

CHAPTER 1

Introduction

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1.1 Vision, Purpose, and Context of the Shoreline Change Special Area Management Plan

1. The coastline of Rhode Island is one the state's most iconic and treasured assets. The 420 miles of barrier beaches, historic waterfronts, bluffs, headlands and salt marsh make Rhode Island the 'Ocean State' and give rise to major sectors in the state's economy including tourism and marine trades.
2. It is the Rhode Island Coastal Resources Management Council's responsibility to ensure that decisions made concerning Rhode Island's coastline are well thought out and based on the best available science. **Toward that end, the vision of the Rhode Island Shoreline Change Special Area Management Plan (SAMP) is to provide guidance and tools for state and local decision makers to prepare and plan for, absorb, recover from, and successfully adapt to the impacts of coastal storms, erosion, and sea level rise.**
3. The Shoreline Change SAMP is a collaborative effort between the state's coastal agency, the CRMC, and a University of Rhode Island (URI) team comprised of both researchers from the College of the Environment and Life Sciences [CELS], the Graduate School of Oceanography, the College of Engineering, and outreach experts from the Coastal Resources Center/Rhode Island Sea Grant College Program [CRC/Sea Grant]. Invaluable expertise is also provided by Roger Williams Law School's Marine Affairs Institute, the Rhode Island Sea Grant Legal Program, and Eastern Connecticut State University. Close collaboration with other state agencies and coastal municipalities is also a key component of the Shoreline Change SAMP. This collaboration ensures that cutting-edge science informs an inclusive policy development process focused on practical solutions and outcomes.
4. Because planning for storms, erosion, and sea level rise is so closely tied to land use decision making at the local level, the research, tools and strategies presented in the Shoreline Change SAMP were developed with coastal municipalities and state agencies in mind. The Shoreline Change SAMP has been designed purposefully to be a guidance and planning document rather than a more prescriptive regulatory document with explicit policies, regulations or standards, in order to provide the flexibility to local and state decision makers on the frontline in protecting the health and welfare of their residents, to identify strategies most appropriate for a specific community.
5. The guidance offered by this Shoreline Change SAMP is primarily for applicants seeking coastal permits from CRMC. CRMC is proposing a requirement that coastal permit applicants complete a five-step risk assessment process for proposed developments within CRMC's jurisdiction as part of the permit application.

6. Other audiences for this SAMP, in addition to CRMC members, staff, and coastal permit applicants, are decision makers, planners, boards and commissions in Rhode Island's 21 coastal communities who are principally responsible for coping with the impacts of storms, coastal erosion, and sea level rise outside of CRMC's jurisdiction. The Shoreline Change SAMP is also intended to aid other state and federal agencies responsible for coastal resources, assets and property in Rhode Island in future planning and decision making.
7. Rhode Island's coastline is continuously shaped by storms, erosion, and tidal inundation. As the climate changes, the impacts of these natural coastal processes and hazards are increasingly threatening coastal properties, infrastructure, and social, cultural and environmental assets throughout the state.
8. Rhode Island has long been a leader in innovative thinking and the successful management of its most prized coastal features and resources. While coastal resilience has now become a modern day buzz word following major storm events such as Hurricane Katrina in 2005 and Hurricane ("Superstorm") Sandy in 2012, resilience has long been a part of the fabric and tradition of Rhode Island. One only has to look back to Rhode Island's history in colonial times to see examples of innovation in policy and technology, or to the recovery from the Great Hurricane of 1938 to see the resilience of Rhode Islanders and the coastal communities and ecosystems that make up the state.
9. Dynamic storm events can highlight the damaging impacts of storm surge and flooding on coastal communities, the migratory nature of the coastal barriers along Rhode Island's southern coast, and the importance of preparedness and planning at both the state and local level to expedite recovery. For example, Superstorm Sandy, a hybrid tropical/extratropical storm that made landfall in October 2012, affected the Rhode Island coastline with several days of storm surge and waves but very little rainfall. National Ocean Service tide gauges reported storm surges of 5.3ft and 6.2ft in Newport and Providence respectively, with maximum sustained winds of 64 mph (56kts) and gusts from 81-86mph (70-75kts) (National Hurricane Center, 2013). The damage was felt heavily across the southern coast of the state from Narragansett to Westerly. Ultimately, this storm affected approximately 300,000 Rhode Island residents (28% of the state's population); resulted in over \$12.6 million in requested public assistance from the Federal Emergency Management Agency; and \$24 million in claims to the National Flood Insurance Program just for damage in Washington County (RI Office of Housing and Community Development, 2013). However, despite the damage along the south shore, this storm wasn't a hurricane or even a once in 100-year (1% annual chance) storm event when it made landfall in Rhode Island, rather it was a once in 25-year storm (4% annual chance) event for Westerly, and a much less intense storm event for the rest of the state. Had this storm been a hurricane or a 1% annual chance storm event, impacts would have much greater.

