Section 309 Assessment and Five-Year Strategy for Coastal Zone Management Enhancement Fiscal Years 2016-2020

Michigan Coastal Zone Management Program
Office of the Great Lakes
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Introduction

The National Coastal Zone Management Program manages the nation's coastal issues through a voluntary partnership between the federal government and coastal and Great Lakes states and territories. Authorized by the Coastal Zone Management Act (CZMA) of 1972, the program provides the basis for protecting, restoring, and responsibly developing our nation's diverse coastal communities and resources.

Currently 34 coastal states, including Michigan, participate. While state partners must follow basic requirements, the program also gives states the flexibility to design unique programs that best address their coastal challenges and regulations. By leveraging both federal and state expertise and resources, the program strengthens the capabilities of each to address coastal issues.

Section 309 of the federal CZMA establishes a voluntary enhancement program for states with federally approved Coastal Zone Management Programs (CZMPs). Under the provisions of Section 309, every five years state CZMPs may assess and prioritize challenges and needs regarding the management of nine "enhancement areas" within their coastal zones. These enhancement areas include:

- Wetlands
- Coastal Hazards
- Public Access
- Marine Debris
- Cumulative and Secondary Impacts
- Special Area Management Planning
- Ocean/Great Lakes Resources
- Energy and Government Facility Siting
- Aquaculture

Guided by the assessments, states may develop and implement changes to their CZMPs that improve management of high- priority enhancement areas over a five-year timeframe, subject to federal approval. States implement the approved strategies with financial support provided under Section 309.

The Michigan Coastal Zone Management Program (MCZMP), Office of the Great Lakes (OGL), Michigan Department of Environmental Quality (MDEQ) developed this draft *Section 309 Assessment and Five-Year Strategy for Coastal Zone Management Program Enhancement: Fiscal Years 2016-2020*, pursuant to final guidance issued by the Office for Coastal Management (OCM) National Oceanic and Atmospheric Administration (NOAA) in June 2014. This draft document contains the Phase I Assessments for each of the nine enhancement areas, including the predicted priority of the management challenge to the MCZMP during the federal Fiscal Years 2016-2020. The State of Michigan's fiscal calendar is offset from the Federal calendar by one year

and, therefore, the State fiscal period covered by this strategy is 2017-2021. Factors that influence the prioritization of the enhancement areas include the immediacy, scope, and magnitude of the management challenge in Michigan's coastal zone, availability of other sources of funding to apply to the management challenge, and the extent to which the MCZMP's enforceable policies encompass the enhancement area. Pursuant to the June 2014 guidance, the draft document also contains Phase II Assessments for Wetlands, Great Lakes Resources, Coastal Hazards, and Aquaculture, because these focus areas were identified as high priorities through the Phase I Assessment, for the MCZMP over the Fiscal Year 2017-2021 timeframe.

A Coastal Hazards strategy, entitled "Coastal Geophysical Properties and Resiliency Strategy" is proposed. This strategy is being pursued based on stakeholder input, MCZMP-identified need, and the status of coastal hazards being identified as a national priority. The development and approval of a Strategy does not guarantee funding for the projects therein; however, only projects contained in an approved Section 309 Assessment and Strategy document are eligible for Section 309 funding annually appropriated and allocated to state MCZMPs.

Stakeholder Input

MCZMP staff prepared this draft document with a combination of internal and external stakeholder input. Internal stakeholders consisted of staff from various MDEQ divisions, Michigan Department of Natural Resources (MDNR), and Michigan Department of Agriculture and Rural Development (MDARD). External coastal stakeholders consisted of select MCZMP partners having a working knowledge of the program, core understanding of our mission and objectives, and having worked with the MCZMP on recent project efforts. Initial stakeholder input was sought during the Phase I assessment, and was conducted through a web-based survey. This survey and associated cover brochure explaining the initiative (see Appendix A) was sent to a total of 33 individuals, with responses received from 5 individuals. Responses covered a range of aspects, but tended to identify coastal wetlands, sand dunes and high-risk erosion areas as priorities. Prioritization of coastal wetlands for acquisition, enhancing/strengthening environmental area protections, strengthening high-risk erosion area protections, and proactively adapting to water level changes were some areas identified as opportunities. Additional input was obtained from internal stakeholders as needed throughout the Phase I and Phase II assessments, and input received through these interactions is identified and reflected throughout the assessment narratives.

As part of the process, a draft of this document was made available for public comments for a period of more than 30 calendar days. Two responses were received during the comment period with one providing suggestions for minor inclusions to various portions of the text. Suggestions within the second response focused on: establishment of a Special Area Management Plan for Saugatuck Dunes located along the central, eastern Lake Michigan coast; protection of coastal wetlands; and protection of critical dune areas. Input received through the various avenues provided valuable insight to the MCZMP for incorporation into this document and beyond.

Summary of Completed Section 309 Projects Included in the Previous Section 309 Assessment and Strategy

The MCZMP's previous Section 309 Assessment and Strategy, as amended, covers Fiscal Years 2012-2016, corresponding to federal Fiscal Years 2011-2015. This period is still ongoing, as Michigan's Fiscal Year 2016 ends September 30, 2016. Consequently, the following summary of projects is necessarily incomplete. Section 309 funds supported projects in three high-priority enhancement areas, specifically, Wetlands, Coastal Hazards, and Great Lakes Resources. Selected major accomplishments are summarized in the table below:

Enhancement Area	Major Accomplishments Supported with Section 309 Funds 2012-2014
Wetlands	• The Great Lakes Commission developed an online toolkit of Climate Change Adaptation Best Practices for Michigan Coastal Wetlands, with a target audience of state and local agencies, nonprofit organizations, and other entities with duties that encompass protection, management, and restoration of coastal wetlands. • The Land Information Access Association developed a white paper with recommendations for local governments on protecting and restoring coastal wetlands to increase their resiliency to the stresses of climate change. • The MDEQ has initiated the development of internal guidance for wetland permitting, enforcement, and mitigation staff on the application of climate change adaptation best management practices in the protection of regulated coastal wetlands.
Coastal Hazards	• University of Michigan and Michigan Technological University researchers studied and identified the weather conditions, coastal geomorphology, and other factors that contribute to the formation of transient dangerous currents at Lake Michigan swimming beaches. This multi-year research yielded significant new information supporting the science of Great Lakes dangerous currents forecasting. • Michigan Sea Grant (MSG) coordinated risk communication research to develop more effective messaging for beachgoers at Michigan State Parks about dangerous currents hazards, and how to reduce their exposure to these hazards. • MSG developed a Great Lakes dangerous currents website (www.dangerouscurrents.org) presenting a variety of information resources, dangerous current rack card, and other outreach products. MSG also sponsored three regional workshops to educate State and local park personnel and other stakeholders about the different types of dangerous currents, dangerous currents research, fatality and rescue data, and hazard messaging. • MCZMP inventoried and conducted field-based GPS mapping showing the locations of rescue equipment, beach warning flag systems, signage, and designated

	swimming areas at select coastal state parks. The resulting GIS data is designed to help state park managers identify and prioritize items and actions for improving beach safety in their parks. • MCZMP, MSG, and MDNR collaborated to develop and deliver a training program for state park personnel on determining the risk of dangerous current formation at state park swimming beaches, and effectively communicating the risk to beachgoers through warning flag systems, signage, and verbal warnings. • MDNR Parks and Recreation Division personnel have begun the internal process of revising the policy addressing designated swimming areas at state parks to incorporate the research results on determining and communicating the risks of dangerous current hazards at Great Lakes beaches. Formal adoption of the revised policy is expected later this year, and the policy will be submitted to the NOAA as a Routine Program Change of the MCZMP promptly thereafter.
Great Lakes Resources	• University and MDNR researchers conducted several projects to identify areas of Michigan's coastal zone, including the offshore waters of the Great Lakes and Great Lakes islands, that are important feeding areas, migration stop-over areas, or are otherwise used by substantial concentrations of migrating songbirds, waterbirds and waterfowl, and bats. Identifying these sensitive areas is a key step toward siting and operating future coastal and offshore wind energy projects to avoid wildlife impacts. Geospatial data resulting from the research can be incorporated into the Offshore Wind Decision Support Tool; a tool which will be applied by MDEQ's Water Resources Division as directed by new guidance documents for the review of offshore wind permit applications.

Phase I Assessments

Wetlands

Section 309 Enhancement Objective: Protection, restoration, or enhancement of the existing coastal wetlands base, or creation of new coastal wetlands. §309(a)(1)

Note: For the purposes of the Wetlands Assessment, wetlands are "those areas that are inundated or saturated at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." [33 CFR 328.3(b)]. See also pg. 17 of the MCZMPA Performance Measurement Guidance1 for a more in-depth discussion of what should be considered a wetland.

PHASE I (HIGH-LEVEL) ASSESSMENT: *(Must be completed by all states.)*
Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment. The more in-depth assessments of Phase II will help the CMP understand key problems and opportunities that exist for program enhancement and determine the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. Using provided reports from NOAA's Land Cover Atlas[2] or high-resolution C-CAP data[3] (Pacific and Caribbean Islands only); please indicate the extent, status, and trends of wetlands in the state's coastal counties. You can provide additional or alternative information or use graphs or other visuals to help illustrate or replace the table entirely if better data are available. Note that the data available for the islands may be for a different time frame than the time periods reflected below. In that case, please specify the time period the data represents. Also note that Puerto Rico and the Commonwealth of the Northern Mariana Islands (CNMI) currently only have data for one time point so will not be able to report trend data. Instead, Puerto Rico and CNMI should just report current land use cover for all wetlands and each wetlands type.

Coastal Wetlands Status and Trends (Coastal Counties)		
Current state of wetlands in 2010 (acres)	**5,302,532**	
Percent net change in total wetlands (% gained or lost)*	from 1996-2010	from 2006-2010
	0.49%	**-0.05%**
Percent net change in freshwater (palustrine wetlands) (% gained or lost)*	from 1996-2010	from 2006-2010
	0.49%	**-0.05%**
Percent net change in saltwater (estuarine) wetlands (% gained or lost)*	from 1996-2010	from 2006-2010
	N/A	**N/A**

[1] http://coastalmanagement.noaa.gov/backmatter/media/MCZMPapmsguide11.pdf
[2] http://www.csc.noaa.gov/ccapatlas/. Summary reports compiling each state's coastal county data are provided on the ftp site.
[3] http://www.csc.noaa.gov/digitalcoast/data/ccaphighres

Though more detailed wetland inventories for the State exist, in the form of National Wetlands Inventory (NWI) maps, the latest iteration of this dataset was completed in 2005. Because of this, the latest iteration of C-CAP data (2010) was used to estimate coastal wetland acreage in the State.

The Landsat imagery used in C-Cap is 30 m resolution, while the imagery used for NWI is 1-2 meter resolution. This results in C-CAP estimates of wetland extent being more spatially 'coarse' than NWI.

NWI tends to be better at picking up smaller wetlands, while C-CAP tends to overestimate wetland extent in every wetland complex. Due to these differences, the acreage estimates developed using C-CAP are very different than Michigan's latest status and trends information.

How Wetlands Are Changing* (Coastal Counties)		
Land Cover Type	**Area of Wetlands Transformed to Another Type of Land Cover between 1996-2011 (Sq. Miles)**	**Area of Wetlands Transformed to Another Type of Land Cover between 2006-2011 (Sq. Miles)**
Development	**5.9**	**3.6**
Agriculture	**4.5**	**1.6**
Barren Land	**3.9**	**1.7**
Water	**4.5**	**1.9**

** Note: Islands likely have data for another time period and may only have one time interval to report. If so, only report the change in wetlands for the time period for which high-resolution C-CAP data are available. Puerto Rico and CNMI do not report.*

The following tables report the coastal wetlands status and trends within Michigan's Coastal Zone Management Boundary.

Coastal Wetlands Status and Trends (Coastal Zone Management Area)		
Current state of wetlands in 2010 (acres)	**352,380**	
Percent net change in total wetlands (% gained or lost)*	from 1996-2010	from 2006-2010
	4.43%	**0.03%**
Percent net change in freshwater (palustrine wetlands) (% gained or lost)*	from 1996-2010	from 2006-2010
	4.43%	**0.03%**
Percent net change in saltwater (estuarine) wetlands (% gained or lost)*	from 1996-2010	from 2006-2010
	N/A	**N/A**

How Wetlands Are Changing* (Coastal Zone Management Area)		
Land Cover Type	**Area of Wetlands Transformed to Another Type of Land Cover between 1996-2011 (Sq. Miles)**	**Area of Wetlands Transformed to Another Type of Land Cover between 2006-2011 (Sq. Miles)**
Development	**0.81**	**0.52**
Agriculture	**0.26**	**0.05**
Barren Land	**0.83**	**0.13**
Water	**0.87**	**0.29**

** Note: Islands likely have data for another time period and may only have one time interval to report. If so, only report the change in wetlands for the time period for which high-resolution C-CAP data are available. Puerto Rico and CNMI do not report.*

2. If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends of coastal wetlands since the last assessment to augment the national data sets.

The first ever basin-wide Great Lakes coastal wetland monitoring project was initiated within the last assessment period. Doctor Don Uzarski from Central Michigan University (CMU) is the lead researcher on the 10 Million dollar project that was funded through the Great Lakes Restoration Initiative (GLRI). The five year monitoring project, which will conclude at the end of the 2015 field season, was based on a plan developed by the Great Lakes Coastal Wetlands Consortium that was finalized in 2008. The goal of the study is to monitor the conditions and trends for more than 1,000 coastal wetlands in the Great Lakes Basin. Data gathered at each site includes: birds, amphibians, fish, invertebrates, plants, water quality and habitat. A database has been developed to house all of the collected data. This information will be available to researchers and state wetland managers. The data from the basin wide monitoring will provide information that will help guide restoration and conservation efforts in the Great Lakes Basin.

Michigan's Wetlands Program has worked on numerous initiatives within the last assessment period. Projects include the update of the Michigan Wetland Monitoring Assessment Strategy, which includes landscape level, rapid and intensive wetlands assessment methods, and statewide monitoring goals. The Wetlands Program has also completed watershed-scale Landscape Level Wetland Functional Assessment for approximately 1/3 of the state, and is continuing this work with financial support from the Environmental Protection Agency. Michigan's wetlands program also partnered on the above mentioned GLRI Great Lakes coastal wetland monitoring project.

Within the last assessment period, the Upper Midwest and Great Lakes Landscape Conservation Cooperative developed a Coastal Conservation Work Group. The MCZMP is participating in the work group. The work group is currently developing a Great Lakes Coastal Wetlands Landscape Conservation Design (LCD). The goal of the LCD is to work with partners to develop a prototype that will guide Great Lakes coastal wetland conservation. The conservation will promote sustainable wetlands functions

and values for water quality, fish, wildlife, and people. Partners on the work group include federal and state representatives as well as non-profits.

Also during the last assessment period, Michigan Technological University Research Institute completed a comprehensive regional baseline map of coastal wetlands for the bi-national Great Lakes. The project includes coastal wetland mapping as well as adjacent land use and two invasive plant species (Typha spp. and *Phragmites australis*). The project was funded through a Great Lakes Restoration Initiative grant. Coastal wetlands and adjacent land use were identified and classified for the entire coastal Great Lakes Basin utilizing 2007-20011 satellite imagery. The process followed the recommended approach of the Great Lakes Coastal Wetland Consortium to provide regional baseline mapping suitable for coastal wetland assessment and management.

Management Characterization:

1. Indicate if there have been any significant changes at the state or territory level (positive or negative) that could impact the future protection, restoration, enhancement, or creation of coastal wetlands since the last assessment.

Management Category	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	N
Wetlands programs (e.g., regulatory, mitigation, restoration, acquisition)	N

2. For any management categories with significant changes briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:

    a) Describe the significance of the changes;
    b) Specify if they were 309 or other MCZMP-driven changes; and
    c) Characterize the outcomes or likely future outcomes of the changes.

During the last assessment period, changes were made to the state statute Part 303, Wetlands Protection, including changes to the regulation of coastal wetlands. Though the changes are not significant, they do require minor modifications to how Part 303 is implemented in the state, therefore, a brief summary of the changes is provided.

An exemption for cutting of vegetation, above the water's edge and below the ordinary high water mark of the Great Lakes, was added in 2012. Although this exemption allows habitat impacts to coastal wetlands, it appears that implementation of this exemption is not widespread.

In 2013, several minor amendments to Part 303 were made through Public Act 98, including:

- clarification of exemptions for agricultural activities, county drains, road maintenance, and utilities,

- creation of new exemptions for certain agricultural activities,
- creation of an agricultural assistance program and general permit categories for certain agricultural activities,
- updates to wetland mitigation rules and creation of a revolving grant and loan fund for municipal wetland mitigation banking.

The OGL has been working on a Section 309 Strategy to address Climate Change Adaptation in Coastal Wetlands Management throughout this last assessment period. The Strategy will be completed in 2016. The strategy was developed to improve the resilience of coastal wetlands to the impacts of climate change. Outcomes of the strategy will include new guidelines and procedures for wetlands permitting and mitigation as well as an enhanced capacity for local units of government to address climate change impacts to coastal wetlands through local planning and zoning. To date external project partners have included the Great Lakes Commission and the Land Information Access Association.

At the forefront of this strategy was a 2011 MCZMP funded project working with the State Association of Wetlands Manager (ASWM). The ASWM in partnership with the MDEQ and the Michigan Wetlands Association (MWA) held a Special Symposium on Wetland Management in Response to Climate Change at the MWA Annual Conference, August 30-September 2, 2011. The Climate Change Adaptation Plan for Coastal and Inland Wetlands[4] in the State of Michigan was the result of these efforts. The white paper provides a summary of climate change predictions, highlights examples of adaptation efforts in other regions, and lists recommendations for climate change adaptation in wetlands for the state of Michigan.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High	**__X__**
Medium	**_____**
Low	**_____**

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

Great Lakes coastal wetlands are among the most biologically diverse ecosystems in Michigan. Coastal wetlands provide critical nesting habitat, serve as spawning ground for the majority of Great Lakes fish species, provide significant water retention functions, as well as provide protection from the Great Lakes erosive forces along shorelines. An

[4] Climate change adaptation plan for coastal and inland wetlands in the State of Michigan. https://www.aswm.org/pdf_lib/michigan_wetlands_and_climate_change_report_final_403251_7.pdf

estimated 50% of historic coastal wetlands have been impacted or converted to other land uses since the time of European settlement.

Though Michigan has a comprehensive wetlands program, there are still gaps that remain. By the fall of 2015, the GLRI funded Great Lakes coastal wetland monitoring effort will be concluded. This effort will provide significant data on approximately 240 coastal wetlands along Michigan's shoreline. Future funding mechanisms will need to be identified, or state programs developed, to continue to monitor the sites in the future. A second gap that exists pertaining to coastal wetlands is stewardship and management of regulated and non-regulated coastal wetlands. While this issue exists on private and state owned properties, there are opportunities to work with our internal partners to develop a policy to address stewardship of significant coastal wetland resources on state owned lands; such as Environmental Areas, which were previously designated for the protection of sensitive coastal fish and wildlife species and habitats. This policy could address impacts related to invasive species infestation, water quality, extreme weather impacts and habitat degradation. The stewardship of privately owned coastal wetland habitat may be addressed through a comprehensive education and outreach program. A third related gap is the lack of a statewide framework for the prioritization of coastal wetland habitat for acquisition, preservation, and restoration. The MCZMP works with locals, non-profits, and other state and federal agencies to deal with coastal issues. These existing partnerships may provide opportunities to address this gap in the state wetlands program.

The stakeholder input survey, conducted as part of the Phase I assessment, provides additional foundation for a "high" priority status for this coastal wetlands focus area. Although survey response was low with only five responses (14% return rate) received, the majority indicated coastal wetlands as their highest priority focus area of the nine options. Opportunities identified through the survey included: developing plans for managing state-owned environmental areas; collecting monitoring and assessment information for coastal wetlands; and identifying priority coastal wetland areas for protection and restoration.

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Coastal Hazards

Section 309 Enhancement Objective: Prevent, or significantly reduce, threats to life and property by eliminating development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential sea level rise and Great Lakes level change. §309(a)(2)

Note: For purposes of the Hazards Assessment, coastal hazards include the following traditional hazards and those identified in the MCZMPA: flooding; coastal storms (including associated storm surge); geological hazards (e.g., tsunamis, earthquakes); shoreline erosion (including bluff and dune erosion); sea level rise; Great Lake level change; land subsidence; and saltwater intrusion.

Phase I (High-Level) Assessment:

Resource Characterization:

1. **Flooding:** The table below depicts data from *NOAA's State of the Coast* "Population in the Floodplain" viewer[5] and summarized by coastal county through NOAA's Coastal County Snapshots for Flood Exposure,[6] to indicate how many people were located within the state's coastal floodplain as of 2010 and how that has changed since 2000.

Population in the Coastal Floodplain			
	2000	**2010**	**Percent Change from 2000-2010**
No. of people in coastal floodplain[7]	254,401	269,519	5.94%
No. of people in coastal counties[8]	4,842,023	4,680,503	-3.34%
Percentage of people in coastal counties in coastal floodplain	5.25%	5.76%	----------

2. **Shoreline Erosion:** (For all states other than Great Lakes and islands; for Great Lakes and islands, see Question 5): Using data from *NOAA's State of the Coast* "Coastal Vulnerability Index,"10 indicate the vulnerability of the state's shoreline to erosion. You may use other information or graphs or other visuals to help illustrate or replace the table entirely if better data is available. *Note: For New York and Pennsylvania that have both Atlantic and Great Lakes shorelines, fill out the table below for the Atlantic shoreline only.*

[5] http://stateofthecoast.noaa.gov/pop100yr/welcome.html. Note FEMA is in the process of updating the floodplain data. This viewer reflects floodplains as of 2010. If you know the floodplain for your state has been revised since 2010, you can either use data for your new boundary, if available, or include a short narrative acknowledging the floodplain has changed and generally characterizing how it has changed.

[6] www.csc.noaa.gov/digitalcoast/tools/snapshots

[7] To obtain exact population numbers for the coastal floodplain, download the Excel data file on the State of the Coast "Population in the Floodplain" viewer: http://stateofthecoast.noaa.gov/pop100yr/welcome.html. Summary population data for each coastal state is available on the ftp site.

[8] To obtain population numbers for coastal counties, see spreadsheet of coastal population and critical facilities data provided or download directly from http://www.csc.noaa.gov/digitalcoast/data/stics. Summary population data for each coastal state is available on the ftp site.

Data from *NOAA's State of the Coast* "Coastal Vulnerability Index,"[9] does not include data for the Great Lakes states, including Michigan, depicting the vulnerability of the shoreline to erosion. Therefore, data from the MDEQ has been substituted, and the table below has been modified (from template provided in Section 309 guidance) for use within the Great Lakes region. Data shown originates from recession rate studies mandated for the High Risk Erosion Area (HREA) program under Part 323, Shorelands Protection and Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA)

Vulnerability to Shoreline Erosion (Modified for Great Lakes)		
Vulnerability Ranking	**Miles of Shoreline Vulnerable**	**Percent of Coastline**
Low or Not Studied (<1.0 ft/yr) stable	3608.37	93.93%
Moderate (>= 1.0 to <2.0 ft/yr) erosion	158.4	4.12%
High (> = 2.0 to < 3.0 ft/yr) erosion	46.73	1.22%
Very high (>= 3.0 ft/yr) erosion	27.94	0.73%

Approximately 233 miles (6.1%) of Michigan's 3,841 mile long[10] Great Lakes shoreland is documented as receding at a rate of one foot per year or greater, and therefore is subject to coastal construction setbacks implemented through the HREA program under Part 323, Shorelands Protection and Management, of the NREPA. This represents a reduction of 35 miles of shoreland receding at a rate greater than one foot per year as compared to the 2011 assessment, which identified a total of 268 miles of shoreland above the threshold rate. Presently about 7,500 individual properties are subject to setback requirements under the HREA program. Appendix A - Sheet 1 shows a map view of those areas identified as being vulnerable to coastal erosion along Michigan's Great Lakes coast.

3. **Other Coastal Hazards:** In the table below, indicate the general level of risk in the coastal zone for each of the coastal hazards. The state's multi-hazard mitigation plan is a good additional resource to support these responses.

[9] http://stateofthecoast.noaa.gov/vulnerability/welcome.html (see specifically "Erosion Rate" drop-down on map). The State of the Coast visually displays the data from USGS's Coastal Vulnerability Index.

[10] Shoreland length is based on the Great Lakes Shoreline Geodatabase developed through the US Army Corps of Engineers and Federal Emergency Management Agency's Great Lakes Coastal Flood Study (available at: http://www.greatlakescoast.org/great-lakes-coastal-analysis-and-mapping/technical-resources/). This dataset was mapped at larger scale than original mapping that identified Michigan's coastline as being 3,288 miles. The newer, high resolution data set is being applied toward all quantitation measures for the purpose of Section 309 assessment and reporting.

Type of Hazard	General Level of Risk[11] (H, M, L)
Flooding (riverine, stormwater)	H
Coastal storms (including storm surge)[12]	M
Geological hazards (e.g., tsunamis, earthquakes)	L
Shoreline erosion[13]	H
Sea level rise[13,14,15]	-
Great Lake level change[14]	H
Land subsidence	L
Saltwater intrusion	-
Other (please specify) – Dangerous Nearshore Currents	M

4. If available, briefly list and summarize the results of any additional data or reports on the level of risk and vulnerability to coastal hazards within your state since the last assessment. The state's multi-hazard mitigation plan or climate change risk assessment or plan may be a good resource to help respond to this question.

Michigan Multi-Hazard Mitigation Plan:

The state's multi-hazard mitigation plan was last updated in March 2014[14]. The plan provides the framework and foundation for hazard mitigation within the State of Michigan, in accordance with the planning requirements set forth in the federal Disaster Mitigation Act of 2000 (and in subsequent regulations and FEMA policies). Implementation of the plan results in greater protection to human life, property, and the environment, and less physical, economic, and social disruption to communities and residents from natural, technological, and human-related hazards, including coastal hazards. The updated plan includes discussion of "Significant Shoreline Hazard Events in Michigan", which lists seven events since the year 2000; four of which were related to rip current and swimmer safety events. No erosion or coastal flooding events are highlighted during this time period although there is mention of low-water impacts in the Muskegon area of Lake Michigan. The type of events highlighted – specifically an overall lack of erosion and coastal flood events – are likely correlated with the prolonged low-water levels on the Great Lakes, while the dangerous currents-related events perhaps highlight a need for continued focus on managing associated swim risks at coastal beaches.

Great Lakes Water Levels Products:

Relatively low Great Lakes water levels persisted from 1998 until 2014, especially on Lake Superior and the Lake Michigan-Huron system. Water levels have increased

[11] Risk is defined as "the estimated impact that a hazard would have on people, services, facilities and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage." *Understanding Your Risks: Identifying Hazards and Estimating Losses. FEMA 386-2. August 2001*

[12] In addition to any state- or territory-specific information that may help respond to this question, the U.S. Global Change Research Program has an interactive website that provides key findings from the 2014 National Climate Assessment for each region of the country, including regions for the coasts and oceans, and various sectors. The report includes findings related to coastal storms and sea level rise that may be helpful in determining the general level of risk. See http://nca2014.globalchange.gov/.

[13] See NOAA State of the Coastal Vulnerability to Sea Level Rise Tool (select "Erosion Rate" from drop-down box) http://stateofthecoast.noaa.gov/vulnerability/welcome.html. The State of the Coast visually displays the data from USGS's Coastal Vulnerability Index.

