



TOWN OF NANTUCKET
Community Resilience Building Workshop
Summary of Findings
DRAFT REPORT
January, 2019



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Overview

As an island community, the Town of Nantucket and its residents have a high awareness of the need for addressing vulnerabilities and risks associated with natural hazards and climate change. Nantucket has a great deal of experience with hazards including storm surge flooding, high winds, erosion, and precipitation. For this island community, such events mean not only interruptions to daily life and damages to low-lying assets, but temporary isolation from the mainland and potential long-term reconfiguration of the Nantucket map.

For this reason, Nantucket has been proactive in recent years with regards to planning for natural hazards, coastal and community resilience, and climate change. Participation in the Massachusetts Municipal Vulnerability Program (MVP) is the latest example of this.

In 2017, the Commonwealth announced the MVP Planning Grant Program, designed provide support to cities and towns to complete climate change vulnerability assessments and develop action-oriented resiliency plans. The program provides funding for communities to run Community Resiliency Building (CRB) workshops with local stakeholders. Municipalities who complete this process and develop a final report will be designated as an "MVP Community," which leads to increased standing in other state grant programs, including additional MVP Action grants.

This *Summary of Findings* report presents the results of the CRB workshop held on Nantucket on January 8, 2019.

COMMUNITY RESILIENCE BUILDING WORKSHOP

Prior to initiating the MVP process, Nantucket was already updating its Hazard Mitigation Plan and developing a Community Resilience Plan. While these two other planning documents build the community's resilience to natural disasters, the MVP program was of particular interest to the community for two reasons:

1. Its unique approach to soliciting participation and input from stakeholders aside from the public at large
2. The opportunity to apply for state MVP Action Grant funding to implement the top actions developed during the MVP process

To encourage participation in the workshop, Nantucket reached out to local neighborhood associations, recreation clubs, conservation associations, historic and cultural resource organizations, small businesses, tourism associations, land stewards, and more. Additionally, Nantucket encouraged town employees from a variety of different departments to participate. Fifty-one people participated in the 8-hour workshop from a group of sixty-eight stakeholders that were invited.

The Workshop's stated goals were to accomplish the following:



1. *To develop a mutual understanding and respect around natural hazard risks, vulnerabilities, and resilience options on Nantucket using a consensus building process.*
2. *Define top hazards faced by the Nantucket community.*
3. *Identify vulnerabilities and strengths with regards to Climate Change on Nantucket.*
4. *Develop risk profiles for Nantucket's assets including infrastructure, society (social environment), natural environment, economy and historic assets.*
5. *Develop actions that reduce vulnerabilities and reinforce strengths for the community.*
6. *Document the top priority actions to reduce the impact of hazards and increase resilience in the community.*

Central objectives were as follows:

- Characterize primary climate-related hazards faced by Nantucket
- Identify the community's strengths and vulnerabilities
- Come to agreement on the top-priority actions for the community

Before starting the small team breakout sessions, participants listened to a presentation that included information about other related municipal initiatives currently underway (the Hazard Mitigation Plan and the Community Resilience Plan), the types of hazards that can threaten the community, and the impacts that climate change is expected to have on those hazards (using data from the *resilient MA Climate Clearinghouse*; resilientMA.org). Following this presentation, participants were directed to their "small team" tables, where they spent the majority of the rest of the workshop. Four small teams were convened. Within each small team, participants engaged in dialogue to identify the top hazards faced by Nantucket, the key strengths and vulnerabilities of the Island, and actions that could be taken to support strengths or protect vulnerabilities in the face of the top hazards listed.



Photo: Nantucket Coastal Conservancy

The entire workshop was recorded by Nantucket Community Television (NCTV) for public viewing.



Hazards

RECENT HAZARD EVENTS

Over the course of the small team conversations, a number of recent hazard events were found to be important for creating context for participants. These events primarily fell into the categories of coastal flooding and erosion.

Nantucket experienced three significant coastal flood events (two during major nor'easters) in the first three months of 2018:

- **Winter Storm Grayson**, in January, brought water levels in Nantucket Harbor up to 5.27 feet NAVD88, and winds up to 76 mph. Streets were flooded under feet of water, cars were totaled, homes were shifted on their foundations, families displaced, and more than 20 people had to be rescued. High water volumes and extreme cold temperatures may have contributed to the failure of a sewer force-main from the downtown pump station and the resulting discharge of sewage directly into the harbor.
- **Blizzard**: On January 30, a coastal storm passed offshore of Nantucket and brought a storm surge that flooded Easy, Easton, and Washington Streets.
- **Winter Storm Riley**, from March 2nd – 4th, brought a storm surge and wind-driven waves that lasted multiple tide cycles and damaged multiple buildings. Water levels peaked at 4.69 feet NAVD88 and wind gusted as high as 89 mph. Roads to Brant Point were flooded, rendering the area completely inaccessible. Scouring occurred on the north side of Madaket Road at Long Pond, and at Polpis Road at Fulling Mill Creek. Sustained wind from the east led to a breach of Sesachacha Pond and wave driven flooding and storm surge that caused undermining of the embankment and roadway on Polpis Road, closing the road in both directions. Erosion produced by the storm was also observed at Children's Beach.

Flood levels from these 2018 storms were among the highest ever recorded; Winter Storm Grayson had the second highest coastal flood crest on record in Nantucket, while Winter Storm Riley, over the course of three high tides, had the fourth, fifth, and seventh-highest crests on record. The blizzard on January 30 brought the tenth-highest recorded storm surge ever measured in Nantucket Harbor, meaning five of the top ten flood elevations measured in Nantucket history occurred in the first three months of 2018.

Top ten flood crests in Nantucket
2018 events **bolded**. Values in feet NAVD88.

1. 5.78 feet - 10/30/1991 – "Perfect Storm"
2. **5.27 feet - 01/04/2018 - Winter Storm Grayson**
3. **5.12 feet - 01/27/2015 - Winter Storm Juno**
4. **4.69 feet - 03/03/2018 - Winter Storm Riley**
5. **4.61 feet - 03/03/2018 - Winter Storm Riley**
6. 4.58 feet - 12/12/1992 - nor'easter
7. **4.53 feet - 03/02/2018 - Winter Storm Riley**
8. 4.48 feet - 01/03/2014 - blizzard
9. 4.25 feet - 01/02/1987 - nor'easter
10. **4.25 feet - 01/30/2018 – blizzard**

(source: NOAA)



The year 2017 also brought damaging storms to Nantucket. In October of 2017, the remains of Tropical Storm Philippe brought winds and waves that washed over the head of Hither Creek and eroded a new channel that exposed Millie's bridge and its embankment to scour. The bridge is now consistently more vulnerable to direct wave action and scour. A house on the beach at the end of California Avenue was demolished in 2019 due to increasing exposure to hazards. More generally, ongoing erosion has led to homes being lost or relocated and roads being undermined and rerouted across the Island. Homes at risk are sometimes relocated to inland neighborhoods, such as Mid-Island.

OTHER HAZARD CONCERNS

In addition to referencing those specific recent events, workshop participants brought up a variety of other issues.

- Participants expressed concern about coastal flooding impacting transportation and electrical systems; of particular concern was the damage that saltwater exposure has to vehicles.
- The impacts of longer exposures to high salt water elevations due to sea level rise were identified as a unique issue; examples include saltwater intrusion into groundwater, corrosion of infrastructure, and exacerbation of storm conditions.
- While erosion was widely agreed upon to be a significant problem, mixed feelings were expressed about the need to address the problem (rather than just letting erosion run its course and responding on a case-by-case basis).
- Severe storms were considered separately from coastal flooding and erosion because of the unique threats posed when high winds, precipitation, and storm surge occur in unison; such threats include overwhelmed drainage systems and temporary loss of ferry transportation.
- The risk from future wildfires, especially with rising temperatures and increased droughts, was recognized. Appropriate wildfire management practices (considered by some participants to already be in place) were thought to sufficiently address the issue. Ultimately, two teams that identified wildfires, high temperatures, and droughts as hazard decided not to include them in the top hazard list.
- Workshop participants spent considerable time discussing the challenges that rising Island populations and increasing development pose in the context of resiliency and sustainability. Many in the group had the perspective that many of the hazards listed are exacerbated because of rising populations and development, possibly exceeding a carrying capacity that would be inherently more resilient if not exceeded.



- The vulnerability of off-island transportation infrastructure (the ferries and the airport) to natural hazards such as high wind and erosion (particularly at the airport) was a commonly-cited issue.
- Some felt that the risk of erosion is connected not only to coastal storm and storm surge events, but also to runoff from the built environment. As development progresses, it is expected that erosion will worsen, and sea level rise will exacerbate the problem.
- Participants discussed concern that increasing peak load during the summer peak season may overwhelm the electrical grid; peak summer load has recently risen above the capacity of each of the two underwater cables that supply electricity to the Island, meaning that if one were to be compromised, the utility would be unable to meet demand.
- There were concerns about threats to the Island’s groundwater posed by hazards (primarily related to groundwater contamination by pollutants).
- Extreme temperatures, both hot and cold, were a concern.

Table 3 summarizes hazards of concern identified by participants (not to be confused with the *top* hazards of concern). Specific concerns related to those hazards, as well as recent examples, are also listed when relevant.

Table 1: Specific Hazards and Concerns

Hazard	Specific Concerns	Recent Examples
Coastal Flooding	Isolation & Fragmentation <ul style="list-style-type: none"> - Road flooding cuts off access to areas - Neighborhoods with one access route are isolated 	Early 2018 nor’easters
	Utilities <ul style="list-style-type: none"> - Flooding of electrical systems could be a problem 	
	Equipment <ul style="list-style-type: none"> - When roads are flooded, Town vehicles must drive through water, splashes salt water onto undercarriage and into other parts of the vehicle – causes rapid corrosion 	Early 2018 nor’easters
Sea Level Rise	Extended increase in saltwater elevations, as opposed to the episodic increases seen during coastal floods/storms, will create unique concerns, in addition to exacerbating storm conditions. Drinking Water <ul style="list-style-type: none"> - Saltwater intrusion into groundwater Infrastructure <ul style="list-style-type: none"> - Corrosion of infrastructure - Water leaking into wastewater pipes 	



Hazard	Specific Concerns	Recent Examples
Erosion	Environment & Recreation Resources - Movement of sand, impacts on beaches	Breaching of Sesachacha Pond in March 2018
	Critical Infrastructure - Critical infrastructure assets are at risk, including: o Airport (southern end of runway at risk) o Surfside Wastewater Treatment Plant	Scour at Polpis Road in March 2018
High Wind	Isolation from Mainland - Temporary loss of ferry transportation during high wind events - Temporary loss of air travel during high wind events	Tropical Storm Jose in 2017
	Snow Drifting - Blocking of Milestone Road	March 2014 blizzard blocked Milsetone Road with trees and snow drifts
	Power Outages	
Severe Storms	Drainage Systems / Sewer Systems - Severe storms overwhelm drainage system due to combination of high precipitation and storm surge	January 2018 sewer main breach
Wildfire	Exacerbation by Climate Change - Increasing temperatures and droughts are expected to increase the risk of wildfires	2016 Brush Fire
Development & Impervious Surfaces	Runoff & Erosion - Increasing development & creation of impervious surfaces has led to, and will continue to lead to, increasing magnitudes of surface runoff, which in turn exacerbates erosion.	

TOP HAZARDS

Discussions around the top hazards faced by Nantucket showed a large degree of agreement between different small teams. Participants identified a range of hazards of concern, including flooding, high winds, sea level rise, extreme high temperatures, extreme low temperatures, drought, and wildfire. Human-related “hazards” such as pollution and overdevelopment were also noted. Ultimately, each small team arrived at four to five top hazards, as laid out in Table 1.

Table 2: Top Hazards Identified by Each Small Team

Red Team	Blue Team	Green Team	Yellow Team
<ul style="list-style-type: none"> Coastal Flooding Sea Level Rise Erosion Severe Storms Wildfire 	<ul style="list-style-type: none"> Flooding Erosion High Winds Sea Level Rise Increasing Storms 	<ul style="list-style-type: none"> Intense Storms (including rain) Flooding Erosion Sea Level Rise Wind 	<ul style="list-style-type: none"> Increasing Storms Floods Drought/Wildfire Sea Level Rise / Erosion



As many of the top hazards were common between small teams, the list of top-priority hazards identified in the workshop can be condensed to the following:

- Coastal Flooding
- Severe Storms (wind, rain, and surge)
- Sea Level Rise
- Erosion
- High Wind
- Wildfires and Droughts



Strengths and Vulnerabilities

Workshop participants identified specific locations, as well as more general systems, of interest in the context of climate resilience. These include features that are vulnerable to climate hazards, those that are strengths with regards to community resilience, and those features that are both vulnerabilities and strengths.



The most commonly highlighted geographic area of concern was the downtown neighborhood, which is a commercial and population hub, contains critical infrastructure and municipal facilities, represents to primary route for people and goods to travel between the Island and the mainland, and is prone to coastal and other types of flooding. Features located in this area are all vulnerable to climate hazards, particularly flooding, but many are also considered to be community strengths.

KEY ASSETS AND SYSTEMS

Assets and systems identified as being important to community resilience are summarized in Table 2. For each asset or system, specific hazard threats and vulnerable locations, as identified by participants, are listed.

Table 3: Hazard-Relevant Assets and Systems Identified by Workshop Participants

Asset or System	Hazard Threats	Specific Locations
Infrastructural		
Roads	Coastal Flooding Sea Level Rise Erosion Snow High Wind	<ul style="list-style-type: none"> - Downtown Area <ul style="list-style-type: none"> o Truck Routes o Easy Street - Brant Point Area - Polpis Road at Folgers Marsh - Polpis Road at Sesachacha Pond - Eel Point Road - Baxter Road - Milestone Road
Bridges	Coastal Flooding Erosion Sea Level Rise	<ul style="list-style-type: none"> - First Bridge (<i>Madaket Road between Long Bond and North Head Long Pond</i>) - Second Bridge (<i>Madaket Road at Second Bridge Bus Station</i>) - Massasoit Bridge (<i>S. Cambridge Street</i>) - Millie's Bridge (<i>Ames Ave</i>) - Eel Point Road (<i>Private</i>)



Asset or System	Hazard Threats	Specific Locations
Docks	Coastal Flooding Sea Level Rise Severe Storms	<ul style="list-style-type: none"> - Private Downtown Docks and Piers - Municipal Downtown Docks and Piers - Coast Guard Dock in Brant Point - Private Docks/Piers in Madaket Harbor - Public Docks on Massachusetts Ave - Steamship Authority Terminal / Pier - Hi-Line Terminal / Pier
Ferries	Coastal Flooding Severe Storms High Wind	<ul style="list-style-type: none"> - Steamship Authority Terminal / Pier (<i>Downtown</i>) - Hi-Line Terminal / Pier (<i>Downtown</i>) - Navigable Channel through Harbor (<i>maintained by US Army Corps of Engineers</i>)
Airport	Severe Storms High Wind Erosion	<ul style="list-style-type: none"> - Airport
Emergency Services	Severe Storms (loss of access)	<ul style="list-style-type: none"> - Fire Station Headquarters - Two Unmanned Satellite Fire Stations (garages) - Ambulance Service (associated with Fire Department) - New Hospital Opening in June - Emergency Alert Sirens - High School (<i>only emergency shelter</i>)
Municipal Fleet Storage	Coastal Flooding	<ul style="list-style-type: none"> - Mid-Island Municipal Vehicle Facilities - Warren Landing Area Municipal Vehicle Facilities
Municipal Offices	Coastal Flooding	<ul style="list-style-type: none"> - Finance Department
Water & Wastewater	Sea Level Rise Severe Storms Erosion	<ul style="list-style-type: none"> - Mid-Island Wellfield - 'Sconset Wellfield - Drinking Water Pipes (<i>island wide</i>) - Surfside Wastewater Treatment Plant - 'Sconset Wastewater Treatment Plant - 15 Sewer Pumping Stations <ul style="list-style-type: none"> o Sewer Pumping Station near Brant Point - Sewer Pipes (<i>island wide</i>)
Energy & Communication	High Wind Severe Storms Coastal Flooding	<ul style="list-style-type: none"> - Electric Cables under Nantucket Sound (<i>into Jefferson Avenue</i>) - Candle Street Substation - Overhead Powerlines - Local Transformers - Cell Phone Towers - Existing Fuel Tank Farm (<i>downtown</i>) - Fuel Supply-Chain - Planned New Fuel Tank Farm (<i>mid-island</i>)
Solid Waste	Severe Storms Coastal Flooding	<ul style="list-style-type: none"> - Madaket Landfill



Asset or System	Hazard Threats	Specific Locations
Environmental		
Great Ponds	Erosion Sea Level Rise	<ul style="list-style-type: none"> - Long Pond - Hummock Pond - Sesachacha Pond - Miacomet Pond
Coastal Water Resources	Severe Storms Rising Temperatures	<ul style="list-style-type: none"> - Polpis Harbor - Madaket Harbor - Non-Point-Source Pollution (<i>impacts on recreation & bathing</i>)
Fisheries & Shellfish	Severe Storms Rising Temperatures	<ul style="list-style-type: none"> - Head of the Harbor Fishing Area - Brant Point Shellfish Hatchery - Non-Point-Source Pollution (<i>impacts on shellfish industry</i>)
Coastal Resources	Sea Level Rise Rising Temperatures Erosion	<ul style="list-style-type: none"> - Monomoy Coastline - Shawmut Coastline - Shawkemo Coastline - Polpis Coastline - Coatue - Coastal Wetlands / Salt Marshes - Recreational Beaches - 'Sconset Bluff Walk - "Barrier Beaches" (<i>between ponds and ocean</i>)
Terrestrial Resources	Rising Temperatures Drought Wildfire	<ul style="list-style-type: none"> - Preservation/Conservation Land (<i>50% of Island</i>) - Moors/Grasslands
Wildlife	Rising Temperatures Erosion	<ul style="list-style-type: none"> - Rare Bird Populations
Societal / Cultural		
Disadvantaged Groups	Severe Storms Coastal Flooding	<ul style="list-style-type: none"> - Elderly Population - Homebound Populations (<i>aging in place, disabled</i>) - Homeless Population - Mobile LMI Communities (<i>seasonal relocation</i>) - Minority Populations - Immigrant & Non-Native English Speakers
Social Services	Severe Storms Coastal Flooding	<ul style="list-style-type: none"> - Our Island Home - Landmark House - Nantucket Interfaith Council - Warming Centers - Food Pantry (<i>Washington Street, in flood zone</i>)



Asset or System	Hazard Threats	Specific Locations
Historic / Cultural Resources	Severe Storms Coastal Flooding Erosion	Historic
		<ul style="list-style-type: none"> - Old Historic District (OHD; Downtown) - 'Sconset Historic District (SHD) - Historic Structures (<i>Island Wide</i>) - 3 Lighthouses - Museums - Dreamland Film & Cultural Center - Whaling Museum

VULNERABILITIES

The following section explores a selection of features of concern identified by participants in more detail.

INFRASTRUCTURE

ROAD NETWORK

Each of the small teams pointed to the Island’s road network as a key vulnerability. The primary issue of concern was roads becoming temporarily impassible due to inundation, but problems caused by significant snow drifting on Milestone Road and more permanent road damage caused by erosion and bridge washout were also noted.

The downtown area was highlighted as a major area of concern with regards to road inundation. Many of the streets in the downtown neighborhood have a history of flooding, and they include both the only routes to the ferry terminals and the only routes for trucks carrying items between commercial docks and the rest of the Island. When the downtown roads are flooded, travel and commerce is significantly disrupted.



Photo: www.ack.net

Another concern with regards to the road network was the effective or complete isolation of certain neighborhoods from the rest of the community, including municipal and emergency services. Eel Point was referenced as an area where this has occurred in the past. The entire area of Madaket, and in particular Smith’s Point, was cited as being at risk of isolation if any one of the four bridges connecting the neighborhood to Mid-Island (First Bridge, Second Bridge, Massasoit Bridge, or Millie’s Bridge) were to be washed out, or the roads leading to those bridge flooded.