10. Tide gauge observations in Newport indicate a rate of 10.8 inches (27.4 cm) of relative sea level rise over the last century or 2.74 mm per year¹. However, the rate of sea level rise globally and in Rhode Island specifically is accelerating. The CU Sea Level Research Group reports current satellite altimetry measurements of the rate of global sea level rise of 3.3 +/-0.4 mm per year since 1993. Relative sea level rise in Rhode Island measured more than 4 millimeters per year between 1983 and 2009 (Carey et al. 2015). Since the start of this Shoreline Change SAMP effort in 2012, NOAA's sea level rise projections have changed several times. In 2015, NOAA projected the range in sea level rise above 1990 levels to be a maximum of approximately 1 foot by 2035, 2 feet by 2050, and 7 feet by 2100.² Currently, NOAA's 2017 "high curve" projections for Newport, Rhode Island suggest that by 2100 sea levels may rise as much as 10 feet above 1990 levels.³
11. Looking forward, as sea level rises both hurricanes and "nor'easters" will be more damaging, and the flooding effects will be felt farther inland. Storm surge and wave heights will increase as sea level rises resulting in more properties being damaged or destroyed during a storm, including inland properties that have never before experienced flood damage. Furthermore, not only will the extent of flooding expand and storm surge levels rise during storm events like "Superstorm" Sandy, but more areas will be affected by high tides on a daily basis. Frequent tidal inundation of coastal properties, roadways and parking lots is already an issue in many coastal communities in Rhode Island from Watch Hill, to Wickford, to Warren and Providence.
12. The state's coastal wetlands are highly vulnerable to accelerating sea level rise; essentially they are drowning in place. Permanent flooding of Rhode Island's wetlands is already occurring, as these wetlands cannot gain sufficient elevation to keep up with sea level rise. This trend will continue into the future causing significant loss of habitat for fish, shellfish, birds, and other wildlife, and recreation areas. The loss of coastal wetlands also means a loss of the protection they provide to coastal communities as an important natural barrier to storm surge. In addition, the loss of coastal wetland will reduce the overall carbon storage potential of these ecosystems and result in an increased contribution of CO² concentrations to the atmosphere. A recent statewide analysis of sea level rise impacts to salt marshes conducted by CRMC and partners estimates a 52% and 87% loss in existing salt marsh with three and five feet of sea level rise, respectively. Therefore, it is imperative that state and local planning and adaptation efforts start now (see Technical Report #1 in Volume 2 for more information).

¹ NOAA Tide Gauge Data for Newport, RI:

http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8452660

² These planning horizons are have been proposed to be included in CRMC's Climate Change and Sea Level Rise Policy (Section 145 of the Coastal Resources Management Program (a.k.a. Red Book).

³ U.S. Army Corps of Engineers and NOAA Sea Level Rise Curves <http://www.corpsclimate.us/ccaceslcurves.cfm>

13. The Shoreline Change SAMP offers adaptation strategies that coastal permit applicants and the other audiences listed above can consider during the planning and design development phase of their project to protect their assets, accommodate changing coastal conditions, or relocate/retreat from high hazard areas in changing coastal areas.