[14] https://michigan.michigan.gov/msp/0,1607,7-123--14743--,00.html

dramatically during the first part of 2014 with all of Michigan's Great Lakes now being above average water levels. Two significant tools developed during the assessment period provide exceptional utility for researching and analysis of water level changes and associated effects on coastal systems. The Great Lakes Water Level Dashboard[15], developed by NOAA's Great Lakes Environmental Research Laboratory, provides a user-friendly, web-based portal containing graphical and raw data of historic, current, and forecasted Great Lakes water levels. **Figure 1** provides a view of the Great Lakes Water Level Dashboard and also clearly depicts the recent rise in lake levels on Lake Superior and Michigan-Huron, to levels not seen for the past decade and a half. NOAA's Office for Coastal Management developed the Lake Level Viewer providing a web-based map viewer tool that illustrates potential flooding or land exposure under scenarios of Great Lakes water level fluctuations from +6 feet to – 6 feet. With water levels being directly related to the potential for coastal flooding and erosion events, it is anticipated that application of these tools will increase in the near term, especially if water levels continue their upward trends.

Figure 1. Screen capture of the Great Lakes Water Level Dashboard showing levels for Lake Superior and Michigan-Huron over the past 20 year. Note that current levels are at the highest levels observed over the past 15 years.

The International Joint Commission's (IJC) International Upper Great Lakes Study concluded in 2012 and resulted in recommendations for a new water level regulation plan for Lake Superior Outflows. The 5-year, $14.6 million study included a Coastal Zone Technical Work Group (CZTWG) to evaluate coastal management implications associated with various regulation plans. Numerous technical reports and products from the CZTWG efforts relate to coastal hazards and potentially serve as resources for assessment and strategy development[16]. Examples include:

[15] http://www.glerl.noaa.gov/data/dashboard/GLWLD.html.
[16] Products from the IJC IUGLS are available for download from: http://www.iugls.org/All_Projects?stakeholdersFilter=668

- Coastal Zone Theme Reports on Erosion, Low Water, Shore Protection, and Flooding (W.F. Baird & Associates 2011).
- Shore Protection Impact Analysis (Davies 2011)
- Erosion Impact Analysis (Geomorphic Solutions 2010)

University of Michigan – Graham Institute Water Levels Integrated Assessment:
The aforementioned IJC study identified that adaptive management options toward dealing with water level variations, such as local shoreland management, potentially provide for different localities to address impacts and issues tailored to their geography, development and shoreline uses. Location-specific shoreland management options have not been widely adopted in Michigan to date. Implementation of such policies can be difficult due to the variability and uncertainty in water levels as well as difficulties in properly considering local conditions and objectives along with political constraints. The University of Michigan Graham Sustainability Institute is commencing an integrated assessment initiative to develop information, tools, and partnerships to help decision makers address challenges associated with Great Lakes water level variations. While the scope of the integrated assessment is broad, it is anticipated that associated coastal hazards impacts will be addressed to some extent through this effort. The integrated assessment is scheduled to conclude in 2017. The MCZMP will monitor this initiative to ensure that information, knowledge, and tools developed are properly leveraged within the MCZMP's section 306 efforts, and potentially within a 309 strategy.

High Risk Erosion Area Update Studies:
The MDEQ continues to reassess recession rates on a county-by-county basis to account for changing physical conditions, and to incorporate up-to-date technology in the recession rate studies associated with the HREA Program under Part 323 of the NREPA. Four county-wide studies were conducted during the assessment period with overall results trending toward significant decreases in the number of regulated properties and in the length of designated shoreline. When recession rates decrease to less than one foot per year, the MDEQ will de-designate the HREA, which correspondingly decreases the number of regulated properties. Approximately 35 miles of shoreline was removed from designation as HREA since 2011, and, therefore, properties along these shoreline areas are no longer subject to coastal construction setbacks under the HREA program. These decreases are partly attributable to the recent prolonged period of relatively low water levels on Michigan's Great Lakes. Generally, beaches accrete or build in profile during low lake levels, which tends to promote lakeward establishment of vegetation on beaches and foredunes. The current HREA administrative rules emphasize the change in location of this vegetation line over time in the calculation of shoreline recession rates. While the HREA studies include study periods of no less than 15 years and the MDEQ considers historic water levels during data (aerial photographs) selection, modern aerial photographs showing the prolonged low-water conditions can significantly affect the recession rate results. Recession rate studies during periods in the lake level cycle when the vegetation line is temporarily advancing lakeward, and ephemeral beach features have accreted, often leads to lower recession rates than those calculated in previous studies for the same stretch of shoreline.

The hazard threat due to erosion remains significant in many locations and with water levels recently returning to normal or above-normal water levels, those areas of shoreland mapped during low-water conditions may have underestimated the potential risk that will be present under high-water conditions. Updating recession rate studies in an expeditious manner under higher water conditions will be key toward reducing this potential under-estimation caused through the low-water studies, and may even be necessary for stretches of shoreline recently studied.

FEMA/USACE Great Lakes Coastal Flood Mapping Study:
The Federal Emergency Management Agency (FEMA) has initiated a coastal analysis and mapping study to produce updated Digital Flood Insurance Rate Maps for coastal counties around the Great Lakes including those in Michigan. This storm surge study is one of the most extensive coastal storm surge analyses to date, encompassing coastal floodplains in eight states. Ultimately, the study will update the coastal storm surge elevations for all of the Michigan's Great Lakes shoreline. This new coastal flood hazard analyses will utilize updated 1-percent-annual chance still water elevations obtained from a comprehensive storm surge study conducted by the U.S. Army Corps of Engineers.

An updated coastal flood study will provide a better estimate of coastal flood hazards and risk for the Great Lakes. The current, or effective, Flood Insurance Rate Maps are outdated primarily due to the age of data and methodologies, many of which date back to the 1970s. Major changes in National Flood Insurance Program policies and methodologies have occurred since the effective dates of many Flood Insurance Studies in the area, creating the need for an update that would reflect a more detailed and complete hazard determination. Additional information is available at: http://www.greatlakescoast.org/great-lakes-coastal-analysis-and-mapping/.

City of St. Joseph, Michigan Coastal Engineering Study
Although not statewide in scope, this 2012 study prepared by Edgewater Resources, LLC and Abonmarche Consulting, Inc. for the City of St. Joseph, provided the foundation for a first of its kind ordinance creating an overlay zoning district for an identified stretch of coast within the City where a fixed setback line was created, lakeward of which the construction of new structures is prohibited to prevent the need for shoreline protection structures that cause unnatural erosion and irreversible damage to the shoreline and adjacent property. Additional information is available at: http://greatlakesresilience.org/stories/michigan/st-joseph-protects-public-trust-ground-breaking-ordinance.
Dangerous Nearshore Currents Studies
Recent efforts under the Section 309-supported strategy to improve forecasting and messaging around dangerous nearshore currents and other swim hazards have shed light on the vulnerability of Great Lakes swimmers from these unique coastal hazards. Products developed through this effort include several final project reports including:

- Rip Currents in the Great Lakes: Advancing Forecasting Through Perishable Data Recovery and Analysis, Meadows, G.A. and Meadows, L.A., 2014, Project #12-309-08
- Implementing the MCZMP's Section 309 Strategy, LaPorte, E. et. al, 2014, Michigan MCZMP Project #13-RIP-001
- Remote Sensing-Based Detection and Monitoring of Rip Currents in the State of Michigan, Meadows, G.A. et. al, 2014, Project #13-RIP-002

A web-based portal for Great Lakes dangerous currents information has also been created through this strategy and is hosted by MSG at: www.dangerouscurrents.org. The site includes the map-viewer based Great Lakes Current Incident Database (GLCID); a graphical tool showing documented rescues and fatalities associated with nearshore currents between 2002 and present (updated annually). Susceptibility to dangerous currents swim hazards is demonstrated through the sheer number of records in the GLCID; however, tools and knowledge developed through the strategy have positioned the MCZMP well to implement actions and initiatives that will promote increased swimmer safety at Michigan's municipal beaches.

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred that could impact the MCZMP's ability to prevent or significantly reduce coastal hazards risk since the last assessment.

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ**[17] (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting that address:			
elimination of development/redevelopment in high-hazard areas[18]	Y	Y	N
management of development/redevelopment in other hazard areas	N	Y	N
climate change impacts, including sea level rise or Great Lake level change	N	Y	N
Hazards planning programs or initiatives that address:			
hazard mitigation	Y	Y	Y
climate change impacts, including sea level rise or Great Lake level change	N	Y	N
Hazards mapping or modeling programs or initiatives for:			
sea level rise or Great Lake level change	N	Y	N

[17] Assistance from the CMP is typically offered in the form of financial and/or technical assistance for short term projects associated with pass-through grants. Select projects are described further under the narrative for question #3.
[18] Use state's definition of high-hazard areas.

other hazards	Y	Y	N

2. Briefly state how "high-hazard areas" are defined in your coastal zone.

HREA in Michigan, as defined under Part 323, as those shorelands of the Great Lakes and connecting waters where recession of the zone of active erosion has been occurring at a long-term average rate of one foot or more per year.

Under the Flood Risk Area provisions of Part 323, Shorelands Protection and Management, of the NREPA, new structures in the 100-year floodplain of the Great Lakes must be elevated to prevent property damage. All of Michigan's 41 coastal counties have designated flood risk areas mapped and regulations in effect, which is the same number of counties identified in the 2011 Assessment. The Flood Risk Area Program continues to be operated mostly at the county level, and MDEQ staff provides periodic technical assistance and monitoring. All 41 counties participate in the National Flood Insurance Program and have local zoning requirements which meet or exceed Flood Risk Area Program standards.

3. For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:

    a. Describe the significance of the changes;
    b. Specify if they were 309 or other MCZMP-driven changes; and
    c. Characterize the outcomes or likely future outcomes of the changes.

<u>Management of development/redevelopment in other hazard areas:</u>

a. Describe the significance of the changes: The MCZMP provided financial support and technical assistance toward several site-specific projects focused on moving built infrastructure away from eroding shorelines. Such projects include managed retreat efforts at Muskallonge Lake State Park and McLain State Park as well as a project with the City of Marquette to plan for moving a 3,000 foot section of roadway away from the eroding shoreline of Lake Superior. The project at McLain State Park best exemplified the MCZMP's recent efforts to strengthen the technical assistance component of the program, as the MCZMP played a key role in the site analysis by conducting a detailed bluff recession rate analysis for the park. The recession rate study is providing the foundation for recommended setback areas and no-build areas which will be incorporated into the park master plan. These projects are also significant in that such projects have not often been needed over the past 15 years or so, during the prolonged low water level period. The three projects mentioned are located on Lake Superior, and their need has been exacerbated by recent upward trends in water levels. Should water levels continue their upward trend, it is anticipated that the need for similar efforts will increase.

b. Specify if they were 309 or other MCZMP-driven changes: These projects were not driven by Section 309 strategies, but rather were identified as needs by property managers at the MDNR and the City of Marquette, respectively.

c. Characterize the outcomes or likely future outcomes of the changes: Outcomes at the specific sites referenced will be the movement of existing infrastructure out of harm's way and siting of future infrastructure in locations that accommodate for natural shoreline erosion processes. Involvement and experience gained through these projects may foster development of future MCZMP initiatives through which the program seeks opportunities to better leverage internal capabilities of studying shoreline change – providing results to local officials for direct application toward hazard mitigation planning efforts.

Hazard initiatives that address hazard mitigation: Improved Dangerous Current Forecasting and Hazard Messaging.

a. Describe the significance of the changes: The MCZMP led an initiative to improve the science and messaging associated with dangerous nearshore currents, including rip currents, to improve swimmer safety with special focus on Michigan's coastal state park beaches. These efforts have caused the MDNR, Parks and Recreation Division to revise its policy guiding implementation of beach safety measures at the state parks. The initiative has the potential, through improved information and messaging, to save lives.

b. Specify if they were 309 or other MCZMP-driven changes: The Improved Dangerous Current Forecasting and Hazard Messaging strategy was supported through the 2012 – 2016 Section 309 Strategy.

c. Characterize the outcomes or likely future outcomes of the changes: Key outcomes will include safer state park beaches due to improved science and messaging about associated risks. Success is largely dependent on the ability to fully implement measures including the deployment of enhanced beach flag warning systems and multi-hazard swim risk signs. The MCZMP will continue working with partners toward full implementation of potential improvements identified through the strategy efforts and will also seek opportunities to assist local units of government in applying the lessons learned from the strategy.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High	**__X__**
Medium	**_____**
Low	**_____**

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

   Increased coastal flooding and erosion anticipated in response to rising Great Lakes water levels result in the coastal hazards enhancement area to be high priority for

the MCZMP. The recent demand for projects focused on managed retreat from erosion represent what is perhaps the beginning of a larger trend; especially should water levels continue their upward trend over the coming months and years. Anecdotal evidence in the form of news stories[19] and other instances of shoreline erosion events provide additional support for such a prioritization.

Stakeholder input received as part of the Phase I assessment process indicated a need for improving coordination with local governments on high risk erosion areas. Input also identified that lake levels may be changing and thus there is a need to be proactive.

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[19] See for example: http://www.harborcountry-news.com/articles/2014/11/13/news/doc5462ebcbb5239711628448.txt

Public Access

Section 309 Enhancement Objective: Attain increased opportunities for public access, taking into account current and future public access needs, to coastal areas of recreational, historical, aesthetic, ecological, or cultural value. §309(a)(3)

Resource Characterization:

1. Use the table below to provide data on public access availability within the coastal zone.

Public Access Status and Trends			
Type of Access	**Current number[20]**	**Changes or Trends Since Last Assessment[21]** (unkwn)	**Cite data source**
Beach access sites[22]	585	-	EPA: Beacon Database http://watersgeo.epa.gov/beacon2/
Shoreline (other than beach) access sites	N/A	unkwn	N/A
Recreational boat (power or non-motorized) access sites	312	↑	MDNR
Number of designated scenic vistas or overlook points	26	unkwn	MDNR, MDOT
Number of fishing access points (i.e., piers, jetties)	More than 130 sites	-	MDNR
Coastal trails/ boardwalks[23]	No. of Trails/ boardwalks 3,685/162 Miles of Trails/boardwalks 901/2.5	unkwn	MDNR

[20] Be as specific as possible. For example, if you have data on many access sites but know it is not an exhaustive list, note "more than" before the number. If information is unknown, note that and use the narrative section below to provide a brief qualitative description based on the best information available.

[21] If you know specific numbers, please provide. However, if specific numbers are unknown but you know that the general trend was increasing or decreasing or relatively stable or unchanged since the last assessment, note that with a ↑ (increased), ↓ (decreased), – (unchanged). If the trend is completely unknown, simply put "unkwn."

[22] Existing data do not allow the discerning of shoreline access points from beach access points. Therefore, these are reported as one cumulative value under beach access points.

[23] The boardwalk data are limited as the only available source is from the Michigan Department of Natural Resources (DNR) for boardwalks on DNR managed lands. More than half of these trail segments (56.41%) have no surface materials data and, therefore, the number or length of broadwalks presented is likely an underestimation.

Public Access Status and Trends			
Type of Access	**Current number[20]**	**Changes or Trends Since Last Assessment[21]** (unkwn)	**Cite data source**
Number of acres parkland/open space	Total sites 766 Sites per miles of shoreline 0.199 (total shoreline length = 3,841 miles)	↑	Ducks Unlimited: Conservation and Recreation Lands (CARL) dataset
Water Trails	No. of Trails 845 Miles of Trails 2714.24	↑	MDNR
Other (please specify)			
Motorized Trails Only	No. of Trails 296 Miles of Trails 238.06	unkwn	MDNR
Non-Motorized Trails Only	No. of Trails 3368 Miles of Trails 630.77	unkwn	MDNR
Both Motorized and Non-motorized Trails	No. of Trails 21 Miles of Trails 32.04	unkwn	MDNR

Appendix A – Sheet 2 shows a high-level view of public coastal access in Michigan as is based on U.S. EPA's BEACON database. Review of the BEACON data with those from the Conservation and Recreation Lands data revealed discrepancies in location and extent of some of these coastal lands. Therefore, one identified data gap is a refined, geospatially accurate and temporally updated GIS dataset depicting coastal public access lands.

Designated scenic turnouts or overlook sites and recreational boat access sites are shown in Appendix A – Sheet 3. The 312 boating access sites within the coastal zone are a subset of data managed by MDNR that is provided to the public through Michigan's Recreational Boating Information System (MRBIS), available at: http://www.mcgi.state.mi.us/MRBIS/mapbasic.aspx. The 26 designated turnouts or overlook sites shown (Appendix A – Sheet 3) include data sourced from both MDNR and the Michigan Department of Transportation (MDOT). These are based on best-available data sets; however, this data set is likely incomplete and does not portray all designated coastal overlooks in the state.

2. Briefly characterize the demand for coastal public access and the process for periodically assessing demand. Include a statement on the projected population increase for your coastal counties.[24]

   The population within the state's coastal shoreline counties is projected to be unchanged between 2010 and 2020. While the overall population within coastal counties is not expected to significantly change in the near term, it is likely that development will continue to expand into previously undeveloped stretches of shoreline. It is also anticipated that population density may increase with proximity to the actual shoreline within those coastal counties. Michigan's vast expanse of shoreline generally provides ample opportunity for the public to gain access to the coast; however, increasing development density along urban and even suburban shorelines may increasingly limit access. Additionally, physical features such as high coastal bluffs may make difficult or prevent public access altogether for significant stretches of the shore. An accurate, updated geospatial layer showing the location for and information about public access points along the state's coast is an identified need. A geospatial layer of this type could facilitate further investigation into available public access, gaps, and opportunities.

3. If available, briefly list and summarize the results of any additional data or reports on the status or trends for coastal public access since the last assessment.

   The Future of Michigan's Parks and Outdoor Recreation: *A Report to Governor Rick Snyder*
   In 2012, the Michigan State Parks and Outdoor Recreation Blue Ribbon Panel with assistance from Public Sector Consultants developed recommendations on Michigan's system of parks and public recreational facilities. The report contains seven core recommendations and 19 complementary recommendations that drive toward a cohesive vision and measurable outcomes. The recommendations focus on creating a 21st century infrastructure built around protecting and interpreting natural, cultural, historic, and prehistoric resources, completing a connected, multi modal trail network, and the development of urban signature parks. They also specify how the state targets investments toward desired outcomes, integrates tourism and economic development promotion, prioritizes safety and maintenance, and helps communities use their park and recreation assets to strengthen regional identity.

   The Michigan Department of Natural Resources, Michigan Comprehensive Trail Plan
   The MDNR Michigan Comprehensive Trail Plan, May 2013, was written to provide the MDNR a planning guide for its statewide trail systems. Additionally, the Trail Plan acknowledged Michigan's position as the nation's Trail State. Michigan has an incredible array of trails, developed and maintained by an extensive collaboration

[24] See NOAA's Coastal Population Report: 1970-2020 (Table 5, pg. 9): http://stateofthecoast.noaa.gov/coastal-population-report.pdf

among state and local governments, non-profits, foundations, and volunteers. The Trail Plan provided eight priority recommendations with associated key actions that should be implemented to assist in achieving the vision and ensuring that Michigan's trail system continues to be nationally recognized for its quality, extent, and the experiences that the trails and their host communities provide. The plan examined each specific trail type; identified a strategic vision for each trail type, prioritized trail links, and made recommendations for growing and improving the system. For each trail type, the plan also identified the existing trail system, opportunities for related business development; private sector involvement and investment, and threats to expansion of the system. The MDNR State Trails Implementation Plan, January 2014, built upon the Trail Plan and identified actions that the MDNR would undertake over a 5-year period to sustain Michigan's title as the Trail State.

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if there have been any significant state- or territory-level management changes (positive or negative) that could impact the future provision of public access to coastal areas of recreational, historical, aesthetic, ecological, or cultural value.

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	N	N	N
Operation/maintenance of existing facilities	N	N	N
Acquisition/enhancement programs	Y	Y	N

2. For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:
    a. Describe the significance of the changes;
    b. Specify if they were 309 or other MCZMP-driven changes; and
    c. Characterize the outcomes or likely future outcomes of the changes.

MCZMP, Great Lakes Water Trails Initiative

In 2013, the MCZMP redirected resources to advance the water trail planning efforts with emphasis on connecting the water trails along the Great Lakes shoreline. Phase I of the Great Lakes Water Trails Initiative encompassed providing $342,141 in federal grant funds to map, market, and develop water trail plans; expand the comprehensive statewide database and promotional website to display water trail information; and

develop a web/cell phone application to promote the tri-modal use of the Lake Michigan Water Trail, the parallel U.S. Bike Route System, and the Lake Michigan Circle Tour along the Lake Michigan shoreline. Ten water trail grants were completed in the fall of 2014. Phase II of the MCZMP Great Lakes Water Trails Initiative will be to provide additional grant funds for the implementation of the water trail plans recommendations expected to begin April 1, 2015, and to be completed by December 31, 2015.

Acquisition Programs – Coastal and Estuarine Land Conservation Program
The MCZMP administers the Coastal and Estuarine Land Conservation Program (CELCP) in Michigan. When available, CELCP funds are used for land acquisition projects to protect in perpetuity coastal lands having significant recreational, historical, aesthetic, ecological, or cultural values. Low impact public access and recreation such as hiking, hunting, berry picking, and bird watching is provided on lands acquired through the CELCP. Two CELCP projects were completed during the assessment period resulting in the opening of 1,842 acres of coastal lands including 3.4 miles of shoreline to public access. The Saugatuck Harbor Natural Area CELCP project, located on the eastern Lake Michigan shore, opened an additional 173 acres of coastal dunes, interdunal wetlands, Great Lakes Marsh, and an Oxbow Lake for public access. This project provides 3,650 feet of additional public access to Lake Michigan and 1,650 of access to the Kalamazoo river shoreline at its confluence to Lake Michigan. The Bete Grise Wetlands project resulted in the addition of 1,669 acres of coastal publically-accessible lands including 3,800 feet of shoreline on the freshwater estuary – Lac La Belle, and 9,100 feet of Lake Superior shoreline.

2. Indicate if your state or territory has a publically available public access guide. How current is the publication, and how frequently it is updated?[25]

Public Access Guide	Printed	Online	Mobile App
State or territory has? (Y or N)	N	N	N
Web address (if applicable)			
Date of last update			
Frequency of update			

Michigan has numerous guides and websites for public access statewide, developed by various state and local agencies and organizations; however, there is no known comprehensive guide or website that focuses specifically on coastal public access. As a result of the aforementioned MCZMP-supported water trails initiative, a comprehensive Great Lakes water trails access guide is now available for Michigan's Great Lakes waters (see www.michiganwatertrails.org).

Enhancement Area Prioritization:

[25] Note some states may have regional or local guides in addition to state public access guides. Unless you want to list all local guides as well, there is no need to list additional guides beyond the state access guide. However, you may choose to note that the local guides do exist and may provide additional information that expands upon the state guides.

1. What level of priority is the enhancement area for the coastal management program?

High	_____
Medium	__X__
Low	_____

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

Creating and enhancing public access continues to be a high priority for the MCZMP; however the utilization of 306 funding with leveraged local funds will be applied in order to maximize impact.

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Marine Debris

Section 309 Enhancement Objective: Reducing marine debris entering the nation's coastal and ocean environment by managing uses and activities that contribute to the entry of such debris. §309(a)(4)

PHASE I (HIGH-LEVEL) ASSESSMENT: *(Must be completed by all states.)*
Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment. The more in-depth assessments of Phase II will help the CMP understand key problems and opportunities that exist for program enhancement and determine the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. In the table below, characterize the existing status and trends of marine debris in the state's coastal zone based on the best available data.

Source of Marine Debris	Existing Status and Trends of Marine Debris in Coastal Zone		
	Significance of Source (H, M, L, unkwn)	**Type of Impact**[26] (aesthetic, resource damage, user conflicts, other)	**Change Since Last Assessment** (unkwn)
Land-based			
Beach/shore litter	H	Aesthetic, user conflict, danger to wildlife (ingestion of and entanglement in debris items), public health hazard (dangerous debris items, such as broken glass)	--
Dumping	L	Aesthetic, user conflict, danger to wildlife	--
Storm drains and runoff	H	Aesthetic, user conflict, danger to wildlife (ingestion of and entanglement in debris items), public health hazard (dangerous debris items, such as broken glass)	--

[26] You can select more than one, if applicable.

Source of Marine Debris	Existing Status and Trends of Marine Debris in Coastal Zone (continued)		
	Significance of Source (H, M, L, unkwn)	**Type of Impact**[27] (aesthetic, resource damage, user conflicts, other)	**Change Since Last Assessment** (unkwn)
Fishing (e.g., fishing line, gear)	M	Aesthetic, danger to wildlife (ingestion of and entanglement in debris items)	--
Other (extreme storms)	M	Aesthetic, user conflict, danger to wildlife (ingestion of and entanglement in debris items), public health hazard (dangerous debris items, such as broken glass)	unkwn
Ocean or Great Lake-based			
Fishing (e.g., derelict fishing gear)	L	Aesthetic, danger to wildlife (potential entanglement in fishing line, nets, etc.)	--
Derelict vessels	L	Danger to navigation	--
Vessel-based (e.g., cruise ship, cargo ship, general vessel)	L	Aesthetic, danger to wildlife, aquatic habitat impacts, water quality impacts	--
Hurricane/Storm	L	Unknown	--
Tsunami	L	Unknown	--
Other (extreme storms)	M	Aesthetic, user conflict, danger to wildlife (ingestion of and entanglement in debris items), public health hazard (dangerous debris items, such as broken glass)	↑

2. If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends or potential impacts from marine debris in the coastal zone since the last assessment.

The MCZMP continues to support the Adopt-a-Beach Program with Alliance for the Great Lakes (Alliance) annually. The Alliance partners with Clean Water Action to implement the Adopt-a-Beach program throughout the coastline of Michigan. The Alliance trains volunteers, coordinates beach clean-up efforts throughout the year and coordinates the September Adopt-a-Beach event that coincides with the International

[27] You can select more than one, if applicable.

Coastal Clean-up. The data that Alliance collects is provided to the MCZMP annually as well as the Ocean Conservancy. Section 306 funding has continued to be the primary funding for addressing these needs in Michigan.

Results from the Michigan Adopt-a-Beach program for the last assessment period do not show decreases in the amount of debris collected. Table 1 below shows statistics for the highest quantity debris items recovered in 2013, which is also generally representative of annual results for debris collected during the last assessment period.

Table 1. Top ten items found during the 2013 Michigan Coastal Clean-up.

2013	
Item	Quantity
Cigarettes/cigarette filters	59,747
Food wrappers/containers	20,956
Caps, lids	14,252
Bags (plastic)	9,328
Straws/stirrers	6,803
Cups, plates, forks, knives, spoons	5,454
Beverage bottles (plastic) 2 Liters or less	5,331
Cigar tips	4,654
Beverage bottles (glass)	3,343
Bags (paper)	3,103

The MCZMP, as part of this assessment, has plotted trends over time from 2009 through 2013 for the 46 different categories of marine debris data as is collected through the beach clean-up efforts. These charts are provided in Appendix B. Cursory review of the charts reveals that quantities for many items appear to be increasing, especially during the last 2 – 3 years of data record. A detailed analysis of these data sets is beyond the scope of this assessment; however, the data provided demonstrates the continued need for a focus on marine debris clean-up efforts.

During the last assessment cycle a Great Lakes land based marine debris action plan was developed through a partnership of the regional marine debris community. The effort was primarily coordinated by the NOAA Marine Debris Program and Alliance. The community first met on July 22, 2011 at John G. Shedd Aquarium in Chicago, Illinois for a one-day meeting, and identified numerous issues associated with marine debris in the Great Lakes region. Nine broad categories were identified and prioritized for action. NOAA staff then followed up with a two-day workshop in December 2011 to further refine and prioritize regional marine debris issues. The partnership includes state and federal agencies as well as non-governmental organizations. A vision statement and mission statement were developed at this meeting.

Vision Statement: The Great Lakes, its coasts, people, and wildlife are free from the impacts of marine debris.

Mission Statement: The Great Lakes will be free from marine debris through an increased understanding of the problem, preventative actions, reductions in impacts, and collaborative efforts of diverse groups.

