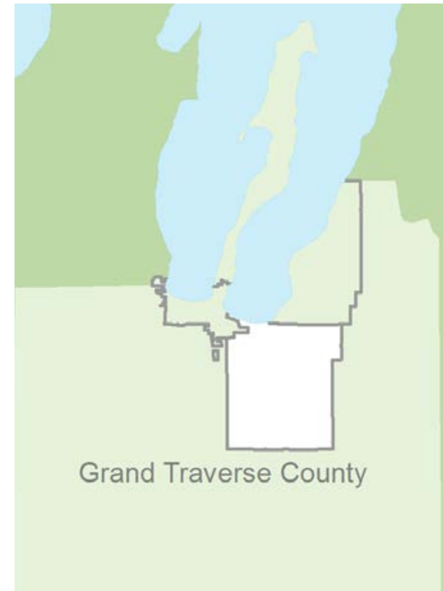
East Bay Twp.


Grand Traverse County

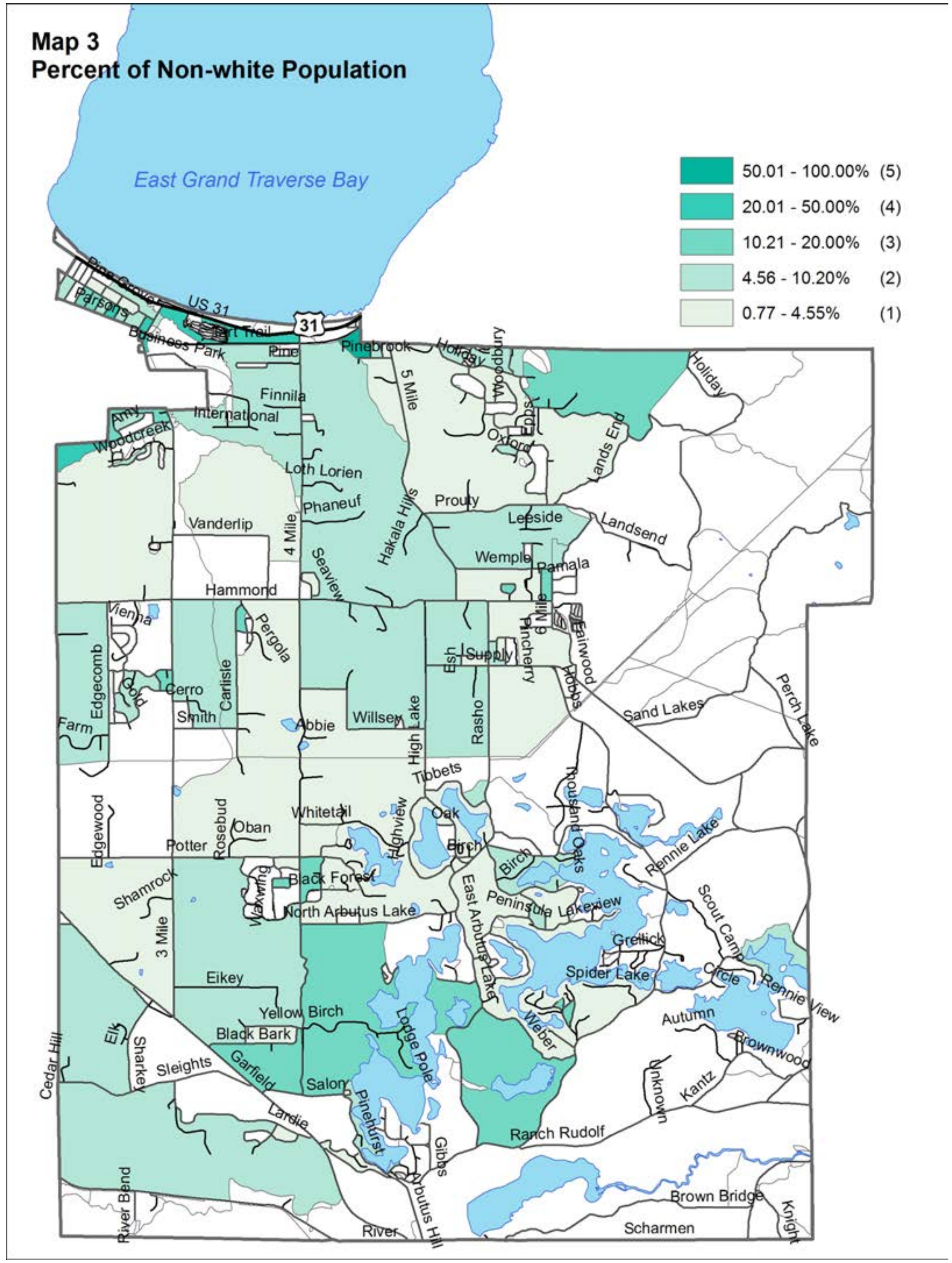

Map 1
Percent of Population 65 Years and Older (male and female)
East Grand Traverse Bay
50.01 - 100.00% (5)
31.04 - 50.00% (4)
19.06 - 31.03% (3)
9.24 - 19.05% (2)
1.79 - 9.23% (1)

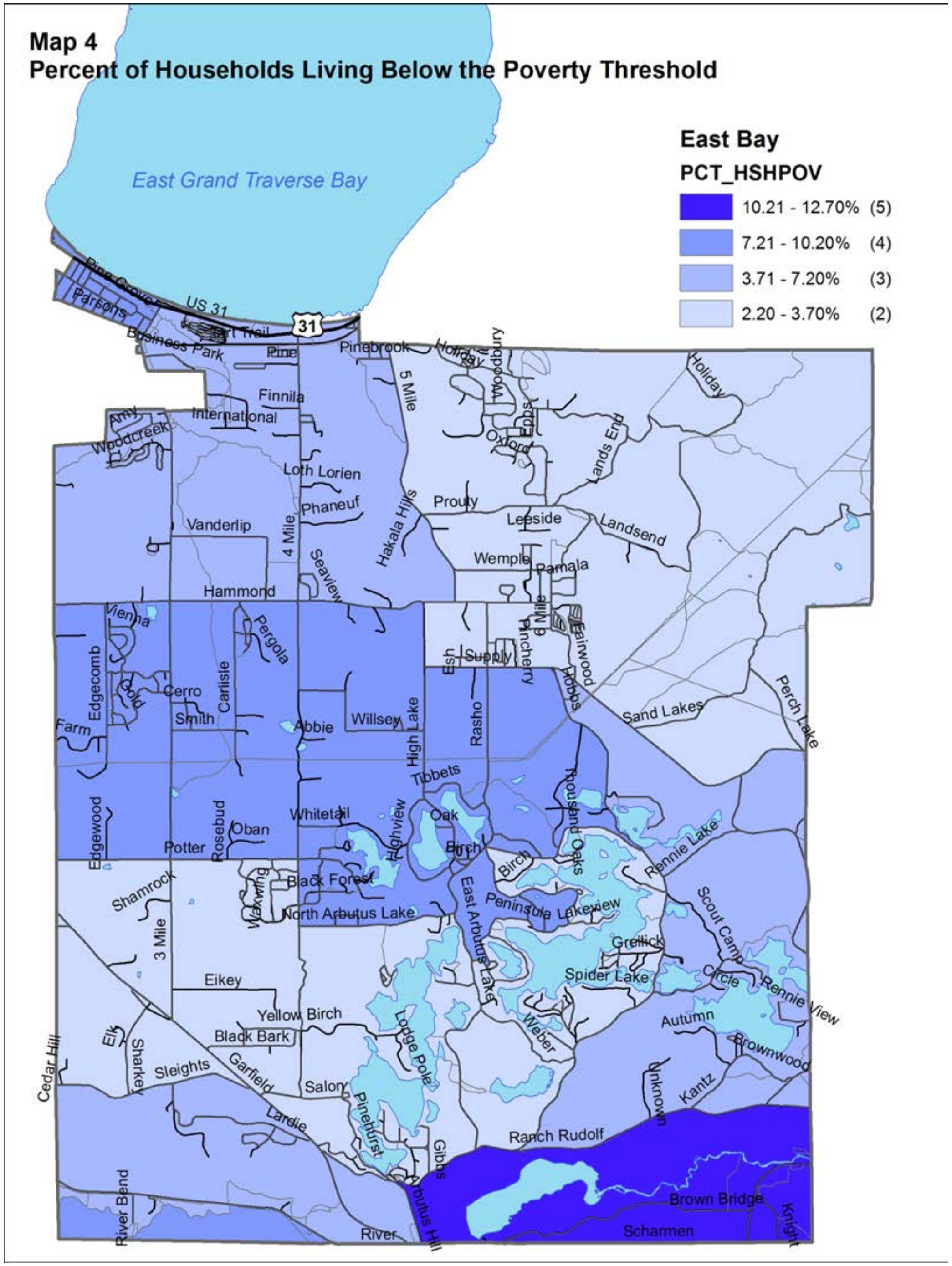
Map 2
Percent of Households with People Living Alone





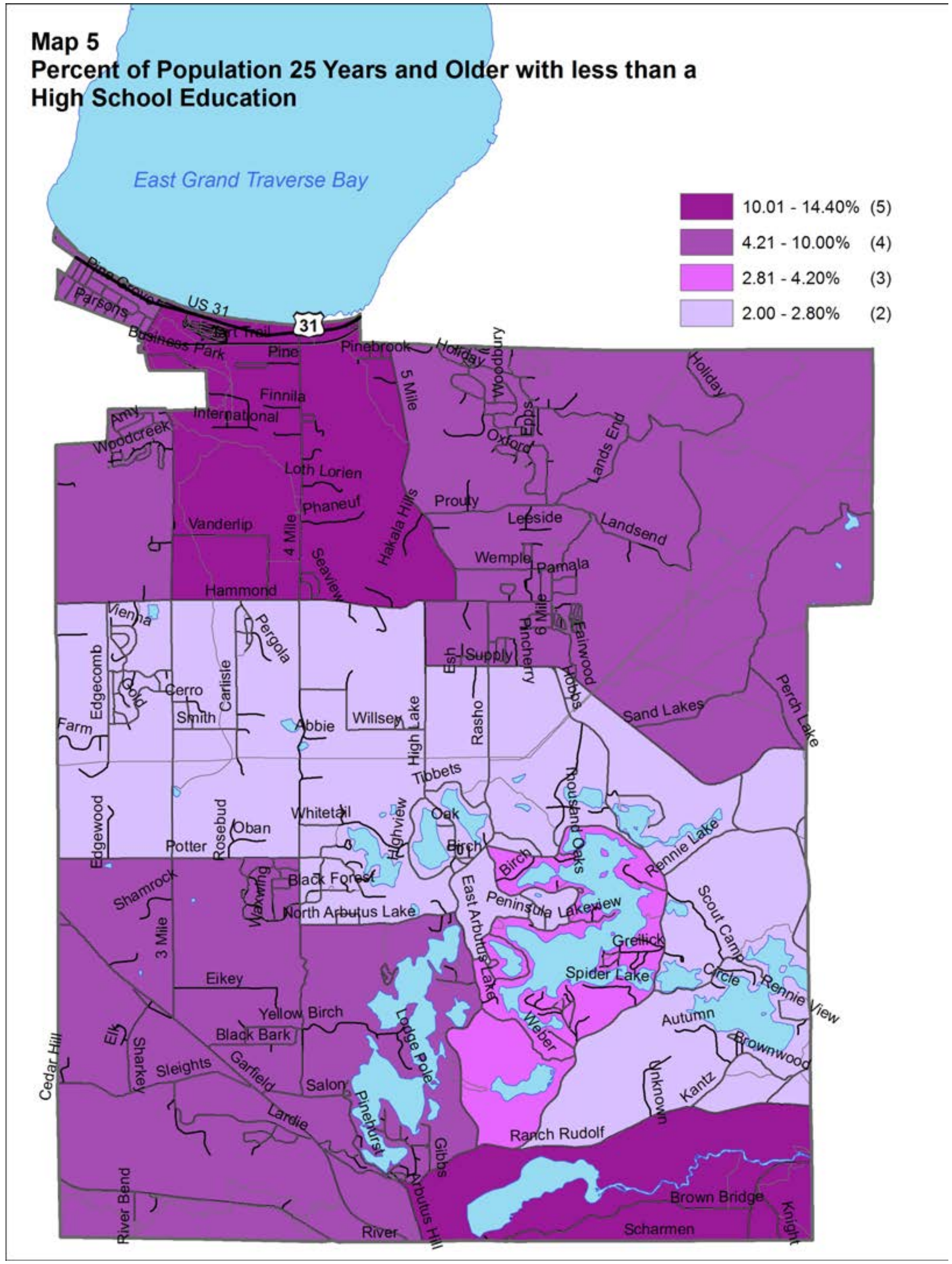

Grand Traverse County

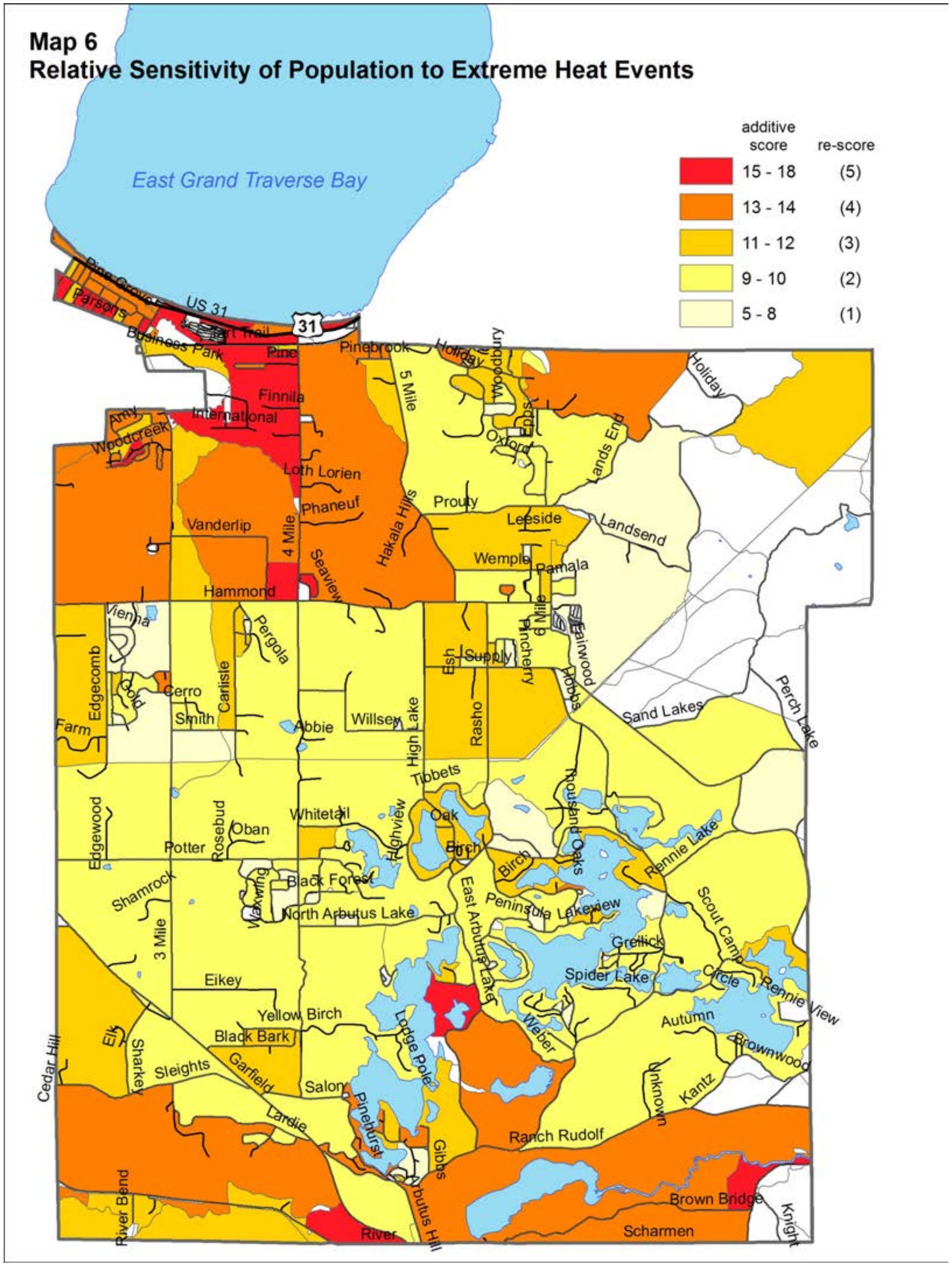

Map 3
Percent of Non-white Population
East Grand Traverse Bay
50.01 - 100.00% (5)
20.01 - 50.00% (4)
10.21 - 20.00% (3)
4.56 - 10.20% (2)
0.77 - 4.55% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
East Bay
PCT_HSHPOV
10.21 - 12.70% (5)
7.21 - 10.20% (4)
3.71 - 7.20% (3)
2.20 - 3.70% (2)
East Grand Traverse Bay


Grand Traverse County

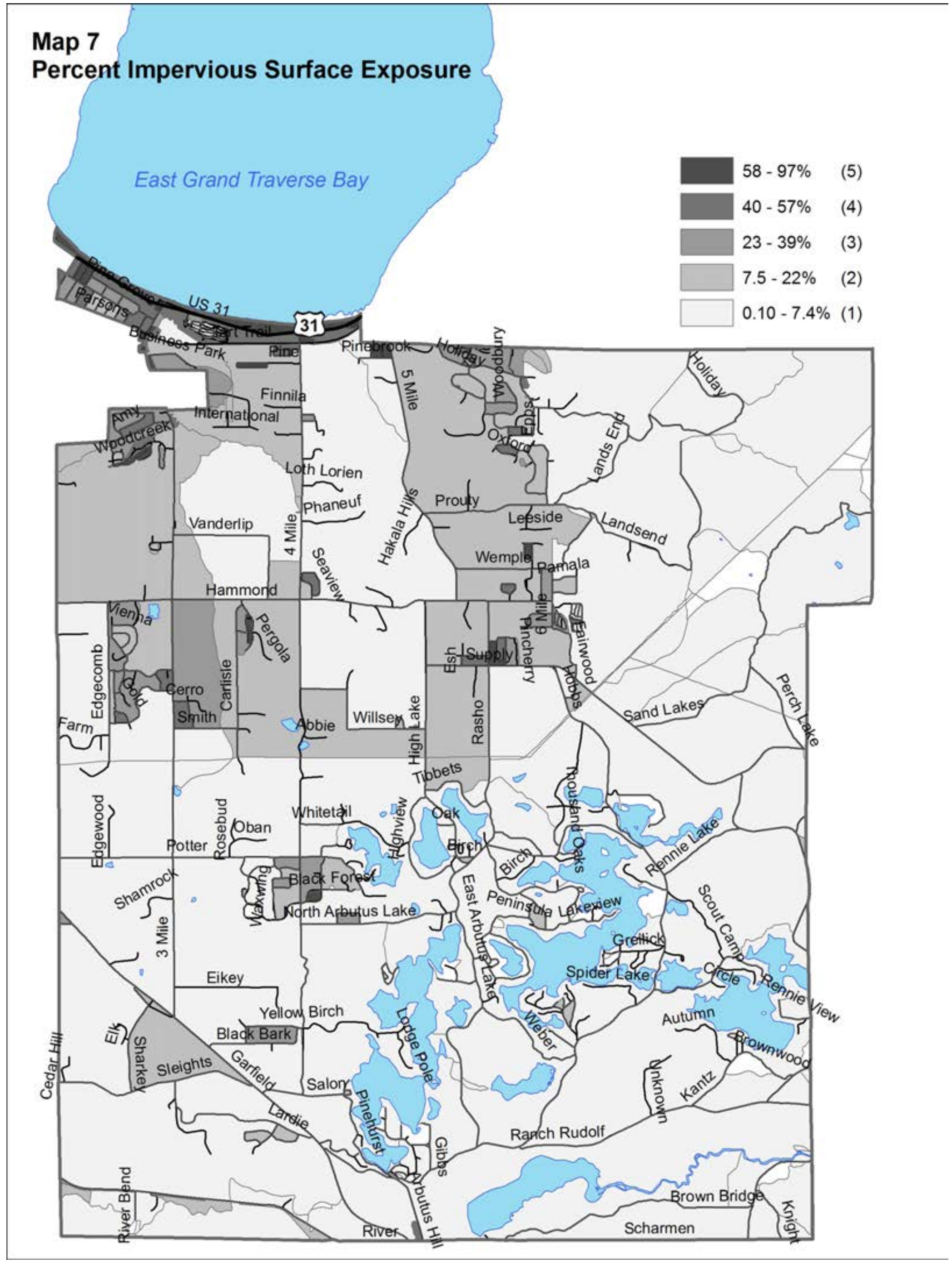

Grand Traverse County

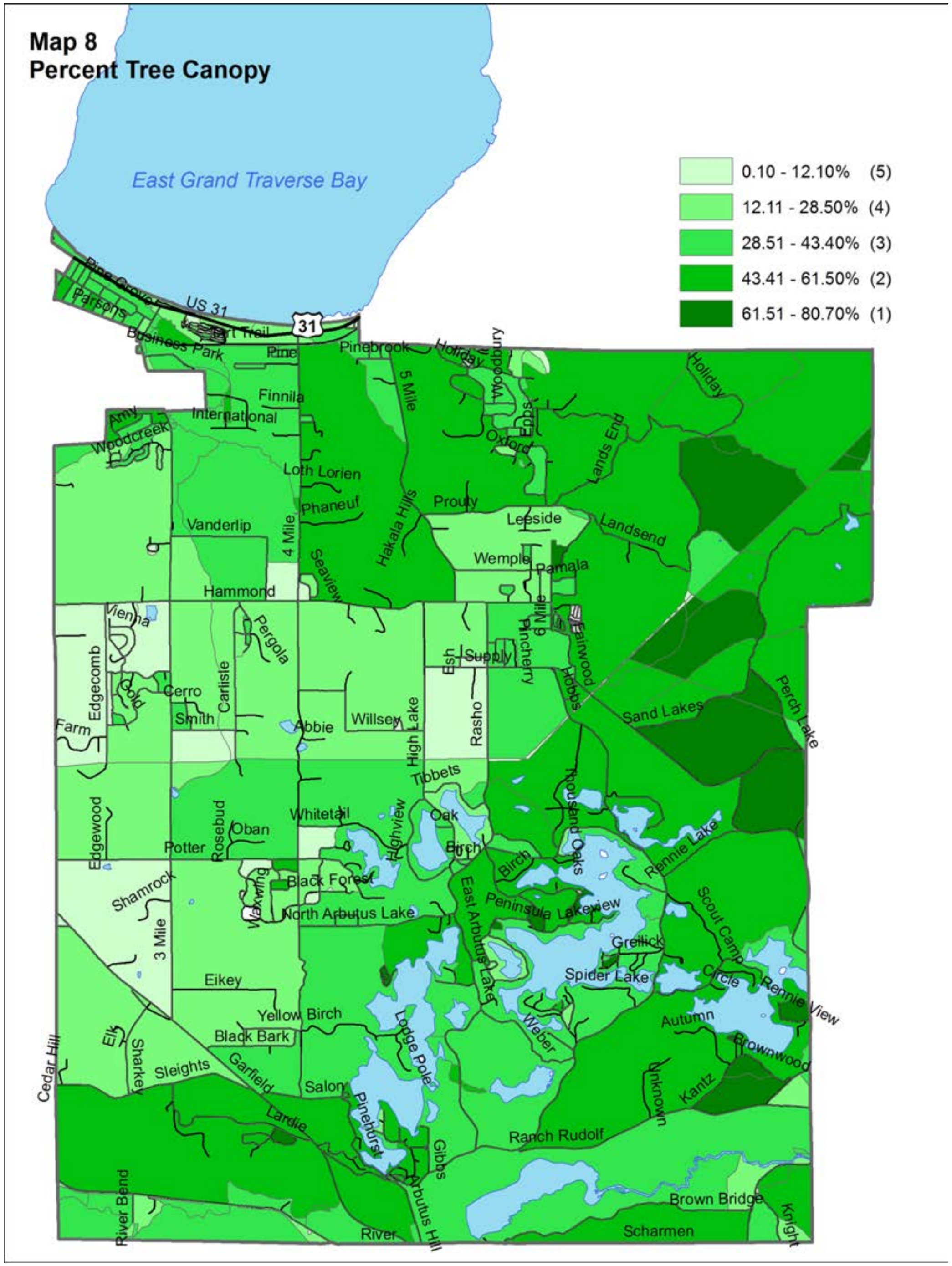

Map 5
Percent of Population 25 Years and Older with less than a High School Education
East Grand Traverse Bay
10.01 - 14.40% (5)
4.21 - 10.00% (4)
2.81 - 4.20% (3)
2.00 - 2.80% (2)

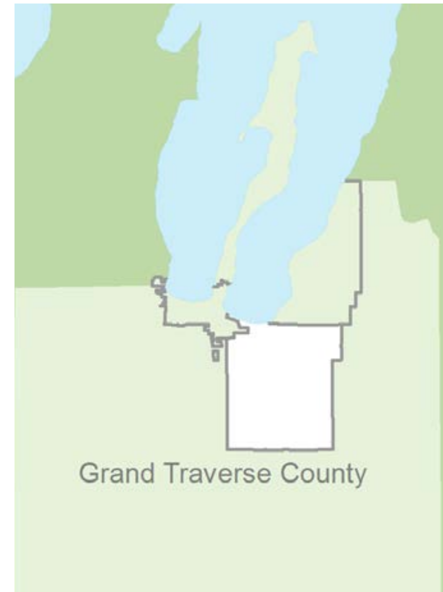

Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
15 - 18 (5)
13 - 14 (4)
11 - 12 (3)
9 - 10 (2)
5 - 8 (1)
East Grand Traverse Bay
US 31
31


Grand Traverse County

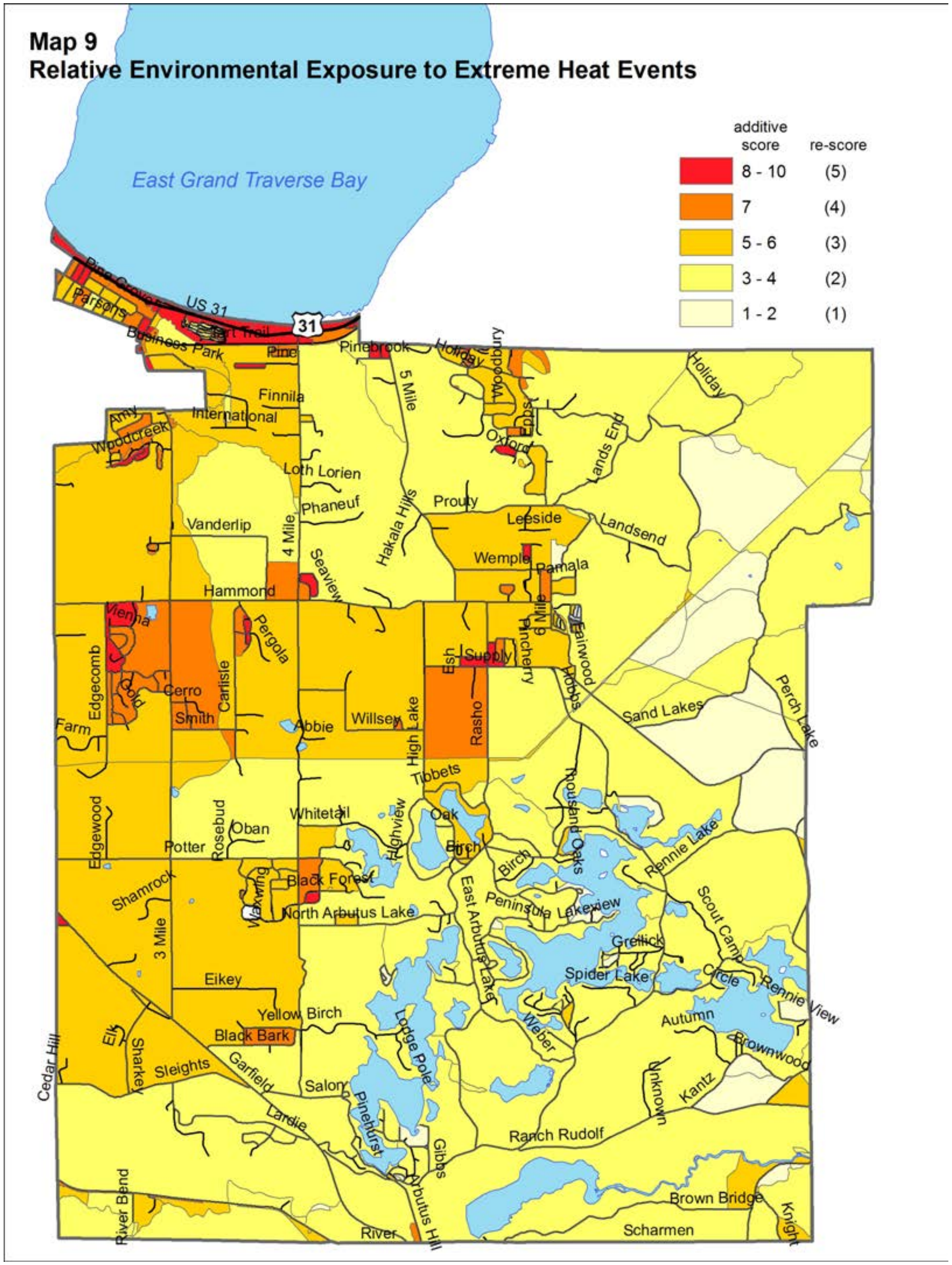

Grand Traverse County

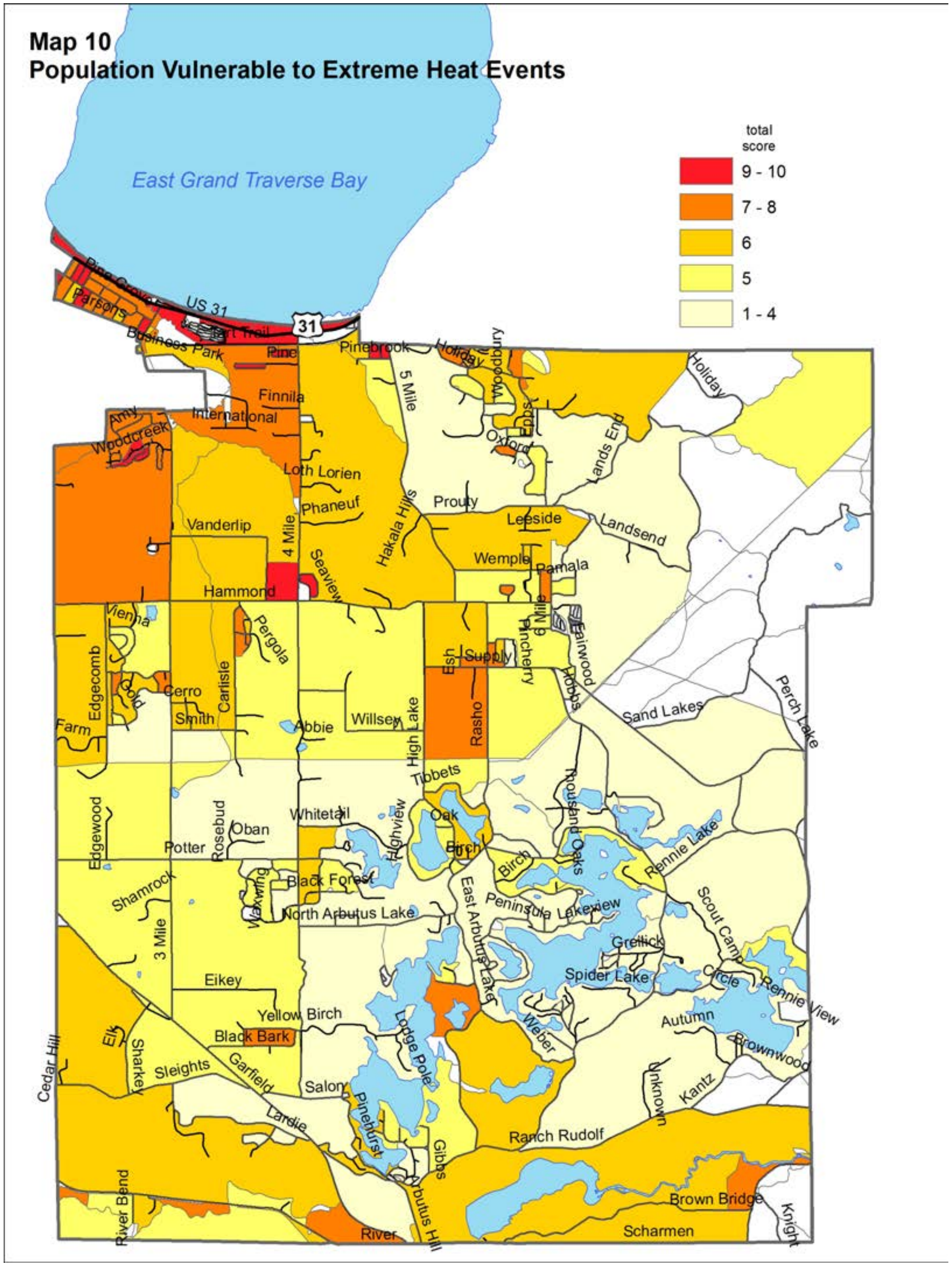

Map 7
Percent Impervious Surface Exposure
East Grand Traverse Bay
58 - 97% (5)
40 - 57% (4)
23 - 39% (3)
7.5 - 22% (2)
0.10 - 7.4% (1)


Map 8
Percent Tree Canopy
East Grand Traverse Bay
0.10 - 12.10% (5)
12.11 - 28.50% (4)
28.51 - 43.40% (3)
43.41 - 61.50% (2)
61.51 - 80.70% (1)
US 31
31
Spider Lake
Sand Lakes
Perch Lake
Rennie Lake
North Arbutus Lake
East Arbutus Lake
Ranch Rudolf
Brown Bridge
Scharmen
River
Cedar Hill
River Bend


Grand Traverse County

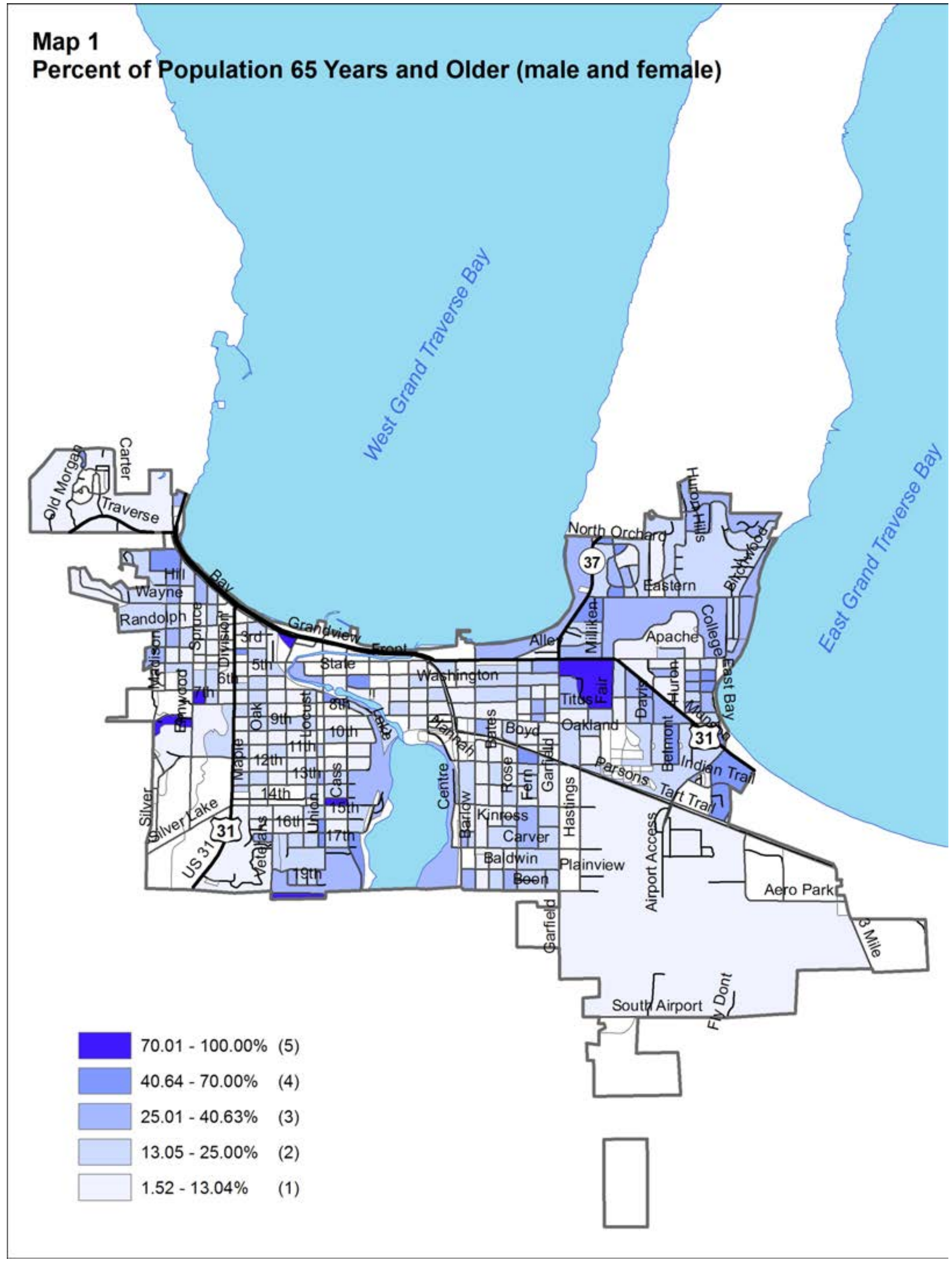

Grand Traverse County

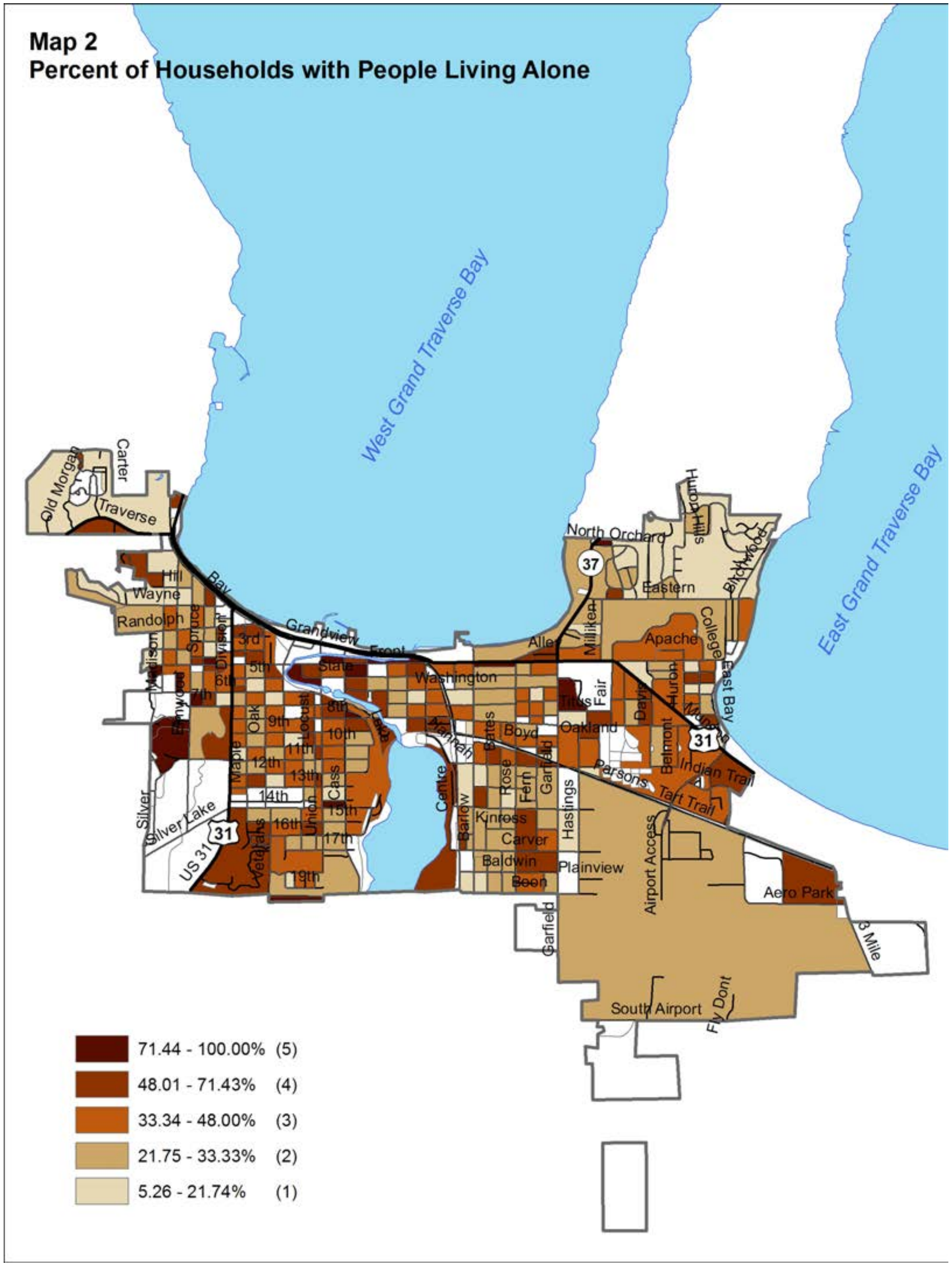

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
8 - 10 (5)
7 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
East Grand Traverse Bay
US 31
31


Map 10
Population Vulnerable to Extreme Heat Events
East Grand Traverse Bay
total score
9 - 10
7 - 8
6
5
1 - 4
US 31
31
Parsons
Business Park
Pine
Pinebrook
Holiday
Woodbury
5 Mile
Finnila
International
Amy
Woodcreek
Loth Lorien
Phaneuf
Prouty
Oxford
Lands End
Leeside
Landsend
Vanderlip
4 Mile
Seaview
Hakala Hills
Wemple
Pamala
Hammond
Vienna
Pergola
6 Mile
Fairwood
Edgecomb
Cerro
Carlisle
Esh
Supply
Pinchery
Hobbs
Sand Lakes
Perch Lake
Farm
Smith
Abbie
Willsey
High Lake
Rasho
Tibbets
Edgewood
Rosebud
Oban
Potter
Whitetail
Highview
Oak
Birch
Thousand Oaks
Rennie Lake
Shamrock
Black Forest
Waxwing
North Arbutus Lake
East Arbutus Lake
Peninsula
Lakeview
Scout Camp
Grellick
3 Mile
Spider Lake
Circle
Rennie View
Eikey
Yellow Birch
Autumn
Weber
Black Bark
Brownwood
Cedar Hill
Elk
Sharkey
Sleights
Garfield
Salon
Lodge Pole
Unknown
Kantz
Lardie
Pinehurst
Gibbs
Ranch Rudolf
River Bend
River
Arbutus Hill
Brown Bridge
Scharmen
Knight


Grand Traverse County

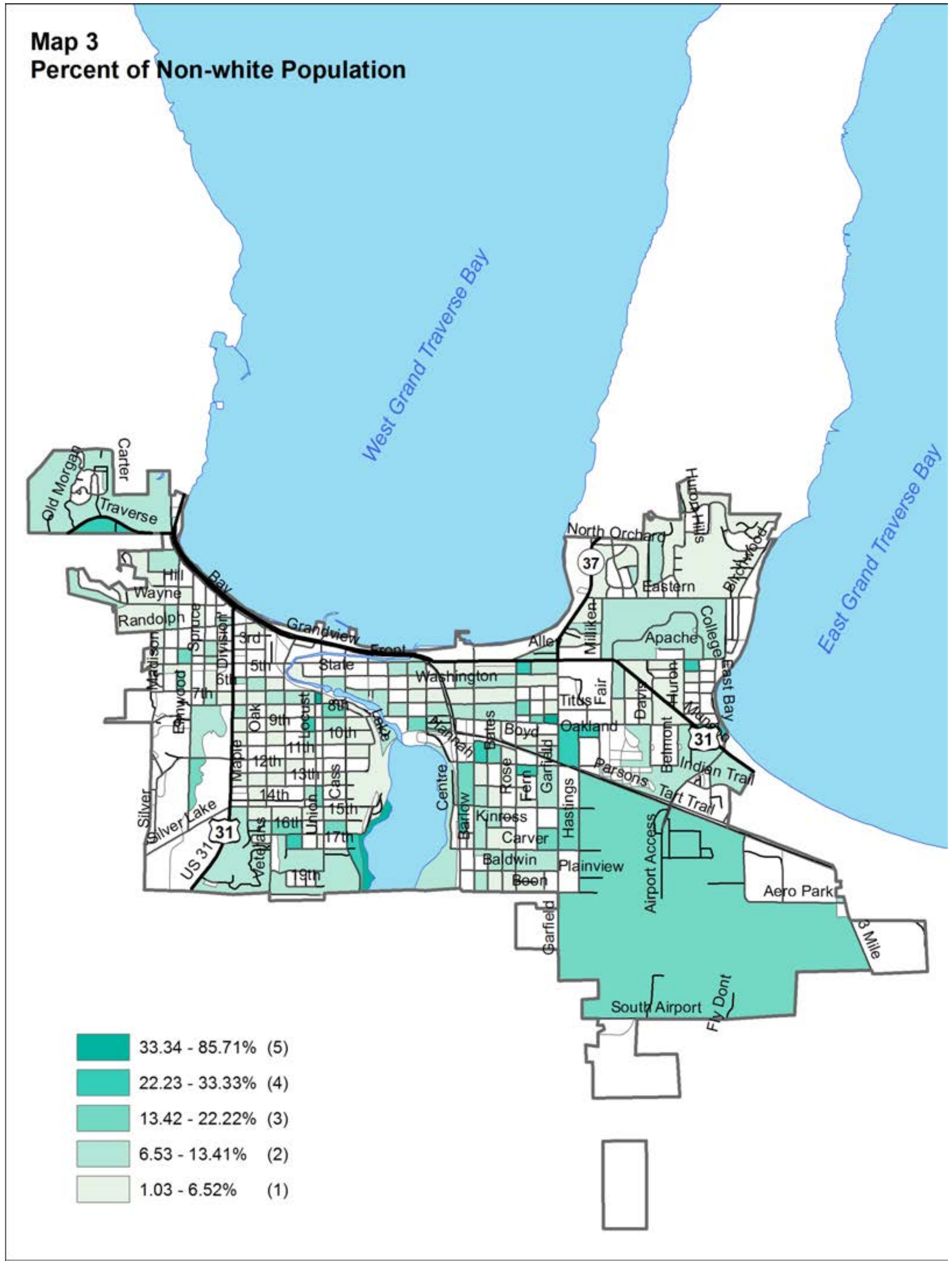
Traverse City

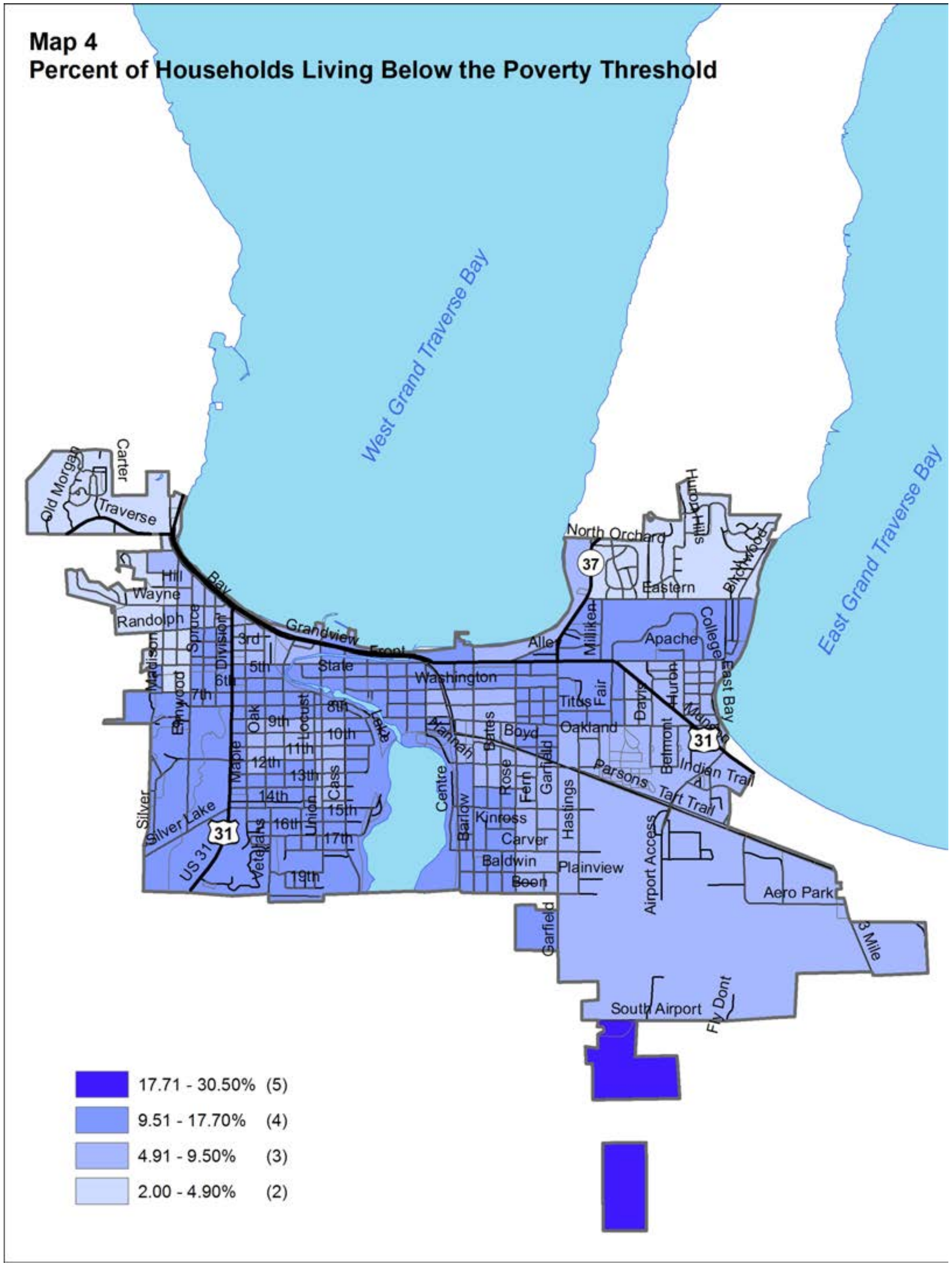



Map 2
Percent of Households with People Living Alone
West Grand Traverse Bay
East Grand Traverse Bay
71.44 - 100.00% (5)
48.01 - 71.43% (4)
33.34 - 48.00% (3)
21.75 - 33.33% (2)
5.26 - 21.74% (1)

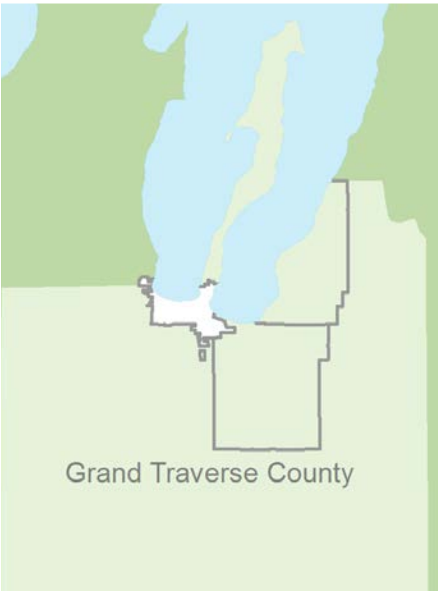

Grand Traverse County

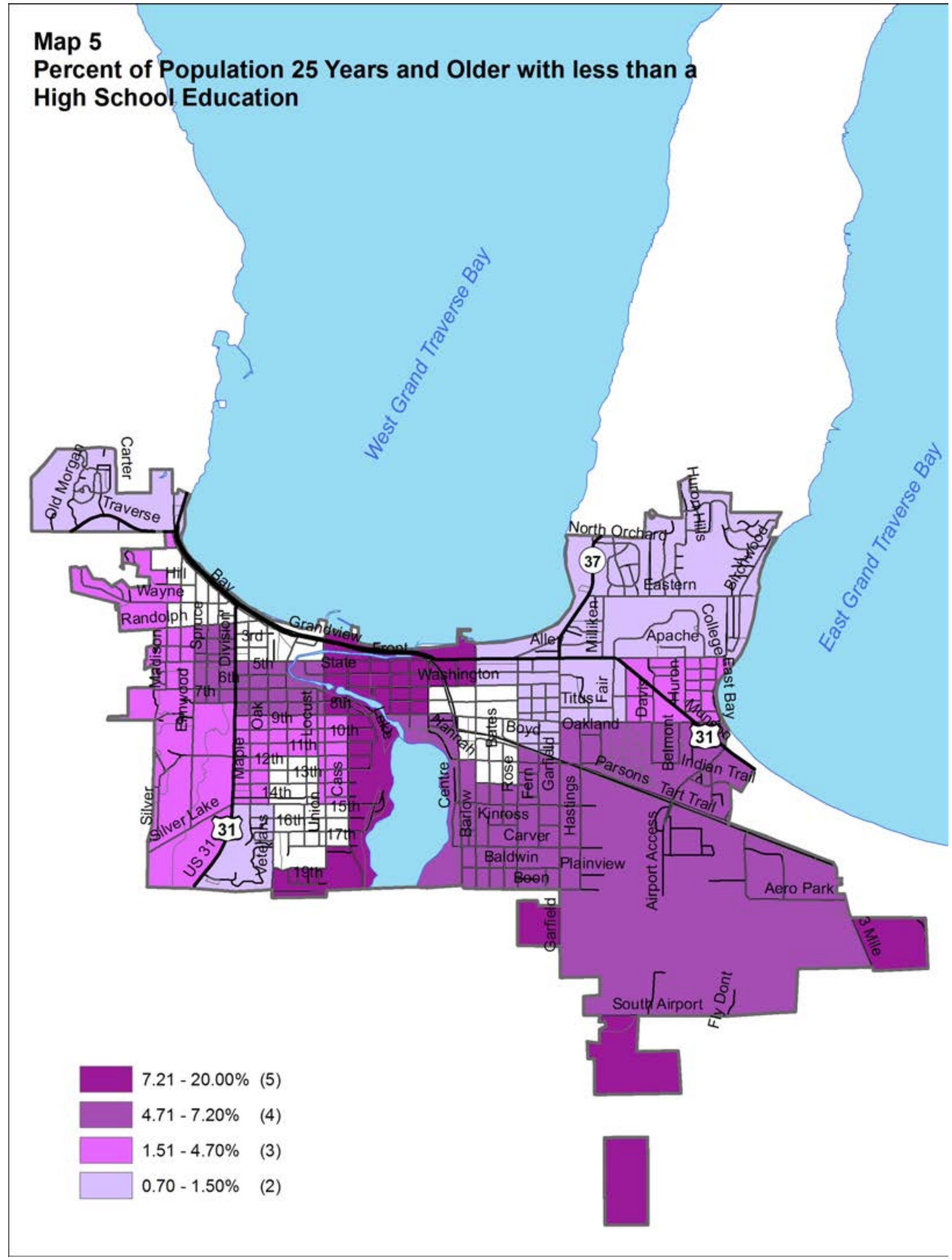

Grand Traverse County

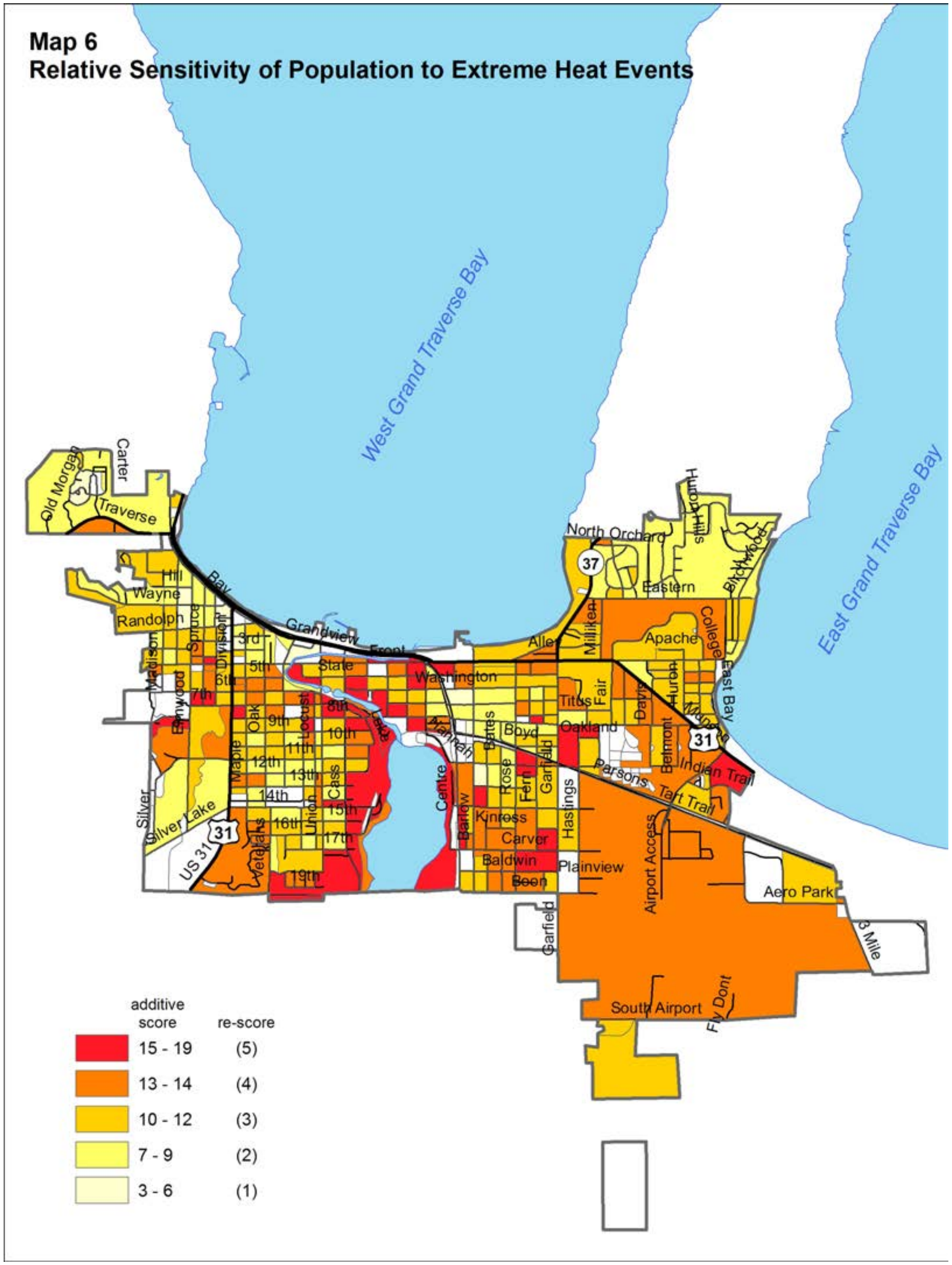

Map 3
Percent of Non-white Population
West Grand Traverse Bay
East Grand Traverse Bay
33.34 - 85.71% (5)
22.23 - 33.33% (4)
13.42 - 22.22% (3)
6.53 - 13.41% (2)
1.03 - 6.52% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
West Grand Traverse Bay
East Grand Traverse Bay
17.71 - 30.50% (5)
9.51 - 17.70% (4)
4.91 - 9.50% (3)
2.00 - 4.90% (2)


Grand Traverse County

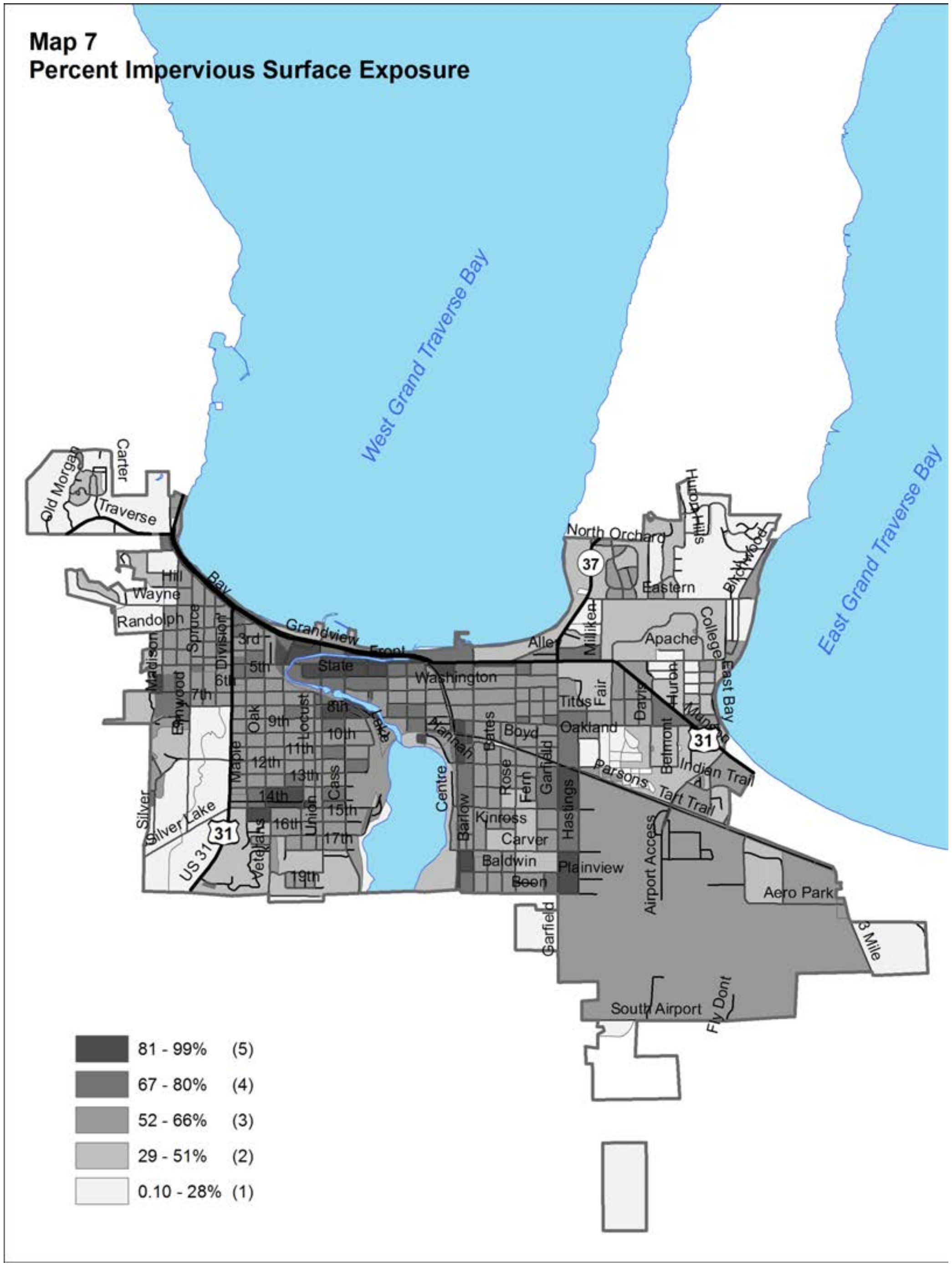

Grand Traverse County

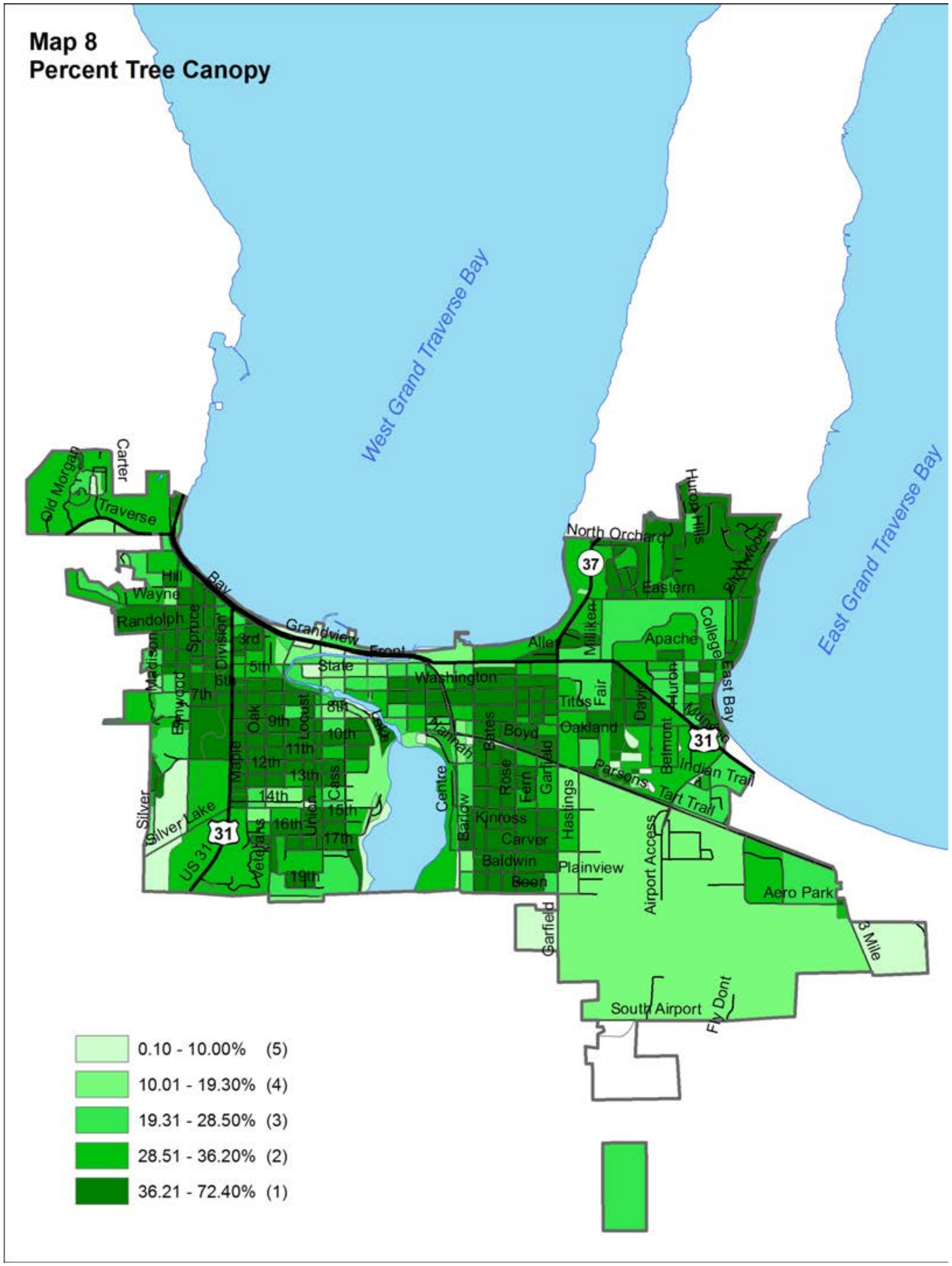

Map 5
Percent of Population 25 Years and Older with less than a High School Education
West Grand Traverse Bay
East Grand Traverse Bay
Carter
Old Morgan
Traverse
North Orchard
Eastern
Birchwood
College
Apache
Hill
Wayne
Randolph
Bay
Grandview
Front
State
Washington
Division
Spruce
Madison
Elmwood
Maple
Oak
Locust
Union
Cass
Centre
Barlow
Rose
Fern
Garfield
Hastings
Milliken
Titus
Fair
Boyd
Oakland
Davis
Huron
Belmont
East Bay
Parsons
Taft Trail
Indian Trail
Kinross
Carver
Baldwin
Boon
Plainview
Airport Access
Aero Park
3 Mile
South Airport
Fly Dont
Silver Lake
Silver
US 31
Veterans
3rd
5th
6th
7th
8th
9th
10th
11th
12th
13th
14th
15th
16th
17th
19th
37
31
7.21 - 20.00% (5)
4.71 - 7.20% (4)
1.51 - 4.70% (3)
0.70 - 1.50% (2)


Map 6
Relative Sensitivity of Population to Extreme Heat Events
West Grand Traverse Bay
East Grand Traverse Bay
additive score
re-score
15 - 19 (5)
13 - 14 (4)
10 - 12 (3)
7 - 9 (2)
3 - 6 (1)


Grand Traverse County

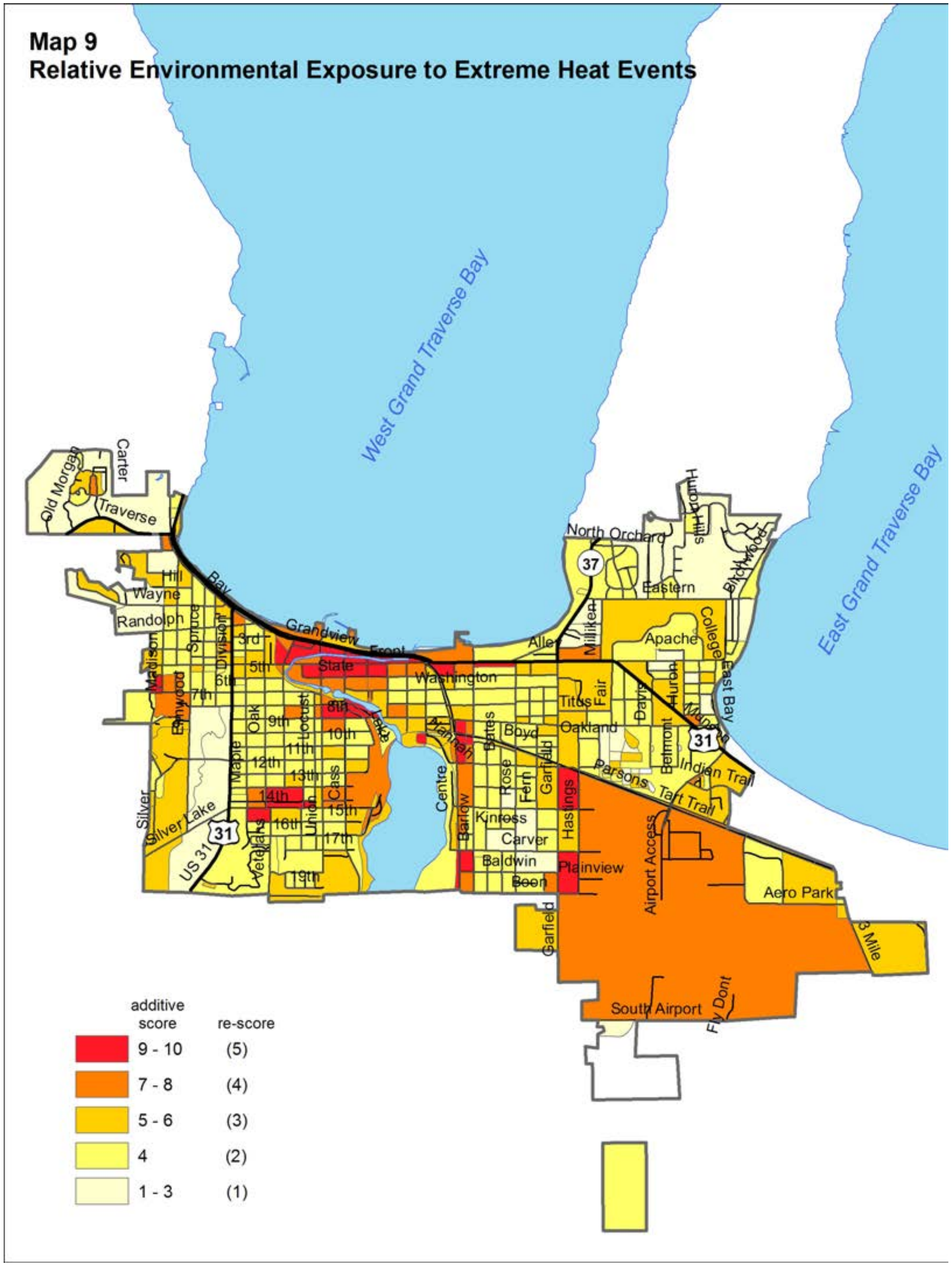

Grand Traverse County

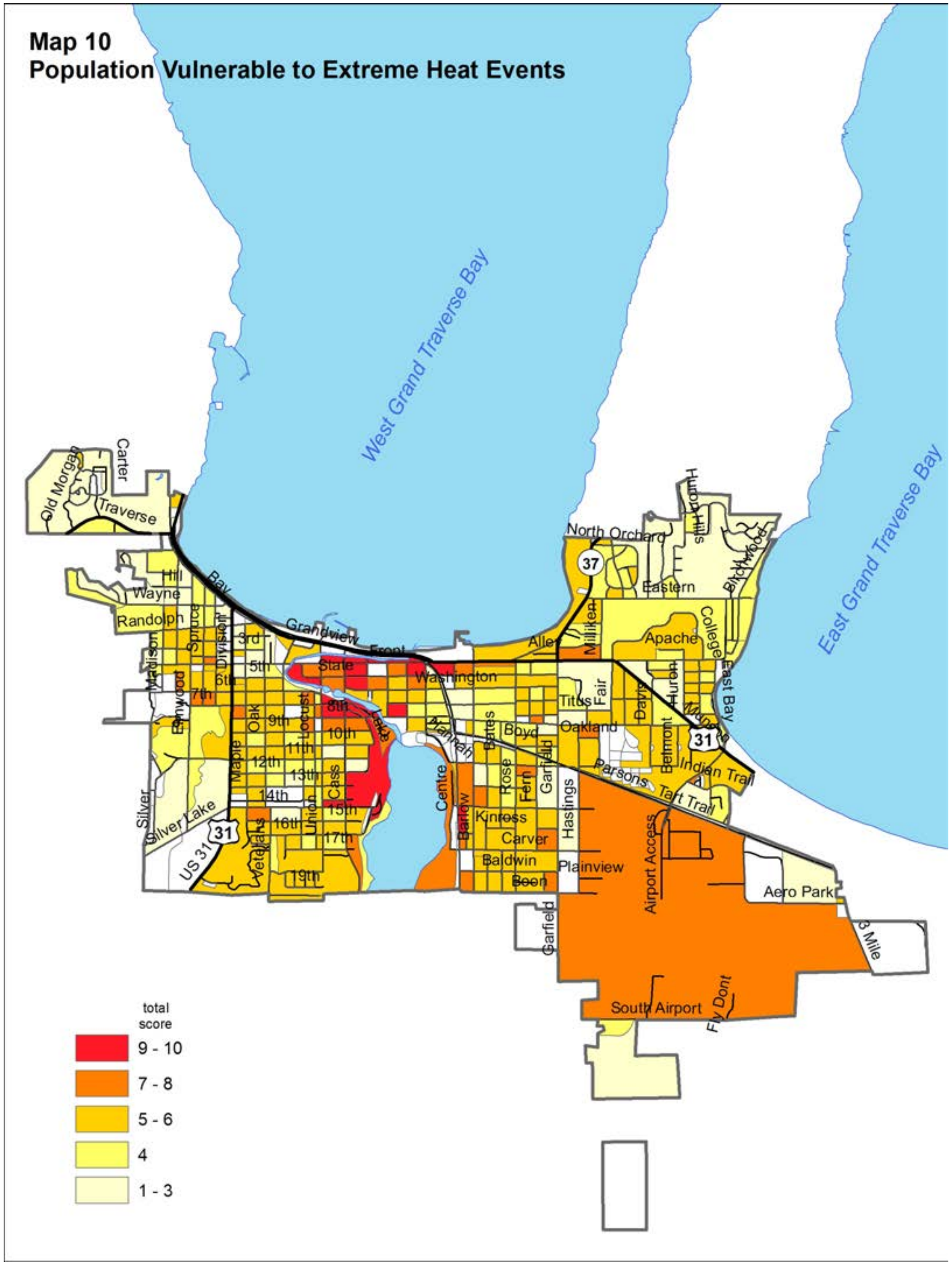

Map 7
Percent Impervious Surface Exposure
West Grand Traverse Bay
East Grand Traverse Bay
81 - 99% (5)
67 - 80% (4)
52 - 66% (3)
29 - 51% (2)
0.10 - 28% (1)


Map 8
Percent Tree Canopy
West Grand Traverse Bay
East Grand Traverse Bay
0.10 - 10.00% (5)
10.01 - 19.30% (4)
19.31 - 28.50% (3)
28.51 - 36.20% (2)
36.21 - 72.40% (1)


Grand Traverse County

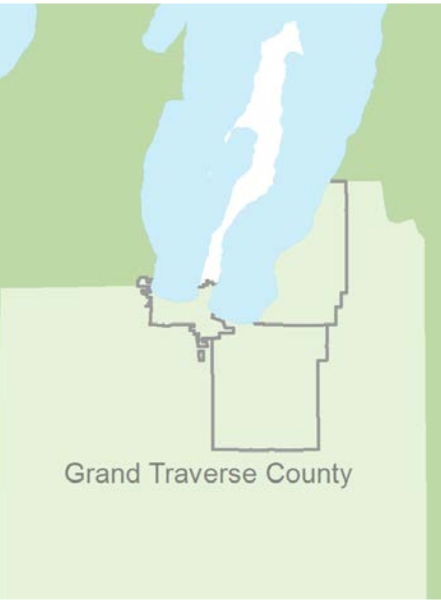

Grand Traverse County

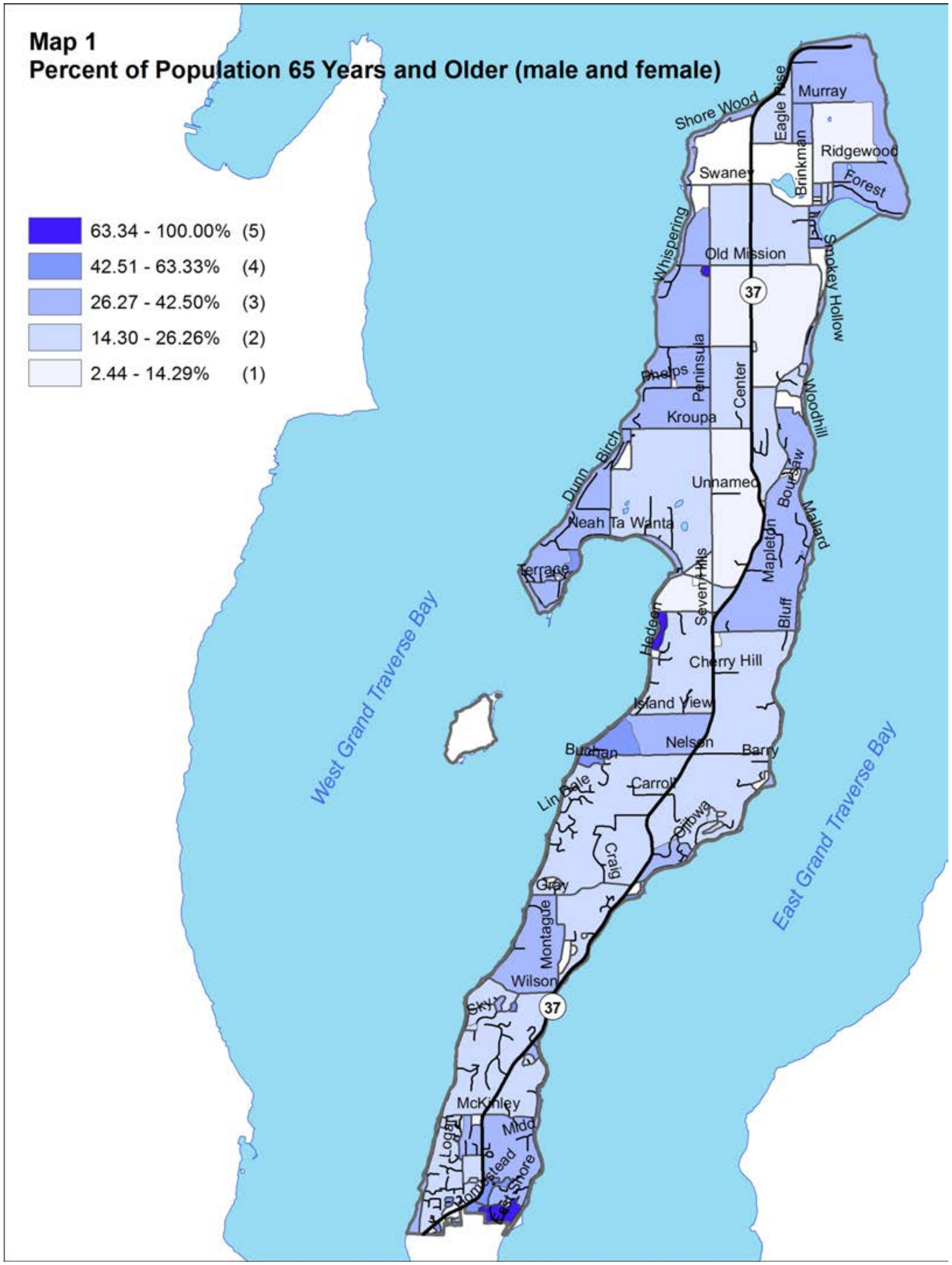

Map 9
Relative Environmental Exposure to Extreme Heat Events
West Grand Traverse Bay
East Grand Traverse Bay
additive score
re-score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
4 (2)
1 - 3 (1)

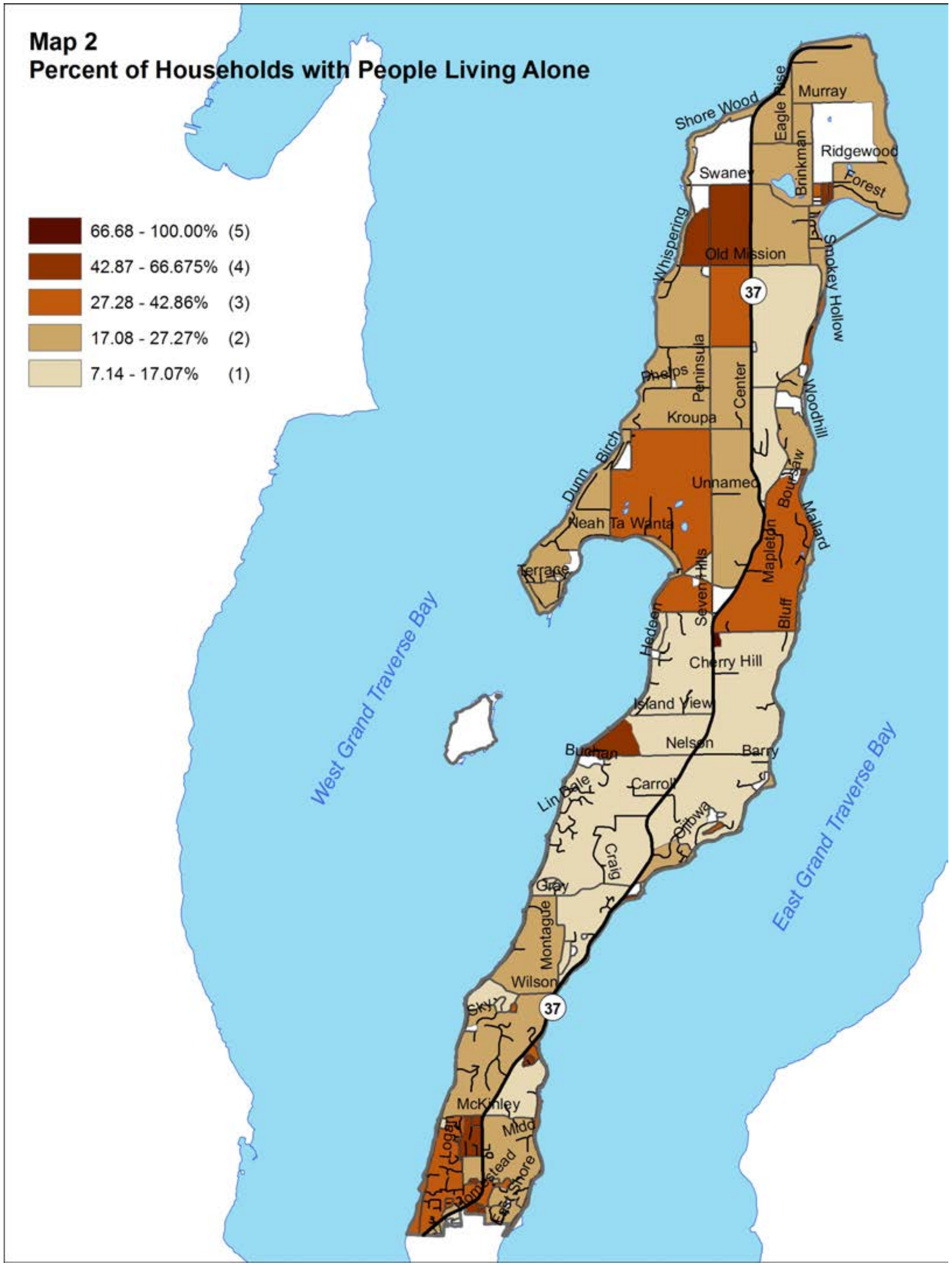

Map 10
Population Vulnerable to Extreme Heat Events
West Grand Traverse Bay
East Grand Traverse Bay
total score
9 - 10
7 - 8
5 - 6
4
1 - 3

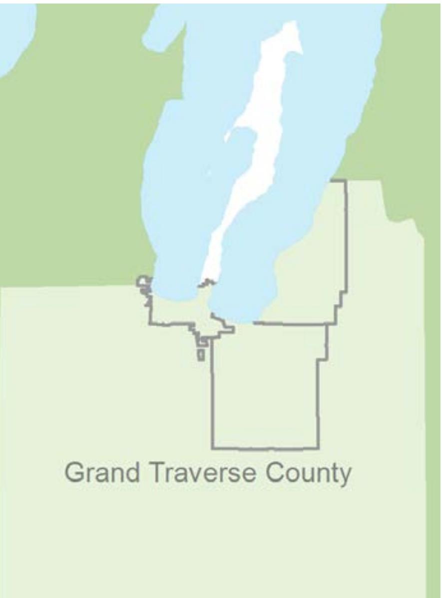

Grand Traverse County

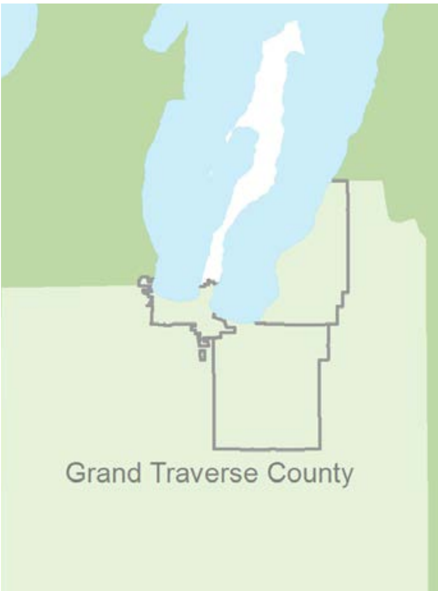
Peninsula Twp.

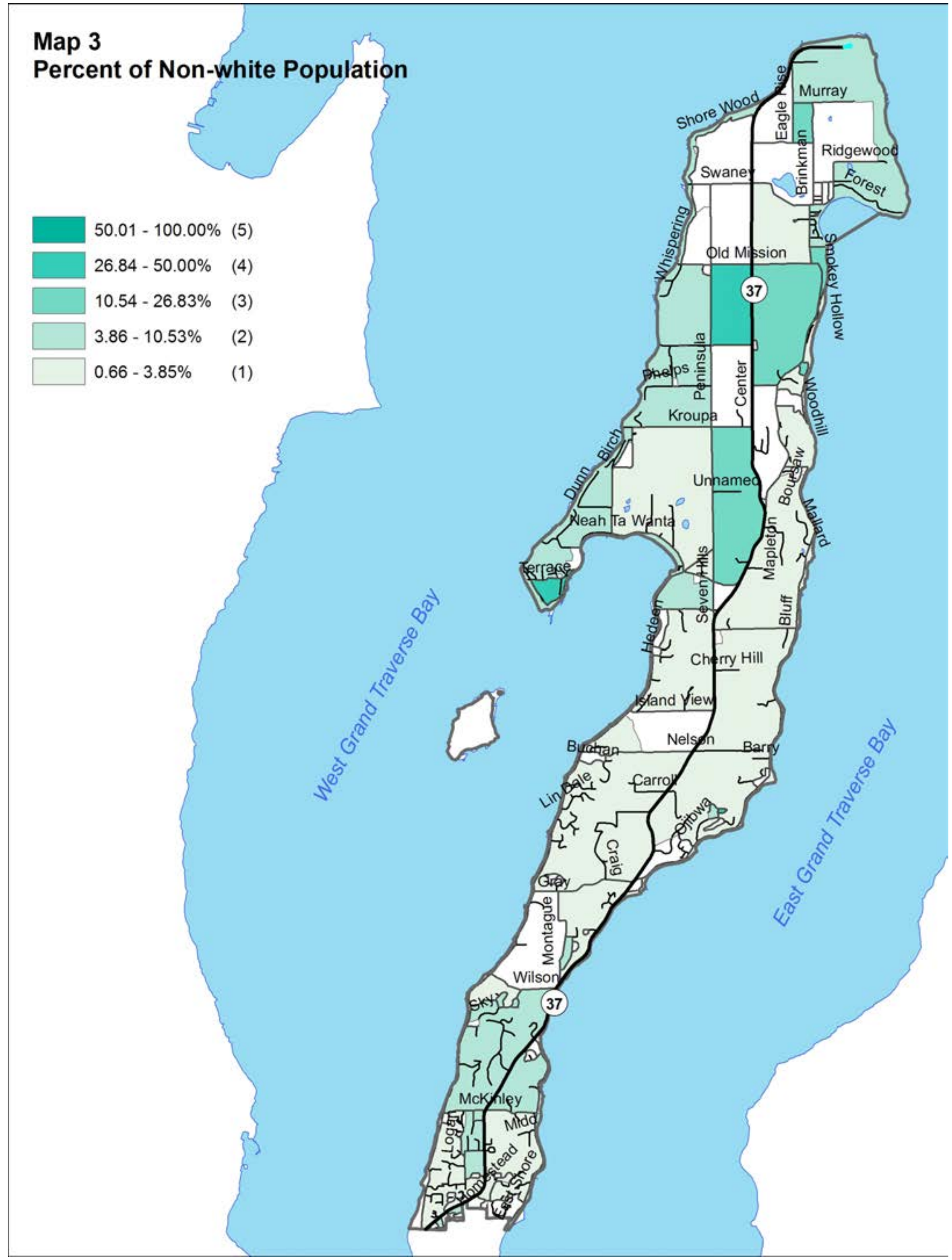


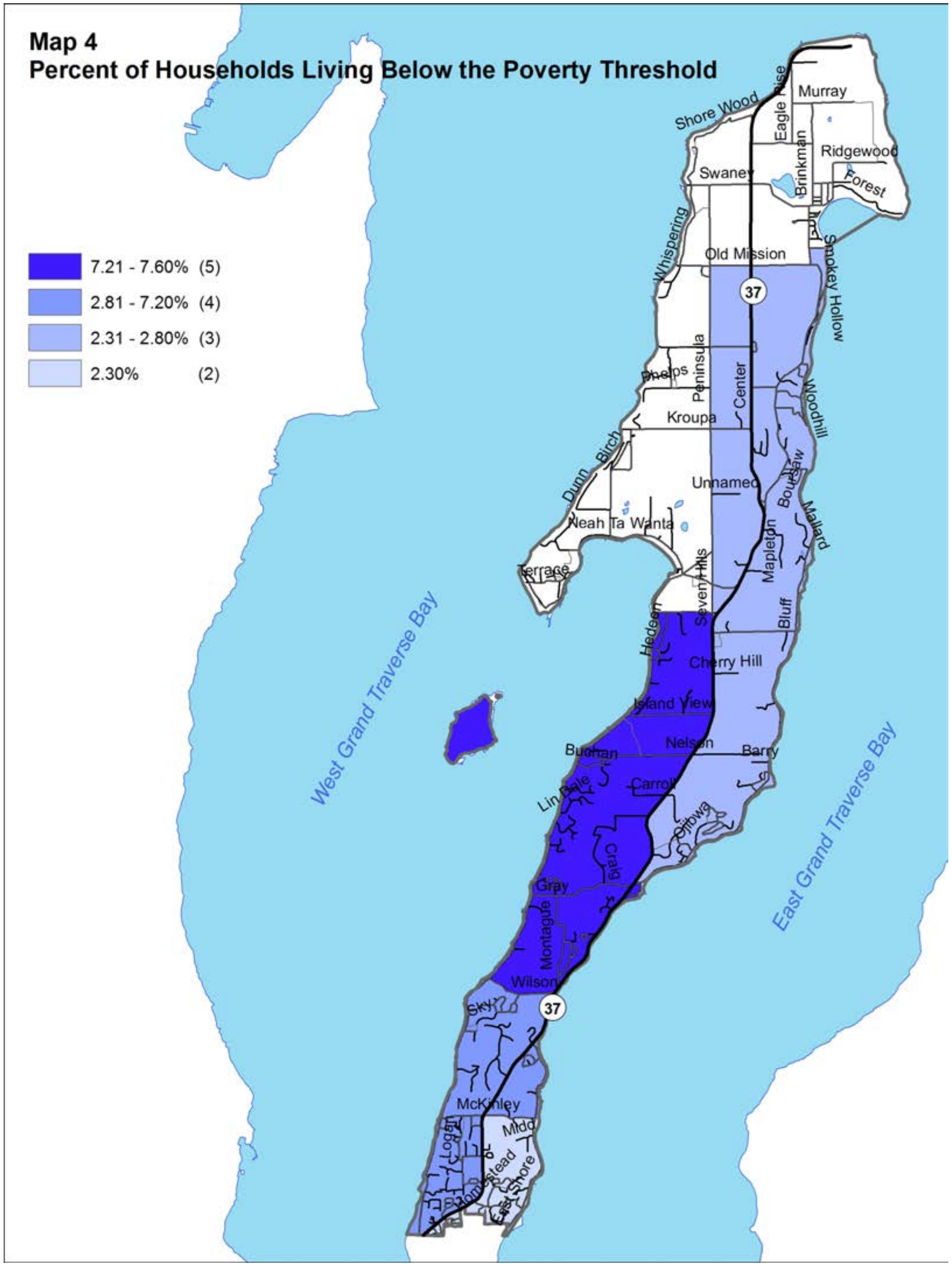


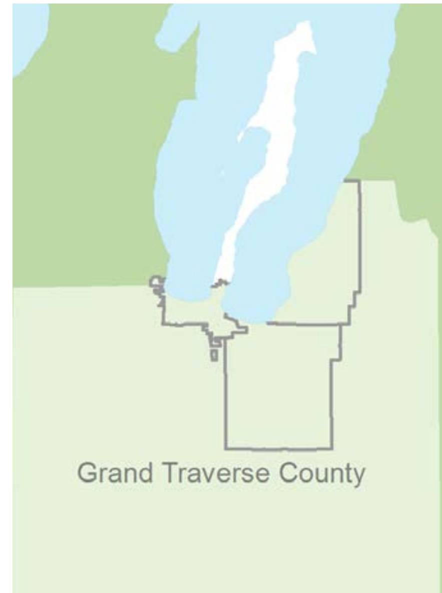

Map 2
Percent of Households with People Living Alone
66.68 - 100.00% (5)
42.87 - 66.675% (4)
27.28 - 42.86% (3)
17.08 - 27.27% (2)
7.14 - 17.07% (1)
West Grand Traverse Bay
East Grand Traverse Bay
37
Murray
Shore Wood
Ridgewood
Swaney
Forest
Old Mission
Smokey Hollow
Whispering
Peninsula
Center
Phelps
Kroupa
Woodhill
Dunn
Birch
Unnamed
Neah Ta Wanta
Mallard
Terrace
Seven Hills
Mapleton
Bluff
Hedden
Cherry Hill
Island View
Nelson
Barry
Carroll
Craig
Wilson
Montague
McKinley

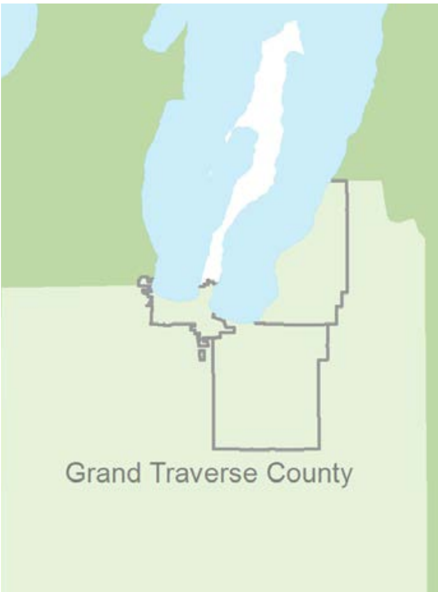

Grand Traverse County

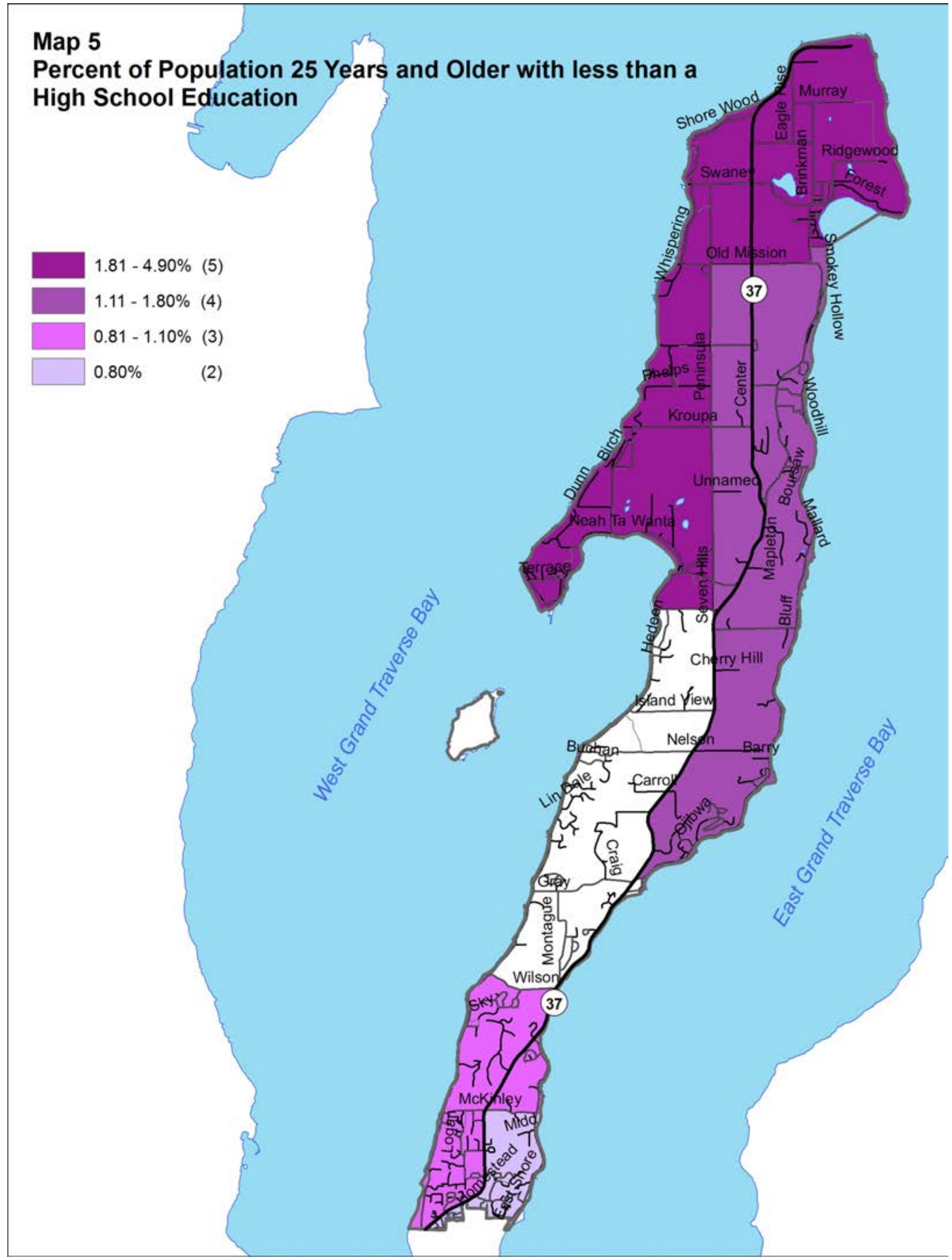

Grand Traverse County

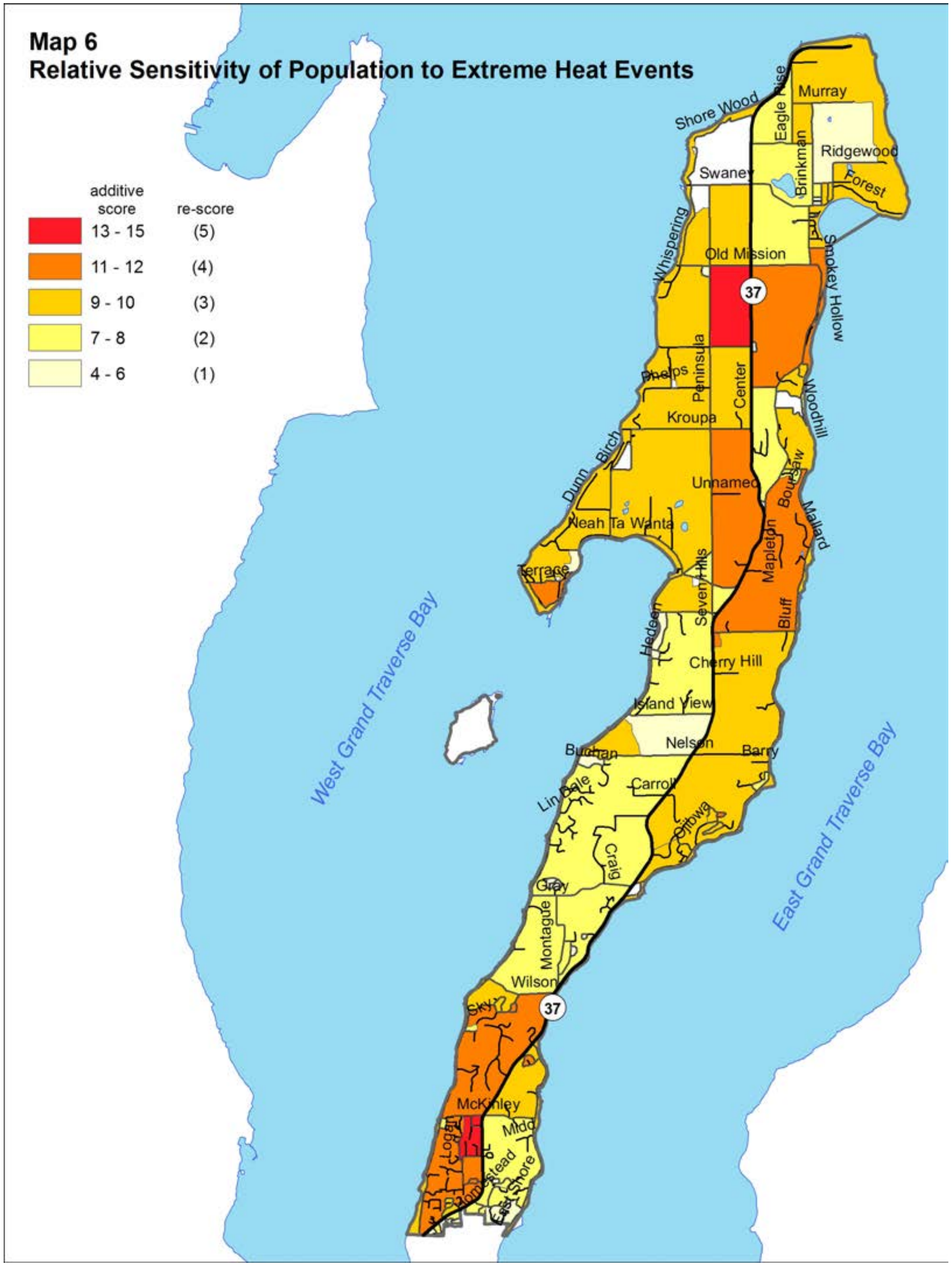

Map 3
Percent of Non-white Population
50.01 - 100.00% (5)
26.84 - 50.00% (4)
10.54 - 26.83% (3)
3.86 - 10.53% (2)
0.66 - 3.85% (1)
West Grand Traverse Bay
East Grand Traverse Bay
Murray
Shore Wood
Ridgewood
Swaney
Brinkman
Forest
Old Mission
37
Smokey Hollow
Whispering
Phelps
Peninsula
Center
Kroupa
Woodhill
Birch
Dunn
Unnamed
Neah Ta Wanta
Mallard
Terrace
Seven Hills
Mapleton
Bluff
Cherry Hill
Island View
Nelson
Barry
Carroll
Lin Dale
Ojibwa
Craig
Gray
Montague
Wilson
Sky
McKinley
Logan
East Shore

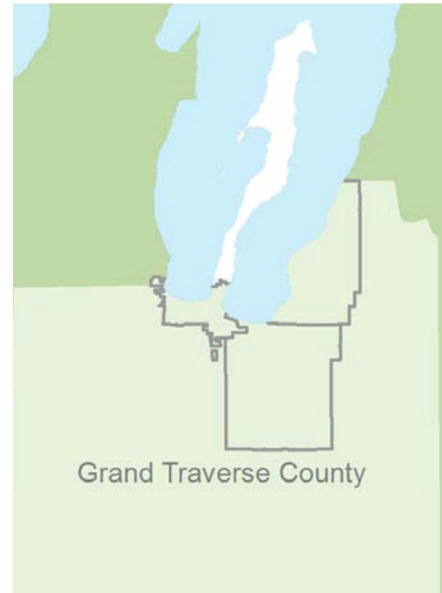

Map 4
Percent of Households Living Below the Poverty Threshold
7.21 - 7.60% (5)
2.81 - 7.20% (4)
2.31 - 2.80% (3)
2.30% (2)
West Grand Traverse Bay
East Grand Traverse Bay
Murray
Ridgewood
Shore Wood
Swaney
Old Mission
Smokey Hollow
Whispering
Phelps
Peninsula
Center
Kroupa
Woodhill
Dunn
Birch
Unnamed
Neah Ta Wanta
Mapleton
Mallard
Terrace
Seven Hills
Bluff
Cherry Hill
Island View
Nelson
Barry
Buchan
Carroll
Craig
Gray
Montague
Wilson
37
Sky
McKinley
Logan
Homestead
East Shore

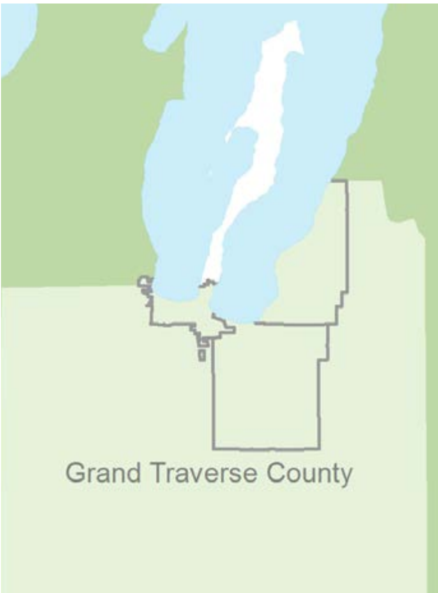

Grand Traverse County

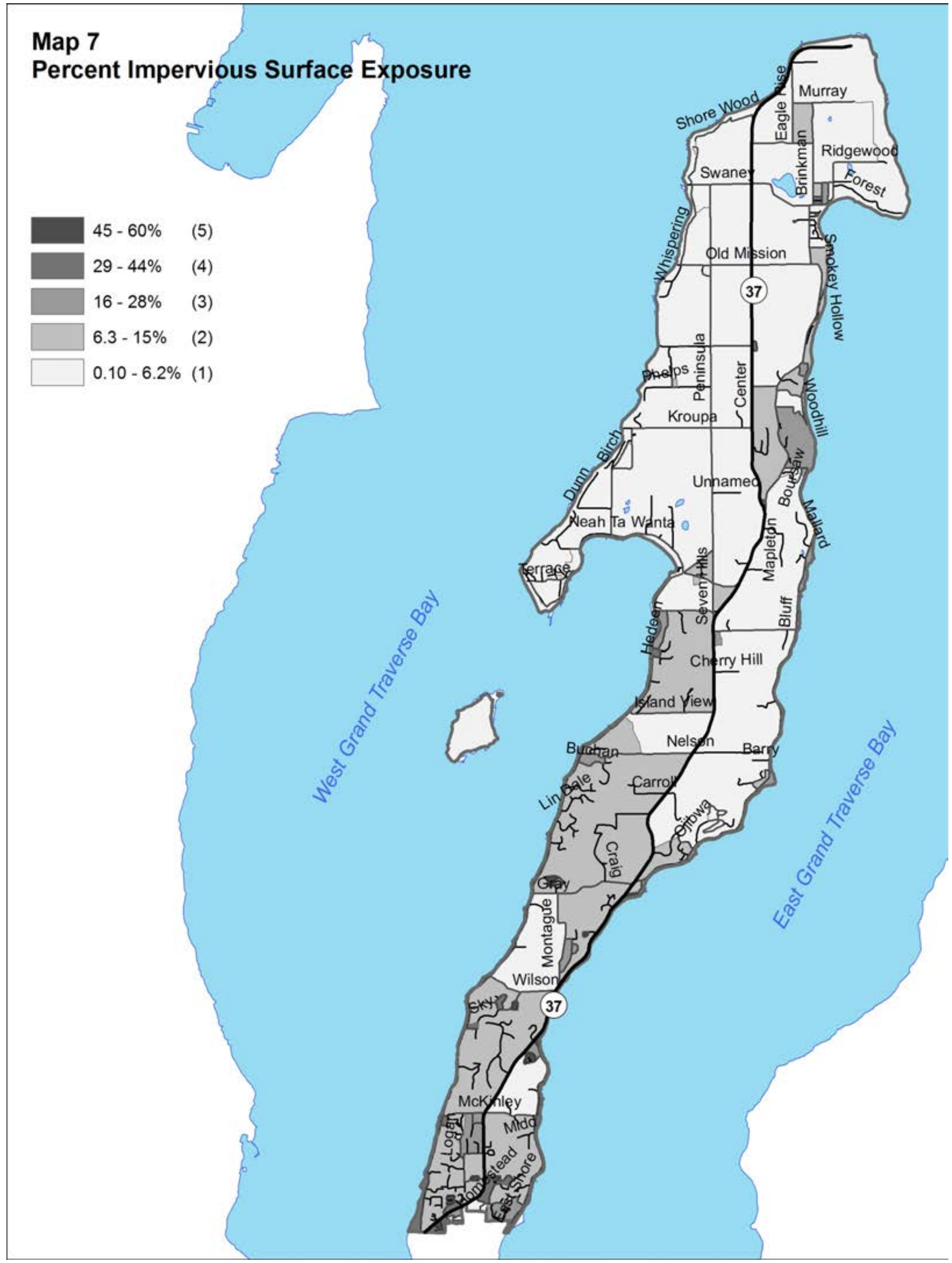

Grand Traverse County

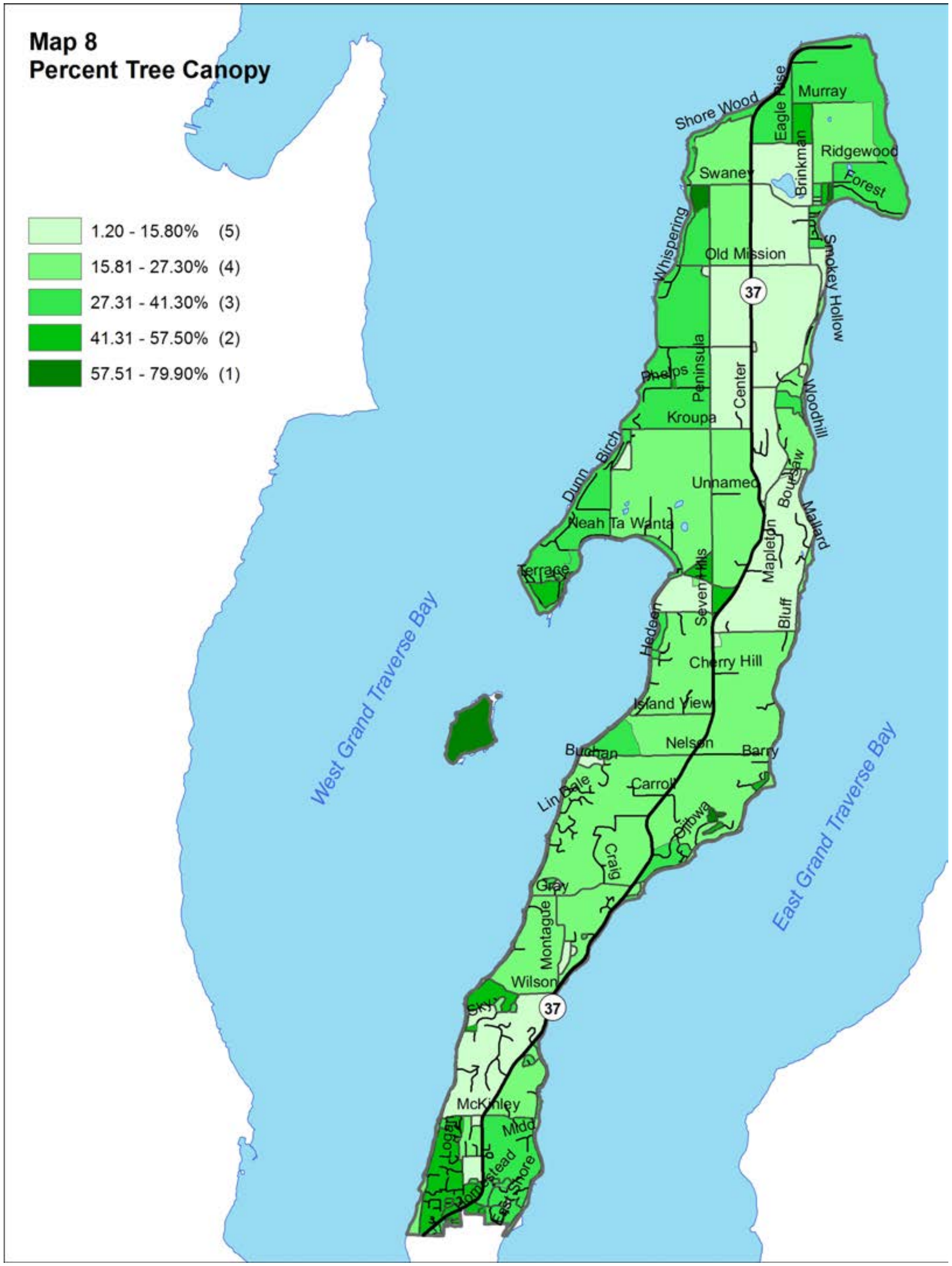

Map 5
Percent of Population 25 Years and Older with less than a High School Education
1.81 - 4.90% (5)
1.11 - 1.80% (4)
0.81 - 1.10% (3)
0.80% (2)
West Grand Traverse Bay
East Grand Traverse Bay
Murray
Shore Wood
Ridgewood
Swaney
Old Mission
Smokey Hollow
Whispering
Center
Kroupa
Woodhill
Unnamed
Neah Ta Wanta
Mallard
Terrace
Mapleton
Bluff
Cherry Hill
Island View
Nelson
Barry
Carroll
Craig
Montague
Wilson
McKinley
37

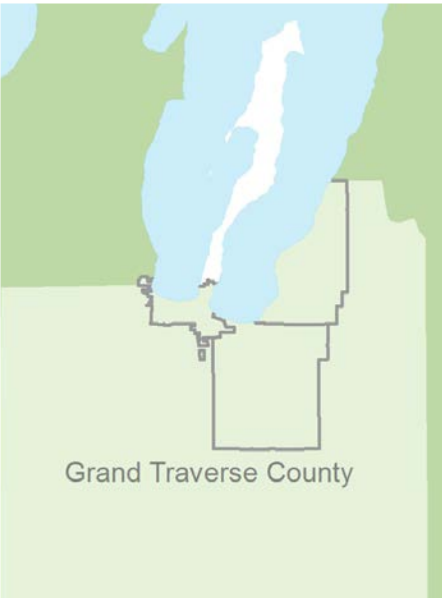

Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
13 - 15
(5)
11 - 12
(4)
9 - 10
(3)
7 - 8
(2)
4 - 6
(1)
West Grand Traverse Bay
East Grand Traverse Bay
37
Murray
Eagle Rise
Shore Wood
Swaney
Brinkman
Ridgewood
Forest
Whispering
Old Mission
Smokey Hollow
Phelps
Peninsula
Center
Kroupa
Woodhill
Dunn
Birch
Unnamed
Neah Ta Wanta
Mapleton
Mallard
Seven Hills
Bluff
Hedden
Cherry Hill
Island View
Nelson
Barry
Carroll
Craig
Gray
Montague
Wilson
Sky
McKinley
Logan
East Shore

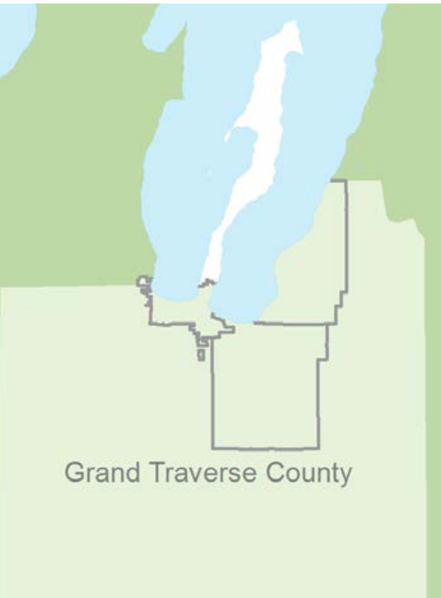

Grand Traverse County

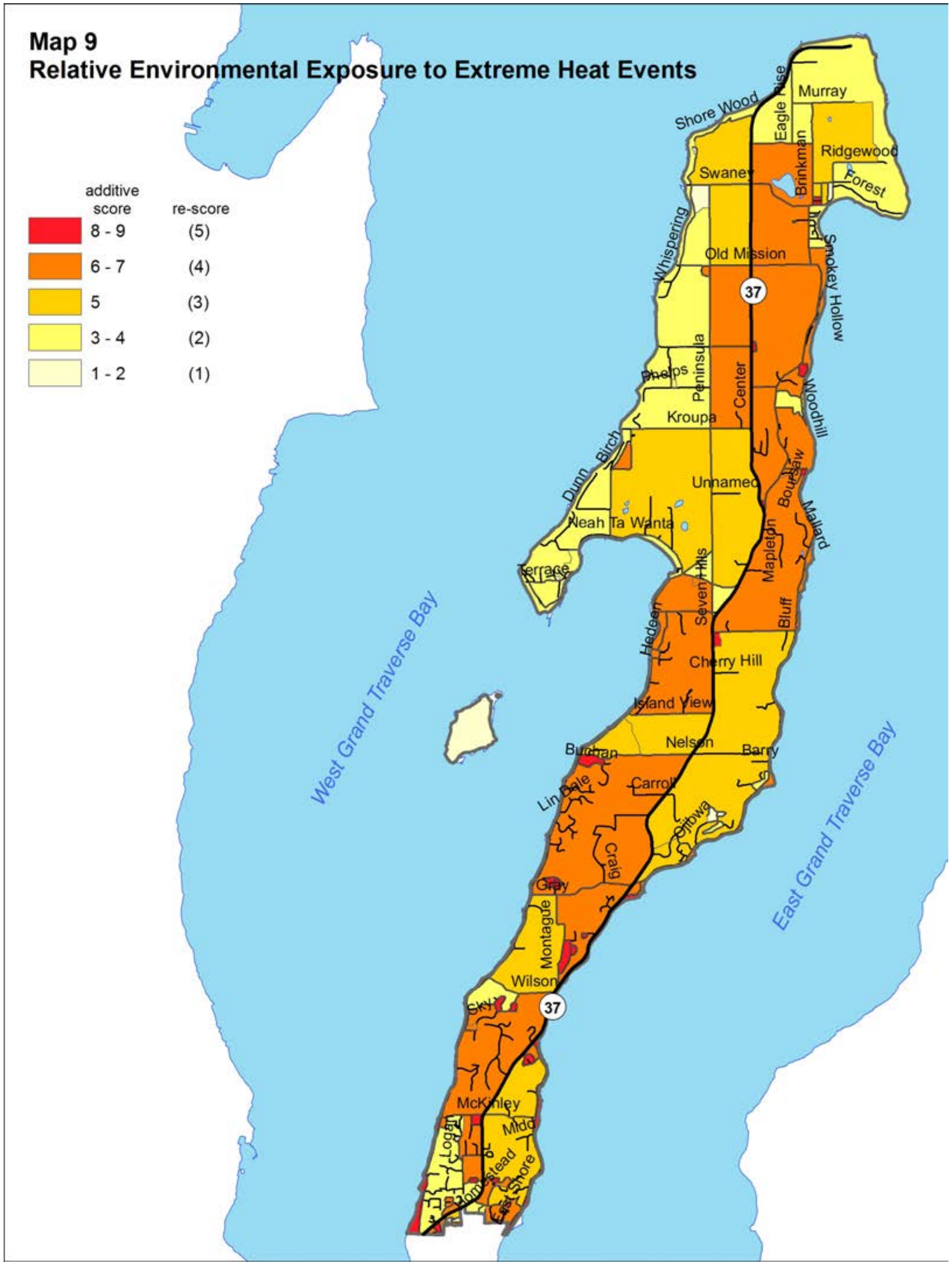

Grand Traverse County

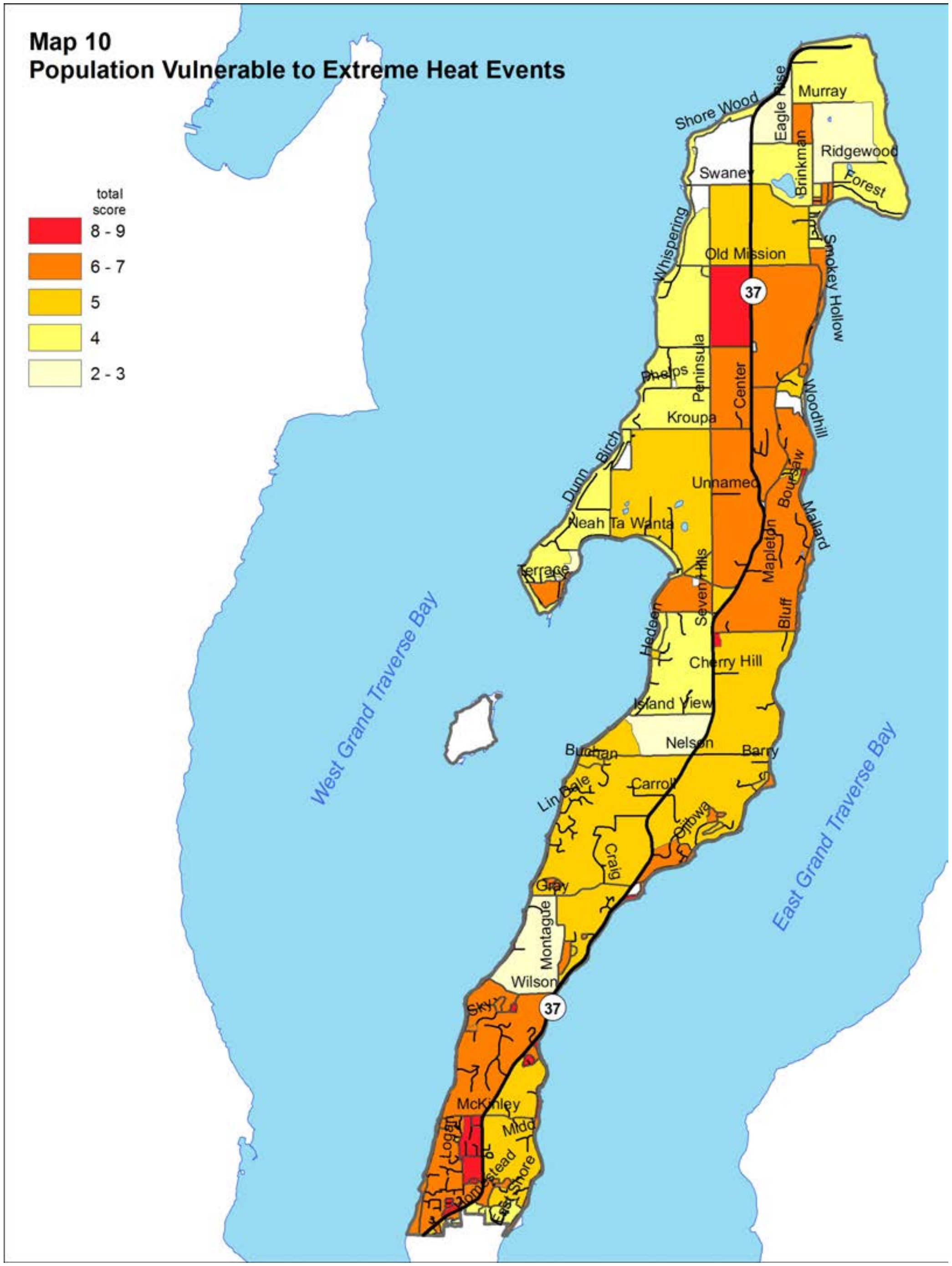

Map 7
Percent Impervious Surface Exposure
45 - 60% (5)
29 - 44% (4)
16 - 28% (3)
6.3 - 15% (2)
0.10 - 6.2% (1)
West Grand Traverse Bay
East Grand Traverse Bay
Murray
Shore Wood
Eagle Rise
Ridgewood
Brinkman
Forest
Swaney
Whispering
Old Mission
Smokey Hollow
37
Phelps
Peninsula
Center
Woodhill
Kroupa
Dunn
Birch
Unnamed
Bowshaw
Neah Ta Wanta
Mallard
Mapleton
Terrace
Seven Hills
Bluff
Hedden
Cherry Hill
Island View
Nelson
Buchan
Barry
Carroll
Lin Dale
Ojibwa
Craig
Gray
Montague
Wilson
Sky
McKinley
Logan
Homestead
East Shore

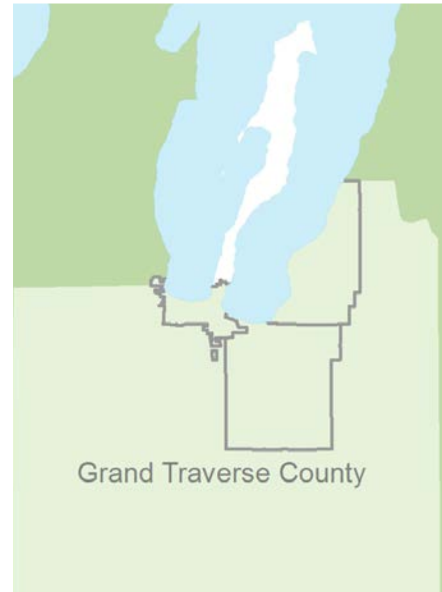

Map 8
Percent Tree Canopy
1.20 - 15.80% (5)
15.81 - 27.30% (4)
27.31 - 41.30% (3)
41.31 - 57.50% (2)
57.51 - 79.90% (1)
West Grand Traverse Bay
East Grand Traverse Bay
Murray
Ridgewood
Forest
Shore Wood
Swaney
Brinkman
Whispering
Old Mission
Smokey Hollow
37
Peninsula
Center
Phelps
Kroupa
Woodhill
Dunn
Birch
Unnamed
Neah Ta Wanta
Mallard
Terrace
Mapleton
Bluff
Hedden
Cherry Hill
Island View
Nelson
Buchan
Barry
Carroll
Craig
Gray
Montague
Wilson
37
McKinley
Logan


Grand Traverse County


Grand Traverse County


Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
8 - 9 (5)
6 - 7 (4)
5 (3)
3 - 4 (2)
1 - 2 (1)
West Grand Traverse Bay
East Grand Traverse Bay
Murray
Ridgewood
Forest
Shore Wood
Swaney
Brinkman
Eagle Rise
Old Mission
Whispering
Smokey Hollow
37
Phelps
Peninsula
Center
Kroupa
Woodhill
Dunn
Birch
Unnamed
Neah Ta Wanta
Bowsaw
Mallard
Terrace
Mapleton
Seven Hills
Hedden
Bluff
Cherry Hill
Island View
Nelson
Barry
Buchan
Lin Dale
Carroll
Ottawa
Craig
Gray
Montague
Wilson
37
McKinley
Logan
East Shore


Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
6 - 7
5
4
2 - 3
West Grand Traverse Bay
East Grand Traverse Bay
Murray
Shore Wood
Eagle Rise
Brinkman
Ridgewood
Swaney
Forest
Whispering
Old Mission
Smokey Hollow
37
Phelps
Peninsula
Center
Kroupa
Woodhill
Dunn
Birch
Unnamed
Neah Ta Wanta
Mapleton
Mallard
Terrace
Seven Hills
Bluff
Hedden
Cherry Hill
Island View
Nelson
Barry
Carroll
Lin Dale
Ojibwa
Craig
Gray
Montague
Wilson
Sky
McKinley
Logan
Homestead
East Shore


Grand Traverse County

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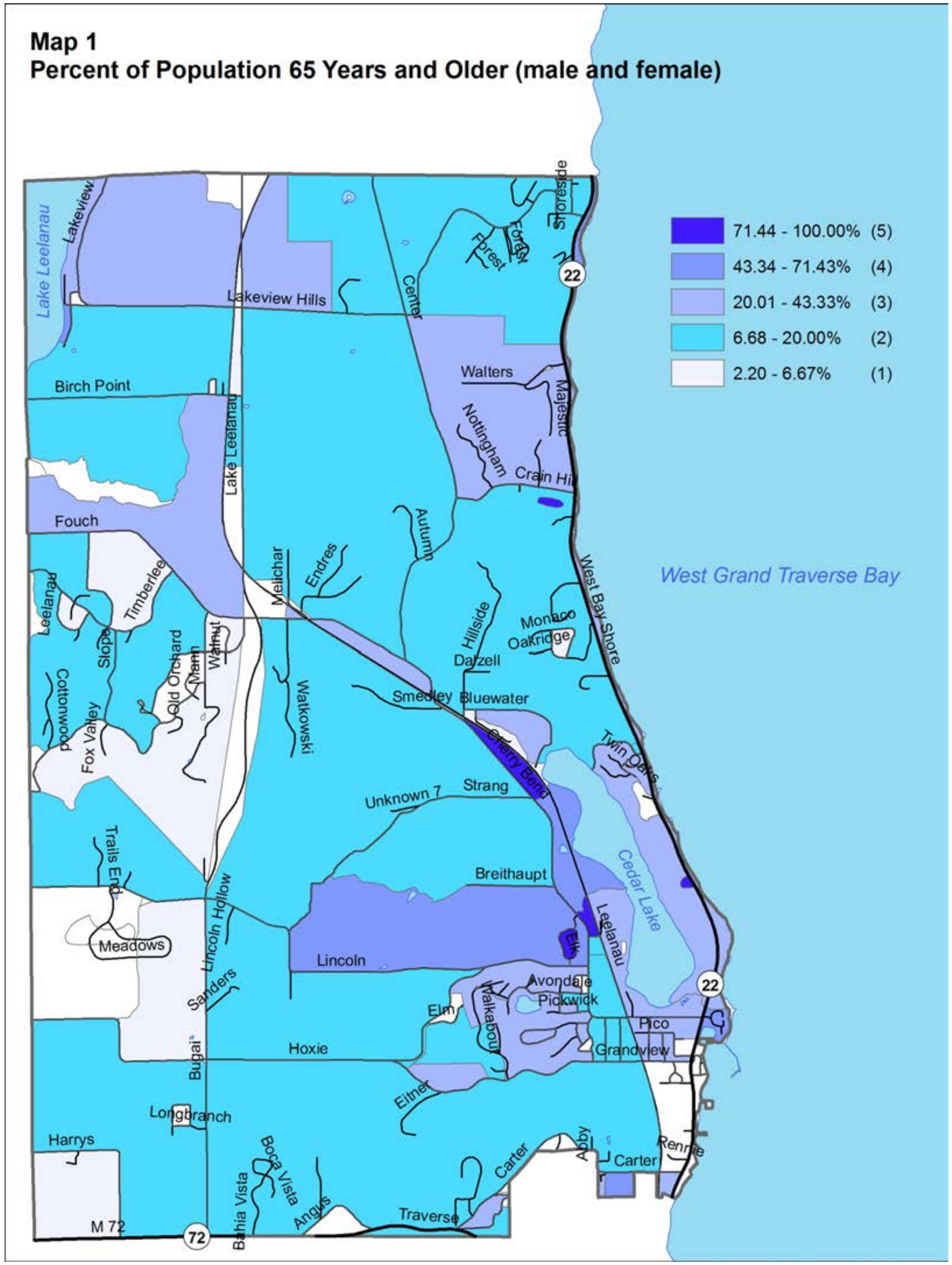
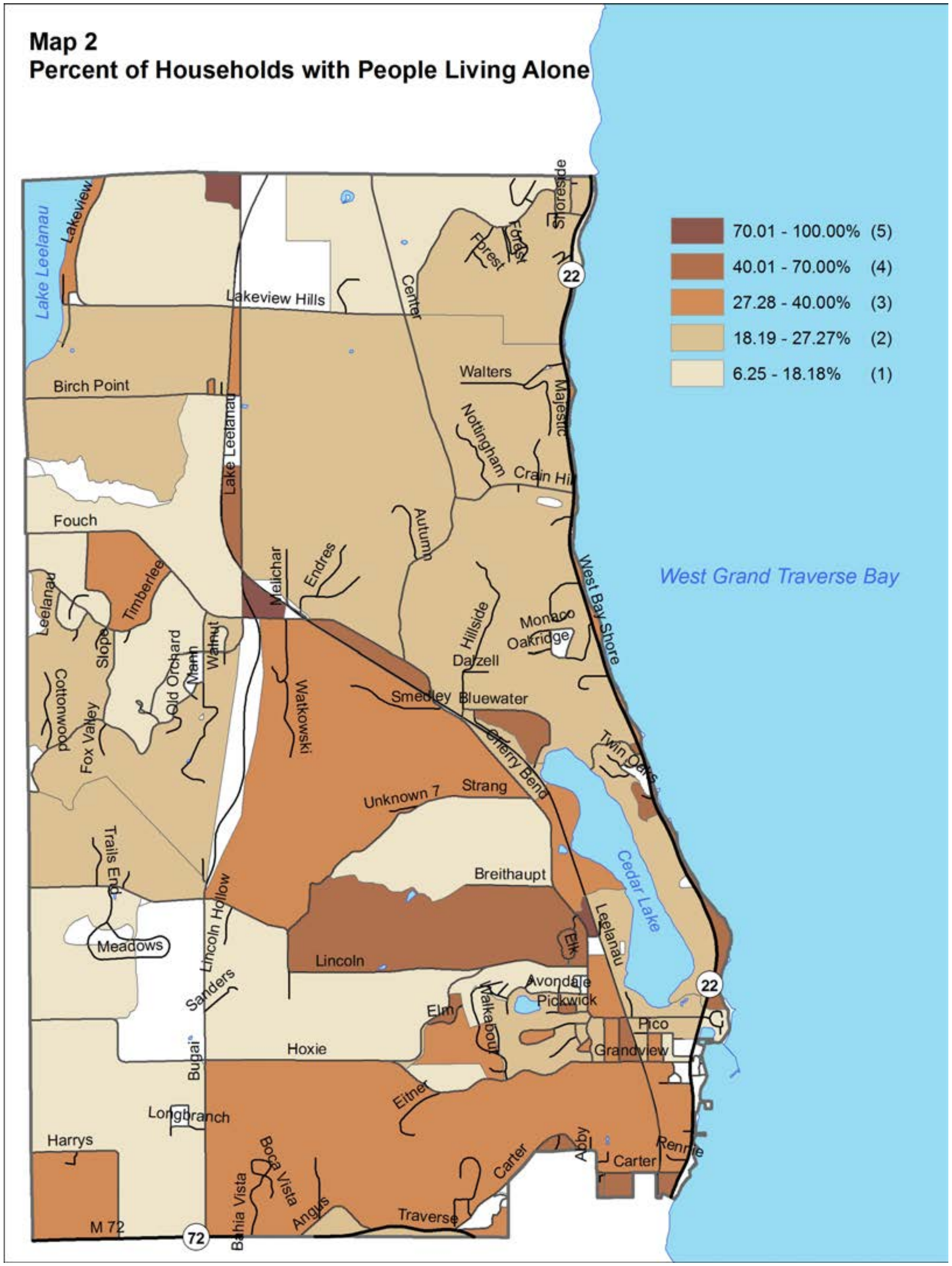
Leelanau County

Elmwood Twp.

