

Appendix

for *Coastal Resilience Self-Assessment*

Appendix A: Example for *Part 1: Identifying Coastal Hazard Risks*

Appendix B: Coastal Resilience Resources

**Appendix C: How was this *Coastal Resilience Self-Assessment*
developed?**

Appendix A: Example for Part 1: Identifying Coastal Hazard Risks

The *Identifying Coastal Hazard Risks* matrix tool is adapted from a [Hazard Vulnerability Analysis tool](#) originally developed by Kaiser Permanente. SEWRPC has used a form of this matrix to prioritize critical hazards in All-Hazards Mitigation Planning.

Below is an example of a completed *Identifying Coastal Hazard Risks* matrix with each issue rated for PROBABILITY, IMPACT and PREPAREDNESS.

COASTAL HAZARD ISSUE	PROBABILITY	IMPACT			PREPAREDNESS	RISK SCORE	I need to learn more about this issue (explain)
	<i>Likelihood this issue will occur</i>	<i>HUMAN</i> <i>Possibility of death or injury</i>	<i>PROPERTY</i> <i>Physical losses and damages</i>	<i>BUSINESS/AGENCY</i> <i>Interruption of services</i>	<i>Level of planning done for this issue</i>	<i>Relative threat *calculated by Coastal Resilience team</i>	
Shoreline Recession & Bluff Failure	High	Low	High	Low	Moderate	58%	
Coastal Flooding	Low	Moderate	Moderate	Low	Low	22%	PROBABILITY may change with new FEMA flood maps
Shore Protection Damage	Moderate	Low	Moderate	Low	Low	39%	Unsure of businesses with shore protection
Beach Loss	High	Low	Moderate	Moderate	Low	67%	
Beach Impairment	Low	Moderate	Low	Moderate	Moderate	19%	
Port, Harbor, & Marina Damage	Moderate	Low	Moderate	High	Low	50%	
Port, Harbor, & Marina Navigation Impairment	Moderate	Low	Low	High	High	33%	Were boats damaged during last low water period?

Calculating RISK SCORE (note: this will be done for you by the Wisconsin Coastal Resilience Team or automatically by the fill-in PDF form)

First, a numeric value is assigned to the PROBABILITY, IMPACT and PREPAREDNESS responses as follows: Low = 1, Moderate = 2, High = 3

Then a RISK SCORE is then calculated for each hazard using the following formula:

$$\text{RISK (in \%)} = \frac{\text{PROBABILITY}}{3} \times \frac{\text{HUMAN} + \text{PROPERTY} + \text{BUSINESS} + (4 - \text{PREPAREDNESS})}{12}$$

Results

In this example, the top 3 hazards based on RISK SCORE are: (1) Beach Loss – 67%, (2) Shoreline Recession & Bluff Failure - 58%, (3) Port, Harbor & Marina Damage – 50%. These results suggest that priority should be given to building resilience to these most critical coastal hazards.

Appendix B: Resilience Resources

Listed below are resources that may be useful for learning about or addressing questions for each of the categories in the *Resilience Practices Questionnaire*. Note that some resources appear more than once if they are applicable to multiple categories.

General Coastal Resilience Resources

[Great Lake Coastal Resilience Planning Guide](#) – A website with guidance on Great Lakes coastal hazard resilience featuring case studies, tools, maps, data and publications.

[Living on the Coast](#) – Booklet describing natural coastal processes and strategies to manage risk to coastal properties.

[Coastal Processes Manual](#) – Manual describing the methods to estimate risk to Great Lakes coastal properties from coastal hazards

[Wisconsin Coastal Atlas](#) - A web platform that provides access to maps, data, and tools to support decision-making about Wisconsin's Great Lakes coast.

Understanding Coastal Hazard Impacts

[Wisconsin Shoreline Inventory and Oblique Viewer](#) – A web mapping tool to view shoreline condition assessments (1976 and 2007) and oblique aerial photos (1976, 2007, 2012, 2016 and 2017) for most of Wisconsin's Great Lakes coast.

[Lake Michigan Shoreline Recession and Bluff Stability in Southeastern Wisconsin: 1995](#) - A report on the 1995 status of bluff recession and bluff stability on selected bluff slopes in Kenosha, Racine, Milwaukee and Ozaukee counties shoreline.

[Coastal Processes Manual](#) – Manual describing the methods to estimate risk to Great Lakes coastal properties from coastal hazards

[Modern Studies of Coastal Erosion in Wisconsin](#) – A review of the efforts to understand and document the shoreline erosion processes and changes in coastal Wisconsin.