Next, a two-day workshop was held in May of 2013 to begin to develop a strategic plan for land based marine debris in the Great Lakes. By the end of the workshop, the five following goals were developed, with objectives and strategies being developed for each goal.

Goal 1: Knowledge gaps are identified and filled through research and monitoring of land-based marine debris.

Goal 2: A science-based and strategic approach is used to guide land-based marine debris policy and management decisions in the Great Lakes.

Goal 3: Land-based marine debris is prevented and reduced through an educated and involved community.

Goal 4: The impacts of land-based marine debris are reduced through removal and tracking efforts.

Goal 5: Strategic partnerships are developed to add value and invest resources to address Great Lakes land-based marine debris.

A subsequent meeting was held in Chicago, Illinois in February 2014. This meeting was the final meeting to help refine the goals, objectives, and specific tasks that would be incorporated into the Great Lakes Land-Based Marine Debris Action Plan. The final plan can be found at the following link:

http://marinedebris.noaa.gov/sites/default/files/Lowe%202014%20-%20GL%20Action%20Plan_0.pdf

Work has begun to implement specific tasks in the plan. Staff from the MCZMP participated in the development of the plan through attendance at mentioned workshops, conference calls, and providing feedback as needed throughout the process. Staff continues to participate in the group as needed.

In 2007, the MSG Clean Marina Program initiated a Boat Shrink-wrap Recycling Pilot Program by partnering with an Ohio company that manufactures recycled plastic products. The MCZMP provided information about this program in the last Assessment. Currently many counties in Michigan offer shrink-wrap recycling services. Residents need to contact the county waste management programs to see if a program is available in the area. Another option is available if a local drop-off location is not available. Dr. Shrink's REBAG Recycling System is a kit that consists of a 30 by 50 inch clear bag and a prepaid UPS shipping label. Each kit will hold the cover from a 26-foot powerboat.

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if there have been any significant state- or territory-level management changes (positive or negative) for how marine debris is managed in the coastal zone.

Management Category	**Employed by State/Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Marine debris statutes, regulations, policies, or case law interpreting these	N	N	N
Marine debris removal programs	Y	Y	N

The MCZMP has been working with the Alliance and its predecessor, the Lake Michigan Federation, to implement the Adopt-a-Beach program, or similar programs for almost two decades. With over 3,000 miles of shoreline Michigan has the largest Great Lakes coastline, and thus a vast challenge in striving toward maintaining debris-free beaches.

Marine debris not only impacts the aesthetic and economic value of our coastal areas but can be a threat to fish and wildlife health from entanglement and ingestion of debris. Each year the Alliance Adopt-a-Beach™ volunteers find animals that have been entangled in debris. In 2013, there were four separate incidences, three seagulls and one duck, reported by volunteers of animal entanglements. The items entangling these animals were rope, balloon strings and plastic bags. It should be noted that plastic bags were listed as the number four most picked up item by volunteers. Although not on the top ten, balloons rank 11 on the list of items removed. In 2013, more than 3,000 balloons were found along coastal areas in Michigan. That is more than double any other Great Lakes state.

A growing concern to our coasts comes from climate change and stressors from extreme storms that wash large amounts of debris onto our coasts. The impacts of these storms have already been felt by Hurricane Sandy in 2012 in Ohio and again in 2008 and 2010 in West Michigan from a mystery trash wash up. In all incidences large amounts of trash along with woody debris was washed out to coastal areas as a result of large amounts of water that fell over short periods resulting in flooding and caused by not only flooding, but by capacity of storm/sewer systems in Cleveland and Milwaukee.

Another important item to note is that food-related items make up more than 40% of all items removed from shorelines. Food-related items are a draw to wildlife which can contribute to bacterial pollution for our beaches.

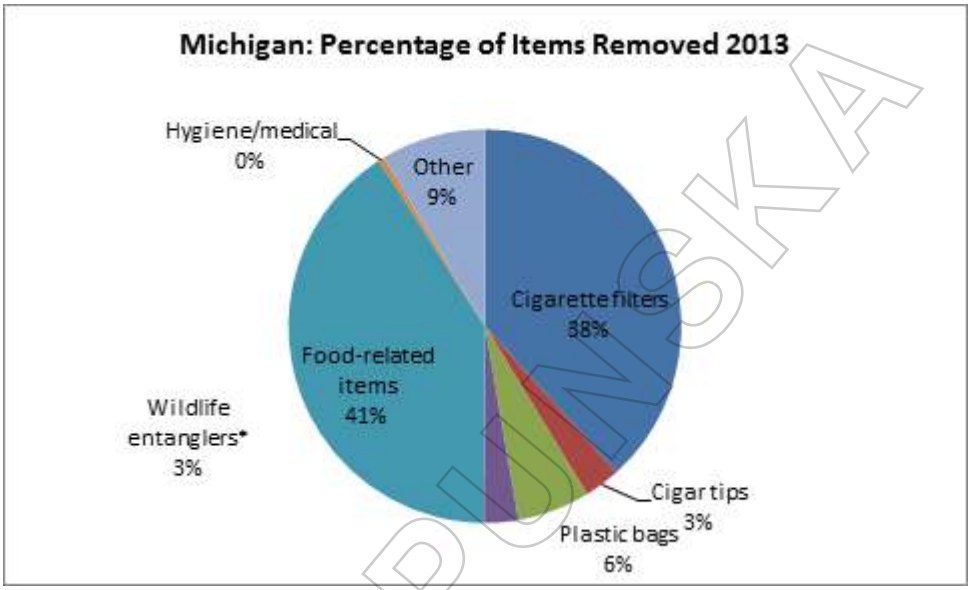

Figure 2. Chart showing percentage of each item type removed from Michigan's Great Lakes Beaches in 2013. Note - Wildlife entanglers include: rope, 6-pack rings, fishing line, nets and balloons.

2. For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:
    a. Describe the significance of the changes;
    b. Specify if they were 309 or other MCZMP-driven changes; and
    c. Characterize the outcomes and likely future outcomes of the changes.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High	_____
Medium	**X**
Low	_____

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

The MCZMP assesses marine debris as a medium priority enhancement area due to the continued impacts of debris on the shoreline for nearly two decades. While numbers of volunteers and beach clean-up programs have grown, the amount of debris has not declined. Marine Debris needs to be addressed at the state level to begin to identify solutions that will result in the overall reduction of marine debris on Michigan's shoreline. The Director of the MDEQ and Michigan's Governor, Rick Snyder, have emphasized the importance of pollution prevention in managing the significant resources of our state. Specifically, the MDEQ placed emphasis on reducing, reusing,

and recycling (the 3 R's) as mechanisms of reducing pollution in the state. The MDEQ provides information, technical assistance, and financial incentives for reducing pollution, and recently received additional funding and staffing to address recycling program development and expansion throughout the state.

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Cumulative and Secondary Impacts

Section 309 Enhancement Objective: Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources. §309(a)(5)

PHASE I (HIGH-LEVEL) ASSESSMENT: *(Must be completed by all states.)*
Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment. The more in-depth assessments of Phase II will help the CMP understand key problems and opportunities that exist for program enhancement and determine the effectiveness of existing management efforts to address those problems.

Resource Characterization:

1. Using National Ocean Economics Program Data on population and housing,[28] please indicate the change in population and housing units in the state's coastal counties between 2012 and 2007. You may wish to add additional trend comparisons to look at longer time horizons as well (data available back to 1970), but at a minimum, please show change over the most recent five year period (2012-2007) to approximate current assessment period.

Trends in Coastal Population and Housing Units				
Year	**Population**		**Housing**	
	Total (# of people)	% Change (compared to 2002)	Total (# of housing units)	% Change (compared to 2002)
2007	5,052,788	-3.98%	2,285,794	-0.58%
2012	4,851,799		2,272,449	

Overall population change (Appendix A – Sheet 4) and housing (Appendix A – Sheet 5) in Michigan's coastal counties declined between 2007 and 2012. Counties showing significant population decreases included Wayne, Ontonagon, and Alcona. Wayne County's decline can certainly be tied to the lingering effects of the economic recession and its impacts on the automotive industry which is so critical to the economic well-being of Detroit and Wayne County. Similarly, Ontonagon County's population was affected by the economic downturn and specifically, the loss of jobs associated with the 2011 closing of a paper plant located in the coastal zone, along the Portage Waterway. The paper plant closure in Ontonagon represents the most recent of a long line of water-dependent business closures over the past decade and a half. The challenges of this working waterfront community are further documented in a case study (Durfee 2013) conducted through a coastal zone management fellowship that reviewed working waterfronts along Michigan's coast.

[28] www.oceaneconomics.org/. Enter "Population and Housing" section. From drop-down boxes, select your state and "all counties." Select the year (2012) and the year to compare it to (2007). Then select "coastal zone counties." Finally, be sure to check the "include density" box under the "Other Options" section.

2. Using provided reports from NOAA's Land Cover Atlas[29] or high-resolution C-CAP data[30] (Pacific and Caribbean Islands only); please indicate the status and trends for various land uses in the state's coastal counties between 2006 and 2011. You may use other information and include graphs and figures, as appropriate, to help illustrate the information. Note that the data available for the islands may be for a different time frame than the time periods reflected below. In that case, please specify the time period the data represents. Also note that Puerto Rico and the Commonwealth of the Northern Mariana Islands (CNMI) currently only have data for one time point so will not be able to report trend data. Instead, Puerto Rico and CNMI should just report current land use cover for developed areas and impervious surfaces.

Distribution of Land Cover Types in Coastal Counties		
Land Cover Type	**Land Area Coverage in 2011 (Acres)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	402,261	10,035
Developed, Low Intensity	630,571	10,730
Developed, Open Space	273,740	11,366
Grassland	800,944	12,815
Scrub/Shrub	714,002	54,946
Barren Land	172,476	-1,432
Open Water	4,103,836	1,567
Agriculture	4,287,904	-17,618
Forested	7,547,554	-80,009
Woody Wetland	4,694,222	-21,441
Emergent Wetland	605,381	18,922

Distribution of Land Cover Types in Coastal Zone Management Areas		
Land Cover Type	**Land Area Coverage in 2011 (Acres)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	48,600	876
Developed, Low Intensity	75,320	543
Developed, Open Space	32,488	178
Grassland	40,291	645
Scrub/Shrub	36,084	943
Barren Land	98,447	-916
Open Water	3,644,999	188
Agriculture	60,815	-718
Forested	516,793	-1859
Woody Wetland	275,681	-538
Emergent Wetland	75,712	530

3. Using provided reports from NOAA's Land Cover Atlas[31] or high-resolution C-CAP data[32] (Pacific and Caribbean Islands only); please indicate the status and trends for developed areas in the state's coastal counties between 2006 and 2011 in the two tables below. You may use other information and include graphs and figures, as

[29] www.csc.noaa.gov/ccapatlas/. Summary data on land use trends for each coastal state is available on the ftp site.
[30] www.csc.noaa.gov/digitalcoast/data/ccaphighres. Summary data on land use trends for each coastal state is available on the ftp site.
[31] www.csc.noaa.gov/ccapatlas/. Summary data on land use trends for each coastal state is available on the ftp site.
[32] www.csc.noaa.gov/digitalcoast/data/ccaphighres. Summary data on land use trends for each coastal state is available on the ftp site.

appropriate, to help illustrate the information. Note that the data available for the islands may be for a different time frame than the time periods reflected below. In that case, please specify the time period the data represents. Also note that Puerto Rico and CNMI currently only have data for one time point so they will not be able to report trend data. Unless Puerto Rico and CNMI have similar trend data to report on changes in land use type, they should just report current land use cover for developed areas and impervious surfaces.

Development Status and Trends for Coastal Counties			
	2006	**2011**	**Percent Net Change**
Percent land area developed	5.26%	5.39%	2.52%
Percent impervious surface area	1.90%	1.95%	2.37%

Development Status and Trends for Coastal Zone Management Areas			
	2006	**2011**	**Percent Net Change**
Percent land area developed	3.16%	3.19%	1.03%
Percent impervious surface area	1.15%	1.17%	1.36%

** Note: Islands likely have data for another time period and may only have one time interval to report. If so, only report the change in development and impervious surface area for the time period for which high-resolution C-CAP data are available. Puerto Rico and CNMI do not need to report trend data.*

How Land Use Is Changing in Coastal Counties	
Land Cover Type	**Areas Lost to Development Between 2006-2011** (Acres)
Barren Land	4,681
Emergent Wetland	442
Woody Wetland	1,864
Open Water	142
Agriculture	19,516
Scrub/Shrub	747
Grassland	2,276
Forested	3,736

How Land Use Is Changing in Coastal Zone Management Areas	
Land Cover Type	**Areas Lost to Development Between 2006-2011** (Acres)
Barren Land	302
Emergent Wetland	87
Woody Wetland	244
Open Water	36

How Land Use Is Changing in Coastal Zone Management Areas (continued)	
Land Cover Type	**Areas Lost to Development Between 2006-2011** (Acres)
Agriculture	267
Scrub/Shrub	65
Grassland	206
Forested	522

** Note: Islands likely have data for another time period and may only have one time interval to report. If so, only report the change in land use for the time period for which high-resolution C-CAP data are available. Puerto Rico and CNMI do not report.*

4. Using data from NOAA's State of the Coast "Shoreline Type" viewer,[33] indicate the percent of shoreline that falls into each shoreline type.[34] You may provide other information or use graphs or other visuals to help illustrate.

Shoreline Types (Modified for Great Lakes)	
Shoreline Material	**Percent of Shoreline**
Artificial	15.95
Boulders, Bedrock	23.81
Cohesive Clays and Silts	1.52
Sand	35.98
Shingles, Pebbles, Cobbles	22.63
No Data	0.1

Shoreline Types (Modified for Great Lakes)	
Primary Coast Type	**Percent of Shoreline**
Bluff 2'-10'	10.5
Coastal Wetland	14.33
Dune 2'-10'	10.17
Flat Coast	53.68
High Bluff 10'+	5.15
High Dune 10'+	5.76
No Data	0.4

5. Data for the tables above is from the Great Lakes Coastal Flood Study being conducted by the FEMA and U.S. Army Corps of Engineers. Nearly 16% of the state's Great Lakes shoreline is artificial or armored in some manner. The tables and associated maps (Appendix A – Sheets 6 and 7) portray the high diversity of shore types that exists in Michigan, having everything from bedrock shores to coastal wetlands and high bluffs and dunes. If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the cumulative and secondary impacts of coastal growth and development, such as water quality and habitat fragmentation, since the last assessment to augment the national data sets.

Management Characterization:

[33] http://stateofthecoast.noaa.gov/shoreline/welcome.html

[34] Note: Data are from NOAA's Environmental Sensitivity Index (ESI) Maps. Data from each state was collected in different years and some data may be over ten years old now. However, it can still provide a useful reference point absent more recent statewide data. Feel free to use more recent state data, if available, in place of ESI map data. Use a footnote to convey data's age and source (if other than ESI maps).

1. Indicate if the approach is employed by the state or territory and if there have been any significant state-level changes (positive or negative) in the development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources, since the last assessment.

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	N	Y	N
Guidance documents	Y	Y	Y
Management plans (including SAMPs)	N	N	N

Local governments have authority over community land use in Michigan. Using Section 306 competitive pass-through funding to local coastal communities, the MCZMP has continued to provide for the development and adoption of local master plans and zoning ordinances.

2. For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:
    a. Describe the significance of the changes;
    b. Specify if they were 309 or other MCZMP-driven changes; and
    c. Characterize the outcomes or likely future outcomes of the changes.

With the assistance of a NOAA Coastal Fellow, the MCZMP advanced understanding of the role and importance of working waterfront communities within the state[35]. Local officials for such communities must identify approaches to best coordinate and leverage water-dependent uses with compatible and supporting land uses in a manner that protects the coastal natural resources, aesthetics, and their community's economy. This initiative developed a series of case studies highlighting 11 of Michigan's working waterfront communities. The resulting report serves as an informational and educational resource for community leaders, resource managers, and anyone interested in learning more about Michigan's working waterfronts. It conveys both the importance of working

[35] See http://www.miseagrant.umich.edu/explore/coastal-communities/vibrant-waterfront-communities-case-studies/

waterfronts to the local and state economy and quality of life in coastal communities as well as the need for strategic waterfront planning that protects these assets.

The MCZMP funded the development and publication of Homes in the Dunes: Designed to Preserve, in 2012 with Section 306 competitive funding awarded to the nonprofit organization Preserve the Dunes, Inc. The guidebook illustrates recommended strategies and methods to protect the dunes and associated ecosystems when building in Michigan's designated Critical Dune Areas. Additionally, the MCZMP supported the 2nd edition of the Filling the Gaps guidance document, which provides Environmental Protection Options for local governments.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High	____
Medium	____
Low	__**X**__

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

During much of the Assessment period, Michigan's sluggish economy and population decline appear to have dampened the rate of residential growth and development to varying degrees throughout the State. This trend began prior to the previous Assessment and may have slowed the conversion of coastal habitats and farmlands to other uses. Many communities, including the coastal communities of Detroit, Ecorse, River Rouge, Muskegon Heights, and Port Huron, have significant numbers of vacant, blighted buildings. Detroit alone has more than 40,000 vacant structures. Demolition of these structures over the next several years will present the opportunity for urban infill development.

Michigan's program will continue to use Section 306 funds to support the development of guidance documents and workshops on managing cumulative and secondary impacts of coastal development, as well as community land use plans and zoning ordinances. The program will also continue to seek ways to apply knowledge gained through the working waterfronts initiative towards future coastal community planning efforts.

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Special Area Management Planning

Section 309 Enhancement Objective: Preparing and implementing special area management plans for important coastal areas. §309(a)(6)

The CZMA defines a Special Area Management Plan (SAMP) as "a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone. In addition, SAMPs provide for increased specificity in protecting natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making."

Resource Characterization:

1. In the table below, identify geographic areas in the coastal zone subject to use conflicts that may be able to be addressed through a special area management plan (SAMP). This can include areas that are already covered by a SAMP but where new issues or conflicts have emerged that are not addressed through the current SAMP.

Geographic Area	Opportunities for New or Updated Special Area Management Plans
	Major conflicts/issues
None	N/A

   No specific geographic areas are currently identified as well-suited for the development of a SAMP. The MCZMP is structured such that program issue areas (e.g., coastal wetlands, public access, coastal hazards) remain of primary focus rather than specific geographic regions of the coast.

2. If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends of SAMPs since the last assessment.

   No SAMP efforts are currently being conducted by the MCZMP.

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if there have been any significant state- or territory-level management changes (positive or negative) that could help prepare and implement SAMPs in the coastal zone.

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
SAMP policies, or case law interpreting these	N	N	N
SAMP plans	N	N	N

Michigan has not developed or adopted a SAMP, and it is not believed that SAMP development is warranted at this time.

For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:

a. Describe the significance of the changes;
b. Specify if they were 309 or other MCZMP-driven changes; and
c. Characterize the outcomes or likely future outcomes of the changes.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High _____
Medium _____
Low __X__

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.
The MCZMP is structured such that the focus is on program issues (e.g., coastal wetlands, public access, coastal hazards) rather than specific geographic regions of the coast. This management approach has been in place since program inception, and has served the program well by promoting equitable distribution of MCZMP funds and resources toward issues of need throughout the state's coastal zone. Opportunities and advantages of potentially identifying new SAMPs were considered as part of this assessment process, and included querying stakeholders through the engagement survey to identify prospective SAMP areas. No compelling prospective SAMP areas have been identified at this time that would prompt the program to initiate a SAMP effort.

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Ocean and Great Lakes Resources

Resource Characterization:

1. Using Economics: National Ocean Watch (ENOW), indicate the status of the ocean and Great Lakes economy as of 2010, as well as the change since 2005, in the tables below. Include graphs and figures, as appropriate, to help illustrate the information.

Table 1. The status of the Great Lakes Economy for Michigan coastal counties in 2010.

Status of Great Lakes Economy for Coastal Counties (2010)				
	Establishments (# of Establishments)	**Employment** (# of Jobs)	**Wages** (Millions of Dollars)	**GDP** (Millions of Dollars)
Living Resources	90	156	$2,982,000	$6,827,000
Marine Construction	187	1,013	$55,435,000	$89,662,000
Marine Transportation	347	12,568	$713,823,000	$1,221,488,000
Offshore Mineral Extraction	389	3,402	$221,371,000	$501,688,000
Ship and Boat Building	38	1,045	$444,010,00	$97,134,000
Tourism & Recreation	3,572	49,982	$698,096,000	$1,417,771,000
All Ocean Sectors	4,623	68,166	$1,736,108,000	$3,334,570,000

Table 2. The change in Great Lakes Economy for Michigan coastal counties between 2005 to 2010.

Change in Great Lakes Economy for Coastal Counties (2005-2010)				
	Establishments (% change)	**Employment** (% change)	**Wages** (% change)	**GDP** (% change)
Living Resources	-4.26%	-40.91%	-44.19%	-49.20%
Marine Construction	0%	0%	8.60%	-5.18%
Marine Transportation	-12.15%	-21.32%	-15.69%	-10.80%
Offshore Mineral Extraction	-5.12%	-22.17%	-2.13%	-19.87%
Ship and Boat Building	8.57%	-46.36%	-39.74%	-44.99%
Tourism & Recreation	-0.28%	-11.37%	0.31%	-2.32%
All Ocean Sectors	-1.70%	-14.75%	-8.57%	-10.64%

Figure 1. Percentage component bar chart of each economic indicator in Michigan coastal counties from 2005 to 2010.

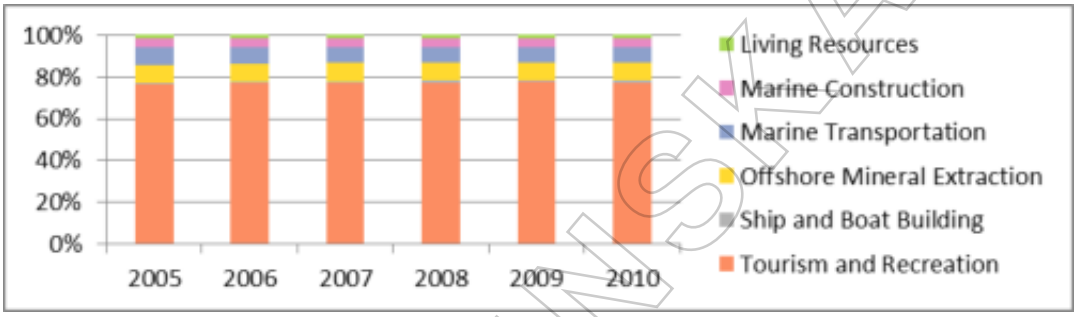

Figure 1-1. Percentage of Business Establishments for economic sectors.

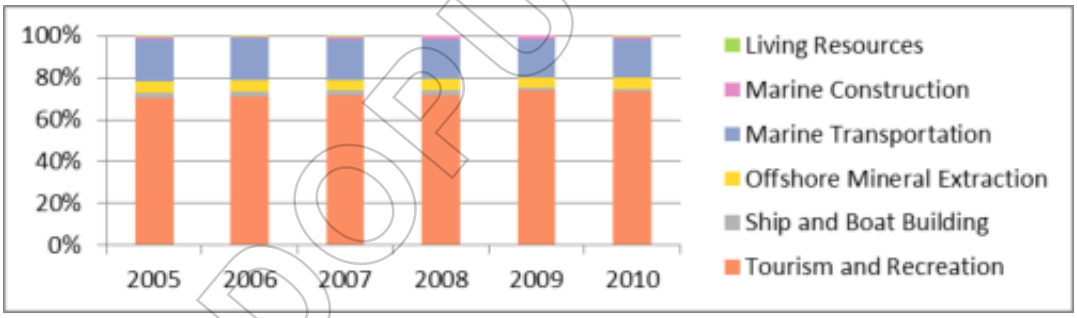

Figure 1-2. Percentage of Employment for economic sectors.

Figure 1-3. Percentage of Annual Wages for different economic sectors.

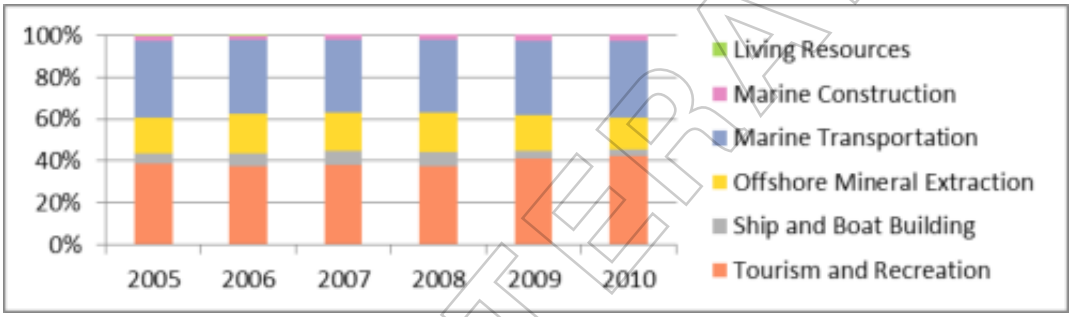

Figure 1-4. Percentage of gross domestic product (GDP) for different economic sectors.

Figure 2. Trend of each economic indicator in Michigan coastal counties from 2005 to 2010. The value from each year was standardized based on the value in 2005.

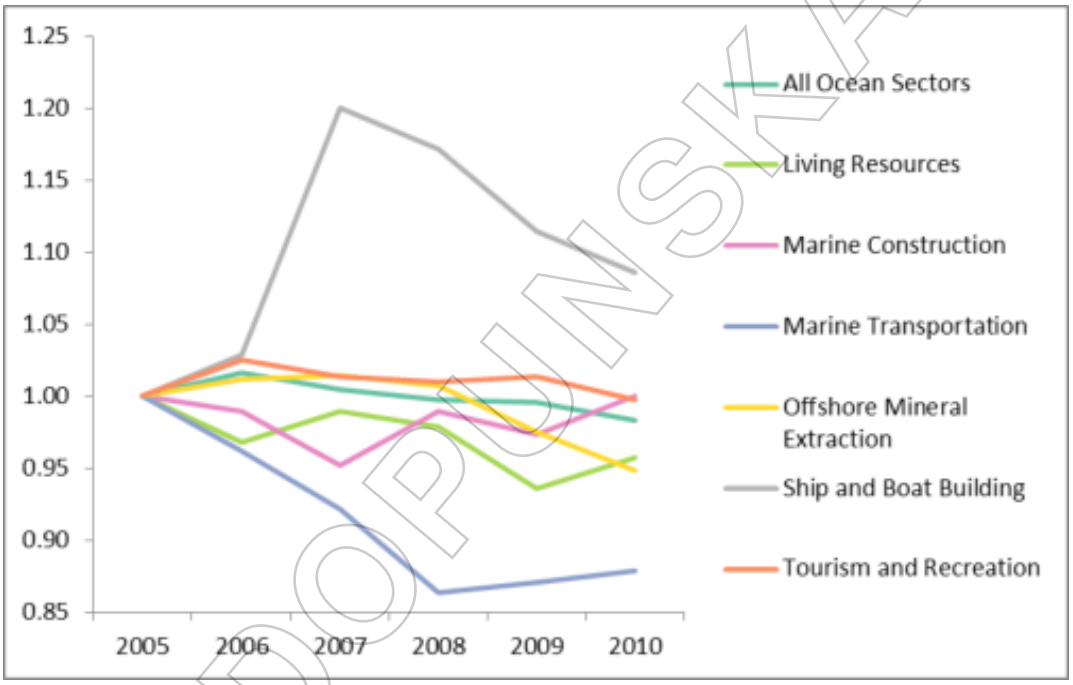

Figure 2-1. Trend of Business Establishments for economic sectors.