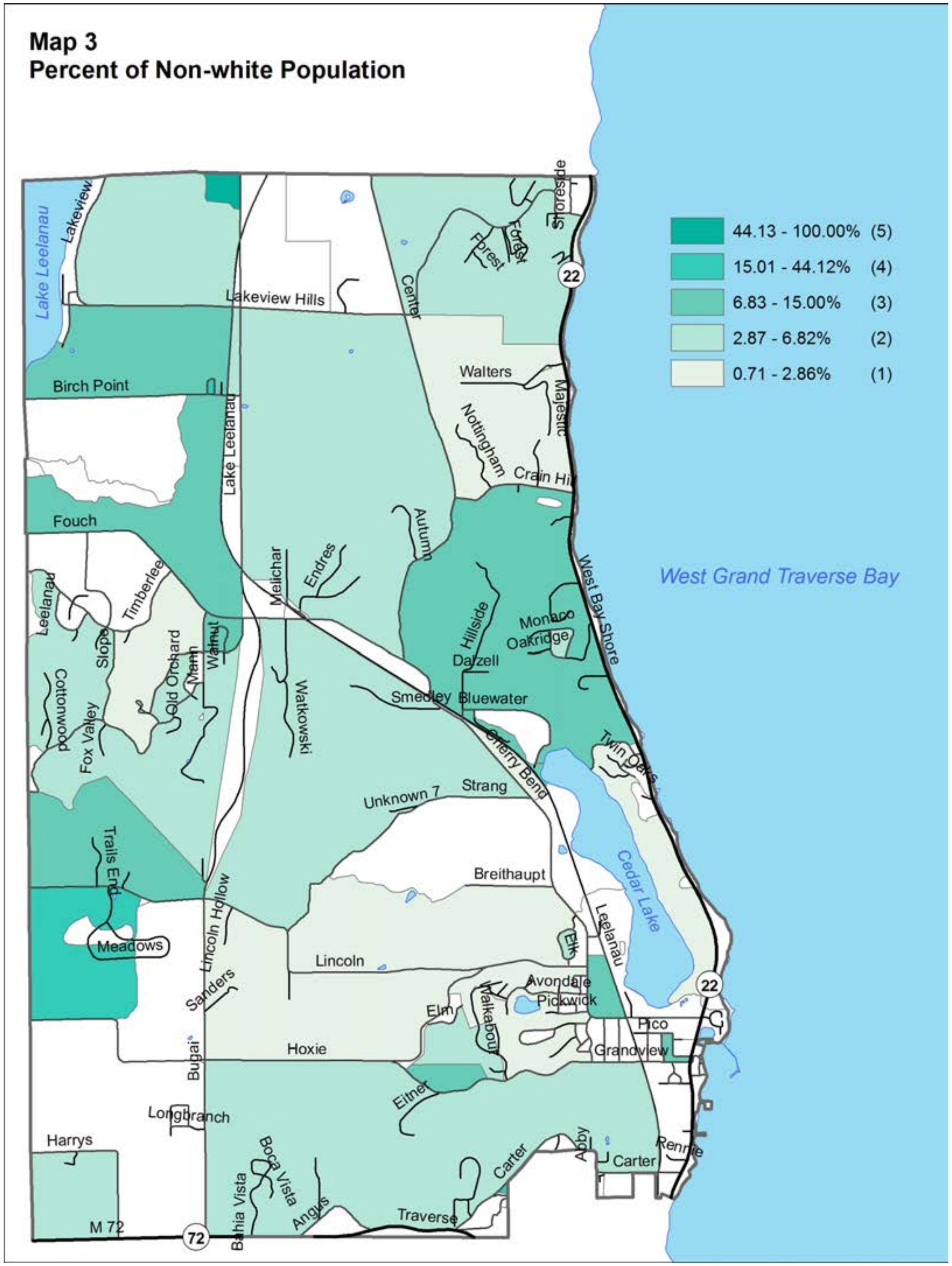

Leelanau County

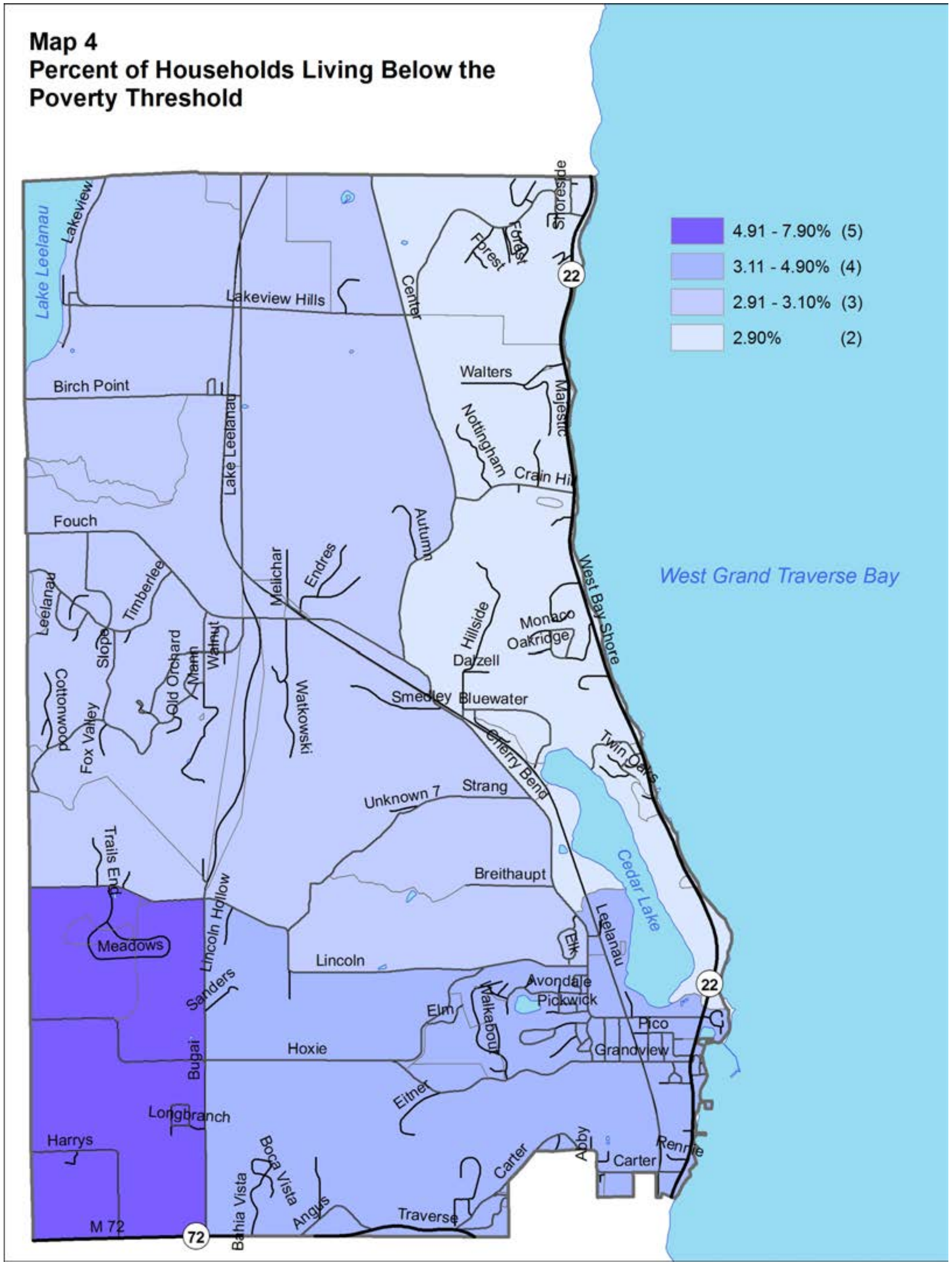

Map 1
Percent of Population 65 Years and Older (male and female)
71.44 - 100.00% (5)
43.34 - 71.43% (4)
20.01 - 43.33% (3)
6.68 - 20.00% (2)
2.20 - 6.67% (1)
West Grand Traverse Bay
Lake Leelanau
Cedar Lake
Lakeview
Lakeview Hills
Center
Forest
Shoreside
Birch Point
Walters
Majestic
Nottingham
Crain Hill
Lake Leelanau
Fouch
Autumn
Melichar
Endres
West Bay Shore
Timberlee
Leelanau
Hillside
Monaco
Oakridge
Dalzell
Slope
Old Orchard
Mann
Walnut
Cottonwood
Fox Valley
Watkowski
Smedley
Bluewater
Cherry Bend
Twin Oaks
Unknown 7
Strang
Trails End
Breithaupt
Lincoln Hollow
Meadows
Lincoln
Elk
Leelanau
Sanders
Avondale
Pickwick
Elm
Walkabout
Pico
Grandview
Hoxie
Bugai
Eitner
Longbranch
Harrys
Boca Vista
Abby
Carter
Rennie
Carter
Bahia Vista
Angus
Traverse
M 72
72
22


Map 2
Percent of Households with People Living Alone
70.01 - 100.00% (5)
40.01 - 70.00% (4)
27.28 - 40.00% (3)
18.19 - 27.27% (2)
6.25 - 18.18% (1)
West Grand Traverse Bay
Lake Leelanau
Cedar Lake
Lakeview
Lakeview Hills
Birch Point
Fouch
Timberlee
Walters
Nottingham
Crain Hill
Autumn
Endres
Melichar
Hillside
Monaco
Oakridge
Dalzell
Smedley
Bluewater
Watkowski
Cherry Bend
Twin Oaks
Unknown 7
Strang
Breithaupt
Lincoln
Meadows
Lincoln Hollow
Sanders
Hoxie
Elm
Avondale
Pickwick
Pico
Grandview
Longbranch
Harrys
Eitner
Carter
Abby
Rennie
Traverse
Bahia Vista
Boca Vista
Angus
M 72
72
22
Center
Forest
Shoreside
Majestic
West Bay Shore
Cottonwood
Fox Valley
Slope
Old Orchard
Walnut
Trails End
Bugai
Walkabout
Elk
Leelanau


Leelanau County

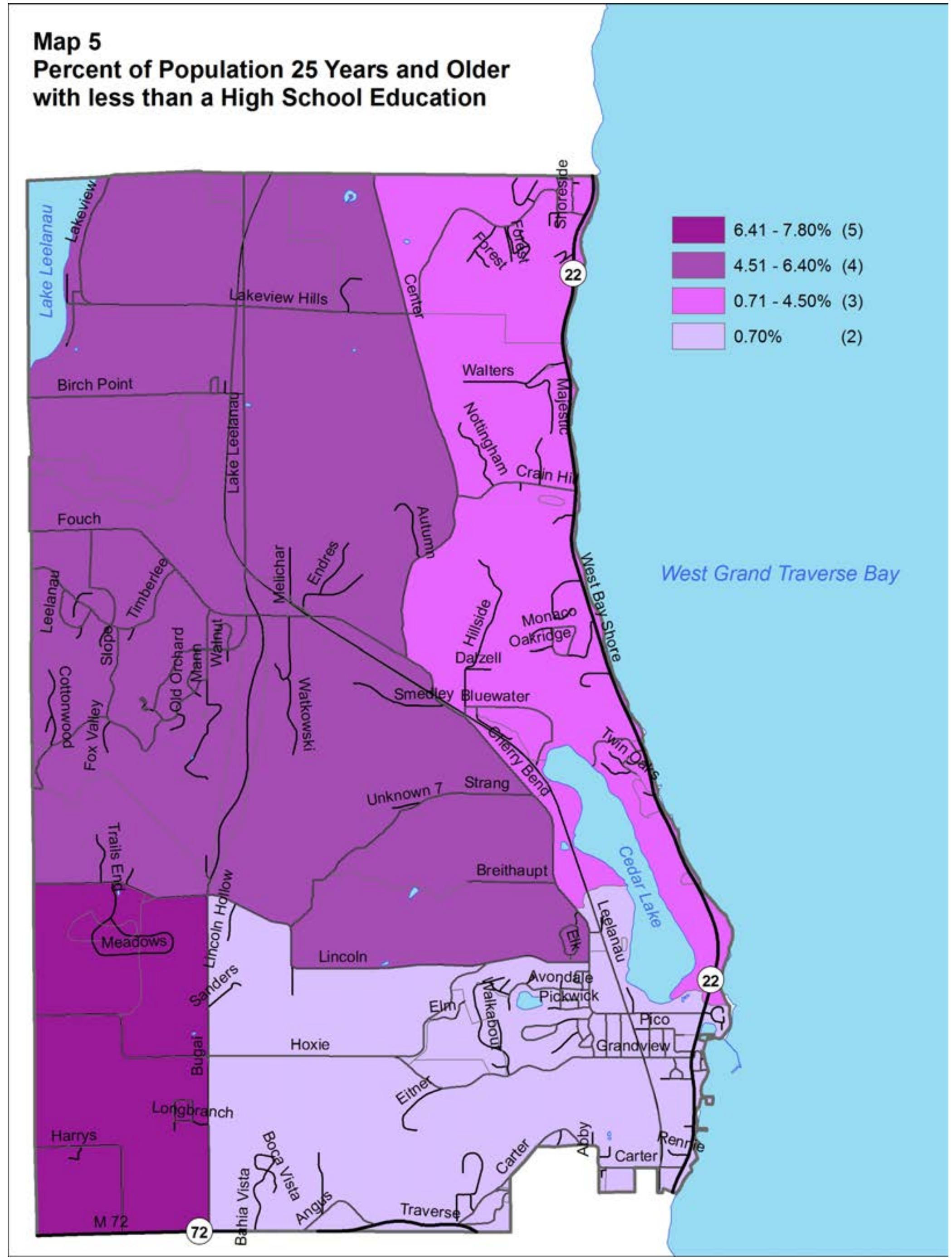

Leelanau County

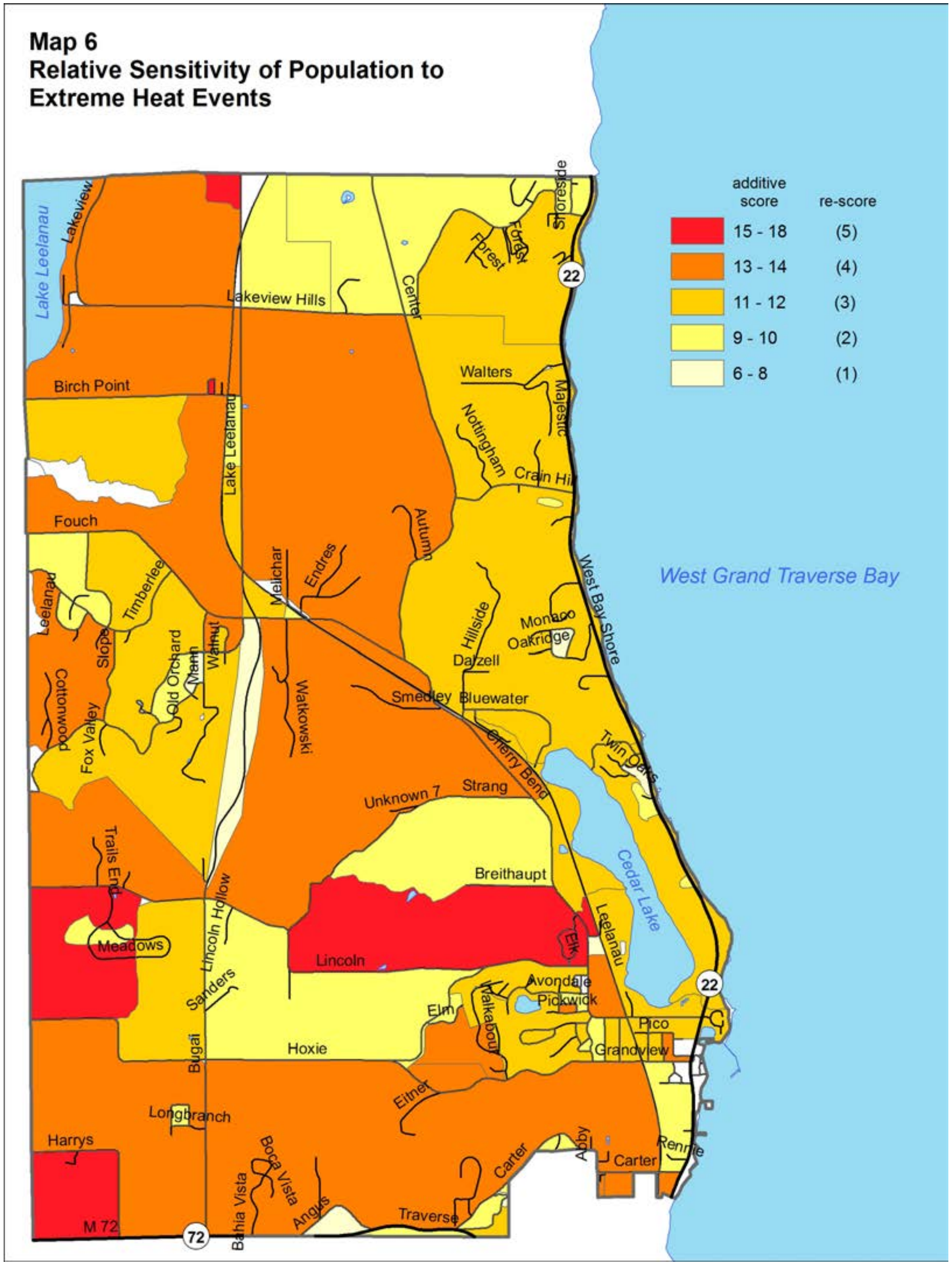

Map 3
Percent of Non-white Population
44.13 - 100.00% (5)
15.01 - 44.12% (4)
6.83 - 15.00% (3)
2.87 - 6.82% (2)
0.71 - 2.86% (1)
West Grand Traverse Bay
Lake Leelanau
Cedar Lake
Lakeview
Lakeview Hills
Birch Point
Fouch
Walters
Crain Hill
West Bay Shore
Smedley
Bluewater
Strang
Unknown 7
Breithaupt
Lincoln
Hoxie
Longbranch
Harrys
M 72
Traverse
Carter
Pico
Grandview
Avondale
Pickwick
Meadows


Map 4
Percent of Households Living Below the Poverty Threshold
4.91 - 7.90% (5)
3.11 - 4.90% (4)
2.91 - 3.10% (3)
2.90% (2)
West Grand Traverse Bay
Lake Leelanau
Cedar Lake
Lakeview
Lakeview Hills
Birch Point
Fouch
Center
Shoreside
Forest
Walters
Majestic
Nottingham
Crain Hil
Autumn
Lake Leelanau
Melichar
Endres
Timberlee
Leelanau
Slope
Old Orchard
Main
Walnut
Cottonwood
Fox Valley
Watkowski
Hillside
Monaco
Oakridge
Dalzell
West Bay Shore
Smedley
Bluewater
Cherry Bend
Twin Oaks
Unknown 7
Strang
Trails End
Breithaupt
Meadows
Lincoln Hollow
Lincoln
Leelanau
Elk
Sanders
Avondale
Pickwick
Elm
Walkabout
Pico
Grandview
Hoxie
Bugai
Longbranch
Eitner
Harrys
Boca Vista
Abby
Carter
Rennie
Carter
Bahia Vista
Angus
Traverse
M 72
72
22


Leelanau County

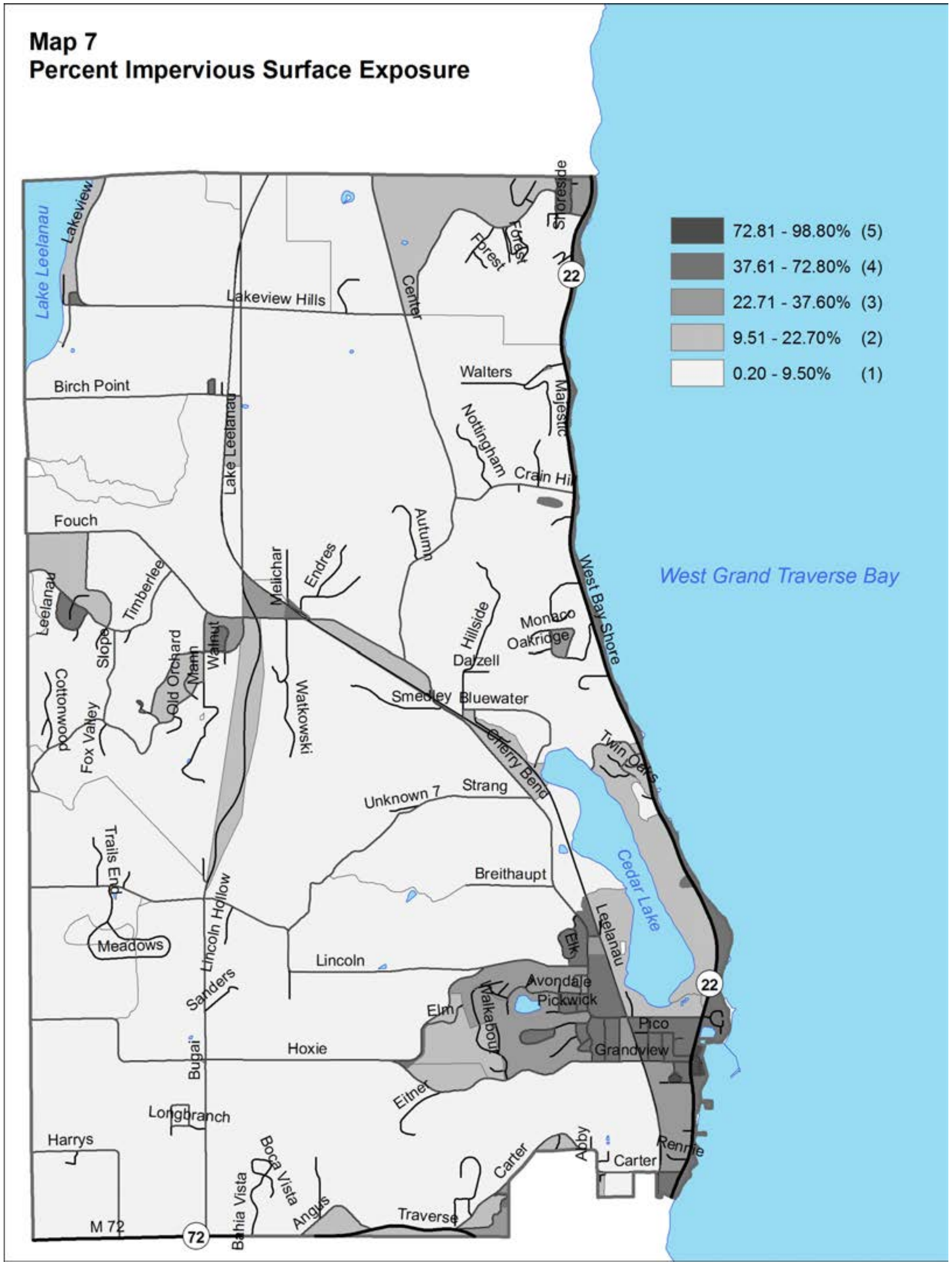

Leelanau County

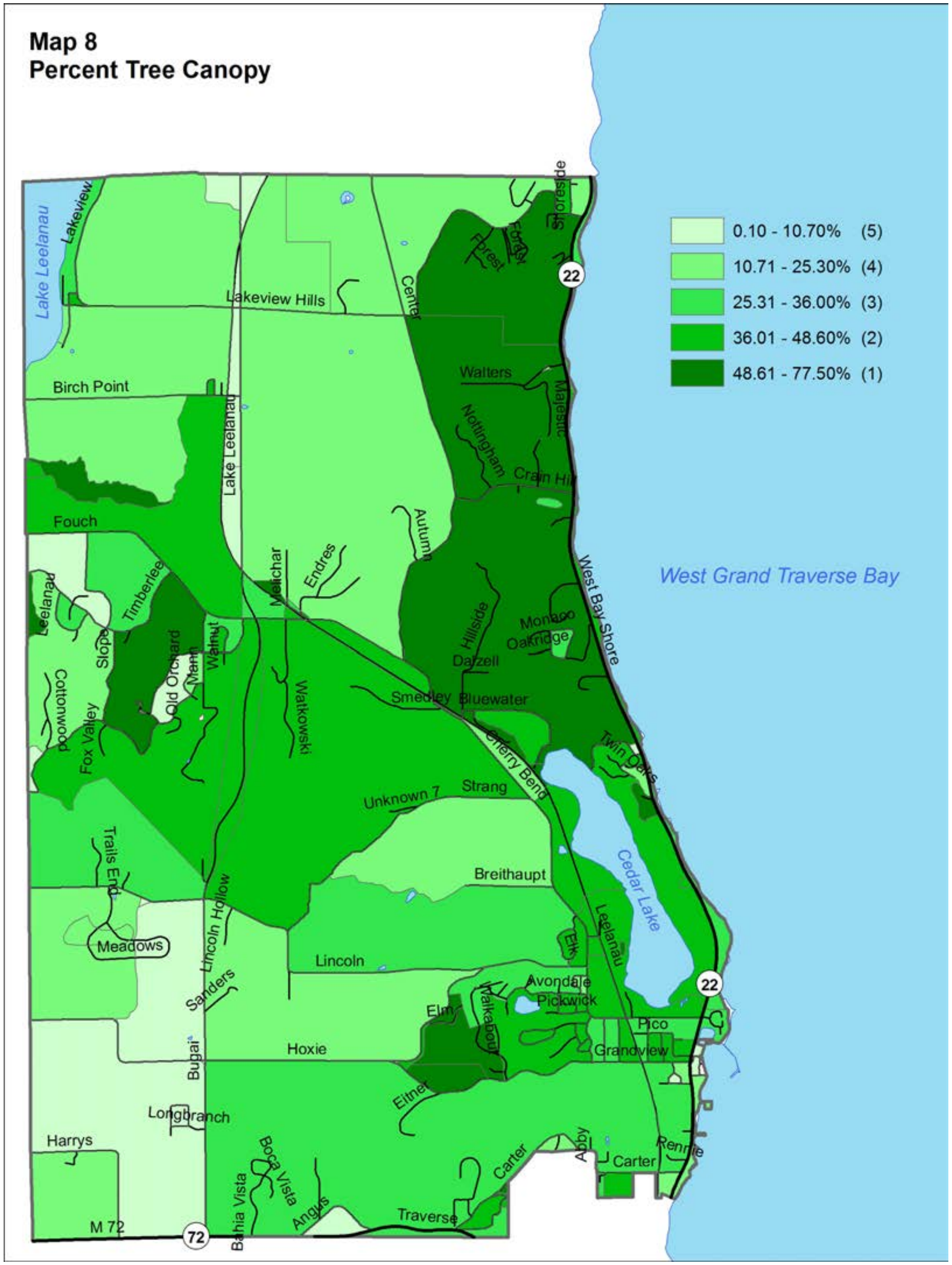

Map 5
Percent of Population 25 Years and Older
with less than a High School Education
6.41 - 7.80% (5)
4.51 - 6.40% (4)
0.71 - 4.50% (3)
0.70% (2)
West Grand Traverse Bay
Lake Leelanau
Cedar Lake
Lakeview Hills
Birch Point
Fouch
Walters
Nottingham
Crain Hill
Autumn
West Bay Shore
Monaco
Oakridge
Dalzell
Hillside
Smedley
Bluewater
Cherry Bend
Twin Oaks
Strang
Unknown 7
Breithaupt
Lincoln
Lincoln Hollow
Sanders
Hoxie
Elm
Avondale
Pickwick
Pico
Grandview
Eltner
Longbranch
Harrys
M 72
Bahia Vista
Boca Vista
Angus
Traverse
Carter
Abby
Rennie
Meadows
Trails End
Bugai
Watkowski
Melichar
Endres
Timberlee
Slope
Cottonwood
Fox Valley
Old Orchard
Walnut
Center
Forest
Shoreside
Majestic
Lakeview
Leelanau
Elk
Walkabout
22
72


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
15 - 18
(5)
13 - 14
(4)
11 - 12
(3)
9 - 10
(2)
6 - 8
(1)
West Grand Traverse Bay
Lake Leelanau
Cedar Lake
Lakeview Hills
Birch Point
Fouch
Walters
Crain Hill
West Bay Shore
Smedley
Bluewater
Cherry Bend
Strang
Unknown 7
Breithaupt
Lincoln
Hoxie
Longbranch
Harrys
M 72
Traverse
Carter
Pico
Grandview
Avondale
Pickwick
Elm
Meadows
Sanders
Lincoln Hollow
Bahia Vista
Boca Vista
Angus
22
72


Leelanau County

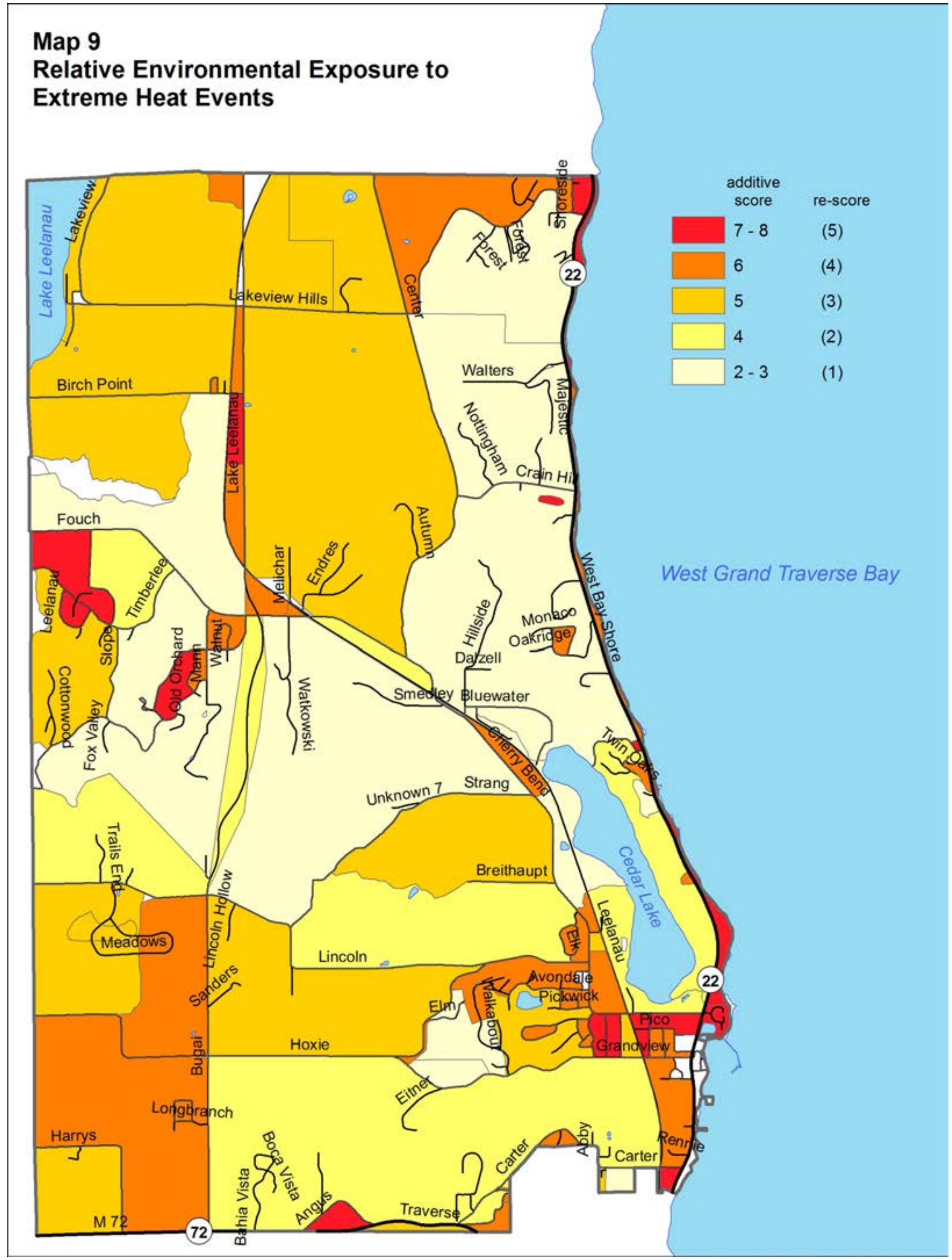

Leelanau County

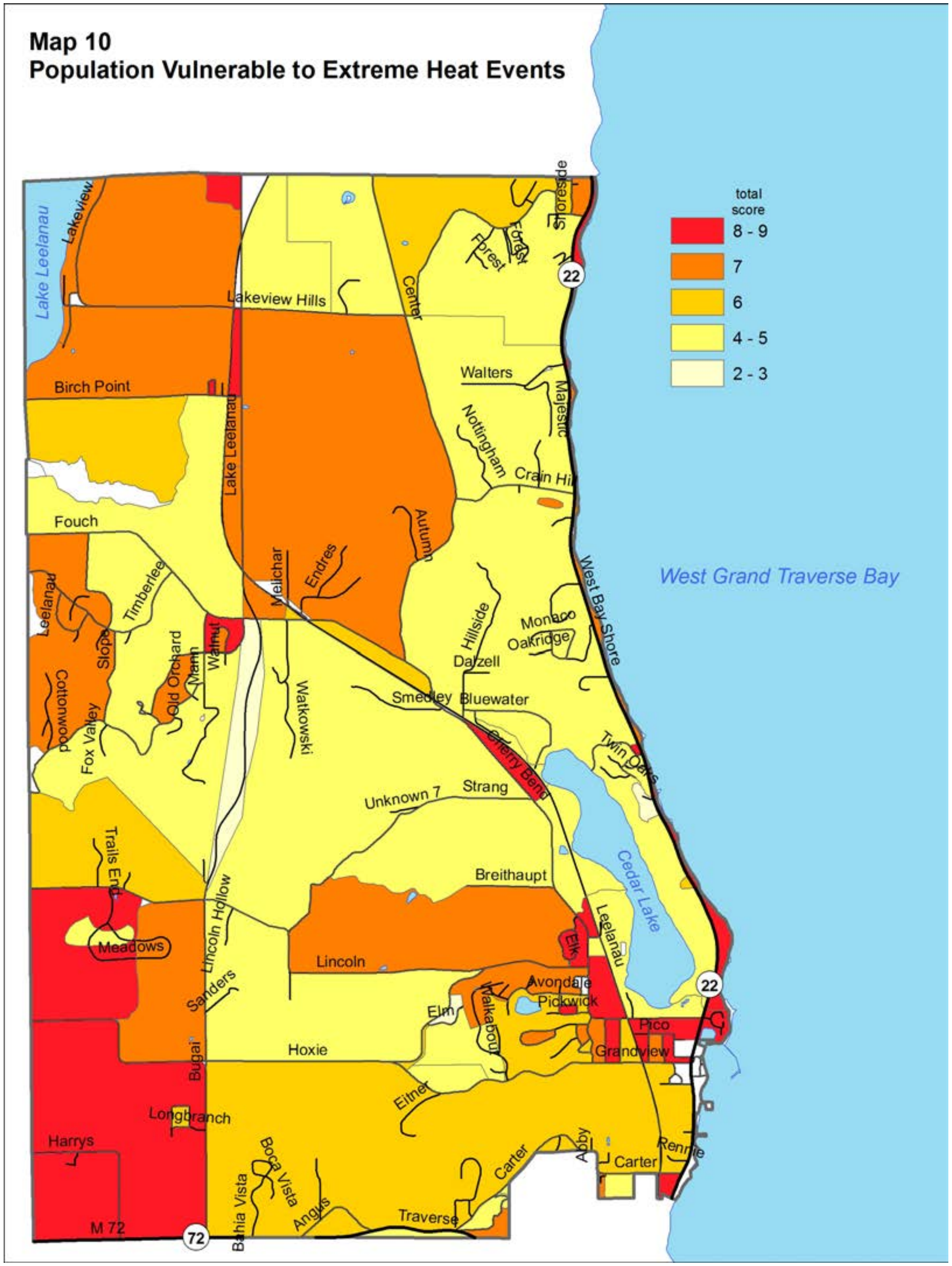

Map 7
Percent Impervious Surface Exposure
72.81 - 98.80% (5)
37.61 - 72.80% (4)
22.71 - 37.60% (3)
9.51 - 22.70% (2)
0.20 - 9.50% (1)
West Grand Traverse Bay
Cedar Lake
Lake Leelanau
Lakeview Hills
Birch Point
Fouch
Walters
Nottingham
Crain Hill
West Bay Shore
Smedley
Bluewater
Cherry Bend
Strang
Unknown 7
Breithaupt
Lincoln
Hoxie
Longbranch
Harrys
M 72
Traverse
Carter
Grandview
Pico
Avondale
Pickwick
Elm
22
72


Map 8
Percent Tree Canopy
0.10 - 10.70% (5)
10.71 - 25.30% (4)
25.31 - 36.00% (3)
36.01 - 48.60% (2)
48.61 - 77.50% (1)
West Grand Traverse Bay
Cedar Lake
Lake Leelanau


Leelanau County


Leelanau County

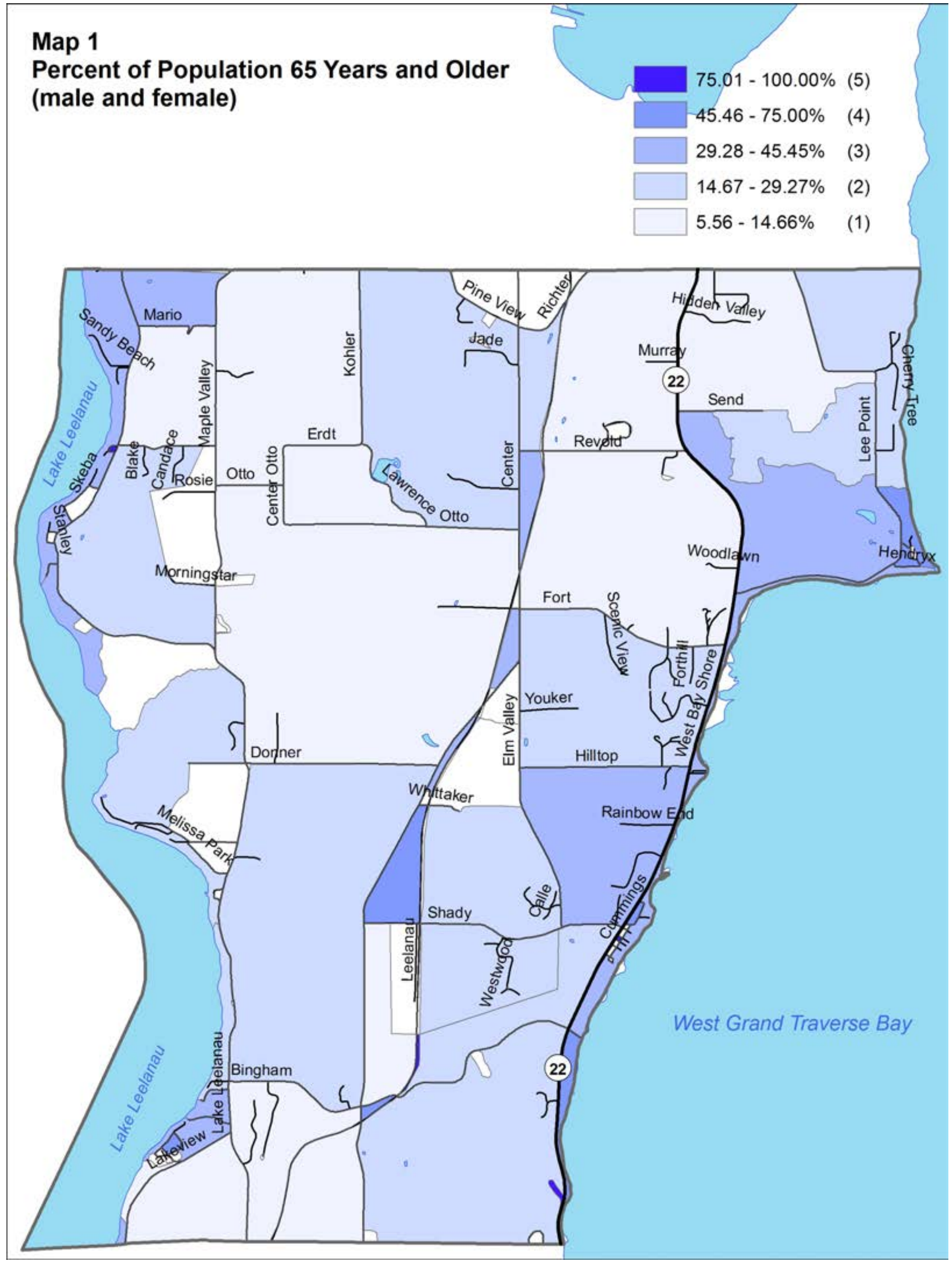

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
7 - 8
(5)
6
(4)
5
(3)
4
(2)
2 - 3
(1)
West Grand Traverse Bay
Lake Leelanau
Cedar Lake
Lakeview
Lakeview Hills
Birch Point
Fouch
Lake Leelanau
Center
Shoreside
Forest
22
Walters
Nottingham
Majestic
Crain Hi
Autumn
Melichar
Endres
West Bay Shore
Hillside
Monaco
Oakridge
Dalzell
Smedley
Bluewater
Cherry Bend
Twin Oaks
Strang
Unknown 7
Breithaupt
Leelanau
Timberlee
Slope
Old Orchard
Walnut
Mann
Cottonwood
Fox Valley
Watkowski
Trails End
Meadows
Lincoln Hollow
Sanders
Lincoln
Elk
Avondale
Pickwick
Elm
Walkabout
Pico
Grandview
Hoxie
Bugai
Longbranch
Harrys
Eitner
Abby
Carter
Rennie
Boca Vista
Bahia Vista
Angus
Traverse
M 72
72

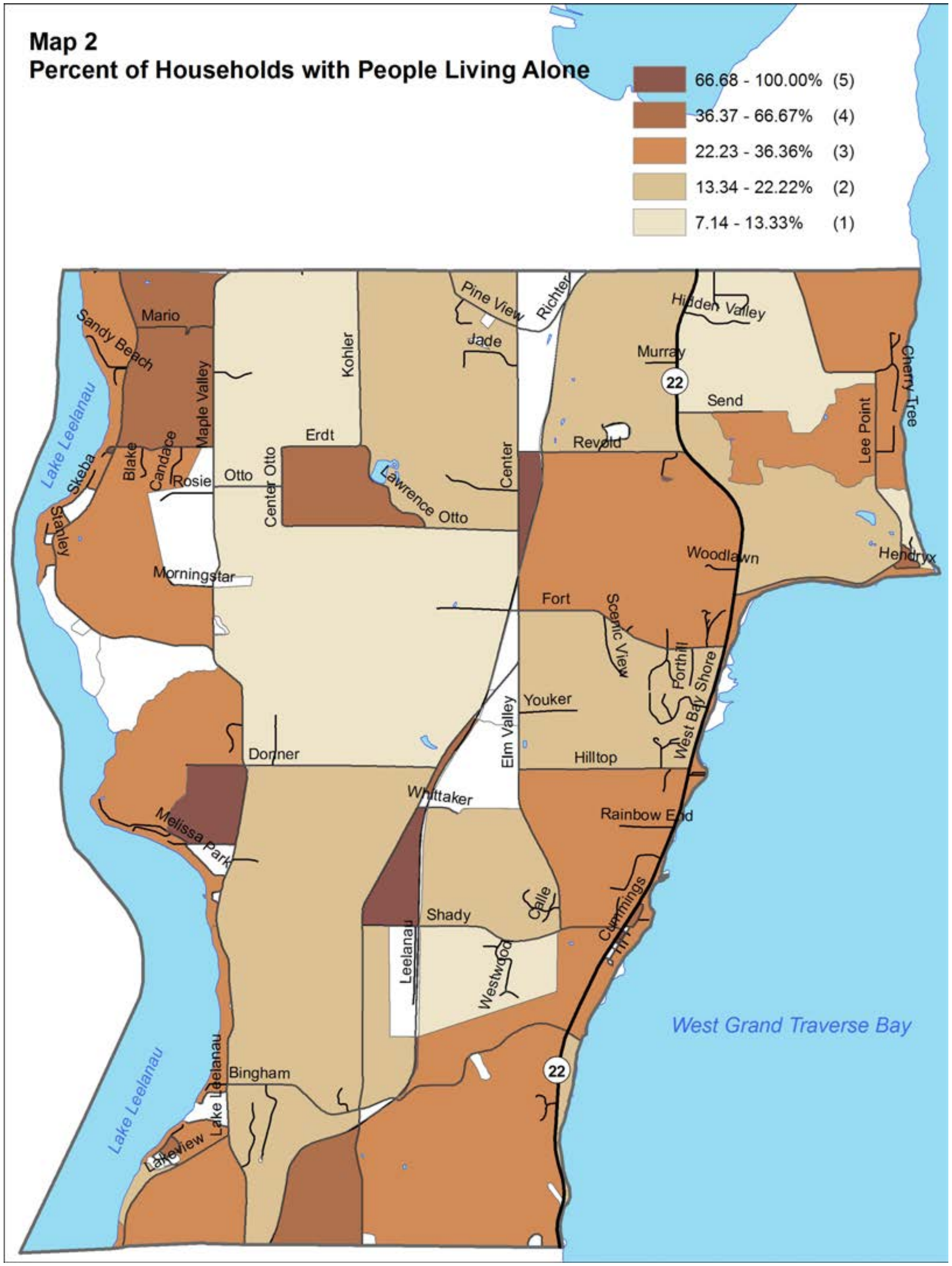

Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
7
6
4 - 5
2 - 3
West Grand Traverse Bay
Cedar Lake
Lake Leelanau
Lakeview
Lakeview Hills
Birch Point
Fouch
Center
Walters
Nottingham
Majestic
Crain Hill
West Bay Shore
Autumn
Melichar
Endres
Hillside
Monaco
Oakridge
Dalzell
Smedley
Bluewater
Cherry Bend
Twin Oaks
Strang
Unknown 7
Breithaupt
Lincoln
Lincoln Hollow
Sanders
Hoxie
Elm
Walkabout
Avondale
Pickwick
Pico
Grandview
Eitner
Carter
Aoby
Rennie
Traverse
Angus
Boca Vista
Bahia Vista
Longbranch
Bugai
Harrys
M 72
72
22
Meadows
Trails End
Fox Valley
Cottonwood
Leelanau
Timberlee
Slope
Old Orchard
Walnut
Watkowski
Shoreside
Forest
Elk


Leelanau County

Bingham Twp.

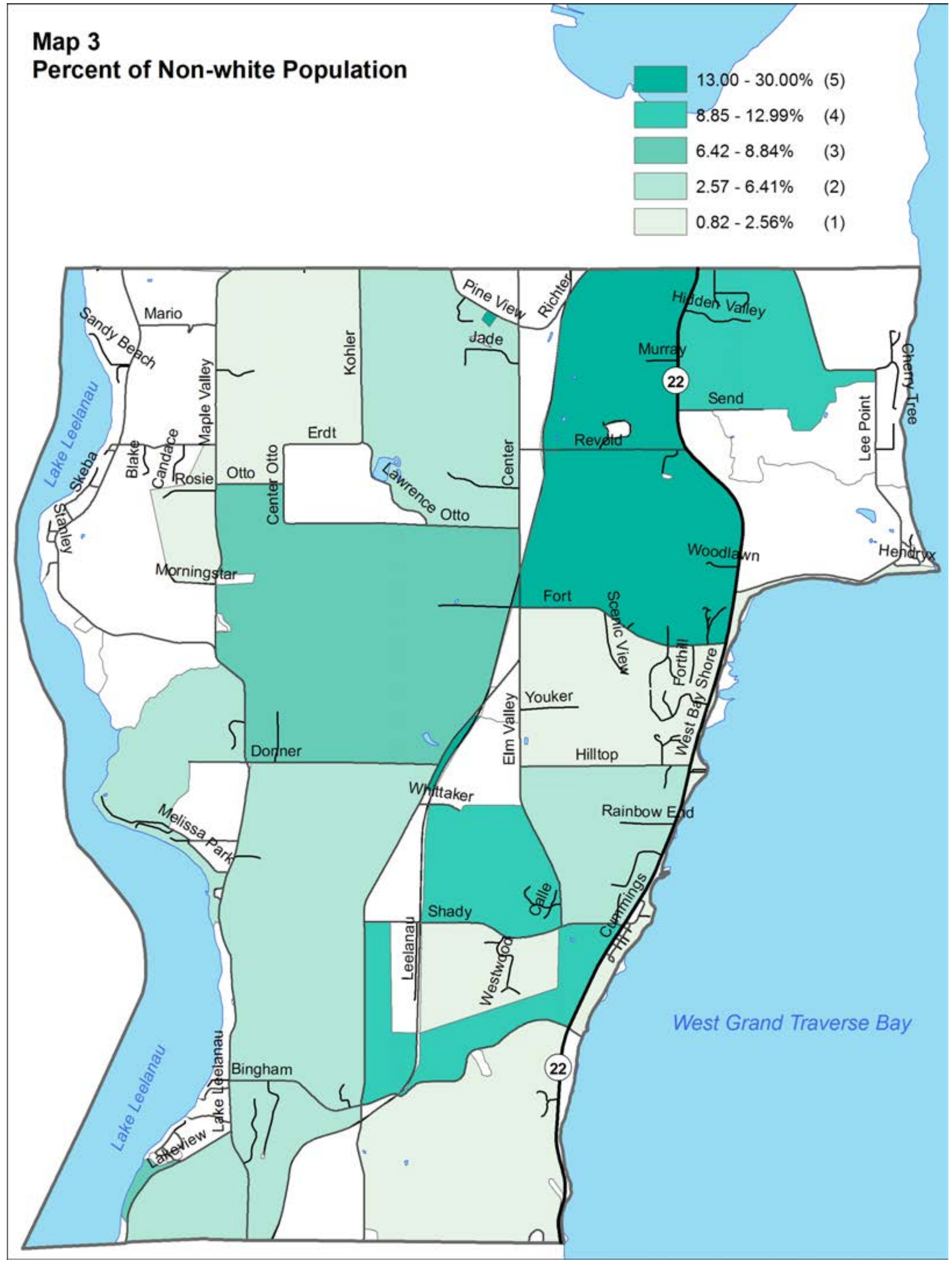

Leelanau County

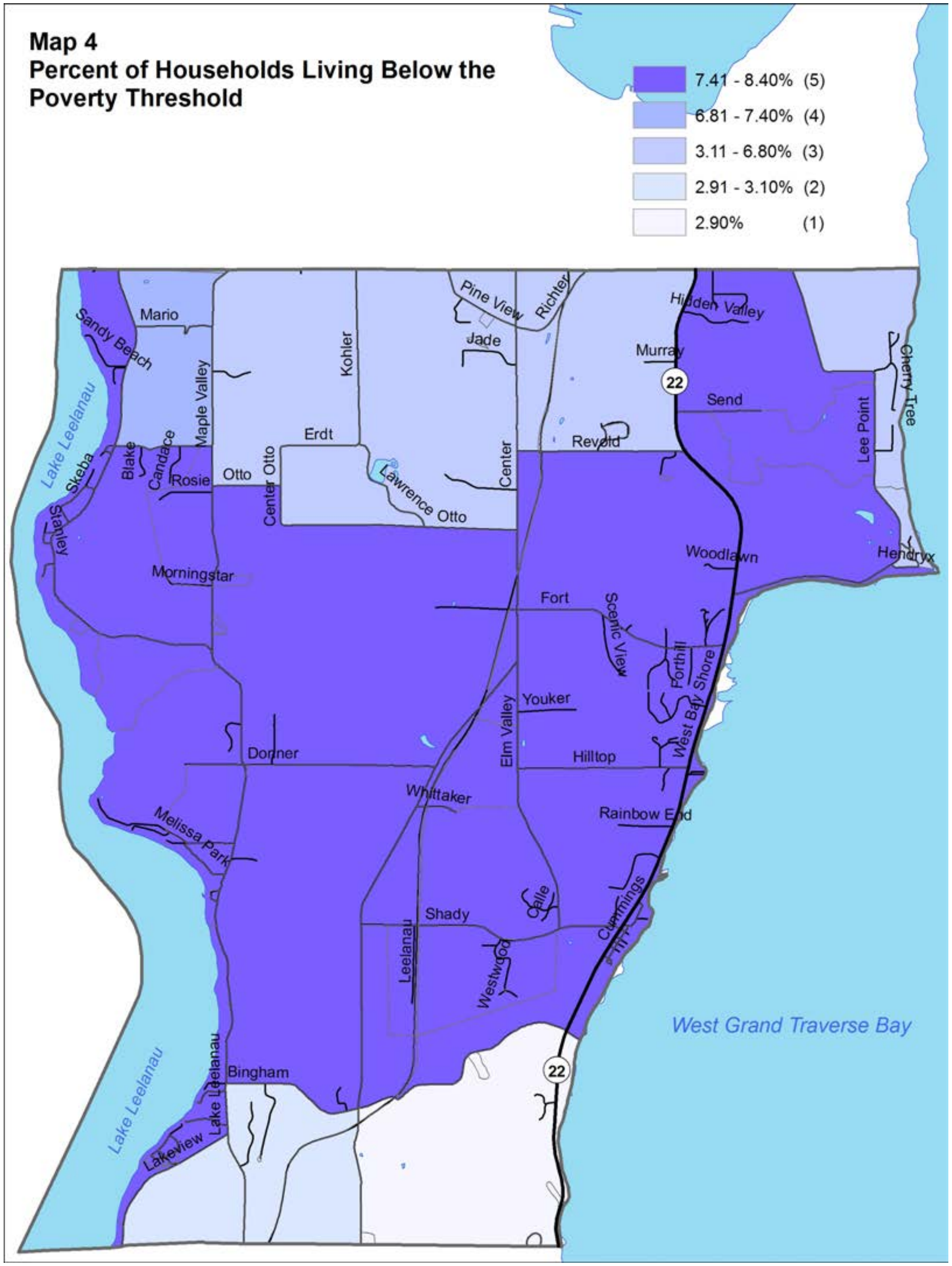

Map 1
Percent of Population 65 Years and Older
(male and female)
75.01 - 100.00% (5)
45.46 - 75.00% (4)
29.28 - 45.45% (3)
14.67 - 29.27% (2)
5.56 - 14.66% (1)
West Grand Traverse Bay
Lake Leelanau
22


Map 2
Percent of Households with People Living Alone
66.68 - 100.00% (5)
36.37 - 66.67% (4)
22.23 - 36.36% (3)
13.34 - 22.22% (2)
7.14 - 13.33% (1)
Lake Leelanau
West Grand Traverse Bay
Sandy Beach
Mario
Maple Valley
Kohler
Pine View
Richter
Jade
Hidden Valley
Murray
22
Send
Cherry Tree
Lee Point
Erdt
Otto
Center Otto
Lawrence
Center
Revold
Rosie
Blake
Candace
Skeba
Stanley
Morningstar
Woodlawn
Hendryx
Fort
Scenic View
Forthill
West Bay Shore
Youker
Elm Valley
Hilltop
Donner
Whittaker
Rainbow End
Melissa Park
Calle
Shady
Cummings
Leelanau
Westwood
Bingham
Lake Leelanau
Lakeview


Leelanau County

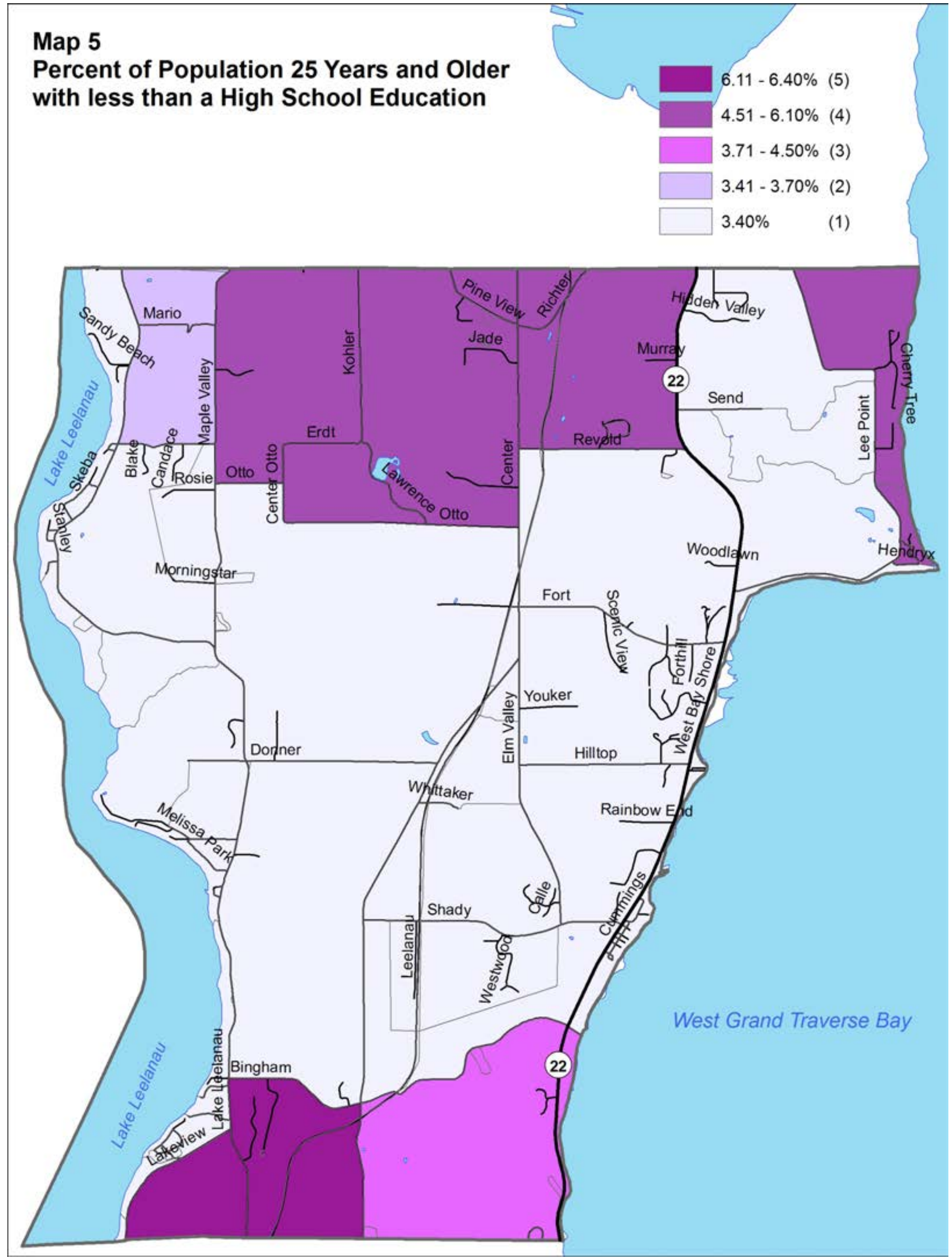

Leelanau County

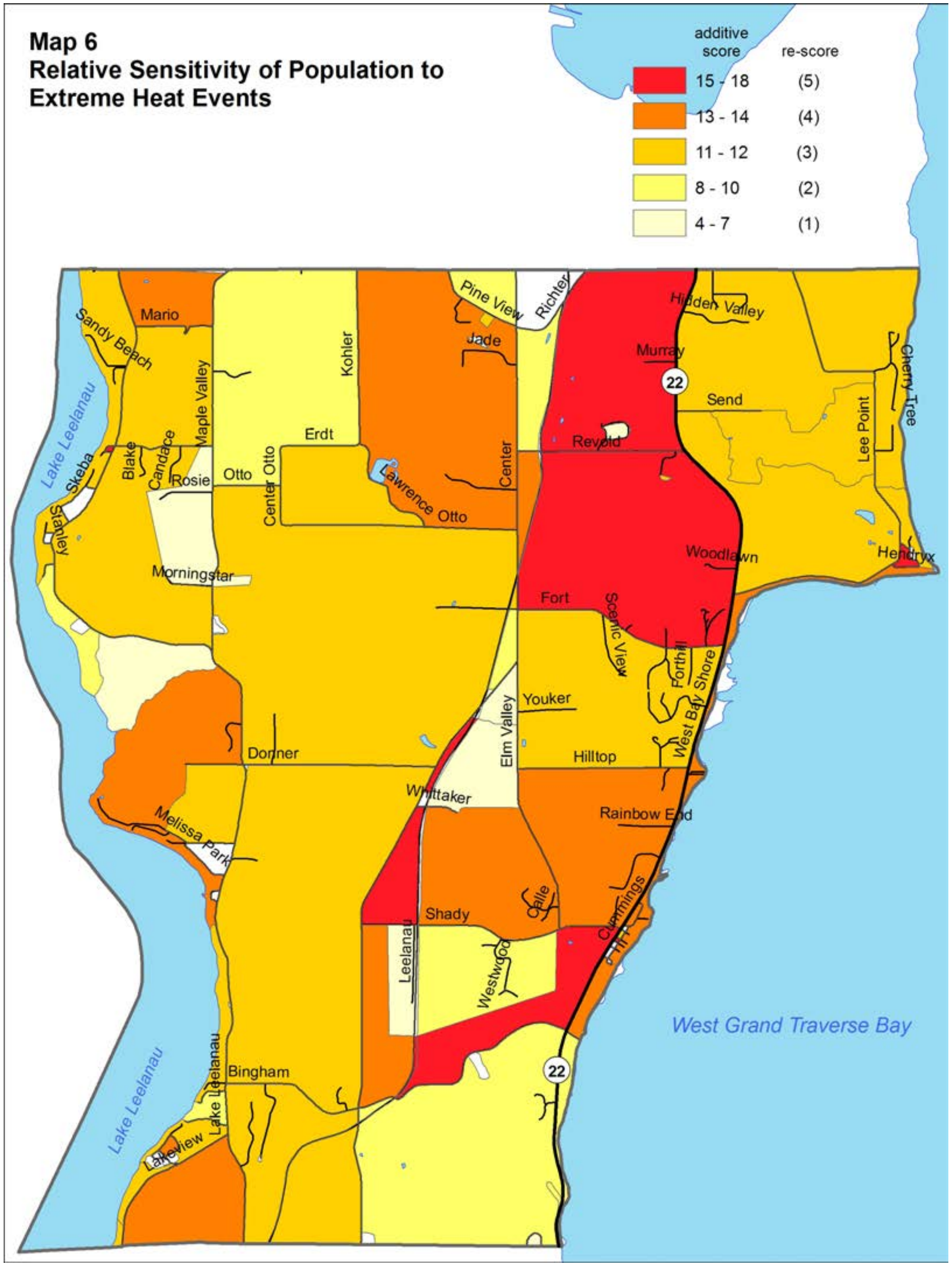

Map 3
Percent of Non-white Population
13.00 - 30.00% (5)
8.85 - 12.99% (4)
6.42 - 8.84% (3)
2.57 - 6.41% (2)
0.82 - 2.56% (1)
Lake Leelanau
West Grand Traverse Bay
22
Mario
Sandy Beach
Maple Valley
Kohler
Pine View
Richter
Jade
Hidden Valley
Murray
Send
Cherry Tree
Lee Point
Erdt
Center
Revold
Blake
Candace
Skeba
Rosie
Otto
Center Otto
Lawrence
Stanley
Morningstar
Woodlawn
Hendryx
Fort
Scenic View
Forthill
West Bay Shore
Youker
Elm Valley
Hilltop
Donner
Whittaker
Rainbow End
Melissa Park
Shady
Dalle
Cummings
Leelanau
Westwood
Bingham
Lake Leelanau
Lakeview


Map 4
Percent of Households Living Below the Poverty Threshold
7.41 - 8.40% (5)
6.81 - 7.40% (4)
3.11 - 6.80% (3)
2.91 - 3.10% (2)
2.90% (1)
Lake Leelanau
West Grand Traverse Bay
Sandy Beach
Mario
Maple Valley
Kohler
Pine View
Richter
Jade
Hidden Valley
Murray
22
Send
Cherry Tree
Lee Point
Erdt
Center
Revold
Blake
Candace
Rosie
Otto
Center Otto
Lawrence
Skeba
Stanley
Morningstar
Woodlawn
Hendryx
Fort
Scenic View
Forthill
Shore
West Bay
Youker
Elm Valley
Hilltop
Donner
Whittaker
Rainbow End
Melissa Park
Calle
Shady
Cummings
Leelanau
Westwood
Bingham
Lake Leelanau
Lakeview


Leelanau County

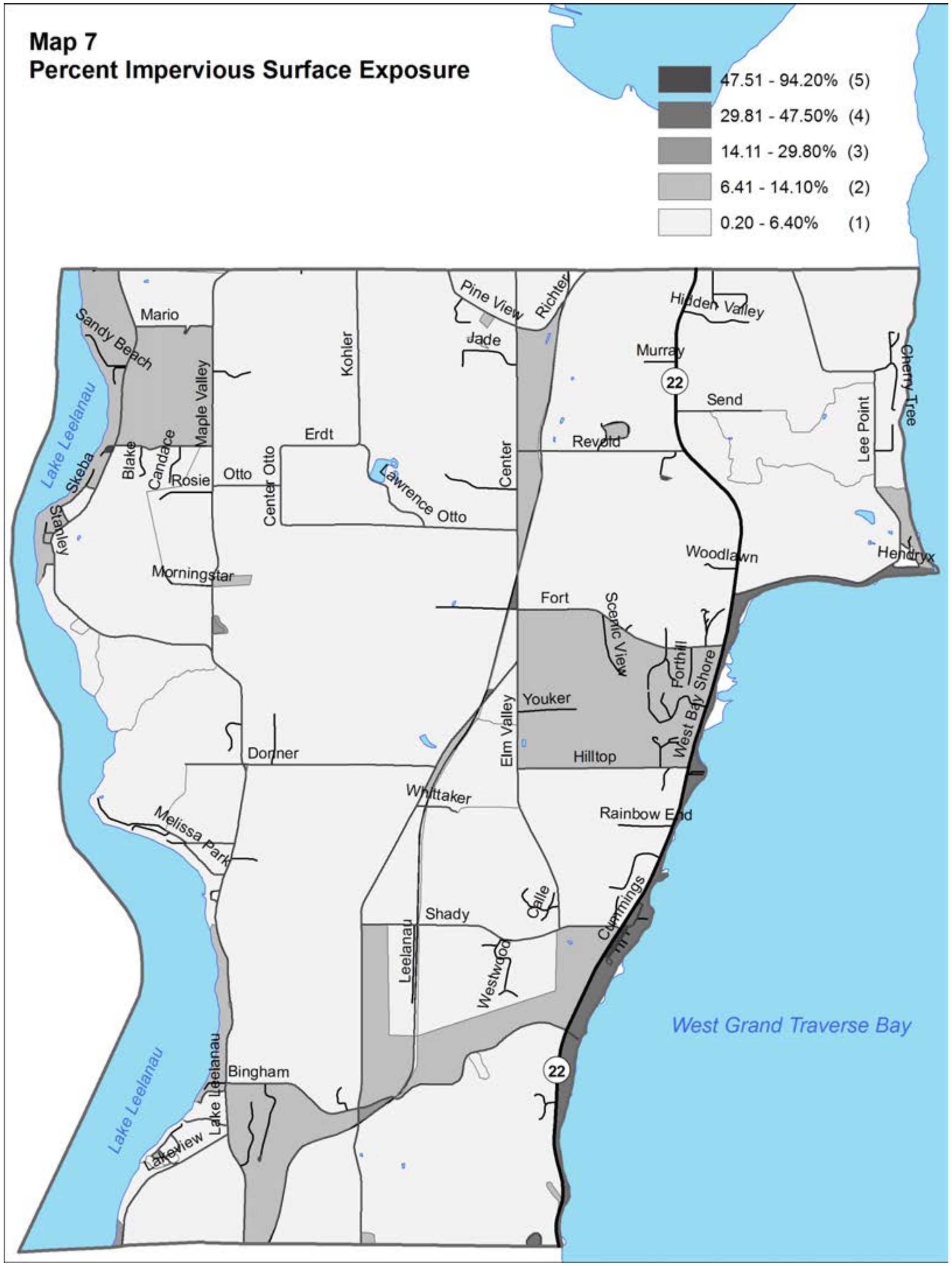

Leelanau County

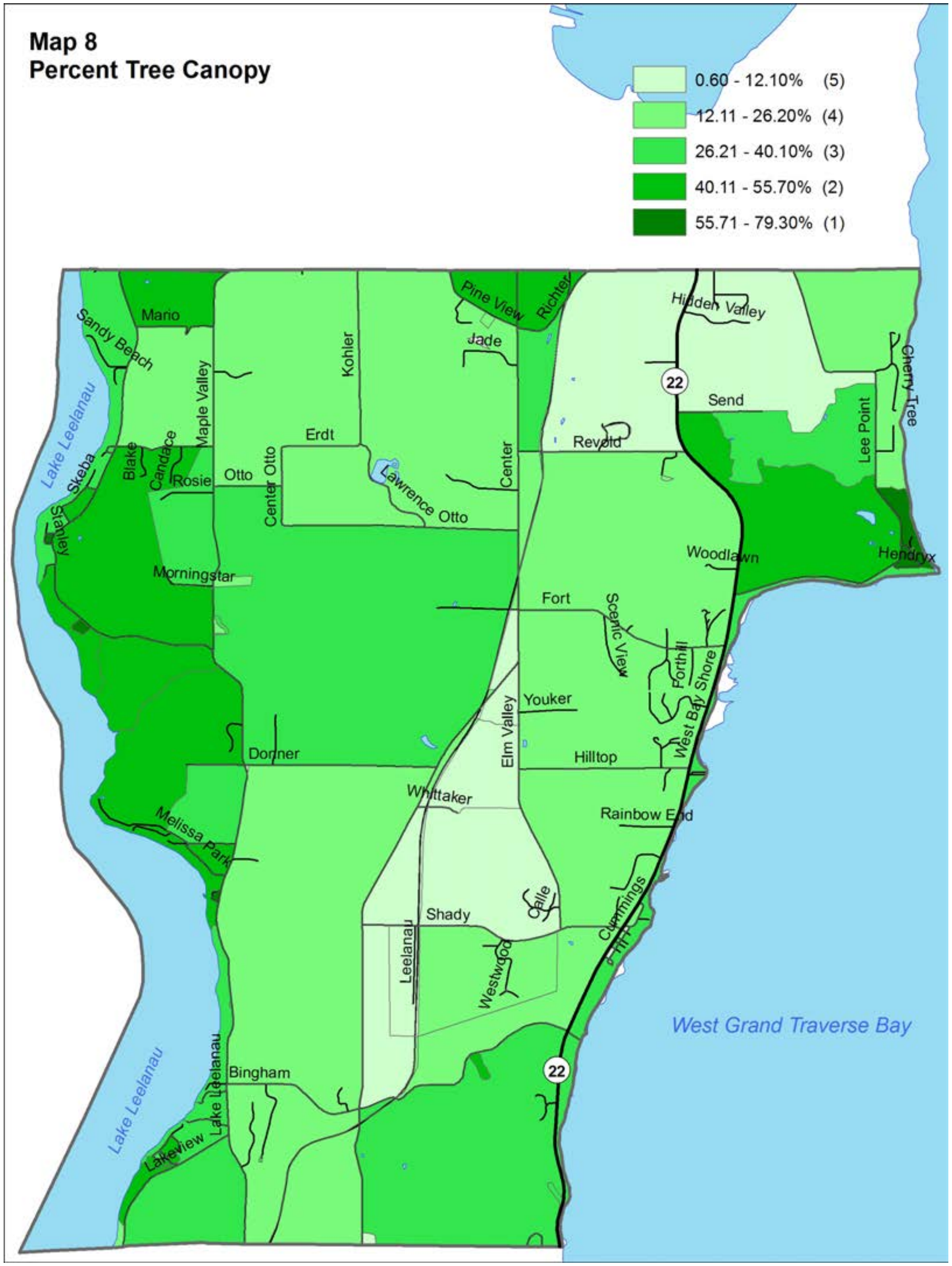

Map 5
Percent of Population 25 Years and Older with less than a High School Education
6.11 - 6.40% (5)
4.51 - 6.10% (4)
3.71 - 4.50% (3)
3.41 - 3.70% (2)
3.40% (1)
West Grand Traverse Bay
Lake Leelanau
22


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
15 - 18 (5)
13 - 14 (4)
11 - 12 (3)
8 - 10 (2)
4 - 7 (1)
West Grand Traverse Bay
Lake Leelanau
Mario
Sandy Beach
Maple Valley
Kohler
Pine View
Richter
Jade
Hidden Valley
Murray
22
Send
Cherry Tree
Lee Point
Erdt
Otto
Center Otto
Rosie
Blake
Candace
Skeba
Stanley
Lawrence Otto
Center
Revold
Woodlawn
Hendryx
Morningstar
Fort
Scenic View
Forthill
West Bay Shore
Youker
Elm Valley
Hilltop
Dorner
Whittaker
Rainbow End
Melissa Park
Cummings
Shady
Leelanau
Westwood
Bingham
Lake Leelanau
Lakeview


Leelanau County


Leelanau County

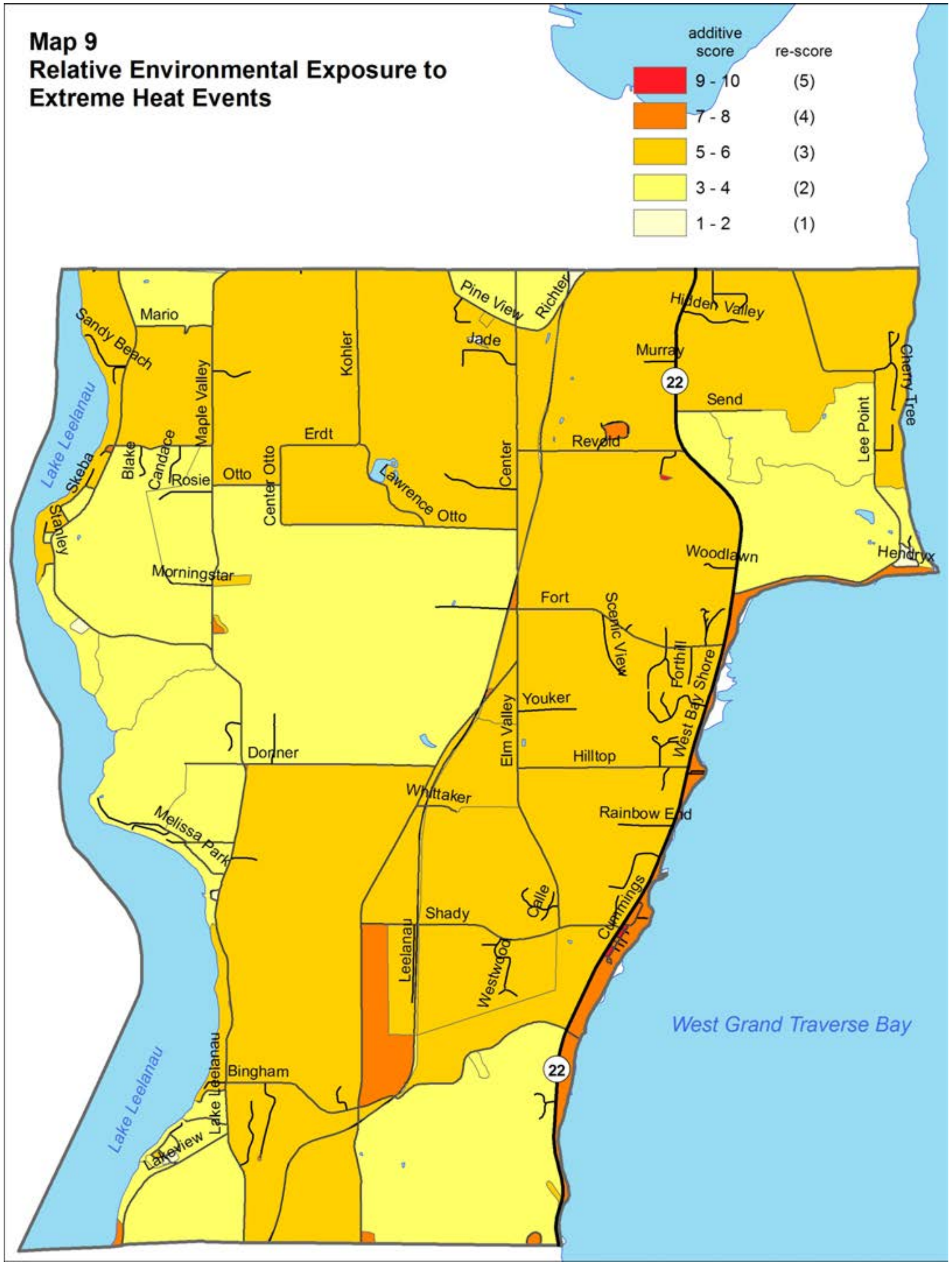

Map 7
Percent Impervious Surface Exposure
47.51 - 94.20% (5)
29.81 - 47.50% (4)
14.11 - 29.80% (3)
6.41 - 14.10% (2)
0.20 - 6.40% (1)
Lake Leelanau
West Grand Traverse Bay
Sandy Beach
Mario
Maple Valley
Kohler
Pine View
Richter
Jade
Hidden Valley
Murray
22
Send
Cherry Tree
Lee Point
Erdt
Revold
Center
Blake
Candace
Skeba
Rosie
Otto
Center Otto
Lawrence
Stanley
Morningstar
Woodlawn
Hendryx
Fort
Scenic View
Forthill
West Bay Shore
Youker
Elm Valley
Hilltop
Donner
Whittaker
Rainbow End
Melissa Park
Shady
Cummings
Leelanau
Westwood
Bingham
Lake Leelanau
Lakeview

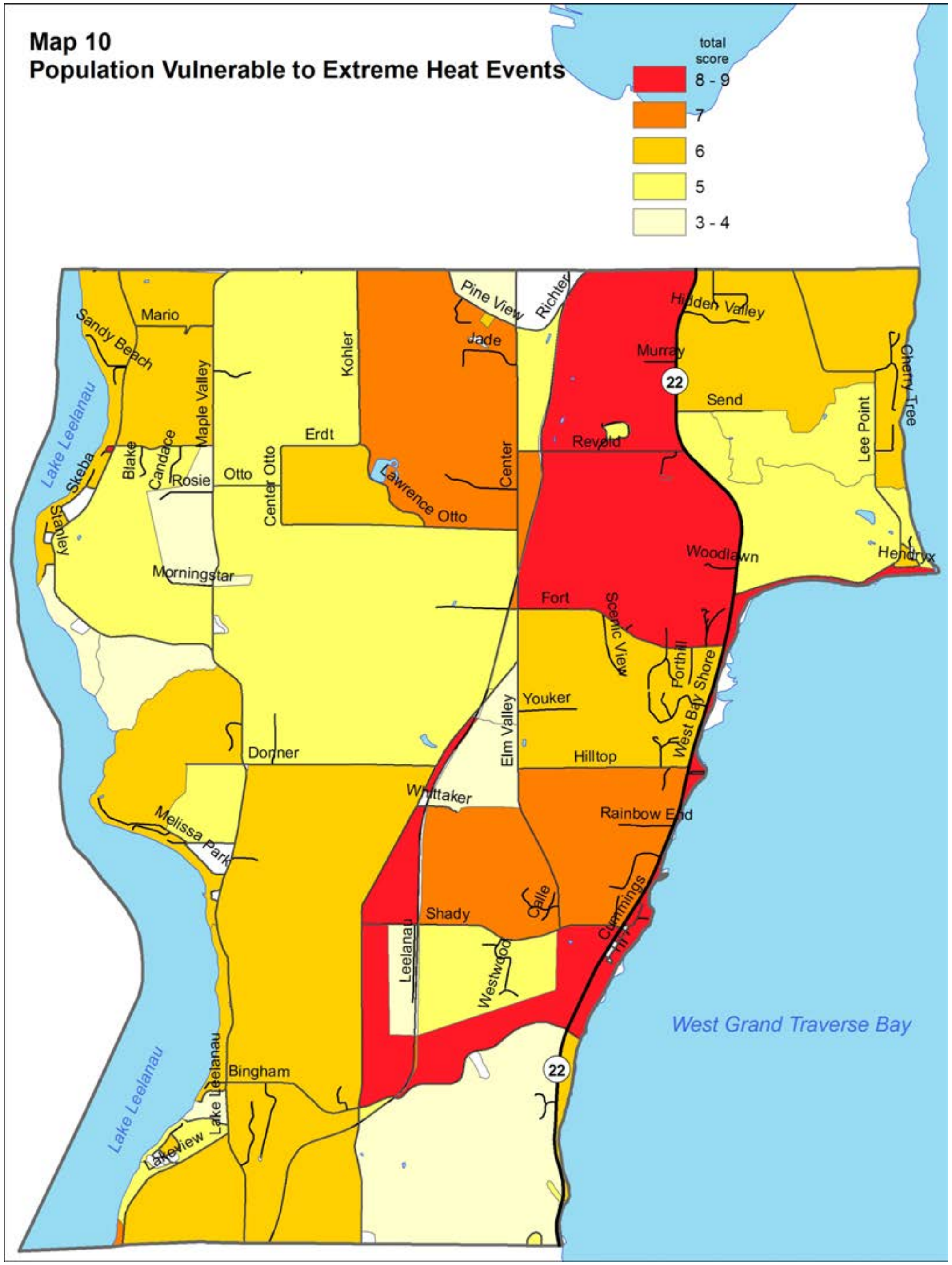


Map 8
Percent Tree Canopy
0.60 - 12.10% (5)
12.11 - 26.20% (4)
26.21 - 40.10% (3)
40.11 - 55.70% (2)
55.71 - 79.30% (1)
Mario
Sandy Beach
Maple Valley
Kohler
Jade
Pine View
Richter
Hidden Valley
22
Send
Cherry Tree
Lee Point
Lake Leelanau
Skeba
Blake
Candace
Rosie
Otto
Center Otto
Erdt
Lawrence Otto
Center
Revold
Stanley
Morningstar
Woodlawn
Hendryx
Fort
Scenic View
Forthill
West Bay Shore
Youker
Elm Valley
Hilltop
Donner
Whittaker
Rainbow End
Melissa Park
Calle
Cummings Hill
Shady
Leelanau
Westwood
West Grand Traverse Bay
Bingham
Lake Leelanau
Lakeview

Leelanau County

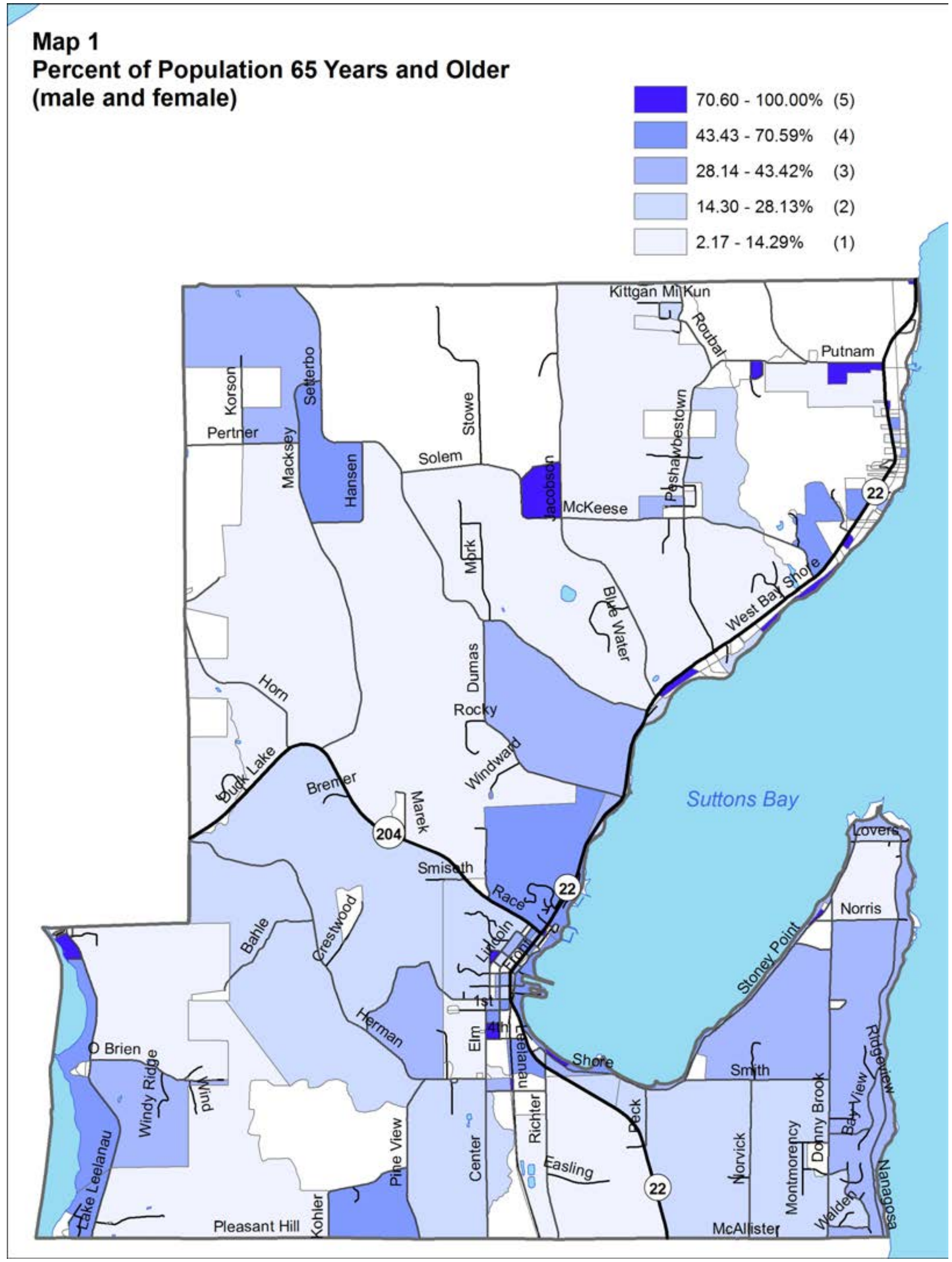

Leelanau County

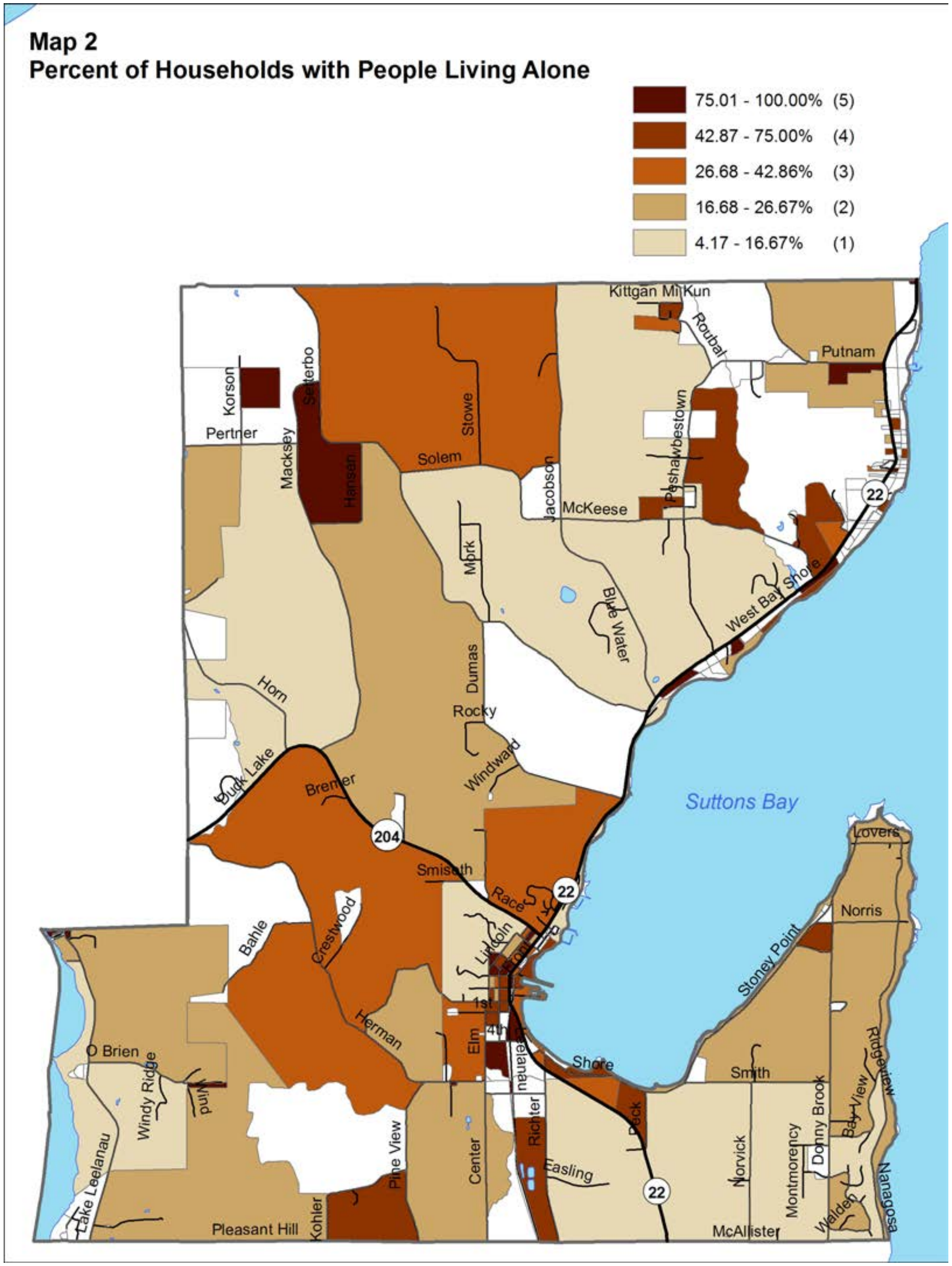

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
Mario
Sandy Beach
Lake Leelanau
Maple Valley
Kohler
Pine View
Richter
Jade
Hidden Valley
Murray
22
Send
Cherry Tree
Lee Point
Erdt
Center
Revold
Skeba
Blake
Candace
Rosie
Otto
Center Otto
Lawrence Otto
Stanley
Woodlawn
Hendryx
Morningstar
Fort
Scenic View
Forthill
West Bay Shore
Youker
Elm Valley
Donner
Hilltop
Whittaker
Rainbow End
Melissa Park
Shady
Calle
Cummings
Leelanau
Westwood
West Grand Traverse Bay
Bingham
Lake Leelanau
Lakeview


Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
7
6
5
3 - 4
Lake Leelanau
West Grand Traverse Bay
22
Sandy Beach
Mario
Maple Valley
Kohler
Pine View
Richter
Jade
Hidden Valley
Murray
Send
Lee Point
Cherry Tree
Erdt
Otto
Center Otto
Rosie
Blake
Candace
Skeba
Stanley
Lawrence Otto
Center
Revold
Woodlawn
Hendryx
Morningstar
Fort
Scenic View
Forthill
West Bay Shore
Youker
Elm Valley
Hilltop
Donner
Whittaker
Rainbow End
Melissa Park
Callie
Cummings
Shady
Leelanau
Westwood
Bingham
Lake Leelanau
Lakeview


Leelanau County

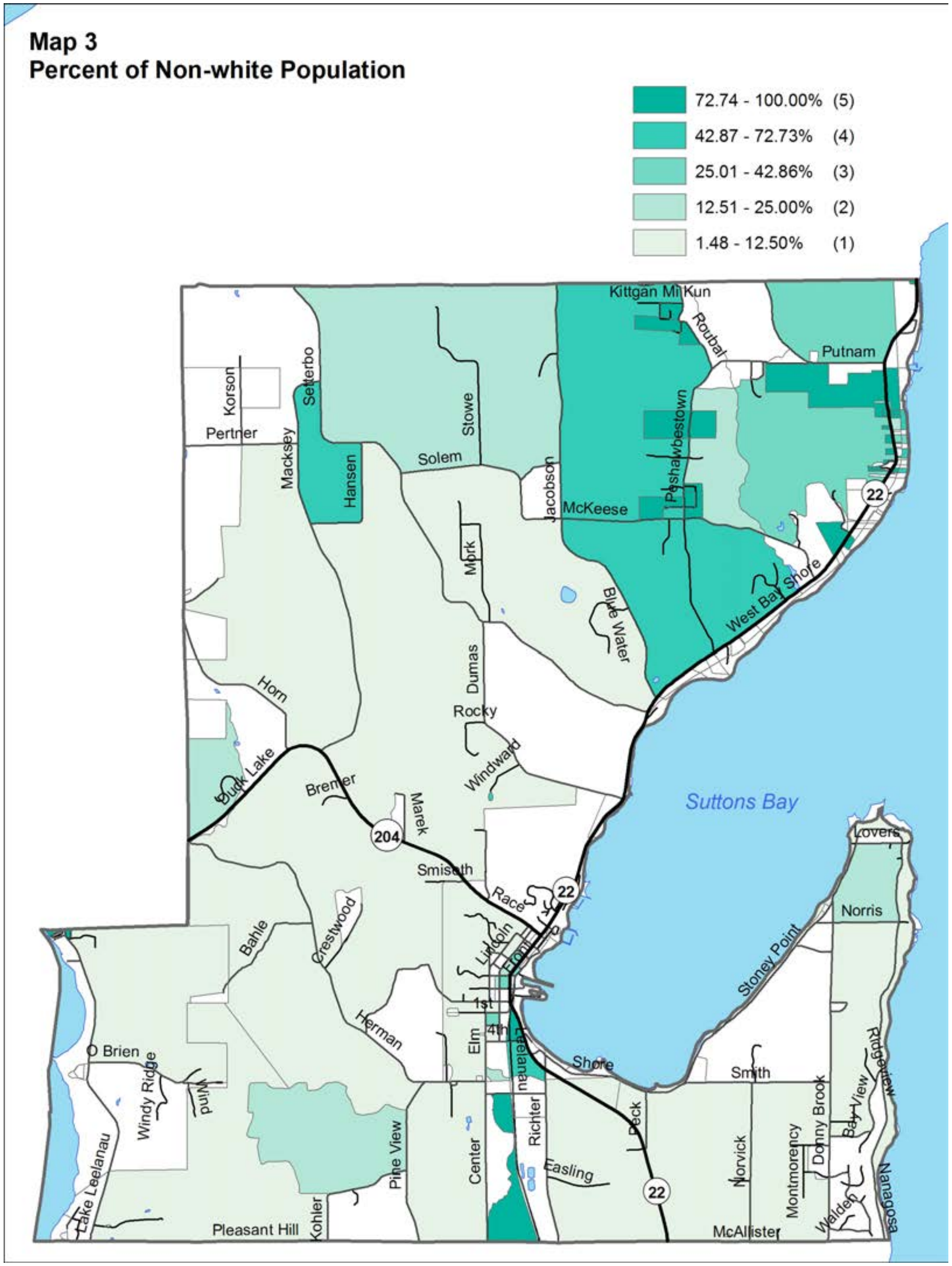
Suttons Bay Twp./ Suttons Bay

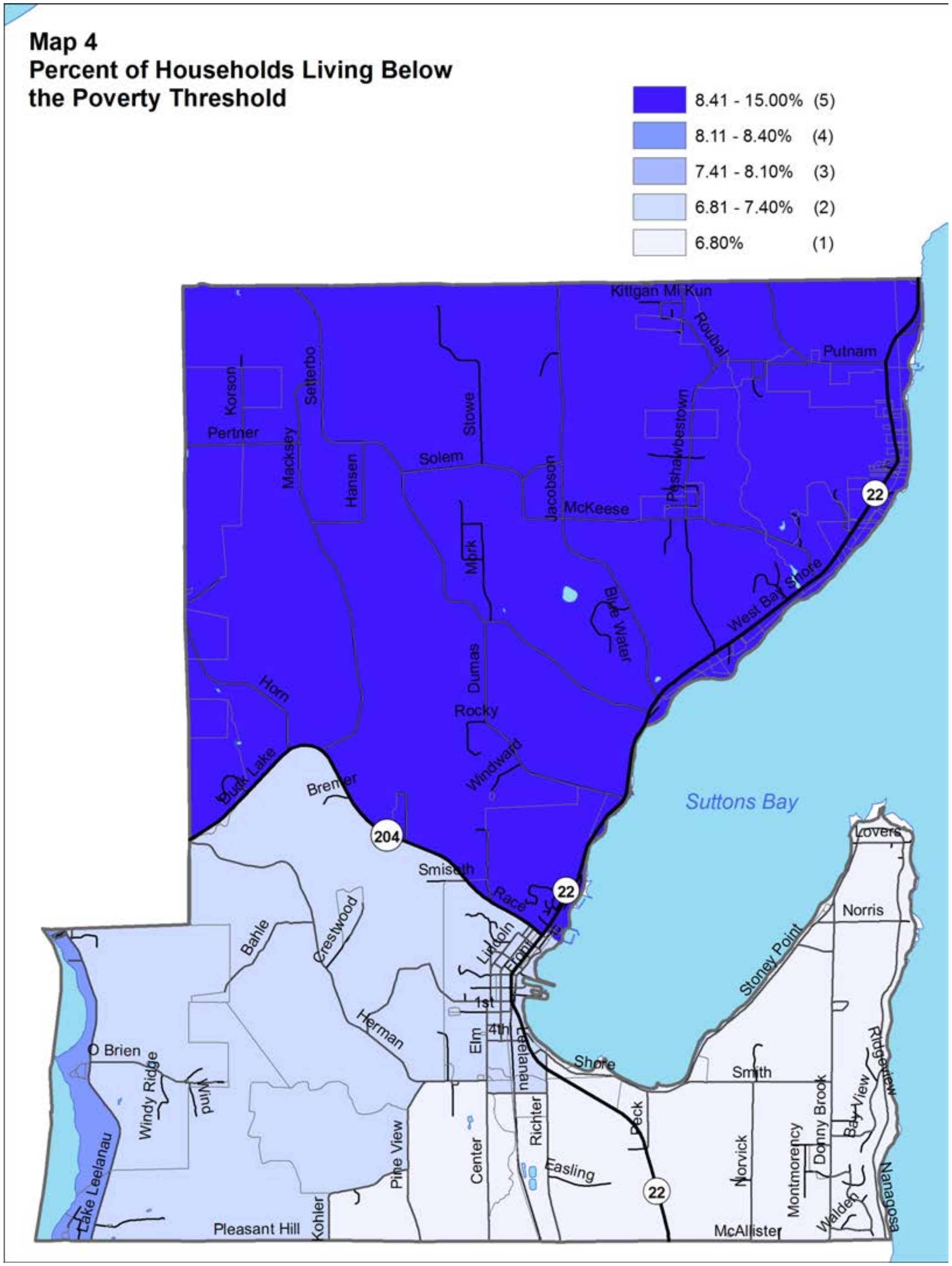



Map 2
Percent of Households with People Living Alone
75.01 - 100.00% (5)
42.87 - 75.00% (4)
26.68 - 42.86% (3)
16.68 - 26.67% (2)
4.17 - 16.67% (1)
Suttons Bay
Kittgan Mi Kun
Putnam
Korson
Pertner
Setterbo
Macksey
Hansen
Solem
Stowe
Jacobson
McKeese
Peshawbestown
Roubal
Mork
Blue Water
West Bay Shore
Dumas
Rocky
Horn
Windward
Duck Lake
Bremer
204
Smiseth
Race
22
Lovers
Norris
Stoney Point
Bahle
Creswood
Lincoln
1st
4th
Elm
Herman
Shore
O Brien
Windy Ridge
Wind
Smith
Ridgeview
Bay View
Donny Brook
Montmorency
Norvick
Richter
Easling
Center
Pine View
Lake Leelanau
Pleasant Hill
Kohler
McAllister
Walden
Nanagosa


Leelanau County

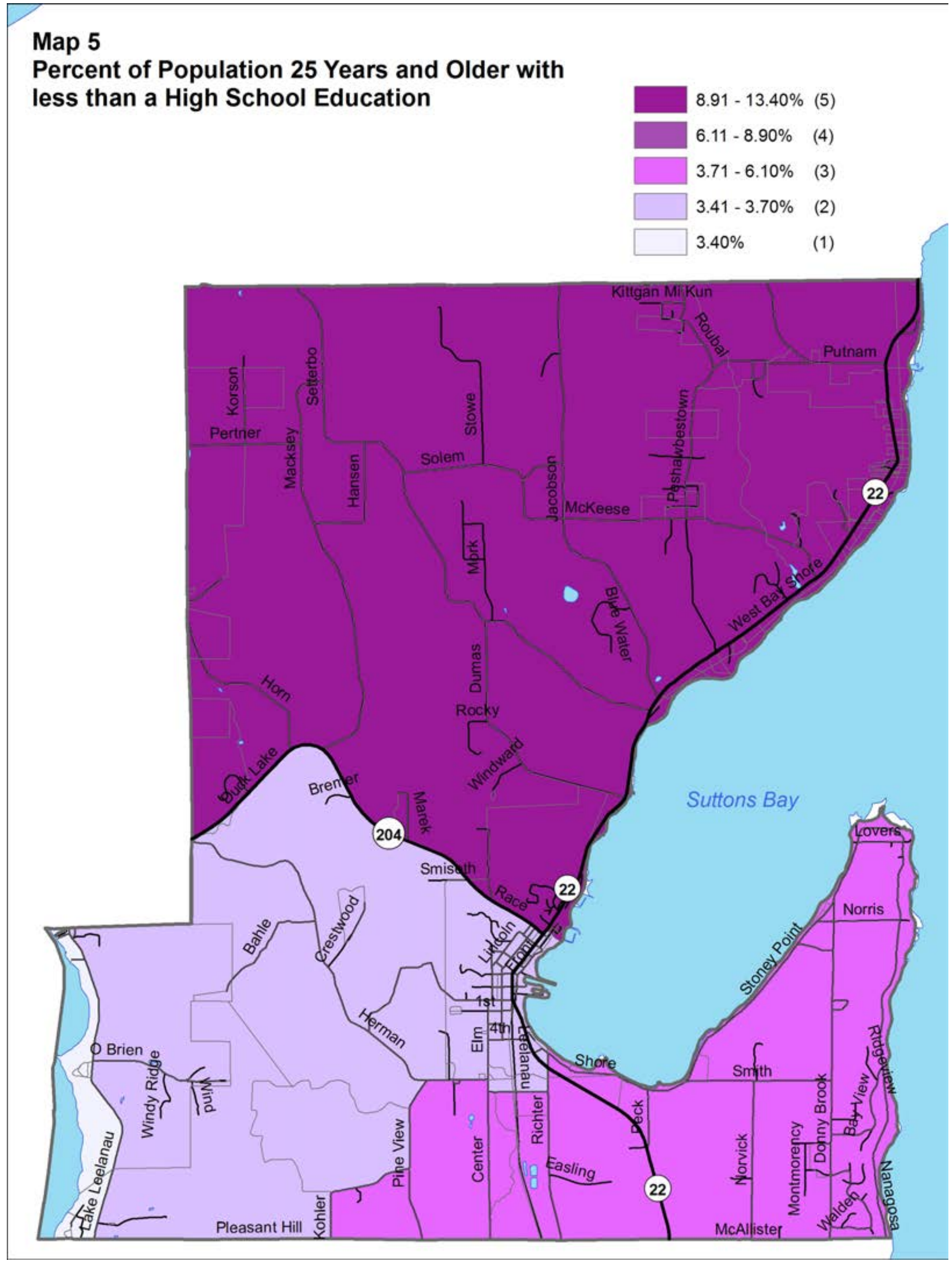

Leelanau County

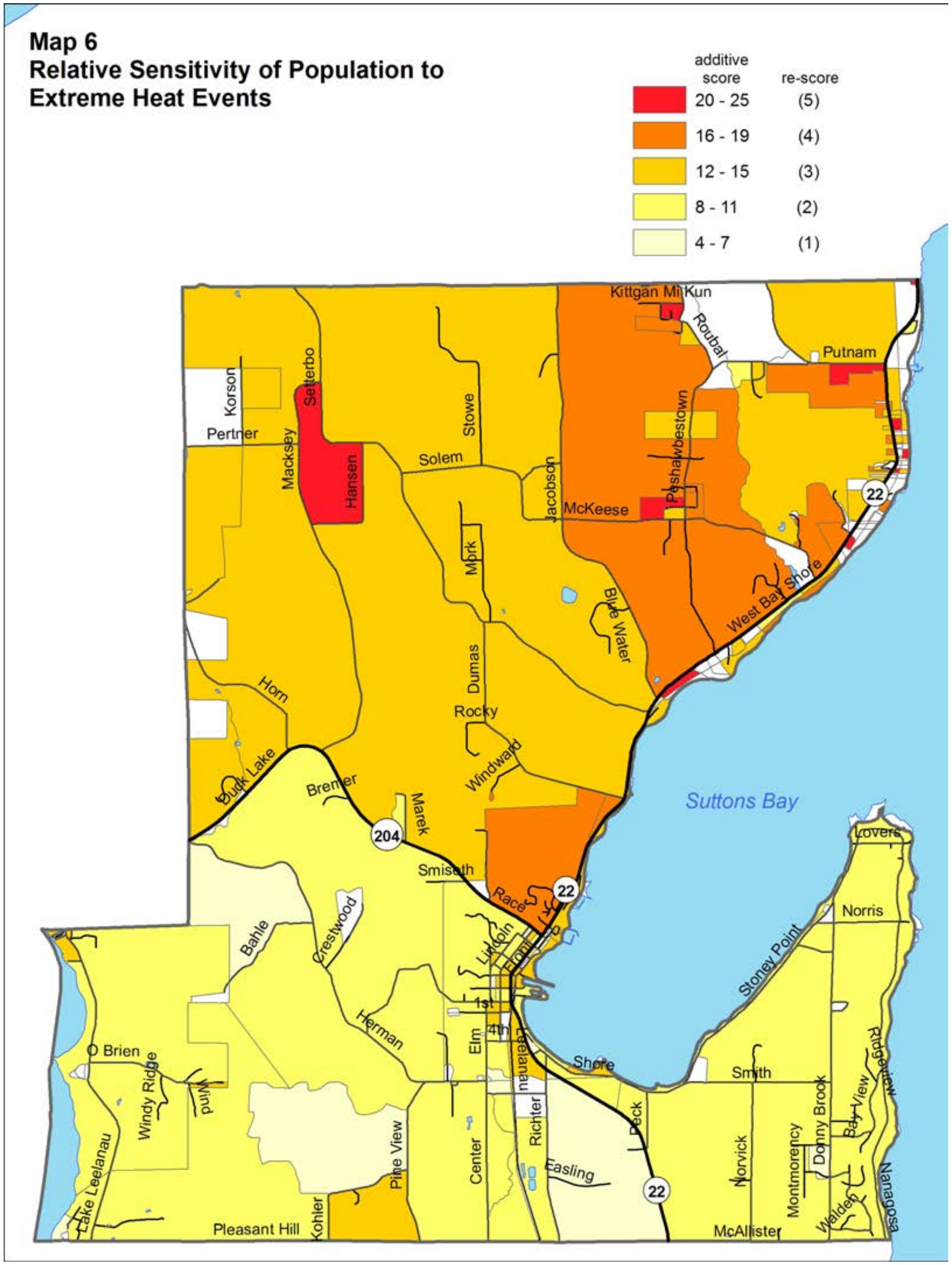

Map 3
Percent of Non-white Population
72.74 - 100.00% (5)
42.87 - 72.73% (4)
25.01 - 42.86% (3)
12.51 - 25.00% (2)
1.48 - 12.50% (1)
Suttons Bay
Kittgan Mi Kun
Roubal
Putnam
Korson
Setterbo
Stowe
Pertner
Macksey
Hansen
Solem
Jacobson
McKeese
Peshawbestown
Mork
Blue Water
West Bay Shore
Dumas
Horn
Rocky
Duck Lake
Windward
Bremer
Marek
Smiseth
Race
Lincoln
Front
Bahle
Crestwood
Herman
Elm
Leelanau
Shore
O Brien
Windy Ridge
Wind
Lake Leelanau
Pine View
Center
Richter
Easling
Peck
Norvick
Montmorency
Donny Brook
Bay View
Ridgeview
Nanagosa
Walden
Smith
McAllister
Pleasant Hill
Kohler
Stoney Point
Norris
Lovers
204
22


Map 4
Percent of Households Living Below the Poverty Threshold
8.41 - 15.00% (5)
8.11 - 8.40% (4)
7.41 - 8.10% (3)
6.81 - 7.40% (2)
6.80% (1)
Suttons Bay
Kitgan Mi Kun
Roubal
Putnam
Korson
Setterbo
Pertner
Mackey
Hansen
Stowe
Solem
Jacobson
McKeese
Peshawbestown
Mork
Blue Water
West Bay Shore
Dumas
Horn
Rocky
Windward
Duck Lake
Bremer
204
22
Smith
Race
Lincoln
Bahle
Crestwood
Herman
1st
4th
Elm
Leelanau
Shore
Lovers
Norris
Stoney Point
Smith
Ridgeview
Bay View
O Brien
Windy Ridge
Wind
Lake Leelanau
Pine View
Center
Richter
Easling
Peck
Norvick
Montmorency
Donny Brook
Walden
Nanagosa
McAllister
Pleasant Hill
Kohler


