RESTORING, RETROFITTING, AND RECOUPLING GREAT LAKES SHORELANDS

LOCAL PLANNING FOR RESILIENT GREAT LAKES COASTAL COMMUNITIES

METHODS MANUAL

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RESTORING, RETROFITTING, AND RECOUPLING GREAT LAKES SHORELANDS

SPONSORED BY
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4 Environmental Impacts

Introduction

The Great Lakes and their shorelands are one of the most unique and precious environmental features in the world. In fact, the Great Lakes basin contains more than 20% of the world's surface freshwater supply and supports a population of more than 30 million people.[1] That said, the nature of the shorelands vary not only within each state in the basin, but also from state to state. Furthermore, each state has a different way of regulating and managing the Lakes' shorelands. As a result, the climate futures and growth management options discussed in this manual will need to be evaluated differently for environmental impacts depending on the state and local regulations for your community.

This section focuses the natural shoreland features of Grand Haven and the regulations that are pertinent to Michigan. This chapter can serve as a guide for how to evaluate environmental impacts for your community.

Michigan is home to nearly 3,300 miles of Great Lakes shoreline, with 36,000 miles of rivers and streams, and 11,000 inland lakes.[2] Yet in general, riparian and littoral lands throughout Michigan are not adequately protected from development pressures.[3] Coastal communities especially have an important role to play in protecting the Great Lakes. In 2001, the Michigan Department of Environmental Quality (MDEQ) acknowledged "fragmentation of coastal habitats, loss of agricultural and forestlands, 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]

This chapter explains the benefits of Michigan's natural coastal features including wetlands and critical dunes, which are critical to mitigating flooding, providing natural habitats for numerous species, and serving as landmarks representing Michigan's unique natural heritage. However, these features are being threatened by natural processes, elevated by climate change and development pressures. This chapter details Michigan's regulations regarding these natural features and briefly discusses different methods to evaluate the impacts of different climate futures and growth management options on existing natural features. In order to effectively plan for coastal areas at the local level, it is critical that decision-makers have knowledge of both local conditions and state and federal regulations regarding these environmental features and understand how different scenarios could affect the natural landscape.

(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, Katherina 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.

(4) Ibid.

Background and Considerations

Federal: National Flood Insurance Program (NFIP)

Federal, state, and local policies play an important role in shaping land use and development along the shoreline. The Federal Emergency Management Agency's (FEMA's) National Flood Insurance Program (NFIP) is among these polices, as are Michigan policies to protect wetlands, High Risk Erosion Areas (HREAs), Critical Dune Areas, and the shoreline. Possible actions local governments can take to supplement state and federal regulations are outlined as well.

The NFIP is an optional program from which communities can receive flood insurance for disaster relief by agreeing to regulate development in the floodplain. The NFIP was created in 1968 under the National Flood Insurance Act. The NFIP is currently administered by FEMA and has four major goals:

- charge flood insurance premiums to private property owners, ensuring taxpayers do not bear the sole burden of private property flood losses;
- provide residents with aid after flooding;
- guide development away from hazard areas; and
- require building construction to minimize or prevent flood damage.

The floodplain must be locally regulated to qualify for the NFIP, but FEMA defines what land is considered eligible in a floodplain for the NFIP. Floodplains are mapped in either a Flood Hazard Boundary Map (FHBM) or, more commonly, a Flood Insurance Rate Map (FIRM).

FIRMs are created and released by FEMA. FIRMs are generated for various return periods, like the 50-year storm (2%), 100-year storm (1%), and 500-year storm (0.2%).[5] It is important to note that individual property owners can petition to change the flood zone designation for their property, so FIRMs may not be fully derived from scientific analysis.

In 1973, the Flood Disaster Protection Act was passed, which penalized communities that did not participate in the NFIP by limiting federal money to acquire floodplain property available to non-participating communities. This act also mandated that buildings in floodplains must have flood insurance coverage in order to receive any federal financing, loans, or disaster relief.[6]

(5) FEMA (2013). Great Lakes Coastal Flood Hazard Studies. Web. Accessed July 2015.

(6) FEMA (2005). Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials. Web. Accessed July 2015.

A participating community has a number of responsibilities to remain compliant with NFIP regulations. These include monitoring floodplain development and building permits, inspecting development, maintaining records, revising and assisting in floodplain mapping, and providing information to the local public about the requirements of the program. Once a community's FEMA region releases updated FIRMs, a community has a period to review and appeal the drafted map. After that point, the community has six months to adopt the new FIRM through an ordinance.[7]