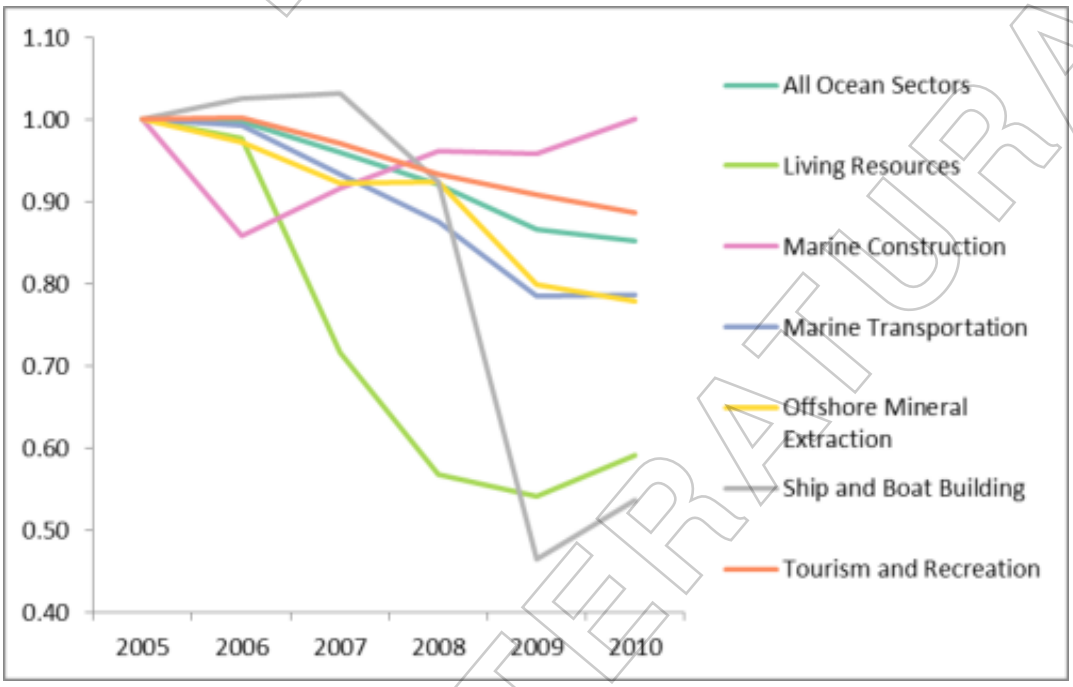

Figure 2-2. Trend of Employment for economic sectors.

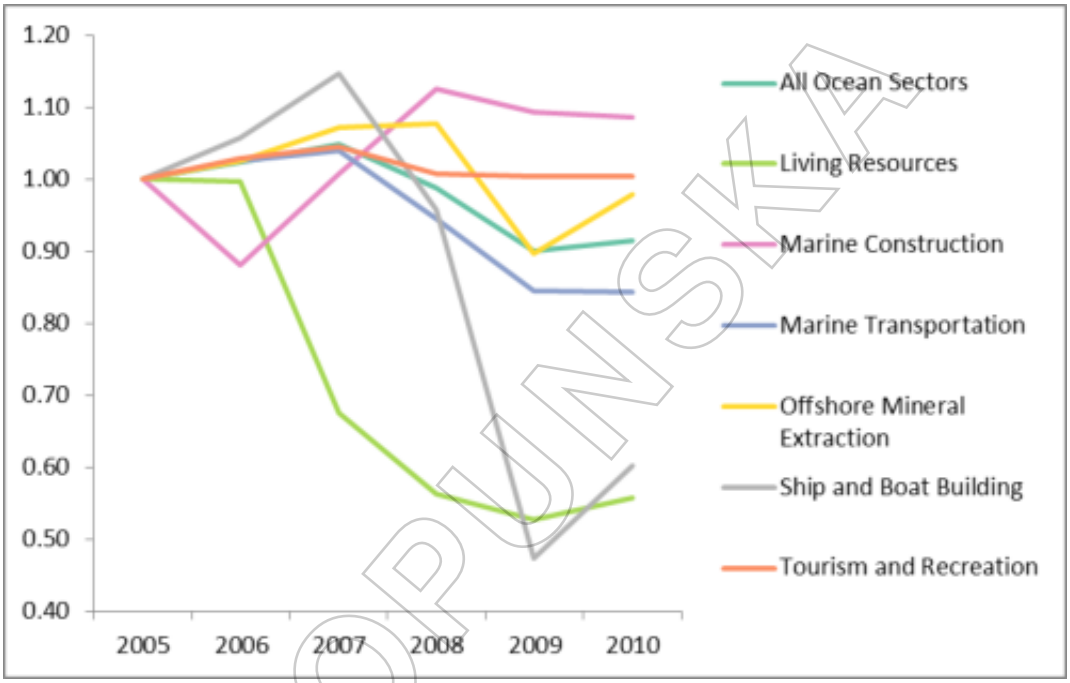

Figure 2-3. Trend of Annual Wages for economic sectors.

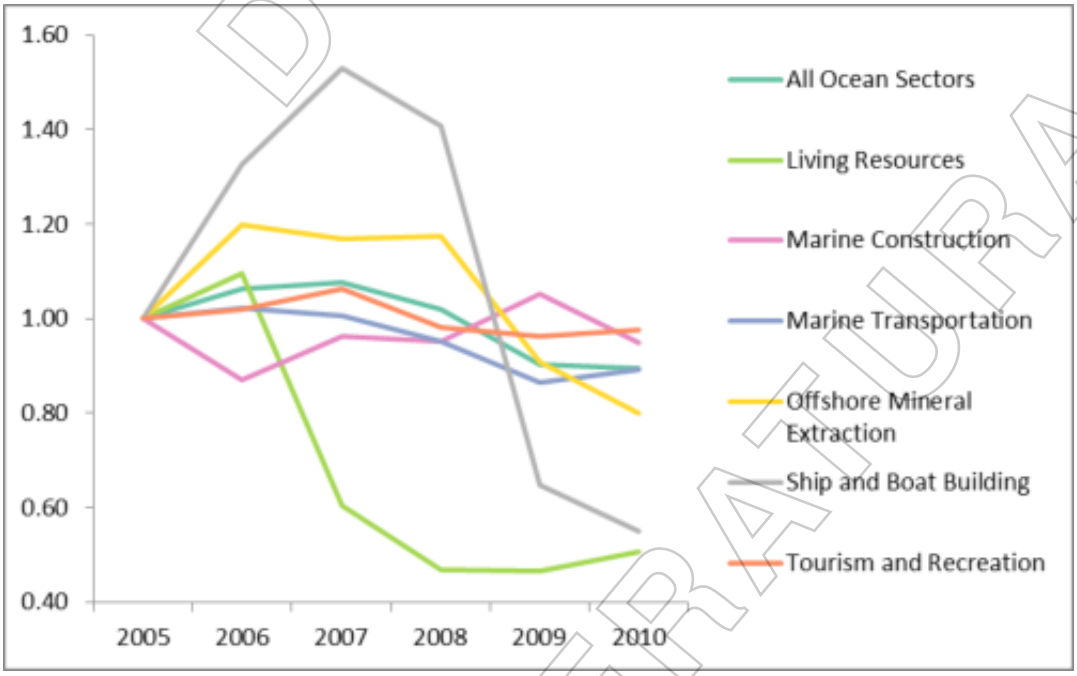

Figure 2-4. Trend of GDP for economic sectors.

Summary of the Economic Indicators in Michigan

Based on the data from Economics: National Ocean Watch (ENOW), most of the Great Lakes economic indicators in Michigan coastal counties in 2010 are lower than the values in 2005 (Table 1 and Table 2). While the values of economic indicators decreased, the structure of economic sectors remained approximately the same throughout all years (Figure 1). The Tourism and Recreation sector takes the highest percentage of business establishments and employment from 2005 to 2010 (Figure 1-1 and Figure 1-2). In addition, the Tourism and Recreation sector, together with Marine Transportation sector, also take a large portion of annual wages and GDP (Figure 1-3 and Figure 1-4). These data suggest that tourism, recreation, and transportation play a major role in the Great Lakes economy of Michigan coastal counties.

Figure 2 plots each economic indicator in Michigan coastal counties from 2005 to 2010. We standardized the data based on the data from 2005, so the values from each year indicate relative intensity compared to 2005. All these graphs reveal that trends of the economic indicators and all sectors, except Business Establishments and Living Resources, are slightly downward or not significantly increasing or decreasing (Figure 2-1 to 2-4). Although it seems like the Business Establishments of the Ship and Boat Building sector show a large increase in 2007 (36 in 2006, 42 in 2007), it is important to note that the number of this sector is small compared to other sectors (range: 35 - 42). Changes in the number of Business Establishments of this sector tends to result in large variation in intensity (Figure 2-1), but they may not actually indicate significant changes in this industry. In contrast, there is a large decreasing trend in all economic indicators of Living Resources sector from 2005 to 2010 (Figure 2-1 to Figure 2-4).

The observed patterns in economic indicators may imply the importance of tourism, recreation, and marine transportation to maintain the Great Lakes economy in Michigan. Figure 2 suggests that the trends of Tourism and Recreation sector and Marine Transportation sector are both similar compared to the pattern of All Ocean Sectors. While Ship and Boat Building sector and Living Resources sector take only a small percentage of total economic indicators, it is more likely that the pattern of the total economic indicators is strongly influenced by major sectors, which are Tourism and Recreation or Marine Transportation in Michigan (Figure 1-1 to 1-4).

Indeed, the environment of the Great Lakes provides economic advantage in transportation and recreation in Michigan. For example, because of the Great Lakes, shipping transportation for commodities and products is generally inexpensive, which sustains the development of other industries. The Great Lakes also provide unique opportunities for recreation and tourism, such as anglers, charter fishing, and recreational boating, creating huge economic benefits. Since tourism, recreation, and transportation are the main drivers of the economy in Michigan, it is crucial to maintain the environmental integrity of the Great Lakes to sustain the ecosystem service[36].

[36] Lynn V. et al. 2009. Michigan's Great Lakes Jobs. Michigan Sea Grant.

1. *In the table below, characterize how the threats to and use conflicts over ocean and Great Lakes resources in the state's or territory's coastal zone have changed since the last assessment.*

Table 3 Changes in threat and resources use to Great Lakes resources in Michigan

Significant Changes to Ocean and Great Lakes Resources and Uses	
Resource/Use	**Change in the Threat to the Resource or Use Conflict Since Last Assessment** (↑, ↓, –, unkwn)
Resource	
Benthic habitat (including coral reefs)	-
Living marine resources (fish, shellfish, marine mammals, birds, etc.)	↑
Sand/gravel	↓
Cultural/historic	unkwn
Other (please specify)	
Use	
Transportation/navigation	↑
Offshore development	-
Energy production	-
Fishing (commercial and recreational)	↑
Recreation/tourism	↑
Sand/gravel extraction	-
Dredge disposal	-
Aquaculture	unkwn
Other (please specify)	

2. *For the ocean and Great Lakes resources and uses in Table 2 (above) that had an increase in threat to the resource or increased use conflict in the state's or territory's coastal zone since the last assessment, characterize the major contributors to that increase.*

Table 4. Major Contributors to an Increase in threat of resources.

Major Contributors to an Increase in Threat or Use Conflict to Ocean and Great Lakes Resources				
Resource	**Major Reasons Contributing to Increased Resource Threat or Use Conflict** (Note All that Apply with "X")			
	Aquatic Invasive Species	Changing Water Level	Increasing Water Temperature	Changing Storm Pattern
Living marine resources	X		X	
Transportation/navigation	X	X		X
Fishing	X		X	
Recreation/tourism	X	X	X	X

3. *If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends of ocean and Great Lakes resources or threats to those resources since the last assessment to augment the national data sets.*

The Focus on Climate Change and Aquatic Invasive Species

With respect to the top threats to the environment and resources in the Great Lakes, recent studies suggest that there could be a shift of primary focus in the Great Lakes among experts from some stressors that have existed for a long time, such as nonpoint phosphorus and toxic pollutions, to climate change and aquatic invasive species. The Great Lakes Environmental Assessment and Mapping (GLEAM) Project team recently published a paper assessing 50 environmental stressors based on expert elicitation[37]. The project team surveyed 141 experts' opinion, including researchers, managers, and non-governmental organization representatives, participating in environmental work about the Great Lakes. Each expert was asked to rate these stressors by evaluating the potential impacts of these stressors. Based on the summary of the experts' opinion, the project team found that the highest-rated stressors were related to aquatic invasive species and climate change, indicating that most experts believe these two factors have a profound and significant impact on the ecosystem because of wide spatial extent, large change of magnitude, and long recovery time[2].

Because of the increasing attention of climate change and aquatic invasive species among experts, we thus assess which resources or uses could be threatened by these two factors in recent years and the near future.

[37] Smith S. D. P. et al. 2014. Rating impacts in a multi-stressor world: a quantitative assessment of 50 stressors affecting the Great Lakes. Ecological Applications. http://dx.doi.org/10.1890/14-0366.1

The Impact of Climate Change

Climate change may systematically alter the environment and ecosystem around the Great Lakes region. The potential threats to the coastal zones include increasing water temperature, changing storm patterns, and changing water level[38].

Water temperature is an important physical characteristic to maintain the integrity of an aquatic ecosystem. Due to changes in climate, the air temperature around the Great Lakes is likely to increase in the near future, which may cause an associated increase in surface water temperature[3]. Although warmer water temperatures could result in a longer warm periods for some aquatic species to grow, most of the impacts from this change are negative. It may cause a shift in distribution and phenology of cold and warm water fish species, altering the local aquatic communities. It may also generate more frequent hypoxia because of higher productivity of algae. Furthermore, aquatic invasive species may be able to expand their distribution to the north if they prefer a warmer environment. Therefore, increasing water temperature of the Great Lakes is a threat to living marine resources, fishery, and recreation.

Warmer air and water temperatures may also lead to increased evaporation, which can result in increased precipitation and storm magnitude. This could have negative impacts on transportation and recreation because extreme weather pattern may cause severe erosion events or floods, damaging the function or use of ports or harbors.

The annual water levels of the Great Lakes fluctuate widely compared to other marine systems[39], which has a direct impact on transportation, navigation, and recreation. Low water level reduces the capacity of cargo and the function of ports, harbors, and waterways. In 2012 and 2013, there was a "dredging crisis" for many ports and harbors because of the record low water level. As a result, the number of dredging projects reached a record high. The low water level condition also affected the efficiency of ship transportation[4041]. However, water levels are on the rise recently, and continued to rise through the fall 2014. This sort of late-year water level rise event as seen in the Lake Superior, Huron, and Michigan, is extremely rare[42].

Recent studies show that the Great Lakes water level could be slightly decreasing[3,4]. In addition, much of the coastal infrastructure in Michigan was built during 1960s to 1980s

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[38] 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. Available from the Great Lakes Integrated Sciences and Assessments (GLISA) Center, http://glisa.msu.edu/docs/NCA/MTIT_Coastal.pdf.

[39] Gronewold A. D. and Stow A. 2014. Water Loss from the Great Lakes. Science.

[40] Lake Carriers' Association 2012 Annual Report. http://www.lcaships.com/wp-content/uploads/2013/01/2012-LCA-Annual-Report-Final.pdf

[41] Lake Carriers' Association 2013 Annual Report. http://www.lcaships.com/wp-content/uploads/2014/07/60005_60005-LCA_p1-4.pdf

[42] Matheny K. 2014. Autumn anomaly: Deepest Great Lakes' levels rising. Detroit Free Press. http://www.freep.com/story/news/local/michigan/2014/10/20/great-lakes-levels-michigan-superior-huron/17587997/

with higher water levels compared to today. Therefore, most of these structures or communities need to develop strategy to adapt to low water conditions. Nevertheless, water fluctuations may still cause high water level for some years. As a consequence, the most appropriate approach would be preparing adaptation plans for both high water and low water conditions, improving resilience.

The Impact of Aquatic Invasive Species

Aquatic invasive species (AIS) may completely change the environment, affecting the use of many different kinds of natural resources (Table 4). A single invasive species can have multiple impacts. For example, zebra mussels attach to hard surfaces, which affect transportation and recreation because of the damage to port functions. Moreover, zebra mussels, together with other notorious invaders such as sea lampreys and Asian carp, may disrupt the food web, altering local ecosystem, which affect biodiversity, fishery, or even recreation or tourism supported by the ecosystem service.

MDEQ, MDNR, and MDARD are working together as a unified AIS Core Team to address AIS issues that range from prevention, monitoring, inspection, and control, with a large portion of this effort being related to Michigan's Great Lakes, connecting waters, and associated coastal lands. The AIS Core Team demonstrates a commitment to coordinating the implementation of Michigan's AIS State Management Plan (last updated 2013)[43] and continues to gain momentum in the battle of AIS within the Great Lakes Region. Components of this initiative are extensive and wide ranging, including extensive education and outreach components as well as a recently introduced Michigan Invasive Species Grant Program[44] Because management plans or efforts targeting aquatic invasive species are usually costly and seldom successful[45], invasive species have been, and could continue to be, significant threats to natural resources in Michigan. Based on this fact and experts' opinion[2], we believe the level of threat caused by aquatic invasive species may increase in the near future.

Notes about Threats of the Great Lakes Resources in Michigan

We consider other potential threats to resources or uses in Table 3 to maintain steady, decrease, or have a threat that is unknown at this time.

Since the last assessment, there has been only one known offshore development project, which is a water intake structure located in the offshore region of Sanilac County, on Lake Huron. There are no known changes in the underwater energy pipelines. Although during the last assessment there were many discussions about the feasibility of offshore wind farm, there have been no offshore wind farm developments. Based on this evidence, we believe the level of threat related to offshore development and energy production will remain steady without significant changes.

[43] Michigan's aquatic invasive species state management plan 2013 update. http://michigan.gov/documents/deq/wrd-ais-smp-public-review_380166_7.pdf

[44] Additional information about the AIS initiative and grant program is available at: www.mi.gov/aquaticinvasives.

[45] State of the Great Lakes 2012. 2012. Michigan Department of Environmental Quality. http://www.michigan.gov/documents/deq/State_of_the_Great_Lakes_2012_405640_7.pdf

Although since the last assessment there have been many dredging projects due to the low water levels of recent years, all dredge materials were disposed in inland locations or applied to beach nourishment. In other words, there were no dredge disposals in the open water of the Great Lakes in Michigan, indicating that there are no significant changes anticipated in the level of threats related to dredge disposals and benthic habitat. The production of sand materials from sand dune mining in Michigan has been gradually decreasing since 2000. In addition, the number of sand dune mining sites may decrease in the near future, because several existing mining sites are planning for closure. This appears to indicate the needs for sand extraction, at least from coastal sources, are decreasing. Therefore, the level of threat to sand/gravel resources and sand/gravel mining is expected to decrease and remain steady, respectively.

The level of threats toward cultural and historic sites is unknown. It is possible that sites near the shoreline could be affected by some extreme weather conditions and associated erosion or flooding under the climate change scenario, but no evidence suggests that the level of threats increases or decreases. The level of threat toward aquaculture is also unknown. Currently there are no aquaculture facilities in the Great Lakes of Michigan although potential exists for aquaculture facility development in the future.

Other resource or use categories, including living marine resources, transportation/navigation, fishing, and recreation/tourism, are considered to have increasing levels of threats due to climate change and aquatic invasive species, as was discussed above.

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if any significant state- or territory-level changes (positive or negative) in the management of ocean and Great Lakes resources have occurred since the last assessment?*

Table 5. Management category of the state and MCZMP.

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	Y	Unknown
Regional comprehensive ocean/Great Lakes management plans	N	N	Unknown
State comprehensive ocean/Great Lakes management plans	N	N	Unknown
Single-sector management plans	N	Y	Unknown

For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the

document, please provide a reference to the other section rather than duplicate the information:

a. *Describe the significance of the changes;*
b. *Specify if they were 309 or other MCZMP-driven changes; and*
c. *Characterize the outcomes or likely future outcomes of the changes.*

Summary of Management Characterization

The State of Michigan has employed laws or policies for Great Lakes resource management. Michigan has enacted act 451 of 1994, Natural Resources and Environmental Protection Act, to protect the environment and natural resources in Michigan. Many parts of this act regulate or protect the use of the Great Lakes natural resources. The MCZMP has certain approved enforceable policies that are relevant to these parts. In addition, Act 169 of 1970, Local Historic Districts Act, is also a MCZMP-approved enforceable policy related to cultural and historical resources in the coastal zones. Table 6 provides a list of the approved enforceable policies of the MCZMP along with associated Great Lakes resources and uses.

The MCZMP has provided assistance for local governments or communities to employ laws or policies for Great Lakes resources management, based on act 110 of 2006, the Michigan Zoning Enabling Act. This approved enforceable policy allows the MCZMP to fund projects to update zoning for local laws, regulations, or plans. For example, in fiscal year (FY) 2013, the MCZMP funded Rogers City in Presque Isle County to update its Master Plan. This ensures the master plan reflects the changing conditions in the community, and protects the shoreline of Lake Huron within the boundary of Roger City.

The MCZMP has also provided assistance for local governments or communities to develop single-sector management plans, which primarily focus on improving one topic of resources use. For example, in FY 2014, the MCZMP funded the St. Clair County Metro Planning Commission for the Blue Water Trail Towns Program. This project develops strategies to facilitate and improve tourism of water trails and greenways for the community engagement, economic development, and revitalization.

2. *Indicate if your state or territory has a comprehensive ocean or Great Lakes management plan.*

Table 6

Comprehensive Ocean/Great Lakes Management Plan	State Plan	Regional Plan
Completed plan (Y/N) (If yes, specify year completed)	N	N
Under development (Y/N)	N	N
Web address (if available)	N	N
Area covered by plan	N	N

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

High __X__
Medium _____
Low _____

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

   There is growing attention focused on the impact of climate change and AIS on the Great Lakes. They both pose potentially serious problems to the environment and ecosystem because of wide spatial extent, large magnitude of change, and long recovery time, which further affect the resources and use for living marine resources, fisheries, recreation, tourism, and transportation. It is, therefore, appropriate to rank this enhancement area as a high priority.

   The state has put forth significant effort in developing the updated AIS State Management Plan and an interdepartmental team tasked with implementation. Though the AIS initiative is a robust effort gaps do remain. Existing gaps include research on species specific risk assessments, pathways, and habitat impacts. Additionally, resources are limited in the areas of public involvement, education and outreach. Similarly, water level changes and climate change are currently being addressed through on-going efforts including the Water Levels Integrated Assessment spearheaded by the University of Michigan's Graham Sustainability Institute and the Section 309-supported Climate Change Strategy for Coastal Wetlands in Michigan. Though both issues are receiving significant attention within the State of Michigan at this time, the MCZMP continues to view this focus area as high-priority and thus worthy of a Phase II level assessment.

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Energy and Government Facility Siting

Section 309 Enhancement Objective: Adoption of procedures and enforceable policies to help facilitate the siting of energy facilities, Government facilities, energy-related activities, and Government activities which may be of greater than local significance. §309(a)(8)[46]

PHASE I (HIGH-LEVEL) ASSESSMENT: *(Must be completed by all states and territories.) Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment. The more in-depth assessments of Phase II will help the CMP understand key problems and opportunities that exist for program enhancement and determine the effectiveness of existing management efforts to address those problems.*

Resource Characterization:

1. In the table below, characterize the status and trends of different types of energy facilities and activities in the state's or territory's coastal zone, based on best available data. If available, identify the approximate number of facilities by type. The MarineCadastre.gov may be helpful in locating many types of energy facilities in the coastal zone.

Status and Trends in Energy Facilities and Activities in the Coastal Zone				
Type of Energy Facility/Activity	**Exists in CZ**		**Proposed in CZ**	
	(# or Y/N)	Change Since Last Assessment (unkwn)	(# or Y/N)	Change Since Last Assessment (unkwn)
Energy Transport				
Pipelines[47]	Yes – Major pipelines carrying gas and/or liquid energy fuels extend into the coastal zone in 22 of 41 coastal counties, and a number of pipelines cross the Straits of Mackinac and Michigan's Great Lakes connecting channels.	No change – It should be noted that in 2011 Enbridge completely replaced an existing 30-inch diameter steel pipeline beneath the St. Clair River that carries crude oil to Sarnia, Ontario.	Unknown	Unknown – No major natural gas pipeline construction and operation proposals that would affect Michigan's coastal zone have been filed with the Federal Energy Regulatory Commission (FERC) for review. However, several major pipeline projects are on the horizon in the Midwest, and it is not known if any of these projects would extend through the coastal zone.

[46] CZMA § 309(a)(8) is derived from program approval requirements in CZMA § 306(d)(8), which states:
"The management program provides for aMDEQuate consideration of the national interest involved in planning for, and managing the coastal zone, including the siting of facilities such as energy facilities which are of greater than local significance. In the case of energy facilities, the Secretary shall find that the State has given consideration to any applicable national or interstate energy plan or program."
NOAA regulations at 15 C.F.R. § 923.52 further describe what states need to do regarding national interest and consideration of interests that are greater than local interests.

[47] For approved pipelines (1997-present): www.ferc.gov/industries/gas/indus-act/pipelines/approved-projects.asp

Status and Trends in Energy Facilities and Activities in the Coastal Zone (continued)				
Type of Energy Facility/Activity	**Exists in CZ**		**Proposed in CZ**	
	(# or Y/N)	Change Since Last Assessment (unkwn)	(# or Y/N)	Change Since Last Assessment (unkwn)
Electrical grid (transmission cables)	Yes – 69 kilovolt or higher transmission lines run through most coastal counties, and electric power generating facilities within the coastal zone are connected to high voltage transmission lines. Three transmission lines cross the St. Clair River, and one crosses the Detroit River into Ontario.	Unknown – The Michigan Public Service Commission authorized the establishment of new transmission lines in Delta and Huron Counties since the previous. Assessment. Most or all of the route of the new lines is outside the coastal zone.	No	Decrease – The extension of a 345 kilovolt electric transmission line into Huron County was proposed at the time of the previous Assessment. It has now been approved and two of three phases are completed.
Ports	99 – This is the number of all Michigan Great Lakes ports and includes ports whose primary function is cargo, ferry service, commercial, recreational, or other uses. A subset of these ports handles bulk energy fuels, notably the Port of Detroit, which is Michigan's only petroleum port.	Not tracked in previous Assessment	No	Not tracked in previous Assessment
Liquid natural gas (LNG)[48]	No	No change	No	No change
Other - bulk fuel terminals supplied by pipeline or marine vessel	Yes	Not tracked in previous Assessment	Unknown	Not tracked in previous Assessment

[48] For approved FERC jurisdictional LNG import/export terminals: www.ferc.gov/industries/gas/indus-act/lng/exist-term.asp

Energy Facilities				
Oil and gas	17 – The previous Assessment counted active oil and gas wells in coastal counties; oil- and gas-fired power plants in the coastal zone are counted here instead.	Not tracked in previous Assessment	Unknown	Not tracked in previous Assessment
Coal	22– The previous Assessment counted coal-fired power plants in coastal counties; coal-fired power plants in the coastal zone are counted here.	Unknown	Yes – proposed closures	Decrease – At least four power plants in the coastal zone are proposed for closure, decommissioning, and demolition.