Leelanau County

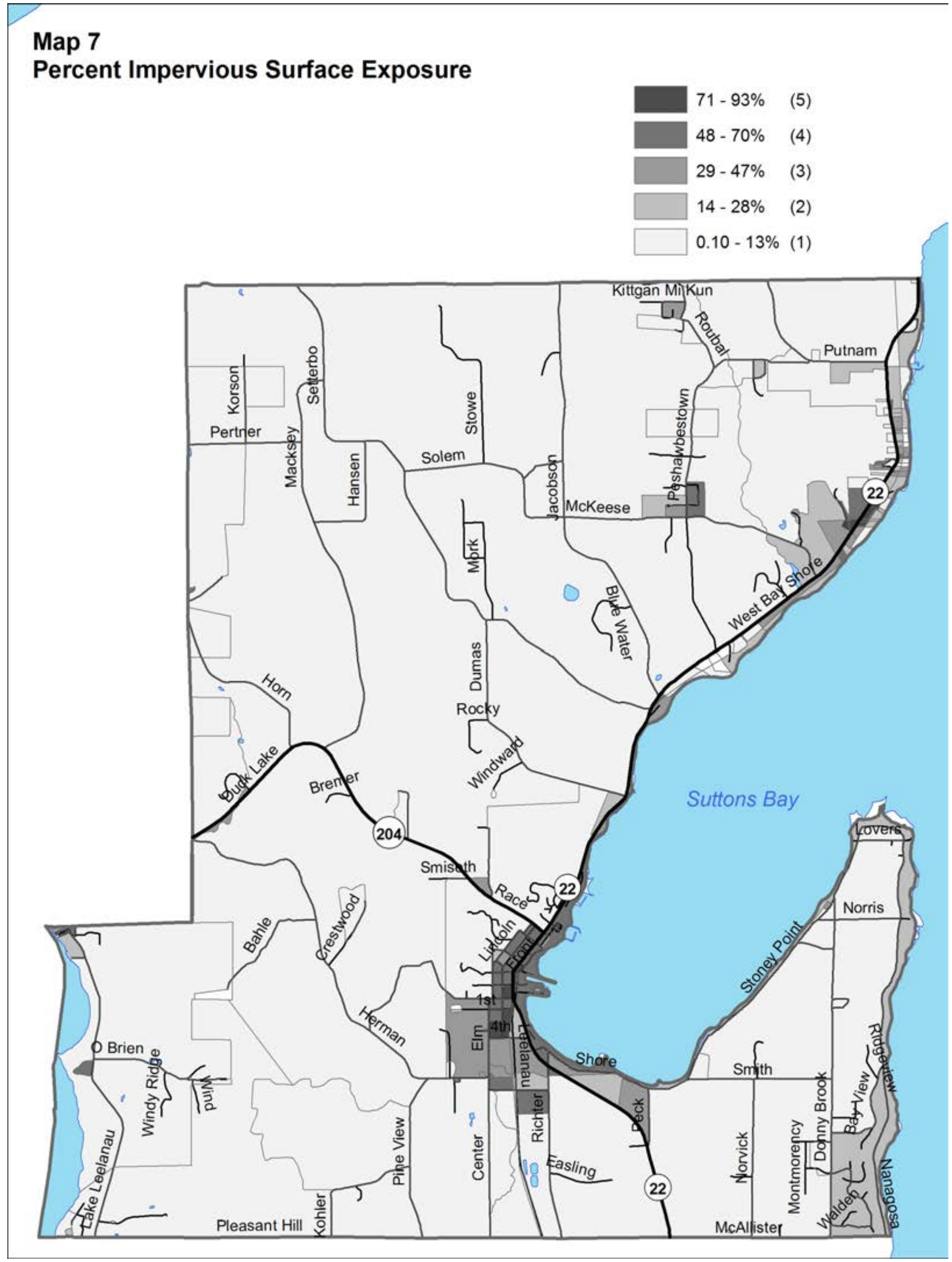

Leelanau County

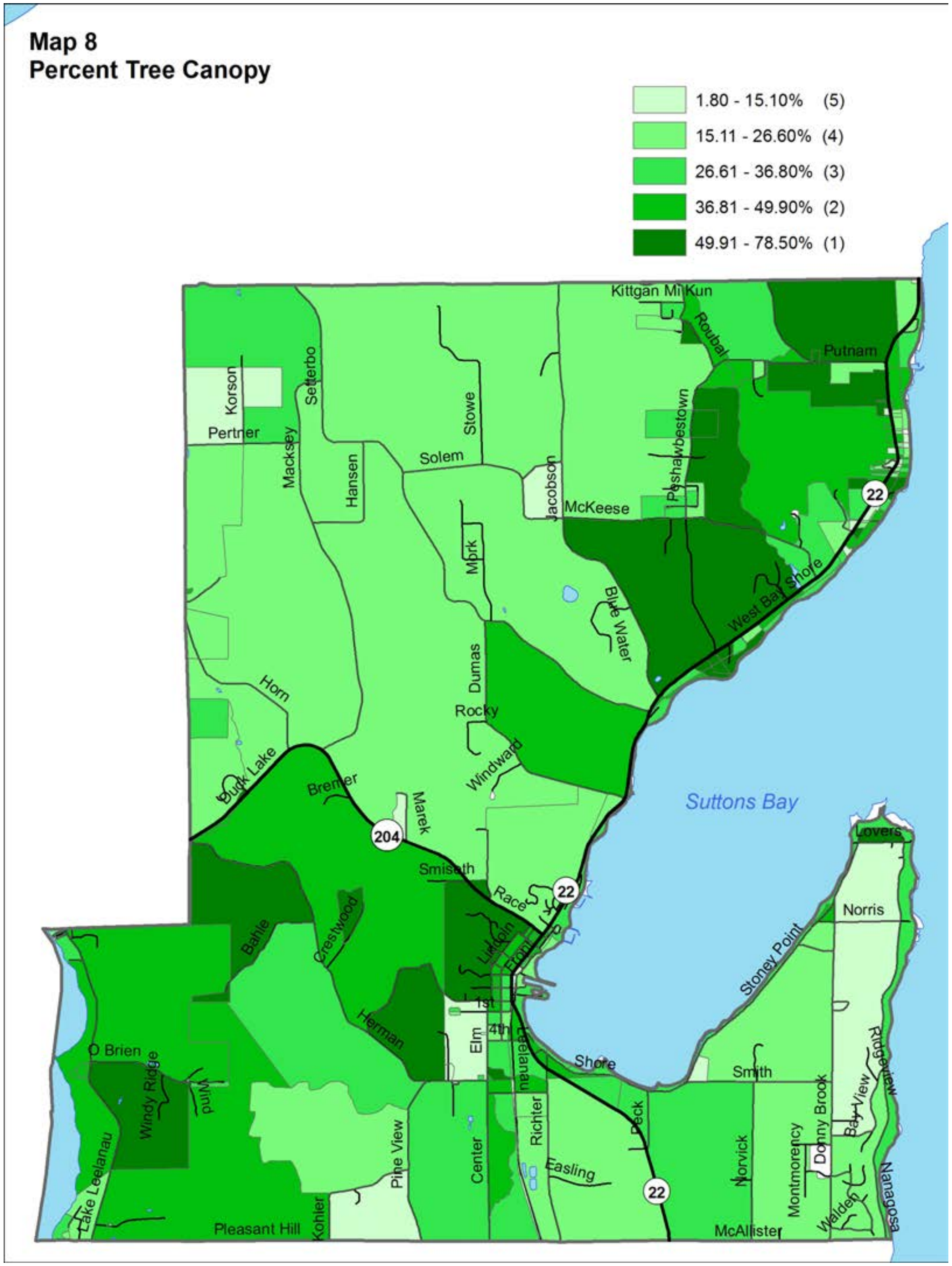

Map 5
Percent of Population 25 Years and Older with less than a High School Education
8.91 - 13.40% (5)
6.11 - 8.90% (4)
3.71 - 6.10% (3)
3.41 - 3.70% (2)
3.40% (1)
Suttons Bay
204
22


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
20 - 25 (5)
16 - 19 (4)
12 - 15 (3)
8 - 11 (2)
4 - 7 (1)
Suttons Bay
Kittgan Mi Kun
Roubal
Putnam
Korson
Setterbo
Pertner
Macksey
Hansen
Stowe
Solem
Jacobson
McKeese
Pashawbestown
Mork
Blue Water
West Bay Shore
Dumas
Rocky
Horn
Windward
Duck Lake
Bremer
Marek
204
Smiseth
Race
22
Lovers
Norris
Stoney Point
Bahle
Crestwood
Lincoln
1st
4th
Elm
Herman
Shore
O Brien
Windy Ridge
Wind
Lake Leelanau
Pine View
Center
Richter
Easling
Peck
Smith
Norvick
Montmorency
Donny Brook
Bay View
Ridgeview
Walden
Nanagosa
Pleasant Hill
Kohler
McAllister


Leelanau County

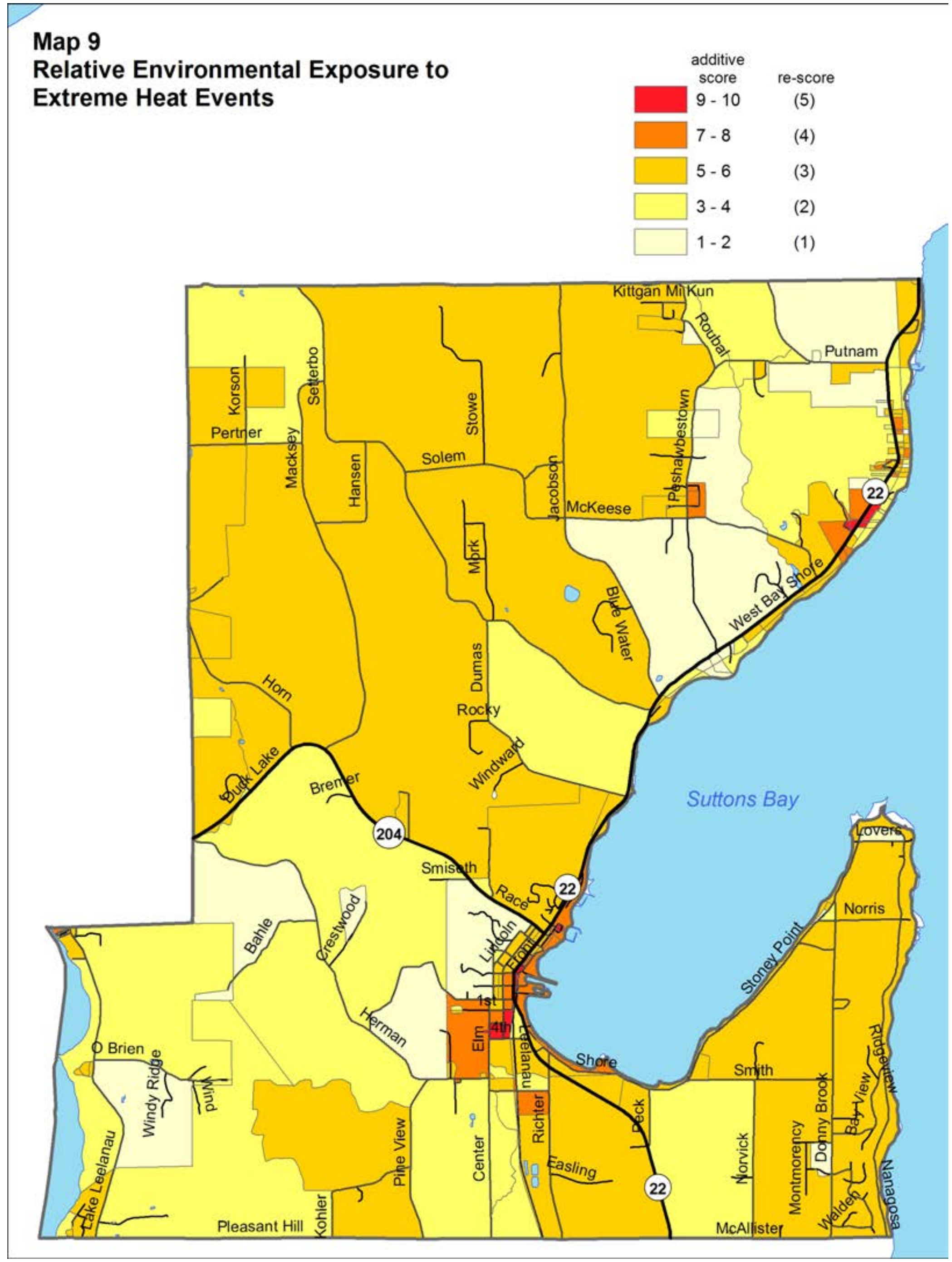

Leelanau County

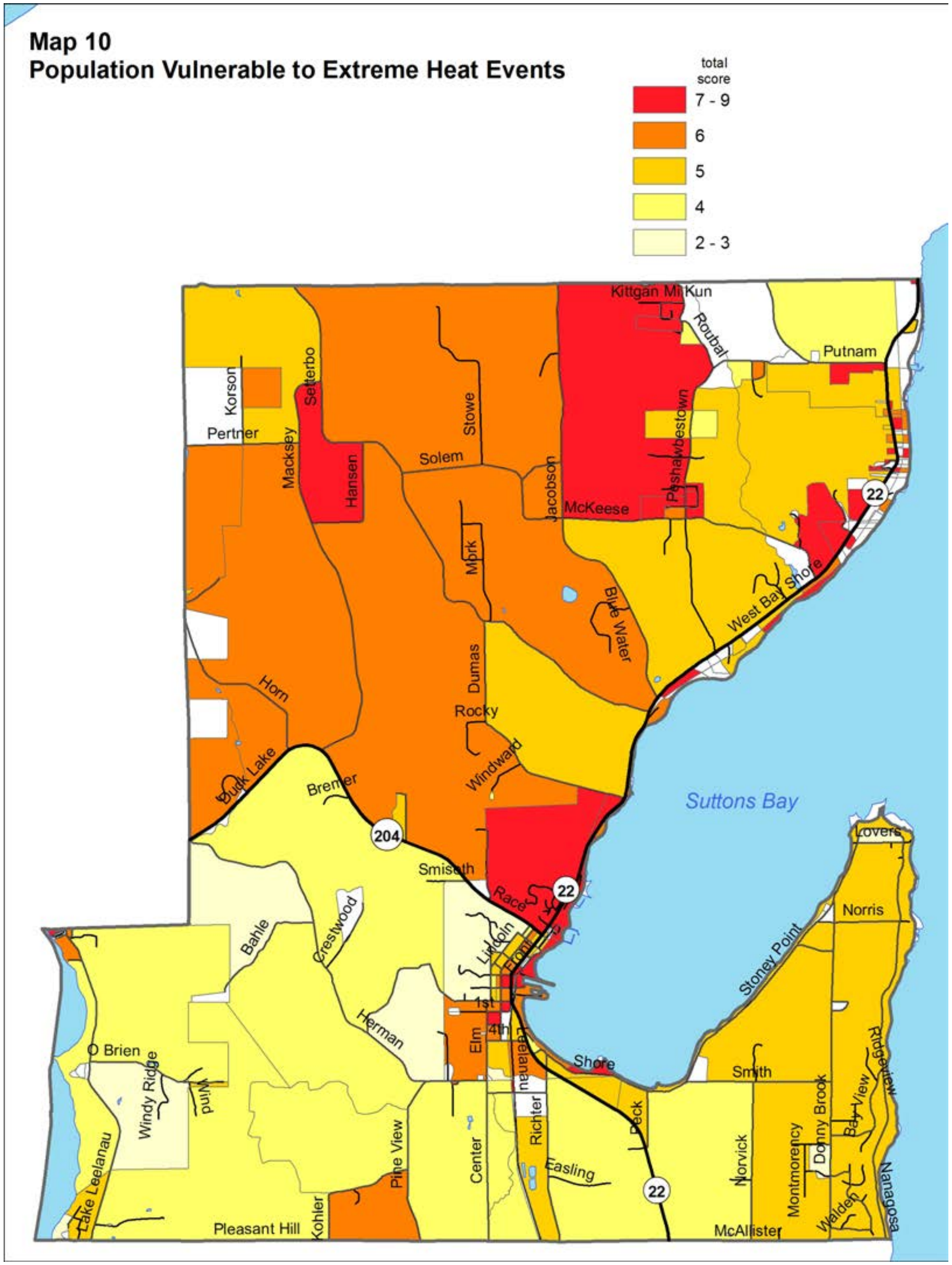

Map 7
Percent Impervious Surface Exposure
71 - 93% (5)
48 - 70% (4)
29 - 47% (3)
14 - 28% (2)
0.10 - 13% (1)
Suttons Bay
Kittgan Mi Kun
Putnam
Korson
Setterbo
Stowe
Pertner
Solem
Macksey
Hansen
Jacobson
McKeese
Peshawbestown
Mork
Blue Water
West Bay Shore
Dumas
Rocky
Horn
Duck Lake
Bremer
Windward
204
22
Smiseth
Race
Lincoln
Front
1st
4th
Elm
Leelanau
Bahle
Crestwood
Herman
Shore
Stoney Point
Lovers
Norris
O Brien
Windy Ridge
Wind
Pine View
Center
Richter
Easling
Peck
Smith
Norvick
Montmorency
Donny Brook
Bay View
Ridgeview
Walden
Nanagosa
Lake Leelanau
Pleasant Hill
Kohler
McAllister


Map 8
Percent Tree Canopy
1.80 - 15.10% (5)
15.11 - 26.60% (4)
26.61 - 36.80% (3)
36.81 - 49.90% (2)
49.91 - 78.50% (1)
Suttons Bay
Kittgan Mi Kun
Roubal
Putnam
Korson
Setterbo
Stowe
Pertner
Macksey
Hansen
Solem
Jacobson
McKeese
Peshawbestown
Mork
Blue Water
West Bay Shore
Dumas
Horn
Rocky
Windward
Duck Lake
Bremer
Marek
204
Smiseth
Race
22
Lovers
Norris
Stoney Point
Bahle
Crestwood
Lincoln
Front
Herman
1st
4th
Elm
Leelanau
Shore
Smith
Ridgeview
O Brien
Windy Ridge
Wind
Pine View
Center
Richter
Easling
Peck
Norvick
Montmorency
Donny Brook
Bay View
Walden
Nanagosa
Lake Leelanau
Pleasant Hill
Kohler
McAllister


Leelanau County

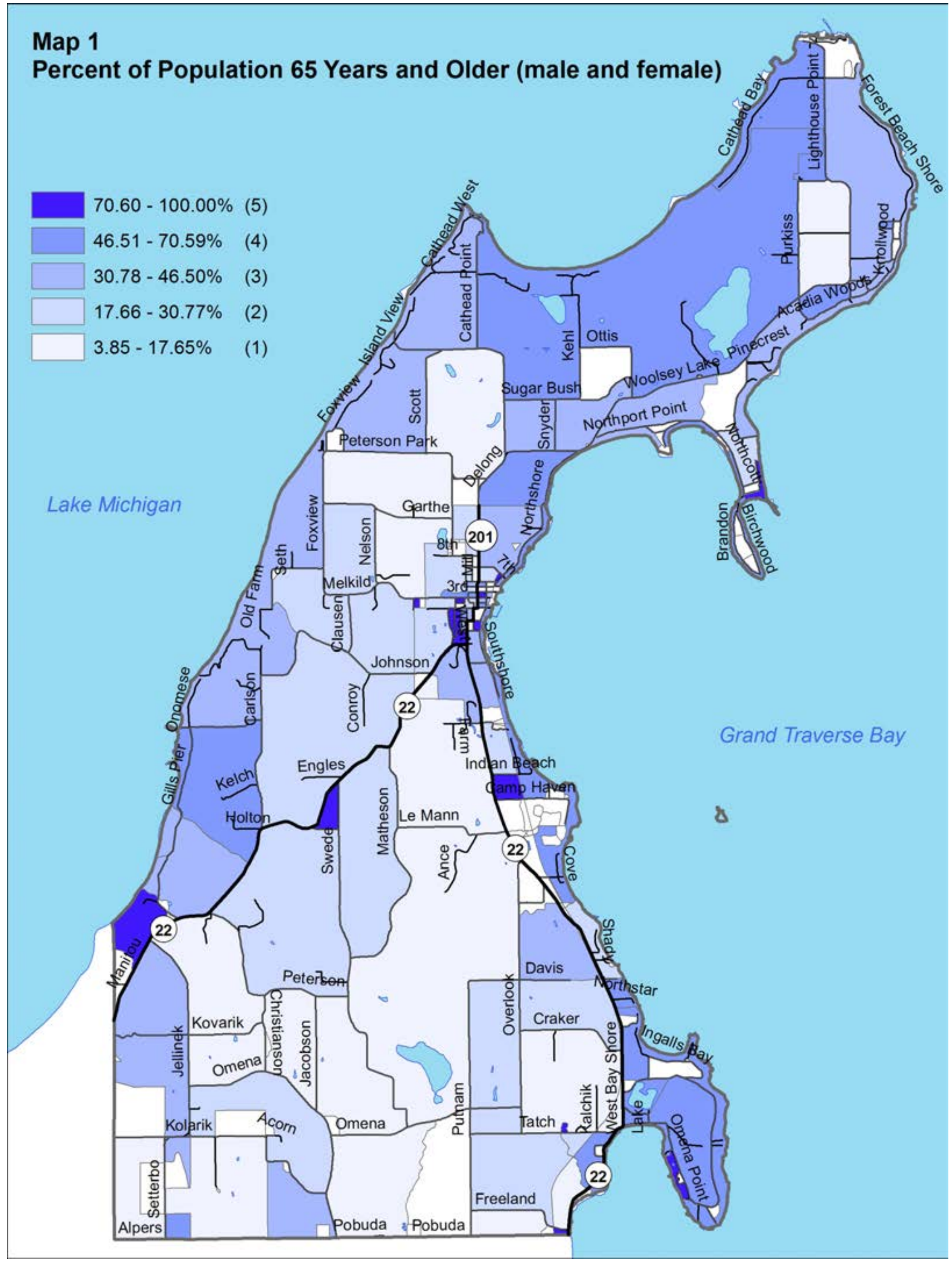

Leelanau County

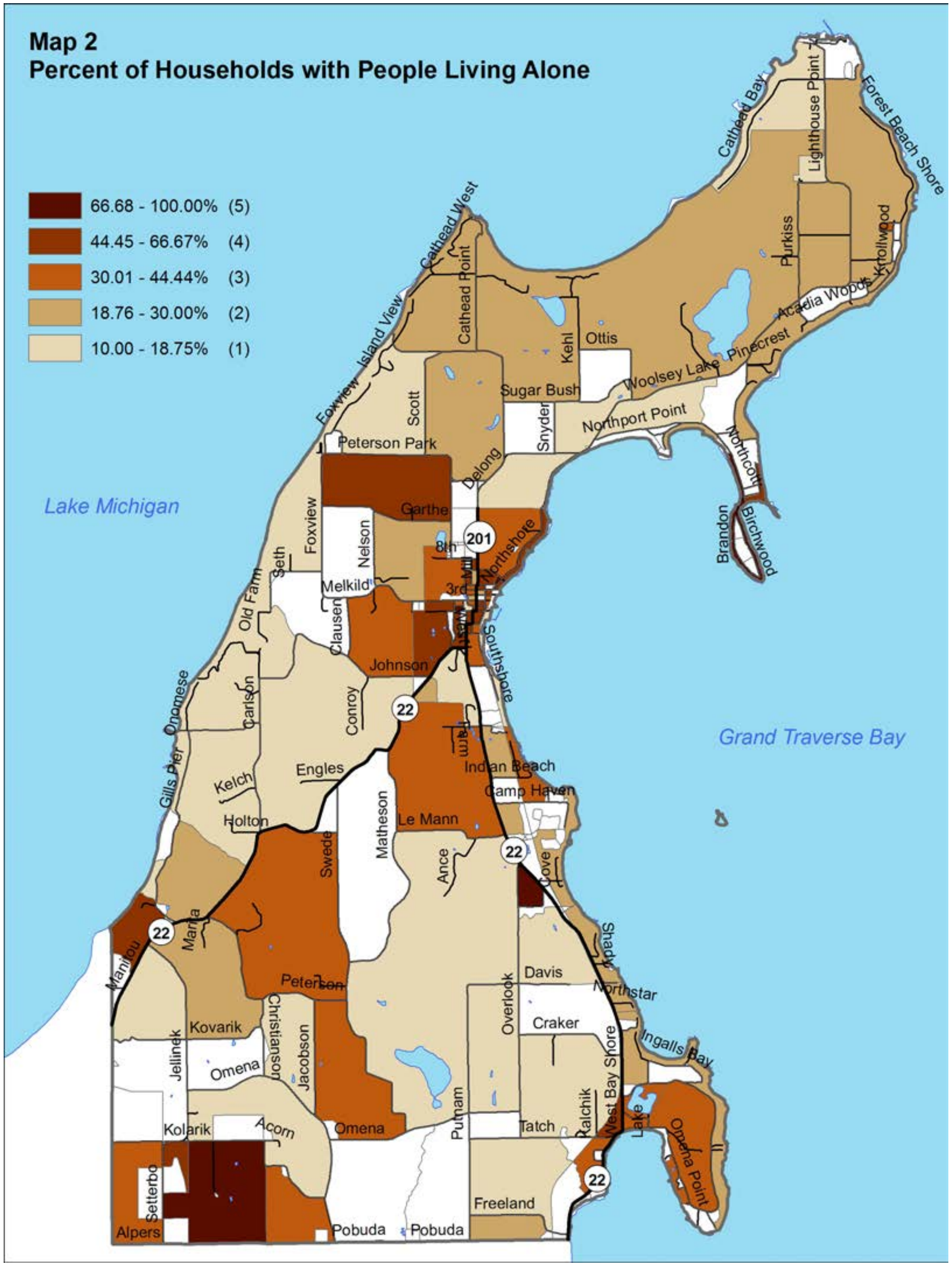

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
9 - 10 (5)
7 - 8 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
Suttons Bay
Kittgan Mi Kun
Putnam
Korson
Pertner
Setterbo
Macksey
Hansen
Stowe
Solem
Jacobson
McKeese
Mork
Blue Water
West Bay Shore
Dumas
Rocky
Windward
Horn
Duck Lake
Bremer
Smiseth
Race
Crestwood
Bahle
Lincoln
Front
Herman
Elm
4th
1st
Leelanau
Shore
Stoney Point
Norris
Lovers
Smith
O Brien
Windy Ridge
Wind
Lake Leelanau
Pine View
Center
Richter
Easling
Peck
Norvick
Montmorency
Donny Brook
Bay View
Ridgeview
Walden
Nanagosa
McAllister
Pleasant Hill
Kohler
204
22


Map 10
Population Vulnerable to Extreme Heat Events
total score
7 - 9
6
5
4
2 - 3
Kittgan Mi Kun
Roubal
Putnam
Korson
Setterbo
Pertner
Stowe
Solem
Macksey
Hansen
Jacobson
McKeese
Peshawbestown
Mork
Blue Water
West Bay Shore
Dumas
Horn
Rocky
Duck Lake
Windward
Bremer
Suttons Bay
204
22
Smiseth
Race
Lovers
Norris
Bahle
Crestwood
Lincoln
Front
1st
4th
Herman
Stoney Point
Elm
Leelanau
Shore
O Brien
Windy Ridge
Wind
Smith
Ridgeview
Bay View
Donny Brook
Montmorency
Norvick
Peck
Richter
Easling
Center
Pine View
Lake Leelanau
Pleasant Hill
Kohler
McAllister
Walden
Nanagosa

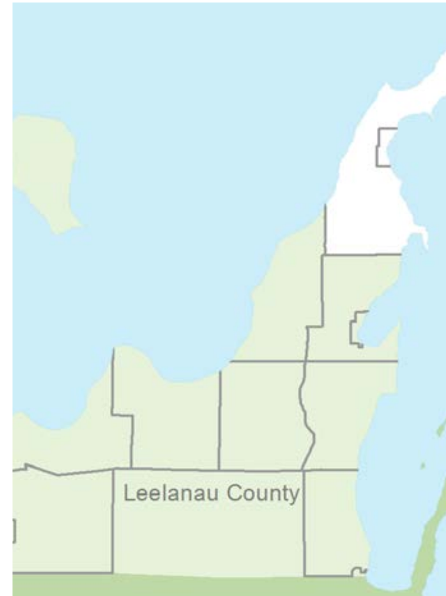

Leelanau County

Leelanau Twp./ Northport

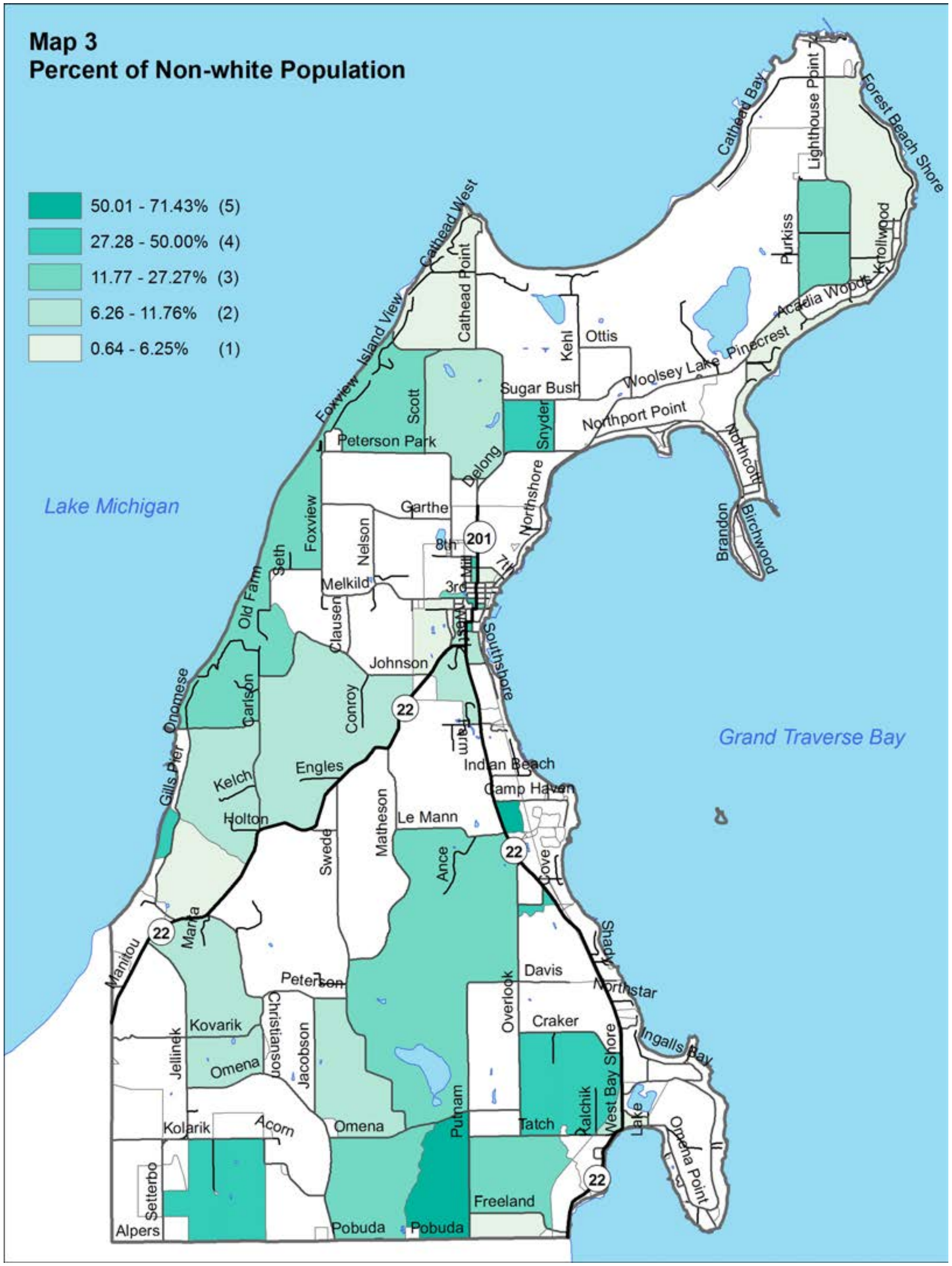


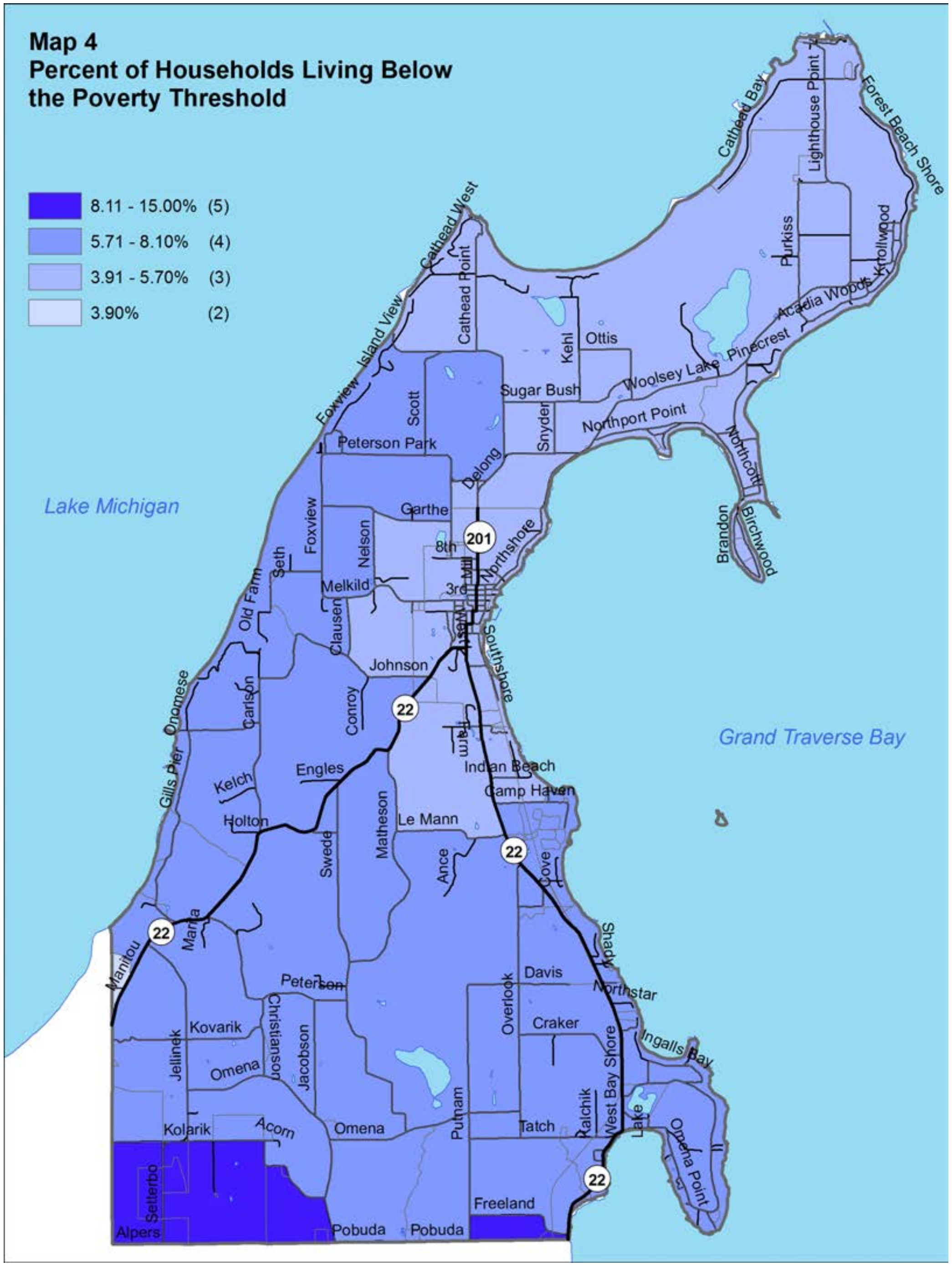


Map 2
Percent of Households with People Living Alone



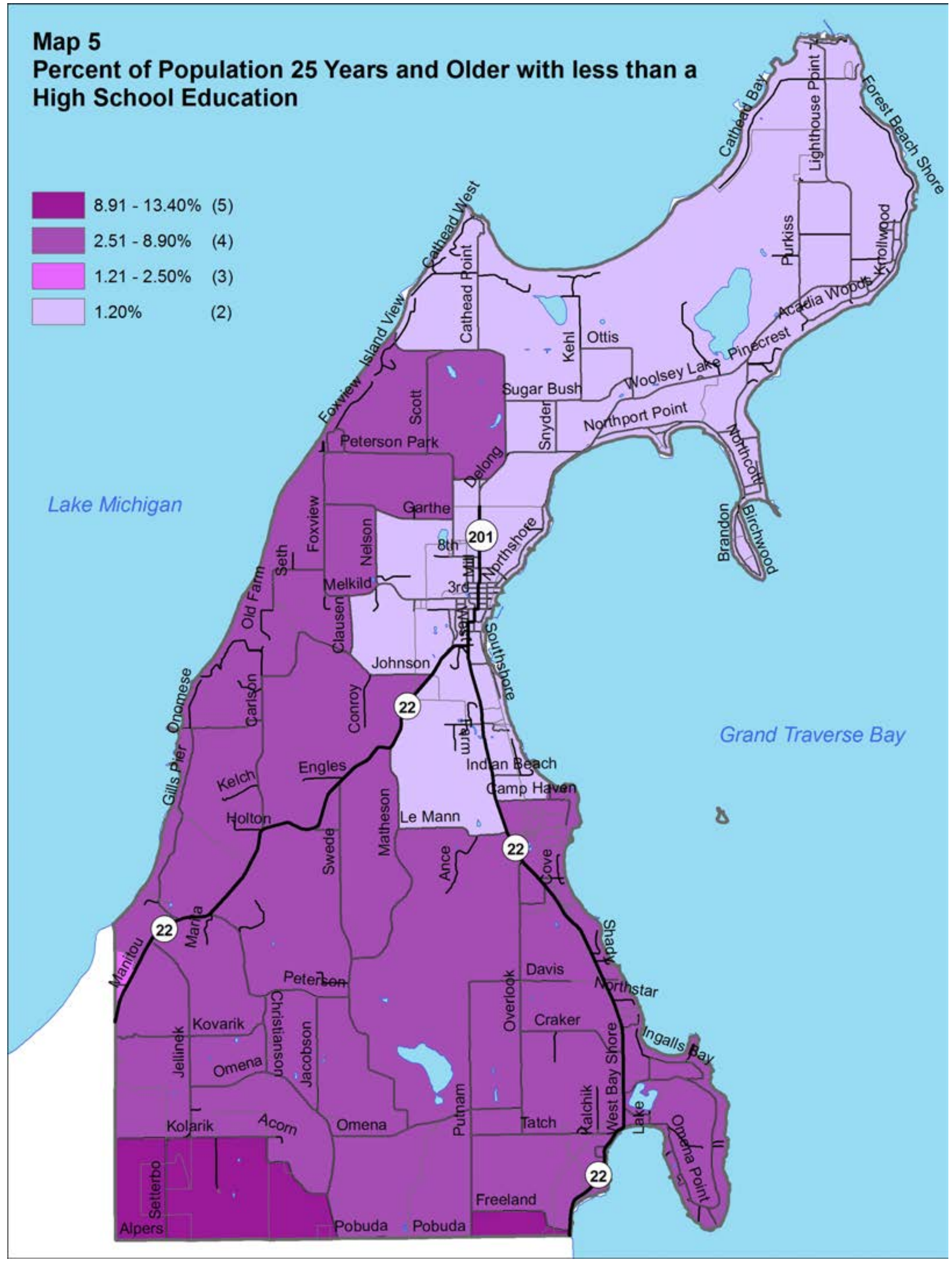

Leelanau County

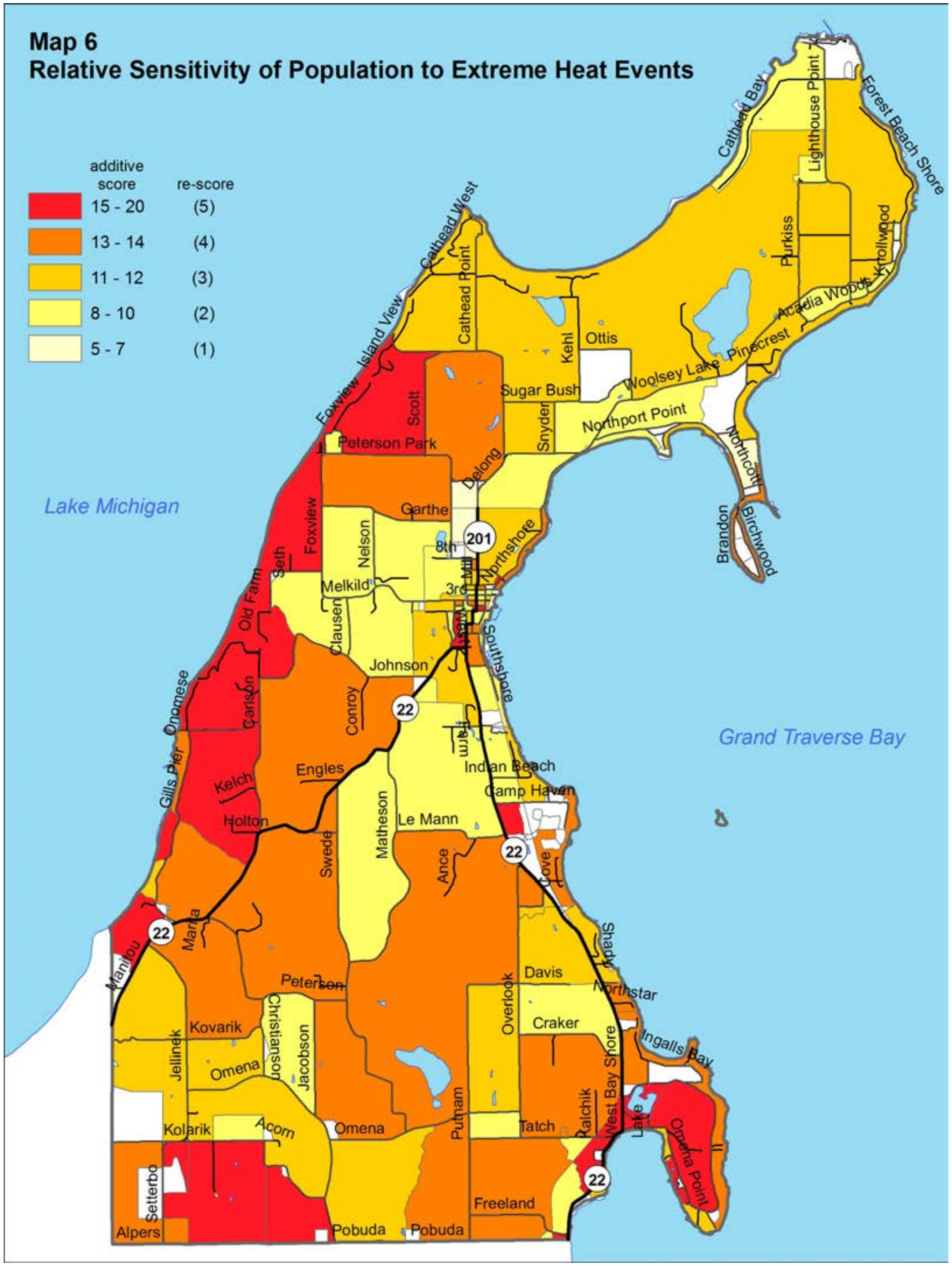

Map 3
Percent of Non-white Population
50.01 - 71.43% (5)
27.28 - 50.00% (4)
11.77 - 27.27% (3)
6.26 - 11.76% (2)
0.64 - 6.25% (1)
Lake Michigan
Grand Traverse Bay

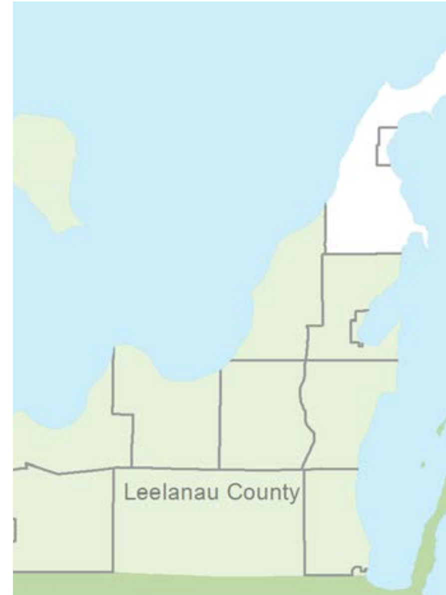

Map 4
Percent of Households Living Below the Poverty Threshold
8.11 - 15.00% (5)
5.71 - 8.10% (4)
3.91 - 5.70% (3)
3.90% (2)
Lake Michigan
Grand Traverse Bay


Leelanau County

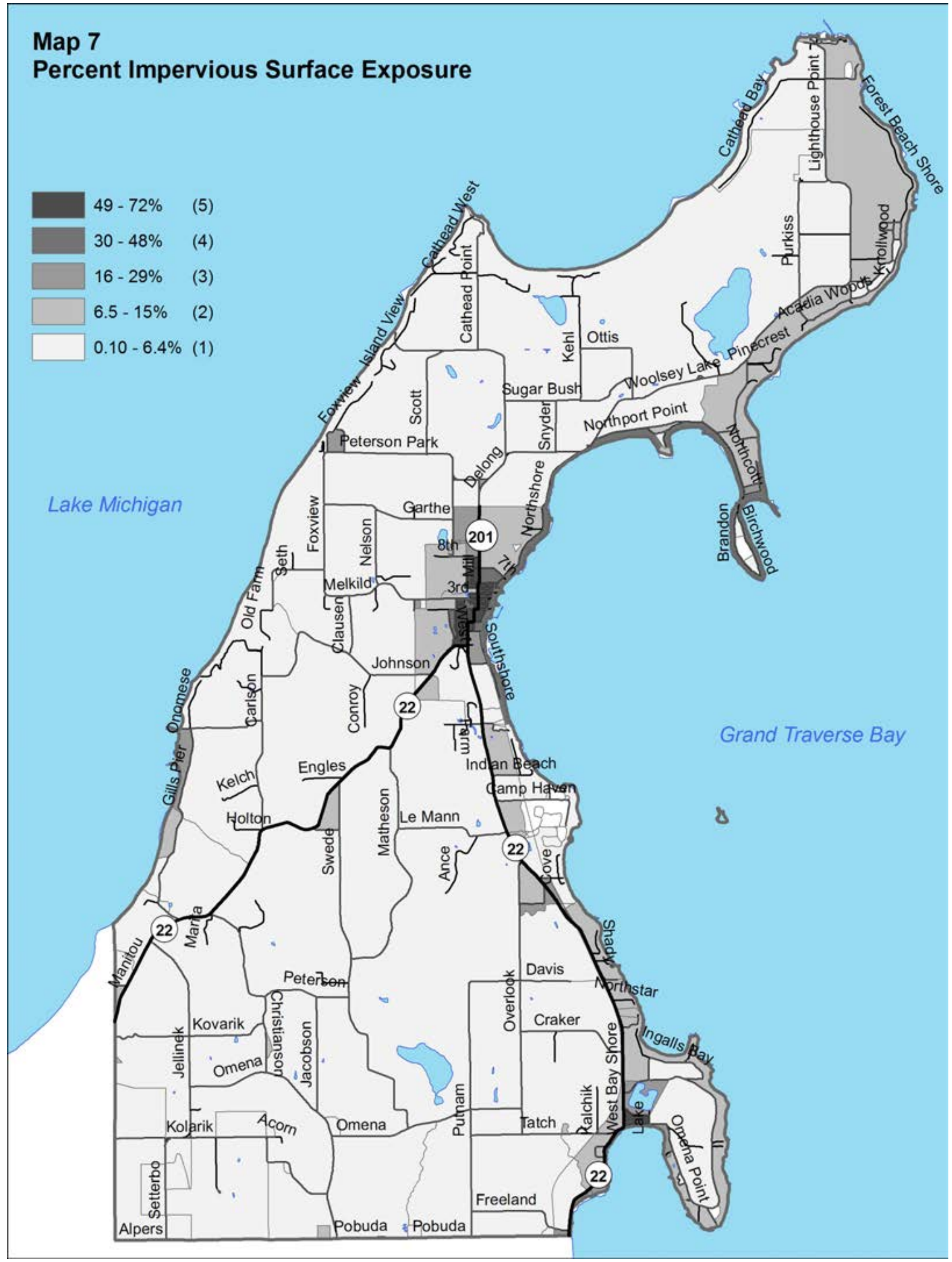

Leelanau County

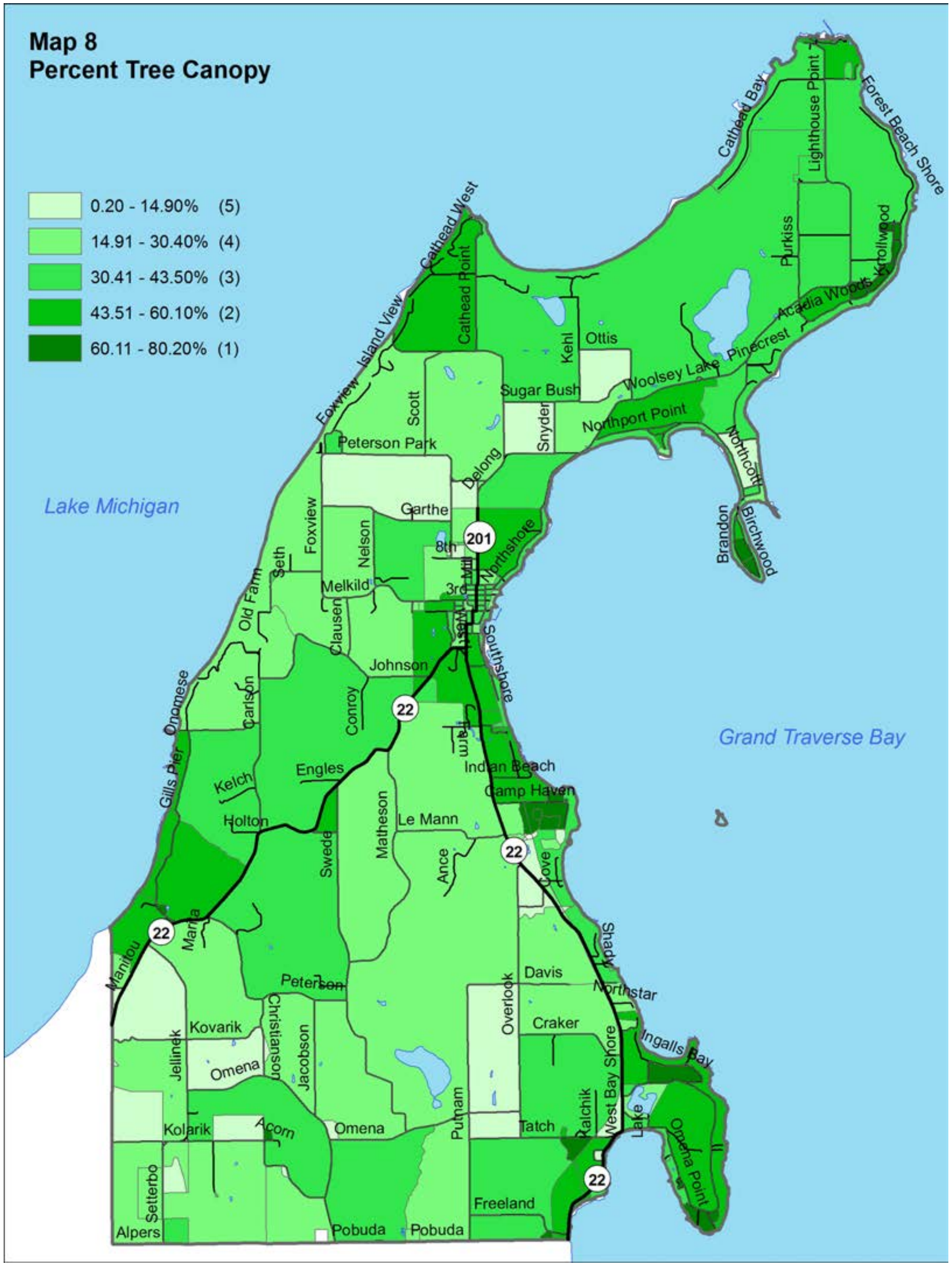

Map 5
Percent of Population 25 Years and Older with less than a High School Education
8.91 - 13.40% (5)
2.51 - 8.90% (4)
1.21 - 2.50% (3)
1.20% (2)
Lake Michigan
Grand Traverse Bay
Cathead Bay
Lighthouse Point
Forest Beach Shore
Cathead West
Cathead Point
Purkiss
Knollwood
Acadia Woods
Pinecrest
Woolsey Lake
Ottis
Kehl
Sugar Bush
Snyder
Northport Point
Northcott
Brandon
Birchwood
Island View
Foxview
Scott
Peterson Park
Delong
Garthe
Foxview
Seth
Nelson
8th
Northshore
Old Farm
Melkild
3rd
Clausen
Southshore
Johnson
Carlson
Conroy
Onomese
Gills Pier
Kelch
Engles
Indian Beach
Camp Haven
Holton
Le Mann
Matheson
Swede
Ance
Cove
Maria
Manitou
Shady
Davis
Northstar
Peterson
Overlook
Craker
Ingalls Bay
Kovarik
Christianson
Jellinek
Omena
Jacobson
West Bay Shore
Kolarik
Acorn
Omena
Putnam
Tatch
Kalchik
Lake
Omena Point
Setterbo
Alpers
Pobuda
Pobuda
Freeland
201
22


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
15 - 20 (5)
13 - 14 (4)
11 - 12 (3)
8 - 10 (2)
5 - 7 (1)
Lake Michigan
Grand Traverse Bay


Leelanau County

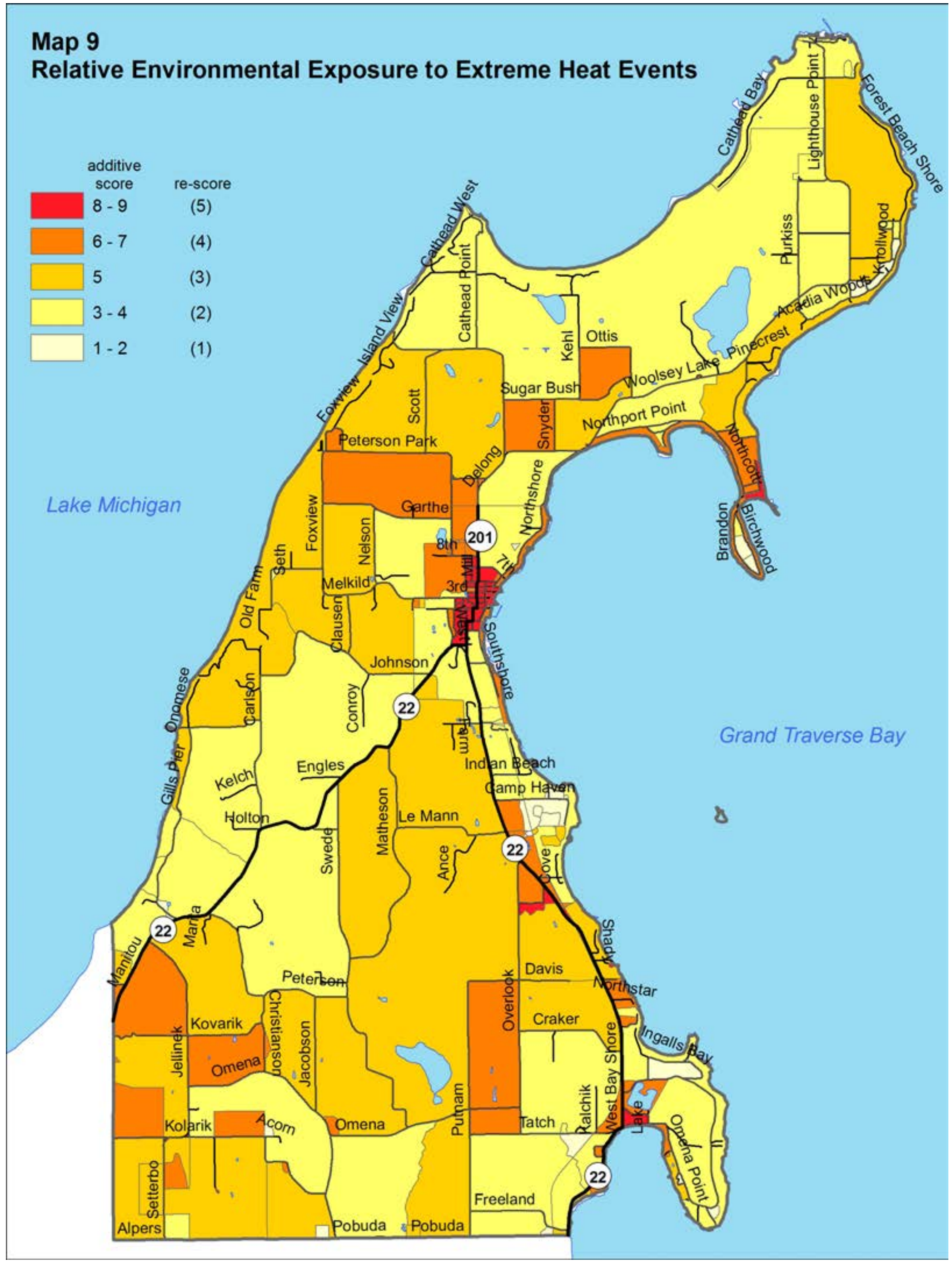

Leelanau County

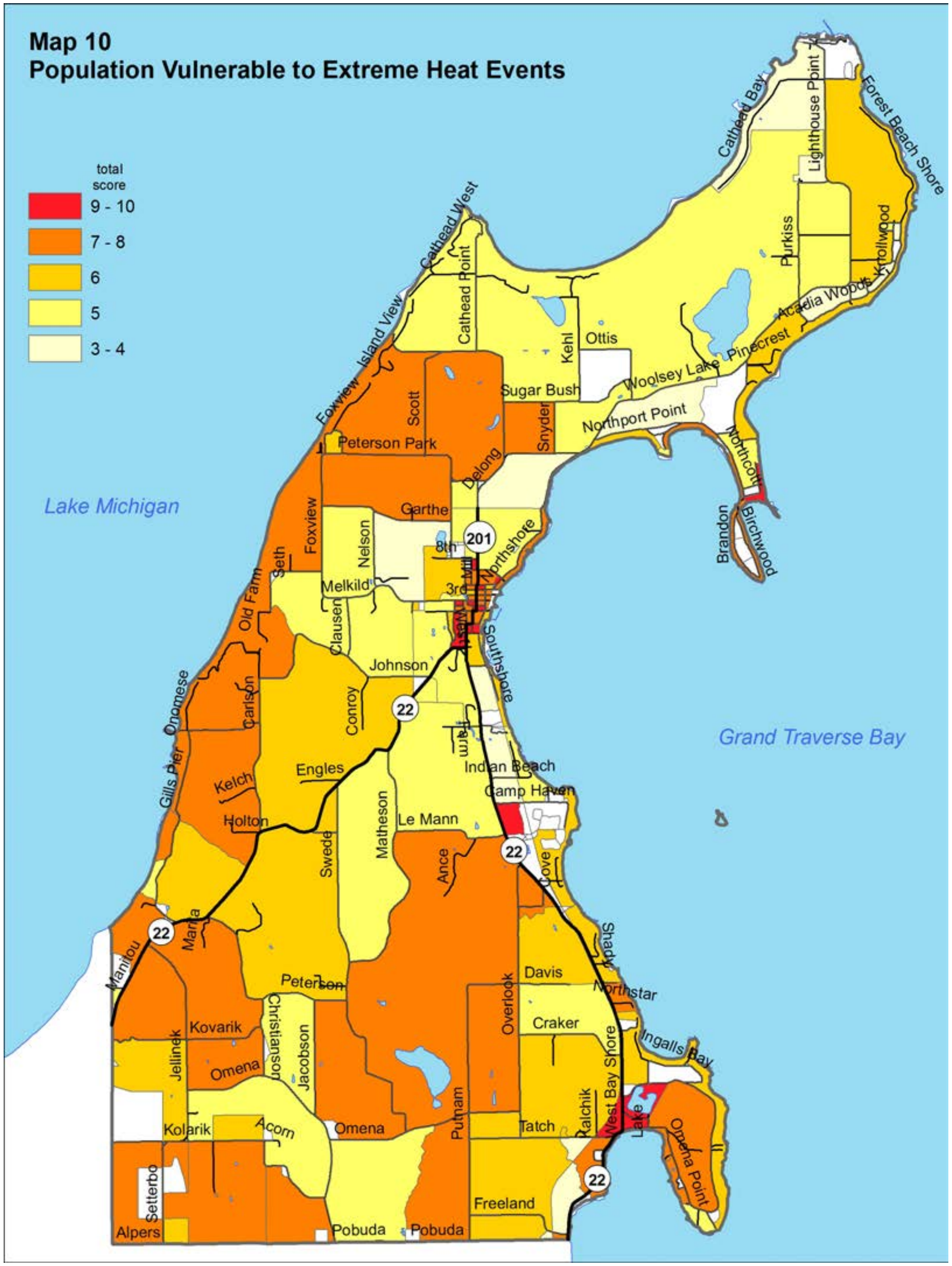

Map 7
Percent Impervious Surface Exposure
49 - 72% (5)
30 - 48% (4)
16 - 29% (3)
6.5 - 15% (2)
0.10 - 6.4% (1)
Lake Michigan
Grand Traverse Bay
Cathead Bay
Lighthouse Point
Forest Beach Shore
Cathead West
Cathead Point
Island View
Foxview
Purkiss
Knollwood
Acadia Woods
Pinecrest
Woolsey Lake
Ottis
Kehl
Sugar Bush
Northport Point
Scott
Snyder
Peterson Park
Delong
Northshore
Northcott
Birchwood
Brandon
Garthe
201
8th
7th
3rd
Mill
Nelson
Foxview
Seth
Melkild
Old Farm
Clausen
Southshore
Johnson
Conroy
Carlson
22
Onomese
Gills Pier
Kelch
Engles
Holton
Swede
Matheson
Le Mann
Indian Beach
Camp Haven
Ance
Cove
Manitou
Maria
Shady
Northstar
Davis
Craker
Ingalls Bay
Overlook
Peterson
Kovarik
Christianson
Jacobson
Jellinek
Omena
Kolarik
Acorn
Putnam
Tatch
Kalchik
West Bay Shore
Lake
Omena Point
Freeland
Setterbo
Alpers
Pobuda

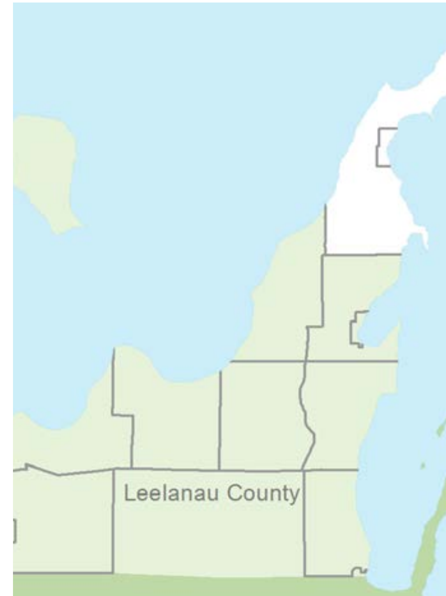

Map 8
Percent Tree Canopy
0.20 - 14.90% (5)
14.91 - 30.40% (4)
30.41 - 43.50% (3)
43.51 - 60.10% (2)
60.11 - 80.20% (1)
Lake Michigan
Grand Traverse Bay


Leelanau County


Leelanau County

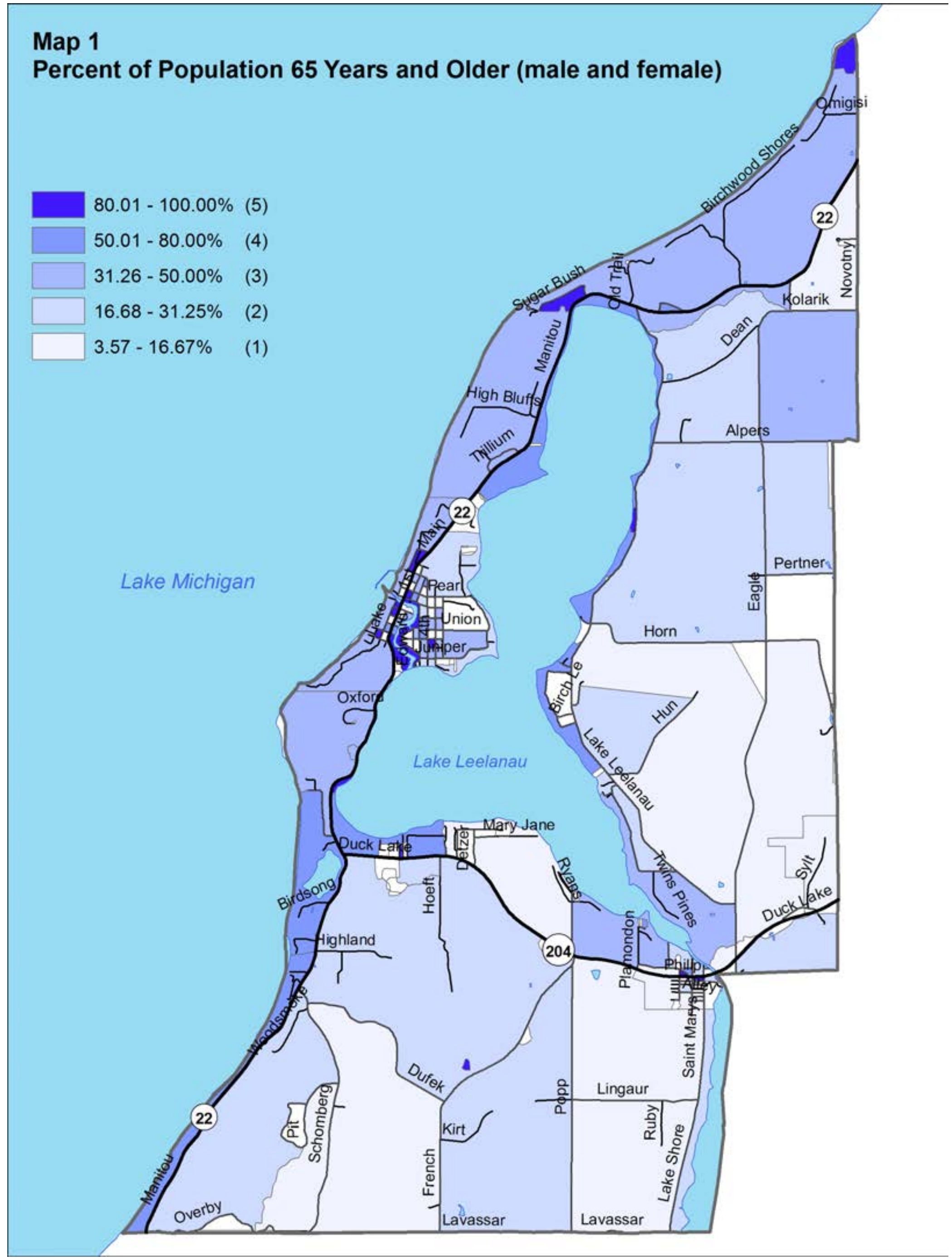

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
8 - 9 (5)
6 - 7 (4)
5 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
Grand Traverse Bay
Cathead Bay
Lighthouse Point
Forest Beach Shore
Cathead West
Cathead Point
Island View
Foxview
Kehl
Ottis
Purkiss
Knollwood
Acadia Woods
Pinecrest
Woolsey Lake
Sugar Bush
Northport Point
Scott
Snyder
Peterson Park
Delong
Northshore
Northcott
Birchwood
Brandon
Garthe
201
8th
Nelson
Seth
Melkild
3rd
Old Farm
Clausen
Southshore
Johnson
Conroy
22
Carlson
Onomese
Gills Pier
Kelch
Engles
Holton
Indian Beach
Camp Haven
Le Mann
Matheson
Swede
Ance
Cove
Shady
Davis
Northstar
Manitou
Marra
Peterson
Kovarik
Christianson
Jacobson
Omena
Overlook
Craker
Ingalls Bay
Jellinek
Kolarik
Acorn
Putnam
Tatch
Ralchik
West Bay Shore
Lake
Omena Point
Setterbo
Alpers
Pobuda
Freeland

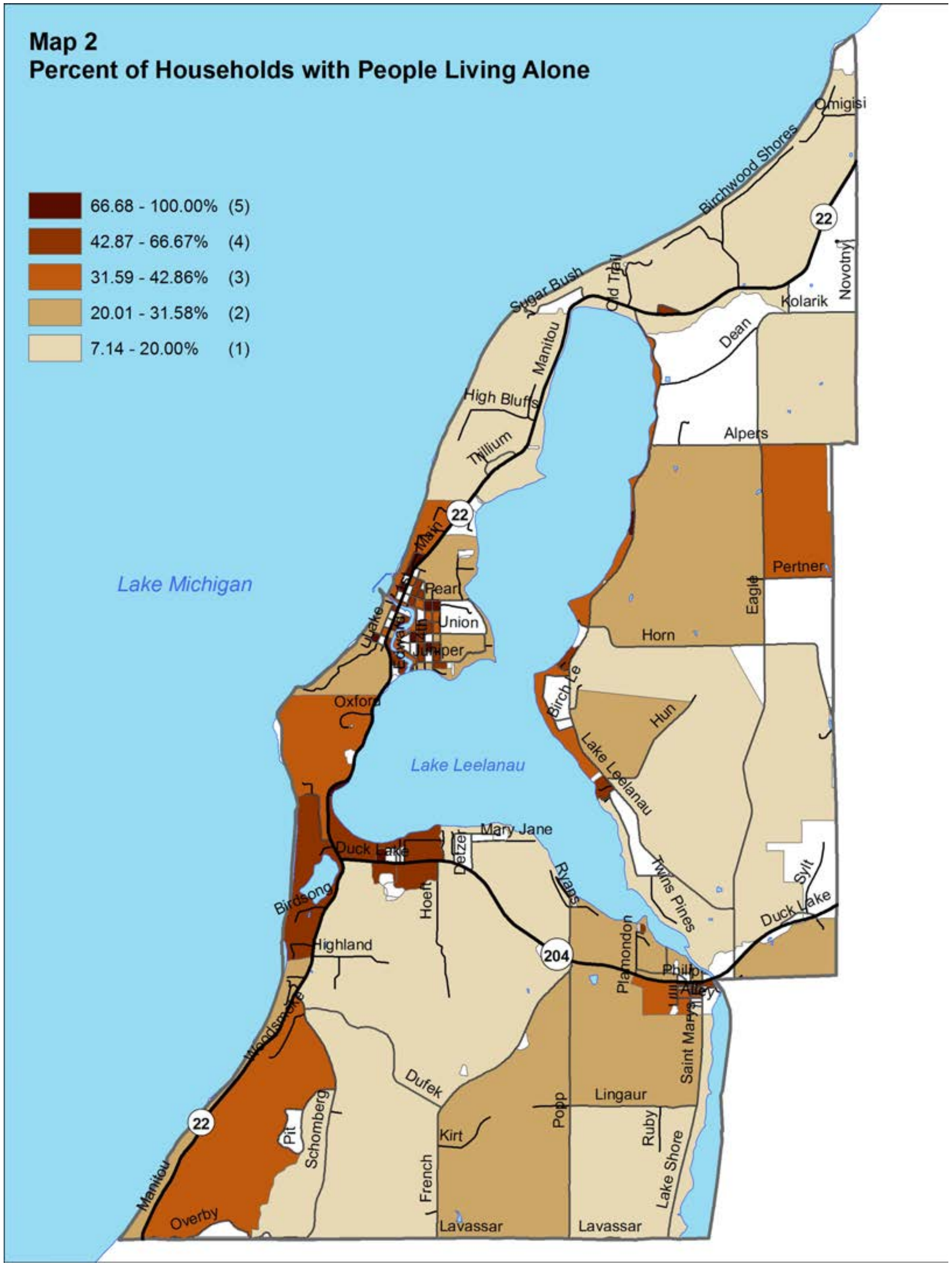

Map 10
Population Vulnerable to Extreme Heat Events
total score
9 - 10
7 - 8
6
5
3 - 4
Lake Michigan
Grand Traverse Bay
Cathead Bay
Lighthouse Point
Forest Beach Shore
Cathead West
Cathead Point
Purkiss
Kolliwood
Acadia Woods
Pinecrest
Woolsey Lake
Ottis
Kehl
Sugar Bush
Northport Point
Northcott
Birchwood
Brandon
Foxview Island View
Scott
Peterson Park
Snyder
Delong
Garthe
8th
201
Northshore
3rd
Nelson
Foxview
Seth
Melkild
Old Farm
Clausen
Southshore
Johnson
Onomese
Carlson
Conroy
22
Gills Pier
Kelch
Engles
Indian Beach
Camp Haven
Holton
Le Mann
Matheson
Swede
Ance
Cove
Manitou
Marina
Shady
Peterson
Davis
Northstar
Overlook
Craker
Christianson
Kovarik
Jellinek
Omena
Jacobson
Ingalls Bay
West Bay Shore
Kolarik
Acorn
Omena
Putnam
Tatch
Kalchik
Lake
Omena Point
Setterbo
Alpers
Pobuda
Pobuda
Freeland


Leelanau County

Leland Twp.

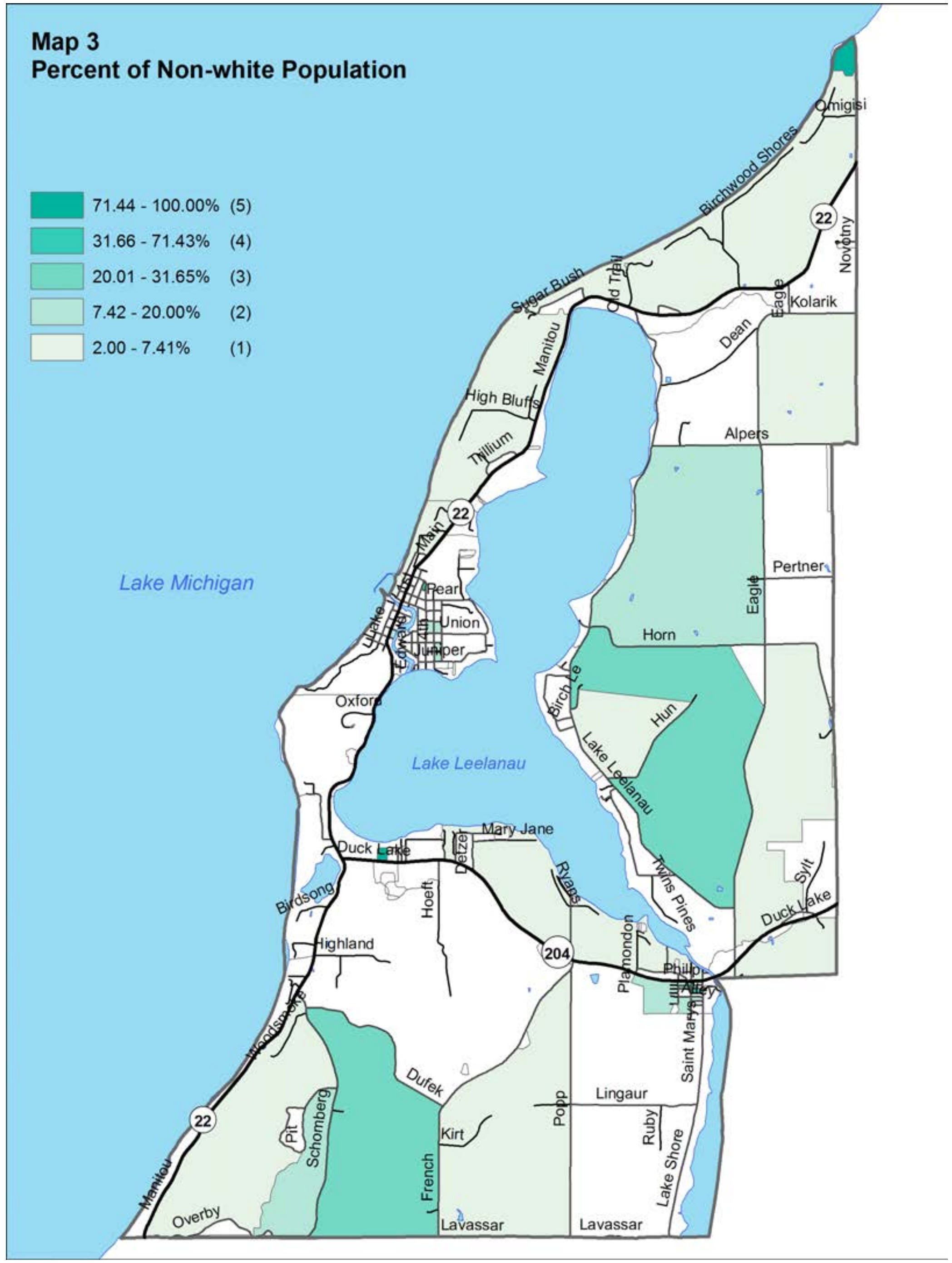

Leelanau County

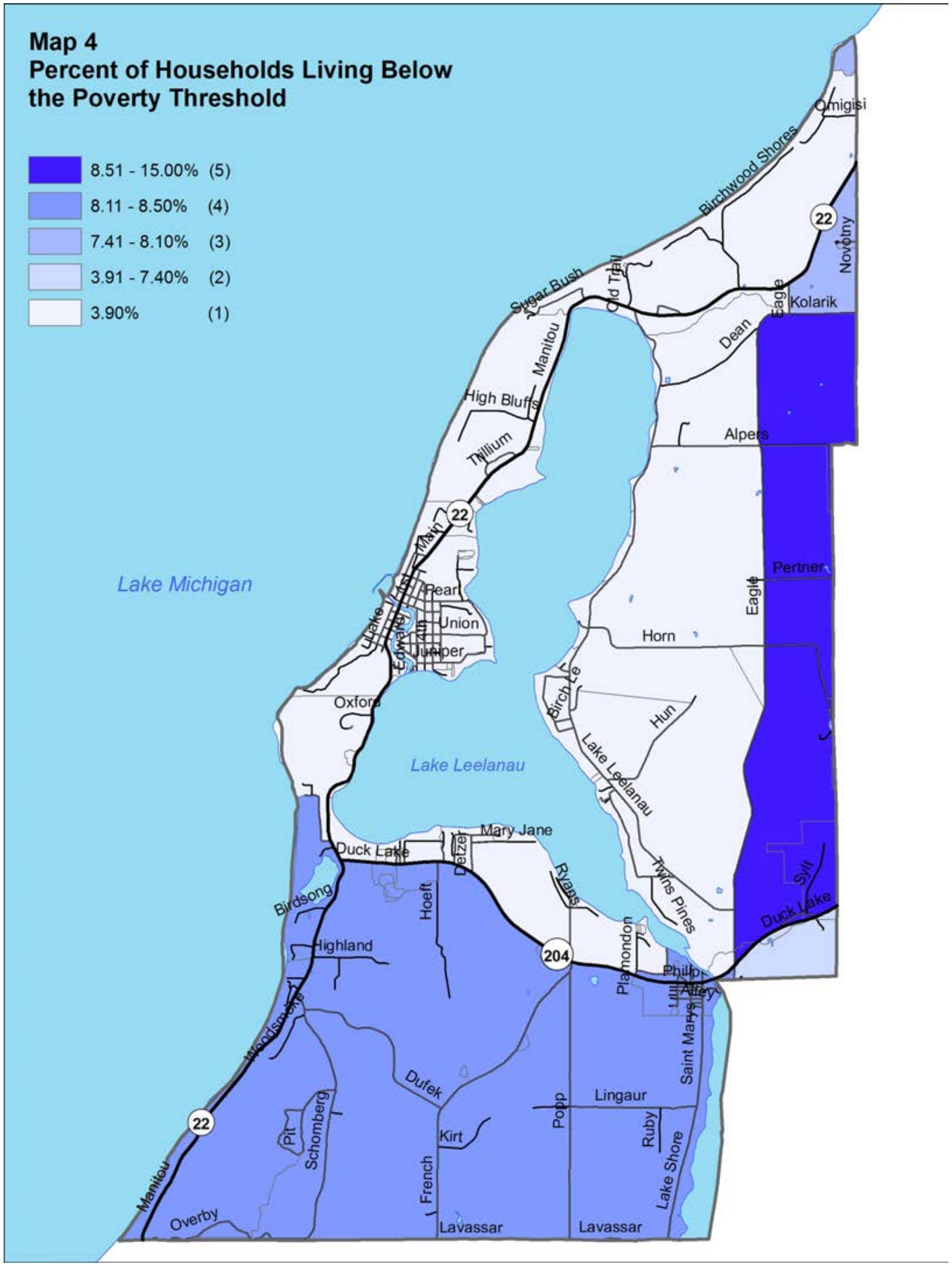

Map 1
Percent of Population 65 Years and Older (male and female)
80.01 - 100.00% (5)
50.01 - 80.00% (4)
31.26 - 50.00% (3)
16.68 - 31.25% (2)
3.57 - 16.67% (1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
Sugar Bush
Old Trail
Kolarik
Novotny
Dean
Manitou
High Bluffs
Trillium
Alpers
Pertner
Eagle
Pear
Union
Juniper
Horn
Oxford
Hun
Lake Leelanau
Mary Jane
Duck Lake
Delzer
Ryans
Twins Pines
Sylt
Duck Lake
Birdsong
Highland
Hoeft
Plamondon
Phillip
Woodsmoke
Saint Marys
Dufek
Popp
Lingaur
Ruby
Lake Shore
Pit
Schomberg
Kirt
French
Manitou
Overby
Lavassar
Lavassar
22
204


Map 2
Percent of Households with People Living Alone
66.68 - 100.00% (5)
42.87 - 66.67% (4)
31.59 - 42.86% (3)
20.01 - 31.58% (2)
7.14 - 20.00% (1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
Sugar Bush
Old Trail
Kolarik
Novotny
Dean
Manitou
High Bluffs
Trillium
Alpers
Pertner
Eagle
Horn
Pearl
Union
Juniper
Main
Lake
Oxford
Birch Le
Hun
Lake Leelanau
Mary Jane
Duck Lake
Detzer
Ryans
Twins Pines
Sylt
Duck Lake
Birdsong
Highland
Hoeft
Plamondon
Philip
Alley
Saint Marys
Woodside
Dufek
Popp
Lingaur
Ruby
Lake Shore
Pit
Schomberg
Kirt
French
Lavassar
Lavassar
Manitou
Overby
22
22
22
204


Leelanau County

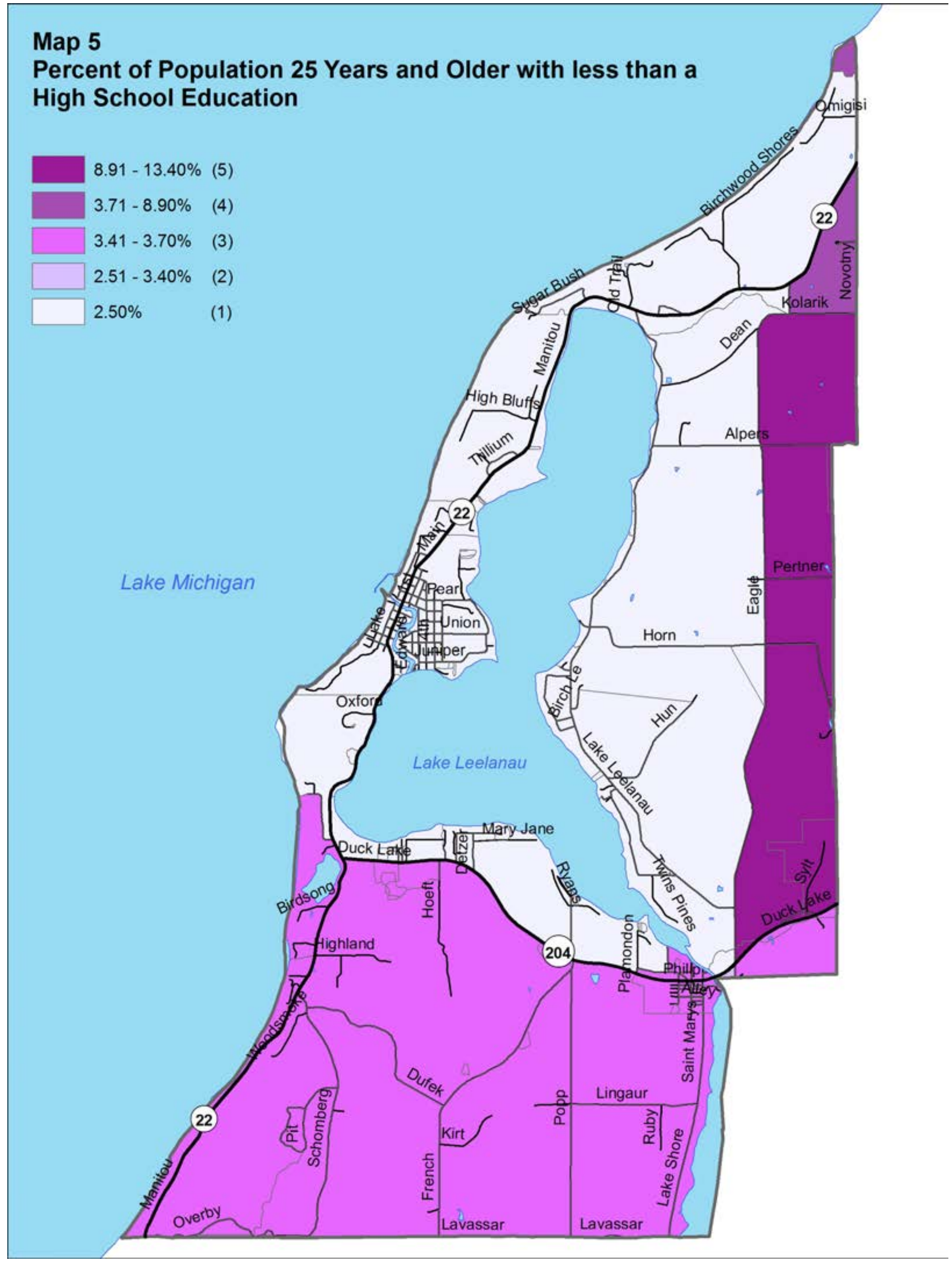

Leelanau County

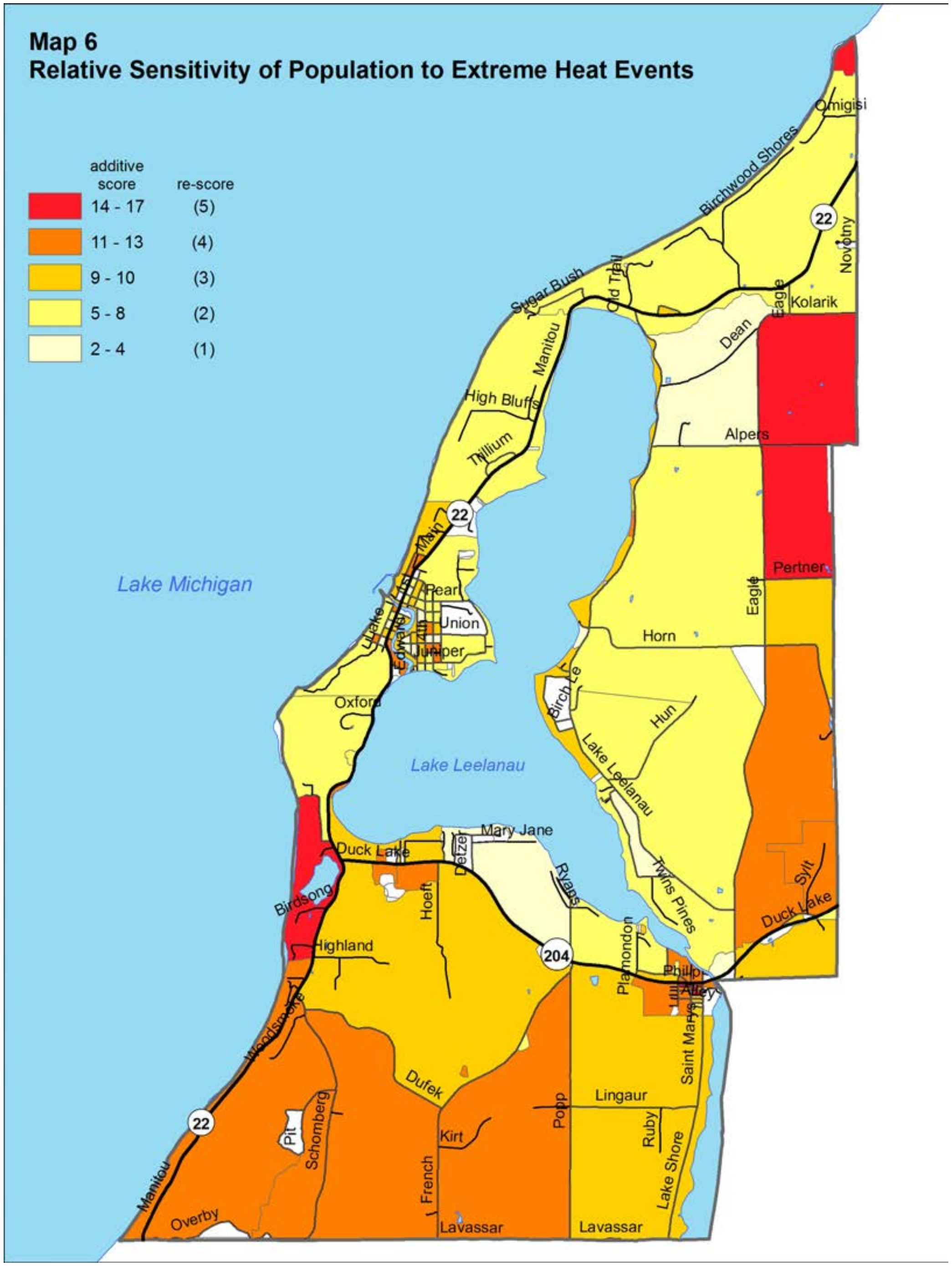

Map 3
Percent of Non-white Population
71.44 - 100.00% (5)
31.66 - 71.43% (4)
20.01 - 31.65% (3)
7.42 - 20.00% (2)
2.00 - 7.41% (1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
Sugar Bush
Old Trail
Manitou
High Bluffs
Trillium
Kolarik
Dean
Alpers
Pertner
Eagle
Horn
Hun
Lake Leelanau
Birch Le
Oxford
Pear
Union
Juniper
Main
Mary Jane
Duck Lake
Detzer
Ryans
Twin Pines
Sylt
Duck Lake
Birdsong
Highland
Hoeft
Plamondon
Philip
Alley
Saint Marys
Woodsmoke
Dufek
Lingaur
Ruby
Lake Shore
Popp
Kirt
French
Schomberg
Pit
Manitou
Overby
Lavassar
Lavassar
Novotny
22
22
22
204


Map 4
Percent of Households Living Below the Poverty Threshold
8.51 - 15.00% (5)
8.11 - 8.50% (4)
7.41 - 8.10% (3)
3.91 - 7.40% (2)
3.90% (1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
Novotny
Kolarik
Sugar Bush
Old Trail
Dean
Manitou
High Bluffs
Trillium
Alpers
Pertner
Eagle
Pearl
Union
Juniper
Horn
Oxford
Birch Le
Hun
Lake Leelanau
Mary Jane
Duck Lake
Deitzer
Ryans
Twins Pines
Sylt
Birdsong
Hoeft
Highland
Plamondon
Philip
Alley
Woodsmoke
Saint Marys
Dufek
Lingaur
Popp
Ruby
Kirt
Schomberg
Pit
Lake Shore
French
Manitou
Overby
Lavassar
Lavassar


Leelanau County

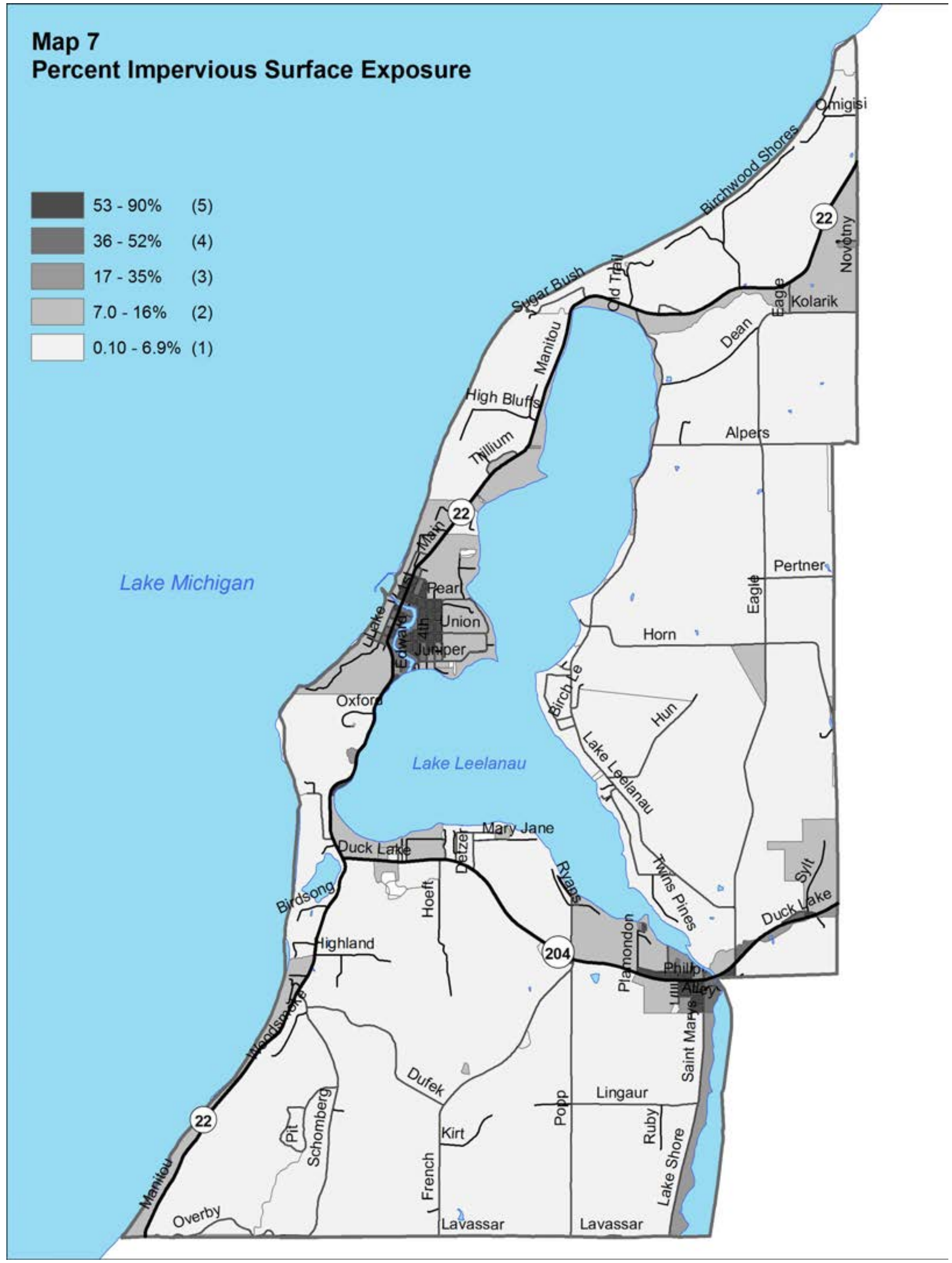

Leelanau County

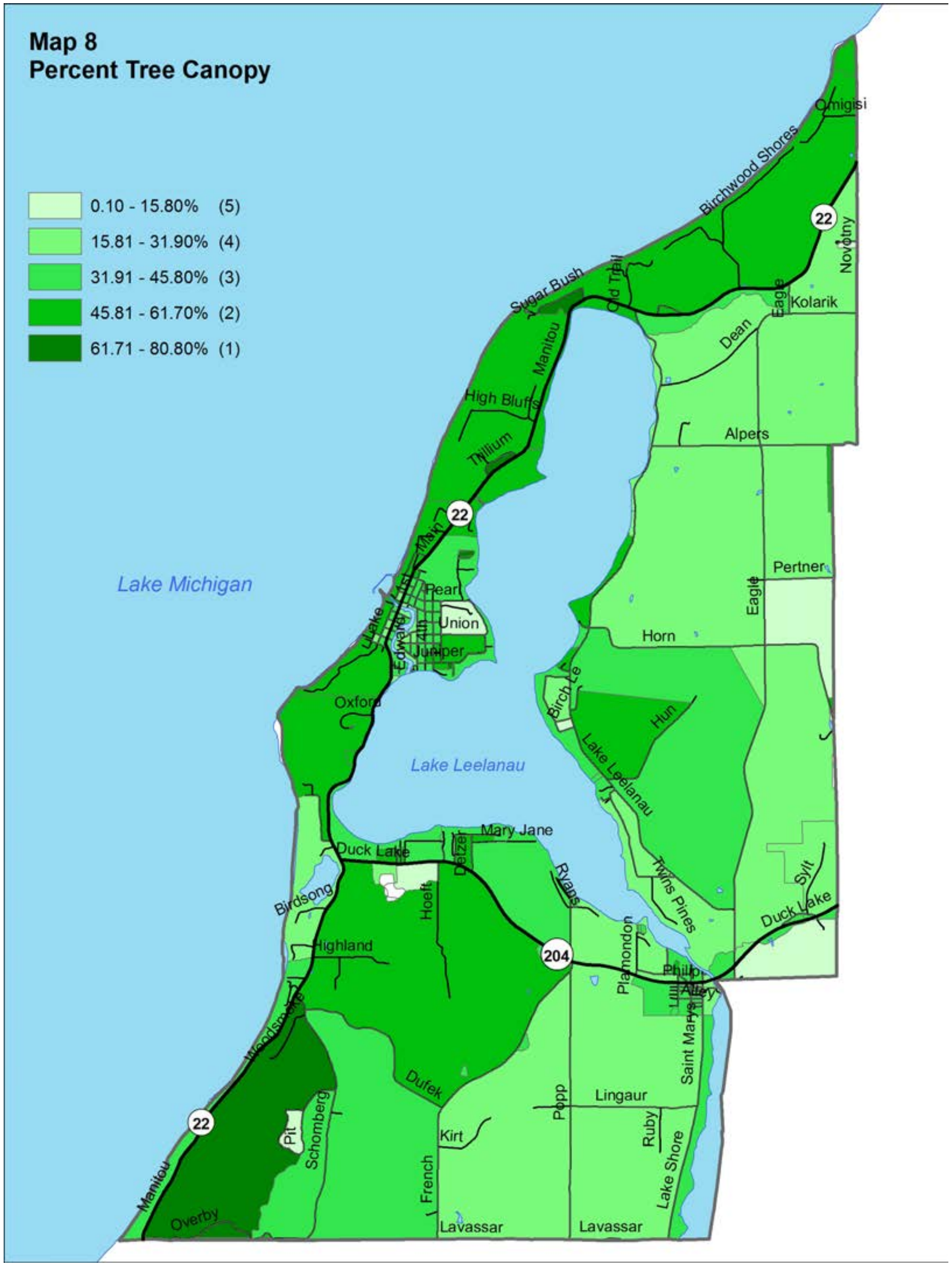

Map 5
Percent of Population 25 Years and Older with less than a High School Education
8.91 - 13.40% (5)
3.71 - 8.90% (4)
3.41 - 3.70% (3)
2.51 - 3.40% (2)
2.50% (1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
22
Novotny
Kolarik
Sugar Bush
Old Trail
Dean
Manitou
High Bluffs
Alpers
Trillium
Main
Pearl
Union
Juniper
Eagle
Pertner
Horn
Oxford
Birch Le
Hun
Lake Leelanau
Mary Jane
Duck Lake
Dietzel
Ryans
Twins Pines
Sylt
Birdsong
Hoeft
Highland
204
Plamondon
Phillips
Alley
Saint Marys
Woodsmoke
Dufek
Lingaur
Popp
Kirt
Ruby
Pit
Schomberg
Lake Shore
French
Manitou
Overby
Lavassar
Lavassar


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
14 - 17
(5)
11 - 13
(4)
9 - 10
(3)
5 - 8
(2)
2 - 4
(1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
Novotny
Kolarik
Eagle
Sugar Bush
Old Trail
Dean
Manitou
High Bluffs
Alpers
Trillium
Main
Pearl
Union
Juniper
Pertner
Horn
Oxford
Birch Le
Hun
Lake Leelanau
Mary Jane
Duck Lake
Dietzer
Ryans
Twins Pines
Sylt
Duck Lake
Birdsong
Hoeft
Highland
Plamondon
Phillip
Woodsmoke
Saint Marys
Dufek
Lingaur
Pit
Schomberg
Kirt
Popp
Ruby
Lake Shore
Manitou
Overby
French
Lavassar
Lavassar


Leelanau County

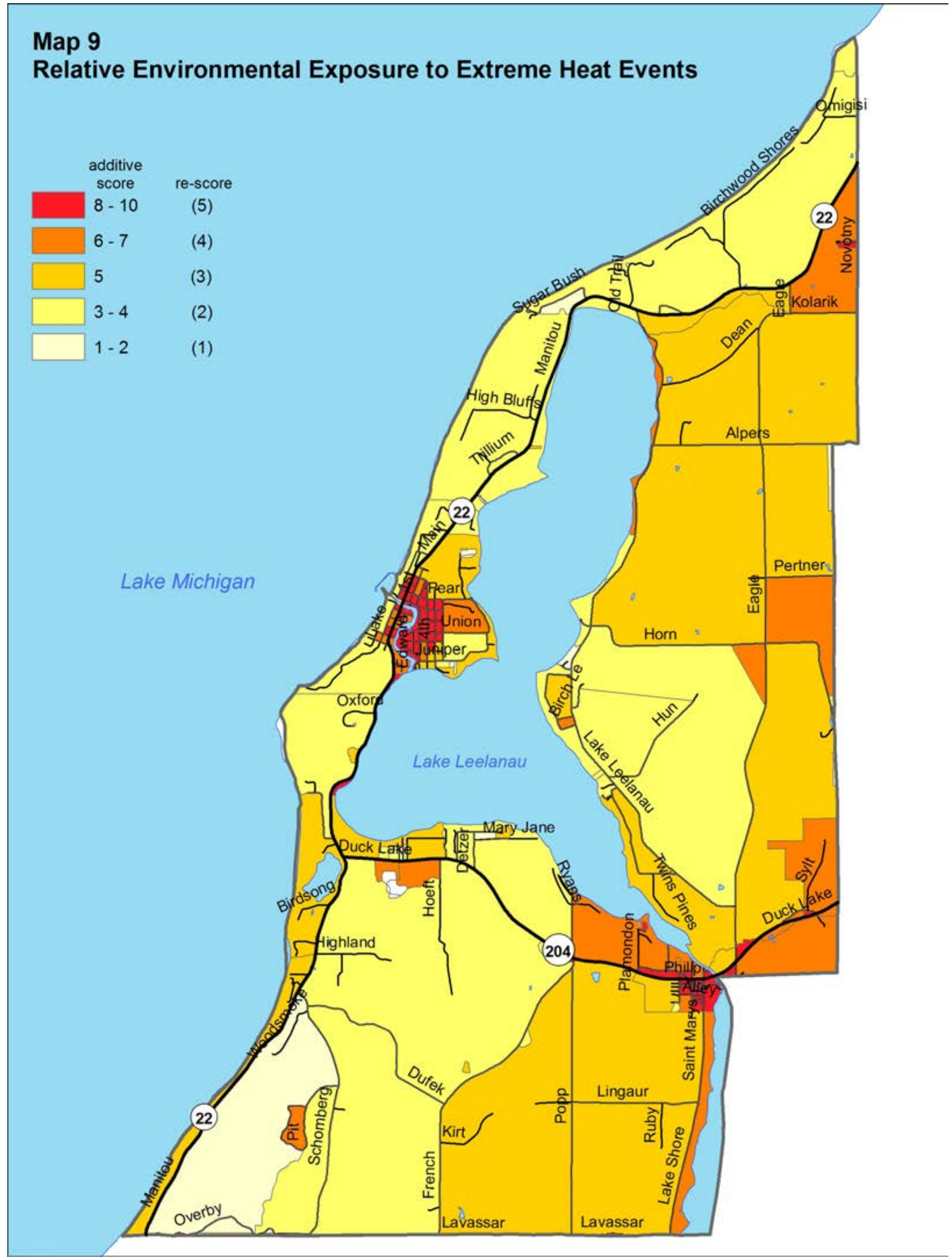

Leelanau County

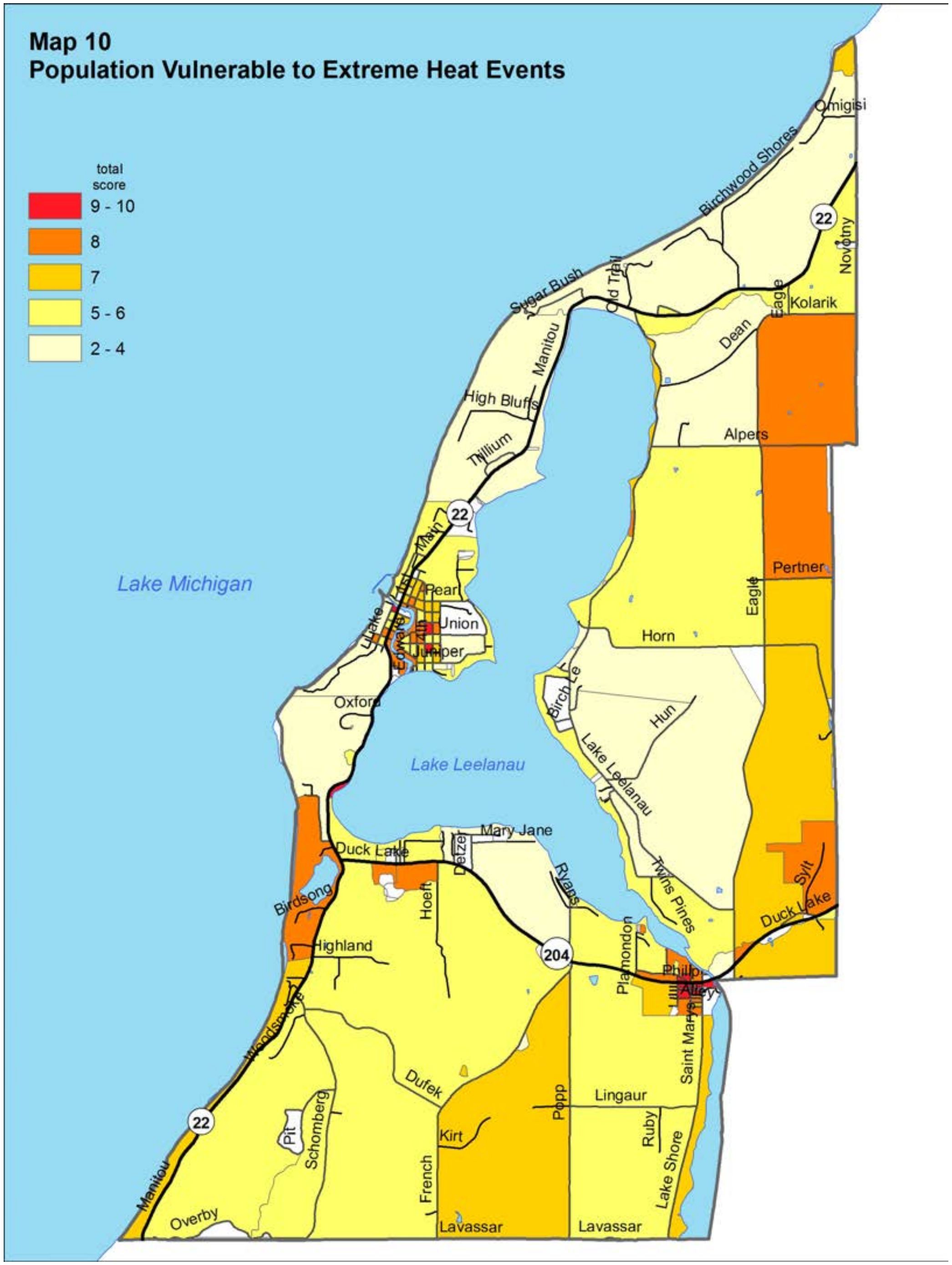

Map 7
Percent Impervious Surface Exposure
53 - 90% (5)
36 - 52% (4)
17 - 35% (3)
7.0 - 16% (2)
0.10 - 6.9% (1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
22
Novotny
Kolarik
Eagle
Sugar Bush
Old Trail
Dean
Manitou
High Bluffs
Alpers
Trillium
Main
Pear
Union
Juniper
Lake
1st
4th
Edward
Oxford
Pertner
Eagle
Horn
Birch Le
Hun
Lake Leelanau
Mary Jane
Duck Lake
Detzer
Ryans
Twins Pines
Sylt
Duck Lake
Birdsong
Hoeft
Highland
204
Plamondon
Philip
Alley
Saint Marys
Woodsmoke
Dufek
Lingaur
Popp
Ruby
Kirt
Pit
Schomberg
Lake Shore
French
Manitou
Overby
Lavassar
Lavassar


Map 8
Percent Tree Canopy
0.10 - 15.80% (5)
15.81 - 31.90% (4)
31.91 - 45.80% (3)
45.81 - 61.70% (2)
61.71 - 80.80% (1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
Sugar Bush
Old Trail
Novotny
Kolarik
Eagle
Dean
Manitou
High Bluffs
Trillium
Alpers
Main
Pearl
Union
Juniper
Lake
Edward
4th
Oxford
Pertner
Horn
Birch Le
Hun
Lake Leelanau
Mary Jane
Duck Lake
Delzer
Ryans
Birdsong
Hoeft
Highland
Twins Pines
Sylt
Duck Lake
Plamondon
Philip
Alley
Saint Marys
Woodsmoke
Dufek
Popp
Lingaur
Pit
Schomberg
Kirt
Ruby
Lake Shore
French
Manitou
Overby
Lavassar
Lavassar
22
22
22
204


Leelanau County

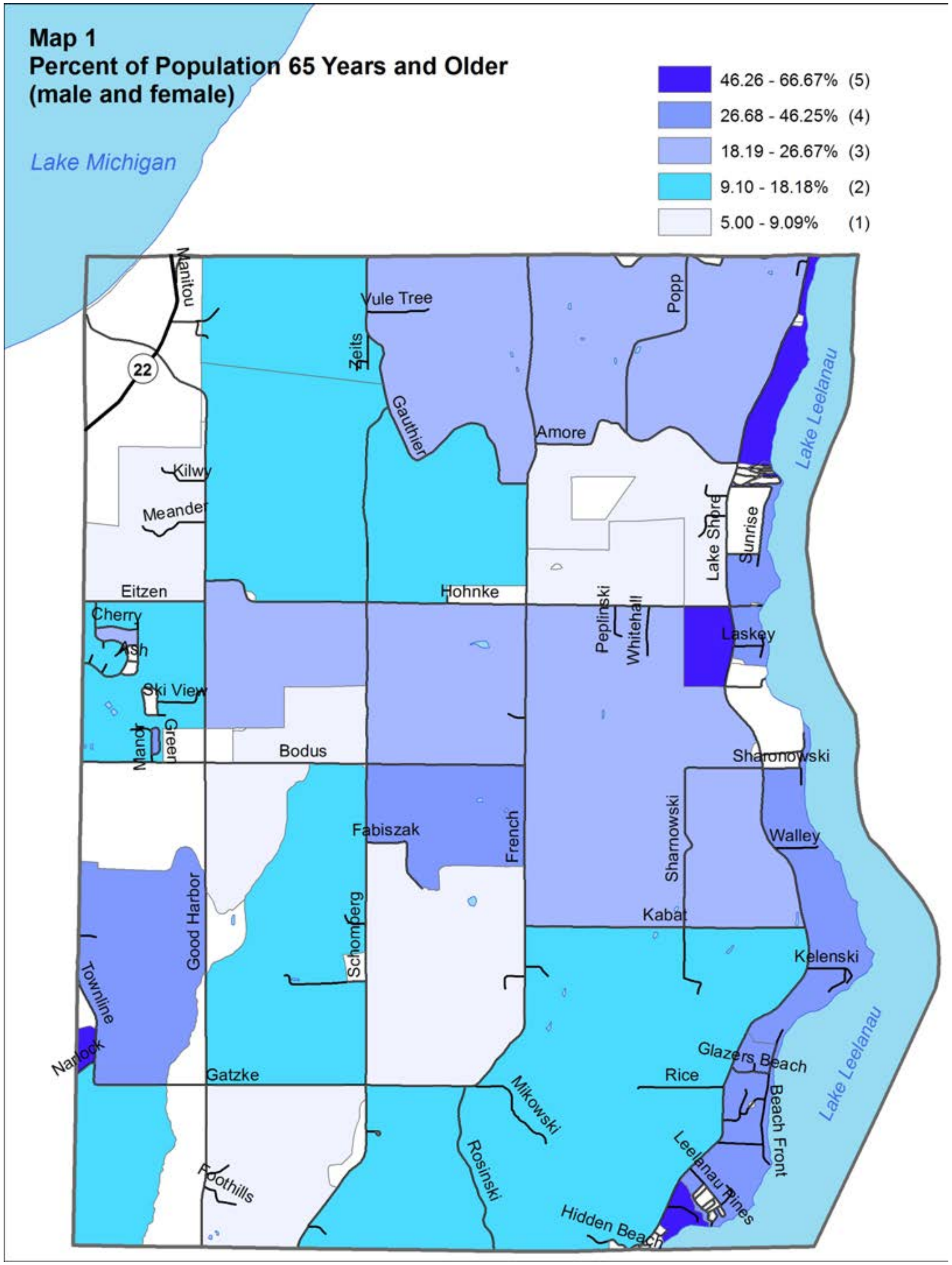

Leelanau County

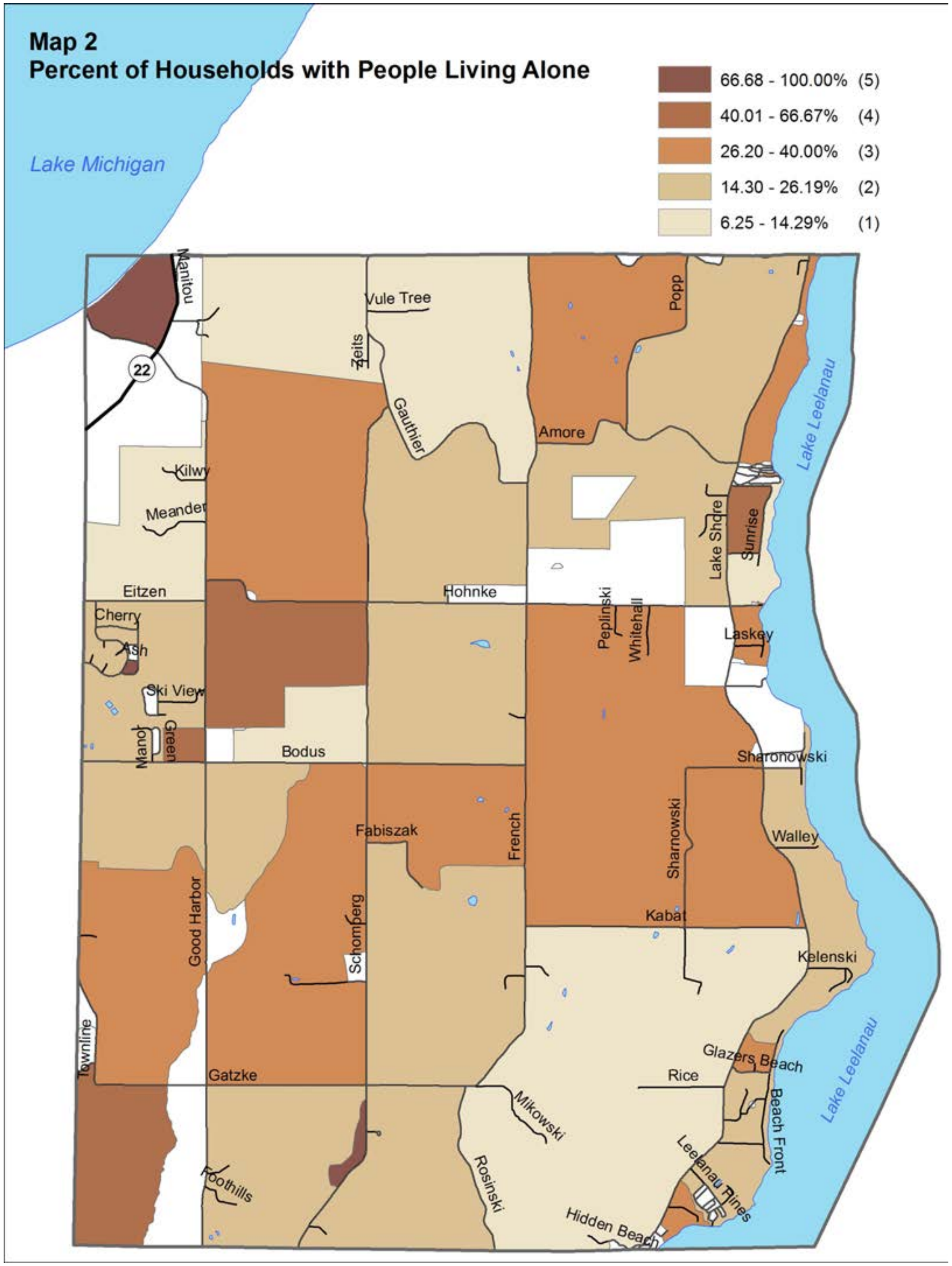

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
8 - 10 (5)
6 - 7 (4)
5 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
Novotny
Kolarik
Sugar Bush
Old Trail
Dean
Eagle
Manitou
High Bluffs
Trillium
Alpers
Main
Pearl
Union
Juniper
Oxford
Pertner
Horn
Birch Le
Hun
Lake Leelanau
Mary Jane
Duck Lake
Detzer
Ryans
Twins Pines
Sylt
Duck Lake
Birdsong
Hoeft
Highland
Plamondon
Philip
Alley
Saint Marys
Woodsmoke
Dufek
Lingaur
Popp
Ruby
Lake Shore
Kirt
Pit
Schomberg
French
Manitou
Overby
Lavassar
Lavassar
22
204


Map 10
Population Vulnerable to Extreme Heat Events
total score
9 - 10
8
7
5 - 6
2 - 4
Lake Michigan
Lake Leelanau
Omigisi
Birchwood Shores
Novotny
Kolarik
Eagle
Sugar Bush
Old Trail
Dean
Manitou
High Bluffs
Trillium
Alpers
Main
Pertner
Pearl
Union
Juniper
Lake
Oxford
Horn
Birch Le
Hun
Lake Leelanau
Mary Jane
Duck Lake
Detzer
Ryans
Twins Pines
Sylt
Duck Lake
Birdsong
Hoeft
Highland
Plamondon
Philip
Alley
Woodsmoke
Saint Marys
Dufek
Popp
Lingaur
Kirt
Ruby
Pit
Schomberg
Lake Shore
Manitou
Overby
French
Lavassar
Lavassar


Leelanau County

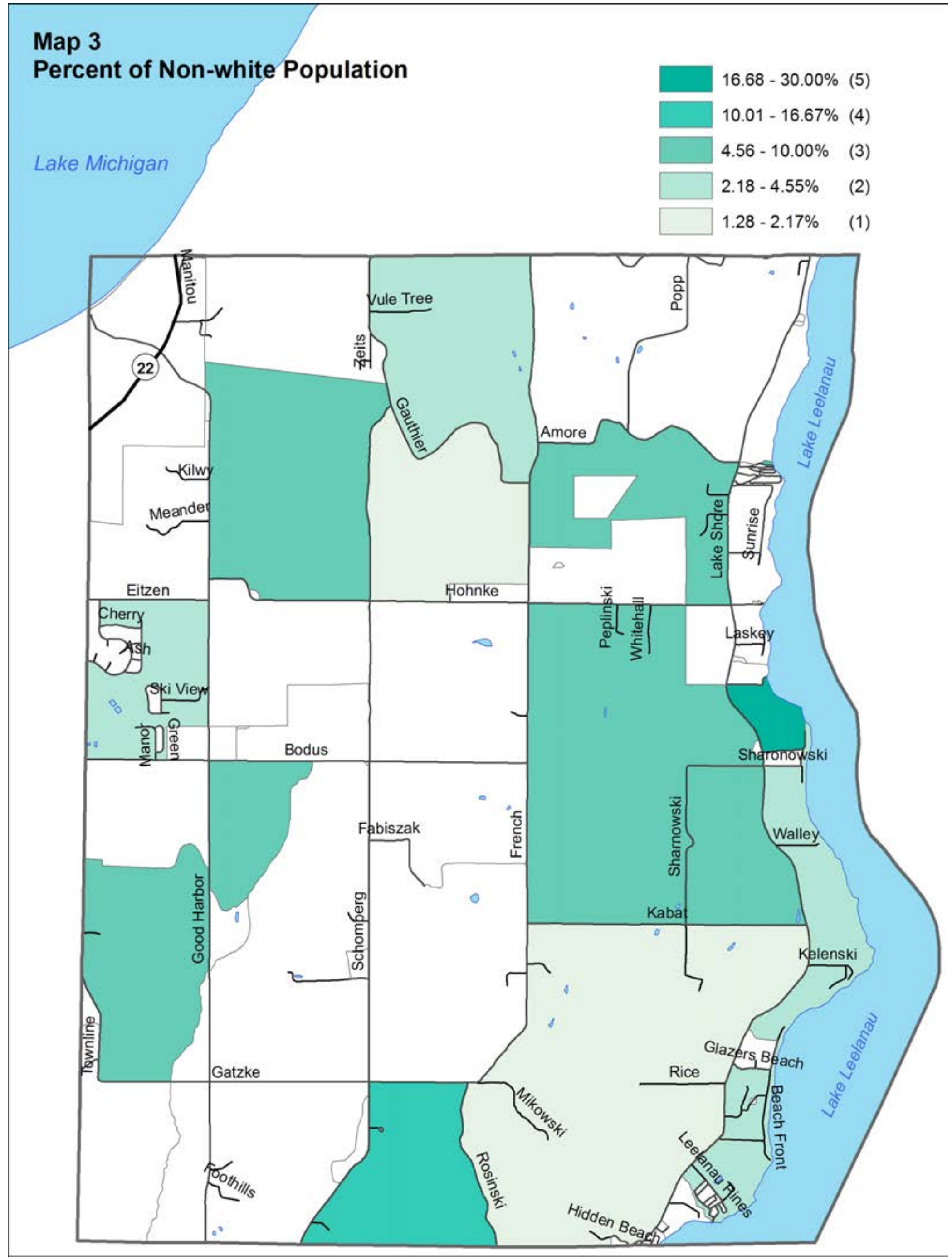
Centerville Twp.

