Block Island Hazard Mitigation Plan, 2017

Town of New Shoreham, Rhode Island

A Multi-Hazard Mitigation Strategy

Created by: The New Shoreham Hazard Mitigation Committee

Adopted by: New Shoreham Town Council, July 5, 2017

New Shoreham Town Council

Kenneth C. Lacoste, First Warden
F. Norris Pike, Second Warden
Andre Boudreau
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Table of Contents

NEW SHOREHAM TOWN COUNCIL RESOLUTION
Block Island Hazard Mitigation Plan, 2017

WHEREAS, the Town of New Shoreham recognizes the threat that natural hazards pose to people and property within the community; and

WHEREAS, the Town of New Shoreham has prepared a multi-hazard mitigation plan, hereby known as the Block Island Hazard Mitigation Plan, 2017 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the Block Island Hazard Mitigation Plan, 2017 identifies mitigation goals and actions to reduce or eliminate risks to people and property in New Shoreham from the impacts of future hazards and disasters; and

NOW, THEREFORE, BE IT RESOLVED THAT:

The Hazard Mitigation Plan is hereby adopted as an official plan of the Town of New Shoreham, Rhode Island.

The Town Manager is hereby directed to pursue implementation of the recommended priority actions. Any action proposed in the Plan shall be subject to and contingent upon budget approval if funding is required and this resolution shall not be interpreted so as to mandate any such appropriations.

The Town Council of the Town of New Shoreham has met the legal requirements for official adoption of its Hazard Mitigation Plan.

FURTHER BE IT RESOLVED that we decree that this resolution be made a part of the permanent record of the Town. Witness our hands and seal this July 5, 2017

First Warden Kenneth C. Lacoste

Second Warden F. Norris Pike

Town Councilor Andre Boudreau

Town Councilor Martha Ball

Town Councilor Christopher Willi

Town Clerk Fiona Fitzpatrick

I. Introduction to Hazard Mitigation

Hazard Mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Mitigation can significantly reduce the costs resulting from a disaster, and can make post-disaster operations more efficient. This, in turn, minimizes disruption of essential services and business operations, destruction of property, and injury and loss of life.

The purpose of the Natural Hazard Mitigation Plan is to identify local policies and actions that can be implemented to reduce risk and loss from hazards. These mitigation policies and actions are identified based on an assessment of hazards, vulnerabilities, and risks, and the participation of stakeholders and the public in the planning process. Planning and implementing mitigation activities can help to prevent or minimize these undesirable outcomes and simultaneously enhance the community's sustainability and safety, and its social, economic and environmental well-being.

The importance of hazard mitigation planning and implementation can be demonstrated by the potential losses of inaction. The following list highlights the types of damages and expenses endured time and again by communities facing similar natural hazards as Block Island.

INITIAL DAMAGES

- CASUALTIES INCLUDING RESIDENTS, TOURISTS, RESCUE PERSONNEL, PETS, AND LIVESTOCK.
- INFRASTRUCTURE DAMAGE AND PROLONGED INTERRUPTION OF UTILITY SERVICES.
- TEMPORARY AND PERMANENT BUSINESS CLOSINGS.
- DAMAGE TO AND DESTRUCTION OF INVALUABLE HISTORIC STRUCTURES.
- LOSS OF VITAL GOVERNMENT RECORDS AND DOCUMENTS.
- LOSS OF PERSONAL PROPERTY INCLUDING ITEMS OF IRREPLACEABLE SENTIMENT.

EXPENSES AND AFTER-EFFECTS

- EMERGENCY RESPONSE COSTS.
- FACILITY AND INFRASTRUCTURE REPAIRS.
- DEBRIS AND CONTAMINATION CLEANUP.
- DEPRECIATED REAL ESTATE VALUES.
- LOST WAGES AND SALES TAX REVENUE.
- RELUCTANCE OF NEW BUSINESS STARTS.
- PERMANENT ENVIRONMENTAL DAMAGE.
- HOME REBUILDING COSTS AND HOMEOWNER RELOCATION COSTS.

Formal adoption and implementation of this document will allow New Shoreham to gain credit points under the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS), which provides discounts on National Flood Insurance Program (NFIP) premiums for property owners in communities that participate in this voluntary program. It is a goal of New Shoreham to join the CRS program. Adoption of this Hazard Mitigation Plan will also increase New Shoreham's eligibility for federal grants available through FEMA's Hazard Mitigation Assistance Programs, including the Hazard Mitigation Grant Program

(HMGP), Flood Mitigation Assistance (FMA), and Pre-Disaster Mitigation (PDM). In addition, the Rhode Island Emergency Management Agency (RIEMA) gives funding priority to municipalities that have completed a risk assessment and established mitigation projects with detailed information on the cost, timeline, and municipal department responsible for completing the project. Regulations pertaining to FEMA's flood mitigation grants and local hazard mitigation plans are provided in the Code of Federal Regulations (CFR), Title 44, Part 201.

FEMA's Pre-Disaster Flood Mitigation Assistance Program makes grants available for communities to implement flood mitigation planning and activities such as acquisition, relocation, and retrofitting of structures. This program is only available for communities having a pre-existing approved hazard mitigation plan.

FEMA's Post-Disaster Hazard Mitigation Grant Program is only available for communities after a federally declared disaster. An approved mitigation plan expedites the application process for pre- and post-federal mitigation funding, as well as, assists in ensuring a funded project is eligible and technically feasible.

This natural hazard mitigation plan is an important step in addressing, in a comprehensive manner, the natural hazards faced by the island. The Town of New Shoreham is committed to fulfilling the goals and actions set forth in this Plan. These strategies and actions will be carefully coordinated among the various town departments, boards, local organizations, and commercial interests which all must be continuously involved in hazard mitigation planning.

It is intended that this plan and the ongoing efforts of the Hazard Mitigation Committee will preserve and enhance the quality of life, property and resources for the Town of New Shoreham. While addressing the plan's action items will help mitigate the impact of natural hazards, minimize damage to people, and property, and speed recovery following an event, the availability of public funding will influence which action items may be implemented by the town. Fortunately, since the adoption of the previous Hazard Mitigation Plan, New Shoreham has been successful in completing several of the previous action items. This was due, in part, to the implementation and funding of projects outlined in the Town's Capital Improvement and operating budgets. With continued effort, cooperation, and funding, New Shoreham is moving toward enhancing its status as a safe, resilient and sustainable community.

2. COMMUNITY PROFILE

Geography

The Town of New Shoreham, also known as Block Island, is located twelve miles off the coast of mainland Rhode Island, in Washington County. The island is approximately seven miles from the northern sandy tip to the high southern bluff wall, and three and a half miles at its widest point east to west. The island narrows to less than 1/10th of a mile at a north-south midpoint, referred to as the "neck" with the Atlantic Ocean to the east, and the Great Salt Pond to the west.

Block Island's topography includes rolling hills and a scenic coastline comprised of both sandy beaches and rugged terrain. Coastal bluffs present obstacles to shoreline approach from both land and sea. Dock location are limited to Old Harbor on the eastern shore and New Harbor to the west.

Demographics

Block Island's historical population trends are aligned with its economic activities. From its beginnings as a (non-native) settlement in the late 1700's and early 1800's when the year round residents numbered between 600 and 700 people, who subsisted mainly on farming, it grew to a bustling island supporting anywhere from 1,000 to 1,300 throughout the mid to late 1800's and well into the twentieth century, when the economy shifted to resort activity and fishing. During and following the Great Depression and the Hurricane of 1938, which forced the fishing fleet back to the mainland, the population began dropping significantly, a trend that continued after World War II. By 1960, only 486 people were counted, the lowest recorded Census for the island. After remaining stable for a few decades, the population began climbing, reaching over a thousand people again by 2000. This recent growth is a function of the island's desirability as a retirement and second home community, an offshoot of its tremendous popularity as a vacation location.

Census 2010 documented 1,051 year-round residents on Block Island. However, the local Ground Hog day Census may provide a more accurate assessment of the year-round population of Block Island at just over 1,000 residents for the most recent couple of years.

Table 1: Block Island Groundhog Day Census

Year	*Year-Round Population Estimate*
2013	1,006
2014	931
2015	930
2016	1,008
2017	1,007

RI Statewide Planning projects that the year-round population will grow steadily but only slightly, to just under 1,319 in 2040 (Rhode Island Population Projections, 2010-2040, Technical Paper 162, April 2013, http://www.planning.ri.gov/documents/census/tp162.pdf).

A break-down by age of island residents as counted in both the 2000 and 2010 Census shows that there is a shift underway of older and retired persons replacing he very young, as well as the possible out-migration of young and young-middle aged workers.

The population of Block Island cannot be accurately evaluated without an accounting of its dramatic seasonal variation, when part-time residents, visitors and vacationers descend on the island for the summer months. It is estimated that the number of people staying on the island, including seasonal residents, renters, guests in hotels, inns and guest houses, and those staying on boats, is over 10,000 on a summer overnight. This figure does not include the day trippers who arrive and leave on the ferries, which is estimated at 15,000 on a typical Saturday or Sunday.

Temporary residents are not counted in the Census, and the seasonal nature of most of the housing stock contributes to the lack of available and affordable year-round housing on the island. Aside from skewing the housing market, this influx represents the island's major economic activities, while influencing the demand for services.

Land Use

Block Island has 6,076 acres within its land boundaries, excluding the Great Salt Pond and connecting coastal ponds. An estimated 47% of Block Island is conserved open space.

The existing land use pattern of Block Island can be categorized as having three distinct areas:

• Village: A compact mixed-use area, serviced by both public water and sewer, it includes the "downtown" associated with Old Harbor and the area between and around Old and New Harbors. Uses include retail and other businesses, tourism facilities, restaurants, accommodations including major hotels and inns, utilities and government, as well as residential. Year-round apartments and rooms for seasonal staff over stores are desirable future uses to provide a viable mixed-use area.

• Transition: A "buffer" zone which consists primarily of single family homes, but also includes some low-impact service establishments and smaller inns and B&B's. This area is partially serviced with town water. It has a lower density than the village, but is still compactly arranged.

• Countryside: The remainder of the island, dominated by openness, interspersed with low-density residential uses, and with compatible economic activities including agriculture, home occupations and B&B's. Of necessity, certain public facilities, including the airport, transfer station and the water treatment plant, are located in this area. However, the outstanding characteristic of this portion of the island is the extensive preserved open space and scenic values, which are critically important to the tourism-based economy, and the overall quality of life.

Community Development & Development Trends

Although New Shoreham has permanently protected a large amount of open space, there is still vacant land available for residential development. The capacity for commercial development is very limited. Block Island's recent growth has been fueled almost entirely by the ability and desire of individuals to purchase vacation properties. Although moderate growth is expected to continue, the town continues to be committed to maintaining a balance and conserve resources to accommodate growth responsibly. Much of the remaining land available for development is away from the coast and inland from flood zones, therefore, the Town does not anticipate increased vulnerably to natural hazard due to incremental residential development on the Island.

Critical Facilities & Utilities

The Block Island Medical Center, the only medical center on the island, administers routine services and acute emergency care. Patients with serious injuries and conditions must be transported off-island to hospitals on the mainland via ferry, plane or helicopter. The center serves as the island's second shelter, with the Block Island School being the primary shelter. Damage to either the medical center or school would not only affect daily care and operations, but also leave the island without a shelter.

Other critical facilities include the Fire Station, which is the center for dispatch and emergency operations; the Town Hall, which provides essential services and administration, and whose vault houses vital records and documents.

Block Island's electricity comes from Block Island Power Company (BIPCO). In September 2016, New Shoreham voters approved the debt necessary to purchase BIPCO shares. The Town has agreed to purchase a 2/3 majority interest in BIPCO and convert it to a nonprofit organization with professional management and a Board of Directors elected by the ratepayers. An advisory transition team has been appointed by the Town Council to oversee the purchase and transition of the Power Company.

Construction of the offshore wind farm and cable to the mainland was completed in Summer of 2016. It is the first offshore wind farm in the Eastern United States. The projects will also bring fiber / high speed internet to Block Island.

Block Island is considered a single continuous sole source aquifer, with the Atlantic Ocean forming the lateral boundaries. The aquifer is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health. Its groundwater supply is replenished only by rainfall, and its quality is essential to the town's quality of life and economic wellbeing. The Block Island Water Company relies on five active wells located in the Sands Pond wellhead protection area. Fresh Pond serves as an auxiliary reservoir.

Transportation

Access to mainland Rhode Island is available via ferry on a year round basis. The main ferry terminal at Old Harbor supports passenger-only ferries and vehicle-carrying boats. Private cruise ships and boats also access the island via New Harbor, in the Great Salt Pond. Rough waters caused by storms and high winds can cause ferry service to be suspended.

Scheduled air service to Westerly, Rhode Island runs on a year round basis, and charter flights are available. Block Island Airport, located near the center of the island, is one of the busiest in the state, second only to T.F. Green. The short runway cannot support larger planes, although small jets have managed to land and take off safely. High winds and fog affect the ability of planes to arrive and depart.

Damage resulting from natural hazards to the harbors, docks, airport, ferries or planes would cripple the island in every way. Residents rely on transportation by water or air in order to access goods and services on the mainland. The island's tourist-based economy relies on the operation of transportation companies to bring tourists to Block Island. Natural hazards, and resulting damage to transportation infrastructure, have the potential to devastate the island's economy.

Historic and Natural Resources

Block Island has many historic and natural resources. Historic homesteads, farmland, two lighthouses, cemeteries, stone walls, scenic landscapes, 28 miles of greenway trails, and sites

of archaeological significance are among the island's many resources. The Old Harbor Historic District boasts a concentration of historic structures including hotels in this walkable 19th century village. The island's two lighthouses are also major points of interest drawing thousands of visitors.

Natural resources include dramatic coastal bluffs, extensive beaches and sand dunes, the Great Salt Pond and associated saltwater ponds and marshes, hundreds of freshwater ponds, wooded and wetland habitats and ecosystems, morainal grasslands, maritime scrubland, open fields and scenic vistas.

The island's habitats support over 40 species of rare and endangered wildlife, making it one of the most ecologically significant locations in Rhode Island and the Northeast. Species include migratory shore and song birds, waterfowl, and raptors. Block Island is a critical stopover along the Atlantic Flyway.

The island's two largest freshwater ponds, Sands Pond and Fresh Pond, are part of the sole source aquifer upon which both public and private water supplies depend.

Commerce

Although there are a number of jobs providing necessary government and medical services, the modern economy is principally based on the island's status as a highly desirable vacation and tourist destination. Activity is concentrated during the summer months, from Memorial Day through Columbus Day, but primarily July and August.

Seasonal economic activity includes businesses in the hospitality industry – hotels, inns, guest houses, restaurants, snack shops and bars. It also includes a range of retail: bicycle, moped and sports equipment rentals; real estate, property rental and maintenance services; landscaping and yard work; wedding and catering services; arts and crafts; taxi and guide services; fishing charters; and all of the construction trades, which represent a principal year-round activity that is supported by a strong second and vacation home market. There are also the businesses related to transportation to and from the island; ferry and airline services, which have intensified schedules during the tourist season.

National Flood Insurance Program (NFIP)

Congress established the National Flood Insurance Program (NFIP) in the face of mounting flood losses and escalating costs of disaster relief to U.S. taxpayers. The goals of the program are to reduce future flood damage through floodplain management, and to provide people with flood insurance. Community participation in the NFIP is voluntary.

The Town of New Shoreham participates in the NFIP, and as such, New Shoreham residents are eligible to purchase federal flood insurance. On October 16, 2013, New Shoreham adopted updated flood insurance rate maps (FIRMs). In order to remain in compliance with the NFIP, New Shoreham enforces floodplain management regulations to help mitigate the effects of flooding on new structures. New Shoreham utilizes FIRMs to regulate development in flood hazard zones.

Community Rating System (CRS)

The Community Rating System (CRS) is a voluntary part of the National Flood Insurance Program that seeks to coordinate all flood-related activities, reduce flood losses, facilitate accurate insurance rating, and promote public awareness of flood insurance by creating incentives for a community to go beyond minimum floodplain management requirements. The incentives are in the form of insurance premium discounts. CRS ratings are on a 10-point scale (from 10 to 1, with 1 being the best rating), with residents of the community who live within FEMA's Special Flood Hazard Areas (SFHA) receiving a 5% reduction in flood insurance rates for every Class improvement in the community's CRS rating.

New Shoreham is working with RIEMA to gain entrance into the CRS. This will involve implementing public information, mapping, loss reduction and flood preparedness activities.

Recent & Significant Storm Events

Several significant events have impacted New Shoreham and the region in recent years. Most notably are major flooding (March 2010); Tropical Storm Irene (August 2011); Snowstorms (January 2011 & February 2013); Hurricane Sandy (October 2012); and Blizzard Juno (January 2015).

Current Mitigation Projects

The Town is currently working on implementing a number of mitigation projects that will protect the island and its environment from the impacts of natural hazards and climate change.

Erosion Mitigation Project at Closed Landfill

Recent storms have eroded the beach and caused the closed landfill to be uncovered. This erosion has resulted in debris on the beach and entering the ocean. This issue, if not corrected, has the potential to cause significant negative impacts on surrounding natural resources. Design work has been completed to construct a revetment from the shoreline to minimize ongoing erosion. The Town has received a CDBG-DR grant that will cover a portion of the construction costs.

Dune Protection

Dunes provide an important natural barrier to the destructive forces of wind and waves and are our first line of defense against coastal storms and beach erosion. They absorb the impact of storm surge and high waves, preventing or delaying flooding of inland areas and damage to island structures. As such, dune restoration efforts are an important priority to the Town. Grasses are planted by the Town and its partners regularly and signs have been installed to remind people to remain off the dunes. The Town is also exploring the use of snow fencing to capture sand and allow dunes to rebuild in a cost-effective and sustainable manner. Corn Neck Road is used by many daytrippers to access the Town Beach by foot from Old Harbor. In an effort to protect this important dune system, the Town is investigating options to install walkovers and stairs for the public to access the island's most heavily visited beach without compromising the dune grasses and other vegetation which stabilize the dunes.

3. PLANNING PROCESS

Goals & Objectives

The following goal and objectives have been identified for the Block Island Hazard Mitigation Plan, 2017.

Goal

Reduce current and future risk to people and property from natural hazards and climate change

Objectives

- ✓ PROTECT THE LIVES AND PROPERTY OF NEW SHOREHAM RESIDENTS AND VISITORS
- ✓ PROTECT THE BUSINESS PROPERTIES AND OPERATIONS ON BLOCK ISLAND
- ✓ SAFEGUARD NEW SHOREHAM'S CRITICAL FACILITIES AND INFRASTRUCTURE INCLUDING TRANSPORTATION CONNECTIONS TO THE MAINLAND
- ✓ SAFEGUARD BLOCK ISLAND'S HISTORICALLY SIGNFICANT STRUCTURES AND SITES
- ✓ PROTECT THE NATURAL FEATURES, HABITATS AND POPULATIONS OF BLOCK ISLAND AND ENSURE THE ISLAND REMAINS ECOLOGICALLY HEALTHY
- ✓ INCREASE RESILIENCY OF THE ISLAND TO CLIMATE CHANGE AND SEA LEVEL RISE IMPACTS
- ✓ IMPLEMENT PRIORITY HAZARD MITIGATION STRATEGIES

Planning Team, Technical Assistance & Local Leadership

The original New Shoreham Local Hazard Mitigation Plan was adopted in 2006. The hazard assessment and vulnerability portions of this Plan were prepared in 2006 by New Shoreham's Hazard Mitigation Committee, assisted by the consulting firm of Resource Specialists, Inc. New Shoreham provided staff time for data acquisition and GIS mapping.

This 2017 Plan updates the 2006 Plan. The 2017 Plan update process was conducted in-house by the Town of New Shoreham, led by Shirlyne Gobern, Administrative Assistant to the Town Manager, under the direction of Town Manager Nancy Dodge. Ms. Gobern was assisted

by the Town's Hazard Mitigation Committee and Town Planner Jane Weidman. GIS Consultant Martha Roldan provided mapping and technical services.

Two working meetings of the Committee were held in 2010 and advertised for the public. On November 10, 2010, Shirlyne Gobern emailed a number of town officials and stakeholders to request that they prepare for and attend a meeting of the Hazard Mitigation Committee to be held on November 18, 2010. Emails were sent to the Building Official, Police Chief, Harbormaster, Emergency Management Director, Town Clerk, Town Planner, Land Use Administrative Officer, Block Island Health Services, Block Island Land Trust, Block Island Water Company, New Shoreham Water Pollution Control Facility, and Interstate Navigation.

The Hazard Mitigation Committee met on November 18, 2010 at Town Hall. Present were Marc Tillson, Building Official, Bonny Ryan, Rescue Squad / Town Clerk's Office, Mike Shea, Highway Superintendent, and Shirlyne Gobern, Town Manager's Office. This was a working meeting of the Hazard Mitigation Plan Update Committee. It was a publicly advertised meeting (newspaper – Block Island Times). No members of the general public were present or provided comments in person or in writing. On December 16, 2010 a second meeting of the Hazard Mitigation Committee was held at Town Hall. Present were the Town Manager, Rescue Squad member, Rescue Captain, and the Town Clerk. This meeting was also advertised in the Block Island Times and the public was encouraged to attend. No members of the general public attended or provided comments in writing.

The Town of New Shoreham was awarded a 2010 Pre-Disaster Mitigation Grant from Rhode Island Emergency Management Agency (RIEMA) to fund preparation of a Hazard Mitigation Plan Update. In August 2010, Town officials met with representatives from FEMA to review FEMA's Local Mitigation Plan Review Crosswalk to be used to guide the update process. The Hazard Mitigation Committee undertook the process of reviewing each section of the Plan, including the planning and plan maintenance process, risk assessment, and vulnerability analysis, and updating mitigation strategy, including goals and actions relating to mitigation efforts.

New Shoreham Hazard Mitigation Committee

NANCY DODGE, TOWN MANAGER
SHIRLYNE GOBERN, ADMINISTRATIVE ASSISTANT TO TOWN MANAGER
JANE WEIDMAN, TOWN PLANNER
VINCENT CARLONE, CHIEF OF POLICE
MARC TILLSON, BUILDING OFFICIAL
STEPHEN LAND, HARBORMASTER JOHN
BREUNIG, WATER SUPERINTENDENT
CHRISTOPHER BLANE, SEWER SUPERINTENDENT
BONNY RYAN, WASTEWATER COORDINATOR, RESCUE SQUAD, AFFORDABLE HOUSING
MARTHA ROLDAN, GIS ADMINISTRATOR
FIONA FITZPATRICK, TOWN CLERK
BRYAN WILSON, RESCUE CAPTAIN
WILLIAM MCCOMBE, EMA DIRECTOR AND SECURITY DIRECTOR, INTERSTATE NAVIGATION
LOIS BENDOKAS, OWNER, NEW ENGLAND AIRLINES
MICHAEL SHEA, HIGHWAY SUPERINTENDENT

The New Shoreham Hazard Mitigation Committee is comprised of a combination of town officials and members of the business community representing planning, permitting, public safety, emergency management, public infrastructure, recreation and transportation. In addition to this representative group, key stakeholders from the local business community and environmental and conservation groups were invited to participate in the planning process. The island's major airline and ferry service companies were included as members of the Committee and, as such, were involved in the planning process. Conservation groups, major landowners on the island, were also involved in the planning process and were solicited for input.

For the 2017 update, the Committee analyzed each section of the plan and revised it to include any hazard events that affected the Town, new facilities that increase the Town's vulnerability, and any new information deemed important to be included. It was determined that the hazards identified in the prior plan continue to pose a threat to the community. In light of new available data, two additional hazards were identified by FEMA that could be added: Climate Change and Sea Level Rise.

Several actions identified in the original Plan approved in 2006 have since been completed, and new actions were identified during the years since the original Plan was adopted. Additionally, the narrative in each section was re-written, and sections were re-organized in an effort to strengthen the relevance and quality of the information presented.

Following State review, the draft plan was edited by Town Planner, Alison Ring, to address State comments in 2015 and 2016. The revised draft plan was posted on the town website on March 23, 2016 when it was resubmitted to the State. Technical Assistance from FEMA Regional Office provided a detailed review with substantial comments of the March 2016 Draft Plan to the Town in November 2016.

On January 3, 2017, the Town Planner of New Shoreham emailed the Town Planners of six neighboring communities with ferry or air connections to Block Island. The communities of Narragansett, RI, Westerly, RI, Newport, RI, East Hampton, NY, New London, CT, and Fall River, MA were provided the direct link to the March 23, 2016 Draft New Shoreham Hazard Mitigation Plan for their review and comment. Municipalities were asked to submit comments to Town Planner, Alison Ring, by January 31, 2017. The Town Planner also distributed request for review and comment with link to draft March 2016 plan on the town website to various stakeholders (The Nature Conservancy, Block Island Conservancy, Block Island Land Trust, Audubon Society of Rhode Island, and the Block Island Chamber) and State agencies (Rhode Island Department of Environmental Management, Rhode Island Department of Transportation, and the Coastal Resources Management Council.)

The Planning Director of the Town of Narragansett, the Coastal Policy Analyst from CRMC and the OVF Naturalist Perch of The Nature Conservancy responded with written comments by email and letter to the Town Planner during the months of January and February of 2017. The Town Planner considered and incorporated required and suggested edits that were submitted by RIEMA (State Hazard Mitigation Officer), FEMA (HM Community Planner), the Town of Narragansett (Planning Director) and The Nature Conservancy (OVF Naturalist Perch) from January to March of 2017. The updated draft was provided to the Town Manager in March of 2017. The New Shoreham Town Planner worked with FEMA Technical Assistance to ensure FEMA comments and all required revisions were addressed in April of 2017. On April 19, 2017, a public meeting before the Town Council was held to

discuss and act of the prioritization and inclusion of action items listed in the April 2017 Draft Plan. The meeting was advertised in the Block Island Times. In April 2017, the final 2017 Draft Block Island Hazard Mitigation Plan was resubmitted to RIEMA.

Public

The public was encouraged to participate throughout the planning process. All meetings of the Hazard Mitigation Committee were properly advertised including in the local newspaper and open to the public. The input of business owners and nonprofit leaders was incorporated by the Committee. Appendix E includes the text from the two 2010 public meeting notices. Additionally, the original Hazard Mitigation Plan was made available at the Library and Town Hall for public access. The draft 2016 update was posted on the Town's website. No public comments were received.

Plan Review, Adoption, and Approval

The 2017 Hazard Mitigation Plan went through several stages of review before its adoption and implementation. Recommended revisions were incorporated, and a final draft was prepared and submitted to RIEMA, who forwarded the draft to FEMA. Once the Plan received the APA (Approval Pending Adoption) notice from FEMA, the Town Council voted on a Resolution to formally adopt the 2017 New Shoreham Hazard Mitigation Plan. The Town then resubmitted the locally adopted plan to FEMA for final approval.