CONNECTION TO THE MAINLAND

Located on an Island about 30 miles off the shore of Cape Cod, Nantucket's residents, are acutely aware of the challenges associated with being isolated from the mainland (or "from America," as some workshop participants referred to it). There are two primary ways for people and materials to travel between Nantucket and "the Mainland" – by route of a ferry that docks in the downtown area, or an airplane that lands at the airport. For this reason, the Steamship Authority Terminal, Hi-Line Terminal, the US Army Corps of Engineers-maintained shipping channel through Nantucket Harbor, and the airport were all listed as critical vulnerabilities for the community.



Grounded Ferry. Photo: www.capecod.com

While no historical damage to any of these assets from natural hazards was brought up during the workshop, risks to the functionality of each were identified. Severe weather will, and frequently does, interrupt both ferry and air travel. High winds create wave conditions that prohibit first high-speed ferries, and then other ferries; many weather conditions will affect most air travel to the Island. Longer term impacts of coastal changes are also a concern: erosion threatens the airport runway, and rising seas will impact the ferry terminals.

ELECTRIC UTILITIES

Nantucket receives electricity through two undersea cables that enter the Island near the Jefferson Street Beach and connect to the local grid through the Candle Street National Grid Substation. One cable has 36 megawatts of capacity and the other has 38 megawatts of capacity. One originates from Hyannis, and other from Harwich. From the Candle Street substation, electricity is distributed to the rest of Town primarily through overhead powerlines, with a selection of areas where the lines are buried underground. Transformers are located around the Island, many at ground level.

The vulnerabilities to the electric system identified during the workshop are:

- The underwater cables
- The Candle Street substation
- Overhead powerlines
- Buried powerlines
- Transformers



The Candle Street substation, buried powerlines, and on-ground transformers are at risk from coastal flooding or flooding due to severe precipitation. Overhead powerlines are at risk from high winds. The underwater cables don't have any specific vulnerabilities, but represent the Island's reliance on outside communities, and its lack of control over its own electrical generation. The community has lost power through one of the two cables in the past due to a power outage that occurred on the Cape side of the line.



Candle Street Substation.
Photo: Design Associates Inc.

In two small teams, problems related to increasing peak load demands during the summer season were noted. Participants expressed concern that continued growth and development, along with rising temperatures, may increase power demand beyond existing capacity.

WATER AND WASTEWATER UTILITIES

Aspects of the water and wastewater systems identified as vulnerabilities include the two municipal wellfields, the private wells scattered around the Island, the two municipal Wastewater Treatment Plants, 15 sewer pumping stations, and the pipe systems delivering drinking water and collecting wastewater.

Both wastewater treatment plant leachfields are vulnerable to erosion due to their locations near the water on the southern side of the Island. Monitoring thresholds have been established that, if triggered, will require the Town to take action to prevent damage to leachfields. Many of the 15 pumping stations are located in flood zones, with the station that serves the downtown area (the Sea Street Station) of critical concern. The concern expressed by participants with regards to the wastewater pipe systems was of leakage of saltwater into the pipes with rising sea level, lowering the carrying capacity of the wastewater pipes. Already, leaking water into wastewater and stormwater pipes (Nantucket has a Combined Sewer Overflow system) is a significant problem that has impacted the capability of the Island's drainage infrastructure to operate during high-volume precipitation events.

Participants expressed concern about contamination of drinking water through saltwater intrusion into groundwater. Participants also considered damage to drinking water infrastructure through exposure to elevated sea levels or during severe weather events to be a risk.

MUNICIPAL FLEET

Workshop participants identified the risk posed to municipal vehicles by coastal inundation. When such events occur, many municipal vehicles are forced to drive through shallow water to access flooded or isolated areas. Using the vehicles in this way introduces saltwater to the vehicle undercarriages, accelerating corrosion and decreasing the lifespan of the equipment.



MUNICIPAL FACILITIES

Nantucket's Town Offices are located downtown and are vulnerable to flooding. Of special concern is the Finance Department on Washington Street, which has experienced flooding numerous times in the last few years. The Finance Department contains important municipal documents; protecting those documents from floods is essential.

ENVIRONMENTAL

Nantucket counts its great ponds (fresh and brackish water ponds separated from the ocean by semi-permanent "barrier beaches"), coastal waters, fisheries and shellfisheries, coasts and beaches, bluffs, moorlands, and wildlife populations all among its natural resources. These resources draw residents and visitors, as well as scientists and researchers, to Nantucket. They create recreational and aquacultural opportunities, and even protect the Island from coastal hazards like waves and storm surge.

All of these resources are threatened by the variety of hazards identified by workshop participants. Of primary concern, though, are climate change's impacts to the intensity and frequency of hazards such as severe storms, droughts, and wildfires, as well as in non-storm conditions, such as increasing average and maximum temperatures and decreasing snow amounts.

SOCIAL AND CULTURAL

DISADVANTAGED GROUPS

Numerous small teams identified vulnerable populations of particular concern with regards to hazard resiliency. Groups identified include elderly populations living in Our Island Home or other group homes, elderly populations aging in place in private homes, other homebound populations such as physically disabled residents, low to moderate income populations, homeless populations, minority populations, and immigrants and non-native English speakers. All of these populations are expected to be at higher risk during a hazard event, or the recovery period following a hazard event.

Many participants noted that Nantucket has a lack of affordable housing. Concern was expressed about the impact this issue might have on the exposure of low-income populations to hazards, as well as the exacerbating effect a hazard event would have on this limited housing availability.

Our Island Home was identified as located adjacent to a FEMA-mapped flood zone.

HISTORIC RESOURCES

The Town of Nantucket's identity is closely associated with its historic character. The entire Island is a National Historic Landmark, the town boasts two National Historic Districts, and



hundreds of historic buildings are spread across the community. These resources present a unique set of vulnerabilities in the face of climate-related hazards. Their age often means that a degree of degradation has occurred, potentially putting the buildings at a higher risk of being damaged during an extreme event. These historic buildings were constructed before the development and adoption of many building codes and zoning regulations, so they may be located in risk zones and built in ways that make them more susceptible to hazards than a new building. Finally, implementing adaptation measures on these buildings can be complicated by requirements or desires to maintain their historic characters.

One primary cluster of vulnerable historic resources is in the Old Historic District, which consists of the Downtown area and is at risk of coastal flooding and flooding during severe storms due to compromised drainage systems. The second cluster is the "Sconset Historic District, located on the eastern edge of the Island and susceptible to erosion.

Nantucket is also known for its three historic lighthouses, each of which is, necessarily, vulnerable to coastal storms. One has had to be relocated in the past to prevent damage from erosion.

ECONOMY

Nantucket's economy is based largely on tourism, and even other significant economic sectors (such as construction) depend on goods and materials being transported from the mainland. The impacts that climate hazards have on the features described in this section are compounded by impacts on the local economy. This is particularly true when ferry or air service is interrupted, both because of the immediate disruption as well as the potential negative effect on perceptions of the Island as a destination, driving down visitor volumes in the long term. The same concern applies to environmental and historic resources, which are primary draws for Island visitors.

STRENGTHS AND ASSETS

In addition to concerns and challenges, workshop participants were able to identify many strengths and assets within the community. These are listed here.

EMERGENCY SERVICE FACILITIES

Nantucket's emergency services are among the community's top strengths with regards to hazard resiliency. The Fire Station, Police Department, and hospital are all located in the Mid-Island Neighborhood, outside of mapped flood zones and away from coastal hazards. The Fire Department also has two satellite stations (unmanned garages with equipment), one located in Madaket and the other in 'Sconset. A new hospital building, constructed to withstand winds up to 150 miles per hour, is slated to open in the Mid-Island neighborhood in June of 2019. Nantucket High School, which serves as the community's only public emergency shelter, is also located in Mid-Island.



Workshop participants also pointed to Nantucket’s emergency alert capabilities as a strength. The emergency alert sirens on the Island were noted as one example of this.

LOCAL KNOWLEDGE, ENGAGEMENT, AND INSTITUTIONS

Nantucket has significant local resources in the way of knowledge, expertise, and institutions.

The community’s active Neighborhood Associations were identified as strengths due to their ability to both advocate for and give information to their constituencies.

Nantucket is home to academic and professional institutions and experts, creating an opportunity for the Town to both tap into local expertise to tackle resiliency, and leverage local networks to bring in outside scientists and practitioners.

Finally, the Coast Guard facility on Brant Point is considered a local strength. Ideas for how to address coastal hazards often come out of the facility, and the Town maintains memoranda of understanding, as well as a positive relationship, with them.

SOCIAL SERVICES

Local social services include the Our Island Home nursing facility, the Landmark House (section 202 Low-Income-Affordable senior housing facility), the Nantucket Interfaith Council (which provides a food, fuel, and rental assistance program), and local churches that sometimes serve as warming centers during winter weather disasters. The Police Department has a call list of 70 to 80 individuals who are home bound; they utilize this list regularly to check up on the residents.

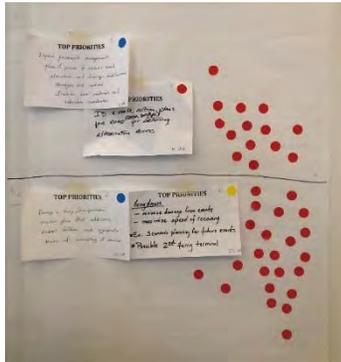
NATURAL RESOURCES

Nantucket’s natural resources serve multiple purposes in the context of community resiliency. Many of the Island’s natural features directly mitigate hazards and increase resiliency; these include the Coatue barrier beach that shelters Nantucket Harbor from waves, coastal wetlands along the southern coastline of Nantucket Harbor that mitigate wave actions and storm surge, and the “barrier beaches” separating the great ponds from the ocean. The high percentage of Nantucket land under conservation or preservation helps limit runoff during storms (as opposed to developed, impervious surfaces). More broadly, an appreciation for and affinity with the beauty and uniqueness of the Island’s natural features, habitats, and rare wildlife, serve to build a sense of local identity and support for resiliency efforts. Participants identified natural resources as an important asset to protect and preserve from climate-related hazards.



Recommendations to Improve Resilience

After identifying top hazards, challenges, and strengths, each small team discussed possible actions that could be taken by the community to mitigate hazards, protect vulnerable assets, and support existing strengths. Actions were then prioritized. All high-priority actions from each work group are summarized in Appendix A.



Following the individual group discussions, all workshop participants were brought together to decide on the full group's top recommendations. Each small team shared their top three or four actions with the full group. Similar actions were consolidated with a resulting list of 10 high-priority recommendations. Participants were then given the opportunity to vote for their top three recommendations using a sticker-dot voting method. The results of this vote are presented in the table below.

Table 4: Top 10 Actions Identified by the Large Group

Priority	Action Name	Recommendation	Votes
1	Resiliency Coordination	<p>Create a municipal position of resilience coordinator, who will help facilitate and coordinate Island-wide resiliency initiatives (including town, private, federal) and the various conservation groups.</p> <p>Perform a review of municipal bylaws, regulations, and policies relevant to hazard mitigation and resilience in order to foster interdepartmental coordination and communication, and guide development of new resiliency policies.</p>	29
2	Isolation from Mainland	<p>Ferry Access:</p> <ul style="list-style-type: none"> • Minimize damage from events • Maximize speed of recovery • Perform scenario planning for future events • Consider second ferry terminal <p>Develop a ferry/transportation master plan that addresses access to and from the Island, and appropriate means of relocating [the ferry terminals] if needed</p>	23
3	Wetland Restoration	Restore wetlands to mitigate storm surge and sea level rise.	20
4	Historic Preservation Guidelines	Develop guidelines to preserve historic streetscapes while mitigating hazards.	16



Priority	Action Name	Recommendation	Votes
5	Road System Resiliency	Identify and make actions plans for roads (raise, build bridges) and determine alternative access routes. Expand pavement management plan and process to include road elevations and drainage modifications, strategies, and actions. Include new materials and relocation considerations.	14
6	Improve reliability of critical infrastructure	Redundancy and reliability of critical infrastructure, both public and private: <ul style="list-style-type: none"> • Work with public utilities to assure reliability • Work with private sector to assure continuous services 	7
7	Downtown area assessment	Downtown Area: conduct assessment of long-term risks and alternatives for the next 25-50 years	6
8	Community engagement around resilience with experts	Foster and implement ongoing community resilience discussions while bringing in subject matter experts to annually share successes and assist with planning	5
9	Sewer Management Plan	Implement sewer management plan by allocating sufficient resources and an effective prioritization process while integrating with other projects	4
10	West End Prototype	West End of Island: Utilize the isolated community of the west end as a prototype for resiliency planning	2

Based on the results of the voting exercise summarized above, the following actions are suggested as the top priorities for the Nantucket Community as identified by the CRB Workshop Participants.

1. RESILIENCY COORDINATION

Establish a municipal Resilience Coordinator position with the following responsibilities:

- Facilitate and coordinate Island-wide resiliency initiatives
- Review existing and new Town Bylaws and Regulations to ensure consistency and efficiency
- Develop new resiliency policies
- Foster ongoing community resilience discussions within the community, including with the MVP stakeholder group, through meetings and hosting subject-matter experts

2. ISOLATION FROM THE MAINLAND

Develop an Isolation Master Plan that addresses resiliency and redundancy of access routes to and from Nantucket. The plan should address:

- Resiliency of existing transportation infrastructure and facilities to climate change and severe weather events
- The potential for development of permanent alternative access routes and/or facilities
- Emergency protocols in case key routes are blocked or facilities damaged



3. TIDAL WETLAND RESTORATION

Enact a long-term wetland restoration and preservation strategy to protect and grow this important community asset. Inland migration of tidal wetlands with sea level rise should be considered.

4. HISTORIC PRESERVATION GUIDELINES

Develop guidelines to preserve historic streetscapes while mitigating hazards. These guidelines should provide information specific to the different and unique types of historic resources found on Nantucket, as well as the different and unique hazard threats in different areas of the Island.

5. INFRASTRUCTURE RESILIENCY PLAN

Develop a plan to ensure redundancy and reliability of the Island's road, water, and wastewater systems in the face of a changing climate and severe storms. The plan should include and address:

- Development of alternate routes in case roads or bridges are rendered impassible
- Identification and prioritization of sites for road elevations and hardening
- Identification and prioritization of sites for culvert or bridge upsizing or construction
- Water and wastewater utility system resiliency



Conclusions and Next Steps

The Nantucket CRB Workshop demonstrated that significant agreement exists across many different stakeholder groups with regard to the strengths, vulnerabilities, and potential resiliency actions for Nantucket.

An important outcome of the process was identification of many existing *strengths* the community has available to combat climate-related hazards, including active and competent emergency response capabilities, a number of resiliency-building projects that have already been initiated, natural resources that mitigate the effects of some hazards, and social service institutions that work with vulnerable populations. The high priority actions developed through the CRB process address coordination across departments, supporting natural and historic resource preservation and resilience, and maintaining essential access routes both on-Island and between the Island and the mainland. These results reflect a broad view of the community and its needs, addressing multiple different sectors of the town.

Carrying out the CRB process accomplishes a specific action listed in the town's Hazard Mitigation Plan (HMP), which was adopted by the town in March 2019. Additionally, the town has already begun development of a Community Resilience Plan (CRP), an effort that will begin addressing the need for coordination across different municipal department and planning processes. The CRP will integrate information from the HMP and the MVP to create a vision for resilience on Nantucket.

Having completed the MVP program, Nantucket will become certified by the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) as an MVP community and therefore eligible for MVP Action Grant funding. MVP certification also increases Nantucket's standing for other grant opportunities from the State. The MVP Action Grant provides funding to pursue priority climate resilience actions as identified through the MVP Planning Grant program. Nantucket intends to pursue MVP Action Grants for one or more of the top-priority recommendations described in this report.



Acknowledgements

JANUARY CRB WORKSHOP PARTICIPANTS:

Table 5: Workshop Participants

Name	Affiliation	Title/Role
Charley Walters	Nantucket Community Association & Nantucket Yacht Club	-
Brendan Coakley	Town of Nantucket - Emergency Management	Emergency Management Coordinator
David Gagnon	Maria Mitchell Association	Executive Director
Chloe Coggins	Madaket Marine	
Charles Stott	Civic League	Co-President
Jim Kelly	Town of Nantucket	Select Board
David Gray	Town of Nantucket - Sewer Department	Director
Matt Fee	Small Business ("Something Natural")	Select Board
Vincent Murphy	Natural Resources Department	Protected Species Technician
Chaz Rogers	Town of Nantucket - DPW	Deputy Director
Roberto Santamaria	Nantucket Board of Health	Health Director
William Pittman	Nantucket Police Department	Police Chief
Karen Macumber	Visitors Services Association	Board Member
D. Anne Atherton	Nantucket Coastal Conservancy	
Rick Atherton	Quidnet Squam Association	
Cormac Coulter	Nantucket Land Council	Executive Director
David Worth	Nantucket Conservation Foundation	Executive Director
Diane Lang	Coskata-Coatue Wildlife Refuge / Trustees of Reservation	Stewardship Manager
Lauren Sinatra	Town of Nantucket	Energy Coordinator
Catherine Slattery	Madaket Marine	CFO
Leslie Forbess	Madaket Resident Association	
Stephen Welch	Capital Program Committee	Chair
Bill Grieder	Madaket Conservation Association	President
Amy Zielinski	Sustainable Nantucket	Executive Director
Jeff Carlson	Town of Nantucket – Natural Resources Department	Natural Resources Director
Mary Bergman	Nantucket Preservation Trust	Media/Communications
Michael May	Nantucket Preservation Trust	Executive Director
Chuck Larson	Town of Nantucket – Town Administration	Manager of Strategic Projects
Rachel Hobart	ReMain Nantucket	Project Manager
Stephen Arceneaux	Town of Nantucket - DPW	Deputy Director of Ops
Barry Rector	Planning Board	Chair
Libby Gibson	Town of Nantucket – Town Administration	Town Manager
Diane O’Neil	Nantucket Public Schools	Director of Facilities
Gregg Tivnan	Town of Nantucket – Town Administration	Assistant Town Manager
Florencia Rullo	Town of Nantucket – Town Administration	POM
Jen Karberg	Nantucket Conservation Foundation	Research Supervisor
Noah Karberg	Nantucket Airport	Assistant Airport Manager



Name	Affiliation	Title/Role
John Stanton	Inquirer & Mirror (Newspaper)	Reporter
Cecil Barron Jensen	ReMain Nantucket	Executive Director
Edwin Rudd	Nantucket Historical Association	Director of Facilities
Stephen Murphy	Nantucket Fire Department	Chief
Sheila Lucey	Harbor Master	Harbormaster
Yvonne Vaillancourt	UMass Field Station	Director
Peter Brace	Nantucket Coastal Conservancy	Writer
Margaretta Andrews	Community Foundation for Nantucket	Executive Director
Morris Hylton	Preservation Institute Nantucket	Director
Lee W Saperstein	Nantucket Town Association	
Karen McGonigle	Town of Nantucket – IT Department	Chief Technology Officer
Sarah Bois	Linda Loring Nature Foundation	Director of Research & Education
Elizabeth Trillos	Tom Nevers	
Vallorie Oliver	Historic District Commission	Commissioner

CITATION

Town of Nantucket, 2019. 2019 Nantucket Community Resilience Building Workshop Summary of Findings. Town of Nantucket, Milone & MacBroom, Inc., and The Nature Conservancy. Nantucket, Massachusetts.

CRB WORKSHOP PROJECT TEAM

Contributors from within the Town and across the community helped make this project a success and there are far too many to recognize everyone by name. The core team consisted of Chuck Larson (Project Manager) along with Holly Backus, Libby Gibson, Gregg Tivnan, and Florencia Rullo. Workshop Scribes were Holly Backus, Jeff Carlson, Florencia Rullo and Chuck Larson. The facilitation team from Milone and MacBroom was comprised of David Murphy and Noah Slovin, with Adam Whelchel and Sarah Burns from the Nature Conservancy.

SPECIAL ACKNOWLEDGEMENTS

Special thanks to the Town of Nantucket and the entire community for their willingness to embrace this process and remain engaged for the duration of an 8-hour workshop. This project was made possible through funding from the Massachusetts Executive Office of Energy and Environmental Affairs and the Municipal Vulnerability Preparedness (MVP) Grant Program.