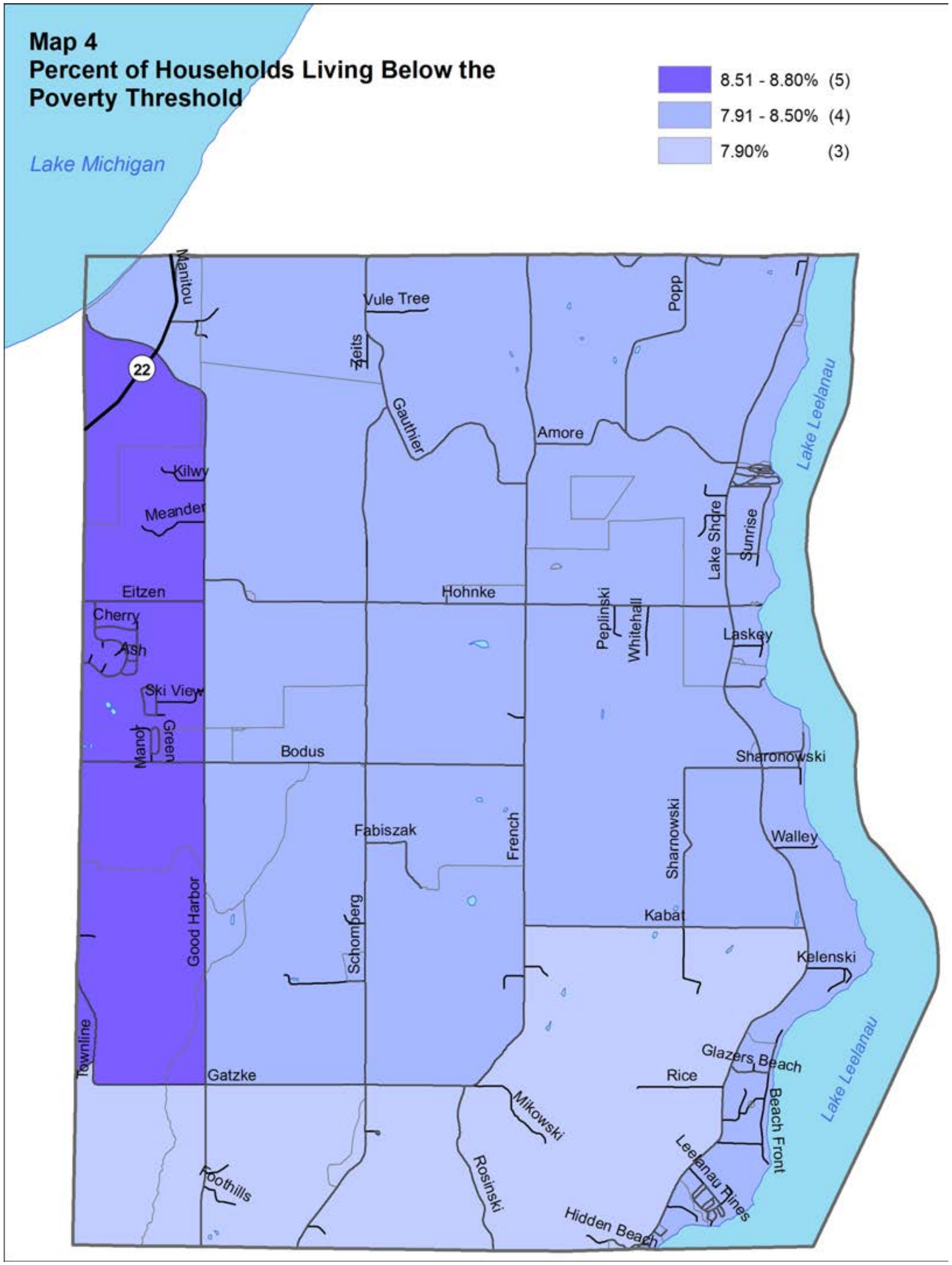



Map 2
Percent of Households with People Living Alone
66.68 - 100.00% (5)
40.01 - 66.67% (4)
26.20 - 40.00% (3)
14.30 - 26.19% (2)
6.25 - 14.29% (1)
Lake Michigan
Lake Leelanau
Manitou
22
Vule Tree
Zeits
Gauthier
Amore
Popp
Kilwy
Meander
Eitzen
Hohnke
Lake Shore
Sunrise
Cherry
Ash
Ski View
Peplinski
Whitehall
Laskey
Manor
Green
Bodus
Sharonowski
Fabiszak
French
Sharnowski
Walley
Good Harbor
Schomberg
Kabat
Kelenski
Townline
Gatzke
Glazers Beach
Rice
Beach Front
Mikowski
Leelanau Pines
Foothills
Rosinski
Hidden Beach


Leelanau County

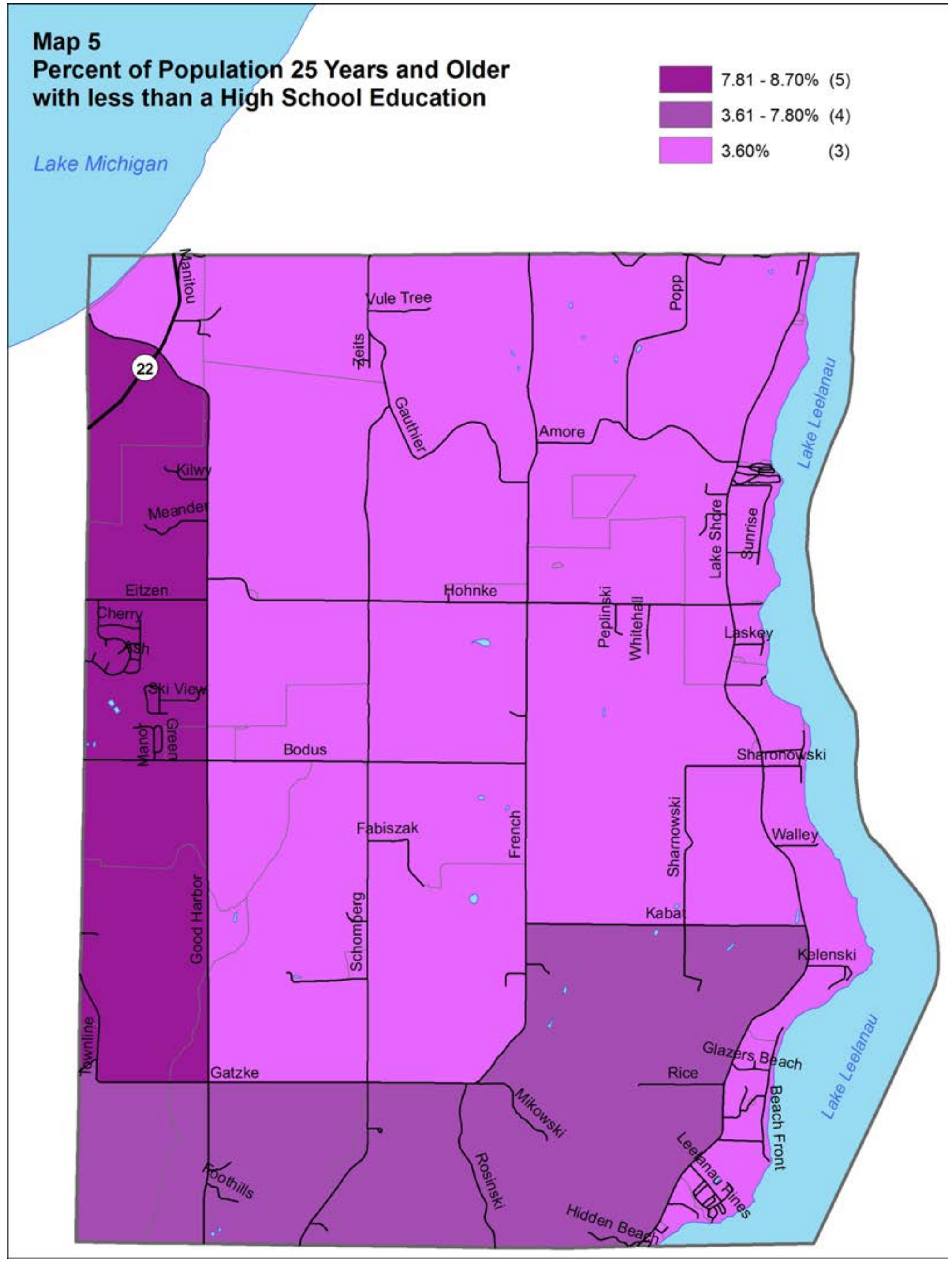

Leelanau County

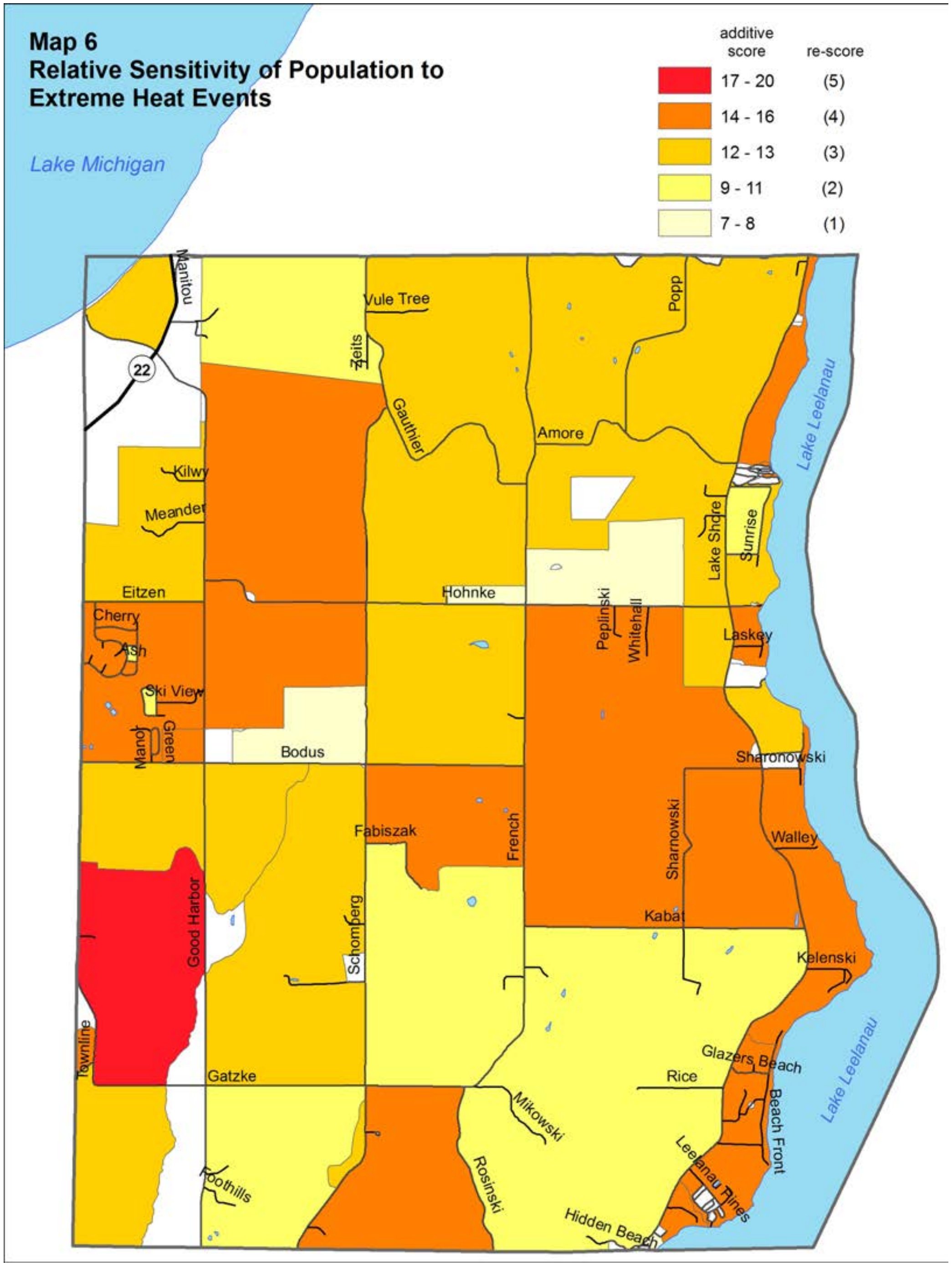

Map 3
Percent of Non-white Population
16.68 - 30.00% (5)
10.01 - 16.67% (4)
4.56 - 10.00% (3)
2.18 - 4.55% (2)
1.28 - 2.17% (1)
Lake Michigan
Lake Leelanau
Manitou
22
Yule Tree
Zeits
Popp
Gauthier
Amore
Kilwy
Meander
Lake Shore
Sunrise
Eitzen
Hohnke
Peplinski
Whitehall
Cherry
Ash
Laskey
Ski View
Green
Manor
Bodus
Sharonowski
Fabiszak
French
Walley
Sharnowski
Good Harbor
Schomberg
Kabat
Kelenski
Townline
Gatzke
Glazers Beach
Rice
Mikowski
Beach Front
Leelanau Pines
Foothills
Rosinski
Hidden Beach


Map 4
Percent of Households Living Below the Poverty Threshold
8.51 - 8.80% (5)
7.91 - 8.50% (4)
7.90% (3)
Lake Michigan
Lake Leelanau
Manitou
22
Vule Tree
Zeits
Gauthier
Popp
Amore
Kilwy
Meander
Eitzen
Hohnke
Lake Shore
Sunrise
Peplinski
Whitehall
Cherry
Ash
Laskey
Ski View
Green
Manor
Bodus
Sharonowski
Fabiszak
French
Sharnowski
Walley
Kabat
Good Harbor
Schomberg
Kelenski
Townline
Gatzke
Glazers Beach
Rice
Beach Front
Mikowski
Leelanau Pines
Rosinski
Foothills
Hidden Beach


Leelanau County

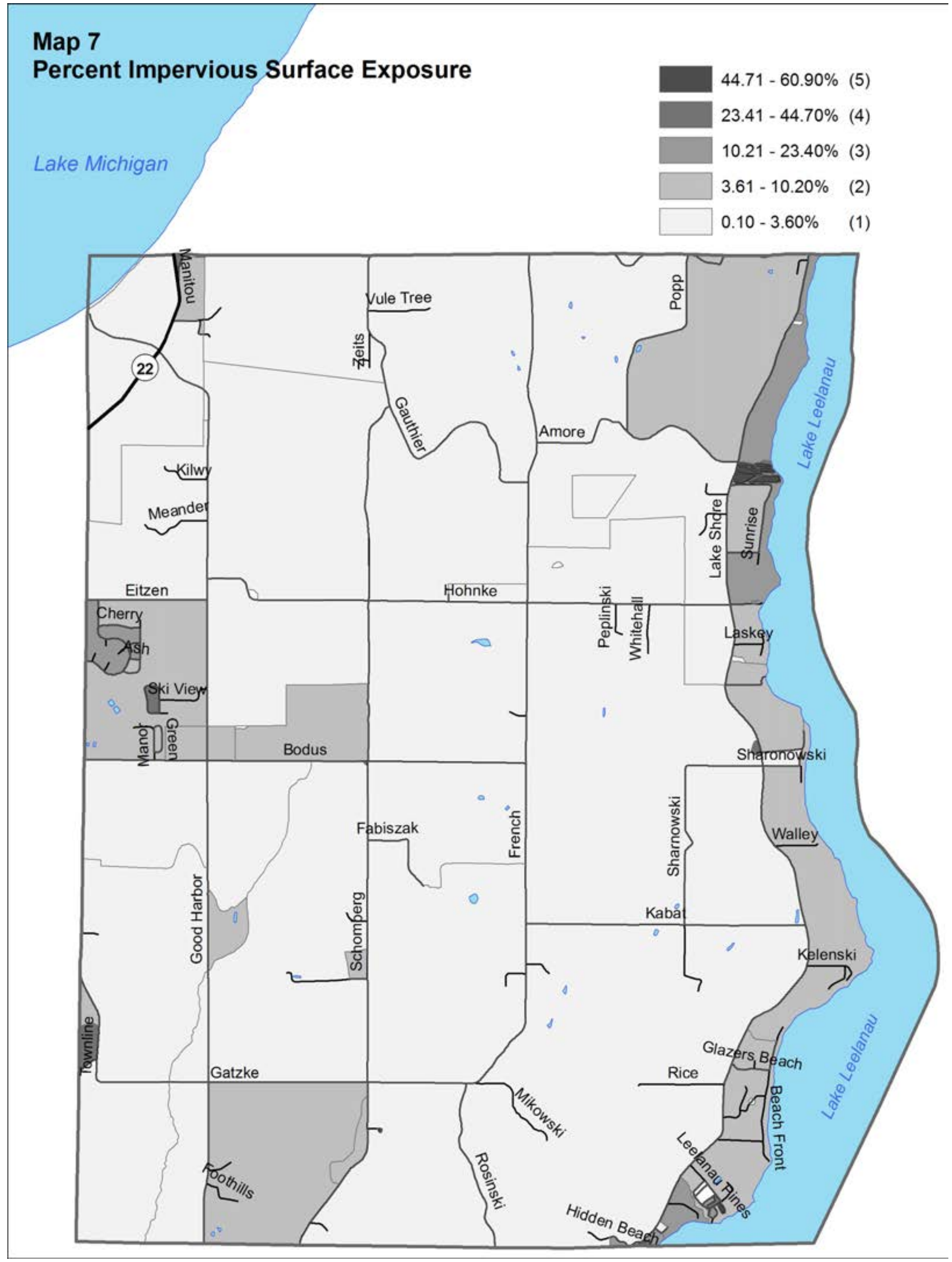

Leelanau County

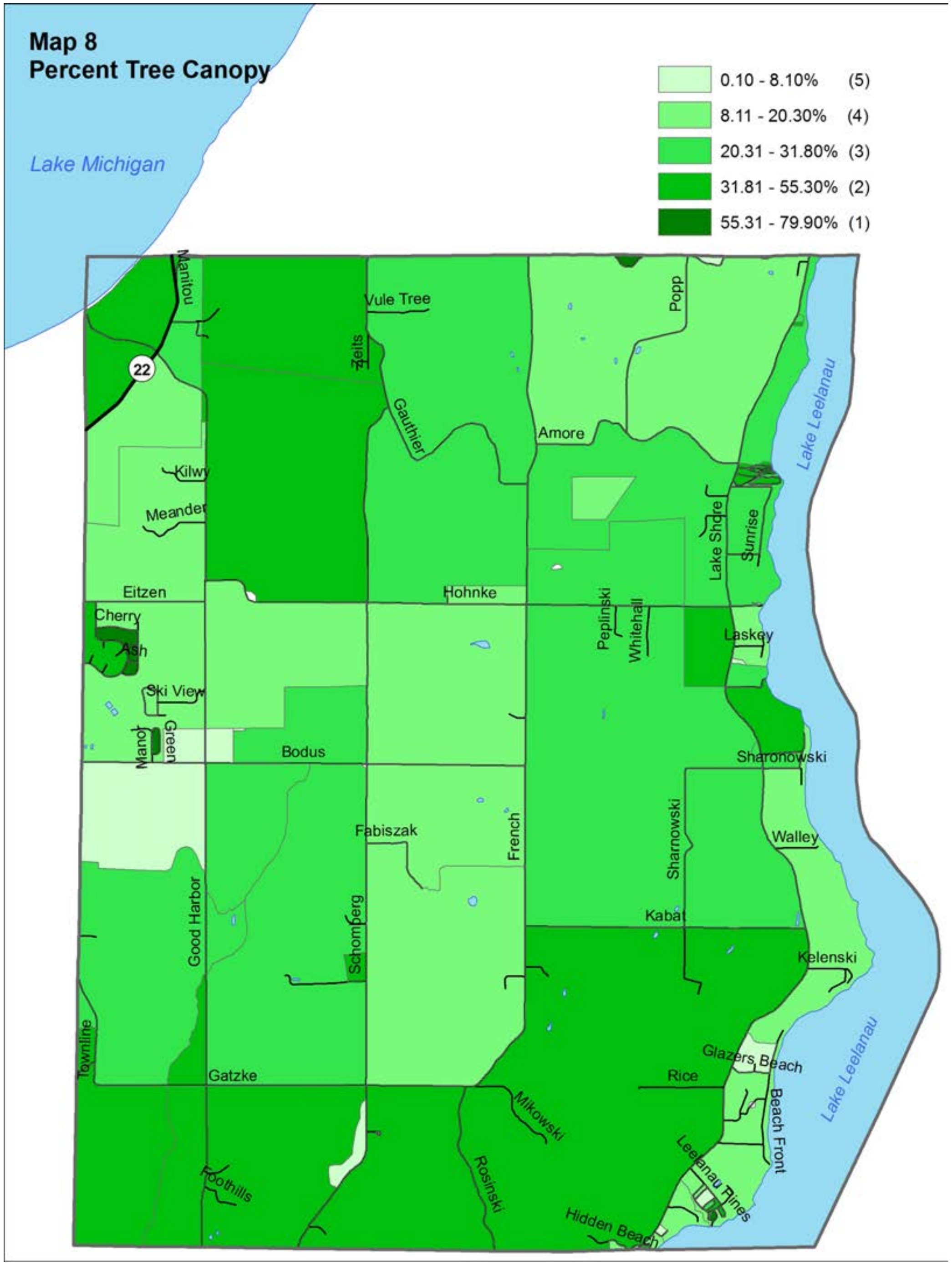

Map 5
Percent of Population 25 Years and Older with less than a High School Education
7.81 - 8.70% (5)
3.61 - 7.80% (4)
3.60% (3)
Lake Michigan
Lake Leelanau
Manitou
22
Yule Tree
Zeits
Gauthier
Popp
Amore
Kilwy
Meander
Lake Shore
Sunrise
Eitzen
Hohnke
Peplinski
Whitehall
Cherry
Laskey
Ski View
Green
Manor
Bodus
Sharonowski
Fabiszak
French
Sharnowski
Walley
Good Harbor
Schomberg
Kabat
Kelenski
Townline
Gatzke
Glazers Beach
Rice
Mikowski
Beach Front
Leelanau Pines
Foothills
Rosinski
Hidden Beach


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
17 - 20 (5)
14 - 16 (4)
12 - 13 (3)
9 - 11 (2)
7 - 8 (1)
Lake Michigan
Lake Leelanau
Manitou
22
Vule Tree
Zeits
Gauthier
Amore
Popp
Kilwy
Meander
Eitzen
Hohnke
Lake Shore
Sunrise
Peplinski
Whitehall
Cherry
Ash
Laskey
Ski View
Manor
Green
Bodus
Sharonowski
Fabiszak
French
Sharnowski
Walley
Good Harbor
Kabat
Schomberg
Kelenski
Townline
Gatzke
Glazers Beach
Rice
Beach Front
Mikowski
Leelanau Pines
Foothills
Rosinski
Hidden Beach


Leelanau County

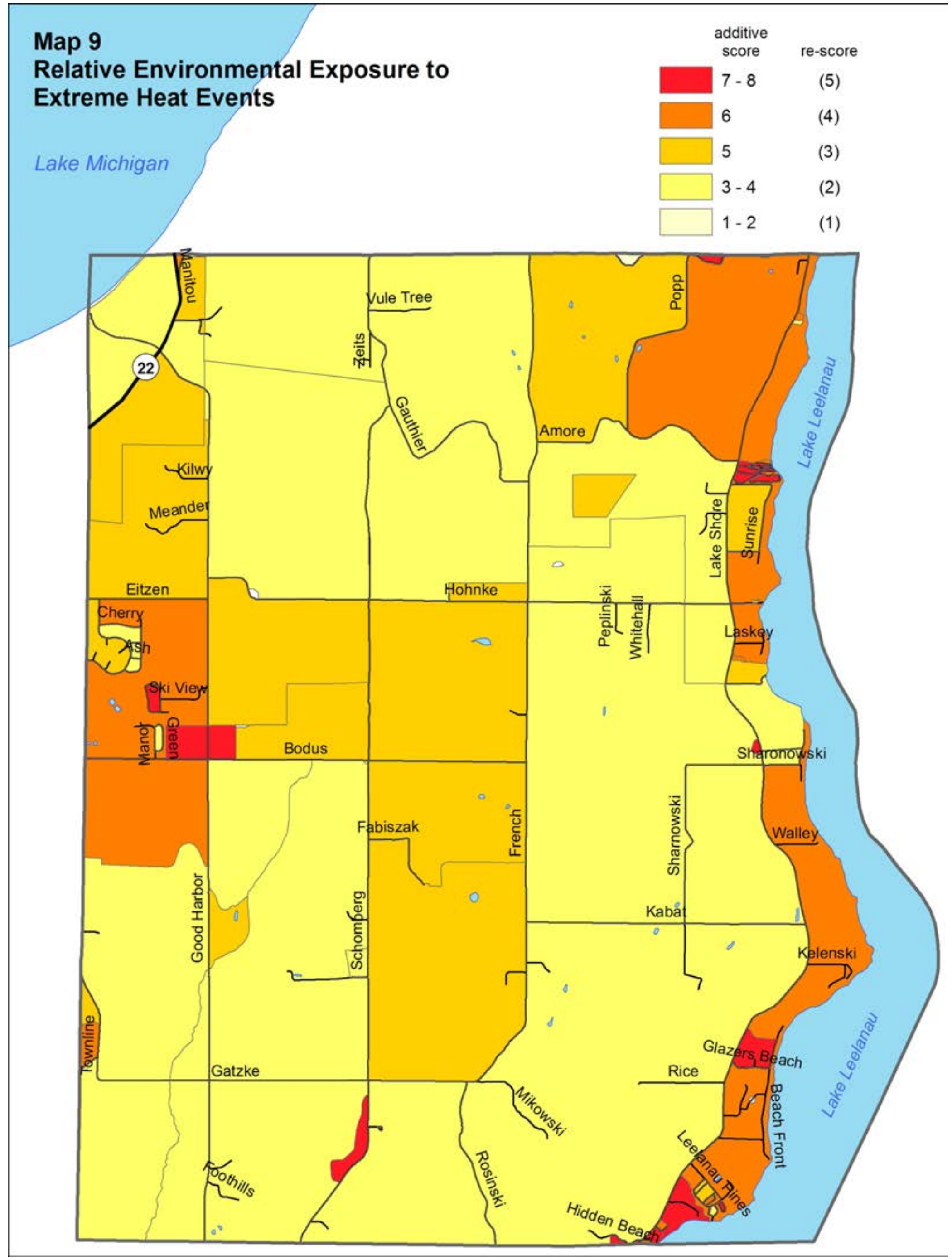

Leelanau County

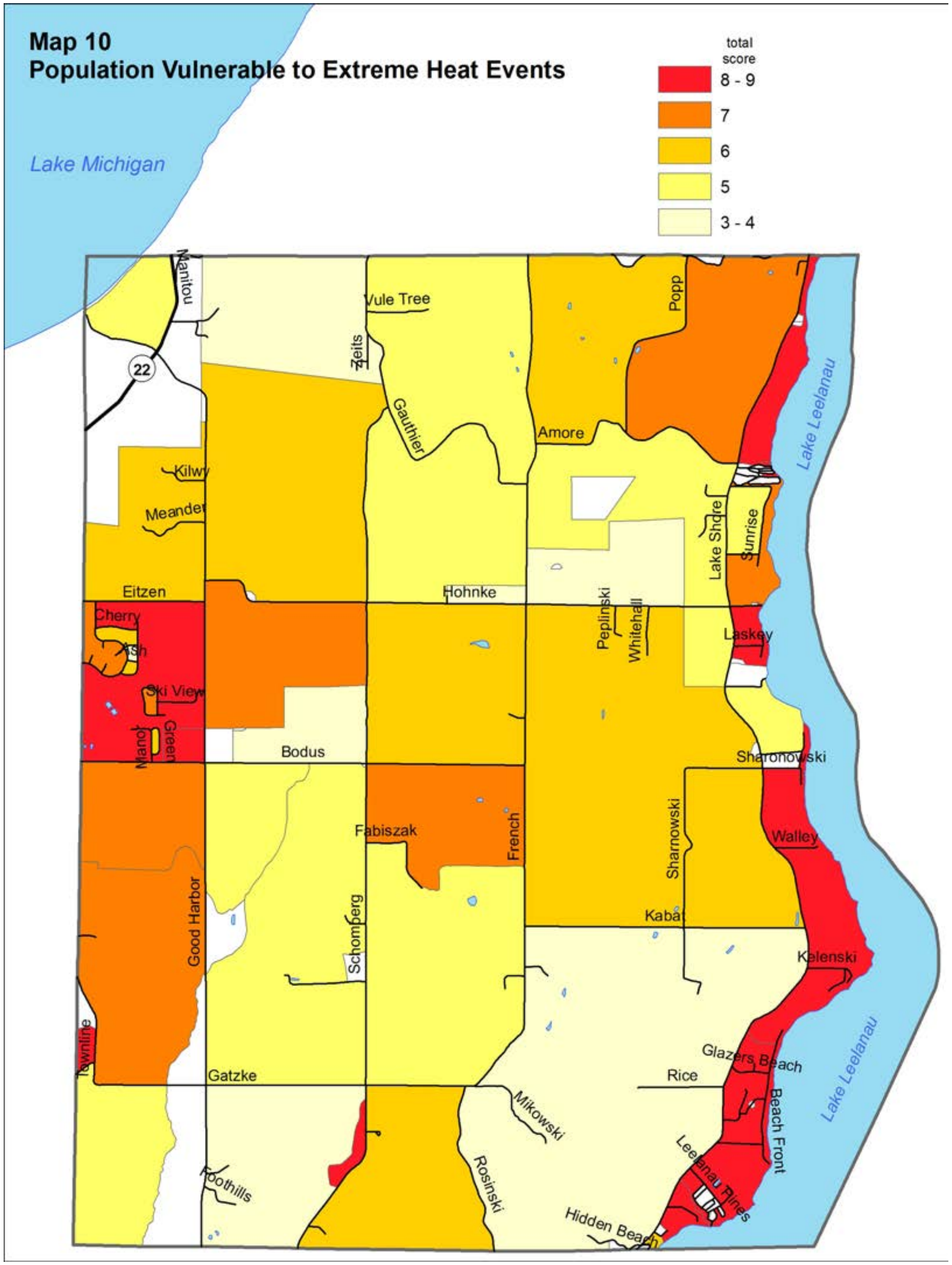

Map 7
Percent Impervious Surface Exposure
44.71 - 60.90% (5)
23.41 - 44.70% (4)
10.21 - 23.40% (3)
3.61 - 10.20% (2)
0.10 - 3.60% (1)
Lake Michigan
Lake Leelanau
Lake Leelanau
Manitou
22
Vule Tree
Zeits
Gauthier
Popp
Amore
Kilwy
Meander
Lake Shore
Sunrise
Eitzen
Hohnke
Peplinski
Whitehall
Cherry
Ash
Laskey
Ski View
Green
Manor
Bodus
Sharonowski
Fabiszak
French
Sharnowski
Walley
Good Harbor
Schomberg
Kabat
Kelenski
Townline
Gatzke
Glazers Beach
Rice
Beach Front
Mikowski
Foothills
Rosinski
Leelanau Pines
Hidden Beach


Map 8
Percent Tree Canopy
Lake Michigan
0.10 - 8.10% (5)
8.11 - 20.30% (4)
20.31 - 31.80% (3)
31.81 - 55.30% (2)
55.31 - 79.90% (1)
Manitou
22
Vule Tree
Zeits
Gauthier
Popp
Amore
Lake Leelanau
Kilwy
Meander
Lake Shore
Sunrise
Eitzen
Hohnke
Peplinski
Whitehall
Cherry
Ash
Laskey
Ski View
Manor
Green
Bodus
Sharonowski
Fabiszak
French
Sharnowski
Walley
Kabat
Good Harbor
Schomberg
Kelenski
Townline
Glazers Beach
Gatzke
Rice
Beach Front
Mikowski
Foothills
Rosinski
Leelanau Pines
Hidden Beach


Leelanau County

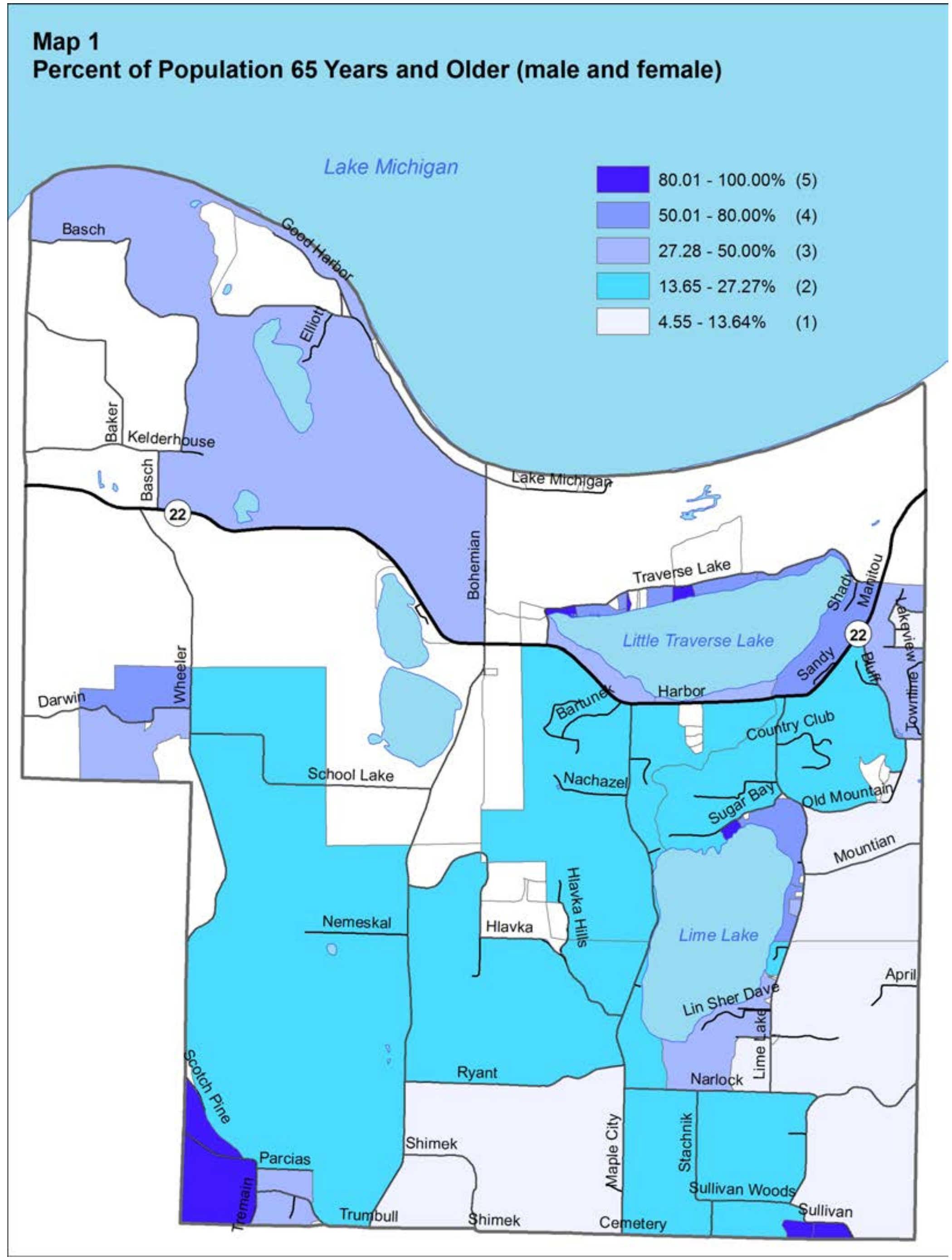

Leelanau County

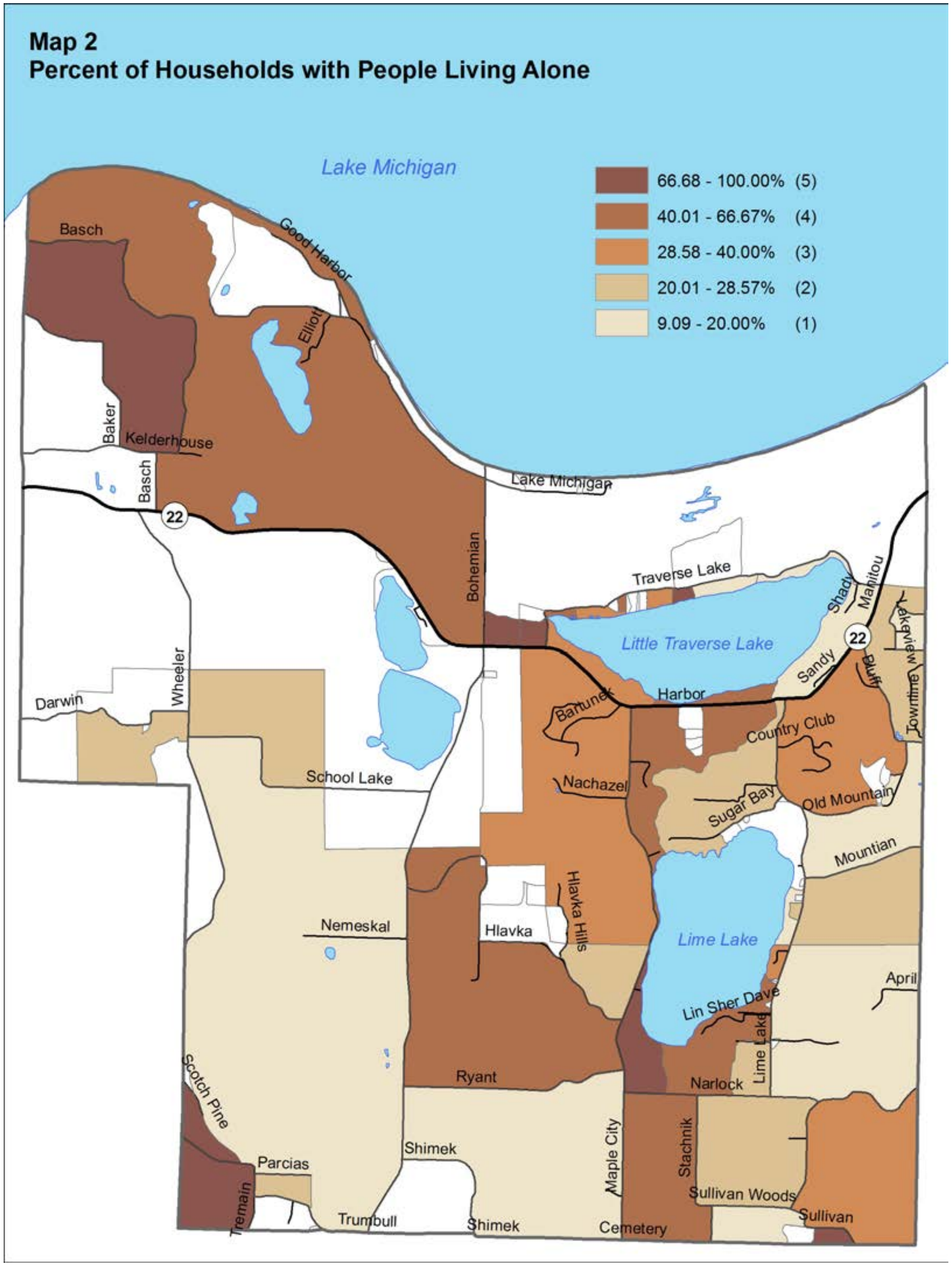

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
7 - 8 (5)
6 (4)
5 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
Lake Leelanau
Manitou
22
Vule Tree
Zeits
Gauthier
Popp
Amore
Kilwy
Meander
Lake Shore
Sunrise
Eitzen
Hohnke
Cherry
Ash
Peplinski
Whitehall
Laskey
Ski View
Manor
Green
Bodus
Sharonowski
Fabiszak
French
Sharnowski
Walley
Good Harbor
Kabat
Schomberg
Kelenski
Townline
Gatzke
Glazers Beach
Rice
Beach Front
Mikowski
Foothills
Rosinski
Leelanau Pines
Hidden Beach


Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 9
7
6
5
3 - 4
Lake Michigan
Lake Leelanau
Manitou
22
Vule Tree
Zeits
Gauthier
Popp
Amore
Kilwy
Meander
Lake Shore
Sunrise
Eitzen
Hohnke
Cherry
Ash
Peplinski
Whitehall
Laskey
Ski View
Manor
Green
Bodus
Sharonowski
Fabiszak
French
Walley
Sharnowski
Good Harbor
Schomberg
Kabat
Kolenski
Townline
Glazers Beach
Gatzke
Rice
Mikowski
Beach Front
Leelanau Pines
Foothills
Rosinski
Hidden Beach


Leelanau County

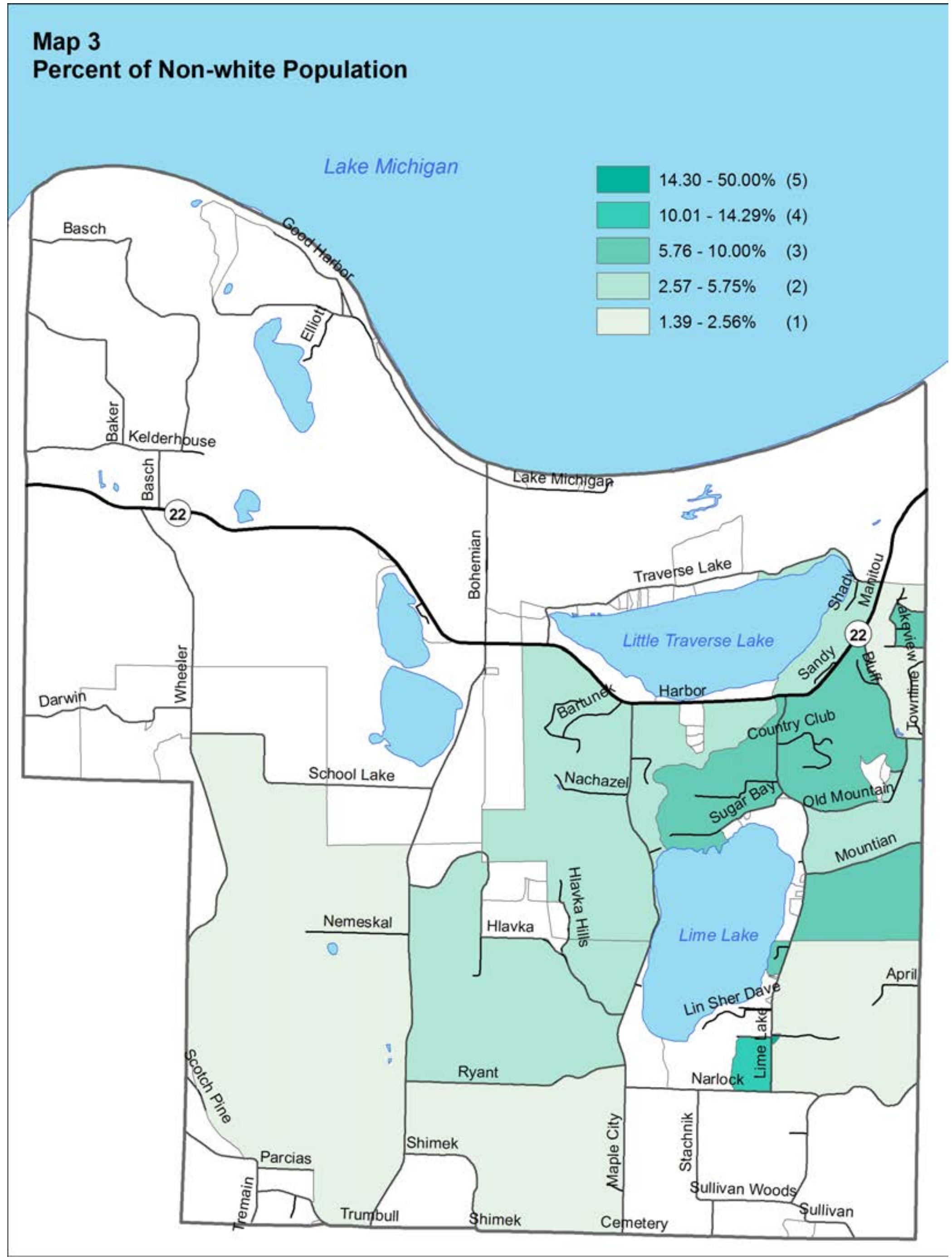
Cleveland Twp.

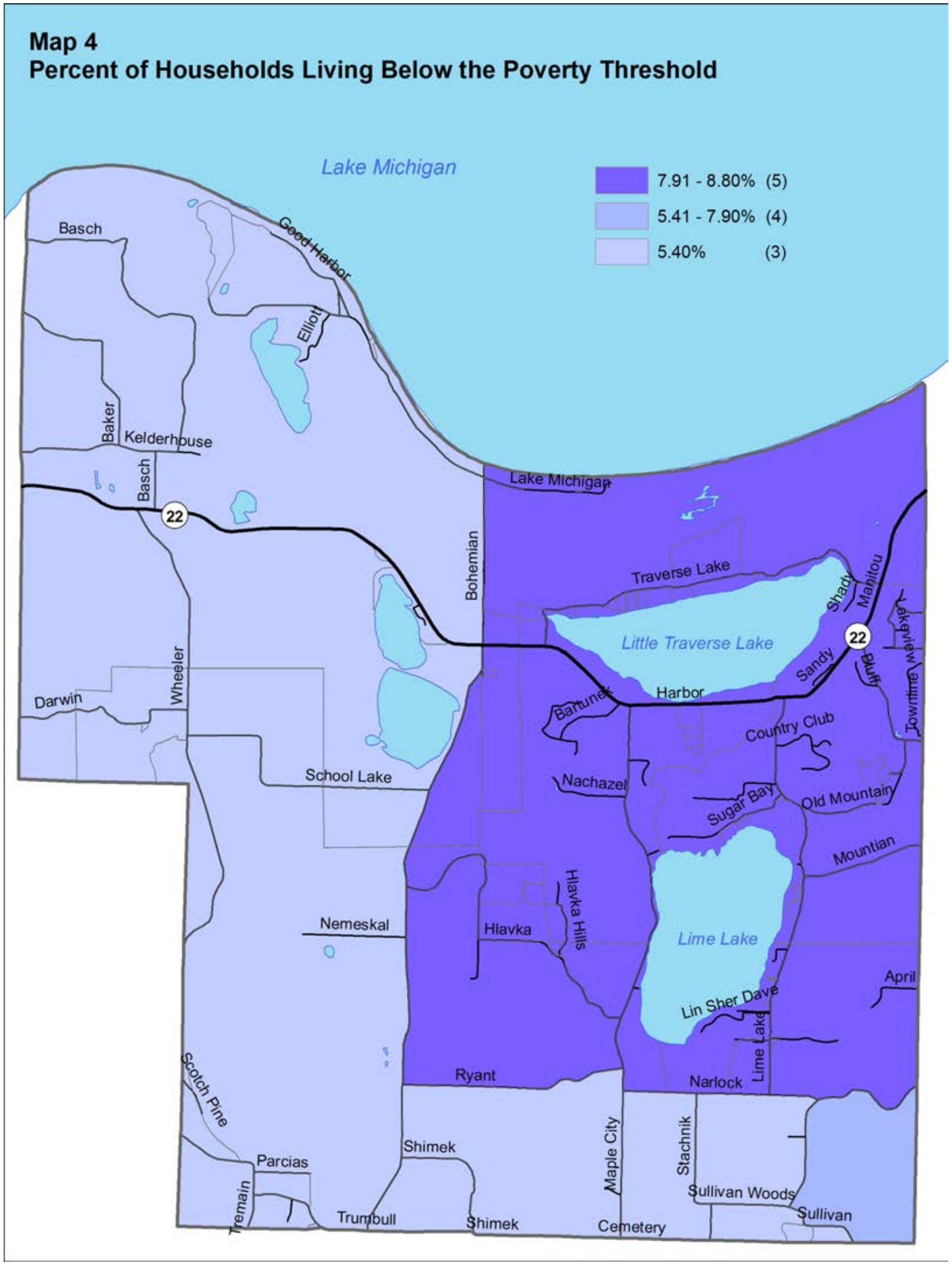



Map 2
Percent of Households with People Living Alone
Lake Michigan
66.68 - 100.00% (5)
40.01 - 66.67% (4)
28.58 - 40.00% (3)
20.01 - 28.57% (2)
9.09 - 20.00% (1)
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Basch
22
Lake Michigan
Bohemian
Traverse Lake
Little Traverse Lake
Shady
Manitou
22
Sandy
Bluff
Lakeview
Townline
Harbor
Bartunek
Country Club
Darwin
Wheeler
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountian
Hlavka Hills
Nemeskal
Hlavka
Lime Lake
Lin Sher Dave
April
Lime Lake
Narlock
Ryant
Scotch Pine
Parcias
Shimek
Maple City
Stachnik
Sullivan Woods
Sullivan
Tremain
Trumbull
Shimek
Cemetery


Leelanau County

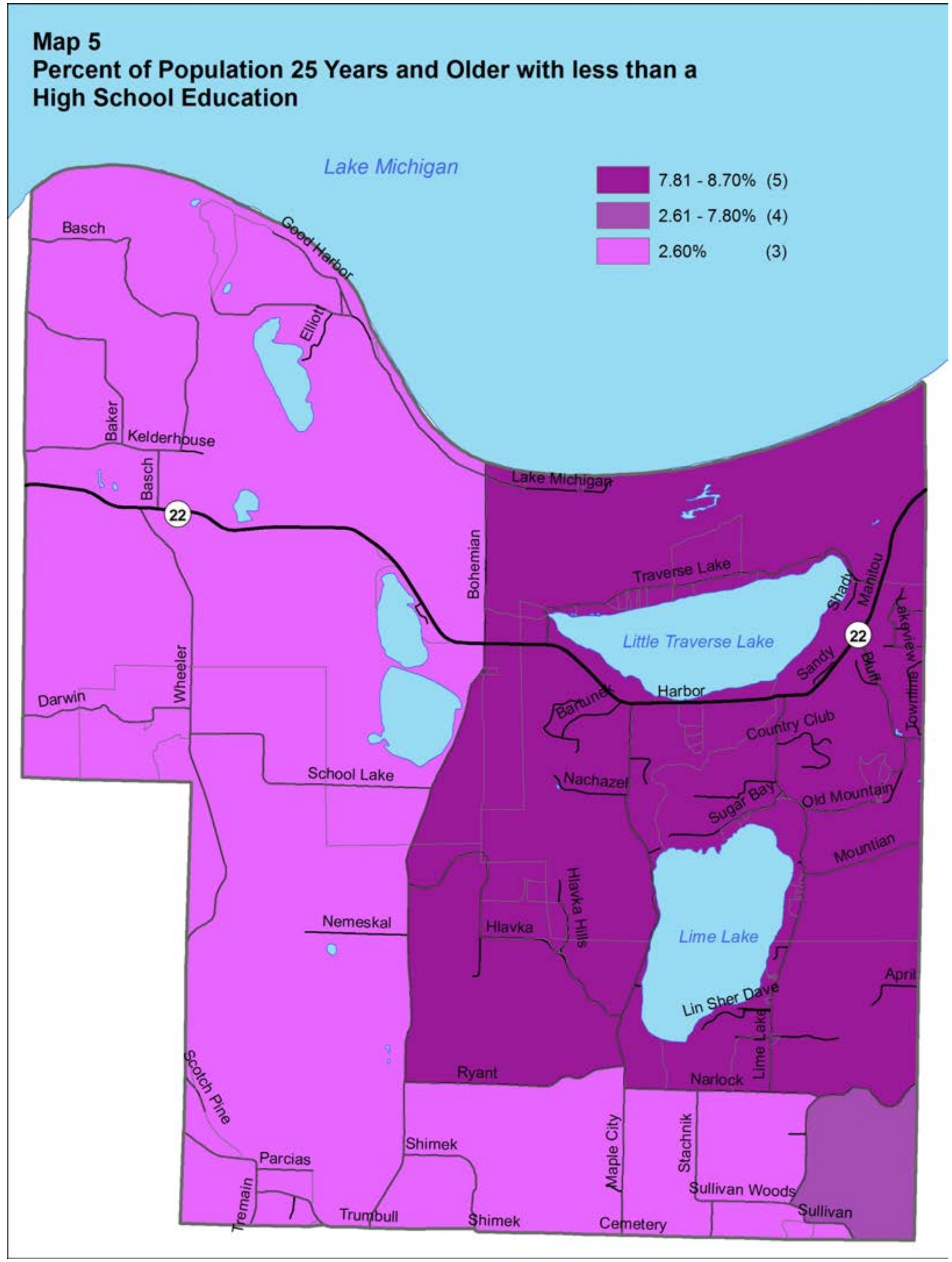

Leelanau County

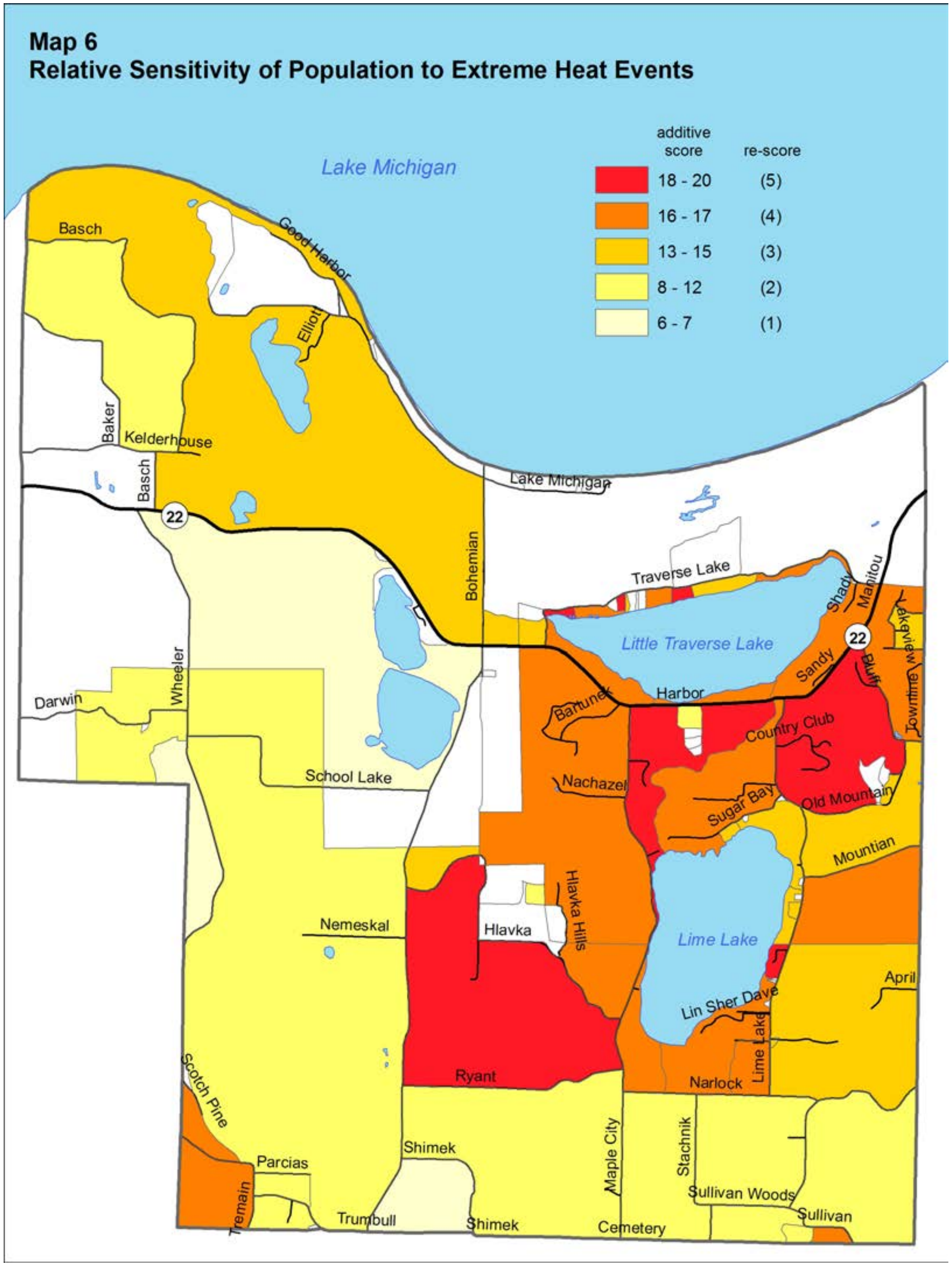

Map 3
Percent of Non-white Population
Lake Michigan
14.30 - 50.00% (5)
10.01 - 14.29% (4)
5.76 - 10.00% (3)
2.57 - 5.75% (2)
1.39 - 2.56% (1)
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Basch
22
Lake Michigan
Bohemian
Traverse Lake
Little Traverse Lake
Shady
Manitou
Lakeview
22
Sandy
Bluff
Harbor
Bartunek
Country Club
Darwin
Wheeler
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountian
Hlavka Hills
Nemeskal
Hlavka
Lime Lake
April
Lin Sher Dave
Lime Lake
Narlock
Ryant
Scotch Pine
Parcias
Shimek
Maple City
Stachnik
Tremain
Trumbull
Shimek
Cemetery
Sullivan Woods
Sullivan


Map 4
Percent of Households Living Below the Poverty Threshold
Lake Michigan
7.91 - 8.80% (5)
5.41 - 7.90% (4)
5.40% (3)
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Basch
22
Lake Michigan
Bohemian
Traverse Lake
Little Traverse Lake
Shady
Manitou
Sandy
Bluff
Lakeview
Townline
Harbor
Bartunek
Country Club
Darwin
Wheeler
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountian
Hlavka Hills
Nemeskal
Hlavka
Lime Lake
April
Lin Sher Dave
Lime Lake
Ryant
Narlock
Scotch Pine
Shimek
Maple City
Stachnik
Parcias
Sullivan Woods
Tremain
Trumbull
Shimek
Cemetery
Sullivan


Leelanau County

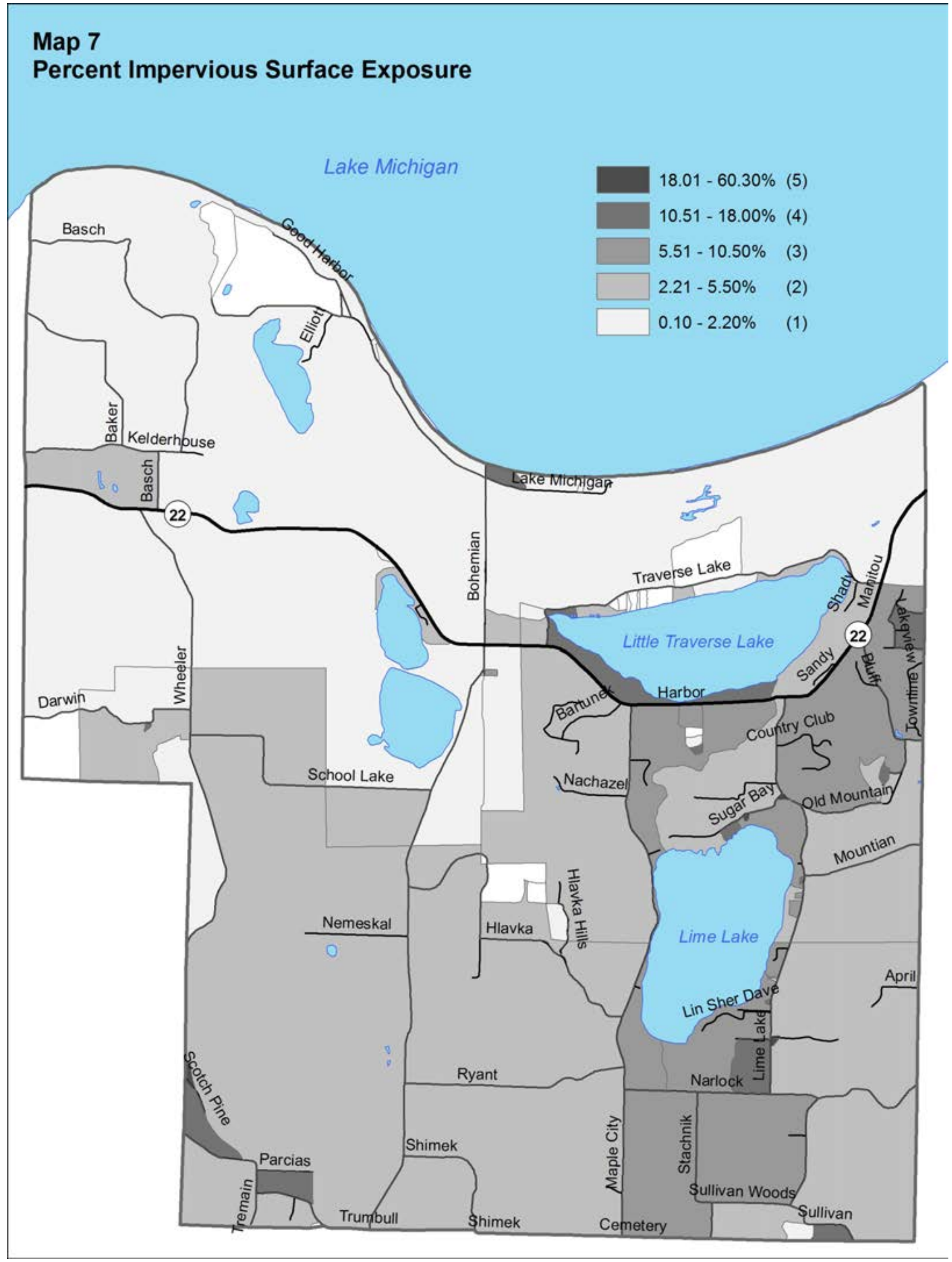

Leelanau County

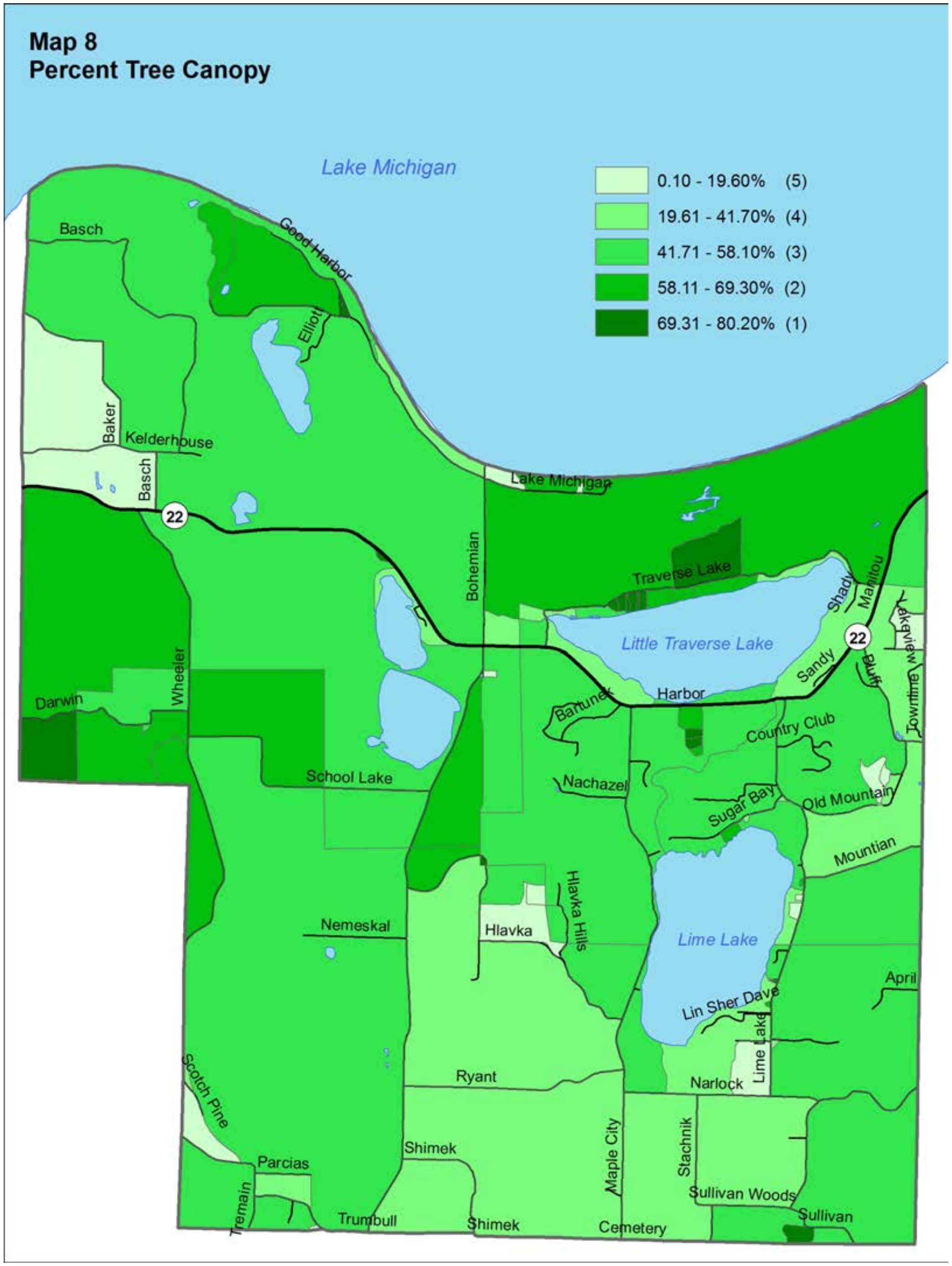

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Lake Michigan
7.81 - 8.70% (5)
2.61 - 7.80% (4)
2.60% (3)
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Basch
22
Bohemian
Lake Michigan
Traverse Lake
Little Traverse Lake
Shady
Manitou
Lakeview
Bluff
Sandy
Harbor
Barrunek
Country Club
Wheeler
Darwin
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountain
Hlavka Hills
Nemeskal
Hlavka
Lime Lake
April
Lin Sher Dave
Lime Lake
Narlock
Ryant
Scotch Pine
Shimek
Parcias
Maple City
Stachnik
Sullivan Woods
Sullivan
Tremain
Trumbull
Shimek
Cemetery


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
18 - 20 (5)
16 - 17 (4)
13 - 15 (3)
8 - 12 (2)
6 - 7 (1)
Lake Michigan
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Basch
22
Lake Michigan
Bohemian
Traverse Lake
Little Traverse Lake
Shady
Manitou
Sandy
Harbor
Bluff
Lakeview
Townline
Darwin
Wheeler
Barunek
Country Club
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountian
Hlavka Hills
Hlavka
Nemeskal
Lime Lake
April
Lin Sher Dave
Lime Lake
Ryant
Narlock
Scotch Pine
Parcias
Shimek
Maple City
Stachnik
Sullivan Woods
Sullivan
Tremain
Trumbull
Shimek
Cemetery


Leelanau County

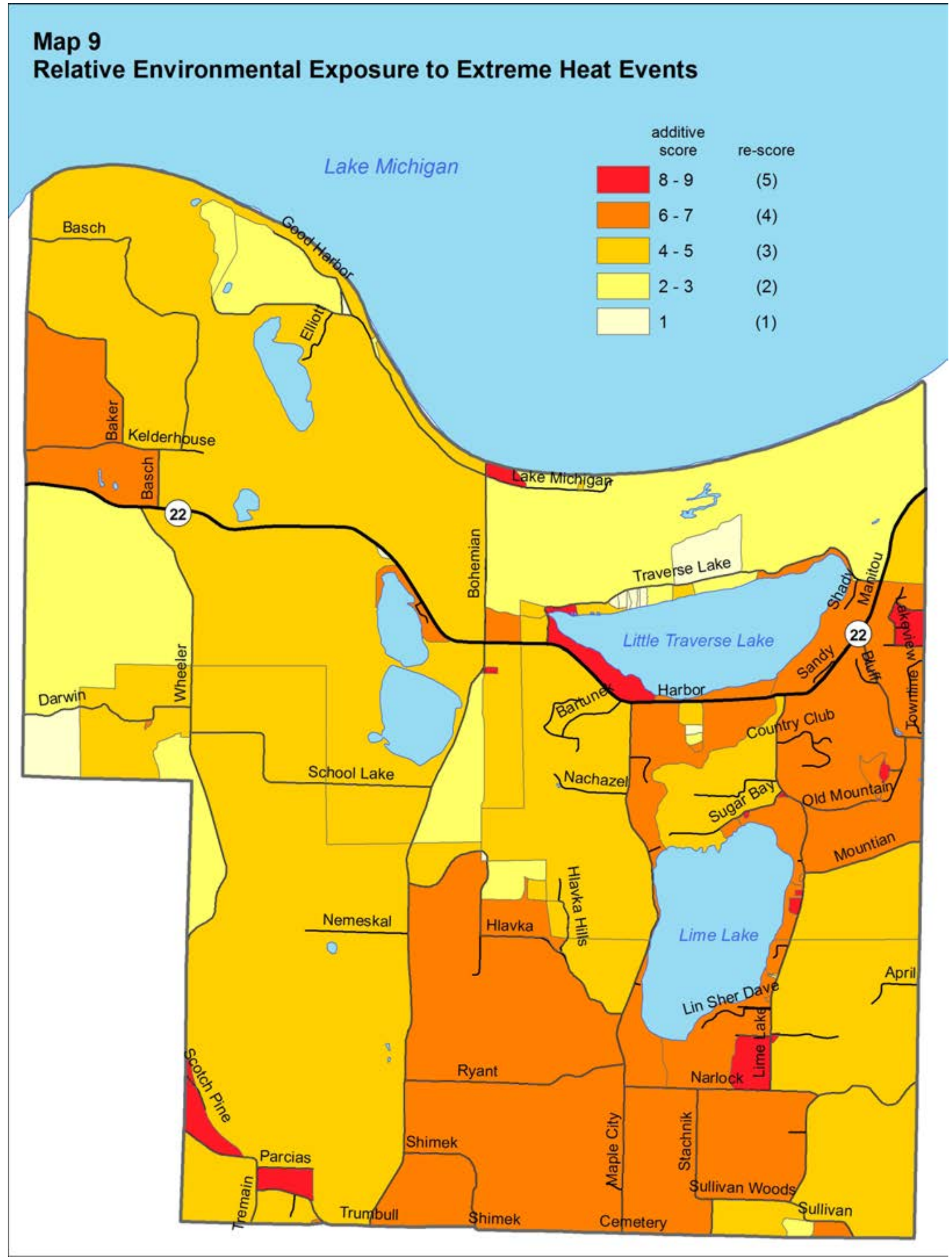

Leelanau County

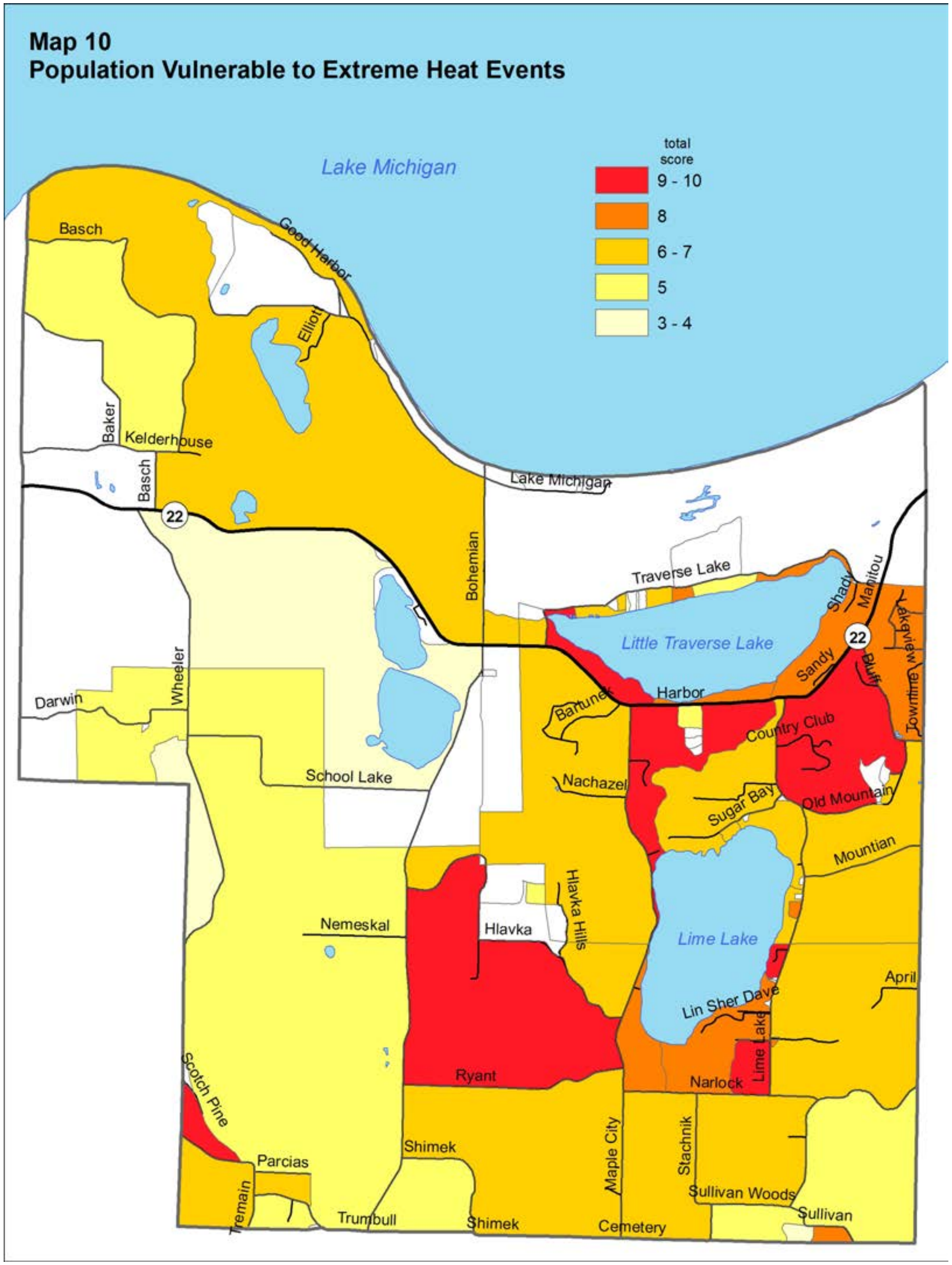

Map 7
Percent Impervious Surface Exposure
Lake Michigan
18.01 - 60.30% (5)
10.51 - 18.00% (4)
5.51 - 10.50% (3)
2.21 - 5.50% (2)
0.10 - 2.20% (1)
Little Traverse Lake
Lime Lake
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Lake Michigan
22
Bohemian
Traverse Lake
Shady
Manitou
Lakeview
Sandy
Bluff
Towntine
Harbor
Bartunek
Country Club
Darwin
Wheeler
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountian
Nemeskal
Hlavka
Hlavka Hills
April
Lin Sher Dave
Lime Lake
Narlock
Ryant
Scotch Pine
Parcias
Shimek
Maple City
Stachnik
Sullivan Woods
Sullivan
Tremain
Trumbull
Shimek
Cemetery


Map 8
Percent Tree Canopy
Lake Michigan
0.10 - 19.60% (5)
19.61 - 41.70% (4)
41.71 - 58.10% (3)
58.11 - 69.30% (2)
69.31 - 80.20% (1)
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Basch
22
Lake Michigan
Bohemian
Traverse Lake
Little Traverse Lake
Shady
Manitou
22
Lakeview
Sandy
Bluff
Harbor
Bartunek
Towntine
Country Club
Wheeler
Darwin
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountian
Nemeskal
Hlavka
Hlavka Hills
Lime Lake
April
Lin Sher Dave
Lime Lake
Narlock
Ryant
Scotch Pine
Parcias
Shimek
Maple City
Stachnik
Sullivan Woods
Sullivan
Tremain
Trumbull
Shimek
Cemetery


Leelanau County

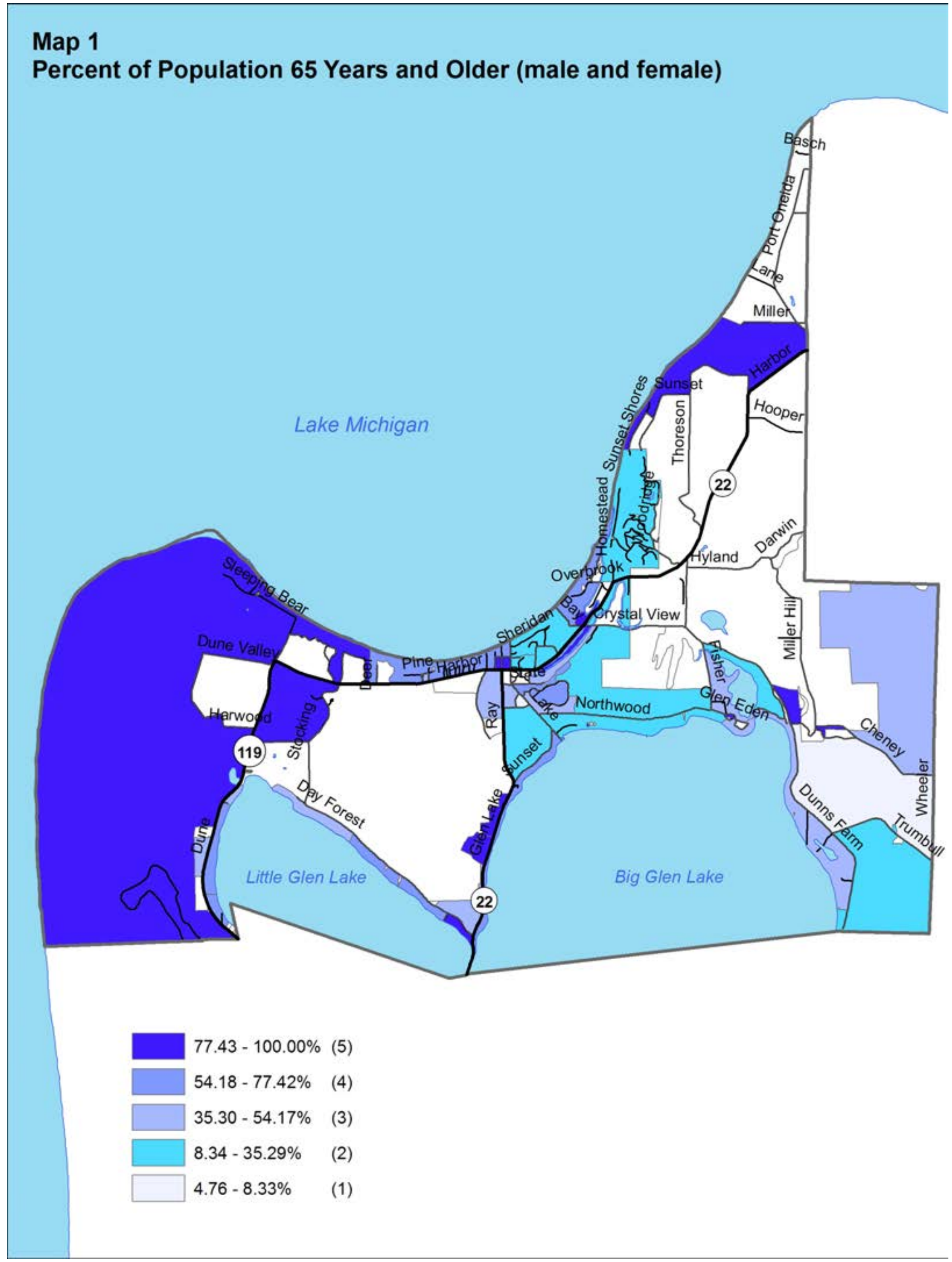

Leelanau County


Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
additive score
re-score
8 - 9 (5)
6 - 7 (4)
4 - 5 (3)
2 - 3 (2)
1 (1)
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Basch
22
Lake Michigan
Bohemian
Traverse Lake
Little Traverse Lake
Shady
Manitou
Lakeview
22
Sandy
Bluff
Townline
Harbor
Bartunek
Country Club
Darwin
Wheeler
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountian
Hlavka Hills
Nemeskal
Hlavka
Lime Lake
April
Lin Sher Dave
Lime Lake
Scotch Pine
Ryant
Narlock
Parcias
Shimek
Maple City
Stachnik
Sullivan Woods
Tremain
Trumbull
Shimek
Cemetery
Sullivan

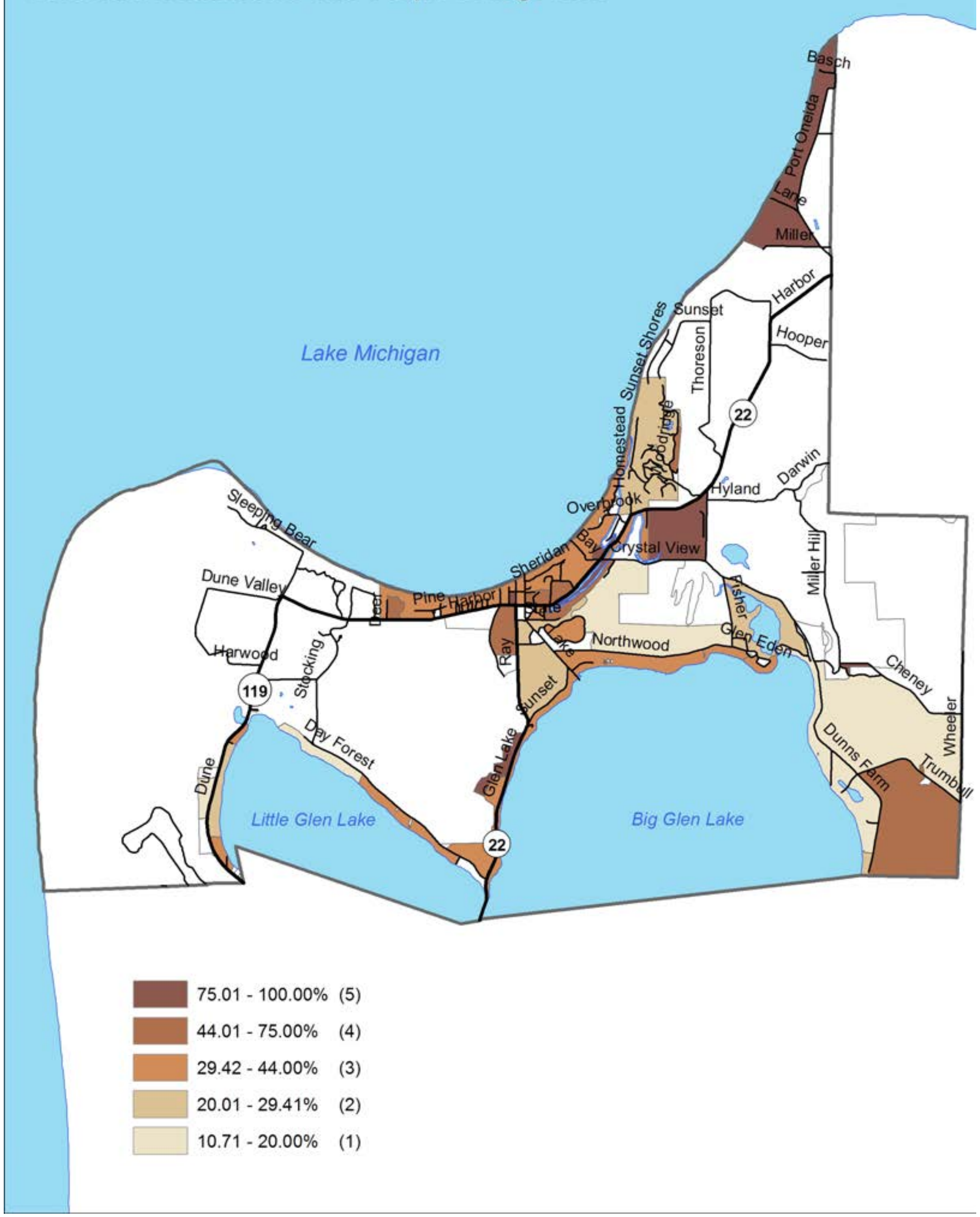

Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
total score
9 - 10
8
6 - 7
5
3 - 4
Basch
Good Harbor
Elliott
Baker
Kelderhouse
Basch
22
Lake Michigan
Bohemian
Traverse Lake
Little Traverse Lake
Shady
Manitou
Lakeview
Sandy
Bluff
Harbor
Bartunek
Country Club
Townline
Darwin
Wheeler
School Lake
Nachazel
Sugar Bay
Old Mountain
Mountian
Hlavka Hills
Nemeskal
Hlavka
Lime Lake
Lin Sher Dave
April
Lime Lake
Scotch Pine
Ryant
Narlock
Parcias
Shimek
Maple City
Stachnik
Tremain
Trumbull
Shimek
Cemetery
Sullivan Woods
Sullivan


Leelanau County

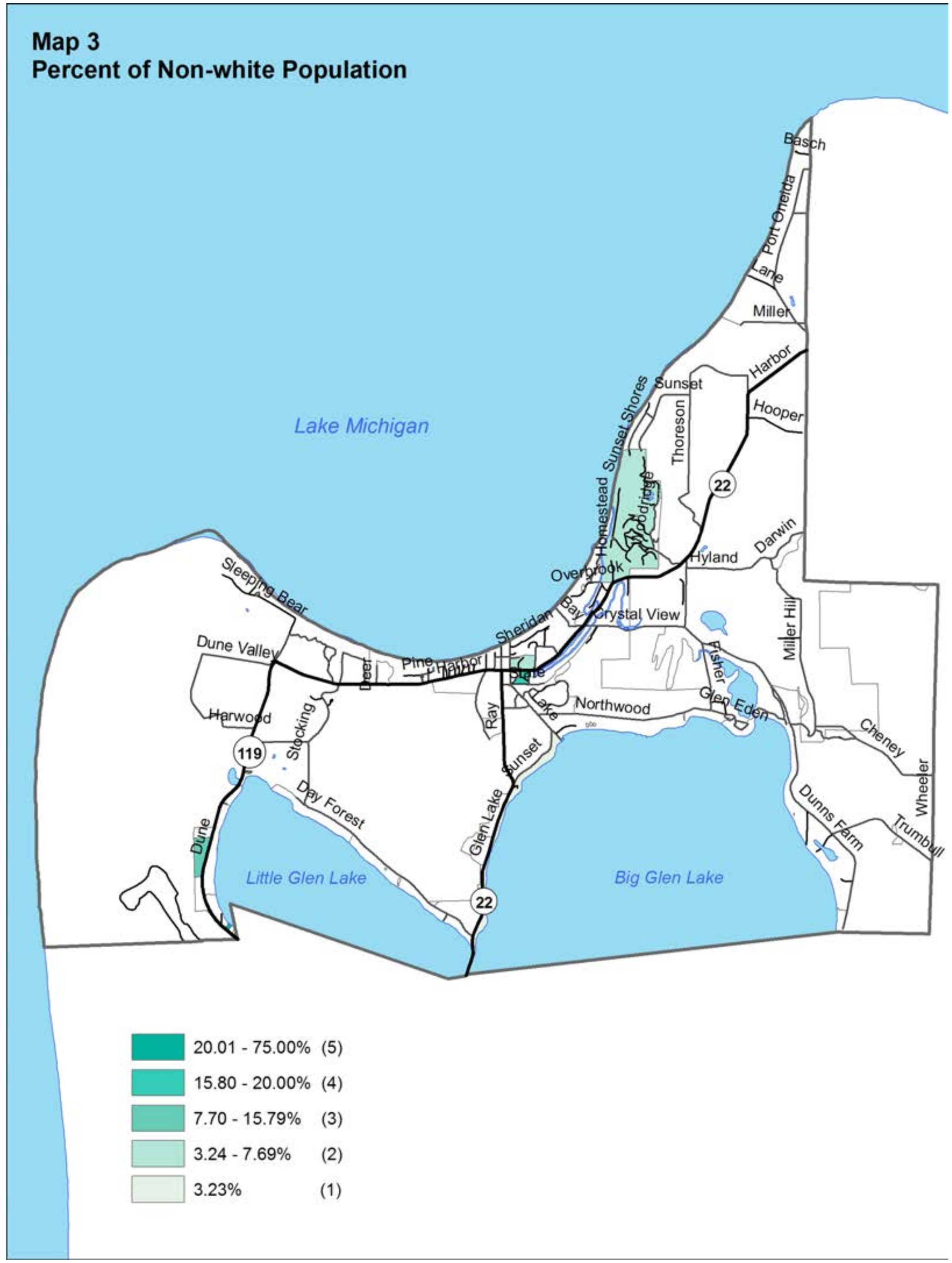
Glen Arbor Twp.

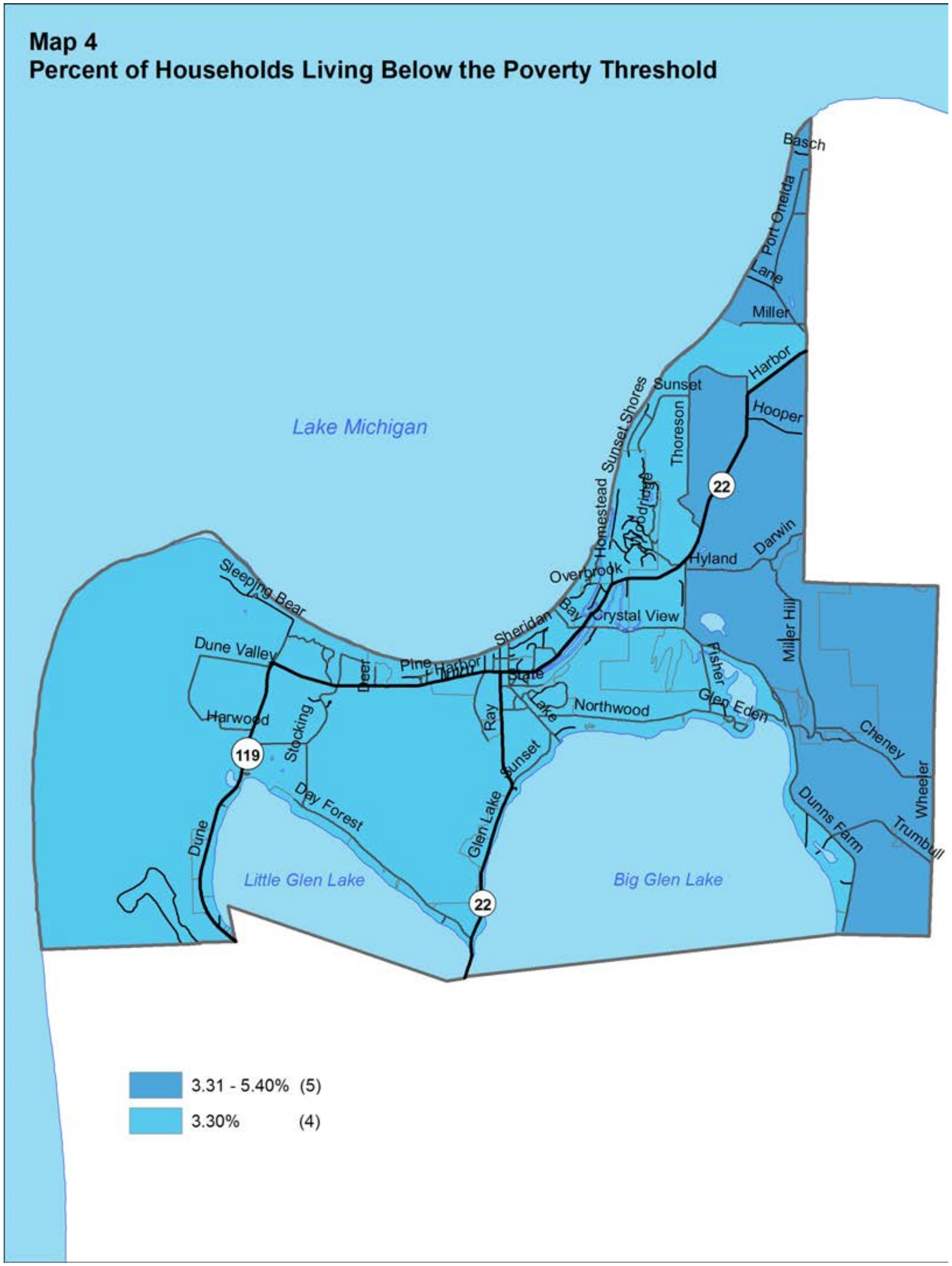


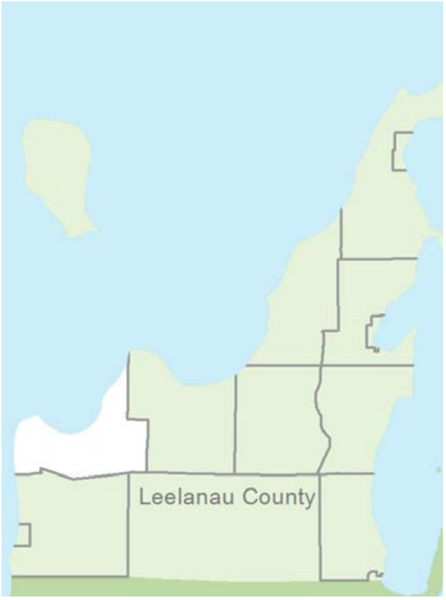
Map 2
Percent of Households with People Living Alone



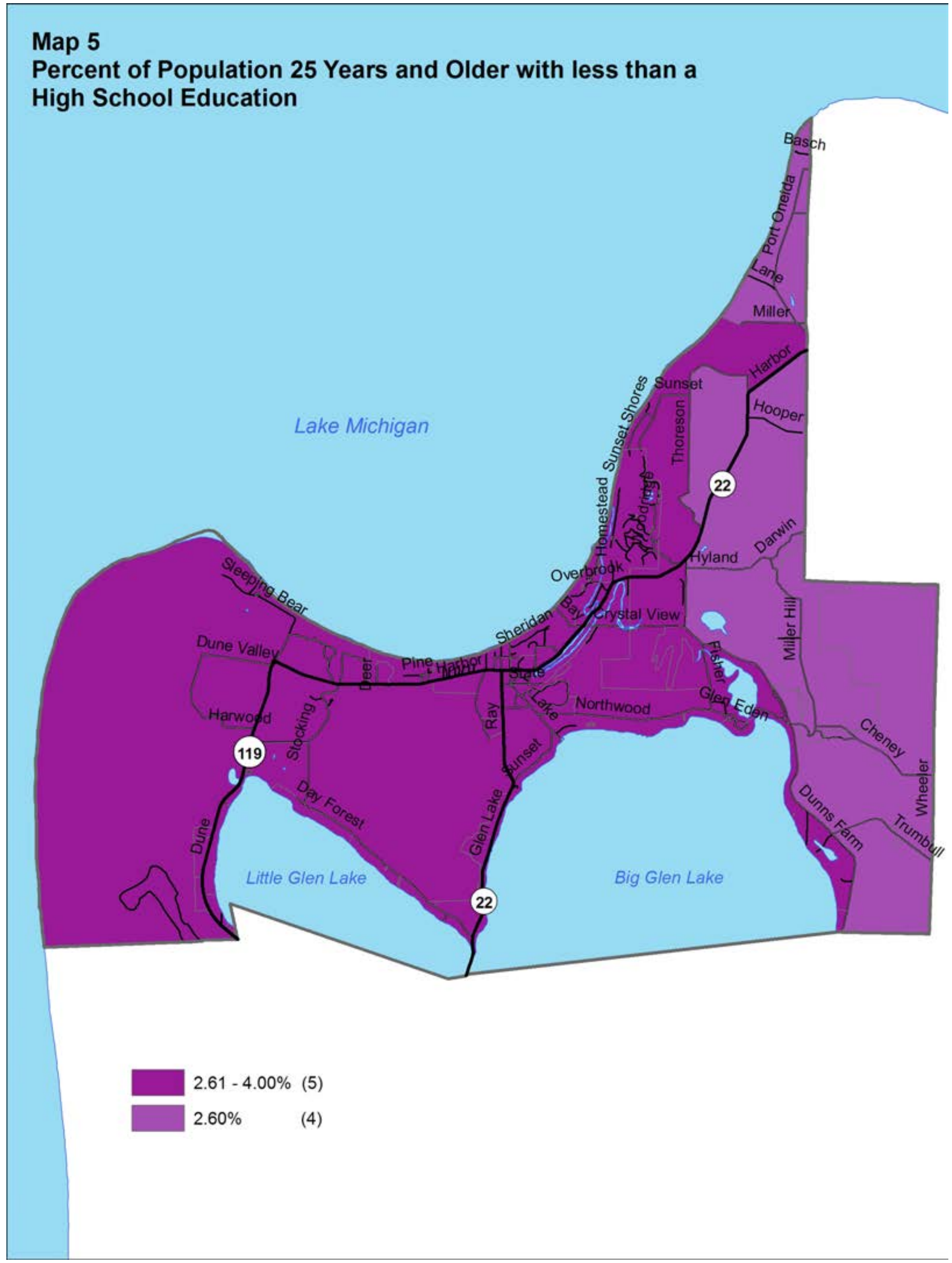

Leelanau County

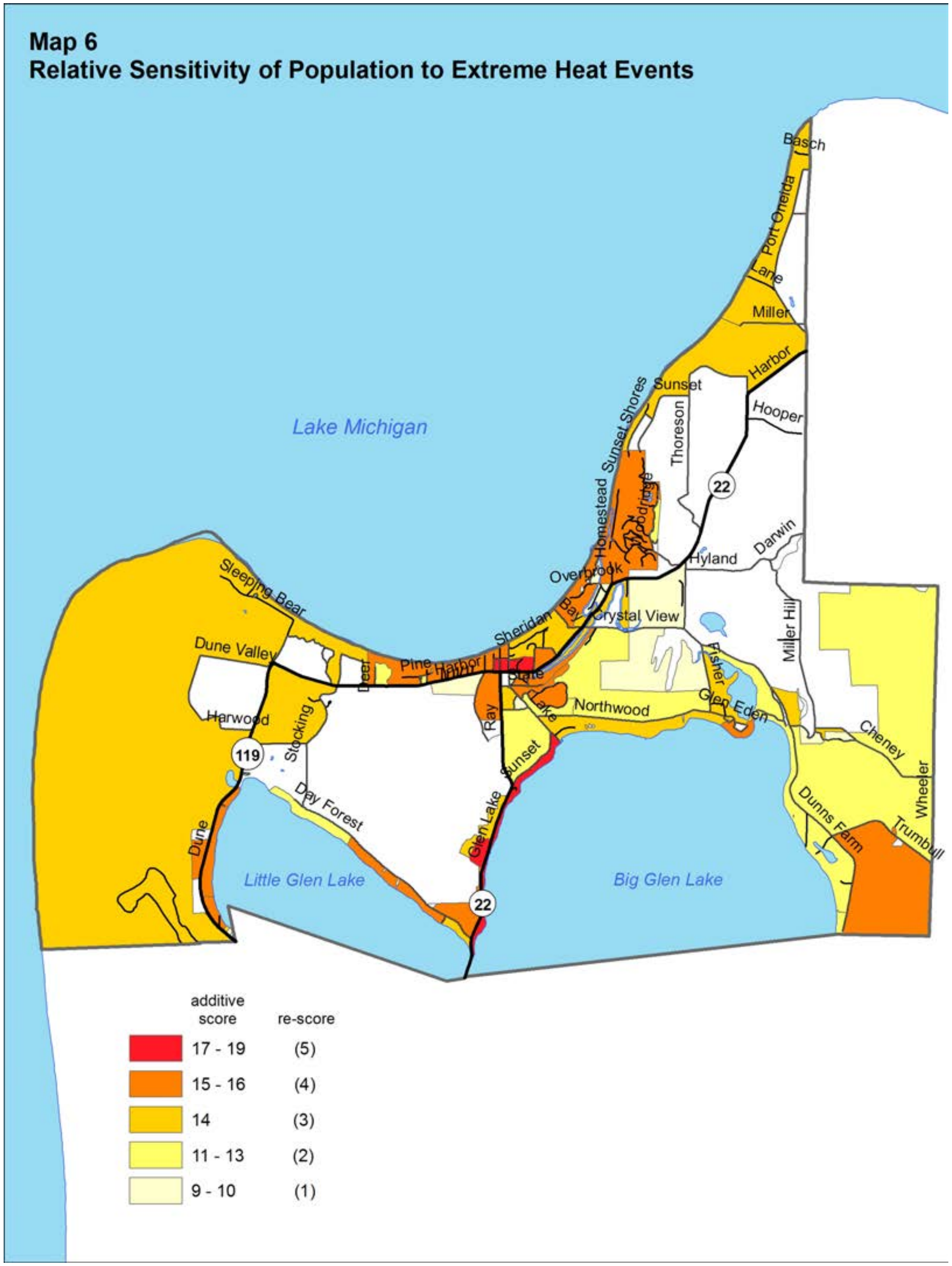

Map 3
Percent of Non-white Population
Lake Michigan
Little Glen Lake
Big Glen Lake
Basch
Port Oneida
Lane
Miller
Harbor
Hooper
Sunset
Sunset Shores
Thoreson
Homestead
Overbrook
Hyland
Darwin
Sleeping Bear
Crystal View
Sheridan
Bay
Dune Valley
Pine
Harbor
State
Deer
Northwood
Harwood
Stocking
Ray
Lake
Glen Eden
Fisher
Miller Hill
Cheney
Sunset
Day Forest
Glen Lake
Dune
Dunns Farm
Wheeler
Trumbull
119
22
20.01 - 75.00% (5)
15.80 - 20.00% (4)
7.70 - 15.79% (3)
3.24 - 7.69% (2)
3.23% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
Lake Michigan
Little Glen Lake
Big Glen Lake
Basch
Port Oneida
Lane
Miller
Harbor
Hooper
Sunset
Sunset Shores
Thoreson
Homestead
22
Hyland
Darwin
Overbrook
Bay
Crystal View
Sheridan
Sleeping Bear
Dune Valley
Deer
Pine
Harbor
State
Harwood
Stocking
119
Ray
Lake
Northwood
Fisher
Glen Eden
Miller Hill
Cheney
Wheeler
Trumbull
Dunns Farm
Sunset
Glen Lake
Day Forest
Dune
3.31 - 5.40% (5)
3.30% (4)

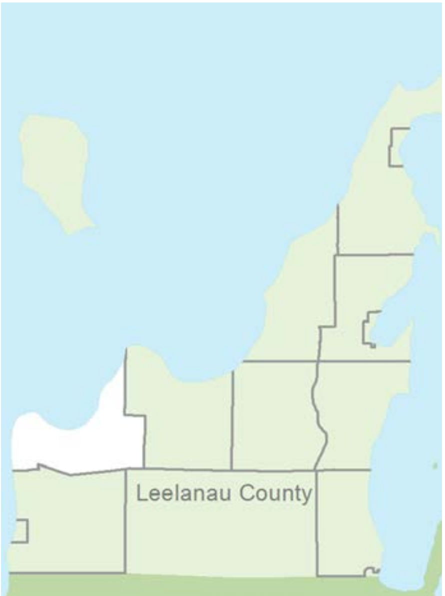

Leelanau County

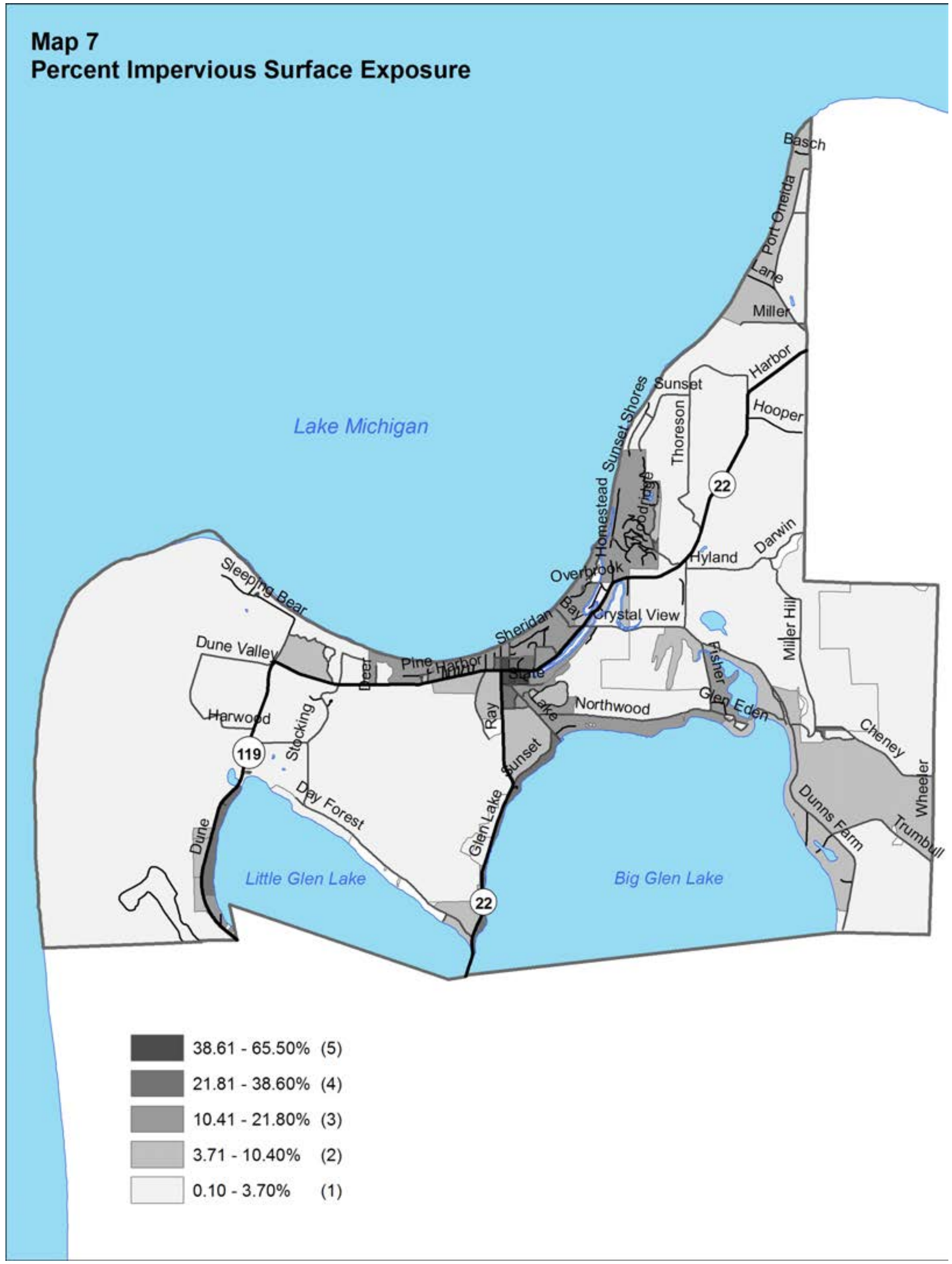

Leelanau County

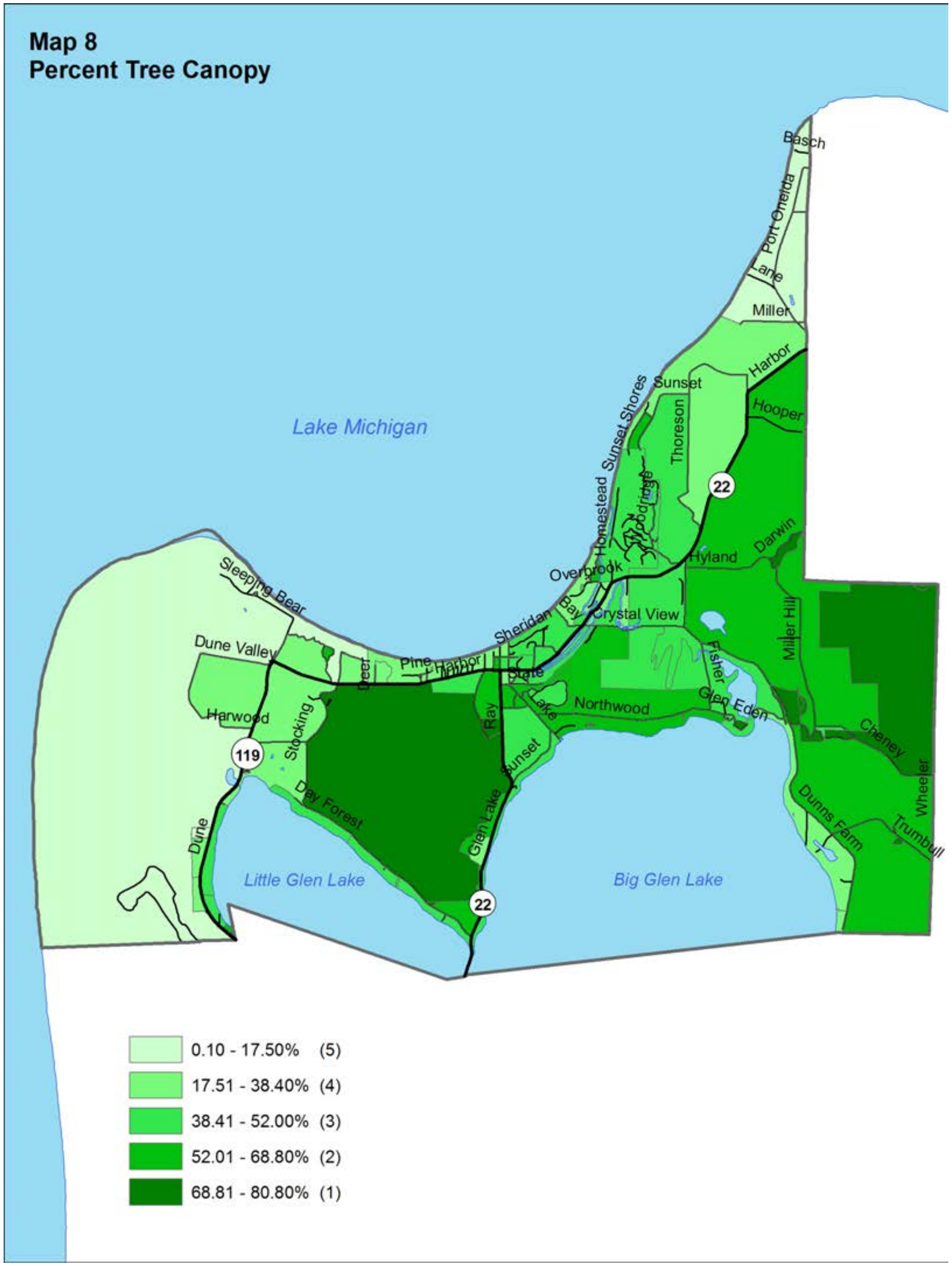

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Lake Michigan
Little Glen Lake
Big Glen Lake
2.61 - 4.00% (5)
2.60% (4)



Map 6
Relative Sensitivity of Population to Extreme Heat Events

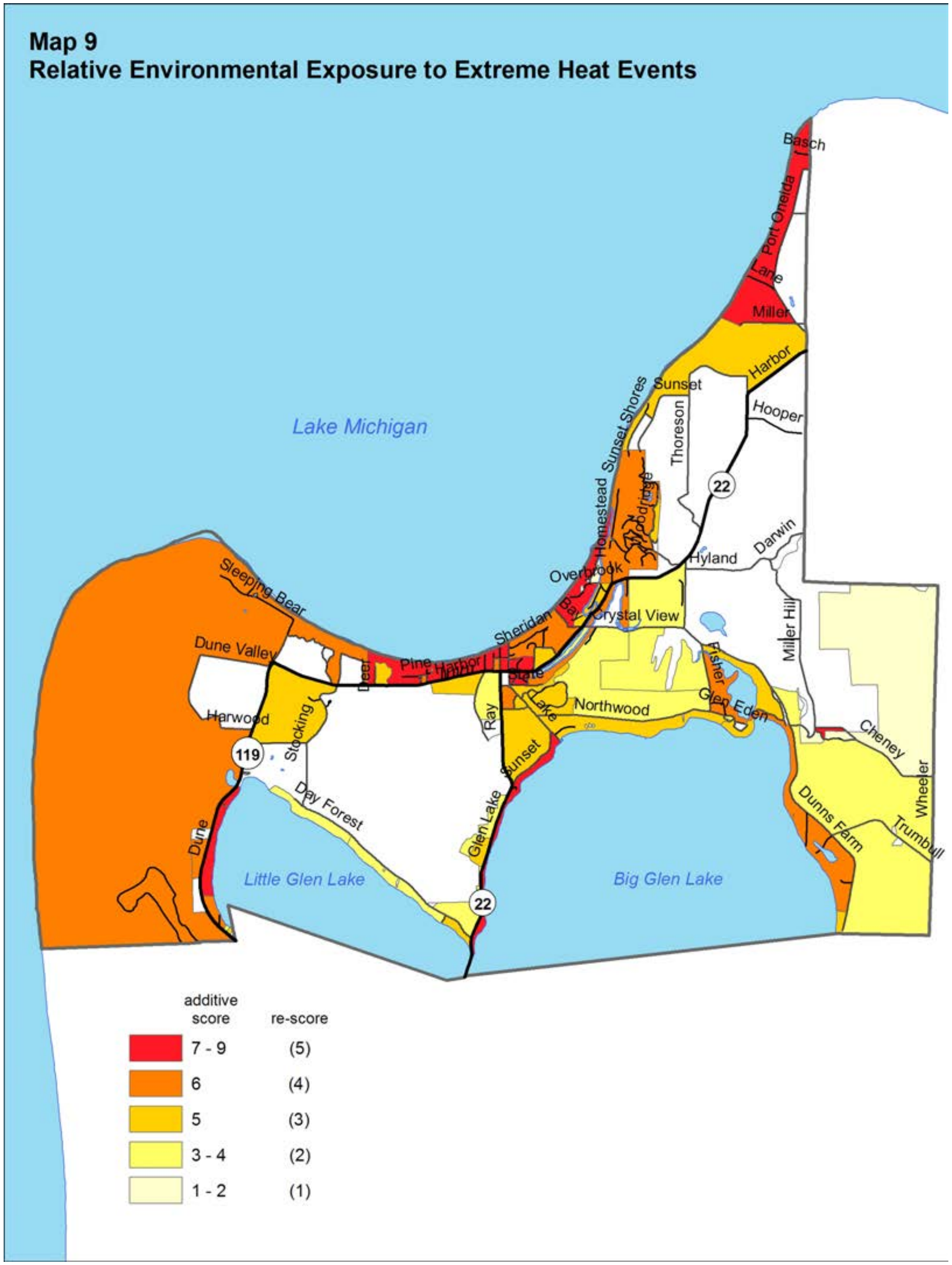

Leelanau County

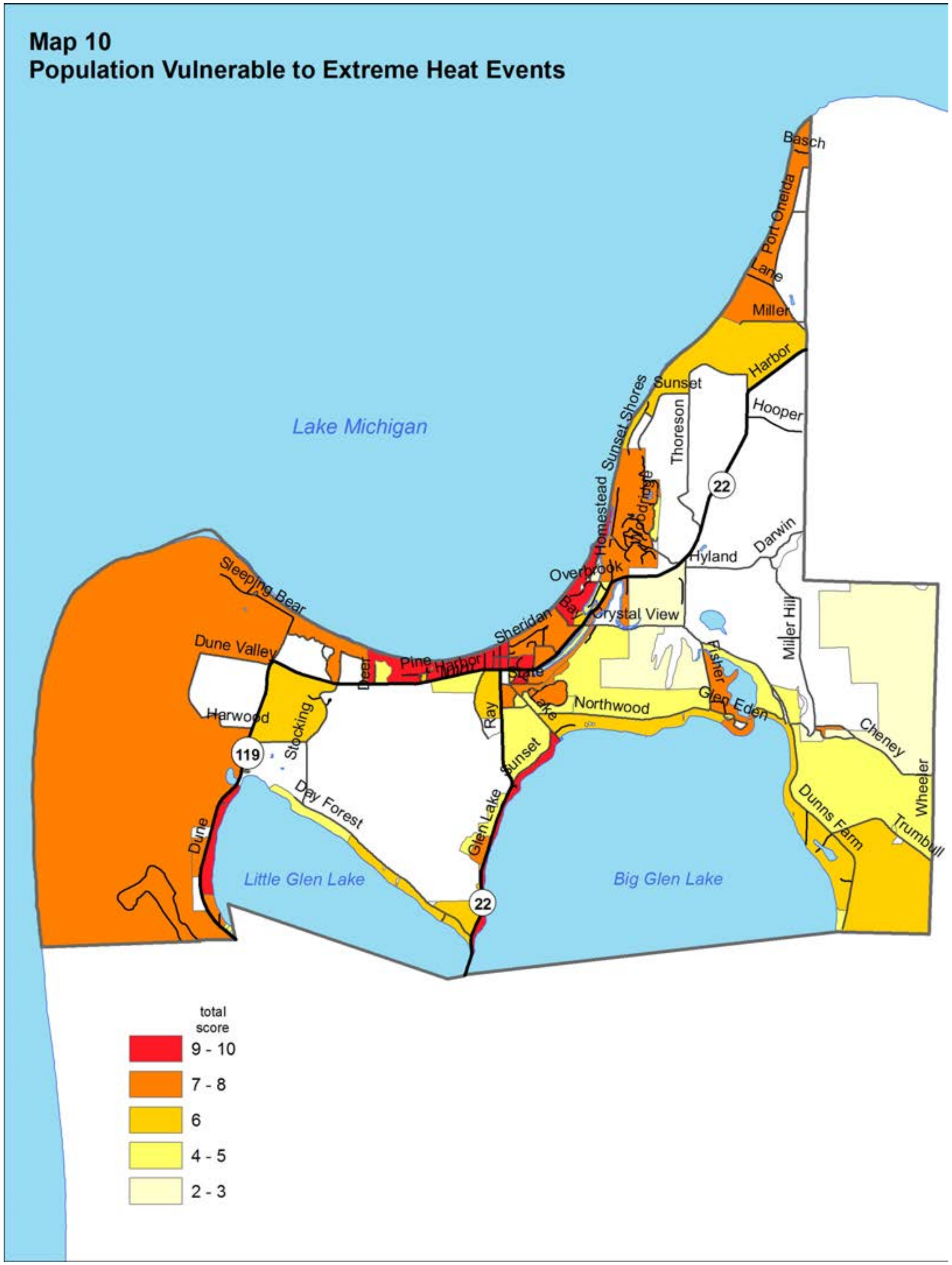

Map 7
Percent Impervious Surface Exposure
Lake Michigan
Little Glen Lake
Big Glen Lake
38.61 - 65.50% (5)
21.81 - 38.60% (4)
10.41 - 21.80% (3)
3.71 - 10.40% (2)
0.10 - 3.70% (1)


Map 8
Percent Tree Canopy
Lake Michigan
Little Glen Lake
Big Glen Lake
Basch
Port Oneida
Lane
Miller
Harbor
Hooper
Sunset
Sunset Shores
Thoreson
Homestead
22
Darwin
Hyland
Overbrook
Bay
Crystal View
Sheridan
Sleeping Bear
Dune Valley
Pine
Deer
State
Harwood
Stocking
119
Day Forest
Dune
Ray
Lake
Northwood
Fisher
Glen Eden
Miller Hill
Cheney
Sunset
Glen Lake
Wheeler
Dunns Farm
Trumbull
0.10 - 17.50% (5)
17.51 - 38.40% (4)
38.41 - 52.00% (3)
52.01 - 68.80% (2)
68.81 - 80.80% (1)


Leelanau County

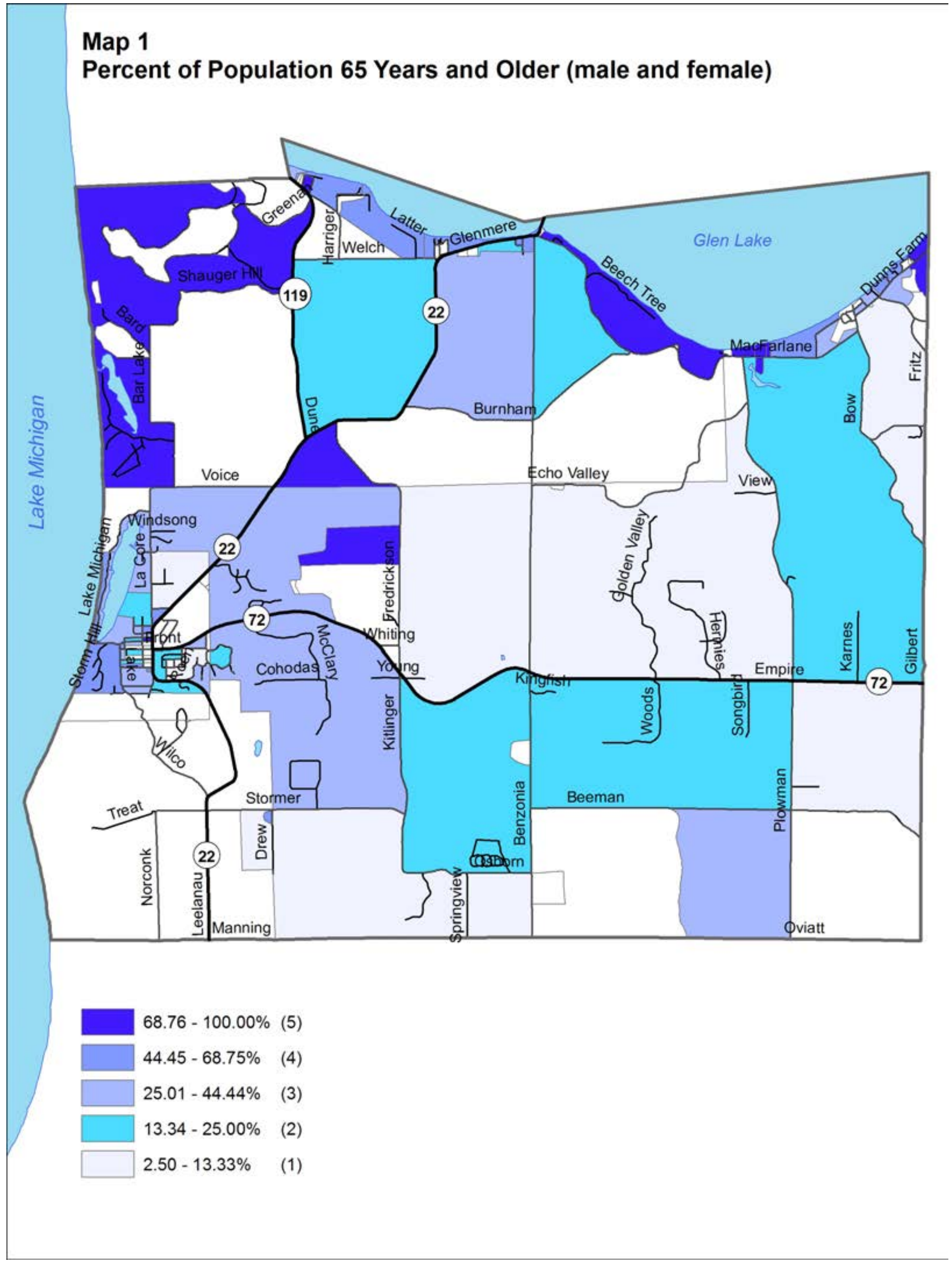

Leelanau County

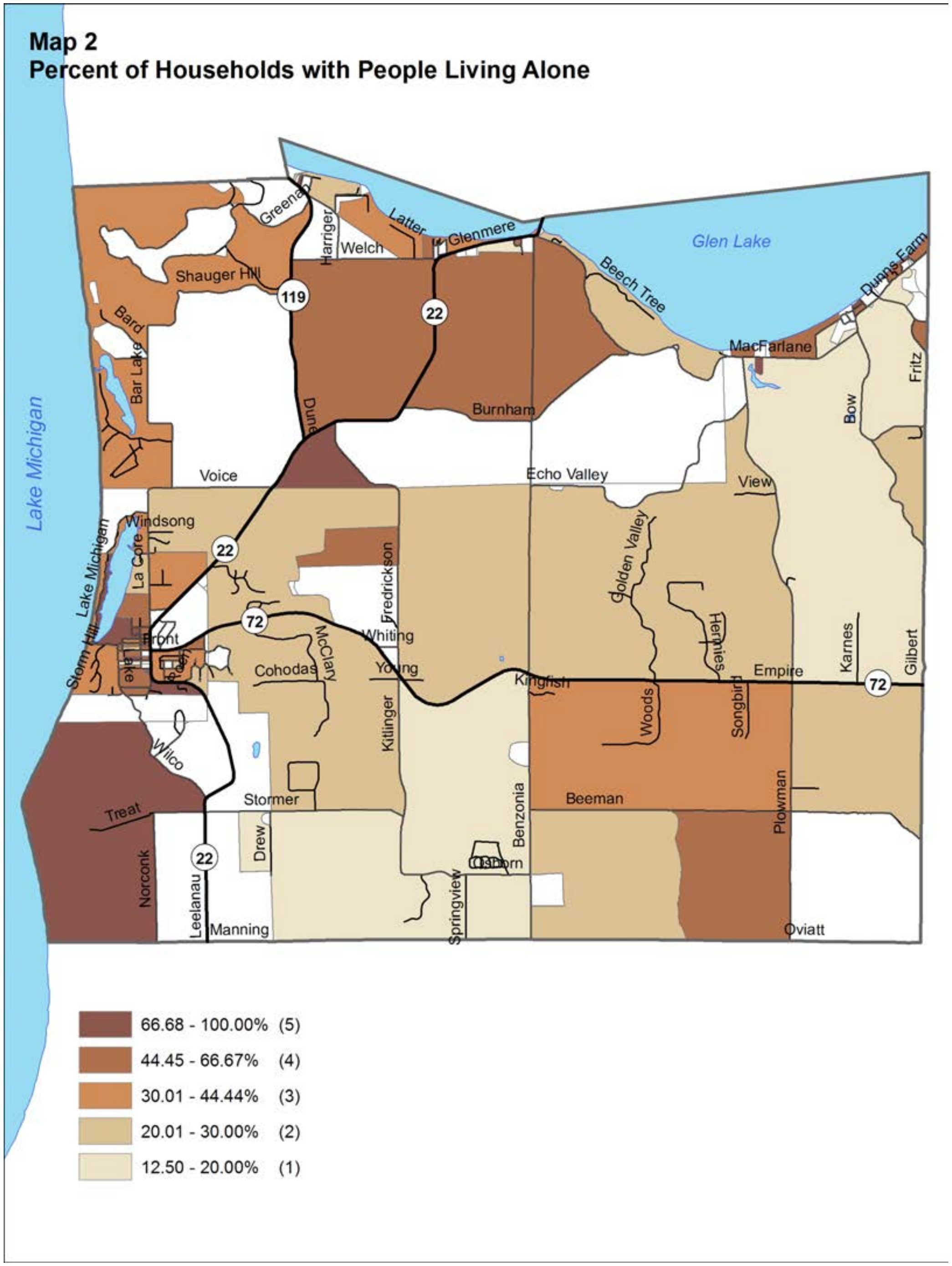

Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
Little Glen Lake
Big Glen Lake
Basch
Port Oneida
Lane
Miller
Harbor
Sunset
Hooper
Thoreson
Sunset Shores
Homestead
Woodridge
22
Hyland
Darwin
Overbrook
Sleeping Bear
Crystal View
Miller Hill
Sheridan
Bay
Dune Valley
Pine
Harbor
State
Deer
Northwood
Fisher
Glen Eden
Harwood
Stocking
Ray
Lake
Cheney
119
Sunset
Day Forest
Glen Lake
Dunns Farm
Wheeler
Trumbull
Dune
22
additive score
re-score
7 - 9
(5)
6
(4)
5
(3)
3 - 4
(2)
1 - 2
(1)


Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
Little Glen Lake
Big Glen Lake
Basch
Port Oneida
Lane
Miller
Harbor
Hooper
Sunset
Sunset Shores
Thoreson
22
Homestead
Darwin
Hyland
Overbrook
Bay
Crystal View
Sheridan
Sleeping Bear
Dune Valley
Pine
Harbor
Deer
Harwood
Stocking
119
Ray
Lake
Northwood
Fisher
Glen Eden
Miller Hill
Cheney
Wheeler
Trumbull
Dunns Farm
Sunset
Glen Lake
Day Forest
Dune
22
total score
9 - 10
7 - 8
6
4 - 5
2 - 3