(7) FEMA. https://www.fema.gov/media-library/assets/documents/26319

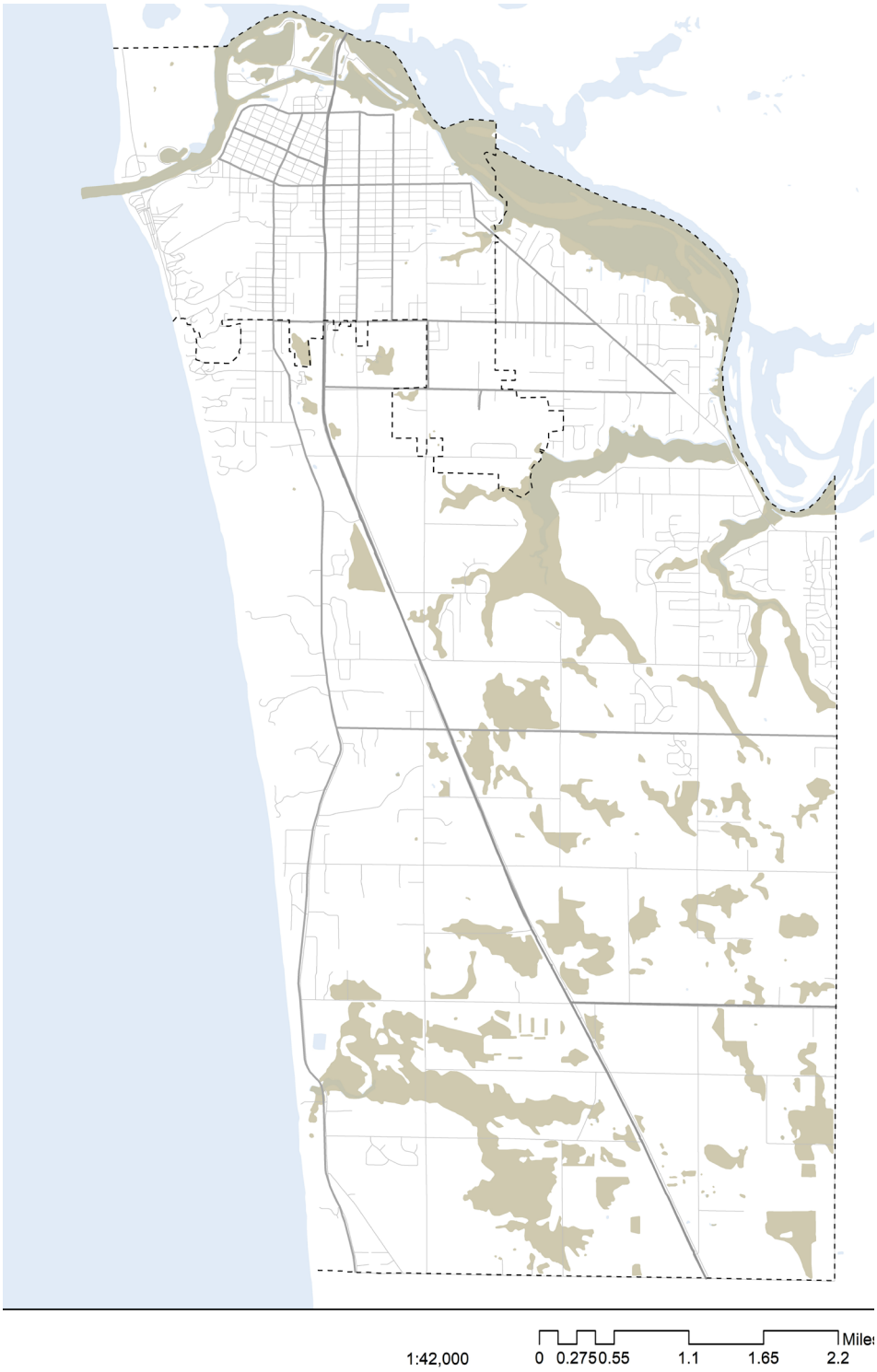

Figure 5. Grand Haven wetlands

Wetlands

Wetlands help reduce flood damage by absorbing flood water and then slowly releasing it. One acre of the typical wetland is able to absorb one million gallons of water, protect adjacent and downstream land from damage, and slow the speed of flooding across an area.[8] The storage capacity of a specific wetland varies by its size, slope, type of vegetation, location relative to the flooding path, and water levels in the wetland prior to flooding. Coastal wetlands also alleviate the severity of erosion along a shoreline during a storm. Perhaps more than any other environmental asset, wetlands buffer the coast by absorbing high energy waves and disrupting the flow of currents.[9]

(8) Environmental Protection Agency (2001). Functions and Values of Wetlands: Wetland Fact Sheet. Web. Accessed July 2015.

(9) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.

The Clean Water Act of 1972 mandated that permits be granted for development on regulated wetlands. This federal act gives the United States Army Corps of Engineers (USACE) the authority to grant permits to build on regulated wetlands, with the Environmental Protection Agency (EPA) having the authority to veto permits issued to all wetlands. MDEQ is the co-administrator of the permitting process, sharing joint regulatory powers with the Army Corps of Engineers. Michigan was the first state, and is one of only two states, to assume a role in the permitting process for wetlands.[10] Here, MDEQ issues a permit to build on wetlands if the applicant meets qualifications. Permitting decisions are subject to public comment, including those made by local governments. A property owner must obtain a permit from the State of Michigan before building on a regulated wetland.

A wetland is regulated if it

- is connected to or within 1000 feet of a Great Lake shoreline,
- is connected to or within 500 feet of an inland lake, pond, or river,
- is equal to or greater than 5 acres in size, or
- is essential to the preservation of the state's natural resources, as designated by the MDEQ.[11]

Local governments in Michigan can protect additional wetlands not regulated by the state. Under Michigan's Natural Resources and Environmental Protection Act (NREPA), local governments can require that wetlands less than 5 acres in size be regulated by a permitting process.[12] A local government must possess an inventory of existing wetlands to adopt a wetland ordinance. The MDEQ must be notified of a local wetland ordinance, though the State does not need to review or approve.[13] Local governments can also protect wetlands through site plan review provisions and zoning ordinances.[14] Under the Michigan Zoning Enabling Act, protecting the natural environment is a justification for zoning requirements like buffers and other tools.[15] Site plan review provisions in the zoning ordinance can require that wetland permits be obtained from the MDEQ as a condition of local zoning approval.[16]

(10) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.

(11) NREPA PA 451 of 1994, Part 303

(12) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.

(13) NREPA, Michigan Public Act 303, 324.30307

(14) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.

(15) NREPA, Michigan Public Act 303, 324.30307

(16) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. Michigan Department of Environmental Quality, Coastal Zone Management Program with financial assistance from the National Oceanic and Atmospheric Administration, authorized by the Coastal Zone Management Act of 1972. 2010.

Michigan has coastal, forested, and shrub wetlands, each inundated with water either all or part of the year.[17] The function and diversity of wetlands was misunderstood as European settlement began, and many wetlands were dredged, drained, and converted to serve industry and agriculture.[18] Today, less than half of the state's wetlands remain, and in a time of changing climate, the need to conserve and restore wetlands is paramount.[19]

Furthermore, wetlands face a number of challenges related to climate variability:

- Rising water levels will actually increase the number of naturally occurring wetlands on low-lying uplands. However, wetlands cannot expand where structures like bulkheads, dikes, and other structures block their advance.[20]
- As precipitation and storminess increase, runoff water and draining can increase sedimentation and nutrient input in wetlands. This can lead to algae blooms and invasive species.[21]
- Consistent high water levels endanger vegetation and animals that depend on the naturally fluctuating water levels in wetlands.

(17) Michigan Department of Environmental Quality. Wetlands Protection: Protecting Michigan's Wetlands. Web. Accessed July 2015.

(18) NREPA PA 451 of 1994, Part 303

(19) LIAA (2014). Climate Change Adaptation & Local Planning for Michigan's Coastal Wetland Resources. Web. Accessed July 2015.

(20) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.