Understanding the Community's Risks

The process of updating New Shoreham's Hazard Mitigation Plan provides an opportunity to review and assess weather and climactic events that have in the past or may in the future impact the community. To evaluate vulnerability, the Committee examined the town's risk from natural hazards and identified its vulnerabilities to those risks. The Committee used the Risk Assessment Matrix and GIS maps as tools for the assessment. Based on those, they established mitigation priorities.

New Shoreham is located twelve miles off the southern coast of Rhode Island, and is physically isolated from the rest of the state. Due to its locations, it cannot rely on mutual aid nor coordinate with neighboring communities as other communities are able to. Its geographic location in the middle of the ocean also increases its vulnerability to certain natural hazards, especially the wind, erosion and flooding that result from hurricanes and coastal storms. Combined with the ecologically significant natural environment, and the abundance of seasonal properties, businesses, and populations, New Shoreham has many unique challenges when it comes to mitigating hazards. Isolation, distance, accessibility, communication and transportation must all be considered when planning hazard mitigation objectives and activities.

One of the most important aspects considered while completing this summary was the likelihood of the island community having to "fend for itself" with respect to the rest of the state. If the island's ferry and/or air transportation were suspended in the midst of a natural hazard, the community must be prepared to stand alone and cope with the after effects until transportation access is restored.

As an isolated island, the need for emergency generators in good working order is essential. There are several critical facilities on Block Island that either don't have generators or which have older generators that are in need of replacement. This includes the Town Hall, Town Highway Garage, Medical Center and School (both of which serve as emergency shelters).

In considering the benefits of mitigating hazards, one must first realize the danger of not identifying and anticipating them, including damage and loss with regard to persons, property, resources, vital records, and the economy, and the interruption of utilities, essential services, and commerce.

The aftermath of natural hazards that are not mitigated can be costly in terms of emergency response, repairs and replacement to facilities, infrastructure and property, debris and contamination cleanup, lost wages and sales revenue, and environmental damage.

Discovery & Gathering of Resources

Town of New Shoreham Emergency Operations Plan, 2011

New Shoreham's Emergency Operations Plan (EOP), updated in 2011, guides the Town's emergency protocol for extraordinary emergency situations associated with various types of disasters, including natural, man-made, and technological. It addresses pre- and post-disaster strategies to deal with hazards identified in this Plan, such as hurricane and flood warnings, dissemination of public information, evacuations, and shelters.

Town of New Shoreham Comprehensive Plan, 2016

To update its Comprehensive Community Plan, New Shoreham solicited public comment from its residents, boards and committees, departments, and business owners and some of these comments related directly or indirectly to Hazard Mitigation. A new chapter, Natural Hazards and Climate Change, was incorporated in the 2016 Comprehensive Plan (adopted November 2016).

The Town Council adopted the 2016 New Shoreham Comprehensive Plan in November of 2016. The plan describes the vision the community aspires to be over a 20-year planning horizon and identified actions to be implemented by the Town in order to achieve that vision. Items such as land use, housing, economic development, natural and cultural resources, open space, municipal services and facilities, public water supply, agriculture, and natural hazards and climate change are addressed in the plan. The Comprehensive Plan identifies the need for maintain a healthy year-round community and economy while at the same time preserving the natural resources and unique characteristics of Block Island. Research, data, and input as part of the Comprehensive Plan update and process also helped to inform the Hazard Mitigation Plan Update. The final 2017 Hazard Mitigation Plan will be incorporated as an appendix to the 2016 Comprehensive Plan. Several projects listed within the 2017 Hazard Mitigation Plan have already been incorporated in the 2016 Comprehensive Plan as implementation actions. Following the next 5-year update of the Hazard Mitigation Plan, updates to projects and new projects included will also considered for incorporation within the Comprehensive Plan Update (which must be adopted by 2026 (10-year approval)).The Planning Board is responsible for the Comprehensive Plan update process.

The Block Island Harbors Sea Level Rise Adaptation Study, 2013

The Block Island Harbors Sea Level Rise Adaptation Study, was completed in 2013 by New Shoreham with the assistance of a New England Municipal Coastal Resilience Initiative Grant.

Rhode Island Hazard Mitigation Plan, 2014

The 2014 State Hazard Mitigation Plan (SHMP) Update was approved on March 28, 2014, and will be in effect for five (5) years. The purpose of the Rhode Island SHMP is to provide comprehensive guidance for hazard mitigation statewide. The Plan serves the people of Rhode Island by providing the impetus for making homes, businesses and communities more resilient to the impacts of climate change, hurricanes, floods, tornadoes, earthquakes, winter storms, wildfires and other natural hazards.

Review and Incorporation of Information with Stakeholder and Public Exchange

New Shoreham solicited input on the plan from residents, property owners, business owners, local organizations, town boards and committees, and town staff. Public community participation was promoted through public notices and invitations posted in the local newspaper and town bulletin boards. Hazard Mitigation Committee meetings were publicized and open to the public. Residents and business owners were notified of open positions on the Committee to ensure that a wide cross-section of the community was represented. The various drafts were posted on the town's website over the course of several years, and copies were available for public review at Town Hall and at the Library. Meetings of the Hazard Mitigation Committee produced goals and policies. Based on the feedback gathered, the Risk Assessment was updated.

Developing & Updating the Risk Assessment

The Town of New Shoreham enforces state and local building codes and participates in the National Flood Insurance Program. The local Comprehensive Community Plan outlines resources available to address various challenges including increasing development pressure, economic stability, open space preservation, public infrastructure and public facilities. Updating the plan with the elements and recommendations of the Natural Hazard Mitigation Plan will help to reduce the impact from a natural disaster. The town acknowledges that incorporating this plan and its mitigation initiatives into the Comprehensive Plan benefits the community by reducing human suffering, damage, and costs of recovery. It also helps to build and maintain the long-term sustainability and economic well-being of the town.

Developing & Updating the Mitigation Strategy

Since the adoption of its first local Natural Hazard Mitigation Plan in 2006, the Town of New Shoreham has been working to update and revise its latest Mitigation Plan. New Shoreham's Hazard Mitigation Committee has continued to work on revising and implementing the Plan to meet FEMA and RIEMA requirements.

The Committee recognizes that natural hazard mitigation is a continuous process. The actions recommended in this plan will guide the town's actions during the next five years. These actions address the highest priority risks to the community, and will help to reduce the community's vulnerability to these risks.

The Town Council is responsible for the overall coordination of the Hazard Mitigation Plan. They will coordinate with representatives from various departments, agencies, and organizations involved in maintaining the Plan. The Town Council or its designee will be responsible for tracking and documenting the progress of each action using the Mitigation Action Progress Form (Appendix F).

The previous 2006 Action Progress Form was not used during the five-year update period, so the evaluation had to be done by the Hazard Mitigation Committee. To encourage ongoing evaluation during the next five-year period, the Committee designed a new form. The format of the new form was changed significantly to increase the amount of detail for each project, and make for easier use by the Town Council or its designee.

Public community participation will continue to be promoted. Committee meetings will continue to be publicized and open for public input. Residents and business owners will be notified when there are open positions on the Committee to ensure that the community is well represented. The Hazard Mitigation Plan will be posted on the town's website, and hard copies will continue to be available at Town Hall and the Library.

4. RISK ASSESSMENT

A natural hazard is an event or physical condition that has the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm of loss. A natural hazard can also be exacerbated by societal practices, such as building in a floodplain, along a sea cliff, or on an earthquake fault. Natural disasters are inevitable, but the impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely (RIEMA, 2014).

The purpose of this section is to provide a comprehensive overview of what and how various natural hazards could impact Block Island. The following section presents a description of each type of natural hazard's Block Island may expect to experience as determined by the Hazard Mitigation Plan Committee. The Hazard Profile Summary, found in Table 2, lists the specific natural hazards identified for Block Island along with information with regard to frequency, impacts, and extent. The following section will also describe historical events that have affected the island, its residents and visitors.

Identifying risk and vulnerability to natural hazards is central to determining how to allocate finite resources and determining which mitigation actions are feasible and appropriate. The hazard analysis involves identifying natural hazards that are a potential threat to New Shoreham, and analyzing each to determine the degree of threat posed.

Due to its location, the Block Island is especially susceptible to coastal storms, hurricanes and Nor'easters, which pose erosion and flooding hazards. In addition, the island is vulnerable to severe winter weather and wind, lightning, and drought.

Block Island generally experiences several natural hazards each year; most as a result of coastal storms. Hurricanes also threaten quite often, causing significant damage as witnessed most recently by Hurricane/Super Storm Sandy in 2012. Sandy, while not categorized as a hurricane according to wind strength, caused most damage because of astronomically high tides over two cycles.

In the Atlantic Basin as a whole, there has been a shift toward category 4 and 5 storms, with fewer category 1 and 2 storms. The trend toward higher sea levels and greater severity of storms will result in greater coastal flooding and erosion, and as a result more widespread property and infrastructure damage on Block Island.

Most of the following information was obtained from the National Climatic Data Center and the National Weather Service (Boston, MA) online database. Unfortunately, records have not been kept specifically for Block Island; rather, events are grouped by county. The only tables that are completely specific to Block Island are Windstorms (Table 4), and Rain/Flooding (Table 7). In the other tables, information specific to Block Island is designated by two asterisks (**).

Grouping Block Island weather events with those of Washington County does not always accurately represent the severity or effects of the events on Block Island. Although

Washington County consists of many coastal communities, Block Island's location in the middle of the ocean means that it usually endures higher winds and heavier rains than along the coast. This was considered when completing the Hazard Profile in Section 3.

Hazard Identification

The Town of New Shoreham identified natural hazards, assessed the degree of vulnerability to those hazards, considered the potential impacts posed by those hazards, and assessed future risk. The appendices provide maps showing the locations of critical facilities and areas of the island most at risk from natural hazards.

The New Shoreham Hazard Mitigation Plan addresses natural hazards and not man-made hazards such as structural fires, hazardous materials, chemical spills, or weapons of mass destruction.

Hazard Identification in State Hazard Mitigation Plan

Rhode Island's State Hazard Mitigation Plan (2014) identifies the following categories of natural hazards in order of frequency and impact: (1) wind-related hazards; (2) winter-related hazards; (3) flood-related hazards; (4) wildfire; (5) geologic-related hazards (Earthquake) and (6) drought and extreme heat. These have the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.

Wind Related Hazards	Winter Related Hazards	Flood Related Hazards	Geologic Related Hazards	Additional Hazards
Storm Surge	Snow	Riverine Flooding	Earthquakes	Wildfire
Hurricanes	Ice	Flash Flooding		Drought
Tornadoes	Extreme Cold	Urban Flooding		Extreme Heat
High Winds		Coastal Flooding		
		Climate Change and Sea Level Rise		
		Coastal Erosion		
		Dam Breach		

Hazards Excluded from Risk Assessment

The State Hazard Mitigation Plan notes other potential natural hazards that are not addressed in the Plan due to the lack of frequency in which they occur, the minimal probability of their occurrence, and the State's lack of resources to conduct research into the potential for occurrence. Until resources and expertise are available to conduct such studies, or until the state or region is impacted by such a hazard, Rhode Island does not have plans to address these low risk hazards. Volcanoes, Tsunamis, Landslides, Land Subsidence, Avalanche, Expansive soils, and Hail are not included in New Shoreham's plan for the same reasons as stated above (lack of frequency and minimal probability of occurrence).

HAZARD PROBABILITY

In order to comprehensively assess the relative risk posed by hazards, the Town of New Shoreham utilized a model that considers both the frequency and potential impacts to identified natural hazards. The following model was utilized as it was identified as a best practice by nearby communities during their plan development. The objective of the rating system is to identify which hazards pose the greatest risk to Block Island.

The model deals with hazards and risk in a relative manner and the risk rankings are to be considered within this context. Frequency and impact were given equal weighting. Specifically, the model uses the following simplified equation:

RISK = FREQUENCY X IMPACT FACTOR

Frequency

The hazard frequency was determined for each hazard using a 1-4 scale:

1) *Unlikely – less than 1% probability hazard will occur in the next 100 years*
2) *Possible – between 1% and 10% probability hazard will occur within the next year or at least one chance in next 100 years*
3) *Likely – between 10% and 100% probability within the next year or at least one chance in next 10 years*
4) *Highly likely – near 100% probability hazard will occur within the next year*

Impact Factor

An impact factor was used to address the various vulnerabilities and the severity of a hazard. The built environment, systems (transportation, utilities, economy, etc.), natural systems, the human population and severity were each assigned a value of zero to three. In order to equally weight frequency and vulnerability, the average of the vulnerabilities provided a "vulnerability factor." The vulnerability ratings used the following equation:

IMPACT FACTOR = (HUMAN + BUILT + NATURAL + SYSTEMS + SEVERITY) / 5

The impact factor was then classified on a 1-4 scale:

1) *The vulnerable population or system will not be affected*
2) *Event causes some mild disturbances to some systems, buildings, natural environment or populations*

3) *Event causes some mild disturbances to all systems, buildings, natural environment or populations OR event causes severe disturbance to some systems, buildings, natural environment or populations*
4) *The entire island is significantly affected by the event*

Due to the variability inherent in each of the hazards and the rating system, the hazards were divided into general categories of low, moderate and high-risk hazards based on their relative risk score (see Risk Priority column in Table 2 Hazard Profile Summary).

Table 2. Hazard Profile Summary						
Hazard	Frequency*	Impact**	Speed of Onset	Seasonal Pattern	Possible Effect	Risk Priority
STORM SURGE	Likely	Catastrophic	24+ hrs.	June-Nov. with Aug. & Sept. most likely	Flooding, downed trees, power outages, property damage, loss of life	High
HIGH WINDS / THUNDERSTORMS	Highly likely	Catastrophic	12-24 hrs.	Any Season	Property damage, power outages, downed trees/ limbs	High
HURRICANE	Likely	Catastrophic	24+ hrs.	June-Nov. with Aug. & Sept. most likely	Flooding, downed trees, power outages, property damage, loss of life	High
HEAVY RAINS / FLOODING	Highly likely	Limited	12-24 hrs.	Spring and Summer	Flooding, property damage, roads closed, dams breached	Moderate
SEVERE WINTER WEATHER	Highly likely	Catastrophic	12-24 hrs.	Winter	Power outages, poor travel conditions, schools/businesses closed	Moderate
COASTAL EROSION	Highly likely	Limited	Minimal	Any	Property damage, environmental damage	Moderate
SEA LEVEL RISE	Highly likely	Critical	Minimal	Any Season	Flooding, roads closed, environmental & property damage	Moderate
DROUGHT	Unlikely	Unlikely	Minimal	Any Season	Environmental & property damage, water infrastructure compromised	Low
EARTHQUAKE	Possible	Critical	Minimal	Any Season	Loss of life, property damage, power outage	Low
TORNADO	Unlikely	Limited	12-24 hrs.	Spring	Property damage	Low
WILDFIRE	Unlikely	Unlikely	Minimal	Any Season	Property damage, environmental damage	Low

** Highly likely=near 100% probability within the next year; Likely=between 10% and 100% probability within the next year or at least one chance in next 10 years; Possible=between 1% and 10% probability within the next year or at least one chance in next 100 years; Unlikely=less than 1% probability in next 100 years*

***Catastrophic=more than 50% of community affected; Critical=25% to 50% affected; Limited= 10% to 25% affected; Negligible=Less than 10% affected.*

Natural Hazard Profiles

Storm Surge

Description

Storm surge is the abnormal rise in water level caused by the wind and pressure forces of a hurricane, Nor'easter or severe winter weather. A number of factors contribute to storm surge, but the fundamental mechanism is wind and the frictional stress imposed on the water surface. Winds blowing over the water surface generate horizontal surface currents flowing in the direction of the wind. These create subsurface currents which may extend from one to several hundred feet below the surface when combined with the intensity and forward speed of a hurricane or Nor'easter. If the currents are in the onshore direction, water is impeded by the shoaling continental shelf, and the water surface rises. This "dome of water" increases shoreward, reaching a maximum height at the shoreline or at some distance inland.

Location

Storm surge most often occurs in and around Block Island's two harbors (Old Harbor and New Harbor). The narrow northern neck of the island, Corn Neck Road, is especially vulnerable being cut off from the rest of the island.

Extent

The extent of storm surge is measures by change in water level due to the presence of a storm, over and above predicted astronomical tide. Extent can also be described by peak wave heights and winds. Storm surge heights in Rhode Island range from a two feet higher than normal tides during Nor'easters to more than 10 feet during hurricanes. The breaking wave height is related to water depth. As water depth increases with storm surge, larger waves are generated. On average, one to two Nor'easters per year affect Rhode Island with a storm surge equal or greater than two feet. The duration of high surge and winds during a Nor'easter can last from 12 hours to three days, while the duration of hurricane conditions generally last only 6 to 12 hours.

Links to Storm Surge Extent Resources

SLOSH maps predict potential flooding from storm surge
http://www.nws.noaa.gov/om/hurricane/resources/surge_intro.pdf
http://www.nhc.noaa.gov/surge/slosh.php

NOAA Storm Surge Inundation Web Maps (SLOSH Maximum of Maximums)
http://noaa.maps.arcgis.com/home/item.html?id=b1a20ab5eec149058bafc059635a82ee

Impact

Storm surge is by far the most disruptive force acting on the Block Island coast. Storm surge can led to extensive damages of island roadways (notably Corn Neck Road and Spring Street) and often leads to inundation of roadways in Old Harbor and New Harbor. Inundated roadways impedes emergency response and evacuation routes. In some instances roadways remain inundated beyond the storm event and can therefore result in economic impacts to local businesses.

Previous Occurrences and Probability of Future Events

See hurricane profile for description of recent significant previous storm surge events.
The probability of a storm surge event is related to the probable occurrence of hurricanes, tropical storms, severe winter weather and Nor'easters.

Probability: New Shoreham is *highly likely* to be impacted by storm surge over the next five years.

High Winds and Thunderstorms

Description

Wind is the movement of air caused by differences in pressure from one place to another. Local wind systems are created by the immediate geographic features of a given area, such as mountains, valleys, or large bodies of water. Wind effects can include blowing of debris, interruptions in power and communications utilities, and intensification of the effects of other hazards related to winter weather or severe storms.

Thunderstorms are formed when atmospheric conditions combine to provide moisture, lift, and warm unstable air that can rise rapidly. The hazard may occur at any time of day and in all months of the year, but are most common during summer afternoons and evenings and in conjunction with frontal boundaries. Thunderstorms affect an isolated area, but can be dangerous and destructive. Thunderstorms can form in less than 30 minutes, allowing for very little warning. They have the potential to produce lightning, hail, tornadoes, powerful winds, and heavy rains that may lead to flash flooding.

Lightning is a giant spark of electricity in the atmosphere or between the atmosphere and the ground. In the initial stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground; however, when the differences in charges becomes too great, this insulating capacity of the air breaks down and there is a rapid discharge of electricity that we know as lightning.

Location

Given the island's location and amount of ocean fetch with easterly storms, high wind events and thunderstorms affecting the island generally impact the entire island and are more intense than for mainland Rhode Island locations.

High winds also contribute to storm surge and increased wave action, resulting in coastal erosion and minor flooding in low-lying areas nearby the Harbor areas, as well as causing island roads in and around Old Harbor and New Harbor to be blocked or breached by water.

Impact

Severe thunderstorms are capable of producing hail an inch or larger and winds over 58 mph. Hail this size can damage property such as plants, roofs and vehicles. Wind this strong is able to break off large branches, knock over trees or cause structural damage to trees.

Lightning kills an average of 49 people in the United State each year, and hundreds more are severely injured. Lightning can cause power failure, fires, and disruption of water service, as well as communication failures if phone lines or the public safety communication tower is struck.

High winds can cause power outages, damage to buildings and property, and can suspend ferry and air service, consequently secluding the island from the mainland. Much of the island vegetation is maritime scrub comprised of smaller, brittle trees with shallow roots, unable to withstand sustained winds. As a result, windstorms can have a significant negative impact on the island's habitat and natural environment.

Extent

Links to Wind, Thunderstorm, Lightning & Hail Extent and Other Resources

Extent of windstorms are measured using the Beaufort Wind Scale (See Table 3).
http://www.spc.noaa.gov/faq/tornado/beaufort.html

Table 3: Beaufort Wind Scale				
Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	On Land
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-19 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (18-25 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	High waves (23-32 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (29-41 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (37-52 ft) waves, foam patches cover sea, visibility more reduced	

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	On Land
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

Thunderstorm Extent

NOAA classifies types of thunderstorms as single-cell, multi-cell, squall line, supercell, vow echo, mesoscale convective system, mesoscale convective complex, mesoscale convective vortex, and derecho. Any of these can be severe, defined by wind speeds of 58 MPH or greater and/or hail 1.0 inches or greater in diameter.
http://www.nssl.noaa.gov/education/svrwx101/thunderstorms/types/

Lightning Extent

Lighting extent is described as lightning strikes per square mile/kilometer per year.
Map example: http://www.lightningsafety.noaa.gov/stats/08_Vaisala_NLDN_Poster.pdf
Lightning website: http://www.lightningsafety.noaa.gov/science.shtml
State averages: http://www.lightningsafety.noaa.gov/stats/06-15_Flashes_flash_Density_State.pdf

Hail Extent

National Weather Service Hail Size Estimation Chart
http://www.weather.gov/btv/skywarn_hailwind

Previous Occurrences and Probability of Future Events

Significant wind storms are shown in Table 4.

Table 4 – Significant Wind Storms for Block Island

Date	Magnitude (mph)	Comments
August 21, 1997	60 mph gusts	High winds caused 16' waves
February 5, 1998	60 mph gusts	Minor beach erosion
December 17, 2000	60 mph	Strong winds cancelled at least one Ferry run
January 23, 2005	85 mph gusts**	Snowstorm with 85 mph wind gusts
November 10, 2005	n/a	Sustained gale-force winds, no ferry service
December 9, 2005	68 mph	
February 1, 2008	58 mph	
March 5, 2008	85 mph	
August 18, 2010		Locally reported microburst (K. Gaffett)
January 12, 2011	63 mph	
November 2, 2014	59 mph	
December 9, 2014	60 mph	ferry service cancelled

Sources: National Climate Data Center, Weather Station at BI Water Company, and Block Island Times

Wind events are the most frequent natural hazard Block Island faces throughout the year. These include Nor'easters in the winter and hurricanes and thunderstorms in the summer.

Over the past century, 15 tropical cyclones (Category H1-H5) have directly hit or passed near Rhode Island. Numerous other subtropical and tropical storms/depressions pass through Rhode Island each season generating large swells, storm surges and high winds causing varying degrees of damage to property.

The December 26, 2010 storm, with some residents reporting 90 mph gusts, caused scattered power outages. Some properties did not have power for four days. The ferries were cancelled for two consecutive days. The high winds caused minor property damage, including fallen trees and broken windows.

Rhode Island (between 2006 and 2015) had an annual average of 2,516 Cloud-to-Ground Flashes (Lightning). Although neither the National Climate Data Center nor the National Weather Service lists any specific lightning events for Block Island, these events have occurred on Block Island in the past. Areas abutting the Block Island Water Company have been struck by lightning several times, once resulting in a devastating fire. Other strikes on the island have caused residential damage including house fires and well pump damage.

A lightning strike on July 5, 2009 knocked out the apparatus for the municipal fire alarm service operating out of the Police Station. This required complete replacement of the system.

Probability: New Shoreham is *highly likely* to be impacted by high wind events and thunderstorms over the next five years.

Hurricanes

Description

A hurricane is a tropical cyclone with rotating winds of at least 74 mph, and is usually accompanied by heavy rain, thunder, and lightning. Tornadoes and storm surge may also result. These seasonal storms are spawned by low-pressure depressions moving over warm, tropical waters and occur over the Atlantic Ocean between June and October. Tropical cyclones are among the most powerful and destructive meteorological systems on earth. A hurricane watch is issued when hurricane conditions could occur within 36 hours. A hurricane warning indicates that sustained winds of at least 74 mph are expected within 24 hours or less.

Location

The New England District of the U.S. Army Corps of Engineers, using data from the National Hurricane Center, developed maps depicting the worst case scenario for hurricane surge inundation for Category 1 through 4 hurricanes striking the coast of Rhode Island. Hurricane surge values were developed using the Sea Lake and Overland Surge from Hurricanes (SLOSH) model, which estimates storm surge heights through hypothetical measures of pressure, size, forward speed, track and winds.

The entire state of Rhode Island is vulnerable to hurricanes and tropical storms. New Shoreham's location in the middle of the ocean and low elevation makes it particularly susceptible to hurricane-related hazards, and the town's small size means that the majority of properties are vulnerable to hurricane impacts to some degree.

Utilizing GIS, the Town of New Shoreham mapped Hurricane Inundation layers and determined that there are an estimated 117 structures located within Hurricane Inundation Zones on Block Island including critical facilities such as pump stations, the power company, cell tower, State Highway Garage, and the Day Care Center.

Impact

While strong winds from hurricanes can pose a threat to life and property, the greatest threat posed by hurricanes in Rhode Island is generally heavy rainfall and severe flooding caused by storm surge. Storm surge is water that is pushed toward the shore by the force of the winds swirling around the storm. When coupled with normal tides, storm surge can raise the mean water level 15 feet or more. Storm surge and hurricanes can also greatly contribute to coastal erosion, and cause downed power lines and structural damage.

Besides the flooding damage from storm surges, the wind from hurricanes can knock down structures or rip off roofs. Even Category 1 or 2 hurricanes produce storm surges that inundate large areas of town. Hurricanes also cause erosion. High winds cause damage to power lines, structural damage to buildings and component parts (gutters, shingles, decking, windows, etc.). Accompanying wind-driven rains enter windows, doorways, and roof vents causing damage to the interior of buildings and critical facilities. Hurricane and gale-force winds can block roadways with debris or water, making them impassable. This poses a danger especially for those requiring emergency services or medical attention. In short, the island's beaches, habitat, historic and critical structures and facilities are all in peril during a hurricane.

Extent

There are three categories of tropical cyclones:

1. Tropical Depression: maximum sustained surface wind speed less than 39 mph.
2. Tropical Storm: maximum sustained surface wind speed from 39-73 mph.
3. Hurricane: maximum sustained surface wind speed exceeding 73 mph.

Hurricanes are measured on the Saffir/Simpson Hurricane Wind Scale (see Table 5 below) with ratings determined by wind speed and central barometric pressure. Hurricane categories range from 1-5, with 5 being the strongest (winds greater than 155 mph). This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures.

Table 5 - Saffir-Simpson Hurricane Wind Scale		
Category	**Sustained Winds**	**Types of Damage Due to Hurricane Winds**
1	74-95 mph 64-82 kt 119-153 km/h	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

In Rhode Island, the increased wind stress from the rotational wind field has a large effect on the level of surge. The contribution to surge generation from the forward motion of the storm can be greater than the contribution made by an increase in hurricane intensity. Storms passing to the west raise the highest storm surges for Rhode Island. The 1938 hurricane made landfall west of Rhode Island as a Category 3 hurricane with a forward speed in excess of 50 mph. Since the center of the storm made landfall in Connecticut, the Rhode Island shoreline experienced the highest storm surge levels.