Status and Trends in Energy Facilities and Activities in the Coastal Zone (continued)				
Type of Energy Facility/Activity	**Exists in CZ**		**Proposed in CZ**	
	(# or Y/N)	Change Since Last Assessment (unkwn)	(# or Y/N)	Change Since Last Assessment (unkwn)
Nuclear[49]	4 - The previous Assessment counted only operating utility-scale facilities; licensed utility-scale facilities are counted here, including operating and decommissioned facilities.	No change	1	No change - The previous Assessment correctly indicated that no new facility was proposed in a coastal county. However, it should be clarified here that DTE Energy applied for a license to construct and operate the "Fermi 3" reactor in September 2008, and if approved, this project will significantly expand an existing facility in Monroe County.
Wind	No – The previous Assessment counted the number of megawatts (MW) of utility-scale wind power projects installed in coastal counties; while wind power generation in coastal counties has increased 250% to 807 MW since the previous Assessment, no utility-scale wind projects operate in the coastal zone itself.	No change	Unknown	Unknown – Nearly 460 MW of additional utility-scale wind power projects are under development in coastal counties, however, it is not known if construction of new turbines is planned in the coastal zone.
Wave[50]	No	No change	No	No change
Tidal[36]	No	No change	No	No change

[49] The Nuclear Regulatory Commission provides a coarse national map of where nuclear power reactors are located as well as a list that reflects their general locations: www.nrc.gov/reactors/operating/map-power-reactors.html

[50] For FERC hydrokinetic projects: www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics.asp

Current (river) [36]	No - The pilot-scale project counted in the previous Assessment is not counted here.	No change	1	No change – In 2010 FERC issued a preliminary permit to Current Connection, LLC to study the feasibility of a hydrokinetic energy project in the St. Clair River offshore of Port Huron, St. Clair County. After conducting studies, the company relinquished the permit in November, 2013. In May, 2014 FERC accepted a preliminary permit application from Vortex Hydro Energy to study the feasibility of a different hydrokinetic energy project in the same location.
Hydropower	4 – The previous Assessment counted hydroelectric dams in coastal counties; hydroelectric dams in the coastal zone are counted here.	No change	Yes – proposed removals	No change – Though existing hydroelectric dams throughout Michigan continue to be relicensed by FERC, a number of historic dams have been or will be removed. For example, two old hydroelectric dams on the Boardman River within the coastal zone are targeted for removal in the next few years.
Ocean thermal energy conversion	No	No change	No	No change

Status and Trends in Energy Facilities and Activities in the Coastal Zone (continued)				
Type of Energy Facility/Activity	**Exists in CZ**		**Proposed in CZ**	
	(# or Y/N)	Change Since Last Assessment (unkwn)	(# or Y/N)	Change Since Last Assessment (unkwn)
Solar	No - The previous Assessment counted solar energy facilities in coastal counties; facilities in the coastal zone are counted here.	Unkwn	Unkwn	Unkwn
Biomass (Wood)	1	Not tracked in previous Assessment	Unkwn	Not tracked in previous Assessment
Pumped Storage	1	No change	No	No change

Other – oil refineries	1	Not tracked in previous Assessment	No	Not tracked in previous Assessment. However, in 2012 the Marathon Petroleum Company completed a major upgrade of its Detroit Refinery, increasing the crude and heavy crude oil refining capacity to 123,000 barrels per calendar day.

2. If available, briefly list and summarize the results of any additional state- or territory-specific information, data, or reports on the status and trends for energy facilities and activities of greater than local significance in the coastal zone since the last assessment.

   Michigan has limited fossil fuel energy sources and imports most of its natural gas needs, almost all of its petroleum needs, and all of its coal needs. All of the nuclear fuel used for power generation comes from out of state as well. The proportion of Michigan's energy needs met by wind, solar, hydroelectric, biomass, and other renewable energy sources is small but increasing, spurred by enactment of Public Act 295 of 2008. Act 295 requires Michigan electric power suppliers to provide 10% of the electricity based on retail sales from renewable sources by 2015. According to the Michigan Public Service Commission's 2014 annual report on progress and performance under Act 295, virtually all regulated electric power suppliers are expected to meet this goal and deadline.

   Michigan's natural gas reserves and producing wells are concentrated in the northern Lower Peninsula, while natural gas storage fields are in scattered locations in the Lower Peninsula. In the summer months when demand for natural gas is low, large volumes of gas are delivered to Michigan and pumped into certain geological formations for underground storage, where it remains until it is withdrawn in the colder months for home heating and other uses in Michigan and neighboring states. Approximately 8,700 miles of natural gas transmission pipelines run through many areas of Michigan, including most coastal counties, and several power plants in the coastal zone generate electricity by burning natural gas. In the coastal zone, major natural gas pipelines cross the Straits of Mackinac between the Upper and Lower Peninsulas and the St. Mary's River, St. Clair River, and Detroit River into Ontario. Gas transmission pipelines cross other major rivers, within or adjacent to the coastal zone, including the Portage River, Menominee River, White River, Saginaw River, and River Rouge.

   A minor proportion of Michigan's petroleum needs are met by small wells scattered across the Lower Peninsula, but most of the crude oil used in or transported through Michigan originates from out of state. Crude oil from Alberta and North Dakota enters Michigan via two major pipelines that are part of Enbridge Energy's Lakehead pipeline system. Enbridge Line 5 enters the Upper Peninsula from Wisconsin and runs east to the Straits of Mackinac and across to the Lower Peninsula, then south

and east to cross the St. Clair River, where a complex of refineries and chemical companies is located on the Ontario shoreline south of Sarnia. Enbridge Line 6B enters the southwest Lower Peninsula from Indiana and runs diagonally northeast to cross the St. Clair River into Ontario as well. Enbridge Lines 17 and 79 branch off Line 6B to destinations in Romulus, Michigan and Toledo, Ohio, respectively. Michigan's only oil refinery is located in the coastal zone in southwest Detroit, and refines crude oil from Canada and other sources. Gasoline, asphalt, petroleum coke, propane, propylene, and other petroleum products leave the Marathon Petroleum Company refinery via pipeline, transport truck, rail, and barge. In addition to the crude oil pipelines that cross the Straits of Mackinac and St. Clair River, pipelines carrying refined petroleum liquids cross major waterways within the coastal zone, including the Muskegon River, Black River, Lake Macatawa, Grand River, Saginaw River, Detroit River, and River Rouge. A Sunoco Logistics pipeline carries refined petroleum products across the St. Clair River to Sarnia, Ontario. Bulk fuel terminals are another important component of Michigan's energy distribution system, and store large volumes of liquid fuels delivered by pipeline or marine vessel. Consequently, many bulk terminals are located at ports. Gasoline and other liquid fuels generally leave the terminals for distribution via transport truck or rail.

In recent decades coal-fired power plants generated most of the electricity used in Michigan, though that proportion has decreased to approximately half due, in part, to the changing economics of complying with federal air pollution regulations. A number of coal-fired plants in the coastal zone are scheduled to cease operations in the next few years, and some are likely to be replaced by new or modified plants fueled by cleaner-burning natural gas. All of the coal burned in Michigan is purchased from other states, mainly Wyoming and Montana. Much of the coal imported from western states is transported by rail to ports at the west end of Lake Superior, where it is loaded onto freighters for delivery to power plants on the shores of Michigan's Great Lakes and connecting channels. Coal from eastern and western states is also delivered to some power plants by rail, though Michigan's current rail network is marked by substantial gaps in service to many areas in the northern Lower Peninsula and Upper Peninsula.

Michigan's four current and historic utility-scale nuclear power facilities comprise four operating reactors, the sites of two decommissioned reactors, and the site of a proposed new reactor. All are located on the shores of the Great Lakes. DTE Energy owns the Enrico Fermi Nuclear Generating Station on the shore of Lake Erie in Monroe County. Unit 2, known as "Fermi 2," is a 3,486 MW-licensed reactor currently in operation. The site of "Fermi 1," shut down in 1972 following operational problems including a partial fuel meltdown and decommissioned in 1975, is also on the facility grounds. No spent fuel from "Fermi 1" remains onsite. DTE Energy plans construction of a "Fermi 3" reactor at the facility; however, the U.S. Nuclear Regulatory Commission (USNRC) has yet to approve the proposed reactor type and license the project. American Electric Power owns the Donald C. Cook Nuclear Plant on the shore of Lake Michigan in Berrien County, which consists of two reactors; Unit 1 is licensed to generate 3,304 MW and Unit 2 is licensed to generate 3,468

MW. Entergy Corporation owns the Palisades Nuclear Plant on the shore of Lake Michigan in Van Buren County, which consists of one 2,565 MW-licensed reactor. Entergy Corporation also owns a portion of the historic site of Michigan's first nuclear facility, the Big Rock Point Nuclear Plant, on the shore of Lake Michigan in Charlevoix County. The reactor was shut down in 1997, and the plant was decommissioned and demolished by 2006. However, the facility remains licensed by the USNRC, and Entergy Corporation is responsible for the storage casks of spent nuclear fuel that remain onsite indefinitely, until the USNRC accepts commercial spent fuel for permanent storage at a federal facility.

3. Briefly characterize the existing status and trends for federal government facilities and activities of greater than local significance[51] in the state's coastal zone since the last assessment.

   Federal agencies own or lease hundreds of buildings and other facilities in Michigan. Notable examples in the coastal zone include the major international border crossing facilities in Detroit, Port Huron, and Sault Ste. Marie, Sault Locks in Sault Ste. Marie, the Thunder Bay National Marine Sanctuary Visitor Center and headquarters in Alpena, Selfridge Air National Guard Base in Harrison Township, and many Great Lakes light stations.

   The federal government continues to dispose of lighthouses in Michigan's coastal zone that are excess property pursuant to the National Historic Lighthouse Preservation Act of 2000, and transfer ownership to the State, coastal communities, or nonprofit organizations.

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) that could facilitate or impede energy and government facility siting and activities have occurred since the last assessment.

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	Yes – For example: Act 3 of 1939 as amended by Act 286 of 2008 (Michigan Public Service Commission review and approval of power plant construction or	No	Yes – Proposed administrative rules establishing gas safety standards

[51] The CMP should make its own assessment of what Government facilities may be considered "greater than local significance" in its coastal zone, but these facilities could include military installations or a significant federal government complex. An individual federal building may not rise to a level worthy of discussion here beyond a very cursory (if any at all) mention.

	renovation); Act 30 of 1995 (electric transmission cables); Act 165 of 1969 (gas safety standards); Act 9 of 1929 (intrastate gas pipelines)		
State comprehensive siting plans or procedures	No	No	No

2. For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:
    a. Describe the significance of the changes;
    b. Specify if they were 309 or other MCZMP-driven changes; and
    c. Characterize the outcomes or likely future outcomes of the changes.

    Federal law provides for states to enforce pipeline safety regulations and inspect pipeline operators by seeking certification from or entering into agreements with the Office of Pipeline Safety (OPS), Pipeline and Hazardous Material Safety Administration, and the U.S. Department of Transportation. Michigan is certified by OPS to inspect intrastate gas pipeline operators and enforce gas pipeline safety regulations. The work is performed by the Michigan Public Service Commission (MPSC) with federal funding support. Michigan has also entered into an agreement with OPS to inspect interstate gas pipeline operators and determine compliance, though probable violations are reported to OPS for enforcement. In March, 2014 the MPSC proposed draft administrative rule revisions necessary for Michigan to continue to operate its gas safety program under state and federal law. The proposed revisions would adopt by reference the current federal gas safety standards set forth in 49 CFR parts 191, 192, and 199. The proposed revisions would also adopt updated technical standards, and add a new administrative rule providing guidance and a timeline for removal or discontinuation of gas service lines servicing abandoned structures, as required by 49 CFR 192.727. The proposed rules have not been adopted by the State as of November, 2014. The last revisions to the State's gas safety standards were adopted in 2010. Failure to adopt the updated federal standards may jeopardize Michigan's jurisdiction over intrastate gas pipeline regulation and the federal funding provided for MPSC to operate the gas safety program. Revisions to Michigan's gas safety standards are not supported by Section 309 or 306 funds.

    Michigan is not certified by or party to an agreement with OPS to inspect petroleum pipeline operators and enforce petroleum pipeline safety regulations. It should be noted that the State convened the Great Lakes Petroleum Pipeline Task Force in June, 2014 partly in response to public concerns about the condition of the more than 60 year-old Enbridge Line 5 which lies on or over the bottomlands in the Straits of Mackinac. The task force will review the status and regulation of petroleum

pipelines in Michigan, and the State's preparedness to respond to petroleum spill emergencies. The Michigan Attorney General and Director of the MDEQ co-chair the task force. The task force will explore coordination of permitting for pipeline upgrades and replacement, among other topics.

Enhancement Area Prioritization:

What level of priority is the enhancement area for the coastal management program?

High	_____
Medium	__X__
Low	_____

1. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

   Energy facility siting and operation is managed at the local, state, and federal level. Local governments have authority over the installation of solar panels and establishment and operation of utility-scale wind turbines. Michigan laws and administrative rules address the establishment and operation of many power generating facilities and intrastate electric transmission lines, and operation of intrastate gas pipelines. However, primary oversight authority for the establishment and operation of nuclear power plants, interstate and intrastate pipelines, interstate electric transmission lines, and operation of hydroelectric facilities is at the federal level. Pipelines and electric transmission lines that cross the U.S. border also require authorization from the U.S. Department of State. The entire U.S. border with Canada that coincides with Michigan's state boundary is within the coastal zone.

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Aquaculture

Section 309 Enhancement Objective: Adoption of procedures and policies to evaluate and facilitate the siting of public and private aquaculture facilities in the coastal zone, which will enable states to formulate, administer, and implement strategic plans for marine aquaculture. §309(a)(9)

Resource Characterization:

1. In the table below, characterize the existing status and trends of aquaculture facilities in the state's coastal zone based on the best available data. Your state Sea Grant Program may have information to help with this assessment.[52]

Type of Facility/Activity	Status and Trends of Aquaculture Facilities and Activities		
	# of Facilities[53]	Approximate Economic Value	Change Since Last Assessment (unkwn)
Crystal Springs Farms, LLC Planting stock	1	Annual revenue less than $500,000	Previous assessment reported private and public facilities in coastal counties

The last assessment (2011) reported 26 licensed aquaculture facilities within coastal counties in Michigan; however it did not indicate the number, if any, residing within the MCZMP area. Currently, Michigan has one facility within the MCZMP area and a total of 24 within coastal counties (see Appendix A – Sheet 8). The number of licensed facilities varies annually, and increased to more than 30 within the MCZMP area in 2013. Generally, the number of facilities has been relatively consistent within the assessment period, and as shown by the data above there has been a slight decrease in facilities within the coastal counties from 2011 to present.

2. If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends or potential impacts from aquaculture activities in the coastal zone since the last assessment.

   The MSG conducted an Integrated Assessment titled, "Exploring and Expanding Michigan's Aquaculture Industry" to understand the interactions between aquaculture industry growth, regulatory controls, economics, and stakeholder risks and benefits. The intent of the assessment was to provide a written strategic plan for expanding Michigan's aquaculture activities into a sustainable seafood production industry; a better understanding of sustainable aquaculture and benefits associated with seafood by stakeholders; and better stakeholder understanding related to sustainable aquaculture in Michigan. The MSG produced the "A Strategic Plan for a

[52] While focused on statewide aquaculture data rather than just within the coastal zone, the *Census of Aquaculture* (www.agcensus.usda.gov/Publications/2002/Aquaculture/) may help in developing your aquaculture assessment. The 2002 report, updated in 2005, provides a variety of state-specific aquaculture data for 2005 and 1998 to understand current status and recent trends. The next census is scheduled to come out late 2014 and will provide 2013 data.

[53] Be as specific as possible. For example, if you have specific information of the number of each type of facility or activity, note that. If you only have approximate figures, note "more than" or "approximately" before the number. If information is unknown, note that and use the narrative section below to provide a brief qualitative description based on the best information available.

Thriving & Sustainable Michigan Aquaculture", January 2014, report providing a roadmap to the creation of a thriving and sustainable aquaculture that could provide abundant healthy food while preserving and improving water resources for other uses including tourism/recreation, industry, and other forms of agriculture.

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if there have been any state- or territory-level changes (positive or negative) that could facilitate or impede the siting of public or private aquaculture facilities in the coastal zone.

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Aquaculture comprehensive siting plans or procedures	N	N	N
Other aquaculture statutes, regulations, policies, or case law interpreting these	Y	N	N

For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:

a. Describe the significance of the changes;
b. Specify if they were 309 or other MCZMP-driven changes; and
c. Characterize the outcomes or likely future outcomes of the changes.

In the Fall of 2012, the Memorandum of Understanding (MOU) between the MDARD, MDNR, and MDEQ Concerning Aquaculture Development, Production, and Regulation was revised and signed by the three respective Directors. The purpose of the MOU is to define the respective roles and responsibilities regarding the development, promotion, and regulation of aquaculture, including importation, facility licensing and permitting, facility effluents, aquatic animal health, transportation, private stocking of aquatic species in public waters, and invasive species management.

Enhancement Area Prioritization:

What level of priority is the enhancement area for the coastal management program?

High __**X**__
Medium _____
Low _____

1. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

Generally, the MDARD, MDNR and MDEQ possess authorities to manage aquaculture facilities under the Michigan Aquaculture Act, Animal Industry Act, and Part 459, Propagation of Game Fish in Private Waters, of the (NREPA) and the Water Resources Protection, Part 31, of the NREPA. Currently, Michigan has 24 inland permitted aquaculture facilities; however interest is growing for the siting of net pen facilities in the open waters of the Great Lakes. The State does not have sufficient fundamental scientific knowledge to evaluate the public trust and environmental risks of net pen facilities, nor has a marketing analysis been conducted to determine if net pen facilities has a sufficient market to be successful. Research, technical assistance, and education/outreach are needed to assist the State in evaluating the future direction of aquaculture in Michigan.

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Phase II Assessments

Wetlands

In-Depth Resource Characterization:

Purpose: To determine key problems and opportunities to improve the CMP's ability to protect, restore, and enhance wetlands.

1. What are the three most significant existing or emerging physical stressors or threats to wetlands within the coastal zone? Indicate the geographic scope of the stressor, i.e., is it prevalent throughout the coastal zone or specific areas that are most threatened? Stressors can be development/fill; hydrological alteration/channelization; erosion; pollution; invasive species; freshwater input; sea level rise/Great Lake level change; or other (please specify). When selecting significant stressors, also consider how climate change may exacerbate each stressor.

	Stressor/Threat	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Stressor 1	Invasive species	Throughout the coastal zone
Stressor 2	Development threat	Throughout the coastal zone
Stressor 3	Great Lakes water level change	Throughout the coastal zone

2. Briefly explain why these are currently the most significant stressors or threats to wetlands within the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.

While the State of Michigan has taken significant steps to address invasive species, both aquatic and terrestrial, in the last assessment period, both still pose significant threats to coastal habitats, including coastal wetlands. Invasive species pose threats to coastal wetland ecosystems by altering the habitat and outcompeting native species. As mentioned in the Phase I section of Ocean and Great Lakes Resource, the MDEQ, MDNR and MDARD (Quality of Life), have recently implemented new programs to help address the significant threats that invasive species pose to the state's resources. Both aquatic and terrestrial species are being addressed through these collaborative efforts. The MCZMP has recently become more involved in the AIS and Terrestrial Invasive Species (TIS) work groups to address invasive species impacts within Michigan's Coastal Zone boundary. Recent discussions include the need for further emphasis on coastal resources. Future priorities may include; additional research on pathways, coastal species vulnerability, and risk assessment.

Michigan has lost approximately 50% of the historical coastal wetlands since European settlement. Development threats along the coast include conversion for residential development, agriculture uses, and industry development. According to the latest Great Lakes Regional Land Cover Change Report (1196-2010), the Great Lakes Region saw land cover conversion from agricultural, forest, and grasslands to developed areas. While it appears that wetlands did not decline through this last period, there were losses

of wetlands to development. The significantly low water levels that were predominant in the Great Lakes Region until 2014 resulted in the addition of coastal wetlands from previously open water habitat. As was briefly mentioned in Phase I of the Wetlands Assessment, the stakeholder input sought through this assessment process included the recommendation to identify priority coastal wetland areas for protection and restoration.

While fluctuating water levels play a key role in maintaining the biodiversity of coastal wetlands, it can also prove to negatively alter coastal wetland habitat. Significantly lower water levels can expose coastal wetlands and alter habitat therefore impacting the success of breeding fishes, waterfowl and invertebrates. Conversely, high water levels can cause erosion; destroy wetland vegetation; and also eliminate ideal habitat for fishes, waterfowl and invertebrates. Whether these water level cycles are a part of a natural short or long term fluctuation, or are due to effects of climate change in our region remains to be seen. Through the current 309 strategy the MCZMP is addressing some of these adaptation issues that will provide local units of government with the tools to incorporate into planning for resilient communities.

Are there emerging issues of concern but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.

Emerging Issue	**Information Needed**
Erosion	Data, research
Pollution	Data, research

In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the wetlands enhancement objective.

1. For each additional wetland management category below that was not already discussed as part of the Phase I assessment, indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred since the last assessment.

Management Category	**Employed By State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Wetland assessment methodologies	Y		N
Wetland mapping and GIS	Y		N
Watershed or special area management plans addressing wetlands	Y		N
Wetland technical assistance, education, and outreach	Y		N

Other (please specify)			

For management categories with significant changes since the last assessment, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information.

a. Describe significant changes since the last assessment;
b. Specify if they were 309 or other MCZMP-driven changes; and
c. Characterize the outcomes or likely future outcomes of the changes.

There were no significant changes to wetlands management categories within the last assessment period. As mentioned briefly in Phase I of the Wetlands Assessment, the MDEQ has further developed aspects of Michigan's Wetlands Program which include; Michigan's Wetland Monitoring Assessment Strategy and Landscape Level Wetland Functional Assessments.

Also mentioned in Phase I of the Wetlands Assessment, the current 309 Strategy to address Climate Change Adaptation in Coastal Wetland Management is underway and will be completed at the end of this assessment period. This strategy will result in the development and implementation of climate change adaptation measures into the current wetland regulatory processes; statewide plans; and local planning and zoning efforts.

2. Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's or territory's management efforts in protecting, restoring, and enhancing coastal wetlands since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's or territory's management efforts?

As mentioned in Phase I of the Wetlands Assessment, the Great Lakes basin-wide monitoring project that is funded under a current GLRI grant, and being implemented by CMU, is in the final year of data collection. This data will be useful in the future assessment of coastal wetlands within the state of Michigan.

Also, mentioned in Phase I of the Wetlands Assessment, and previously in this phase, Michigan has developed a Wetland Monitoring and Assessment program that includes; Landscape level assessments, Rapid Wetland Assessments (MiRAM), and Intensive Site Assessments. Moving forward, these tools will be beneficial in assessing the success of Michigan's protection, management, and restoration of wetland resources in the state.

The State has also been involved in ongoing efforts supported through the GLRI, which since 2010 has worked to protect, restore, and enhance habitat in the Great Lakes

basin. According to the GLRI Report to Congress[54], more than 100,000 acres of wetlands and 48,000 acres of coastal, upland, and island habitat were protected, restored and enhanced. One example of the MCZMP leveraging the ongoing GLRI was the GLRI-supported land acquisition for preservation and conservation at Bete Grise Preserve in the Keweenaw Peninsula of Michigan's Upper Peninsula. The project preserves, in perpetuity 1,681 of coastal lands including high-quality coastal wetlands and more than two miles of shoreline.

Identification of Priorities:

1. Considering changes in wetlands and wetland management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to more effectively respond to significant wetlands stressors.

   Management Priority 1: Prioritization of coastal wetlands for preservation, conservation and restoration.

   Description: With continued development and environmental threats to coastal wetland habitats the CMP has an opportunity to work collaboratively to assist in the development of a prioritization tool for coastal wetlands conservation, preservation and restoration. Through this process the CMP will promote the conservation of some of Michigan's most significant coastal resources.

   Management Priority 2: Addressing Aquatic and Terrestrial Invasive Species within the Coastal Zone Boundary.

   Description: The CMP has the opportunity to work the QOL workgroups to address specific concerns for AIS and TIS within the coastal zone boundary. Specifically further research is needed to quantify high priority coastal habitats that are most vulnerable to invasive species. Other priorities to be addressed within the coastal zone boundary include risk assessments for pathways for introductions of AIS and TIS into coastal habitats.

2. Identify and briefly explain priority needs and information gaps the CMP has to help it address the management priorities identified above. The needs and gaps identified here do not need to be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.

Priority Needs	**Need?** (Y or N)	**Brief Explanation of Need/Gap**
Research	Y	Invasive species pathways, species vulnerability and risk assessment for coastal wetland habitat.
Mapping/GIS	Y	Prioritization of wetlands for conservation efforts

[54] Great Lakes Restoration Initiative Report to Congress: Fiscal Years 2010-2014 (http://greatlakesrestoration.us/pdfs/21050720-report_to_congress.pdf)

Data and information management	N	A new database (MiWaters) is currently under development that will provide updated data management for the wetlands regulatory programs. The MCMP is also pursuing the development of a new database that would provide efficiencies for reporting and program administration.
Training/capacity building	N	
Decision-support tools	Y	Central Michigan University is currently piloting a Decision Support Tool that will be utilized for prioritization of coastal wetlands for conservation, preservation and restoration. The MMCZMP anticipates the application will be transferable to the entire Michigan coast within the next assessment period.
Communication and outreach	N	
Other (Specify)		

Enhancement Area Strategy Development:

1. Will the CMP develop one or more strategies for this enhancement area?

Yes _____
No **X**

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

The MCZMP ultimately determined that the priority needs associated with coastal wetlands management may be advanced through funding and efforts outside of the Section 309 enhancement program and also that the actions needed do not rise to the required level of a program change as is required for a Section 309 strategy.

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Coastal Hazards

In-Depth Resource Characterization:

Purpose: To determine key problems and opportunities to improve the CMP's ability to prevent or significantly reduce coastal hazard risks by eliminating development and redevelopment in high-hazard areas and managing the effects of potential sea level rise and Great Lakes level change.

1a. **Flooding In-depth** (for all states besides territories): Using data from *NOAA's State of the Coast* "Population in the Floodplain" viewer[55] and summarized by coastal county through NOAA's Coastal County Snapshots for Flood Exposure,[56] indicate how many people at potentially elevated risk were located within the state's coastal floodplain as of 2010. These data only reflect two types of vulnerable populations. You can provide additional or alternative information or use graphs or other visuals to help illustrate or replace the table entirely if better data are available. *Note: National data are not available for territories. Territories can omit this question unless they have similar alternative data or include a brief qualitative narrative description as a substitute.*

2010 Populations in Coastal Counties at Potentially Elevated Risk to Coastal Flooding[57]				
	Under 5 and Over 65 years old		**In Poverty**	
	# of people	**% Under 5/Over 65**	**# of people**	**% in Poverty**
Inside Floodplain	51,827	21	29,988	12
Outside Floodplain	899,077	20	754,578	17

1b. **Flooding In-depth** (for all states besides territories): Using summary data provided for critical facilities, derived from FEMA's HAZUS[58] and displayed by coastal county through NOAA's Coastal County Snapshots for Flood Exposure,[59] indicate how many different establishments (businesses or employers) and critical facilities are located in the FEMA floodplain. You can provide more information or use graphs or other visuals to help illustrate or replace the table entirely if better information is available.

Critical Facilities in the FEMA Floodplain[44]						
	Schools	**Police Stations**	**Fire Stations**	**Emergency Centers**	**Medical Facilities**	**Communication Towers**
Inside Floodplain	1271	205	369	0	0	82

[55] http://stateofthecoast.noaa.gov/pop100yr/welcome.html
[56] http://www.csc.noaa.gov/digitalcoast/tools/snapshots
[57] To obtain exact population numbers for the coastal floodplain, download the excel data file from the State of the Coast's "Population in Floodplain" viewer.
[58] http://www.fema.gov/hazus; can also download data from NOAA STICS http://www.csc.noaa.gov/digitalcoast/data/stics. Summary data on critical facilities for each coastal state is available on the ftp site.
[59] http://www.csc.noaa.gov/digitalcoast/tools/snapshots

Coastal Counties[60]	2528	394	514	15	81	233

2. Based on the characterization of coastal hazard risk, what are the three most significant coastal hazards[61] within the coastal zone? Also indicate the geographic scope of the hazard, i.e., is it prevalent throughout the coastal zone or are specific areas most at risk?

	Type of Hazard	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Hazard 1	Shoreline Erosion	Throughout Coastal Zone – Most threatened areas along Lake Superior shoreline and southeastern Lake Michigan
Hazard 2	Flooding	Throughout Coastal Zone – Most threatened areas include Lake Erie shoreline, Lake St. Clair shoreline and Saginaw Bay portion of the Lake Huron shoreline
Hazard 3	Great Lakes Level Change	Throughout Coastal Zone

3. Briefly explain why these are currently the most significant coastal hazards within the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.