(21 NREPA, Michigan Public Act 303, 324.30307

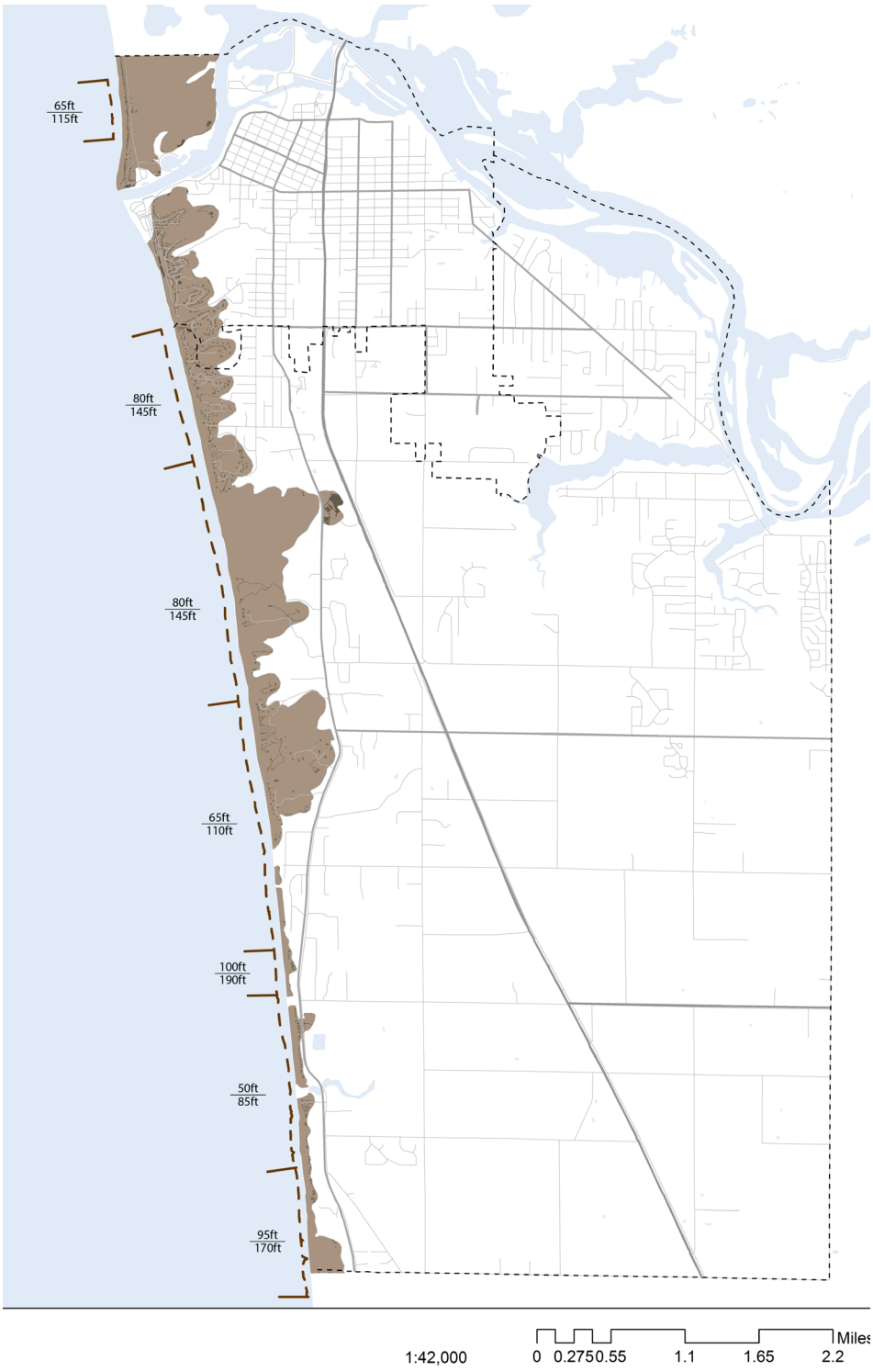

Figure 6. Grand Haven High Risk Erosion Areas (indicated by dashed line on coast)

High Risk Erosion Areas

The State of Michigan regulates development in what it designates as High Risk Erosion Areas (HREAs). The authority for this regulation comes from the Shoreline Protection and Management Act.[22] To identify HREAs, MDEQ compares new and historic imagery to designate areas of coastline that have eroded by more than 1 foot per year. The MDEQ then uses erosion rates to calculate setbacks from the "erosion hazard line," or generally, the line of stable vegetation. These setbacks, based on the projected eroding shoreline, are calculated 30 and 60 years into the future. Usually, new structures must be built landward of the erosion hazard line, but the regulations regarding those structures depend on whether the structure is readily moveable. While some small permanent structures may be permitted within the 30-year setback, all new structures must be built landward of the erosion hazard line.

The purpose of this regulation is to prevent costly clean up, mitigation, and hazards to residents, while keeping insurance costs down. Preventing construction in HREAs also protects the Great Lakes from pollutants from structure debris and septic fields.[23]

(22) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition.

Michigan Department of Environmental Quality, Coastal Zone Management Program with financial assistance from the National Oceanic and Atmospheric Administration, authorized by the Coastal Zone Management Act of 1972. 2010.

(23) Ibid.

The MDEQ is in the process of updating HREAs in some areas of Michigan.[24] Local governments can assume MDEQ's permitting responsibilities for HREAs through an ordinance. To do so, the ordinance cannot be less restrictive than the State's regulations and the MDEQ must approve the ordinance. A local government can adopt an ordinance requiring greater and more uniform setbacks in HREAs than the MDEQ.[25] Other actions can be taken through a local zoning ordinance, including performance standards for soil and vegetation, clustering development away from vulnerable erosion areas, and instituting site plan review processes for any development in HREAs.[26]

(24) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. Michigan Department of Environmental Quality, Coastal Zone Management Program with financial assistance from the National Oceanic and Atmospheric Administration, authorized by the Coastal Zone Management Act of 1972. 2010.

(25) NREPA, 1994 Michigan PA 451, Part 323.

(26) Michigan Department of Environmental Quality. High Risk Erosion Areas: Program and Maps. Web. Accessed July 2015.