Previous Occurrences

Table 6 lists significant previous hurricanes which impacted Block Island.

Table 6 – Significant Hurricanes

Date	Name	Category	Sustained Winds (mph)	Property Damage (U.S.) ($million)	Deaths (U.S.)
September 21, 1938	N/A	3	121	308	600
September 14, 1944	N/A	3	134	100	46
August 31, 1954	Carol	3	80-100	461	60
September 11, 1954	Edna	3	80-100	40	20
September 12, 1960	Donna	2	95	387	50
September 27, 1985	Gloria	2	98	900	8
August 19, 1991	Bob	2	103	680	6
October 30, 1991	No Name	1	75	200	13
August 26-27, 2011	Irene	1	76	1,000	41
October 22-29, 2012	Sandy	1	80	50,000	147

Sources: "Southern New England Tropical Storms and Hurricanes, A Ninety-eight Year Summary 1909-1997", by David R. Vallee and Michael R. Dion, National Weather Service, Taunton, MA. http://www.nhc.noaa.gov/outreach/history; http://www.nhc.noaa.gov/data/tcr/AL092011_Irene.pdf ; http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf

Two recent events are detailed below.

Tropical Storm Irene, 2011

In late August 2011, this destructive and costly tropical storm, which made landfall in the Outer Banks of North Carolina, and in New Jersey and Brooklyn, New York days later, and eventually became a tropical cyclone in New Hampshire and Vermont, caused widespread wind damage and power outage throughout much of Rhode Island, particularly Aquidneck Island (Newport). The storm passed Block Island, which was spared power outage and only lost ferry service for a day. High winds did cause some tree damage and there was excitement from large waves rolling in from the south which swept over the east section of the breakwater in Old Harbor. However, there was no permanent damage to any roads or structures, nor to any vessels due to early preparation by the Harbors Department. The west side of the island was subjected to some erosion.

Hurricane Sandy, 2012

Hurricane Sandy, also referred to as a "Super Storm Sandy", was the most destructive storm of the Atlantic 2012 season. It affected the entire eastern seaboard in the last days of October, most dramatically the New Jersey shore, which took a direct hit, and New York City, which experienced significant storm surges. In Rhode Island, most of the damage was

along the south coast where fifteen to thirty foot seas pounded the coast over two days, destroying dunes and causing significant flooding and property damage. The duration lasted through multiple tide cycles; storm surges of four to five feet on top of high tide resulted in a storm tide high of over eight feet above mean low tide, as recorded in Newport.

Although the storm did not hit Rhode Island directly, it produced significant damage to the southern coastline. On Block Island, the storm pummeled the eastern side of the island, including Old Harbor and Crescent Beach. Corn Neck Road, which parallels the beach and connects the harbor and village area to the north part of the island, was significantly damaged for a length of 1,800 feet, isolating one business, restricting access to a number of residences and requiring travelers along the remainder of Corn Neck Road to use an alternate route (Ocean and Beach Avenues). A shorter section of Spring Street, leading out of town south of Old Harbor, and also paralleling close to the shore, was damaged.

Both roads were rebuilt as part of a $3.1 million emergency repair contract (funding by US DOT), with construction completed in March, 2013. The town beach pavilion also suffered damage, including structural damage. The cost of these repairs was $160,000, and the pavilion was opened for business in June, 2013. A private residence on the shoreline lost approximately 50 feet of its ocean frontage during the storm, and the septic system had to be relocated further inland.

In Old Harbor, the bait dock on the east side of the Inner Basin was destroyed. The Army Corp East Dock sustained significant damage. The recently constructed town docks and the ferry dock withstood the storm. However, Ballard's, a large restaurant and bar located on what is essentially a coastal feature between the harbor and the beach, sustained significant damage; waves washed through the building, destroying the easterly wall and filling the first floor with sand. The Town's bait dock was rebuilt in 2013, at a cost of $200,000.

In New Harbor, there was no structural damage, only localized flooding due to the storm surge that entered the Great Salt Pond. Under the direction of the harbormaster, the harbor had been almost entirely emptied of recreational boats in preparation for the storm. The harbor and marinas had minimal traffic because the storm hit after Columbus Day. The marinas all took precautions to secure their facilities. The few boats that remained in New Harbor weathered the storm without damage, as they had been thoroughly secured in locations most favorable for the wind direction.

Outside of the harbors area, there was considerable beach erosion and damage to the dune system, particularly along Crescent Beach. The Block Island Conservation Commission responded with a plan to install snow fencing to capture the sand, allowing the dunes to rebuild in a cost-effective and sustainable manner. The Conservation Commission, together with the BI Residents Association, purchased (with donations) 90 rolls of fencing and installed it along several access paths to the beach during three community work days in late March and early June 2013, events which attracted a total of over a hundred and fifty volunteers. Beach grass or beach roses are to be planted later as the dunes re-establish. Signs were installed to remind people to stay off the dunes.

Probability of Future Events

The National Hurricane Center uses satellite imagery, radar, and weather balloons to spot conditions that could trigger a hurricane. Information is gathered and analyzed by computer models that estimate the storm's strength, rate of development, path, and estimated storm surge. Based on this information, a tropical storm warning, a hurricane watch, or a hurricane warning are then issued.

A tropical storm warning is issued if winds of 39 to 73 mph are expected. A hurricane watch is issued for coastal areas when tropical storm or hurricane threatens within 24 to 36 hours. A hurricane warning is issued for specific coastal areas when hurricane-force winds are expected to strike within 24 hours or less.

According to the National Hurricane Center, approximately six Atlantic tropical storms mature into hurricanes in an average year. The Rhode Island State Hazard Mitigation Plan indicates that Rhode Island is particularly vulnerable to hurricanes due to its geographic location and features such as Narragansett Bay, which can act as a funnel for hurricane surges. The State plan indicates that in any given year, the probability of a hurricane reaching Rhode Island is six percent.

Probability: New Shoreham is *likely* to be impacted by a hurricane during the next 5-years.

Since 2006, the island has worked with RIEMA to assure that plans are in place and revisited each hurricane season, with necessary adjustments made or long-term planning initiated. The town also runs advertisements each summer in the newspapers advising all readers about hurricane preparation techniques and evacuation procedures.

Heavy Rains and Flooding

Description

The National Flood Insurance Program (NFIP) defines flooding as a temporary, partial or complete inundation of land that is normally dry. The inundation must cover two or more acres or two or more properties.

Floodplains are low, flat, periodically flooded lands adjacent to rivers, lakes and oceans and are subject to geomorphic (land-shaping) and hydrologic (water flow) processes. These areas form a complex physical and biological system that supports a variety of natural resources and also provides natural flood and erosion control. In addition, the floodplain represents a natural filtering system, with water percolating back into the ground and replenishing groundwater.

A flash flood occurs when heavy rains collect in a stream or gully, turning the normally calm area into an instant rushing current. Any flood involves water rising and overflowing its normal boundaries. Flash floods result from heavy rainfall concentrated over one area. Most flash flooding is caused by thunderstorms or heavy rains from hurricanes and tropical storms.

Coastal flooding is typically a result of storm surge and wind-driven waves, which erode the coastline. These conditions are produced by hurricanes (tropical storms) during the summer and fall, and Nor'easters and other large coastal storms (extra-tropical storms) during the fall, winter and spring. Storm surges may overrun barrier islands and push sea water up coastal rivers and inlets, blocking the downstream flow of inland runoff.

Location

See official FIRM maps for locations at risk of flooding on Block Island (also displayed on Risk Maps in Appendix A). Lands surrounding the Great Salt Pond and portions of New Harbor and Old Harbor (Sections of Ocean Ave) are identified as being in a flood hazard area (A-zone). Also, the west (northerly) side of the island is identified on the FIRM maps as within a flood hazard area (A-Zone). The coastline of Block Island is within the V-Zone.

Impact

Given the fact that Block Island is surrounded by water, heavy rains and resulting floods are serious risks to the community. Furthermore, there are 365 freshwater ponds on the island that can swell over their banks and create flooding problems for property and business owners. Many island roadways are susceptible to flooding or washouts due to low elevation, poor drainage or road makeup. Majority of island roadways are privately owned and made of dirt or gravel. The major roadways of Ocean Ave, Beach Ave, and Corn Neck Road are most susceptible to significant damage. Heavy rain event and flooding events could damage municipally owned critical facilities located within flood hazard areas. These

facilities include the North Light, Town Beach Pavilion, Harbormaster's Shack, and former Coastguard Station.

Dam Failure Resulting From Heavy Rain/Flooding

Dam failures due to natural events such a prolonged periods of rainfall and flooding can result in overtopping, which is the most common cause of dam failure. Overtopping occurs when a dam's spillway capacity is exceeded and portions of the dam which are not designed to convey flow begin to pass water, erode away, and ultimately fail. Dam failures can create the most damaging flash flood events. When a dam or levee breaks, a large quantity of water is suddenly let loose downstream, potentially destroying anything in its path.

The State of Rhode Island created an inventory of dams in Rhode Island when it instituted Dam Safety Regulations in 2007 through the Rhode Island Department of Environmental Management. There are only two dams located in New Shoreham, identified as State ID # 424 and #765. (A third, identified as #470 was determined not to be present, and was removed from the inventory.) Both dams are in the location of Mill Tail Pond/brook near the Town Hall.

In the RIDEM Annual Dam Safety Report (2015), the two dams in New Shoreham, identified above, are classified as "Significant Hazard." The hazard classification relates to the probably consequences of failure of the dam; it does not relate to the current condition or the likelihood of failure of the dam. "Significant Hazard" means "a dam where failure or misoperation results in no probable loss of human life but can cause major economic loss, disruption of lifeline facilities or impact other concerns detrimental to the public's health, safety or welfare. Examples of major economic loss include washout of a state or federal highway, washout of two or more municipal roads, loss of vehicular access to residences, (e.g. a dead end road whereby emergency personnel could no longer access residences beyond the washout area), or damage to a few structures." (RI State Hazard Mitigation Plan, 2008, page 41).

Rhode Island has experienced many dam failures, mainly resulting from major flood events. The probability of future dam failure events is not easily measured, but correlates to some extent with the probability of future major flood events coupled with preventative measures, including the routine inspection, maintenance, repair, and proper operation of dams. There is no previous recorded history of dam failure occurring on Block Island as a result of natural hazards. However, it is *possible* that a dam breach could occur on Block Island over the next 5 years.

Extent

In March 2010, heavy rains (5.55 inches in Washington County) caused the level of Sands Pond to rise to 133.5 feet above sea level. The Block Island Water Company's electrical boxes that service the reservoir pumps, backwash holding tanks were submerged and damaged. The flood also posed a threat to water treatment equipment. There are a dozen residential properties surrounding the pond that were at risk / yards were submerged.

The extent of a flooding can be expressed a number of ways including by flood depth, crest height, XX ft. over flood stage, recurrence interval; XX ft. wall of water, or acreage inundated.

Links to Flood Resources

Historical, USGS http://waterdata.usgs.gov/nwis/sw

Terminology http://aprfc.arh.noaa.gov/resources/docs/floodterms.php

FEMA Flood Map Service Center https://msc.fema.gov/portal

Sea Level Rise and Nuisance Flood Frequency Changes around the US, NOAA, 2014

http://tidesandcurrents.noaa.gov/publications/NOAA_Technical_Report_NOS_COOPS_073.pdf

Previous Occurrences and Probability of Future Events

Table 7 lists previous significant rainfall and flooding events for Block Island.

Table 7 – Significant Heavy Rain/Flooding for Block Island

Date	Rainfall (inches)	Comments
October 11, 1998	4.84”	Three-day rain event, no flooding resulted
March 31, 2001	4.37”	Minor flooding
Oct.13-15, 2005	13.1”	Rain, flooding in poor drainage areas & flood prone properties
November 22, 2005	4.26”	
February 13, 2006	6”	No major damage
May 15, 2006	4.13”	No major damage
June 24, 2006	4.57”	
August 28, 2006	3.31”	
April 15-16, 2007		Coastal flood, new moon combined with storm surge resulted in moderate erosion along beaches
August 29, 2009	2.50’	
October 3, 2009	3.28”	
March 28-31, 2010	8”	Rain, widespread flooding, major property damage

Sources: National Climate Data Center and National Weather Service; Weather Station at BI Water Company, and The Block Island Times

Probability: New Shoreham is *highly likely* to be impacted by heavy rains and flooding over the next 5 years.

Severe Winter Weather (Snow, Ice & Extreme Cold)

Description

A heavy snow is generally defined as having more than eight inches of accumulation in less than 24 hours. Heavy snow can bring a community to a standstill by inhibiting transportation, downing trees and utility lines, and by causing structural collapse in buildings due to the weight of the snow. Repair and snow removal costs can be significant and surpass annual municipal snow removal budgets.

The term “ice storm” is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Ice storms result from the accumulation of freezing rain, which is rain that becomes super-cooled and freezes upon impact with cold surfaces. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations. If extreme cold conditions are combined with low/no snow cover, the cold can better penetrate downward through the ground and potentially create problems for underground infrastructure as well. When utilities are affected and heaters do not work, water and sewer pipes can freeze and even rupture.

Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold can lead to hypothermia and frostbite, which are both serious medical conditions. What is considered an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In Rhode Island, extreme cold usually involves temperatures below zero degrees Fahrenheit.

The wind chill index attempts to quantify the cooling effect of wind with the actual outside air temperature to determine a wind chill temperature that represents how cold people and animals feel, based on the rate of heat loss from exposed skin. A wind chill index of -5 indicates that the effects of wind and temperature on exposed flesh are the same as if the air temperature alone were five (5) degrees below zero (0), even though the actual temperature could be much higher. The NWS issues a wind chill advisory when wind chill temperatures are potentially hazardous and a wind chill warning when the situation can be life-threatening.

Location

Severe winter weather occurs town-wide / island-wide. Nor’easters, while often less dramatic than a hurricane, are far more frequent in Rhode Island, and can produce considerable damage. Although Block Island’s southerly coastal location makes it somewhat less prone to frequent heavy snowfall than inland Rhode Island communities, when

conditions and storm track are right, Block Island is vulnerable to severe winter storms and Nor'easters.

Although the island climate is tempered by the surrounding ocean waters, late winter weather delivers its fair share of snow. Typical heavy, wet snows can cause tree limbs and branches to break and produce power outages. Island storms tend to be accompanied by strong winds. Depending on the severity of the storm, ferry service to and from the island can be interrupted for several days.

Extent

Winter storms are a regular occurrence on Block Island, with snowfall ranging from a few inches to several feet, and including sustained winds or gusts 35 mph or greater, considerable drifting, loss of power, and damage to structures. New England's "Nor'easters" can at times be more destructive than hurricanes. This is due, in part, to their large size and slow speed, and also because they can form with little advanced notice, which limits time to prepare. Typically occurring between November and March, Nor'easters bring high winds and heavy prolonged precipitation. Howling winds associated with Nor'easters also have the potential to produce significant storm surge, similar to that of a Category 1 hurricane. In addition, they can also produce wind gusts to near hurricane force as well as flooding rain and crippling snowfall, ice buildup, tree and structural damage, and power outages. Nor'easters pose a threat to compromised structures. If a major snowfall accompanies the heavy wind, snow drifts can block roads for days. Other wind hazards include downed power and cable lines, cutting off power, telephone and Internet communications. Other impacts are severe beach erosion, large waves, flooding, and injury or loss of life.

Extent

The extent of a winter storm is generally described by meteorological conditions such as inches of snow, ice, or freezing rain; duration of event; and/or wind speed and temperature.

Severe Winter Weather Extent & Resources Links

The Northeast Snowfall Impact Scale (NESIS) is based on impact factors including population, and is not strictly a measure of extent.
https://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis

NWS Windchill Temperature (WCT) index addresses winter winds and freezing temperatures. http://www.nws.noaa.gov/om/winter/windchill.shtml

An ice storm is defined as greater than ¼ inch (http://w1.weather.gov/glossary/index.php?word=ice+storm).

Sperry-Piltz Ice Accumulation Index incorporates forecast ice accumulation, winds and temperatures; categories 0-5.
http://www.spia-index.com
Note: the 1998 ice storm in New England was likely a category 5.

Previous Occurrences and Probability of Future Events

Winter weather events in Rhode Island can be described as unpredictable. Snowfall and rainfall vary; however, Rhode Island residents can expect to experience several Nor'easters per year, which usually bring coastal erosion and a possibility for heavy rain or blizzard conditions depending upon the time of year and temperature. Table 8 details historic winter storms in the region.

Table 8 – Significant Snowstorms for Washington County

Date	Snowfall (inches)	Comments
January 7, 1996	12"-24"	Schools closed, transportation systems disrupted
February 2, 1996	6"-8"	Difficult travel
February 16, 1996	5"-7"	Highway travel disrupted
March 2, 1996	6"-11"	Many minor accidents reported
April 9, 1996	6"-10"	Heavy wet snow with scattered power outages
April 1, 1997	4"-7"	Heavy wet snow with scattered power outages
February 25, 1999	9"-12"	Hazardous travel, schools closed
March 15, 1999	11"	Poor travel conditions, schools closed
December 5, 2002	6"	No storm damage or injuries reported
February 7, 2003	6"-8"	No major problems reported
February 17, 2003	15"-20"	Storm fell on President's Day, only minor accidents reported
March 6, 2003	6"-10"	Dozens of minor accidents
December 5, 2003	10"-20"	Major disruption to transportation due to poor visibility
January 27, 2004	6"	No major problems reported
February 18, 2004	6"	Coastal storm, heavy snow and strong winds
January 23,2005	18 -21"	Widespread power outage, travel disrupted
February 13, 2005	6"	No major damage
February 21, 2005	6"	No major damage
February 25, 2005	6"	No major damage
December 20, 2009	18"	Power outages, travel disrupted
December 26-27, 2010	18"	Wide-spread power outages, gale force winds, trees knocked down, erosion, no ferry service
February 8-9, 2013	12-24"	Extensive power outages, high winds and heavy snow caused coastal erosion
January 1-2, 2014	7-8''	Heavy snow across Washington County
January 21-22, 2014	3-10''	Heavy snow across Washington County
February 15-16, 2014	6-9''	Heavy snow across Washington County
January 26-28, 2015	12''	Historic regional winter storm, one foot of snow fell on Block Island, heavy winds
March 5, 2015	8-12''	Snowstorm with heavier totals along coastal Rhode Island, SE Mass, Cape Cod and islands

Sources: National Climate Data Center and National Weather Service; Weather Station at BI Water Co., and The Block Island Times

The worst Nor'easter to affect Rhode Island in the last 100 years was the Blizzard of 1978. Snow accumulation reached 4 feet, and wind speeds exceeded 60 mph.

On Block Island, a Nor'easter on December 26, 2010 caused damage to part of the sidewalk on Ocean Avenue, adjacent to the Great Salt Pond. The earth underneath the concrete eroded and was washed away by the storm. This caused the sidewalk to become detached. It also added to the ongoing erosion along Corn Neck Road.

The February 2013 severe snowstorm affected all of New England. High winds and heavy snow caused damage to dunes and resulted in extensive power outages.

An historic winter storm brought heavy snow to southern New England with blizzard conditions to much of Rhode Island and eastern Massachusetts, beginning during the day on Monday, January 26 and lasting into the early morning hours of Tuesday, January 27, 2015. At its peak, snowfall rates of 2 to 3 inches per hour were common. Approximately one foot of snow fell on Block Island.

The National Climatic Data Center (NCDC) suggests that Rhode Island can anticipate between two and six significant winter weather events per season. Probability: New Shoreham is *highly likely* to be impacted by severe winter storms or Nor'easters over the next 5 years.

Coastal Erosion

Description

Coastal zones are dynamic areas that are constantly undergoing change in response to a multitude of factors, including sea level rise (SLR), wave and current patterns, hurricanes, coastal flooding and human influences. High winds and associated marine flooding from storm events such as hurricanes, Nor'easters, flooding and SLR, all increase the risk exposure along developed coastal lands. In addition to the natural processes that cause erosion, human alterations are affecting erosion rates.

The bluffs of Block Island represent a world-class exposure of a tectonic end moraine, and the complex stratigraphy and topography creates a vast array of landforms as the bluffs erode from waves during storms, as well as via surface water and groundwater processes.

Erosion has been wearing away bluffs and moving beaches and barriers along the coast from the powers of flooding, storm surge, rising sea levels, and high surf. As shorelines retreat inland, waterfront homes, public infrastructure such as roads, bridges, wastewater treatment facilities, and stormwater drainage systems, eventually become severely damaged.

Block Island is home to miles of spectacular coastal bluffs including the famed Mohegan Bluffs. These cliffs are a beautiful site, and can be observed from the top, where visitors can look out for miles on the Atlantic Ocean or climb down the steep staircase of over 100 steps and view them from the beach (also known as Corn Cove). Beaches and coastal bluffs are critically important attractions for the tourism industry on Block Island and are

vital economic, environmental, and cultural resources. A healthy, wide sandy beach provides protection against the effects of storm surge, coastal flooding, and high surf impacts. The beach and barrier environment provides habitat for marine and terrestrial organisms with beach dependent life stages and is home to species of indigenous and endemic Rhode Island plants.

Location

Most of the damage will occur in low-lying areas, nearby the Harbor areas and to critical roadways such as Corn Neck Road, Spring Street, and Ocean Avenue – areas also subject to the highest risk of flooding. Additional damage will also occur along coastal bluffs as waves reach higher on the shoreline and erode the toe of the bluff and gravity takes its course.

Extent

Extent of coastal erosion is typically measured in cubic yards of sand; meters/feet of coast lost. While visually majestic, the coastal bluffs of Block Island are extremely susceptible to erosion, in many locations at the rate of one foot or more per year. Through the years, the Mohegan Bluffs have eroded about 250 feet, and because of this, the Block Island Southeast Lighthouse had to be moved back 300 feet to keep it from being lost to the Ocean.

Impacts

The beaches, barrier spits and coastal bluffs of Rhode Island, and particularly of Block Island, are vital economic, environmental, and cultural resources. Acceleration of coastal erosion could have a significant impact on the local economy, natural environment, historic and cultural resources, and private property values.

Shoreline flooding and increased wave action contribute to the erosion of bluffs and dunes along the island's shores. This poses a risk to residences perched atop bluffs, and the island's lighthouses.

Coastal erosion caused by recent storms, including Hurricane Sandy, in 2012, unearthed long-buried landfill debris causing debris to spill onto the beach below. This prompted the Hazard Mitigation Committee to add an action item to the Plan to mitigate the effects of this erosion.

Previous Occurrences and Probability of Future Events

Coastal erosion is an ongoing natural process, however, it can be assumed that some previous significant storm events such as high winds, flooding, hurricanes, Nor'easters, have contributed to an acceleration of coastal erosion or have increased the risk of future coastal erosion.

The Transfer Station is located in the northern part of the island, which is bounded on two sides by the ocean. This area usually takes the brunt of storms. During the December 26, 2010 storm, vehicles that had been buried at the Transfer Station for decades were

unearthed due to erosion resulting from the storm. The transfer station was also impacted by erosion during Hurricane Sandy.

In 1993, the Southeast Lighthouse was lifted and moved 300 feet back from the eroding bluff edge. On April 10, 2001 a private property lost 1/3 of an acre of land when it succumbed to erosion on the South side of the island. Trails at Clayhead Trail, at the Northeast of the island, have also had to be moved back from the cliff's edge due to dangerous conditions caused by erosion, and the steps leading the DEM property at Mohegan Bluffs have required reconstruction for the same reason.

During Hurricane Irene, the west side of the island was subjected to some erosion. Outside of the harbors area, there was considerable beach erosion and damage to the dune system, particularly along Crescent Beach. The Block Island Conservation Commission responded with a plan to install snow fencing to capture the sand, allowing the dunes to rebuild in a cost-effective and sustainable manner. The Conservation Commission, together with the BI Residents Association, purchased (with donations) 90 rolls of fencing and installed it along several access paths to the beach during three community work days in late March and early June 2013, events which attracted a total of over a hundred and fifty volunteers. Beach grass or beach roses are to be planted later as the dunes re-establish. Signs were installed to remind people to stay off the dunes.

When Superstorm Sandy made landfall in the Northeast on Oct. 29, 2012, it left in its wake extensive erosion along the coast of Block Island, RI. To document the erosion, Bryan Oakley, with the assistance of students, undertook an evolving research project that culminated in a presentation at a meeting of the Geological Society of America (GSA). Approximately 400 photos at GPS points along the Block Island coastline were taken. Using a variety of software, and after a lengthy editing process, the images can now be viewed through Google Earth for the public and other scientists to reference.

Block Island Bluff Photograph Database

http://www.easternct.edu/oakleyb/bi-bluff-photos/

> *The overarching goal of this project was to document bluff erosion that occurred on Block Island, Rhode Island during Superstorm Sandy, by compiling field photographs of the ground condition of the bluffs after the storm. This project began as a way for Bryan Oakley, Ph.D., Professor Of Environmental Geoscience, Eastern Connecticut University, to take a photographic inventory of the bluff to aide interpretation of topographic profiles measured in digital elevation models created using airborne Light Detection and Ranging (LiDAR) in 2011 (pre-Sandy) and November 2012 (post-Sandy). It quickly evolved into a larger project, and the creation of an on-line database as a 'virtual' field-trip for the bluffs of Block Island. Utilizing Google Drive, Google Earth and Spreadsheet mapper, the images can be housed on an external website, and accessed via the Google Earth KMZ file.*

New Shoreham is *highly likely* to be impacted by coastal erosion over the next 5 years.

Sea Level Rise

Description

Climate change and sea level rise are not issues to be addressed in the distant future but something already present and recordable, requiring Block Island to take action now to mitigate potential impacts. The main issues surrounding climate change are rising global temperatures, and the resulting increase in weather extremes such as more frequent floods, droughts and rising sea levels. Climate change and sea level rise also has the potential for displacement of coastal populations and threatened infrastructure.

According to the Rhode Island Coastal Resources Management Council (CRMC), potential effects of a rise in sea level include:

- INCREASED EXTENT OF FLOOD DAMAGE AND GREATER VULNERABILITY TO STORM SURGES IN LOWER ELEVATIONS;
- GREATER RISK TO INFRASTRUCTURE—ROADS, SEWERS, STORMWATER FACILITIES, UTILITIES—IN AREAS MORE PRONE TO FLOODING;
- SALTWATER INTRUSION INTO AQUIFERS CONTAMINATING WATER SUPPLIES;
- HIGHER WATER TABLES RESULTING IN SUBSURFACE ISSUES SUCH AS WET BASEMENTS;
- HIGHER WATER TABLES POTENTIALLY AFFECTING LOW LYING ONSITE WASTEWATER TREATMENT SYSTEMS IN CLOSE PROXIMITY TO THE SHORELINE, ESPECIALLY WITHIN GREAT SALT POND
- A SIGNIFICANT INCREASE IN INCIDENCE OF EXTREME HIGH TIDE LEVELS;
- MORE COASTAL LANDS BECOMING SUSCEPTIBLE TO EROSION DUE TO INCREASED INTENSITY AND FREQUENCY OF STORMS;
- A NET LOSS OF COASTAL MARSHES THAT BECOME INUNDATED AT A GREATER RATE, RESULTING IN A LOSS OF SALT MARSH VEGETATION AND AN ALTERATION OF HABITAT TYPES.