Appendix A
Opening Presentation

Appendix B
Resource Packet

Appendix C
Base Maps Used for the Participatory Mapping Exercise

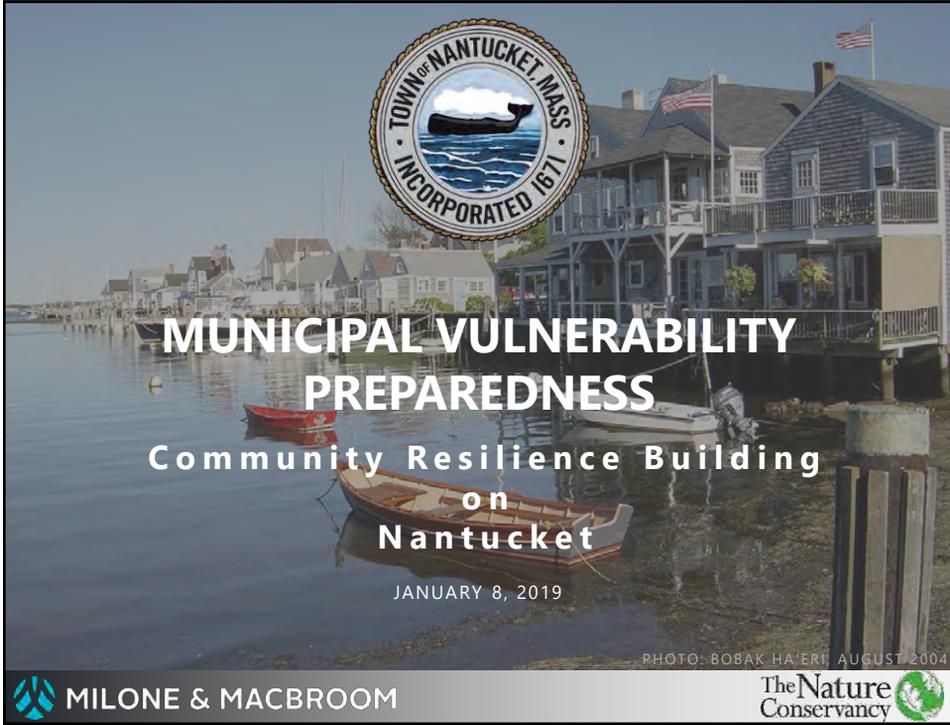
Appendix D
Completed Participatory Maps

Appendix E
Completed Risk Matrices

Appendix F
High Priority Recommendations Identified by Small Groups

Appendix G
Sticky-Dot Voting Boards





MUNICIPAL VULNERABILITY PREPAREDNESS

Community Resilience Building on Nantucket

JANUARY 8, 2019

PHOTO: BOBAK HA'ERT, AUGUST 2004

 MILONE & MACBROOM

The Nature Conservancy 

1



WELCOME & INTRODUCTIONS

2



3

Time	ACTIVITIES and OBJECTIVES
8:30	Registration
9:00	Welcome and Introductions
9:20	Overview Presentation on Workshop
9:30	Overview Presentation on Science and Resources
9:50	Small Team Exercise
10:45	BREAK
11:00	Small Team Exercise, Continued
12:30	LUNCH (provided on-site)
1:30	Small Team Exercise, Continued
2:00	Report Outs
2:30	Top Priorities
3:30	Wrap up and Next Steps
4:00	Adjourn

4

WORKSHOP OVERVIEW

OTHER PLANNING EFFORTS

Hazard Mitigation Plan

- All Natural Hazards
- Regulatory Document
- Affects Flood Insurance
- Positions for Mitigation Grants
- Limitations
 - 5-year planning window
 - Focus on loss reduction
 - Highly prescribed
 - Backward-looking
- Currently Under FEMA Review

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WORKSHOP OVERVIEW

OTHER PLANNING EFFORTS

Coastal Resilience Plan

- Coastal Hazards
 - (flood, wind, erosion)
- Community-wide Vision
- Positions for Various Funding
- Strengths
 - Focus on resilience
 - Long-term planning window
 - Comprehensive
 - Cross-sector/interdisciplinary
 - Forward-looking
 - Flexible content & format
- Currently in-process

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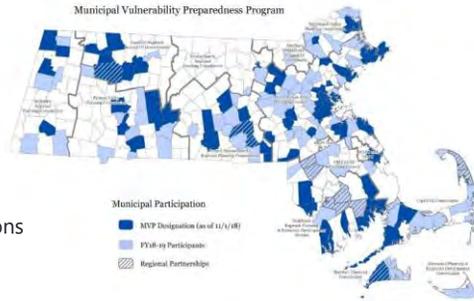
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WORKSHOP OVERVIEW

MUNICIPAL VULNERABILITY PREPAREDNESS

- Massachusetts Commonwealth-Wide
- Community Resilience Building Approach
 - Stakeholder-Developed Priorities
 - Develop Relationships and Support
 - Process is Part of the Goal
- Two Opportunities
 - MVP Planning Grant
 - Stakeholder Workshop
 - Public Listening Session
 - Identification of Top Actions
 - MVP Action Plan
 - Implementation of Top Actions
 - Must be MVP Certified
- Other Benefits
 - MVP Communities get Priority for State Funding (future plan)

UTILIZE PARTNERSHIPS & LEVERAGE EXISTING STRENGTHS



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WORKSHOP OVERVIEW

COMMUNITY RESILIENCE

What is Resilience?

- Capacity to establish a positive trajectory after a disturbance or event
- Resist (prepare), Absorb, Recover, Adapt

Risk = Vulnerability x Frequency

Vulnerability: how susceptible to loss or damage?

Frequency: how often does the event happen?

**Minimize Vulnerabilities
Capitalize on Strengths**

- Infrastructure
- Social Capital
- Natural Environment



- Economic Environment
- Historic Resources
- The Nantucket Experience



umane- www.dhvd.com

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WORKSHOP OVERVIEW

NANTUCKET CRB WORKSHOP

- **Goals:**
 - Dialogue, Understanding, and Collaboration
 - Stakeholder Supported Mitigation Actions
 - Integration with HMP and CRP
- **Objectives:**
 - Characterize Primary Hazards
 - Identify Strengths and Vulnerabilities
 - Agree on Priority Actions



9



OVERVIEW PRESENTATION ON SCIENCE AND RESOURCES

10

RISKS AND HAZARDS ON NANTUCKET

EXTREME EVENTS & CLIMATE CHANGE

KEY HAZARDS



**Rising
Temperature**



**Increased
Drought**



**Less Snow
and More
Rain**



**Potential for
More Large
Storms**



**Sea Level
Rise &
Erosion**

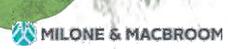
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CONTEXT: RISKS AND HAZARDS FOR NANTUCKET

Average and Extreme Temperatures

- Public Health
- Infrastructure
- Agriculture and Aquaculture
- Wildfire Risk
- Rain vs Snow
- Water Quality

FIRE-RESCUE: MIKE WAY
 CONCRETE: PICTURE-ALLIANCE/DPA/PLUGHAFEN HANNOVER
 SCALLOPING: FISHERNANTUCKET.COM
 ALGAL BLOOM: DR. JENNIFER L. GRAHAM, USGS



12

CONTEXT: RISKS AND HAZARDS FOR NANTUCKET

Changing Precipitation Patterns

- Totals & Magnitude
- Drought Frequency & Severity
- Wildfire Risk
- Ecosystem Impacts
- Agriculture Impacts
- Water Quality



RAIN: YESTERDAYSISLAND.COM
 DROUGHT: WWW.PBS.ORG
 FIRE: JIM POWERS
 FARM: WWW.SUSTAINABLENANTUCKET.ORG

MILONE & MACBROOM

13

CONTEXT: RISKS AND HAZARDS FOR NANTUCKET

Sea Level Rise

- Coastal Flooding & Erosion
- Saltwater Intrusion
- Infrastructure Impacts
- Ecosystem Impacts
- Aquaculture Impacts



WAVES: LAUREN MARTILLA
 EROSION: NICOLE HARNISHFEGER
 SALT MARSH: NANTUCKET CONSERVATION FOUNDATION

MILONE & MACBROOM

14

RISKS AND HAZARDS ON NANTUCKET

CLIMATE CHANGE



resilient **MA**

Climate Change Clearinghouse for the Commonwealth

OBSERVATIONS & PROJECTIONS

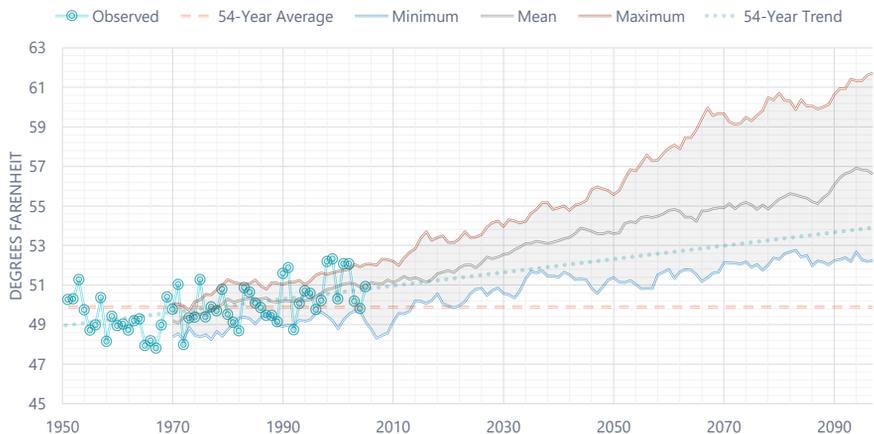
- Clearinghouse for Massachusetts Climate Data
- Consistent Data for Region
- "Downscaled" from Global Projections

15

RESOURCES AVAILABLE FOR NANTUCKET



Projected Average Annual Temperature, Nantucket

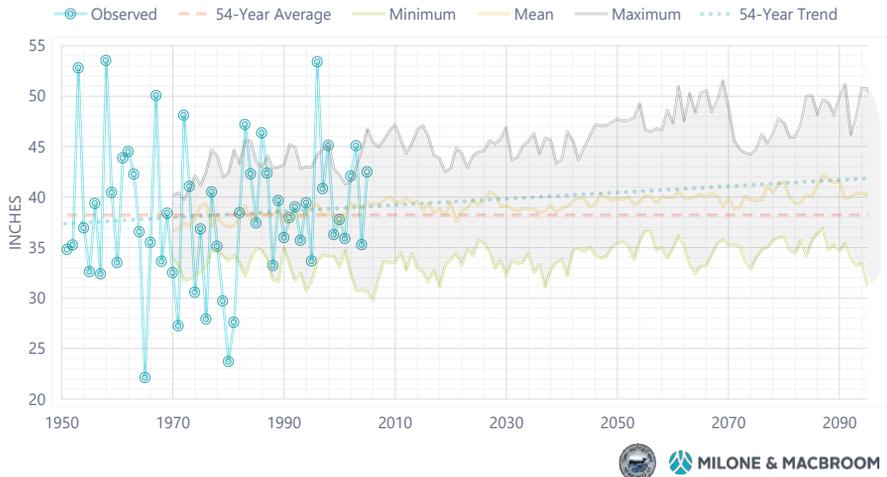


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RESOURCES AVAILABLE FOR NANTUCKET



Projected Annual Precipitation, Nantucket

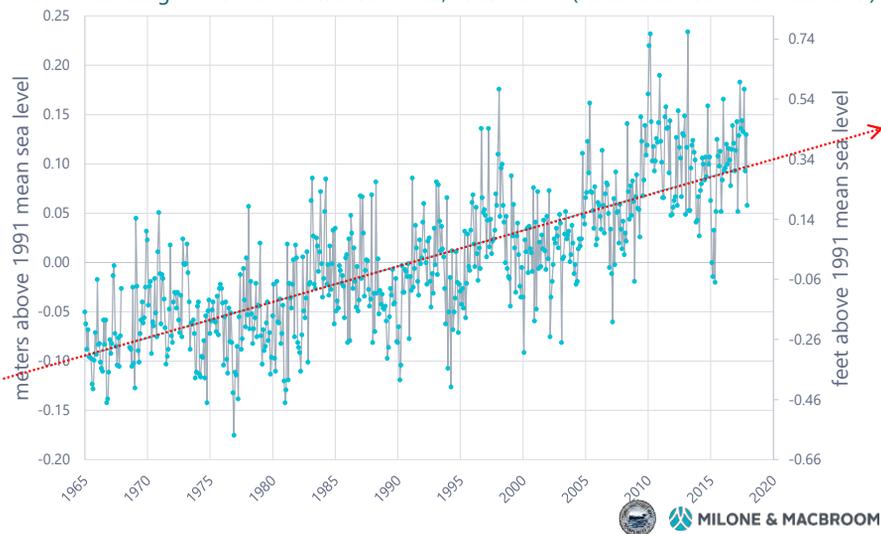


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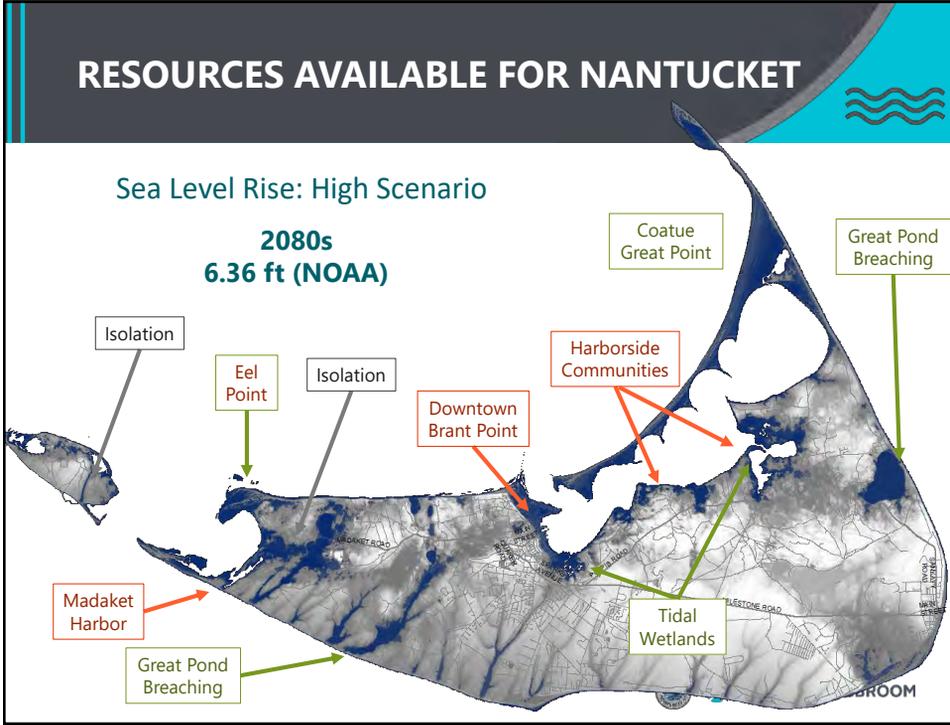
RESOURCES AVAILABLE FOR NANTUCKET



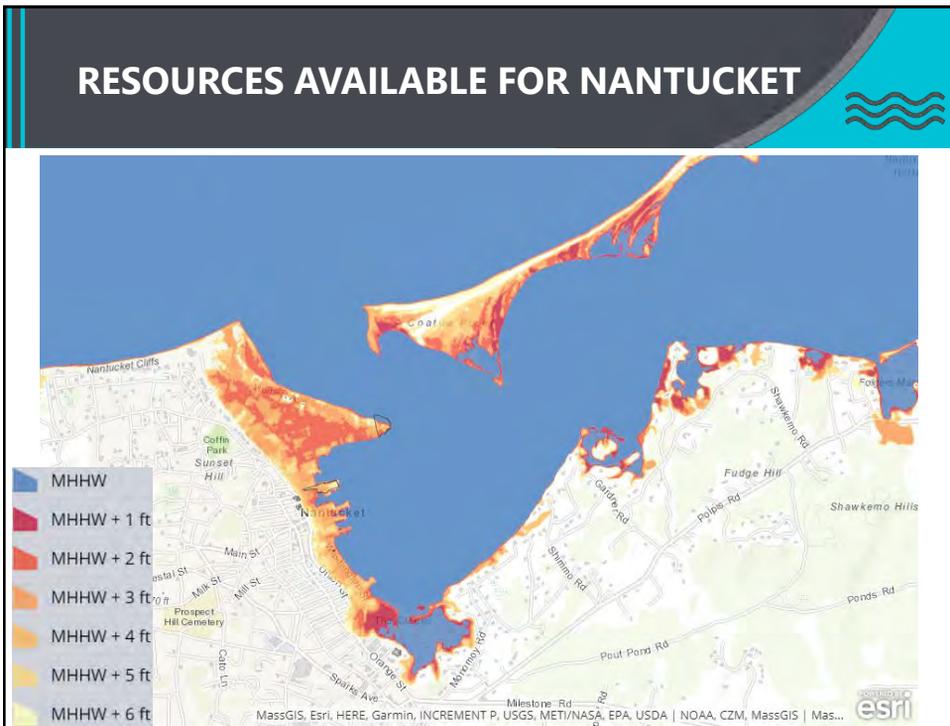
NOAA Tide Gauge 8449130. Nantucket Harbor, 1965 – 2017 (Relative to 1991 mean sea level)