1.2 The Shoreline Change SAMP Scope and Project Boundary

1. This SAMP is focused on the coastal effects of rising sea levels and the increased frequency and severity of coastal storm events. Other climate change impacts caused by increased precipitation, riverine flooding, heat, etc. are not addressed in this document.
2. The study area for this SAMP encompasses the entire coastal zone of Rhode Island and all 21 coastal communities impacted by sea level rise, storm surge and tidal flooding, as well as coastal erosion. The planning boundary for the Shoreline Change SAMP was identified through the development and application of STORMTOOLS, a cloud-based online mapping tool that illustrates various storm surge and sea level rise scenarios for all 420-miles of Rhode Island's Coastline. Because CRMC adopted the NOAA High Curve in 2016 as its reference for future sea level rise projections, CRMC has defined the Shoreline Change SAMP Planning Boundary as the 7-feet of sea level rise with a 100-year return period storm event, which can be equated to the water levels documented in Rhode Island during 1954's Hurricane Carol. For more information on sea level rise data, see Section 1.1.5.

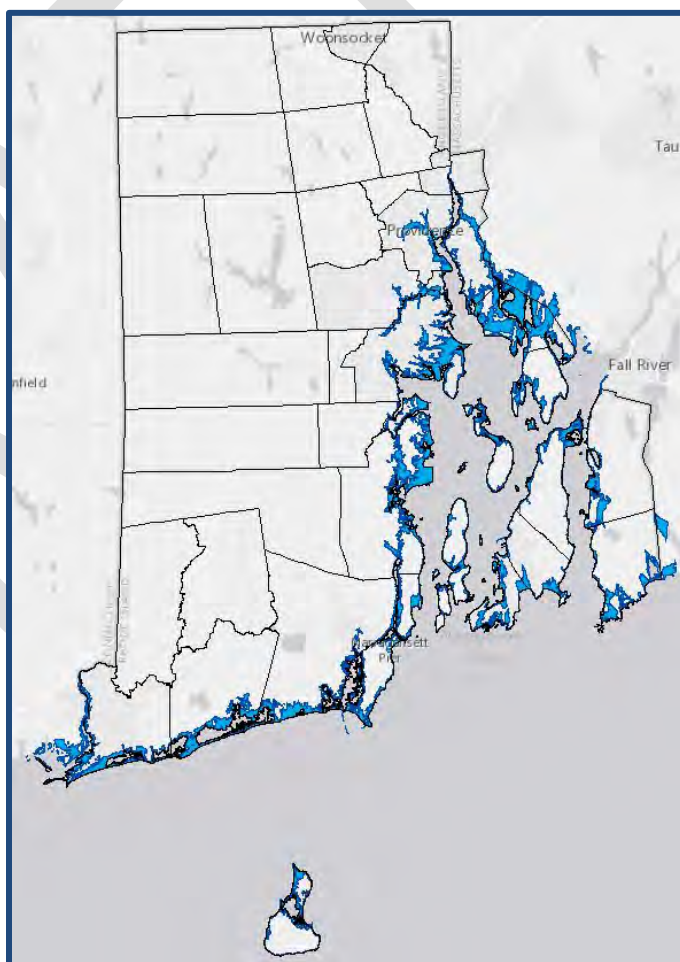


Figure 1. Shoreline Change SAMP Planning Boundary

3. CRMC's jurisdiction does not cover all the land area within the Shoreline Change SAMP Planning Boundary. For this reason, the Shoreline Change SAMP also includes recommendations and guidance to assist other state agencies and municipal governments with decision making for high hazard coastal areas that are out of CRMC's jurisdiction.