Block Island is one of the most susceptible communities in the State to impacts from projected rises in sea level. *Recent NOAA scenarios, which CRMC adopted in 2016 for planning purposes (CRMP Section 145), project 2 meters (6.6 feet) of sea level rise by 2100. One foot of sea level rise is expected by 2035.*

In 2013, the Town conducted a sea level rise adaptation study which identified potential strategies the town can implement to prepare for and mitigate potential impacts of sea level rise. Inundation mapping conducted as part of the study shows land, docks, and roadways surrounding the Great Salt Pond as being either inundated by sea level rise or more susceptible to flooding during extreme storm conditions as a result of sea level rise.

Impacts

Sea level rise has the potential to cause dramatic impacts to Block Island's natural resources and infrastructure and as a result commerce and quality of life. The main issues surrounding climate change are rising global temperatures, and the resulting increase in weather extremes such as more frequent floods, droughts and rising sea levels. Climate change and sea level rise also has the potential for displacement of coastal populations and threatened infrastructure.

As a result of sea level rise, both hurricanes and severe winter storms will be more damaging to property on Block Island, and coastal flooding effects will be felt farther inland. For instance, storm surge heights will increase as sea level rises, resulting in many more properties being damaged or destroyed during a storm. Residential and commercial structures, roads, and bridges will be more prone to flooding. Sea level rise will also reduce the effectiveness and integrity of existing seawalls and revetments, designed for historically lower water levels.

The combination of higher sea levels and high tides, along with increased frequency of more severe storms will result in greater coastal flooding and erosion, and more widespread property and infrastructure damage.

Sea level rise, even if not immediately threatening in the form of inundation to a particular coastal site, has a negative impact in other ways. The elevation of a spring high tide today could be the equivalent of a daily high tide in the future, and surges during storms, especially in conjunction with a high tide, will be greater in intensity. The shoreline will also be subject to greater storm induced erosion.

Climate change and sea level rise is a potential major threat to marine and wildlife populations and habitats on Block Island. It is anticipated that sea level rise will have a substantial impact on the coastal features, marshes, wetlands and coastline habitat on Block Island. More frequent and severe storm events will also contribute to an acceleration of bluff erosion and dune destabilization.

With the likely potential of over six and a half feet of sea level rise by the end of this century, as predicted by NOAA (National Oceanic and Atmospheric Administration), several roads on the island may be inundated twice daily and access to Sandy Point could be compromised. Block Island must continue to plan for and implement adaptation measures to lessen the impacts of climate change and sea level rise.

Location

GIS analysis conducted as part of the 2016 New Shoreham Comprehensive Plan update indicates that portions of Corn Neck Road (5 sections), Ocean Avenue (5 sections) and Beach Avenue (2 sections) are projected to be inundated as a result of 3 to 5 feet of sea level rise.

See Map NHC4 SLAMM (Sea Level Affecting Marshes Model) in the Comprehensive Plan for a visual of the potential impact on saltwater marshes at the 1-foot, 3-feet, and 5-feet sea level rise scenarios. SLAMM maps are available statewide at http://www.crmc.ri.gov/maps/maps_slamm.html. CRMC reports that, based on the Seal Level Affecting Marshes Model (SLAMM), Block Island is projected to lose 3.6, 49.6 and

61.4 acres of marshes with 1, 3, and 5 feet of sea-level rise, respectively. Considering that the island has a total of about 72 existing coastal wetlands as of 2010, these projected losses are very significant and would result in substantial habitat loss.

Block Island Harbors Sea Level Rise Study, 2013

In 2013, the Town conducted a Sea Level Rise Adaptation Study which identified potential strategies the town can implement to prepare for and mitigate potential impacts of sea level rise. Inundation mapping conducted as part of the study shows land, docks, and roadways surrounding the Great Salt Pond as being either inundated by sea level rise or more susceptible to flooding during extreme storm conditions as a result of sea level rise. Specific strategies to mitigate the impacts of sea level rise include the raising of roadbeds and flood-proofing of pump stations.

Preliminary project mapping was prepared by the New Shoreham GIS Department applying the digital elevation model of coastal Rhode Island made available through the Rhode Island Sea Grant Program. These maps show the impact of one, three and five foot sea level rise, as well as the areas inundated by the Hurricane of 1938, on the entire island, with more detail focused on the area between Old Harbor and New Harbor. The model uses elevations of the coastal areas of the state based on the consolidation of a number of digital elevation data sources, including bathymetric data, and tidal conditions as measured by the Newport tide gage.

A goal of this project is to verify and improve the level of detail provided by these preliminary maps, and to show the various degrees of inundation that will occur under various sea level rise and storm surge scenarios. Of particular interest are impacts on the Old Harbor breakwater, the docks, the ferry landing and staging area, the land areas and adjoining docks at New Harbor, and many of the roadways in between and leading to other parts of the island.

A second set of maps was generated using data from the statewide LiDAR survey of 2011. This more accurate depiction of elevations on the island, along with 2011 aerial photography, provided valuable information for education and public discussion. The maps showed cumulative impacts of four inundation scenarios: the elevation of mean higher high water (MHHW) plus one foot sea level rise (SLR); three foot SLR; one foot plus three foot storm surge; and five foot SLR.

OLD HARBOR AND MARINE FACILITIES

Preliminary mapping showed that under the most extreme scenario, five foot SLR, the breakwater that forms the harbor of refuge would be partially inundated, along with up to half of the ferry landing area. The updated project mapping shows significant inundation impacts on the breakwater, particularly the west and north sections. Dramatic results will occur as sea level rise reaches three feet, when these sections of the breakwater will be entirely submerged. The eastern section of the breakwater will be narrowed under three foot SLR and significantly compromised under five foot SLR. A portion of the beach area between Ballard's and the south end of the eastern breakwater will be submerged under five foot SLR. These scenarios show that, as sea level rises, the breakwater as currently constructed would be expected to provide only marginal protection to the inner harbor area, and certainly would be breached by waves on top of storm surge generated by tropical and extra-tropical storms.

North and West Sections of Old Harbor Breakwater

As sea level rise reaches three feet, some of the marine facilities and shore-side areas of Old Harbor will become flooded. The town dock and adjoining landside area, including the harbormaster's building, will all be inundated, as will the area alongside the ferry docks and the ferry office and ticket building. A three foot storm surge on top of one foot SLR will flood a significant portion of the area, impacting all of the buildings except the freight office. As sea level rise reaches five feet, Old Harbor will become a much different place than it is today, as most of the landing area will be inundated, including all the buildings and about half the parking and queuing area. The natural shoreline (small beach area) west of the ferry site will eventually loose area to inundation because of its lower elevation. Given the possibility of stronger storm surges, the impacts from rising sea level will be quite dramatic long before the five foot scenario occurs.

Roadways between Old Harbor and New Harbor

Access out of Old Harbor includes a number of roads – Spring Street, High Street, Old Town Road – that lead to the central and southern parts of the island. These all rise in elevation and are not subject to any foreseeable inundation scenarios. However, as climate changes, some roads will be subject to more severe and frequent storm induced erosion damage. The section of Spring Street damaged by Hurricane Sandy adjoins a bluff that was undercut by wave action. The narrow part of Corn Neck Road was damaged by waves accompanying the storm surges of Hurricane Sandy. While the actual loss of the road to the rising sea appears to be many years away, it will be subject to storm erosion.

For the village area road network, the impact of sea level rise will be increased flooding and the eventual submergence of some sections. The two bridges – Beach Avenue, near its intersection with Corn Neck Road, and Ocean Avenue, approaching New Harbor – are vulnerable as well. The roads and bridges connecting Old Harbor to New Harbor include many areas that are vulnerable to flooding from the large inland water bodies tidally connected to the Great Salt Pond – Harbor Pond and Trim's Pond. As sea level rises, the geography of the area connecting the harbors will be dramatically impacted, requiring that alternatives to the present roadway configuration be developed.

The impacts will be noticeable as sea level rise reaches three feet. Ocean Avenue, between the intersection with Corn Neck Road (Bridge Gate Square) and Beach Avenue, will be inundated in a couple of areas, including its intersection with Connecticut Avenue, which connects with Old Town Road to the south and is an access to the center of the island. Beach Avenue, west of its intersection with Ocean Avenue and another important access to the center of the island, will be inundated due to flooding associated with a large wetland system behind the Block Island power plant. Most dramatically, the section of Ocean Avenue between the Hog Pen and Payne's Dock, including its intersection with West Side Road, the major road connecting New Harbor with the outlying residential areas, will be completely flooded on an average high tide.

As sea level rise reaches five feet, the flooded areas described above will be enlarged significantly; most of Ocean Avenue between Bridge Gate Square and Beach Avenue will be inundated, as will both approaches to the Beach Avenue Bridge, cutting off connection to Corn Neck Road. Corn Neck Road will be flooded along its west side from a rising Trim's Pond. At its present elevation, the Ocean Avenue Bridge will be lost, as will a small complex of buildings on the west side of Ocean Avenue just south of the bridge.

With no changes to infrastructure, the result of three foot SLR, and eventually five foot SLR, will be the isolation, in terms of public roadway access, of a number of areas in and around the village and New Harbor. This includes residential and commercial areas adjoining most of Ocean Avenue west of Bridge Gate Square. When the bridges are damaged or become impassable, the peninsula that separates the east portion of Trim's Pond from Harbor Pond, traversed east-west by Beach Avenue, will be cut off from both Corn Neck and New Harbor, and from the remainder of the island by flooding along Beach Avenue to the west and that described along Ocean Avenue. This area includes a number of residences and some inns, but most significantly, the public safety buildings – the police station, and next door, the fire station which also houses the island's ambulance services.

New Harbor

In New Harbor, all the marine facilities will eventually sustain impacts to some degree. The shoreline areas alongside the three dock structures will eventually succumb to higher sea levels, requiring adjustments. The buildings associated with Champlin's Marina, and with the Boat Basin, including a commercial building and a popular restaurant, appear to be protected by elevation. However, the dock at Champlin's, and more significantly, Payne's Dock, show inundation as sea level rise reaches three feet. A large wetland system lying between Champlin's and the Boat Basin can absorb a lot of the eventual flooding impact. However, as sea level rises, the impacts of storm surges will become more significant and as it reaches five feet, the Boat Basin complex will be cut off from West Side Road.

More significant is the permanent loss of a large low-lying area between Payne's Dock and the Hog Pen on both sides of Ocean Avenue, which as stated above, will be completely inundated at three foot SLR. On the west side it includes a cottage associated with the Narragansett Inn property, a mostly hilly parcel which lies between the Boat Basin and Payne's Dock and fronts a small beach (unaltered shoreline). On the east side of Ocean Avenue the doomed area supports a large restaurant, a small residence and the BI Maritime Institute building which also houses a restaurant. At five foot SLR more of this area will be inundated, as will the Ocean Avenue Bridge (at its present elevation).

This inundation scenario indicates an opening between two sections of Trim's Pond near its inlet with the Great Salt Pond by the submergence of a significant area of low-lying land. This will result in the creation of a small island in the middle of an enlarged Trim's Pond; if the Ocean Avenue Bridge is abandoned, it will have no roadway connection to the rest of the island. This small area is partially developed, used for marina and boat rental activities and the storage of individual oil tanks, but with no permanent structures. The complete inundation of the lower section of Ocean Avenue will mean that someday the only way to connect New Harbor with the rest of the island, including Beach Avenue, will be by West Side Road.

Long-term impacts of sea level rise may require the relocation of the town's boat ramp at New Harbor.

Sewer Lines and Pump Stations

The village area subjected to the impacts of climate change and sea level rise is also associated with the Town's water and sewer districts. The Town's sewage treatment processing facility is located just south of the Old Harbor village area on Spring Street and does not appear vulnerable to either storm surges or sea level rise. It also has two diesel

generators, used to run the sewage treatment plant during the summer season as an alternative to the high cost of electricity on the island.

Sewer lines run along all of the streets in the village area and a short distance along Corn Neck Road. Ocean Avenue has sewer lines for its entire length; this line which continues along West Side Road, provides sewer services to all of the marine businesses – Payne's Dock, the Boat Basin and Champlin's Marina. There are a number of pump stations, five shown within the study area.

Extent

In the northeast over the past half century, sea levels have been increasing three to four times faster than the global average rate, resulting in a 6 inch rise between 1970 and 2012. Block Island is one of the most susceptible communities in the State to impacts from projected rises in sea level. **Recent NOAA scenarios project 2 meters (6.6 feet) of sea level rise by 2010.**

Links to Resources for Sea Level Rise Extent

RI CRMC SLAMM Project report and maps: www.crmc.ri.gov/maps/maps_slamm.html

http://climate.nasa.gov/vital-signs/sea-level/

NOAA Sea Level Rise Viewer https://coast.noaa.gov/digitalcoast/tools/slr

Sea Level Rise and Nuisance Flood Frequency Changes around the US, NOAA, 2014
http://tidesandcurrents.noaa.gov/publications/NOAA_Technical_Report_NOS_COOPS_073.pdf

Previous Occurrences and Probability of Future Events

Climate change and sea level rise are not issues to address in the distant future but something already present and recordable, requiring Block Island to take action now to mitigate potential impacts. In Rhode Island, as in the other New England states, there has been a documented increase in the average annual air temperature, as well as the temperature of Narragansett Bay. The amount of precipitation has increased gradually over the past 100 years, which has resulted in more intense storms with greater flooding, although there is less snow in the winter. The intensity of hurricanes has increased, and sea level rise is evident; as measured at tide gages in Newport, sea level has increased 8.7 inches since 1930.

Probability: It is *highly likely* that a sea level rise could impact Block Island over the next 5 years.

The following hazards profiled are of low priority.

Drought and Extreme Heat

Description

Drought is characterized as a continuous period of time in which rainfall is significantly below the norm for a particular area. The American Meteorology Society defines drought as a period of abnormally dry weather sufficiently long enough to cause a serious hydrological imbalance. Drought differs from other natural hazards in that it is not something that occurs suddenly. Rather, a drought evolves over months or even years and, while causing very little structural damage, can have profound economic, environmental, and social impacts.

Four methods are used to define the severity of drought: meteorological, hydrological, agricultural, and socioeconomic. Meteorological drought refers to a reduction in the normal rainfall for a given geographic area. This is area-specific, as the average rainfall can vary greatly in different areas. Hydrological drought is based on the amount of surface and groundwater relative to normal levels. Agricultural drought pertains to the amount of moisture in soil available for plants. Socioeconomic drought measures the impact of any or all of the first three on people and businesses.

Location

The risk of drought is island-wide.

Impact

Block Island's groundwater supplies are finite, irreplaceable, and essential to the town's quality of life and economic wellbeing. The island's freshwater ponds are vital elements in the island's environmental system and public and private drinking water supply. The Rhode Island Department of Environmental Management (DEM) has classified the groundwater under all of Block Island as "GAA," the highest classification, which, in most communities, is limited to highly selective areas. Because the water supply is replenished only by rainfall, a drought would have a significant impact on all aspects of the island's wellbeing.

With a large percentage of Block Island residents dependent on private wells for drinking water, a prolonged drought would pose a major health hazard if its effects on the water supply were not mitigated with preventive measures. Additionally, a drought would have a negative economic impact.

Extent

The Palmer Drought Severity Index (PDSI), shown in Table 9 below, was devised in 1965. It was the first drought indicator to assess moisture status comprehensively. It uses temperature and precipitation data to calculate water supply and demand, incorporates soil

moisture, and is considered most effective for unirrigated cropland. It primarily reflects long-term drought and has been used extensively to initiate drought relief.

Palmer Drought Severity Index
https://www.drought.gov/drought/content/products-current-drought-and-monitoring-drought-indicators/palmer-drought-severity-index
U.S. Drought Monitor
https://www.drought.gov/drought/content/products-current-drought-and-monitoring-drought-indicators/us-drought-monitor
Keetch-Byram Drought Index (KBDI) – developed to assess fire risk
https://www.drought.gov/drought/content/products-current-drought-and-monitoring-wildfire/keetch-byram-drought-index

Table 9 - Palmer Drought Severity Index	
Severity	*Index Value*
Extreme Drought	-4 or less
Severe Drought	-4 to -3
Moderate Drought	-3 to –2
Mild Drought	-2 to –1
Incipient Dry Spell	-1 to –0.5

Given past experience (no severe droughts recorded on Block Island), the extent estimate for a potential future drought is mild to moderate.

Previous Occurrence and Probability of Future Events

Extended droughts are rare in Rhode Island with a record of six major droughts (those lasting more than one year) since 1929. The longest and most severe drought occurred in 1963-1967, and affected most of the Northeast. Water shortages affected most communities in Rhode Island and several municipal supply wells were drilled to augment declining public supplies. No severe droughts have been recorded for Block Island.

The Water District has planned for emergencies, including drought, and has a system of primary sources with redundant back-up sources in the event of emergency need. When installed, the individual water supply systems distributed across the island typically are designed with location and depth that should assure continued adequate supply even in droughts of historic severity.

The Rhode Island Drought Steering Committee assigns drought levels for the seven designated drought regions in the state, based on hydrological indices such as precipitation, groundwater, stream flow, and the Palmer Drought Index (PDI), as well as local supply indices such as static groundwater and reservoir levels. Normal, Advisory, and Watch levels

are issued statewide. Warning and Emergency levels are issued on a regional basis and consider local conditions, source of water supply, and water storage capacity issues.

With or without drought conditions, New Shoreham encourages water conservation measures, and publishes public service announcements educating residents and visitors and encouraging them to conserve water and other natural resources. The Town does not have any plans in place to address water shortage.

The current and future demand for water in New Shoreham is a function of the population growth. Since the population is expected to grow only slightly during the next 25 years, water needs are not expected to increase significantly.

Probability: New Shoreham is *unlikely to be impacted by a drought or extreme heat* over the next 5 years.

Earthquakes

Description

An earthquake is caused by a sudden displacement within the earth. Strong and destructive earthquakes usually result from the rupturing or breaking of great masses of rocks far beneath the surface of the earth. All earthquakes produce both vertical and horizontal ground shaking. This begins at the focus or hypocenter, deep in the earth, and spreads in all directions. The felt motion is the result of several kinds of seismic vibrations. The primary, or P waves are compressional. The secondary, or S waves have a shear motion. These body waves radiate outward from the fault to the ground surfaces where they cause ground shaking.

Geologists have found that earthquakes tend to reoccur along faults, which reflect zones of weakness in the Earth's crust, a theory known as plate tectonics. Earthquakes beneath the ocean floor sometimes generate immense sea waves or tsunamis. These waves travel across the ocean at speeds as great as 597 mph, and may be 49 feet high or higher by the time they reach the shore. Liquefaction, which happens when loosely packed, water-logged sediments lose their strength in response to strong shaking, causes major damage during an earthquake.

Location

New Shoreham, Rhode Island is located in a region of the North American tectonic plate and falls within seismic Zone 2A with 8-16% ground acceleration, which translates to a "moderate" seismic hazard. People may experience moderate intensity shaking that can lead to slight damage during an earthquake event. There are no significant geologic fault lines in New Shoreham or the surrounding regions of Rhode Island or New England, and the USGS Earthquake Hazards Program identifies all of Rhode Island as a low seismic risk area. Earthquakes occur infrequently in Rhode Island and surrounding New England, but historically earthquakes originating in other states have been felt in various parts of Rhode Island. The risk of an earthquake is equal town/island-wide / a specific location on Block Island is not predictable.

Impact

The fast moving P waves are the first to cause the vibrations of a building. The S waves arrive next and may cause a structure to vibrate from side to side. Rayleight and Love waves (surface waves), which arrive last, cause low-frequency vibrations and are more likely to cause tall buildings to vibrate. Surface waves decline less rapidly than body waves, so as the distance from the fault increases, tall buildings located at relatively great distances from the epicenter can be damaged.

Impacts from earthquakes can be severe and cause significant damage. Ground shaking can lead to the collapse of buildings and bridges and damage to gas and electric lines, phone service, and other critical utilities. Death, injuries, and extensive property damage are possible. Secondary hazards resulting from earthquakes include fire, hazardous material spills, landslides, flash flooding, avalanches, tsunamis, and dam failure.

If Block Island experienced a strong earthquake, critical facilities and services, town buildings, and residences could be impacted with potential structural damage. The effects could impact transportation, communications, power, and emergency capabilities.

Extent

The severity of an earthquake can be measured in terms of both intensity and magnitude. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. The scale currently used in the United States is the Modified Mercalli Intensity (MMI) Scale (See Table 10). This scale is composed of 12 increasing levels of intensity, ranging from imperceptible shaking to catastrophic destruction, and is an arbitrary ranking based on observed effects. Magnitude is a measure of the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of the earthquake waves recorded on instruments which have a common calibration, called seismographs, using the Richter Magnitude Scale (See Table 10). The Richter scale does not express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does no damage. Large magnitude earthquakes occurring beneath the ocean may not even be felt by humans.

Events with magnitudes of 4.5 or greater are strong enough to be recorded by sensitive seismographs. Great earthquakes have magnitudes of 8.0 or higher. On average, one earthquake of such size occurs somewhere in the world each year.

Table 10- Richter Magnitude Scale and the Modified Mercalli Intensity Scale	
Richter Magnitude Scale	***Modified Mercalli Intensity Scale***
1.0 to 3.0	I
3.0 to 3.9	II
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX
7.0 and Higher	VIII or Higher
Defined Modified Mercalli Intensity Scale Rating	
I	Not felt except by a very few under especially favorable conditions
II	Felt only by a few persons at rest, especially on upper floors of buildings
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors, disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, wallks. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Previous Occurrences and Probability of Future Events

Rhode Island is not prone to major earthquakes; however, they are not unknown to the area, although usually felt only as a slight rumble lasting seconds. Despite the low probability of a high impact earthquake, some physical characteristics in Rhode Island may increase the vulnerability to earthquakes. These include New England's hard base rock, which increases the conduction of seismic energy; the soft soil present in New England's coastal regions, which can magnify an earthquake's effects; the large number of older, unreinforced masonry structures in New England, which make them very vulnerable to seismic forces; and low public awareness of earthquake threat or preparation for this hazard.

As Table 11 shows, Block Island has experienced the effects of several earthquakes in the past. The most recent earthquake centered in Rhode Island was near Exeter in December of 2012, measuring 1.0 on the Richter Scale. Most quakes felt in Rhode Island are centered in surrounding states. Therefore, earthquakes should be considered a hazard to Block Island, but with low priority.

Table 11 – Significant Earthquakes in Region		
Date	**Point of Origin**	**Impact on RI**
February 28, 1925	St. Lawrence River region	Intensity V affects felt on Block Island and in Providence. Intensity IV effects felt in Charlestown
November 19, 1929	Grand Banks of Newfoundland	Moderate vibrations felt on Block Island and in Chepachet, Newport, Providence and Westerly
November 1, 1935	Quebec, Canada	A magnitude of 6.25 with intensity IV felt on Block Island and in Providence and Woonsocket
December 20 & 24, 1940	Lake Ossipee, NH	Intensity V affects knocked pictures off walls in Newport. Intensity IV effects were felt at Central Falls, Pascoag, Providence and Woonsocket. Intensity I-III effects were felt at Kingston, New Shoreham and Wakefield.
September 4, 1944	Massena, NY	Intensity I-III reported in Kingston, Lonsdale, Providence, Wakefield and Woonsocket
October 16, 1963	Coast of Massachusetts	A magnitude 4.5 quake caused Intensity V to be felt in Chepachet with reports of some cracked plaster. There were also reports of rattling windows and dishes and rumbling earth sounds. Other Northern RI locations felt the tremor, but with less intensity.
December 7, 1965	Unknown	Windows and doors shook in Warwick and furniture and small objects moved in Bristol.
February 2, 1967	Unknown	A magnitude 2.4 created intensity V effects in Middletown, Newport, North Kingstown and Jamestown. No damage reported.
February 3, 1973	Unknown	Explosion like or sonic boom noises were heard throughout RI and houses and windows shook, but nothing was reported by seismographs.
June 14, 1973	Western Maine	Intensity IV effects felt at Charlestown and Intensity I-III felt at Bristol, E. Providence, Harmony and Prov.
October 6, 2003	West Warwick	A magnitude of 1.8 caused minor shaking in the community, no damage reported
November 2007	West of Warwick, RI	Unknown
August 2011	Near South Kingstown, RI	0.9 magnitude earthquake
December 2012	Near Exeter, RI	1.0 magnitude earthquake

Source: US Geological Survey; Earthquake History of Rhode Island

However, Earthquakes are impossible to predict with any degree of accuracy. Rhode Island is located in an area of moderate seismicity and high risk. Seismic risk applies to the seismic hazard, location demographics, and regional economics to the vulnerabilities of the structure or lifeline on the site. Seismologists have estimated that there is about a 50% probability of a very damaging magnitude 5.0 earthquake occurring anywhere in New England in a 50 year period.

Probability: New Shoreham is *unlikely to be impacted by an earthquake* over the next 5 years, however, it is *possible*.

Tornadoes

Description

A tornado is a violently rotating column of air in contact with and extending between a cloud and the surface of the earth. Winds in most tornadoes are 100 mph or less, but in the most violent, and least frequent tornadoes, wind speeds can exceed 250 mph. Tornadoes typically track along the ground for a few miles or less and they measure less than 100 yards wide, though some can remain in contact with the earth for well over fifty miles and exceed one mile in width.

Several conditions are required for the development of tornadoes and the thunderstorm clouds with which most tornadoes are associated. Abundant low level moisture is necessary to contribute to the development of the thunderstorm and a “trigger” (perhaps a cold front or other low level zone of converging winds) is needed to lift the moist air aloft. Once the air begins to rise and becomes saturated, it will continue rising to great heights and produce a thunderstorm cloud, if the atmosphere is unstable. An unstable atmosphere is one where the temperature decreases rapidly with height. Finally, tornadoes usually form in areas where winds at all levels of the atmosphere are not only strong, but also turning with height in a clockwise direction.

A tornado begins in a severe thunderstorm called a super cell. A super cell can last longer than a regular thunderstorm. The wind coming into the storm starts to swirl and forms a funnel. The air in the funnel spins faster and faster and creates a very low pressure that sucks more air (and sometimes objects) into it. The severe thunderstorms that produce tornadoes form where cold dry polar air meets warm moist tropical air. This is most common in a section of the United States called Tornado Alley.

Tornadoes can form at any time during the year, but most occur in May, although northern areas experience the peak tornado season later. Tornadoes are measured by the damage they produce and the wind speed they generate. The Storm Prediction Center issues tornado and severe thunderstorm watches. A tornado watch does not indicate an imminent tornado, but rather an advisory to be alert and prepared to seek shelter. If a tornado has been detected, or if Doppler radar identifies a thunderstorm circulation capable of spawning a tornado, a tornado warning is issued by the local National Weather Service (NWS) office.