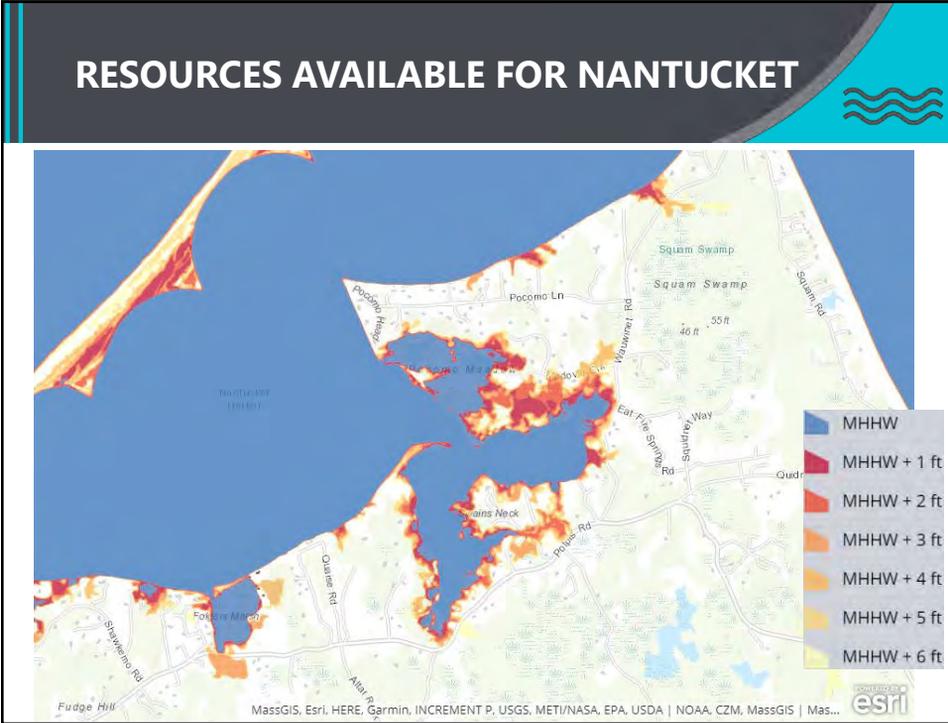
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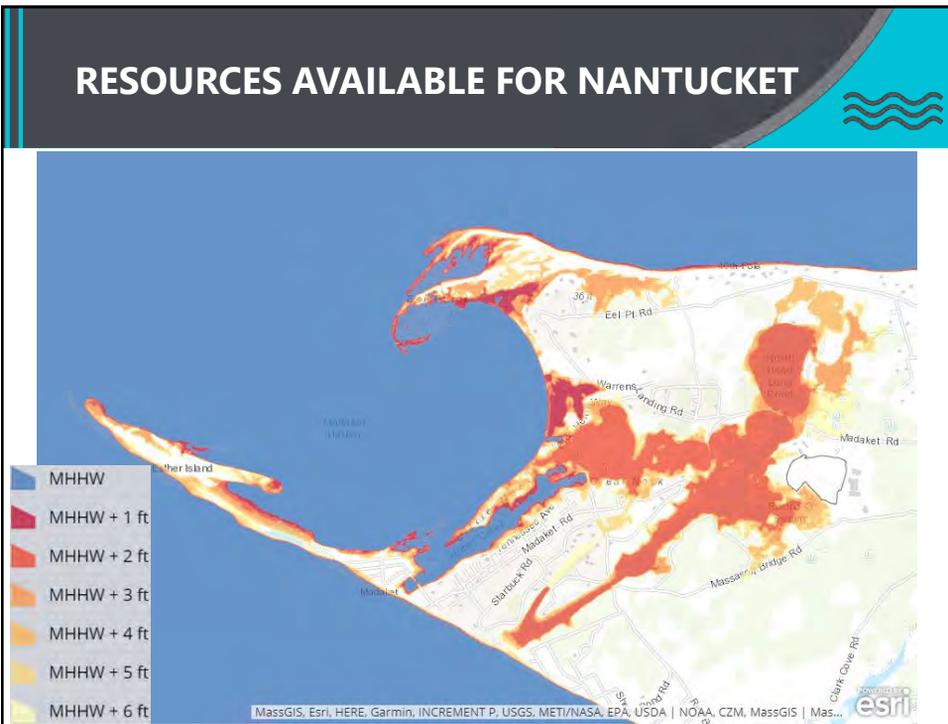
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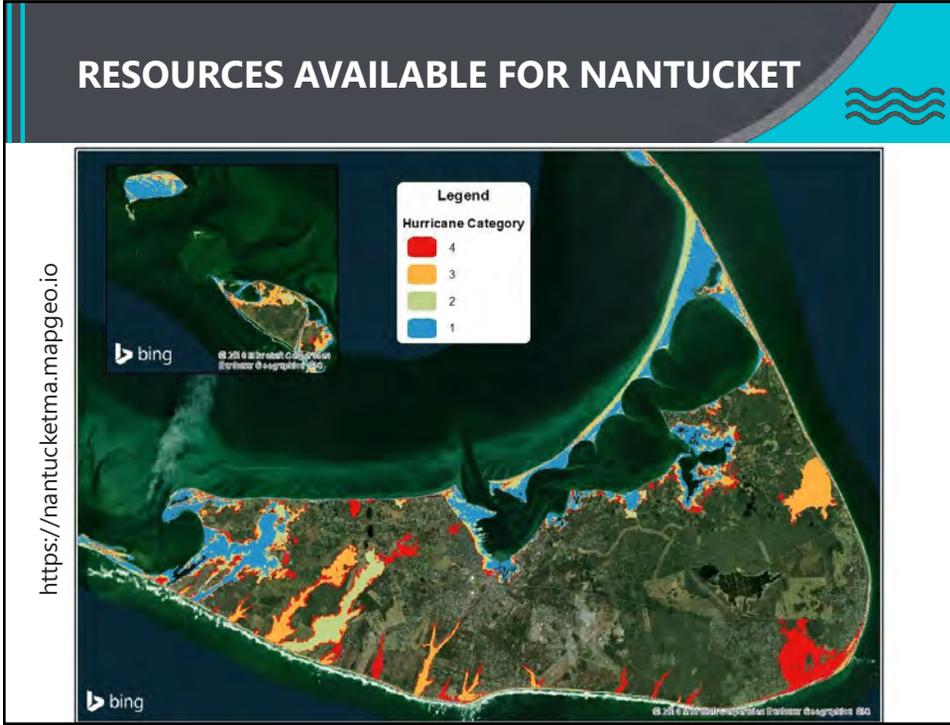
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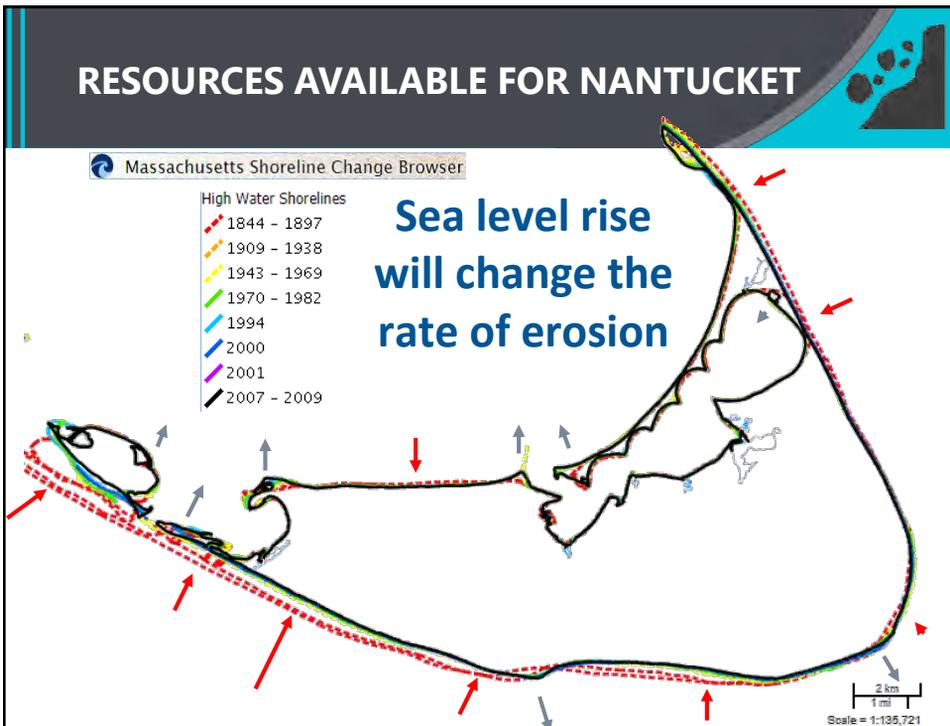
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**OVERVIEW PRESENTATION ON
COMMUNITY RESILIENCE
BUILDING**

25

Community Resilience Building
WORKSHOP GUIDE



www.CommunityResilienceBuilding.org

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Process...



- Current and future hazards?
- What are our strengths & vulnerabilities?
- What can we do about it?

Community Resilience Building Workshop - Nantucket - 8 January 2019



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Community Resilience Building

Hazards

Infrastructure

Societal

Environmental



Community Resilience Building Workshop - Nantucket - 8 January 2019



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Hazards

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Infrastructure Vulnerability/Strength

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Infrastructure

- **What infrastructure/facilities are exposed?**
 - *WWT, nursing homes, schools, hazardous materials, etc...*
 - **What makes this infrastructure vulnerable?**
 - *Location, age, building codes, type of housing, etc...*
 - **Consequences of this infrastructure vulnerability?**
 - *Lack of access to critical facilities – urgency care, pharmacies*
- POSSIBLE ACTIONS: What can be done?**
- *Assess housing stock in vulnerable areas?*
 - *Prioritize future development in lower-risk areas?*
 - *Integrate risks into capital improvement plans?*

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Societal

- **Population characteristics in high-risk areas?**
 - *Elderly, low income, special needs, etc...*
- **How will hazards intensify these characteristics?**
 - *Where are areas for improvement in the community?*
- **Strengths of your community?**
 - *Active civic groups, organizations, associations?*

POSSIBLE ACTIONS: What can be done?

- *Improve existing programs (which ones)?*
- *Increase awareness via education/outreach on hazards?*
- *Increase involvement by citizens (on what and with whom)?*

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Environmental Vulnerability/Strengths

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Introduce Today's Activities

Elements

- Participatory process for assessing a community's vulnerability/strengths and priority actions
- Risk Matrix and Base Maps

Process and outputs:

- Exercise
- Complete assessment using Risk Matrix/Base Maps
- Discuss summary



Risk Matrix/Base Map

Step #1: List top hazards

Step #2: Vulnerabilities and Strengths

- Infrastructure; Societal; Ecosystem
 - Indicate location and ownership

Step #3: Mark your Base Maps

Step #4: Develop actions

- For each action;
 - **Rank Priority** (High (H), Medium (M) or Low (L))
 - **Urgency** (On-going (O), Short (S) or Long-term (L)).



Report outs

- Each Team reports out on its priority hazards, vulnerabilities, strengths, and Actions.
- Discuss top Actions



Expectations of Participants

- Permission to be active participants
- Your ideas & expertise are needed
- Respect contributions of others
- Be creative and remain optimistic
- Stay on task (as defined by your facilitators)
- Be accountable for your group's discussions

Your Turn!

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NEXT STEPS

PHOTO: TOWN OF NANTUCKET

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NEXT STEPS

-  Workshop Results Report
-  Public Listening Session
-  MVP Certification and Funding Opportunities

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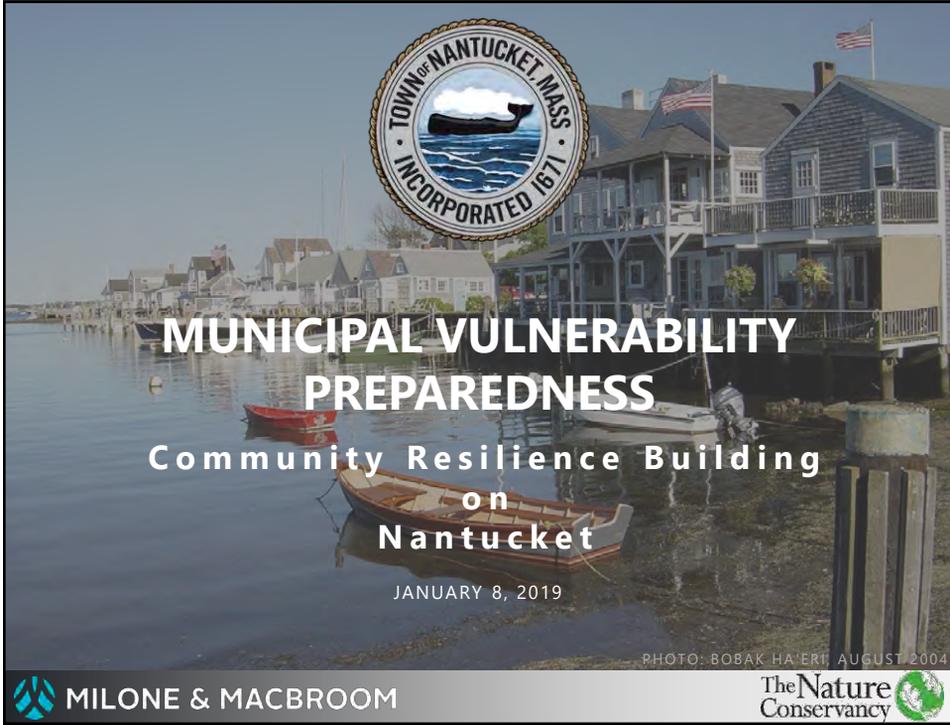
WRAP UP



PHOTO: NANTUCKET, MA

  MILONE & MACBROOM

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RESOURCE MAP PACKET

Community Resilience Building on Nantucket

JANUARY 8, 2018

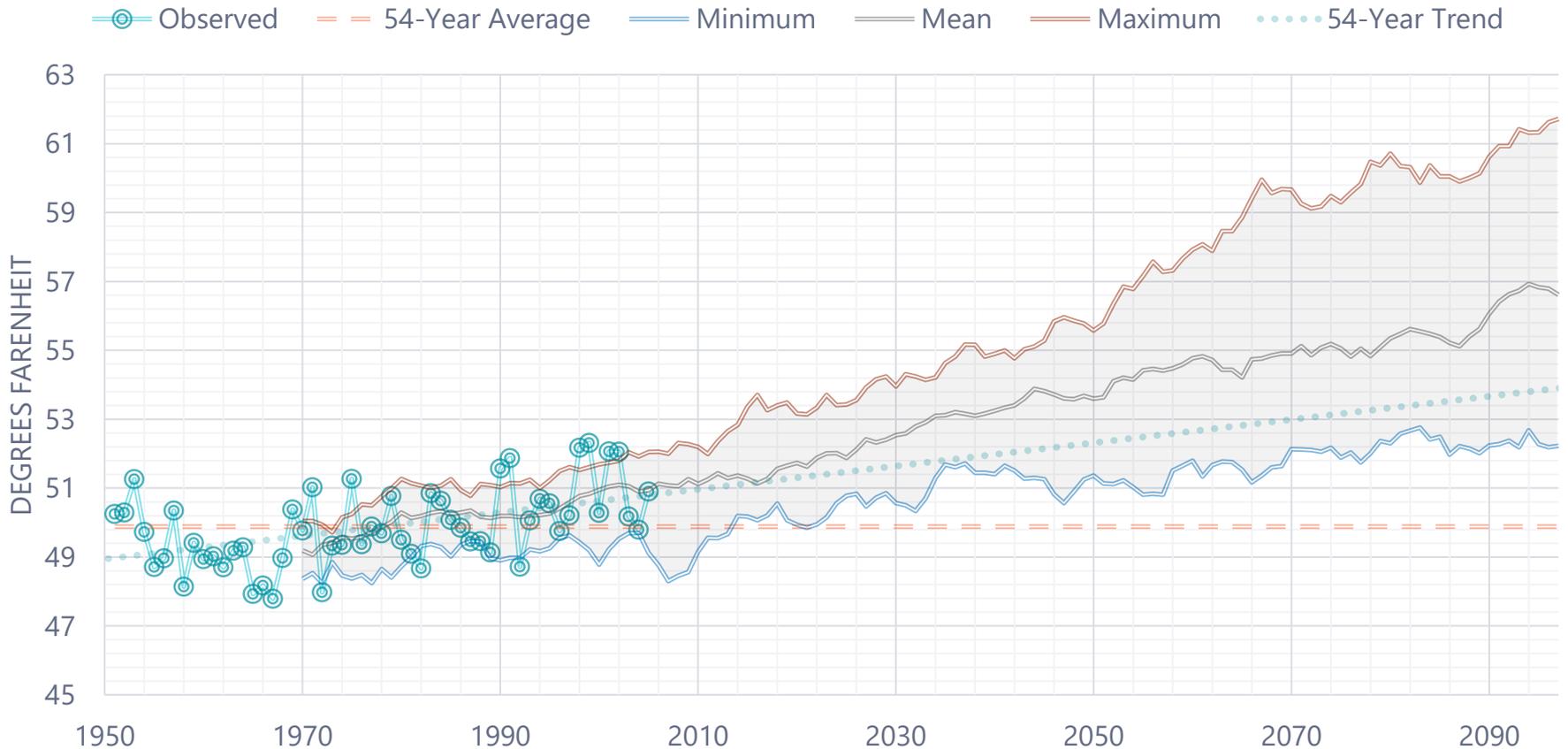


PHOTO: BOBAK HA'ERI, AUGUST 2004

RESOURCES AVAILABLE FOR NANTUCKET



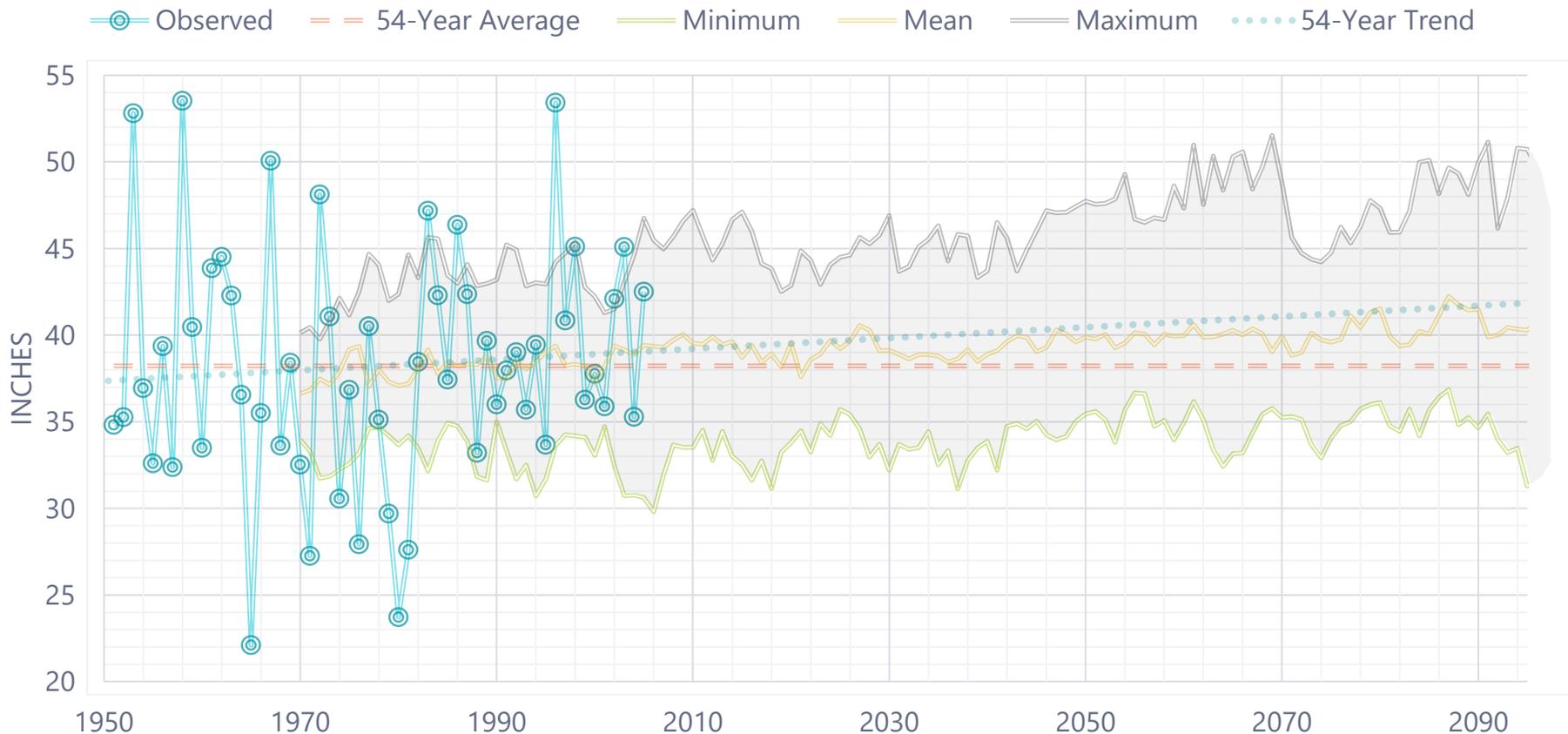
Projected Average Annual Temperature, Nantucket



RESOURCES AVAILABLE FOR NANTUCKET



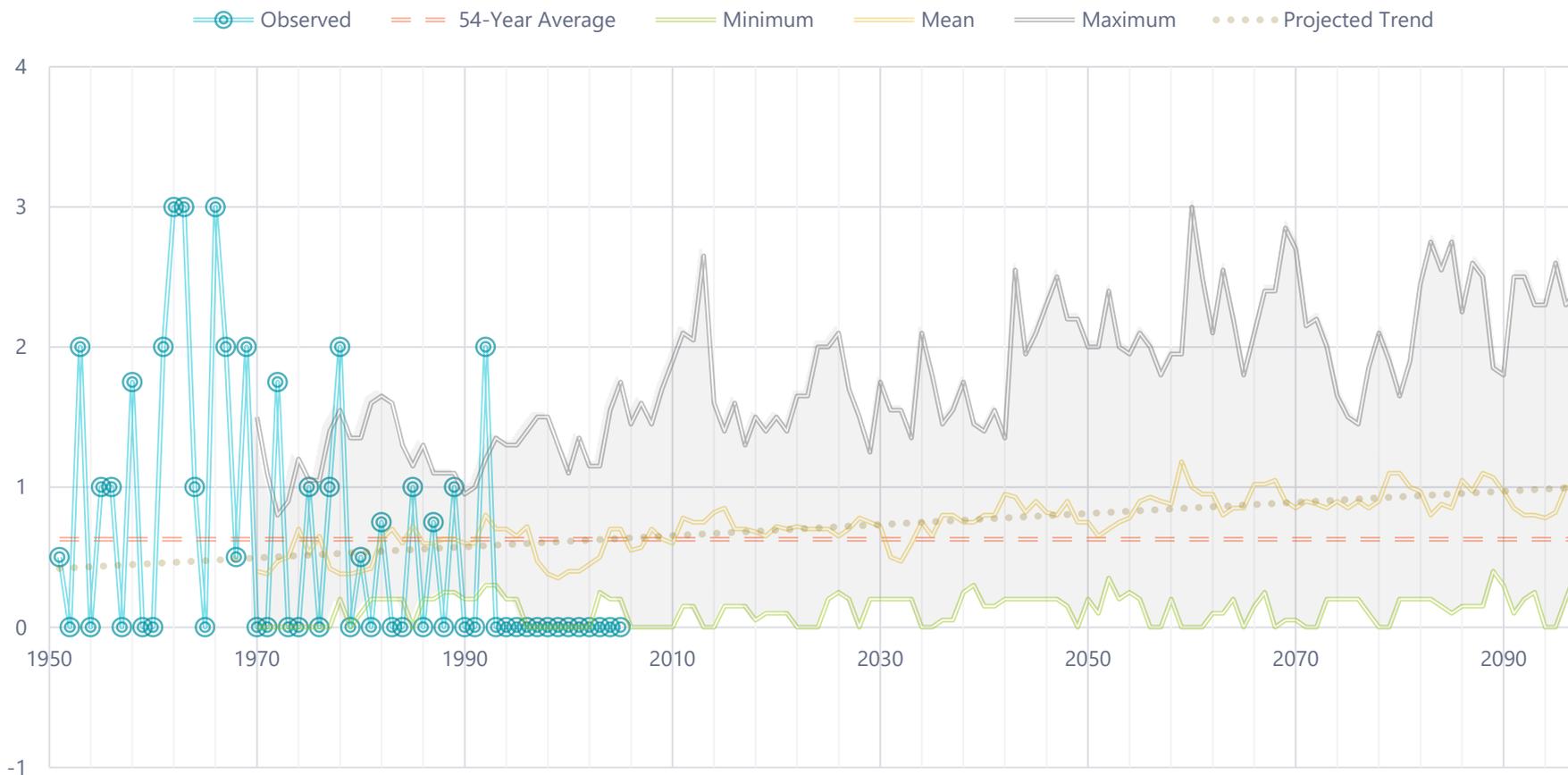
Projected Annual Precipitation, Nantucket