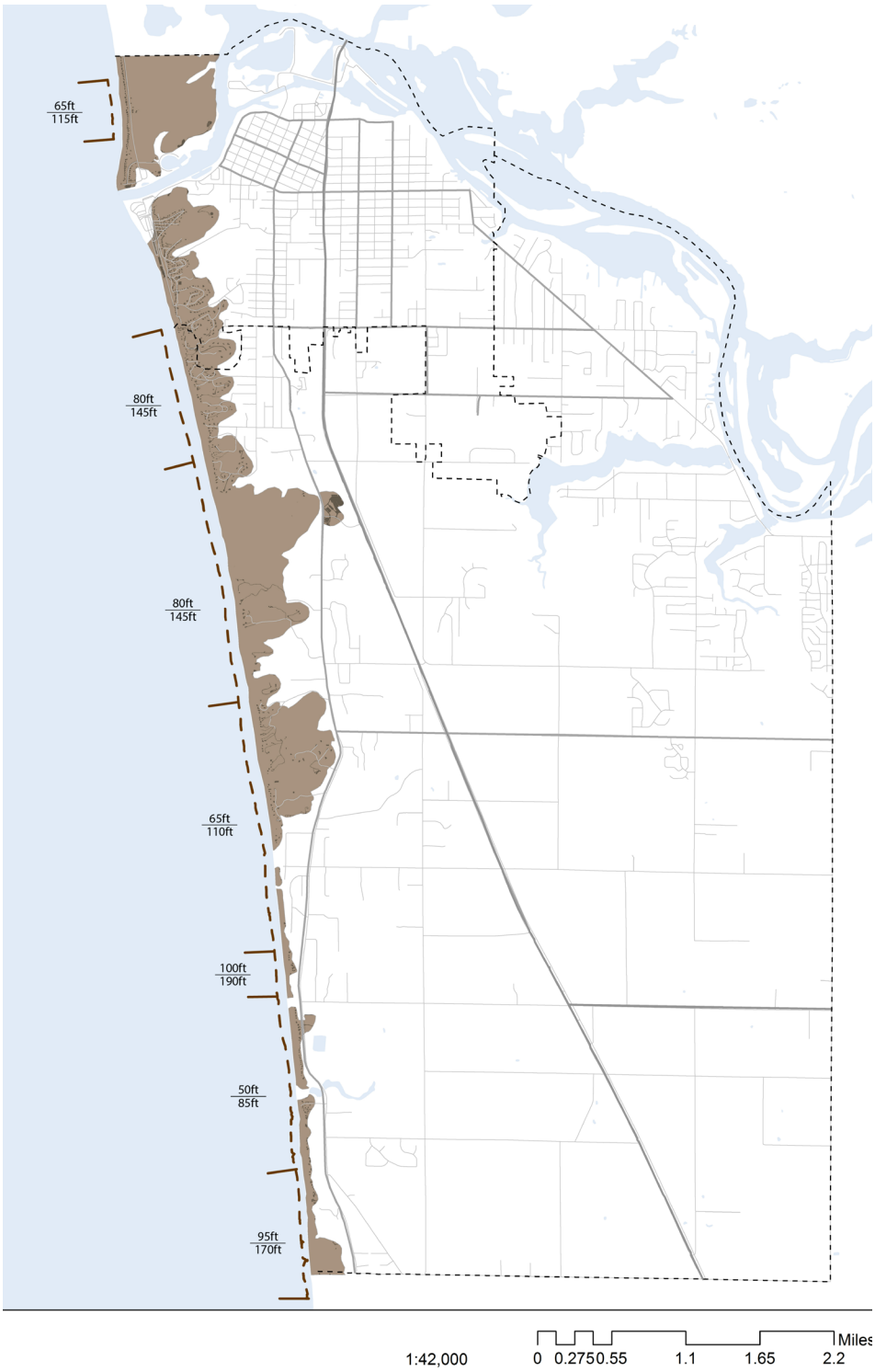

Figure 7. Grand Haven critical dunes

Critical Dunes

Michigan's dunes are one of the most striking environmental features in the nation. Together, they represent the largest freshwater dune ecosystem in the world. The dunes provide unique habitats for rare and endangered species and hold priceless environmental and recreation value. Michigan's Sand Dune Protection and Management Act calls for the protection of Critical Dune Areas (CDAs) through state regulation. MDEQ determines whether a dune is designated a Critical Dune Area.(27) Under the statute, a property owner must receive a permit for any activity that alters the appearance or contour of a Critical Dune.

Generally, CDA regulation states development:

- should not occur lakeward of the crest of the dune
- should plan for soil erosion and water runoff
- should not alter the elevation or slope of the dune

(27) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.

In 2012, Governor Snyder signed Public Act 297. This Act updates the Critical Dune regulation in several ways, which all make acquiring permits to build on the dunes easier. The amendment clarifies that MDEQ cannot deny a permit solely because "public interest" would be violated by the proposed development. It also limits who is able to challenge a permit to just property owners and those living nearby. The Act no longer requires an analysis of alternative placements for buildings and requires the MDEQ to issue permits for driveways and other paved pathways to permanent structures in a CDA. Additionally, the Act now permits building on the lakeward-facing slope of the first foredune.[28]

Local opportunity under the updated Sand Dune Protection and Management Act is limited. While Part 353 allows the local government to assume the permitting process for CDAs, local governments can no longer be more restrictive than the State. As a result, adopting the permitting power of the State through the Sand Dune Protection and Management Act will not increase regulation on Critical Dune Areas. A local government can do much more to protect the dunes through zoning ordinances and other planning efforts. Only 30% of the State's dunes are considered Critical Dune Areas and are subject to state regulation, unless wetlands, High Risk Erosion Areas, or other environmental areas are located on the property.[29] Local government administration of the permitting process has been met with mixed results, especially in areas with small coastal lot sizes, where the requirements of Part 353 may trigger a regulatory takings claim.

(28) Ardizone, Katherina A. and Mark A. Wyckoff, FAICP. Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition. 2010.

(29) Ibid.

Water Mark Lines

In addition to the above regulatory powers, there are also three water marks used by different entities to regulate activities along the shoreline.