Location

New Shoreham is located outside of Tornado Alley, which extends from Texas to the Dakotas. However, tornadoes may occur in Rhode Island including New Shoreham at any time. These can be dangerous because Rhode Island tornadoes are rare, residents do not expect them, and are ill-prepared to respond to a tornado. In New Shoreham, tornadoes are considered to be low frequency, high-impact events.

Impact

The immediate threat of a tornado is danger to life and property from wind and large debris carried by wind. Other vulnerabilities include electrical utilities, gas lines, and communications infrastructure, and also water mains and sewer systems. A tornado has the potential to cause outages for residents, businesses, and critical facilities, as well as danger to personal safety. Downed wires and lightning strikes can also start fires. Human vulnerability is dependent upon early warnings of tornadoes, and access to adequate shelter. Indoor shelter on the lowest floor of a substantial building away from windows is the best protection from bodily harm.

Extent

Table 12 below describes the Enhanced Fujita Tornado Damage Scale. Implemented in 2007, the Enhanced F-scale is a set of wind estimates (not measurements) based on damage. It uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to the 28 indicators listed below. These estimates vary with height and exposure. Important: The 3 second gust is not the same wind as in standard surface observations. Standard measurements are taken by weather stations in open exposures, using a directly measured, "one minute mile" speed.

Table 12: Enhanced F Scale for Tornado Damage

FUJITA SCALE			DERIVED EF SCALE		**OPERATIONAL EF SCALE**	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	**EF Number**	**3 Second Gust (mph)**
0	40-72	45-78	0	65-85	**0**	**65-85**
1	73-112	79-117	1	86-109	**1**	**86-110**
2	113-157	118-161	2	110-137	**2**	**111-135**
3	158-207	162-209	3	138-167	**3**	**136-165**
4	208-260	210-261	4	168-199	**4**	**166-200**
5	261-318	262-317	5	200-234	**5**	**Over 200**

Enhanced F Scale Damage Indicators

NUMBER (Details Linked)	DAMAGE INDICATOR	ABBREVIATION
1	Small barns, farm outbuildings	SBO
2	One- or two-family residences	FR12
3	Single-wide mobile home (MHSW)	MHSW
4	Double-wide mobile home	MHDW
5	Apt, condo, townhouse (3 stories or less)	ACT
6	Motel	M
7	Masonry apt. or motel	MAM
8	Small retail bldg. (fast food)	SRB
9	Small professional (doctor office, branch bank)	SPB
10	Strip mall	SM
11	Large shopping mall	LSM
12	Large, isolated ("big box") retail bldg.	LIRB
13	Automobile showroom	ASR
14	Automotive service building	ASB
15	School - 1-story elementary (interior or exterior halls)	ES
16	School - jr. or sr. high school	JHSH
17	Low-rise (1-4 story) bldg.	LRB
18	Mid-rise (5-20 story) bldg.	MRB
19	High-rise (over 20 stories)	HRB
20	Institutional bldg. (hospital, govt. or university)	IB
21	Metal building system	MBS
22	Service station canopy	SSC
23	Warehouse (tilt-up walls or heavy timber)	WHB
24	Transmission line tower	TLT
25	Free-standing tower	FST
26	Free standing pole (light, flag, luminary)	FSP
27	Tree - hardwood	TH
28	Tree - softwood	TS

Given previous occurrences in the region, the estimated extent of a potential future tornado on Block Island would be an F-Scale between 0 and 3.

Previous Occurrences and Probability of Future Events

While uncommon, tornadoes in New England can inflict substantial damage. From 1950 to present, approximately 20 tornadoes were reported in or near Rhode Island, but none as devastating as the two tornadoes that hit Worcester Massachusetts on July 9, 1953 (F-scale of 4 and 3), leaving 94 killed and nearly 1,300 injured. The strongest tornado (F-scale of 2) on record in Rhode Island occurred on August 7, 1986, in the Providence, Cranston area, causing 20 injuries, and significant property damage. A powerful series of tornadoes occurred on June 1, 2011 (F-scale of 3, 1 and 0) spanning southwest and south-central Massachusetts and southern Maine. Four tornadoes touched down in Massachusetts, resulting in three deaths, over 200 injuries, and $140 million in property damage. On July 28, 2014, a tornado (EF-2) touched down in the coastal community of Revere, Massachusetts. At least 65 buildings were destroyed or damaged, and over 2,800 residents lost power.

Block Island has no record of tornadoes. The National Climatic data center reports an average of 0 tornadoes per year in Rhode Island, and the Tornado Project reports that there have been 1 tornado in Washington County between 1950 and 2012. The event occurred on August 10, 2012 (F-scale of 0).

There was a microburst reported on Block Island on August 18, 2010. A microburst is a small downdraft that moves in a way opposite of a tornado.

Based on this history, it can be concluded that a tornado on Block Island would be a very rare event; however it cannot be ruled out because the conditions that generate tornadoes can happen anywhere.

Probability: New Shoreham is *unlikely* to be impacted by a tornado during the next 5-years.

Wildfires

Description

Wildfires are fueled by natural cover, including native and non-native species of trees, brush, grasses, and crops, along with weather conditions and topography. While fuel, topography, and weather provide the conditions that allow wildfires to spread, many wildfires are caused by people, through criminal or accidental misuse of fire. Wildfires pose serious threats to human safety and property in rural and suburban areas. They can destroy crops, natural resources, recreation areas, and critical wildlife habitat.

Climatic and meteorological conditions that influence wildfires include solar insulation, atmospheric humidity, and precipitation, all of which determine the moisture content of wood and leaf litter. Dry spells, heat, low humidity, and wind increase the susceptibility of vegetation to fire. In Rhode Island, common factors leading to large fires include short-term drought, humidity below 20%, and fuel type.

New Shoreham, like the rest of Rhode Island, generally experiences a humid continental climate, with hot, rainy summers and cold winters. This results in a low or medium (Class 1 or 2) fire class rating. However, dry, windy weather does occur, and drought can exacerbate fire conditions. The peak fire season in Rhode Island is typically between March and May. During this time, there is no leaf canopy, so the sun can dry out grasses and fallen leaves. Windy conditions and the low humidity of spring further contribute to an increased fire risk. Although less common, wildfires may be a risk during the summer and fall, particularly if drought conditions occur.

Location

Block Island was heavily forested prior to settlement in the mid 1600's according to several accounts by early navigators. Once the settlers arrived, the forest was cut for lumber for homes, farm structures, boats, fences, fuel and other uses. The majority of Block Island's landscape was open agricultural fields from then on for several centuries until farming declined considerably in the mid-1900's. Inactive fields became covered with native shrub species mentioned above. Block Island now has some small patches of forest dominated by black cherry, and some forest-like areas dominated by large shad. There are a few isolated forest patches of large native black gum or tupelo trees in the middle of the island near swamps north and south of the airport, and one small patch of American beech in the same area.

Although the island does not have large stands of trees / significant forested areas, approximately 47% of Block Island's 6,000 acres is conserved open space. These large areas of open space, mostly open fields and shrubland, contribute to the island's rural character and serve as quality habitat. They also provide fuel that could raise the potential risk of brushfires. Many of these undeveloped natural areas are not easily accessible for firefighters and fire protection equipment, further increasing risk and vulnerability.

Impact

Wildfires have the potential to destroy valuable natural resources, damage structures including private property (residential homes and businesses), historic and cultural resources, and government facilities. Wildfires also threaten people's lives and livelihoods. Predicting of the potential risk of a wildfire, and the forewarning of wildfire conditions can help to reduce the incidence and seriousness of wildfires. It can also provide firefighters with the critical time needed for readiness and preparation, and also assist decision makers in limiting public activities to aid in prevention.

Extent

Typically the extent of a wildfire is described as an estimate of the total number of acres burned. There are no recorded wildfire events on Block Island to extrapolate an estimated

extent for future wildfires. The majority of Block Island is scrubland and not upland forest. The total island is approximately 6,000 acres with approximately 600 of those acres being waterbodies and wetlands. The west side of the island has been identified as being more at risk due to its denser vegetation cover and lower development density pattern. Given the vegetation type cover pattern on the island (small patches of forests, scrubland, open fields, and ponds), a wildfire with an extent beyond 1,000 acres would be highly unlikely.

The U.S. Forest Service has established the National Fire Danger Rating System (NFDRS) to determine the daily risk of fire for different regions of the country. The fire indexes are grouped into five classes, based on severity and an associated fire risk level. Class 1 has no rating, and the remaining classes progress from low to extreme danger.

The Keetch-Byram Drought Index (KBDI) is an index used to determining forest fire potential. The drought index is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8-inches) and is expressed in hundredths of an inch of soil moisture depletion. The drought index ranges from 0 to 800, where a drought index of 0 represents no moisture depletion, and an index of 800 represents absolutely dry conditions.

Previous Occurrences and Probability of Future Events

There is no official recorded history of major brush fires on Block Island. Oral history suggests that decades ago brush fires were a regular occurrence on Block Island as residents more regularly burned brush in the fields along stonewalls. In 1973, there was a large brush fire on the west side of the island and many residents volunteered to put out the fire. A cultural shift in attitudes towards burning brush, as well as a change in vegetation and increased development on the island has decreased brush fire occurrences. However, the potential remains, especially on the west side of the island where vegetation is lush. A fire in this area would be very difficult to control due to the lack of fire hydrants and terrain that makes access by emergency vehicles difficult.

Probability: New Shoreham is *unlikely* to be impacted by a significant wildfire over the next 5 years.

4.5 Vulnerability

New Shoreham is vulnerable to a number of natural hazards, with the potential for substantial loss of life and damage to people, property, and natural resources. Vulnerability includes all populations and assets (environmental, economic and critical facilities) that may be at risk from natural hazards. Vulnerability is a function of the built environment, local economy, demographics, and environmental uses of a given region.

Community Assets

New Shoreham's community assets include its people, the local economy, the build environment, and the natural environment. By examining the vulnerabilities of each of these assets, the town will be better prepared to respond to natural hazards, and protect these assets.

People

As previously mentioned, the year-round population on the Island is approximately 1,000, with a seasonal population of approximately 20,000 (June-September). This means that depending on the time of year, there are two populations at risk.

During the peak season, there are daily visitors to the island arriving in the morning and leaving the same day and therefore do not have somewhere to seek shelter (i.e. a hotel room or bed and breakfast, etc.) should it become necessary.

The community must provide a safe haven for visitors as well as a way to communicate information to them. Accommodations also need to be made for those individuals that are visiting the Island for an extended period of time that need to seek shelter somewhere other than where they are staying (ie boat). Furthermore, in the event of bad weather, the ferry service and airport may need to close for a period of time, basically stranding people on the Island.

New Shoreham has an evacuation procedure in place to address the concern of visitor safety. The procedure uses the June 2013 FEMA Hurricane Evacuation Zone Map (Risk Map 4) for New Shoreham, found in Appendix A. With advance warning of a Category 1 or 2 Hurricane or above, visitors would be notified and advised to evacuate the island as soon as possible and prior to the time when ferry service would be cancelled. Zone A includes those housed on the entire shoreline perimeter of the island, and especially those on "the Neck" of the island and on Coast Guard Road, who could be isolated from the rest of the island due to storm surge and flooded roads. Zone B includes residents in the Old Harbor area of town, and those located just south of Dorry's Cove Road on the island's west side. For Category 1, 2 or above, residents in Zone A are advised to move inland and stay with inland residents or move to the island's shelters. For Category 3 or above, residents in Zone B are also advised to move inland and seek shelter. For lesser storms, the town has a mobile emergency unit that is put in place to cover "the Neck" portion of the island.

The second population potentially at risk which could need sheltering during a severe weather event is the year round population. In the event of a power outage where electricity, water or sewer service is interrupted, this population would need somewhere to stay for an unknown duration. Furthermore, some residents live in areas of the Island can be cut off from the rest of the island (the north area of the "neck") when access roads to their property are flooded. These people would need shelter locations that are accessible to them in the event that they become isolated from the rest of the Island.

Between the 2000 and 2010 Census, there was a shift in the age breakdown of New Shoreham's population with greater numbers of older and retired persons as compared to the very young and working age adults. According to the 2010 Census, 21.3% of the year-round population is 65 years of age or older. This is an increase over the 2000 Census figures, which indicated that 17.3% were 65 years of age or older. Since older people are particularly vulnerable to natural hazards, Block Island's aging population is increasingly at risk to the impacts of natural hazards.

The main shelter for the Island has been designated at the Block Island School. This shelter is more than adequate to accommodate the year-round island population in the event of an emergency, but would be inadequate when the population rises dramatically in the summer months. Another smaller shelter location has been identified at the Block Island Medical Center. It is imperative that both the School and the Medical Center have operational emergency generators.

Economy

According to the Town's Comprehensive Plan, the economy of Block Island is fundamentally shaped by its resort/vacation economy. There is little in the island economy that is not directly or indirectly reliant on that seasonal activity for its financial base. Additionally, fewer than 2% of the island's residents work off-island. The Town of New Shoreham is the largest single employer on the island, including municipal and school employees.

The island's economy, and the livelihood of its residents would be devastated in the event of a natural disaster with significant damage. Unfortunately, hurricane season coincides with the peak tourist season. Disruption to the steady flow of tourists visiting the island would have significant negative impact on businesses and the island's economy.

The commercial area of New Shoreham is the most vulnerable zoning district to many of the frequent natural hazards on Block Island given its low elevation. Any disruption to this area would have a severe negative impact to town residents in accessing services. Damage to these businesses could cause major economic and social hardship.

In New Harbor, there are five marinas, five restaurants, four hotels, and two seasonal fuel stations to serve the marinas. Old Harbor supports over 50 businesses, including inns, hotels, restaurants, a grocery store, an auto repair shop, a gas station, and a movie theater.

Structures

Block Island consists of residential homes, historical buildings, and hotels/inns that are vulnerable to the effects of natural disasters. The island school also functions as the town's primary shelter. The medical center doubles as a secondary shelter. Other critical facilities

at risk are the water, sewer and power plants that serve the island, the town hall, which contains vital documents and records, the fire/rescue building, the post office, library, community and daycare center, post office, transfer station, highway garages, public beach pavilion, gas station, grocery store, telephone company, and the airport and ferry docks. In total, there are 15 municipal buildings with a value of $38,328,413. Critical infrastructure includes marine infrastructure (ferry landings, docks, breakwater, and seawalls), bridges, cell towers, sewer and water distribution lines. Damage to these facilities would be detrimental to the residents since these services are not accessible elsewhere, and no neighboring community exists where residents could access alternative services.

New Shoreham's building and zoning codes reflect efforts by the town to be proactive in reducing potential risks from disasters; however, some properties are located in known risk areas.

Table 13 – FEMA NFIP Insurance Report

Community	V-Zone Policies	A-Zone Policies	Total Premium	Total Coverage	Total Claims since 1978	Total Payments since 1978
New Shoreham	2	43	$178,823	$25,254,600	17	$346,761

Source: FEMA NFIP Insurance Report, RIEMA data as of March 2017

There have also been occasions where properties have been damaged by high winds, but no dollar amount is available for these damages.

Infrastructure

The New Shoreham Wastewater Treatment Facility is located on Spring St. just south of the Old Harbor and Downtown area. The sewer district includes all of Old Harbor, and New Harbor as far west as Champlin's Marina. It extends south to include the Spring House Inn and restaurant on Spring Street and the Block Island School and the Medical Center on High Street, and west to include the Town Hall on Old Town Road and properties at the west end of Connecticut Avenue. It extends along Corn Neck Road as far as the Beachead restaurant. The collection system consists of over 3.5 miles of lateral and intercepting sewer pipelines, and five pump stations.

In addition to processing most of the sewage from the water district, including that from hotels, marinas and public facilities at both harbors, the plant also handles waste pumped by contractors from individual on-site systems and waste from boat pump outs. It is designed and permitted to process an average daily flow of 450,000 gallons, with a peak of 1.2 million gallons per day (GPD). The plant processes a wide range of wastewater flows, from a high of 300,000 GPD (in the summer peak) to a low of 50,000 GPD (during the winter months). The treated effluent is pumped into the ocean from the outfall pipe in the jetty located off of Spring Street.

Public water supply for the commercial area of Block Island was once provided by a private company. The water supply and distribution system was acquired by the Town in 1984, but is still referred to as the Block Island Water Company. Since 2000, operations and

maintenance have been overseen by the Water District Commission, a Town Council appointed board.

With the exception of the area adjacent to and north of Sands Pond, the boundaries of the water district align closely with that of the sewer district. In 2011, the water district was extended into the New Harbor commercial area. A large majority of residential properties on Block Island (estimated at 80%) are served by private wells.

The current capacity of the Block Island water system is .225 MGD (million gallons per day). Block Island Water does not have an approved WSSMP (Water Supply Systems Management Plan).

The Town has identified a need to complete a drainage project to divert excess water from Sand's Pond. The flood of March 2010 caused rapid elevation of the water level in Sand's Pond. The resulting overflow encroached upon the electrical boxes which service the Water Company's reservoir pumps. These were damaged, and the underground backwash holding tanks were submerged underwater. Neighboring properties were also compromised. Flooding of this equipment causes damage, which in turn, compromises the operation of the Company and its ability to provide safe drinking water to its users. This HMP includes an action to re-establish the natural drainage to the South that was blocked about 50 years ago.

The Block Island Power Company (BIPCo) services virtually all of the electric power demand on the island, with a few individual property owners opting to use their own generators, solar panels, and wind energy conversion systems (WECS). Generation consists exclusively of diesel-fired generators. The company is a regulated utility subject to the oversight of the RI Public Utilities Commission (PUC) but exempt from the competitive initiatives introduced on the mainland due to the geographic isolation of its electric power generation and distribution system. Due to the seasonal disparity in customers, a significant challenge is to maintain sufficient capacity to meet peak summer demand while running just a single generator to serve the winter population.

The use of diesel fuel to run the generators at the power plant is in the range of 1 million gallons per year, or about one hundred 10,000 gallon tank trucks transported to the island each year by ferry. The handling and storage of this volume of fuel carries the risk of a mishap that could jeopardize the island's aquifer, its sole water source, as well as marine life and other natural resources. The use of diesel fuel as the generation source also requires significant emissions controls to meet current EPA requirements, as well as the transport of urea to the island, which poses its own environmental risk.

Transportation

Block Island's two harbors, Old Harbor and New Harbor, are an important component of the town's infrastructure which are highly vulnerable to natural hazards. Docks and marinas are located in both harbors and are critical transportation infrastructure connecting residents and freight to the mainland.

Critical Facilities

New Shoreham's critical facilities are shown on the map in Appendix A. They include the following:

Block Island School (and primary shelter)
Block Island Medical Center (and secondary shelter)
Town Hall
Power Company
Police, Fire and Rescue Station
Water Plant
Water Distribution Lines
Sewer Plant
Sewer Pump Stations
Sewer Lines
State Highway Garage
Town Highway Garage
Transfer Station
Ferry Docks (Old and New Harbors)
Block Island Airport
Community Center/Daycare Facility
Library
Historical Society
Post Office
Cell Tower (communications)
Bridges
Old Town Road Sluice

Located within flood hazard areas are the following municipally-owned structures: the North Light; Beach Pavilion; Harbormaster's Shack; and former Coastguard Station.

Historic and Cultural Resources

New Shoreham's historic and cultural resources are integral to its tourism-based economy and economic survival. Protection of these resources, particularly those listed below, is critical. Some of the island's most significant historic structures are located within areas susceptible to inundation due to sea-level rise and storm surge.

There are two National Register Districts on Block Island.
Old Harbor Historic District – A densely developed impressive collection of vintage hotels, shops and restaurants.
Great Salt Pond Archaeological District – located along the shores of the Great Salt Pond was a primary area of residence by Native Americans.

Two Historic Lighthouses
North Light
Southeast Light

The North Light is particularly vulnerable to a number of natural hazards including hurricanes, storm surge, and sea level rise. The current lighthouse is built on the site of

three former lighthouses which had been rendered useless following storms or shifting sands. The present lighthouse was built in 1867.

The Southeast Light is vulnerable to erosion. The present lighthouse was built 1873-4. The lighthouse, once over 300 feet from the edge of the bluff was in the 1990's only 55 feet from the edge due to erosion. The National Trust for Historic Preservation listed it as one of America's 11 most endangered structures of historic significance. A group of volunteers, the Block Island Southeast Lighthouse Foundation, raised approximately $2 million in federal and private dollars to fund the relocation of the lighthouse. In August 1993, historic structure was moved to its present location about 300 feet from the bluff.

Noteworthy privately-owned historic properties on Block Island include the Spring House Hotel, The Surf Hotel, Beacon Hill Tower, and the Work War II observation towers of which three remain. The Spring House Hotel, built in 1854, is the older hotel on the Island and is still open to the public.

Future Development

An overarching goal of the New Shoreham Comprehensive Plan is to ensure that future residential growth is compatible with the island's traditional landscape. One of the main goals cited in the Plan is to maintain the current balance of protected land, limited residential development and concentrated commercial and institutional development on the island, and to ensure that its land use policies and regulations, as well as infrastructure and services, support this balance.

New Shoreham presently has 1680 housing units. Of those, less than one-third are year-round homes. Currently, approximately 47% of the island's land area is protected from development. As part of the Comprehensive Plan, in 2016, the Town conducted an assessment of the future residential development capacity of Block Island under current zoning regulations. This build-out analysis included an assessment by zoning district of both undeveloped and underdeveloped parcels and estimates maximum subdivision potential. The analysis includes a summary table, chart, and map. There are over 2,200 parcels within the Town of New Shoreham. The total number of buildable lots (after subdivision yield of undeveloped / unrestricted plus subdivision yield of underdeveloped / unrestricted) is estimated at 532.

Average household size on Block Island is 2.07 according to American Community Survey, 2013. Therefore, if 532 single family homes are constructed on Block Island, the Town could expect an additional population of 1,101. However, if the current ratio of seasonal housing units (2010 Census) continues in the future (69.3%), this figure would equate to an estimated additional 338 year-round residents.

Based on building permit data, the average annual number of new single family dwellings on Block Island between the years 2006 and 2015 was ten (note: this figure does not includes tear down and rebuilds on same lot). Therefore, it is estimated that residential build-out could occur in 53 years, which would be the year 2069.

As part of implementing the Comprehensive Plan, the Planning Board will be further considering and evaluating the results of the build-out analysis and determining if any modifications to existing land use regulations should be enacted to encourage appropriate development on the island (including discouraging future development in lands prone to current and/or future impacts from natural hazards).

Natural Resources

Arguably Block Island's most important assets are its natural features and conserved lands. In 1991, The Nature Conservancy (TNC) selected Block Island as one of its 12 initial "Last Great Places" in the northern hemisphere, primarily due to its ecological significance. TNC considers Block Island an internationally significant biodiversity reserve due to the presence of rare and endemic species and habitats and because of the concentrations of songbirds, shorebirds, and raptors that migrate through it. At least 15 rare, threatened or endangered federal or state listed species, including birds, insects, mammals and plants reproduce on the island. Many additional rare birds pass through during migration. Block Island is internationally recognized as one of the most important migratory bird habitats on the East Coast attracting hundreds of "birders" to the island each fall.

The natural features of the island, including its morainal topography, groundwater supply, freshwater ponds and emergent wetlands, mud flats, salt marshes, sandy dunes and beaches, sea cliffs, and upland shrub habitat and other vegetation provide critical habitat and resources for the species it sustains. Should any of these be contaminated or damaged by natural hazards, whether directly or indirectly, there would be serious repercussions for the island, both ecologically and economically. The Natural Hazards Risk map displays the approximately 47% of Block Island which is protected from development.

The island also boasts hundreds of freshwater bodies. The Sands Pond watershed supplies wells for the municipal water supply. The town is reliant upon surface and ground water for drinking water. Local water resources must, therefore, be protected to ensure a continued source of safe drinking water.

The prospect of a natural disaster including hurricanes and Nor-easters impacting the Great Salt Pond and accelerating natural shoreline erosion must be factored into the Town's planning process. A major storm that results in a breach from the sea into the pond could cause catastrophic environmental and economic impacts. The most likely sites for such an event are the locations where the sea and harbor are separated by a narrow neck of land composed of sand, gravel and loose soil, easily moved by wave action. One such area is north of the channel and Beane Point where the land rises just a few yards above mean sea level. Hurricane Sandy did result in a breach of the Great Salt Pond.

Recent NOAA scenarios project 2 meters (6.6 feet) of sea level rise by 2100. In 2013, the Town conducted a sea level rise adaptation study which identified potential strategies the town can implement to prepare for and mitigate potential impacts of sea level rise. Inundation mapping conducted as part of the study shows land, docks, and roadways surrounding the Great Salt Pond as being either inundated by sea level rise or more susceptible to flooding during extreme storm conditions as a result of sea level rise. Specific strategies to mitigate the impacts of sea level rise on the Great Salt Pond and its uses include the raising of roadbeds, flood-proofing of pump stations, and the eventual relocation of the town's boat ramp.

The following table provides a summary of categorized specific assets of Block Island along with the natural hazards each is most vulnerable to.