Leelanau County

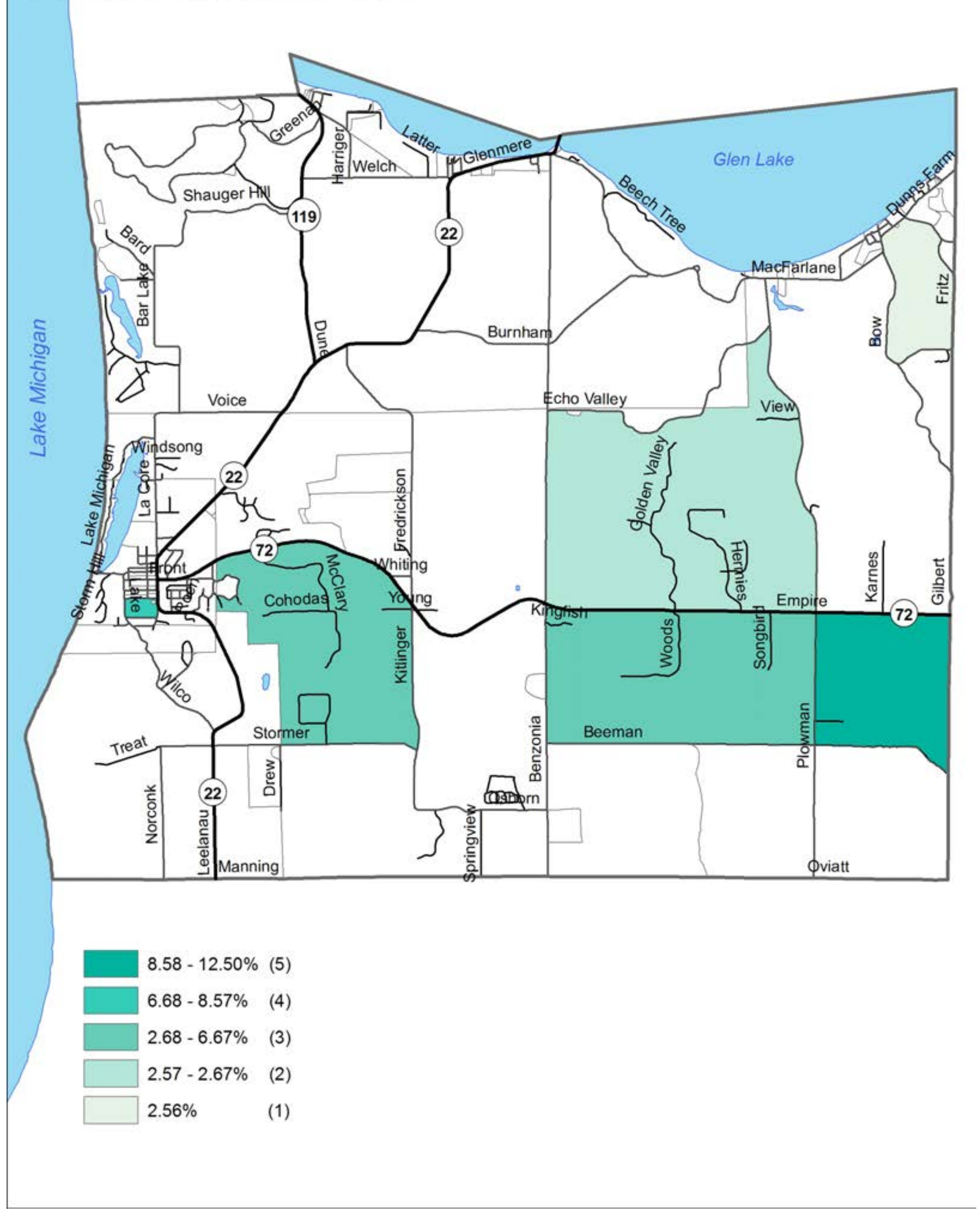
Empire Twp./ Empire



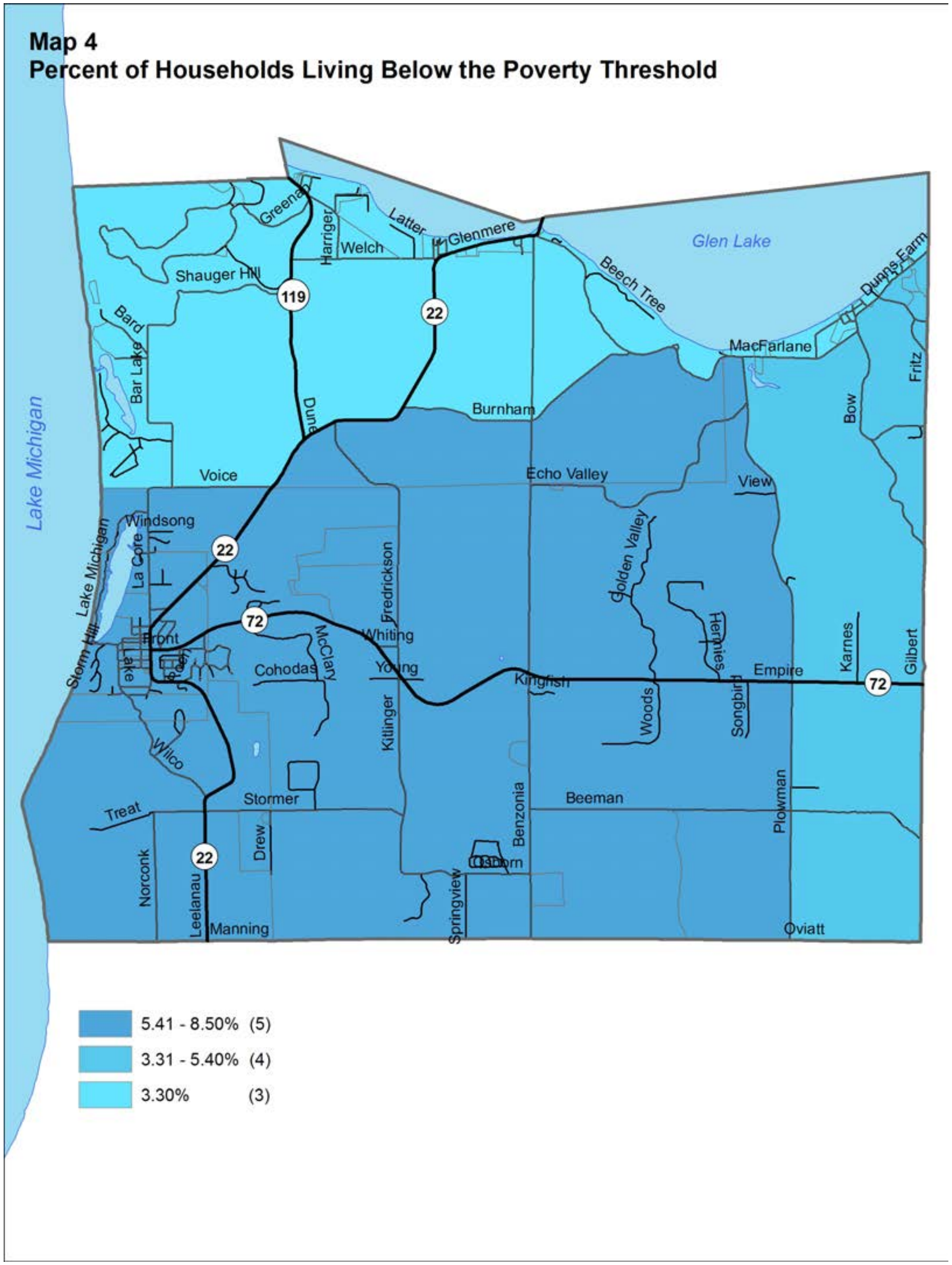

Map 2
Percent of Households with People Living Alone
Lake Michigan
Glen Lake
66.68 - 100.00% (5)
44.45 - 66.67% (4)
30.01 - 44.44% (3)
20.01 - 30.00% (2)
12.50 - 20.00% (1)

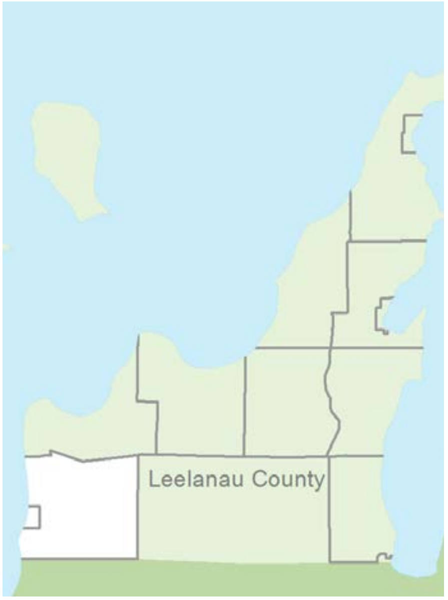

Leelanau County

Map 3
Percent of Non-white Population

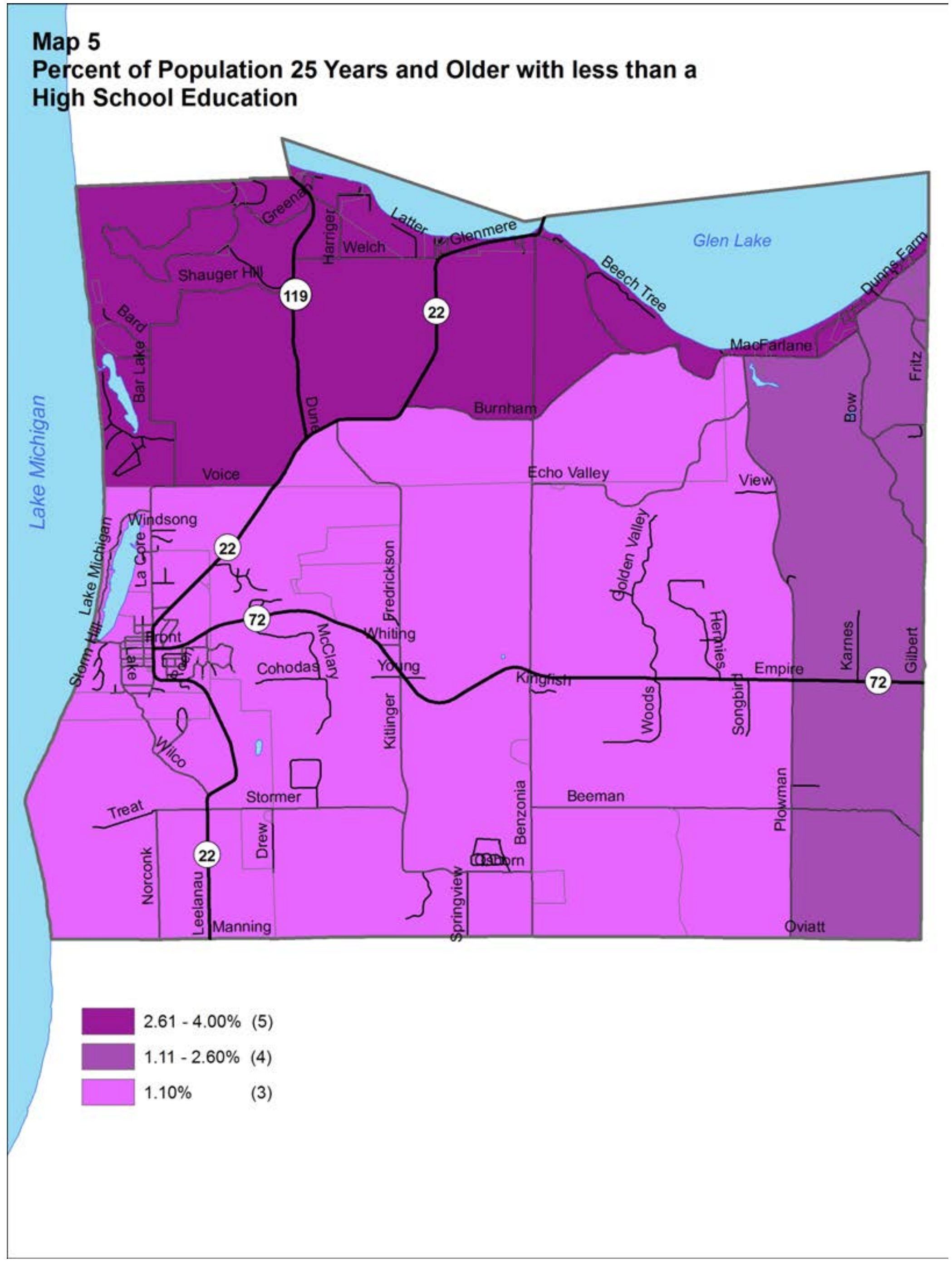


Map 4
Percent of Households Living Below the Poverty Threshold

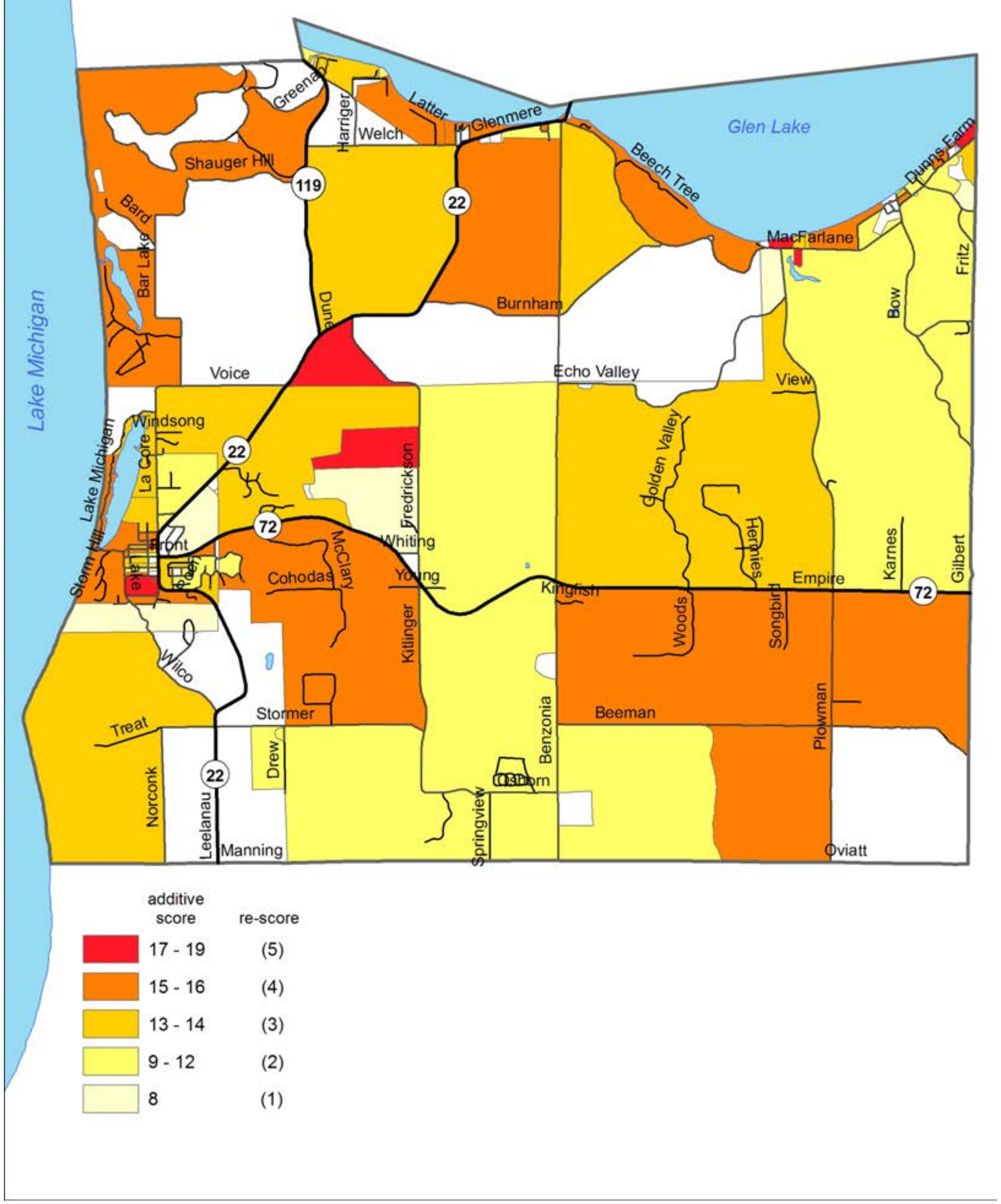


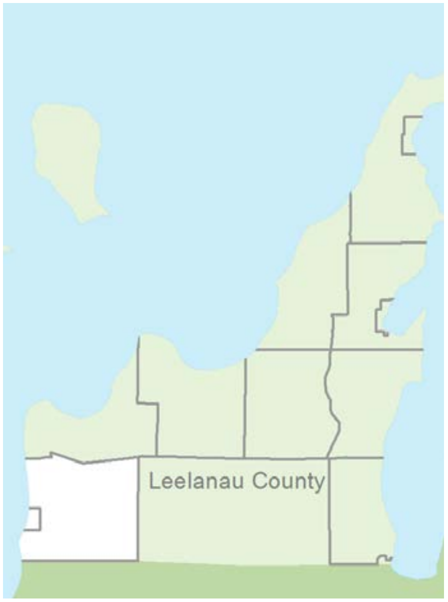



Leelanau County

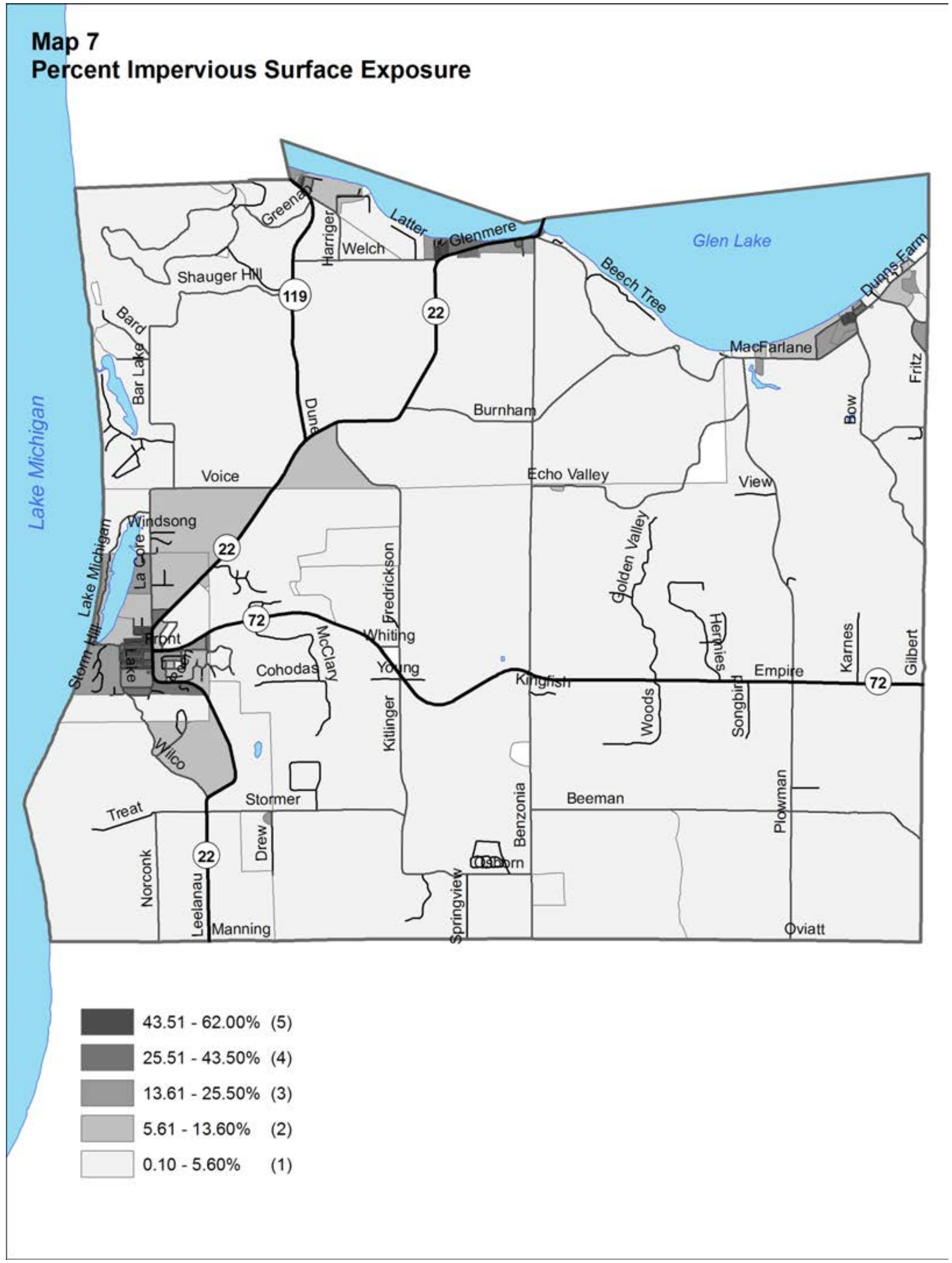

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Lake Michigan
Glen Lake
Greenan
Harriger
Latter
Glenmere
Welch
Shauger Hill
119
22
Bard
Bar Lake
Beech Tree
Dunns Farm
MacFarlane
Fritz
Bow
Burnham
Voice
Echo Valley
View
Windsong
La Core
Lake Michigan
Fredrickson
Golden Valley
Storm Hill
Front
72
Whiting
McClary
Cohodas
Young
Kingfish
Hermies
Empire
Karnes
Gilbert
Woods
Songbird
Kitlinger
Wilco
Stormer
Beeman
Treat
Benzonia
Plowman
Drew
Norconk
Leelanau
Manning
Springview
Oviatt
2.61 - 4.00% (5)
1.11 - 2.60% (4)
1.10% (3)

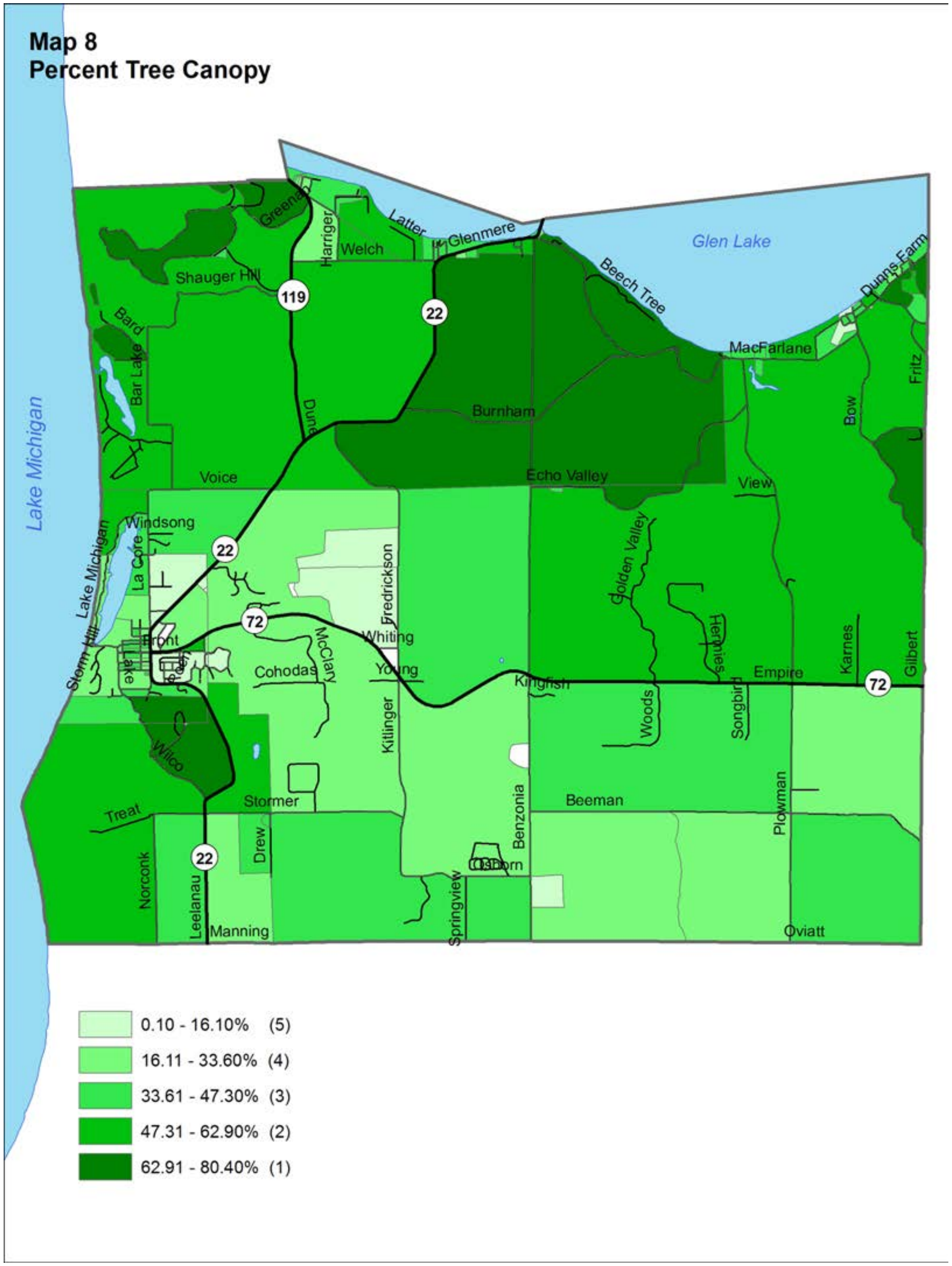
Map 6
Relative Sensitivity of Population to Extreme Heat Events





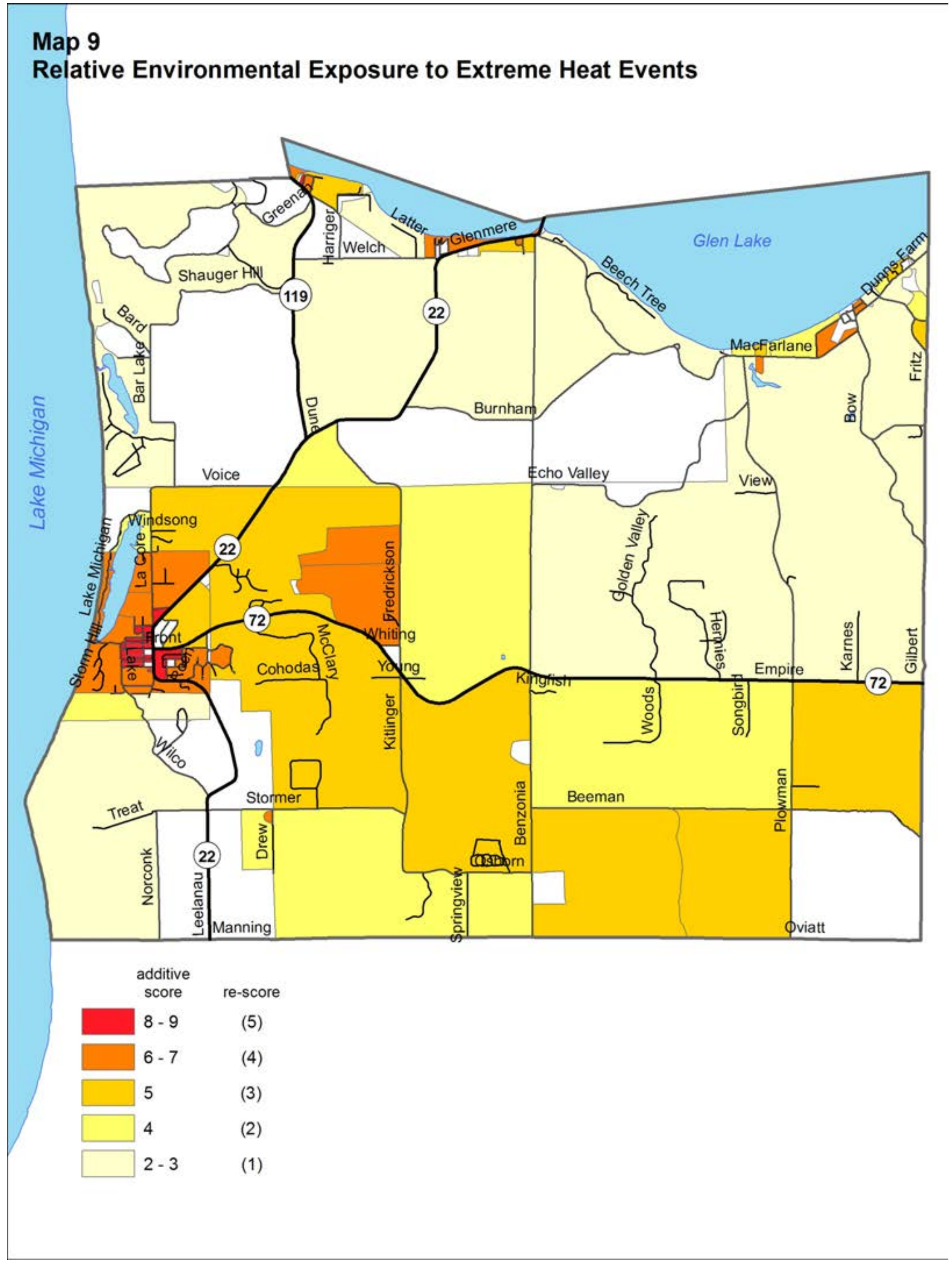

Leelanau County

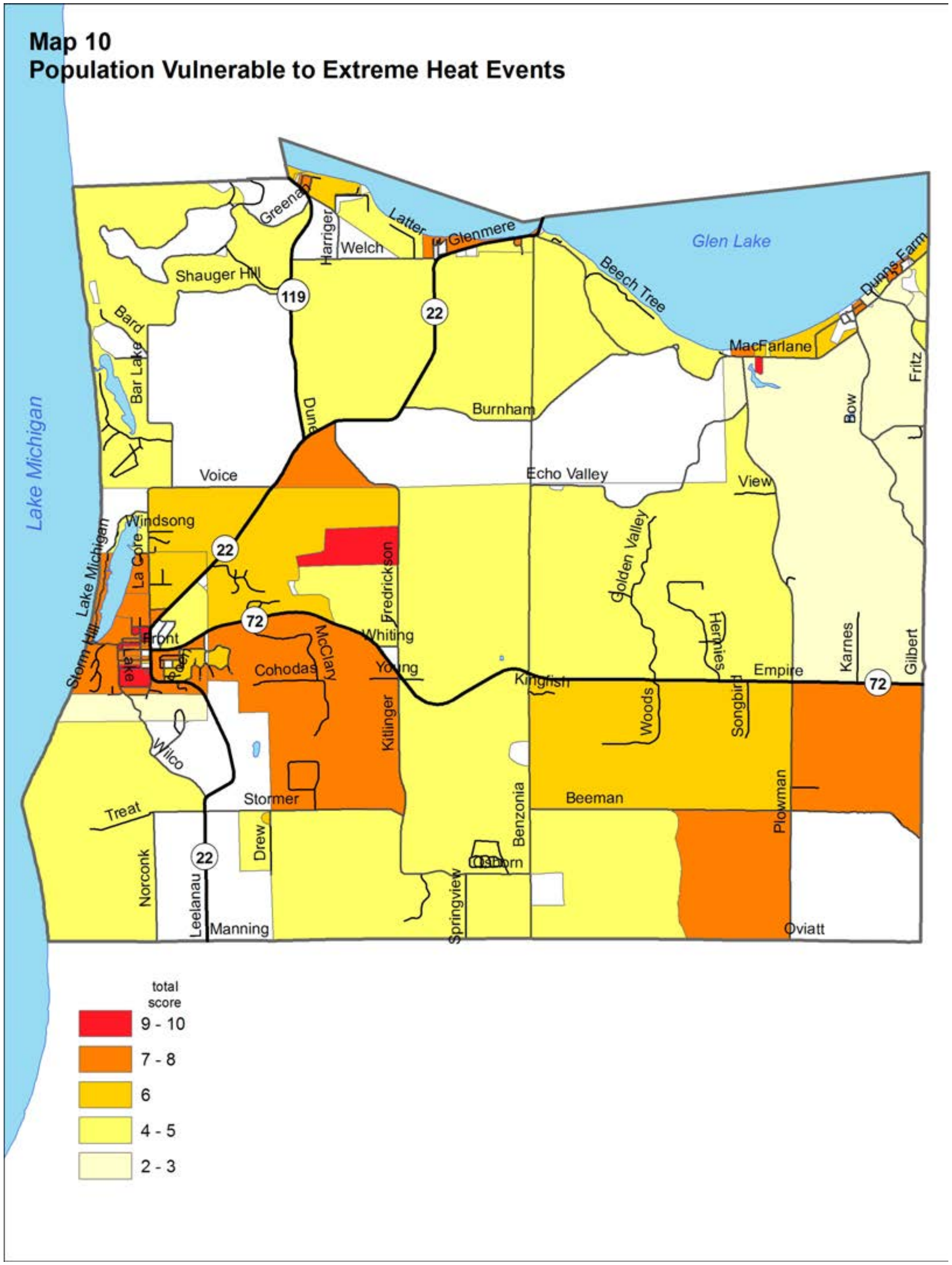

Map 7
Percent Impervious Surface Exposure
Lake Michigan
Glen Lake
43.51 - 62.00% (5)
25.51 - 43.50% (4)
13.61 - 25.50% (3)
5.61 - 13.60% (2)
0.10 - 5.60% (1)

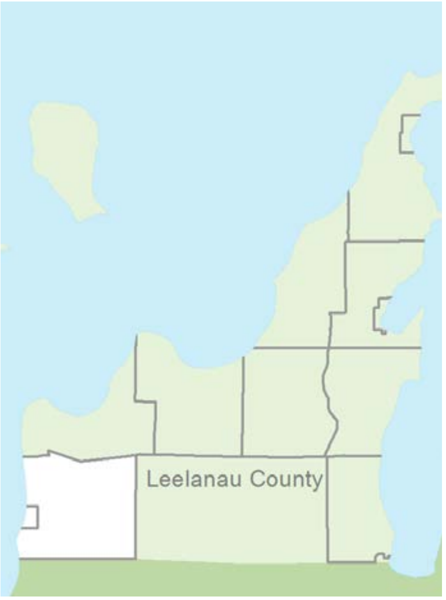

Map 8
Percent Tree Canopy
Lake Michigan
Glen Lake
0.10 - 16.10% (5)
16.11 - 33.60% (4)
33.61 - 47.30% (3)
47.31 - 62.90% (2)
62.91 - 80.40% (1)


Leelanau County


Leelanau County


Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
Glen Lake
additive score
re-score
8 - 9 (5)
6 - 7 (4)
5 (3)
4 (2)
2 - 3 (1)


Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
Glen Lake
total score
9 - 10
7 - 8
6
4 - 5
2 - 3


Leelanau County

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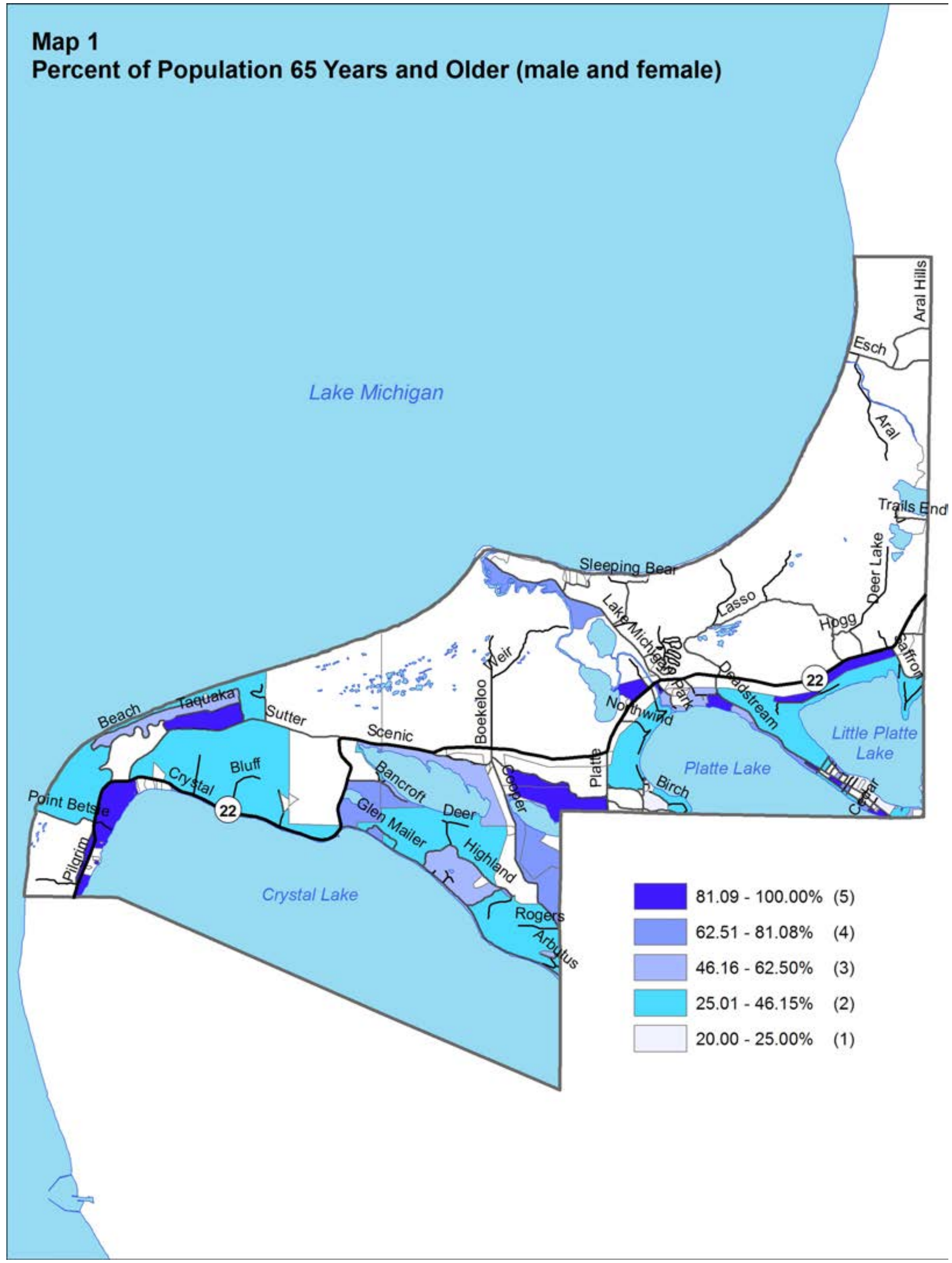
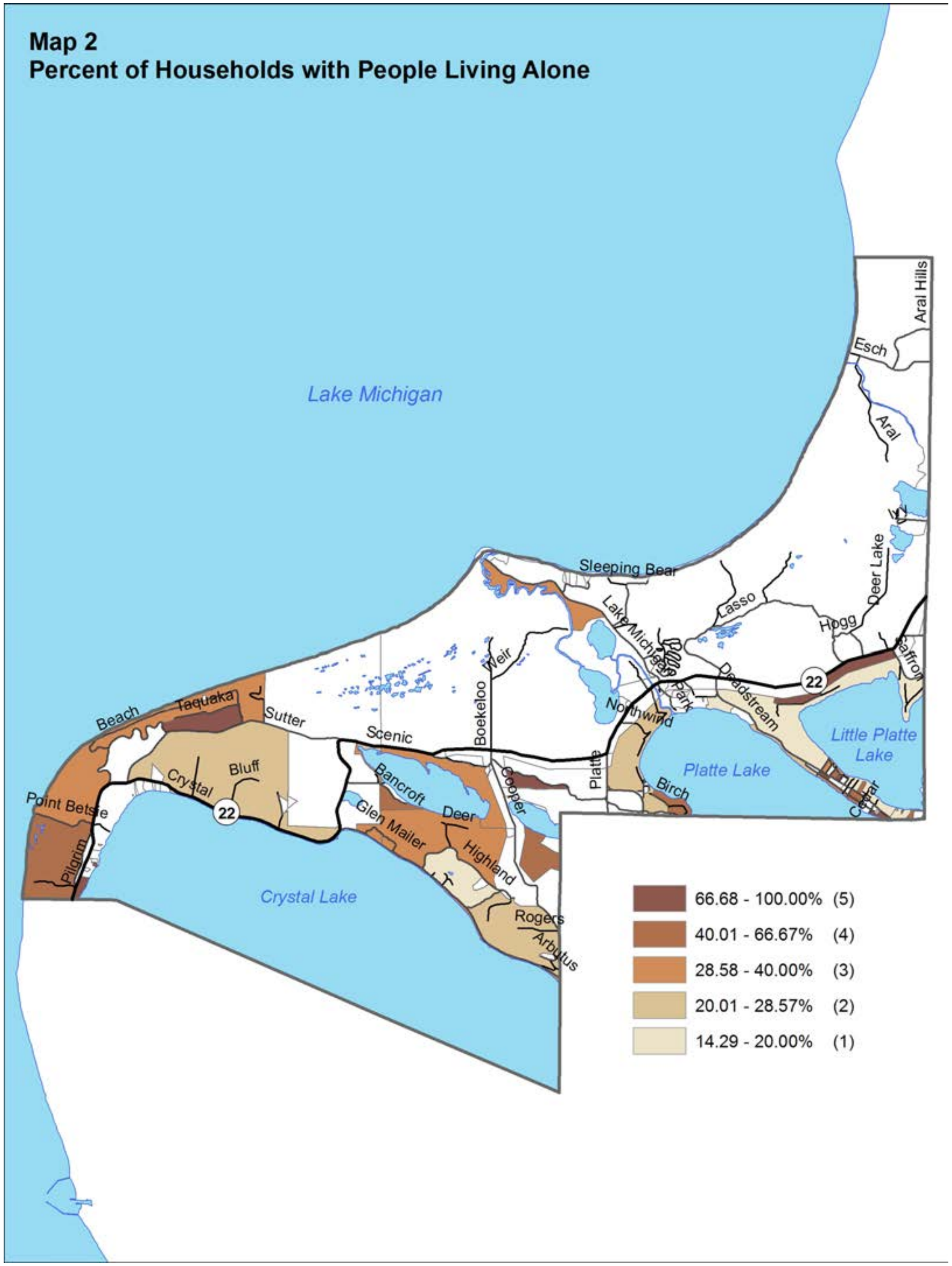
Benzie County

Lake Twp.

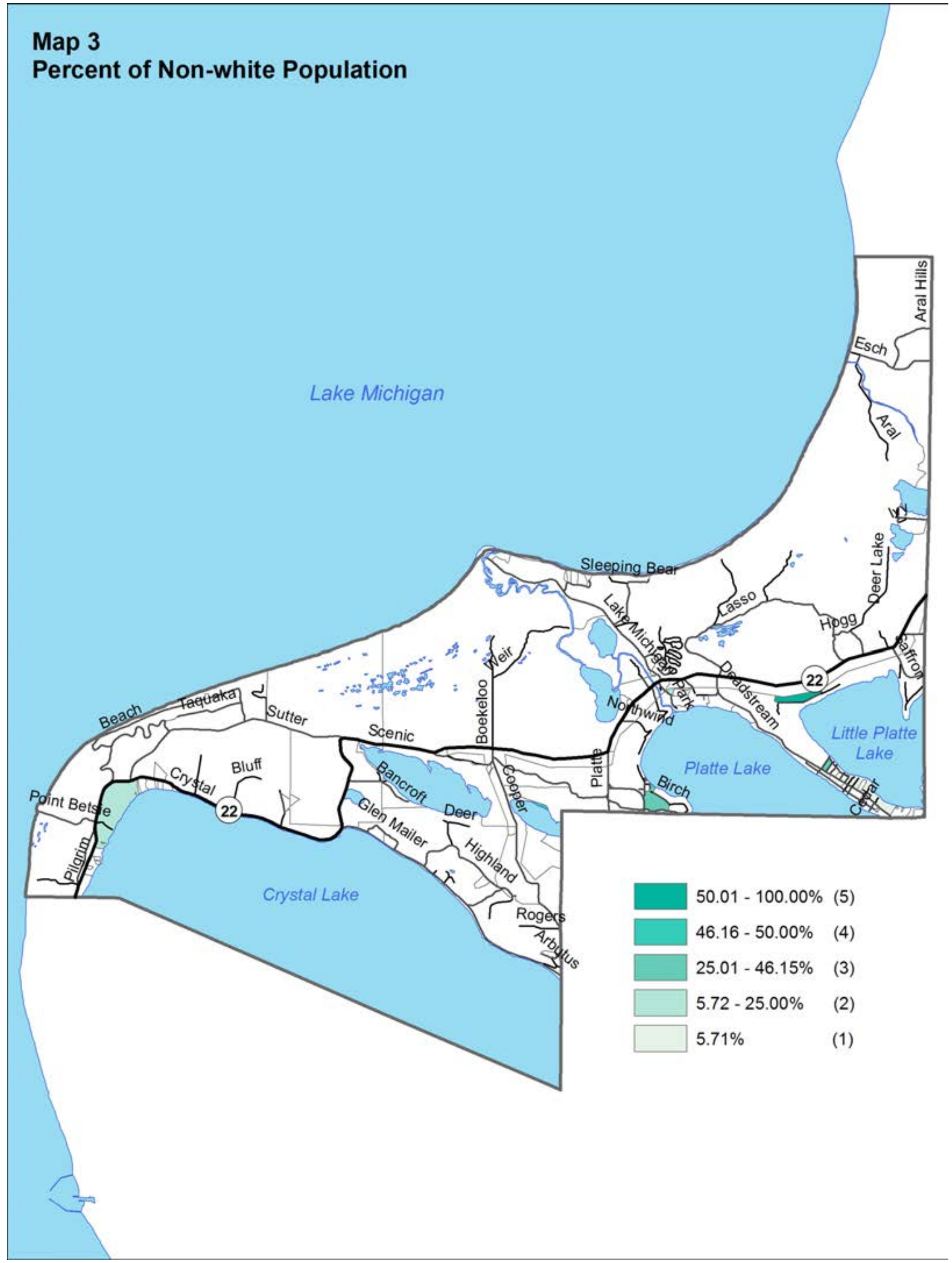

Benzie County

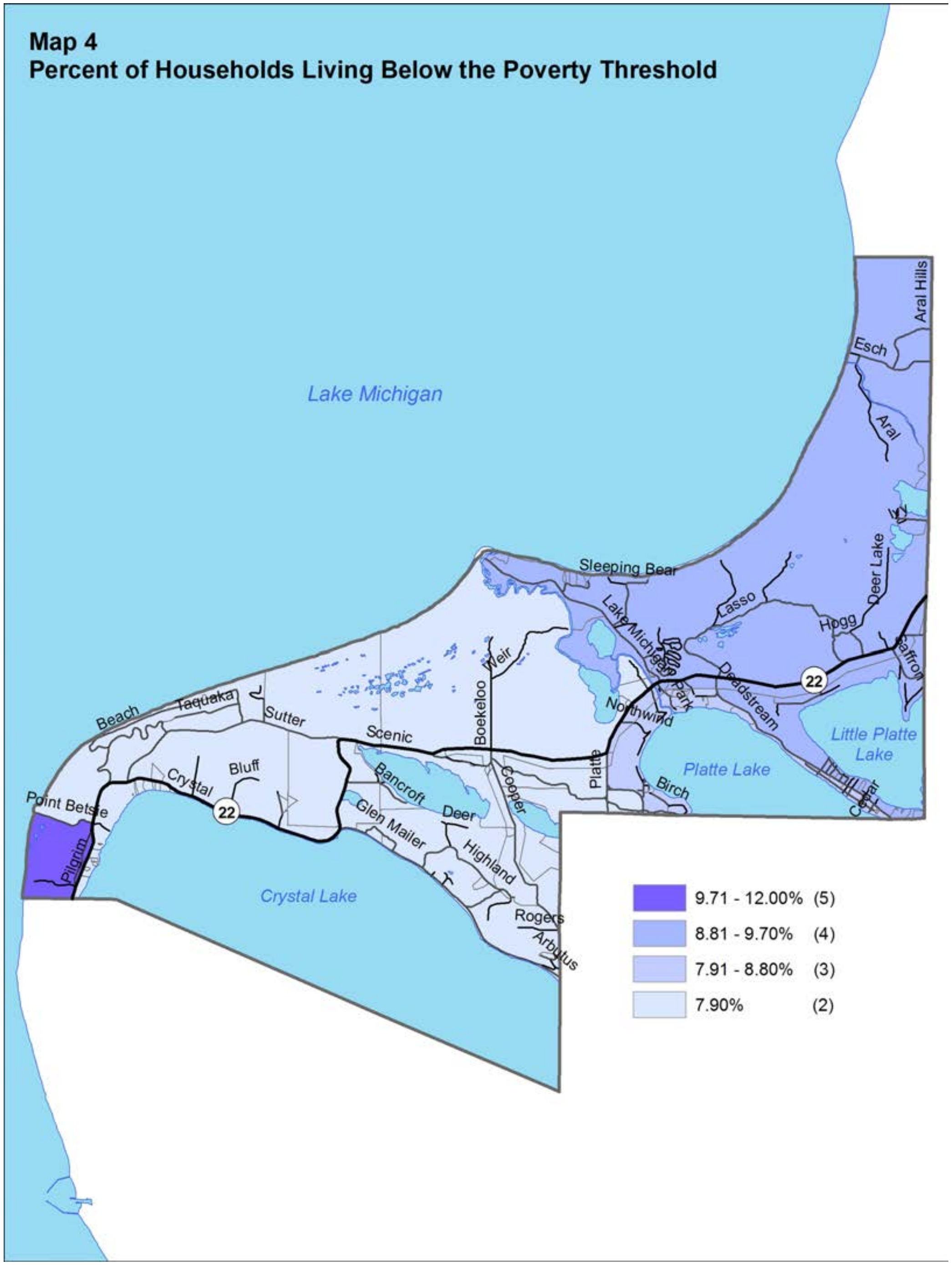

Map 1
Percent of Population 65 Years and Older (male and female)
Lake Michigan
Crystal Lake
Platte Lake
Little Platte Lake
Aral Hills
Esch
Aral
Trails End
Deer Lake
Sleeping Bear
Lasso
Hogg
Lake Michigan
Saffron
Weir
Deadstream
Boekeloo
Northwind
Beach
Taquaka
Sutter
Scenic
Bluff
Crystal
Point Betsie
Pilgrim
Bancroft
Deer
Cooper
Platte
Birch
Glen Mailer
Highland
Rogers
Arbutus
22
81.09 - 100.00% (5)
62.51 - 81.08% (4)
46.16 - 62.50% (3)
25.01 - 46.15% (2)
20.00 - 25.00% (1)


Map 2
Percent of Households with People Living Alone
Lake Michigan
Sleeping Bear
Aral Hills
Esch
Aral
Deer Lake
Lasso
Hogg
Saffron
Lake Michigan
Weir
Boekeloo
Taquaka
Beach
Sutter
Scenic
Northwind
Deadstream
22
Little Platte Lake
Platte Lake
Platte
Birch
Cooper
Bancroft
Deer
Glen Mailer
Highland
Crystal
Bluff
Point Betsie
Pilgrim
Crystal Lake
Rogers
Arbutus
66.68 - 100.00% (5)
40.01 - 66.67% (4)
28.58 - 40.00% (3)
20.01 - 28.57% (2)
14.29 - 20.00% (1)


Benzie County

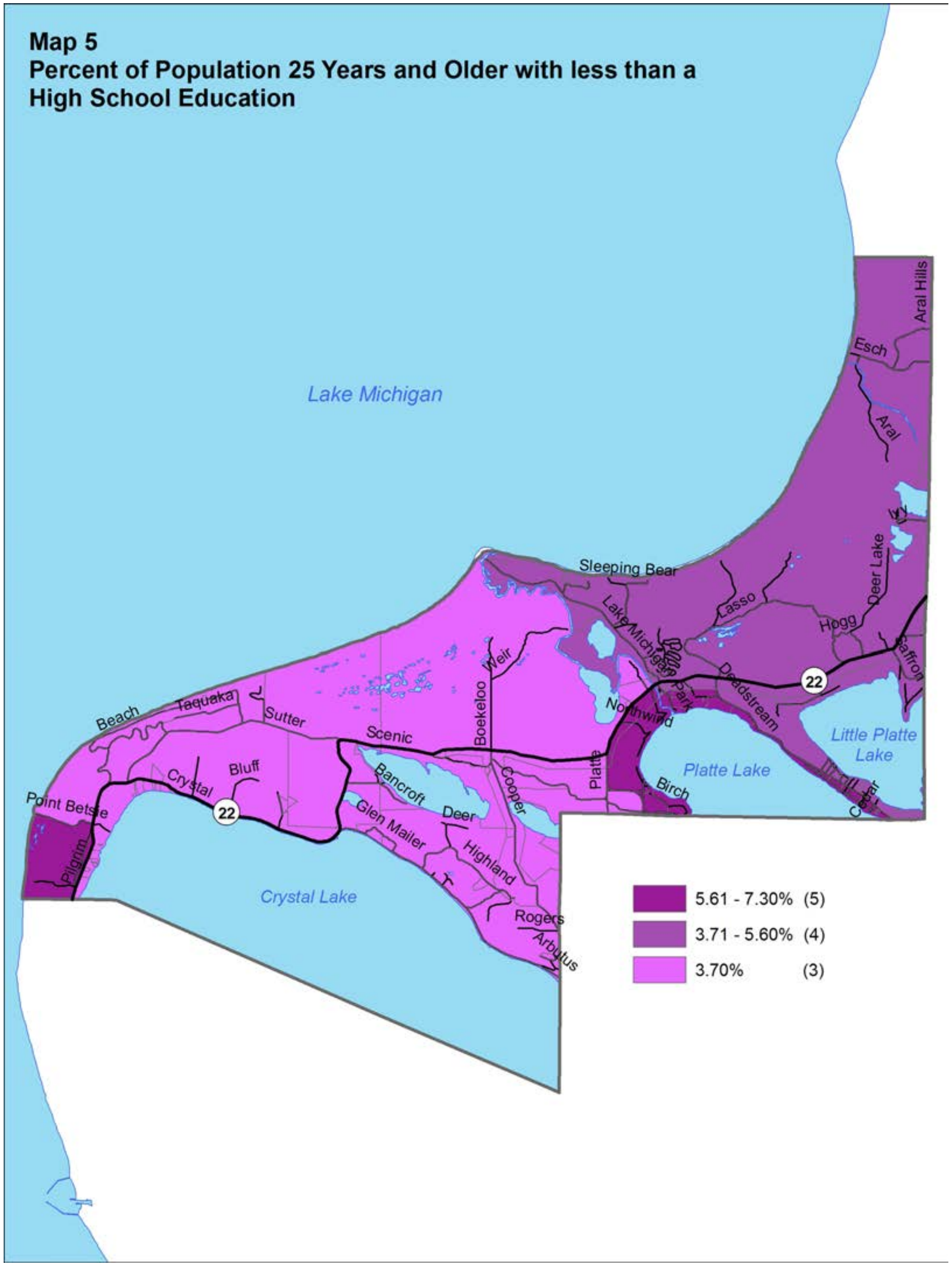

Benzie County

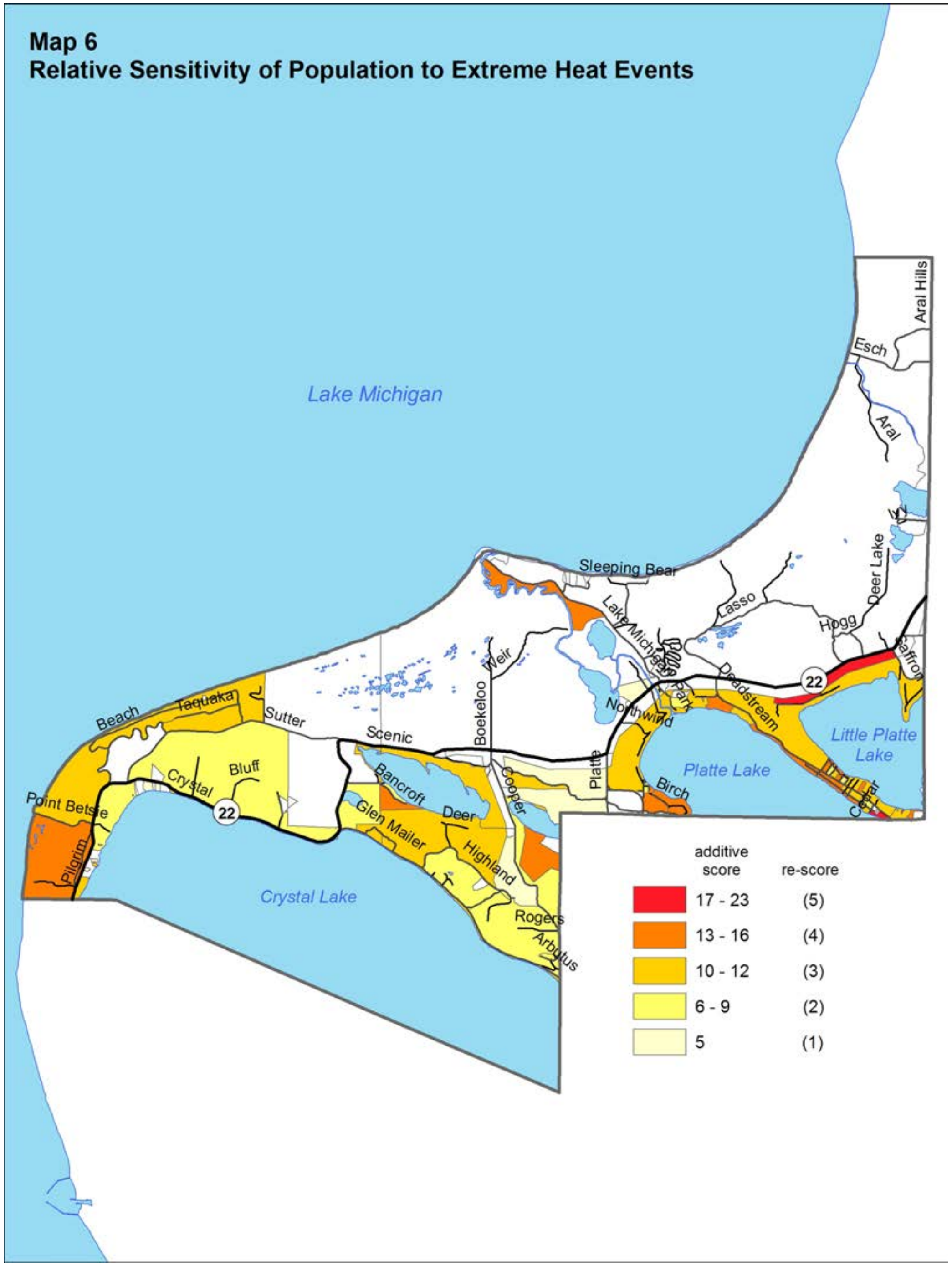

Map 3
Percent of Non-white Population
Lake Michigan
Crystal Lake
Platte Lake
Little Platte Lake
Sleeping Bear
Aral Hills
Esch
Aral
Deer Lake
Lasso
Hogg
Saffron
Deadstream
Northwind
Lake Michigan
Weir
Boekeloo
Scenic
Sutter
Taquaka
Beach
Point Betsie
Pilgrim
Crystal
Bluff
Bancroft
Deer
Cooper
Platte
Birch
Glen Mailer
Highland
Rogers
Arbutus
Cedar
22
50.01 - 100.00% (5)
46.16 - 50.00% (4)
25.01 - 46.15% (3)
5.72 - 25.00% (2)
5.71% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
Lake Michigan
Crystal Lake
Platte Lake
Little Platte Lake
Sleeping Bear
22
9.71 - 12.00% (5)
8.81 - 9.70% (4)
7.91 - 8.80% (3)
7.90% (2)


Benzie County

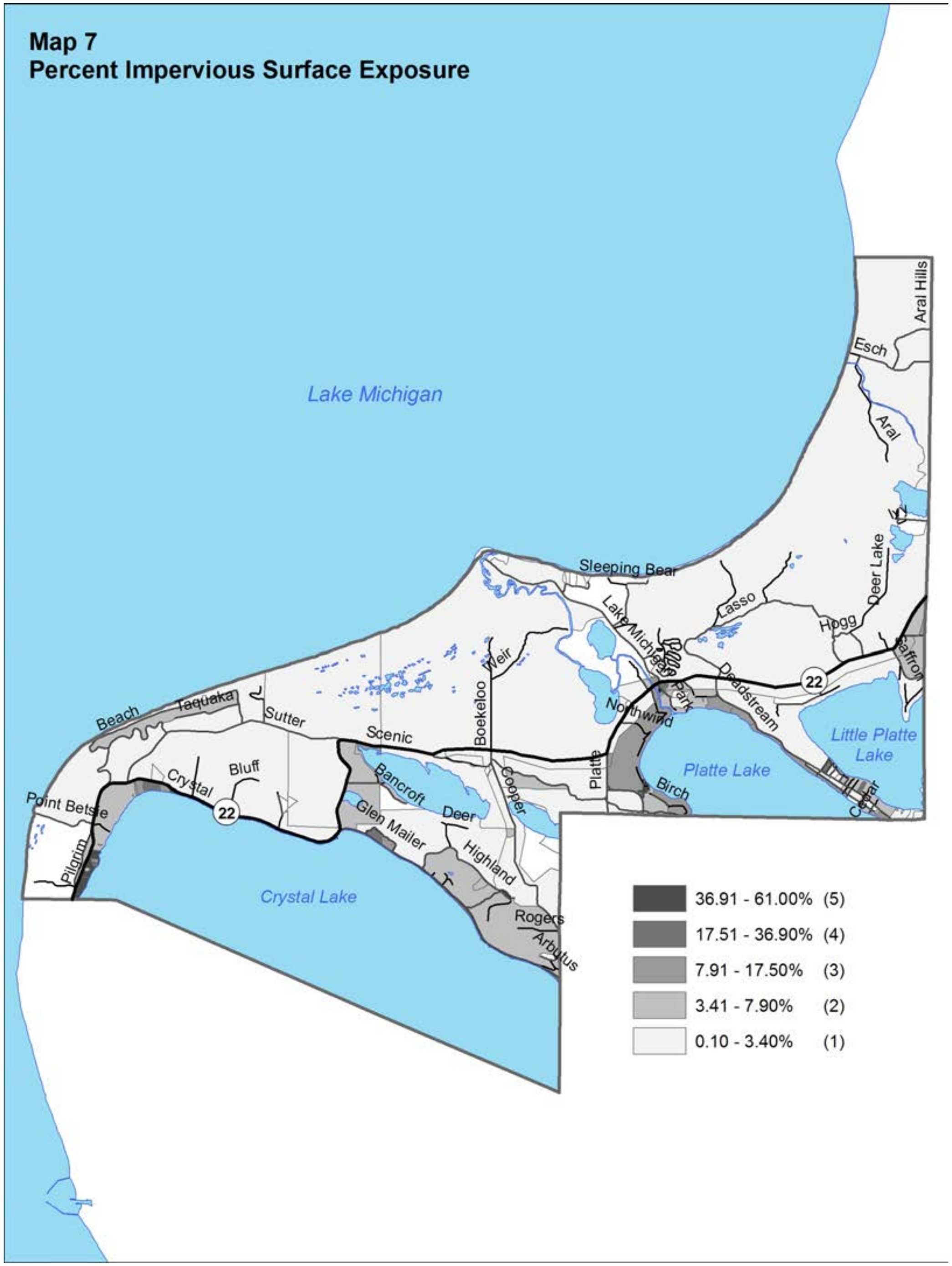

Benzie County

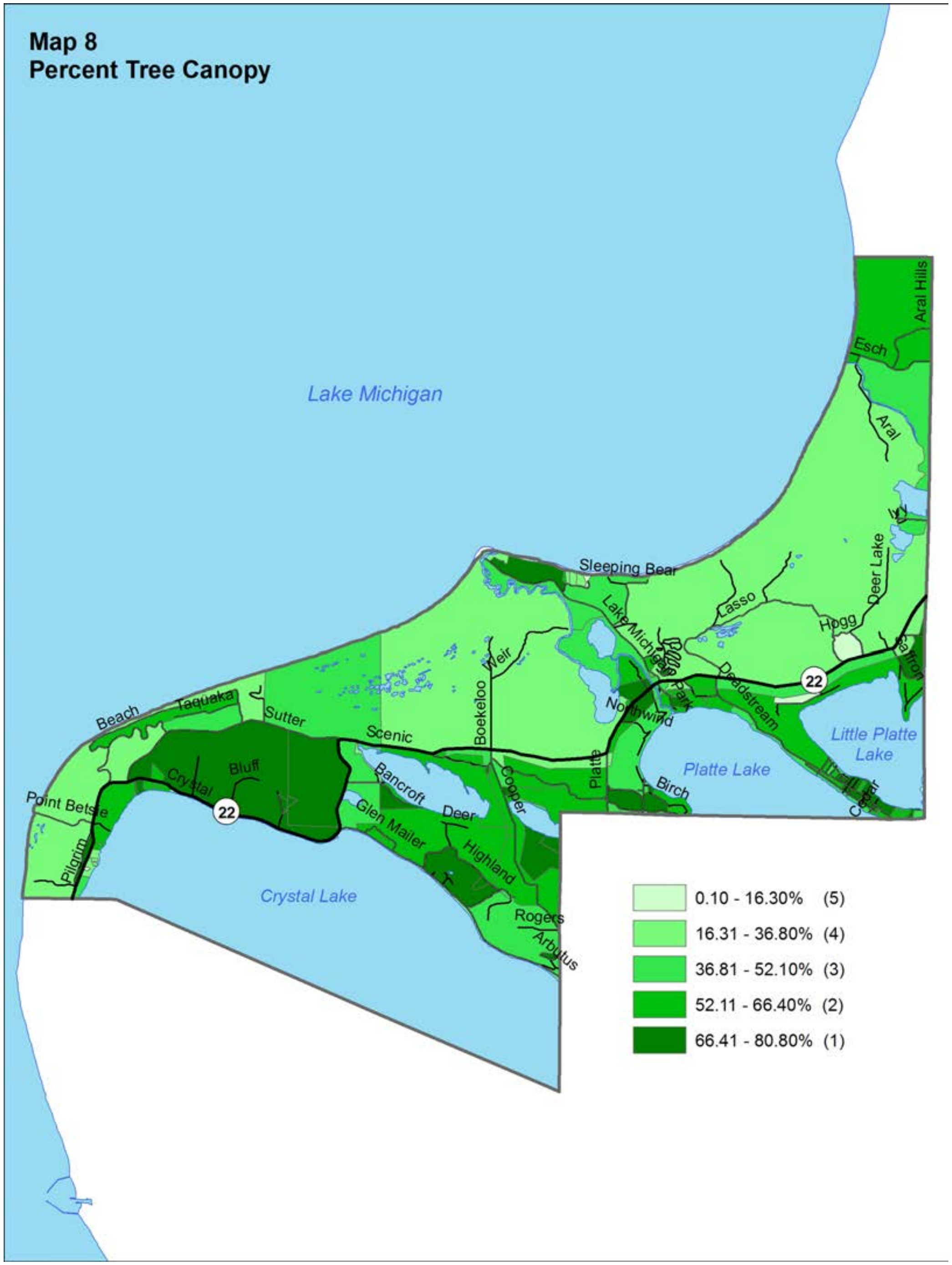

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Lake Michigan
Crystal Lake
Platte Lake
Little Platte Lake
Sleeping Bear
Point Betsie
Beach
Taquaka
Sutter
Scenic
Bluff
Crystal
22
Boekeloo
Weir
Bancroft
Glen Mailer
Deer
Cooper
Highland
Rogers
Arbutus
Platte
Northwind
Birch
Lake Michigan
Deadstream
Lasso
Hogg
Deer Lake
Saffron
Aral
Esch
Aral Hills
Pilgrim
5.61 - 7.30% (5)
3.71 - 5.60% (4)
3.70% (3)


Map 6
Relative Sensitivity of Population to Extreme Heat Events
Lake Michigan
Crystal Lake
Platte Lake
Little Platte Lake
additive score
re-score
17 - 23 (5)
13 - 16 (4)
10 - 12 (3)
6 - 9 (2)
5 (1)
Sleeping Bear
Point Betsie
Beach
Taquaka
Sutter
Scenic
Boekeloo
Weir
Bluff
Crystal
Pilgrim
Bancroft
Glen Mailer
Deer
Cooper
Highland
Rogers
Arbutus
Platte
Northwind
Birch
Deadstream
Lasso
Hogg
Deer Lake
Aral
Esch
Aral Hills
22


Benzie County

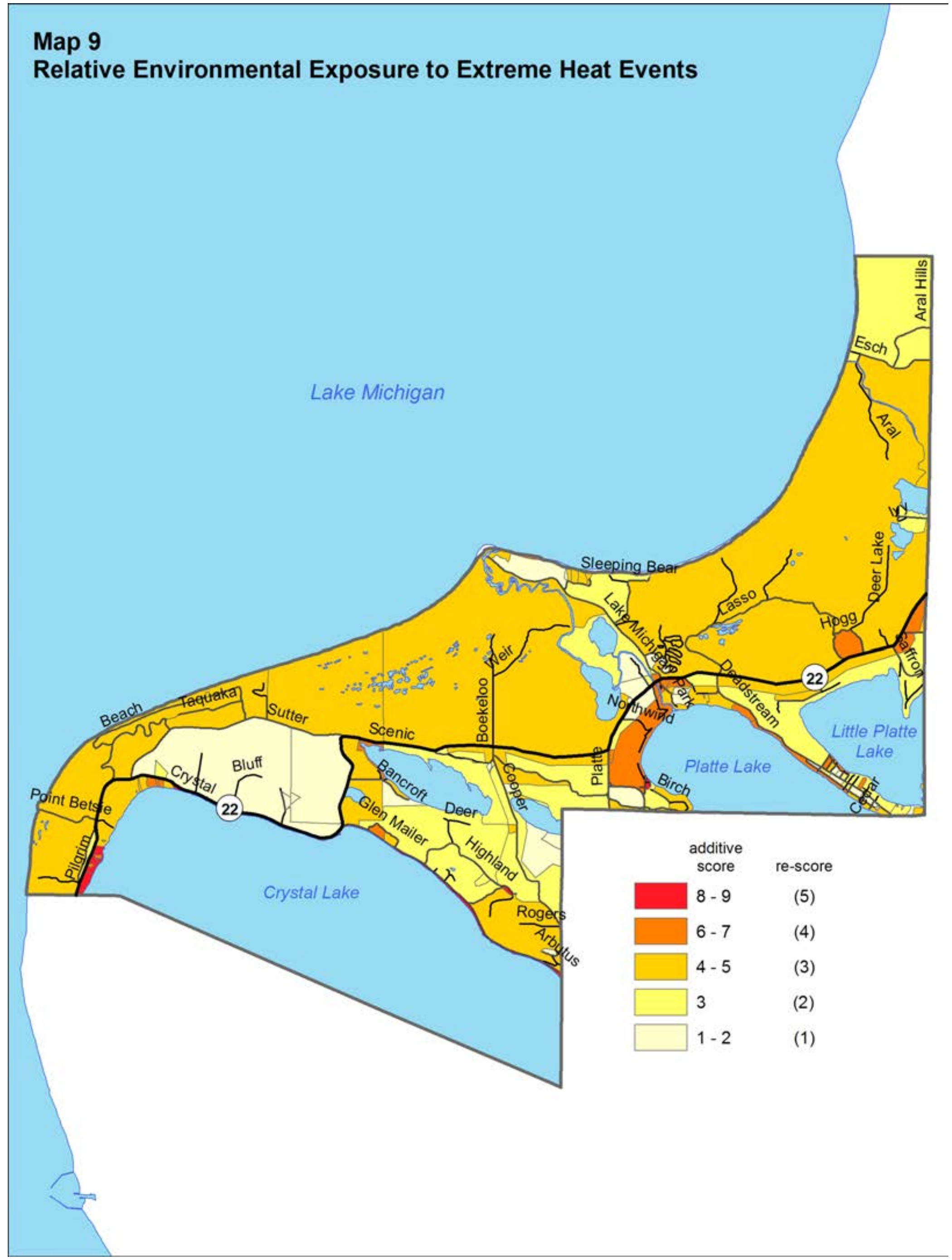

Benzie County

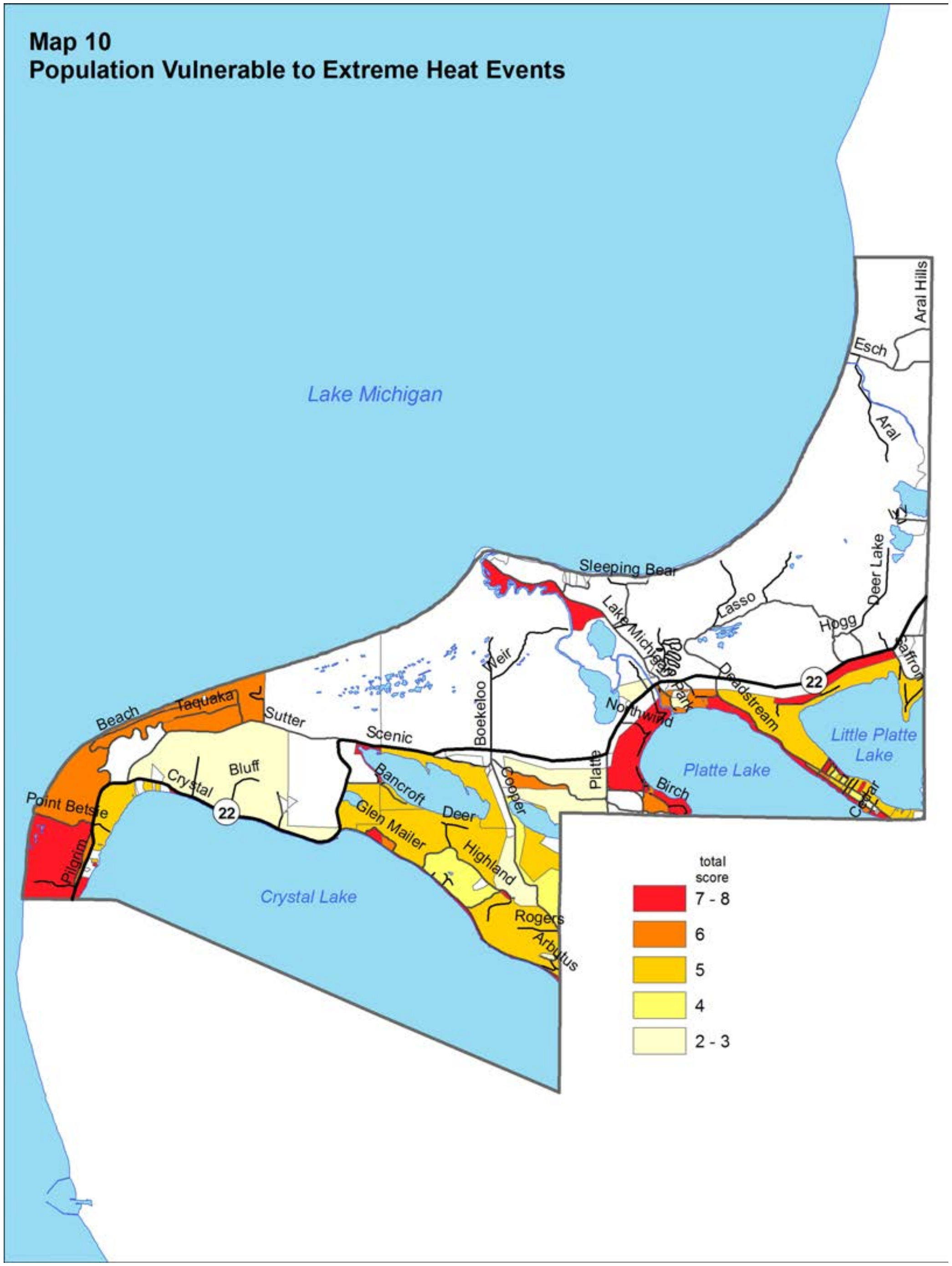

Map 7
Percent Impervious Surface Exposure
Lake Michigan
Crystal Lake
Platte Lake
Little Platte Lake
Sleeping Bear
Point Betsie
Beach
Taquaka
Sutter
Scenic
Boekeloo
Weir
Crystal
Bluff
22
Pilgrim
Bancroft
Glen Mailer
Deer
Cooper
Highland
Rogers
Arbutus
Platte
Northwind
Birch
Deadstream
Lasso
Hogg
Deer Lake
Aral
Esch
Aral Hills
36.91 - 61.00% (5)
17.51 - 36.90% (4)
7.91 - 17.50% (3)
3.41 - 7.90% (2)
0.10 - 3.40% (1)


Map 8
Percent Tree Canopy
Lake Michigan
Sleeping Bear
Crystal Lake
Platte Lake
Little Platte Lake
0.10 - 16.30% (5)
16.31 - 36.80% (4)
36.81 - 52.10% (3)
52.11 - 66.40% (2)
66.41 - 80.80% (1)


Benzie County

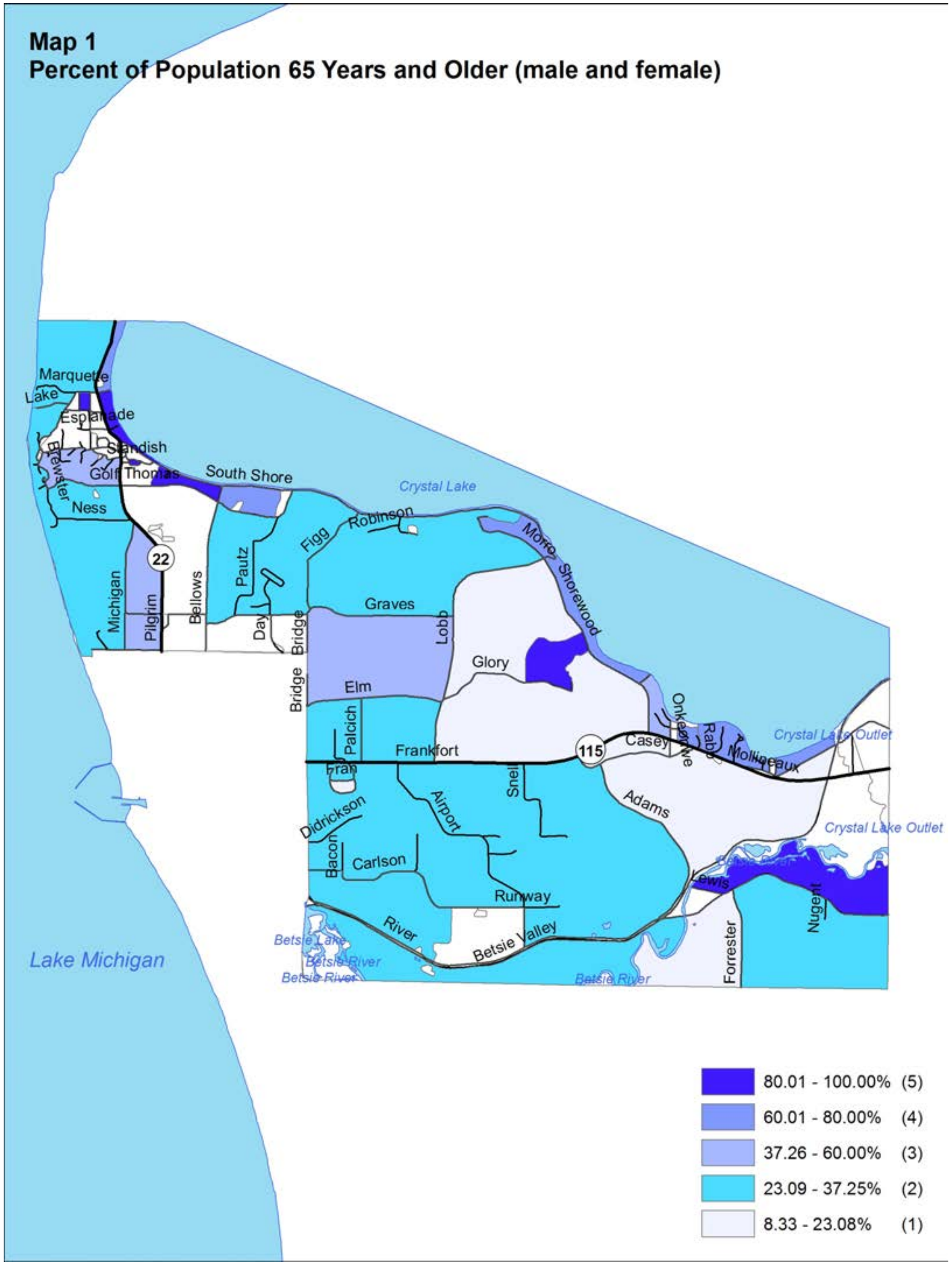

Benzie County


Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
Crystal Lake
Platte Lake
Little Platte Lake
Sleeping Bear
Aral Hills
Esch
Aral
Deer Lake
Hogg
Saffron
Deadstream
Northwind
Platte
Birch
Cooper
Bancroft
Glen Mailer
Deer
Highland
Rogers
Arbutus
Boekeloo
Weir
Scenic
Sutter
Taquaka
Beach
Bluff
Crystal
Point Betsie
Pilgrim
22
additive score
re-score
8 - 9 (5)
6 - 7 (4)
4 - 5 (3)
3 (2)
1 - 2 (1)

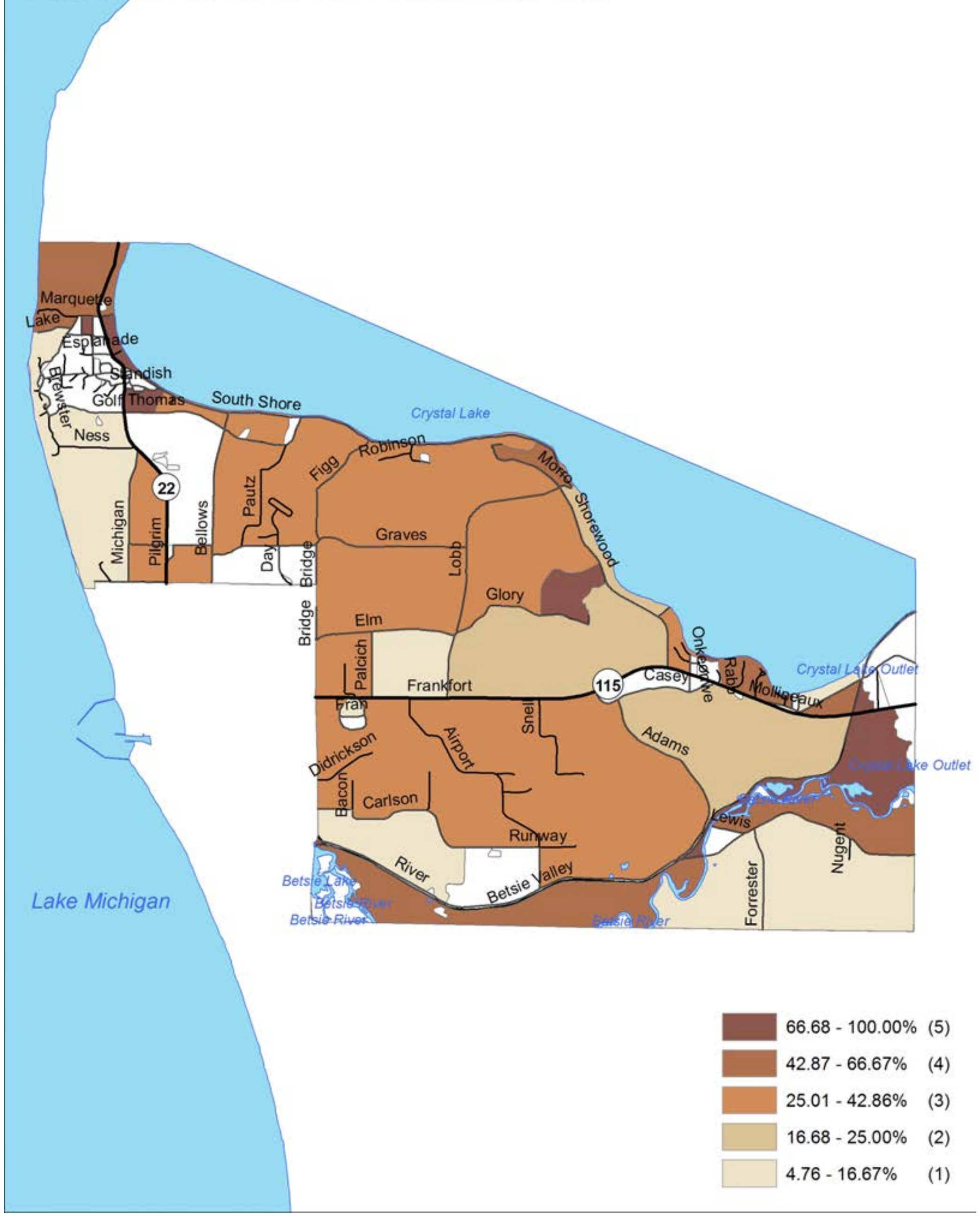

Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
Sleeping Bear
Esch
Aral Hills
Aral
Deer Lake
Lasso
Hogg
Saffron
22
Lake Michigan
Deadstream
Little Platte Lake
Platte Lake
Northwind
Birch
Platte
Cooper
Boekeloo
Weir
Scenic
Sutter
Taquaka
Beach
Bluff
Crystal
Point Betsie
Pilgrim
Bancroft
Deer
Glen Mailer
Highland
Rogers
Arbutus
Crystal Lake
total score
7 - 8
6
5
4
2 - 3


Benzie County

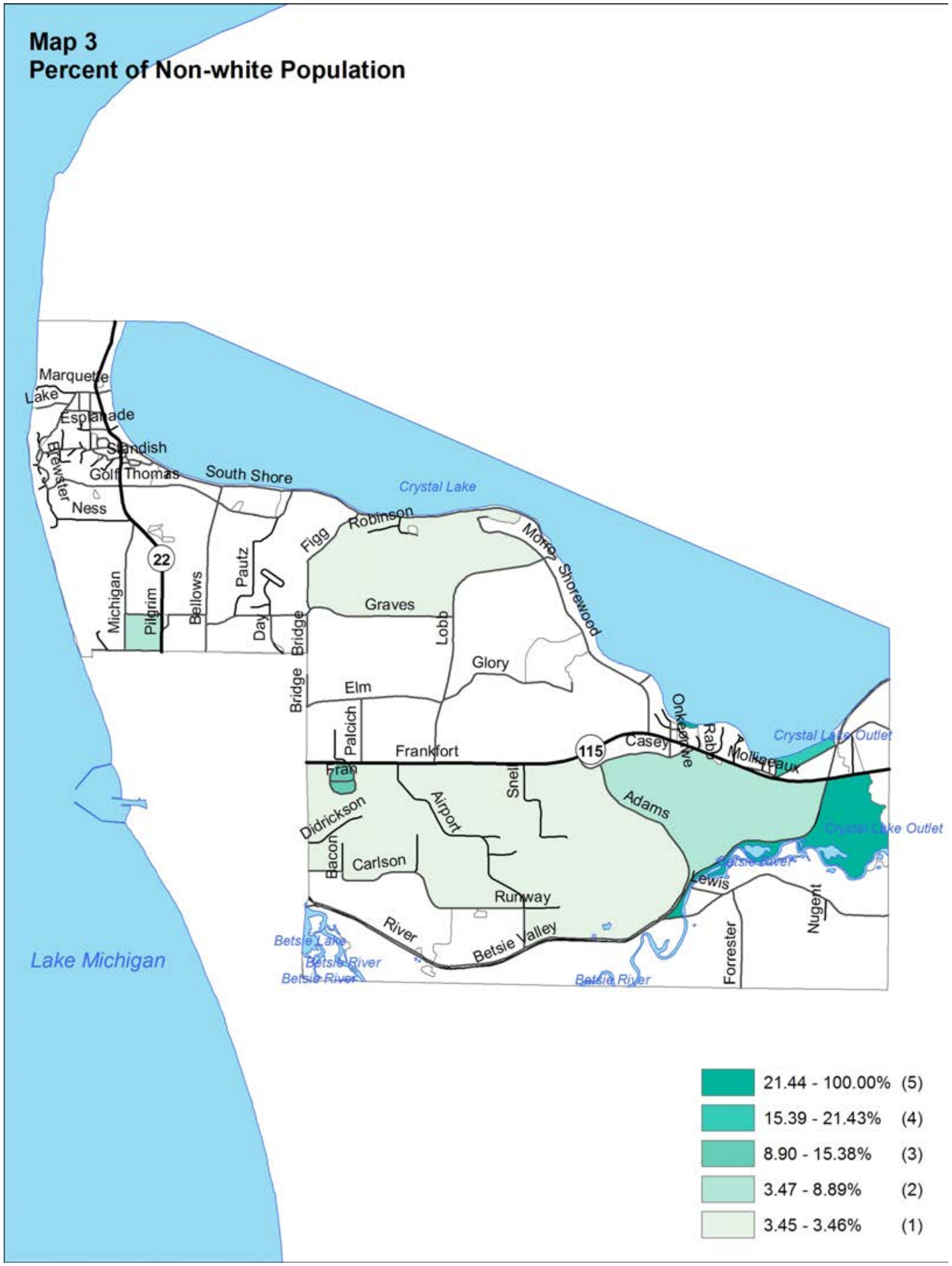
Crystal Lake Twp.

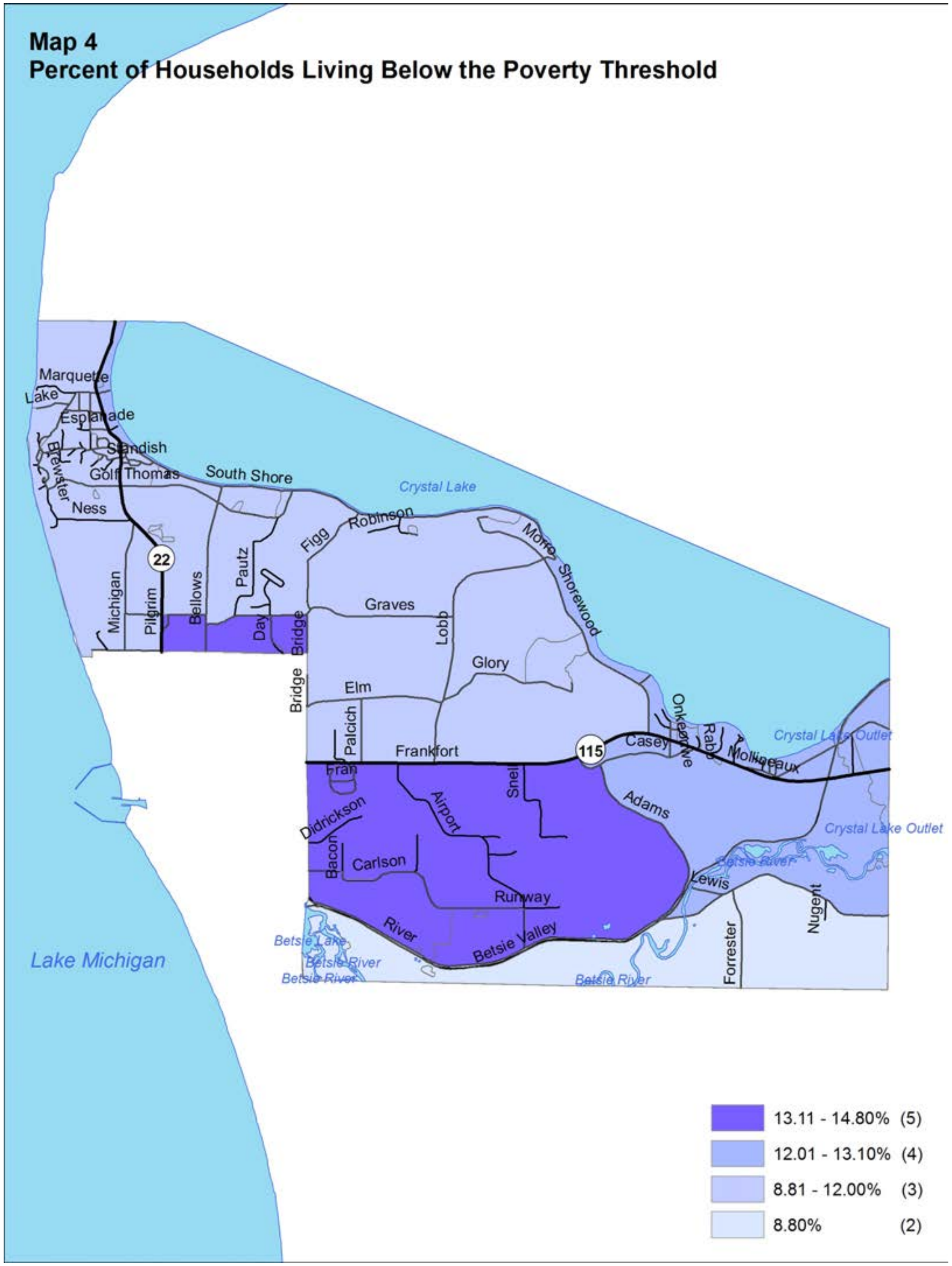


Map 2
Percent of Households with People Living Alone



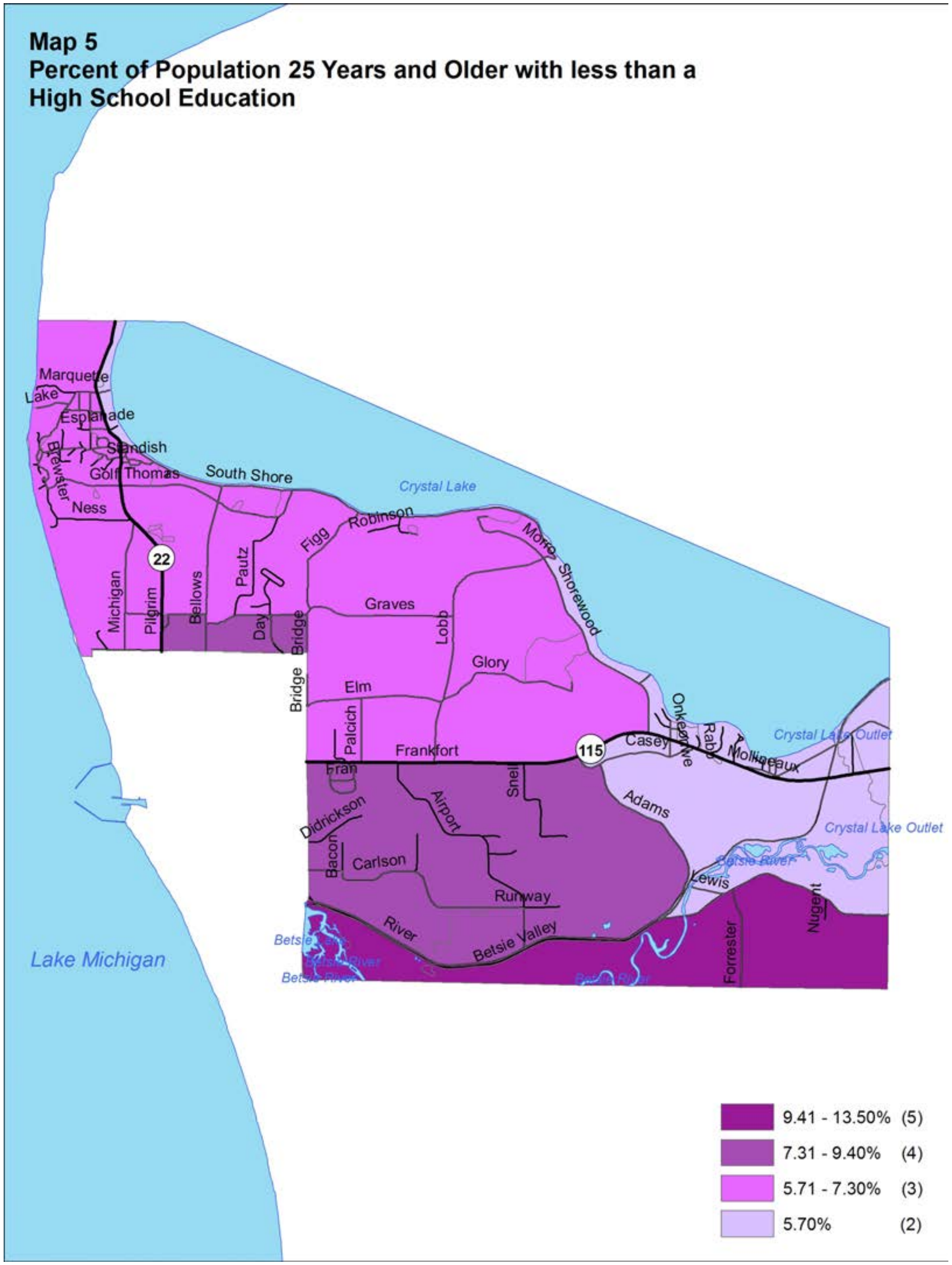

Benzie County

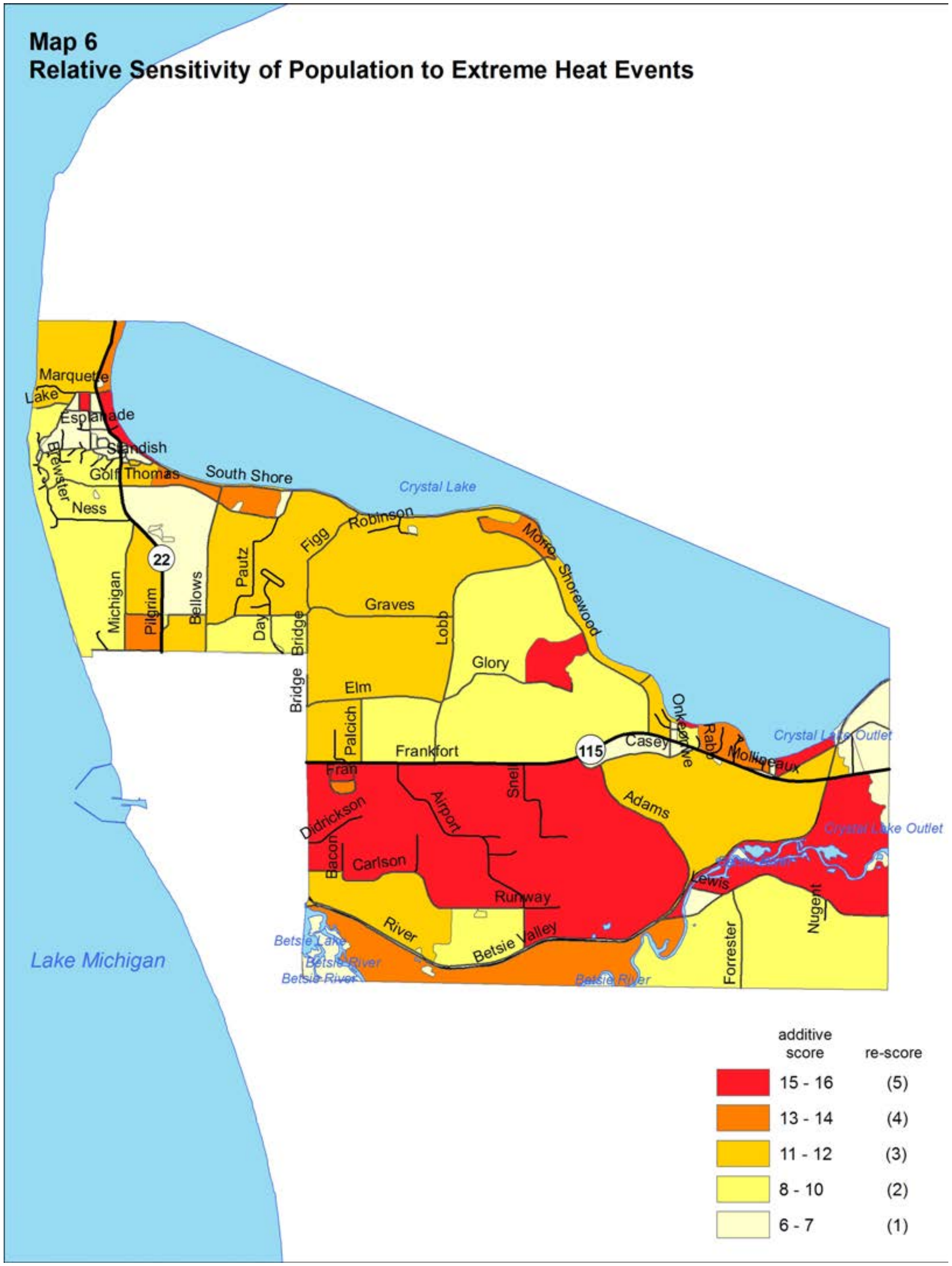

Map 3
Percent of Non-white Population
Lake Michigan
Crystal Lake
Marquette
Lake
Esplanade
Standish
Golf
Thomas
South Shore
Brewster
Ness
Robinson
Figg
Michigan
Pilgrim
22
Bellows
Pautz
Day
Bridge
Graves
Lobb
Glory
Elm
Palcich
Frankfort
115
Casey
Adams
Didrickson
Airport
Snell
Bacon
Carlson
Runway
River
Betsie Valley
Lewis
Forester
Nugent
Betsie Lake
Betsie River
Crystal Lake Outlet
21.44 - 100.00% (5)
15.39 - 21.43% (4)
8.90 - 15.38% (3)
3.47 - 8.89% (2)
3.45 - 3.46% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
Marquette
Lake
Esplanade
Standish
Brewster
Golf
Thomas
South Shore
Ness
Crystal Lake
Robinson
Figg
Morris
Shorewood
22
Michigan
Pilgrim
Bellows
Pautz
Day
Bridge
Graves
Lobb
Glory
Elm
Bridge
Palcich
Frankfort
115
Casey
Onkeonwe
Rabb
Molligeaux
Crystal Lake Outlet
Fran
Snell
Airport
Didrickson
Adams
Crystal Lake Outlet
Bacon
Carlson
Betsie River
Lewis
Runway
River
Betsie Valley
Nugent
Forrester
Betsie Lake
Betsie River
Betsie River
Betsie River
Lake Michigan
13.11 - 14.80% (5)
12.01 - 13.10% (4)
8.81 - 12.00% (3)
8.80% (2)


Benzie County

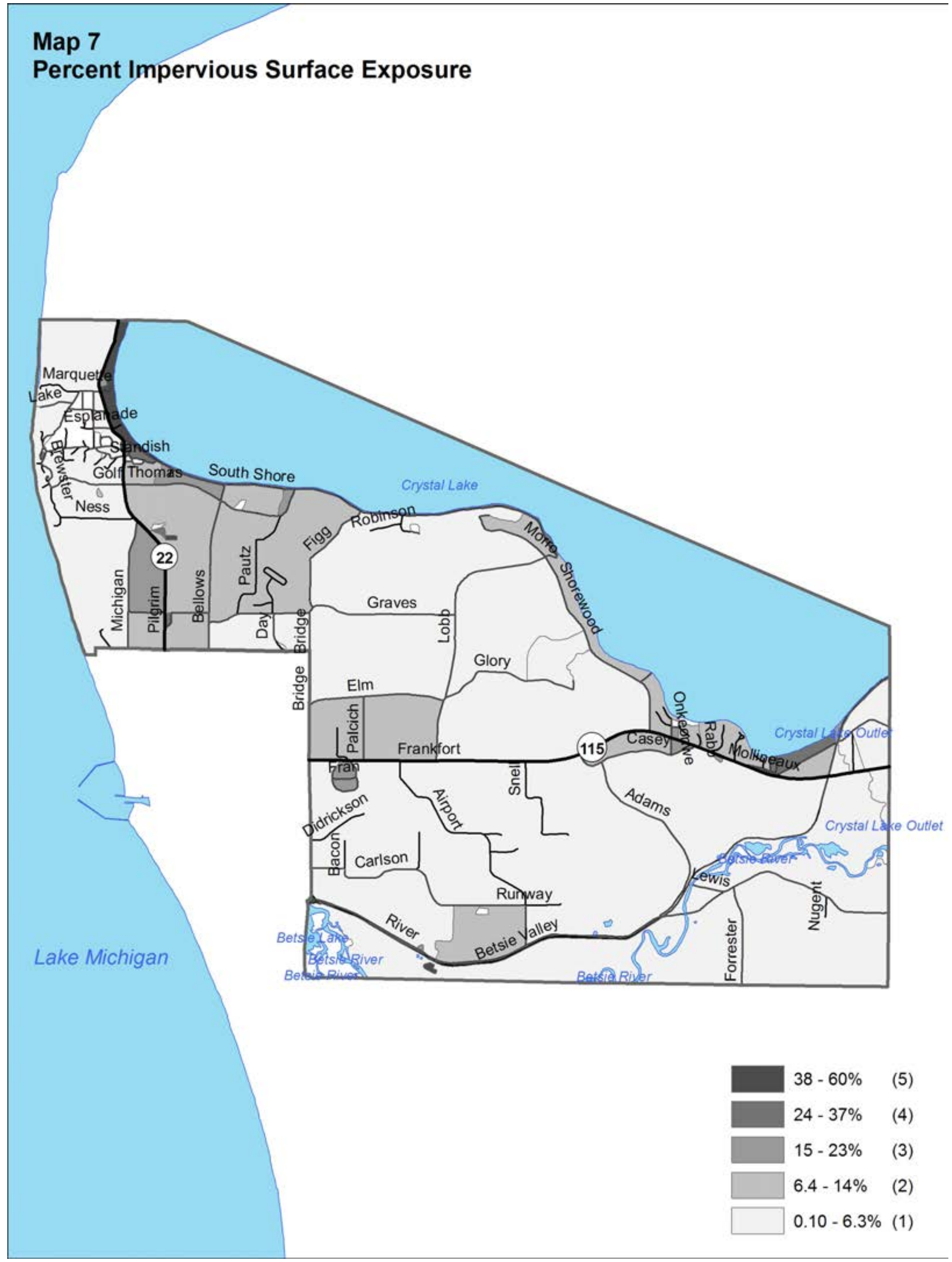

Benzie County

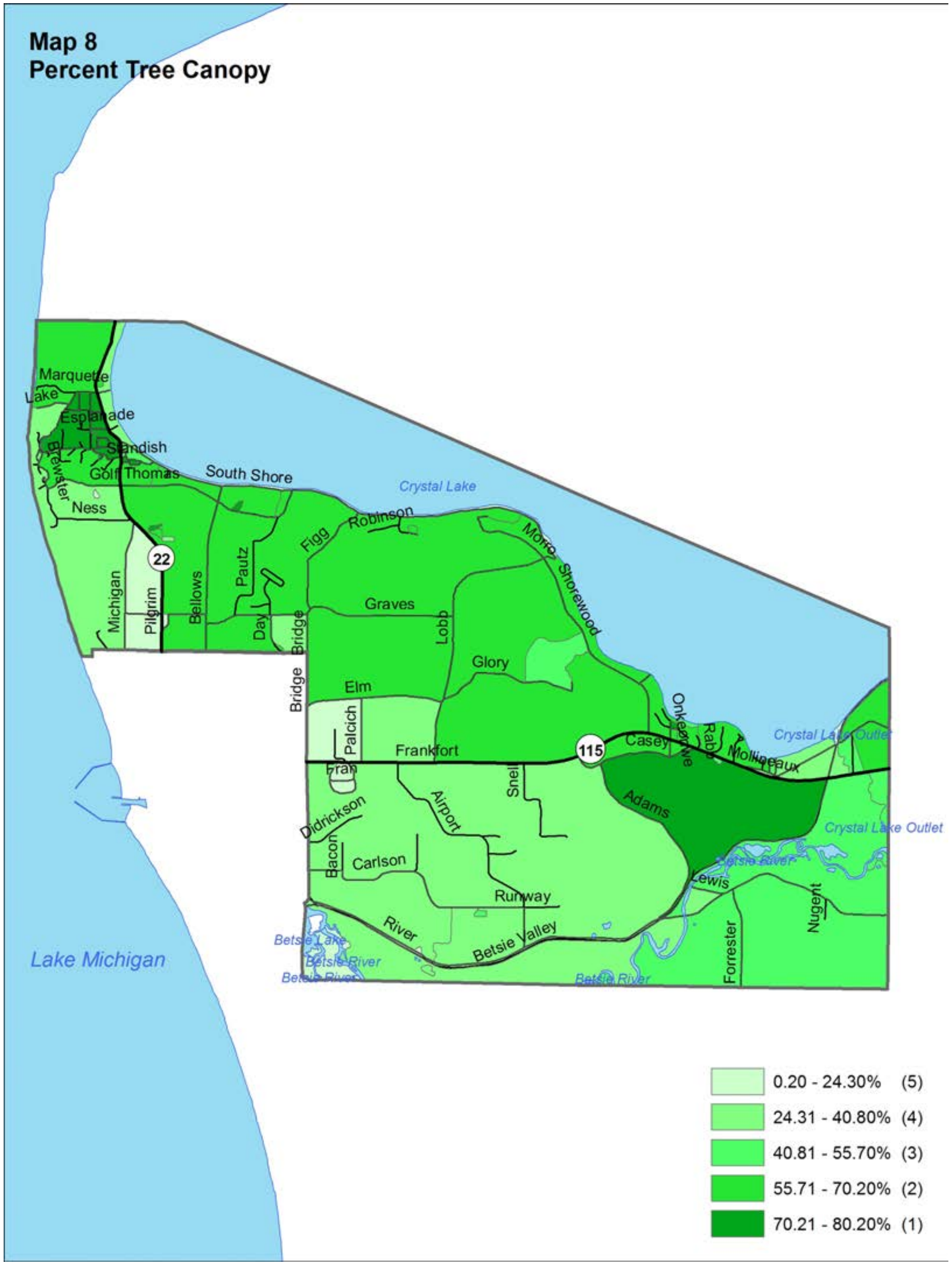

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Marquette
Lake
Esplanade
Standish
Golf
Thomas
Brewster
Ness
South Shore
Crystal Lake
Robinson
Figg
Morro
Shorewood
22
Michigan
Pilgrim
Bellows
Pautz
Day
Bridge
Graves
Lobb
Glory
Elm
Palcich
Frankfort
115
Casey
Onkeonwe
Rabe
Mollineaux
Crystal Lake Outlet
Fran
Didrickson
Airport
Snell
Adams
Bacon
Carlson
Runway
Lewis
Betsie River
River
Betsie Valley
Forrester
Nugent
Betsie Lake
Lake Michigan
9.41 - 13.50% (5)
7.31 - 9.40% (4)
5.71 - 7.30% (3)
5.70% (2)


Map 6
Relative Sensitivity of Population to Extreme Heat Events
Marquette
Lake
Esplanade
Standish
Brewster
Golf
Thomas
South Shore
Ness
Crystal Lake
Robinson
Figg
Morrow
Shorewood
22
Michigan
Pilgrim
Bellows
Pautz
Day
Bridge
Graves
Lobb
Glory
Elm
Palcich
Frankfort
115
Casey
Rabe
Mollineaux
Crystal Lake Outlet
Fran
Didrickson
Airport
Snell
Adams
Bacon
Carlson
Lewis
Runway
Nugent
River
Betsie Valley
Forrester
Betsie Lake
Betsie River
Lake Michigan
additive score
re-score
15 - 16 (5)
13 - 14 (4)
11 - 12 (3)
8 - 10 (2)
6 - 7 (1)


Benzie County

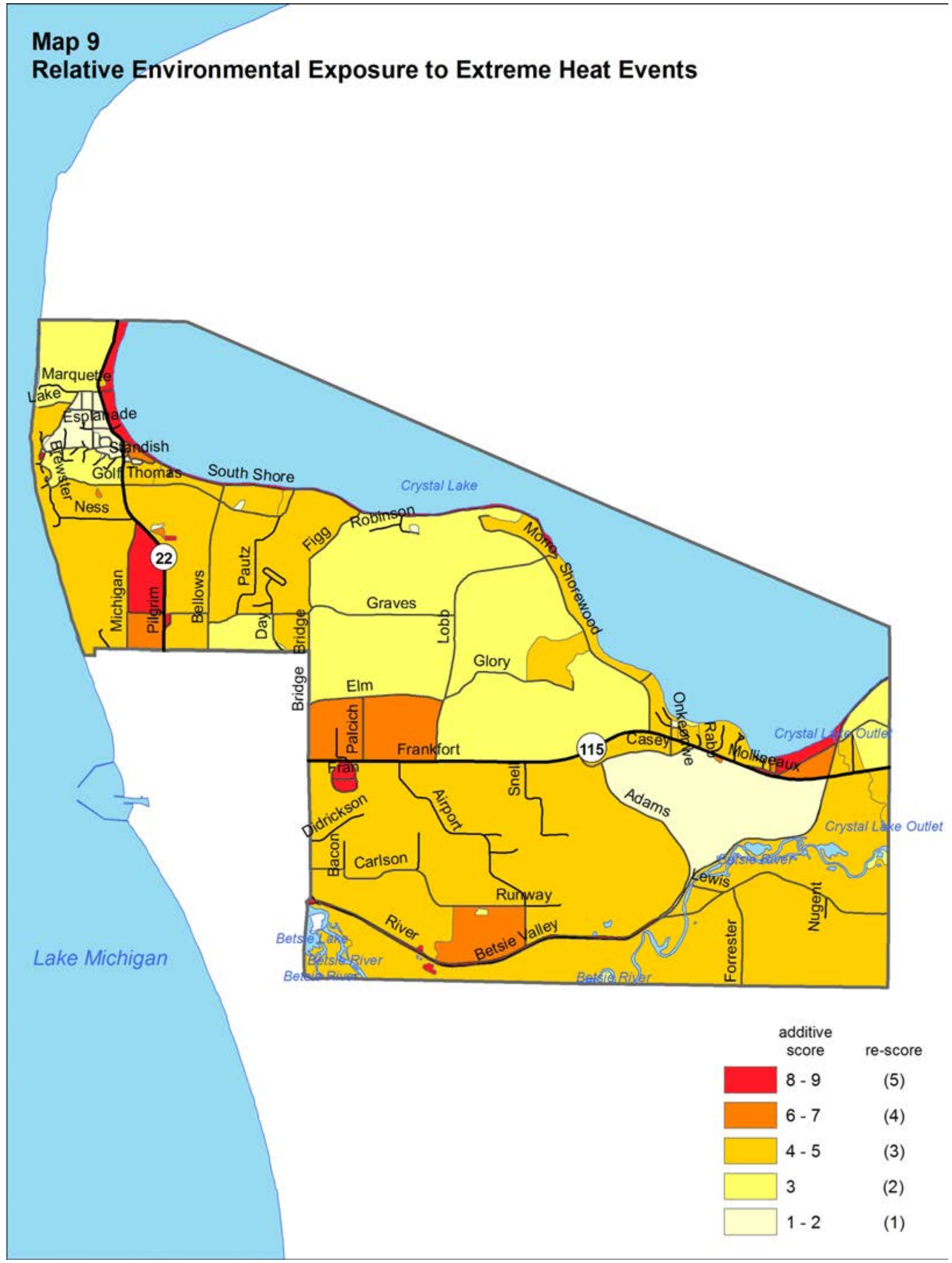

Benzie County

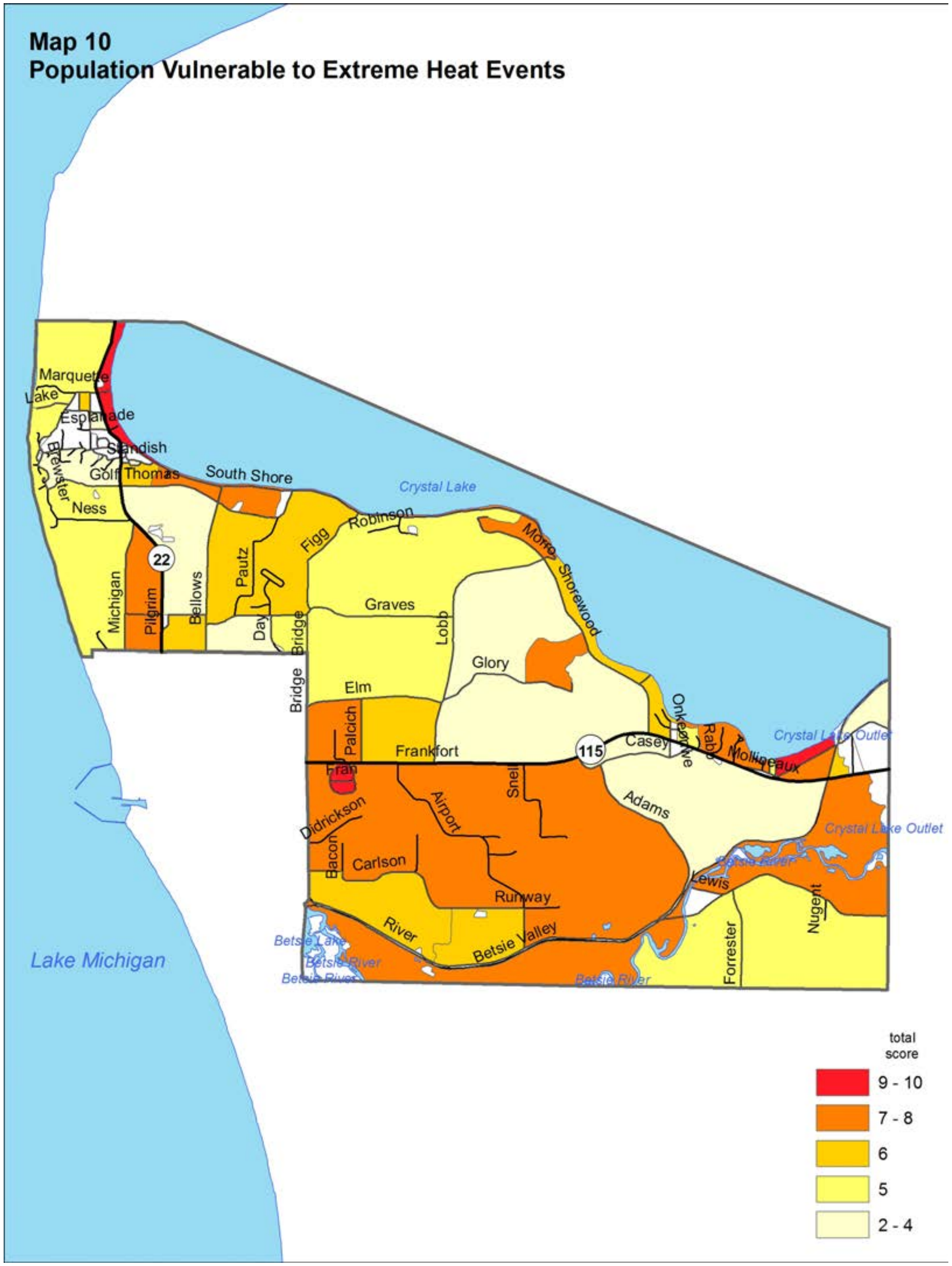

Map 7
Percent Impervious Surface Exposure
Marquette
Lake
Esplanade
Standish
Brewster
Golf
Thomas
South Shore
Ness
Crystal Lake
Robinson
Figg
Monroe
Shorewood
22
Michigan
Pilgrim
Bellows
Pautz
Day
Bridge
Graves
Lobb
Glory
Elm
Palcich
Frankfort
115
Casey
Onkeemave
Crystal Lake Outlet
Mollineaux
Snell
Airport
Adams
Didrickson
Bacon
Carlson
Runway
Crystal Lake Outlet
Betsie River
Lewis
River
Betsie Valley
Betsie Lake
Betsie River
Forrester
Nugent
Lake Michigan
38 - 60% (5)
24 - 37% (4)
15 - 23% (3)
6.4 - 14% (2)
0.10 - 6.3% (1)


Map 8
Percent Tree Canopy
Lake Michigan
Crystal Lake
Crystal Lake Outlet
Betsie Lake
Betsie River
0.20 - 24.30% (5)
24.31 - 40.80% (4)
40.81 - 55.70% (3)
55.71 - 70.20% (2)
70.21 - 80.20% (1)


Benzie County


Benzie County

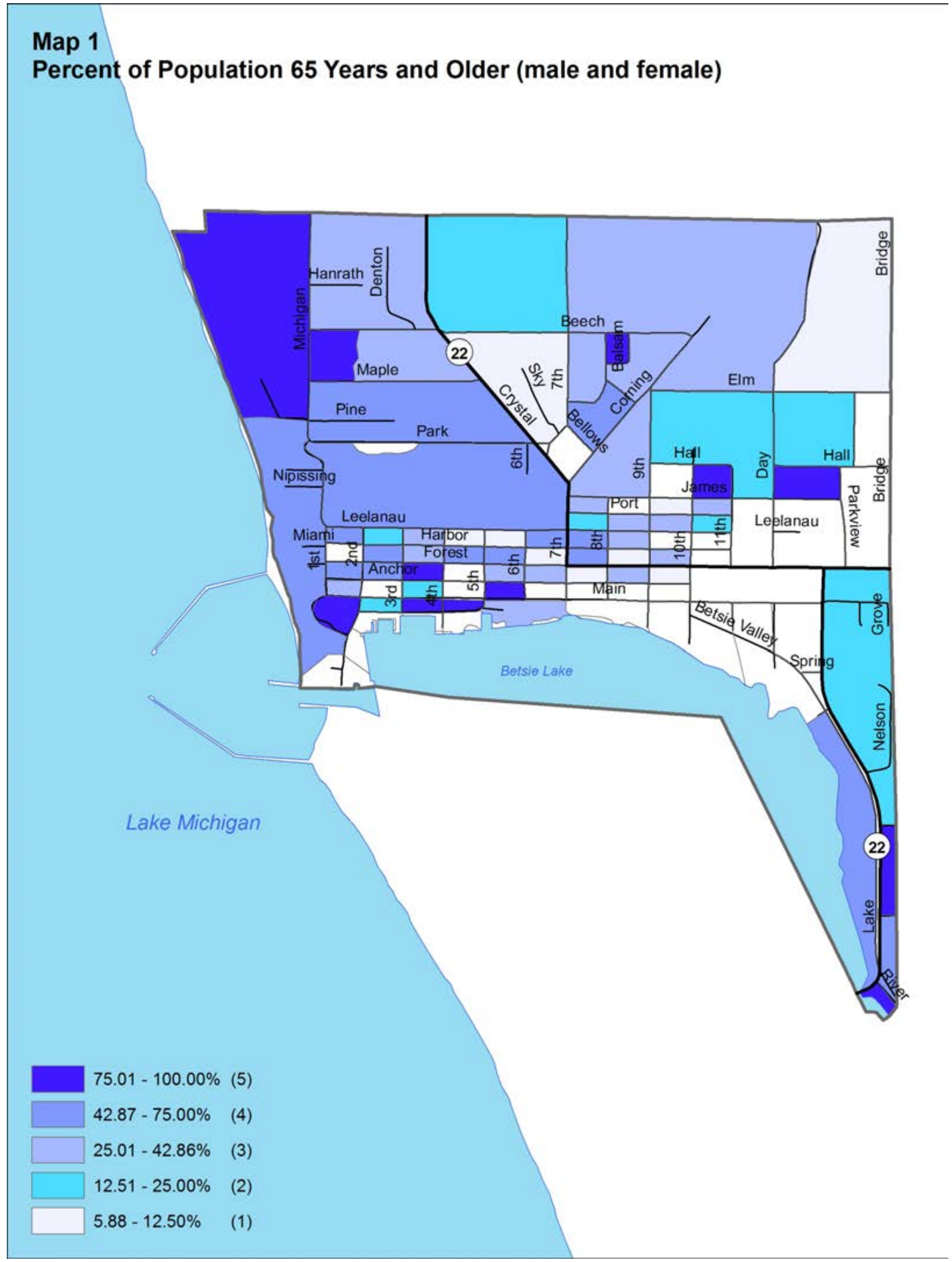

Map 9
Relative Environmental Exposure to Extreme Heat Events
Marquette
Lake
Esplanade
Standish
Brewster
Golf
Thomas
South Shore
Ness
Crystal Lake
Robinson
Figg
Michigan
Pilgrim
22
Bellows
Pautz
Day
Bridge
Graves
Lobb
Monroe
Shorewood
Glory
Elm
Bridge
Palcich
Frankfort
115
Casey
Onkeonwe
Rabe
Mollineaux
Crystal Lake Outlet
Adams
Snell
Airport
Didrickson
Bacon
Carlson
Runway
River
Betsie Valley
Betsie Lake
Betsie River
Lewis
Forrester
Nugent
Lake Michigan
additive score
re-score
8 - 9 (5)
6 - 7 (4)
4 - 5 (3)
3 (2)
1 - 2 (1)