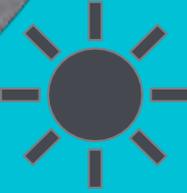
RESOURCES AVAILABLE FOR NANTUCKET



Projected Days with Precipitation Over 2 inches

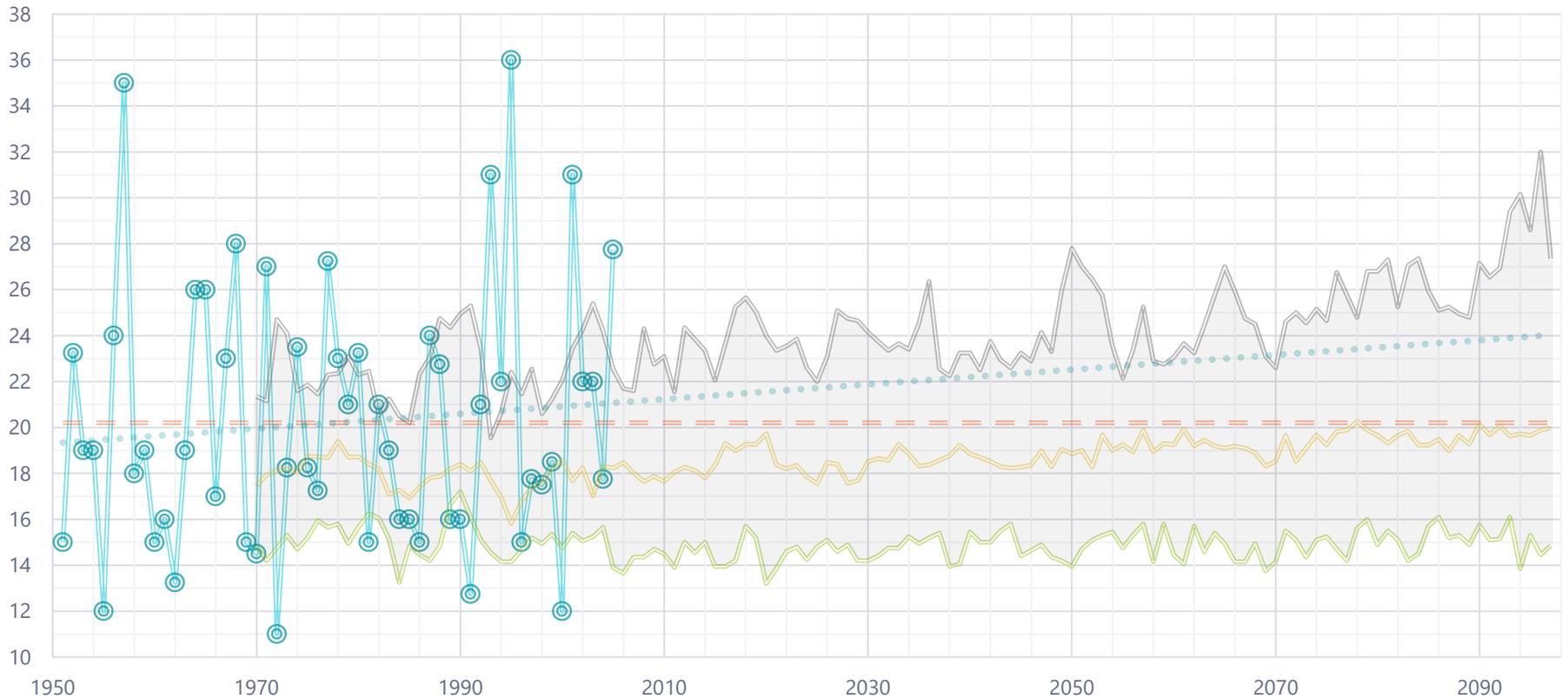


RESOURCES AVAILABLE FOR NANTUCKET



Projected Consecutive Dry Days

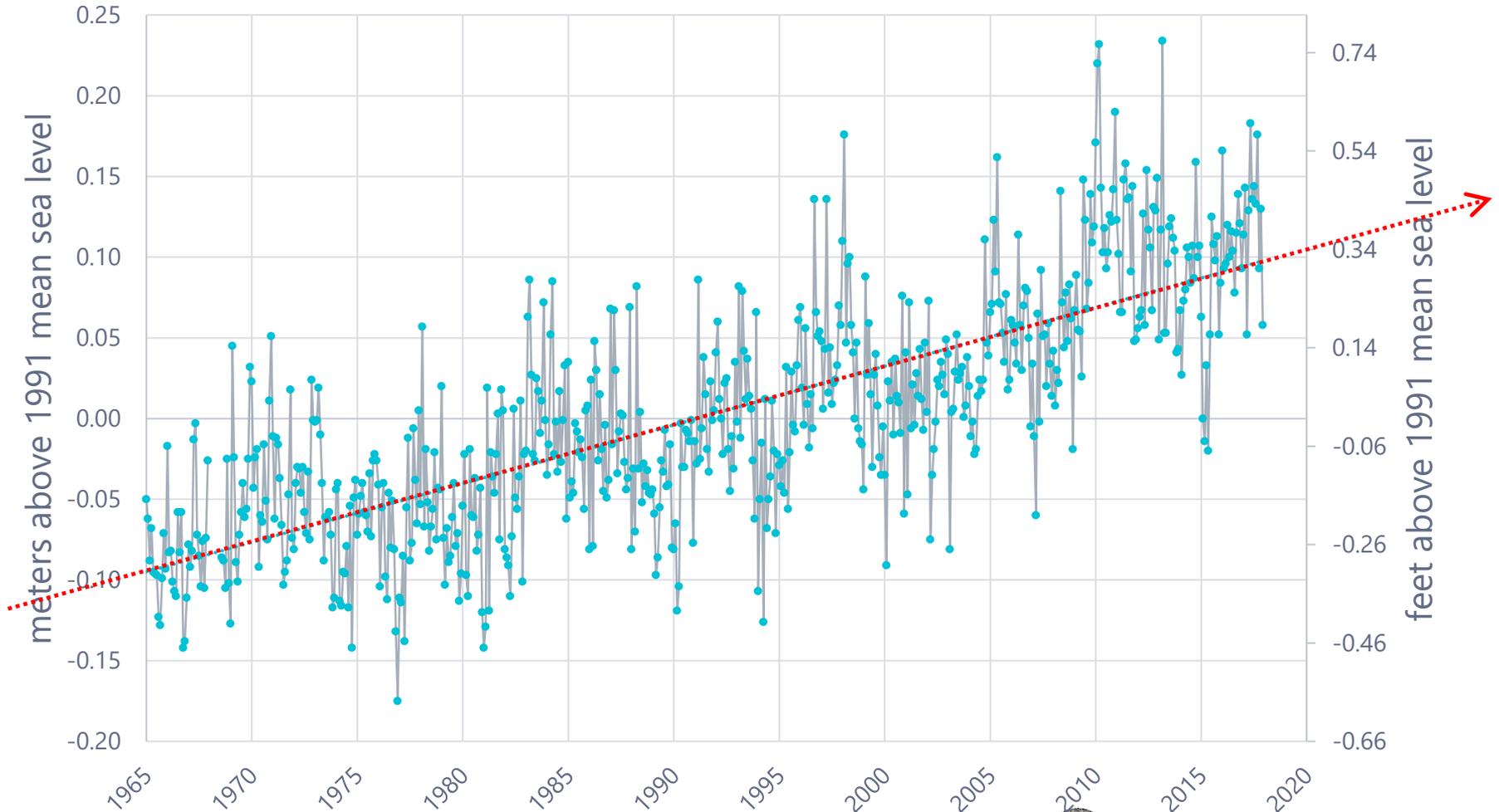
—○— Observed - - - 54-Year Average — Minimum — Mean — Maximum ●●●● 54-Year Trend

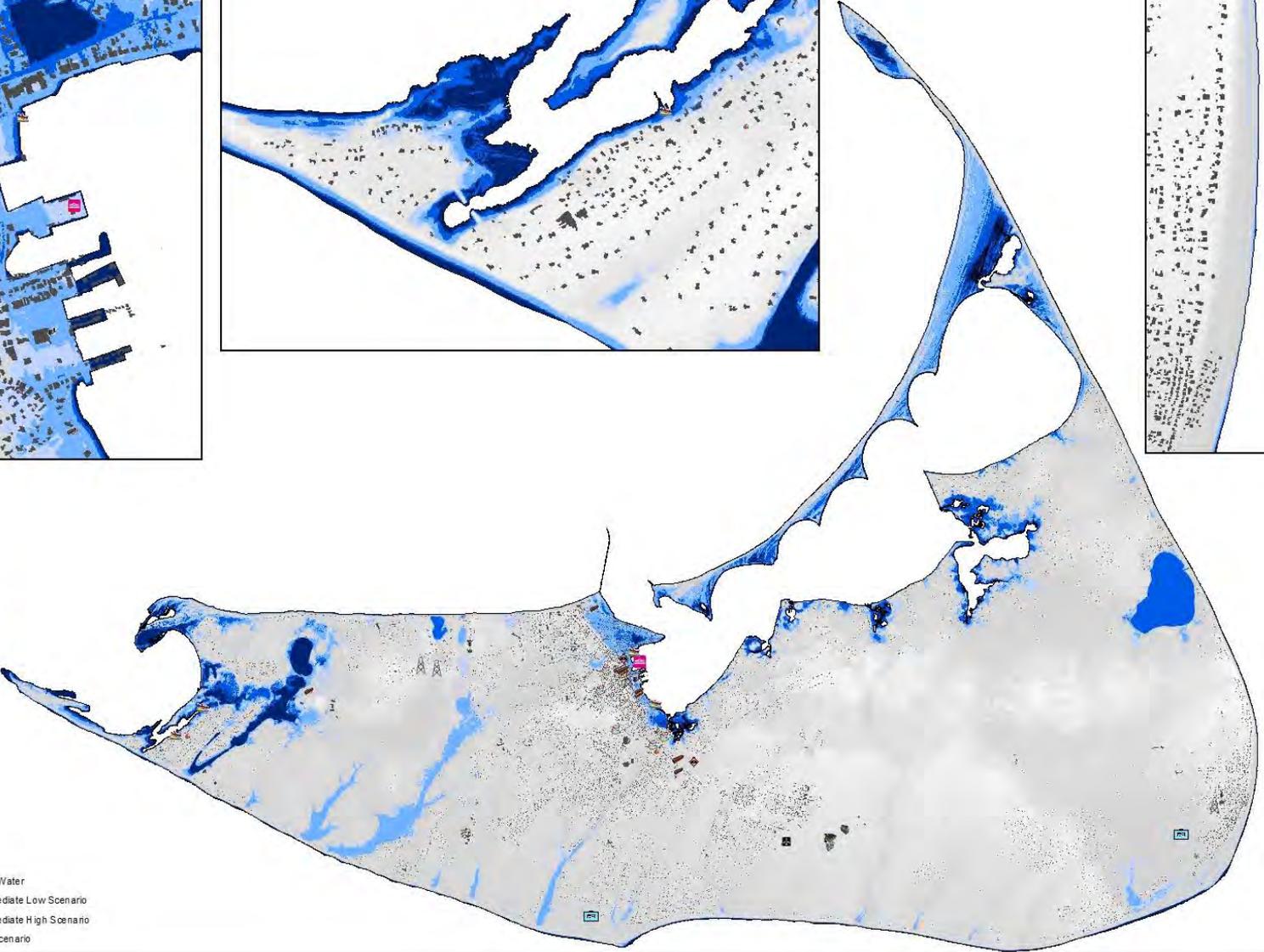
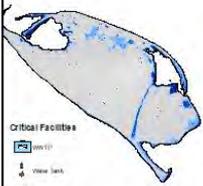
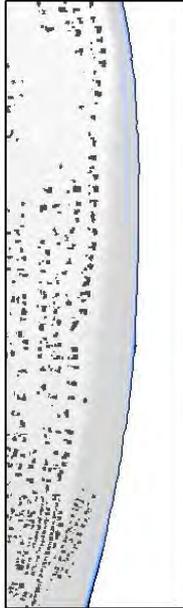
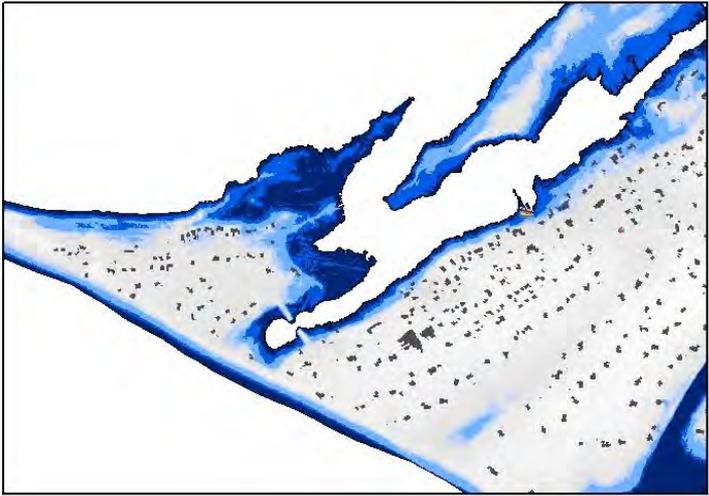


RESOURCES AVAILABLE FOR NANTUCKET



NOAA Tide Gauge 8449130. Nantucket Harbor, 1965 – 2017 (Relative to 1991 mean sea level)





Critical Facilities

- Airport
- Water Tank
- Pumping Station
- Communication Tower
- School
- Gas Station
- Office
- Ferry
- Municipal Building
- Court House
- Post Office
- Police Station
- Fire Station
- Hospital
- Power Generation
- Fuel Tank Farm
- Pipeline Substation
- Dam
- Public
- Communication Tower
- Repetitive Losses

Legend

- Building
- Current High Water
- 2080s Intermediate Low Scenario
- 2080s Intermediate High Scenario
- 2080s High Scenario

MILONE & MACBROOM
 CONSULTING ENGINEERS
 100 STATE STREET
 NANTUCKET, MASSACHUSETTS

DESCRIPTION	DATE	BY

Hazard Overview: Sea Level Rise - 2080s
Nantucket Coastal Resilience Plan
Hazard Analysis
 NANTUCKET, MASSACHUSETTS

NBS	INDEXED
T: 5-814	
DATE: January, 04 2019	
REV: 2067-12	
PROJECT NUMBER	
11x17	

PREPARED BY: MILONE & MACBROOM, INC.



Legend

- █ EvacuationRoutes

Road Type

- █ Paved
- █ Unpaved

FEMA Flood Zones

- 1% Annual Chance Flood Hazard Zone
- 0.2% Annual Chance Flood Hazard Zone



MILLNER & MCGLOTHLIN
 99 Beady Drive
 Shelton, Connecticut 06410
 Phone: (203) 271-1773 Fax: (203) 272-9734
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SOURCE: ESRI

MAJOR ROADS AND EVACUATION ROUTES
TOWN OF NANTUCKET NATURAL HAZARD MITIGATION PLAN
NANTUCKET, MASSACHUSETTS

Map By: MER
 MMR#: 2007-06
 MFD: 1/15/2008 10:00AM (Geo-2-500000_ roads, flood.mxd)
 1st Version: 08/26/2007
 Revision: 3/7/2008
 Scale: 1 in. = 4,025 ft

FIGURE 2-2

Zone A: Areas subject to inundation, hydraulic analysis not performed, no base flood elevations.
Zone AE: Areas subject to inundation determined with detailed methods. Base flood elevations available.
Zone AH: Areas of shallow flooding (ponding) at average depths of 1 to 3 feet.
Zone AO: Areas of shallow flooding (sheet flow along sloping terrain) at average depths of 1 to 3 feet.
Zone VE: Areas along coasts subject to inundation with additional hazards due to storm-induced velocity wave action.
Zone X: Areas with moderate to minimal flood hazard between 100 year and 500 year events.