Table 14 - Vulnerabilities Summary		
Critical Assets	***Natural Hazard Vulnerabilities***	***Specific Concerns***
Municipal Facilities		
Transfer Station	erosion, hurricane	Recent storm damage uncovered old landfill; further erosion will result in contamination of beach and water
Town Beach Pavilion	hurricane, storm surge, winds	Physical damage to structure from storm surge and winds
Harbormaster's Shack	flooding, hurricane, sea level rise	Physical damage to structure from storm surge, flooding, sea level rise
Coast Guard Station (former)	flooding, hurricane, sea level rise	Physical damage to structure from storm surge, flooding, hurricane, sea level rise
Town Boat Ramp at New Harbor	sea level rise	Functionality impacted as a result of sea level rise
Fire/Rescue Building and Police Station	flooding, storm surge	Flooding of roadways around the facility
Transportation		
Critical Roads (Corn Neck Rd, Spring St, Ocean Ave)	storm surge, winds, sea level rise, hurricane	Residents vulnerable from being cut off from the rest of the island and emergency services; single road access is susceptible to inundation
Dams (Old Town Road; Mill Tail Brook)	hurricane, flooding; sea level rise	Major evacuation route; cannot support emergency vehicles; property downstream subject to flooding
Transportation Services (ferry and air)	winds, hurricane, severe winter weather	Medical care and economic impacts from not being able to move people and goods to and from the mainland
Local and Privately-Owned Dirt Roads	flooding	Flooding of roadways may cut off emergency access to citizens
State Highway Garage	hurricane, flooding	Flooding of roadways and impact to facility from flooding
Bridges (Beach Avenue and Ocean Avenue)	sea level rise	Flooding of roadways and damage to infrastructure resulting from flooding and sea level rise

Private Property		
Commercial Areas	storm surge, winds, flooding, hurricane, severe winter weather	Structural damage from flooding
Private Property Abutting Freshwater Ponds	flooding	Structural damage from flooding
Oceanfront Private Properties	erosion, hurricane	Structural damage from flooding
Private Property Abutting New Harbor / Great Salt Pond	sea level rise	Structural damage from flooding
Day Care Center	hurricane, flooding	Structural damage from flooding
Utilities		
BIPCO (Block Island Power Company)	hurricane, storm surge, sea level rise, lightning, flooding	Flooding of public water facility and equipment; could cause major/costly infrastructure damage
Cell Tower	hurricane, wind	Damage to utility from hurricane, winds
Sewer and Water Infrastructure	sea level rise, storm surge	Damage to infrastructure from inundation
Pump Stations	hurricane, sea level rise, flooding	Damage to infrastructure from hurricane, storm surge, sea level rise, flooding and potential loss of power - impact on water quality
Electric - Utility Poles/Lines	winds, hurricane, severe winter weather	Loss of power from downed power lines
Cultural Resources		
Southeast Light	erosion	Relocated once away from dunes, could be at risk in the future with continued erosion of bluff
North Light	storm surge, flooding, hurricane, sea level rise	Structure very vulnerable to destruction from hurricanes and storm surge
Marine Infrastructure		
Ferry Landing and Docks	hurricane, sea level rise	If docks/landing are damaged, ferry service could be suspended for a consideration length of time
Breakwater at Old Harbor & New Harbor	hurricane, sea level rise	If breakwaters are damaged, safe harbors/ferry service could be impacted
Seawalls and Revetments	hurricane, sea level rise	If breakwaters are damaged, safe harbors/ferry service could be impacted and private properties could be at greater risk to impacts from storm surge and coastal flooding

Natural Resources		
Coastal Resources (Saltmarshes, Dunes, Beaches, Bluffs)	erosion, sea level rise, storm surge, flooding	Salt marshes could become degraded due to flooding / sea level rise, Natural Resources at critical to the local economy (tourism) of Block Island
Great Salt Pond (New Harbor)	sea level rise, storm surge, hurricane	Ecological and economic impacts resulting from sea level rise and storm surge - potential island bifurcation
Populations		
Older people	severe winter weather, flooding, hurricane, extreme cold	Older residents without access to vehicles or other vulnerable populations could suffer during times without power
Visitors without shelter	hurricane, winds, storm surge, lightning	Day trippers and boaters could be exposed to natural hazards without proper shelter
Note: Highlighted assets are most vulnerable.		

Risk Analysis & Assessment Matrix

The New Shoreham Hazard Mitigation Committee assessed the town's risks to natural disasters in terms of population, property, economic resources, and probability of occurrence. The committee considered public health and safety, structural damage, area or town-wide evacuation, and economic effects. The committee also identified specific needs and projects that would help mitigate natural disasters.

Methodology

Vulnerable areas were determined by considering past and potential natural hazards that pose a threat to the population, property, and economic resources of the town. Historical data was reviewed, and more recent hazard events considered. Examining past events helps to some degree in predicting the probability of a similar event occurring in the future.

The benefit of implementing each mitigation action was also considered carefully. Benefits included public safety and protection, economic stability, and continuity of essential services.

Exposure Analysis

A second criteria in evaluating the risks of New Shoreham to natural hazards is the area of impact. Some hazard events impact only a small area, while others can

affect the entire region. Historical data was used to evaluate damage and loss records from previous hazard events to estimate the amount of property damage that might occur from future events.

Historical Analysis

Priority projects were identified by considering the historical or potential occurrence of natural disasters, the effects on the town, and the benefit that would result if the mitigation action was implemented.

Repetitive Loss Properties

Repetitive loss properties are those for which two or more losses of at least $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any ten year period since 1978. A severe repetitive loss property (SRL) is a structure having a minimum of four claims, each over $5,000, cumulatively adding up to $20,000 or more. New Shoreham has 17 repetitive loss properties (9 non-residential and 8 residential). There are no severe repetitive loss properties.

Vulnerability Summary

Hurricanes

New Shoreham is particularly vulnerable to tropical storms. This is due, in part, to the geography of southern New England in relation to the Atlantic seaboard. This places Rhode Island in direct line of any storm that moves northward on a track that parallels the eastern seaboard maintaining a slight north-northeast direction.

A second factor in New Shoreham's vulnerability to hurricanes is due to the significant increases in forward speed by the time the hurricane makes its way northward. Although hurricanes tend to weaken with northward movement, the increase in speed can often compensate with the surge flooding, wave effects, and high winds that accompany a faster moving though weaker hurricane. This means that the effects from a Category 2 hurricane traveling at 60 mph could be worse than those from a Category 4 hurricane moving at 20 mph.

Vulnerability from the impact of a hurricane is affected by the ability to evacuate in advance, storm surge and coastal flooding, and shelter capacity. Damage to power lines of communication towers are some additional effects.

Tornadoes

Tornadoes are a high-impact, low-probability hazard for New Shoreham, whose effect depends upon the intensity and degree of development in its path. Although

there have been none documented on Block Island, the entire state of Rhode Island is considered uniformly vulnerable to tornadoes. The type and age of construction affects the vulnerability of facilities to tornadoes. In general, concrete, brick and steel-framed structures tend to fare better in tornadoes than older, wood-framed structures.

Thunderstorms and High Winds

Wind vulnerability is based in large part on building construction and standards. Other factors, such as location, condition, and maintenance of trees also plays an important role in determining vulnerability. If a structure is located on a hilltop, is tall, has other tall structures nearby, or has large exposed windows, it is subject to damage during a strong storm. Communications and power supplies may be compromised, and critical facilities that are not equipped with a backup power source are vulnerable. Because of its open ocean location, Block Island is extremely vulnerable to the effects of strong storms.

Winter Related Hazards

Severe winter storms can cripple New Shoreham. Electrical utilities and communications, and infrastructure are especially vulnerable.

Flood Related Hazards

All areas of Rhode Island are vulnerable to flooding and the impacts associated with it. Local land use regulations and ordinances have done much to control unregulated development within flood hazard areas.

RIDEM has the responsibility to inspect dams and determine their condition on a five year schedule. The two dams on Block Island, along Mill Tail Brook, State ID # 424 and #765, have been identified as significant hazards.

Coastal Erosion

New development along coastal areas in New Shoreham is regulated by CRMC and the town. One regulation requires a Coastal Buffer Zone, or a “land area adjacent to a shoreline (coastal) feature that is vegetated with native shoreline species and which acts as a natural transition zone between the coast and adjacent upland development” on property within 200 feet of the inland edge of a coastal feature. The benefits of the Coastal Buffer Zone include protection of water quality, coastal habitat, scenic and aesthetic quality, erosion and flood control.

Wildfire

Although wildfire is not a significant risk on Block Island, precautions are needed to monitor conditions and vulnerabilities.

Geologic Related Risks

Though the projected economic impacts resulting from simulations of the annualized economic losses based on earthquakes for Newport County, Rhode Island, are low ($183,329), the potential economic impact must be considered. Although New England is considered to have a moderate seismic risk, in general it has a high seismic vulnerability because of the built environment.

In Rhode Island, there is little public recognition of earthquake threat, and no established system to educate the public of the threat or how to prepare or respond to an earthquake. Therefore, it is anticipated that higher losses will occur than in other regions of the country.

Drought

The entire state of Rhode Island is susceptible and vulnerable to the occurrence of a drought. New Shoreham is particularly vulnerable to the effects of drought due to its sole source aquifer designation and the increased demand for water from the large summer population. Because droughts are a normal part of any climate, it is important to have a plan in place providing for response actions.

Table 15 - Risk Assessment Matrix						
	Vulnerable Areas	**Location**	**Ownership**	**Natural Hazard**	**Mitigation Objective**	**Risk - Historic or Potential**
1	**Natural Environment**	Island-wide	Town	Coastal Erosion; Sea Level Rise, Hurricane; Wind Storm; Storm Surge ; High Winds; Drought; Wildfire	environmental quality; scenic quality; mitigate coastal erosion	Historic & Potential
2	**Dams & Bridges**	Old Town Road; Mill Tail Brook near the Town Hall	Town / State	Hurricane; Heavy Rains / Flooding;Winter Storm; Sea Level Rise; Dam breach	maintain evacuation route; ensure public safety; prevent property damage from flooding	Historic
3	**Critical Roads**	Corn Neck Road, Beach Avenue, Ocean Avenue	Town / State	Hurricane; Wind Storm; Sea Level Rise; Storm Surge	public safety for the residents of the northern end of the island	Historic & Potential
4	**Essential Services**	Island-wide	BIPCO/Town	Hurricane; Severe Winter Weather; Earthquake; Flooding; Storm Surge; High Winds	maintain electric power; public safety; reduce loss and damge of facility and equipment	Historic & Potential
5	**Residential and Commerical Land Uses**	Island-wide	Private	Flooding; Storm Surge; High Winds; Severe Winter Weather; Coastal Erosion; Sea Level Rise	prevent property damage from flooding	Historic & Potential

** The Town focused on the highest risk hazards when developing the Risk Assessment Matrix. Lower risk hazards with less predicable impacts and locations such as drought, wildfire, tornado and earthquake are not included.*

5. CAPABILITY ASSESSMENT

The following section details the town's hazard mitigation capabilities. The town has the capability to implement and institutionalize hazard mitigation through its human, legal, and fiscal resources, and intergovernmental coordination.

New Shoreham has a variety of planning and support capabilities to apply toward its hazard mitigation activities. The business owners, residents, nonprofit organizations, and visitors all contribute to promote growth and stability in town. The following sections provide an overview of the critical capabilities within the town and how they play a role in the mitigation effort.

The public services and facilities provided by the town of New Shoreham are crucial resources for preparation for natural hazard events, as well as the response to and mitigation of such events. There are also several state agencies that share responsibility for natural hazard preparation and response.

Form of Government

Established in 1664 and incorporated by Home Rule Charter on October 30, 1672, the Town of New Shoreham has a Council-Manager form of government. The Town Council is comprised of a First Warden, Second Warden and three Town Councilors, elected each even numbered year for a two-year term. The Town Council appoints a Town Manager to be responsible to the Town Council for the administration of all town affairs. The Town Manager is responsible for the appointment of department heads and with overall supervision of the town departments.

In addition to the town employees serving in the town departments, a number of boards and commissions are active in mitigation activities, including the Planning Board, Zoning Board of Review, Harbors Committee, Board of Assessment Review, Conservation Commission, and Water and Sewer Commissions.

Emergency Management Team

Emergency Management in New Shoreham is made up of several town and State departments and agencies. Locally, emergencies are coordinated among the New Shoreham Emergency Management Officer, New Shoreham Police Department, Block Island Bulletin Board, Senior Advisory Committee, New Shoreham Volunteer Fire Department and Rescue Squad.

When warning of a natural hazard comes from RIEMA, a team of town authorities, consisting of the Emergency Management Director, Town Manager, Police Chief, and any other necessary personnel, meet in advance to prepare and implement response plans utilizing existing resources, policies, and programs.

Resources, policies and programs to address various hazards are in place, including flood hazard mapping, an emergency notification system to alert residents to imminent emergencies and evacuation orders, shelter procedures, procedures for the mobile unit for Corn Neck, backup generators, power company personnel to address outages and downed lines.

If the need for a shelter is anticipated, a team of personnel exists to set up and staff the shelter.

Facilities Management

The Town of New Shoreham created a new position of Facilities Manager in 2015.
New Shoreham has 15 municipal buildings with a value of $38,328,413 as of March 2015, according to the Town's Insurance Company, Rhode Island Interlocal Trust. Part of the duties of this position is to plan for the long-term maintenance and use of municipal facilities. This work could involve coordinating implementation of mitigation activities for town-owned structures.

Building, Zoning, Land Use and Planning

The New Shoreham Building, Zoning, Land Use and Planning Department provides professional planning and community development services for the Town, including construction reviews, permitting and inspections, administration of land use and subdivision regulations, zoning regulations, development and implementation of long-term planning projects and studies, coordination with federal and state agencies, and coordination with town boards, departments and agencies. This department staffs the Planning Board, Zoning Board, Conservation Commission, and Historic District Commission. Town staff and consultants complete reviews of development application for boards including the evaluation of potential impacts of proposed development within or nearby flood zones, hydric soils, wetlands, coastal zones and other environmentally sensitive areas. This department is responsible for administering the town's stormwater regulations, including soliciting for review and comment by the Town Engineer on whether proposed developments meet the Town's stormwater regulations and soil erosion and sediment control standards.

The Town's Building Official is responsible for ensuring new structures meet the State building code requirements, including those related to development in flood zones and requirements for structures to withstand wind. Contractors from outside Rhode Island meet with the Building Official and are informed of Rhode Island building codes.

In 2013, the Town adopted a flood ordinance, with the purpose being identified as "to ensure public safety; minimize hazards to persons and property from flooding, to protect watercourses from encroachment, and to maintain the capability of floodplains to retain and carry off floodwaters. The Town of New Shoreham elects to comply with the requirements of the National Flood Insurance Act of 1968." Special Flood Hazard Areas are established as a floodplain overlay district within local regulations. The office of the Building Official is responsible for floodplain management. The FIRM and FIS report and any revisions are on file with the Building Official. All proposed construction of other development activities within the floodplain overlay district require a permit. Non-structural activities are permitted either by RI CRMC or RIDEM. If a State agency issues a permit, the Building Official has the opportunity to provide input and keeps a record of the permit on file.

The Town Planner and Town Engineer review subdivision and other land development proposals to ensure such proposals minimize potential flood damage, all utilities are located and constructed to minimize or eliminate flood damage and adequate drainage is provided to reduce exposure to flood hazards.

The Town Planner assists the Town in preparing long-range planning documents such as the Comprehensive Community Plan and Hazard Mitigation Plan. The Town Planner provides an analysis of community vulnerabilities and can recommend potential action items related to hazard mitigation for inclusion in planning documents. The Town Planner assists in drafting local land use regulations.

The Town Council adopted the 2016 New Shoreham Comprehensive Plan in November of 2016. The plan describes the vision the community aspires to be over a 20-year planning horizon and identified actions to be implemented by the Town in order to achieve that vision. Items such as land use, housing, economic development, natural and cultural resources, open space, municipal services and facilities, public water supply, agriculture, and natural hazards and climate change are addressed in the plan. The Comprehensive Plan identifies the need for maintain a healthy year-round community and economy while at the same time preserving the natural resources and unique characteristics of Block Island. Research, data, and input as part of the Comprehensive Plan update and process also helped to inform the Hazard Mitigation Plan Update. The 2017 New Shoreham Hazard Mitigation Plan is incorporated as an Appendix to the 2016 New Shoreham Comprehensive Plan. Several action items overlap between the two plans. There may be a need for additional staff time and funding to implement actions identified in the Comprehensive Plan.

Public Works

The road network on Block Island can be categorized as a combination of paved State roads, few local roads, and many gravel/dirt privately-owned roads. The Town and State have a cooperative agreement, whereby some routine maintenance tasks are covered by the local public works department and reimbursed by the State. Major repairs and improvements to State roads are contracted by the State.

Prior to storm events the Public Works Department conducts a number of preparedness activities to lessen impacts on roadways and other municipal facilities. One activity example includes closing a beach access gapway in dunes for pedestrians and emergency vehicles to prevent sand, debris, and ocean water from spilling onto Corn Neck Road. The Public Works Department also ensures catch basins and storm drains are clear of debris, Town Beach Pavilion is boarded up and conducts preventative maintenance on dirt roads to alleviate as much damage as possible, such as grading to direct rain runoff in a certain direction. Public Works removes public trash cans around town and porta johns.

Although it has no formal debris plan, the Public Works Department employs debris management strategies designed to promptly address debris or tree limbs accumulating on roads during or after a wind or other hazard event.

Public Safety

Block Island's public safety buildings – the police station, built in 1970, the attached fire barn, built in 1972, and the newer rescue barn, built in 2009, all are located on the same parcel on Beach Avenue in the village near New Harbor.

As of 2017, the Block Island Police Department has five full-time officers, including the chief, as well as four full-time and two part-time dispatchers. Eight additional officers, as well as three community service officers (bicycle patrol) and one police dog (K-9) work seasonally to handle the extra demand during the busy tourist season. During the months of July and August there is also a Rhode Island State Trooper presence on the island Friday through Sunday.

The Block Island Volunteer Fire and Rescue protects life and property on the island and provides assistance in medical emergencies. Fire and Rescue is staffed by about 75 volunteers. The rescue squad maintains its status as a volunteer organization with the exception of a twelve-week period in the summer when people are paid to be on call in order to avoid any serious lapse in caring for the community and its visitors.

Harbors Department

The Harbors Department is responsible for regulating and managing the waters of New Shoreham. The Harbors Department is involved in natural hazard preparedness activities, such as, encouraging boat owners with moored vessels to seek refuge, remove boats from water, or to take other actions to minimize damaging effects. The Harbors Department is also involved with updating the Harbor Management Plan.

GIS – Geographic Information Systems

New Shoreham has GIS software, data and professional capabilities to assist the Town in hazard mitigation planning, storm preparation and post disaster analysis. The Town maintains its own data layers including but not limited to parcels, zoning, utilities, open

space, and house identification numbers and utilizes data layers maintained by RIGIS (Rhode Island Geographic Information System) and federal agencies including but not limited to E911 addresses and flood hazard areas. Recent GIS Mapping produced by the Town includes Sea Level Rise mapping conducted as part of the Sea Level Rise Study, Comprehensive Plan mapping, build-out analysis, and the mapping of all public shoreline access points (ROWs) on the island as part of the Shoreline Access Working Group (SAWG).

Maps are publicly available on the town's website including FEMA DFIRM flood maps. The Town's GIS Administrator will continue to maintain this data warehouse. Currently, the GIS Administrator is utilizing ArcGIS Online to provide free interactive online access to the Town's GIS data to the public and town staff without the need for software or training. Map services are being published to the town's new website (anticipated launch date in 2017) and will include flood and sea level rise data layers. There is a need for data collection capabilities in the field and a robust municipal GIS website capable of providing the public and staff more interactive functions to access and analyze geographic data.

Cultural & Natural Resources

The town's historic and archeological resources are well documented to allow the town and private entities to make optimal decisions about property management and preservation. The Block Island Historical Society (museum) houses historic documents and artifacts.

The Block Island Land Trust (BILT) acquires and preserves open space on Block Island for conservation, recreation, aquifer protection and agricultural uses. The BILT was established by state legislation and is funded by a 3% fee on the transfer of real property on Block Island. The Land Trust is administered by five unpaid Trustees who are elected for staggered four-year terms.

Private partners including The Nature Conservancy, the Block Island Conservancy, and Audubon Society have also been critical in helping the Town achieve natural resources protection goals and implementing mitigation projects including dune replanting.

Renewable Energy & Technology

Block Island has taken steps to incorporate alternative energy into its municipal buildings, including solar electric systems in the new Town Hall, Rescue building and the Block Island School. The community will continue to pursue opportunities for wind power and other alternative energy technologies to reduce the town's reliance on the present power system, and provide backup sources of power. While these new technologies will alleviate certain risks, they may create new ones, in terms of potential damage to these new systems and equipment.

A 30 megawatt windfarm (5 6-watt turbines) off the coast of Block Island began operation in 2016. It is the first offshore windfarm in the United States. The project included a fiber cable that will bring faster more reliable internet to Block Island.

This technological investment will improve natural hazard capabilities for the island's medical center, public safety operations and the economy as a whole. The Town is currently investigating options and costs involved with an island-wide fiber network buildout.

Lack of adequate and consistent internet access has constrained economic development opportunities for island businesses, particularly tourism and hospitality. Over the course of several years, the Block Island Residents Association, Chamber of Commerce, Tourism Council, Block Island School and Town government have aggressively pursued solutions to this problem. The proposed on-Island fiber network will connect the Town's leased fiber in the National Grid subsea cable to all occupied premises on Block Island

6. MITIGATION STRATEGY

The Risk Assessment Matrix presented in Table 8 is the basis for the Mitigation Actions Table that follows. In accordance with FEMA requirements, an emphasis was placed on the importance of a cost-benefit analysis in determining project priority. STAPLEE is an acronym for a general set of criterion common to public administration officials and planners. It stands for the Social, Technical, Administrative, Political, Legal, Economic, and Environmental criterion for making planning decisions. The questions were considered and answered in order to determine the acceptability of the proposed mitigation action when being viewed in terms of the seven distinct criteria. The Hazard Mitigation Committee's prioritization of each action was based partly on the prioritization of the vulnerable area each action is intended to protect and partly on the magnitude of benefit each action is likely to achieve as compared to its costs and overall feasibility. Although the priority ranking will guide implementation, the actions to be implemented will depend upon the availability of funding.

STAPLEE Criteria for Selecting Mitigation Actions

Social	Is the proposed action socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly? Will the action cause social disruption?
Technical	Will the proposed action work? Will it create more problems than it solves? Does it solve a problem or only a symptom? Is it the most useful action in light of the community goals?
Administrative	Can the community implement the action? Is there someone to coordinate and lead the effort? Is there sufficient funding, staff, and technical support available? Are there ongoing administrative requirements that need to be met?
Political	Is the action politically acceptable? Is there public support both to implement and to maintain the project? Will the Town Manager, Town Council and other decision-making political bodies support the mitigation measure?
Legal	Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity? Is enabling legislation necessary? Are there any legal side effects (e.g. could the action be construed as taking)? Will the community be liable for action or lack of action? Will the activity be challenged?

Economic	What are the costs and benefits of this action? Does the cost seem reasonable for the size of the problem and the likely benefits? Are maintenance and administrative costs taken into account as well as initial costs? How will this action affect the fiscal capability of the community? What burden will this action place on the tax base or the local economy? What are the budget and revenue effects of this action? Does the action contribute to other community goals, such as capital improvements or economic development? What benefits will the action provide?
Environmental	Sustainable mitigation actions should not have an adverse effect on the environment, they should comply with federal, state, and local environmental regulations and should be consistent with the community's environmental goals.

New Shoreham's preparations are based on experience with previous hazard events. Of course, each event brings a different set of challenges, and the team is always working to improve and learn from past experiences, adapt based on lessons learned, and improve to the best of its ability with the resources it has available.

Mitigation Actions

Presently, the town does not foresee that any of the recommended action items would be able to receive funding to implement them through the town budget, but rather would require bonding and/or grant funding. When funding does become available for mitigation actions, either through grants or town allocation, the responsible departments are prepared to implement the following identified actions.

Timeframes:
Short-term = 0 to 6 Months
Medium-term = 6 to 18 Months
Long-term = 18 Months to 5 Years

Note: Change in Priority from 2006 Plan
During the 2006 Plan process more than one item was ranked as a 1, 2 or 3 because the Committee wanted to emphasis the importance of those items, but not move them to a lower ranking since they have similar importance – The eight actions from the 2006 Plan were ranked 1.1–1.4, 2.1-2.2, 3.1-3.2.

Cost:
$ = $0 -$149,000
$$ = $150,000 - $749,000
$$$ = $750,000- $1,999,000
$$$$ = over $2,000,000

Action 1: Mitigate Beach Erosion at Old Landfill

Project Description: Recent storms have eroded the beach and caused the closed landfill to be uncovered. Debris has migrated onto the beach and into the ocean. This issue, if not corrected, has the potential to cause significant negative impacts on the surrounding natural resources in the area. A concern also exists for the people and wildlife coming into contact with the debris. Engineering work has been completed to construct a revetment from the shoreline to minimize ongoing erosion. The Town has received a CDBG-DR grant for construction but is in search of additional sources of funding to close an estimated $1,000,000 funding gap.

Action Type: Structural Project, Post-Disaster
Priority: High
Change in Priority since 2006 Plan: New Action
Lead: Town Manager
Supporting: Engineering
Time Frame: Medium-term (6 to 18 months)
Cost: $$$$
Finance Options: CDBG-DR; FEMA
Benefit: Environmental, Aesthetic and Public Health

Action 2: Old Town Road Sluice/Bridge

Project Description: Upgrade the culvert and sluice, construct the bridge/roadway capable of serving as an evacuation/rescue route. Old Town Road serves as a main route connecting Old Harbor with the airport and points west of town. The portion of road containing the bridge also serves as a connector from the Police/Fire/Rescue Building with the school and the medical center. At this time, the roadway over the sluice is unable to support trucks or rescue vehicles.

The bridge also serves as a culvert, directing drainage from Mill Tail Pond to Harbor Pond and, ultimately, the Atlantic Ocean. Malfunction of the dam/sluice would put the road and downstream properties at risk from flooding. Also downstream is Ocean Avenue, a heavily-traveled connecting road from Old Harbor to the Police and Fire/Rescue Building and New Harbor locations. Also located on Ocean Avenue, just below the overflow from the dam/sluice is the sewer pump station. This pump station is at risk of flooding if the dam fails.

The Town Engineer completed design and presented project on December 15, of 2016 to the public. Current activities include seeking DEM wetlands determination and undergoing an archeological survey. Objectives of the Old Town Road Improvements Project include pedestrian safety, vehicle safety, maintaining Mill Pond Dam Overflow, maintaining island history, complying with wetland and dam permit conditions. Design elements include maintaining historical features of the roadway and culvert, sizing culvert for 100-year storm event and H-20 wheel loading, stormwater management, guard rails and pedestrian rails. The project design, permitting and construction will involve coordination with the State permitting agencies and local utility providers. The town received a RIIB (Rhode Island Infrastructure Bank grant in the amount of $269,000 to implement this activity).

Action Type: Structural Project, Pre-Disaster
Priority: High
Change in Priority since 2006 Plan: 1.4 in 2006 Plan
Lead: Engineering
Supporting: Highway Department
Time Frame: Short-term (0-6 months)
Cost: $$
Finance Options: RIIB (Rhode Island Infrastructure Bank); Town bond money
Benefit: Public Safety, Emergency Access, Flooding Prevention

Action 3: Corn Neck Road Mitigation

Project Description: Planning, design and construction of relocation or raising of roadbed for segments of Corn Neck Road to address ongoing inundation due to storm surge and the potential permanent inundation due to projected sea level rise. This road serves as an evacuation route and connects many homes on the northern end of the island to the rest of the island. Storm surge from Hurricane Sandy caused substantial damage to Corn Neck Road. The Town received emergency repair funding in the amount of $3.1M in order to repair Corn Neck Road and a shorter section of Spring Street which also suffered damage. Corn Neck Road is a state-owned roadway that is maintained by the Town of New

Shoreham. The Town of New Shoreham was awarded in 2016 a CDBG-DR grant in order to conduct a planning study to identify potential alternatives to address the issues described above. The study will be completed by August 2017 and will include a preferred alternative/s for the future of Corn Neck Road and maintaining a connection to the north end of the island in the event of potential permanent inundation.

Action Type: Structural Project, Pre-Disaster
Priority: High
Change in Priority since 2006 Plan: New Action
Lead: Town Manager; RIDOT
Supporting: Engineering; Highway Department
Time Frame: Long-term (18 months -5 years)
Cost: $$$$
Finance Options: CDBG-DR; RIDOT; FEMA (Section 406), RIEMA
Benefit: Decreased cost of post-disaster clean-up; increased public safety; effective evacuations; emergency access

Action 4: Back-up Power for Sewer Pump Stations

Project Description: Purchase a generator and portable fuel storage tank which will provide back-up power for sewer pump stations. This will mitigate the potential danger to residents and damage to property by quickly providing power in the event of power disruption. This action item is partially completed as the Town purchased one portable generator for this purpose. The goal of the Town is to acquire an additional portable generator so the Town has access to two portable generators for the purposes of restoring power to sewer pump stations during times of outages.