   As outlined in the Phase I assessment, recent Great Lakes water levels have trended upward resulting in increased shoreline erosion and flooding concerns. All of the Great Lakes with shoreline in Michigan have current water levels above average and projections for the summer of 2015 that remain above average. While future water levels are uncertain, recent trends and the prospects of higher levels command increased effort towards coastal resilience of both erosion and flooding impacts. Great Lakes level change itself is of critical importance; however such change is the norm for the Great Lakes and is not itself a hazard. Rather, flooding and erosion hazards which are exacerbated by higher lake levels require primary consideration.

   Recent shore erosion impacts to infrastructure are not widespread; however intermittent reports of shore erosion damage at public lands such as McLain and Muskallonge Lake State Parks as well as the abandonment of a private residence in Berrien County along the southeastern Lake Michigan shore indicate that the threat associated with shore erosion has increased relative to the threat level of the past decade and a half.

   A 2014 survey[62] of local planners in the Great Lakes region reported bluff and shoreline erosion as the highest rated (67%) coastal storm hazard that moderately or greatly impacts their local community. The on-going Great Lakes flood mapping update study conducted jointly by FEMA and the USACE is filling the need for updated coastal flood information and outreach, however bluff and shoreline erosion studies of similar magnitude and scope are not being conducted at this time. The

[60] Data shown covers coastal counties, which are those that intersect Michigan's approved Coastal Zone Management Boundary.

[61] See list of coastal hazards at the beginning of this assessment template.

[62] NOAA Great Lakes Coastal Storms Program Great Lakes Planning and Mitigation Needs Assessment of Coastal Storms Hazards: Survey Summary, University of Wisconsin Sea Grant Institute. June 2014. See: http://www.seagrant.wisc.edu/home/Portals/0/Files/Coastal%20Communities/SG_GL_CoastalStormHazard.pdf

U.S. Army Corps of Engineers is conducting a study of the Great Lakes under the National Shoreline Management Study (NSMS), which may provide insight on coastal erosion issues in the lakes; however, extensive creation of new data resources is not anticipated as part of the NSMS to the extent of those being developed through the FEMA flood mapping efforts.

4. Are there emerging issues of concern, but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.

Emerging Issue	Information Needed
Structures sited during low water may be prone to increased threat due to water level rise trends	Data on the number of buildings threatened by coastal erosion over planning time horizons. This would require building footprints, location of erosion hazard line, and recession rates.

In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the coastal hazards enhancement objective.

1. For each coastal hazard management category below, indicate if the approach is employed by the state or territory and if there has been a significant change since the last assessment.

Management Category	Employed by State/Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Change Since the Last Assessment (Y or N)
Statutes, Regulations, and Policies:			
Shorefront setbacks/no build areas	Y	Y	N
Rolling easements	N	N	N
Repair/rebuilding restrictions	Y	Y	N
Hard shoreline protection structure restrictions	Y	Y	N
Promotion of alternative shoreline stabilization methodologies (i.e., living shorelines/green infrastructure)	Y[63]	Y	Y
Repair/replacement of shore protection structure restrictions	Y	Y	N
Inlet management	Y	N	N
Protection of important natural resources for hazard mitigation benefits (e.g., dunes, wetlands, barrier islands, coral reefs) (other than setbacks/no build areas)	Y	Y	
Repetitive flood loss policies (e.g., relocation, buyouts)	Y	N	N
Freeboard requirements	Y	N	N

[63] Limited to projects by federal agencies and federally-funded (total or partial) projects by the public/private sector under Floodplain Management Executive Order 13690.

Real estate sales disclosure requirements	N	N	N
Restrictions on publicly funded infrastructure	N	N	N
Infrastructure protection (e.g., considering hazards in siting and design)	N	N	N
Other (please specify)	N	N	N
Management Planning Programs or Initiatives:			
Hazard mitigation plans	Y	N	N
Sea level rise/Great Lake level change or climate change adaptation plans	N	N	N
Statewide requirement for local post-disaster recovery planning			
Sediment management plans	N	N	N
Beach nourishment plans	N	N	N
Special Area Management Plans (that address hazards issues)	N	N	N
Managed retreat plans	N	Y	N
Other (please specify)	N	N	N
Research, Mapping, and Education Programs or Initiatives:			
General hazards mapping or modeling	Y	Y	N
Sea level rise mapping or modeling	N/A	N	N
Hazards monitoring (e.g., erosion rate, shoreline change, high-water marks)	Y	Y	N
Hazards education and outreach	Y	Y	Y
Other (please specify)	Y	Y	N

2. Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's management efforts in addressing coastal hazards since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's management efforts?

   Improving beach safety from rip currents and other dangerous nearshore currents has been a primary coastal hazards focus area since the last assessment. Final Evaluation Findings under NOAA's Section 312 program review found the leadership provided by the MCZMP to be noteworthy, stating in part the following.

   "The evaluation team found that the dangerous currents approach provides a model for bringing together partners, science, and outreach to improve management of important coastal zone management issues. This has resulted in more than changes to MDEQ/MDNR policy—it has impacted the way these issues are understood, messaged, and acted upon within the broader coastal management community".

   The MCZMP will continue efforts with partners toward improving beach safety from dangerous nearshore currents, but will do so outside of the Section 309 program.

   Assessment and tracking effectiveness of existing coastal hazards related programs is an identified gap. Outcome-based measures are needed in association with coastal construction setback implementation as well as for regulatory review programs for installation of shore protection structures.

Identification of Priorities:

1. Considering changes in coastal hazard risk and coastal hazard management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to more effectively address the most significant hazard risks.

   Management Priority 1: Steward implementation of local zoning and planning that fosters resilience toward shore erosion while maximizing use of non-structural alternatives

   Description: The majority of local coastal units of government in Michigan have local plans and zoning ordinances that do not include coastal resilience components related to coastal hazards. A policy gap analysis is needed - identifying existing local plans and ordinances that contain coastal construction setbacks and/or shore protection siting provisions versus those containing no such provisions. Subsequently, identification of coastal local units of government receptive to strengthening their local shoreland management approaches through planning and implementing zoning approaches is needed. This effort may also consider options to improve state/local coordination and messaging approaches when the State implements updated coastal construction setback requirements under the HREA Program.

   Management Priority 2: Improve geospatial information available for application towards local coastal planning and zoning efforts, and which also fosters development of coastal erosion metrics and status and trends tracking on a statewide basis

   Description: Even when local officials desire to implement coastal resilience through planning and zoning efforts they often lack geospatial tools and resources needed to properly guide their efforts. Most local units of government do not have internal expertise on coastal erosion, flooding, and geospatial approaches toward assessing vulnerabilities. Such geospatial resources and decision support tools need to be developed and packaged for application by these local officials. A stakeholder and subject matter expert input process is needed to specify priority information needs, and from those needs identify supporting data sets to be acquired. Examples may include recession rate data (including making existing data more accessible), beach widths, location of erosion hazard line, and built structures. Web-based tools and resources specific to Michigan's Great Lakes coast are also needed to educate about long-term coastal erosion and to guide decision making of coastal property owners to promote best management practices for coastal properties.

   Management Priority 3: Assess feasibility of implementing programs that promote soft-shore approaches towards shoreline stabilization

   Description: The use of living shorelines and other soft-shore approaches toward coastal stabilization have expanded greatly on the national level in recent years.

While Michigan has significantly advanced the implementation of natural shoreline management approaches on inland lakes, similar advances have not taken place along our Great Lakes coast. The feasibility of various soft-shore management approaches on the Great Lakes coast needs to be assessed from a physical science, ecological, and engineering standpoint as well as from a policy and economic standpoint.

2. Identify and briefly explain priority needs and information gaps the CMP has for addressing the management priorities identified above. The needs and gaps identified here should not be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.

Priority Needs	**Need?** (Y or N)	**Brief Explanation of Need/Gap**
Research	Y	There exists a need for Michigan-specific legal analysis providing policy options and recommendations for local shoreland management approaches (e.g. local setbacks, easements, planning/zoning provisions). Research regarding feasibility for soft-shore alternatives, including sand-source availability and economic analyses for beach nourishment and engineered living shoreline options is needed.
Mapping/GIS/modeling	Y	There exists a need for geospatial inventory of local planning and zoning requirements that promote coastal resilience; geospatial inventory of coastal features and infrastructure; and updated recession rate information for many shoreline stretches. Geospatial data for various stretches of the coast and specific coastal management themes have been developed; however, improved integration of data and distribution systems is needed. A data development schema and framework is needed to ensure consistency, usability of data, and integration of regional data sets into a statewide effort. A review of existing distribution platforms (e.g. Great Lakes Shoreviewer) should be conducted; determining whether an existing platform is ripe for expansion into a statewide coastal hazards atlas or if a new platform is needed.
Data and information management	Y	Continued challenges exist with the State's efforts to maintain up-to-date parcel records for those properties designated as high-risk erosion areas. This complicates the department's task of notifying property owners of changes in designation, and also may restrict property owners from quickly and efficiently obtaining knowledge about their property's status with respect to erosion hazards.
Training/Capacity building	Y	Training and capacity building is needed on best management practices for incorporating coastal hazards resilience components into local planning and zoning.
Decision-support tools	Y	Need decision support tools that assist in identifying impacts (downdrift and elimination of recreational beach) of proposed shore protection structures. A decision support tool focused on identifying those stretches of coast suitable for soft-shore protection approaches would be of value.
Communication and outreach	Y	Publically available materials detailing coastal erosion trends along Michigan's Great Lakes Shore are needed as well as

		resources that assist local officials and the general public with best management practices for eroding properties.
Other (Specify)	N	N/A

Enhancement Area Strategy Development:

1. Will the CMP develop one or more strategies for this enhancement area?

   Yes ___X__
   No _____

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

   The MCZMP will develop an enhancement area strategy for coastal hazards. Rising Great Lakes water levels suggest that the State should be prepared for a potential increase in coastal erosion and flooding impacts in the coming years. Coastal development has pushed lakeward during the prolonged low Great Lakes water levels thereby increasing vulnerability. Existing coastal hazards programs have not been significantly enhanced in recent times and contain limitations in scope (coastal construction setbacks program) and their ability to promote modern, sustainable coastal protection approaches. Significant opportunities exist to enhance existing efforts by promoting and guiding coastal management towards increased hazards resilience at the local level.

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Ocean and Great Lakes Resources

In-Depth Resource Characterization:

Purpose: To determine key problems and opportunities to enhance the state CMP to better address cumulative and secondary impacts of coastal growth and development.

1. What are the three most significant existing or emerging stressors or threats to ocean and Great Lakes resources within the coastal zone? Indicate the geographic scope of the stressor, i.e., is it prevalent throughout the coastal zone or are specific areas most threatened? Stressors can be land-based development; offshore development (including pipelines, cables); offshore energy production; polluted runoff; invasive species; fishing (commercial and/or recreational); aquaculture; recreation; marine transportation; dredging; sand or mineral extraction; ocean acidification; or other (please specify). When selecting significant stressors, also consider how climate change may exacerbate each stressor.

Table 1. Top three stressors of Great Lake Resources.

	Stressor/Threat	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Stressor 1	Invasive species	Throughout coastal zone
Stressor 2	Changing water level and storm pattern	Throughout coastal zone
Stressor 3	Increasing water temperature	Throughout coastal zone

As was discussed in Phase I, the potential threats of climate change to the coastal zones include increasing water temperature, changing storm patterns, and changing water level[64]. Because increasing water temperature may systematically change the aquatic environment, it may create a more favorable condition for certain aquatic invasive species to expand. As a consequence, climate change could be the main driving force for these three stressors.

2. Briefly explain why these are currently the most significant stressors or threats to ocean and Great Lakes resources within the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.

   The Great Lakes Environmental Assessment and Mapping (GLEAM) Project team recently published a research paper evaluating the potential stressors in the Great Lakes based on expert elicitation through online survey[65]. The results show that

[64] 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. Available from the Great Lakes Integrated Sciences and Assessments (GLISA) Center, http://glisa.msu.edu/docs/NCA/MTIT_Coastal.pdf

[65] Smith S. D. P. et al. 2014. Rating impacts in a multi-stressor world: a quantitative assessment of 50 stressors affecting the Great Lakes. Ecological Applications. http://dx.doi.org/10.1890/14-0366.1

stressors related to invasive species and climate change were considered to have the greatest potential impacts. These two stressors both have a wide spatial extent, large change of magnitude, and long recovery time. Furthermore, the outcome of invasive species and climate change will negatively and widely affect many Great Lakes Resources in Michigan. Therefore, in the Phase I Assessment, invasive species and climate change are identified as the two most significant stressors or threats to the Great Lakes resources within the coastal zone. In Table 1, we rank the invasive species as the top 1 stressor because of its profound negative effects on natural resources[66].

In regard to climate change, based on the report from the Great Lakes Integrated Sciences and Assessments Center (GLISA) and the National Laboratory for Agriculture and the Environment[1], the impact of climate change on the coastal zone of Great Lakes region includes increasing water temperature, changing storm patterns, and changing water level.

Based on the Table 4 of the Phase I assessment, changing water level and changing storm patterns are highly likely to affect the use of Great Lake Resources in the coastal zone, such as transportation, navigation, recreation and tourism. Because management plans or strategies for these two factors are usually interrelated, we combine these two factors into one stressor and rank it as the second-most concerning stressor in Table 1.

Increasing water temperature is also a threat, which greatly affects aquatic biological resources. More importantly, changing the aquatic environment may increase the possibility of invasive species expansion. We thus rank this stressor as the third-most concerning stressor in Table 1.

3. Are there emerging issues of concern, but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.

Table 2. Emerging issues and information needed to evaluate the potential threat.

Emerging Issue	Information Needed
The need of climate change models at local scales.	Local climate model prediction.
The need of tools for decision-making, communication, and information query for climate change (Tools for climate change information).	1. Data from climate model prediction that can be interpreted by the public or state holders. 2. Tools to assist with both planning and public outreach about risks and how to reduce risks.
The need of assessment for economic impact of climate change.	1. Economic data about resource and use. 2. Tools for climate change information.
The need of adaptation plan of climate change on local scales.	1. Tools for climate change information.

[66] Michigan's aquatic invasive species state management plan 2013 update. http://michigan.gov/documents/deq/wrd-ais-smp-public-review_380166_7.pdf

	2. Assessment for economic impact of climate change
The need of research on species specific ecological characteristics and habitat impacts.	Field investigation data and habitat vulnerability research.
The need of tools for decision-making, communication, and information query for invasive species (Tools for invasive species information).	Data about species-specific ecologic traits and habitat information.
The need of assessment of economic impact of aquatic invasive species.	1. Economic data about resource and use. 2. Tools for invasive species information.
The need of species specific detection, prevention and management plan.	1. Tools for invasive species information. 2. Tools for climate change information. 3. Assessment of economic impact of aquatic invasive species.

Table 1 lists eight emerging issues and information needed that can facilitate the evaluation of potential threat of invasive species and climate change. Four emerging issues are related to climate change, while the other four emerging issues are related to invasive species.

Emerging Issues Related to Climate Change

Adaptation plan of climate change on local scales are needed for many coastal communities in Michigan. Although there are some adaptation plans for the whole state[67][68], they may not be able to reflect the needs of local communities. Ideally, each community would have a strategy or plan focusing on changing water level or severe storm conditions. To achieve this, assessment of the economic impact of climate change would be informative. Local climate change prediction and tools for information dissemination would be also valuable.

There are several climate models that focus on a global scale[69]. While these models shed light on the possible future scenarios, the downscaling of these models for regional or local climate change projection would provide more information for the public or stakeholders.

Tools that facilitate the dissemination of information are important to developing strategies for climate change adaptation. This is due to the difficulty in conveying the output of climate change models to the public or stakeholders given the complexity of such information. Therefore, tools bridging the gap between the climate models and the usability of the information are needed. Additionally, tools that can display the existing

[67] Climate change adaptation plan for coastal and inland wetlands in the State of Michigan. https://www.aswm.org/pdf_lib/michigan_wetlands_and_climate_change_report_final_403251_7.pdf

[68] Best practice for climate change adaptation: spotlight on Michigan coastal wetlands. http://www.nwf.org/~/media/PDFs/Global-Warming/2014/MI_CoastalWetlandsBestPractices_Toolkit_2014.pdf

[69] Winkler, J.A., R.W. Arritt, and S.C. Pryor, 2014. Climate projections for the Midwest: Availability, interpretation, and synthesis. In: Climate Change in the Midwest: A Synthesis Report for the National Climate Assessment, J.A. Winkler, J.A. Andresen, J.L. Hatfield, D. Bidwell, and D. Brown,eds., Island Press, 37-69. http://www.cakex.org/sites/default/files/documents/NCA_Midwest_Report_0.pdf

climate information would also facilitate planning, education, communication, and outreach. The Cities Impacts & Adaptation Tool provides a good example for such tools[70].

Emerging Issues Related to Invasive Species

The emerging issues related to invasive species are similar to those identified for climate change. While some invasive management plans focused at the state level[71] exist, species-specific detection, prevention, and management plans are still needed. Information about habitat vulnerability for invasive species is lacking. As a result, research or data collection focusing on this topic would greatly facilitate our understanding of the interaction between species and habitats, thus promoting the development of management plans. Tools that display information or study results about invasive species are also needed for education, outreach, and planning.

Assessment of economic impact should be an integral part for management plans, along with tools for information dissemination. Due to the impact of climate change on invasive species, tools for climate change information that are developed may also be helpful for the management plans on invasive species.

The Causal Relationship of These Issues

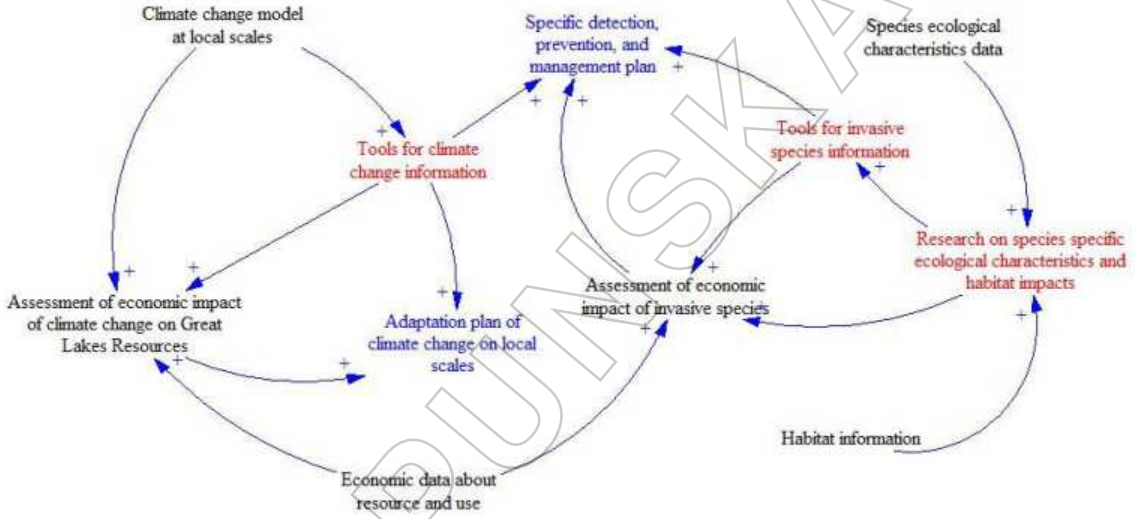
Causal relationships exist among these issues and therefore tackling those issues that are related to the "root cause" may facilitate the solution of other issues. Identification of these causal relationships is crucial to determine management priorities.

A causal loop diagram of emerging issues and information needs is provided in Figure 1. Arrows indicate the causal relationship. For example, collection of habitat information will facilitate the research on species ecological characteristics and habitat impacts, so in Figure 1, an arrow shows the causal relationships between these two factors. Blue text indicates two end goals (Species specific detection, prevention, and management plan; Adaptation plan of climate change on local scales). Red text indicates identified management priorities. Additional detail on the causal loop diagram is provided in the "Identification of Priorities" section.

[70] http://graham-maps.miserver.it.umich.edu/ciat/

[71] Michigan's aquatic invasive species state management plan 2013 update. http://michigan.gov/documents/deq/wrd-ais-smp-public-review_380166_7.pdf

Figure 1. Causal Loop Diagram of factors to facilitate the development of adaptation and management plan.



In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the ocean and Great Lakes resources enhancement objective.

1. For each of the additional ocean and Great Lakes resources management categories below that were not already discussed as part of the Phase I assessment, indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred since the last assessment.

Table 3. Management Category Summary

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Ocean and Great Lakes research, assessment, monitoring	Y	Y	N
Ocean and Great Lakes GIS mapping/database	Y, but limited	Y	Y
Ocean and Great Lakes technical assistance, education, and outreach	Y	Y	N
Other (please specify)			

The State of Michigan has established joint efforts among several departments to combat invasive species. MDEQ, MDNR, and MDARD are working together on the AIS Core Team to address issues that range from prevention, monitoring, inspection, control, education, and outreach with a large portion of this effort being related to Michigan's Great Lakes, connecting waters, and associated coastal lands.

It plays a central role coordinating the implementation of Michigan's AIS State Management Plan[72] (Last updated in 2013). The Core Team organized the Michigan Invasive Species Grants Program[73] to monitor, prevent and manage invasive species. MDEQ, MDNR, MDARD, and Michigan Department of Transportation (MDOT) also established a Terrestrial Invasive Species (TIS) Core Team to address TIS issues, similar to the role of AIS Core Team.

The MCZMP has funded projects focusing on climate change adaptation plans. One example is the Climate Change Adaptation Plan for Coastal and Inland Wetlands in the State of Michigan[74], which is a collaborative effort between the Water Resources Division-MDEQ and the State Association of Wetlands Manager. Another project is the best practice for climate change adaptation: spotlight on Michigan coastal wetlands[75], which is a collaborative effort between Great Lakes Commission and National Wildlife Federation. Both provide good management practices and plans for adaptation focusing on the coastal wetland. A large portion of these practices and plans are also feasible to other land cover types in the coastal zone.

Mapping data or GIS databases related to Great Lakes resources exist, such as the Great Lakes Habitat Framework developed by the Institute for Fisheries Research at MDNR[76]. However, the GIS data for many resources are lacking. Even where such data exist, availability of the data is often still limited. The MCZMP has supported the Superior Watershed Partnership's development of the Great Lakes Shoreviewer, which is an online tool that displays color images and other data resources of the shoreline in the Upper Peninsula of Michigan[77]. This tool, which is presently being expanded in both functionality and geographic scope, provides an example of the dissemination of spatial data for public use.

2. For management categories with significant changes since the last assessment, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information.
    a. Describe significant changes since the last assessment;
    b. Specify if they were 309 or other MCZMP-driven changes; and
    c. Characterize the outcomes or likely future outcomes of the changes.

[72] Michigan's aquatic invasive species state management plan 2013 update. http://michigan.gov/documents/deq/wrd-ais-smp-public-review_380166_7.pdf

[73] http://www.michigan.gov/dnr/0,4570,7-153-58225_69835---,00.html

[74] Climate change adaptation plan for coastal and inland wetlands in the State of Michigan. https://www.aswm.org/pdf_lib/michigan_wetlands_and_climate_change_report_final_403251_7.pdf

[75] Best practice for climate change adaptation: spotlight on Michigan coastal wetlands. http://www.nwf.org/~/media/PDFs/Global-Warming/2014/MI_CoastalWetlandsBestPractices_Toolkit_2014.pdf

[76] http://ifr.snre.umich.edu/projects/glahf/

[77] http://superiorwatersheds.org/shorelineviewer2011/

3. Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's or territory's management efforts in planning for the use of ocean and Great Lakes resources since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's or territory's management efforts?

   Formation of the AIS Core Team as well as development of the various plans or strategies focusing on invasive species or climate change have occurred quite recently and thus, additional time and more information is needed to evaluate the effectiveness. Additional information or tools related to species distribution and habitat condition would be valuable to assess the effectiveness of invasive species management program or plans. Feedback and comment form the public, subject matter experts, and stakeholders are also crucial to evaluate the success of management plans of climate change adaptation and invasive species.

Identification of Priorities:

1. Considering changes in threats to ocean and Great Lakes resources and management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to effectively plan for the use of ocean and Great Lakes resources.

   Management Priority 1: Development or Improvement of tools for decision-making, communication, and information query for climate change

   Description: As was mentioned in Table 2, tools that facilitate communication and dissemination of climate change information are the key to develop adaptation strategies

   Management Priority 2: Development or Improvement of tools for decision-making, communication, and information query for invasive species

   Description: As was mentioned in Table 2, tools that facilitate communication and dissemination of invasive species information are also imperative to develop species specific detection, prevention, and management plan.

   Management Priority 3: Promoting Research on species specific ecological characteristics and habitat impacts

   Description: As was mentioned in Table 2, species specific and habitat specific information are the foundation to understand or predict how invasive species may interact with the habitat.

2. Identify and briefly explain priority needs and information gaps the CMP has to help it address the management priorities identified above. The needs and gaps identified here do not need to be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.

Table 4. Summary of Priority Needs.

Priority Needs	**Need?** (Y or N)	**Brief Explanation of Need/Gap**
Research	Y	Field investigation, habitat information. Data about other Great Lakes Resources.
Mapping/GIS	Y	GIS data for species distribution and habitat information. Data about other Great Lakes Resources.
Data and information management	Y	Tools for climate change and invasive species information
Training/Capacity building	N	
Decision-support tools	Y	Tools for climate change and invasive species information
Communication and outreach	Y	Tools for climate change and invasive species information
Other (Specify)		

The priority needs identified in Table 4 are all related to the management priorities we identified previously. These activities will add values to the progress of the management priorities.

Enhancement Area Strategy Development:

1. Will the CMP develop one or more strategies for this enhancement area?
   Yes _____
   No ___X__

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

In the Phase II assessment of Great Lakes Resources, we identified emerging issues and needs (Table 2). After that, we further developed a causal loop diagram that demonstrates the causal relationships of these issues or needs (Figure 1). Finally, we identified three management priorities to alleviate the threat of invasive species and climate change.

Based on the causal loop diagram (Figure 1), it is clear that developing adaptation plans of climate change on local scales and developing species-specific detection, prevention and management plans are two end goals. However, we did not rank these two goals as our top 3 management priorities because, based on the causal loop diagram, focus on those needed information or issues first is preferable before allocating resources to management plans. Abundant information, data, and tools available, will facilitate the development of management plan. The allocation of resources toward the “causal” will achieve greater advances over the long term. This decision does not mean management plans are not important. On the contrary, efforts that can effectively develop management plans have great value, but the development of the information needed to inform those plans is of highest priority.

Finally, developing climate change models at local scales will establish a strong the foundation for developing tools and economic assessment since it is on the “upstream” of the causal loop diagram. This too was not included as a management priority because the CMP’s focus is within the coastal zone boundary, while the geographic extent of the downscaling model is typically larger than the boundary, such as a local watershed.

The MCZMP is not proposing a strategy for this enhancement area due to the significant on-going focus efforts through the AIS/TIS Core Teams. The MCZMP ultimately determined that the priority needs associated with Invasive Species management may be advanced through funding and efforts outside of the Section 309 enhancement program and also that the actions needed do not rise to the required level of a program change as is required for a Section 309 strategy.

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Aquaculture

In-Depth Resource Characterization:

Purpose: To determine key problems and opportunities for facilitating the siting of aquaculture facilities in the coastal zone.

1. What are the three most significant existing or emerging challenges to facilitating the siting of aquaculture facilities within the coastal zone? Indicate the geographic scope of the challenge, i.e., is it prevalent throughout the coastal zone or are specific areas most threatened? Challenges can be conflicting uses; coastal resource impacts; coordinating regulatory processes or review; insufficient data; natural disasters; or other (please specify). When selecting significant challenges, also consider how climate change may exacerbate each challenge.