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 99 Beady Drive
 Cheshire, Connecticut 06410
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SOURCE(S):
 FEMA FIRMS

FEMA FLOOD ZONES
TOWN OF NANTUCKET NATURAL HAZARD MITIGATION PLAN
NANTUCKET, MASSACHUSETTS

Map By: MBG
 MMR#: 2007-06
 MFD: 1/15/2008
 1st Version: 08/26/2007
 Revision: 02/2/2018
 Scale: 1 in = 5,792 ft

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FIGURE 3-1

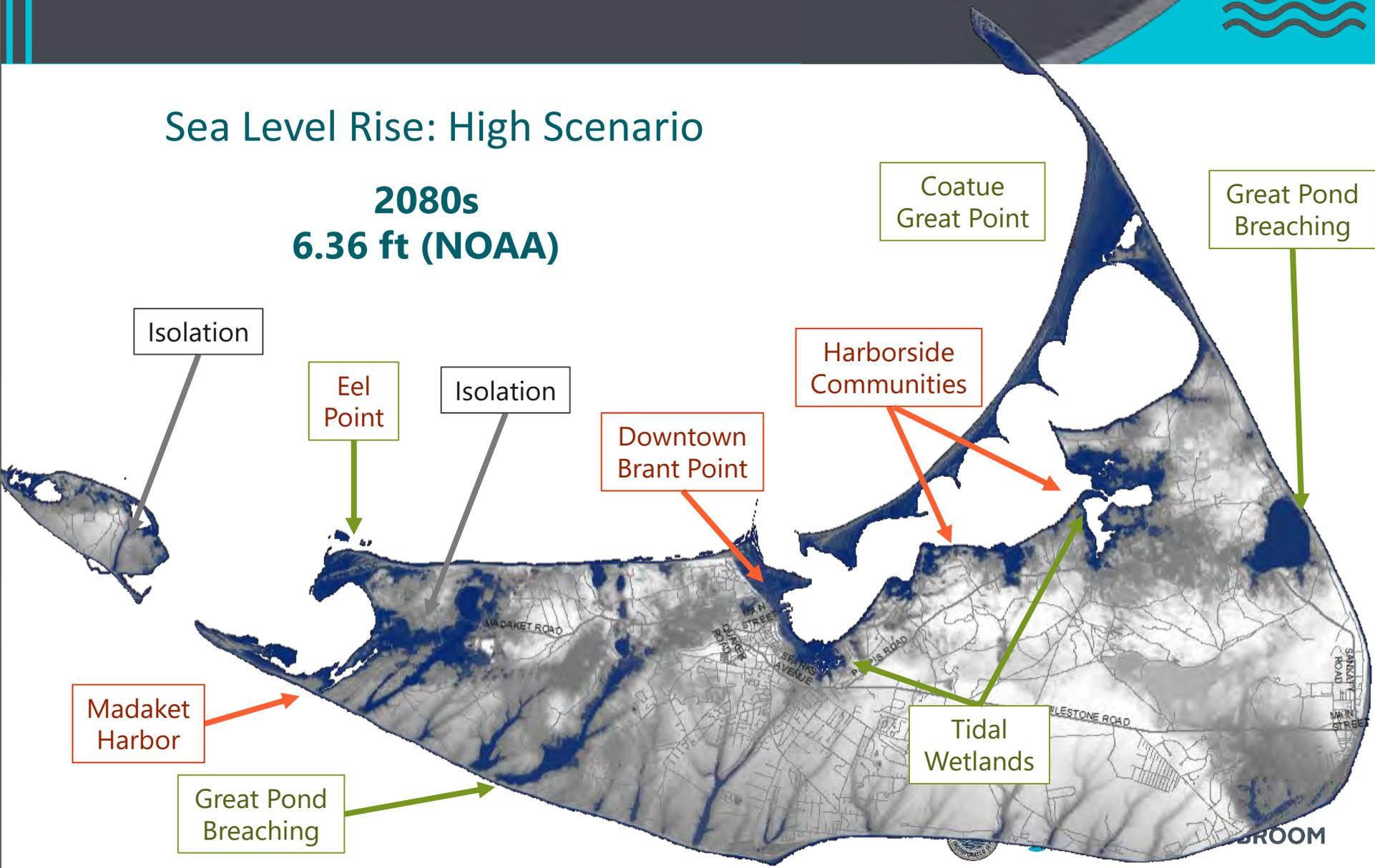


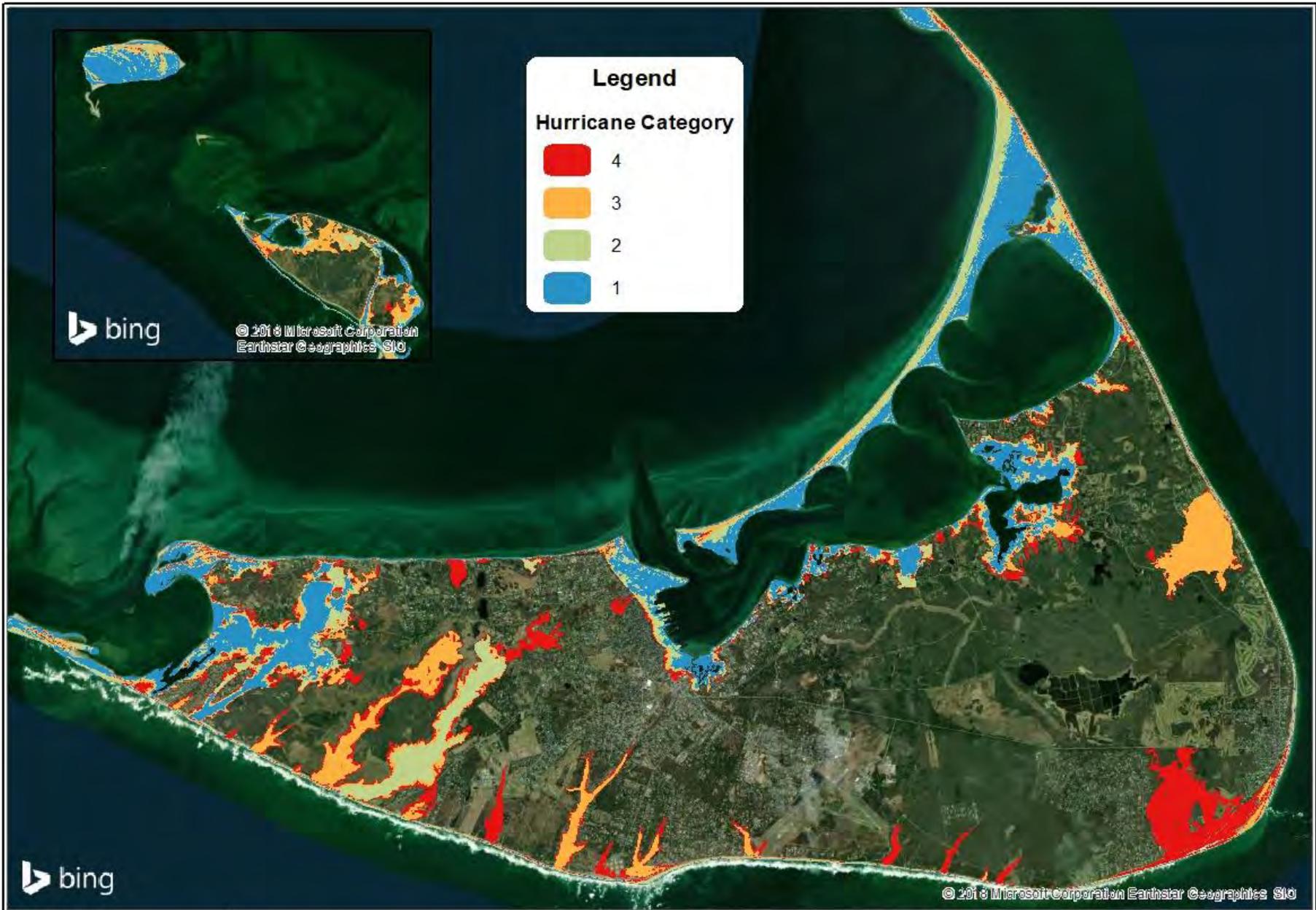
RESOURCES AVAILABLE FOR NANTUCKET



Sea Level Rise: High Scenario

2080s
6.36 ft (NOAA)





SOURCE(S):
MASS GIS

MXD: U:\Y\2967-09\Maps\Fig5-1_hurr_inundation1.mxd

Figure 5-1: Storm Surge Areas

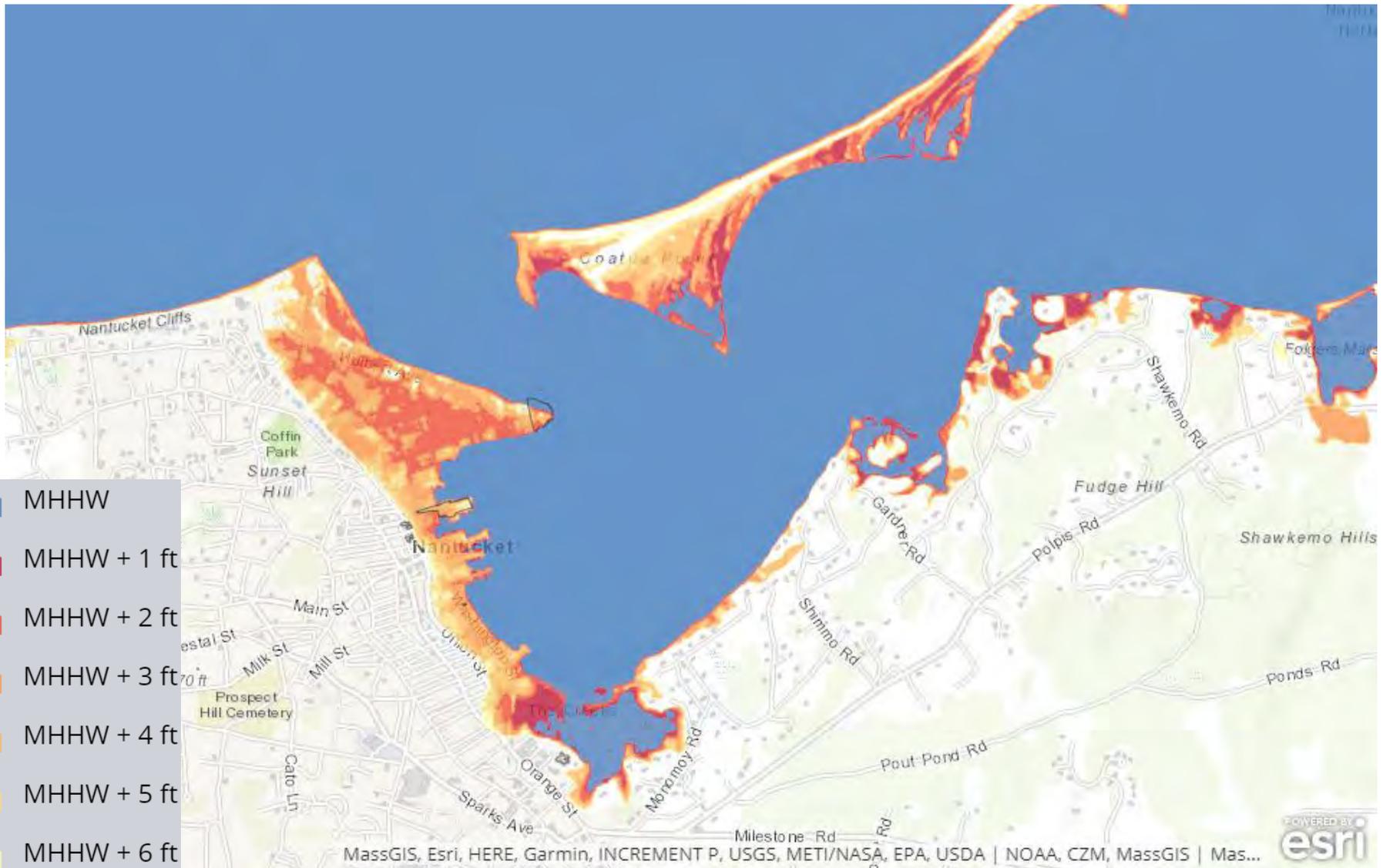
**Town of Nantucket
Natural Hazard Mitigation Plan**

LOCATION: Nantucket, MA

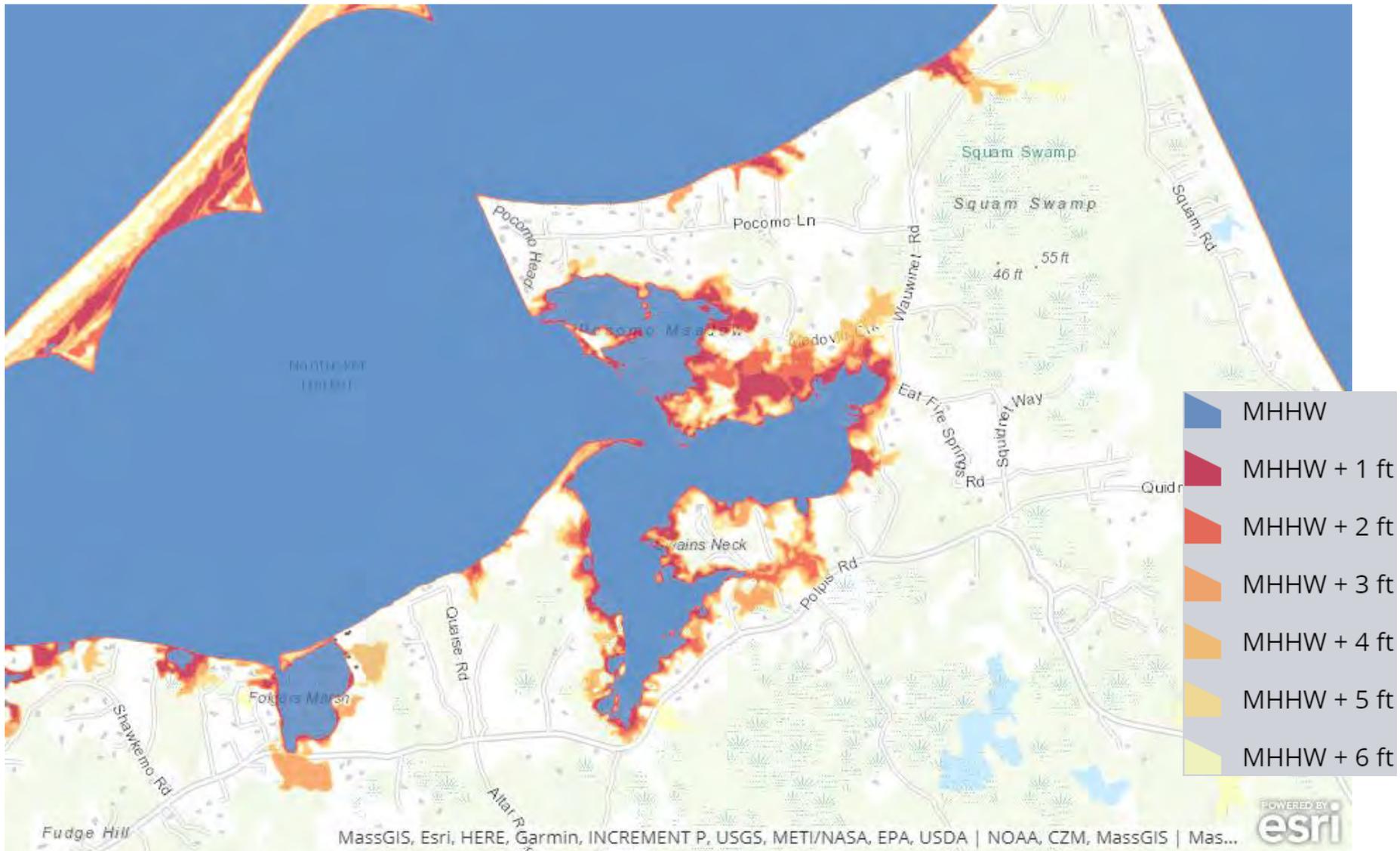
Map By: MER
MMI#: 2967-09
Original: 3/7/2018
Revision:
Scale: 1:87,536

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RESOURCES AVAILABLE FOR NANTUCKET



RESOURCES AVAILABLE FOR NANTUCKET



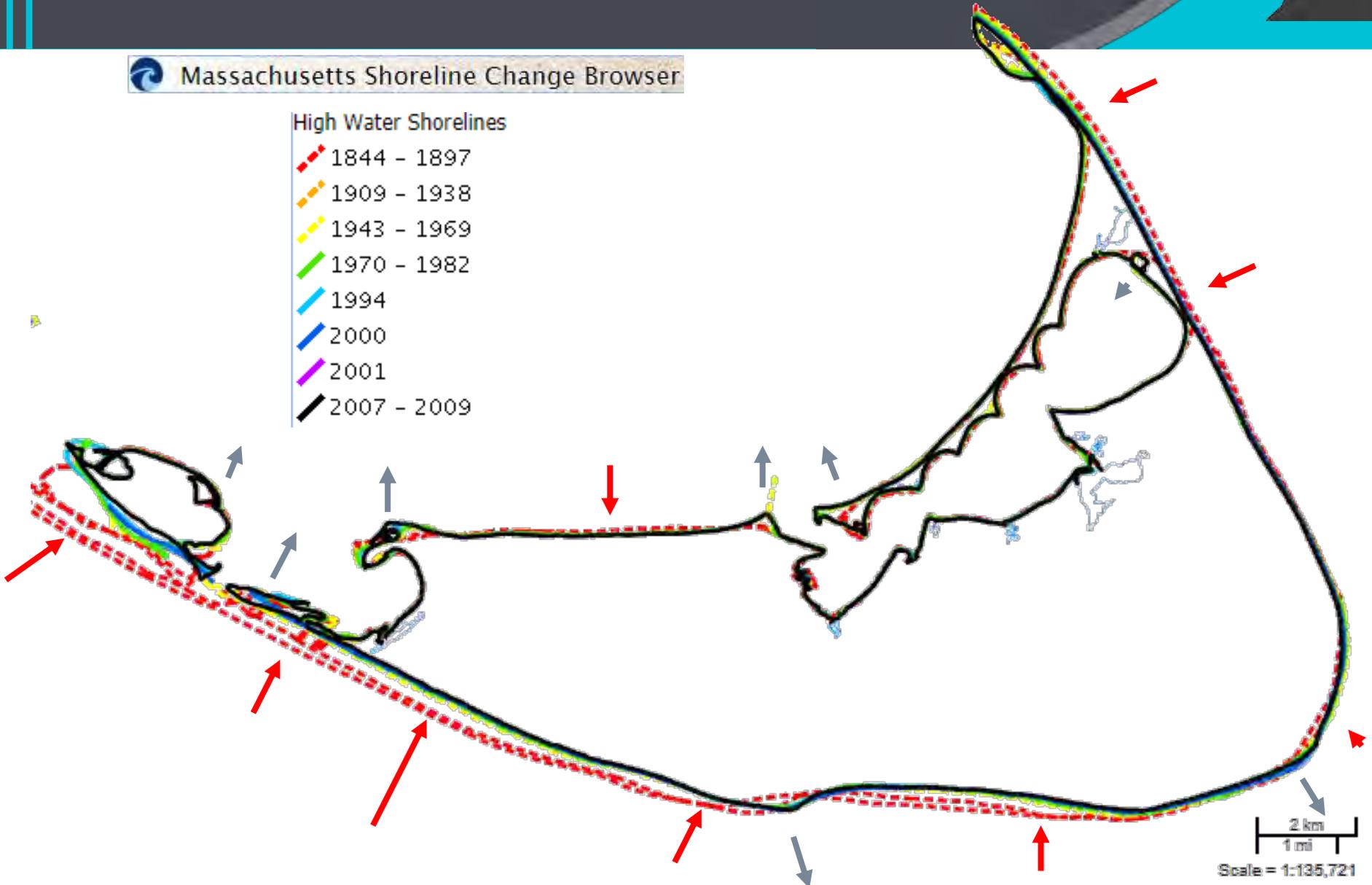
RESOURCES AVAILABLE FOR NANTUCKET



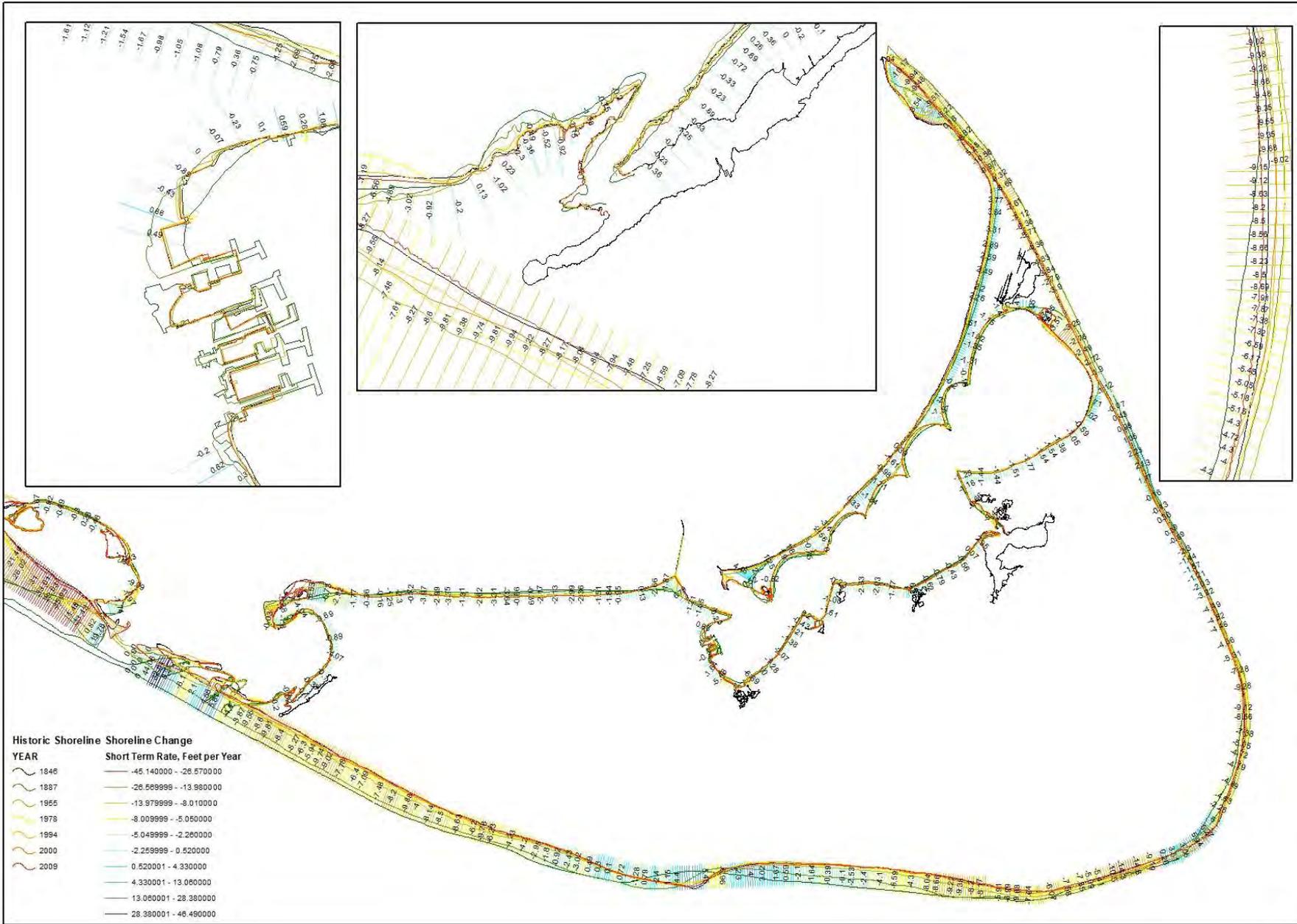
Massachusetts Shoreline Change Browser

High Water Shorelines

- 1844 - 1897
- 1909 - 1938
- 1943 - 1969
- 1970 - 1982
- 1994
- 2000
- 2001
- 2007 - 2009