1.3 Goals and Principles of the Shoreline Change SAMP

1. **The Rhode Island Shoreline Change SAMP provides state and local decision makers with information, guidance and a suite of tools to assess, plan for, recover from and adapt to the impacts of coastal storms and sea level rise.** To accomplish this goal, new data and information will be collected and modeled to illustrate areas, resources and infrastructure that may be impacted under different storm and sea level rise scenarios. Planning tools, adaptation strategies and best practices relevant to Rhode Island will be compiled and shared to inform state and local decision making. Tailored technical assistance will be provided to the maximum extent possible to local and state officials to assist in the implementation and use of the information, guidance and tools developed through this SAMP.
2. **Provide a forum for public discourse on current and future impacts and how best to adapt to the short and long-term impacts of coastal storm events and rising tide levels.** The Rhode Island Shoreline Change SAMP stakeholder process will be designed so that information can be shared on how sea level rise, storm events and coastal erosion will impact the people, places and resources in Rhode Island. In addition, this public forum will provide an avenue for two-way exchange of ideas and concerns regarding adaptation, planning and response to these impacts at both the state and local level.
3. **The Rhode Island Shoreline Change SAMP informs revisions to the policies and standards in the Rhode Island Coastal Resources Management Program and existing CRMC SAMPs to better address the risks posed by erosion, coastal storms and sea level rise.** The Shoreline Change SAMP research, tools and stakeholder process will provide the scientific evidence, background information, and best practices to support updates to Rhode Island's coastal policies aimed at increasing coastal resilience throughout the State.
4. **Minimize the impacts of coastal hazards through proactive planning.** Following the federal mandate set forth in the Coastal Zone Management Act, the development of the Shoreline Change SAMP will aim to provide guidance on how to minimize the impacts and consequences caused by improper development in areas at risk to coastal hazards

including erosion, storm surge and sea level rise. Guidance will be focused on reducing damage and supporting wise investments in sustainable coastal development

5. Maximize the protection of public access, recreation and sensitive coastal resources.

Guidance developed through the Shoreline Change SAMP will consider how public access, recreation and sensitive coastal resources will be impacted by coastal hazards and how planning, development standards, adaptation strategies, or policies can protect or minimize negative impacts.

Guiding Principles of the Shoreline Change SAMP

- Serve as a guidance document to support regulatory changes (CRMC policy and standards), and any regulatory changes will be made to the Red Book and other existing SAMPs;
- Be developed in a transparent manner;
- Use best science available to understand changing conditions of Rhode Island's shoreline and help develop appropriate strategies for response;
- Consider synergistic long-range impacts over time of sea level rise, coastal storms, and erosion;
- Incorporate risk identification and awareness in design and development;
- Identify early actions and recommended strategies to monitor, evaluate, and readjust;
- Encourage incremental phasing of adaptation strategies and actions, and keep flexibility in the system;
- Maximize agency coordination and public participation; and
- Emphasize "No Regrets" decisions.

1.4 Contents of Shoreline Change SAMP Document

1. The Shoreline Change SAMP is comprised of two volumes. Volume 1 provides: a synthesis of the current scientific understanding of sea level rise, storm surge, tidal flooding, and coastal erosion, as well as the impacts these hazards pose to infrastructure, other developed property such as municipal buildings and residential properties, and the social, environmental and cultural assets in Rhode Island; a description of the tools developed to model and map potential future impacts from these coastal hazards; a discussion of risk and risk management within the coastal zone; and recommendations for best management practices and adaptation strategies or techniques to be employed at both the state and local level to minimize future risk. Volume 2 contains all the technical reports that support the new research conducted as part of the SAMP project. These technical reports contain more detailed information on research methodology and findings and ultimately support the synthesis provided in Volume 1.