	Challenges	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Challenge 1	Insufficient Data regarding water quality and pathogen risks	Throughout coastal zone
Challenge 2	Impacts on aquatic life habitat	Throughout coastal zone
Challenge 3	Siting and user conflicts	Throughout coastal zone
Challenge 4	Animal health	Throughout coastal zone
Challenge 5	Environmental systems that are economical and sustainable	Throughout coastal zone
Challenge 6	Develop or update related rules or statutes	Throughout coastal zone

2. Briefly explain why these are currently the most significant challenges to facilitating the siting of aquaculture facilities in the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.

   The Phase I assessment identified only one land-based aquaculture facility located within the coastal zone. There exists no net pen facilities in the open waters of the Great Lakes, however there is growing interest to promote Great Lakes aquaculture[78]. Because there are several challenges for commercial net pen aquaculture, in Phase I assessment we ranked this enhancement area as a high priority.

3. Are there emerging issues of concern, but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.

Emerging Issue	**Information Needed**

[78] http://www.cadillacnews.com/ap_story/?story_id=329545&issue=20150323&ap_cat=2

Water Quality	Need information on types and amounts of fish foods, drugs, etc. and effluent discharges from net pens.
Habitat Vulnerability	Need information on current and past trend of benthic environment and biodiversity data.
Impacts on Animal Health	Need information on the best practice of net pen aquaculture in terms of production efficiency and animal welfare.
Sustainable Development	Need information on the economic analysis of net pen aquaculture.

In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the aquaculture enhancement objective.

1. For each additional aquaculture management category below that was not already discussed as part of the Phase I assessment, indicate if it is employed by the state and if significant state- or territory-level changes (positive or negative) have occurred since the last assessment.

Management Category	**Employed by the State** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Aquaculture research, assessment, monitoring	Y	N	N
Aquaculture GIS mapping/database	N	N	N
Aquaculture technical assistance, education, and outreach	Y	N	N
Other (please specify)			

2. For management categories with significant changes since the last assessment, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information.
    a. Describe significant changes since the last assessment;
    b. Specify if they were 309 or other MCZMP-driven changes; and
    c. Characterize the outcomes or likely future outcomes of the changes.

3. Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's or territory's management efforts to facilitate the siting of aquaculture facilities since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's or territory's management efforts?

The MSG has recently published a strategy plan for sustainable and thriving aquaculture development, which utilizes integrated assessments and points out several strategic actions[79]. This report provides a good framework for aquaculture development that meets the economic, social, and ecological needs of the Michigan citizens.

In 2012, the MDEQ, MDNR, and MDARD formed a working group, focusing on aquaculture development. It is an important step to facilitate communication and collaboration on current resources, assessments, and refinement of permitting and regulatory compliance.

Identification of Priorities:

1. Considering changes in aquaculture activities, the management of these activities since the last assessment, and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve the effectiveness of its management effort to better respond to the most significant aquaculture challenges.

   Management Priority 1: Development and improvement of coastal tools for decision making.

   Description: Conduct research to develop industry based standards and develop a Michigan-specific best management manual to provide guidelines designed to minimize or prevent adverse environmental impacts, to maximize the health and well-being of the organisms being raised, and encourage efficient and economical animal production.

2. Identify and briefly explain priority needs and information gaps the CMP has to help it address the management priorities identified above. The needs and gaps identified here do not need to be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.

[79] Colyn, J., G. Boersen, C. Weeks and B. Knudson. 2014. A Strategic Plan for a Thriving and Sustainable Aquaculture Industry in Michigan. Final report prepared for Michigan Sea Grant [MICHU-14-208]. http://www.miseagrant.umich.edu/wp-content/blogs.dir/1/files/2012/09/2014-MAA-Strategic-Plan_Final_141215.pdf

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Research	Y	Research focused on environmental assessment economic analysis, and best practice of management
Mapping/GIS	Y	GIS data that can support research and decision-making, such as benthic environment data or native species distribution data
Data and information management	Y	Tools available from which the public and stakeholders can access information
Training/Capacity building	Y	Buildings that can facilitate training or education about the best practice of net pen aquaculture
Decision-support tools	Y	Tools that can facilitate site selection or management practice
Communication and outreach	Y	The public has some concerns about the environmental impacts of net pen aquaculture. It is this important to have communication and outreach efforts to improve public perception and acceptance.
Other (Specify)		

Enhancement Area Strategy Development:

1. Will the CMP develop one or more strategies for this enhancement area?
   Yes_____
   No __X___

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

   The MCZMP ultimately determined that the priority needs associated with aquaculture management may be advanced through funding and efforts outside of the Section 309 enhancement program, and also that the actions needed do not rise to the required level of a program change as is required for a Section 309 strategy.

Strategy

Coastal Geophysical Properties and Resiliency Strategy

I. Issue Area(s)

The proposed strategy or implementation activities will support the following high-priority enhancement areas *(check all that apply)*:

☐ Aquaculture
☐ Cumulative and Secondary Impacts
☐ Energy & Government Facility Siting
☐ Wetlands
☒ Coastal Hazards
☐ Marine Debris
☐ Ocean/Great Lakes Resources
☐ Public Access
☐ Special Area Management Planning

II. Strategy Description

A. The proposed strategy will lead to, or implement, the following types of program changes *(check all that apply):*
☐ A change to coastal zone boundaries;
☐ New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;
☒ New or revised local coastal programs and implementing ordinances;
☐ New or revised coastal land acquisition, management, and restoration programs;
☐ New or revised special area management plans (SAMP) or plans for areas of particular concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,
☒ New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable MCZMP policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.

B. Strategy Goal: The goal of the strategy is to increase the capacity of coastal communities to understand, anticipate, assess, adapt, and/or recover from the coastal processes and hazards of coastal erosion and flooding. This will be achieved through the development of critical geospatial data, data visualization and analysis tools, and outreach mechanisms to facilitate locally driven plans and implementing ordinances that promote prudent and sustainable shoreline land uses. The program changes will consist partly of the local master plans and ordinance(s) developed under pilot projects, and informed through newly created data and resources, to enhance coastal communities' resilience and address the challenges and opportunities posed by the dynamic nature of the Great Lakes coast. An additional program change will consist of a policy, with accompanying guidance for coastal communities, shaped by the results of the pilot projects and

adopted by the MCZMP to guide the program's future efforts supporting local community resilience from coastal hazards through improved planning and zoning.

Approximately 93% of Michigan's Great Lakes coast is not subject to state-specific regulatory requirements under the state's HREA program, and thus local coastal policies provide the key opportunity to thoughtful system management, fostering prudent community growth in a way that reduces coastal hazard impacts. Therefore, this strategy provides technical assistance and community capacity building within pilot communities to develop knowledge about supporting data needs at the local, regional, and statewide levels. The pilot planning or zoning efforts will be supported in 1 - 2 communities in each year of the strategy with an eye towards informing needs and opportunities across various geographic regions and coastal typology regions in the state. Pilot studies over a wide range of coastal typologies will determine similarities and differences in information requirements according to differing physical, ecological, and social settings. The MCZMPs adopted policy represents a key program change by serving as a guide which will be used to replicate the successful results of the pilot throughout the remaining coastal regions after the strategy ends.

C. Strategy Short Description: This strategy enhances MCZMP efforts for improving coastal community planning and zoning - placing greater emphasis on integrating geospatial information for use within analysis tools that support local decision-making. This strategy builds the knowledge base for decision makers on nearshore hydro-geophysical processes and nearshore systems and raises awareness of policy approach options to increase resilience from coastal erosion and flooding and the concomitant effects on people and communities. The vision is that successful local coastal policy will be implemented that establishes prudent and sustainable land uses near the shoreline, in a manner that alleviates risk of impacts to public health, safety, and welfare, and vulnerability of public and private property, while also fostering the sustainability of natural coastal ecosystems including beach, bluff, and dune systems. Efforts will be made to develop effective communication tools conveying the value of, and services provided by, natural protective coastal systems and assets in terms of how they serve the community by boosting economic and social aspects within Michigan's coastal communities. Strategy objectives may be achieved by applying one or more from the suite of approaches including, but not limited to: promoting the appropriate siting of infrastructure, fostering development away from hazardous areas, and encouraging nature-based shore protection efforts.

The MCZMP will collaborate with a Coastal Partners Network (CPN) including coastal processes/engineering and land use planning experts to navigate three primary components: 1) identify the range of policy options available to local governments for directing the establishment of land uses considered appropriate for areas subject to coastal erosion and flooding; 2) verify and finalize geospatial data requirements and preferred analysis tools and approaches in support of scenario-based local land use planning needed to visualize outcomes of implementing various policy options; and 3) explore potential delivery tools for

data (e.g., visualizations and participatory maps), information, and coastal resilience planning concepts with the goal of fully informing the community about its options for managing the community's coast. In this manner, the geospatial data and decision support systems will be better integrated into the scenario-based assessment portion of the planning process.

The strategy will proceed by developing geospatial data sets and products needed to implement scenario-based planning in the pilot study communities. Data set needs and priorities will be identified in consultation with the CPN and local communities, but for example, are likely to include development of flood event depth grids necessary to support use of the FEMA HAZUS model. An important component will be the processing of available raw data sets into information sources that are readily understandable and applicable by local land use managers. Significant coastal data collection efforts have occurred in Michigan; however, these efforts often support end-use by scientists and fall short of being transformed into the type of data and information products needed by local land-use decision makers. For example, high-resolution coastal elevation data provided by new LiDAR data acquisition is a valuable raw data set, but does not directly aid decision-making by a local official to the same extent as if this LiDAR data were used in a model to map flood depths anticipated during a 1% storm event based on this LiDAR data. The pilot planning and data collection efforts with local communities will provide knowledge on which data sets are needed by communities located in specific settings or coastal typologies versus those that are needed on a statewide basis.

Community-based pilot efforts will inform the approach to be applied by the MCZMP for future facilitation of coastal resilience planning efforts. The process and feedback will shape specific details of these efforts, but in general it is anticipated that this will transform how the MCZMP solicits, selects, and guides coastal resilience planning projects. These new approaches will be reflected in new guidelines, procedures, and/or policies to be adopted by the MCZMP, Office of the Great Lakes.

Products will be developed for external viewing that foster application toward additional Michigan coastal communities in the future. The CPN will again be leveraged to identify high-priority products, which may include case studies, process guidance, data and decision support tool resources, and a community self-assessment tool similar to Maryland's CoastSmart Communities Scorecard (see http://dnrweb.dnr.state.md.us/CoastSmart/scorecard.asp).

This strategy, through the CPN, will bring together a range of ongoing initiatives and, revolving around the new data enhancement initiative included within this strategy, foster a new arrangement for local coastal planning which utilizes data-driven, scenario based planning as the driver for local decision making. Specifically, this effort builds upon momentum of MCZMP-supported projects including LIAAs *Planning for Resilient Coastal Communities*, the University of Michigan's *Restoring, Retrofitting, and Recoupling Michigan's Great Lakes Shorelands (R3GLS)* project, the UM/MTU/LIAA Great Lakes Water Levels Integrated Assessment project entitled *Implementing Adaptation: Developing*

Land Use Regulations and Infrastructure Policies to Implement Great Lakes Shoreland Area Management Plans, and the FY 2015 effort by Michigan Association of Planning to improve coastal community planning and resilience related to climate change. External efforts such as the *Great Lakes Aquatic Habitat Framework (GLAHF)* will also be leveraged. The opportunity exists to build upon the momentum already achieved through these individual projects, coordinating efforts and building capacity so that these sort of local coastal management policy efforts become institutionalized in Michigan.

Local coastal planning and zoning efforts may consider a range of adaptation options, including for example: planned unit developments, coastal construction setbacks, coastal retreat requirements, shore protection structure regulations, natural shoreline protection and restoration, and land acquisition programs for hazard-prone parcels. Each community will determine which specific options best reflect the community's vision for prudent future growth as informed by the scenario-based planning approach. Efforts put forth, and choices made by the communities, will guide the CPN with identifying commonalities in approaches that are pursued based on regional perspective, coastal physical typology and characteristics, and thus may provide an opportunity to move towards a regionalization of policy approach recommendations.

No legal requirement exists in Michigan requiring local units of government to develop or enact local coastal management policies, and to date few local communities in Michigan have enacted policies focused on coastal resilience. Local desire to pursue such policies and public acceptance and support requires understanding of the ultimate outcomes, and the environmental, social, and economic benefits that may result. Application of the scenario-based planning approach toward planning and zoning provides the ability to consider spatially explicit alternatives representing a variety of possible outcomes, which can then be evaluated so that local stakeholders can make informed decisions on how they wish to manage coastal development. The primary difference between scenario-based efforts vs. traditional approaches is that scenario planning identifies land-use patterns (and other system stressors) as variables (probabilistic) rather than static (deterministic) inputs. The use of scenarios to compare and contrast interactions between multiple factors such as coastal population growth, land divisions, pace of development and shoreline management approaches (e.g. structural vs. natural) allow residents to choose which management options should be established through master plans and ordinances in order to have the best chance of realizing the preferred future of how their coast will look and function. One great advantage of this approach is that it allows the testing of "multiple realities" while seeking solutions and responses that are durable across the range of planning parameters. These are often termed "no regrets" strategies and rely less on divisiveness or rancor over planning assumptions versus allowing a more proper focus on the response mechanisms under multiple scenarios. Scenarios also prompt consideration of natural Great Lakes water level variations, as well as potential water level regime shifts or changes in the frequency and intensity of extreme storm events that may result from climate change.

Scenario-based planning requires significant geospatial data resources, which are lacking in Michigan. This strategy will inventory and collect existing datasets in pilot communities; working to differentiate data set needs particular to a specific community or region versus those in commonality that are needed on a statewide basis. We will finalize a data collection protocol and database schema for priority data sets, and subsequently develop those necessary supporting geospatial datasets for application towards scenario-based planning within the pilot communities. Priority data gaps identified as existing at the more comprehensive scale will be filled to the extent possible given available financial and time constraints and will also be pursued through other funding opportunities, potentially including Section 309 Project(s) of Special Merit opportunities. Collected and created geospatial data sets are expected to include: 1) an inventory of existing local master plan districts and zoning districts; 2) land ownership; 3) shore classification; 4) existing land/use/cover; 5) shore protection structure inventory; 6) littoral cell and reach mapping; 7) coastal sediment budget information; and 8) coastal building footprints and infrastructure vulnerability information. Data collection efforts may also include acquisition of baseline data sets including LiDAR, orthophotos, and/or oblique aerial imagery; however, we will fully leverage existing data resources to the extent possible. An analysis of shore protection structures serves as an example as to how a community might consider scenarios. By developing a geospatial data layer depicting trends in the extent of shoreline armoring over time, the future "armored" status of the coast can be visualized as it would occur under the existing policy scheme vs. a range of identified options (e.g. enhanced retreat policy or shore protection construction restrictions). If natural recreational beaches are an important part of the community's shared vision, and we know that shore protection structures lead to the destruction of natural beaches, such a scenario-based visualization would assist the community in identifying those policy options needed to pursue an outcome that maximizes and sustains the desired healthy natural beach systems.

Data visualization (e.g. ASFPM Flood Visualization Tool and NOAA Great Lakes Lake Level Viewer) and land use planning analysis tools (e.g. CommuntyVis®) and other outreach mechanisms are essential to conveying various future scenarios to local stakeholders. As such, this strategy will review and assess functionality of existing tools and identify and apply those tools that lend well towards improved coastal resilience planning in Michigan. These tools will be applied as-is in certain cases and when appropriate we will explore opportunities to tailor such applications toward the pilot planning communities or work towards the development of new applications, if needed.

This strategy represents a nested approach, in which pilot planning efforts directly improve local coastal resilience planning and implementing ordinances, and in turn these pilot efforts inform the approach and tools the MCZMP will use to facilitate future similar efforts. The updated local master plans and zoning ordinances incorporating coastal resilience components comprise program changes under Section 309 of the CZMA. The application and integration of enhanced geospatial information on Michigan's nearshore (e.g. land and water

interface), which is necessary to the understanding of the critical systems linkages at the land water interface, serves as the cornerstone of the coastal management decision-making process. A scenario-based planning process is applied, and facilitated by planning experts and coastal science/engineering experts; providing direct technical assistance and application of the developed data resources toward coastal communities' implementation of these coastal hazards resilience concepts during planning and/or zoning development. The body of knowledge created and lessons learned through the development and adoption of the local plans and ordinances in the pilot project will serve as the foundation for the MCZMP policy on building community resilience to coastal hazards, and the associated guidance. This amounts to another program change under Section 309, changing the manner in which the MCZMP solicits and facilitates coastal resilience planning in the state. The combination of on-the-ground results and alteration of the MCZMPs facilitation approach have potential to be transformative in locally implemented coastal planning resilience in the state.

III. Needs and Gaps Addressed

Michigan's coast serves as a significant asset for coastal communities, especially when it is healthy and naturally functioning, serving as a dynamic buffer system bridging the land and water interface. The Phase I and II assessments identified rising water level trends as a potential challenge forthcoming due to associated increase in coastal erosion and flooding. Furthermore, the state's HREA regulatory program provides controls over only a small percentage of the coast. Local coastal management options, while voluntary in the State of Michigan, can enhance protections in designated HREAs and provide for much-needed provisions along the more than 3,000 miles of shoreline which are not currently regulated under the HREA program. Building capacity at the local level allows coastal communities to be proactive in the manner in which they protect public and private property from coastal hazards and also the protection of coastal natural resources.

While the MCZMP has supported local coastal planning efforts for many years, only the most recent efforts have targeted improved coastal resilience as a primary objective. The resilience-focused coastal planning efforts to date have only touched the surface in terms of identifying the range of policy options and have been hindered by a lack of supporting data, information, and tools that are needed to visualize the range of outcomes that may be realized through implementation of various policy approaches. This effort will transform the MCZMPs role in local coastal resilience planning efforts, realize coastal resilience improvements in pilot communities, and develop the data sets and products needed to inspire and support the application of scenario-based planning and zoning efforts towards other local coastal communities in the state.

IV. Benefits to Coastal Management

This strategy builds capacity of the MCZMP to work with coastal planning partners and directly with local managers in protecting coastal resources at the local level. It

develops needed data resources and tools while implementing scenario-based planning/zoning effort(s) in to-be-identified pilot community(ies), thereby serving as a model for future efforts. The vast majority of coastal communities in Michigan lack the necessary geospatial data – and technical expertise and tools needed to understand and analyze the data – to manage land uses in areas subject to coastal erosion and flooding. These local officials are currently unaware of the gaps existing in state and federal protection policies as well as the opportunities afforded them through local coastal management. Therefore, they rely on the state and federal governments to manage their local coasts through existing regulatory programs. This strategy will help inform local managers of the limited scope and breadth of existing state regulations, and provide guidance and tools for improved local management, thereby empowering them to manage their coastal assets via planning and zoning in a manner better aligned with the community's shared vision for their future coast.

V. Likelihood of Success

This strategy has a high likelihood of success. Accomplishing this strategy does not require new statutes, statutory amendments, administrative rule promulgation, or other legislative involvement. Adoption of a community master plan and zoning ordinance is entirely under local control. MCZMP will work with the CPN to identify and engage communities interested in managing coastal land uses to achieve resiliency. Engagement may take a variety of forms including informal communications, discussions through other efforts (e.g., Michigan Association of Planning workshops), and potentially hosting regional information meetings or webinars. If local communities are not receptive or willing to participate in any given year, focus during that time frame will be shifted towards development of information and resources that educate about coastal hazards and vulnerabilities and the options available and importance of applying local decision-making toward management and mitigation of such risk. As needed, the MCZMP may undertake activities to better understand drivers (and deterrents) for community involvement in coastal resilience planning and zoning efforts, with the intent of applying gained knowledge towards efforts that motivate more communities to participate. Development and adoption of the MCZMP policy on building community resiliency to coastal hazards is entirely under OGL control. The strategy is designed to utilize existing OGL staff in concert with external project partners, and, as such, no new OGL positions are proposed to be supported under this strategy.

Due to recent record low water levels, water level change trends and the anticipation that coastal hazard threats may be realized on a more widespread and recurrent basis, it is expected that community officials will increasingly seek approaches to protect their community resources. On-going cooperative efforts between the MCZMP and partner organizations regarding coastal community resilience set the stage for this coastal hazards-focused planning/zoning initiative. The recent coastal resilience zoning effort in the City of St. Joseph (see Phase I assessment) also serves as a potential model, and may indicate that coastal communities in the state are prepared to move forward on this front. Other work with partners in the MDNR's

Waterways Program, MHHSDA, OGL and MSG on Small Harbor Sustainability also augment the outreach and engagement underway in coastal communities.

VI. Strategy Work Plan

Total Years: 5
Total Budget: $2,470,000

Year(s): 1 (2016-17)

Description of activities:
Create the CPN which will exist throughout the strategy. Collaborate with the CPN to work towards the following overarching strategy tasks: 1) identify, refine, and prioritize geospatial data requirements at various scales in support of scenario-based local land use planning; 2) Identify the range of policy options available to local governments for managing coastal hazards; and 3) explore potential data delivery tools such as visualizations and participatory maps with the goal of fully informing the community about its options for managing the community's coast.

Year one activities leveraging the CPN will include development of a white paper documenting significant overarching concepts including: coastal resilience in the Great Lakes context, options to increase resilience through local planning and zoning actions, and knowledge learned to date regarding geospatial data and information gaps and identifying priority data acquisition needs for integrating resilience-based geospatial data and tools into the planning processes of local coastal communities. Existing geospatial data resources and decision support tools will be reviewed with the CPN and local community partners to ensure full leveraging of assets, such as the coastal hazards classification data set and oblique aerial imagery being developed as part of the CZM-supported enhancement of the Great Lakes ShoreViewer.

The MCZMP and CPN will leverage existing relationships built through ongoing CZM-supported coastal resilience planning efforts including local units of government in Holland, Grand Haven, Ludington, and St. Clair, and regional units of government in Northwest Lower Michigan and the Eastern Upper Peninsula, to identify communities ripe and willing to proceed with coastal resilience planning and zoning. New partnerships with local communities and regional coastal council of governments and watershed councils will also be forged to identify and coordinate with communities interested in serving as a pilot to conduct local coastal resilience planning or zoning efforts. As necessary, workshop(s), webinar(s), or the release of a focused Request for proposals may be used to garner community interest. The workshop(s) or webinar(s) would discuss coastal hazards, the environmental and economic importance of managing growth in hazard areas, and general policy options for local governments to direct establishment of land uses appropriate for coastal hazard areas. Resilience planning or zoning efforts will commence and be facilitated by contracted partners and the MCZMP in one to two communities.

Geospatial data creation efforts supporting planning in the on-going pilot communities will commence. Data development efforts will be restricted to those that can be accomplished on a short time frame, and within the given budget, to allow for incorporation into the planning process before its conclusion. For example, coastal flood depth grids have been identified as a primary data gap, and represent data that may be possible to develop on a relatively short time frame if supporting data sets and experts with the necessary modeling expertise are readily available.

Major Milestone(s):

- Formation of the CPN; CPN meeting to review existing knowledge of data gaps and policy options.
- White paper(s) detailing existing knowledge of local coastal hazards management resilience options and the geospatial data and product gaps needing to be filled to support coastal resilience planning efforts.
- Identify and engage community(ies) to serve as pilot(s) for application of geophysical properties and resilience data toward planning/zoning efforts.
- As needed, workshop(s) conducted for local officials to inform about coastal hazards resilience and local management options, scenario-based planning approaches, and the importance of geospatial data integration.
- Planning and zoning subject matter experts with specific expertise in local coastal management are contracted to guide and facilitate local coastal planning or zoning process in pilot community(ies).
- Scenario-based planning methods for driving improvements to the coastal resilience of the community within the pilot community(ies) are further developed and tested.
- Based on existing knowledge and lessons learned through early phases of initial pilot planning process, finalize geospatial data framework, schema, and cost estimates.
- Commence geospatial data collection and development for application within the pilot community(ies).

Budget:

Contractual - $389,840
Staff – $104,160

Year(s): 2 (2017-18)

Description of activities:

Year 2 includes application of the core year one activities towards an additional one to two coastal communities. The CPN and project partners will facilitate coastal resilience planning and zoning efforts in these additional communities; applying and further testing the scenario-based planning methods. Related data resources will be inventoried and gaps identified; comparing data gaps with those identified during year one. The geospatial data white paper will be revised as needed to serve as an updated resource and guide for future communities wishing to conduct similar coastal planning and zoning efforts. Commonalities in data gaps will be reviewed in order to begin identifying those data gaps existing on either a regional or statewide

basis. Similarly, potential local policy options will be refined as additional approaches are identified. Geospatial data collection efforts will be conducted as necessary in support of the scenario based planning.

Major Milestone(s):

- Identify and engage additional community(ies) to serve as pilot(s) for application of geophysical properties and resilience data toward planning/zoning efforts.
- Planning and zoning subject matter experts with specific expertise in local coastal management are contracted to guide and facilitate local coastal planning updates; completing the master plan portions and then transitioning to work on development of the local implementing ordinances.
- Continue development and testing of scenario-based planning methods for driving improvements to the coastal resilience of the community within the pilot community(ies).
- Based on knowledge gained through pilot planning efforts to date, refine identification of supporting geospatial data priorities, including specifics on data framework, schema, and cost estimates.
- Refine white paper examining local coastal resilience policy options.
- Acquire supporting geospatial data and apply to ongoing planning efforts within the pilot community(ies), as needed.

Budget:

Contractual - $386,777
Staff – $107,223

Year(s): 3 (2018-19)

Description of activities:

Year 3 replicates the core activities from the first two years towards an additional one to two coastal communities. The CPN and project partners will facilitate coastal resilience planning and zoning efforts in these communities; applying and refining the scenario-based planning methods. Related data resources will be inventoried and gaps identified; comparing data gaps with those identified during the previous years. Trends should start to form with respect to local data gaps compared to those existing at larger scales and the geospatial data white paper will be revised as needed to acknowledge and convey such trends and data gaps and will also begin to prioritize larger scale data needs. Geospatial data collection efforts will be conducted as necessary in support of the new pilot community's scenario based planning efforts. At this time, pilot study findings will be utilized for a data gaps review and assessment of available decision support tools to develop a plan for large scale data collection and/or tool development for the final two years of the strategy.

Major Milestone(s):

- Additional community(ies) to serve as pilot(s) for application of geophysical properties and resilience data toward planning/zoning efforts are identified and engaged.

- Planning and zoning subject matter experts with specific expertise in local coastal management are contracted to guide and facilitate local coastal planning updates; completing the master plan portions and then transitioning to work on development of the local implementing ordinances.
- Scenario-based planning methods are applied toward improving the coastal resilience of the pilot community(ies).
- Acquire supporting geospatial data and apply to ongoing planning efforts within the pilot community(ies), as needed.
- White paper(s) developed, based on experience gained through pilot community planning efforts, documenting the following:
    - Geospatial data priorities and recommendations, including specifics on data framework, schema, and cost estimates. Data gaps are identified on both a regional and statewide basis.
    - Local coastal resilience policy options.
    - Recommendations for actions to be taken by the MCZMP to foster the continued growth of local coastal hazards planning and zoning.
    - A prioritized list of education and outreach products needed.
    - Inventory of available decision support tools for coastal resilience planning and identification and prioritization of any new decision support tools needed.

Budget:

Contractual: $383,622
Staff – $110,378

Year(s): 4 (2019-20)

Description of activities:

Convene the CPN to review and evaluate the interim results of the pilot region planning and zoning efforts, and transform recommendations from Year 3 milestones into the framework of the draft MCZMP policy for building community resilience to coastal hazards. Design and develop supporting components including priority decision support tools and education and outreach products. Special emphasis will be placed on acquisition of priority geospatial data sets, especially those identified as significant statewide or regional gaps.