Historic Shoreline Shoreline Change

YEAR	Short Term Rate, Feet per Year
1846	-45.140000 - 26.570000
1887	-26.569999 - 13.980000
1965	-13.979999 - 8.010000
1978	-8.009999 - 5.050000
1994	-5.049999 - 2.260000
2000	-2.259999 - 0.520000
2009	0.520001 - 4.330000
	4.330001 - 13.060000
	13.060001 - 28.380000
	28.380001 - 46.490000






MILONE & MACBROOM
Civil & Mechanical Engineers
ARCHITECTS
INTERIORS

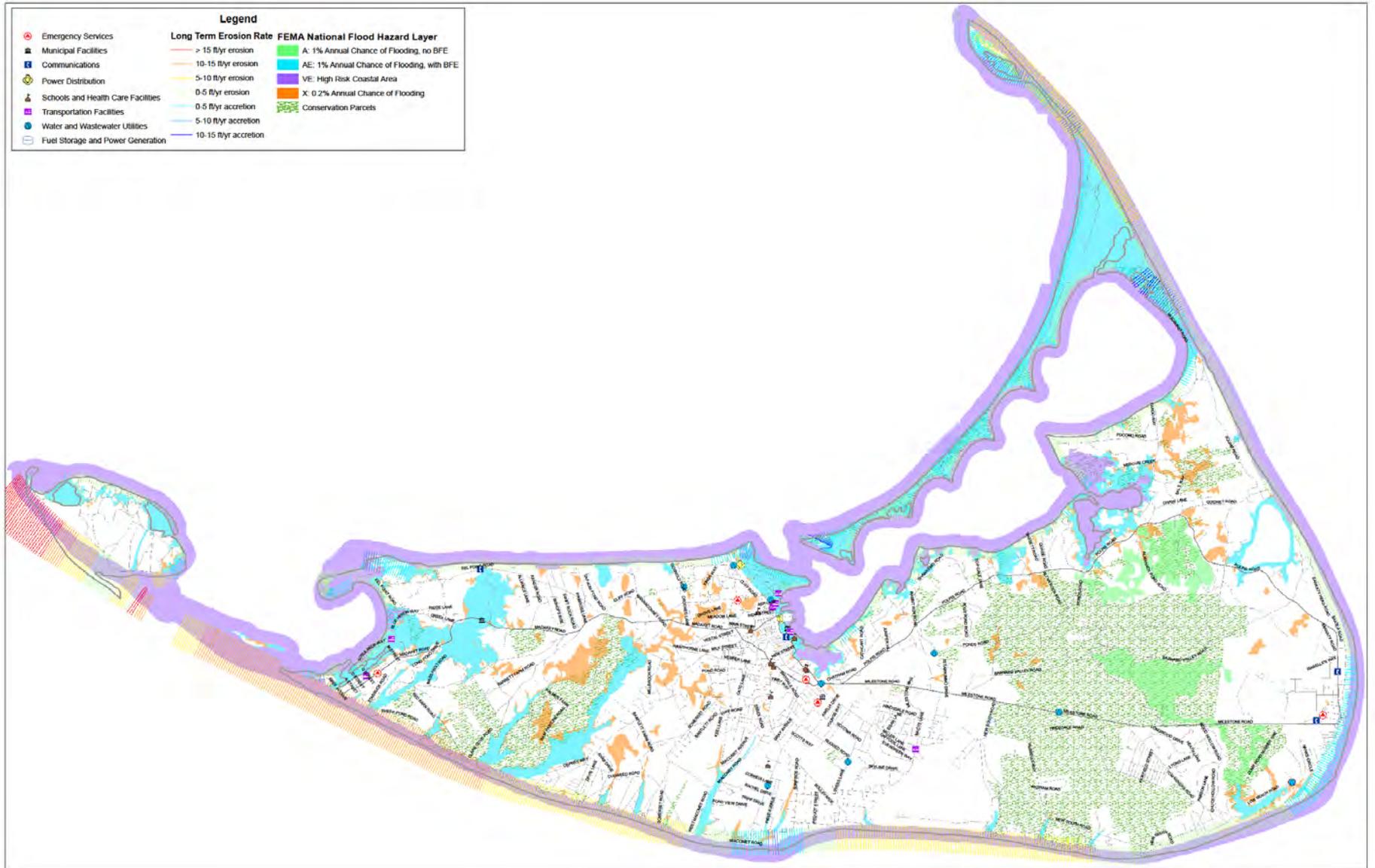
NO.	DESCRIPTION	DATE

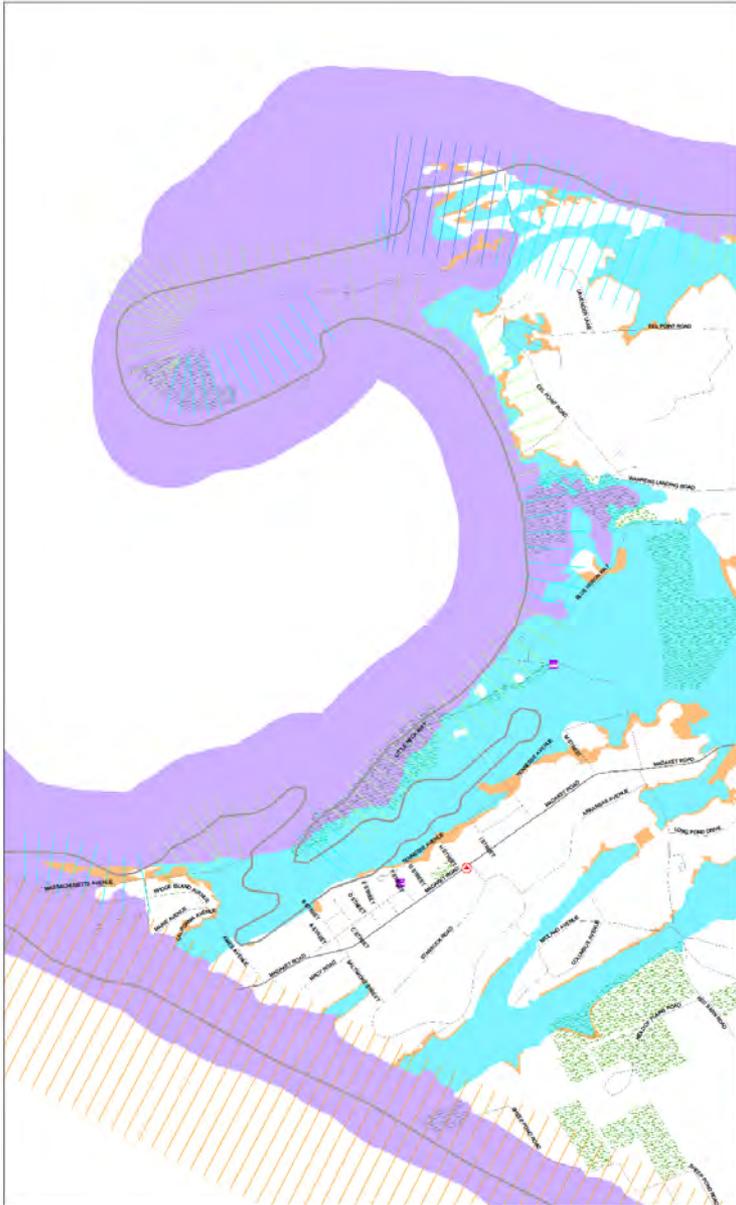
Hazard Overview: Erosion
Nantucket Coastal Resilience Plan
Hazard Analysis
NANTUCKET, MASSACHUSETTS

DATE	NBS DRAWN	ISSUED
January, 04 2019	T: 25, 8 29'	
2019-07-12		
PROJECT NUMBER		

11x17

SCALE





Legend

<ul style="list-style-type: none"> Emergency Services Municipal Facilities Communications Power Distribution Schools and Health Care Facilities Transportation Facilities Water and Wastewater Utilities Fuel Storage and Power Generation 	<p>Long Term Erosion Rate</p> <ul style="list-style-type: none"> > 15 Ryr erosion 10-15 Ryr erosion 5-10 Ryr erosion 0-5 Ryr erosion 0-5 Ryr accretion 5-10 Ryr accretion 10-15 Ryr accretion 	<p>FEMA National Flood Hazard Layer</p> <ul style="list-style-type: none"> ACF: 1% Annual Chance of Flooding, with DFE VE: High Risk Coastal Area X: 0.2% Annual Chance of Flooding Conservation Parcels
--	---	---



Legend

Nantucket Conservation Lands

- Private, Non-Profit, and Nantucket Land Bank
- Federal, State, and Local Government
- Nantucket Conservation Foundation

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

<p>Map by: MFR MWH: 2/6/09 MCD: 11/20/09 Lst Version: 09/07/2017 Revision: 3/7/2018 Scale: 1 in = 1,000 ft</p>	<p>NANTUCKET CONSERVATION LANDS NATURAL HAZARD MITIGATION PLAN NANTUCKET, MASSACHUSETTS</p>	<p>SOURCE (P): TOWN OF NANTUCKET</p> <p style="text-align: center;">  N E S W </p> <p>MILLORIS & MACBROOK 39 Beatty Drive Chelsea, MA 02140 (617) 271-7733 Fax: (617) 272-8733 www.millorrisandmacbrook.com</p>
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Legend

-  Wildfire Risk
-  Nantucket Conservation Foundation
-  Private, Non-Profit, and Nantucket Land Bank
-  Federal, State, and Local Government



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Sources:
Town of Nantucket

Figure 9-1: Wildfire Risk Areas

MKD: U:\Y\2967-09\Maps\Fig9-1Wildfire Risk1.mxd

**Town of Nantucket
Natural Hazard Mitigation Plan**

LOCATION: Nantucket, MA

Map By: MER
MMI#: 2967-09
Original: 3/12/2018
Revision: 9/05/2017
Scale: 1:120,000



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PHOTO: HURRICANE SANDY. JASON GRAZIADEI

NANTUCKET: BASE MAP

Red Group



NANTUCKET: BASE MAP

Yellow Group



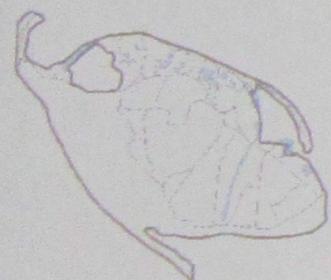
NANTUCKET: BASE MAP

Green group

Caribbean
hot tubs
(residential)

Swamp
N. & N. Needs

W. 125 ft.
Private
Caribbean Station
W. 125 ft.
Private
Caribbean Station



Community Resilience Building Risk Matrix

Nantucket January 8, 2019 Group: RED



www.CommunityResilienceBuilding.org

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

H-M-L priority for action over the Short or Long term (and Ongoing)
 V = Vulnerability S = Strength

Features	Location	Ownership	V or S	Coastal Flooding	Sea Level Rise	Erosion	Severe Storm	Priority	
								H-M-L	Time
Infrastructural									
* Roads (isolation)	All Coastal	T	V/S	ID & Make action plan for roads to raise/bridge/lift access			Alt Access plans	H	S
Electric System	Downtown & Islandwide	Nat Grid/T	V/S	Elevate Transformers			Incentivize independent Energy Generation	M/H M	L L/O
Town Fleet	NA	T	S _v	Purchase saltwater-resistant flood-resistant vehicles	Municipal Truck Wash			H L	S S
Wetlands Docks & Piers	Downtown Madaket	P & T	V	Alternative Access Points				M	L
Milk's Bridge	Madaket	T	V/S	Complete relocation of Ames Ave				M/H	○
Solid Waste	Madaket	T	V	Capping				L	○
Waste water Collection	Central & Scanset	T	V	Buld Coastal Hazard into CMON Plan				M H	○
Societal									
Recreation sewer beds	Surfside	T	V	Already Plan in Place					
Drinking Water (Pipes)	All	T	S/V						
Airport	S Shore	T	S/V						
Aesthetics	All	varied	V/S						
fisheries & scalloping/scams	Great Harbor Madaket	T & S	V						
Environmental									
Well Water/Aquifers	Mid-Island Scanset/Deer	P/S/T D/ISO/PI	V						
Freshwater Ponds/Grass	Southwest	T/S	V						
Stormwater	All	T/P	S	Identify areas with II. and get offline				H	S
Coastal habitats Wetlands	GH MH	S/T/P	V/S	Restore non-functioning wetlands				H	L
Wildlife	All	—	V						

Community Resilience Building Risk Matrix



Nantucket January 8, 2019 Group: _____

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

H-M-L priority for action over the Short or Long term (and Ongoing)
 V = Vulnerability S = Strength

Need to Review Regs + Barriers

Intense Storms (incl rain)	Flooding!	Erosion!	SLR	Wind	Priority	Time
					H-M-L	Short Long Ongoing

Features	Location	Ownership	V or S						
Infrastructural									
Failure/air roads	Townwide	Town	V	Address drainage (more, less, new)	Elevate Rds + Culvert capacities	Alt Access			H
Failure/air sewers	2 Systems	Town	V	Sewer Master Plan (implement)					H
Critical buildings	Townwide	Various	V, S	Digitize Documents! Relocate some functions	Elevate critical systems inside bldgs				M
Access (Steamship) Ferries	Specific	Not Town	V	Involve them more! Emergency Plan needed	Elevate roads to/from Relocate Hyline	Wave Barriers			H
WWTP	2 Loc.	Town	V	Reduce I+I	Relocate Plant, Beds, Consider Alt. Methods				H
Airport	Mid Is.	Town	S, V		Reduce encroachment of imp. surfaces	Study runway length	Larger aircraft		L
Coastal Hard Infras.	Coastal	Various	V, S		High? Easy St example! Need consistency criteria	Examine/ID artificial reef technologies			M
Societal									
Aquaculture		Town & Private	V	Reduce SW runoff, Seed stranding recovery		Protect eelgrass			L
Historic/Cultural Res.	Everywhere	Mostly Private	V, S	Guidance needed that works for Nantucket!	Consider Flood walls	Document which need to be moved			M
Tourism	"	"	V, S	Update plans for dealing w/stranded folks		"Eco Adventure"	PR - Town is open for business!		L
Pop. Distrib. (age dist.)	"		S!						
Nursing Home	Mid-Is	Town	V, S		Relocate!				L L
What the Boats (Ferries) do			V						
Acad + Prof Experts / Resources			S	More best practices workshops - 4 per year					H S
Environmental									
Protective Natural Barriers		Mix	S, V	Implement permits for dredge/use	Xmas tree type solutions for banks	Sand movement study (like Cape Cod)	Living shorelines		H S
Groundwater			S, V	Backup locations for wells	Nitrates		Monitor for Salinity		
Ponds / Harbor			S, V	Complete pond mgmt plan + establish principles	Property owners to address flooding				
Moors (Logical place to move after retreat?)			S			protect? Use deliberately?	Need to decide		
Salt Marshes			S, V		Stronger/diff regs - More tidal flushing				

require comp. mitigation

Community Resilience Building Risk Matrix

Nantucket January 8, 2019

Group: New Buildout → Master Plan



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Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

H-M-L priority for action over the Short or Long term (and Ongoing)

V = Vulnerability S = Strength

Land Use Planning / Management

Intense Storms	Flooding !	Erosion !	SLR	Wind	Priority	Time
					H-M-L	Short Long Ongoing

Features	Location	Ownership	V or S						
Infrastructural									
New Tank Farm	Mid Is.	H. Fuel	S	Alt. Access / resilient access		LT need another site			
Substation	Downtown	NGrid	V, S	(Lots of backup plans and generation locations)					
CG Facility	Brant Pt.	Feds	(S)	Listen to them - good ideas Need to keep MOUs w/ Town					
New Hospital (150 mph)	Mid Is	other	S						
Landfill	Westish	Town	S, V	R/R/R!					
FAA Navig.		FAA?	S						
C.B. Pump Station		Town	V, S	Study capacity	Consider others?	—			
Societal									
NonRes Owners / Seasonal	—	—	S, V						
Immigrant & Minority	—	—	S, V	In the context of emergencies, need to determine what the pop. is b/c it affects the needs					
COMMUNITY			(S)	Comm. Resilience Building like Annapolis					
Govt. Structure (T+C)			S						
Town Staff Versatility			S						
Environmental									
Cons. Land Ownership	Everywh.	Various	S						
Threat & End. Species		—	V						
LID / Stormwater Mgmt.				Develop Plan w/ LID		—			

Community Resilience Building Risk Matrix

Nantucket January 8, 2019 Group: Green



WEALTH vs Not

www.CommunityResilienceBuilding.org

Septic Systems
LD the O
Regul + Tank etc => □

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Features	Location	Ownership	V or S	Top Priority Hazards	Priority		Time	
					H-M-L	Short Long Ongoing		
Infrastructure	Downtown - D Area		V	Assess/Workplan for Downtown Alterations	H	S		
Roads Satach Park Polpis	Spente	mun	V	Raising Rd.s -> HMP Truck Rules	M	O-S		
Isolated neighborhoods	Spente Pt.	Private	V	Predeploy Resorce (STAFF) in Isolated Neighborhood	H	O		
Fire Station / 2 Satellite Stations	Spente	Muni	S	all set	H	S		
Hospital - (Cat 5)	Spente	Muni	S	LEED Certified	H	O		
Renewable Energy -> wind farms / solar panels	Spente	Muni	V/S	Landfill - Solon Mattomat	H	S		
Cables from Cape Cod	Spente	Muni	S	Erosion of Runway -> Airport Closure	M	O		
Societal								
Police Call list 70-90	Spente	Muni	S		H	O		
CODE Red / Power 911	Spente	Muni	V/S	COMMUNICATIONS -> Turn no Cell / Boats	H	O		
Eldery Apartments - Max Emer Infrastructure			S	TRANSIT SERVICES School's good center churches				
Working Poor -			S	Climate Res. Plan -> Local Grants -> (?)				
M60 - Infrastructure Council	Spente	Muni	S	State statute -> NRTA -> Year Round Res Transport to Work	H	O		
Affordable housing - Employee Prority		Private	V					
Museum / shops			S					
Environmental	Septic / H2O cleaner	Private	V	Septic Eject				
Conservation Lands	56-10 (Affordable)	Muni	S/V	Umbrella ->	M	O		
Land Park Purchase of low lying lands	Islet	Muni	S	Land survey -> Need to Cover Land				
Recreational areas			S					
Conservation Commission	Private	Muni	S					

Just one change

Conservation Commission / Private Muni S

Community Resilience Building Risk Matrix

Nantucket January 8, 2019 Group: GREEN

Entitlement

NOT Big Enough?!? www.CommunityResilienceBuilding.org

State Backup Codes

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc)

WIND

H-M-L priority for action over the Short or Long term (and Ongoing)