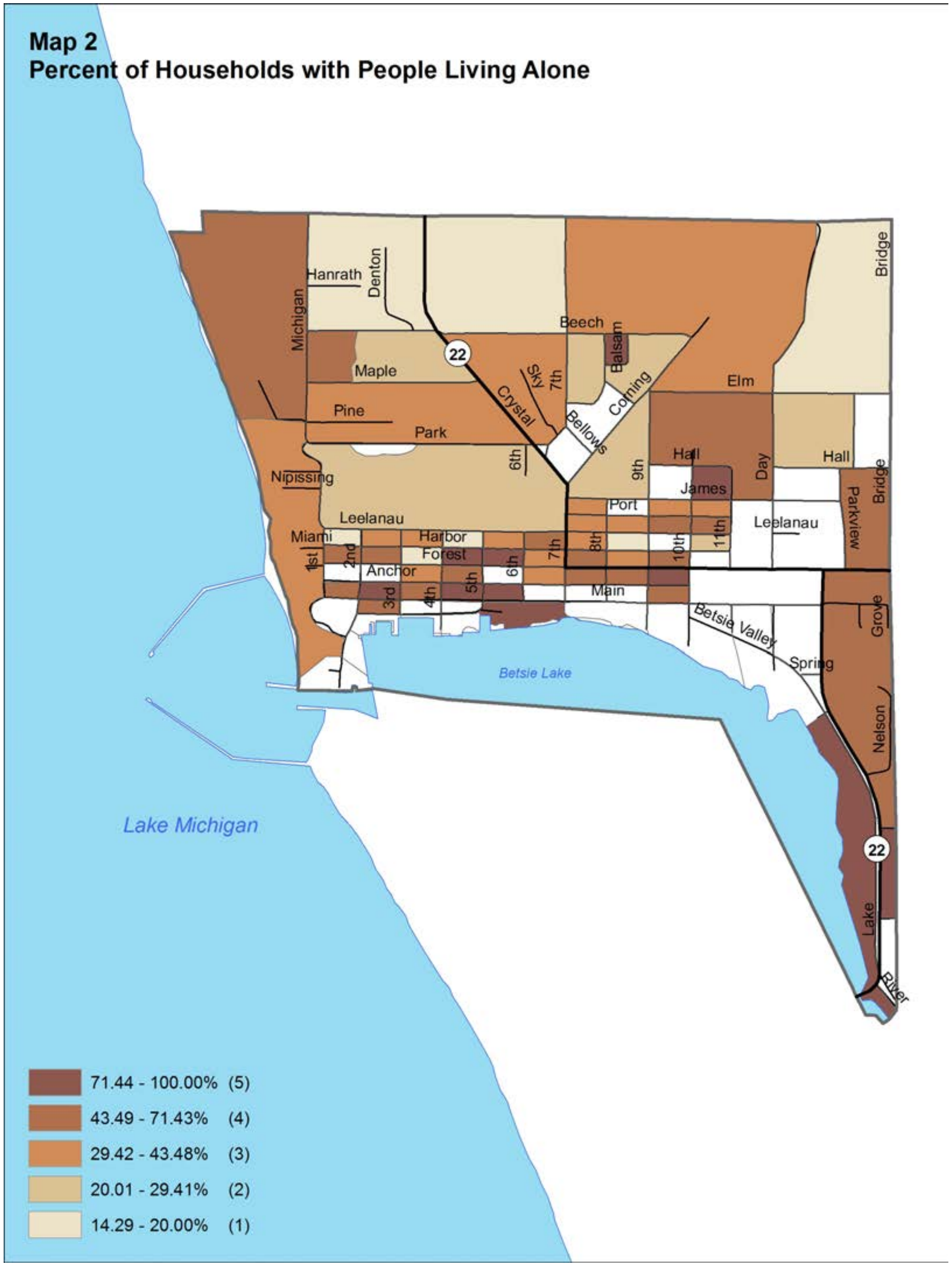


Map 10
Population Vulnerable to Extreme Heat Events

Frankfort

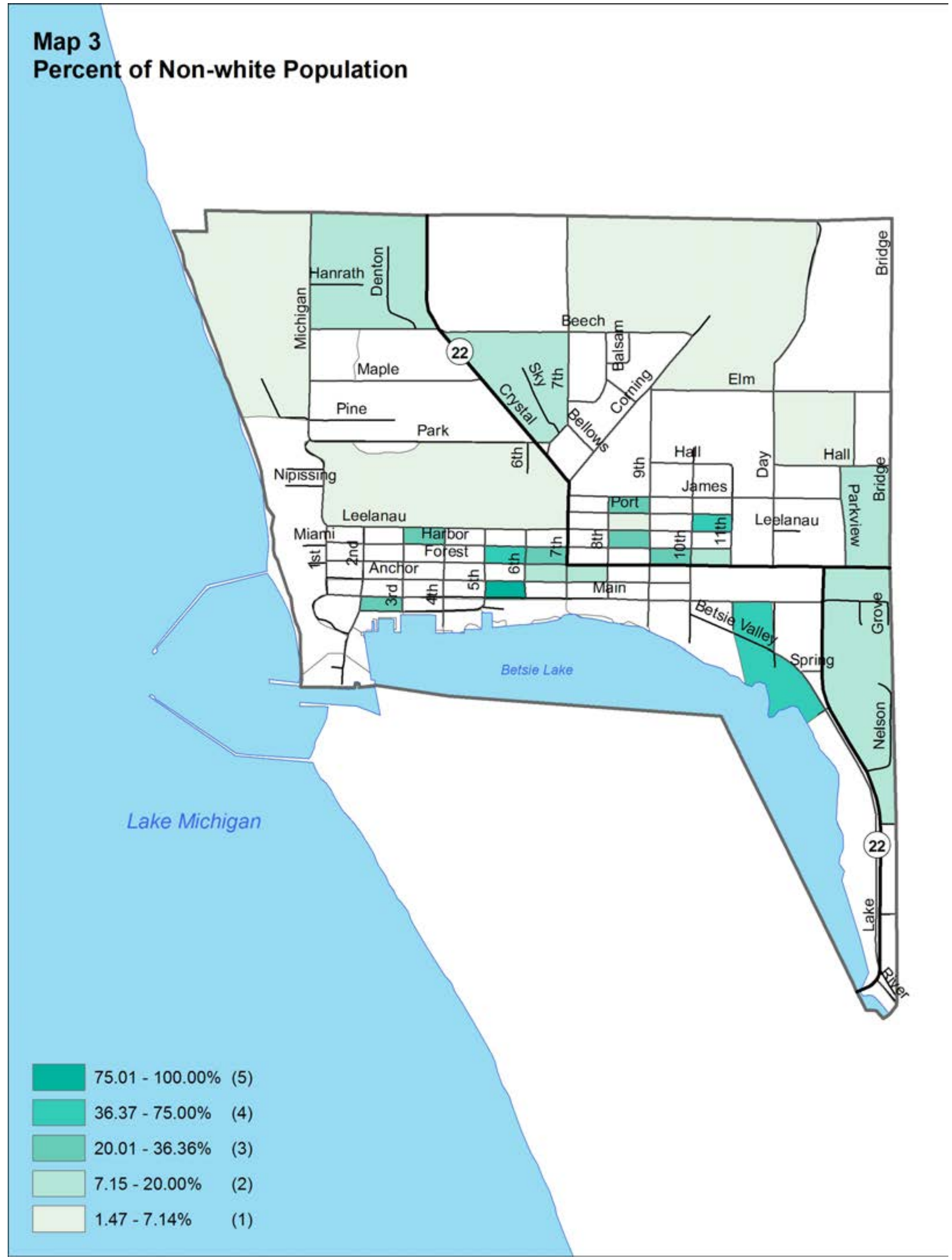

Benzie County

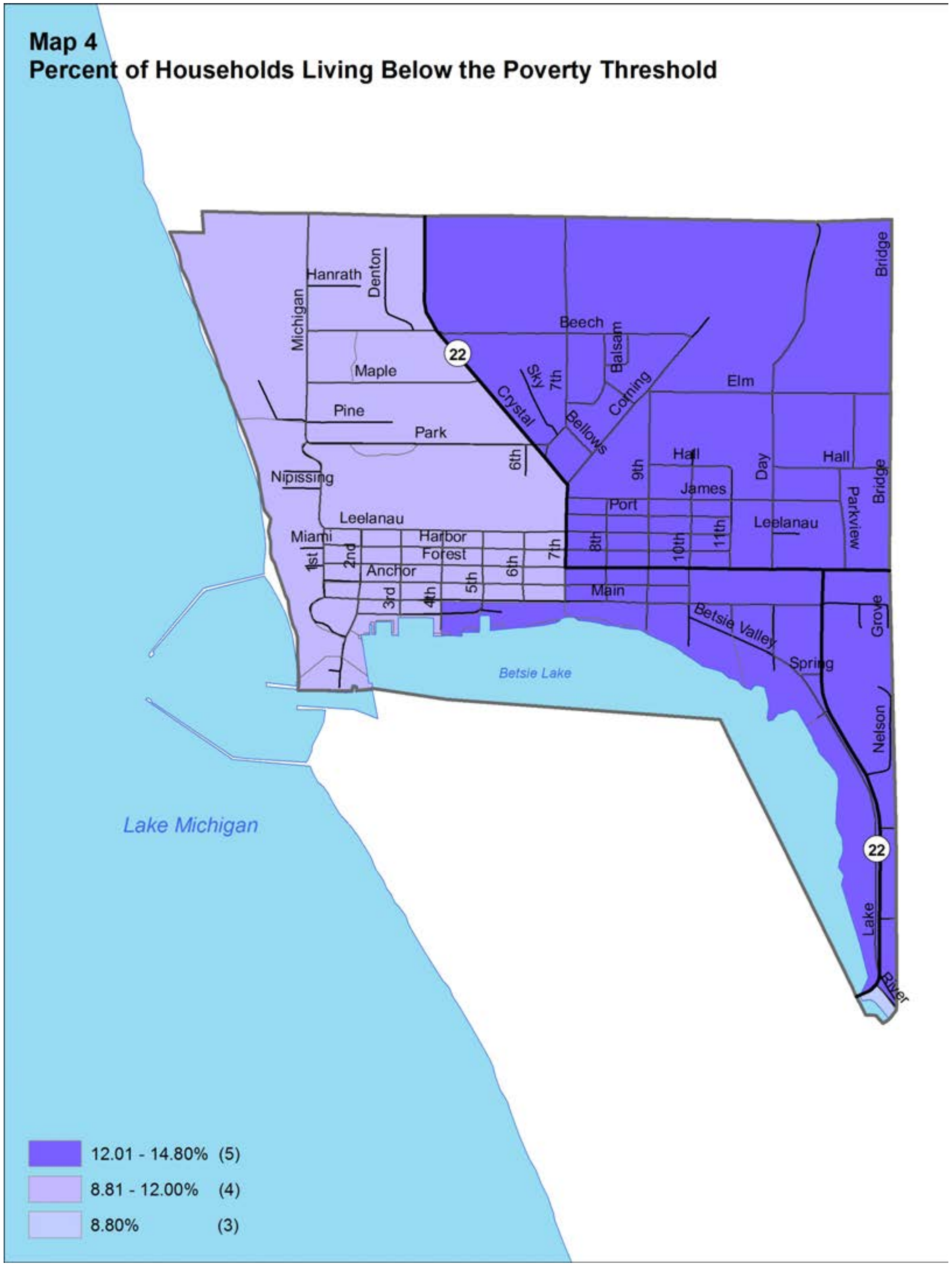

Map 1
Percent of Population 65 Years and Older (male and female)
Lake Michigan
Betsie Lake
75.01 - 100.00% (5)
42.87 - 75.00% (4)
25.01 - 42.86% (3)
12.51 - 25.00% (2)
5.88 - 12.50% (1)



Map 2
Percent of Households with People Living Alone

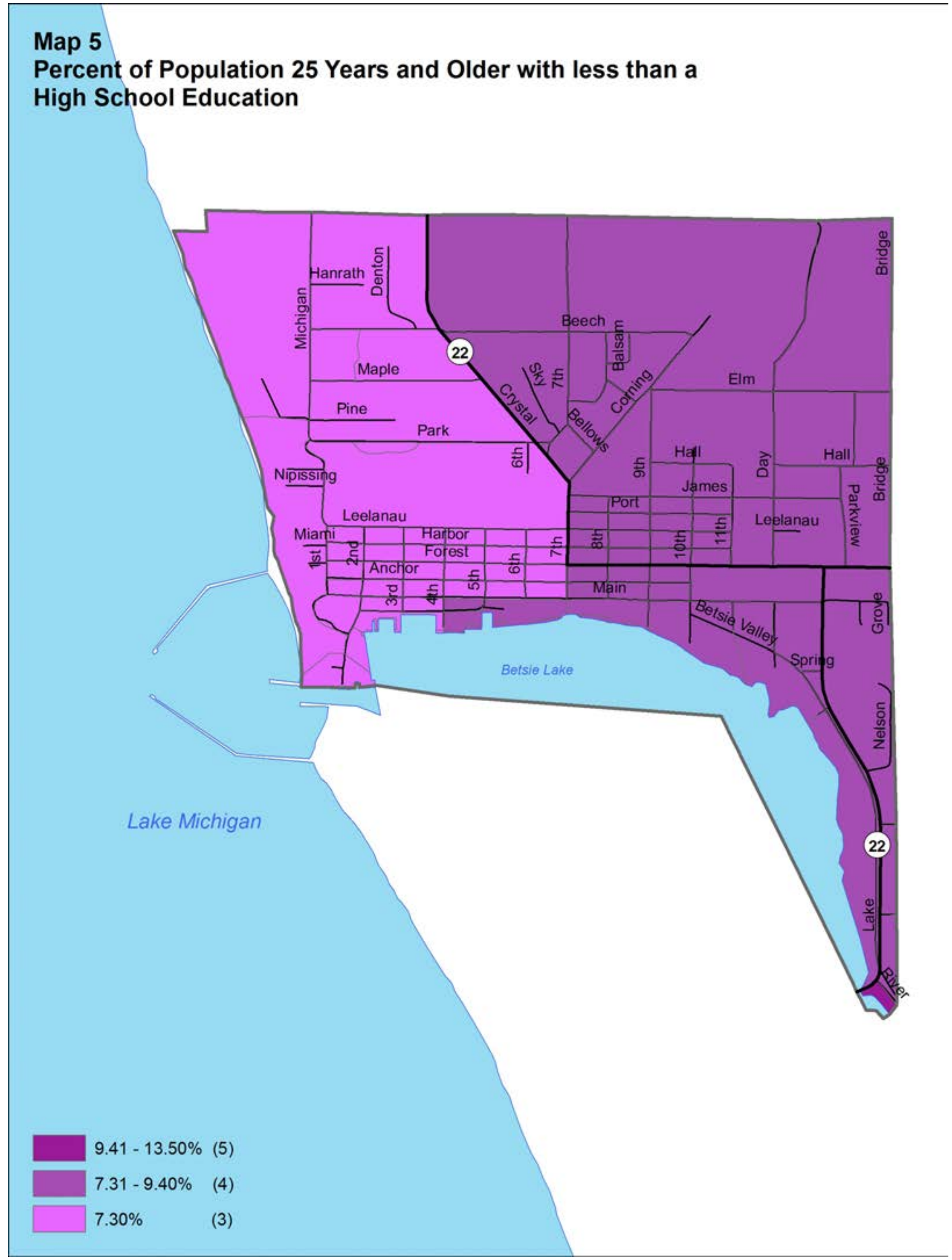

Benzie County

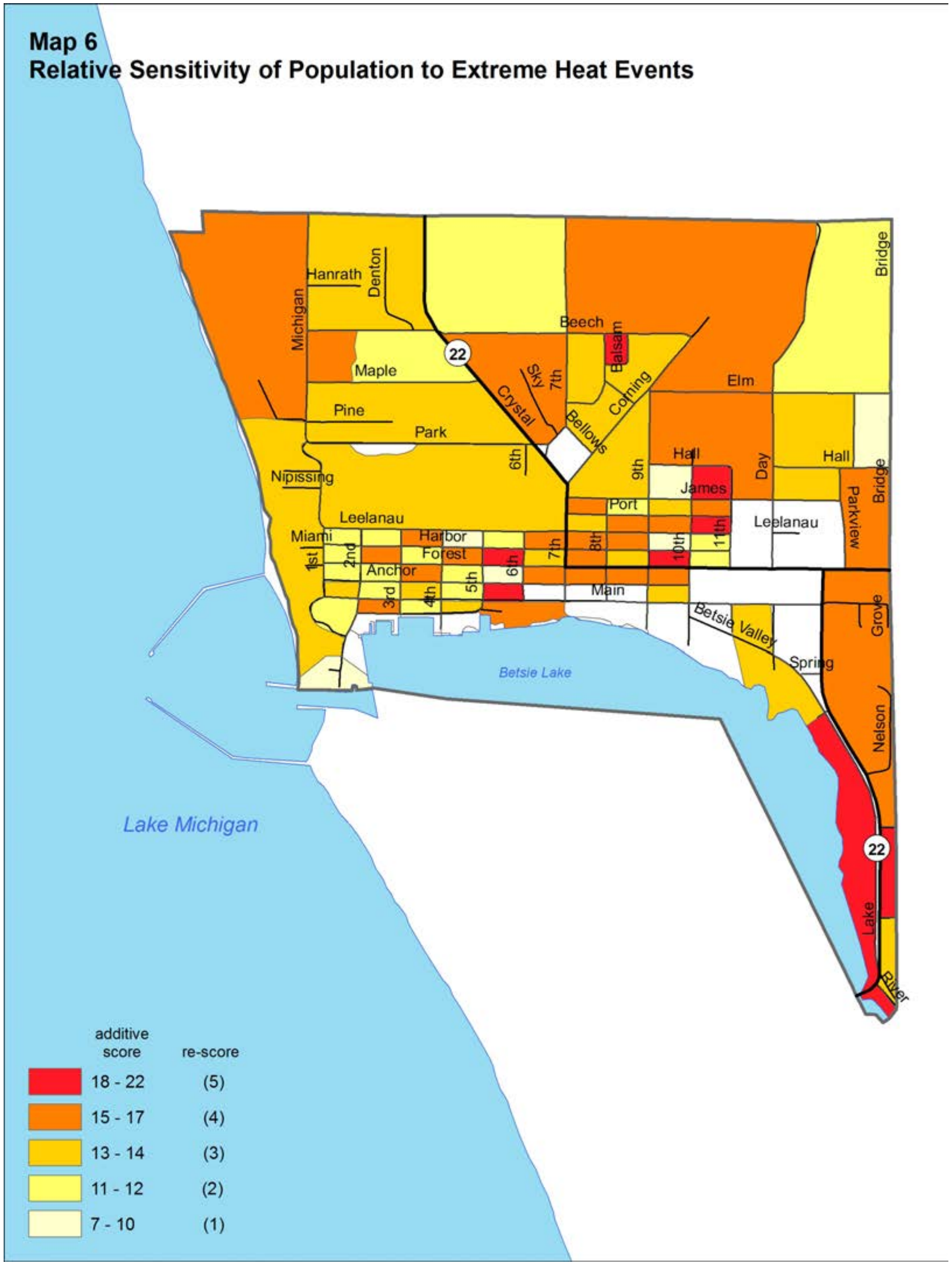

Map 3
Percent of Non-white Population
Hanrath
Denton
Michigan
Beech
Balsam
Maple
Sky
7th
Crystal
Coming
Bellows
Elm
Pine
Park
Hall
Hall
Bridge
Day
Parkview
6th
9th
James
Nipissing
Port
Leelanau
Leelanau
Miami
Harbor
Forest
Anchor
1st
2nd
3rd
4th
5th
6th
7th
8th
10th
11th
Main
Betsie Valley
Spring
Grove
Nelson
Betsie Lake
Lake Michigan
22
Lake
River
75.01 - 100.00% (5)
36.37 - 75.00% (4)
20.01 - 36.36% (3)
7.15 - 20.00% (2)
1.47 - 7.14% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
Hanrath
Denton
Michigan
Beech
Balsam
Maple
Sky
7th
Crystal
Corning
Elm
Bridge
Pine
Park
Bellows
Hall
Day
Hall
6th
9th
James
Parkview
Bridge
Nipissing
Port
Leelanau
Leelanau
Miami
Harbor
Forest
Anchor
1st
2nd
3rd
4th
5th
6th
7th
8th
10th
11th
Main
Betsie Valley
Grove
Spring
Betsie Lake
Nelson
22
Lake Michigan
Lake
River
12.01 - 14.80% (5)
8.81 - 12.00% (4)
8.80% (3)


Benzie County

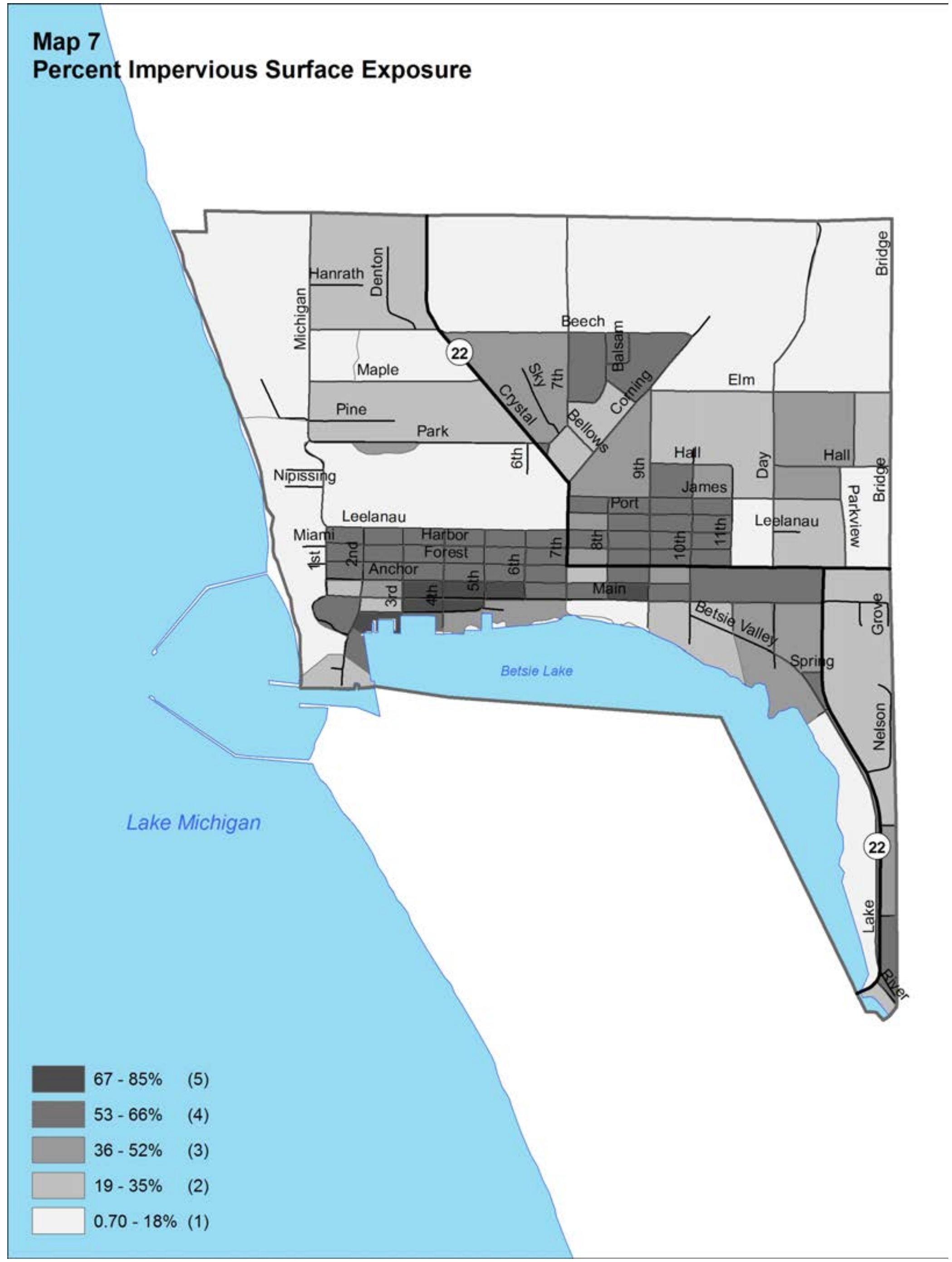

Benzie County

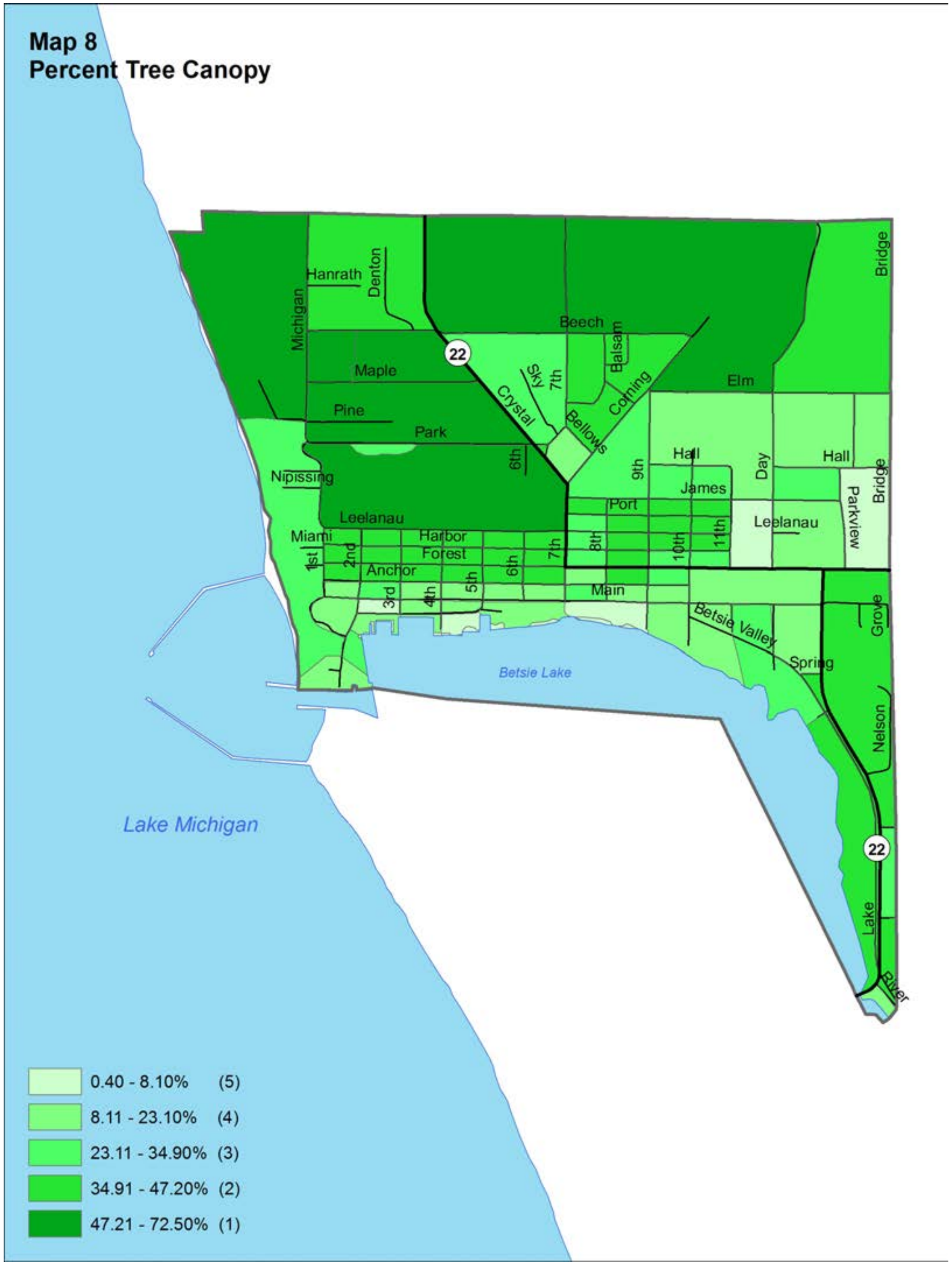

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Hanrath
Denton
Michigan
Beech
Balsam
22
Maple
Sky
7th
Elm
Crystal
Corning
Pine
Bellows
Park
Hall
Hall
Bridge
Nipissing
6th
9th
Day
James
Port
Parkview
Leelanau
Leelanau
Miami
Harbor
Forest
8th
10th
11th
1st
2nd
7th
Anchor
6th
5th
3rd
4th
Main
Betsie Valley
Grove
Spring
Betsie Lake
Nelson
Lake Michigan
22
Lake
River
9.41 - 13.50% (5)
7.31 - 9.40% (4)
7.30% (3)


Map 6
Relative Sensitivity of Population to Extreme Heat Events
Hanrath
Denton
Michigan
Beech
Balsam
22
Maple
Sky
7th
Crystal
Corning
Elm
Bridge
Pine
Park
Bellows
6th
9th
Hall
Day
Hall
Nipissing
James
Parkview
Bridge
Port
Leelanau
Leelanau
Miami
Harbor
Forest
8th
10th
11th
1st
2nd
Anchor
6th
7th
3rd
4th
5th
Main
Betsie Valley
Grove
Spring
Betsie Lake
Nelson
Lake Michigan
22
Lake
River
additive score
re-score
18 - 22 (5)
15 - 17 (4)
13 - 14 (3)
11 - 12 (2)
7 - 10 (1)


Benzie County

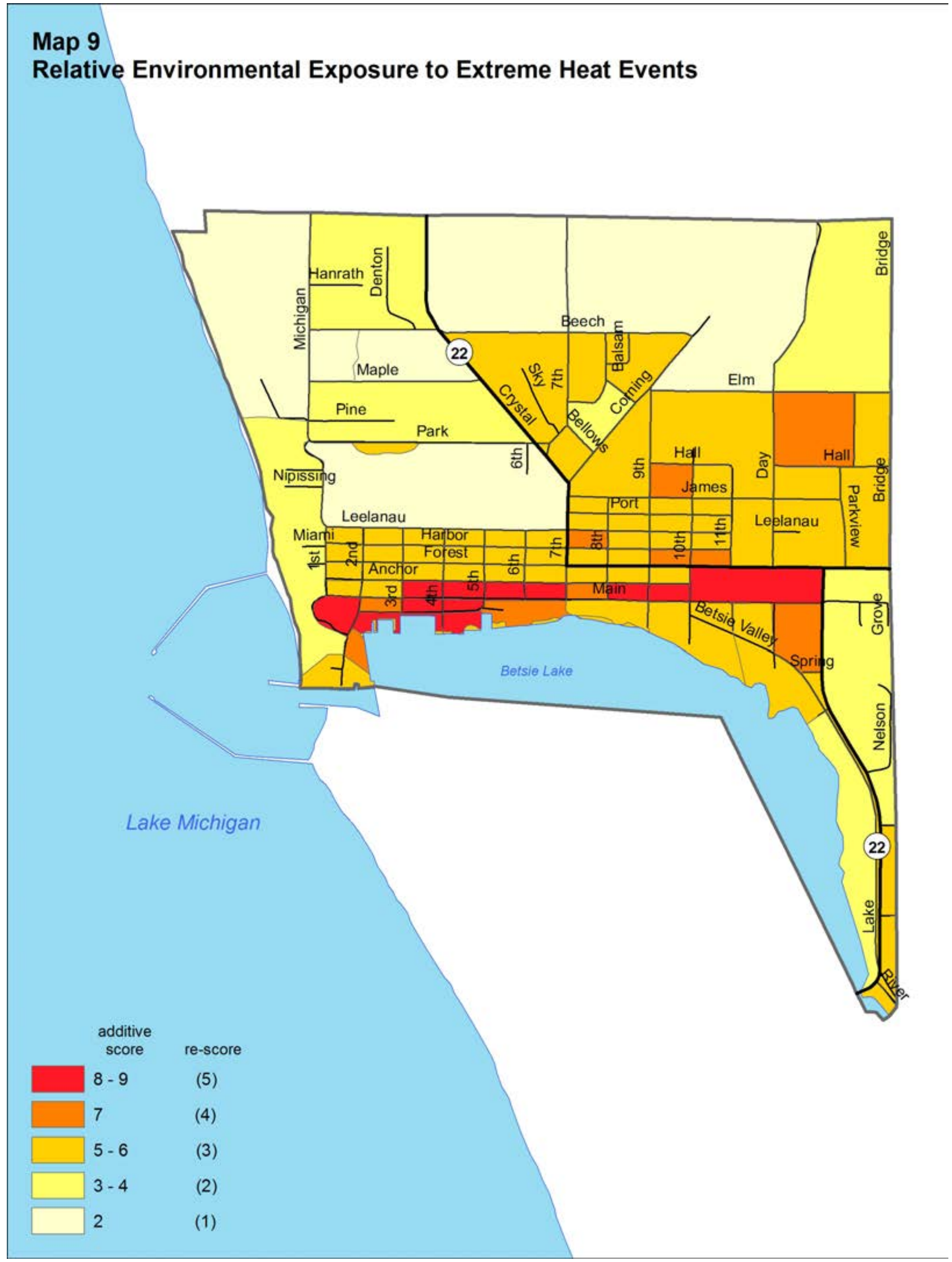

Benzie County

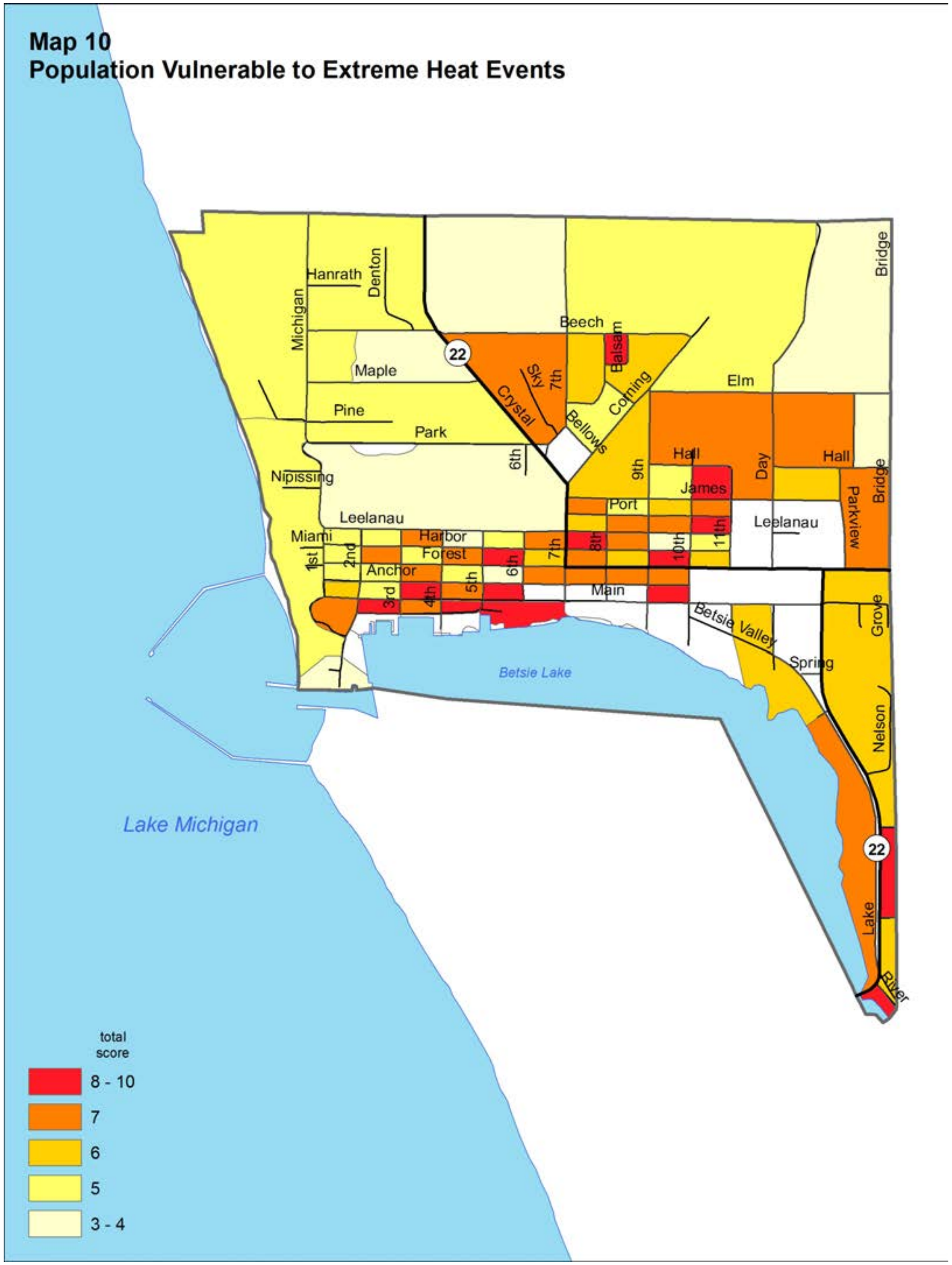

Map 7
Percent Impervious Surface Exposure
Hanrath
Denton
Michigan
Beech
Balsam
22
Maple
Sky
7th
Crystal
Corning
Elm
Bridge
Pine
Park
Bellows
6th
9th
Hall
Day
Hall
Nipissing
James
Parkview
Bridge
Port
Leelanau
Leelanau
Miami
Harbor
Forest
1st
2nd
Anchor
7th
8th
10th
11th
6th
3rd
4th
5th
Main
Betsie Valley
Grove
Spring
Betsie Lake
Nelson
Lake Michigan
22
Lake
River
67 - 85% (5)
53 - 66% (4)
36 - 52% (3)
19 - 35% (2)
0.70 - 18% (1)


Map 8
Percent Tree Canopy
Hanrath
Denton
Michigan
Beech
Balsam
Maple
Sky
7th
Crystal
Coming
Elm
Pine
Park
Bellows
Hall
Hall
Day
Nipissing
6th
9th
James
Parkview
Bridge
Bridge
Port
Leelanau
Leelanau
Miami
Harbor
Forest
Anchor
1st
2nd
3rd
4th
5th
6th
7th
8th
10th
11th
Main
Betsie Valley
Spring
Grove
Nelson
Betsie Lake
Lake Michigan
22
22
Lake
River
0.40 - 8.10% (5)
8.11 - 23.10% (4)
23.11 - 34.90% (3)
34.91 - 47.20% (2)
47.21 - 72.50% (1)


Benzie County

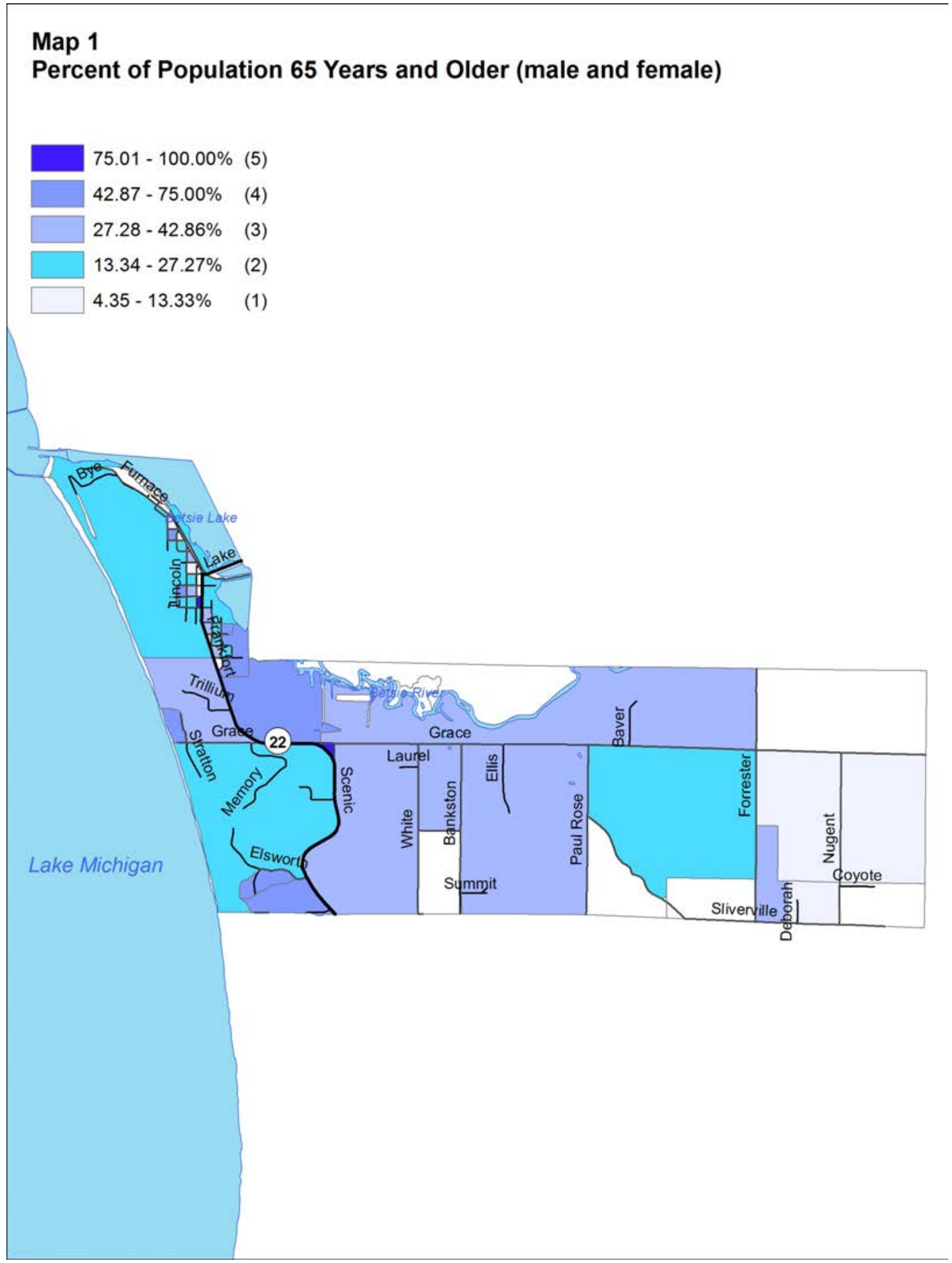

Benzie County

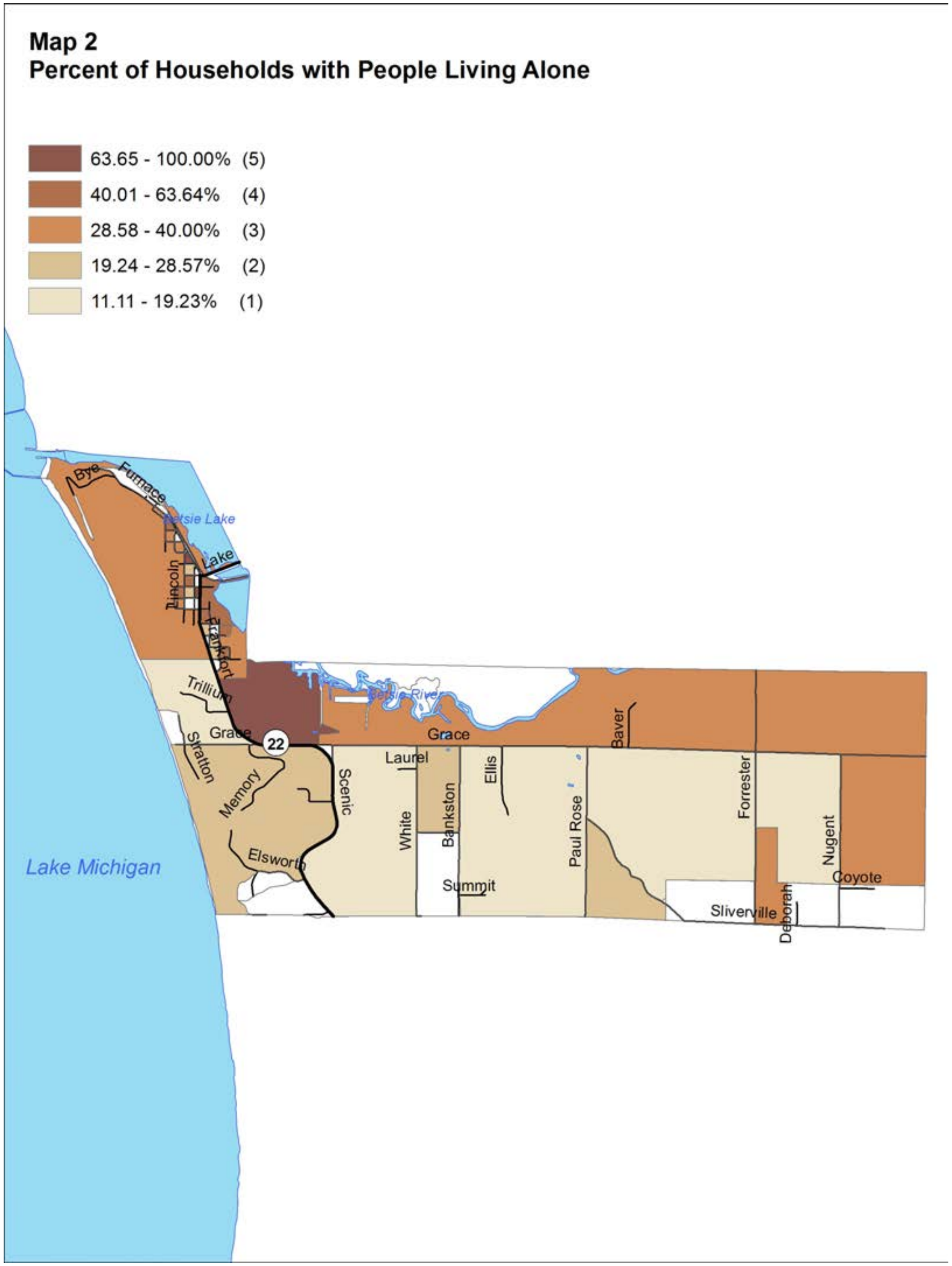

Map 9
Relative Environmental Exposure to Extreme Heat Events
Hanrath
Denton
Michigan
Beech
Balsam
22
Maple
Sky
7th
Crystal
Corning
Elm
Bellows
Pine
Park
Bridge
6th
9th
Hall
Day
Hall
Nipissing
James
Port
Parkview
Leelanau
Leelanau
Miami
Harbor
Forest
Anchor
1st
2nd
3rd
4th
5th
6th
7th
8th
10th
11th
Main
Betsie Valley
Grove
Spring
Betsie Lake
Nelson
Lake Michigan
Lake
River
additive score
re-score
8 - 9 (5)
7 (4)
5 - 6 (3)
3 - 4 (2)
2 (1)


Map 10
Population Vulnerable to Extreme Heat Events
Hanrath
Denton
Michigan
Beech
Balsam
Maple
Sky
7th
Crystal
Corning
Bellows
Elm
Pine
Park
6th
9th
Hall
Day
Hall
Bridge
Nipissing
James
Port
Parkview
Leelanau
Leelanau
Miami
Harbor
Forest
Anchor
1st
2nd
3rd
4th
5th
6th
7th
8th
10th
11th
Main
Betsie Valley
Spring
Grove
Betsie Lake
Nelson
Lake Michigan
22
Lake
River
total score
8 - 10
7
6
5
3 - 4


Benzie County

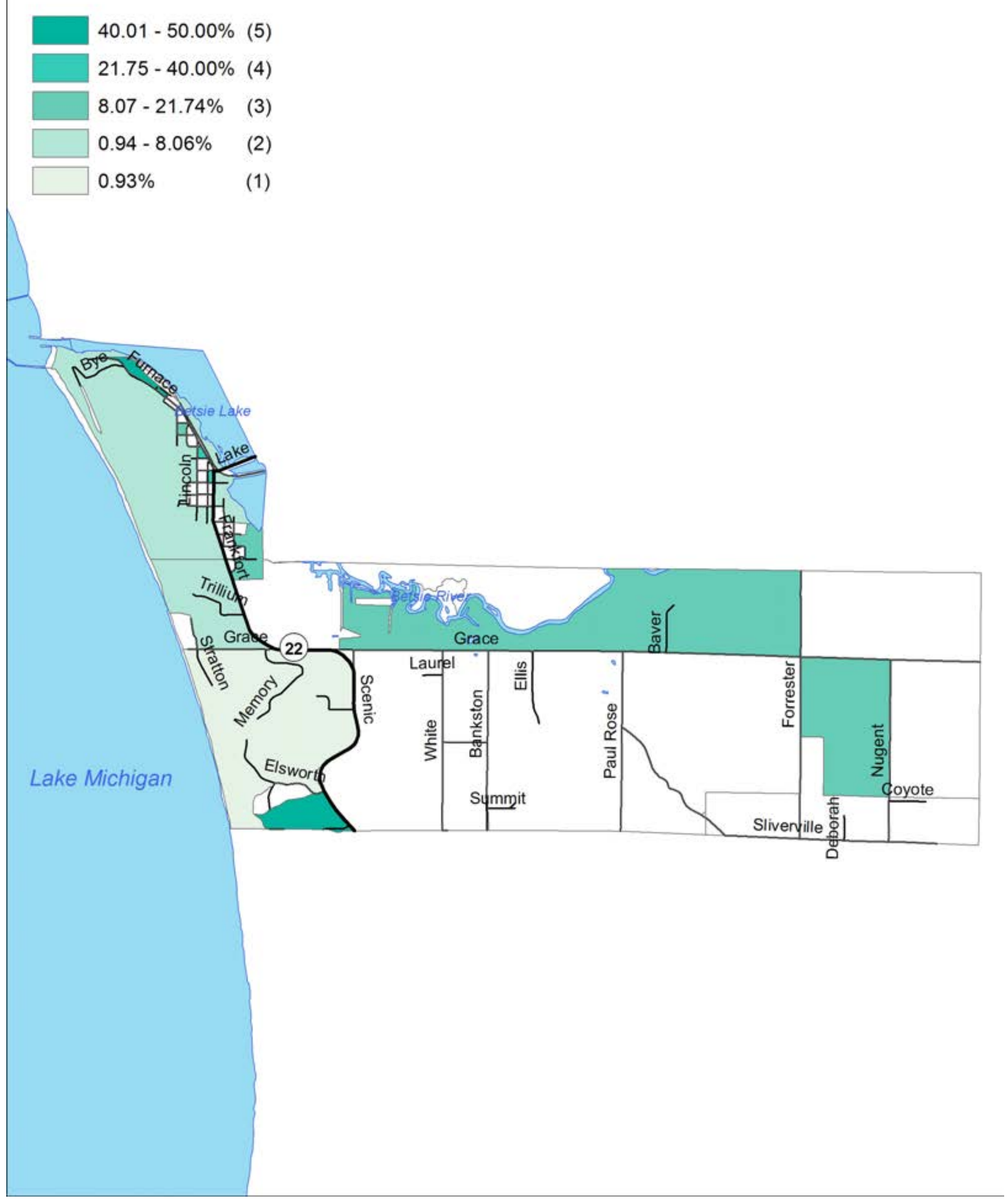
Gilmore Twp./Elberta



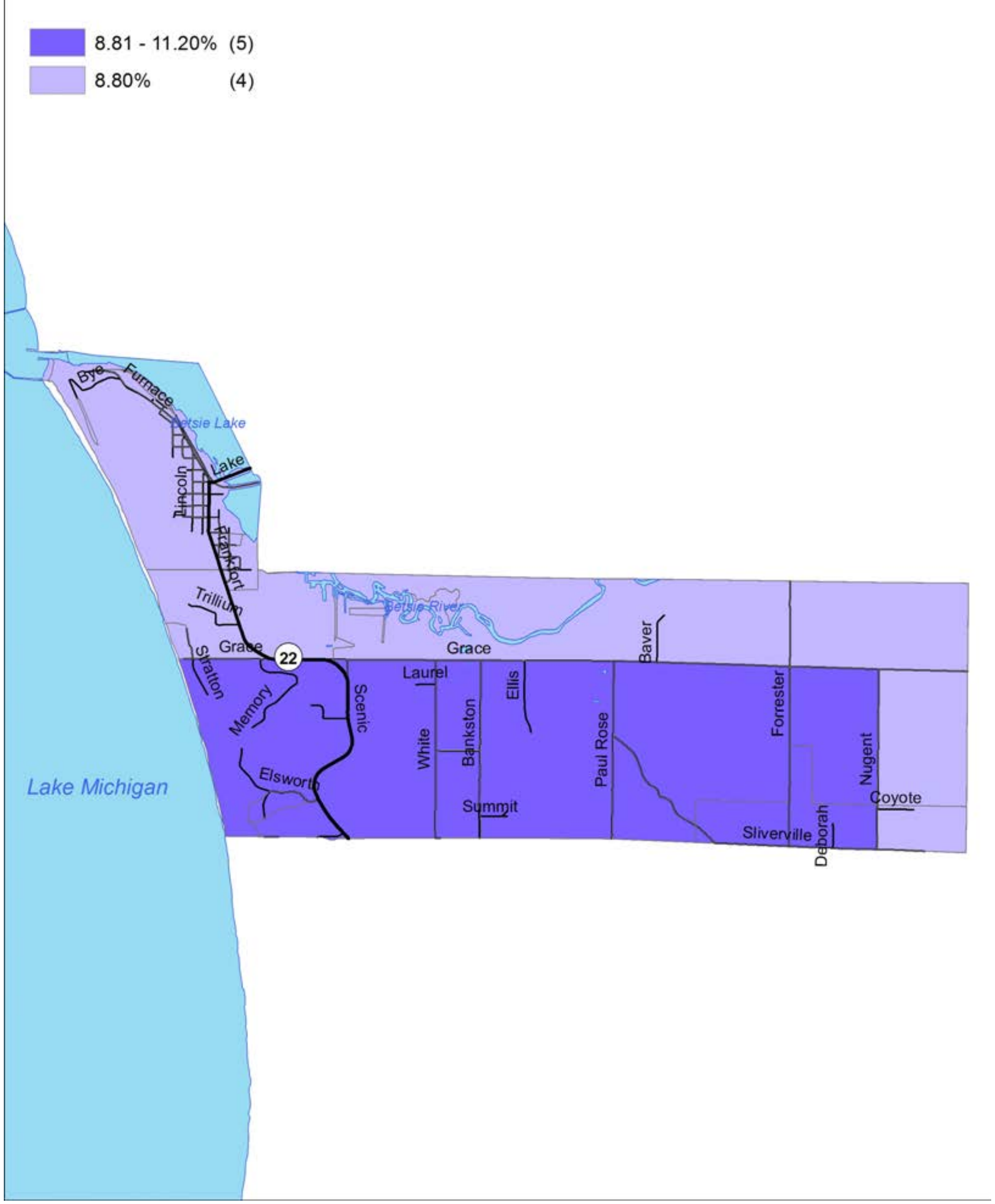

Map 2
Percent of Households with People Living Alone
63.65 - 100.00% (5)
40.01 - 63.64% (4)
28.58 - 40.00% (3)
19.24 - 28.57% (2)
11.11 - 19.23% (1)
Lake Michigan
Bye
Furnace
Lake
Lincoln
Frankfort
Trillium
Grace
22
Stratton
Memory
Elsworth
Scenic
Laurel
White
Bankston
Ellis
Summit
Paul Rose
Baver
Forrester
Nugent
Coyote
Silverville
Deborah


Benzie County

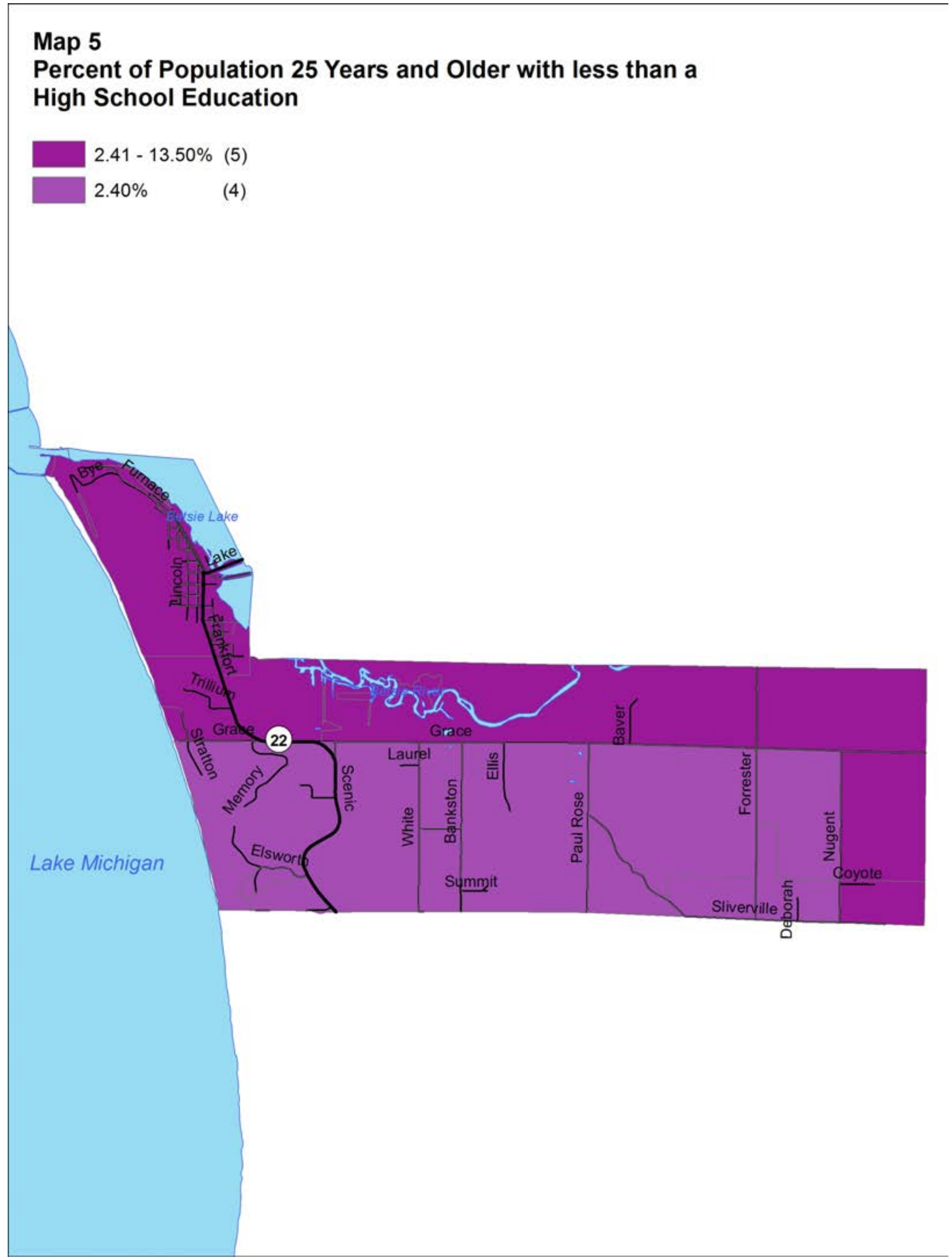
Map 3
Percent of Non-white Population

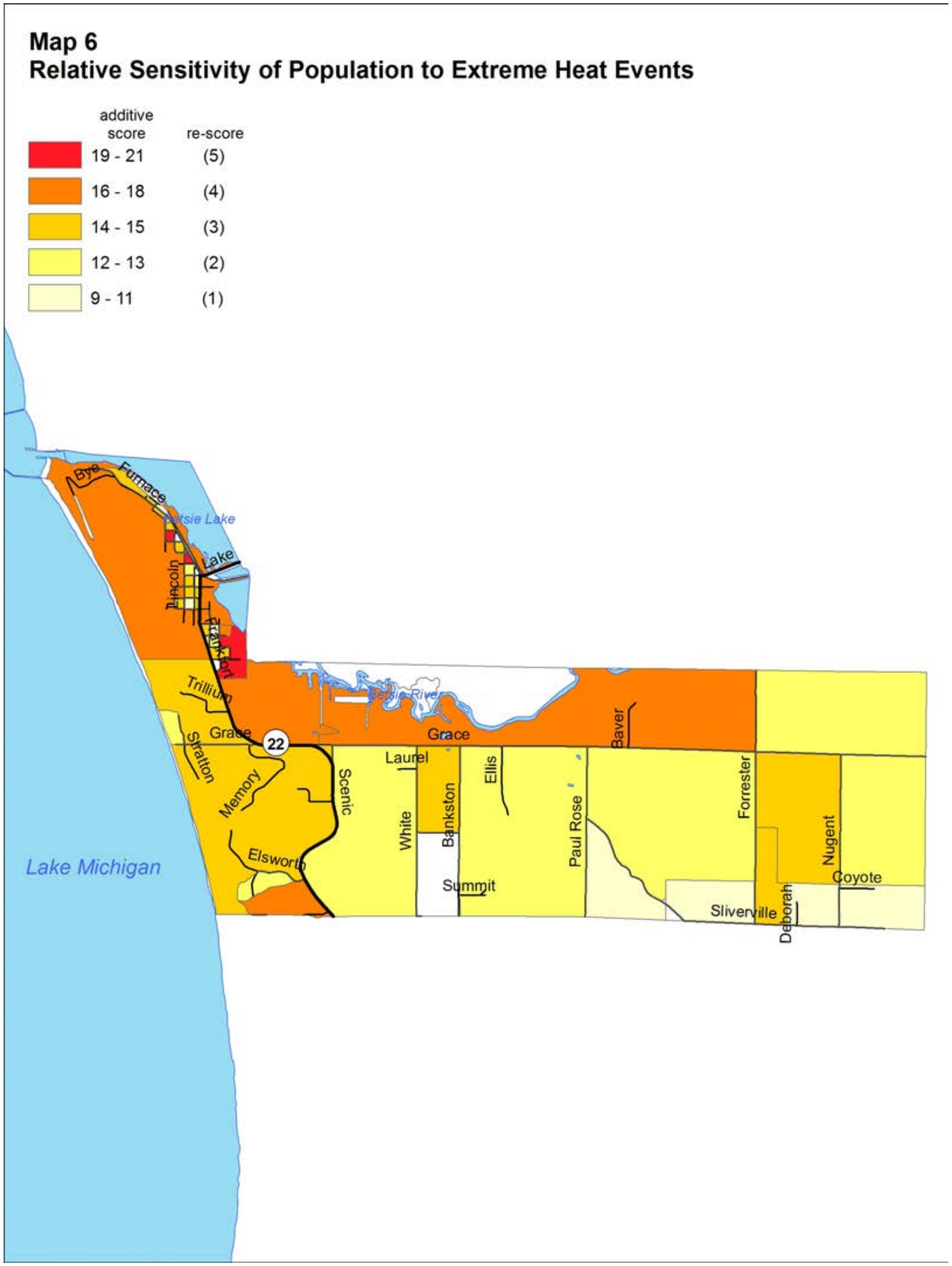


Map 4
Percent of Households Living Below the Poverty Threshold



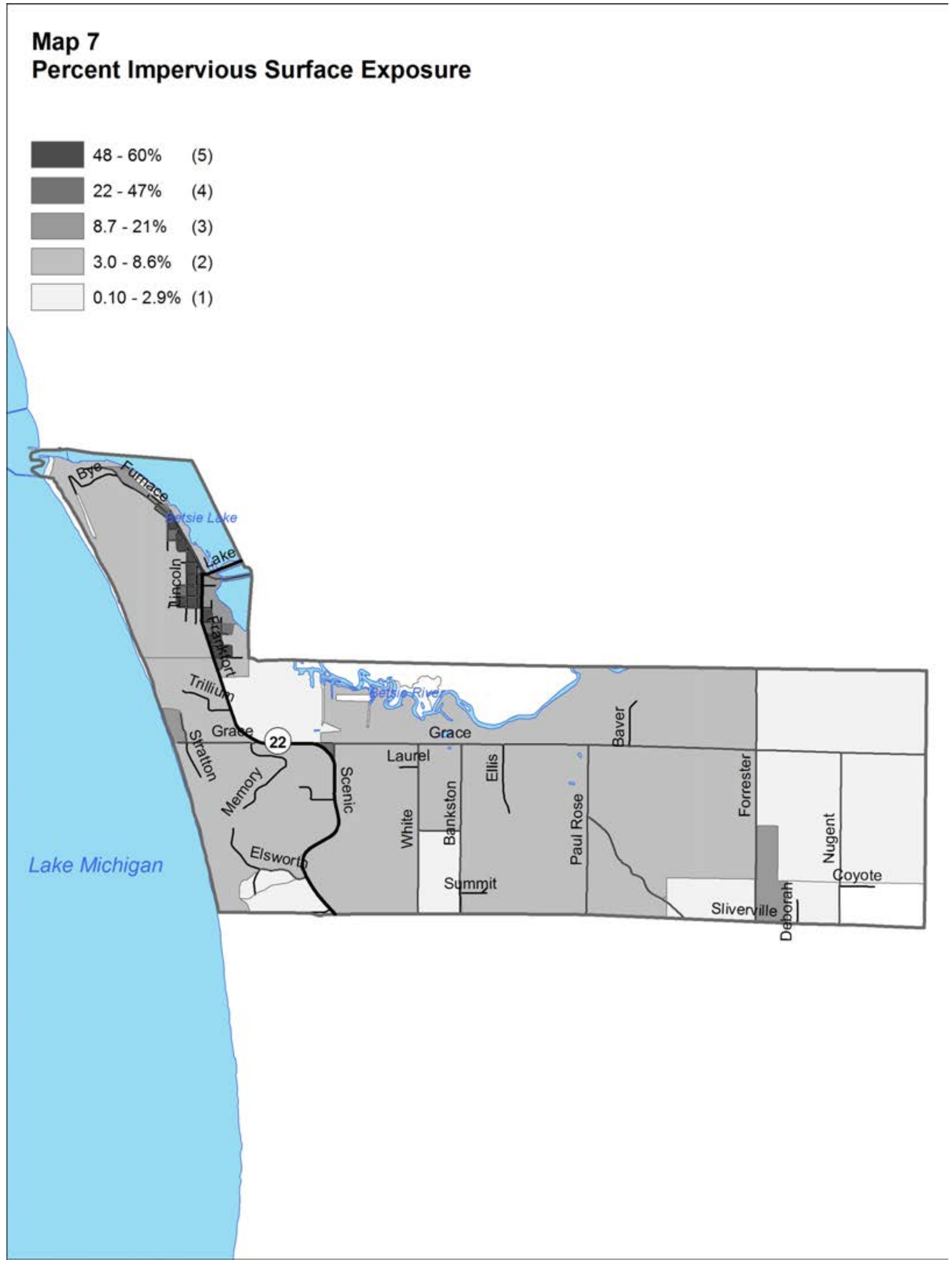

Benzie County

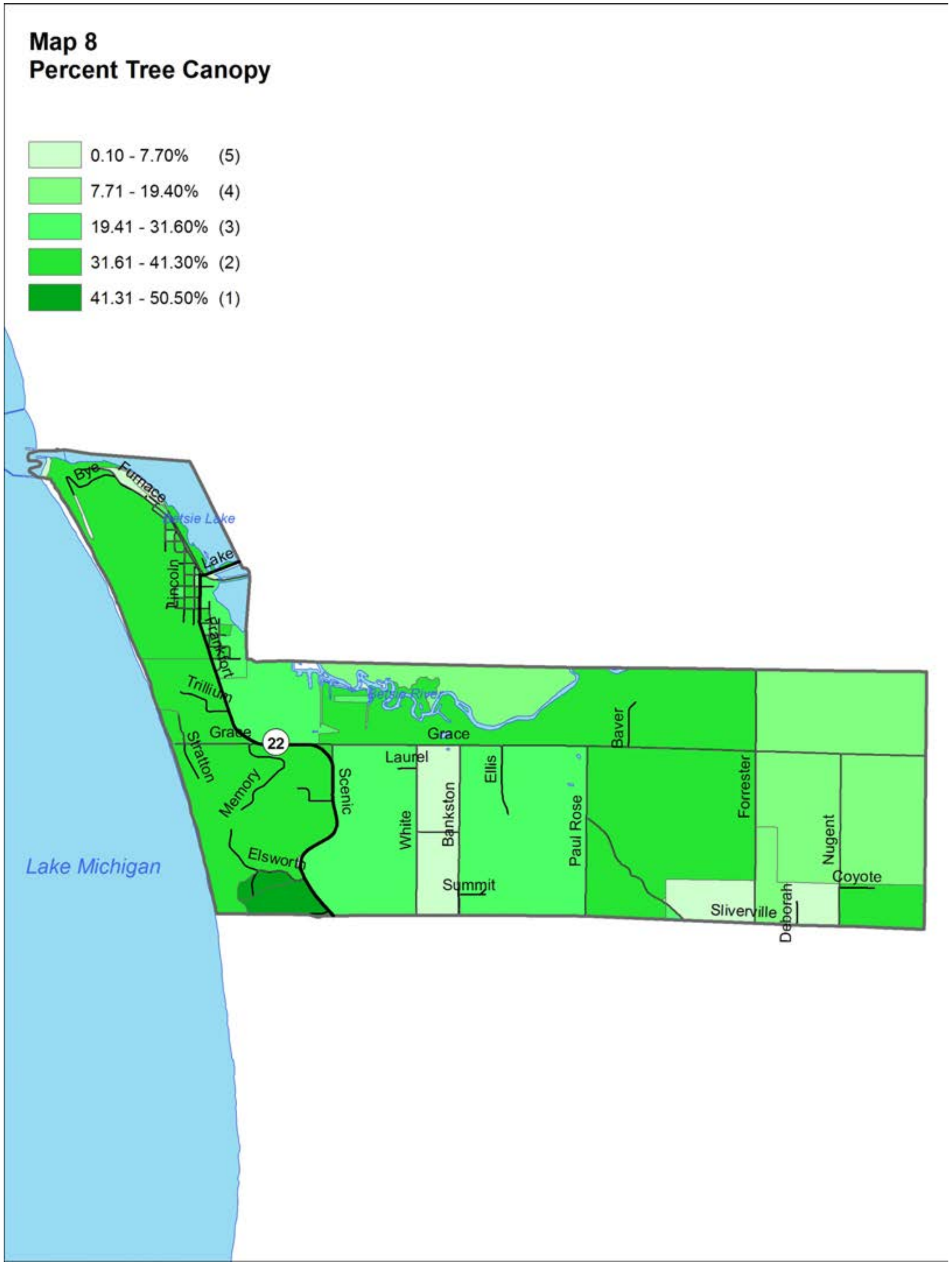

Map 5
Percent of Population 25 Years and Older with less than a High School Education
2.41 - 13.50% (5)
2.40% (4)
Lake Michigan
Betsie Lake
Bye
Furnace
Lake
Lincoln
Frankfort
Trillium
Grace
Stratton
22
Memory
Scenic
Laurel
White
Bankston
Ellis
Paul Rose
Baver
Forrester
Nugent
Coyote
Elsworth
Summit
Sliverville
Deborah


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
19 - 21 (5)
16 - 18 (4)
14 - 15 (3)
12 - 13 (2)
9 - 11 (1)
Lake Michigan
Bye
Furnace
Lake
Lincoln
Frankfort
Trillium
Grace
22
Stratton
Memory
Elsworth
Scenic
Laurel
White
Bankston
Ellis
Summit
Paul Rose
Baver
Forrester
Nugent
Coyote
Deborah
Silverville


Benzie County

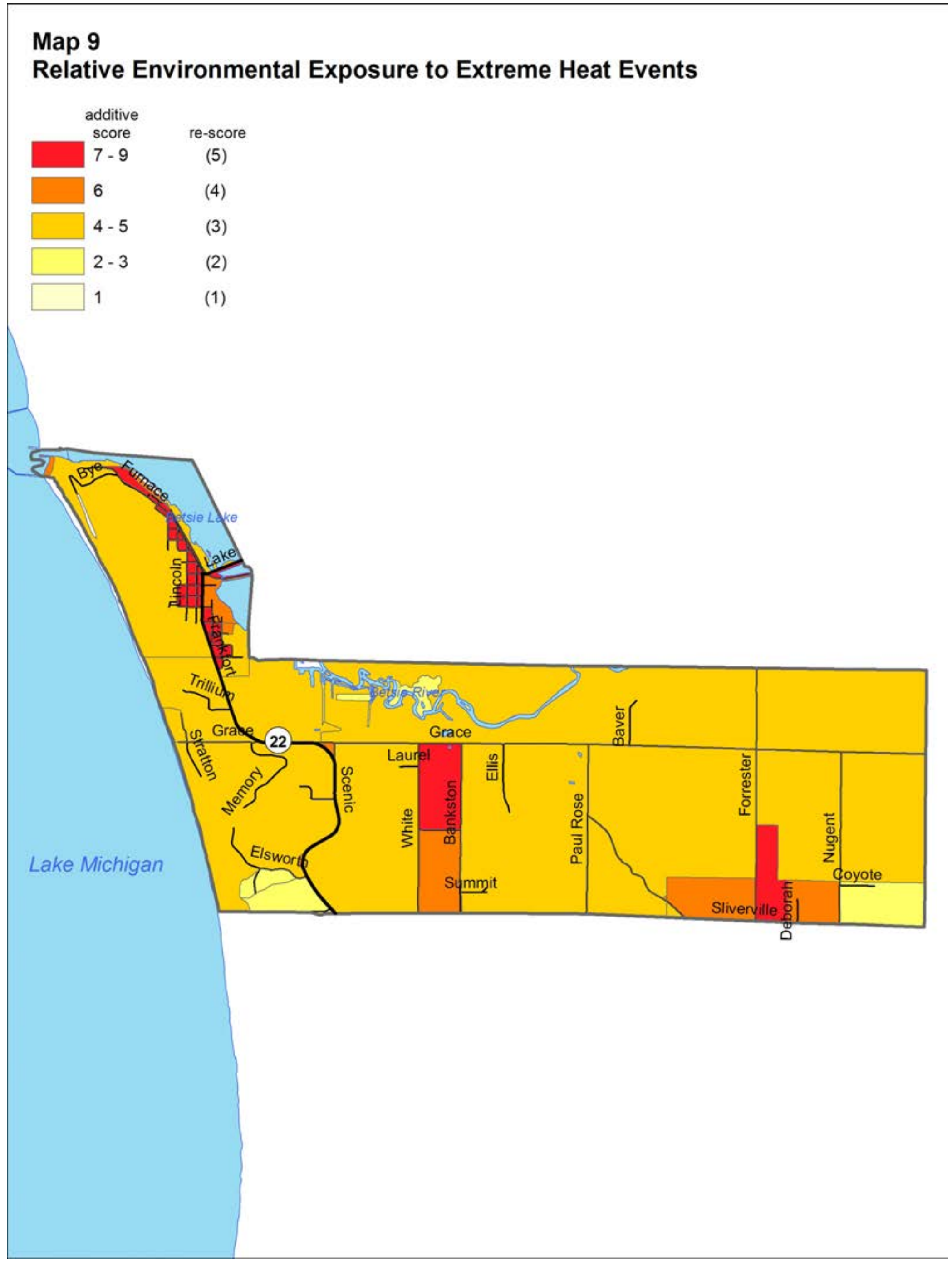

Benzie County

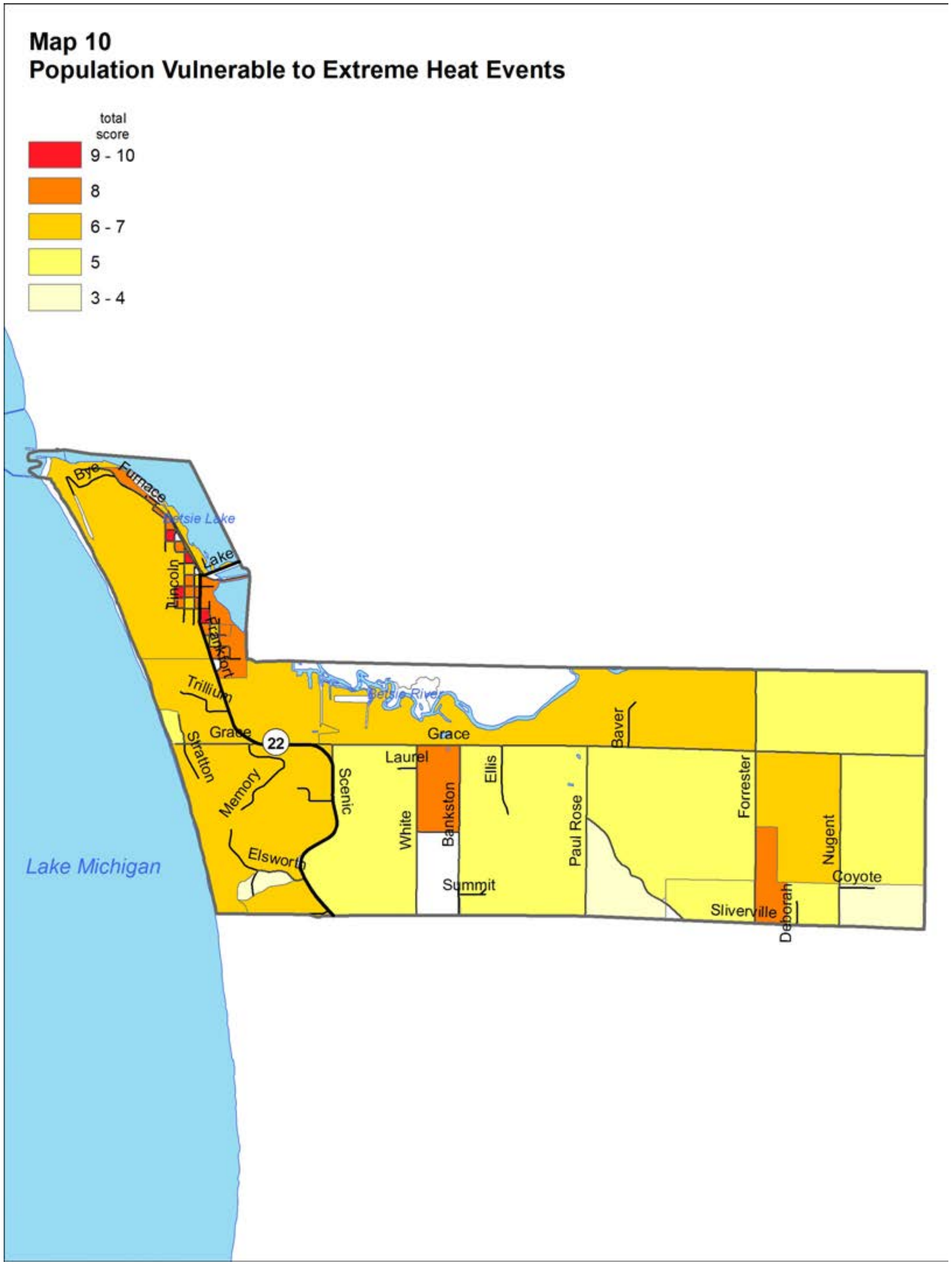

Map 7
Percent Impervious Surface Exposure
48 - 60% (5)
22 - 47% (4)
8.7 - 21% (3)
3.0 - 8.6% (2)
0.10 - 2.9% (1)
Lake Michigan
Betsie Lake
Betsie River
Bye
Furnace
Lake
Lincoln
Frankfort
Trillium
Grace
22
Stratton
Memory
Elsworth
Scenic
Laurel
White
Bankston
Ellis
Summit
Paul Rose
Baver
Forrester
Nugent
Coyote
Sliverville
Deborah


Map 8
Percent Tree Canopy
0.10 - 7.70% (5)
7.71 - 19.40% (4)
19.41 - 31.60% (3)
31.61 - 41.30% (2)
41.31 - 50.50% (1)
Lake Michigan
Rye
Furnace
Lake
Lincoln
Frankfort
Trillium
Grace
22
Stratton
Memory
Elsworth
Scenic
Laurel
White
Bankston
Ellis
Summit
Paul Rose
Baver
Forrester
Nugent
Coyote
Silverville
Deborah


Benzie County


Benzie County

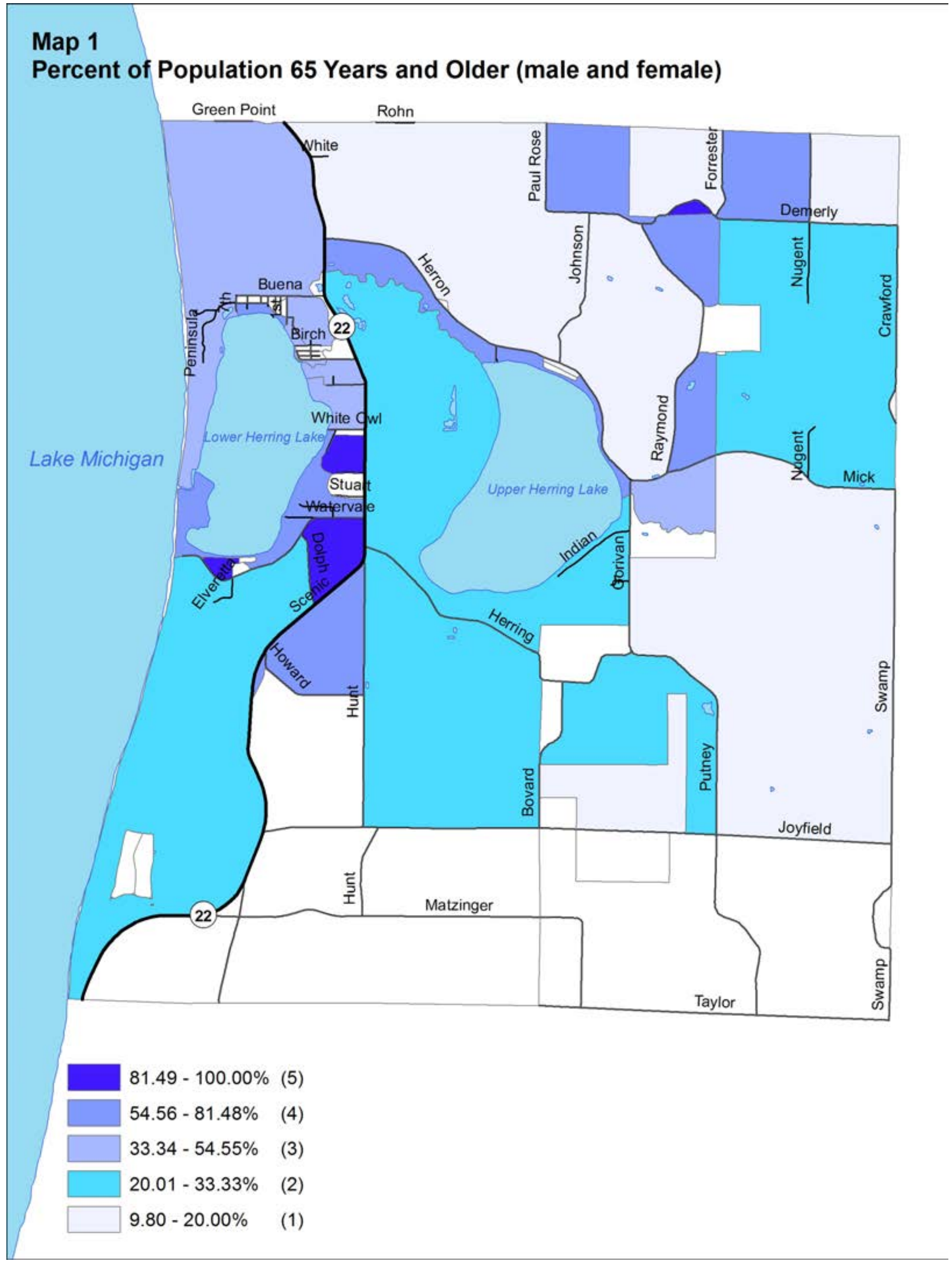

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
7 - 9 (5)
6 (4)
4 - 5 (3)
2 - 3 (2)
1 (1)
Lake Michigan
Betsie Lake
Betsie River
Bye
Furnace
Lake
Lincoln
Frankfort
Trillium
Grace
Stratton
22
Memory
Elsworth
Scenic
Laurel
White
Bankston
Ellis
Summit
Paul Rose
Baver
Forrester
Nugent
Coyote
Sliverville
Deborah

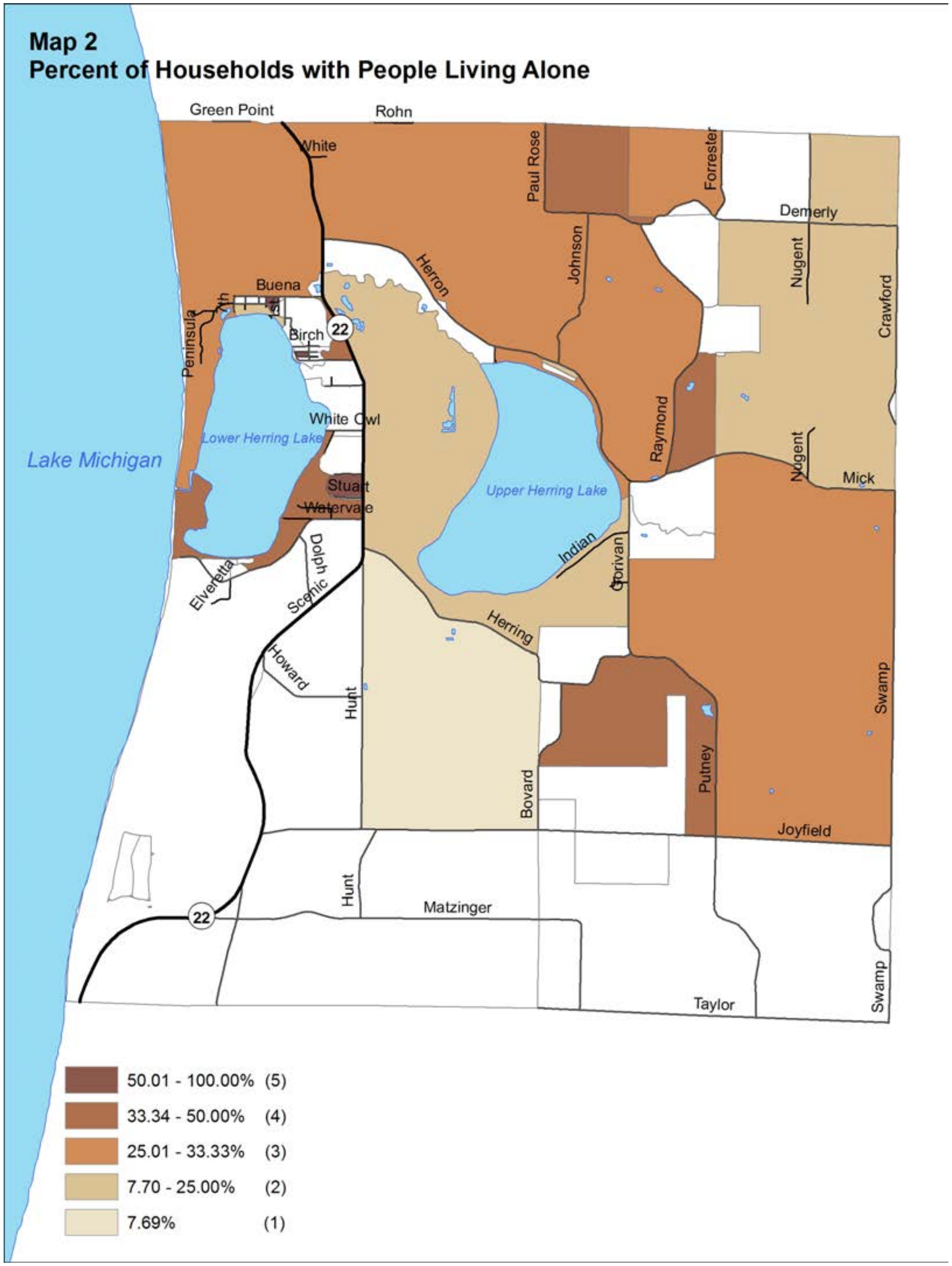

Map 10
Population Vulnerable to Extreme Heat Events
total score
9 - 10
8
6 - 7
5
3 - 4
Lake Michigan
Bye
Furnace
Lake
Lincoln
Frankfort
Trillium
Grace
22
Stratton
Memory
Elsworth
Scenic
Laurel
White
Bankston
Summit
Ellis
Paul Rose
Baver
Forrester
Nugent
Coyote
Silverville
Deborah


Benzie County

Blaine Twp.

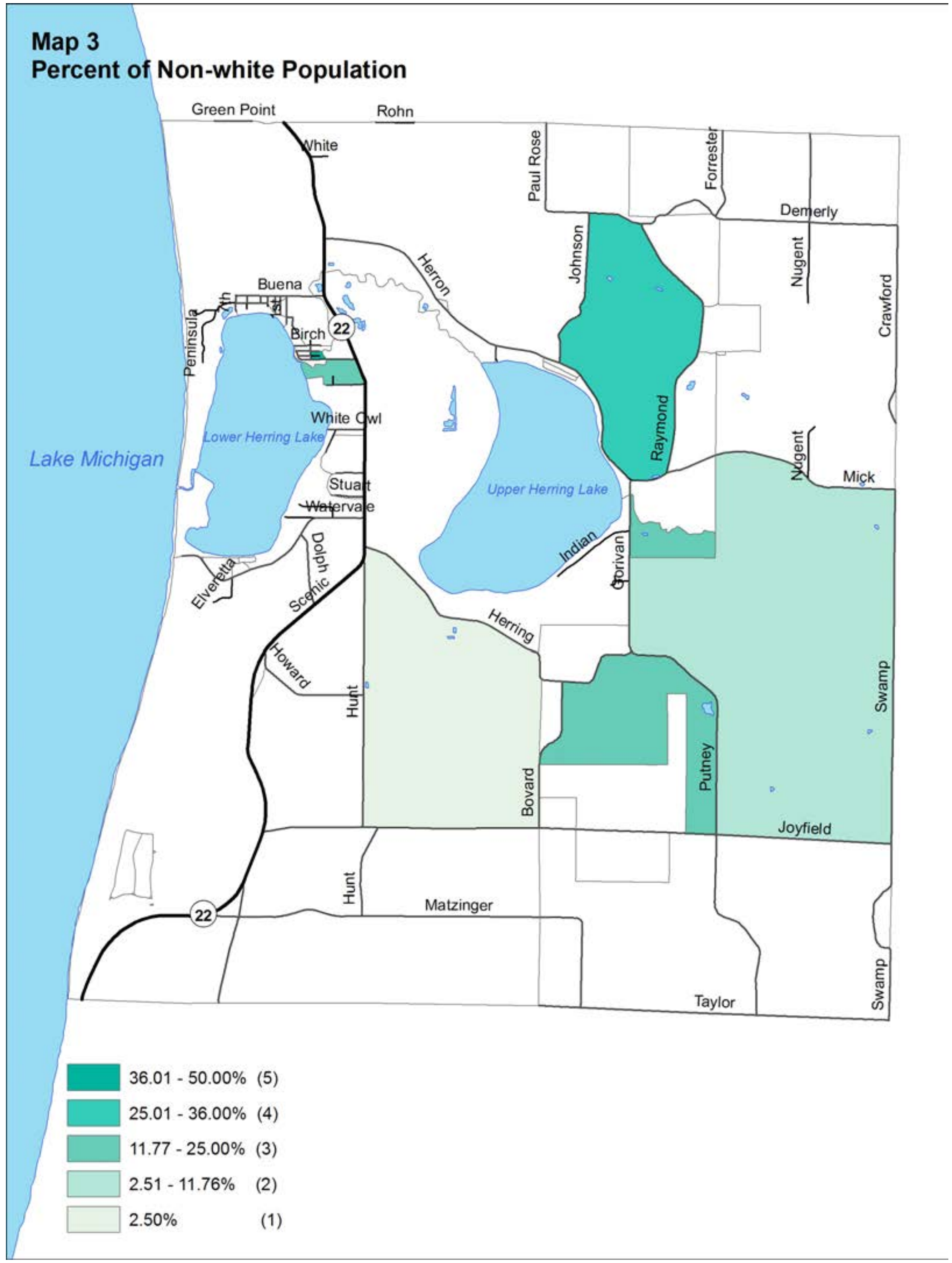

Benzie County

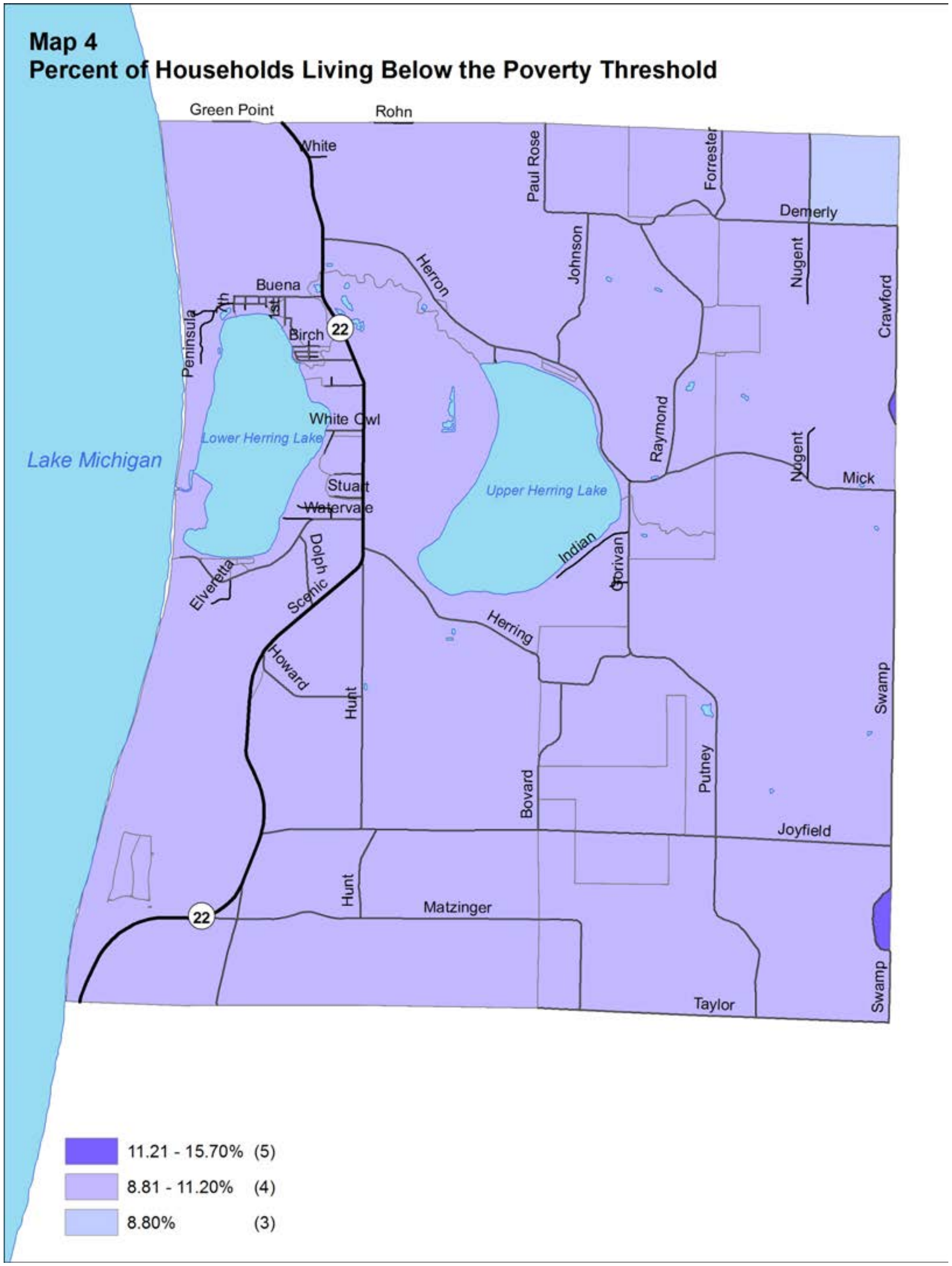

Map 1
Percent of Population 65 Years and Older (male and female)
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Herron
Johnson
Nugent
Crawford
Buena
Birch
22
Peninsula
White Owl
Lower Herring Lake
Lake Michigan
Raymond
Nugent
Mick
Stuart
Watervale
Upper Herring Lake
Indian
Scenic
Dolph
Elveretta
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Hunt
Matzinger
22
Taylor
Swamp
81.49 - 100.00% (5)
54.56 - 81.48% (4)
33.34 - 54.55% (3)
20.01 - 33.33% (2)
9.80 - 20.00% (1)


Map 2
Percent of Households with People Living Alone
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Herron
Johnson
Nugent
Crawford
Buena
Birch
22
Peninsula
Raymond
White Owl
Lower Herring Lake
Lake Michigan
Upper Herring Lake
Mick
Stuart
Watervale
Dolph
Indian
Scenic
Elverta
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Matzinger
Taylor
50.01 - 100.00% (5)
33.34 - 50.00% (4)
25.01 - 33.33% (3)
7.70 - 25.00% (2)
7.69% (1)


Benzie County

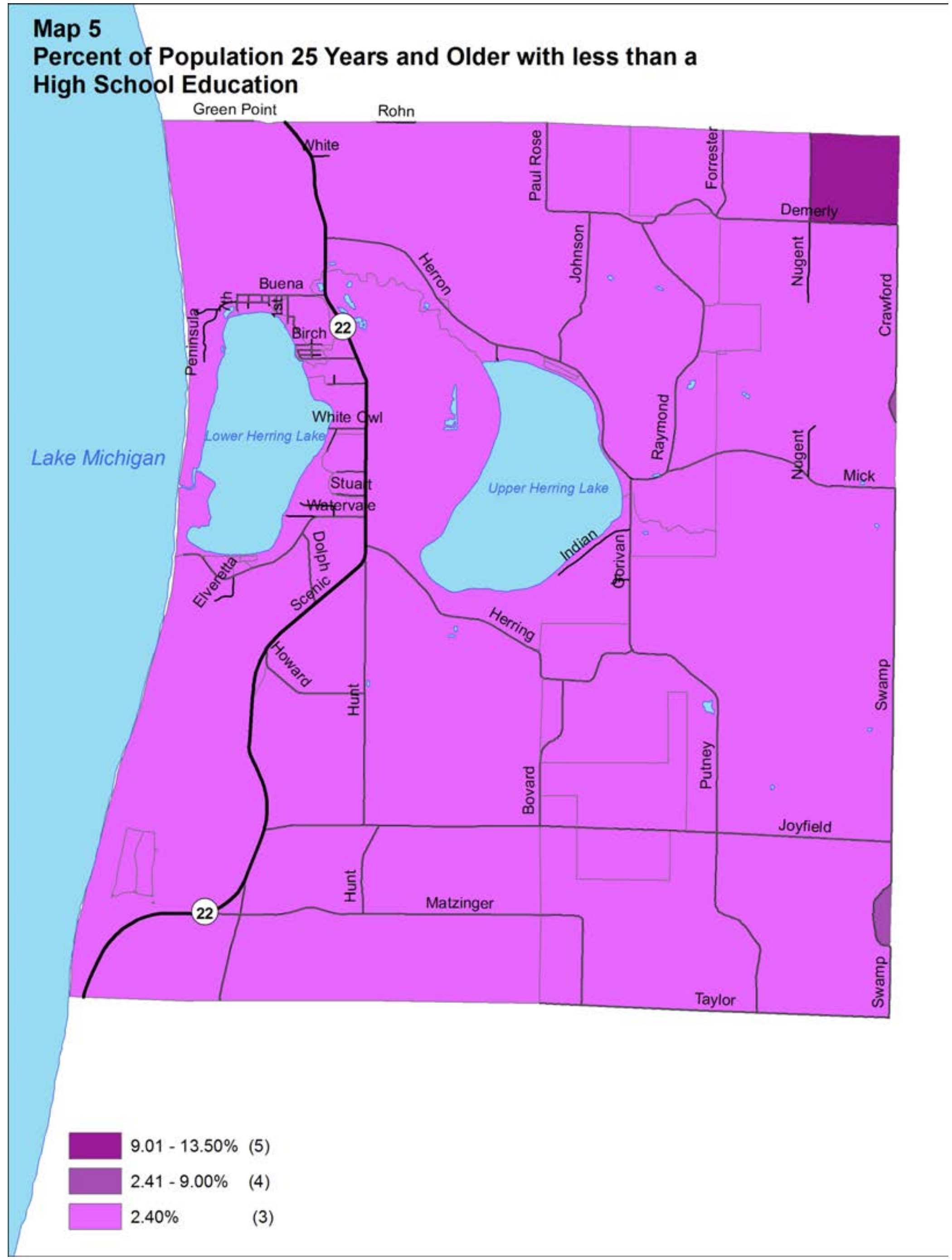

Benzie County

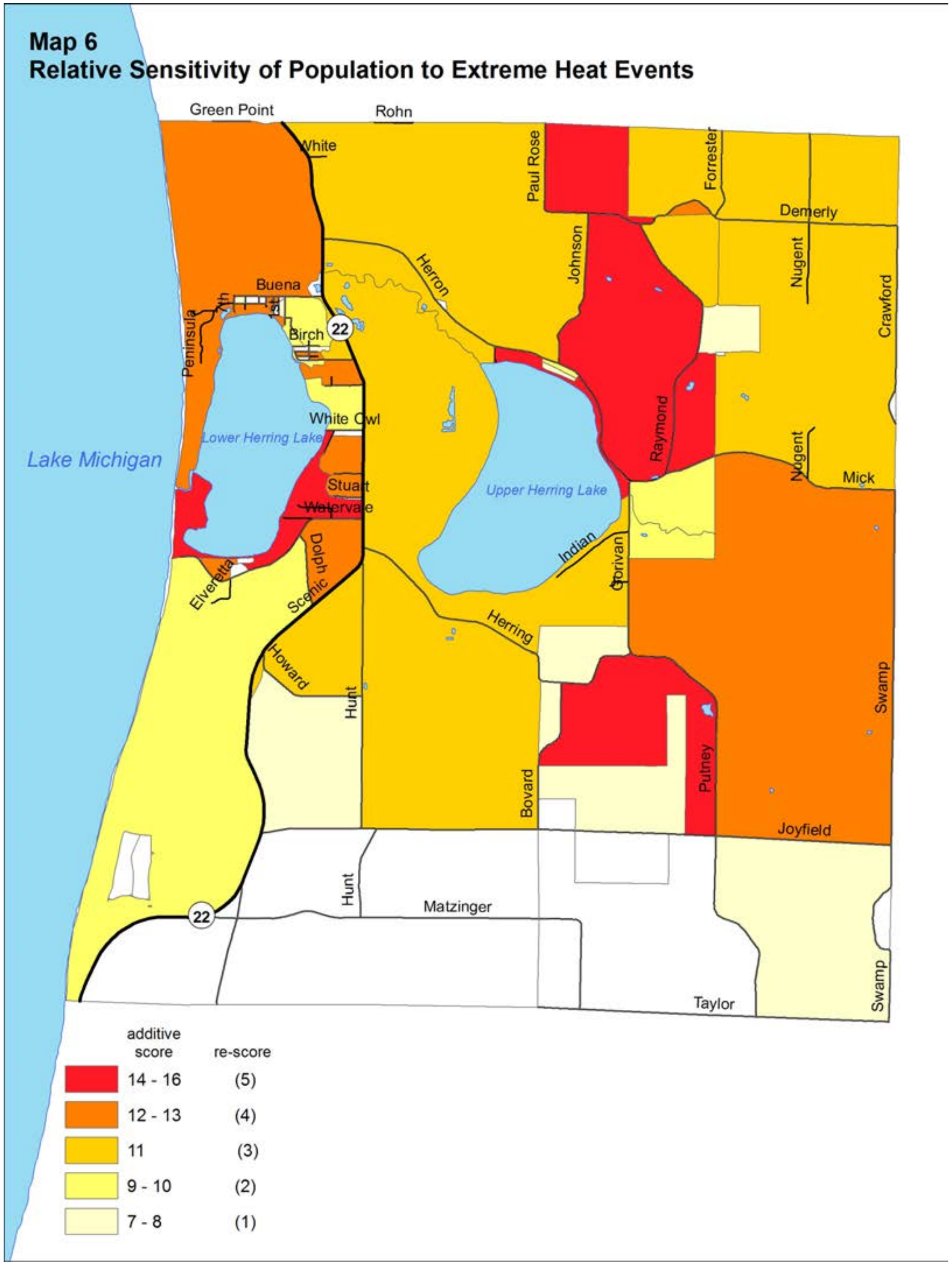

Map 3
Percent of Non-white Population
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Johnson
Nugent
Crawford
Herron
Buena
Birch
22
Peninsula
Lower Herring Lake
White Owl
Lake Michigan
Upper Herring Lake
Raymond
Nugent
Mick
Stuart
Watervale
Dolph
Scenic
Elverettta
Indian
Gorivan
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Hunt
Matzinger
22
Taylor
Swamp
36.01 - 50.00% (5)
25.01 - 36.00% (4)
11.77 - 25.00% (3)
2.51 - 11.76% (2)
2.50% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Johnson
Herron
Nugent
Crawford
Buena
Birch
22
Peninsula
White Owl
Lower Herring Lake
Lake Michigan
Upper Herring Lake
Raymond
Mick
Stuart
Watervale
Dolph
Indian
Scenic
Elvertta
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Matzinger
Taylor
11.21 - 15.70% (5)
8.81 - 11.20% (4)
8.80% (3)


Benzie County

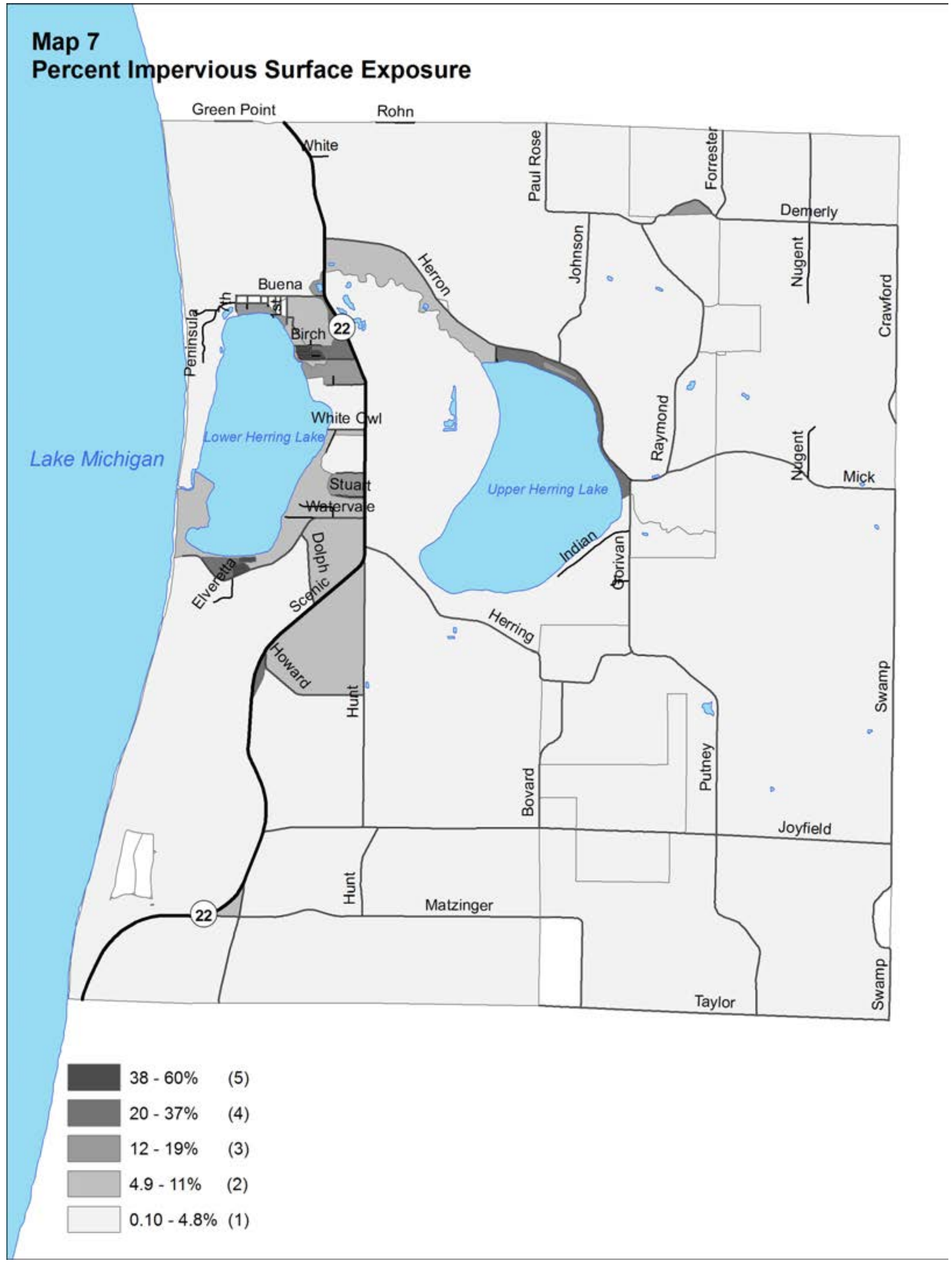

Benzie County

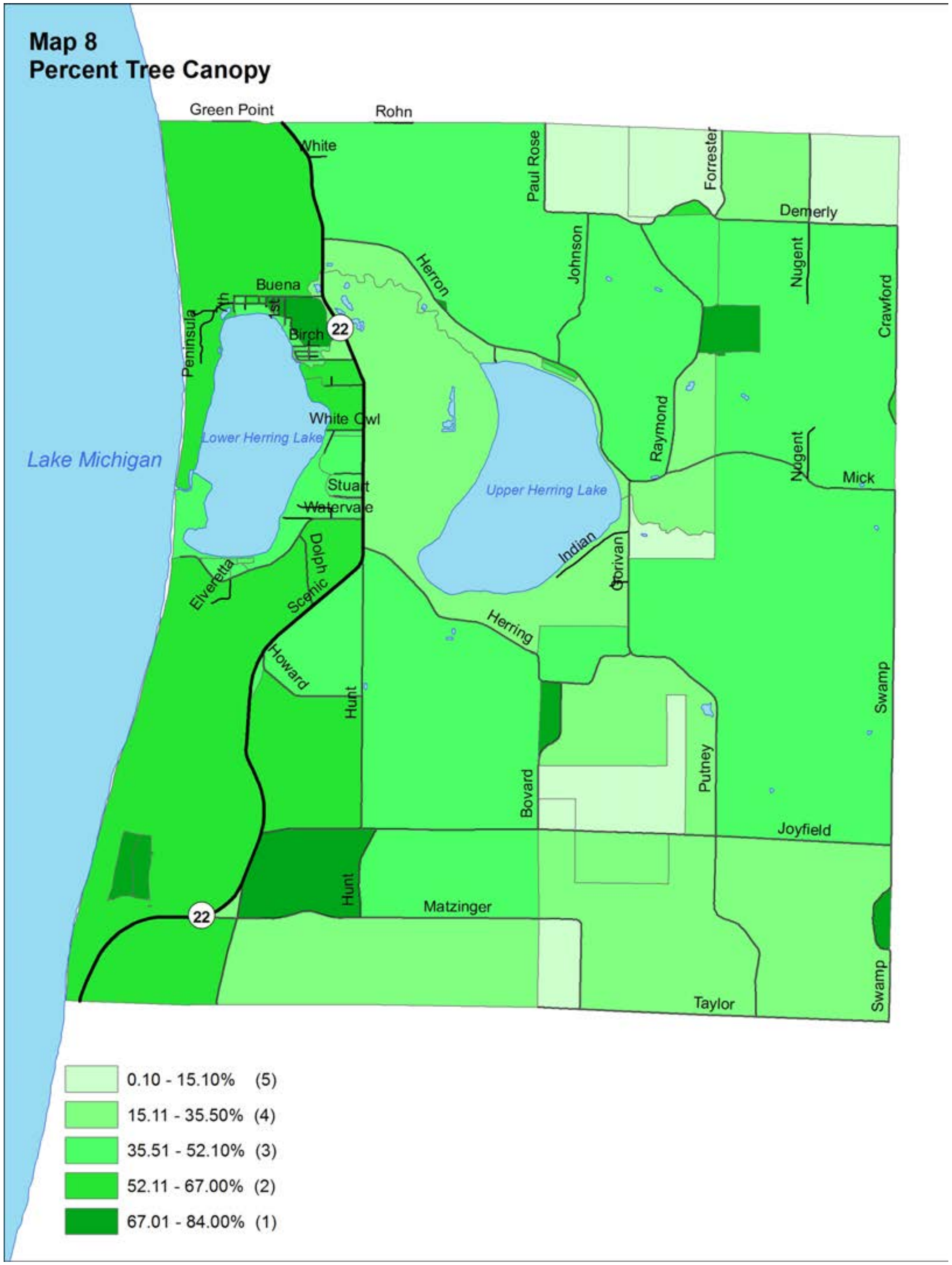

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Johnson
Nugent
Herron
Buena
Birch
22
Peninsula
Crawford
Raymond
White Owl
Lower Herring Lake
Lake Michigan
Upper Herring Lake
Mick
Stuart
Watervale
Dolph
Indian
Scenic
Elvereta
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Matzinger
Taylor
9.01 - 13.50% (5)
2.41 - 9.00% (4)
2.40% (3)


Map 6
Relative Sensitivity of Population to Extreme Heat Events
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Johnson
Herron
Buena
Peninsula
Birch
22
Nugent
Crawford
White Owl
Lower Herring Lake
Lake Michigan
Raymond
Nugent
Mick
Stuart
Watervale
Upper Herring Lake
Indian
Dolph
Elvercetta
Scenic
Corivan
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Hunt
Matzinger
22
Taylor
Swamp
additive score
re-score
14 - 16 (5)
12 - 13 (4)
11 (3)
9 - 10 (2)
7 - 8 (1)


Benzie County

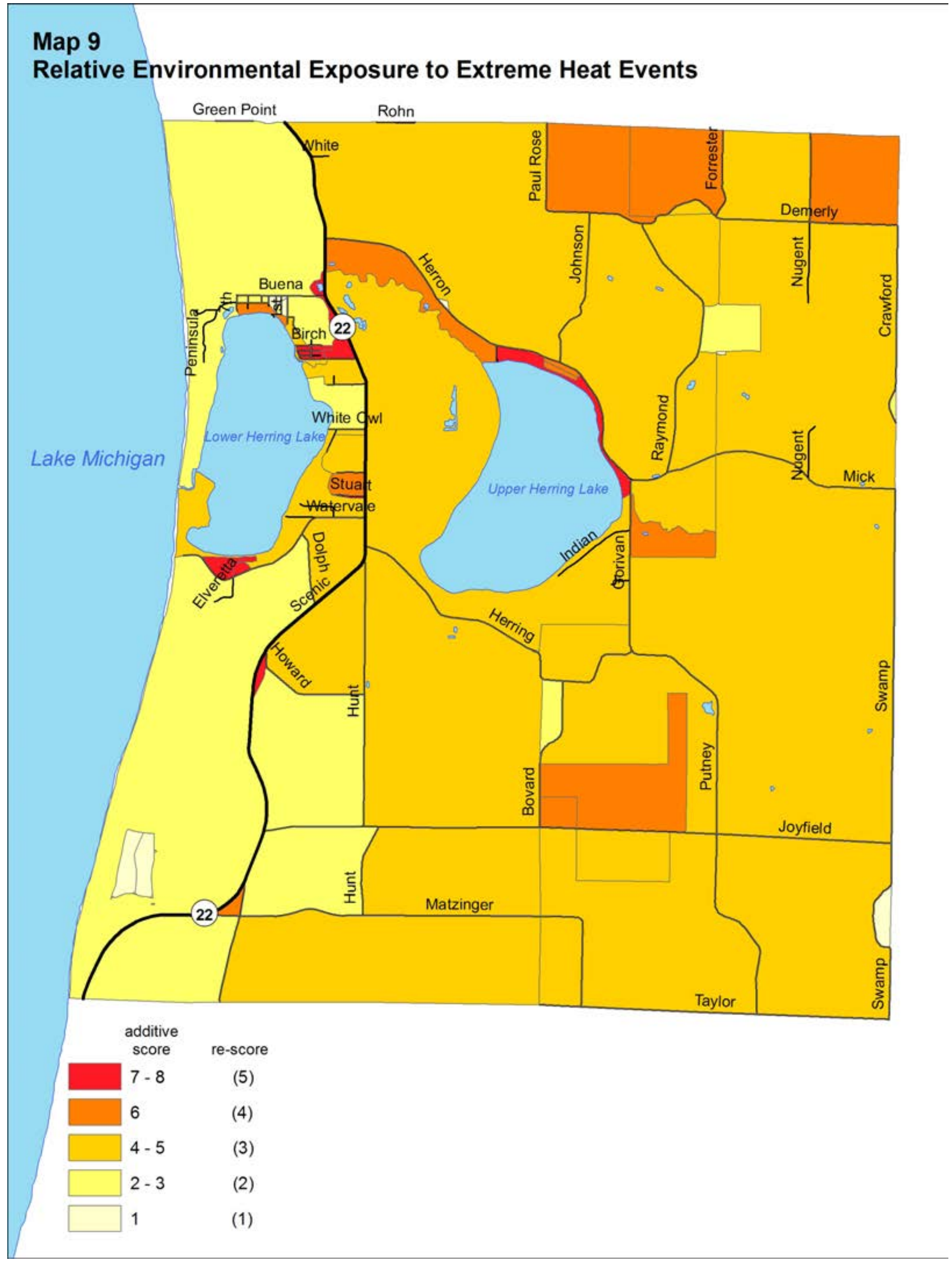

Benzie County

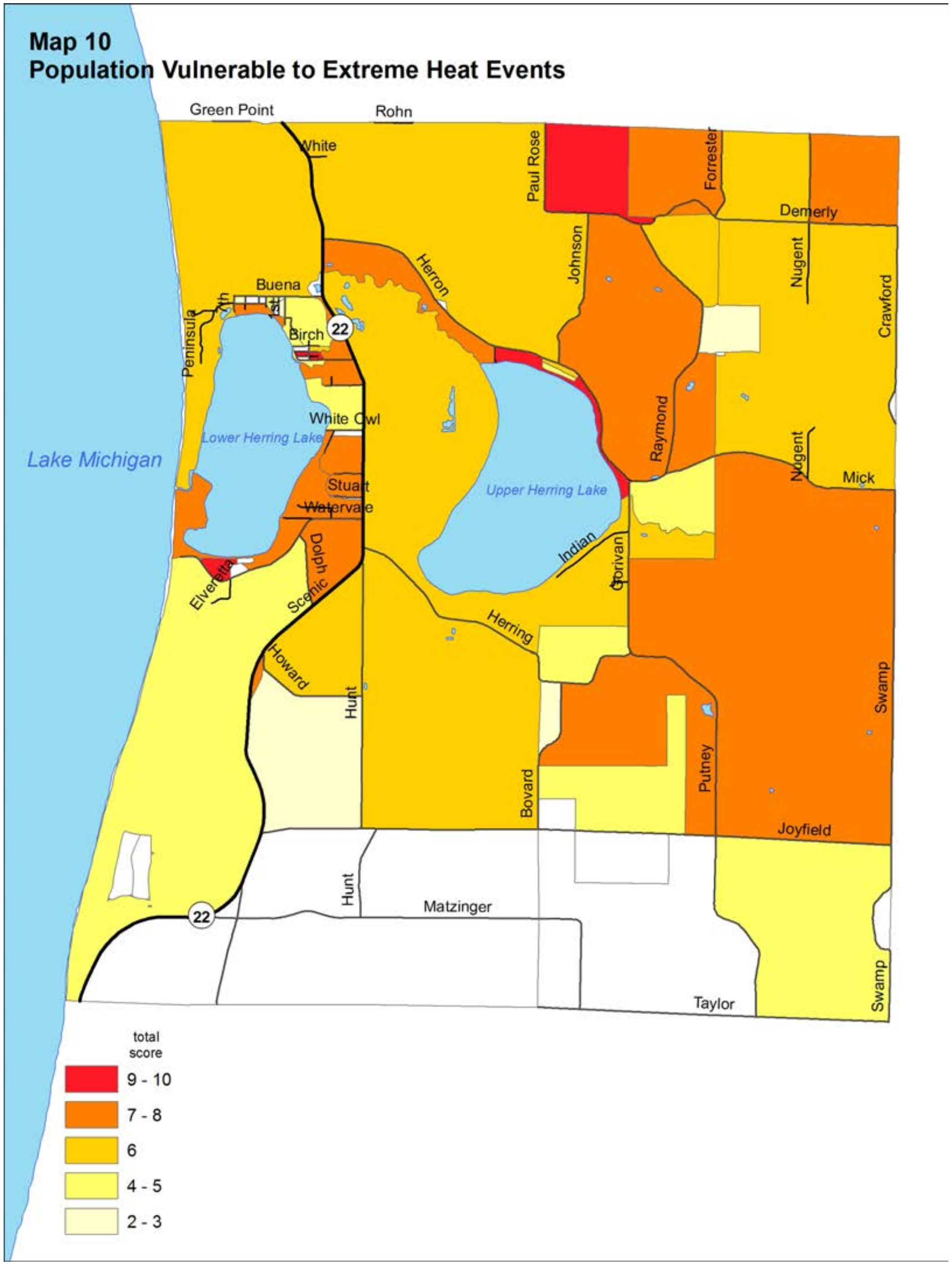

Map 7
Percent Impervious Surface Exposure
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Johnson
Nugent
Crawford
Herron
Buena
Birch
22
Peninsula
White Owl
Lower Herring Lake
Lake Michigan
Raymond
Mick
Stuart
Watervale
Upper Herring Lake
Indian
Dolph
Scenic
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Matzinger
Taylor
38 - 60% (5)
20 - 37% (4)
12 - 19% (3)
4.9 - 11% (2)
0.10 - 4.8% (1)


Map 8
Percent Tree Canopy
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Herron
Johnson
Nugent
Crawford
Buena
1st
Birch
22
Peninsula
White Owl
Lower Herring Lake
Lake Michigan
Upper Herring Lake
Raymond
Nugent
Mick
Stuart
Watervale
Dolph
Indian
Corivan
Elvercetta
Scenic
Herring
Howard
Hunt
Swamp
Putney
Bovard
Joyfield
Hunt
Matzinger
22
Taylor
Swamp
0.10 - 15.10% (5)
15.11 - 35.50% (4)
35.51 - 52.10% (3)
52.11 - 67.00% (2)
67.01 - 84.00% (1)


Benzie County


Benzie County


Map 9
Relative Environmental Exposure to Extreme Heat Events
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Herron
Johnson
Nugent
Crawford
Buena
Birch
22
Peninsula
White Owl
Lower Herring Lake
Lake Michigan
Raymond
Nugent
Mick
Stuart
Watervale
Upper Herring Lake
Indian
Dolph
Elvertta
Scenic
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Hunt
Matzinger
22
Taylor
Swamp
additive score
re-score
7 - 8 (5)
6 (4)
4 - 5 (3)
2 - 3 (2)
1 (1)


Map 10
Population Vulnerable to Extreme Heat Events
Green Point
Rohn
White
Paul Rose
Forrester
Demerly
Herron
Johnson
Nugent
Crawford
Buena
Birch
22
Peninsula
White Owl
Lower Herring Lake
Lake Michigan
Raymond
Nugent
Mick
Stuart
Watervale
Upper Herring Lake
Indian
Corivan
Dolph
Scenic
Elverta
Herring
Howard
Hunt
Swamp
Bovard
Putney
Joyfield
Hunt
Matzinger
22
Taylor
Swamp
total score
9 - 10
7 - 8
6
4 - 5
2 - 3


Benzie County

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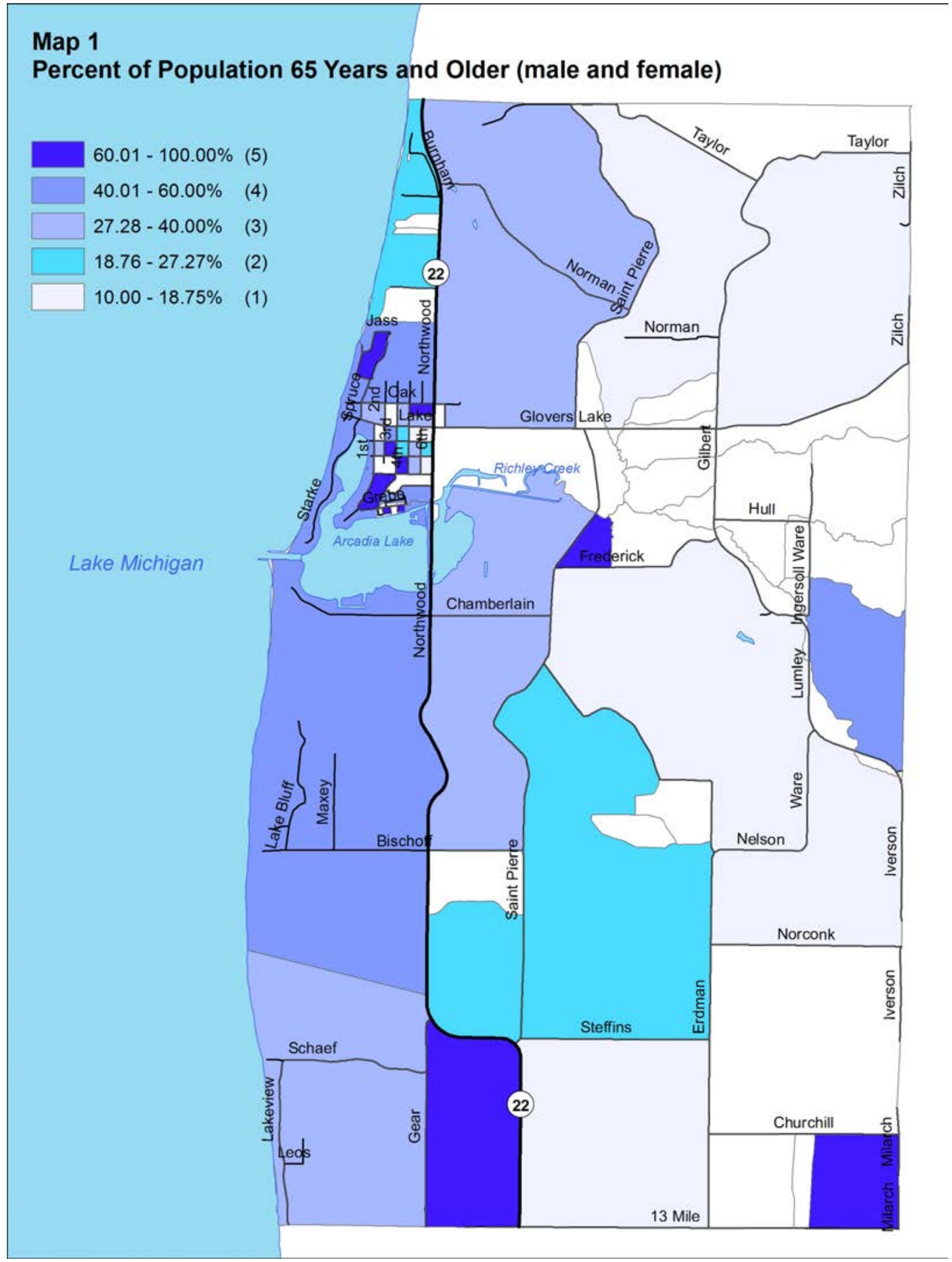
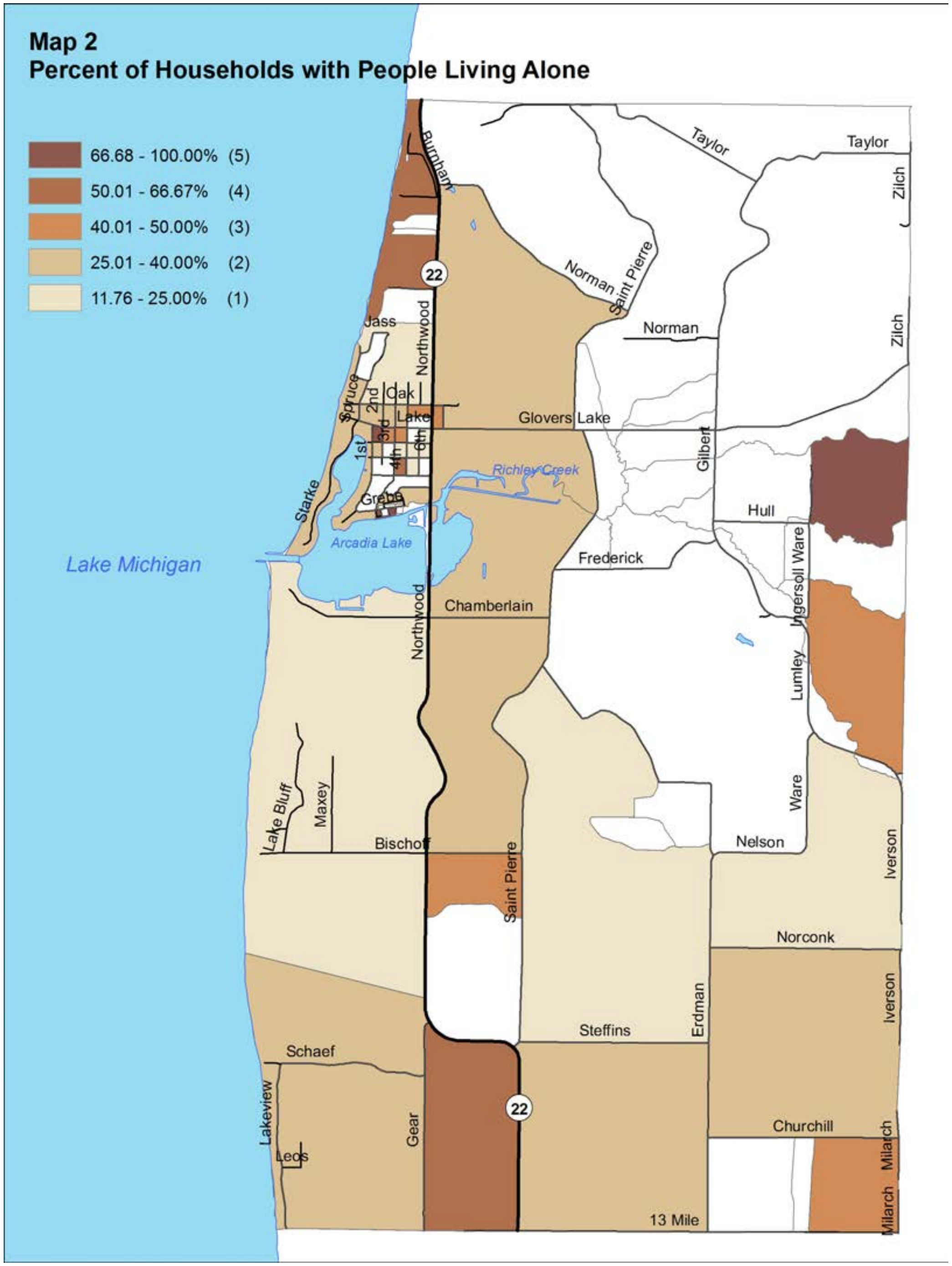
Manistee County

Arcadia Twp.