[Lake Level Viewer](#) – A web mapping tool to examine the potential impacts of lake level changes on shoreline position and water depth in the Great Lakes.

[Great Lakes Water Level Dashboard](#) – A dashboard interface to access and visualize over 150 years of Great Lakes water level data, as well as seasonal forecasts of future lake levels.

Hazard Mitigation Planning

[A Guide to Hazard Mitigation Planning for Wisconsin's Coastal Communities](#) - A guide which describes how to identify, profile and mitigate coastal hazards for inclusion in an All-Hazards Mitigation Plan.

[Plan Integration for Resilience – Scorecard Guidebook](#) - A guide which describes how to evaluate how multiple community plans (i.e. hazard mitigation, land use, economic development, etc.) may affect a community's vulnerability to hazards and how to identify priorities for better integrating strategies across plans to reduce overall community vulnerability to hazards.

Community Planning

[Managing Coastal Hazard Risks on Wisconsin's Dynamic Great Lakes Shoreline](#) - A report which describes coastal hazard processes, reviews past efforts to address coastal hazards in Wisconsin and provides a set of strategies for managing the risks to coastal development, including an erosion hazard model ordinance.

[Plan Integration for Resilience – Scorecard Guidebook](#) - A guide which describes how to evaluate how multiple community plans (i.e. hazard mitigation, land use, economic development, etc.) may affect a community's vulnerability to hazards and how to identify priorities for better integrating strategies across plans to reduce overall community vulnerability to hazards.

[A Guide for Planning for Coastal Communities in Wisconsin](#) – A guide which describes how to address coastal issues in a variety of community planning considerations.

Local Ordinances

[Managing Coastal Hazard Risks on Wisconsin's Dynamic Great Lakes Shoreline](#) - A report which describes coastal hazard processes, reviews past efforts to address coastal hazards in Wisconsin and provides strategies for managing the risks to coastal development, including an erosion hazard model ordinance.

[Coastal Ordinance Provisions in Wisconsin Communities](#) - A report which reviews county, city, village and town ordinances in Wisconsin which contain provisions that have been adopted to reduce the risks to coastal development as of 2016.

[Protecting Coastal Investments: Examples of Regulations for Wisconsin's Coastal Communities](#) - A guide which describes the causes of coastal erosion and suggests ordinance language that can be used by communities to address locally identified needs.

Public Education and Engagement

[Adapting to a Changing Coast: Options & Resources for Lake Michigan Property Owners](#) – A booklet describing actions that Lake Michigan property owners can take to address coastal erosion

[Stabilizing Coastal Slopes on the Great Lakes](#) – Fact sheet describing shoreline erosion and slope instability and steps that can be taken to address these issues

[Working with Engineers and Contractors on Shore Protection Projects](#) – Fact sheet describing the process of finding and working with qualified coastal professional

[Great Lakes Shore Protections Structures](#) – Fact sheet describing shore protection structures and their effects, both positive and negative, on the shoreline

[Natural and Structural Measures for Shoreline Stabilization](#) – Brochure about the range of green and gray shore protection infrastructure

[Wisconsin Shoreline Inventory and Oblique Viewer](#) – A web mapping tool to view shoreline condition assessments (1976 and 2007) and oblique aerial photos (1976, 2007, 2012, 2016 and 2017) for most of Wisconsin's Great Lakes coast.

Shore Protection

[Great Lakes Shore Protections Structures](#) – Fact sheet describing shore protection structures and their effects, both positive and negative, on the shoreline

[Ohio Coastal Design Manual](#) – Online manual demonstrating how common Great Lakes coastal structures are designed

[Systematic Approaches to Geomorphic Engineering \(SAGE\)](#) – Website for a Community of Practice focused on advancing natural coastal infrastructure practices

[Natural and Structural Measures for Shoreline Stabilization](#) – Brochure about the range of green and gray shore protection infrastructure

[Living Shorelines Academy](#) – Web resource for natural “living” shoreline practices

[Engineering with Nature](#) – Web resource detailing United States Army Corps of Engineers approaches to align natural and engineering processes to achieve economic, environmental, and social benefits

[Engineering with Nature: Alternative Techniques to Riprap Bank Stabilization](#) – A Federal Emergency Management Agency booklet that illustrates case studies of engineering techniques that incorporate natural functionality into streambank protection

Managing Water on the Land

[Stabilizing Coastal Slopes on the Great Lakes](#) – Fact sheet describing bluff stabilization, including surface water and groundwater management actions that can be taken to stabilize slopes (page 5).