First, the United States Army Corps of Engineers (USACE) uses a high water mark line (called the Ordinary High Water Mark or OHWM) to determine the extent of navigational waters they regulate. For example, Lake Michigan's boundary is set based on a 581.5-foot water level above sea level.(30) Second, the MDEQ regulates development below a separately determined water line. This is sometimes referred to as the Elevation Ordinary High Water Mark Line (or EOHWM). This water line is elevation-based and for Lake Michigan is determined using a 580.5-foot water level above sea level line.(31)

There is only a one-foot difference on Lake Michigan between the water level used to determine the regulatory authority of the USACE and the MDEQ. There is also a difference between the water mark lines on the other Great Lakes, but it varies. Because of this, the two bodies co-administer a joint permitting process for activities taking place below either water mark line. These include dredging, placing seawalls or rock revetment, or building of permanent docks.(32)

Lastly, the State of Michigan uses a water mark line sometimes referred to as the Natural Ordinary High Water Mark (or NOHWM) to determine the extent of the public trust with regard to access along the shore. The NOHWM comes from the 2005 Michigan Supreme Court case Glass v. Goeckel, which found that the public has a valid right to walk below the NOHWM, defined as the point where natural vegetation begins or evidence of past high water levels exist.(33) This case also determined the NOWHM line is not equal to, or dependent on, the State's regulatory power defined by the Elevation Ordinary High Water Mark.

(30) http://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Links/Ordinary-High-Water-Mark-and-Low-Water-Datum/. Use this website to access the different OHWMs set by the USACE for the other Great Lakes.

(31) http://www.michigan.gov/deq/0,4561,7-135-3313_3677_3702-352662--,00.html. Use this website to access the different EOHWMs set by the MDEQ for the other Great Lakes.

(32) http://www.michigan.gov/deq/0,4561,7-135-3313_71520_24403---,00.html. The details of that joint permitting process can be found at this website.

(33) Glass v. Goeckel. Michigan Supreme Court. 29 July 2009

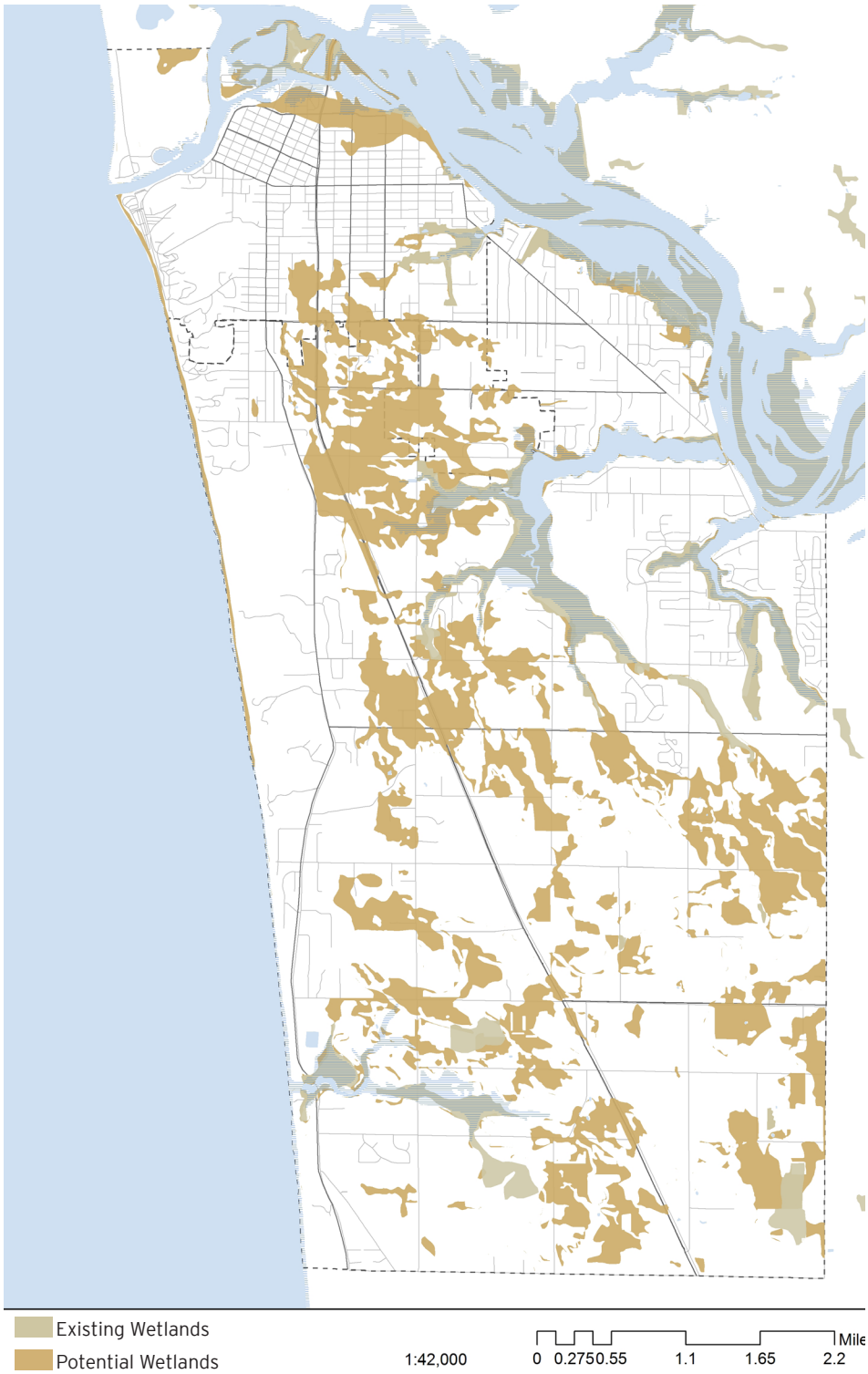

Figure 8. Grand Haven's existing and potential restored wetlands in relationship to the Lucky climate future.

Methods

Wetlands

Wetlands are an important tool for community resilience, particularly for benefits related to flood control and water quality. In our study, GIS was used to compare existing wetlands to areas of potential wetland restoration in each climate future to give the community a broader picture of areas that could best provide the flood-control benefits of wetlands. Additionally, unprotected wetlands (i.e., under 5 acres in size) were counted using GIS. It is important that this analysis is an overall, generalizable study useful to compare one scenario to another. It should not be used to identify individual wetlands or areas of private property suitable to wetland restoration.