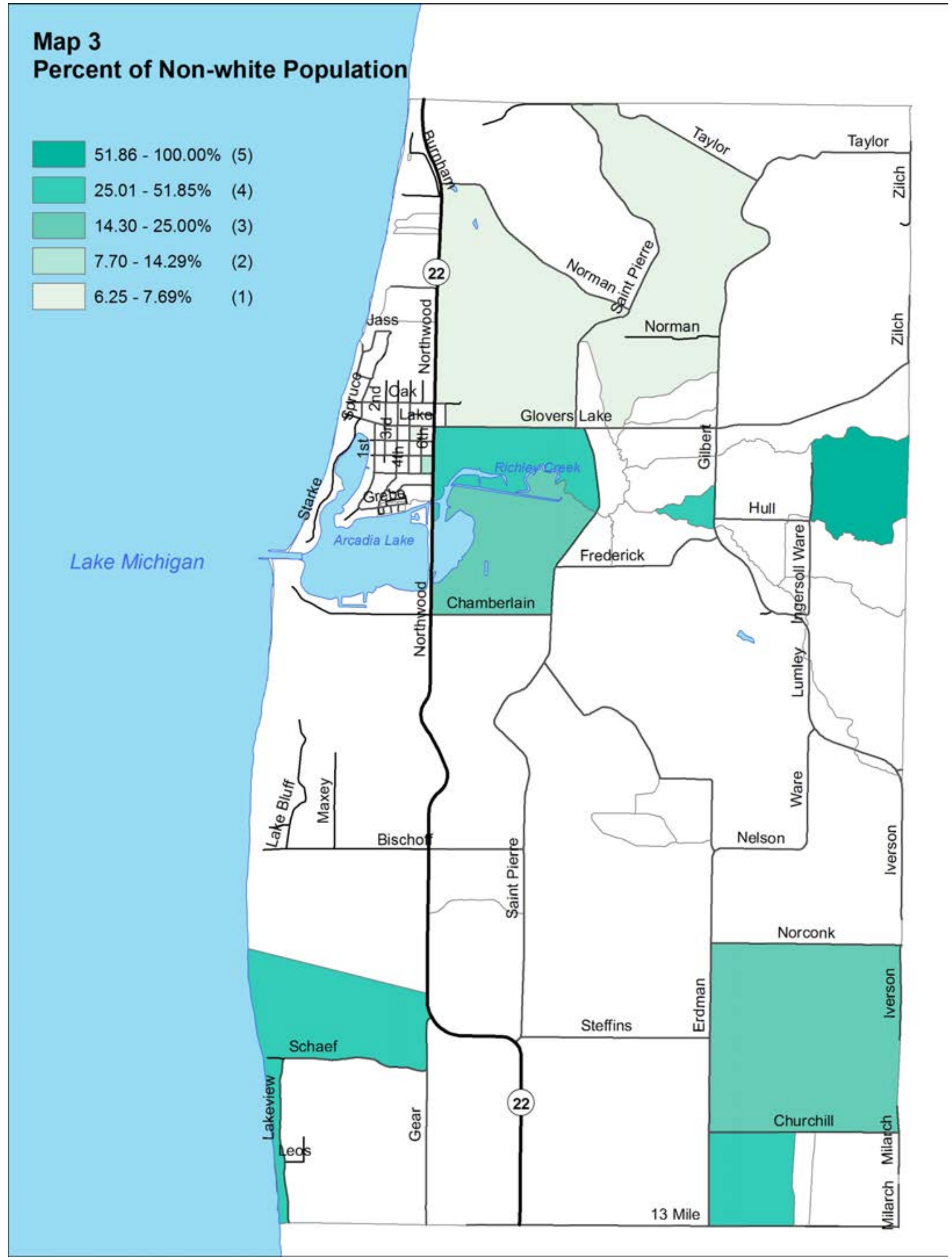

Manistee County

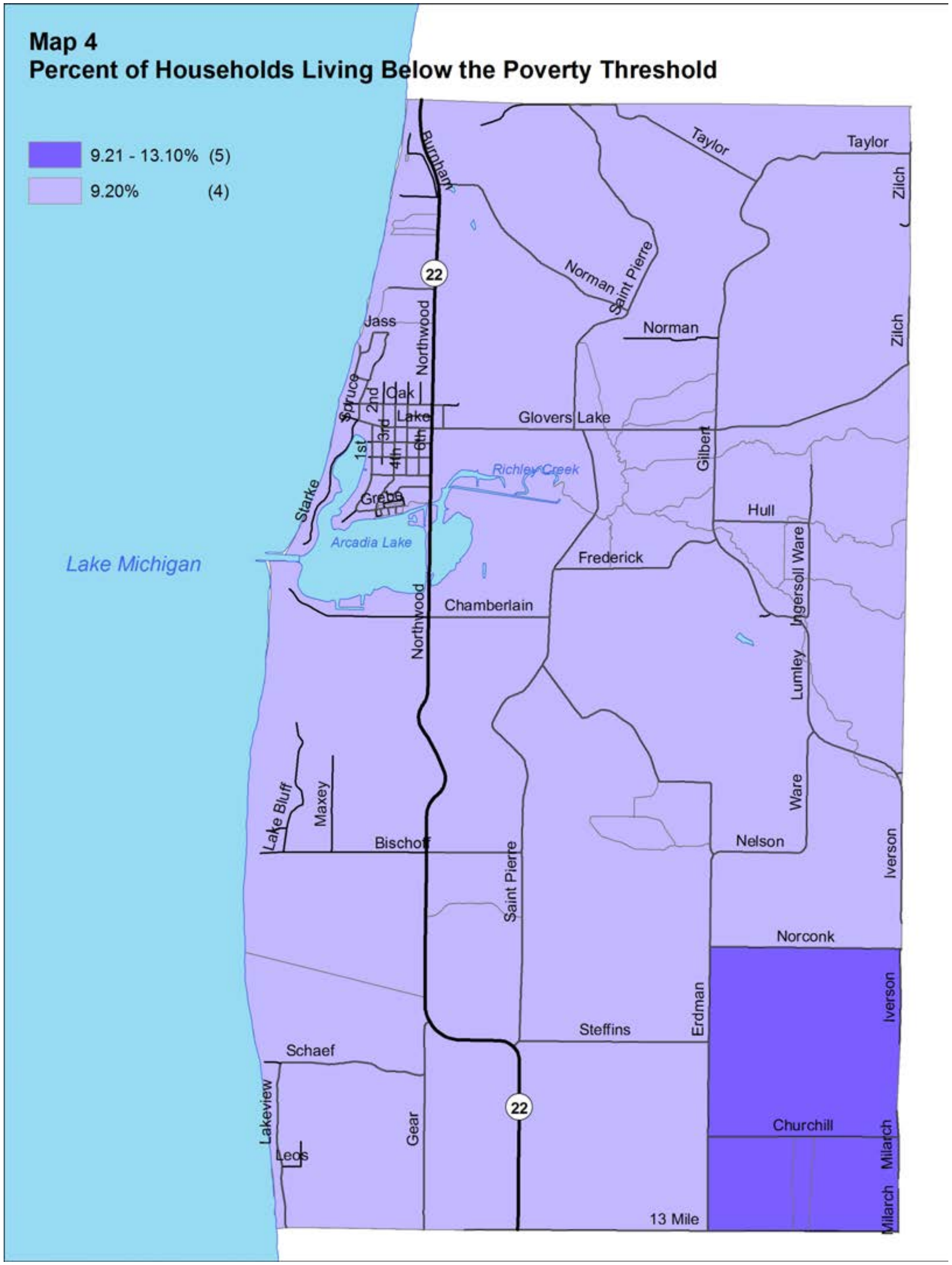

Map 1
Percent of Population 65 Years and Older (male and female)
60.01 - 100.00% (5)
40.01 - 60.00% (4)
27.28 - 40.00% (3)
18.76 - 27.27% (2)
10.00 - 18.75% (1)
Lake Michigan
Arcadia Lake
Richley Creek
Burnham
Taylor
Zilch
Norman
Saint Pierre
Jass
Northwood
Spruce
2nd
Oak
Lake
1st
3rd
4th
6th
Glovers Lake
Gilbert
Starke
Grebe
Hull
Frederick
Ware
Ingersoll
Chamberlain
Lumley
Lake Bluff
Maxey
Bischoff
Nelson
Iverson
Norconk
Erdman
Steffins
Schaef
Lakeview
Gear
Leos
Churchill
Milarch
13 Mile
22


Map 2
Percent of Households with People Living Alone
66.68 - 100.00% (5)
50.01 - 66.67% (4)
40.01 - 50.00% (3)
25.01 - 40.00% (2)
11.76 - 25.00% (1)
Lake Michigan
Arcadia Lake
Richley Creek
Burnham
Northwood
Jass
Spruce
2nd
Oak
Lake
1st
3rd
4th
5th
6th
Grebe
Starke
Glovers Lake
Norman
Saint Pierre
Taylor
Zilch
Gilbert
Hull
Frederick
Chamberlain
Ingersoll Ware
Lumley
Ware
Nelson
Lake Bluff
Maxey
Bischof
Iverson
Norconk
Steffins
Erdman
Schaef
Lakeview
Leos
Gear
Churchill
Milarch
13 Mile
22


Manistee County

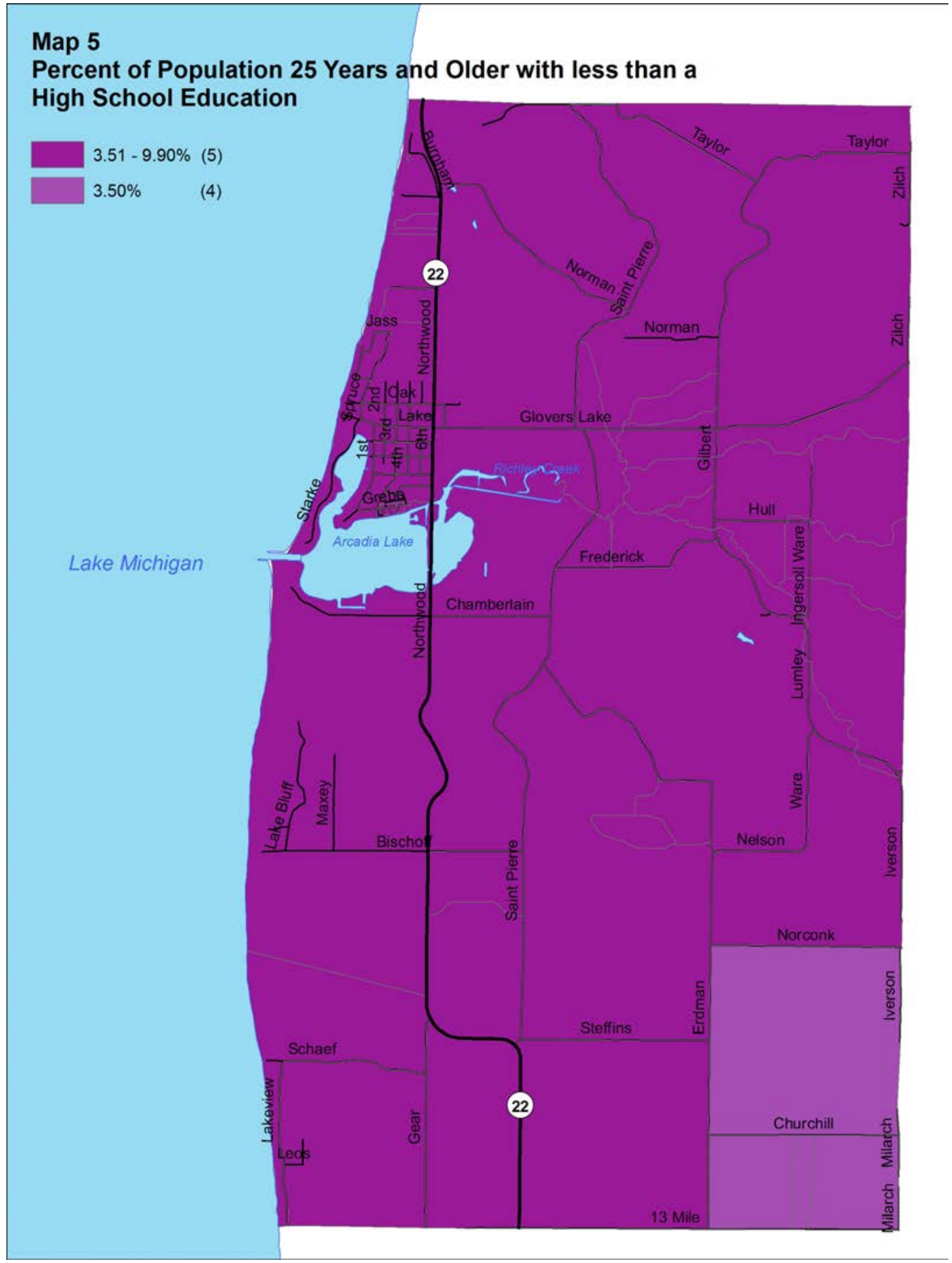

Manistee County

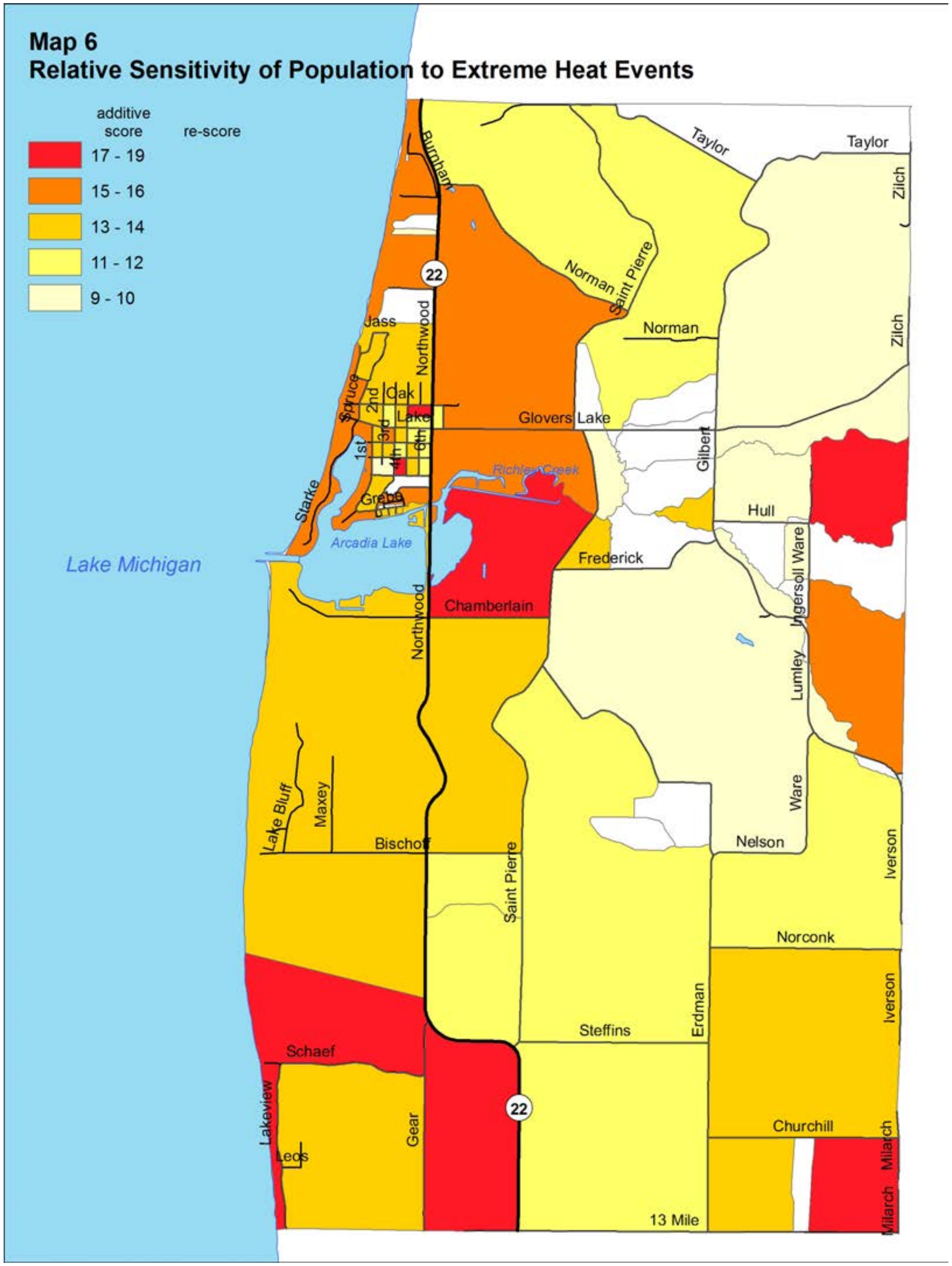

Map 3
Percent of Non-white Population
51.86 - 100.00% (5)
25.01 - 51.85% (4)
14.30 - 25.00% (3)
7.70 - 14.29% (2)
6.25 - 7.69% (1)
Lake Michigan
Arcadia Lake
Richley Creek
Burnham
Taylor
Zilch
Norman
Saint Pierre
Jass
Northwood
Spruce
2nd
Oak
Lake
1st
3rd
4th
6th
Glovers Lake
Gilbert
Starke
Grebe
Hull
Frederick
Chamberlain
Ingersoll Ware
Lumley
Ware
Lake Bluff
Maxey
Bischof
Nelson
Iverson
Norconk
Erdman
Steffins
Schaef
Lakeview
Leos
Gear
Churchill
Milarch
13 Mile
22


Map 4
Percent of Households Living Below the Poverty Threshold
9.21 - 13.10% (5)
9.20% (4)
Lake Michigan
Arcadia Lake
Richley Creek
Burnham
Taylor
Zilch
Norman
Saint Pierre
Jass
Northwood
Spruce
2nd
Oak
Lake
Glovers Lake
Gilbert
1st
3rd
4th
6th
Starke
Grebe
Hull
Frederick
Ingersoll Ware
Chamberlain
Lumley
Lake Bluff
Maxey
Ware
Bischoff
Nelson
Iverson
Norconk
Erdman
Steffins
Schaef
Lakeview
Leos
Gear
Churchill
Milarch
13 Mile
22


Manistee County

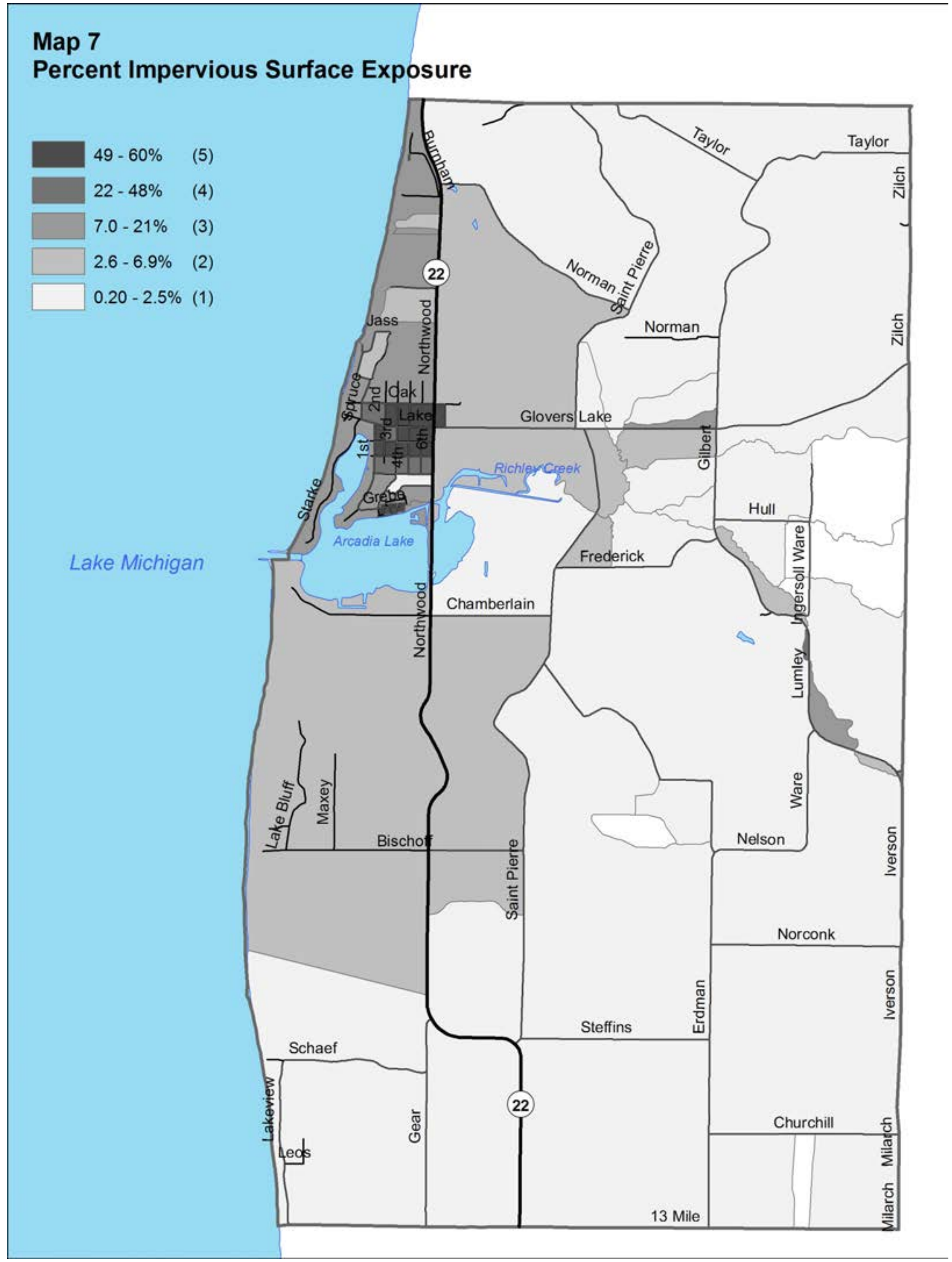

Manistee County

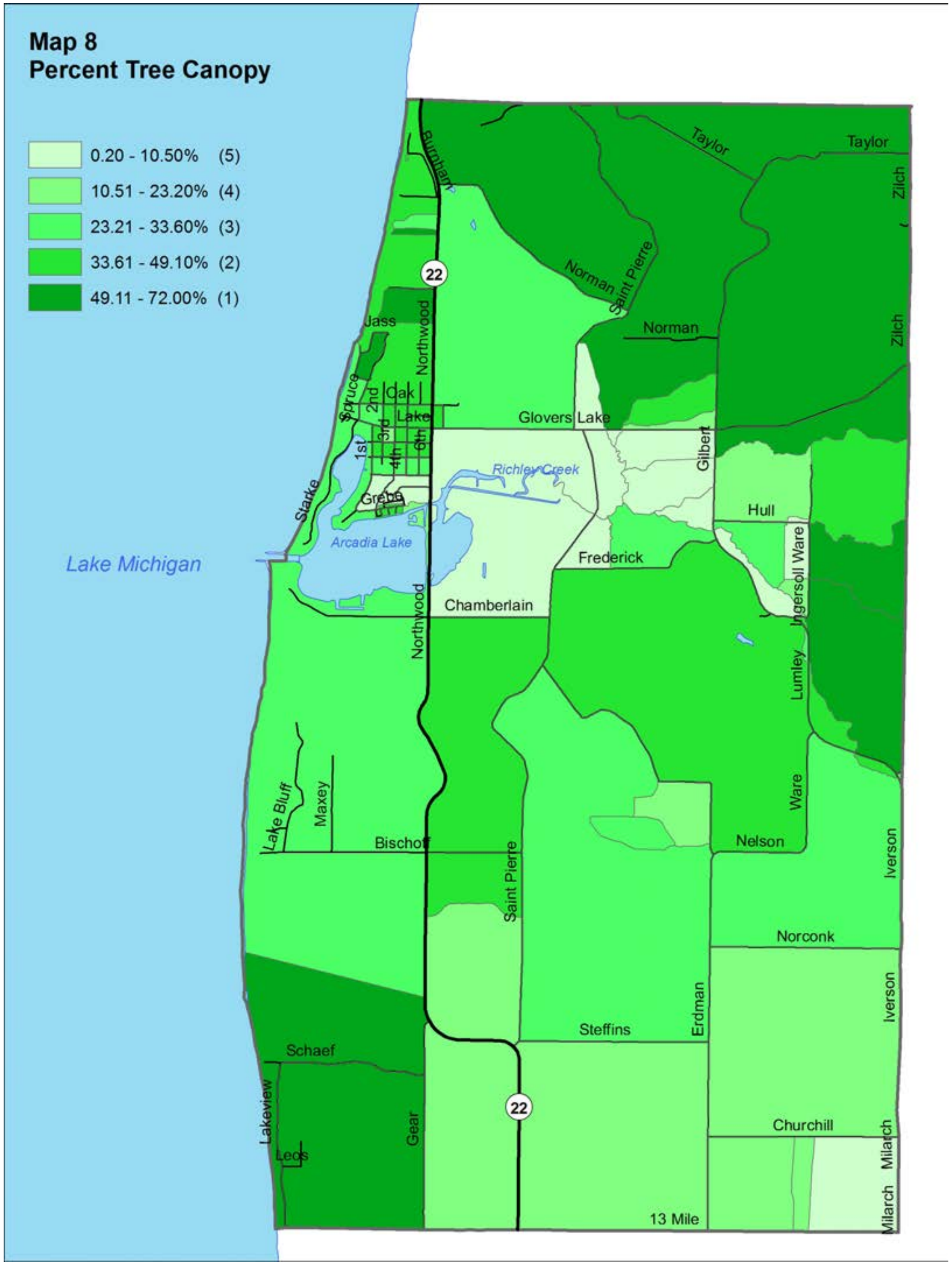

Map 5
Percent of Population 25 Years and Older with less than a High School Education
3.51 - 9.90% (5)
3.50% (4)
Lake Michigan
Arcadia Lake
Richland Creek
Taylor
Burnham
Zilch
Norman
Saint Pierre
22
Jass
Northwood
Spruce
2nd
Oak
Lake
1st
3rd
4th
6th
Glovers Lake
Gilbert
Starke
Grebe
Hull
Frederick
Chamberlain
Ingersoll Ware
Lumley
Lake Bluff
Maxey
Bischoff
Ware
Nelson
Iverson
Norconk
Erdman
Steffins
Schaef
Lakeview
Gear
Churchill
Milarch
Leeds
13 Mile


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
17 - 19
15 - 16
13 - 14
11 - 12
9 - 10
Lake Michigan
Arcadia Lake
Richley Creek
Taylor
Zilch
Norman
Saint Pierre
Burnham
Northwood
Jass
Spruce
2nd
Oak
Lake
1st
3rd
4th
6th
Starke
Grebe
Glovers Lake
Gilbert
Hull
Frederick
Ware
Ingersoll Ware
Chamberlain
Lumley
Lake Bluff
Maxey
Bischoff
Nelson
Iverson
Norconk
Steffins
Erdman
Schaef
Lakeview
Leos
Gear
Churchill
Milarch
13 Mile
22


Manistee County

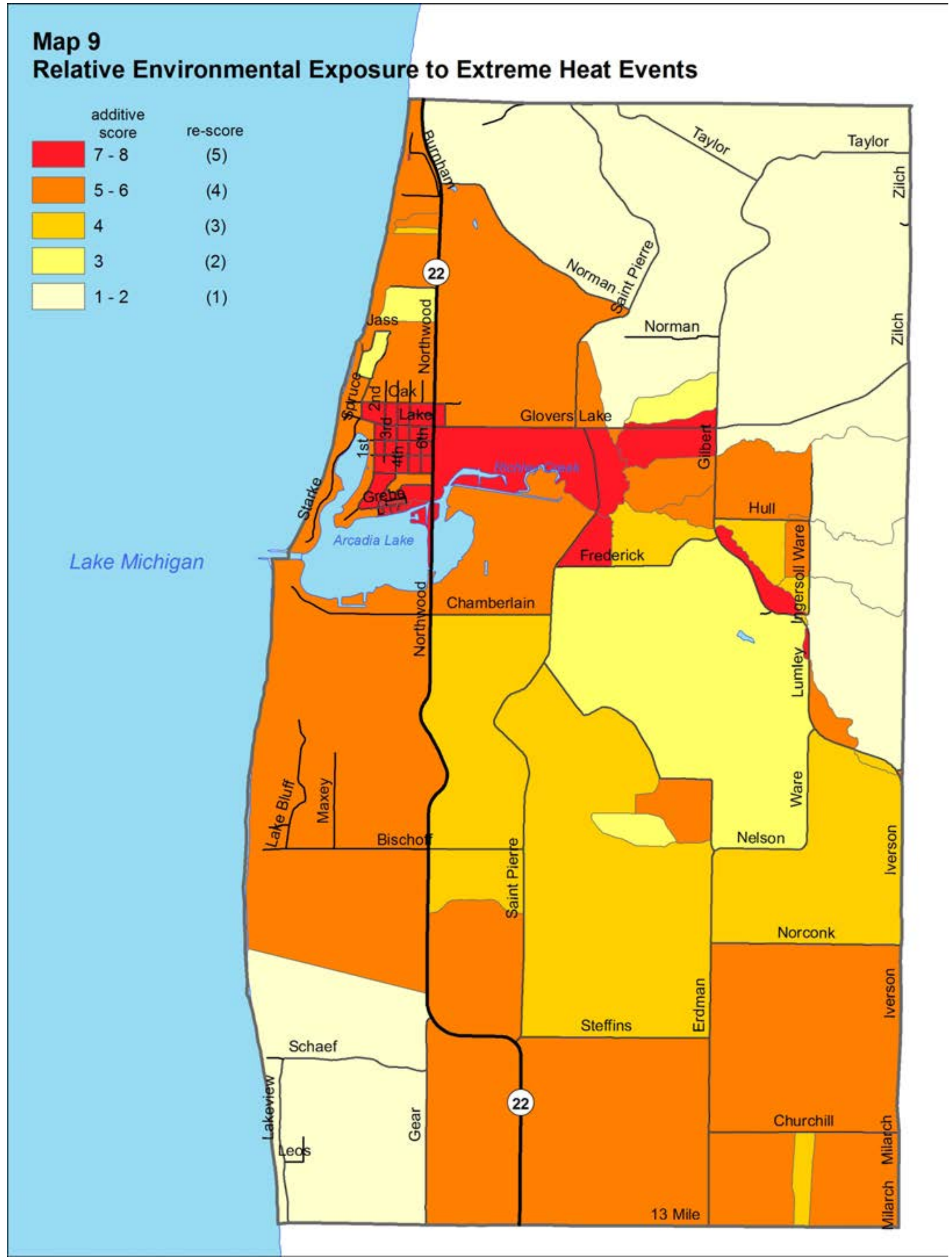

Manistee County

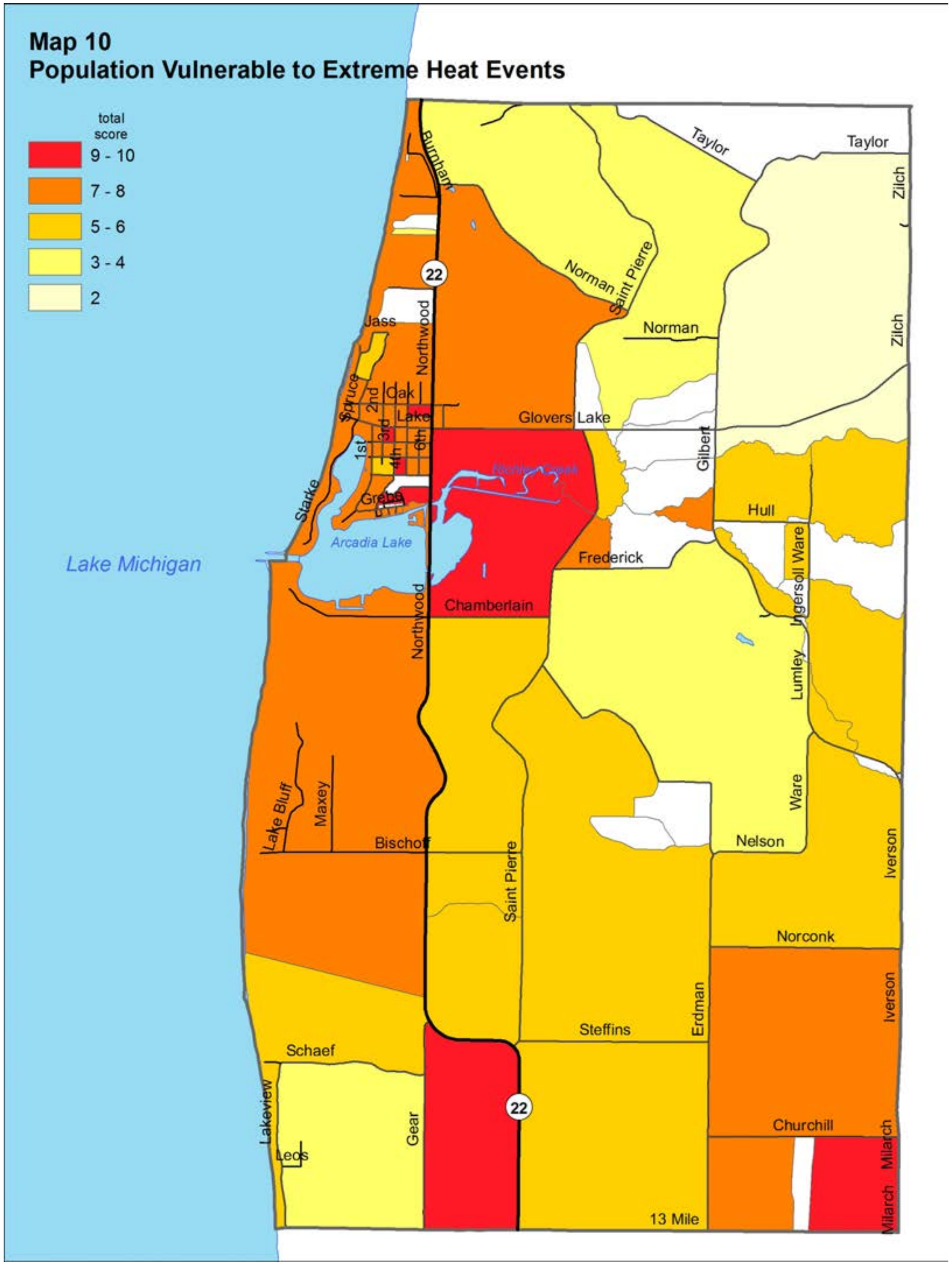

Map 7
Percent Impervious Surface Exposure
49 - 60% (5)
22 - 48% (4)
7.0 - 21% (3)
2.6 - 6.9% (2)
0.20 - 2.5% (1)
Lake Michigan
Arcadia Lake
Richley Creek
22
Burnham
Taylor
Zilch
Norman
Saint Pierre
Jass
Northwood
Spruce
2nd
Oak
Lake
Glovers Lake
1st
3rd
4th
6th
Gilbert
Starke
Grebe
Hull
Ware
Ingersoll
Frederick
Chamberlain
Lumley
Lake Bluff
Maxey
Bischoff
Nelson
Iverson
Norconk
Erdman
Steffins
Schaef
Lakeview
Gear
Leos
Churchill
Milarch
13 Mile


Map 8
Percent Tree Canopy
0.20 - 10.50% (5)
10.51 - 23.20% (4)
23.21 - 33.60% (3)
33.61 - 49.10% (2)
49.11 - 72.00% (1)
Lake Michigan
Arcadia Lake
Richley Creek
Taylor
Zilch
Norman
Saint Pierre
Burnham
22
Jass
Northwood
Spruce
2nd
Oak
Lake
3rd
4th
6th
1st
Glovers Lake
Gilbert
Starke
Grebe
Hull
Frederick
Ingersoll Ware
Chamberlain
Lumley
Lake Bluff
Maxey
Ware
Bischoff
Nelson
Iverson
Norconk
Steffins
Erdman
Schaef
Lakeview
Leos
Gear
Churchill
Milarch
13 Mile


Manistee County

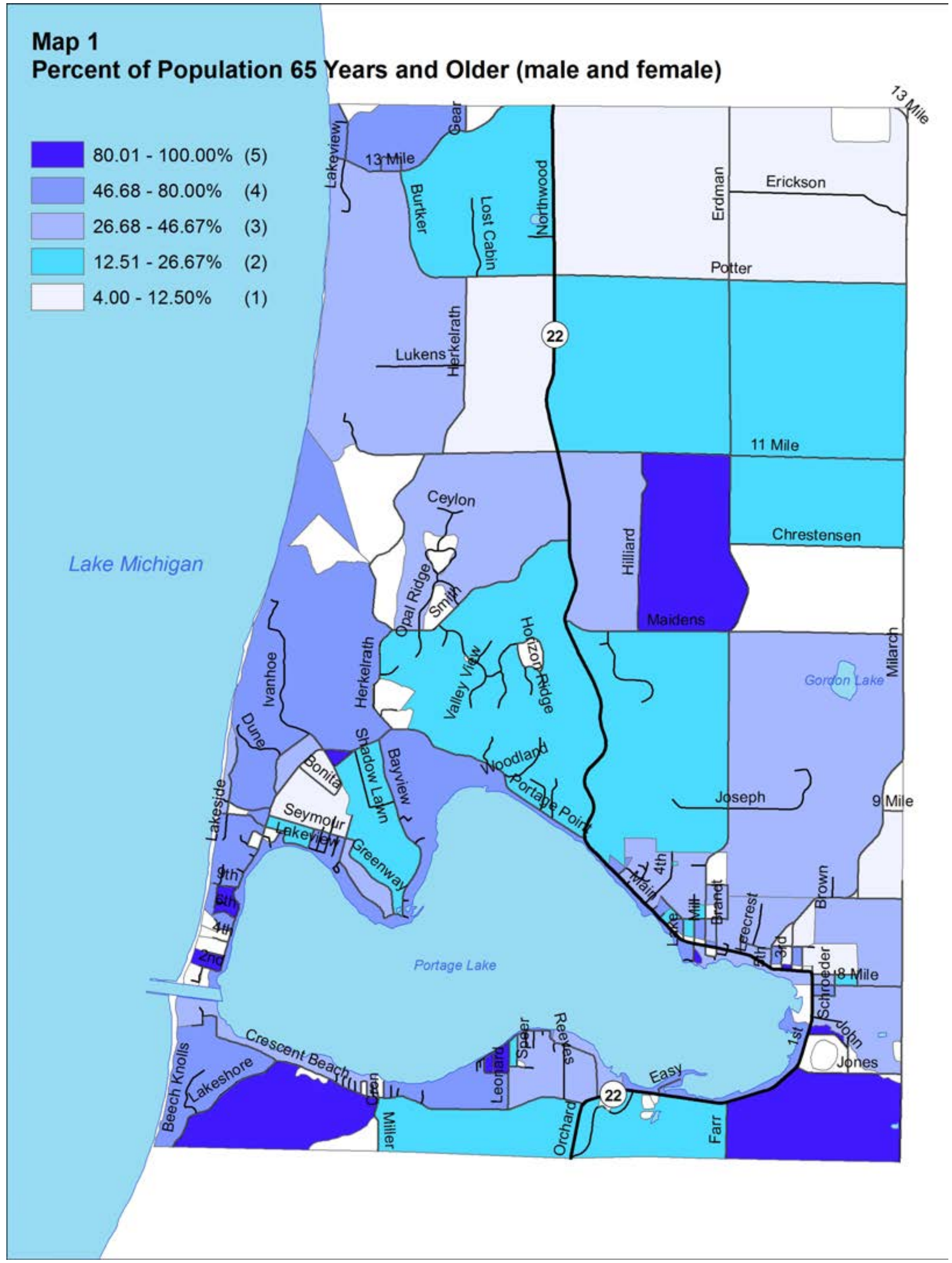

Manistee County

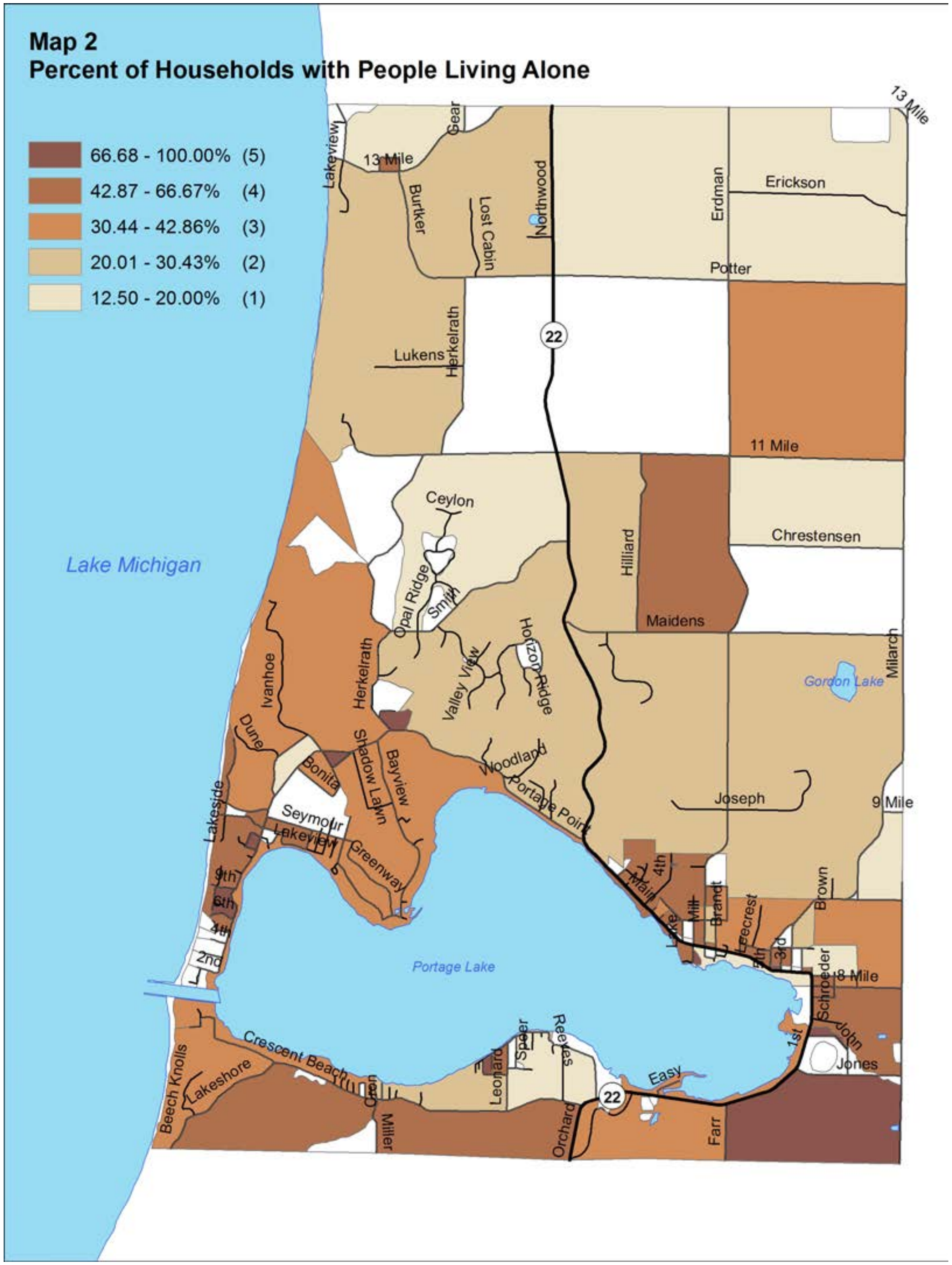

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
7 - 8 (5)
5 - 6 (4)
4 (3)
3 (2)
1 - 2 (1)
Lake Michigan
Arcadia Lake
Burnham
Taylor
Zilch
Norman
Saint Pierre
Jass
Northwood
Spruce
2nd
Oak
Lake
Glovers Lake
1st
3rd
4th
6th
Gilbert
Starke
Grebe
Hull
Frederick
Ware
Ingersoll
Chamberlain
Lumley
Lake Bluff
Maxey
Bischoff
Nelson
Iverson
Norconk
Steffins
Erdman
Schaef
Lakeview
Leos
Gear
Churchill
Milarch
13 Mile
22


Map 10
Population Vulnerable to Extreme Heat Events
total score
9 - 10
7 - 8
5 - 6
3 - 4
2
Lake Michigan
Arcadia Lake
Taylor
Taylor
Zilch
Zilch
Burnham
Norman
Saint Pierre
Norman
Northwood
Jass
Spruce
2nd
Oak
Lake
1st
3rd
4th
6th
Glovers Lake
Gilbert
Starke
Grebe
Hull
Frederick
Ware
Ingersoll
Chamberlain
Lumley
Ware
Lake Bluff
Maxey
Bischoff
Saint Pierre
Nelson
Iverson
Norconk
Iverson
Erdman
Steffins
Schaef
Lakeview
Gear
Leos
Churchill
Milarch
Milarch
13 Mile
22
22


Manistee County

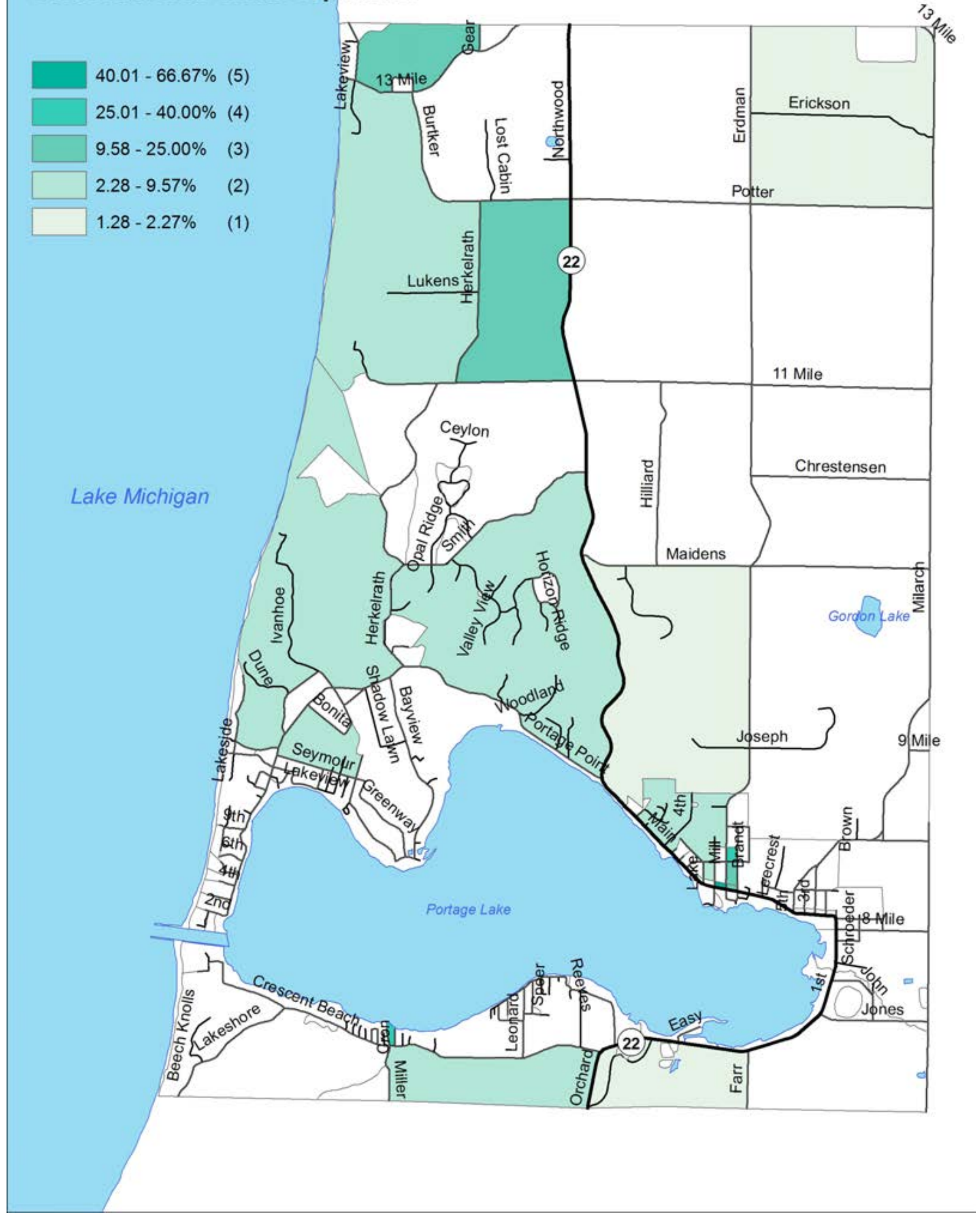
Onekema Twp./ Onekema

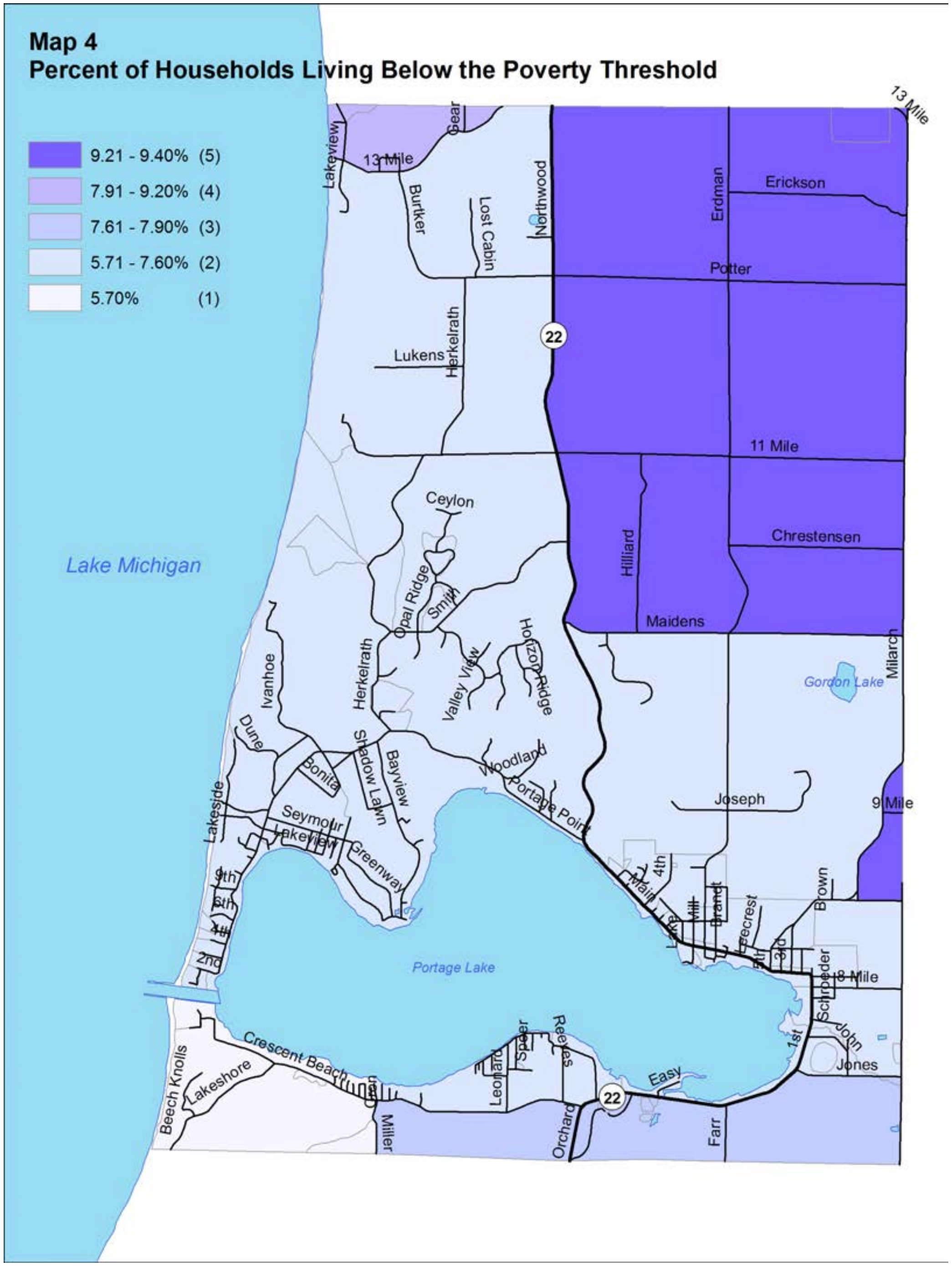



Map 2
Percent of Households with People Living Alone
66.68 - 100.00% (5)
42.87 - 66.67% (4)
30.44 - 42.86% (3)
20.01 - 30.43% (2)
12.50 - 20.00% (1)
Lake Michigan
Portage Lake
Gordon Lake
13 Mile
11 Mile
9 Mile
8 Mile
Erickson
Potter
Lukens
Ceylon
Chrestensen
Maidens
Joseph
Woodland
Portage Point
Crescent Beach
Lakeshore
Beech Knolls
Easy
Jones
22


Manistee County

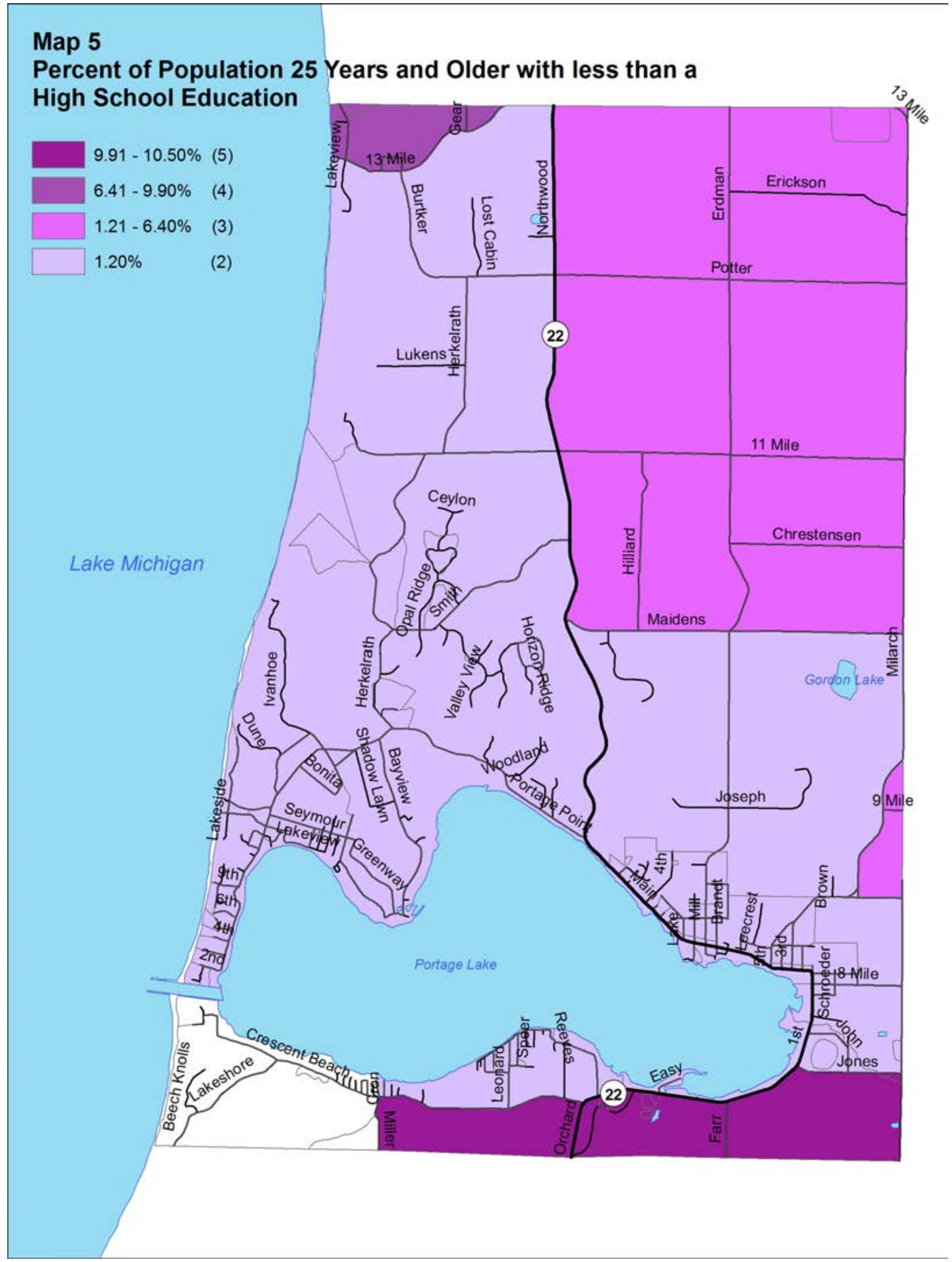
Map 3
Percent of Non-white Population

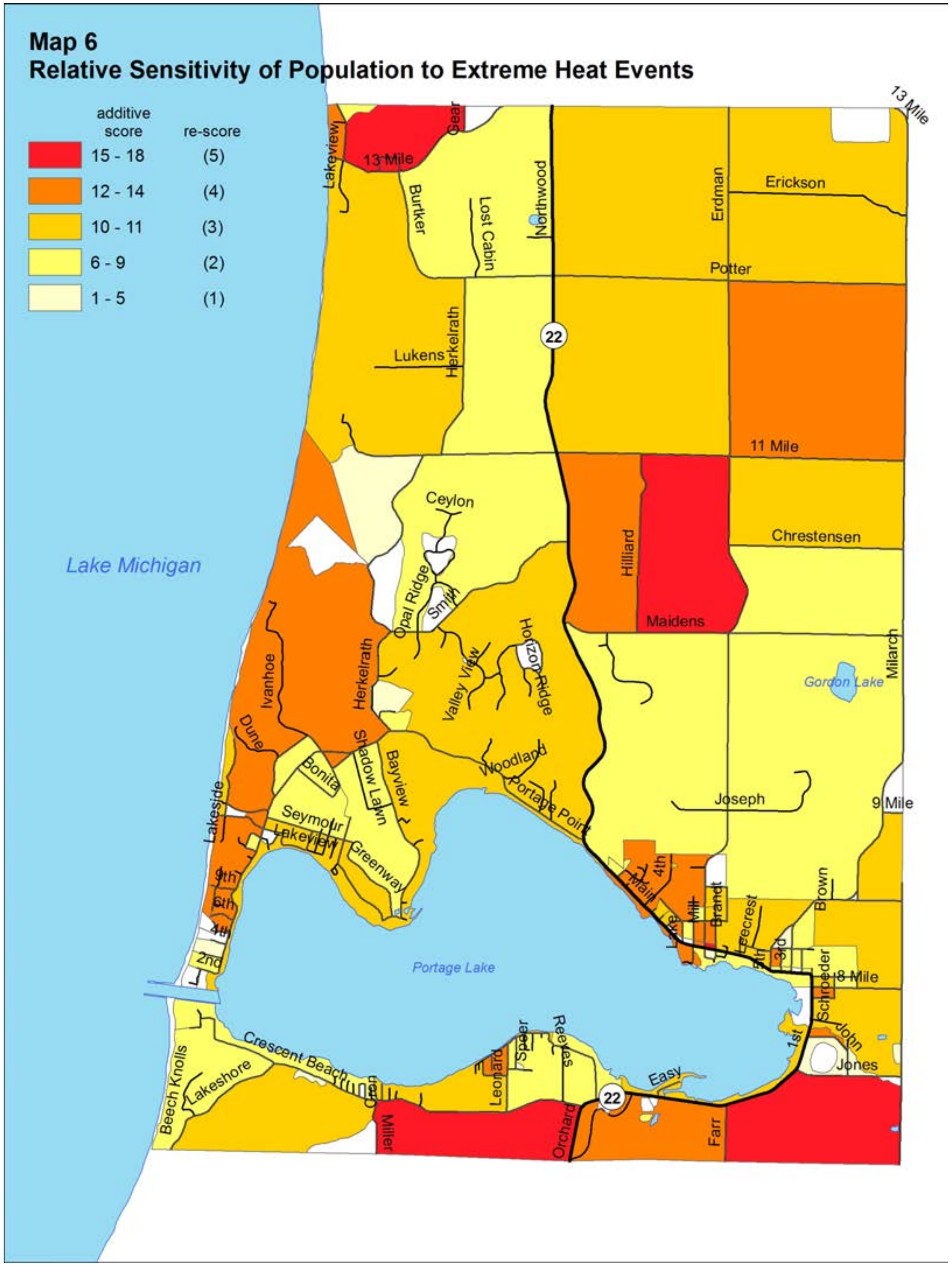



Map 4
Percent of Households Living Below the Poverty Threshold
9.21 - 9.40% (5)
7.91 - 9.20% (4)
7.61 - 7.90% (3)
5.71 - 7.60% (2)
5.70% (1)
Lake Michigan
Portage Lake
Gordon Lake
13 Mile
Erickson
Erdman
Potter
Northwood
Lost Cabin
Burtiker
Lakeview
Lukens
Herkelrath
11 Mile
Ceylon
Chrestensen
Hilliard
Maidens
Opal Ridge
Smith
Valley View
Ivanhoe
Dune
Bonita
Shadow Lawn
Bayview
Woodland
Portage Point
Joseph
9 Mile
Seymour
Greenway
Lakeside
Main
4th
Brown
Milarch
8 Mile
Schroeder
John
Jones
1st
Easy
Crescent Beach
Lakeshore
Beech Knolls
Miller
Leonard
Speer
Reeves
Orchard
Farr
22


Manistee County

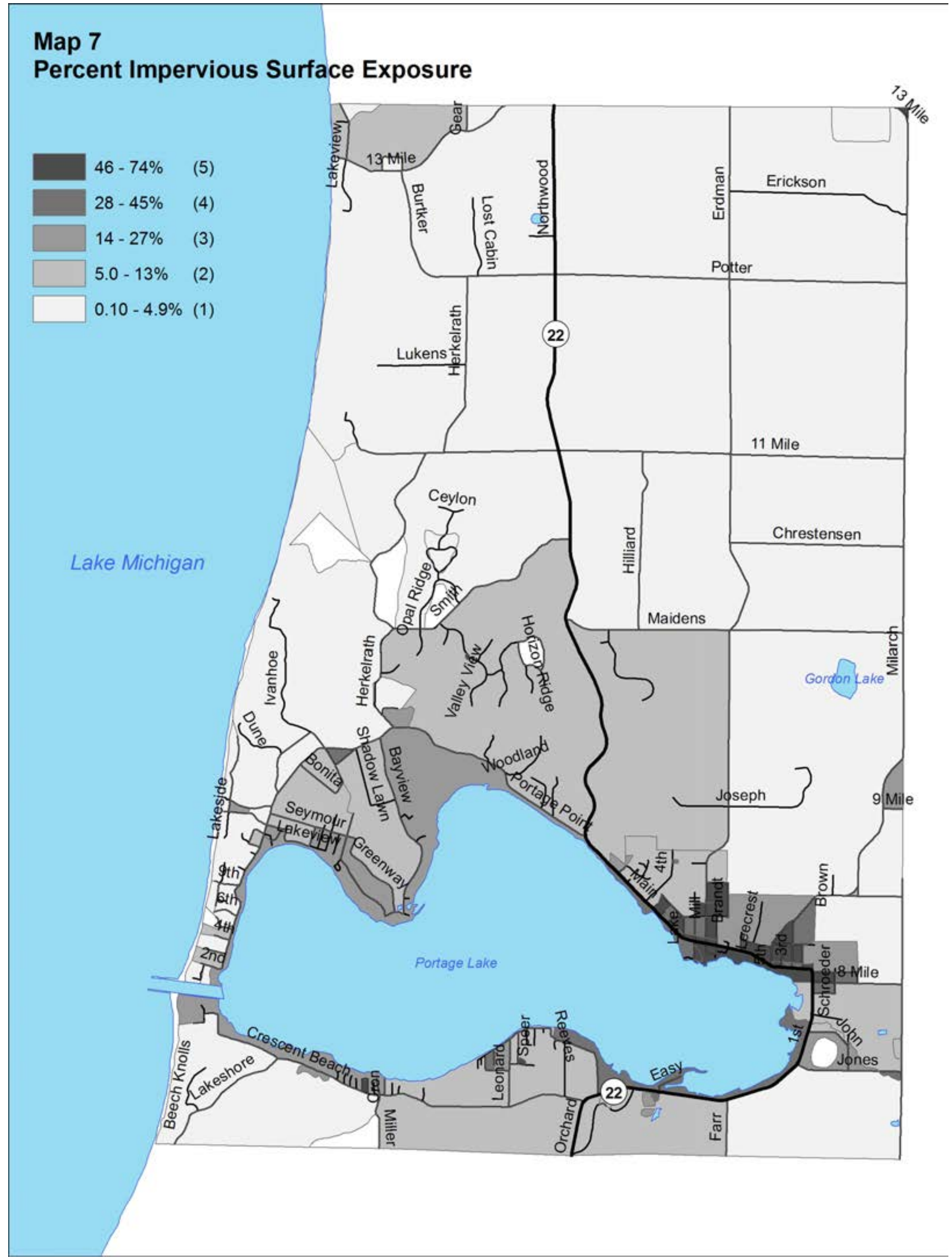

Manistee County

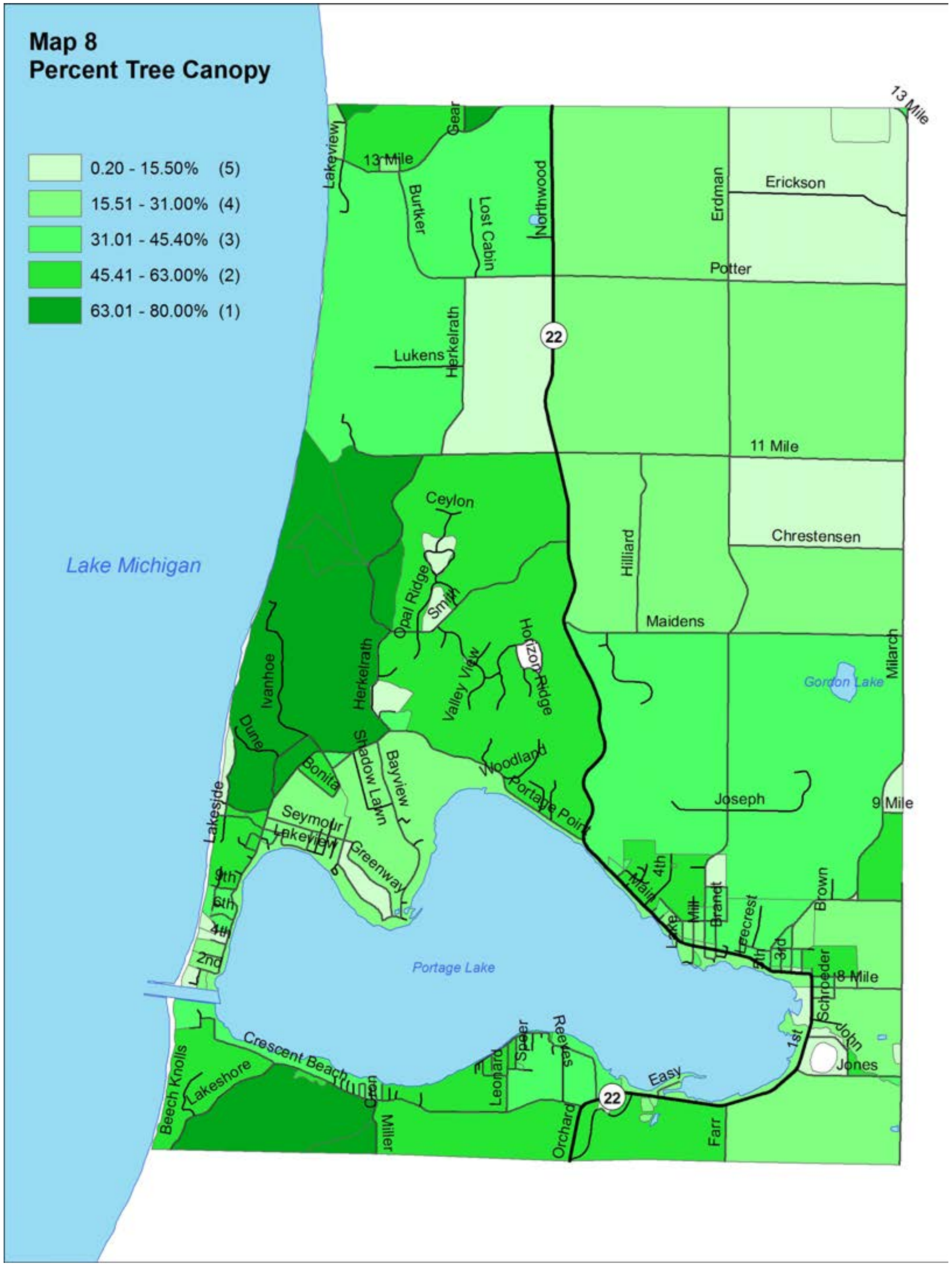

Map 5
Percent of Population 25 Years and Older with less than a High School Education
9.91 - 10.50% (5)
6.41 - 9.90% (4)
1.21 - 6.40% (3)
1.20% (2)
Lake Michigan
Portage Lake
Gordon Lake
13 Mile
11 Mile
9 Mile
8 Mile
Erickson
Potter
Lukens
Ceylon
Chrestensen
Maidens
Joseph
Woodland
Portage Point
Crescent Beach
Lakeshore
Beech Knolls
Easy
Jones
22


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
15 - 18
(5)
12 - 14
(4)
10 - 11
(3)
6 - 9
(2)
1 - 5
(1)
Lake Michigan
Portage Lake
Gordon Lake
13 Mile
11 Mile
9 Mile
8 Mile
Lakeview
Burtker
Lost Cabin
Northwood
Erdman
Erickson
Potter
Lukens
Herkelrath
22
Ceylon
Chrestensen
Hilliard
Maidens
Opal Ridge
Smith
Valley View
Horizon Ridge
Milarch
Ivanhoe
Dune
Bonita
Shadow Lawn
Bayview
Woodland
Portage Point
Joseph
Lakeside
Seymour
Greenway
Main
Mill
Grant
Brown
Schroeder
John
Jones
Easy
Farr
Orchard
Reeves
Speer
Leonard
Miller
Crescent Beach
Lakeshore
Beech Knolls
9th
6th
4th
2nd
1st
3rd


Manistee County

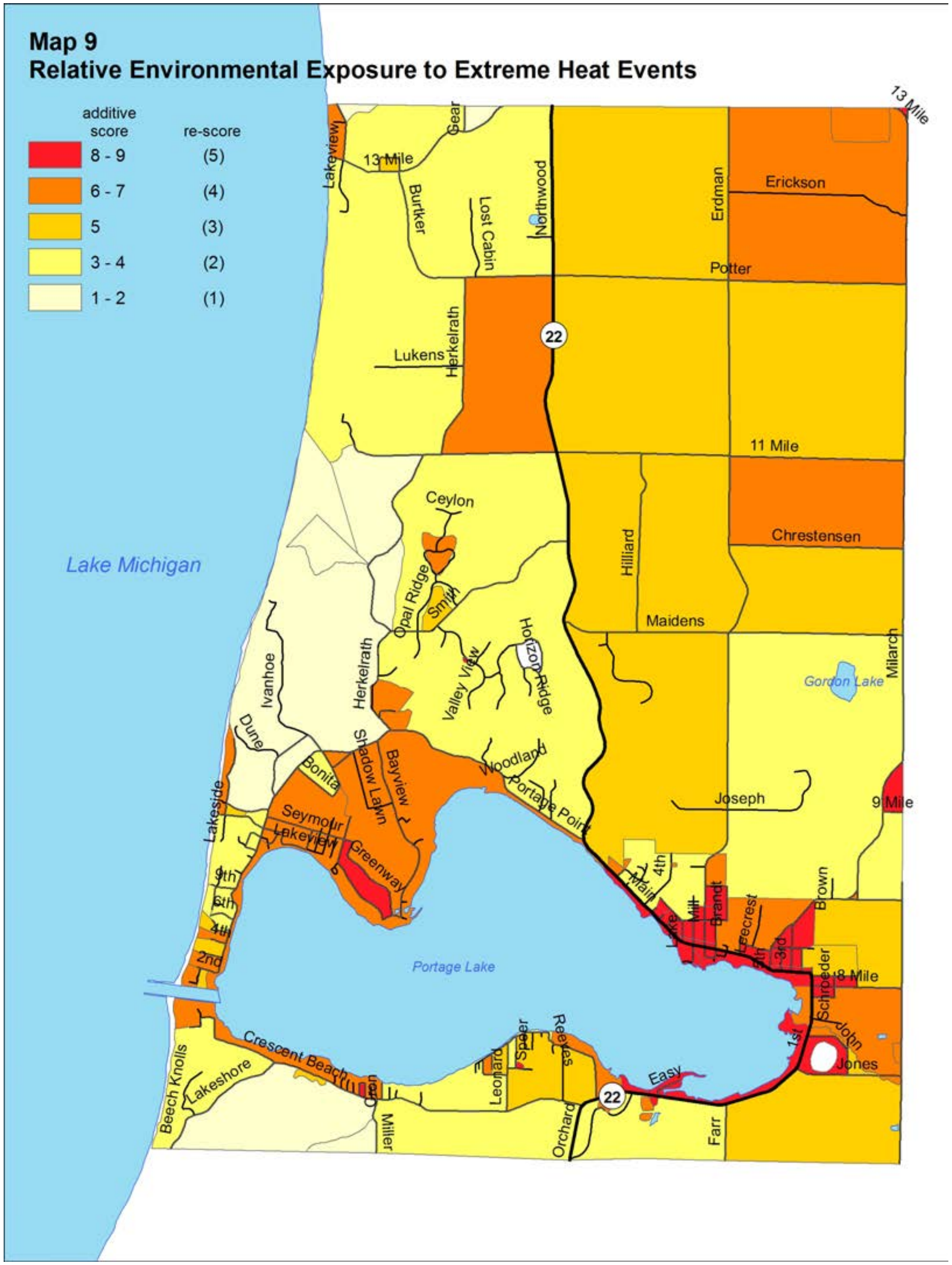

Manistee County

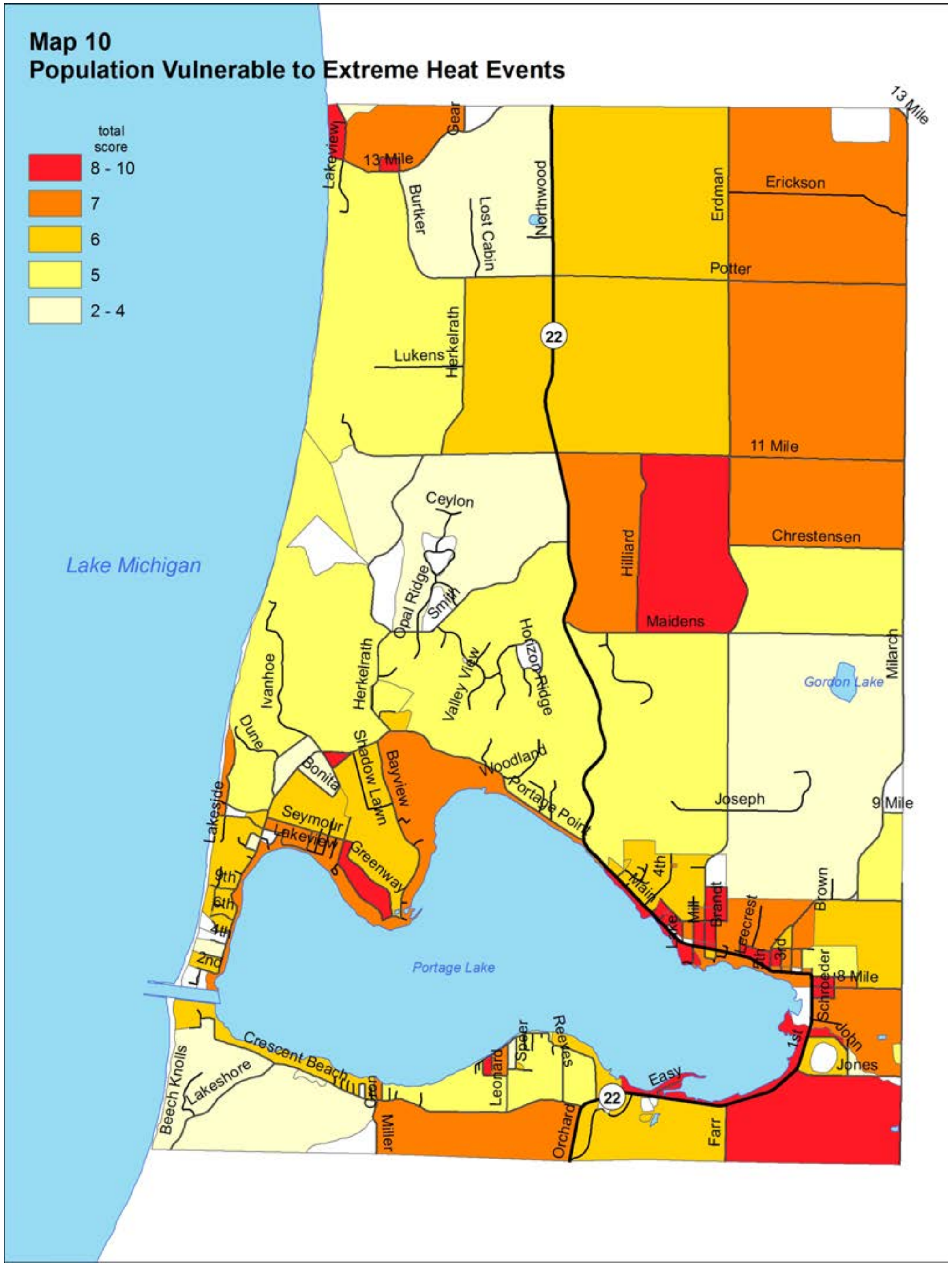

Map 7
Percent Impervious Surface Exposure
46 - 74% (5)
28 - 45% (4)
14 - 27% (3)
5.0 - 13% (2)
0.10 - 4.9% (1)
Lake Michigan
Portage Lake
Gordon Lake
22
13 Mile
11 Mile
9 Mile
8 Mile
Erickson
Potter
Chrestensen
Maidens
Joseph
Lukens
Ceylon
Northwood
Erdman
Hilliard
Milarch
Brown
Schroeder
John
Jones
Easy
Farr
Orchard
Reeves
Speer
Leonard
Miller
Crescent Beach
Lakeshore
Beach Knolls
Lakeside
Dune
Ivanhoe
Herkelrath
Opal Ridge
Smith
Valley View
Horizon Ridge
Woodland
Portage Point
Shadow Lawn
Bayview
Bonita
Seymour
Lakeview
Greenway
Burtker
Lost Cabin
Gear
Main
Lake
Mill
Brandt
Lakecrest
4th
3rd
2nd
6th
9th
1st


Map 8
Percent Tree Canopy
0.20 - 15.50% (5)
15.51 - 31.00% (4)
31.01 - 45.40% (3)
45.41 - 63.00% (2)
63.01 - 80.00% (1)
Lake Michigan
Portage Lake
Gordon Lake
13 Mile
Lakeview
Gear
Burtker
Lost Cabin
Northwood
Erdman
Erickson
Potter
Lukens
Herkelrath
22
11 Mile
Ceylon
Hilliard
Chrestensen
Opal Ridge
Maidens
Ivanhoe
Valley View
Horizon Ridge
Milarch
Dune
Shadow Lawn
Bayview
Woodland
Bonita
Portage Point
Lakeside
Seymour
Lakeview
Greenway
Joseph
9 Mile
4th
Main
Mill
Brandt
Brown
Lake
8 Mile
Schroeder
1st
John
Jones
Crescent Beach
Lakeshore
Beech Knolls
Reeves
Speer
Leonard
Miller
Orchard
Easy
Farr


Manistee County

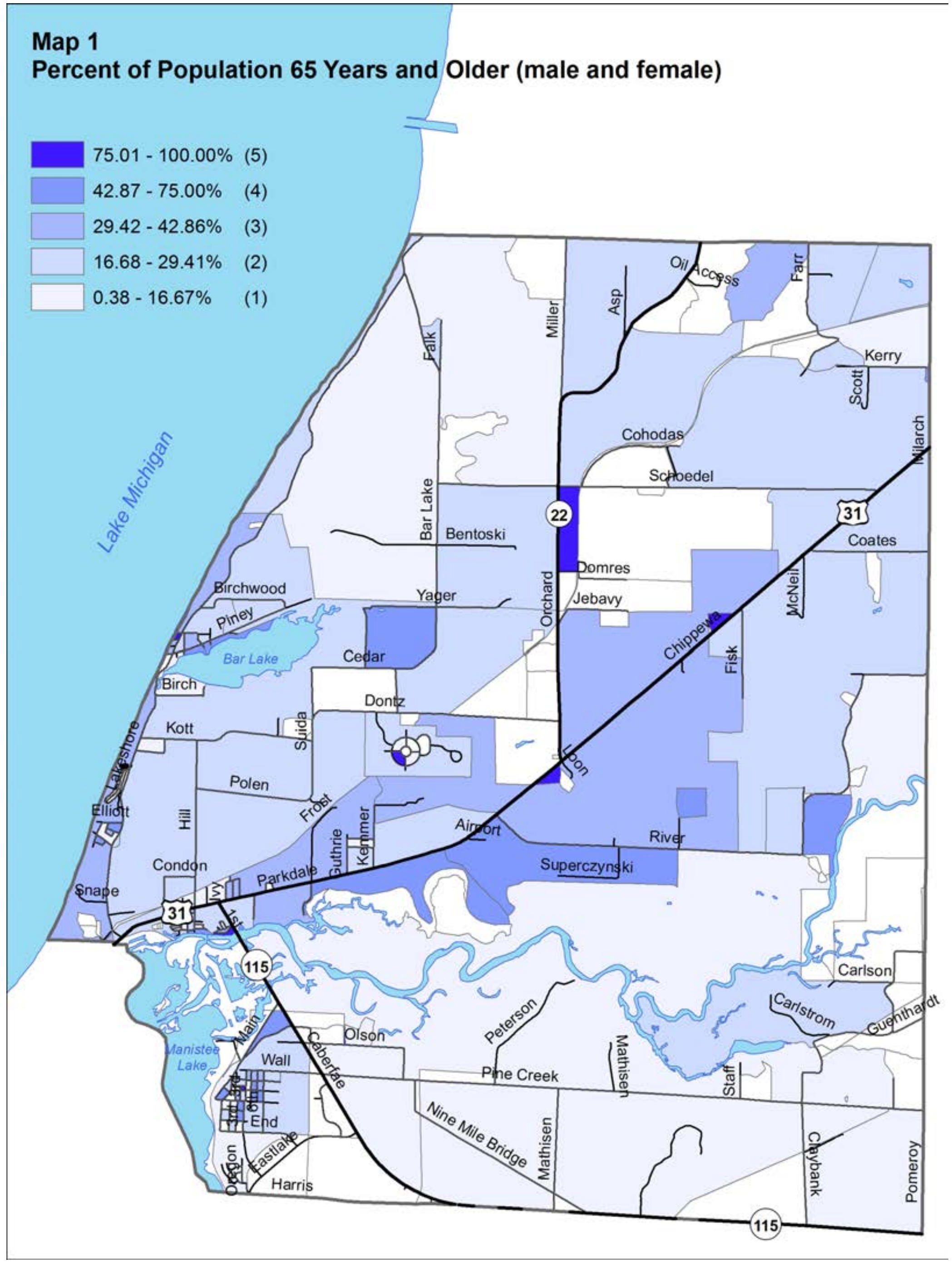

Manistee County

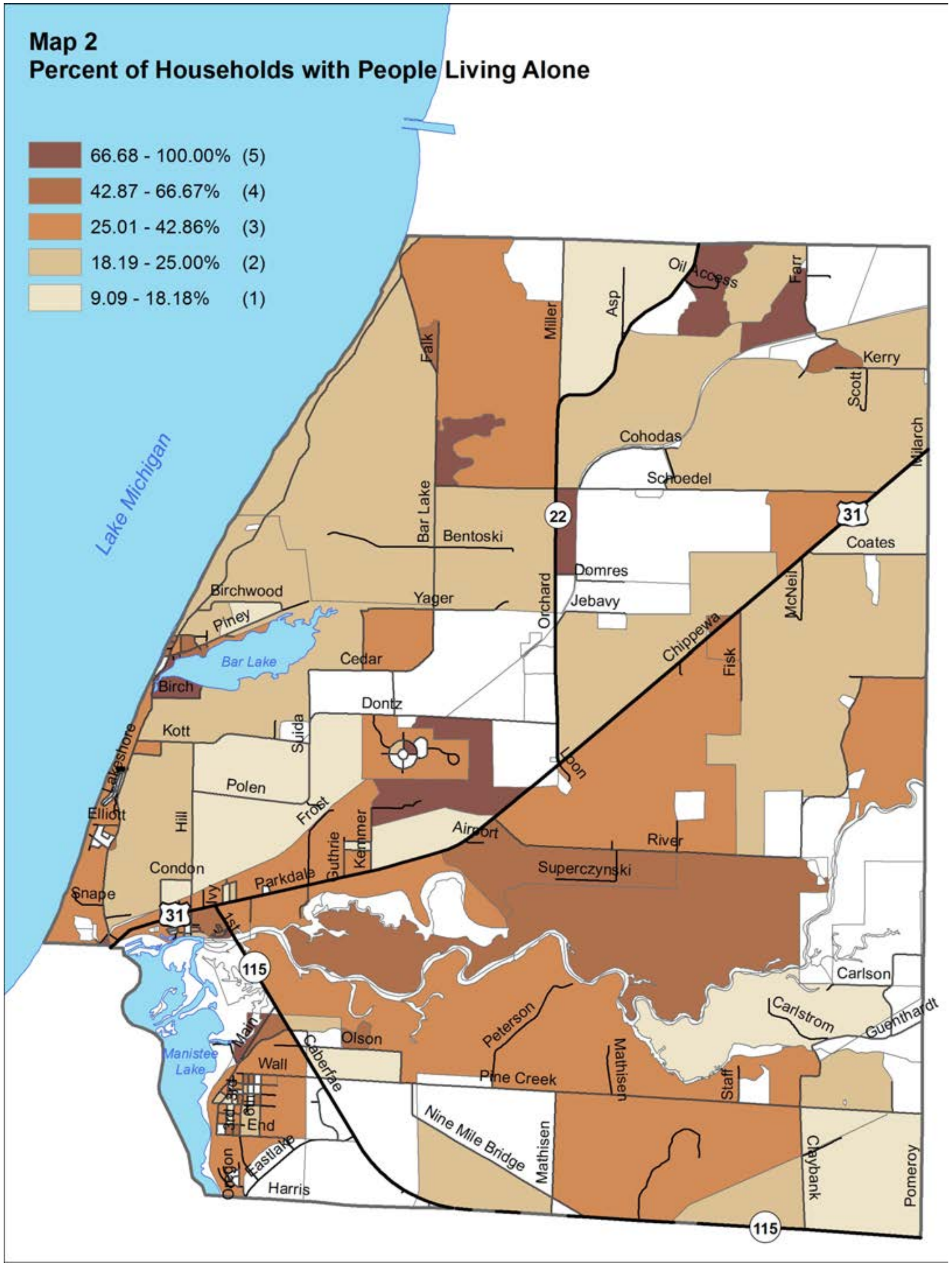

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
8 - 9 (5)
6 - 7 (4)
5 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
Portage Lake
Gordon Lake
13 Mile
Lakeview
Burtker
Lost Cabin
Northwood
Erdman
Erickson
Potter
Lukens
Herkelrath
22
11 Mile
Ceylon
Opal Ridge
Smith
Hilliard
Chrestensen
Maidens
Horizon Ridge
Valley View
Ivanhoe
Dune
Millarch
Woodland
Portage Point
Bonita
Shadow Lawn
Bayview
Joseph
9 Mile
Lakeside
Seymour
Lakeview
Greenway
Main
4th
Lake
Mill
Brandt
Seacrest
3rd
Brown
8 Mile
Schroeder
John
Jones
1st
9th
6th
2nd
Crescent Beach
Lakeshore
Beech Knolls
Miller
Leonard
Speer
Reeves
Easy
Orchard
Farr


Map 10
Population Vulnerable to Extreme Heat Events
total score
8 - 10
7
6
5
2 - 4
Lake Michigan
Portage Lake
Gordon Lake
13 Mile
Erickson
Potter
Lukens
11 Mile
Ceylon
Chrestensen
Maidens
Joseph
9 Mile
8 Mile
Crescent Beach
Lakeshore
Beech Knolls
Jones
Easy
22


Manistee County

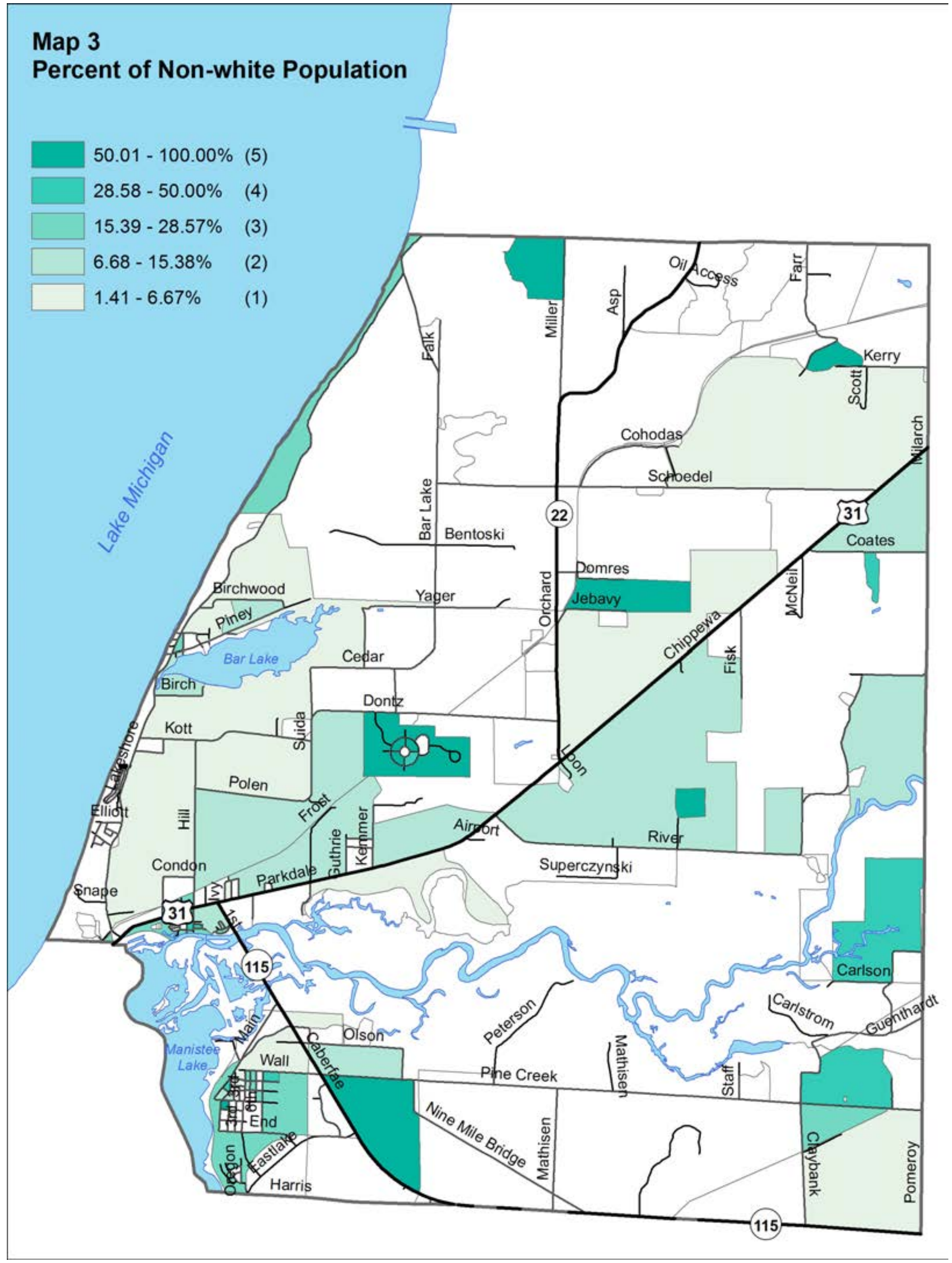
Manistee Twp./ Eastlake

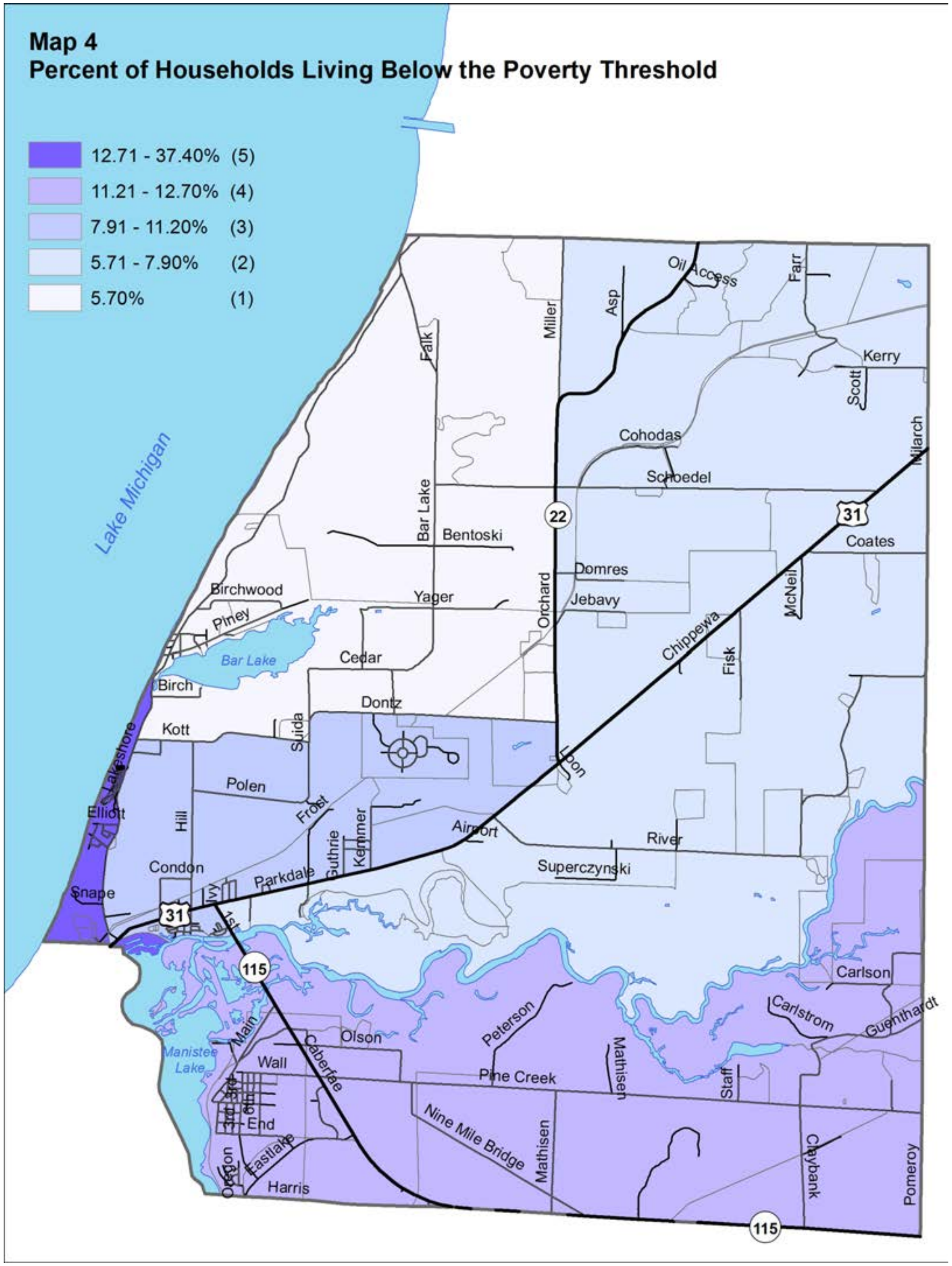



Map 2
Percent of Households with People Living Alone
66.68 - 100.00% (5)
42.87 - 66.67% (4)
25.01 - 42.86% (3)
18.19 - 25.00% (2)
9.09 - 18.18% (1)
Lake Michigan
Bar Lake
Manistee Lake
Oil Access
Farr
Asp
Miller
Falk
Kerry
Scott
Cohodas
Schoedel
Milarch
Bar Lake
Bentoski
Coates
Domres
Jebavy
Yager
Orchard
Birchwood
Piney
Cedar
Chippewa
Fisk
McNeil
Birch
Dontz
Kott
Suida
Lakeshore
Polen
Elliott
Frost
Hill
Kemmer
Guthrie
Airport
River
Superczynski
Condon
Parkdale
Snape
Ivy
1st
Carlson
Carlstrom
Guenthardt
Main
Olson
Caberfae
Peterson
Wall
Pine Creek
Mathisen
Staff
End
Nine Mile Bridge
Eastlake
Harris
Claybank
Pomeroy
22
31
115

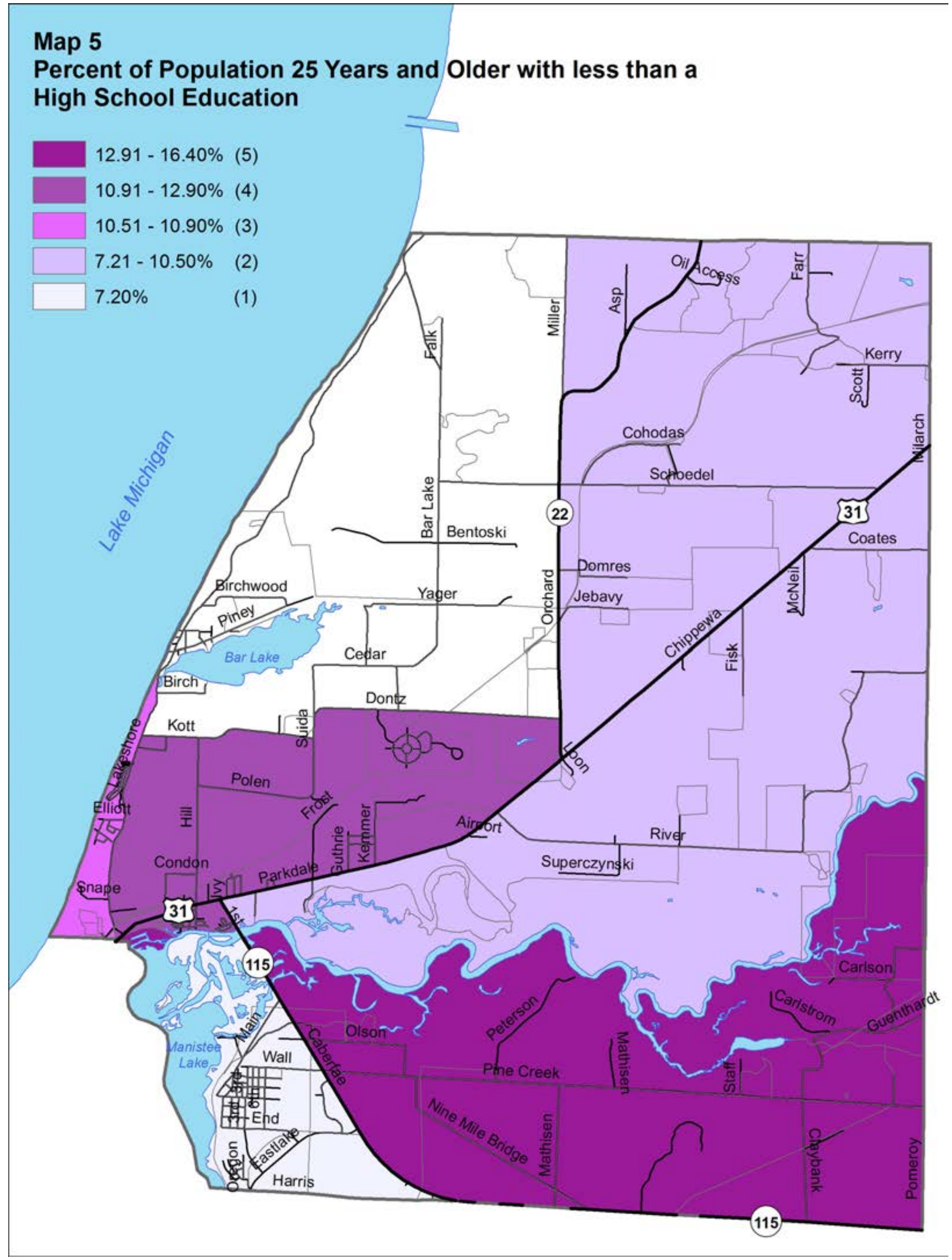

Manistee County


Manistee County

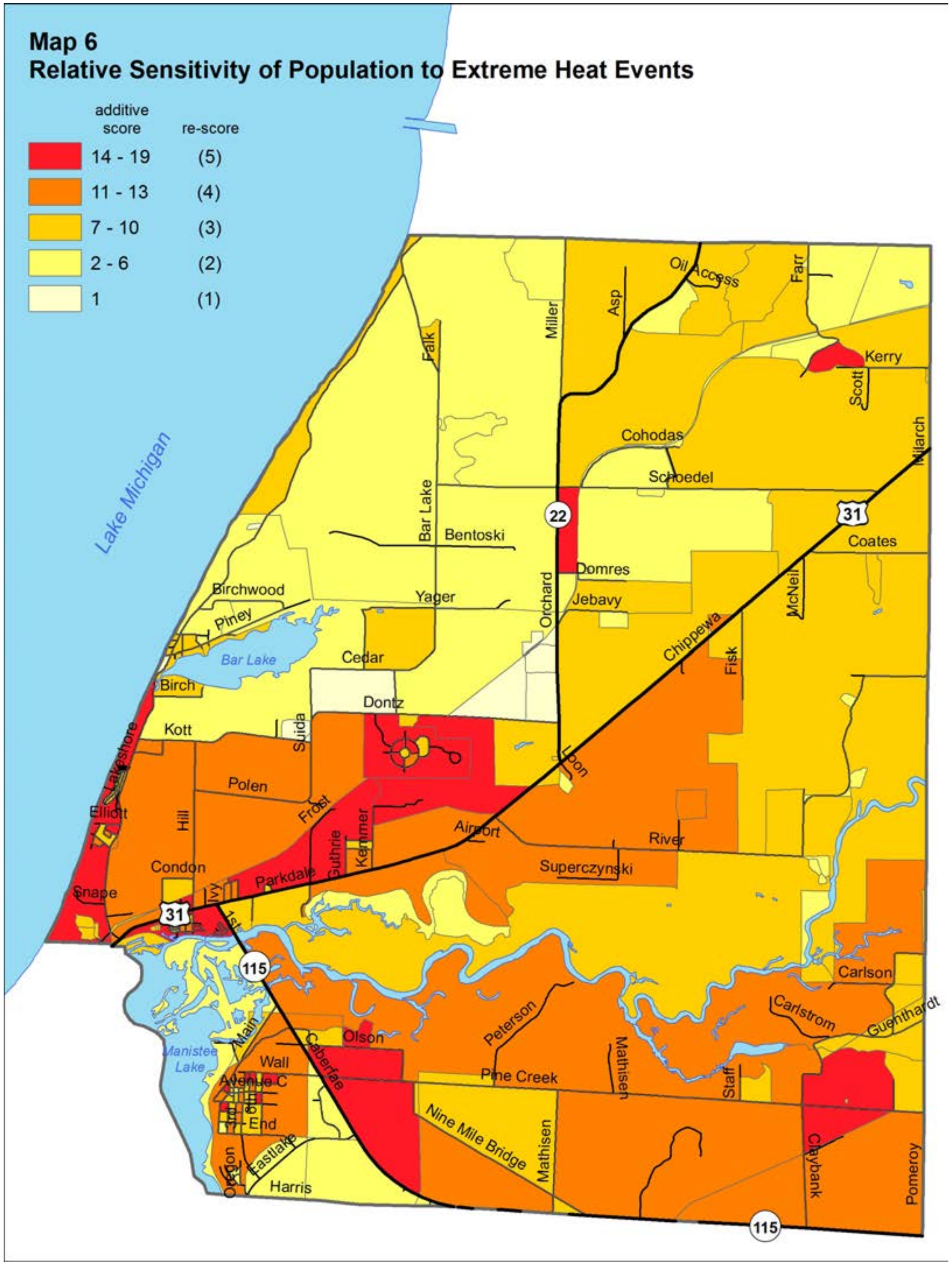

Map 3
Percent of Non-white Population
50.01 - 100.00% (5)
28.58 - 50.00% (4)
15.39 - 28.57% (3)
6.68 - 15.38% (2)
1.41 - 6.67% (1)
Lake Michigan
Bar Lake
Manistee Lake
Miller
Asp
Oil Access
Farr
Kerry
Scott
Falk
Cohodas
Schoedel
Milarch
Bar Lake
Bentoski
Coates
Domres
Jebavy
Orchard
Yager
Birchwood
Piney
McNeil
Chippewa
Fisk
Cedar
Birch
Dontz
Kott
Suida
Lakeshore
Polen
Elliott
Hill
Frost
Guthrie
Kemmer
Airport
River
Superczynski
Condon
Parkdale
Snape
Olson
Wall
Main
Caberfae
Peterson
Pine Creek
Mathisen
Staff
Carlson
Carlstrom
Guenthardt
End
Eastlake
Harris
Nine Mile Bridge
Mathisen
Claybank
Pomeroy
22
31
115


Map 4
Percent of Households Living Below the Poverty Threshold
12.71 - 37.40% (5)
11.21 - 12.70% (4)
7.91 - 11.20% (3)
5.71 - 7.90% (2)
5.70% (1)
Lake Michigan
Bar Lake
Manistee Lake
Birchwood
Piney
Birch
Kott
Lakeshore
Elliott
Snape
Condon
Hill
Polen
Frost
Suida
Cedar
Dontz
Yager
Bentoski
Bar Lake
Falk
Miller
Asp
Oil Access
Farr
Kerry
Scott
Cohodas
Schoedel
Milarch
Coates
Domres
Jebavy
Orchard
Chippewa
Fisk
McNeil
Udon
Airport
River
Superczynski
Parkdale
Guthrie
Kemmer
Ivy
1st
Main
Olson
Caberfae
Wall
Peterson
Pine Creek
Mathisen
Staff
Carlson
Carlstrom
Guenthardt
Nine Mile Bridge
Claybank
Pomeroy
End
Eastlake
Harris
Orchard
31
22
115


Manistee County

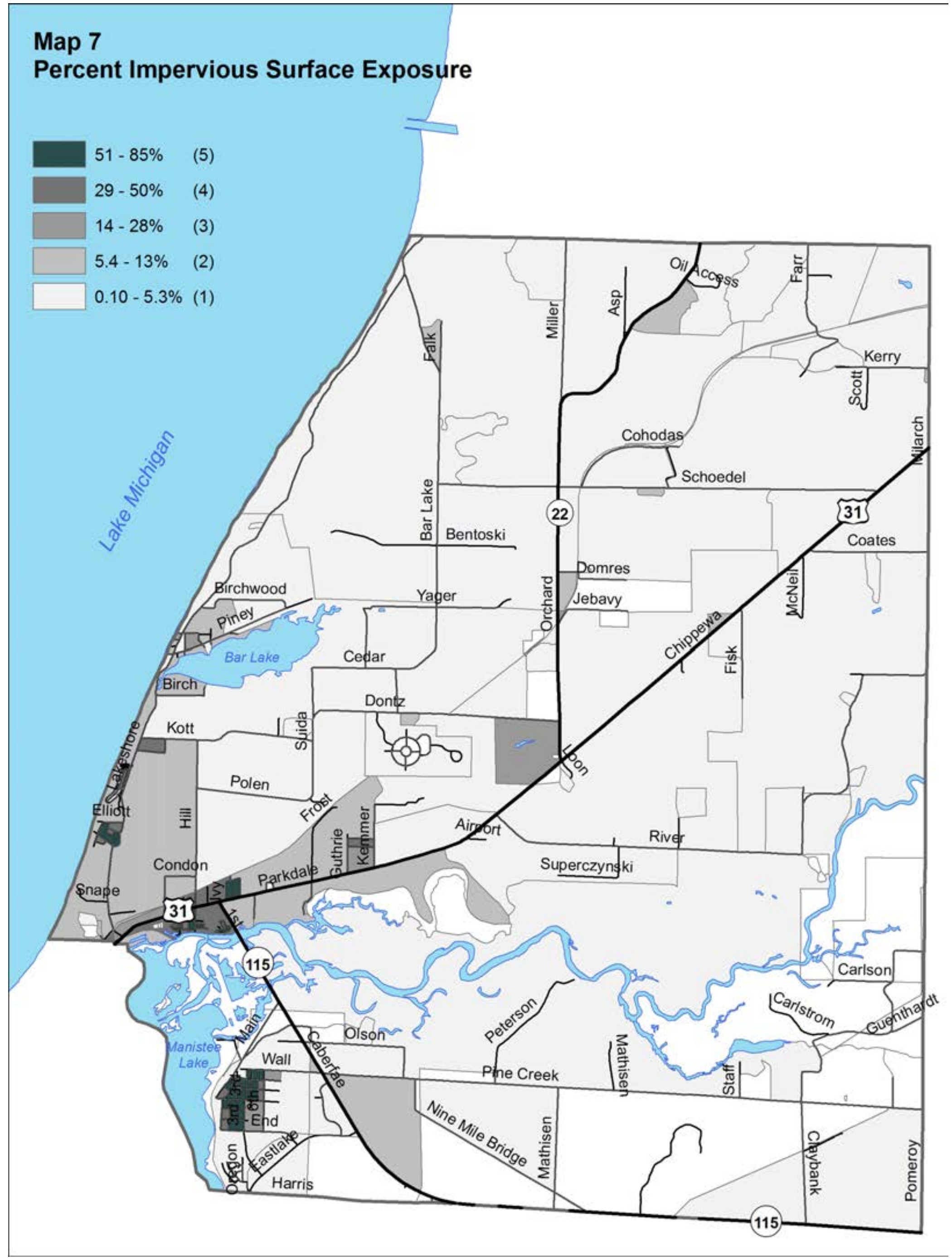


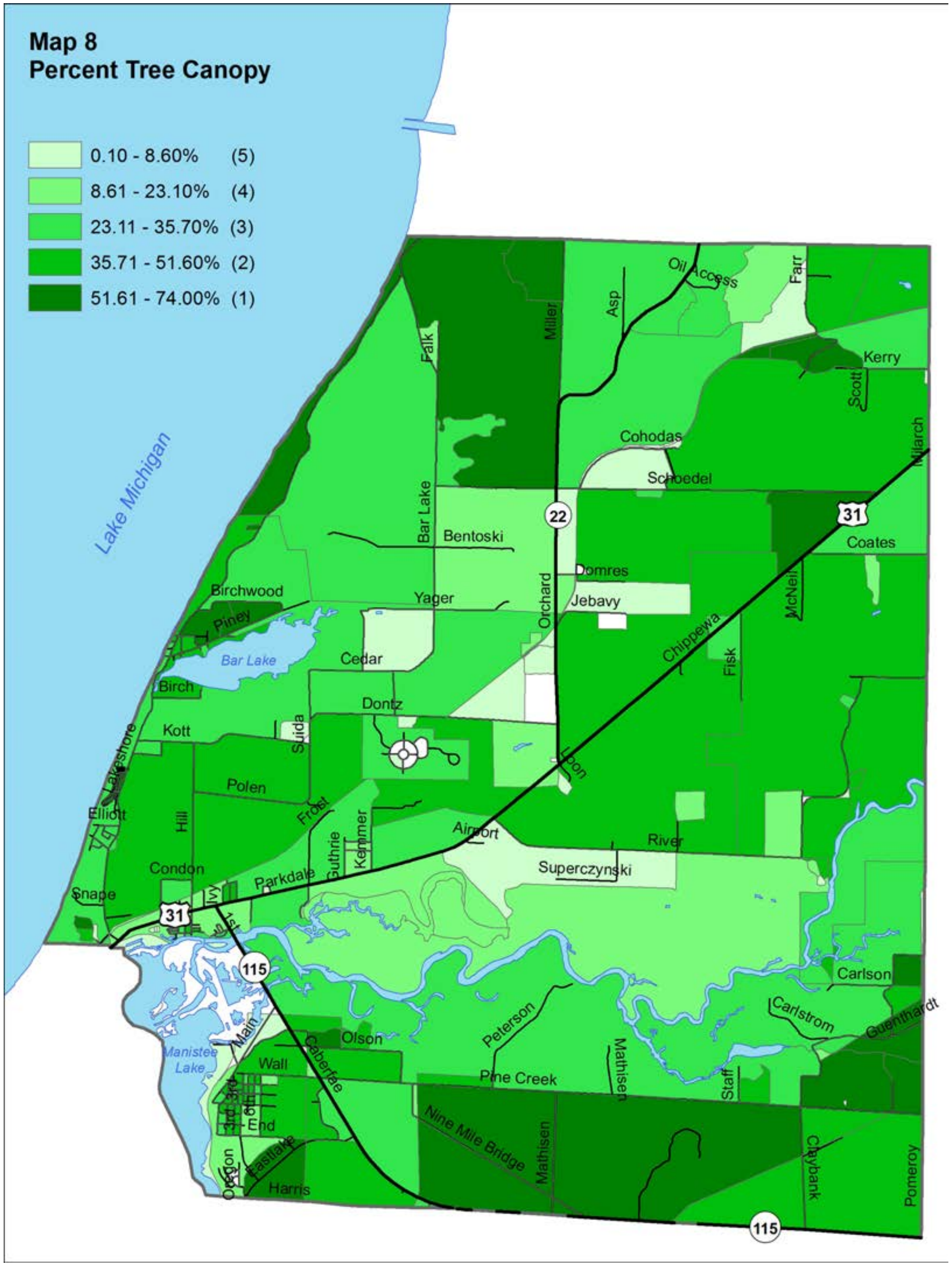
Map 5
Percent of Population 25 Years and Older with less than a High School Education


Map 6
Relative Sensitivity of Population to Extreme Heat Events
additive score
re-score
14 - 19 (5)
11 - 13 (4)
7 - 10 (3)
2 - 6 (2)
1 (1)
Lake Michigan
Bar Lake
Manistee Lake
Miller
Asp
Oil Access
Farr
Kerry
Scott
Falk
Cohodas
Schoedel
Milarch
Bar Lake
Bentoski
Coates
Domres
Jebavy
Orchard
Birchwood
Piney
Yager
McNeil
Chippewa
Fisk
Cedar
Birch
Dontz
Kott
Suida
Lakeshore
Polen
Frost
Elliott
Hill
Airport
River
Superczynski
Condon
Parkdale
Guthrie
Kemmer
Snape
Ivy
1st
Carlson
Carlstrom
Guenthardt
Peterson
Olson
Main
Wall
Avenue C
End
Eastlake
Harris
Caberfae
Pine Creek
Mathisen
Staff
Nine Mile Bridge
Claybank
Pomeroy
22
31
115