V = Vulnerability S = Strength

4000 house

Features	Location	Ownership	V or S	Top Priority Hazards				Priority H-M-L	Time Short Long Ongoing
				Flooding Coastal Storm	Inland Flooding	Drought Wildfire	Earthquake		
Infrastructural									
WWT - 15 pump station 5-9'	Spout	Muni	S	100,000 cum ft.					
WWT 3 pumps Voluntary Flat	Spout site	Muni	V	By Pass Pump -> 3 pump		Mitigate overall H ₂ O use			
Stonewall Sewer Mass Plan (9' Feeds)		Mun	S	Practical - Sun (un)					
14000 m ² / 80-1. res level Elastic seat	All am	Private		Island wide Energy Plan ->		Lique Fuel / solar / M. energy			
HARBOR Facility / Ferry / Storage	HARBOR	Muni	V/S	HARBOR Masses Plan -> 91'		2011 - 2015 - 19 construction	H	S	
Truck Route Closure (Warehouse)	Spout	Mun	V	Severe Alt Routes (-)		Quarantine Access -> Commercial	H	O	
1st / 2nd Bridge Metastock / volume				Study w/ for Portes ->		Capital Plan	H	O	
Societal									
Electric Utility -> Combus									
Access of Markets / Supply / Routes									
Supply Chain ->						Consider on other side			
26 Neighborhood Association									
Language Barriers / Non-English									
Elderly people									
Town Meeting ->		Muni	V						
Environmental									
Protectable Public Lands	"	Private	V/S	Caps on vehicles -> Emission		Line item - Restriction (closed Area)			
6 Different Coastal Orgs / umbrella	"	Private	V/S	Town Meeting with Consider		COASTAL Resilience Plan			
Nantucket Biol. Institute	"	Private	S			Group			
Resilience for Program / Program Plans	Spout	Private	S						
Tourism - Env - Protected			S	Beach Privog - Closed / Waterways - still					

File Plan for Water - King

Community Resilience Building Risk Matrix



www.CommunityResilienceBuilding.org

Nantucket January 8, 2019 Group: _____

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

H-M-L priority for action over the Short or Long term (and Ongoing)

V = Vulnerability S = Strength

Increased Storm Intensity	Flooding	DROUGHT / Tomy Spring (Wildfire if T)	SLR/erosion	Priority	Time
				H-M-L	Short Long Ongoing

Features	Location	Ownership	V or S	Notes	Priority	Time
Infrastructural						
Roads/Inverts - Sesach-st - Easy st (Part of downtown that floods, truck R/S - jetties may hold in tide)	Various	town	V/S	Seasonal Notification Needs vary for pop'n		
Downtown Area	downtown	town		Emergency services		
Ferry terminals	V/S	State		V - wind; ice (2 wks → hard to break ice); EM coordinates supplies based on need (can help 1 wk)	H	O
Airport	S	town		Manage Fuel inventory to winter events; power outage → think about airlift capacity		
Sewer Treatment Plant	V/S	town		Keep modernizing →		
Bridge to Madaket [1.5 mi, Long Miles]	V/S			analytic lab for on-island testing → interdep. communication [consider: cost analysis]		
Societal						
Food Pantry	Washington St	private	V/S	Alternative and/or secondary → move to mid island?		4m L
Housing - Availability/Affordability	Various	private/public	V	Ongoing: continue working towards solutions → jagger naut		K B
Tax Revenue Shifts	Coastal	private	V	SLR/erosion overlays for scenario planning; consider zoning sol'ns		L L
Shifting Properties	Coastal	private	V	See Out A		
Public Awareness				Share hazard info w/ planning, HDC, other Departs. Town on same pg for messaging. Document! Develop outreach plan w/ info from all sundies. Same operating system across departments. Continue building awareness (emails/rev)		H 40
Town/Private Planning Communi.	All	All	V	Leverage planning to coordinate permitting resilience projects, private owners proactive, need to coordinate early + often w/ all planning/permitting boards; consider holistic effects; how high to set standards; if high enough for SLR, do climate & education		M 40
Environmental						
Grasslands	South Shore	private/public	V/S			
Coasts	All	private/public	V/S			
Salt Marshes	Madaket	" "	V/S			
Harbor		town/grate/conservation				
Coastal Barrier (protects downtown)		Conservation	V/S			

Public Awareness

Excluded Policy

See ALL Island Fire Note

think about LS techniq

Understand/plan for impacts to aquaculture, tourism

Consider nourishment project think native spp + Dune grass!

Community Resilience Building Risk Matrix



www.CommunityResilienceBuilding.org

Nantucket January 8, 2019 Group: _____

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

H-M-L priority for action over the Short or Long term (and Ongoing)

V = Vulnerability S = Strength

Features	Location	Ownership	V or S	Increasing Storm	Flood	Drought/Wildfire	SLB/Erosion	Priority		Time	
								H-M-L		Short	Long Ongoing
Infrastructural											
Brant Pt	N of downtown	private res Coast Guard	V	Elevated / barriers → see combination here							
Dreamland Theater	Easy St	private	V	See FP*							
Candle St Stn Station	VAR	National Grid	S	keep up good work: alternative backups, microgrids, Just raised substations				H		O	
Communication poles	VAR	National Grid	S/V	Revisit local Regs to allow for towers w/ power				H		S	
Drinking Water - Pumping Cap. Limit (3 towers - wellhead recharge: creeks/rotary)	wellhead	Town	S/V	Inform any truck Re upgrades to consider oil spill / Wellhead protection; test soil → regularly, develop program; conservation program exists; changing well structures				H		O	
Infrastructure prioritization for road, bridge low-lying Repair/improvement				10-15% pipe needs repair, Revisit HO prohibitions/fertilizer							
Societal											
Whaling Museum	Downtown	private	V	See FP*	did install a flood wall						
Tourism/Historic Hub - Downtown	Downtown	VAR	V/S		continue to value, document, & archive historic places → modernize			H/M		S/O	
Hospital	Mid-Island	private	S	Brand new							
Island Home	downtown/mid island	town	S	supernaut → consider future feasibility/options							
Seasonal Population / Emergency Communication	VAR	VAR	V/S	Share/UP Awareness about how dynamic/hard to reach tourists can be (Inter Department)				M		O	
Schools (Shabeta)	mid island	town (private by path)	S	Keep up good work. Dog friendly. Have generators. Don't flood. Yr round residents aware				L		O	
Churches/Worshiping				"	"	"					
Environmental											
Entire Island (wildfire)	ALL	ALL	V	S	wave/flood			H		S/O	
Stormwater Infrastructure	ALL	town/private	V	Looking for holistic management; at map, clear blockages, understand tidal, precip impacts				M		O	
Green Infra: Brant Pt Cons Area	Brant Pt	town	V	continue preserving open space wetlands; develop plan to add capacity for H2O; private action for rain barrel storage, plant use, other GI consid.							

Handwritten note: "Handwritten note" (circled)

**NANTUCKET MASSACHUSETTS MUNICIPAL VULNERABILITY PREPAREDNESS
APPENDIX F: HIGH PRIORITY RECOMMENDATIONS IDENTIFIED BY SMALL GROUPS**

HIGH PRIORITY RECOMMENDATIONS

After identifying top hazards, challenges, and strengths, each small team discussed possible actions that could be taken by the community to mitigate hazards, protect vulnerable assets, and support existing strengths. Actions were then prioritized. All high-priority actions from each work group are summarized in the table below.



Table 1: High Priority Actions Recommended by Each Small team

<u>Top Actions</u>	
Red Team	<ul style="list-style-type: none"> • Historic Preservation Guidelines: Develop guidelines to preserve historic streetscapes while mitigating hazards. • Road Action Plan: Identify and make actions plans for roads (raise, build bridges) and determine alternative access routes. • Coastal Wetland Restoration: Restore wetlands to mitigate storm surge and sea level rise.
	<p align="center"><u>Other High Priority Actions</u></p> <ul style="list-style-type: none"> • Municipal Fleet: Purchase Saltwater-Resistant, Floodable Vehicles – to withstand saltwater when vehicles need to drive through flooded streets • Build Coastal Hazards into the Capacity, Management, Operations, and Maintenance (CMOM) Plan: The Town is in the process of developing a wastewater system plan. The town should make sure that coastal hazards and resilience are built into/addressed in that plan. • Identify Areas with I.I. (Inflow and Infiltration) and Address: The town is already implementing a plan to use closed-circuit cameras to inspect the stormwater system. They should identify areas where water is leaking into the pipes, filling them with water and diminishing their capacities to hold new water during rain events. Once identifies those sites must be sealed and repaired. • Elderly Aging in Place and Disabled Populations: Develop a database of these populations: or, if such a database already exists, make sure it is regularly updated and increase its utility if possible.

NANTUCKET MASSACHUSETTS MUNICIPAL VULNERABILITY PREPAREDNESS
APPENDIX F: HIGH PRIORITY RECOMMENDATIONS IDENTIFIED BY SMALL GROUPS

Blue Team	<p style="text-align: center;"><u>Top Actions</u></p> <ul style="list-style-type: none">• Pavement Management Plan: Expand “pavement management plan” (road management plan) and planning process to address or include road elevations and drainage modifications, strategies, and actions. Include new materials and road relocation considerations. The result would be more comprehensive and forward-looking than a traditional pavement management plan.• Ferry Master Plan: Develop a ferry/transportation master plan that addresses access to and from the Island, and appropriate means of relocating [the ferry terminals] if needed• Sewer Management Plan: Implement the upcoming new sewer management plan by allocating sufficient resources and an effective prioritization process while integrating with other projects• Community Engagement with Experts: Foster and implement ongoing community resilience discussions while bringing in subject matter experts to annually share successes and assist with planning
	<p style="text-align: center;"><u>Other High Priority Actions</u></p> <ul style="list-style-type: none">• Protective Natural Barriers: Implement permits for use of dredged material for nourishment, conduct a sand movement study, or install living shorelines for protection• Building: Regulations with respect to climate change and sea level rise should be reviewed when building plans are approved. Of particular interest is the interaction between historic district commission and FEMA requirements.

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Green Team

Top Actions

- **Island-Wide Resilience Coordinator:** Create a municipal position of resilience coordinator, who will help facilitate and coordinate Island-wide resiliency initiatives (including town, private, federal) and the various conservation groups
- **Downtown Area:** conduct assessment of long-term risks and alternatives for the next 25-50 years
- **Critical Infrastructure:** Improve the redundancy and reliability of critical infrastructure. Work with public utilities to assure reliability, and with the private sector to assure continuous services.
- **West End of Island:** Utilize the isolated community of the west end as a prototype for resiliency planning

Other High Priority Actions

- **Comprehensive Plan:** Develop an Island Wide comprehensive plan that includes all aspects and partners, and addresses local and regional need for resilience
- **Partnerships:** Enhance the strength of partnerships with on- and off-Island groups
- **Sustainability Coordinator:** Create a municipal position of sustainability coordinator
- **Water Quality:** Address water quality issues with a holistic approach, integrating siloed efforts.
- **Isolation:** Pre-deploy emergency response staff in isolated neighborhoods.

NANTUCKET MASSACHUSETTS MUNICIPAL VULNERABILITY PREPAREDNESS
APPENDIX F: HIGH PRIORITY RECOMMENDATIONS IDENTIFIED BY SMALL GROUPS

Yellow Team

Top Actions

- **Ferry Access:** To minimize damage from events and maximize speed of recovery, perform scenario planning for future events and consider development of a second ferry terminal.
- **Bylaw/Regulation Policy Review:** Perform a review of municipal bylaws, regulations, and policies relevant to hazard mitigation and resilience in order to foster interdepartmental coordination and communication, and guide development of new resiliency policies.
- **Infrastructure Analysis:** Perform an Island-wide analysis of infrastructure, including road, stormwater, sewer, and drinking water infrastructure, to identify vulnerabilities and guide resiliency efforts.

Other High Priority Actions

- **Airport Resiliency:** Perform scenario planning for future events to identify risks.
- **Communications:** Revisit local regulations to allow for cell phone towers; towers can be equipped with backup batteries to allow continued communication during power outages.
- **Drinking Water:** Develop a holistic wellfield protection plan that will address issues including: truck routes through the rotary in the wellfield, and the risk of associated oil spills; more regular soil testing in the wellfield; 10-15% of piping infrastructure needs to be repaired or replaced; homeowner prohibitions around fertilizer use in the protection zone.
- **Public Awareness & Outreach:** Share hazard information across all town departments and develop an outreach plan to get departments on the same page in terms of messaging and solutions and to publicize information from all of the various relevant studies and plans.
- **Coastal Resources:** Employ living shoreline and beach nourishment techniques.
- **Natural-Resource Industries:** Research the risks posed by projected climate change to tourism and aquaculture.
- **Wildfire Risk:** Identify and incentivize best management practices for fuel management.
- **Stormwater:** Pursue a holistic approach to water quality and flood management with a study that addresses tidal actions, drainage backflow issues, and precipitation impacts.
- **Green Infrastructure:** Develop a plan to increase water retention and infiltration, including implementation of rain barrels, green roofs, bio-swales, etc.

#6

TOP PRIORITIES

7



Downtown Area

Conduct assessment of long term risks
+ alternatives - 25-50 years



6 WIR



6

#8

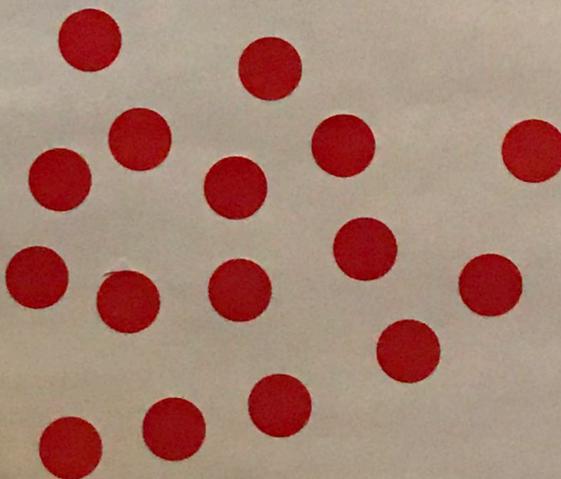
TOP PRIORITIES

8



Dev. guidelines to preserve
historic streetscape while
mitigating HAZARDS

16 WIR



16

TOP PRIORITIES

Expand pavement management plan & process to include road elevations and drainage modifications strategies and actions. Include new materials and relocation considerations.

PRIORITIES

ID & make action plans for ROAD (RAISE, bridges) for determining alternative Access

TOP PRIORITIES

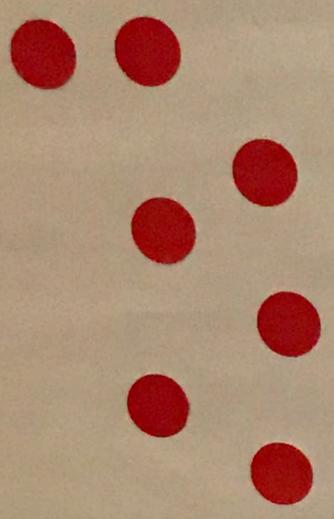
Develop a ferry/transportation master plan that addresses access to/from and appropriate means of relocating if needed.

TOP PRIORITIES

ferry access
- minimize damage from events
- maximize speed of recovery
* Ex. Scenario planning for future events
* Possible 2nd ferry terminal



#11



TOP PRIORITIES 11 ●

Redundancy + ~~dependability~~ ^{reliability} of critical infrastructure, both public + private.

- work with public utilities to assure reliability
- work with private sector to assure continuous services

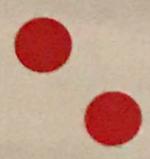
7 vote

#12



TOP PRIORITIES 12 ●

Foster and implement ongoing community resilience discussions while bringing in subject matter experts to annually share successes and assist with planning. 5 vote



#1

TOP PRIORITIES

1



West end Island

~~utilize~~ utilize the isolated community of the west end ~~to~~ as a prototype for resiliency planning.

2 vote



2

#

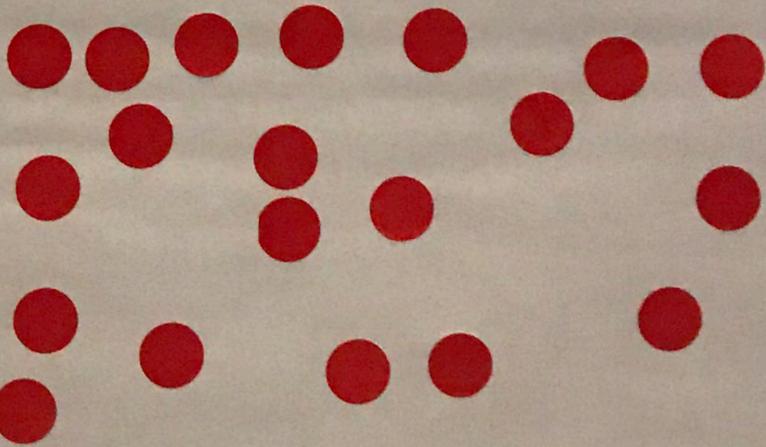
TOP PRIORITIES

2



Restore wetlands to mitigate storm surge & events.

20 vote



20

#3

TOP PRIORITIES

3a

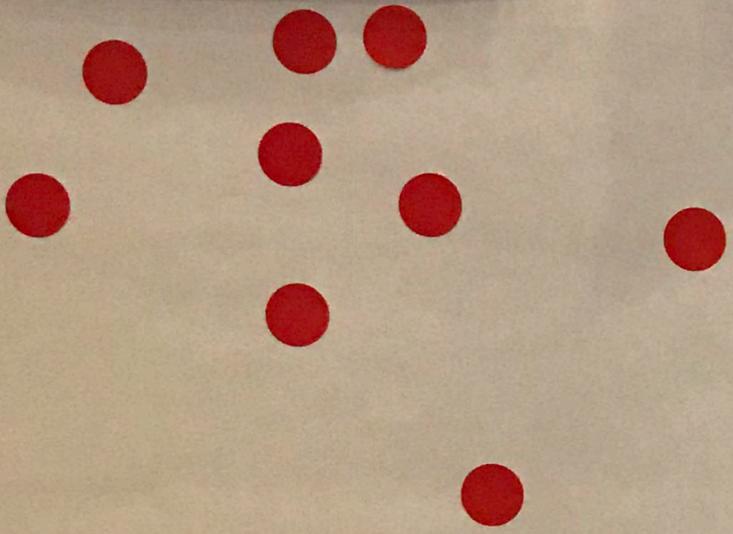


Bylaw/Regulation Policy Review

- inter departmental coordination and communication
- policy development

Ex. Two different sea walls rendering them ineffectual

29 vote (9 vote)



TOP PRIORITIES

3b

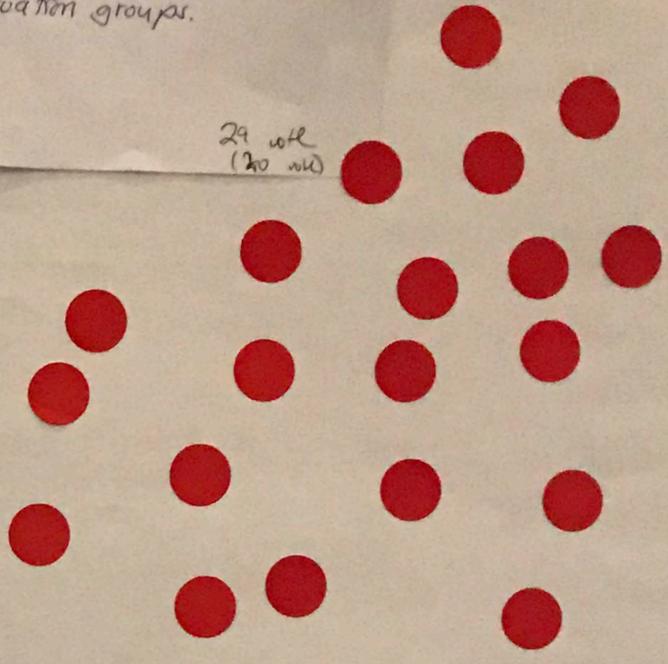


Island-wide Resilience Coordinator

- create a resilience coordinator position

who will help facilitate and coordinate island-wide resiliency initiatives, take including town, private, federal, and the various conservation groups.

29 vote (20 vote)



29

#4

TOP PRIORITIES

4



Implement sewer management plan by allocating sufficient resources and an effective prioritization process while integrating with other projects.

4 vote