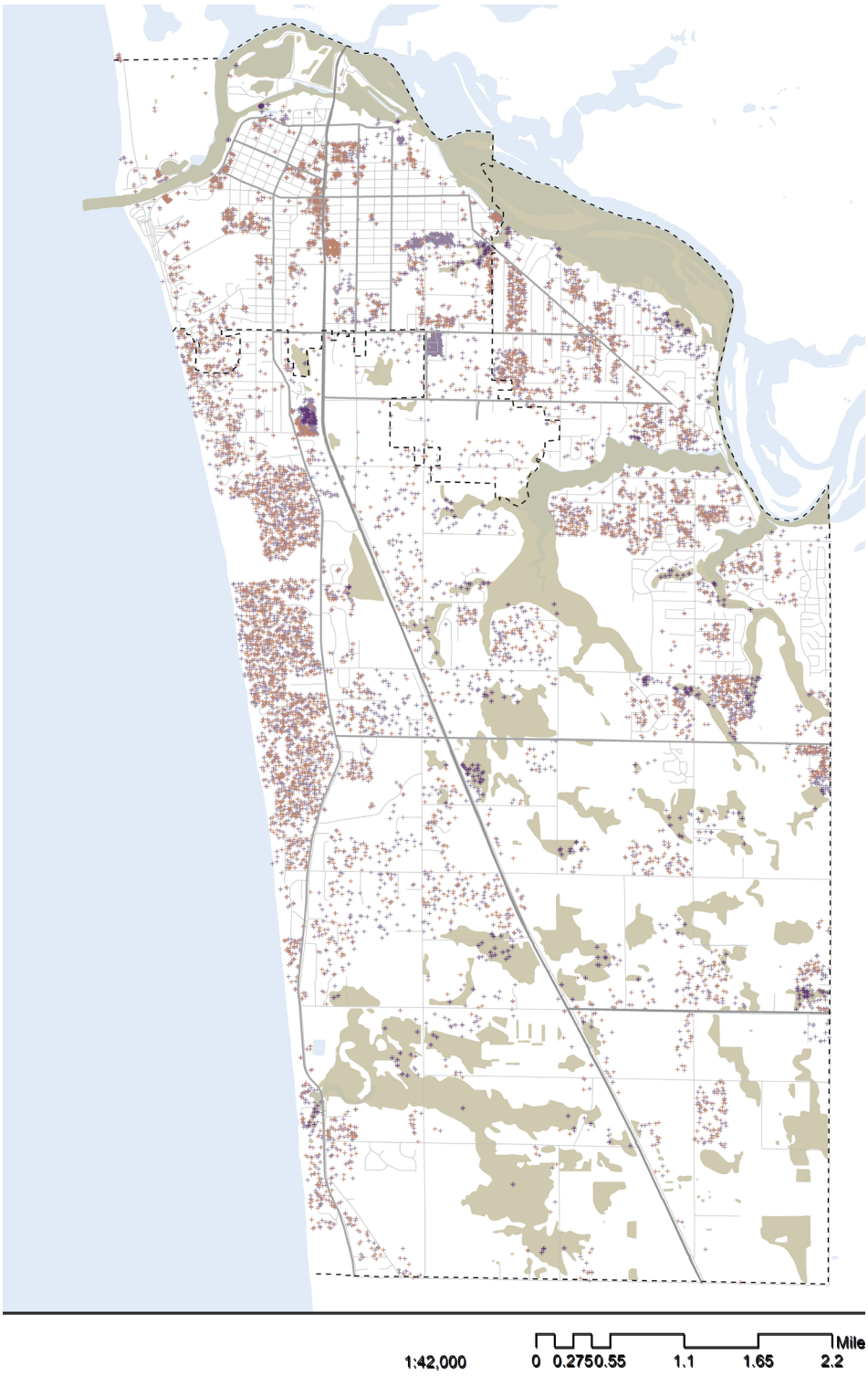

Figure 9. Grand Haven's wetlands in relationship to growth management scenarios

Potential wetlands were also mapped to identify restorative opportunities in communities. Potential wetlands are areas with hydric soils that are not currently developed, and have been identified by the National Wetland Inventory as potential wetland restoration areas. Wetlands under 5 acres in size are considered unprotected, as they are not currently regulated by any local or state process. These, too, were mapped because in aggregate, small wetlands can still have a large effect on the ecosystem's flood control and water quality.

It is difficult to estimate the impacts of future development on existing and potential wetlands, given the site-specific permitting process currently in place. That is, it is impossible to predict how many landowners may apply to develop a wetland area, or how many of those applications may be approved or denied. However, our team was able to demonstrate the impact future development may have on wetlands by visually showing the wetlands on or near properties with room for development under current zoning (Figure 9). A discovered trend is that if communities pursue development in line with BMPs (of the kind described previously), fewer existing wetlands are at risk.