Manistee County

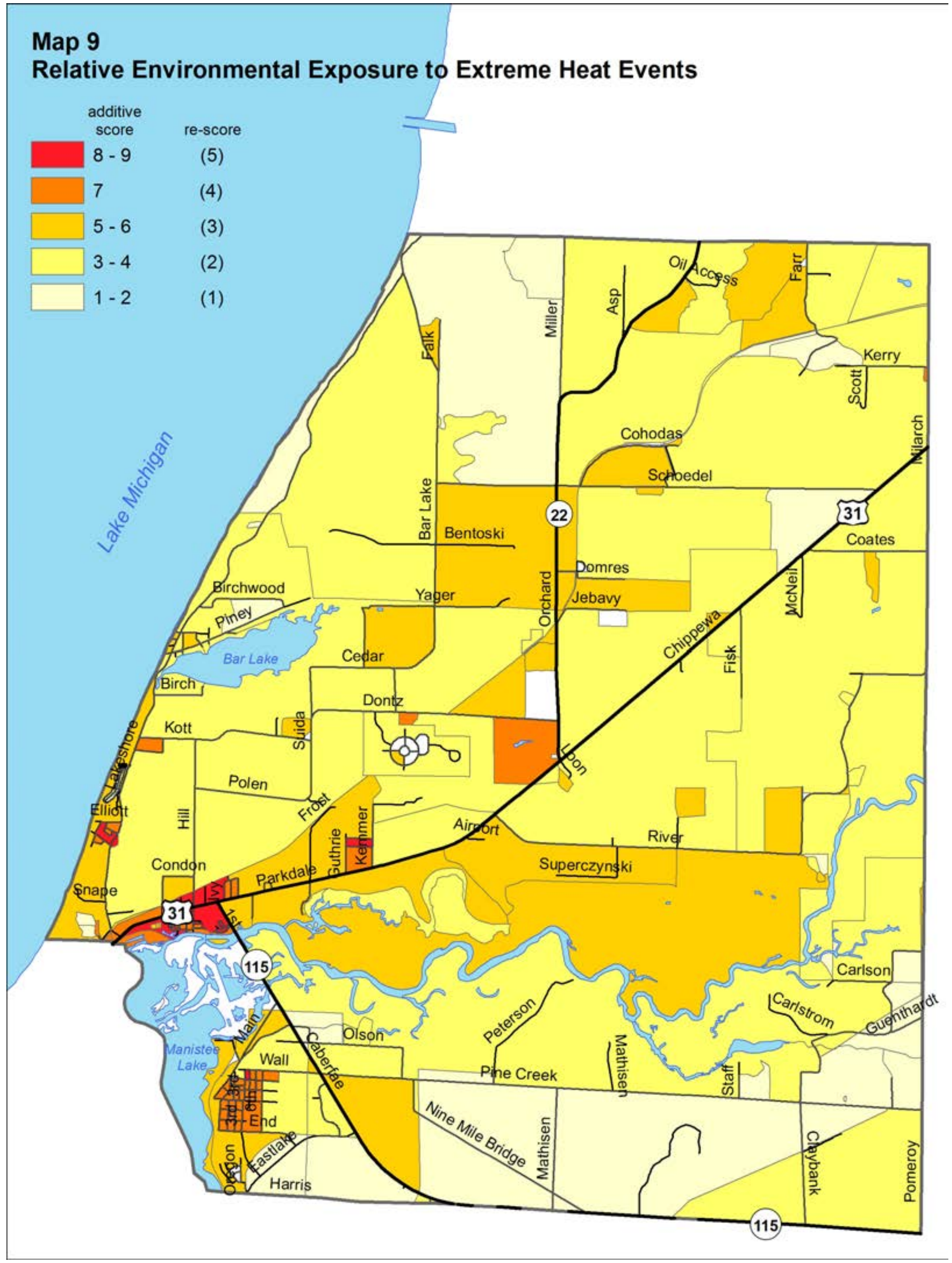

Manistee County

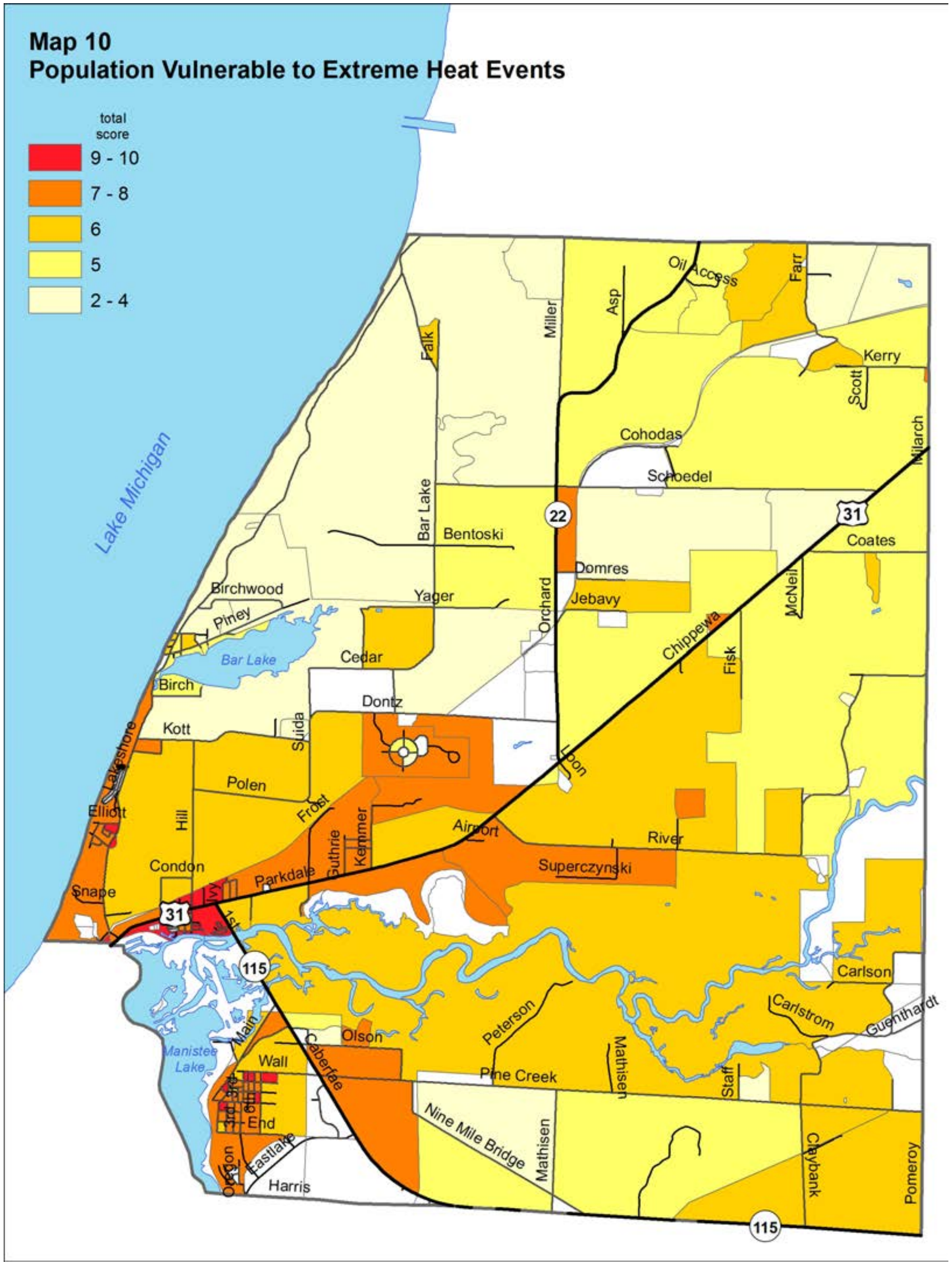

Map 7
Percent Impervious Surface Exposure
51 - 85% (5)
29 - 50% (4)
14 - 28% (3)
5.4 - 13% (2)
0.10 - 5.3% (1)
Lake Michigan
Bar Lake
Manistee Lake
Birchwood
Piney
Birch
Kott
Lakeshore
Elliott
Hill
Polen
Suida
Condon
Snape
Parkdale
Frost
Guthrie
Kemmer
Cedar
Dontz
Yager
Bentoski
Bar Lake
Falk
Miller
Asp
Oil Access
Farr
Kerry
Scott
Cohodas
Schoedel
Milarch
Coates
Domres
Jebavy
Orchard
Chippewa
Fisk
McNeil
Don
Airport
River
Superczynski
Carlson
Carlstrom
Guenthardt
Peterson
Olson
Wall
Main
Caberfae
Pine Creek
Mathisen
Staff
Nine Mile Bridge
Mathisen
Claybank
Pomeroy
Harris
Eastlake
End
3rd
6th
Gordon
22
31
115


Map 8
Percent Tree Canopy
0.10 - 8.60% (5)
8.61 - 23.10% (4)
23.11 - 35.70% (3)
35.71 - 51.60% (2)
51.61 - 74.00% (1)
Lake Michigan
Bar Lake
Manistee Lake


Manistee County


Manistee County

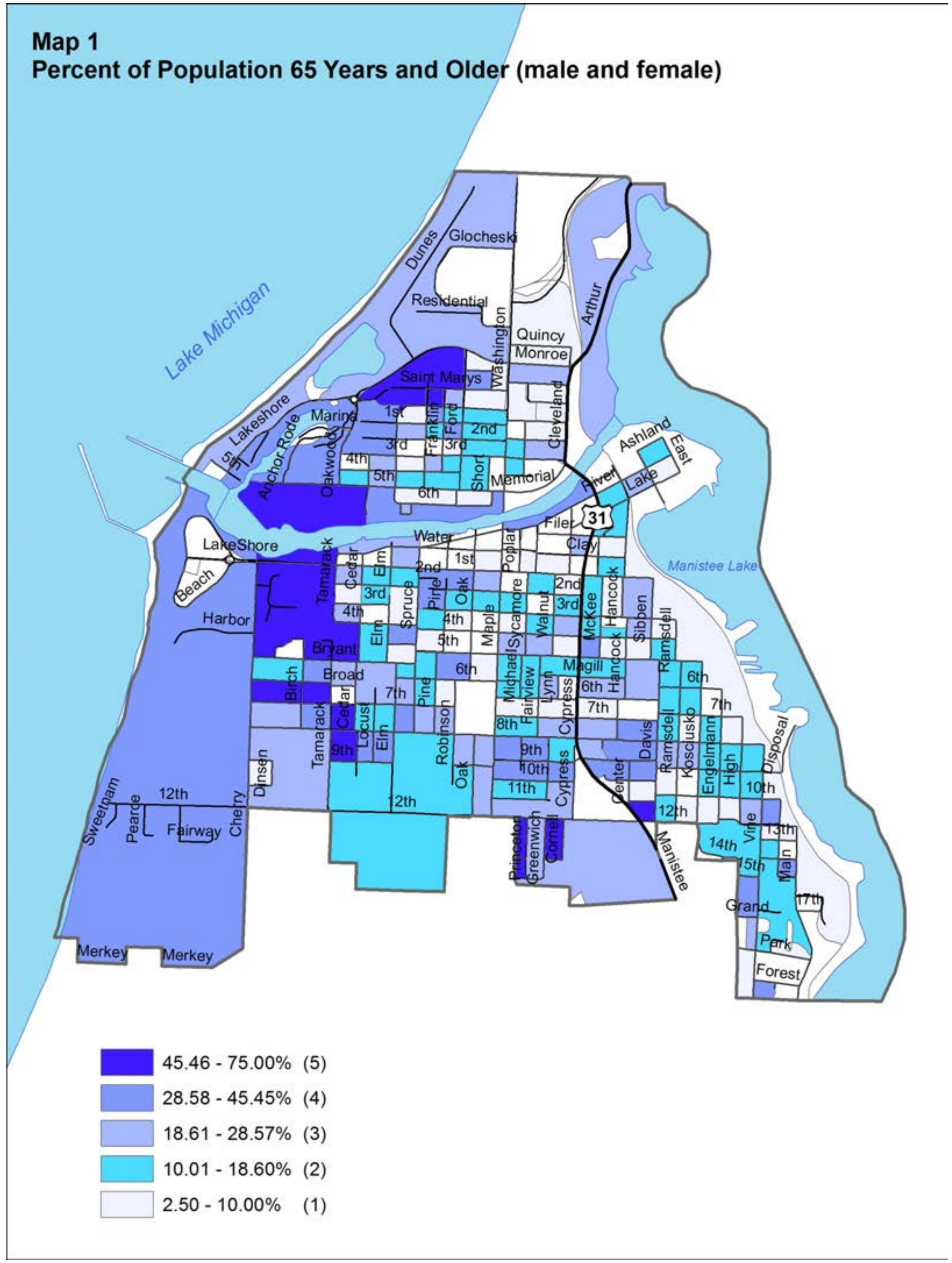

Map 9
Relative Environmental Exposure to Extreme Heat Events
additive score
re-score
8 - 9 (5)
7 (4)
5 - 6 (3)
3 - 4 (2)
1 - 2 (1)
Lake Michigan
Bar Lake
Manistee Lake
22
31
115
Oil Access
Farr
Asp
Miller
Falk
Kerry
Scott
Cohodas
Schoedel
Milarch
Bar Lake
Bentoski
Coates
Domres
Jebavy
Orchard
Yager
McNeil
Birchwood
Piney
Chippewa
Cedar
Fisk
Birch
Dontz
Kott
Suida
Lakeshore
Polen
Elliott
Hill
Frost
Kemmer
Guthrie
Airport
River
Superczynski
Condon
Parkdale
Snape
Carlson
Carlstrom
Guenthardt
Peterson
Olson
Main
Caberfae
Wall
Mathisen
Staff
Pine Creek
End
Eastlake
Nine Mile Bridge
Mathisen
Claybank
Pomeroy
Harris


Map 10
Population Vulnerable to Extreme Heat Events
total score
9 - 10
7 - 8
6
5
2 - 4
Lake Michigan
Bar Lake
Manistee Lake
Oil Access
Farr
Asp
Miller
Falk
Kerry
Scott
Cohodas
Schoedel
Milarch
Bar Lake
Bentoski
22
31
Coates
Domres
Jebavy
Orchard
Yager
McNeil
Birchwood
Piney
Chippewa
Cedar
Fisk
Birch
Dontz
Kott
Suida
Lakeshore
Polen
Frost
Elliott
Hill
Kemmer
Guthrie
Airport
River
Superczynski
Condon
Parkdale
Snape
115
Carlson
Carlstrom
Guenthardt
Peterson
Olson
Main
Wall
Caberfae
Pine Creek
Mathisen
Staff
End
Eastlake
Harris
Nine Mile Bridge
Claybank
Pomeroy


Manistee County

Manistee

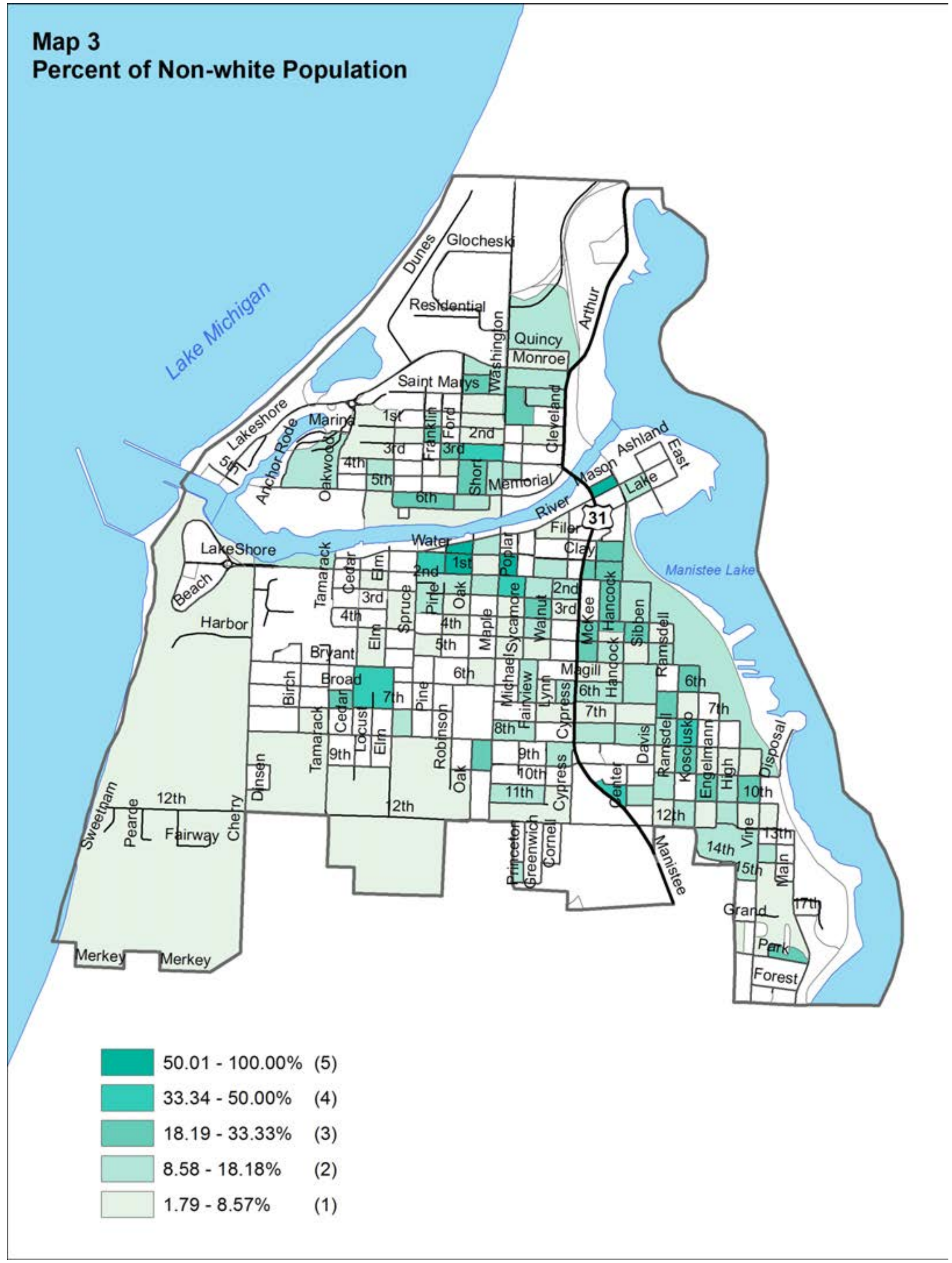

Manistee County

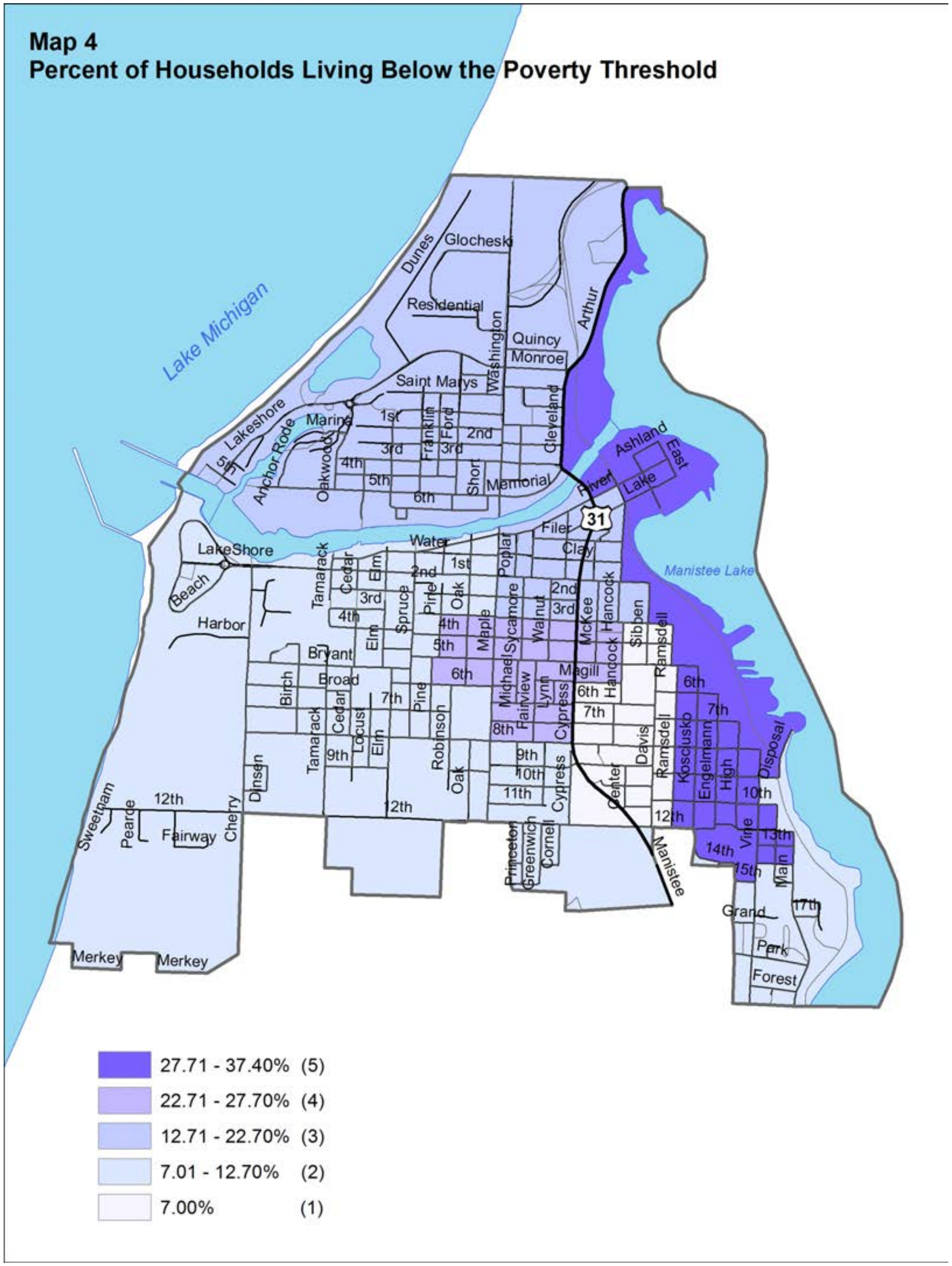

Map 1
Percent of Population 65 Years and Older (male and female)
Lake Michigan
Manistee Lake
45.46 - 75.00% (5)
28.58 - 45.45% (4)
18.61 - 28.57% (3)
10.01 - 18.60% (2)
2.50 - 10.00% (1)

Map 2
Percent of Households with People Living Alone

■	66.68 - 100.00%	(5)
■	44.45 - 66.67%	(4)
■	31.26 - 44.44%	(3)
■	18.76 - 31.25%	(2)
■	7.14 - 18.75%	(1)

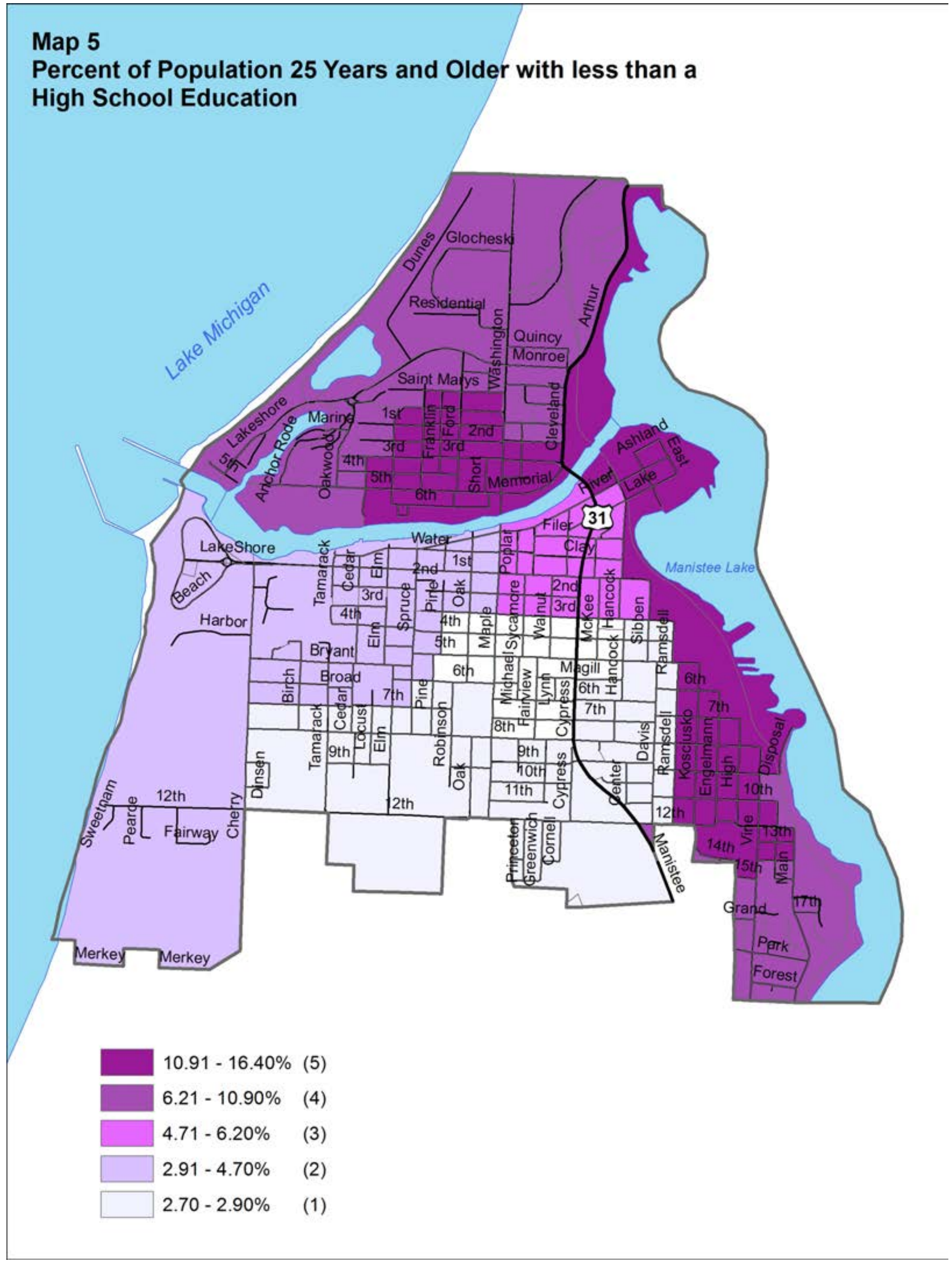

Manistee County

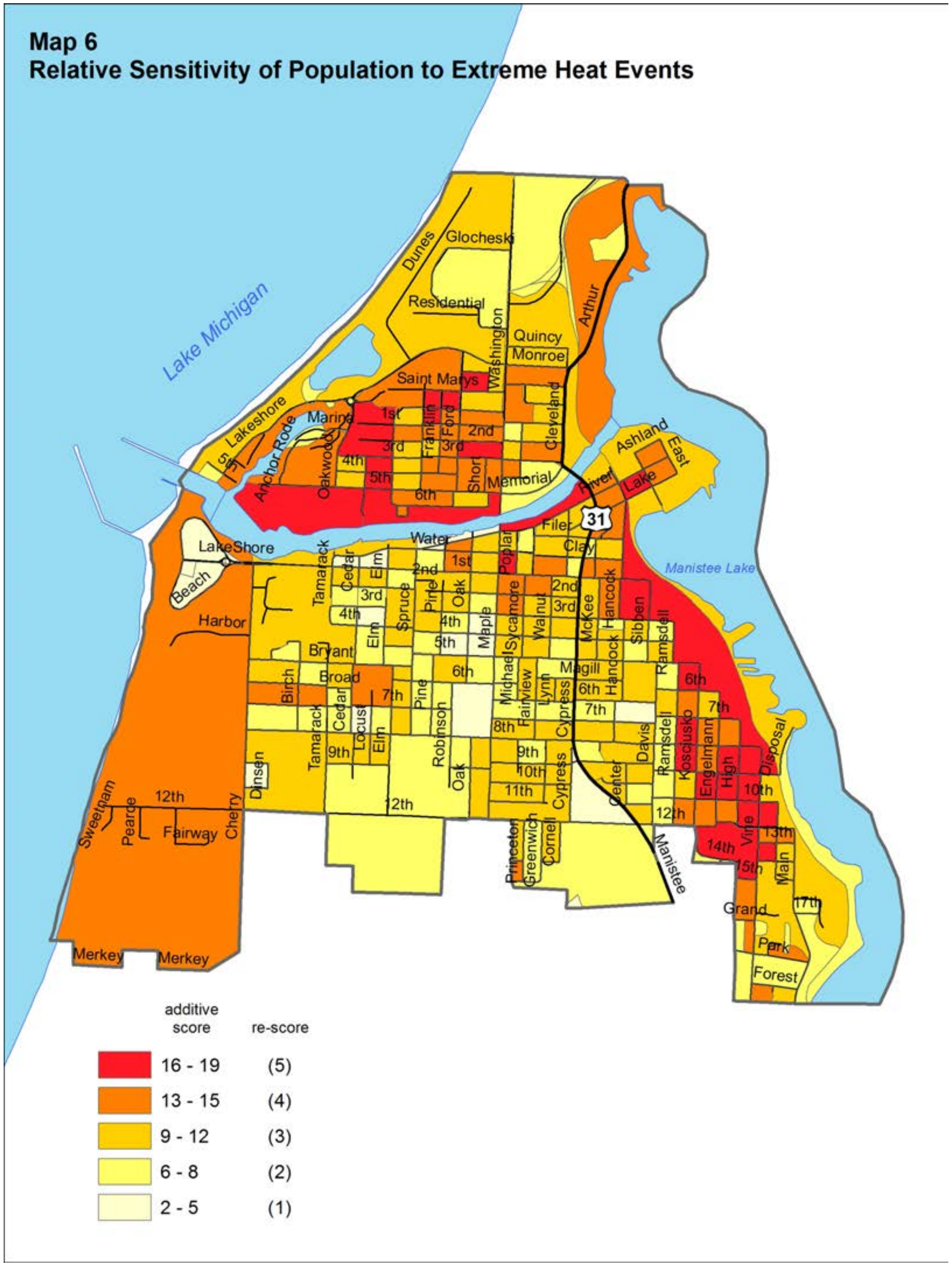

Map 3
Percent of Non-white Population
Lake Michigan
Manistee Lake
31
50.01 - 100.00% (5)
33.34 - 50.00% (4)
18.19 - 33.33% (3)
8.58 - 18.18% (2)
1.79 - 8.57% (1)



Map 4
Percent of Households Living Below the Poverty Threshold

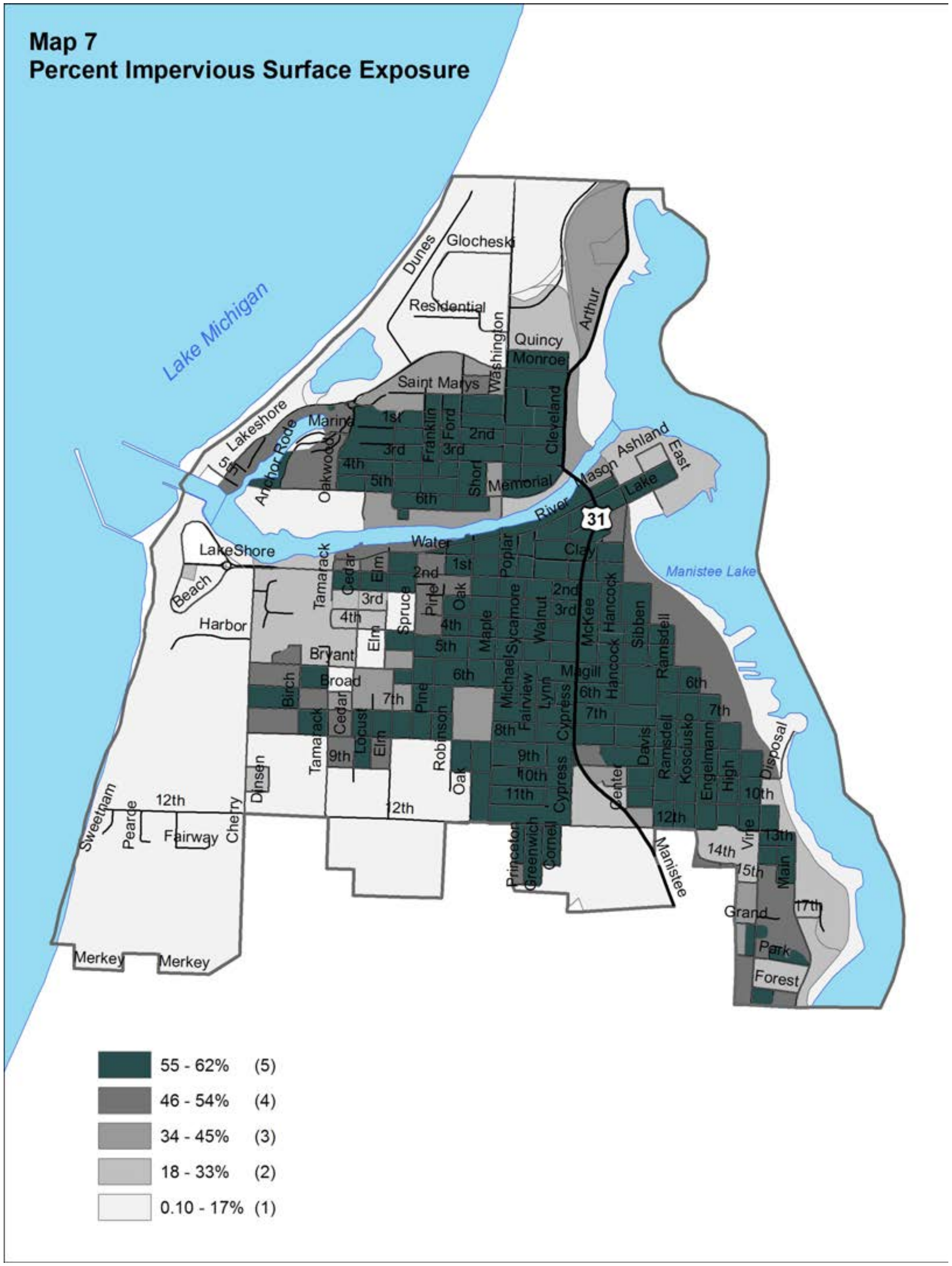

Manistee County

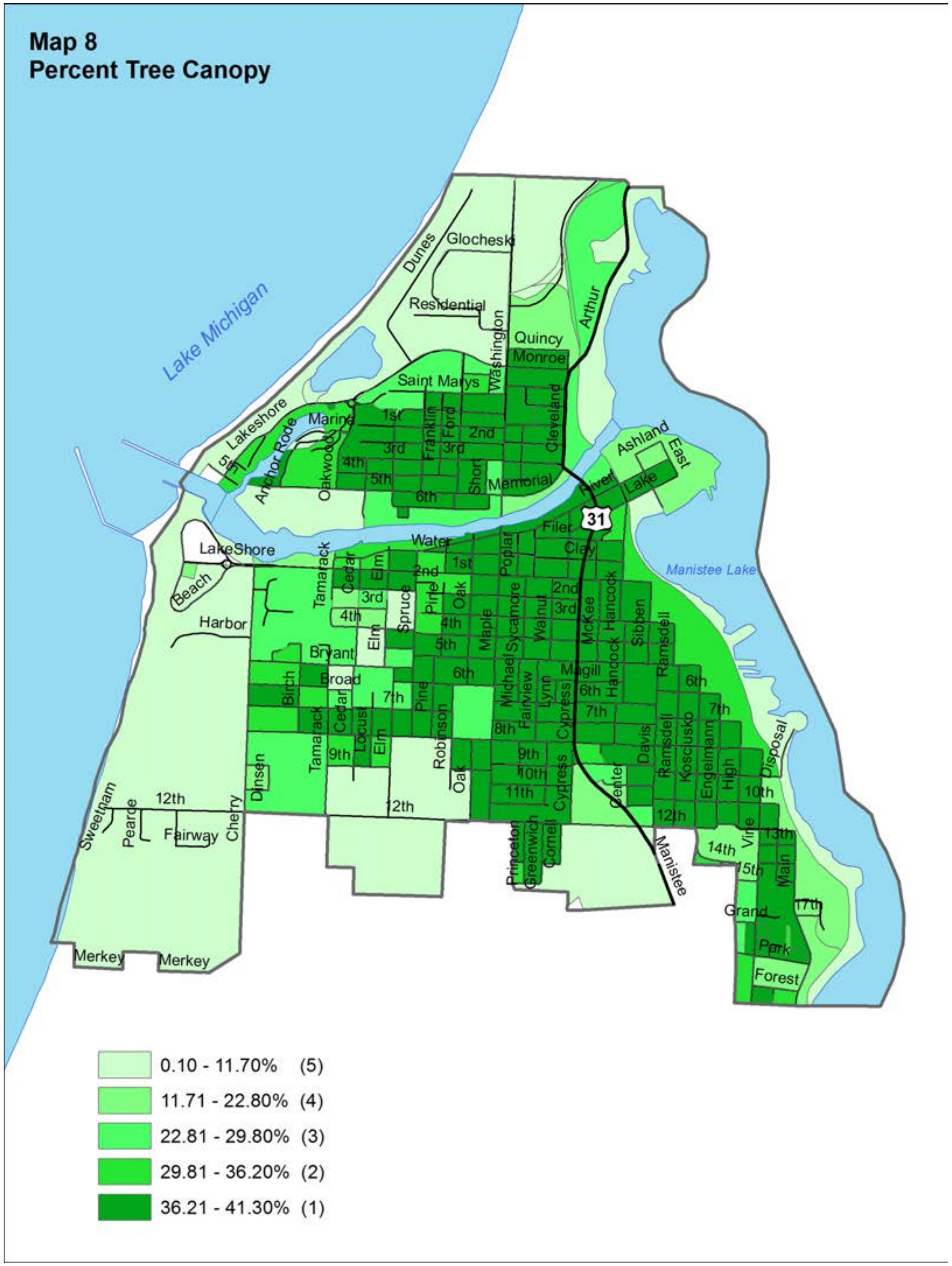

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Lake Michigan
Manistee Lake
10.91 - 16.40% (5)
6.21 - 10.90% (4)
4.71 - 6.20% (3)
2.91 - 4.70% (2)
2.70 - 2.90% (1)



Map 6
Relative Sensitivity of Population to Extreme Heat Events

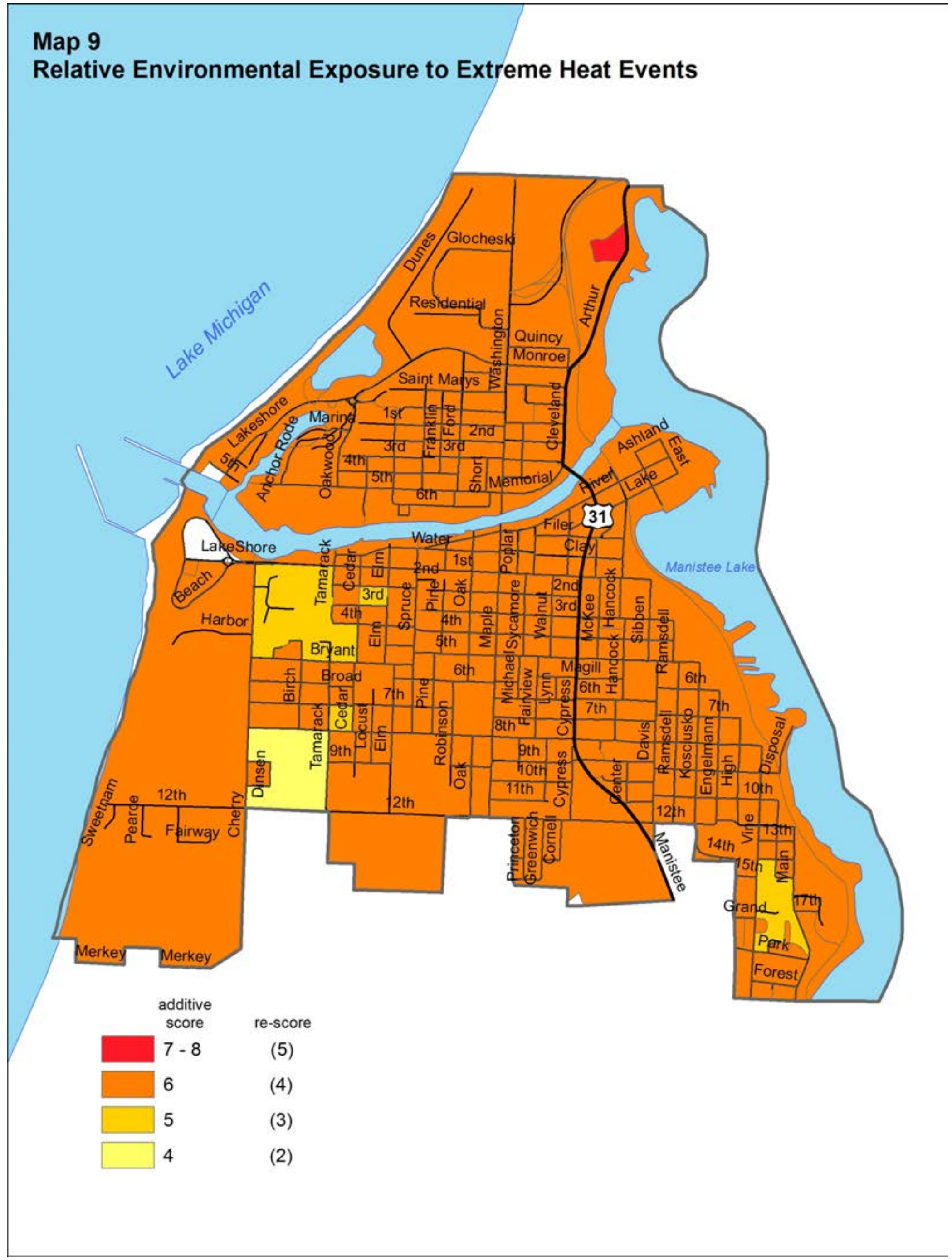

Manistee County

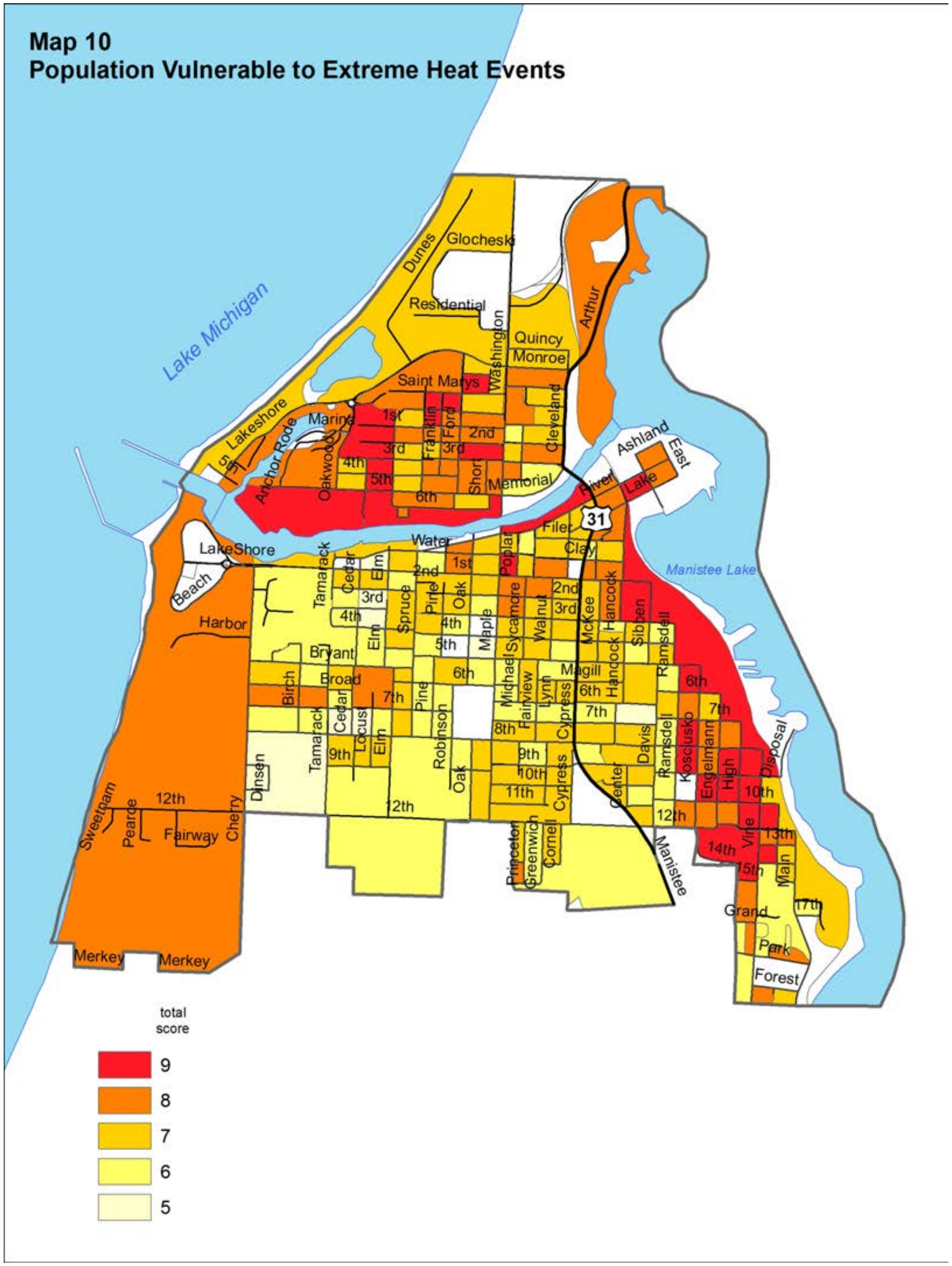

Map 7
Percent Impervious Surface Exposure
Lake Michigan
Manistee Lake
31
55 - 62% (5)
46 - 54% (4)
34 - 45% (3)
18 - 33% (2)
0.10 - 17% (1)


Map 8
Percent Tree Canopy
Lake Michigan
Manistee Lake
Glocheski
Dunes
Residential
Quincy
Monroe
Arthur
Saint Marys
Washington
Lakeshore
Marine
Anchor Rode
Oakwood
Cleveland
Ashland
East
Memorial
River
Lake
Filer
Water
Clay
LakeShore
Beach
Harbor
Bryant
Broad
Tamarack
Cedar
Spruce
Pine
Oak
Poplar
Maple
Sycamore
Walnut
McKee
Hancock
Sibben
Ramsdell
Magill
Michael
Fairview
Lynn
Cypress
Robinson
Locust
Birch
Elm
Dinsen
Sweetgum
Pearce
Fairway
Cherry
12th
Merkey
Princeton
Greenwich
Cornell
Center
Davis
Kosciusko
Engelmann
High
Disposal
Vine
Main
Manistee
Grand
Park
Forest
14th
15th
17th
0.10 - 11.70% (5)
11.71 - 22.80% (4)
22.81 - 29.80% (3)
29.81 - 36.20% (2)
36.21 - 41.30% (1)


Manistee County


Manistee County

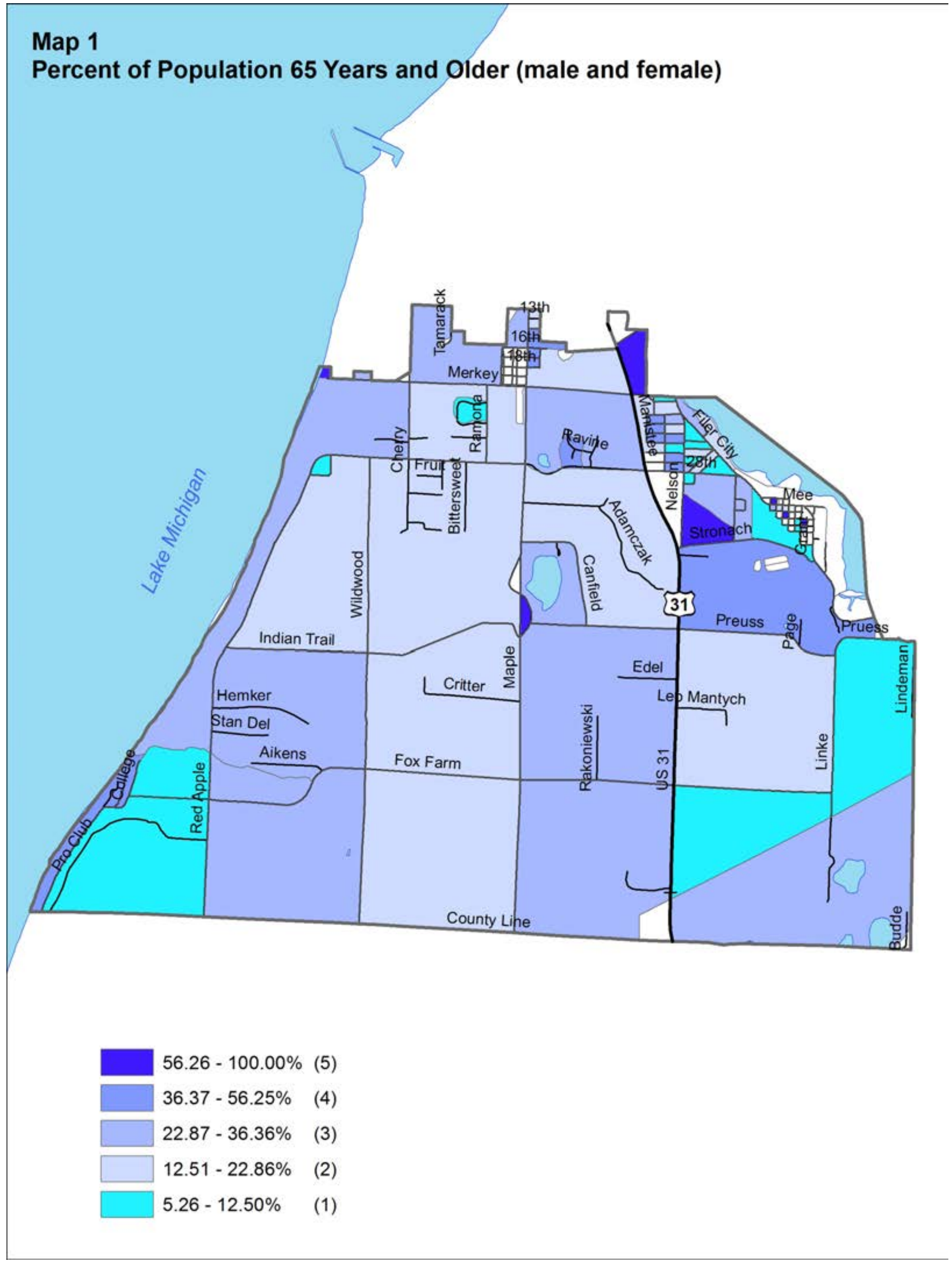

Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
Manistee Lake
additive score
re-score
7 - 8
(5)
6
(4)
5
(3)
4
(2)

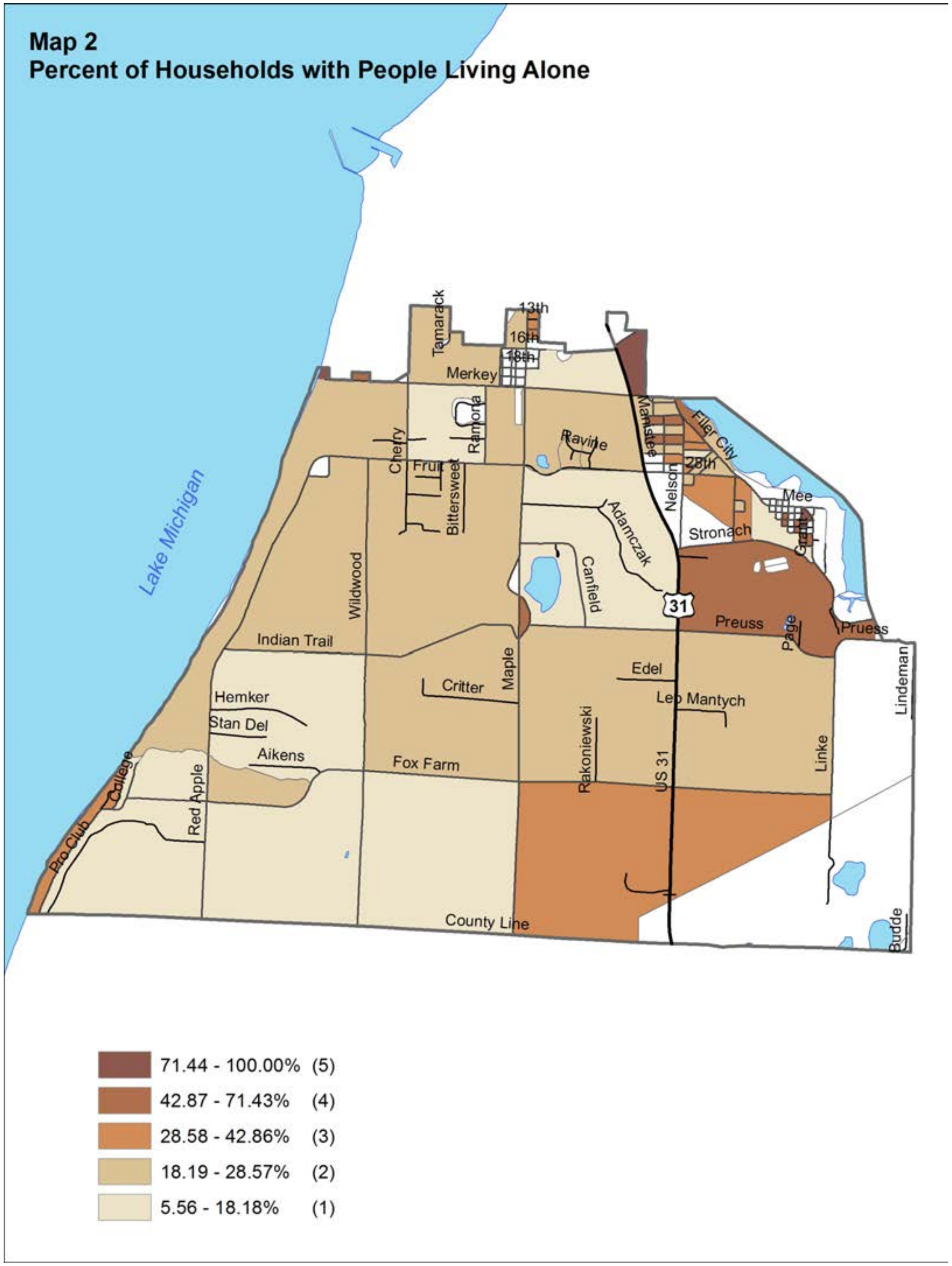

Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
Manistee Lake
31
total score
9
8
7
6
5


Manistee County

Filer Twp.

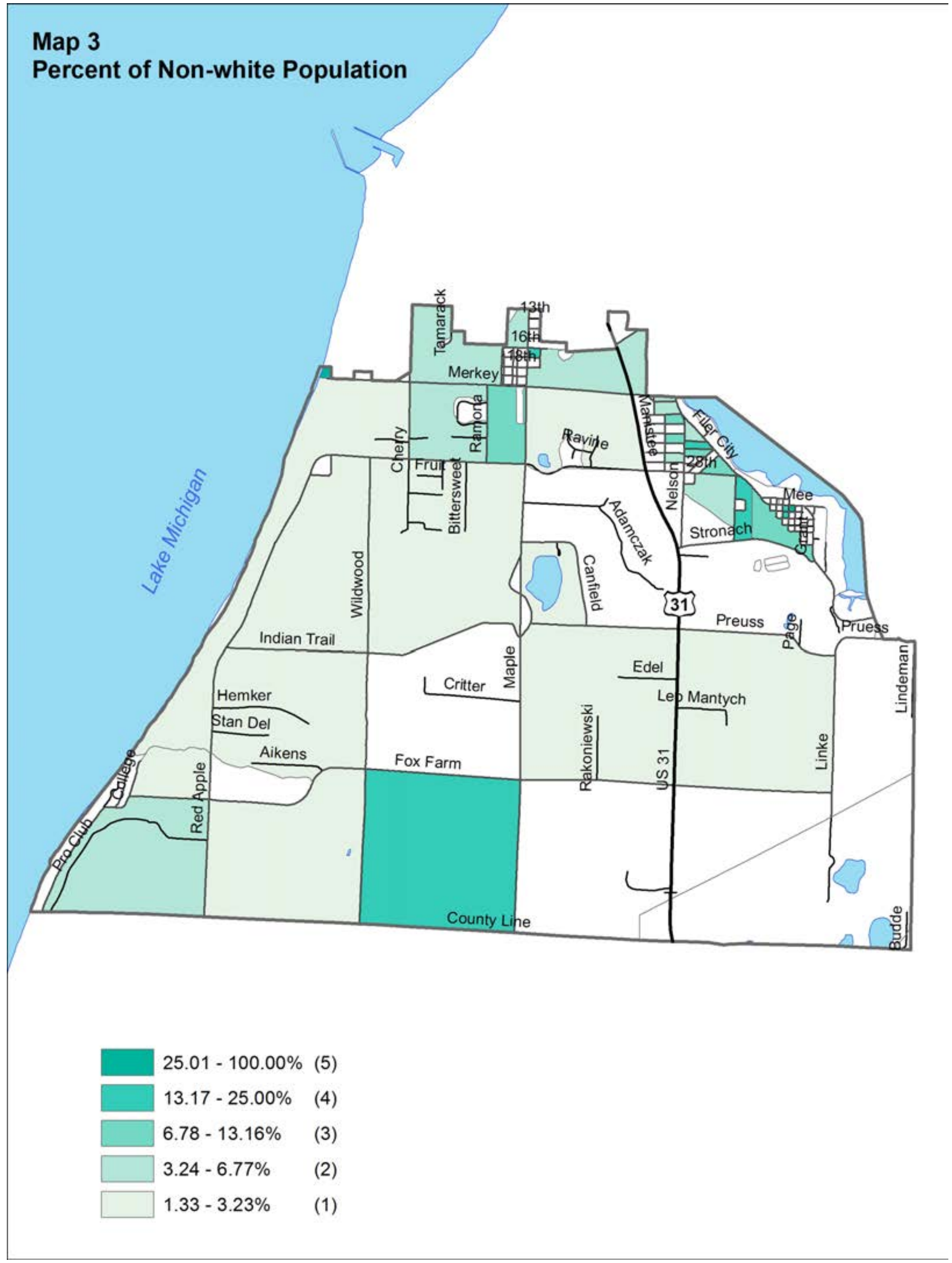

Manistee County

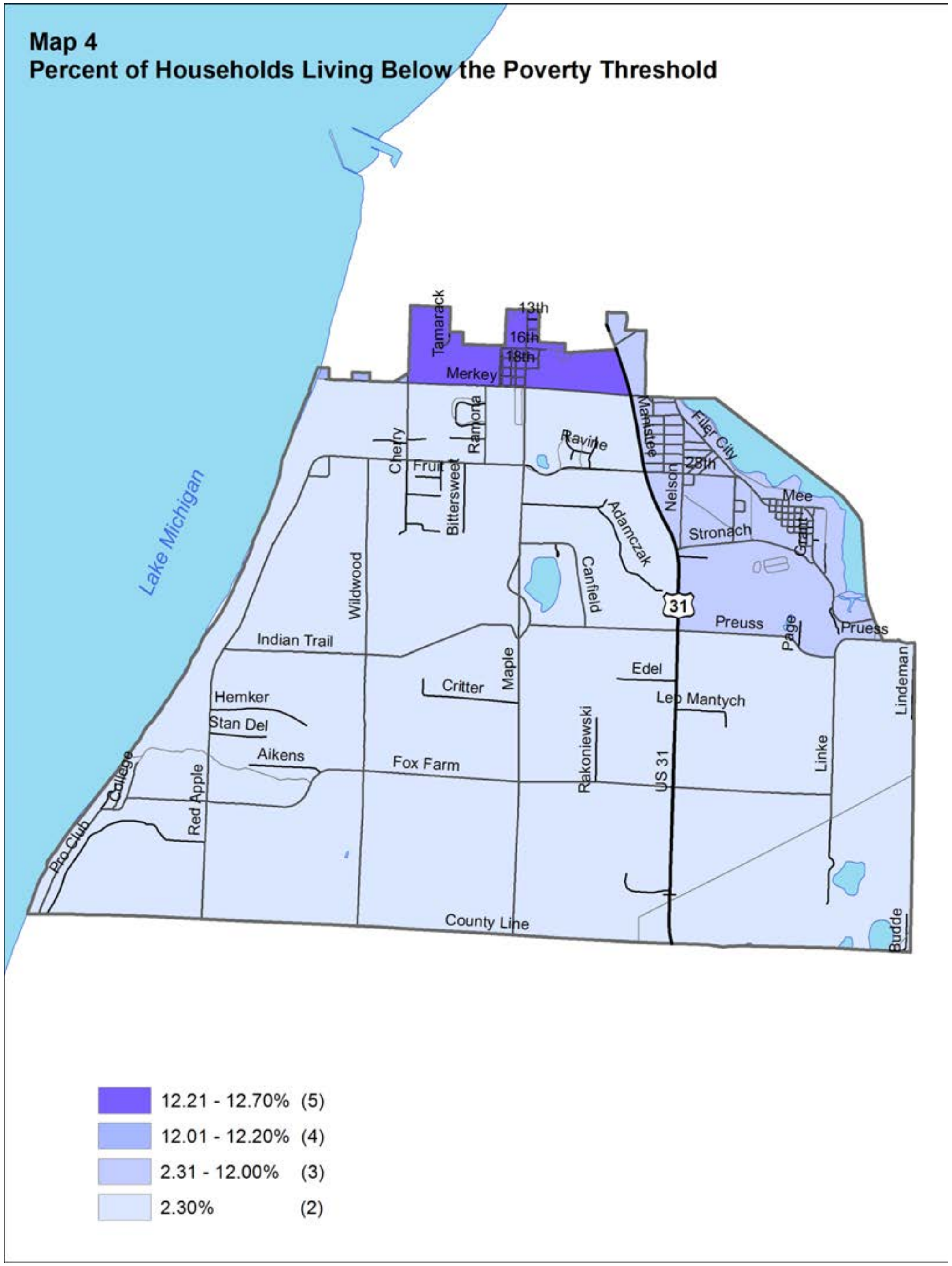

Map 1
Percent of Population 65 Years and Older (male and female)
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Cherry
Fruit
Bittersweet
Ramona
Ravine
Manistee
Filer City
28th
Nelson
Mee
Adamczak
Stronach
Canfield
Wildwood
Indian Trail
31
Preuss
Page
Pruess
Critter
Maple
Edel
Leo Mantych
Hemker
Stan Del
Aikens
Fox Farm
Rakoniewski
US 31
Linke
Lindeman
College
Pro Club
Red Apple
County Line
Budde
56.26 - 100.00% (5)
36.37 - 56.25% (4)
22.87 - 36.36% (3)
12.51 - 22.86% (2)
5.26 - 12.50% (1)


Map 2
Percent of Households with People Living Alone
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Cherry
Ramona
Fruit
Bittersweet
Ravine
Manistee
Filer City
28th
Nelson
Mee
Stronach
Adamczak
Canfield
Wildwood
Indian Trail
31
Preuss
Page
Pruess
Edel
Critter
Maple
Hemker
Stan Del
Aikens
Fox Farm
Leb Mantych
Rakoniewski
US 31
Linke
Lindeman
College
Red Apple
Pro Club
County Line
Budde
71.44 - 100.00% (5)
42.87 - 71.43% (4)
28.58 - 42.86% (3)
18.19 - 28.57% (2)
5.56 - 18.18% (1)


Manistee County

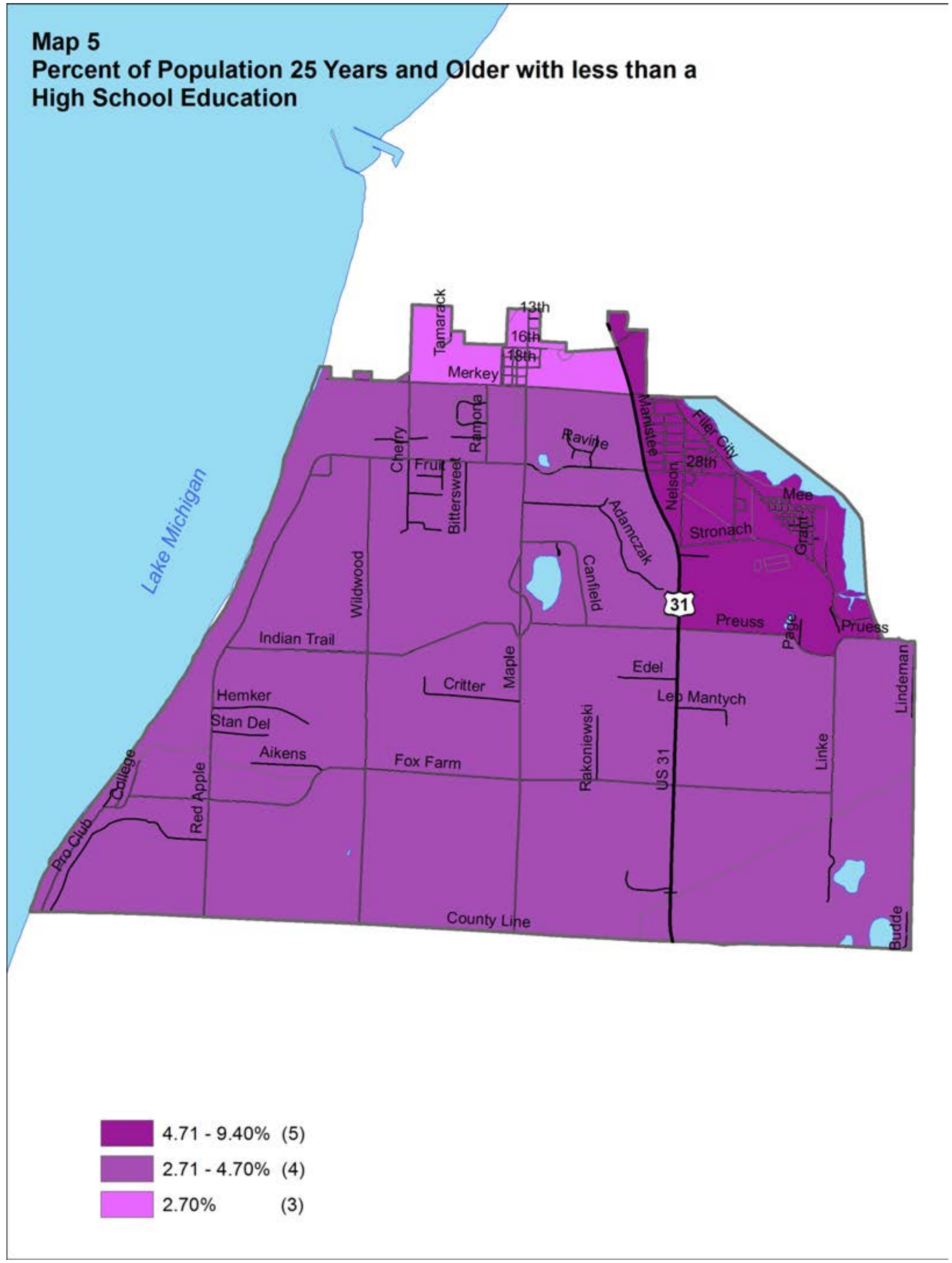

Manistee County

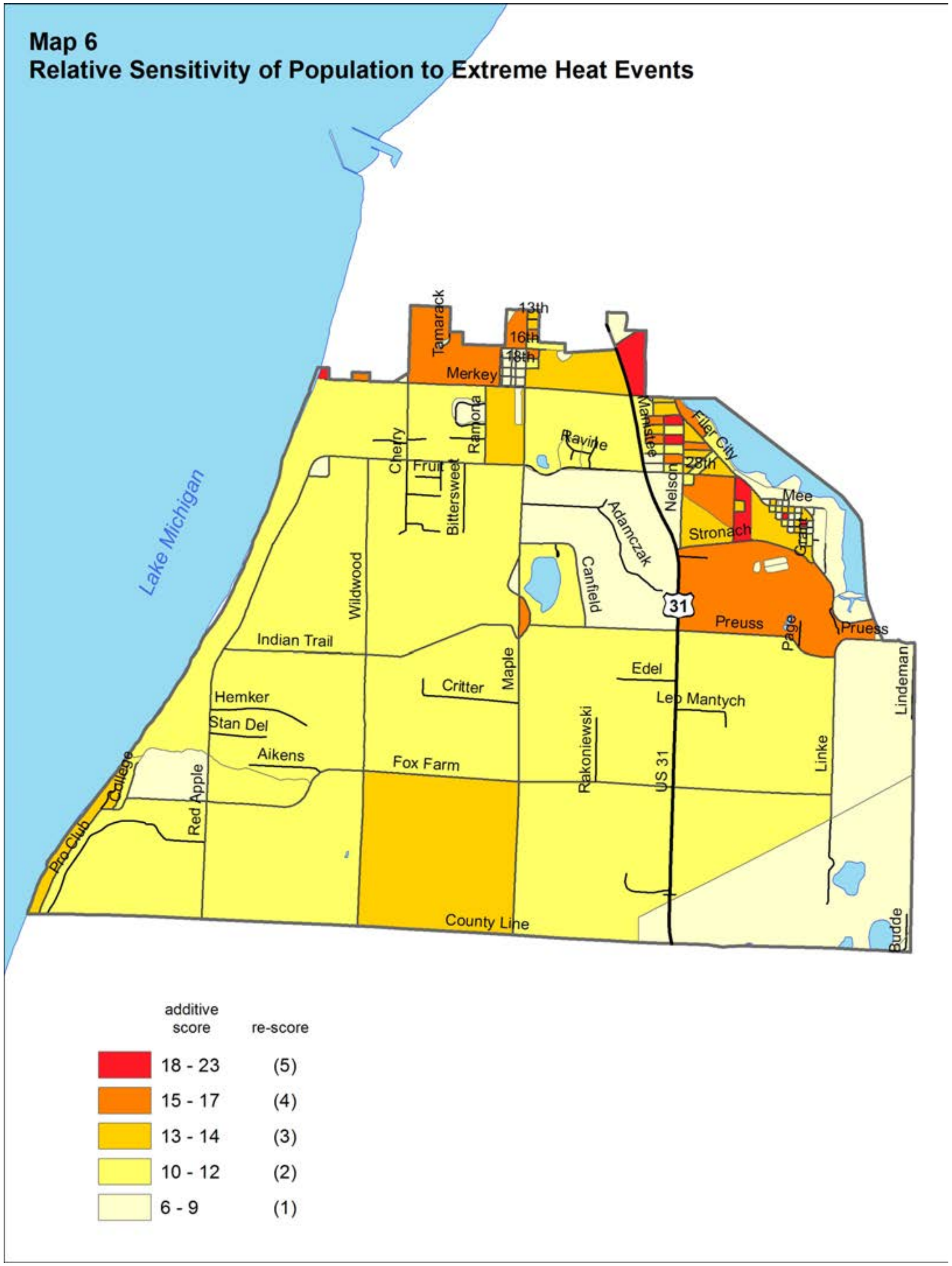

Map 3
Percent of Non-white Population
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Ramona
Ravine
Manistee
Filer City
28th
Nelson
Cherry
Bittersweet
Adamczak
Mee
Stronach
Grant
Canfield
Wildwood
31
Preuss
Pruess
Page
Indian Trail
Maple
Edel
Critter
Lee Mantych
Hemker
Stan Del
Aikens
Fox Farm
Rakoniewski
US 31
Linke
Lindeman
College
Red Apple
Pro Club
County Line
Budde
25.01 - 100.00% (5)
13.17 - 25.00% (4)
6.78 - 13.16% (3)
3.24 - 6.77% (2)
1.33 - 3.23% (1)


Map 4
Percent of Households Living Below the Poverty Threshold
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Ramona
Cherry
Fruit
Bittersweet
Ravine
Manistee
Filer City
28th
Nelson
Mee
Adamczak
Stronach
Grant
Canfield
Wildwood
31
Preuss
Page
Pruess
Indian Trail
Maple
Edel
Critter
Hemker
Stan Del
Lep Mantych
Lindeman
Aikens
Fox Farm
Rakoniewski
US 31
Linke
College
Red Apple
Pro Club
County Line
Budde
12.21 - 12.70% (5)
12.01 - 12.20% (4)
2.31 - 12.00% (3)
2.30% (2)


Manistee County

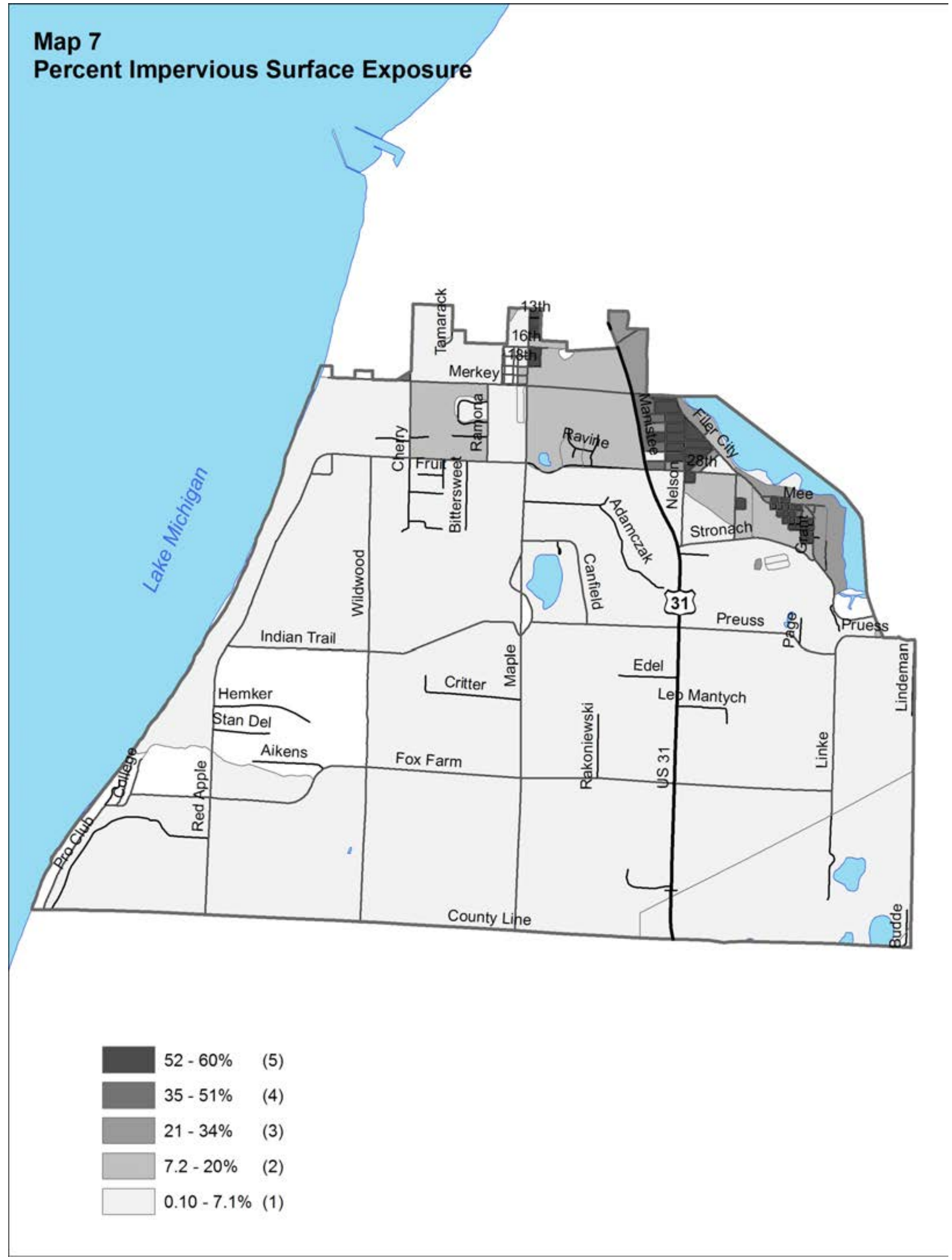

Manistee County

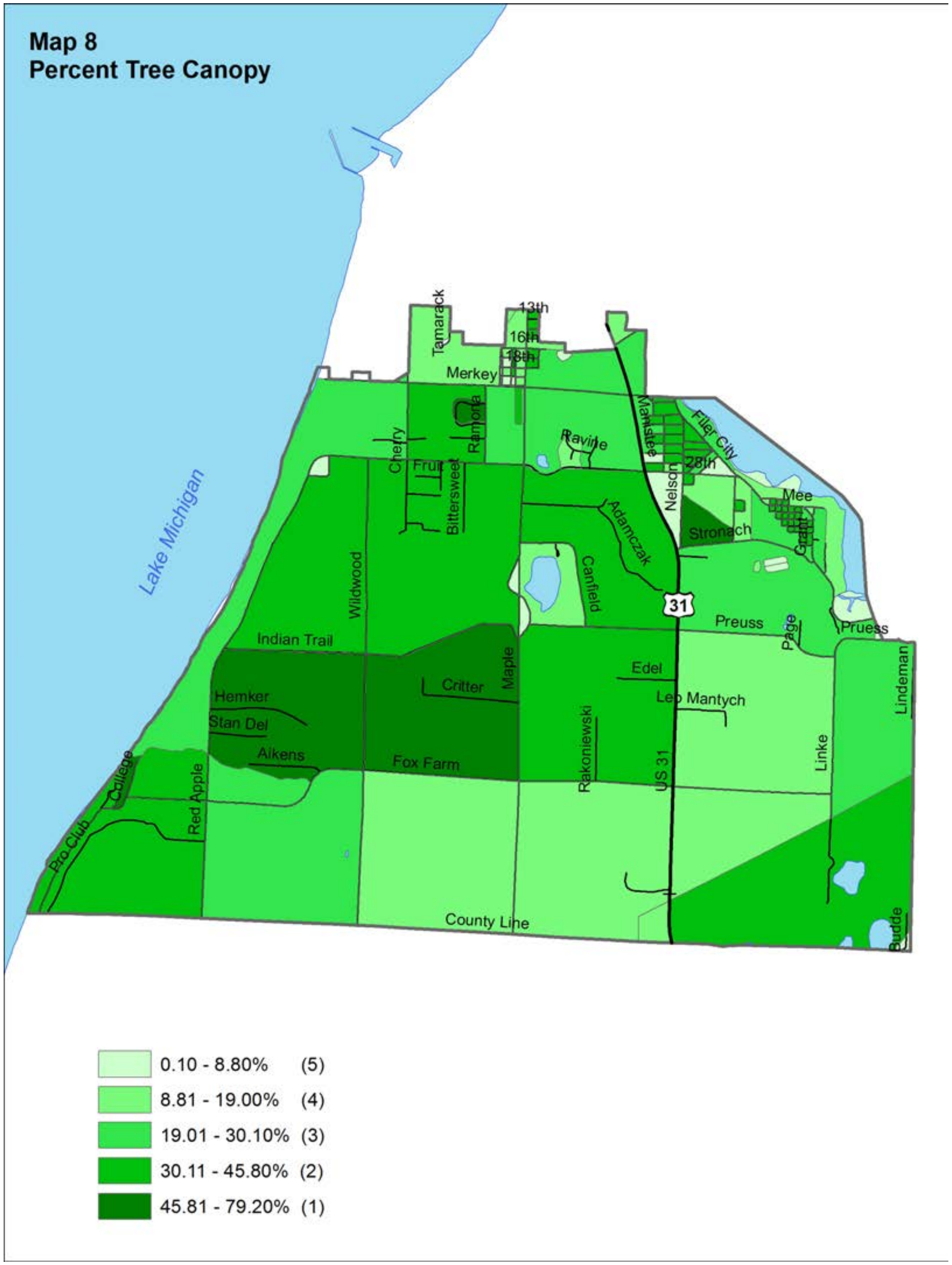

Map 5
Percent of Population 25 Years and Older with less than a High School Education
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Cherry
Ramona
Fruit
Bittersweet
Ravine
Manistee
Filer City
28th
Nelson
Mee
Stronach
Grant
Adamczak
Canfield
Wildwood
31
Preuss
Page
Pruess
Indian Trail
Maple
Critter
Edel
Leo Mantych
Lindeman
Hemker
Stan Del
Aikens
Fox Farm
Rakoniewski
US 31
Linke
College
Red Apple
Pro Club
County Line
Budde
4.71 - 9.40% (5)
2.71 - 4.70% (4)
2.70% (3)


Map 6
Relative Sensitivity of Population to Extreme Heat Events
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Ramona
Cherry
Fruit
Bittersweet
Ravine
Manistee
Filer City
28th
Nelson
Mee
Adamczak
Stronach
Grant
Canfield
31
Wildwood
Preuss
Page
Pruess
Indian Trail
Maple
Critter
Edel
Hemker
Stan Del
Leo
Mantych
Lindeman
Aikens
Fox Farm
Rakoniewski
US 31
Linke
College
Red Apple
Pro Club
County Line
Budde
additive score
re-score
18 - 23 (5)
15 - 17 (4)
13 - 14 (3)
10 - 12 (2)
6 - 9 (1)


Manistee County

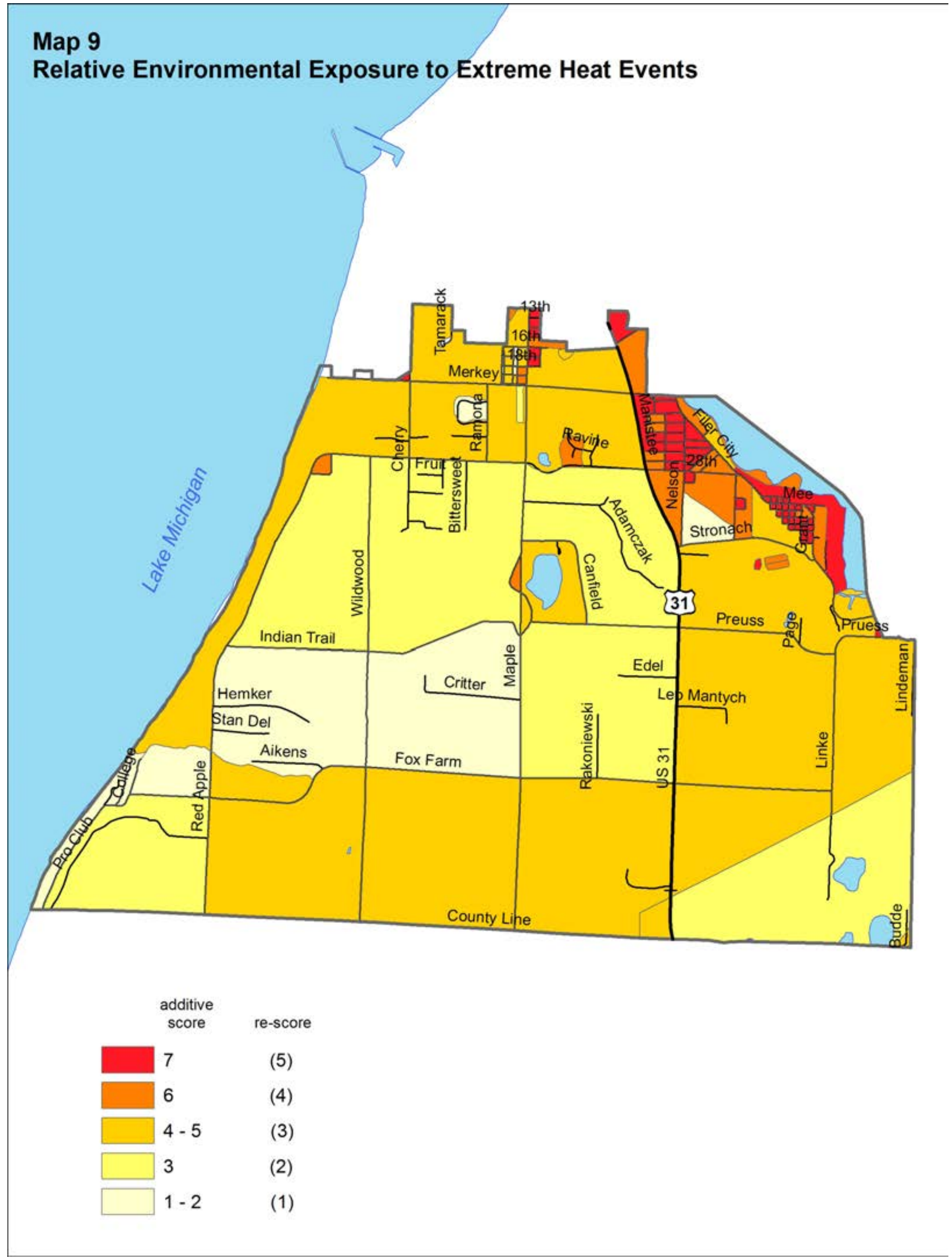

Manistee County

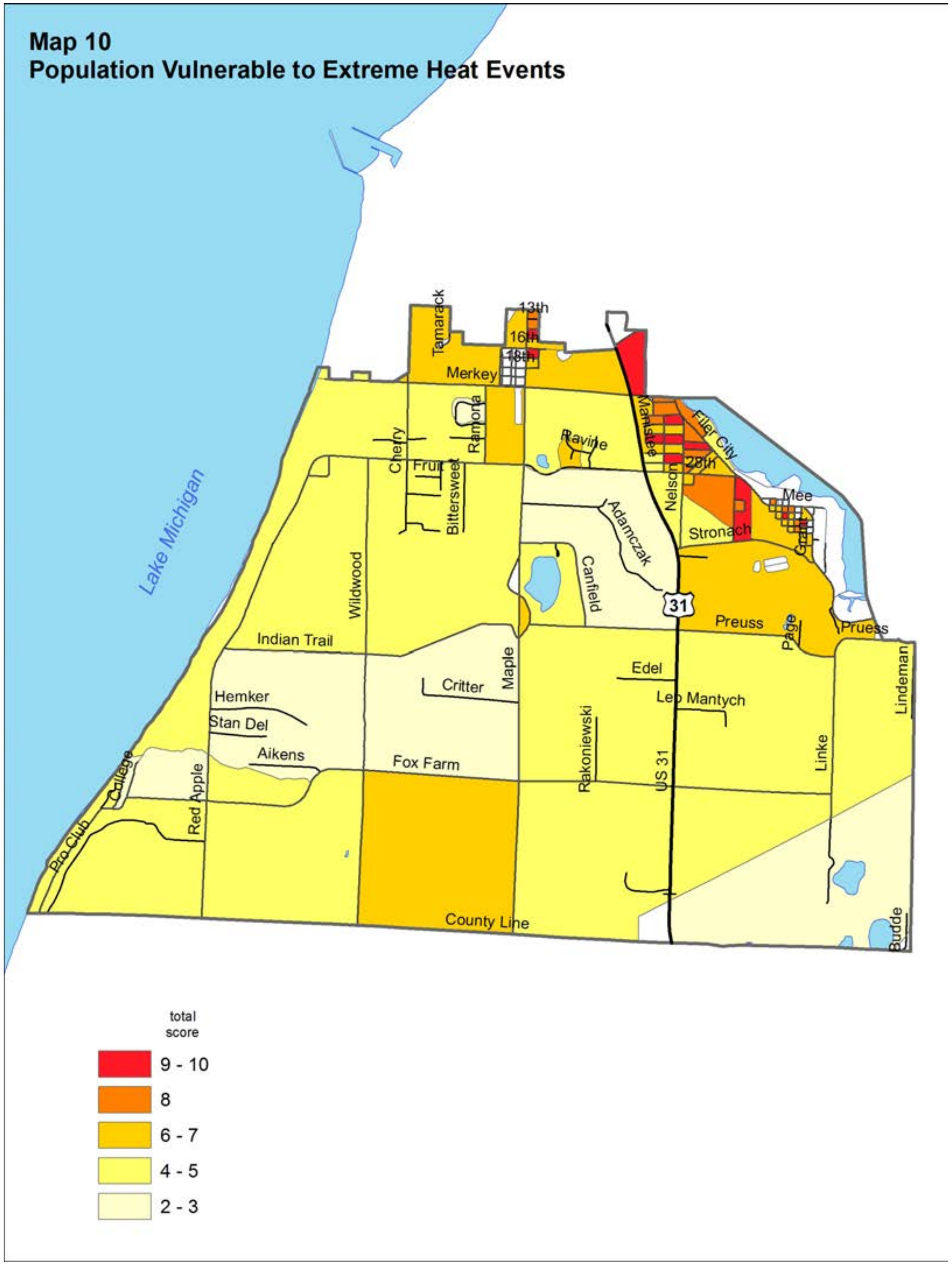

Map 7
Percent Impervious Surface Exposure
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Cherry
Ramona
Ravine
Manistee
Filer City
28th
Nelson
Mee
Bittersweet
Adamczak
Stronach
Canfield
Wildwood
31
Preuss
Page
Pruess
Indian Trail
Maple
Edel
Critter
Hemker
Stan Del
Leo Mantych
Lindeman
Aikens
Fox Farm
Rakoniewski
US 31
Linke
College
Red Apple
Pro Club
County Line
Budde
52 - 60% (5)
35 - 51% (4)
21 - 34% (3)
7.2 - 20% (2)
0.10 - 7.1% (1)



Map 8
Percent Tree Canopy


Manistee County


Map 9
Relative Environmental Exposure to Extreme Heat Events
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Ramona
Cherry
Fruit
Bittersweet
Ravine
Manistee
Filer City
28th
Nelson
Mee
Stronach
Adamczak
Canfield
Wildwood
31
Preuss
Pruess
Page
Indian Trail
Maple
Critter
Edel
Hemker
Stan Del
Leo Mantych
Aikens
Fox Farm
Rakoniewski
US 31
Linke
Lindeman
College
Red Apple
Pro Club
County Line
Budde
additive score
re-score
7 (5)
6 (4)
4 - 5 (3)
3 (2)
1 - 2 (1)


Map 10
Population Vulnerable to Extreme Heat Events
Lake Michigan
Tamarack
13th
16th
18th
Merkey
Ramona
Cherry
Fruit
Bittersweet
Ravine
Manistee
Filer City
Nelson
28th
Mee
Stronach
Grant
Adamczak
Canfield
31
Wildwood
Indian Trail
Preuss
Page
Pruess
Maple
Critter
Edel
Leo Mantych
Hemker
Stan Del
Aikens
Fox Farm
College
Red Apple
Pro Club
Rakoniewski
US 31
Linke
Lindeman
Budde
County Line
total score
9 - 10
8
6 - 7
4 - 5
2 - 3


Manistee County

CHAPTER 6

Local Zoning in Michigan for Great Lakes Coastal Shoreline Management: Initial Findings and Guidance

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Oday Salim, J.D., Environmental Law and Sustainability Clinic, School of Law, UM

Michael Friese, J.D., M.U.R.P. Candidate, Urban and Regional Planning Program, UM

Everett Secor, J.D. Candidate, School of Law, UM

July 31, 2019

With funding from the Michigan Coastal Zone Management Program,[1] researchers at the University of Michigan have conducted a preliminary review of zoning ordinance provisions that Great Lakes coastal localities might adopt to improve their management of Great Lakes shoreland areas, focusing on hazard mitigation. We conducted this review primarily in the Networks Northwest Region of the Lower Peninsula. This document presents some initial findings and guidance drawn from that preliminary work.[2]

Michigan's "inland seas" — the Great Lakes — are not large enough to be discernably tidal, but their standing water levels fluctuate substantially over the course of decades.[3] Especially during periods of high water, the lakes aggressively erode their shorelines, especially those comprised primarily of sands and gravels (i.e., much of them). Michigan experienced high lake levels on all of its Great Lakes from roughly the late 1940s through the late 1950s, from the late 1960s through the late 1980s (including the next-to-last recorded "all-time high" for all of the lakes, in 1986), and again for a shorter period during the mid 1990s. The lakes were then relatively low for an unusually long period of time, from the late 1990s through the early 2010s. They are now, as of this writing, at or above all-time high levels again.

Those same periods of high water corresponded roughly with governmental efforts both to address harms caused by shoreline

1 Financial assistance for this project was provided, in part, by the Michigan Coastal Zone Management Program, Department of Environment, Great Lakes, and Energy, and is supported through a grant under the National Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration

2 The statements, findings, conclusions and recommendation in this report are those of the authors and do not necessarily reflect the views of the Michigan Department of Environment, Great Lakes, and Energy and the National Oceanic and Atmospheric Administration.

3 For a more detailed discussion of Great Lakes water level and shoreline processes, see Richard K. Norton, Guy A. Meadows, and Lorelle A. Meadows. 2013. "The deceptively complicated 'elevation ordinary high water mark' and the problem with using it on a Great Lakes shore." *Journal of Great Lakes Research* 39(2013):527-535.

processes and to better conserve coastal resources, along with the emergence of a heightened environmental protection sensibility more broadly. Michigan passed the Great Lakes Submerged Lands Act in 1955,[4] for example, followed by the Shorelands Protection and Management Act in 1970.[5] Similarly, during the 1970s and 1980s — in the middle of an extended period of high water levels — the State of Michigan commissioned a number of reports and produced a number of guidance brochures, including legal analyses focusing on local zoning authorities and model zoning provisions.[6] Aside from additional information booklets and studies published in the late 1990s and early 2000s (i.e., at the end of the last extended period of high lake levels),[7] relatively little has been published on the state of shoreland management efforts, or providing guidance for improving local shoreland management, since.

Today, it makes little sense to present a single recommended model zoning ordinance, or even specific recommended model zoning provisions, because of the unique conditions that any given stretch of Great Lakes coastline enjoys, and given the wide array of approaches to zoning that Michigan communities already employ. Rather, we present some background information on enabling authorities; a summary of key shoreland management issues a coastal locality typically faces, along with corresponding regulatory goals it might adopt; a set of zoning options a locality might employ to advance one or more of those regulatory goals; and a set of questions and other considerations to account for in deciding how to proceed. Altogether, these materials provide a protocol a locality can use to tailor its development management program, including especially its local zoning regulations, to best manage its Great Lakes coastal shorelands so as to conserve Michigan's coastal resources while respecting coastal shoreland owners' private property rights.

For purposes here, we refer to the submerged land and dry beach immediately at the water's edge of a Great Lake as the "coastline" or "shoreline." We refer to the land area relatively close to a Great Lake that might be affected by coastal storms, bluff failures, erosional processes, or other related events within the foreseeable future as "coastal shorelands." Coastal shorelands include, for example, beaches, foredunes, dunes, bluffs, and near-lake riverine floodplains.[8]

AUTHORITIES

The primary purpose of this analysis is to address the management of Great Lakes coastal shorelands in terms of the public regulation of the use and development of privately owned shoreland areas, as well as public investment in infrastructure like roads, water, and sewer systems within those shoreland areas, for a variety of reasons noted below. Historically in Michigan, as with the rest of the U.S., most of the responsibility for managing coastal shorelands — especially those beyond the coastline itself — falls to the state and especially to local government.[9]

4 Public Act 247 of 1955, MCL 322.701 et seq. This act was subsequently amended several times (1958 PA 94, 1982 PA 68, 1982 PA 68, 1985 PA 180), and it has since been consolidated as part of the Natural Resources and Environmental Protection Act (NREPA) (1994 PA 451), Part 325, MCL 324.32501 *et seq.*.

5 Public Act 245 of 1970, MCL 281.631. This act has since been consolidated as part of NREPA, Part 323, MCL 324.32301 *et seq.*

6 See for example: Michigan Department of Natural Resources. No Date (but apparently produced in the early 1970s). *Erosion*. Lansing, MI: Water Development Services Division; Earnest F. Brater. No Date (but apparently produced in the late 1970s). *Beach Erosion in Michigan: An Historical Review*. Lansing, MI: Water Development Services Division, Michigan Department of Natural Resources; Jerry Mitchell. 1978. *Legal Analysis of Local Shoreland Ordinances* (Final Draft). Escanaba, MI: CUPPAD Regional Commission (prepared under contract from the Michigan Coastal Management Program, Department of Natural Resources).

7 See for example Philip Keilor. 2003. *Living on the Coast: Protecting Investments in Shore Property on the Great Lakes*. Madison, WI: University of Wisconsin Sea Grant Aquatic Sciences Center (prepared under contract from the U.S. Army Corp of Engineers, Detroit Division).

8 These definitions are consistent with, but more illustrative than, those provided by Part 323 (Shorelands Protection and Management) of NREPA: "(f) 'Shoreline' means that area of the shorelands where land and water meet'", and "(e) 'Shoreland' means the land, water, and land beneath the water that is in close proximity to the shoreline of a Great Lake or a connecting waterway" (MCL 324.32301).

9 For more information on Great Lakes coastal management issues generally, as well as findings from a study of current shoreland management efforts by Michigan's Great Lakes coastal localities specifically, see: Richard K. Norton, Nina P. David, Stephen Buckman, and Patricia D. Koman. 2018. "Overlooking the coast: Limited local planning for coastal area management along Michigan's Great Lakes." *Land Use Policy* 71(2018): 183-203.

The federal government plays a role in Great Lakes coastal management primarily through programs administered by the Federal Emergency Management Agency (FEMA, including most prominently the National Flood Insurance Program, NFIP), and through permits issued by the U.S. Army Corp of Engineers for the placement of structures within waters of the U.S.[10] The latter is sometimes referred to as the federal navigational servitude, and it is applicable lakeward of an elevation-based "ordinary high-water mark." In any case, while these programs are important where they apply, they are also limited in terms of the shorelands to which they apply — primarily at the shoreline or lakeward of it, or along riverine areas that are not necessarily coastal.[11]

The State of Michigan plays a more substantial role with regard to the management of development within Great Lakes coastal shoreland areas. It enjoys the authority to provide public services and to manage private land use through a combination of constitutional and common law doctrines.[12] Upon admission to the Union, the electors of the state recognized the inherent powers enjoyed by the state, along with limitations on those powers, in ratifying the Michigan Constitution.[13] Most notably for purposes here, those inherent powers include powers and duties emanating from the police power and the public trust doctrines.[14]

Through its inherent police power authorities, the state has the broad prerogative to adopt regulations and establish programs designed to protect public health, safety, morals, and the general welfare.[15] Through the public trust doctrine, the state owns the submerged lands of the Great Lakes. It also holds in trust for the people of the state an interest — for the purposes of navigation, fishing, commerce, and recreation — in the navigable waters, submerged lands, and shorelands of the lakes up to the "ordinary high-water mark."[16]

Drawing on those authorities, the State of Michigan has adopted several acts that speak directly to the regulation of Great Lakes shorelands, all of which are now codified in the Natural Resources and Environmental Protection Act (NREPA).[17] These include: floodplain protection (Part

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10 The Great Lakes are also an international water body, implicating international authorities that have some implications—albeit limited—regarding shoreland management. For a thorough discussion of legal doctrines as they relate to governance of the Great Lakes generally, see Noah D. Hall and Benjamin C. Houston. 2014. "Law and governance of the Great Lakes." *Depaul Law Review* 63(723): 723-770). For an overview of governance of Great Lakes shorelands in particular, see Richard K. Norton and Guy A. Meadows. 2014. "Land and water governance on the shores of the Laurentian Great Lakes." *Water International* 39(6): 901-920.

11 Through the NFIP, FEMA produces Flood Insurance Rate Maps (FIRMs) and it requires that localities participating in the NFIP adopt floodplain regulations to control development within designated flood areas. Great Lakes coastal localities participating in the NFIP, therefore, should have already adopted some minimal protections against hazardous flooding either through their zoning codes or stand-alone floodplain management ordinances. These protections apply to near-lake coastal shorelands along riverine systems as they drain into a drowned river mouth lake or delta (e.g., Pere Marquette Lake), or directly into a Great Lake. Unlike in ocean coastal settings, FEMA has not adopted maps showing coastal zones at risk from high-velocity or high-energy waves (often referred to as VE zones), although it is currently conducting a study and may adopt formal maps showing Great Lakes coastal VE zones in the future (see http://www.greatlakescoast.org/great-lakes-coastal-analysis-and-mapping/).

12 Article IV, Section 52 of the Michigan Constitution, for example, provides:

> The conservation and development of the natural resources of the state are hereby declared to be of paramount public concern in the interest of the health, safety and general welfare of the people. The legislature shall provide for the protection of the air, water and other natural resources of the state from pollution, impairment and destruction.

13 See John J. Rae, ed. 1999. *Local Government Law and Practice in Michigan*. Michigan Municipal League. § 1.2.

14 For a detailed analysis of the sources of the police power and public trust doctrines, and their applicability along Michigan's Great Lakes shorelands, see: Richard K. Norton and Nancy H. Welsh. 2019. "Reconciling police power prerogatives, public trust interests, and private property rights along Laurentian Great Lakes shores." *Michigan Journal of Environmental & Administrative Law* 8(2): 409-476. In addition to these sovereign powers, the state of Michigan may enjoy the 'property power'—the power to take actions to protect both public and private property. We are currently researching the contours and potential scope of that power for future presentation.

15 See, e.g., Clements v. McCabe, 210 Mich. 207 (1920). See also generally Gerald A. Fisher, *et al*. 2019. *Michigan Zoning, Planning, and Land Use* (January 2019 Update). Ann Arbor, MI: Institute of Continuing Legal Education (discussing planning and zoning authorities specifically in Michigan); Julian C. Juergensmeyer, *et al*. 2018 *Land Use Planning and Development Regulation Law* (4th Ed.). St. Paul, MN: Thompson West (discussing planning and zoning authorities broadly in the U.S.).

16 See, e.g., State v. Venice of America Land Co., 160 Mich. 680 (1910); Nedtweg v. Wallace, 237 Mich. 14 (1926); Glass v. Goeckel, 473 Mich. 667 (2005).

17 Public Act 451 of 1994, MCL 324.101 *et seq*.

31);[18] wetlands protection (Part 303);[19] shorelands protection and management (Part 323,[20] speaking specifically to state-designated "high risk erosion areas" (HREAs), "environmental areas" (EAs), and "flood risk areas" (FRAs)); submerged lands of the Great Lakes (Part 325);[21] and sand dune protection (Part 353,[22] speaking specifically to state-designated "critical dune areas" (CRAs)).[23]

In turn, through these acts, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) directly regulates the development and use of these specific state-designated Great Lakes shoreland areas, following administrative procedures that are detailed and extensive.[24] As with federal law, however, while those regulatory programs are important where they apply, they are also limited in terms of the Great Lakes shorelands to which they apply. The HREA and EA regulations, for example, each apply to only about 10 percent of the state's some 3,200 miles of linear shoreland area.[25]

Because the state's current shoreland management program is so limited spatially, and given the historical devolution of land management authorities from the state to local government, coastal localities play the primary role in managing the development and use of the state's coastal shorelands. This is true especially for shorelands not currently at risk from coastal storms but that could be at risk within a long-term planning horizon given Great Lakes shoreline dynamics, discussed more below.

The primary authorities that localities enjoy for managing land use are the authority to adopt zoning, guided by the authority to engage in community master planning. These authorities generally, and the authority to regulate through zoning in particular, is a specialized exercise of the police power.[26] The Michigan Supreme Court ruled early in the 20th century that localities do not enjoy the power to zone through their broad, delegated police power authorities, but that it must be delegated specifically to them by the state.[27] The Michigan legislature subsequently enabled all of Michigan's localities — villages, cities, townships, and counties — to undertake both community master planning and zoning through several separate enabling laws, which today have been consolidated in the Michigan Planning Enabling Act (MPEA)[28] and the Michigan Zoning Enabling Act (MZEA), respectively.[29]

It is important to note that the MZEA requires that a "zoning ordinance shall be based upon a plan designed to promote the public health, safety, and general welfare…."[30] Local planning engaged pursuant to the MPEA thus plays an important role both in satisfying this requirement and in ensuring that zoning provisions such as those discussed here are coherent, comprehensible, appropriately designed, and well-justified — all for the purposes of informing landowners looking to understand what they are allowed to do with their shoreland properties, zoning administrators as they administer the

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18 MCL 324.3108.

19 MCL 324.30301 *et seq.*

20 MCL 324.32301 *et seq.*

21 MCL 324.32501 *et seq.*

22 MCL 324.35301 *et seq.*

23 For a general overview of these and other state and local programs addressing land-use related environmental protection issues in Michigan, see Katherine A. Ardizone and Mark A. Wyckoff. 2010. *Filling the Gaps: Environmental Protection Options for Local Government* (2nd Ed.). Lansing, MI: Michigan Department of Environmental Quality, Coastal Zone Management Program.

24 See, for example, Administrative Rule sections R.281.21, *et seq.*, which address permitting requirements for development within HREAs, EAs, and FRAs.

25 For overviews of these programs and information regarding the spatial extents of them, see: https://www.michigan.gov/egle/0,9429,7-135-3313_3684_3725---,00.html (Floodplain Management, including the National Flood Insurance Program); https://www.michigan.gov/egle/0,9429,7-135-3313_3687---,00.html (wetlands protection); https://www.michigan.gov/egle/0,9429,7-135-3313_3677_3700---,00.html (Shorelands Management Program); https://www.michigan.gov/egle/0,9429,7-135-3313_3677_3702---,00.html (Submerged Lands Program); and https://www.michigan.gov/egle/0,9429,7-135-3311_4114-9832--,00.html (Critical Dunes Area Program).

26 See Gerald A. Fisher. 2019. "Chapter 1: Overview of zoning and planning." In, Gerald A. Fisher, *et al.*, *Michigan Zoning, Planning, and Land Use* (January 2019 Update). Ann Arbor, MI: Institute of Continuing Legal Education.

27 Clements v. McCabe, 210 Mich. 207 (1920).

28 Public Act 33 of 2008, MCL 125.3801, *et seq.*

29 Public Act 110 of 2006, MCL 125.3101, *et seq.*

30 MCL 125.3203.

local zoning code, and courts as they adjudicate disputes that may arise.[31] Nonetheless, the focus of the material presented here is on the process and provisions that localities might adopt for coastal shoreland management through their zoning ordinances, assuming that the need for and contours of those provisions have been called for and contemplated by the locality through its planning efforts.

Finally, note that the state provisions for the regulation of shorelands pursuant to floodplain risk areas, high risk erosion areas, environmental areas, and critical dune areas described above all allow localities to administer regulations adopted pursuant to those provisions, or specifically enable localities to adopt zoning regulations for those purposes with reference to the MZEA. In any of these cases, a locality zoning to manage its shorelands for any of those purposes must submit their ordinances to EGLE for review and approval. Even so, all of these provisions allow localities to adopt regulations more stringent than the minimum provisions established by state law, save for those addressing critical dune areas under Part 353, which has pre-empted local regulation more stringent than the provisions established by that part.[32] Accordingly, the zoning provisions presented here pertain to provisions that a locality might adopt to regulate its shorelands for the purposes of hazard mitigation and environmental conservation broadly, either in conjunction with the relevant state-established program or separate from it (or in addition to it), excluding the regulation of state-designated critical dune areas *per se*.

SHORELAND MANAGEMENT STUDY OVERVIEW

The need for improved local management of coastal shorelines given the dynamic nature of those shorelines — dynamics that are increasingly exacerbated by the effects of climate change — has been well established in the academic and practitioner literatures. This includes the need for improved local management of Great Lakes coastal shorelands.[33] In fact, the Great Lakes pose a unique challenge because of the effects of lake water level fluctuations over time, as noted above.[34]

Most importantly, while the lakes are not large enough to be discernably tidal, they fluctuate in vertical elevation substantially over the course of decades. As a result, when the lakes are low for extended periods, Great Lakes beaches may appear to accrete. As lake levels rise again, however, sandy beaches quickly erode away. Moreover, when lake levels are high for extended periods, the lakes erode their shorelines aggressively, especially along beaches characterized primarily by sands and gravels. Thus, much of Michigan's Great Lakes shorelines are experiencing long-term erosion rates of about one foot per year landward on average, but they experience that erosion in a "two-step-forward-one-step-back" progression as lake levels fluctuate. That phenomenon obscures the long-term erosion dynamic, and it makes the process of fixing relevant setback lines challenging, as discussed more below.

Given the authorities localities enjoy to manage Great Lakes shorelands, and given the unique challenges posed by Great Lakes dynamics, we conducted a web-based review of analyses and model zoning provisions that might inform local zoning efforts by Michigan's Great Lakes coastal localities. A selection of those materials is provided in the Appendix to this chapter. In addition, drawing from those provisions and the academic literature, we developed an evaluation protocol to assess local zoning ordinances with regard to their coastal shoreland management provisions; we collected local zoning ordinances within the Networks Northwest Region available on the web; and we evaluated a selection of them using that protocol (totaling 20 codes evaluated, including 12 townships, five cities, and three villages). Table 1 presents selected findings from that evaluation exercise. Finally, using that background literature review and code evaluation exercise, we developed the preliminary guidance materials presented here.

31 See Richard K. Norton. 2011. "Who decides, how and why? Planning for the judicial review of local legislative zoning decisions." The Urban Lawyer 43(4):1085-1105.

32 MCL 324.35312(2).

33 See, e.g., Richard K. Norton et al. 2018. "Overlooking the coast: Limited local planning for coastal area management along Michigan's Great Lakes." *Land Use Policy* 71(2018): 183-203.

34 See Richard K. Norton et al. 2013. "The deceptively complicated 'elevation ordinary high water mark' and the problem with using it on a Great Lakes shore." *Journal of Great Lakes Research* 39(2013):527-535.

Table 1. Results from evaluation of selected local zoning ordinances in the Networks Northwest Region.
(20 codes evaluated: 12 townships, 5 cities, and 3 villages)

PROVISION	NUMBER (PERCENT)
Special Great Lakes Shoreline Protection / High Hazard District	***5 (25%)***
Construction-related provisions (in general or within a GL District)	7 (35%)
Development limitations on or with regard to:	
Steep slopes	11 (55%)
Impervious surfaces / non-point source pollution	10 (50%)
Vegetation removal	10 (50%)
Septic systems	8 (40%)
Placement of armoring structures (e.g., seawalls)	5 (25%)
Structural protections for buildings (e.g., elevation)	3 (15%)
Setbacks from Great Lakes Coastline Specifically	14 (70%)
Setbacks tied to:	
Property line	2 (10%, 14% of those using setbacks)
Ordinary high-water mark	10 (50%, 70% using setbacks)
Process for siting OHWM provided	4 (20%, 29% using setbacks)
Natural feature other than OHWM (water's edge, wetland, bluffline)	5 (25%, 36% using setbacks)
Post-Storm Recovery / Response Performance Guarantee	0 (0%)

ZONING PROCESSES AND PROVISIONS FOR GREAT LAKES COASTAL SHORELAND MANAGEMENT

GENERAL PURPOSES FOR SHORELAND MANAGEMENT ZONING

Drawing from the sources noted, we identify five larger purposes for which a Great Lakes coastal community might adopt shoreland management provisions, including the following.

1. **Hazard mitigation.** Provisions designed to protect the following from storm-related flooding and high-energy wave damage:
   - Private shoreland and beaches, including
     - Uplands beyond the coastline but subject to inundation and high-energy waves

    - Private/public trust beach (i.e., publicly owned beach and privately owned beach subject to the public trust interest lakeward of the OHWM)
- Private and public structures within the shoreland area subject to inundation and waves
- State lake bed and beach shoreland as boundaries naturally shift over time, including
    - State submerged lands
    - Public trust/private beach

2. **Post-storm response and recovery.** Provisions designed to ensure that funds for post-storm response and recovery:

- Minimize the cost of response and recovery efforts
- Fairly allocate those costs incurred vis-à-vis the benefits of the developed land uses affected

3. **Resource conservation and pollution control.** Provisions designed to ensure the following:

- Safeguard the natural movement of the Great Lakes shoreline and beach over time
- Conserve coastal wetlands and other natural habitats
- Minimize water flows perpendicular to the shore or flowing from upland areas to the shore that might accelerate and/or otherwise alter natural erosion processes
- Minimize non-point source pollution, including
    - Runoff from impervious surfaces
    - Septic discharges

4. **Aesthetics / cultural preservation.** Provisions designed to ensure the following:

- Protect the visual setting along the shore, including sight lines perpendicular to the shore and the massing of structures along the shoreline
- Conservation of historic structures and other culturally important features

5. **Public access.** Provisions designed to ensure adequate access of the public to public trust beaches for the purposes of beach walking and other appropriate recreational activities.

OPTIONS FOR ZONING / LOCAL REGULATION (OVERVIEW)

To advance those general purposes or goals, Michigan's coastal communities face several fundamental options for adopting zoning codes, or amending their current codes, including the following, most of which are not exclusive.

1. **Do nothing** (i.e., with regard to zoning). Under this option, a community would:

    - Rely on beach nourishment (i.e., deposition of sediments onto beaches to maintain them), if source sediments are readily available (e.g., from nearby channel dredging projects);
    - Allow lake-bed armoring (i.e., lakeward of the OHWM) by private shoreland owners seeking to protect their properties (if permitted by the state and federal governments);
    - Allow shoreland armoring (i.e., landward of the OHWM) for the same; and/or
    - Allow (or experience) natural shoreline dynamics, and rely on private structural retreat where property owners make the decision to retreat individually.

2. **Address shoreland management through general provisions only** (i.e., not a Great Lake shoreland district specifically). Under this approach, a community might use or continue a variety of provisions applicable throughout most or all of the jurisdiction zoned, such as:

    - Protections for wetlands;
    - Controls on impervious surfaces to control water flow and nonpoint source pollution;
    - Controls on the development of steep slopes (or tops of bluffs) to diminish the risk of bluff failures; and/or
    - Generic setbacks from property lines (e.g., a standard but arbitrary 30-foot setback from the "rear" or lakefront lot line, not necessarily adjusted for shoreline movement).

3. **Adopt a coastal shoreland district or overlay zone with development management provisions.** Under this approach, the default would be to allow for development within the shorelands district, with standards imposed to address potential harms or protect coastal resources (such as those just described; see more discussion below). This approach might include the adoption of shoreline setbacks tied to natural features and/or dynamic shoreline movement.

4. **Adopt dynamic setbacks from Great Lakes shorelines.** Under this approach, the default would be to prohibit development of most structures (and/or permanent structures) lakeward of the setback, possibly with provisions for variances (see more discussion below). Setbacks might be adopted as free-standing provisions, or included as part of a coastal shoreland district or overlay zone.

5. **Impose post-storm response and recover bond (performance guarantee) requirements.** While not clearly enabled by the MZEA,[35] a growing number of communities in Michigan are requiring that developers of cell tower facilities and wind turbines post bonds or performance guarantees

35 Section 505(1) of the MZEA (MCL 125.3505(1)) authorizes the imposition of a performance guarantee to "ensure compliance with a zoning ordinance and any conditions imposed under a zoning ordinance," which is a broad provision, but the details of that section appear to contemplate primarily (perhaps only?) a bond intended to ensure the completion of improvements required during some construction or development-related project, with a date-certain timeframe, rather than an more open 'end of serviceable life' timeframe.

to ensure that those facilities are removed and the sites restored (or adequately and appropriately replaced) at the end of the service life of the facility. It may be possible for coastal communities to similarly require the posting of a response and recovery bond to be used if and when a structure becomes irreparably damaged by a coastal storm. That requirement might be imposed, for example, at the time the structure becomes a nonconforming use by virtue of a new or shifted setback. The purpose of the bond would be to ensure that the structure is adequately and safely removed once damaged, or if and when placed at unacceptable risk by a coastal storm or by long-term erosion, and that the cost of doing so is born by the property owner who benefited from the structure rather than the general public.

COASTAL DISTRICT / OVERLAY DISTRICT PROVISIONS

If a coastal community decides to adopt a special Great Lakes shoreland district, or an overlay district, the community should consider the following issues and provisions:

- The establishment of the **spatial boundaries** of the district. Approaches to doing so might include or be based on, for example:
  - A standard (but arbitrary) distance from the shoreline (e.g., 1000 feet)
  - A point based on an anticipated erosion distance (e.g., the 30 year, 60 year, or some longer erosion rate)
  - A point based on some other existing natural feature (e.g., dune field, some distance beyond the top of a bluff line)
  - A boundary based on potential inundation areas during extreme coastal storms (i.e., including storm surge and flooding)
  - Some combination of these approaches
- The establishment of **dynamic shoreline setbacks** (see below).
- The establishment of other restrictions and/or requirements related to the **development and use** of shorelands, such as:
  - Limits on lot splits, limits on the creation of sub-standard lots, and/or provisions for lot consolidation of substandard lots
  - The requirement that lakefront lots be "deep" (i.e., extending for some substantial distance away from the shoreline) to allow for the eventual movement of structures landward
  - Provisions addressing the placement of structures so as to limit potential for damage from structural projectiles during storms or ensure adequate access for post-storm recovery (e.g., limits on density or the proximity of structures to one another)
- The establishment of structural requirements so as to minimize **risks to structures** caused by storms or ongoing erosion, such as:
  - Requirements to anchor buildings and/or elevate them above the base flood elevation or a storm-surge elevation
  - Limitations on overall size, story, and/or building footprints
  - Requirements that all structures be (realistically) movable should erosion or other natural features threaten those structures, including requirements such as:
    - Use of a crawl space for access, but no basement

- Stud wall construction (not log, brick, stone)
- Single story construction
- Regular rectangular or square building footprints
- Limits on footprint size

- The establishment of provisions to ensure the conservation of **environmental conditions** like coastal habitats and water quality, such as:
  - Requirements for the maintenance of, or prohibitions on the removal of, native vegetation (and/or vegetation generally)
  - Requirements that small wetlands (i.e., those not addressed by state regulation, or augmenting those regulations) be protected and/or restored
  - Provisions requiring and/or incentivizing the use of landscaping (especially “living shoreline” landscaping) in lieu of hard armoring structures
  - Limits on the use and/or placement of septic systems
  - Requirements for the use of “green infrastructure” (e.g., swales, rain gardens) to control the infiltration of surface water runoff (promoting the natural filtration of surface waters, but attending to the potential deleterious effects of infiltration on bluff stability)

DYNAMIC SHORELINE SETBACKS

In addition to a special Great Lakes shoreland zoning district, or in conjunction with the establishment of such a district, a coastal community might consider the adoption of setbacks from the shoreline that are based upon the natural features and dynamics of that shoreline, and that are tied to the natural movement of that shoreline over time. In adopting such setbacks, the community should consider the following issues and provisions:

- The **specific and unique shoreland features** to be considered in establishing the setback, such as:
  - The height and slope of banks and/or bluffs, along with shoreline stability
  - The natural background erosion rate for the area or subareas
  - The presence of other existing natural features of concern (e.g., wetlands, dunes)
  - The lot sizes and dimensions of existing lots, especially those that have been developed
  - The amount and types of existing structural development, including shoreline armoring
- The appropriate shoreline feature(s) from which to **benchmark the setback,** such as:
  - Shoreland property lakeside boundary lines[36]

36 Note that even though shorefront properties are ‘movable freeholds,’ where the shoreline boundaries of those properties naturally move as the shoreline accretes and erodes over time (see Glass v. Goeckel, 473 Mich. 667 (2005)), the property line is not a good feature, and we do not recommend its use, for the purpose of benchmarking a naturally shifting setback because of potential confusion regarding the legal status of that boundary and because of the regular movement of it over shorter periods of time.

- The water's edge[37]
- A designated high-hazard boundary (e.g., a high-hazard line that could be estimated should a "perfect" coastal storm hit, accounting for high lake levels and storm surge)
- The "ordinary high water mark" (OHWM), which might be, for example,
    - Defined via the federal or state regulatory OHWM boundary and fixed by the state, or
    - Defined in the local ordinance itself and fixed by local officials or the petitioner following a prescribed analytical process
- An erosion hazard or shoreline recession line (e.g., the 30-year or 60-year erosion hazard or recession line, etc.)

ORDINANCE MECHANICS TO ADDRESS

In drafting these various provisions, the coastal locality should address a variety of considerations related to the mechanics of both developing the provisions and implementing them, such as the following:

- Providing a **statement of findings and intent** that both justifies and contextualizes the requirements;
- Clearly specifying **allowable uses,** accessory uses, prohibited uses, and so on, within the shoreline district and/or setback area;
- Clearly specifying **permitting requirements** (e.g., standards for site plan review, standards and procedures for special uses);
- Establishing special provisions for coastal districts and/or setbacks through the use of **planned unit development** (PUD), **special exception use** (SEU), or **conditional use** provisions;
- Clearly establishing appropriate conditions, types, and standards for the issuance of **variances** within coastal shoreland districts and/or setbacks;
- Addressing the creation, continuance, and removal of **nonconforming uses and structures** within coastal shoreland districts and setback areas, such as:
    - Allowing the rebuilding of structures damaged to whatever extent and however damaged, without altering use or structure dimensions, if site conditions allow; or
    - Allowing the rebuilding of structures damaged for non-coastal-dynamics reasons only (e.g., fire) if conditions allow, while requiring removal of a structure if damaged X% by coastal dynamics; or
    - Requiring removal of structures damaged X% by whatever cause
- Stating the intent to (and effectively providing notice of) **periodic review of setback lines** and/or coastal district boundaries, which may result in non-conforming status based on changes in natural conditions; and
- Linking the proposed zoning provisions to other state program requirements and local ordinances.

37 We similarly do not recommend the use of the water's edge as a setback benchmark for the same reasons noted, regardless of whether the water's edge serves as a property boundary or is lakeward of a platted property boundary.

QUESTIONS TO ASK IN DRAFTING THE ORDINANCE

Finally, in anticipation of drafting coastal shoreland management provisions, and during the process of doing so, local officials and citizens should continually reflect on a number of pivotal issues and decision-points that will shape the overall approach taken, such as the following.

1. What are the primary goals of the ordinance, especially where goals may conflict? Most pointedly, when natural processes are highly dynamic and both objectives cannot be served simultaneously, has the community decided to save the naturally functioning beach even at the expense of a beach structure, or has it decided to allow a shoreland property owner to save the beach house even at the expense of the naturally functioning beach?

2. What is the appropriate method to be used in drawing the boundaries of districts and/or benchmarking the boundaries for setbacks given the larger goals for which those provisions are being adopted? The code might employ, for example:

   - Textual definitions and references only (especially if relying on a state-established boundary);
   - Textual descriptions and fixed/mapped locations made within the ordinance itself (i.e., established and fixed by the community in the adopted ordinance); or
   - A textual description of the boundary conceptually and an analytical siting process for siting the boundary provided by the ordinance, with the analysis and actual siting conducted by local officials or by the petitioner on an as-needed basis.[38]

3. Similarly, given the characteristics of the shorelands at issue and the approach taken by the community through its existing code, does it make most sense for the community to adopt shoreland management provisions that are specific and fixed, providing increased certainty regarding potential uses and requiring little discretion on the part of the zoning administrator, but correspondingly providing less flexibility for shoreland property owners? Or, alternatively, does it make most sense to use an approach based on performance standards (e.g., via PUD provisions), providing more flexibility for the shoreland property owner but correspondingly raising the potential for inappropriate or unwieldly discretionary decision-making by local officials?

4. Does the code adequately and appropriately specify monitoring and administration responsibilities, and given that question along with review of the provisions themselves, is it credibly possible to adequately monitor and administer the new code provisions?

5. Is the code adequately and appropriately linked to, or at least not in conflict with, other local zoning, subdivision, and related regulatory provisions that apply to the development and use of coastal shorelands (e.g., building standards; requirements regarding the use, siting, maintenance, and/or removal of septic systems)? Is it similarly linked to and in compliance with applicable state regulatory programs (e.g., the HREA program)?

6. Finally, does the code clearly specify an appropriate and fixed period for reviewing the boundaries of a shoreland district and/or setback, and does it clearly state the implications of adjusting those boundaries (specifically, potentially converting a permitted structure to a nonconforming use/structure status)?

38 If the latter, the code should also specify whether the analysis must be conducted by some type of certified professional, be subject to site plan review, etc.

APPENDIX – LINKS TO SELECTED MODEL ORDINANCES

WETLANDS AND RIPARIAN BUFFERS:

- Wetland and riparian habitat stream buffer ordinance (ASWM): http://www.aswm.org/pdf_lib/model_ordinance_1209.pdf
- Shoreland zoning and wetland ordinance (Wisconsin): http://dnr.wi.gov/topic/ShorelandZoning/documents/NR117model.pdf
- Critical line buffer ordinances (SC Sea Grant): https://www.scdhec.gov/HomeAndEnvironment/Docs/CLBO_Manual.pdf
- Riparian buffer ordinance (HRWC): http://www.hrwc.org/wp-content/uploads/2009/11/HRWC_riparianbuffer_model_ordinance.pdf
- Aquatic buffer ordinance (no author): http://www.epa.gov/sites/production/files/2015-12/documents/2002_09_19_nps_ordinanceuments_buffer_model_ordinance1.pdf
- Riparian buffer (SWP): http://superiorwatersheds.org/images/riparianbufferreportnew.pdf

MAXIMUM % LOT COVERAGE (LIMITING IMPERVIOUS SURFACES):

- Impervious surface limits (WCCA): http://www.ncwrpc.org/county_ftp/NR115/Chapter2.pdf
- Reduce impervious cover (Providence WSB and NPS): http://www.dem.ri.gov/programs/bpoladm/suswshed/pdfs/imperv.pdf

GENERAL MODEL ORDINANCE INFORMATION:

- County shoreland zoning (Wisconsin): http://dnr.wi.gov/topic/ShorelandZoning/documents/NR115ModelOrdinance.pdf
- Various resources for local shoreland and floodplain zoning (Wisconsin): http://dnr.wi.gov/topic/ShorelandZoning/LocalGovResources/local.html
- Coastal and waterfront zoning (NOAA): http://coastalsmartgrowth.noaa.gov/elements/design.html
- Coastal community working waterfronts (MI Sea Grant): http://www.miseagrant.umich.edu/wp-content/blogs.dir/1/files/2013/08/13-720-Best-Practices-Working-Waterfronts-Case-Study.pdf
- Low impact development manual (MI SEMCOG): http://www.semcog.org/reports/lid/index.html#
- Various rural water quality resource protection materials (MSU): http://landpolicy.msu.edu/resources/rural_water_quality_protection_a_planning_zoning_guidebook_for_local_offici