Major Milestone(s):

- Framework of MCZMP policy for building coastal community resilience completed.
- Education and outreach products necessary for support of local coastal hazards resiliency efforts are developed.
- Decision support tools necessary for support of local coastal hazards resiliency efforts are designed and developed, if necessary.
- Intensive acquisition efforts conducted for priority statewide or regional geospatial data sets that support coastal resiliency.

Budget:
Contractual: $380,374
Staff – $113,626

Year(s): 5 (2020-21)

Description of activities:
Finalize assessment of the pilot planning and zoning efforts, develop and adopt MCZMP policy on building community resilience to coastal hazards, and develop and post accompanying guidance and best practices to the program Web site. Finish acquisition of high-priority geospatial data sets and development of decision support tools. Serve data out for consumption and use by local communities through decision support tools or other means. Promote the MCZMP's support of local coastal resilience informing stakeholders about newly available data, tools, and opportunities.

Major Milestone(s):
- Developed products including geospatial data and decision support tools are made available via geospatial data portals and/or decision support tools for direct application toward local coastal management efforts.
- Planning and zoning subject matter experts with specific expertise in local coastal management engaged to continue to guide and facilitate local coastal zoning ordinance development.
- MCZMP policy adopted, guidance developed and publicized.

Budget:
Contractual: $377,028
Staff – $116,972

VII. Fiscal and Technical Needs

A. Fiscal Needs:

Efforts presented within this strategy represent high-priority outcomes for the MCZMP, and, as such, the MCZMP has also applied for funding of a similar, related effort under federal funding opportunity (FFO) NOAA-NOS-OCM-2015-2004324. The needs in this area are vast and receipt of funding under the aforementioned FFO would not satisfy needs, but rather serve to jump start efforts proposed here. Should funding be received under the FFO certain tasks, such as the formation of the CPN, will be completed before commencement of the strategy. Two primary advantages will be realized: 1) Additional pilot communities will undertake coastal resilience planning efforts providing increased understanding of supporting product needs, and 2) geospatial data acquisition and development of other supporting products will be expedited, allowing more time for development and acquisition of these items and potentially additional funding being reallocated towards data acquisition and development. The funding requested through this Section 309 strategy is sufficient to accomplish the tasks identified; however, it is

anticipated that geospatial data needs will be extensive and thus additional funding will need to be sought in order to fully satisfy needs on a statewide basis.

B. Technical Needs:

The MCZMP will leverage outside (contractual) expertise in coastal planning and zoning. Additionally, the MCZMP will contract extensively for geospatial data collection and development efforts. Existing staff will conduct the MCZMP's work efforts and maintain the experience and knowledge necessary to guide and assist with strategy components. All data collection efforts will comply with NOAA's geospatial data sharing requirements.

VIII. Projects of Special Merit (Optional)

The MCZMP may submit Project(s) of Special Merit (PSM) to advance strategy efforts. Specifically, a PSM may be pursued to conduct significant geospatial data acquisition once statewide and regional gaps have been identified and prioritized. Additionally, a PSM may be pursued to develop needed decision support tools such as a web-based map viewer through which the geospatial data products and tools being developed herein would be served out to local coastal managers and the general public. Efforts under this strategy are scalable and may be readily expanded to additional communities as additional support becomes available. Therefore, a project of special merit could also be utilized to broaden these efforts in geographic scope; enhancing coastal planning and zoning in multiple additional coastal communities.

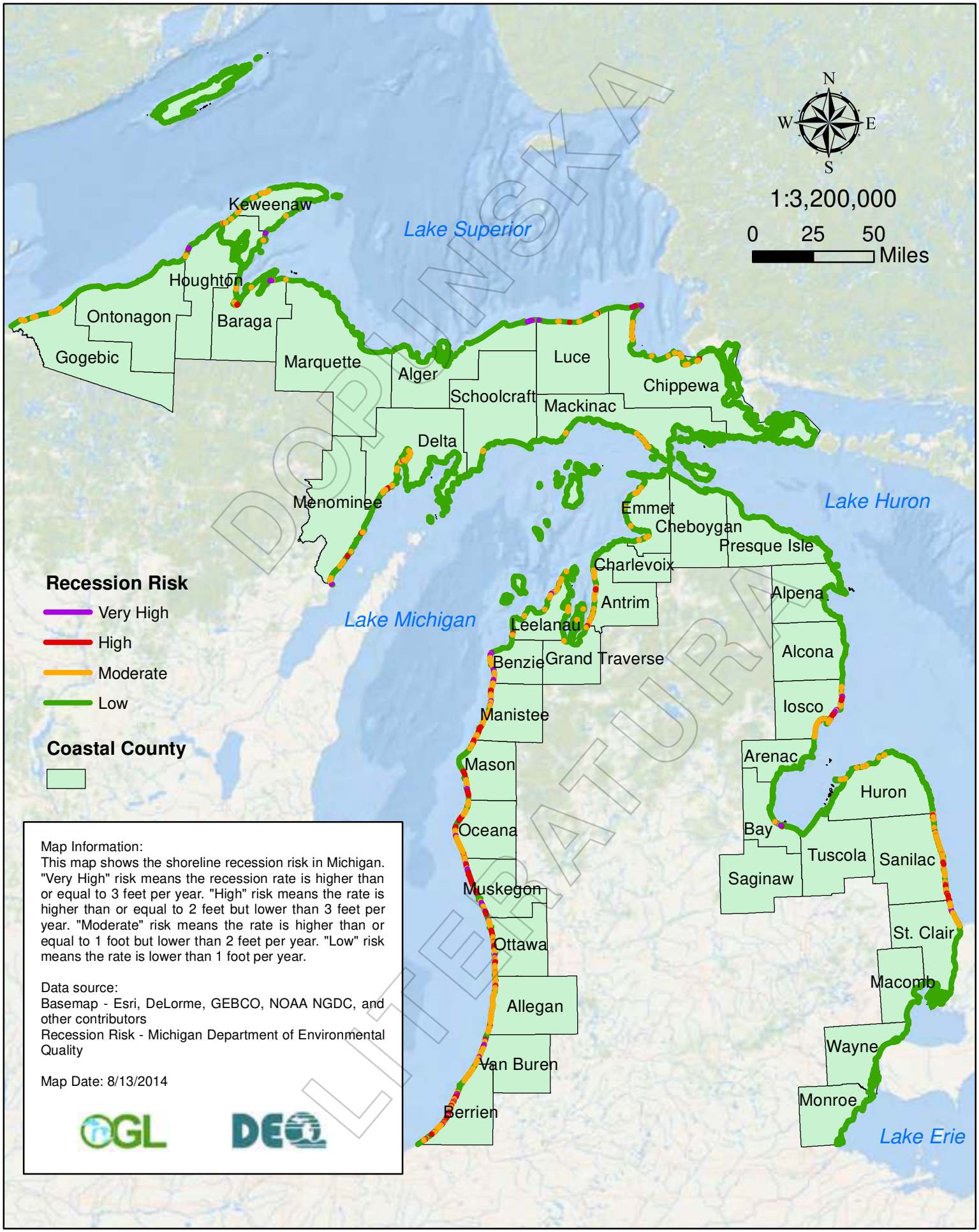
5-Year Budget Summary by Strategy

At the end of the strategy section, please include the following budget table summarizing your anticipated Section 309 expenses by strategy for each year.

Strategy Title	**Year 1 Funding**	**Year 2 Funding**	**Year 3 Funding**	**Year 4 Funding**	**Year 5 Funding**	**Total Funding**
Coastal Geophysical Properties and Resiliency Strategy	$494,000	$494,000	$494,000	$494,000	$494,000	$2,470,000
Total Funding	$494,000	$494,000	$494,000	$494,000	$494,000	$2,470,000

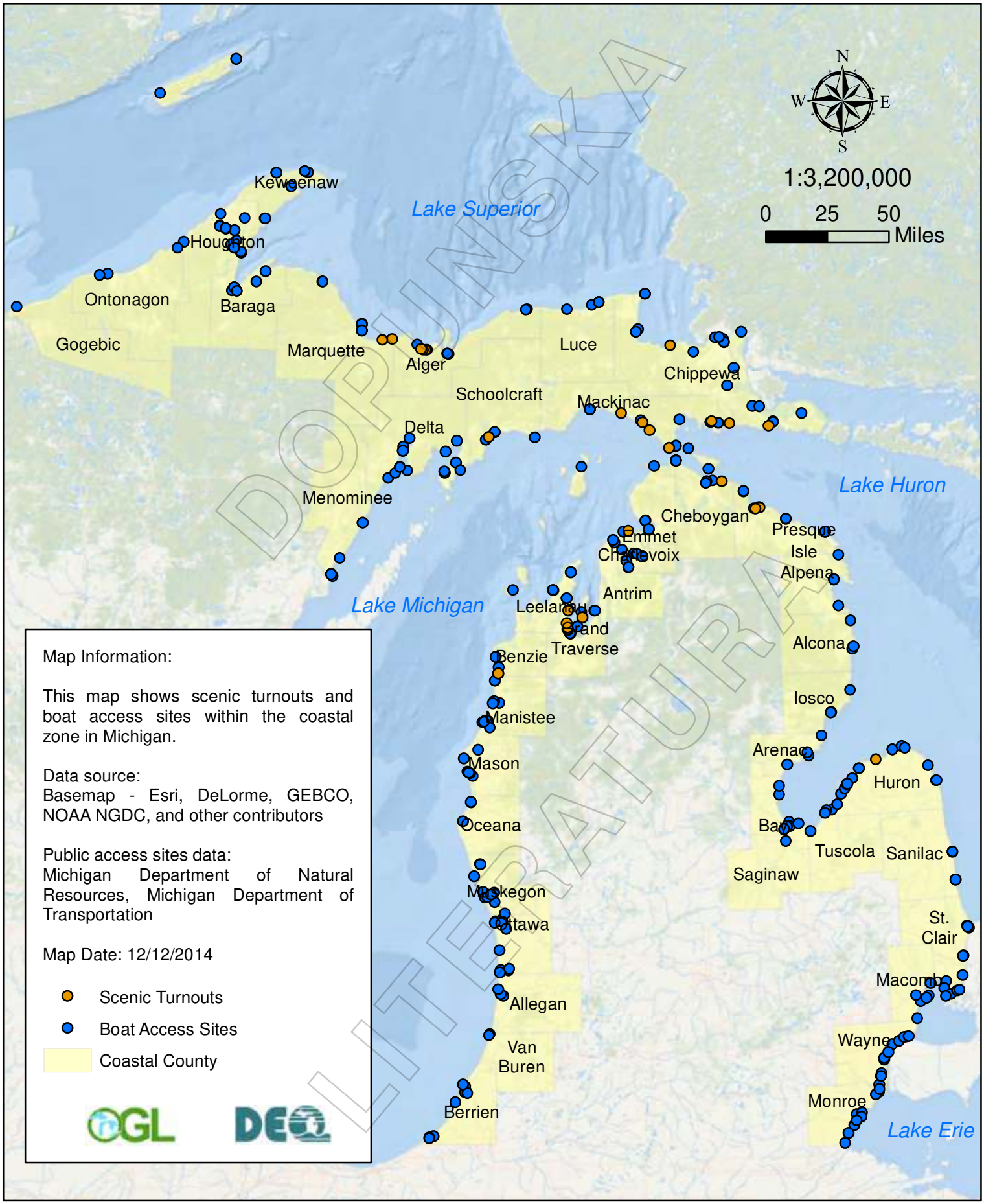
Appendix A – Map Sheets

Shoreline Recession Risk in Michigan

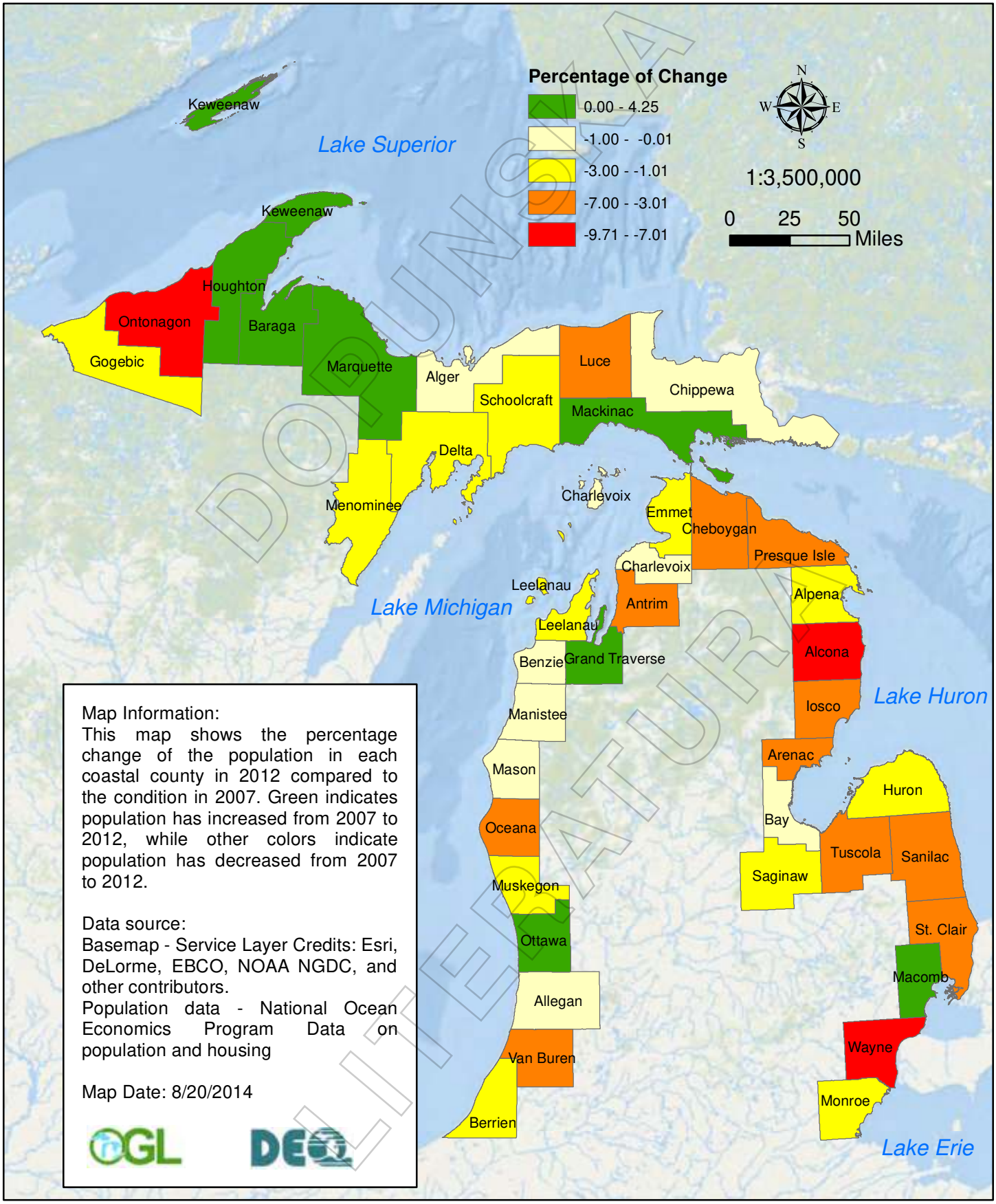


Public Beach of the Great Lakes and Connecting Waters in Michigan in 2014

Scenic Turnouts and Boat Access Sites within the Coastal Zone in Michigan



Trend in Michigan Coastal County Population from 2007 to 2012

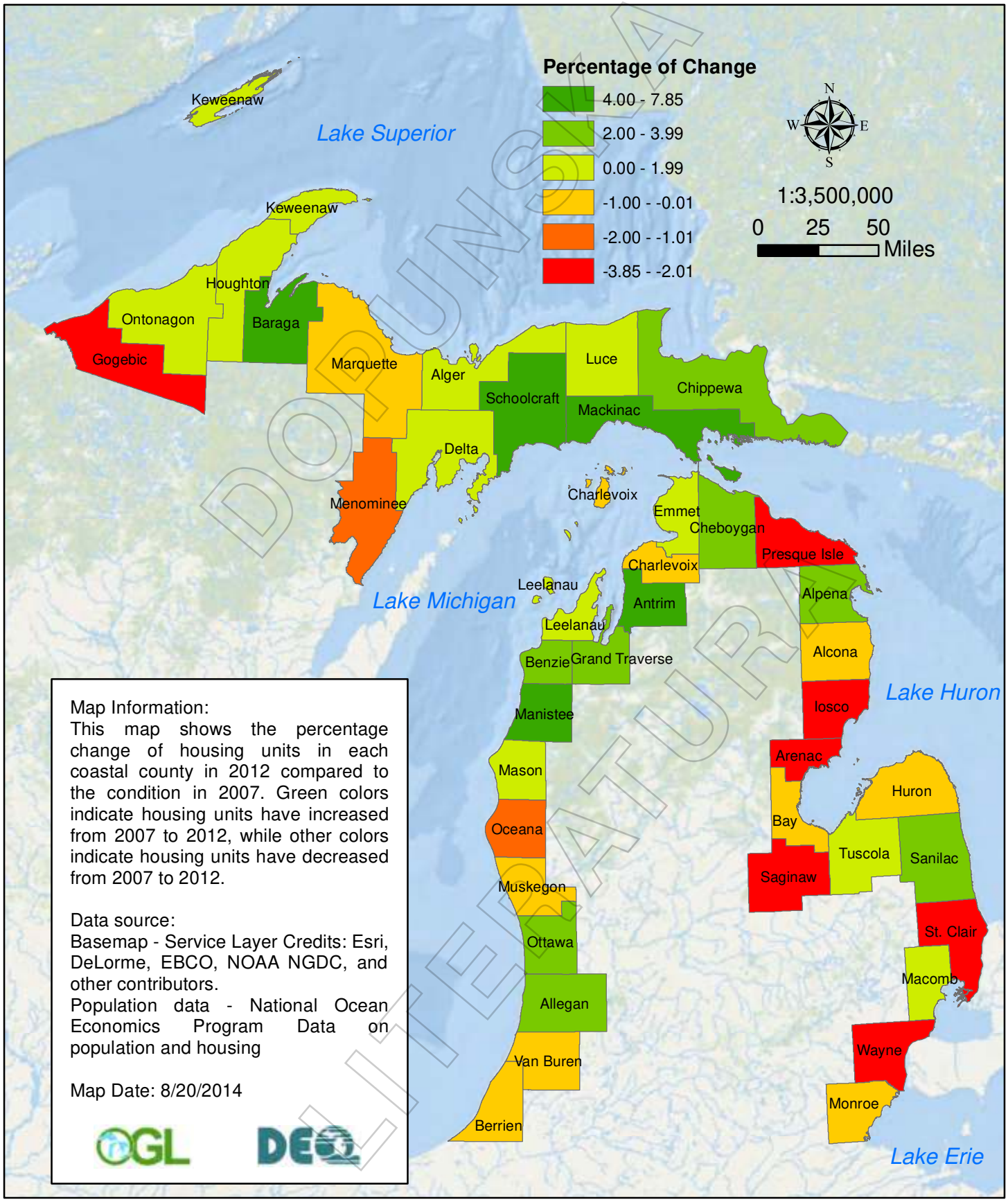


Map Information:
This map shows the percentage change of the population in each coastal county in 2012 compared to the condition in 2007. Green indicates population has increased from 2007 to 2012, while other colors indicate population has decreased from 2007 to 2012.

Data source:
Basemap - Service Layer Credits: Esri, DeLorme, EBCO, NOAA NGDC, and other contributors.
Population data - National Ocean Economics Program Data on population and housing

Map Date: 8/20/2014

Trend in Michigan Coastal County Housing Unit from 2007 to 2012

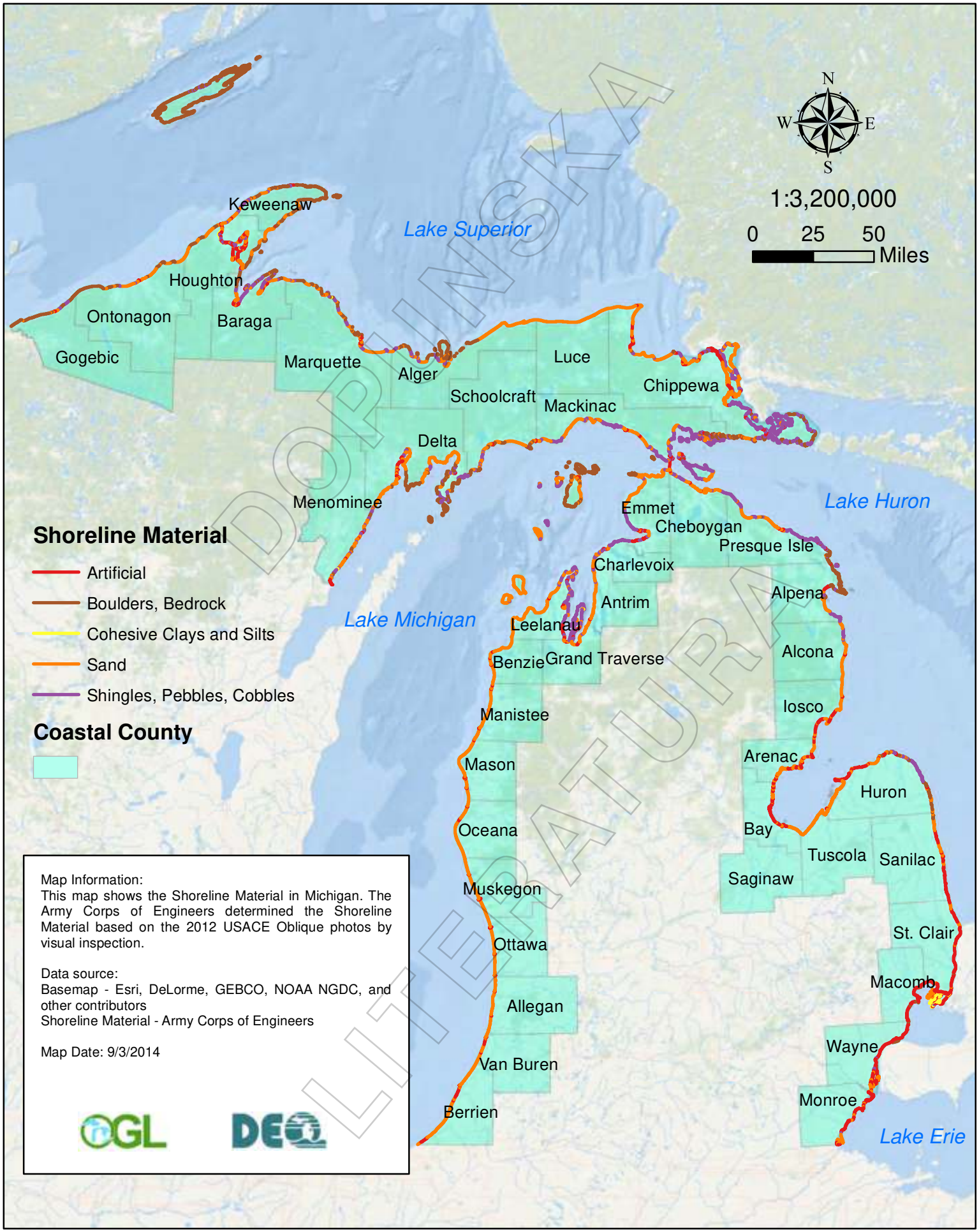


Map Information:
This map shows the percentage change of housing units in each coastal county in 2012 compared to the condition in 2007. Green colors indicate housing units have increased from 2007 to 2012, while other colors indicate housing units have decreased from 2007 to 2012.

Data source:
Basemap - Service Layer Credits: Esri, DeLorme, EBCO, NOAA NGDC, and other contributors.
Population data - National Ocean Economics Program Data on population and housing

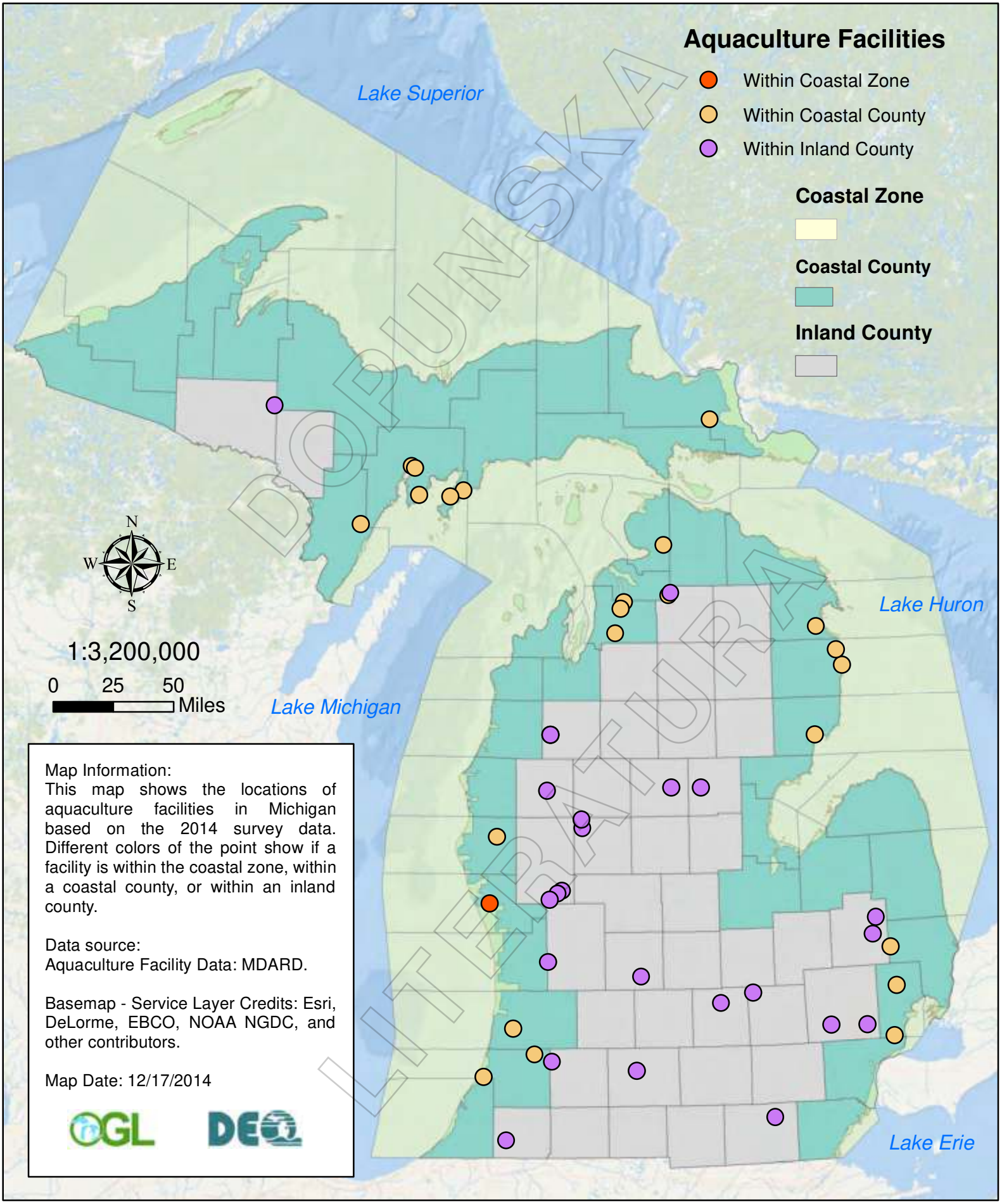
Map Date: 8/20/2014

Shoreline Material in Michigan



Primary Coast Type in Michigan

Aquaculture Facilities in Michigan



Map Information:
This map shows the locations of aquaculture facilities in Michigan based on the 2014 survey data. Different colors of the point show if a facility is within the coastal zone, within a coastal county, or within an inland county.

Data source:
Aquaculture Facility Data: MDARD.

Basemap - Service Layer Credits: Esri, DeLorme, EBCO, NOAA NGDC, and other contributors.

Map Date: 12/17/2014