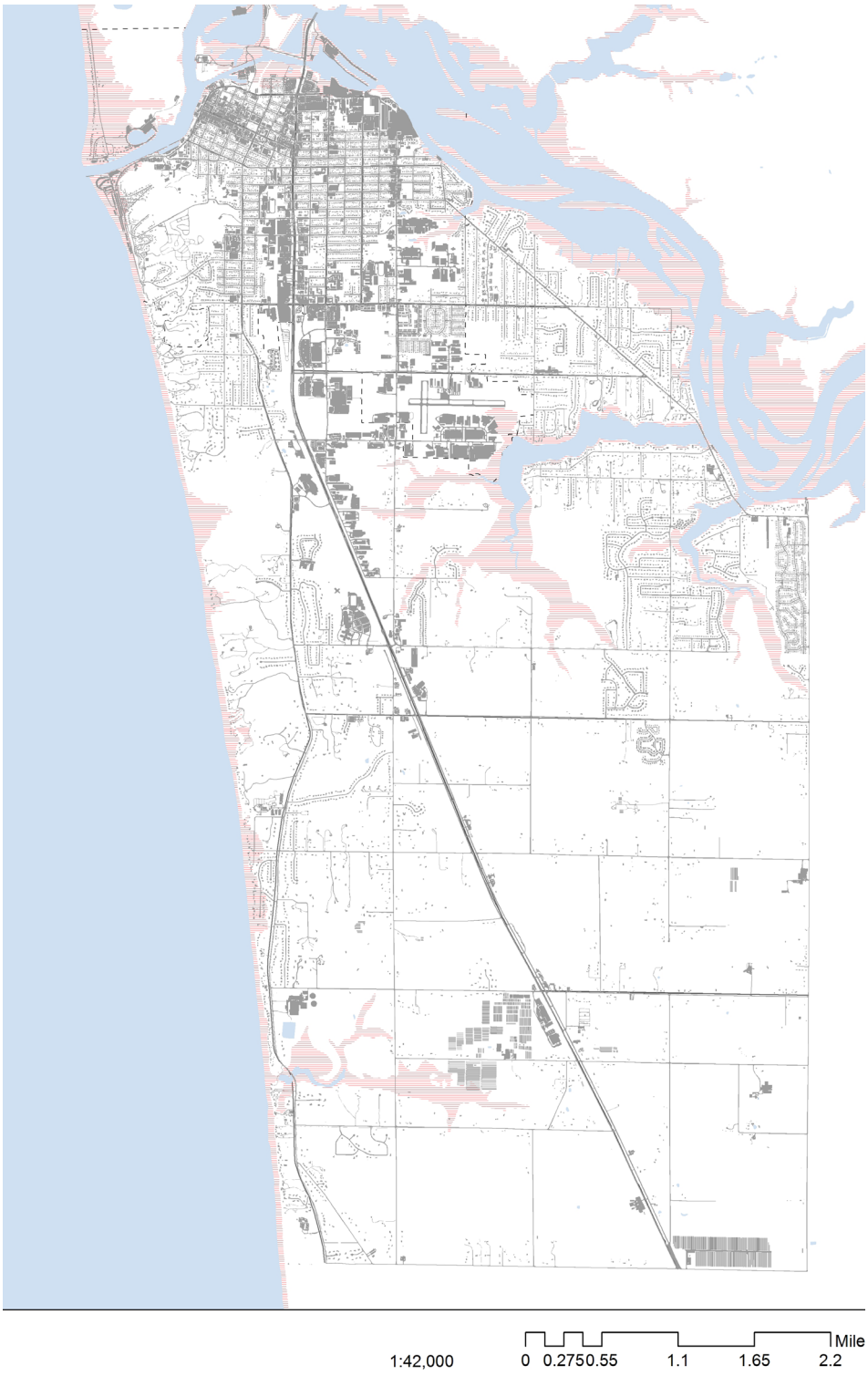

Figure 10. Grand Haven impervious surface

Impervious Surfaces in Areas Likely to Flood

Impervious surfaces have a well-understood negative impact in a flood event. The increased runoff can exacerbate the risk of structural damage and reduce regional water quality. This is an especially important variable to consider in a flood zone. Impervious surface includes building footprints as well as sidewalks, driveways, and roads. As such, impervious surfaces were mapped in GIS and overlaid on high-risk flood areas generated by each of the climate futures to estimate the percentage of impervious that each flood forecast impacts (Figure 10). This analysis reflected only current build-out conditions, and can thus be seen as a conservative estimate in light of inevitable future growth. Studies recommend the percentage of impervious surface in any general area be below 10% to remain protected from harmful amounts of runoff. Our analysis informs communities whether or not they are above or below this threshold. That said, in highly urbanized areas, it may make sense for communities to fall above the 10% impervious margin if the greater watershed they exist within is largely pervious.

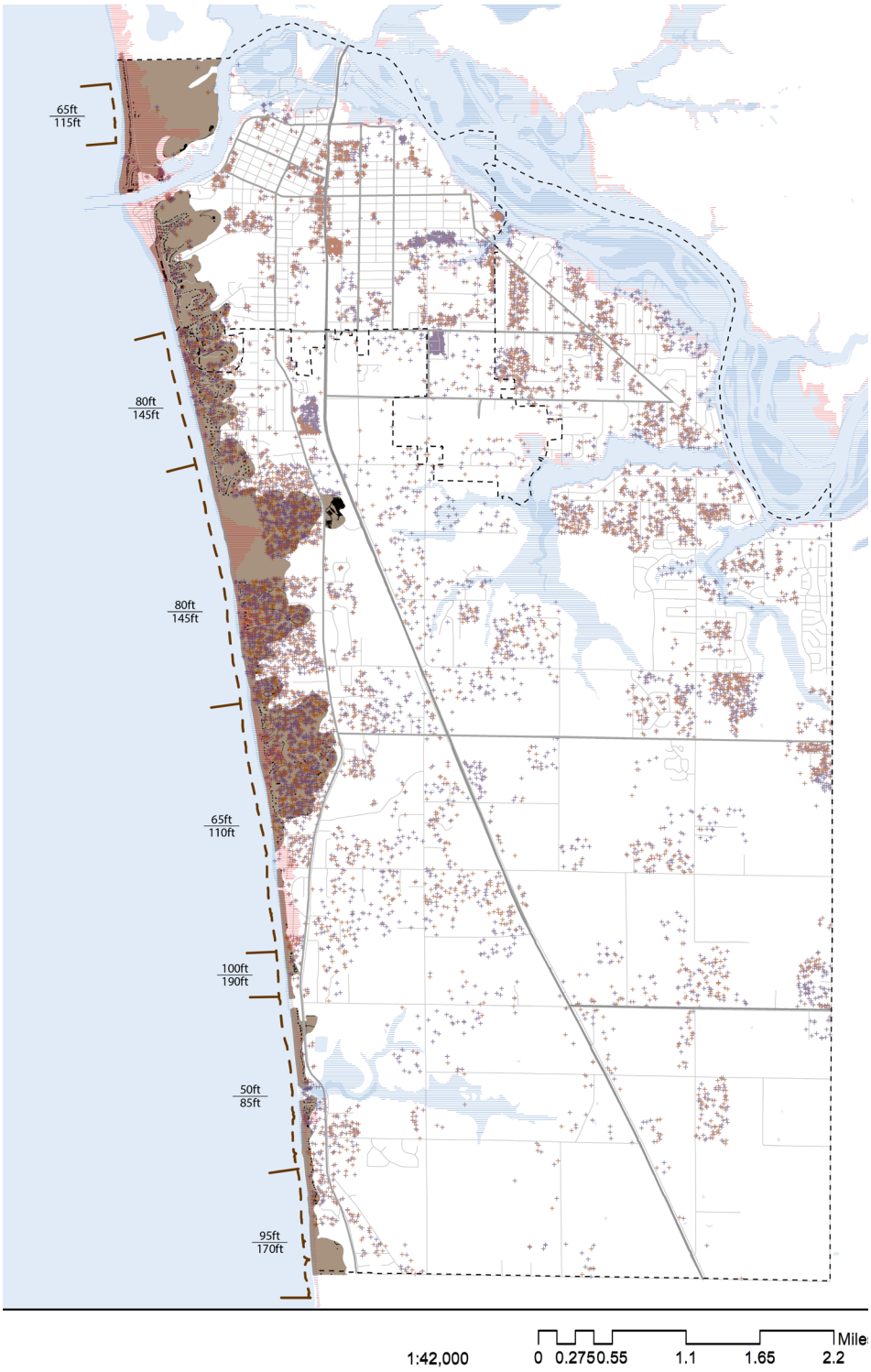

Figure 11. Grand Haven critical dunes with Full and BMP Build-Outs

Critical Dune Areas Impacted by Flooding

Critical Dune Areas are important assets for coastal communities and, due to their soil composition, may be especially vulnerable to damage from both flooding and development. Our intent was to provide some base of analysis for the future health of Critical Dunes, especially as development on Critical Dunes is likely to increase due to weakened regulations noted earlier.