Action Type: Emergency Services, Pre-Disaster
Priority: Medium
Change in Priority since 2006 Plan: 1.3 in 2006 Plan (partially completed)
Lead: Emergency Management; Town Manger
Supporting: Facilities Manager
Time Frame: Long-term (18 months -5 years)
Cost: $
Finance Options: RIEMA; FEMA
Benefit: Public Safety, Power

Action 5: Participate in the FEMA National Flood Insurance Program's (NFIP) Community Rating System (CRS)

Project Description: The National Flood Insurance Program (NFIP) enables property owners in participating communities to purchase insurance protection against flood losses. This action is to undertake activities that, when combined, gain the Town entrance into the Community Rating System (CRS). CRS is a voluntary part of the National Flood Insurance Program that seeks to coordinate all flood-related activities, reduce flood losses, facilitate accurate insurance rating, and promote public awareness of flood insurance by creating

incentives for a community to go beyond minimum floodplain management requirements. The incentives are in the form of insurance premium discounts for property owners based upon the community's CRS score. This project will involve engaging in several of the nineteen creditable activities under the four general categories of public information, mapping and regulations, flood damage reduction, warning and response. The Town already conducts several of the creditable activities. Project will include preparation of CRS application. Potential activities that are eligible to receive credit include: advising the public about the flood hazard areas, flood insurance, and flood protection measures; enacting and enforcing regulations that exceed NFIP minimum standards so that more flood protection is provided for new development; stormwater management, implementing damage reduction measures for existing buildings such as acquisition, relocation, retrofitting, and maintenance of drainageways and retention basins.

Action Type: Property Protection and Incentives Program
Priority: Low
Change in Priority since 2006 Plan: New Action
Lead: Building; Planning
Supporting: Town Manager; GIS
Time Frame: Long - term (18 months – 5 years)
Cost: $
Finance Options: staff time / town's annual operating budget
Benefit: Property Protection, Reduced flood insurance premium for Block Island property owners

Action 6: Back-up Power for North End of Island

Project Description: Purchase and install a 500 kw generator and portable fuel storage tank at the Transfer Station, which will be attached to the power grid and provide back-up power if the integrity of the grid is compromised. This will mitigate the potential danger to residents and damage to property by quickly providing power in the event of disruption.

The north end of the island is vulnerable to being cut off from the rest of the island. Corn Neck Road, the only road connecting north to south could be breached by wave action during a hurricane or winter storm, or might be washed out by heavy rain. This would place residents on the north end of the island at risk of having no power or access to town and supplies. Historically, storms have flooded and damaged the road at its narrowest point, demonstrating the potential of isolating the north end.

Action Type: Emergency Services, Pre-Disaster
Priority: High
Change in Priority since 2006 Plan: 3.1 in 2006 Plan
Lead: Emergency Management
Supporting: Fire
Time Frame: Medium- term (6-18 months)
Cost: $
Finance Options: RIEMA; FEMA
Benefit: Public Safety, Power

Action 7: Town Highway Garage Generator

Project Description: The Public Works Department is a lead in natural hazard preparedness and recovery activities. A generator at the Town Highway Garage would permit essential town employees to continue work activities related to storm response and recovery during a power outage. This need was identified by Highway Superintendent.

Action Type: Emergency Services, Pre-Disaster
Priority: Medium
Change in Priority since 2006 Plan: New Action
Lead: Public Works
Supporting: Facilities Manager; Emergency Management
Time Frame: Long-term (18 months – 5 years)
Cost: $
Finance Options: FEMA, RIEMA
Benefit: Power, Essential Services

Action 8: Medical Center Generator Replacement

Project Description: The Block Island Medical Center, which also serves as an emergency shelter for the island, is in need of a new generator. This will allow the Medical Center to continue to provide medical care and to serve as a shelter during a power outage.

Action Type: Emergency Services, Pre-Disaster
Priority: Medium
Change in Priority since 2006 Plan: New Action
Lead: Public Works
Supporting: Block Island Medical Center; Emergency Management
Time Frame: Long-term (18 months – 5 years)
Cost: $
Finance Options: FEMA, RIEMA
Benefit: Power, Essential Services

Action 9: Town Hall Generator

Project Description: Purchase and install generator at the New Shoreham Town Hall to provide back-up during times of outages. This will allow essential government services to continue during times of emergencies and loss of power.

Action Type: Emergency Services, Pre-Disaster
Priority: Medium
Change in Priority since 2006 Plan: New Action

Lead: Town Manager
Supporting: Facilities Manager; Emergency Management
Time Frame: Long-term (18 months – 5 years)
Cost: $
Finance Options: FEMA, RIEMA
Benefit: Power, Essential Services

Action 10: Salt Marsh Migration

Project Description: Existing salt marshes, subject to sea level rise, are showing signs of degradation in Rhode Island coastal communities. Marsh processes important for coastal protection include wave attenuation, shoreline stabilization, and floodwater attenuation. Marshes that can adapt, by migrating update, as sea levels rise are most likely to continue to provide coastal protection services in the face of seal level rise. The Town's Comprehensive Plan highlights the ecological significance of the network of coastal wetlands of the Great Salt Pond and states that they must be understood and protected. Many of these wetlands are threatened by sea level rise and accommodations should be planned for wetland migration. See SLAMM maps of Block Island for specific locations. This action is to first, identify and prioritize lands that will provide marsh migration areas for coastal wetlands of the Great Salt Pond in response to sea level rise utilizing existing GIS mapping information and site inspections, then work with land conservation partners to acquire or protect through conservation easements those lands with the greatest potential.

Action Type: Planning; Property Protection; Pre-Disaster
Priority: Moderate
Change in Priority since 2006 Plan: New Action
Lead: Planning; Land Trust
Supporting: Town Manager; GIS
Time Frame: Long - term (18 months – 5 years)
Cost: $$$$
Finance Options: BILT; partners; open space bond; staff time
Benefit: Property Protection, Natural Resources Protection

Action 11: Block Island Stormwater Management Plan

Project Description:
Stormwater runoff can contribute to increased destabilization and erosion rates of the coastal bluffs of Block Island, flood island roadways and impair water quality of the Great Salt Pond. This project is to complete an island-wide stormwater management plan that will identify stormwater program activities and best management practices to reduce runoff volume to prevent flooding during rain events and improve water quality, particularly in the Great Salt Pond watershed.

Action Type: Planning; Property Protection; Pre-Disaster
Change in Priority since 2006 Plan: New Action
Lead: Planning; Highways; Engineering
Supporting: GIS
Time Frame: Long-term (18 months – 5 years)
Cost: $
Finance Options: CDBG-DR; RIDEM; other federal and private grants
Benefit: Property Protection, Natural Resources Protection; Drinking Water Quality Protection

Action 12: Implement WebGIS

Project description: Offer free interactive GIS hazard mapping online for residents, business owners, real estate professionals, town staff, emergency management officials, etc. A municipal GIS website could include information for the public on which properties may be subject to sea level rise impacts in the future and flood hazard areas. Additional data layers could include evacuation routes, utilities, and fire hydrants.

Action Type: Planning; Property Protection; Pre-disaster; Post-disaster
Change in Priority since 2006 Plan: New Action
Lead: GIS
Supporting: IT
Time Frame: Short-term
Cost: $
Finance Options: Grants; staff time
Benefit: Public Outreach; Property Protection; Improved Emergency Management before, during and after a natural disaster

Action 13: Burying Overhead Power Lines

Project Description: The island's distribution system consists of six 2.4 kilovolt circuits with about fifty miles of lines, the majority of which are overhead lines. The distribution system on Block Island is outdated and inefficient, resulting in large line losses, frequent power supply interruptions, brownouts and damage to appliances and equipment. The system requires upgrading to provide more reliable service.

Burying power lines can protect this critical utility asset and infrastructure from the impacts of winter storms, hurricanes and wind storms. Placing the distribution system underground

would keep utilities out of high wind, ice, and the corrosive salt of the island environment, thereby reducing vulnerability to natural hazards, power loss, and fire.

This project involves burying critical lines along the east side of the island. The Old Harbor section on the eastern coast of the Island has been assessed as susceptible to high winds during much of the year and as highly susceptible during high winds or a hurricane, ice, or snow. Many of the town's critical facilities are in this area of the island including the Library, Town Hall, Community/Day Care Center, Post Office, and Sewer Treatment Plant and would be susceptible to power failure caused by downed power lines. The Town, with the assistance of the Old Harbor Task Force, could partner with the local Chamber of Commerce and area businesses to implement this project.

Action Type: Structural Project, Pre-Disaster
Priority: High
Change in Priority since 2006 Plan: 3.2 in 2006 Plan
Lead: Town Manager; Block Island Power Co. (BIPCO)
Supporting: Engineering; Highway Department
Time Frame: Medium-term (18 months to 5 years)
Cost: $$$$
Finance Options: BIPCO, National Grid, Private Organizations
Benefit: Public Safety, Power, Aesthetic

Action 14: Sand's Pond Drainage Project

Project Description: Complete drainage project to divert excess water from Sand's Pond. The flood of March 2010 caused rapid elevation of the water level in Sand's Pond. The resulting overflow encroached upon the electrical boxes which service the Water Company's reservoir pumps. These were damaged, and the underground backwash holding tanks were submerged underwater. Neighboring properties were also compromised. Flooding of this equipment causes damage, which in turn, compromises the operation of the Company and its ability to provide safe drinking water to its users.

This project involves re-establishing the natural drainage to the South that was blocked about 50 years ago. A structural design would have to be implemented that would be in compliance with RI Department of Environmental Management and Coastal Resource Management Council. Easements would have to be given from neighboring property owners.

Action Type: Structural Project, Pre-Disaster
Priority: High
Change in Priority since 2006 Plan: New Action
Lead: Town Manager
Supporting: Engineering; Water Company
Time Frame: Medium-term (6-18 months)
Cost: $$$
Finance Options: RIDEM
Benefit: Property Protection, Essential Services, Environment and Water Quality

Action 15: New Fire Station

Project Description: The Town has identified the need for a new fire station. The current fire station, built in 1972, is now over 40 years old. This is a critical facility which serves as the center for dispatch and emergency operations. The existing site is surrounded by and in close vicinity to A and V flood hazard zones. Adjacent roadways are subject to flooding. An alternative location has not been identified as an option. The current location is in close proximity to a greater density of structures, public facilities and population. If a new fire station is to be constructed at the same location, a combination of structural and non-structural flood proofing measures could be incorporated into the design. The planning and design of the new fire station should consider the preparedness measures necessary in order to respond to different areas of the island during hazard events and potential inundation of roadways.

Action Type: Structural Project, Pre-Disaster
Priority: Low
Change in Priority since 2006 Plan: 2.2 in 2006 Plan (partially completed) – New Rescue Barn constructed in 2009
Lead: Town Manager; Fire
Supporting: Facilities Manager
Time Frame: Long- term (18 months – 5 years)
Cost: $$$$
Finance Options: Town Bond
Benefit: Public Safety, Essential Services

Action 16: Public Outreach Regarding Droughts and Brushfires

Project Description: Develop a guide to educate property owners on actions that they can take to reduce risk to property from brush fires including drought tolerate landscape design and maintenance measures. Include also measures regarding safe disposal of yard and household waste rather than open burning. Conduct public outreach to discourage the use of water resources for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc., during droughts.

Action Type: Planning; Property Protection; Pre-disaster; Post-disaster
Change in Priority since 2006 Plan: New Action
Lead: Land Use, Building & Zoning; Water Company, Fire Department
Supporting: Planning; IT; BILT
Time Frame: Long-term
Cost: $
Finance Options: staff time
Benefit: Public Outreach; Property Protection; Improved Emergency Management before, during and after a natural disaster

Table 16 - Natural Hazards Mitigation Actions								
Action #	**Vulnerable Area / Critical Asset**	**Project Name**	**Priority**	**Location**	**Owner**	**Hazard Type**	**Mitigation Objective**	**Existing or New Action**
1	Natural Environment / Transfer Station	Beach Erosion at Old Landfill Site	High	West Beach Road	Town	Hurricane, Wind, Erosion	Terrace and create a new rip rap slope at edge of land impacted by storms	New
2 *(1.4 in 2006 Plan)*	Dams & Bridges / Old Town Road	Old Town Road Sluice / Bridge	High	Old Town Road	Town & State	Flooding, Hurricane, Wind	Upgrade bridge/culvert; engineering design, DEM permits, etc.	Existing
3	Critical Roads / Corn Neck Road	Corn Neck Road Mitigation	High	Corn Neck Road	State	Storm Surge, Hurricane, Severe Winter Weather; Sea Level Rise	Planning, design and construction of relocation or raising of roadbed for segment of Corn Neck Road subject to storm inundation and damage	New
4 2006 Plan 1.3	Natural Environment / Great Salt Pond	Back-up Power for Sewer Pump Stations (Partially Completed - Town acquired 1 portable generator)	High	5 sites in Old and New Harbors	Town	Hurricane, Severe Winter Weather	Purchase two portable generators, maintain critical services during times of outages, minimize risk to environment	Existing
5	Residential & Commercial Land Uses / Private Property	Participate in FEMA's Community Rating System	Medium	Island-wide	N/A	Flooding	Initiate additional flood mitigation efforts; save property owners on costs associated with flood insurance premiums	New
6 *(3.1 in 2006 Plan)*	Essential Services / Electric	Back-up Power for Northern End of Island	High	Transfer Station on West Beach Road	Town	Flooding, Hurricane, Severe Winter Weather	Purchase 500 kw generator for Neck use; fuel storage unit	Existing
7	Essential Services / Electric	Town Highway Garage Generator	Medium	Ocean Avenue	Town	Hurricane, Severe Winter Weather	Maintain critical services during times of power outages	New
8	Essential Services / Electric	Medical Center Generator Replacement	High	Payne Road	Town	Hurricane, Severe Winter Weather	Maintain critical services during times of power outages	New
9	Essential Services / Electric	Town Hall Generator	Medium	Old Town Road	Town	Hurricane, Severe Winter Weather	Maintain critical services during times of power outages	New
10	Natural Environment / Coastal Resources	Salt Marsh Migration	Medium	Surrounding Great Salt Pond/ New Harbor/Old Harbor and Northern End	Multiple	Flooding, Sea Level Rise	Acquire undeveloped land having a high potential for salt marsh migration	New
11	Natural Environment / Great Salt Pond	Block Island Stormwater Management Plan	Medium	Island-wide	Multiple	Flooding	Prepare, adopt and implement an Island-wide Stormwater Management Plan	New
12	Essential Services	Implement WebGIS	Medium	Island-wide	Multiple	Flooding, Sea Level Rise, Hurricane	Implement WebGIS to increase public access to municipal and natural hazard geographic data	New
13 *(3.2 in 2006 Plan)*	Essential Services / Private Property	Bury Power Lines	Low	Water St., Corn Neck, Spring St.	Town, State, BIPCO	Hurricane, Winds, Severe Winter Weather	Bury critical lines along east side of island	Existing
14	Residential & Commercial Land Uses / Private Property	Sand's Pond Drainage Project	Low	Sand's Pond Road	Town	Flooding; Sea Level Rise	Divert water from the pond to the ocean when the pond nears flood stage	New
15 2006 Plan 2.2	Essential Services / Fire/Rescue Building and Police Station	New Fire Station (Rescue Building completed in 2009)	Low	Existing Location - Ocean Avenue	Town	Flooding; Sea Level Rise	Construct a new fire station at current location	Existing
16	Residential & Commercial Land Uses & Natural Environment / Private Property	Public Outreach Regarding Droughts and Brushfires	Low	Island-wide	Multiple	Drought, Wildfire	Development of Public Outreach Material Regarding Droughts and Brushfires	New
1.1 in 2006 Plan	New Town Hall and Fire-Proof Records Vault (COMPLETED 2007)			Old Town Road	Town	Flooding, Hurricane	Protect vital records, provide for continuity of local government	
1.2 in 2006 Plan	Block Island Water Company Sprinkler System (COMPLETED 2010)			Payne Road	Town	Flood, Fire, Lightning	Install lightning protection to mitigate an occurrence of fire and damage to equipment that	
2.1 in 2006 Plan	Old Harbor Dock Rebuilt (COMPLETED 2011)			Water Street	Town	Hurricane, Winter Storm	Replace & repair bulkheads, replace decking to secure the sole access for year-round ferry service	
2.2 in 2006 Plan	New Fire / Rescue Building (RESCUE BUILDING COMPLETED 2009)			Beach Avenue	Town	Hurricane, Winter Storm, Fire	Construct building with 2 bays for rescue vehicles, training area, and area for filling oxygen tanks (with sprinkler system & rated to withstand high	

7. Plan Implementation & Next Update

The Town of New Shoreham and the New Shoreham Hazard Mitigation Committee realize that successful hazard mitigation is an ongoing process that requires implementation, evaluation, and updates to this plan. The Town also understands the importance of integrating appropriate sections of the plan into the Town's Comprehensive Plan, Emergency Operations Plan, and site plan review process. Elements of the Hazard Mitigation Plan will also be considered when updating local land use regulations including zoning. It is intended that this plan and the ongoing efforts of the New Shoreham Hazard Mitigation Committee will preserve and enhance the quality of life, property, and resources for the Town of New Shoreham. Assigned time frames also provide inputs to a project plan used for tracking the progress of all activities. It is recognized that progress on plan implementation may vary dependent upon available funding and capacity of staff to complete assigned tasks. Adoption of this mitigation strategy increases New Shoreham's eligibility for federal hazard mitigation grants. These grants originate from FEMA's Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM) and post-disaster Hazard Mitigation Grant (HMGP) Programs. The New Shoreham Hazard Mitigation Committee will meet annually (or more frequently if necessary) to monitor, evaluate, and make updates to the plan. The New Shoreham Town Council will hold public meetings when considering implementation of mitigation strategies and actions. The Town Council will also hold public meetings when considering any updates to the Plan in order to solicit public input. All meetings of the Hazard Mitigation Committee and the Town Council will be advertised in the local newspaper (Block Island Times) and on the town website. The next required update of the Hazard Mitigation Plan will be led by the Town Planner who will assist in advertising public meetings and soliciting for public comments through a host of media including newspaper, website, email, and social media. The physical location, mailing address, and email address of the town department and specific contact person to submit comments will be included in the public outreach material that will be posted on the town website and social media.

Monitoring

The New Shoreham Hazard Mitigation Committee will meet annually to monitor plan progress. At each of these meetings, the members will discuss the actions assigned to them to ensure continual progress with mitigation efforts. The status of each mitigation action will be documented and minutes recorded for the record. The New Shoreham Hazard Mitigation Committee will also continue to reevaluate membership on the committee to ensure effective engagement of the appropriate parties. New members may be invited to serve on the New Shoreham Hazard Mitigation Committee as priorities shift.

Evaluation

At the annual meetings, the New Shoreham Hazard Mitigation Committee will evaluate both the actions and the planning process. The New Shoreham Hazard Mitigation Committee will base its evaluation on

whether or not the actions have met the following criteria: increased public awareness/education, reduction in hazard damage, actions being implemented in the designated time frames, and actions staying within the cost estimate. The committee will document and report its findings to the Planning Board and Town Council. The New Shoreham Hazard Mitigation Committee will involve the public in the action evaluation process by holding an annual advertised public meeting in order to review the evaluation and solicit input. It is advantageous the annual review be conducted prior to the Town's annual budget process so any locally funded projects can be considered in the budget process. During the annual evaluation process, the plan will be promoted online, in the local library, at Town Hall, and the Community Center for public review. Comments and suggestions can be sent directly to the Emergency Management Director or Town Planner or brought up at the advertised public meeting.

Updates

As per 44 CFR S 201.6(d)(3), the Plan will be reviewed and revised to reflect progress in local mitigation efforts and changes in priorities, and resubmitted for approval within 5 years in order to continue to be eligible for mitigation project grant funding. In order to ensure that the Plan remains current, the New Shoreham Hazard Mitigation Committee, which consists of representatives from the Emergency Management, Public Works, Zoning, Water/Sewer Department, Fire Department, and Police Department, will meet annually. The Plan will also be evaluated and updated after a disaster, or as funding opportunities arise for the actions and projects identified in the plan. These revisions will also reflect changes to priorities and funding strategies that may have been implemented. Any updates will be reviewed and submitted to RIEMA upon local approval to ensure that the state hazard mitigation strategy remains current. An update to the plan will be completed every five years and will incorporate a formalized process for prioritizing actions and weighing the cost/benefit of such actions. A full revision of the plan will commence a year in advance of the current plan expiration date in order to ensure the Town always has an approved plan.

When the New Shoreham Hazard Mitigation Committee actively begins the next plan update in 2021, Block Island residents and business owners will be asked to provide their thoughts and suggested mitigation priorities actions early on in the planning effort via a survey tool. The New Shoreham Hazard Mitigation Committee will design a survey for the public that will guide their internal planning efforts. All updates or revisions to the plan will be submitted to RIEMA. The Town Council will involve the public again later in the plan revision process by holding an annual advertised public meeting to present recommended revisions and solicit input. Future revisions of the plan will be sent to the Emergency Management Directors and Planners in neighboring communities for their input. Upon completion, the final approved plan will also be provided to neighboring communities for their records.

8. Definitions

Extent *means the strength or magnitude of the hazard.* For example, extent could be described in terms of the specific measurement of an occurrence on a scientific scale (for example, Enhanced Fujita Scale, Saffir-Simpson Hurricane Wind Scale, Richter Scale, flood depth grids) and/or other quantitative hazard factors, such as duration and speed of onset.

Impact *is the effect of the hazard on the community and its assets.* The community determines its valued assets, e.g., populations, structures, facilities, cultural resources, capabilities, and/or activities.

Vulnerability is the degree to which assets are susceptible to the effects of hazards. Vulnerability depends upon exposure and sensitivity, and to adaptability for some assets especially in response to climate change.

REFERENCES

Block Island Harbors Sea Level Rise Adaptation Study, August, 2013.

Earthquake: Needs Assessment. Rhode Island Emergency Management Agency. October 1994.

Flood Hazard Mitigation Planning: A Community Guide. Massachusetts Department of Environmental Management Flood Hazard Management Program. June 1997.

Local Mitigation Plan Review Crosswalk for Review of Local Mitigation Plans. FEMA. July 1, 2008.

Local Mitigation Planning Handbook. FEMA. March 2013.

New Shoreham Comprehensive Plan, 2016, Adopted.

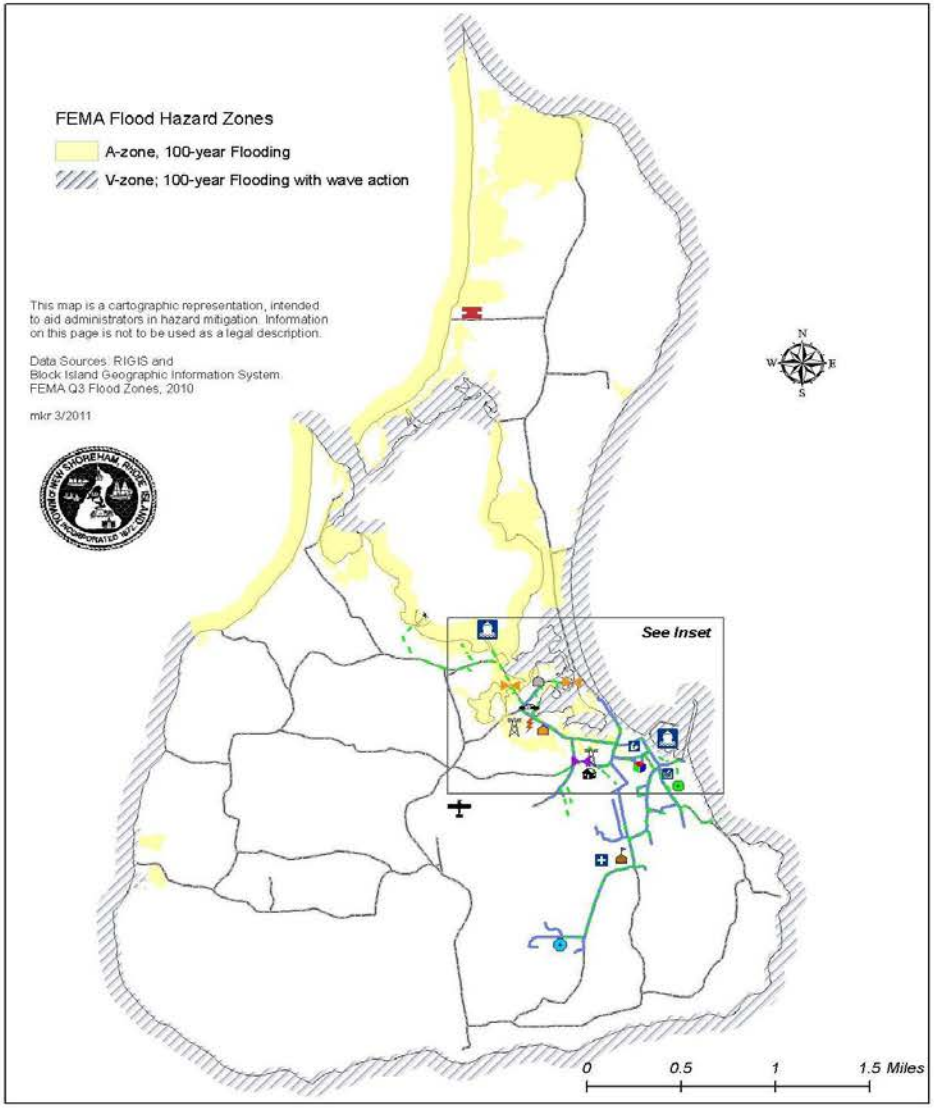
New Shoreham Harbor Management Plan 2013.

Rhode Island Hazard Mitigation Plan, 2014 update. RIEMA.