[Managing Coastal Hazard Risks on Wisconsin’s Dynamic Great Lakes Shoreline](#) - A report which describes strategies for managing the risks to coastal development, including recommendations for managing surface water and ground water to stabilize slopes (page 36).

[Surface Water and Groundwater on Coastal Bluffs](#) – A guide for property owners on Puget Sound in Washington that describes options for managing surface water and groundwater on bluffs. Many of these practices may be applicable for Great Lakes coastal bluffs.

Beaches

[Virtual Beach](#) – A free software program for developing and operating beach water quality models that can aid both short term decisions on testing and closures as well as long term remediation activities

[Beach Nourishment Database](#) – A database with information on beach nourishment projects nationwide, including the Great Lakes

[Lake Level Viewer](#) – A web mapping tool to examine the potential impacts of lake level changes on shoreline position and water depth in the Great Lakes.

Port, Harbor and Marinas

[Great Lakes Port and Harbor Infrastructure and Dredging Cost Evaluation Matrix](#) – A matrix model to estimate the cost of building and maintaining structures at large ports in the Great Lakes

[Failing Coastal Wood Infrastructure on the Great Lakes](#) – A fact sheet on timber structure failure mechanisms and potential solutions

[Best Practice Inspection Guidelines for Great Lakes Port, Harbor and Marina Structures](#) – A fact sheet with inspection guidelines to prevent structure deterioration

[Adaptation Strategies for Great Lakes Ports, Harbors and Marinas](#) – A fact sheet on potential future Great Lakes water levels and their possible impacts

[Wisconsin Clean Marina Best Management Practices](#) – A guidebook that describes regulations and practices that address marine facilities and nonpoint sources of pollution

[Reinforcing our Waterfronts](#) – A brochure which summarizes risks to marinas and harbors as well as best practices to prepare for these risks.

Appendix C: How was this Coastal Resilience Self-Assessment developed?

This *Coastal Resilience Self-Assessment* is modeled after a number of existing self-assessment tools that are aimed at identifying opportunities to develop resilience to natural hazards. Though coastal resilience indicators, metrics and rating systems exist, most of these tools focus on the issues faced by ocean coasts. While some of those resilience issues are applicable to the Great Lakes, no tool exists that is focused on the coastal hazard issues faced in the Great Lakes. We have adopted the approaches of other successful self-assessment tools, which are listed below, and incorporated many resilience recommendations for Great Lakes coastal issues into the *Coastal Resilience Self-Assessment*.

Coastal Community Resilience Indicators and Rating Systems

National Oceanic and Atmospheric Administration (NOAA)

<https://coast.noaa.gov/digitalcoast/training/resilience-indicators.html>

Maryland's CoastSmart Communities Scorecard

Chesapeake and Coastal Service

http://dnr.maryland.gov/ccs/coastsmart/Pages/cs_Scorecard.aspx

Getting to Resilience: A Community Planning Evaluation Tool

New Jersey Coastal Management Program

<http://www.prepareyourcommunitynj.org/>

The Coastal Community Resilience Index

Mississippi-Alabama Sea Grant Consortium

http://masgc.org/assets/uploads/publications/662/coastal_community_resilience_index.pdf

The Ports Resilience Index

Mississippi-Alabama Sea Grant Consortium

http://masgc.org/assets/images/Ports_resilience_index.pdf

The Fisheries Resilience Index

Mississippi-Alabama Sea Grant Consortium

http://masgc.org/assets/uploads/publications/1141/fisheries_resilience_index.pdf

The Tourism Resilience Index

Mississippi-Alabama Sea Grant Consortium

http://masgc.org/assets/uploads/publications/1142/tourism_resilience_index.pdf

Climate Adaptation Checklist

University of Wisconsin Sea Grant Institute

<https://publications.aqua.wisc.edu/product/great-lakes-coastal-community-climate-adaptation-checklist/>

Climate Ready Infrastructure and Strategic Sites Protocol (CRISSP) Risk Matrix

Great Lakes and St. Lawrence Cities Initiative

<https://glslcities.org/initiatives/municipal-climate-adaptation/crissp/>

A Self-Assessment to Address Climate Change Readiness in Your Community: Great Lakes

Minnesota Sea Grant

<https://glslcities.org/library/a-self-assessment-to-address-climate-change-readiness-in-your-community/>