While it is impossible to predict the number and scope of development permits that may be granted in the future, we were able to provide some insight into parcels that may be developed in or near Critical Dune Areas. Mapped Critical Dune Areas were overlaid on the climate futures in GIS to understand how much Critical Dune land is impacted under each forecast. While this analysis does not investigate how dune land behaves during flooding, the proportion of dune land in each flood zone is useful information for planning future development in communities.

Additionally, the build-out management options were overlaid on the Critical Dune Areas in GIS to see the potential for future development within these sensitive areas (Figure 11). In at least one of our communities, the observed potential for development in and near Critical Dune Areas is very high. This illustration can help prompt communities to start discussing new planning methods to regulate their sensitive environmental features, despite being handicapped by some state regulations.

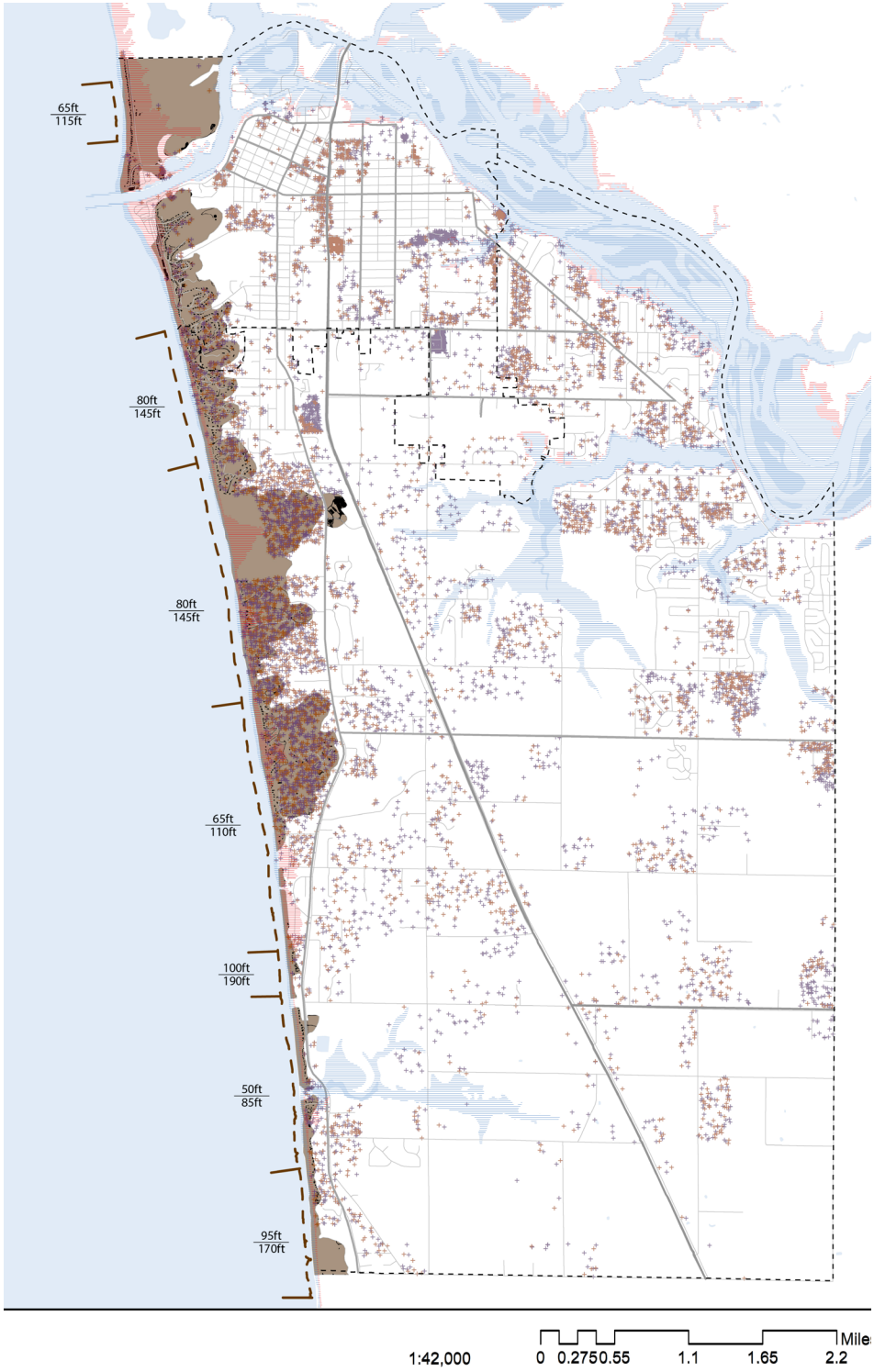

Figure 12. Grand Haven High Risk Erosion Areas (coastal dashed line) with climate futures

High Risk Erosion Areas Impacted by Flooding

While high-risk erosion areas, as identified by the State of Michigan, can vary spatially over time, it is important to consider where they have been identified and how coastal flooding might influence the pace of erosion in HREAs (Figure 12). As part of this study, we identified where MDEQ's designated HREAs in communities overlap with coastal VE zones because these flooding zones are prone to strong, high velocity waves that could increase the pace of erosion in already high risk areas. This relationship could affect the projected 30-year and 60-year setback lines for new development and subsequently the community's growth management plan. Therefore, the intersection of HREAs with coastal VE zones provides an additional layer of environmental information from which communities can make more resilient land management decisions.

Other Approaches

The analysis presented above only discusses some of the environmental features and practices that could be considered when developing growth management plans and BMPs. Your community may want to consider the impact of tree canopy or other features that are more appropriate for their community. The goal of this exercise is to identify the magnitude of change that occurs as flood risks rise.

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There are many lists of BMPs collected from other research throughout the state and nationally. No list is on its own completely comprehensive, and any BMP recommendation requires a community to determine if it is appropriate given their circumstances.