2. Volume 1 of the Shoreline Change SAMP contains the following chapters:
 - **Chapter 1- Introduction:** This chapter outlines the purpose and structure of Shoreline Change SAMP.
 - **Chapter 2- Trends and Status: Current and Future Impacts of Coastal Hazards:** This chapter summarizes the best available science on coastal erosion, storm and sea level rise trends in Rhode Island.
 - **Chapter 3 Assessing Coastal Hazard Risk:** The purpose of this chapter is to define coastal risk, resilience & related terms, present future planning scenarios that illustrate risk from storm events with projected sea level rise, and present the various mapping and modeling tools developed as part of the Shoreline Change SAMP to aid planning and decision making.
 - **Chapter 4 Rhode Island's Exposure to Coastal Hazards -** This chapter summarizes how current and future coastal hazards may impact infrastructure, property, and the social, environmental and cultural assets in Rhode Island.
 - **Chapter 5- RI CRMC Coastal Hazard Application Guidance.** This chapter presents a five-step process for how CRMC intends to require coastal development permitting applications to consider the impacts of current and future coastal hazards.
 - **Chapter 6- State and Municipal Considerations:** The purpose of this chapter is to provide guidance on how to incorporate coastal hazards into state agency and municipal planning and decision making.
 - **Chapter 7- Adaptation Strategies & Techniques:** The focus of this chapter is on presenting an array of best management practices to improve state and local planning and decision making with respect to shoreline change and coastal

hazards. In addition, physical adaptation techniques, retrofits and structural design considerations are also discussed.

- **Chapter 8- Future Research Needs:** This final chapter summarizes the data gaps and research needs identified throughout the Shoreline Change SAMP process.

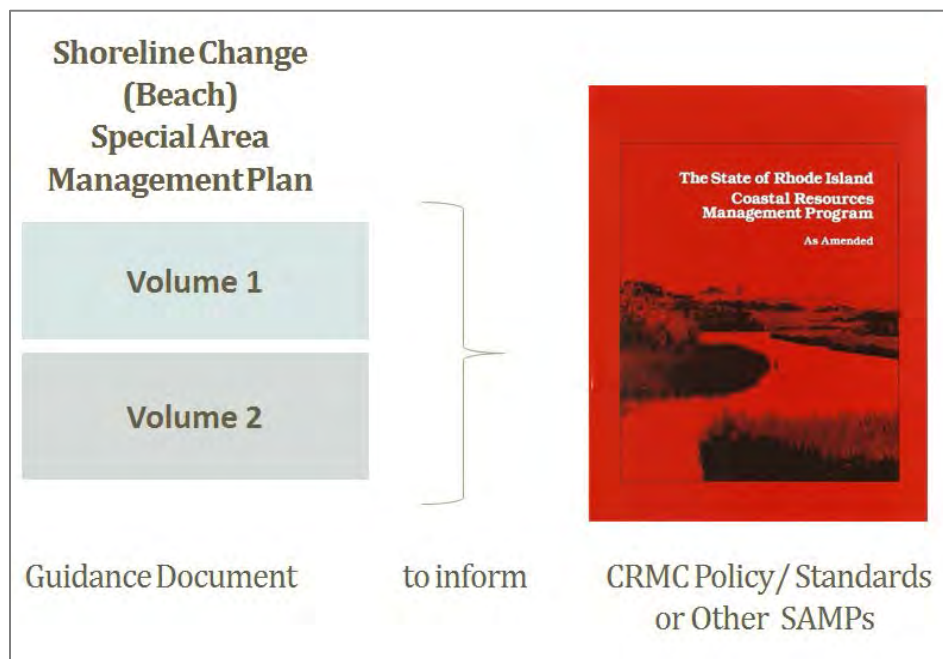


Figure 1. The Shoreline Change SAMP will be a guidance document that is used to inform regulatory changes to the Rhode Island Coastal Resources Management Program.

3. All new or revised CRMC policies and standards concerning sea level rise, storm events and erosion developed through the Shoreline Change SAMP process will be made directly to the RICRMP (also referred to as the Red Book) or existing SAMP policies and standards (see Figure 1). As a result, there will not be a section or chapter within Volume 1 of the Shoreline Change SAMP that lists new policies.

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