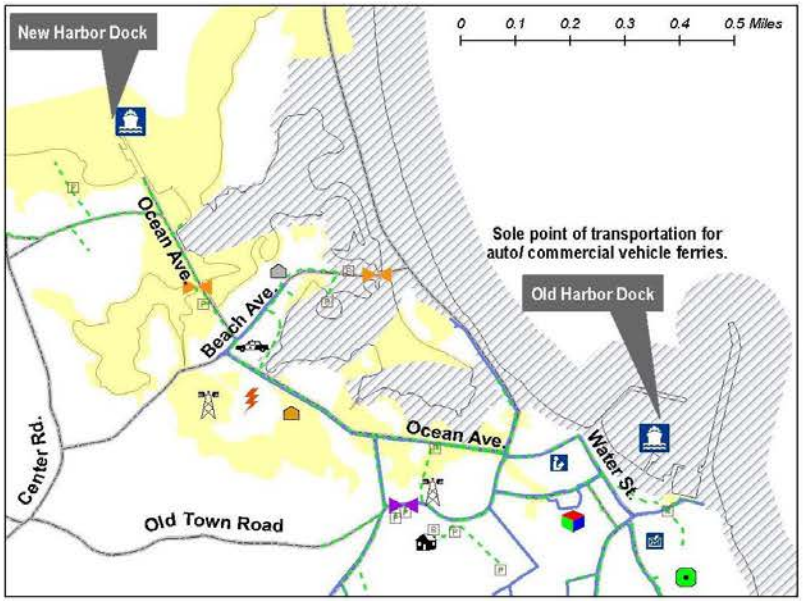
State and Local Mitigation Planning How-To Guides. FEMA.
FEMA 386-2, August 2001. FEMA 386-3, April 2003. FEMA 386-4, April 2003.

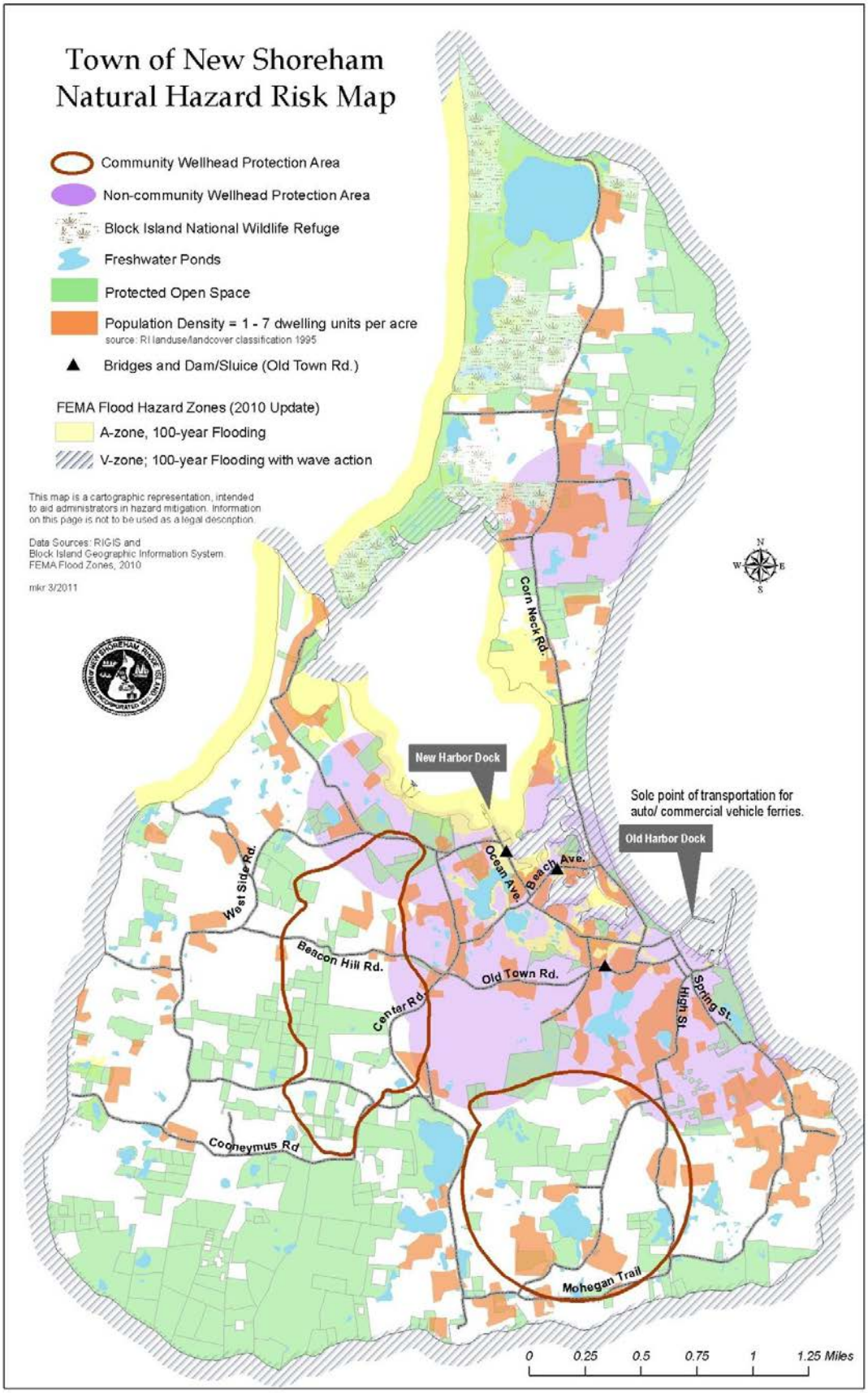
Town of New Shoreham Emergency Operations Plan, 2011.

APPENDIX A
Risk Maps

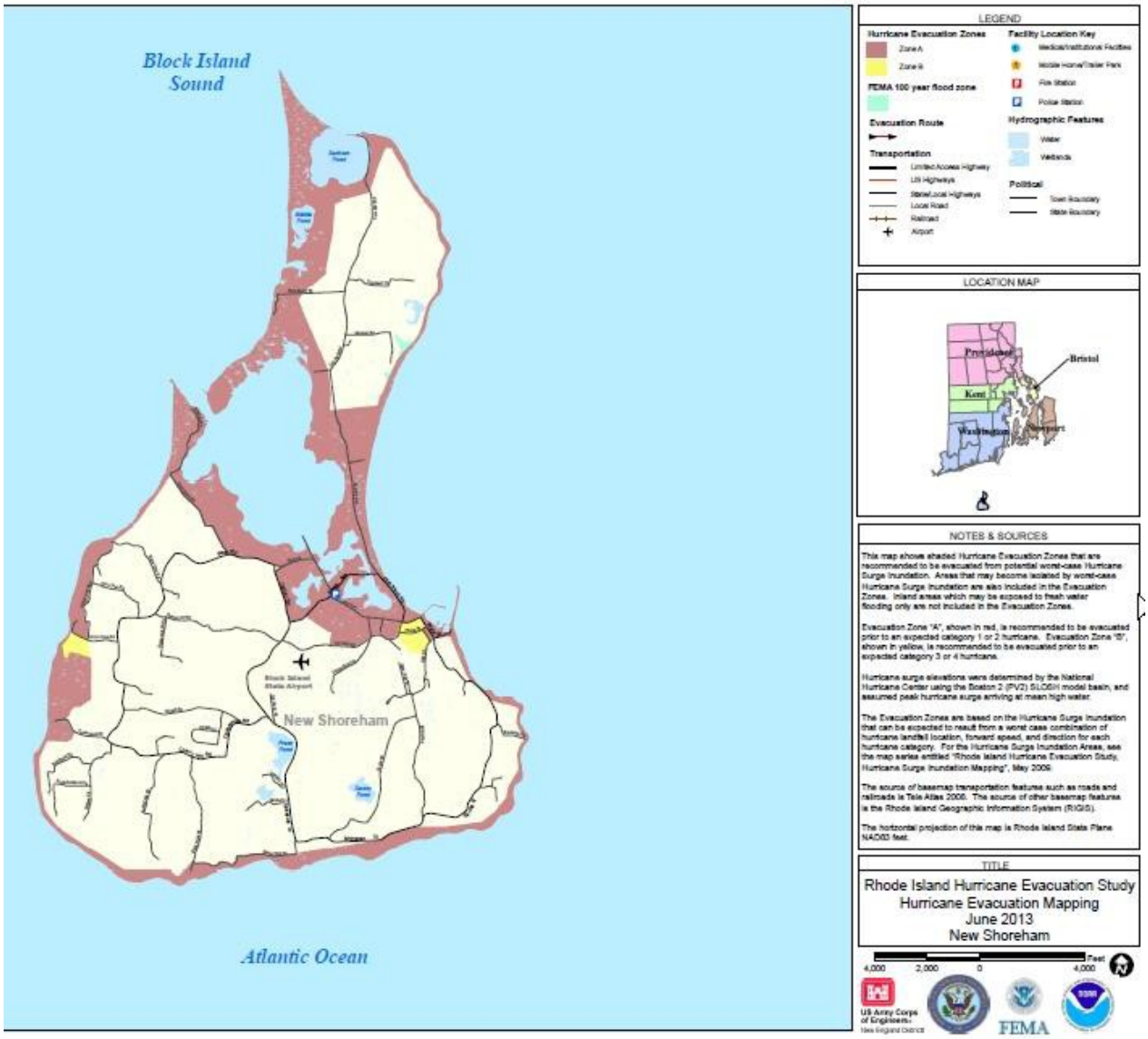

FEMA Flood Hazard Zones
A-zone, 100-year Flooding
V-zone; 100-year Flooding with wave action
This map is a cartographic representation, intended to aid administrators in hazard mitigation. Information on this page is not to be used as a legal description.
Data Sources: RIGIS and Block Island Geographic Information System. FEMA Q3 Flood Zones, 2010
mkr 3/2011
See Inset
0 0.5 1 1.5 Miles


Town of New Shoreham
Critical Facilities
Airport
BI School
Community Ctr/Day Care
Library
Medical Center
Ferry Docks
Town Hall
Police, Fire, Rescue
Post Office
Cell Tower
Old Town Rd Sluice
Bridge
State Highway Garage
Town Highway Garage
Transfer Station
Sewer Plant
Sewer Pump Stations
Sewer Lines
Water Company
Water Distribution Lines
Power Company


New Harbor Dock
0 0.1 0.2 0.3 0.4 0.5 Miles
Ocean Ave.
Beach Ave.
Sole point of transportation for auto/ commercial vehicle ferries.
Old Harbor Dock
Center Rd.
Ocean Ave.
Water St.
Old Town Road


Town of New Shoreham
Natural Hazard Risk Map
Community Wellhead Protection Area
Non-community Wellhead Protection Area
Block Island National Wildlife Refuge
Freshwater Ponds
Protected Open Space
Population Density = 1 - 7 dwelling units per acre
source: RI landuse/landcover classification 1995
Bridges and Dam/Sluice (Old Town Rd.)
FEMA Flood Hazard Zones (2010 Update)
A-zone, 100-year Flooding
V-zone; 100-year Flooding with wave action
This map is a cartographic representation, intended to aid administrators in hazard mitigation. Information on this page is not to be used as a legal description.
Data Sources: RIGIS and Block Island Geographic Information System. FEMA Flood Zones, 2010
mkr 3/2011
N
W
E
S
Corn Neck Rd.
New Harbor Dock
Sole point of transportation for auto/ commercial vehicle ferries.
Old Harbor Dock
Ocean Ave.
Beach Ave.
West Side Rd.
Beacon Hill Rd.
Old Town Rd.
Center Rd.
High St.
Spring St.
Cooneymus Rd
Mohegan Trail
0 0.25 0.5 0.75 1 1.25 Miles

Hurricane Evacuation Map FEMA 2013



APPENDIX B
Block Island Harbors Sea Level Rise Adaptation Study 2013

The following is the Public Information pamphlet produced as an outcome of the Block Island Harbors Sea Level Rise Adaptation Study completed in 2013.

SEA LEVEL RISE ON BLOCK ISLAND
HOW WILL IT AFFECT YOU?

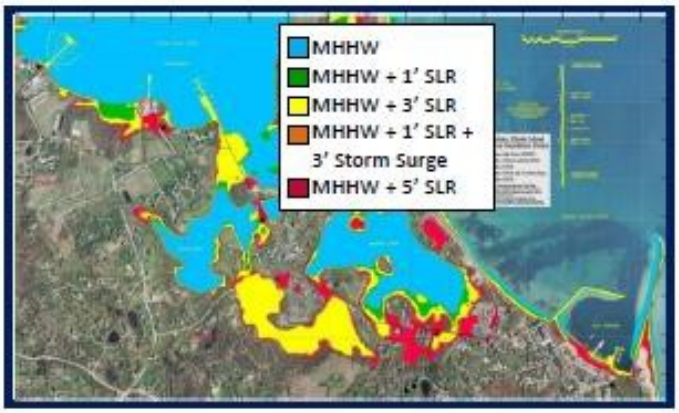
Our climate is changing. Rhode Island is experiencing warmer air temperatures, increased Bay temperatures, more extreme weather events and accelerated sea level rise. Since 1930, sea level rise as measured by tide gages in Newport has risen at a rate of about 1 inch every 10 years, but this rate is increasing. In another 20 years it is probable the sea level will rise several more inches. This heightened sea level means higher high tides and greater storm surges. The result will be greater coastal flooding and erosion, and more widespread property damage.

Owing to its geographical location, Block Island is vulnerable to hurricanes, coastal storms and nor'easters. The community is dependent on privately owned ferry and airline companies for transport to and from the mainland. The island's residents must plan for inevitable long term impacts that a rising sea will have on its two harbors and village roads. Residents and visitors alike must prepare for the next inevitable coastal storm on the scale of a Super Storm Sandy, which caused significant damage to roads, buildings and marine facilities due to wave action, storm induced erosion and flooding.

Damage to Corn Neck Road from Super Storm Sandy October 2012

A 2013 study* of the impact of sea level rise on the Block Island harbors and connecting roadways included preparation of maps illustrating areas predicted to be inundated under various scenarios. The maps demonstrate vulnerable flood damage areas that result as sea levels rise over the long term. Under extreme storm conditions in the near term, certain roads, bridges and marine areas, particularly Old Harbor and the ferry landing site and the roads leading into New Harbor, are also vulnerable to flooding and damage. This will result in some areas of the island becoming temporarily isolated. Ferry travel to and from the island may be disrupted beyond the anticipated normal storm duration. This information is important both for emergency planning purposes, and for scheduling and designing major infrastructure replacement.

Public Information pamphlet (continued)



Inundation zones depicted for sea level rise (SLR) scenarios

There are many things that Block Island officials, conservation organizations, residents, vacationers and visitors can do to prepare for climate change and sea level rise.

Maintaining public infrastructure:

* Plan for sea level rise and storm flooding when designing upgrades to marine facilities, roadways, bridges, and pump stations

Learning about and adapting to climate change impacts:

* Assist the organizations and agencies monitoring the impacts of climate change with efforts such as documenting and photographing high tide events, storm flooding impacts, bluff erosion and changes in species composition in the ocean and coastal pond, etc
* Be aware of vulnerable areas when using and developing property and designing buildings
* Focus land acquisition efforts on flood-prone areas most susceptible to damage
* Follow only pathways to the beach, and stay off the dunes, which serve to protect inland areas against wave erosion and flooding

Emergency procedures in advance of a major coastal storm or hurricane:

* Renters and visitors should leave the island when directed to do so
* Recreational boaters should leave for their home ports when instructed by the harbormaster
* Residents should follow the procedures for hurricane planning established by the emergency management director, and be aware of island roadways subject to temporary inundation

APPENDIX C
Technical and Financial Assistance for Mitigation

State Resources

Coastal Resources Center
University of Rhode Island
Narragansett Bay Campus
Narragansett RI 02882
(401) 874-6224

Coastal Resources Management Council
Stedman Government Center
4808 Tower Hill Road
Wakefield RI 02879
(401) 222-2476

RI Department of Administration
Division of Planning
One Capitol Hill
Providence RI 02908
(401) 222-2635

RI Department of Environmental Management
Division of Parks & Recreation
2321 Hartford Avenue
Johnston RI 02919
(401) 222-2635

RI Department of Transportation-
Design Section/Bridges
2 Capitol Hill, Room 231D
Providence RI 02903
(401) 222-2053

RI Banking Commission/
Associate Director
233 Richmond Street
Providence RI 02903
(401) 222-2405

RI Builders Association –New Address
Terry Lane, The Terry Lane Corporation
Gloucester RI 02814
(401) 568-8006

RI Department of
Business Regulations
233 Richmond Street
Providence RI 02903
(401) 222-2246

RI Emergency Management Agency
645 New London Avenue
Cranston RI 02920
(401) 946-9996

Public Utilities Commission
89 Jefferson Blvd
Warwick, RI 02888
(401) 941-4500

State Fire Marshal's Office
118 Parade St
Providence RI 02909
(401) 222-2335

RI Building Committee Office
Building Commissioner's Office
One Capitol Hill
Providence RI 02903
(401) 222-3529

Federal Resources

Economic Development Administration
143 North Main Street, Suite 209
Concord, NH 03301
(603) 225-1624

Federal Emergency Management Agency
Mitigation Division
Region I Office
99 High Street
Boston, MA 02110

U.S. Department of Housing and Urban Development
Comm. Development Block Grants
Region I-O'Neill Federal Building
10 Causeway Street
Boston, MA 02222
(617) 656-5354

U.S. Army Corps of Engineers
New England District
424 Trapelo Road
Waltham, MA 02254
(617) 647-8505

U.S. Department of Agriculture
Natural Resources Conservation Service
(formerly Soil Conservation Service)
451 West Street
Amherst, MA 01002
(413) 253-4362

U.S. Fish and Wildlife Service
New England Field Office
22 Bridge Street, Unit #1
Concord, NH 03301-4986

U.S. Department of Commerce National Weather Service
Forecast Office
445 Myles Standish Boulevard
Taunton, MA 02780
(508) 823-2262

Small Business Administration
360 Rainbow Blvd., South, 3rd Floor
Niagara Falls, NY 14303
(716) 282-4612 or (800) 659-2955

U.S. Department of the Interior National Park Service
River & Trail Conservation Program
Regional Office
15 State Street
Boston, MA 02109
(617) 223-5203

U.S. Environmental Protection Agency – Region I
JFK Federal Building
Government Center
Boston, MA 02203
(617) 565-3400

U.S. Geological Society
12201 Sunrise Valley Drive
Reston, VA

Other Resources

The Association of State Floodplain Managers (ASFPM)
Professional association with a membership of almost 1,000 state employees that assists communities with the NFIP. ASFPM has developed a series of technical and topical research papers and a series of proceedings from their annual conferences. Many mitigation "success stories" have been documented through these resources and provide a good starting point for planning.

Floodplain Management Resources Center
Free library and referral service of the ASFPM for floodplain management publication. Co-located with the Natural Hazards Center at the University of Colorado in Boulder, staff can use keywords to identify useful publications from the more than 900 flood-related documents in the library.

Institute for Business and Home Safety (IBHS) (formerly Insurance Institute for Property Loss Reduction)
An insurance industry sponsored, nonprofit organization dedicated to reducing losses – deaths, injuries and property damage – resulting from natural hazards. IBHS efforts are directed at five specific hazards: flood, windstorm, hail, earthquake and wildfire. Through its public education efforts and information center, IBHS communicates the results of its research and statistical gathering, as well as mitigation information, to a broad audience.

Volunteer Organizations
Organization, such as the American Red Cross, the Salvation Army, Habitat for Humanity, Interfaith and the Mennonite Disaster Service are often available to help after disasters. Service organization, such as the Lions, Elks and VFW are also available. These organizations have helped others with food, shelter, clothing, money, etc. Habitat for Humanity and the Mennonite Disaster Service provide skilled labor to help rebuild damaged buildings incorporating mitigation or flood proofing concepts. The offices of individual organizations can be contacted directly or the FEMA Regional office may be able to assist.

Flood Relief Funds
After a disaster, local businesses, residents and out-of-town groups often donate money to local relief funds. They may be managed by the local government, one or more local churches or an ad hoc committee. No government disaster declaration is needed. Local officials should recommend that the funds be held until an applicant exhausts all sources of public disaster assistance. Doing so allows the funds to be used for mitigation and other projects that cannot be funded elsewhere.

New England States Emergency Consortium (NESEC) – Lakeside Office Park
NESEC conducts public awareness and education programs on natural disaster and emergency management activities throughout New England. Brochures and videotapes are available on such topics as earthquake preparedness, mitigation and hurricane safety tips. NESEC maintains a world wide web home page that is accessible at http://www.serve.com/NESEC.

The New England Floodplain and Stormwater Managers Association (NEFSMA)
Professional organization for New England floodplain and stormwater managers. Provides workshops, conferences and a newsletter to membership and interested individuals and companies. NEFSMA home page is accessible at http://www.seacoast.com/~nefsma.

APPENDIX D
Existing Protection Systems

State

Earthquakes and Hurricanes:
A certain amount of funding is allotted to each state per year based on a risk formula for earthquakes. Coastal states are allocated funds based on a risk formula for hurricanes. Each state receiving such funds has the ability to grant project funds to a community. There is not a match requirement on the part of the community, but the funds are limited and are generally only available once a year. The projects or products proposed for such funding must demonstrate that earthquake or hurricane risk will be reduced or eliminated and that the proposed projects or product is a cost-effective measure (a stringent cost/benefit analysis need not be performed). Information about the amount of funding available per year and the state requirements for eligibility and performance may be obtained from the RIEMA at (401) 946-9996.

Economic/Community Development
There may be programs existing to help flood proof homes using Community Development Block Grant funds. There may be housing assistance programs in the community that can be used following a major flood, achieving both the objectives of reducing flood damage and improving the community's housing stock (see Appendix C for more information).

Evacuation Plans and Systems
The community's emergency operations center should have evacuation plans in place. For communities near a nuclear power plant, evacuation plans are required and may also be used for flood evacuation. The RIEMA may have additional evacuation plan information.

Land Use Restrictions
There are several federal and state regulations that serve to restrict land use in certain areas that may help reduce flood hazard vulnerability. If the community has open land owned by the state or federal government, examine what restrictions are placed on its development. In addition, the state Wetlands Protection Act regulates the development of all lands identified as significant to the protection of resources identified in the act.

Septic Systems (On-Site Wastewater Treatment Systems)
Areas in the community not served by a public sewer system are affected by State OWTS regulation in terms of development and may be a consideration for mitigation alternatives that include rebuilding and elevation of structures. Specific design requirements must be met for any construction in coastal velocity zones or river floodways. Generally, an inspection of a septic system is required if there is a change in use of the structure, an increase in flow or failed system. Limited inspections are required if the footprint of the structure is being changed. Upgrades are required by the State if an inspection reveals a failed system. However, local regulations may be more restrictive than state requirements, requiring inspections or upgrades in other cases. See Town of New Shoreham OWTS Ordinance.

Warning Systems and Emergency Operations Plans:
The community may have a flood warning system in place and should have a plan for response to flooding.

Federal

Community Rating System (CRS)
A voluntary initiative of the NFIP, the CRS was developed to encourage communities to perform activities that exceed the minimum NFIP floodplain management standards. If a community participating in the CRS performs activities that include maintaining records for floodplain development, publicizing the flood hazard, improving flood data and conducting floodplain management planning, then the flood insurance premiums paid by policy holders in the community will be reduced by 5 to 45 percent. Developing a flood mitigation plan will help communities gain additional credit under the CRS.

Hazard Mitigation Grant Program
Also known as the 404 Program or HMGP, this program is available only after a federally declared disaster occurs. It represents an additional 15 percent of all the infrastructure and individual assistance funds that are provided to states to repair damages and recover from losses and is administered by the state in partnership with FEMA. Having a plan or completed mitigation action matrix prior to a disaster event is required by FEMA and is extremely helpful in meeting the states' deadlines for applications and ensuring the project is eligible and technically feasible. It provides 75/25 matching grants on a competitive basis to state, local and tribal governments, as well as to certain nonprofit organization that can be matched by either cash or in-kind services. The grants are specifically directed toward reducing future hazard losses and can be used for projects protecting property and resources against the damaging effects of floods, earthquakes, wind and other hazards. Specific activities encouraged under the HMGP include acquiring damaged structures to turn the land over to the community for open space or recreations use, relocating damaged or damage-prone structures out of the hazard area and retrofitting properties to resist the damaging effects of disasters. Retrofitting can include wet- or dry-flood proofing, elevation of the structure above flood level, elevation of utilities or proper anchoring of the structure.

Two programs that have been authorized under the National Flood Insurance Reform Act of 1994 include the Flood Mitigation Assistance (FMA) program and a provision for increased cost of compliance (ICC) coverage. FMA makes grants available on a pre-disaster basis for flood mitigation planning and activities, including acquisition, relocation and retrofitting of structures. FMA grants for mitigation projects will be available only to those communities with approved hazard mitigation plans. ICC coverage has recently been implemented for all new NFIP policies and renewals and is intended to be "mitigation insurance" to allow homeowners whose structures have been repeatedly or substantially damaged to cover the cost of elevation and design requirements for rebuilding with their flood insurance claim up to a maximum of $15,000. A certain amount of funding is allotted to each state per year based on a risk formula for floods. Each state has the discretion to award funds to communities or to state government agencies. States may use whatever criteria or method they choose to award the funds as long as the applicant and the proposal are eligible. The program may fund up to 75 percent of the total cost of the proposed project, with a minimum of 25 percent of the cost coming from the community. A minimum of half the community share must be cash or "hard match". Funds can also be granted to communities to help them prepare local flood mitigation plans. The same match requirements apply. Once a community receives a planning grant, however, it is not eligible to receive additional planning grants for another five years. For further information on the FMA program or ICC coverage, contact the RIEMA at (401) 946-9996.

National Flood Insurance Program (NFIP)
All of Rhode Island's 39 municipalities participate in the NFIP. This program is a direct agreement between the federal government and the local community that flood insurance will be made available to residents in exchange for community compliance with minimum floodplain management regulations. Communities participating in the NFIP must:

- Adopt the flood insurance rate maps as an overlay regulatory district

- Require that all new construction or substantial improvement to existing structures in the flood hazard area be elevated or (if nonresidential) flood proofed to the identified flood level on the maps
- Require design techniques to minimize flood damage for structures being built in high hazard areas, such as floodways or velocity zones
- In return for community adoption of these standards, any structure in that community is eligible for protection by flood insurance, which covers property owners from losses due to inundation from surface water of any source. Coverage for land subsidence, sewer backup and water seepage is also available subject to the conditions outlined in the NFIP standard policy (see Appendix C for contacts regarding insurance coverage and purchase). Since homeowners insurance does not cover flooding, a community's participation in the NFIP is vital to protecting property in the floodplain as well as being essential to ensure that federally backed mortgages and loans can be used to finance flood prone property.

APPENDIX E
Public Notices

PUBLIC NOTICE

The Town of New Shoreham is in the process of updating its 2006 Hazard Mitigation Plan. Members of the public are encouraged to participate. Copies of the Plan are available at the Town Hall and Library or can be downloaded from the Town's website. The next meeting is scheduled for Thursday, November 18, 2010 @ 8:00 a.m. at Town Hall.
Posted:
11/8/10
sjg

PUBLIC NOTICE

The Town of New Shoreham is in the process of updating its 2006 Hazard Mitigation Plan. Members of the public are encouraged to participate. Copies of the Plan are available at the Town Hall and Library or can be downloaded from the Town's website. The next meeting is scheduled for Thursday, December 16, 2010 @ 3:00 p.m. at Town Hall.
Posted:
12/8/10
sjg

APPENDIX F
Mitigation Action Progress Form

MITIGATION ACTION PROGRESS REPORT FORM

Report Date:

Action or Project Title:

Project Status:

Anticipated Completion Date:

Comments: