TOWN OF NANTUCKET

Community Resilience Building Workshop
Summary of Findings
FINAL REPORT
April 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 caused major sediment displacement at Madaket beach, filling the pond and covering the existing salt marsh near Millie's Bridge. During this event, daily high tide migrated closer to the southwestern side of the bridge, making that important access route more exposed to daily tidal fluctuations.

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 - Road flooding cuts off access to areas - Neighborhoods with one access route are isolated	Early 2018 nor'easters
	Utilities - Flooding of electrical systems could be a problem	
	Equipment - 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 - Saltwater intrusion into groundwater Infrastructure - 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.

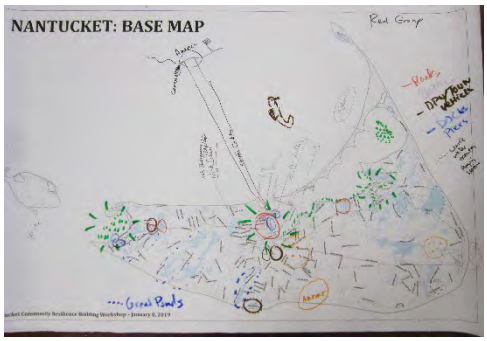
Table 2: Top Hazards Identified by Each Small Team

Red Team	Blue Team	Green Team	Yellow Team
• Coastal Flooding • Sea Level Rise • Erosion • Severe Storms • Wildfire	• Flooding • Erosion • High Winds • Sea Level Rise • Increasing Storms	• Intense Storms (including rain) • Flooding • Erosion • Sea Level Rise • Wind	• 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. Sea level rise is a concern in this area. Features located in this area are all vulnerable to climate hazards, particularly flooding, but many are also considered to be community strengths.

This section presents the many features of interest identified by workshop participants. It is important to note that this list is not an exhaustive review of community features; it presents only those features noted during the workshop.

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 Noted by Participants
Infrastructural		

Roads	Coastal Flooding
	Sea Level Rise
	Erosion
	Snow
	High Wind
		- Downtown Area
		  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
		- Madaket Road
		- Wauwinet Road
		- Eel Point Road *(Private)*

Bridges & Culverts	Coastal Flooding Erosion Sea Level Rise	- First Bridge *(Madaket Road between Long Bond and North Head Long Pond)* - Second Bridge *(Madaket Road at Second Bridge Bus Station)* - Massasoit Bridge *(S. Cambridge Street)* - Millie's Bridge *(Ames Ave)*
Docks	Coastal Flooding Sea Level Rise Severe Storms	- 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	- Steamship Authority Terminal / Pier *(Downtown)* - Hi-Line Terminal / Pier *(Downtown)* - Navigable Channel through Harbor *(maintained by US Army Corps of Engineers)*
Airport	Severe Storms High Wind Erosion	- Airport
Emergency Services	Severe Storms (loss of access)	- 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 *(only emergency shelter)*
Municipal Fleet Storage	Coastal Flooding	- Mid-Island Municipal Vehicle Facilities - Warren Landing Area Municipal Vehicle Facilities
Municipal Offices	Coastal Flooding	- Finance Department

Asset or System	Hazard Threats	Specific Locations Noted by Participants
Water & Wastewater	Sea Level Rise Severe Storms Erosion	- Mid-Island Wellfield - 'Sconset Wellfield - Drinking Water Pipes *(island wide)* - Surfside Wastewater Treatment Plant - 'Sconset Wastewater Treatment Plant - 15 Sewer Pumping Stations o Sewer Pumping Station near Brant Point - Sewer Pipes *(island wide)* - Stormwater Drainage Infrastructure
Energy & Communication	High Wind Severe Storms Coastal Flooding	- Electric Cables under Nantucket Sound *(into Jefferson Avenue)* - Candle Street Substation - Overhead Powerlines - Local Transformers - Cell Phone Towers - Existing Fuel Tank Farm *(downtown)* - Fuel Supply-Chain - Planned New Fuel Tank Farm *(mid-island)*
Trash and Recycling	Severe Storms Coastal Flooding	- Madaket Landfill
Environmental		
Great Ponds	Erosion Sea Level Rise Coastal Flooding	- Long Pond - Hummock Pond - Sesachacha Pond - Miacomet Pond
Coastal Water Resources	Severe Storms Rising Temperatures	- Polpis Harbor - Madaket Harbor - Nantucket Harbor - Non-Point-Source Pollution *(impacts on recreation & bathing)*
Fisheries & Shellfish	Severe Storms Rising Temperatures	- Brant Point Shellfish Hatchery - Nantucket Harbor *(all)* o Head of the Harbor Fishing Area - Madaket Harbor - Other Nearshore Fish & Shellfish Areas - Non-Point-Source Pollution *(impacts on shellfish industry)*
Coastal Resources	Sea Level Rise Rising Temperatures Severe Storms Erosion	- Nantucket Harbor Coastal Area - Polpis Harbor Coastal Area - Madaket Harbor Coastal Area - Coastal Sandplain Grasslands - Coastal Wetlands / Salt Marshes - Recreational Beaches - 'Sconset Bluff Walk - "Barrier Beaches" *(between ponds and ocean)*

Asset or System	Hazard Threats	Specific Locations Noted by Participants
Terrestrial Resources	Rising Temperatures Drought Wildfire	- Preservation/Conservation Land *(More than 50% of Island)* - Moors/Grasslands
Rare Wildlife and Plants	Rising Temperatures Erosion Sea Level Rise	- Rare Bird Populations (State & Federal Level) - Rare Insect Populations (State & Federal Level) - Rare Plant Populations (State & Federal Level)
Societal / Cultural		
Disadvantaged Groups	Severe Storms Coastal Flooding	- Elderly Population - Homebound Populations *(aging in place, disabled)* - Homeless Population - Mobile LMI Communities *(seasonal relocation)* - Minority Populations - Immigrant & Non-Native English Speakers
Social Services	Severe Storms Coastal Flooding	- Our Island Home - Landmark House - Nantucket Interfaith Council - Warming Centers - Food Pantry *(Washington Street, in flood zone)*
Historic		
Historic / Cultural Resources	Severe Storms Coastal Flooding Sea Level Rise Erosion	- Old Historic District (OHD; Downtown) - 'Sconset Historic District (SHD) - Historic Structures *(Island Wide)* - 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. Stormwater infrastructure was also identified as a vulnerability; there are many locations where this infrastructure is in need of upgrades.

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 whether 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, salt marshes, moorlands, and wildlife populations all among its natural resources. The fishing and shellfishing industries in particular are both economically and culturally important to Nantucket.

Nantucket is also home to rare habitats such as scrub oak and pitch pine barrens, sandplain grasslands, coastal heathlands. These habitats, in turn, support rare and endangered species of plants, birds, insects, and other animals. Protecting these rare natural resources is a priority for many workshop attendees. These resources draw residents and visitors, as well as scientists and researchers, to Nantucket. They create recreational and aquaculture opportunities, are important economic drivers in the community, 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. Coastal wetlands in particular are very sensitive to sea level rise due, a challenge exacerbated by human activities that often isolate them from areas where they would be able to migrate inland along with coastal waters. Non-natural hazards like development and pollution put these natural resources under additional pressure. Due to the interconnectivity of different habitats, degradation of any one can have negative effects on others: loss of open space inland can increase runoff, polluting coastal wetlands; degradation of coastal wetlands will impact the

fish and birds for which that is an essential habitat (in turn impacting aquaculture, fisheries, and tourism).

A primary concern is 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. Participants stressed that Nantucket has a highly-diverse community with regards to race, language, and income.

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 identifying 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 are important economic drivers for the community, creating jobs for residents and attracting visitors for activities including birdwatching, hiking, boating, fishing, swimming, surfing, aquaculture, and environmental education.

Natural resources also 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 and flooding during storms by absorbing more water through infiltration (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.

The large amount of Nantucket land under conservation is reflected in the highly active conservation organizations on the Island. These include:

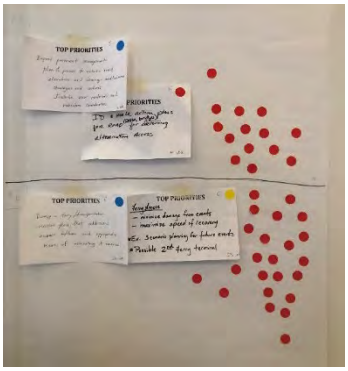
- Nantucket Land Bank <www.nantucketlandbank.org>
- The Nantucket Land Council <www.nantucketlandcouncil.org>
- Nantucket Conservation Foundation <www.nantucketconservation.org>
- Linda Loring Nature Foundation <www.llnf.org>
- The Madaket Land Trust <www.mariamitchell.org>
- Maria Mitchell Association <www.mariamitchell.org>
- Massachusetts Audubon Society <www.massaudubon.org>
- The 'Sconset Trust <www.sconsettrust.org>
- Tuckernuck Land Trust <www.tuckernucklandtrust.org>
- The Trustees of Reservations <www.thetrustees.org>

Most of the conservation land on Nantucket, while open to public use, is privately owned.

Participants identified natural resources as an important asset to protect and preserve from climate-related hazards. The community includes many local experts with vast knowledge about the Island's natural resources, including the freshwater and saltwater wetlands on the Island. Municipal staff will be able to make use of local knowledge about ownership, conservation status, health, and ecosystem functions of specific natural resources assets to inform resiliency-building efforts.

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	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. 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.	**29**
2	Isolation from Mainland	Ferry Access: • Minimize damage from events • Maximize speed of recovery • Perform scenario planning for future events • Consider second ferry terminal Develop a ferry/transportation master plan that addresses access to and from the Island, and appropriate means of relocating [the ferry terminals] if needed	**23**
3	Wetland Restoration	Restore coastal 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 stormwater 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: • 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**

TOP PRIORITIES TO IMPROVE RESILIENCE

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
- Screen actions from the MVP report and solicit expertise as needed and as appropriate
- 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
- Make sure that resiliency-building actions and decisions are based on the latest science on climate change, hazard mitigation, and resiliency

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 Protection and Restoration

Enact a long-term tidal wetland restoration and preservation strategy to protect and grow this important community asset.

This strategy will aim to help the town protect existing tidal marshes, restore degrading marshes, provide space for inland marsh migration as sea levels rise, and mitigate negative impacts from climate change, severe storms, invasive species, and human impacts (such as pollution). This strategy will need to address real estate, infrastructure, and economic challenges, and will have to take an Island-wide view of tidal wetland preservation and restoration; inland migration of wetlands may lead to a similar inland migration of property and infrastructure, and inland development and pollution loading will impact wetland health.

Specific actions within this strategy should include:
- Identify all existing wetlands, Island-wide
- Identify all "potential wetland areas" under current conditions and projected sea level rise conditions
- Identify strategies for increasing the functionality of existing wetlands to mitigate flooding
- Identify areas that can be altered to create space for creation of new wetlands

Local expertise can be utilized for information and data gathering, as well as strategy development. Local conservation organizations, many of which are already active in wetland preservation and restoration, should be involved in implementation of this action.

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
- Upgrades to stormwater drainage infrastructure

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.

JANUARY CRB WORKSHOP PARTICIPANTS:

Table 5: Workshop Participants

No.	Name	Affiliation	Title/Role
1	Holly Backus	Town of Nantucket	Planning & Land Use Services
2	Charley Walters	Nantucket Community Association & Nantucket Yacht Club	-
3	Brendan Coakley	Town of Nantucket - Emergency Management	Emergency Management Coordinator
4	David Gagnon	Maria Mitchell Association	Executive Director
5	Chloe Coggins	Madaket Marine	
6	Charles Stott	Civic League	Co-President
7	Jim Kelly	Town of Nantucket	Select Board
8	David Gray	Town of Nantucket - Sewer Department	Director
9	Matt Fee	Small Business ("Something Natural")	Select Board
10	Vincent Murphy	Natural Resources Department	Protected Species Technician
11	Chaz Rogers	Town of Nantucket - DPW	Deputy Director
12	Roberto Santamaria	Nantucket Board of Health	Health Director
13	William Pittman	Nantucket Police Department	Police Chief
14	Karen Macumber	Visitors Services Association	Board Member
15	D. Anne Atherton	Nantucket Coastal Conservancy	
16	Rick Atherton	Quidnet Squam Association	
17	Cormac Collier	Nantucket Land Council	Executive Director
18	David Worth	Nantucket Conservation Foundation	Executive Director
18	Diane Lang	Coskata-Coatue Wildlife Refuge / Trustees of Reservation	Stewardship Manager
20	Lauren Sinatra	Town of Nantucket	Energy Coordinator
21	Catherine Slattery	Madaket Marine	CFO
22	Leslie Forbess	Madaket Resident Association	
23	Stephen Welch	Capital Program Committee	Chair
24	Bill Grieder	Madaket Conservation Association	President
25	Amy Zielinski	Sustainable Nantucket	Executive Director
26	Jeff Carlson	Town of Nantucket – Natural Resources Department	Natural Resources Director
27	Mary Bergman	Nantucket Preservation Trust	Media/Communications
28	Michael May	Nantucket Preservation Trust	Executive Director
29	Chuck Larson	Town of Nantucket – Town Administration	Manager of Strategic Projects
30	Rachel Hobart	ReMain Nantucket	Project Manager
31	Stephen Arceneaux	Town of Nantucket - DPW	Deputy Director of Ops
32	Barry Rector	Planning Board	Chair
33	Libby Gibson	Town of Nantucket – Town Administration	Town Manager
34	Diane O'Neil	Nantucket Public Schools	Director of Facilities

No.	Name	Affiliation	Title/Role
35	Gregg Tivnan	Town of Nantucket – Town Administration	Assistant Town Manager
36	Florencia Rullo	Town of Nantucket – Town Administration	POM
37	Jen Karberg	Nantucket Conservation Foundation	Research Supervisor
38	Noah Karberg	Nantucket Airport	Assistant Airport Manager
39	John Stanton	Inquirer & Mirror (Newspaper)	Reporter
40	Cecil Barron Jensen	ReMain Nantucket	Executive Director
41	Edwin Rudd	Nantucket Historical Association	Director of Facilities
42	Stephen Murphy	Nantucket Fire Department	Chief
43	Sheila Lucey	Harbor Master	Harbormaster
44	Yvonne Vaillancourt	UMass Field Station	Director
45	Peter Brace	Nantucket Coastal Conservancy	Writer
46	Margaretta Andrews	Community Foundation for Nantucket	Executive Director
47	Morris Hylton	Preservation Institute Nantucket	Director
48	Lee W Saperstein	Nantucket Town Association	
49	Karen McGonigle	Town of Nantucket – IT Department	Chief Technology Officer
50	Sarah Bois	Linda Loring Nature Foundation	Director of Research & Education
51	Elizabeth Trillos	Tom Nevers	
53	Vallorie Oliver	Historic District Commission	Commissioner
53	David Murphy	Milone and MacBroom, Inc.	MVP Workshop Facilitator
54	Noah Slovin	Milone and MacBroom, Inc.	MVP Workshop Facilitator
55	Adam Whelchel	The Nature Conservancy	MVP Workshop Facilitator
56	Sarah Burns	The Nature Conservancy	MVP Workshop Facilitator

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.

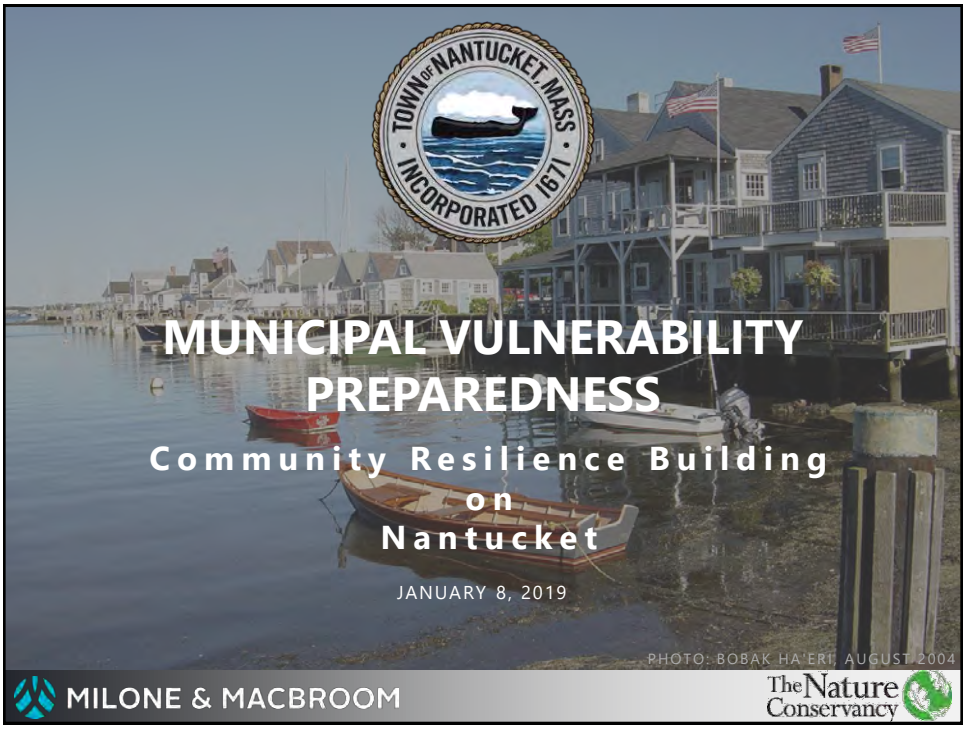
CRB Workshop Project Team

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


TOWN OF NANTUCKET, MASS
INCORPORATED 1671
MUNICIPAL VULNERABILITY PREPAREDNESS
Community Resilience Building on Nantucket
JANUARY 8, 2019
PHOTO: BOBAK HA'ERI, AUGUST 2004
MILONE & MACBROOM
The Nature Conservancy

1

TOWN OF NANTUCKET, MASS
INCORPORATED 1671
WELCOME & INTRODUCTIONS

2

OVERVIEW PRESENTATION ON WORKSHOP

3

AGENDA

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

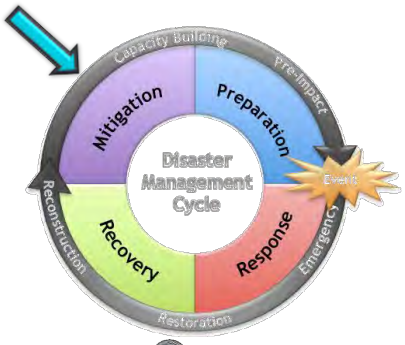
4

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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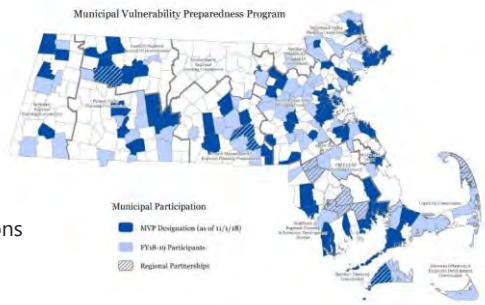
6

WORKSHOP OVERVIEW

MUNICIPAL VULNERABILITY PREPAREDNESS

UTILIZE PARTNERSHIPS & LEVERAGE EXISTING STRENGTHS

- 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)



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7

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

MILONE & MACBROOM

Image: www.dnvgl.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

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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

11

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

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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

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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

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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

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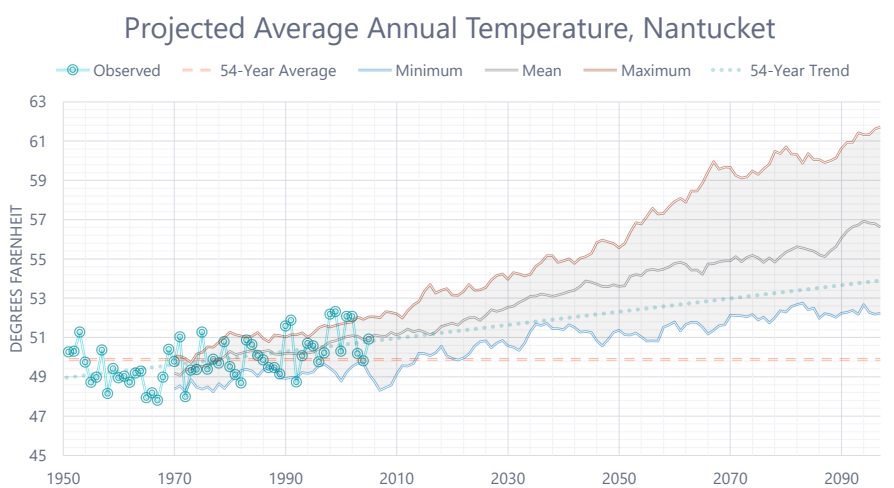
RESOURCES AVAILABLE FOR NANTUCKET



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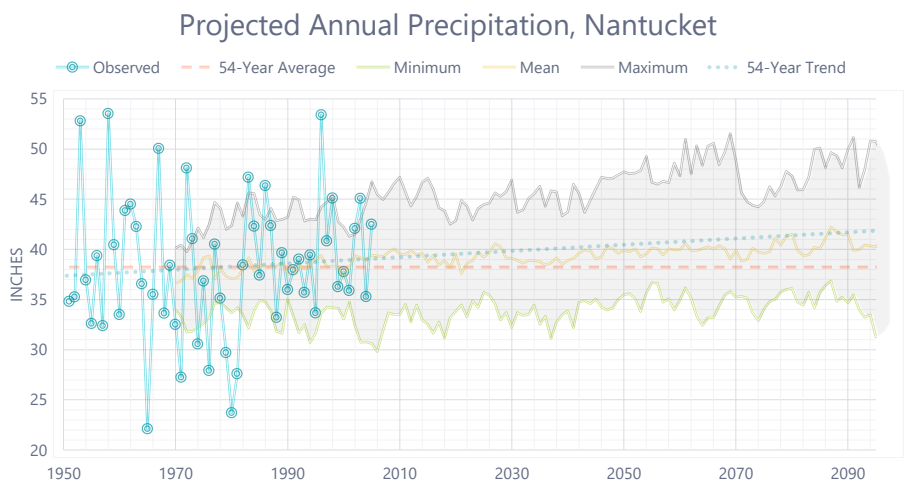
RESOURCES AVAILABLE FOR NANTUCKET



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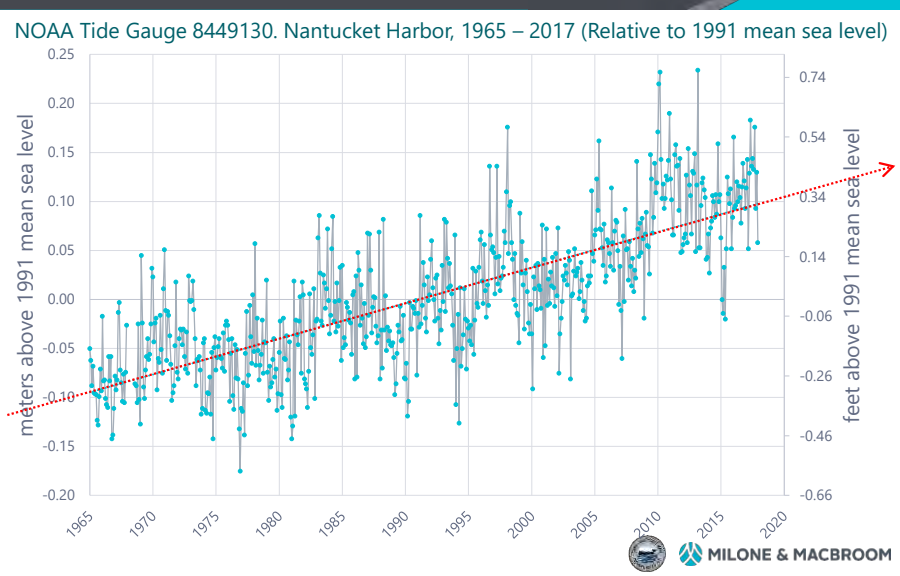
RESOURCES AVAILABLE FOR NANTUCKET



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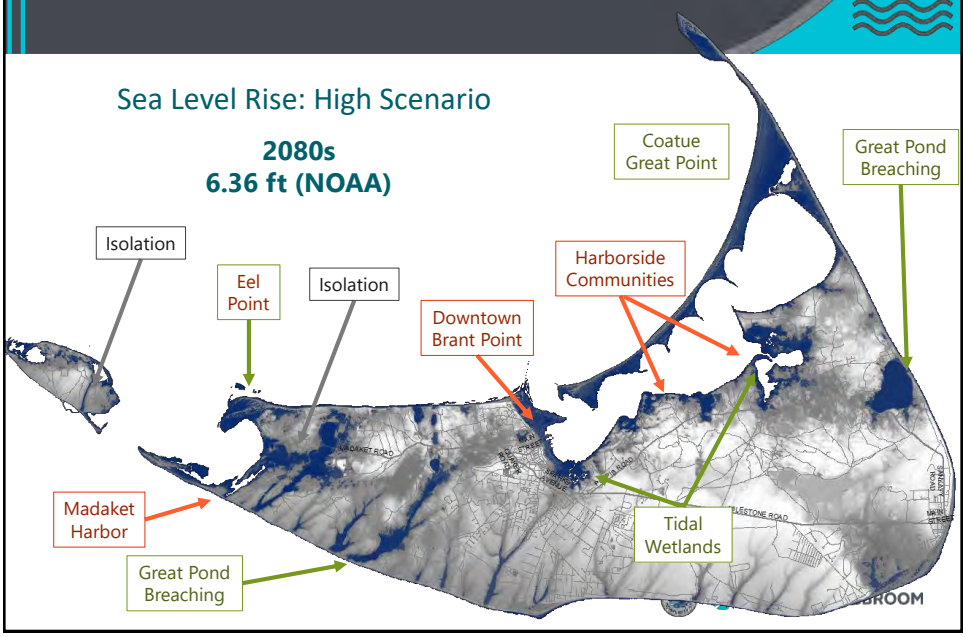
18

RESOURCES AVAILABLE FOR NANTUCKET

Sea Level Rise: High Scenario

2080s
6.36 ft (NOAA)



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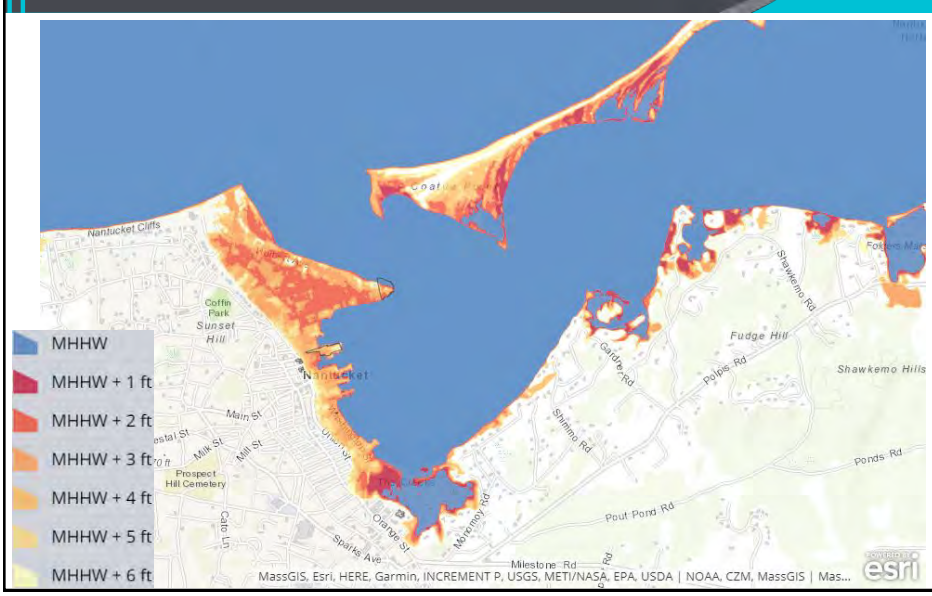
RESOURCES AVAILABLE FOR NANTUCKET



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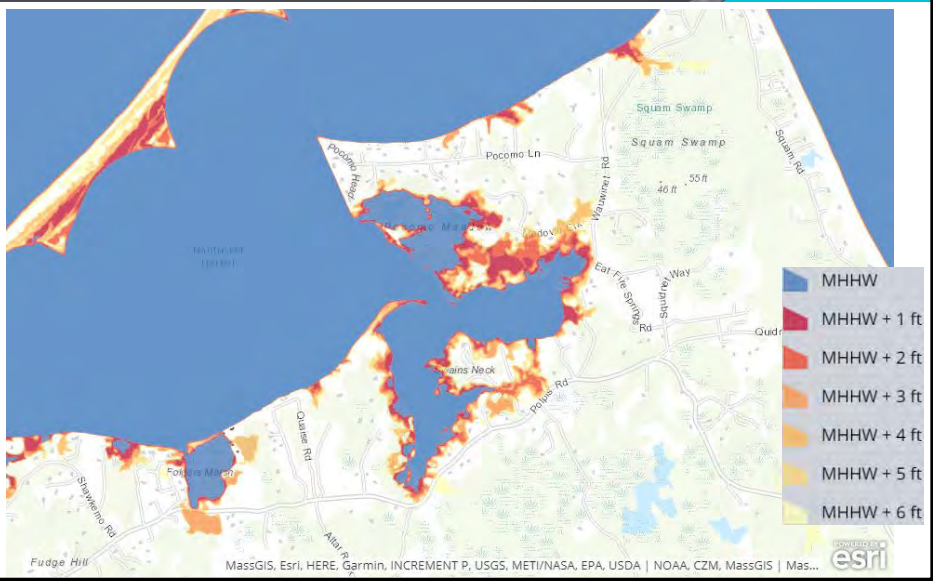

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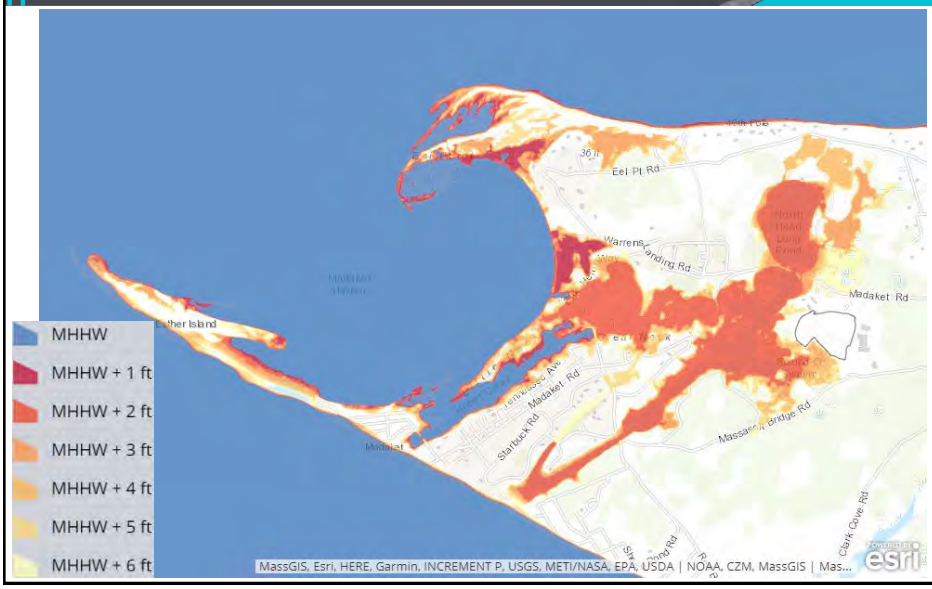
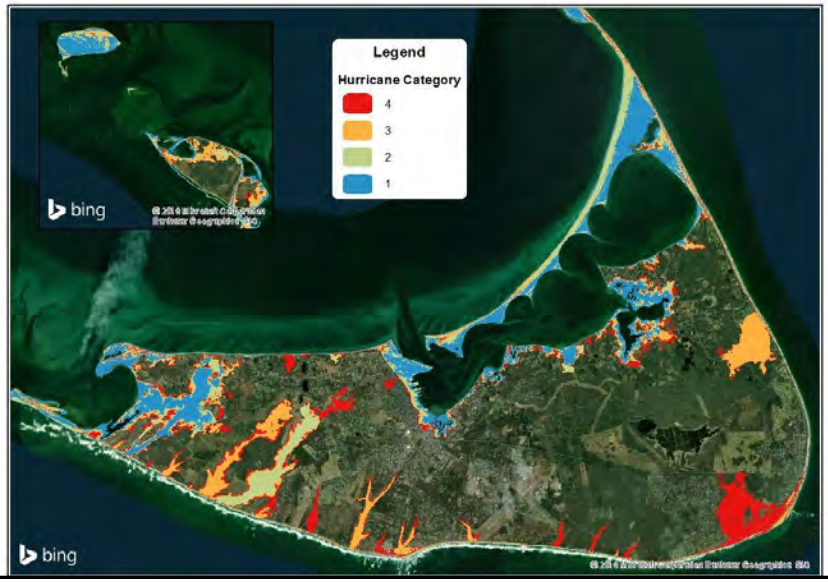
RESOURCES AVAILABLE FOR NANTUCKET



22

RESOURCES AVAILABLE FOR NANTUCKET

https://nantucketma.mapgeo.io



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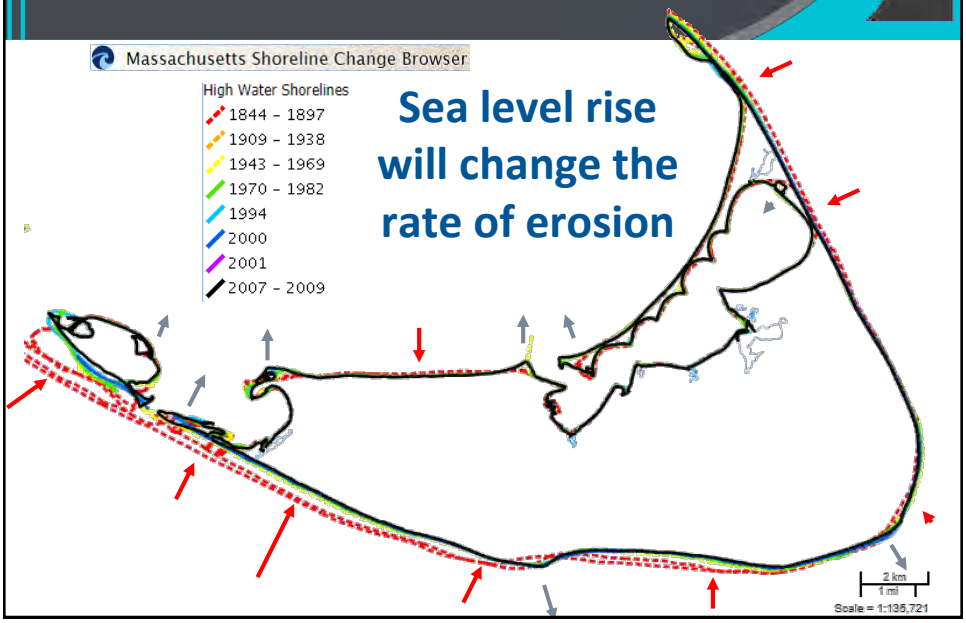
RESOURCES AVAILABLE FOR NANTUCKET



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OVERVIEW PRESENTATION ON COMMUNITY RESILIENCE BUILDING

25

Community Resilience Building

WORKSHOP GUIDE

www.**CommunityResilienceBuilding**.org

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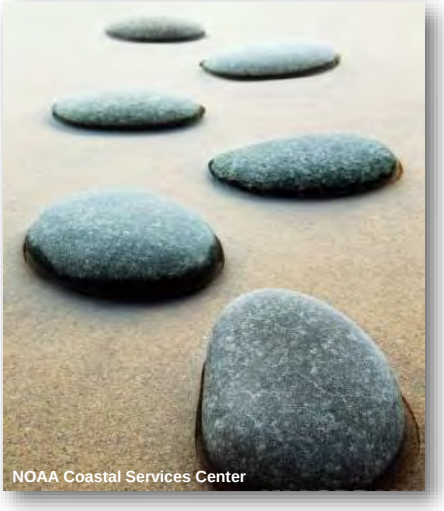
Process…



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

27

Community Resilience Building

Hazards

Infrastructure

Societal

Environmental

28

Hazards

29

PHOTO: JASON GRAZIADEI
Infrastructure Vulnerability/Strength

30

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?*

31

32

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)?*

33

Environmental Vulnerability/Strengths

34

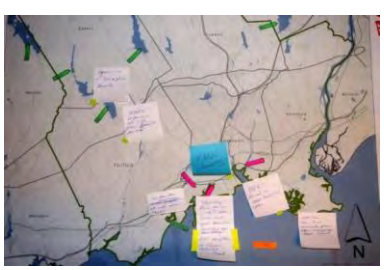
Environmental

- **Natural resources important to your community and where?**
- **Benefits natural resources provide and where?**
  - *Storm buffering, flood protection, erosion control, water quality, recreation, etc…*
- **High risk areas and effects of hazards?**
  - *Impact without and with more natural resources*

POSSIBLE ACTIONS: What can be done?

- *Conserve land located adjacent to flood zones?*
- *Green infrastructure in neighborhoods?*
- *Increase habitat restoration?*

Base Map Example



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

37

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)).

38

Report outs

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

39

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

40

Your Turn!

41

42

NEXT STEPS

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

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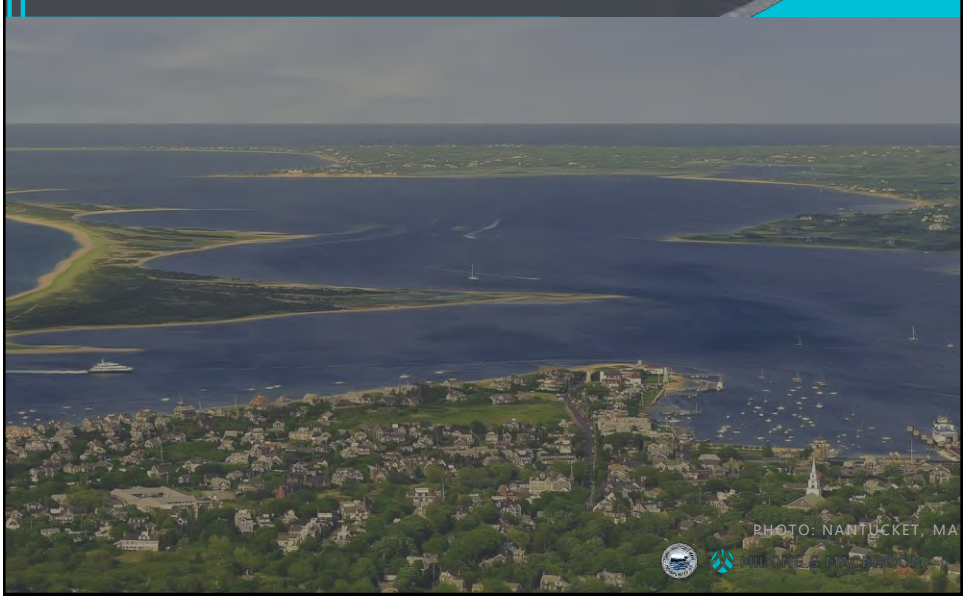
43

WRAP UP



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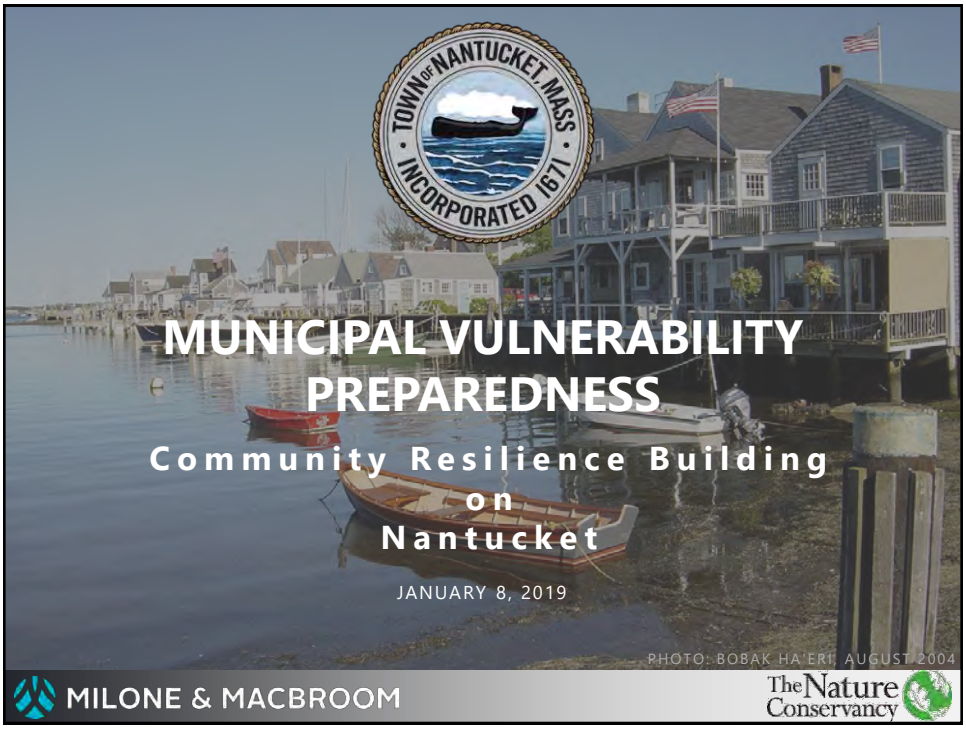
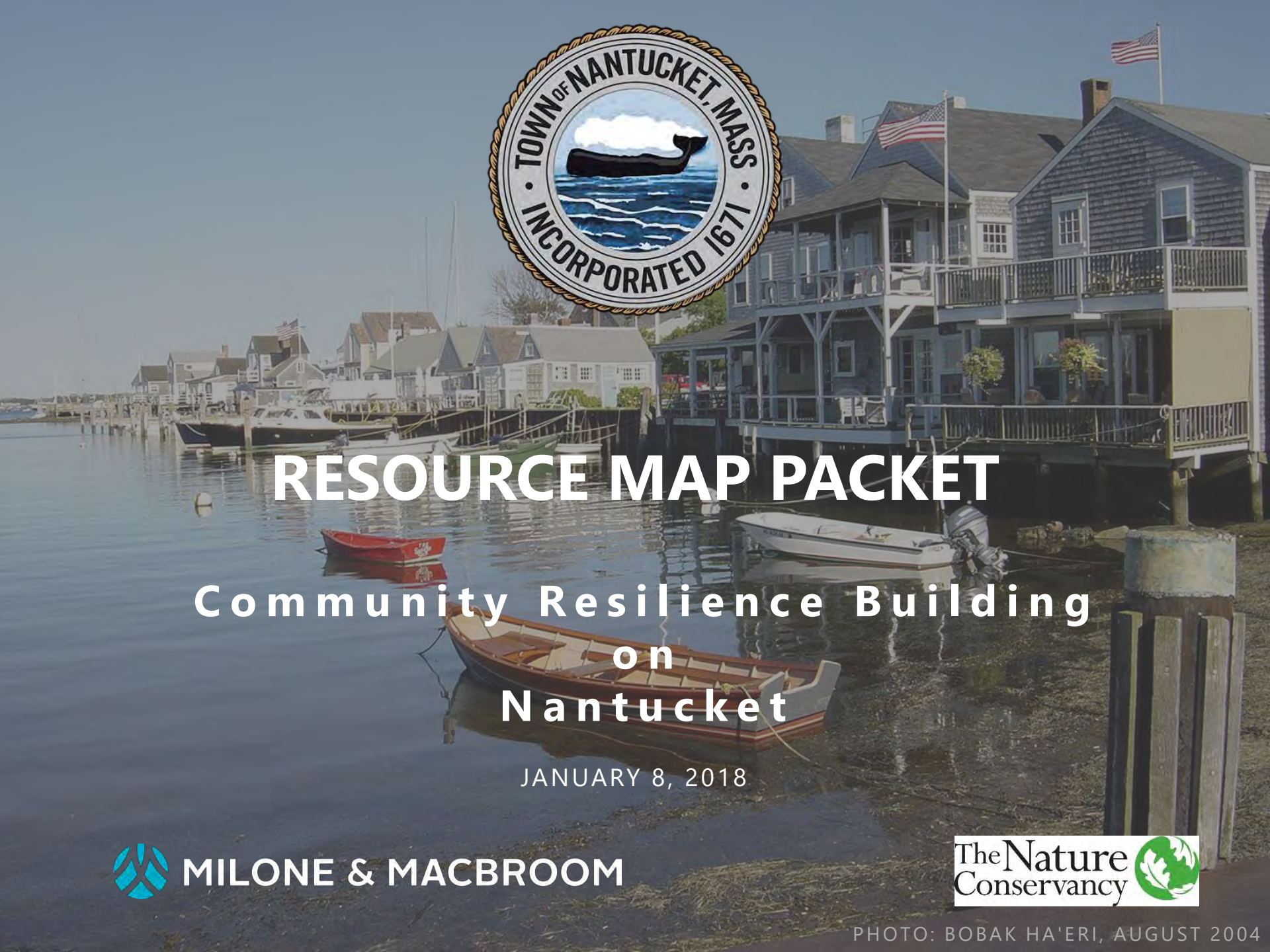

TOWN OF NANTUCKET, MASS
INCORPORATED 1671
MUNICIPAL VULNERABILITY PREPAREDNESS
Community Resilience Building on Nantucket
JANUARY 8, 2019
PHOTO: BOBAK HA'ERI, AUGUST 2004
MILONE & MACBROOM
The Nature Conservancy

45

Appendix B

Resource Packet



RESOURCE MAP PACKET

Community Resilience Building on Nantucket

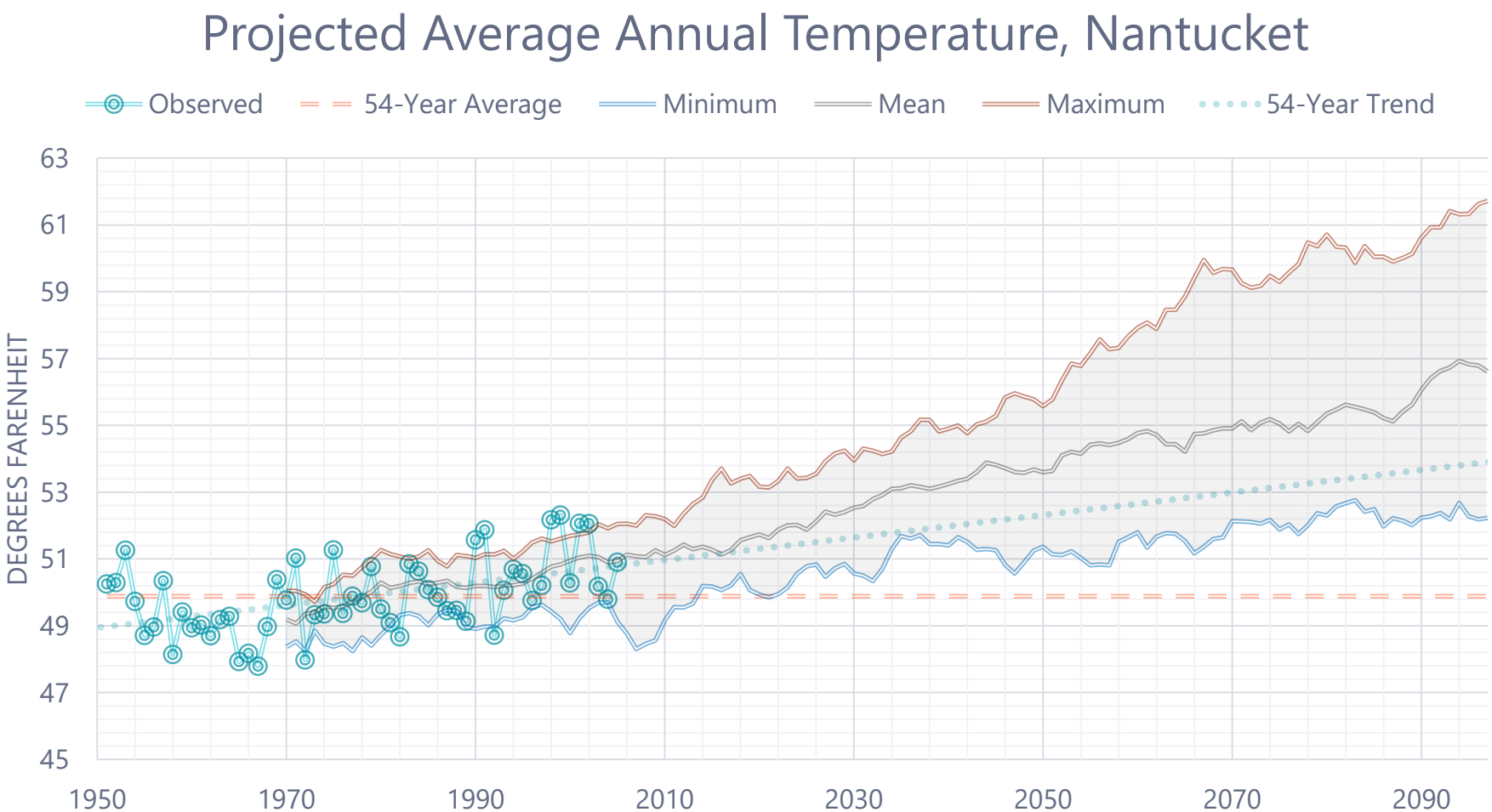
JANUARY 8, 2018

MILONE & MACBROOM

The Nature Conservancy

PHOTO: BOBAK HA'ERI, AUGUST 2004

RESOURCES AVAILABLE FOR NANTUCKET



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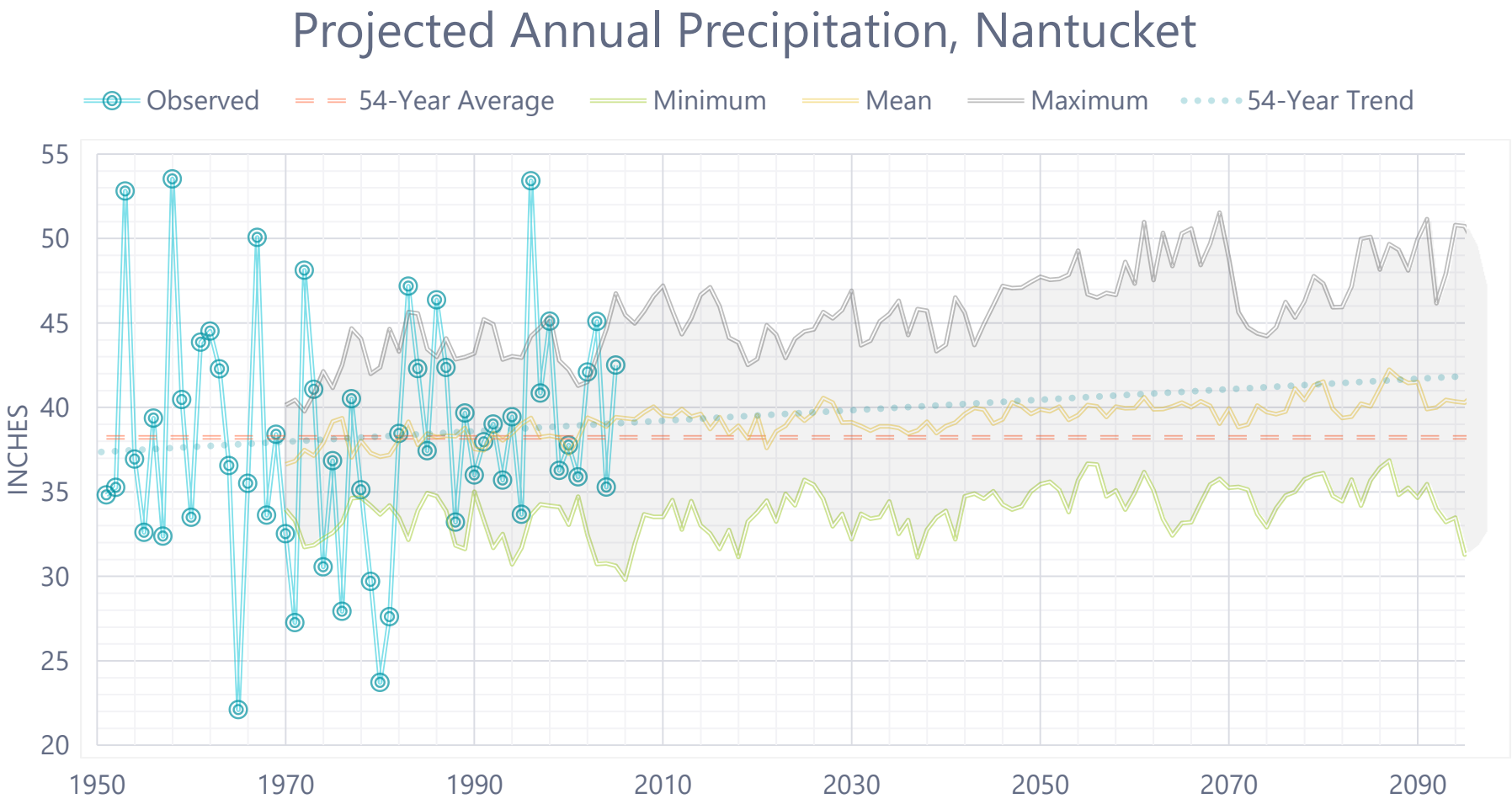
RESOURCES AVAILABLE FOR NANTUCKET



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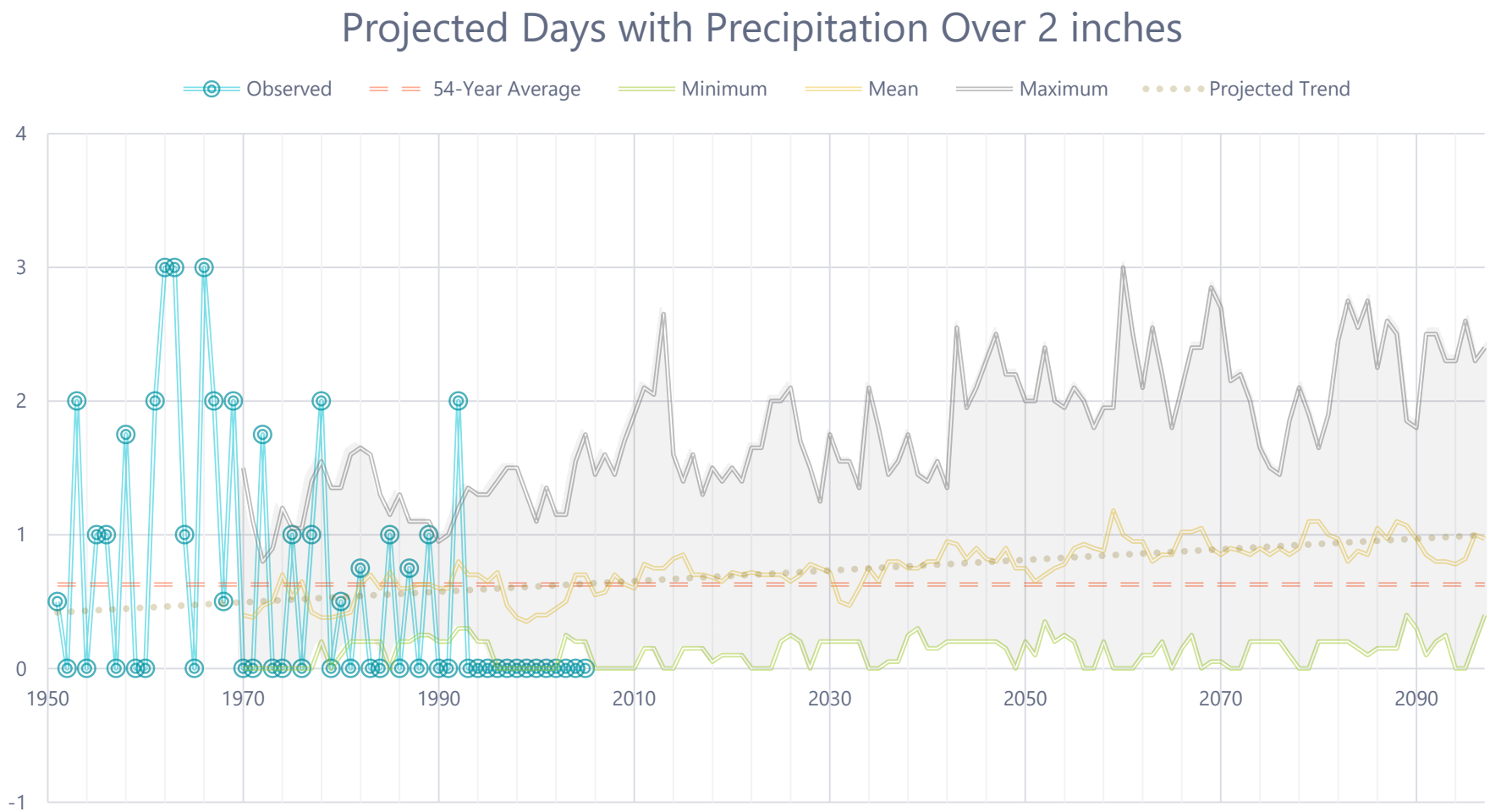
RESOURCES AVAILABLE FOR NANTUCKET



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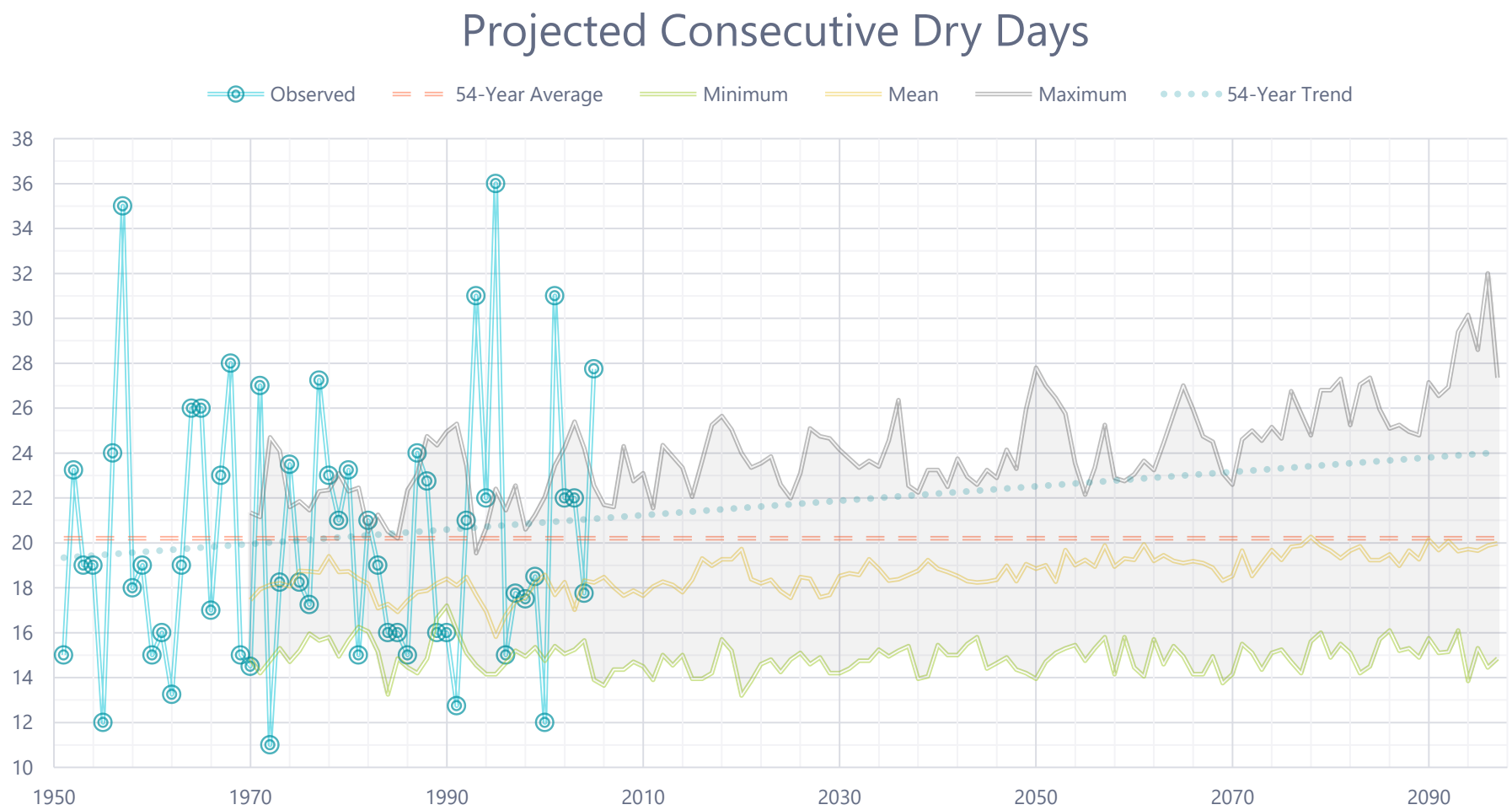
RESOURCES AVAILABLE FOR NANTUCKET



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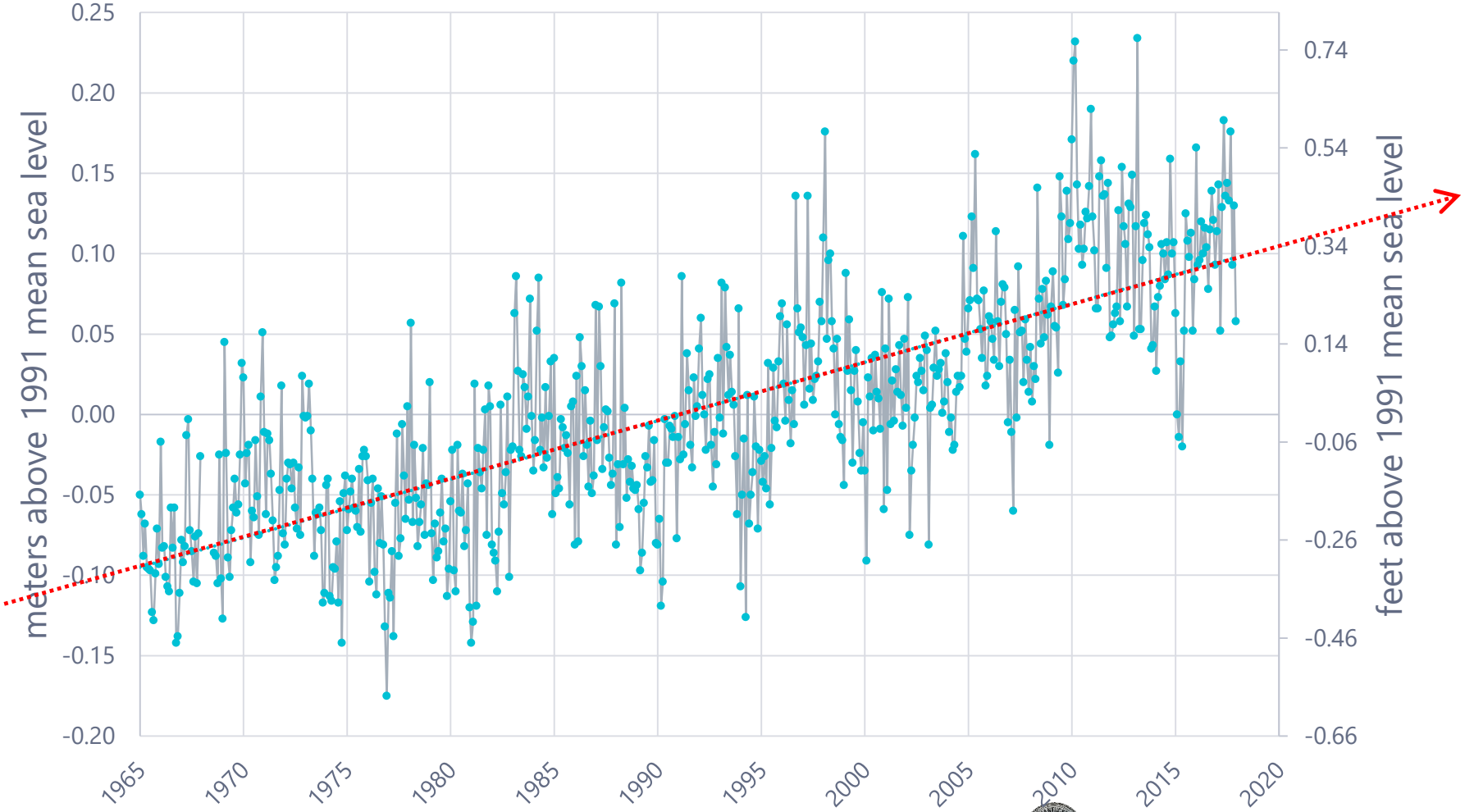
RESOURCES AVAILABLE FOR NANTUCKET

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



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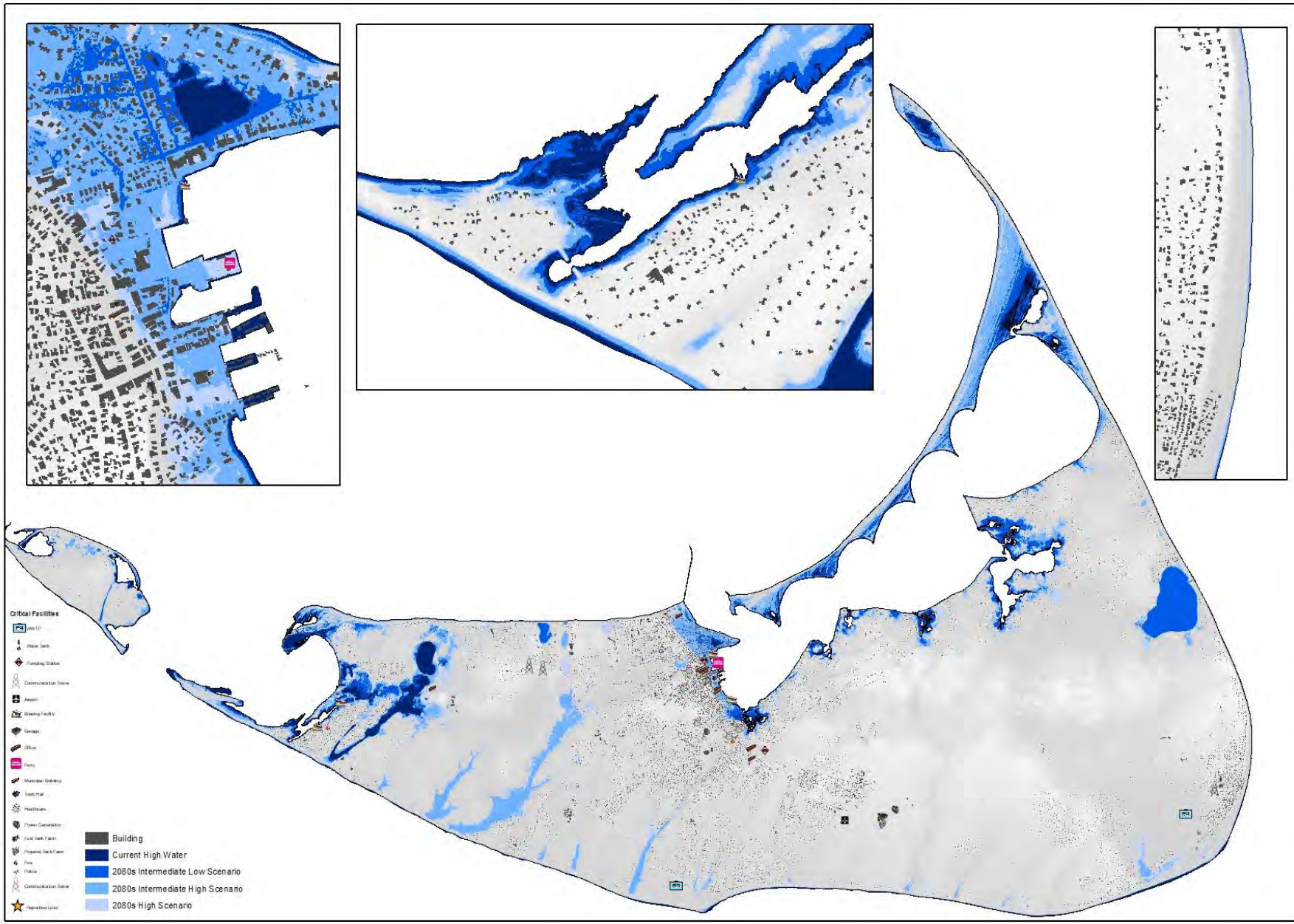

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www.milonemacbroom.com

DESCRIPTION	DATE	BY

Hazard Overview: Sea Level Rise - 2080s

Nantucket Coastal Resilience Plan
Hazard Analysis

NANTUCKET, MASSACHUSETTS

DRAWN	CHECKED
NBS	

SCALE: 1" = 5,814'

DATE: January, 04 2019

PROJECT NUMBER: 2967-12

SHEET NAME: 11x17

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99 Realty Drive
Cheshire, Connecticut 06410
Phone: (203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

SOURCE(S):
XXXXXXX

MAJOR ROADS AND EVACUATION ROUTES

TOWN OF NANTUCKET NATURAL HAZARD MITIGATION PLAN

NANTUCKET, MASSACHUSETTS

Map By: MER
MMII#: 2967-09
MXD: U:\Y\2967-09\Maps\Figure2-2\Major_Roads_Evac2.mxd
1st Version: 08/28/2017
Revision: 3/7/2018
Scale: 1 in = 4,975 ft

FIGURE 2-2

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Cheshire, Connecticut 06410
Phone: (203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

N
W E
S

SOURCE(S):
FEMA DFIRM

FEMA FLOOD ZONES

TOWN OF NANTUCKET NATURAL HAZARD MITIGATION PLAN

NANTUCKET, MASSACHUSETTS

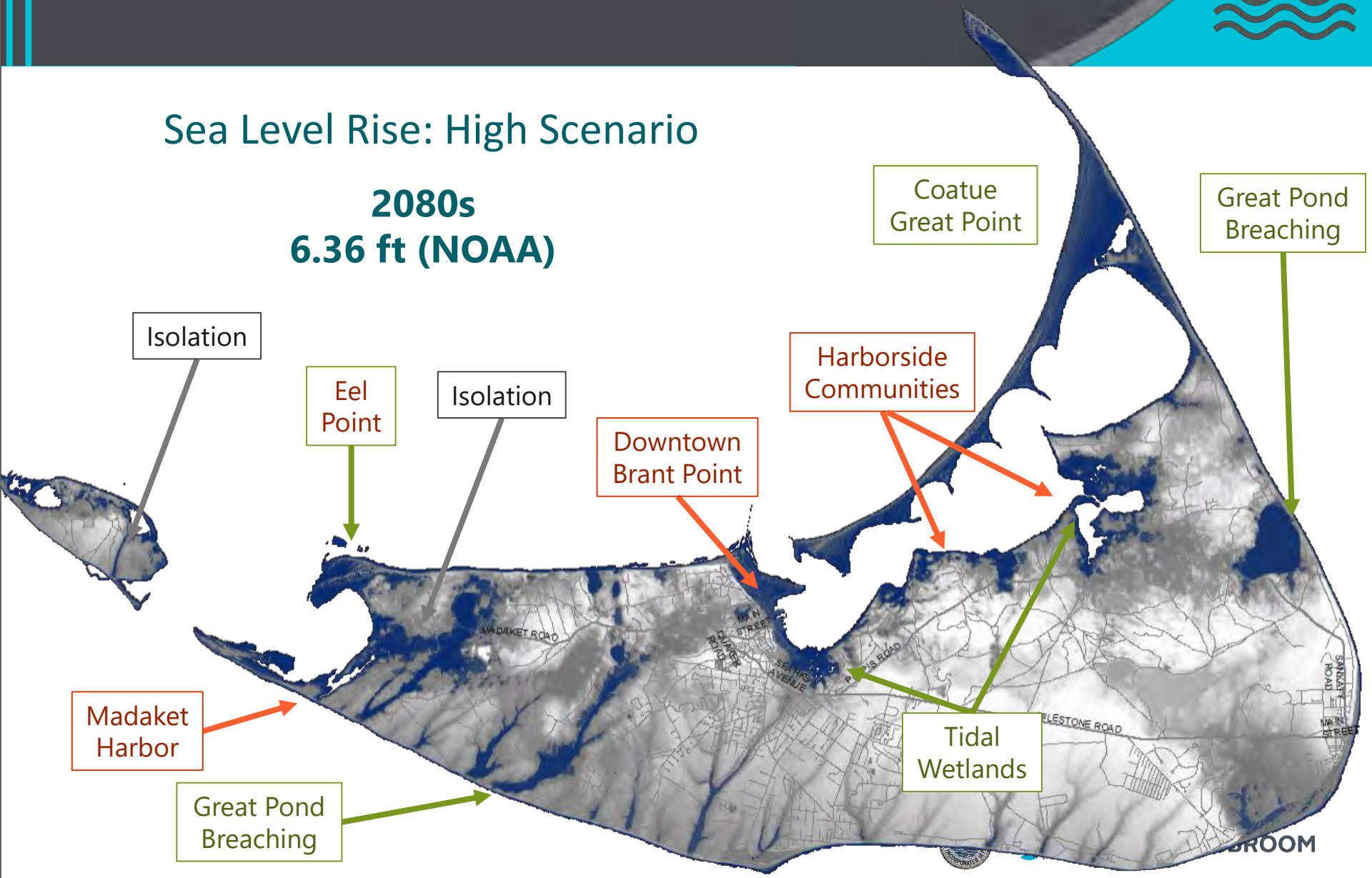
Map By: NBS
MMI#: 2967-09
MXD: U:\Y\2967-09\Maps\Figure3_1FloodZones.mxd
1st Version: 08/28/2017
Revision: 3/12/2018
Scale: 1 in = 5,792 ft

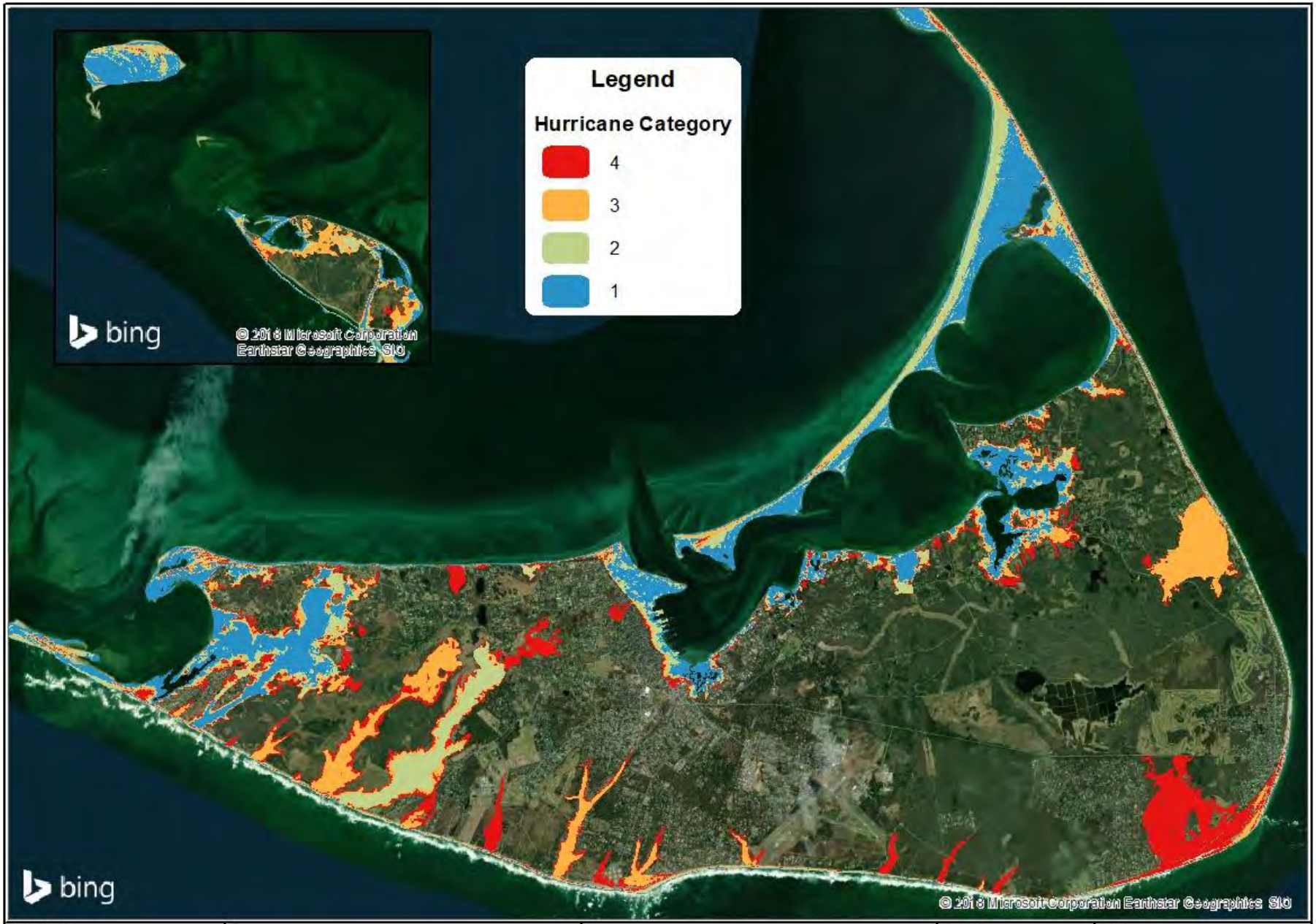
FIGURE 3-1

RESOURCES AVAILABLE FOR NANTUCKET

Sea Level Rise: High Scenario

2080s
6.36 ft (NOAA)





SOURCE(S):
MASS GIS

N

Figure 5-1: Storm Surge Areas

MXD: U:\Y\2967-09\Maps\Fig5-1_hurr_inundationl1.mxd

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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Cheshire, Connecticut 06410
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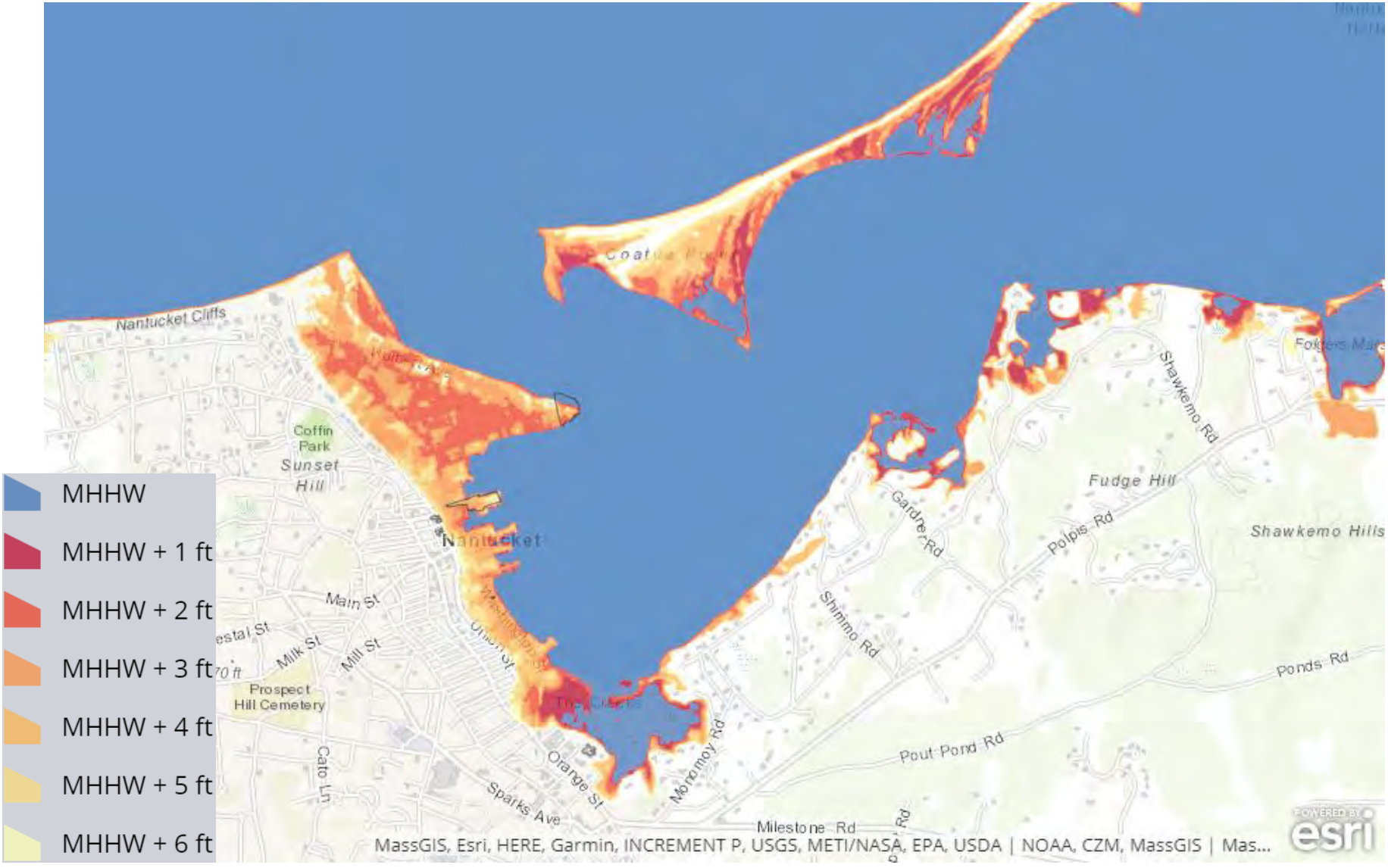
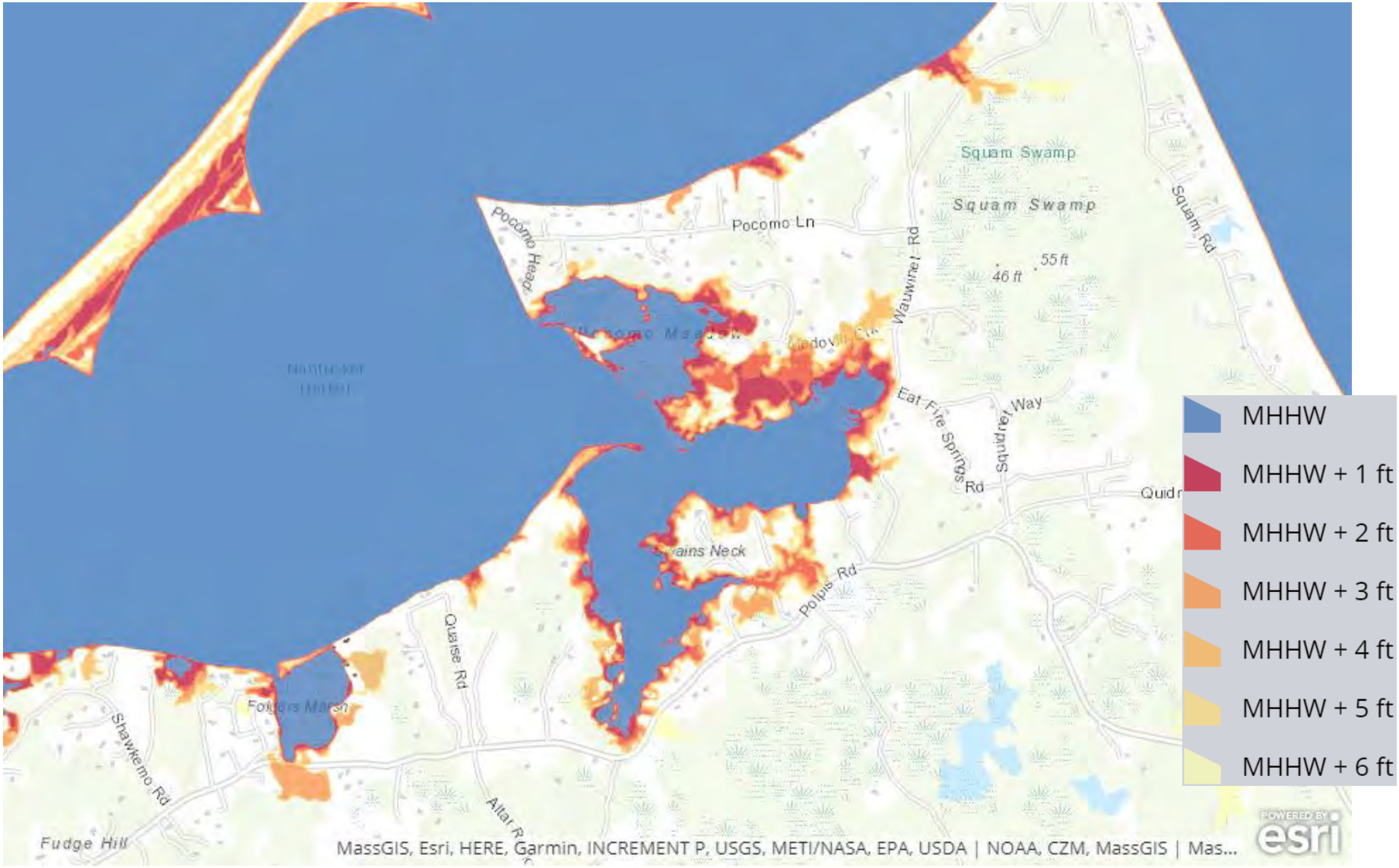
RESOURCES AVAILABLE FOR NANTUCKET



RESOURCES AVAILABLE FOR NANTUCKET



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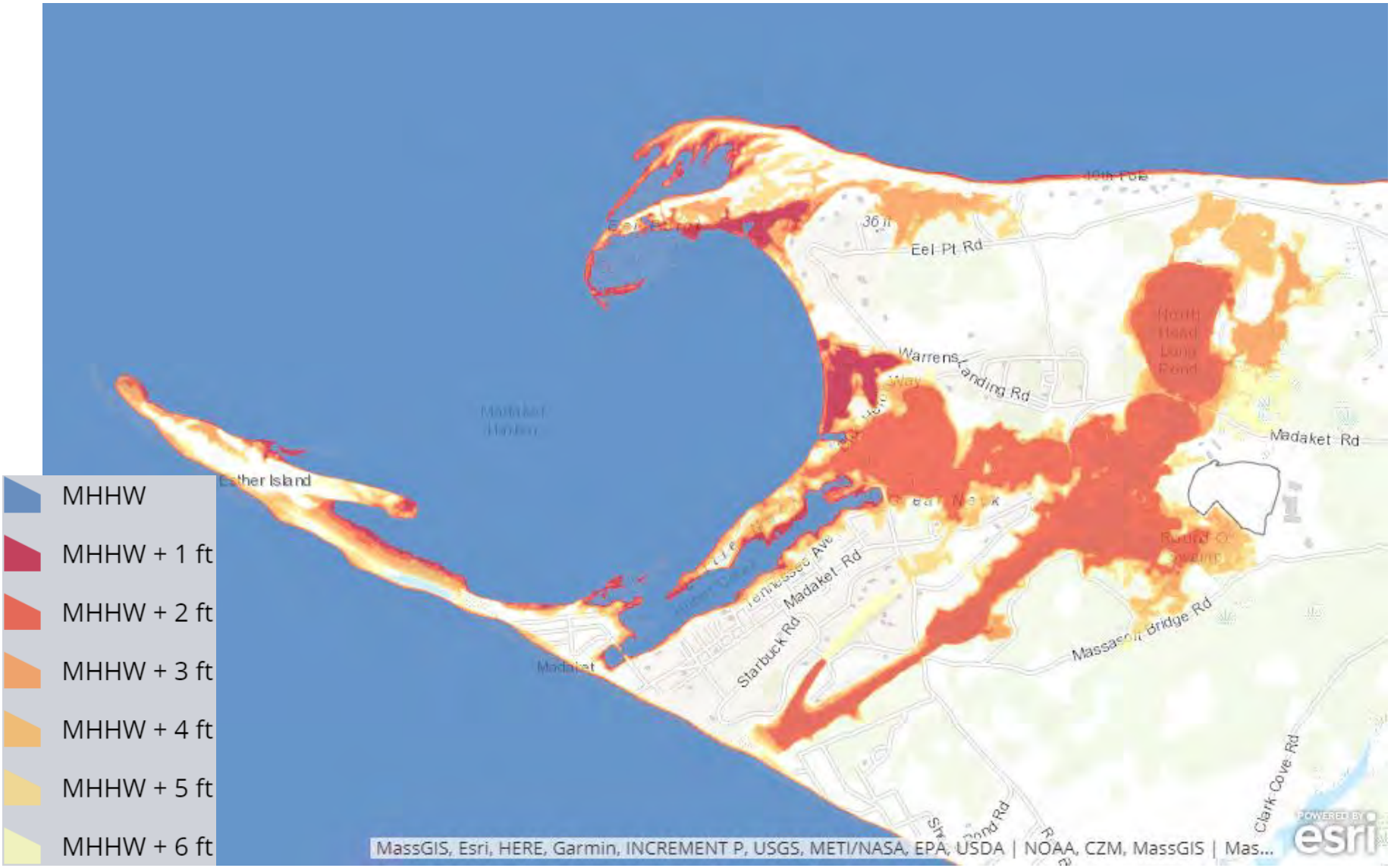
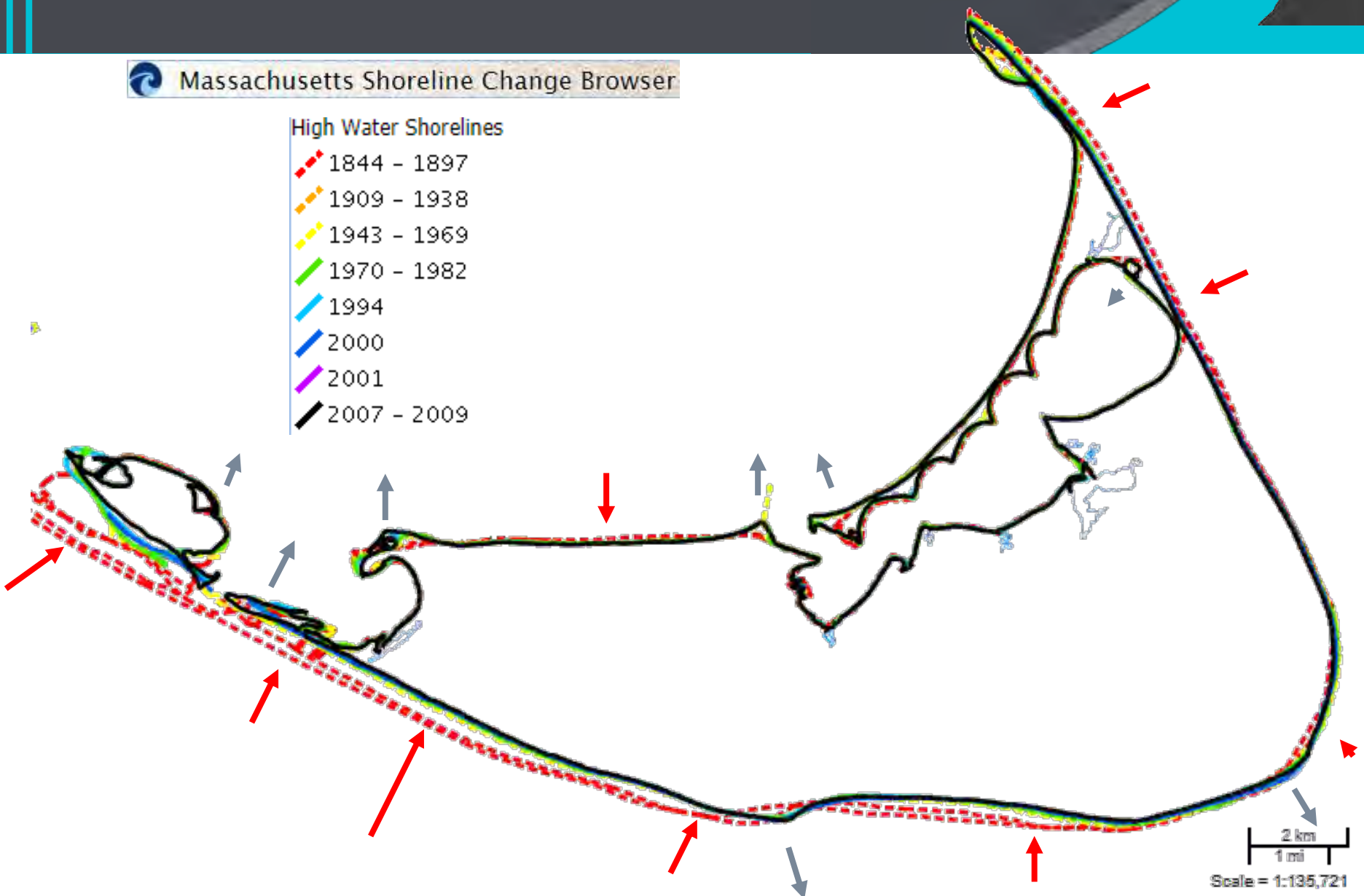
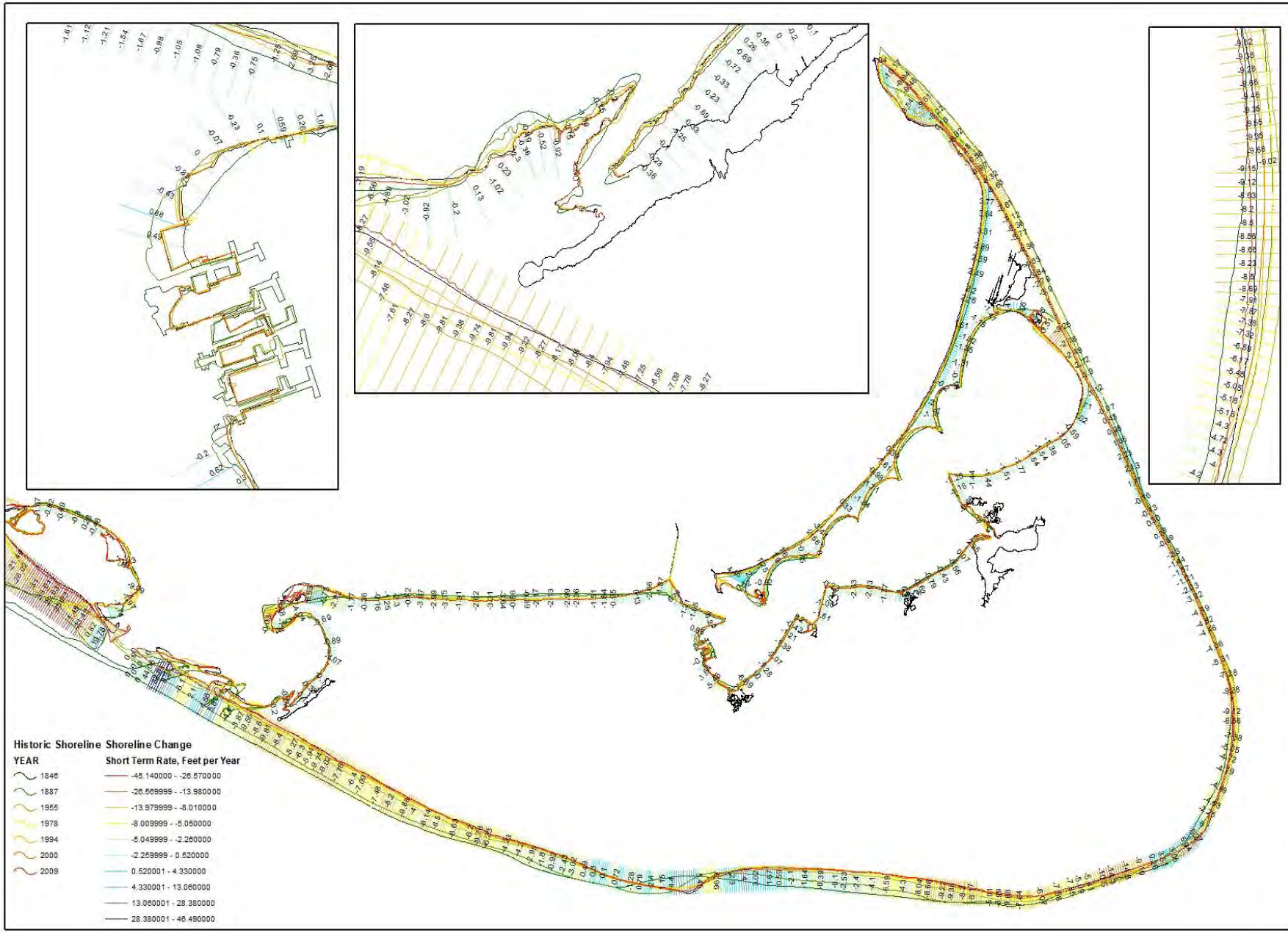


RESOURCES AVAILABLE FOR NANTUCKET



Atlantic Ocean
Esri, HERE, Garmin, © OpenStreetMap contributors, Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community



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DESCRIPTION	DATE	BY

Hazard Overview: Erosion

Nantucket Coastal Resilience Plan
Hazard Analysis

NANTUCKET, MASSACHUSETTS

NBS
DRAWN

CHECKED

1" = 5,827'
SCALE

January, 04 2019
DATE

2967-12
PROJECT NUMBER

11x17
SHEET NAME

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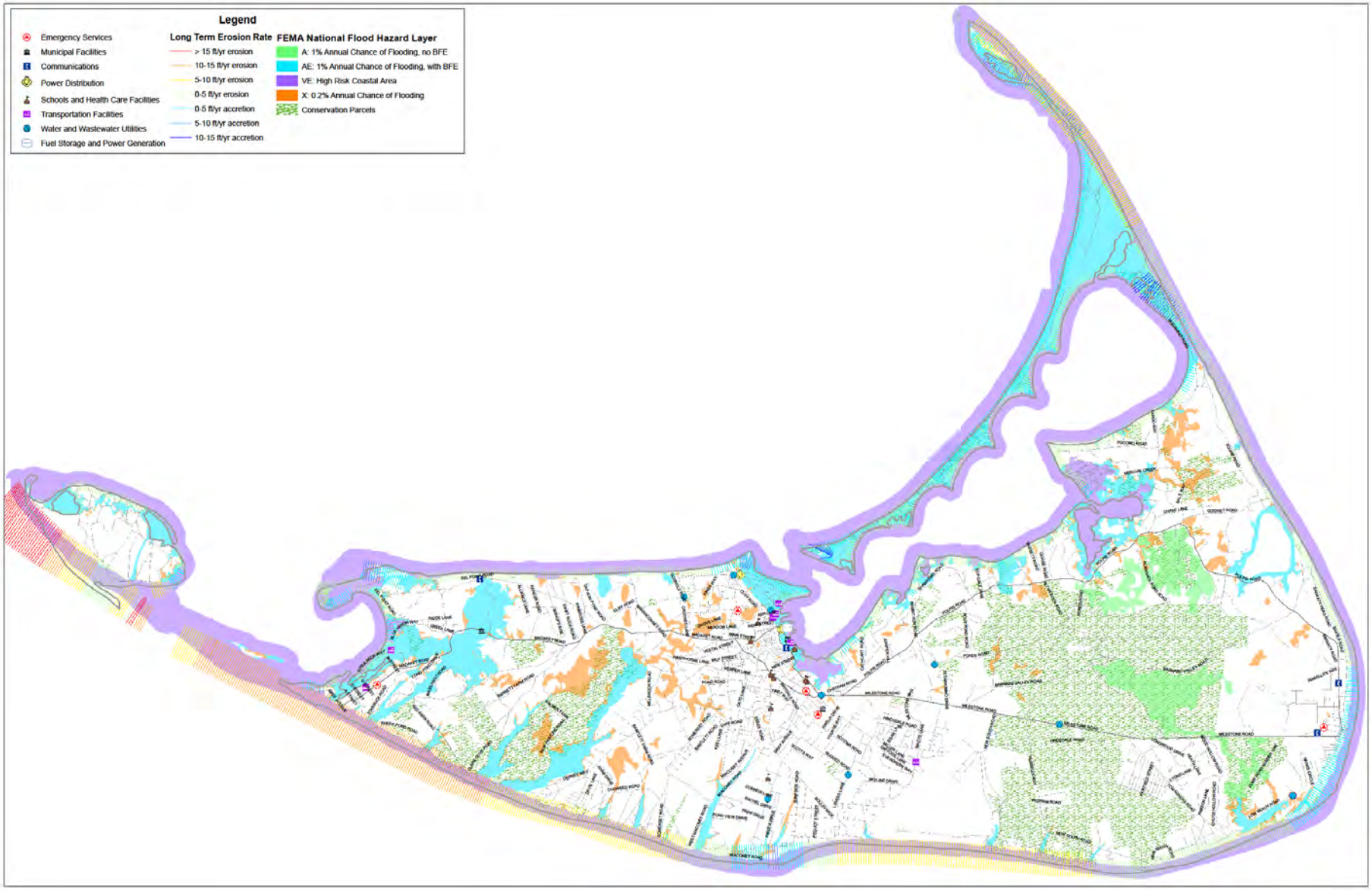
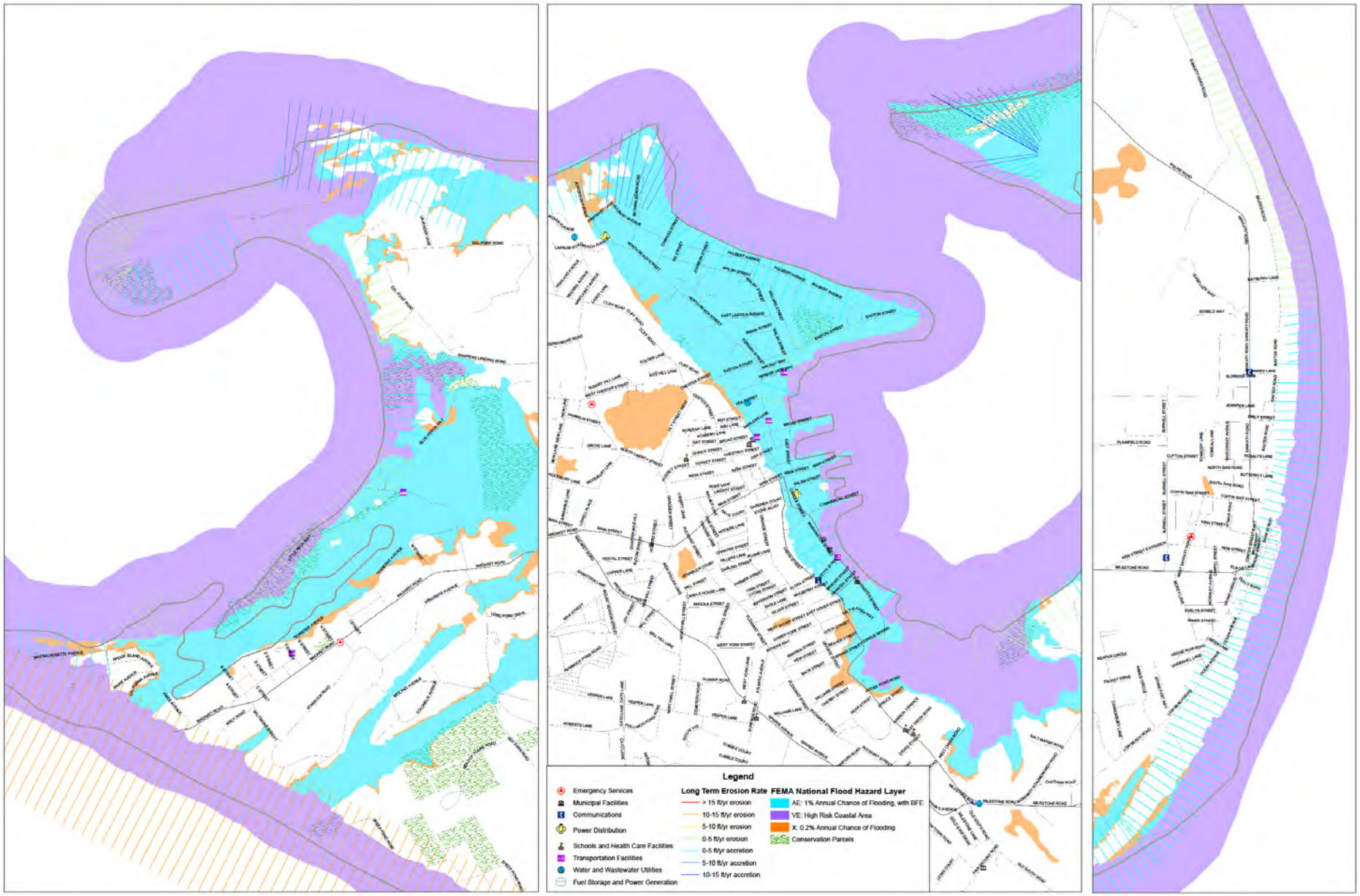
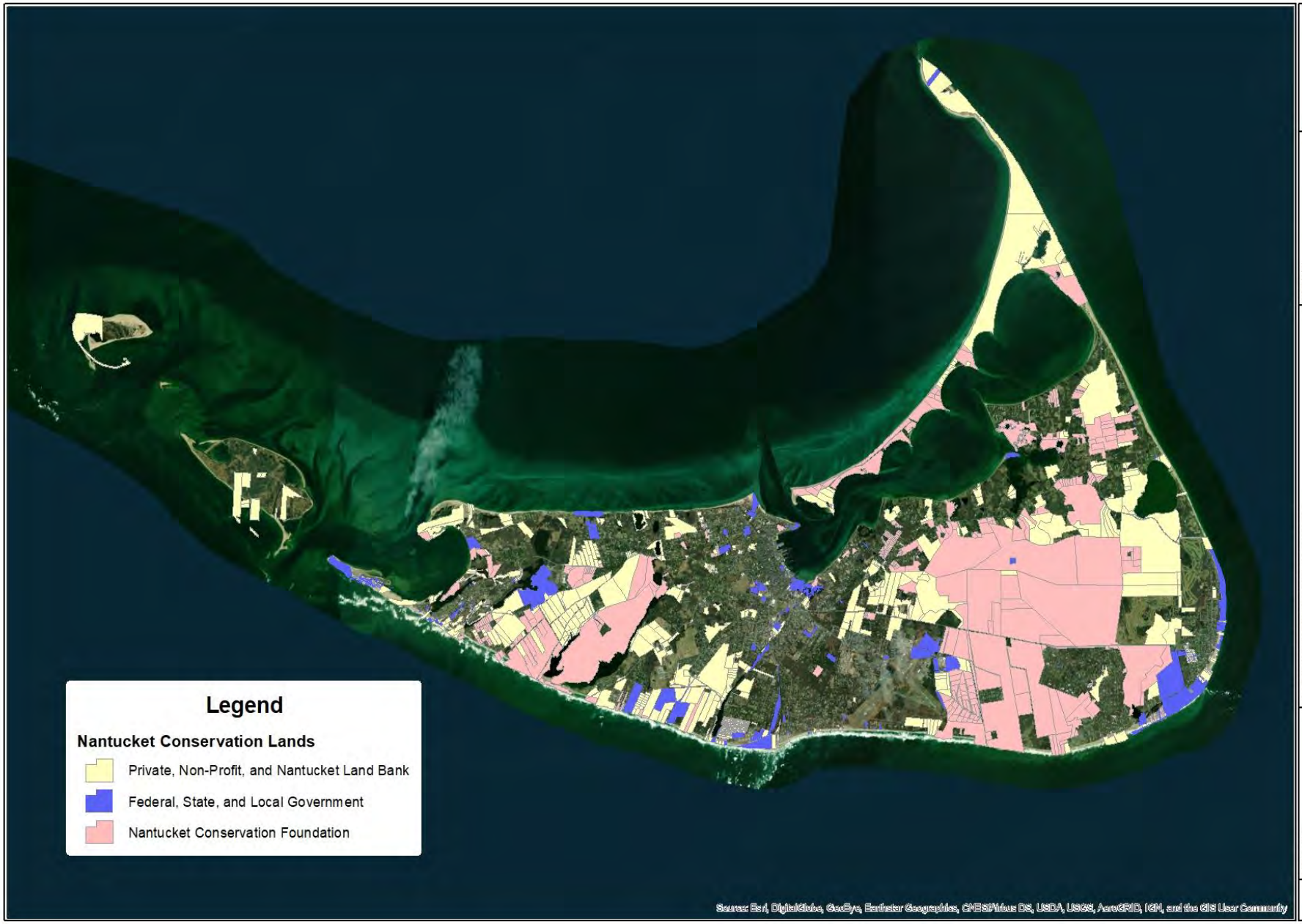

Legend
Emergency Services
Municipal Facilities
Communications
Power Distribution
Schools and Health Care Facilities
Transportation Facilities
Water and Wastewater Utilities
Fuel Storage and Power Generation
Long Term Erosion Rate
> 15 ft/yr erosion
10-15 ft/yr erosion
5-10 ft/yr erosion
0-5 ft/yr erosion
0-5 ft/yr accretion
5-10 ft/yr accretion
10-15 ft/yr accretion
FEMA National Flood Hazard Layer
A: 1% Annual Chance of Flooding, no BFE
AE: 1% Annual Chance of Flooding, with BFE
VE: High Risk Coastal Area
X: 0.2% Annual Chance of Flooding
Conservation Parcels


Legend
Emergency Services
Municipal Facilities
Communications
Power Distribution
Schools and Health Care Facilities
Transportation Facilities
Water and Wastewater Utilities
Fuel Storage and Power Generation
Long Term Erosion Rate
> 15 ft/yr erosion
10-15 ft/yr erosion
5-10 ft/yr erosion
0-5 ft/yr erosion
0-5 ft/yr accretion
5-10 ft/yr accretion
10-15 ft/yr accretion
FEMA National Flood Hazard Layer
AE: 1% Annual Chance of Flooding, with BFE
VE: High Risk Coastal Area
X: 0.2% Annual Chance of Flooding
Conservation Parcels



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SOURCE(S):
TOWN OF NANTUCKET

NANTUCKET CONSERVATION LANDS

NATURAL HAZARD MITIGATION PLAN

NANTUCKET, MASSACHUSETTS

Map By: MER
MMIII: 2967-09
Mxd: U:\Y2967-09\Maps\Fig1_6ConservationLands11X171.mxd
1st Version: 09/07/2017
Revision: 3/7/2018
Scale: 1 in = 7,000 ft.

Sources:
Town of Nantucket

N

Figure 9-1: Wildfire Risk Areas

MXD: 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

Appendix C

Base Maps Used for the Participatory Mapping Exercise

BAILEY'S HEAD ROAD
BAILEY ROAD
SEACATT ROAD
HAWES CIRCLE
SQUAW ROAD
GARNET ROAD
POTTS ROAD
ALMANACK POND ROAD
MEADOW CREEK
POTOMO ROAD
APPLETON WAY
CHASE LANE
MILESTONE ROAD
HEATH LANE
TOM MEAHER ROAD
NEW SOUTH ROAD
PONDS ROAD
GUAGE ROAD
ALTAR ROCK ROAD
BASSETT ROAD
HEREDIAN VALLEY ROAD
RUSSELL'S WAY
MORRIS ROAD
TOP SAIL LANE
POUT POND ROAD
POINTS ROAD
TETAWANIMO DRIVE
RABBIT RUN ROAD
JUNIPER WAY
CATTICHAT ROAD
CHAMBERLAIN ROAD
MILESTONE ROAD
BAY VIEW DRIVE
RIDGED ROAD
TOMOCO WAY
ROCKWELL AVENUE
BOULEVARD
PEQUOT STREET
SUNRISE ROAD
BOTTS WAY
GRAY AVENUE
FERRY ROAD
CONCH LANE
MACKEL DRIVE
POND VIEW DRIVE
MACDUFFIELD
WEST MOORES ROAD
SOMERSET ROAD
BARTLETT FARM ROAD
DUNBAR ROAD
DAVIS LANE
CONRAD WAY
CLAM COVE ROAD
RED BARN ROAD
STEEP HOLLOW ROAD
ARMS DRIVE
BEL POINT ROAD
PALE ROCK WAY
LONG THOMAS ROAD
RIDGE LANE
CIRCLE LANE
ALLIANCE LANE
RANGER ROAD
BISHOPS RISE
PAINT ROCK ROAD
PRIMROSE LANE
CAPHUM POND ROAD
CLIFF ROAD
BOSWOLD ROAD
MAGNET ROAD
MAX STREET
HAWES STREET
CHURCH STREET
PLEASANT STREET
MAIN STREET
WEST STREET
EAST STREET
ARMS DRIVE

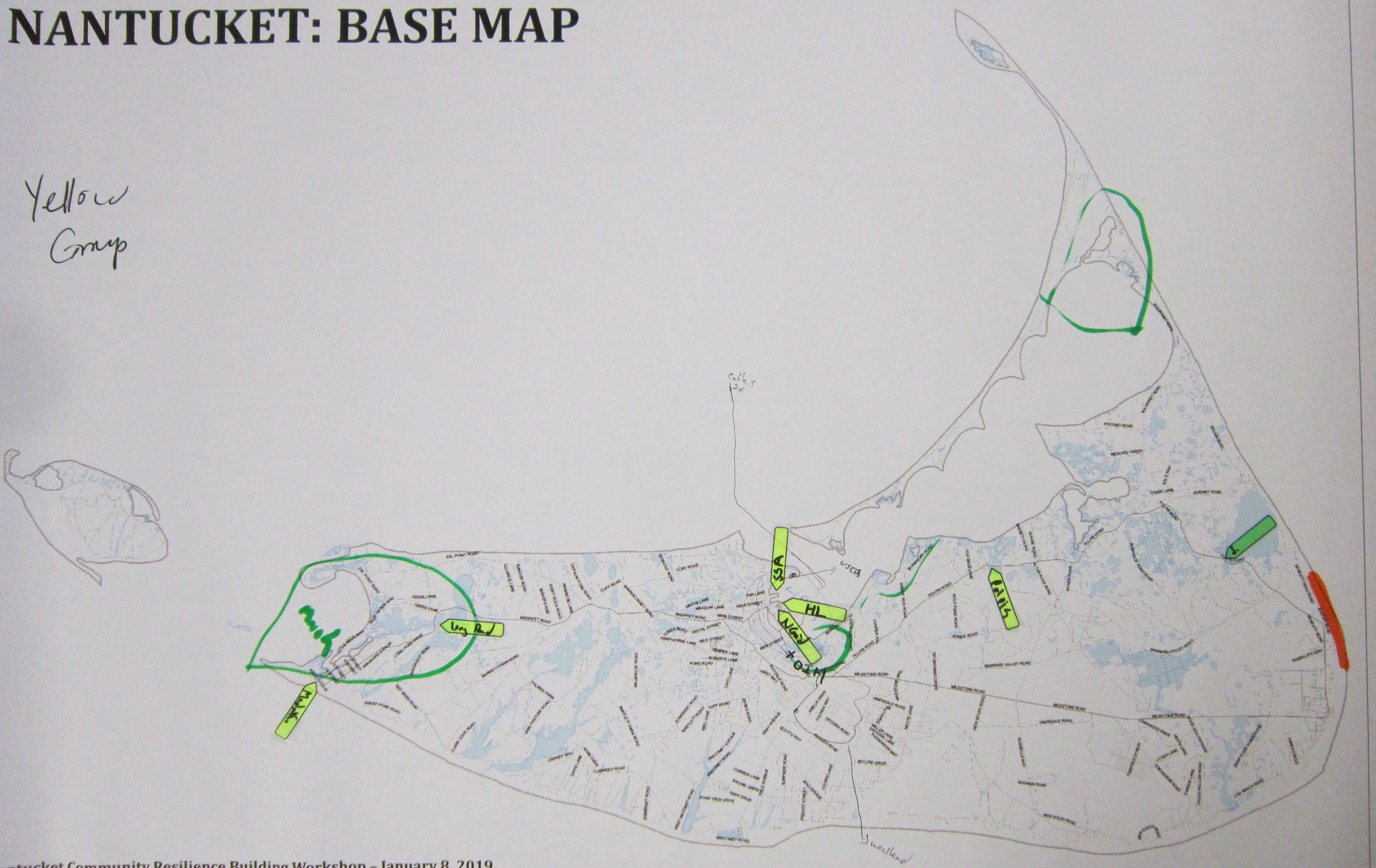
Appendix D
Completed Participatory Maps

NANTUCKET: BASE MAP

Red Group

NANTUCKET: BASE MAP

Yellow
Group



NANTUCKET: BASE MAP

Appendix E
Completed Risk Matrices

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

Nantucket January 8, 2019 Group:_____

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

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

Features	Location	Ownership	V or S	Coastal Flood	Sea Level Rise	Erosion	Severe Storm	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
* H D OHD	DT	T/Pr	V	Develop Guidelines to preserve historic streetscape while mitigating ~~flooding~~ hazards				H	S
Historic Districts (~~OHD~~ SOHD)	~~DT~~ Sconset	Pr/T	V	"	"				
Our Island Home (OIH)	DT	T	V/S						
Community Groups	—	Private	S						
Social Services	—	T/S	S						
LMI	Mobile	—	V						
Elderly Aging In Place & disabled	—	Private	V	Development of database				H	S
Societal									
Recreation/Cultural Landmarks	—								
Historic Structures	All	Mult.	V	See above					
Insurance/Cost of Living									
Isolation from America				Work w/ Steamship on emergency plans			Stockpile food/Supplies	M/H M	L L
E. Shelter	Mid Island	Town	S						
Tourism	—	—	V						
Quality of Life / ~~Ex~~ Investment	—	—	V						
Environmental									
Beaches (Protecting Ponds, Harbor)	Coastal S Side	Pr/S	V/S						
Lighthouses	All 3	~~Coast~~ Coast Guard	V						

Community Resilience Building Risk Matrix

Nantucket January 8, 2019 Group: RED

www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

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

Features	Location	Ownership	V or S	Coastal Flooding	Sea Level Rise	Erosion	Severe Storm	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
* Roads (isolation)	All Coastal	T	V/S	ID & Make action plan for roads to raise/bridge/alt access			Alt Access Plans	H	S
Electric System	Downtown & Islandwide	Nat Grid / T	V S	Elevate Transformers			Incentivise Independent Energy Generation	M/H M	L L/O
Town Fleet	N/A	T	S V	Purchase saltwater-resistant floodable vehicles	Municipal Truck Wash			H L	S S
(iso) ~~Well Ha~~ Docks & Piers	Downtown Madaket	P & T	V	Alternative Access Points				M	L
(iso) Millie's Bridge	Madaket	T	V/S	Complete relocation of Ames Ave				M/H	O
Solid Waste	Madaket	T	V	Capping				L	O
Wastewater Collection	Central & Sconset	T	V	Build Coastal Hazard	into CMON Plan			H	O
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/Surfers	Great Harbor Madaket	T & S	V						
Environmental									
Well Water/Aquifers	Mid-Island Sconset/Dec.	P/S/T 50/50 P/T	V						
Freshwater Ponds/Grat	Southwest	T/S	V						
Stormwater	All	T/P	S	Identify areas with I.I. and get offline				H	S
* Coastal ~~Habitats~~ Wetlands	GH MH	S/T/P	V/S	Restore low lying non-functioning wetlands/lawns				H	L
Wildlife	All	—	V						

Community Resilience Building Risk Matrix

Nantucket January 8, 2019 Group:_____

www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Need to Review Regs + Barriers

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

Features	Location	Ownership	V or S	Intense Storms (incl rain)	Flooding !	Erosion !	SLR	Wind	Priority H-M-L	Time Short Long Ongoing
Infrastructural										
Failure/dam roads (Maint. underlies everything)	Townwide	Town	V	Address drainage (more, less, new)	Elevate Rds + Culvert capacities	Alt Access →	→	—	H	
Failure/failure 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 Stexample! Need consistency criteria Drff. boards need to Know	Examine/ID artificial reef technologies			M	L
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 -		1 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

www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Land Use Planning / Management

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

Features	Location	Ownership	V or S	Intense Storms	Flooding !	Erosion !	SLR	Wind	Priority H-M-L	Time Short Long Ongoing
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) V	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	Everywhere.	Various	S							
Threat & End. Species		—	V							
LID / Stormwater Mgmt.				Develop Plan w/ LID		—				

Community Resilience Building Risk Matrix

Nantucket January 8, 2019 Group: Green

Septic Systems

WEALTH vs Not → Land use change

www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Regional + Tourist ↔ ☐

→ H2O

Features	Location	Ownership	V or S	Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)				Priority H-M-L	Time Short Long Ongoing
Infrastructural Downtown – D Area			V	Assessment/workshop for Downtown Alternative			Town Meeting	H	S
Roads Satellite Park [Polpis]	Spread	Mun	V	Raising Rds → HMP Truck Routes			Economy	M	O-S
Isolated neighborhoods Esp. Pt.		Private	V	Predeploy Resource (STAFF) in Isolated Neighborhoods			Ma Hocet	H	O
Fire Station / 2 satellite stations (24) (Sac)	Spread	Muni	S	all set	[Comprehensive Approach & Method]		3 Assessing DPW Garage	H	S
Hospital – (Cat 5)	Spread	Muni	S	LEED Certified				H	O
Renewable Energy → wind farms/solar arrays	Spread	Muni	V/S	Landfill – Solar Mattoodix		500 Tesla Rooftop	in Hinsdale	H	S
Cables from Cape Cod – Microgrid									
Airport	Spread	Muni	S	Erosion of Runway → Airport Commission				M	O
Societal									
Police Call list 70-80	Spread	Muni	S					H	O
CODE Red/Reverse 911 –	Spread	Muni	V/S	COMMUNICATIONS → Tower Mobile / Boats				H	O
Elderly Apartments – Non Emergency Infrastructure			S	Translate Services / Schools and Council / Churches					
Working Poor – (Esp. Elderly, Hispanic, Young Families)				☒ ☒ Indefinite Nantucket Community Fund			Target $$		
NGO – Interfaith Council Low/Medium Income	Spread	Muni	S	Climate Resilience → Locate Grants → (?)					
Affordable housing – Employee Housing		Private	V	State Statute → NRTA → Year Round Bus Transport to Work (!)				H	O
Museum/ships Historic Sconset			S	→ Remote to and Bike in Low Income Area					
Environmental Septic / H2O Quality	Spread	Private	V	Sea Fish Farm					
Conservation Lands 50% (Affordable Housing)		Muni	S/V	⟹ G+	Umbrella →			M	O
MASS Audubon / Private / Land Bank 2% transfer									
Land Bank Purchase of Low Lying Lands	Island	Mun.	S	Land swaps →	Need to Coordinate				
Beach Replenishment – Primary Role (?)			S						
Recreational areas									
Conservation Commission / Nantucket		Mun	S						

Entitlement

Community Resilience Building Risk Matrix

Nantucket January 8, 2019 Group: GREEN

Stable Burky Cases

NOT Big Enough?!? www.CommunityResilienceBuilding.org

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

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Features	Location	Ownership	V or S	Flooding Coastal Storm	Inland Flooding	Drought Wildfire	Erosion	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
WWT - 15 pump Station 5-9' (400 homes)	Sport	Mun	S	100, 500 Comm Fr.			Overall H_2O Supply		
WWT 3 pumps Vulnerable Flood Barrier Wall	Surf side Rt. OLD SALEM Rd	Mun	V	By Pass Pump → 3 pump (3 yr)		Mitigate Sewer Master plan	/ Repair Coastline	H	O
Sewer Master Plan (9' Flood) (Stormwater)		Mun	S	~~Beach Road~~	Summer Mitigate Pressure			H	
140 Commercial / 80% residential Electric vehicle	All over	Private		Island Wide	Energy Plan →	Liquid Fuel / solar	/ Microgrid		
HARBOR Facility / Ferry / Stormstorm	Harborside	Mun	V/S	HARBOR Master Plan →	91'	2011 - 2013-14	/ Condition	H	S
Truck Route Closure / (Warehouse)	Sports	Mun	V	Severe Alt	Routes (-)	Quarrie Cutting	Access → Commercial	H	O
1st / 2nd Bridge Metatook / Culvert				Study when	Fair Bridges	→ Capital Plan		H	O
Societal									
Electric Utility → Combustion									
Access of Materials / Supply / Resources									
Supply Chain →				Connect on other side					
26 Neighborhood Associations									
Language Barriers / Non-English									
Elderly people									
Town Neighborhood →		Mun	V						
Environmental									
Protected Public Lands	"	Private	V/S	Caps on Wetlands → Erosion			/ Line item - Restriction / Clean Ponds		
6 Different Coastal Groups / Umbrella	"	Private	V/S	Town Wide with Coastal Group			Coastal Resilience Plan		
Nantucket Biodiv. Initiative	"	Private	S						
Prescribe Fire Program / Prescribed Plants	Species	Private/Pub	S						
Tourism - Eco - Preserved			S	Beach Driving - Closures / Waterways - Stroll					

Fire Plan for Nantucket - Fire

H O

Housing - Transportation - Env. (H_2O)
Down " Commercial

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

Nantucket January 8, 2019 Group:_____

H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

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

Features	Location	Ownership	V or S					Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Downtown Area	Specific	Mixed	V/S	Conduct Assemess of Long term (25 yr to 50 yrs)		Risks + Alternatives	→ Protection → Relocation	H	S
Island-wide Planning	Island wide	Mixed	V/S	~~Need For~~ Island-wide Comprehensive Plan that Address Local / Regional need for resilience (2) Not just Manual (1) Policy Code / Tracking				H	S
WILDFIRE	Island wide	Mixed	~~V~~ S	~~Need For~~ Island-wide Comprehensive Plan that includes all Aspects + Partners (Coordination)				~~H~~	O
OFF/ON Island Partnerships	"	"	V/S	Enhance Partnership Strength on island and off island / Infrastructure				H	S
Staffing	"	Mun.	S	Resilience Coordinator		Hire → Dedicated			
				→ $ Private / Public (?)					
				→ Working Group					
Societal									
Staffing	"	Mun.	S	Sustainability Coordinator				H	O
H_2O Quality	"	Mixed		Integration / Holistic Approach					
Infrastructure	"	Mixed	V/S	Reliability - Redundancy / Maintain Critical Infrastructure				H	S
West End Island	West	Mixed	V	Prototype For Resilience			Public	H	S
Historic District / Building	Downtown	Mixed	V/S	Plan in progress For 20 Buildings / up Coming Conference					
Environmental									

Community Resilience Building Risk Matrix

Nantucket January 8, 2019 Group:_____

www.CommunityResilienceBuilding.org

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

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

Features	Location	Ownership	V or S	Increased Storm Intensity	Flooding	Drought (Wildfire ↑T) / Temp Swing	SLR/erosion	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Roads/Culverts - Polpis culvs obsolet. - Sesach-St	Various	town	V/S	Seasonal Notification Needs vary for pop'n	Raise Road - Polpis		See OUT ★		
- Easy St (Part of downtown that floods + tick RdS - jetties, may hold in tide)		town/priv.			See FP★		Seawall low @ private property		
Downtown Area	downtown	town		Emergency services	hard → Boats Currently (SEE FP★)			H	
★ Ferry terminals	V/S	State		V - wind; ice (2 wks → hard to break ice); Develop Redundant Landing Plan → N SHORE potential			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 → Scenario planning airport, ferry, EM, food storage, water supply, fuel, meds				
Sewer Treatment Plant	V/S	town		Keep modernizing →	[~~Build~~ analytic lab for on-island (maybe) testing → interdep. communication [Consider: cost analysis]		Infil beds close to SLR; develop long-term erosion plan		
Bridge to Madaket [First, Long Millers]	V/S				Kisk/Been armored Millers → potential causeway				
Societal									
Food Pantry	Washington St	private	V/S	Alternative and/or	secondary → move to	mid Island?		M	L
Housing - Availability / Affordability	Various	private/public	V	Ongoing: continue working towards solutions		→ juggernaut		~~H~~	~~L~~
Tax Revenue Shifts (Brant, Sconset, Madaket, South Shore)	Coastal	private	V	SLR/erosion overlays	for scenario planning	; consider zoning solns		L	L
Shifting Properties → Back, then up (SLR, erosion)	Coastal	private	V	See Out ★					
Public Aware/Ed [SLR, erosion] → mut.				Share hazard info w/ planning, HDC, other Departs. Outreach plan w/ info from all sources. Continue building enforcement efforts (DPW)	Town on same pg for messaging. Document! Develop all sources. Same operating system across departments.		Modernize info sharing. [Off Route]	H	L/O
Town/Private Planning Communi.	ALL	ALL	V	Leverage Planning to coordinate permitting to coordinate early + often w/all planning & permitting boards; consider holistic effects; how high to raise if high enough for SLR, ~~remb~~ Document.	Resilience Projects, Private Owners proactive, need			H	L/O
~~Public~~			★ Output ↑ Reg/Policy review	Climate & Education					
Environmental									
Grasslands	South Shore	private/public	V/S			See ALL Island Fire Note			
Coasts	ALL	private/public	V/S				think about LS techniques	H	O
Salt Marshes	Madaket	" "	V/S			Understand/plan for impacts to aquaculture, tourism		H	O
Harbor		town/state/conservation					consider nourishment projects think native spp & Dune grass		
Coastal Barrier (protects downtown)		Conservation	V/S					H	O

Public Coordinate

"Out" ~~Public~~

Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.org

Nantucket January 8, 2019 Group:_____

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

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

Features	Location	Ownership	V or S	Increasing Storm	Flood	Drought/Wildfire	SLR/Erosion	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Brant Pt	N of downtown	private Res Coast Guard	V	elevated / barriers → see coordination Note					
Dream Land Theater [Easy St flooding]	Easy St	private	V	See FP ★					
Candle St ~~Pump~~ Sub Station / Power (Gulpt. Mid)	var	National Grid	S	keep up good work: alternative backups, microgrids, just raised substation				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	wellfeild	Town	S/(V)	Inform any truck Rte upgrades to consider oil spill / Wellhead protection; test soil → Regularly, develop program; Conservation program exists; changing wellstructures				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 ★	die install a flood wall				
Tourism/Historic Hub - Downtown (2nd / Cultural)	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/	juggernaut → 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 (Shelter)	mid island	town (private by mid-March)	S	Keep up good work. Dog friendly. Have generators. Don't flood. Yr round Residents aware				L ↕	O ↕
Churches/Warming				"	"	"			
Environmental									
Entire Island (wildfire)	All	All	V			Fuel built up. More Ed/incent. for off. manag't.		H	S/O
Stormwater Infrastructure (old, backed up, [sewer] [gas])	All	town/ private	V	→ looking for Holistic water/flood Management; ~~it~~ Map, ~~clear blockages~~ maintain; document, centralize information about system, understand tidal, precip impacts				H	O
Green Infr. Brant Pt Cons. Area (Flood Plan)	Brant Pt	town	V	→ continue preserving open/space wetlands; develop plan to add capacity for H_2O; private action for rain barrel storage, plant use, other GI consid.				↕	↕

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

Red Team	**Top Actions** • **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. **Other High Priority Actions** • **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.

Blue Team

Top Actions

- **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

Other High Priority Actions

- **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.

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.

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.

Appendix G
Sticky-Dot Voting Boards

#4

TOP PRIORITIES

7

Downtown Area

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

6 vote

6

#8

TOP PRIORITIES

8

Dev. guidelines to preserve historic streetscape while midigating HAZARDS

16 vote

16

#2

TOP PRIORITIES 5

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

14 vote

PRIORITIES 5

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

14 vote

14

#6

TOP PRIORITIES 6

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

23 vote

TOP PRIORITIES 6

Ferry Access
- minimize damage from events
- maximize speed of recovery

*Ex. Scenario planning for future events

*Possible 2nd ferry terminal

23 vote

23

Post-it
SUPERSTICKY EASELPAD
TABLEAU À FEUILLES MOBILES SUPERCOLLANTES
SUPERADHESIVAS BLOC DE HOJAS REPOSICIONABLES
30
25 IN/PO x 30 IN/PO
63,5 cm x 76,2 cm
5.2 SQ FT/PI² (0,48

11

TOP PRIORITIES

11

Redundancy + 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

7

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

2 vote

2

#

TOP PRIORITIES 2

Restore wetlands to mitigate storm surge. & events.

20 vote

#3

TOP PRIORITIES 3a

Bylaw/Regulation Policy Review

- interdepartmental 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, including town, private, federal, state 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

4

Appendix H
Listening Session Presentation

1

AGENDA

- MVP Workshop Overview
- Prioritized Risks & Hazards
- Community Vulnerabilities & Strengths
- Top Priority Actions
- Next Steps

2

3

WORKSHOP OVERVIEW

MUNICIPAL VULNERABILITY PREPAREDNESS

- Massachusetts Commonwealth-Wide
- Community Resilience Building **(CRB)** 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

UTILIZE PARTNERSHIPS & LEVERAGE EXISTING STRENGTHS

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WORKSHOP OVERVIEW

COMMUNITY RESILIENCE BUILDING

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

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Image: www.dnvol.com

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WORKSHOP OVERVIEW

NANTUCKET CRB WORKSHOP

- **Goals:**
  - Dialogue, Understanding, and Collaboration
  - Stakeholder Supported Mitigation Actions
  - Integration with Hazard Mitigation Plan and Coastal Resilience Plan
- **Objectives:**
  - Characterize Primary Hazards
    - Current & Future
  - Identify Strengths and Vulnerabilities
  - Agree on Priority Actions

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WORKSHOP OVERVIEW

WORKSHOP REPORT

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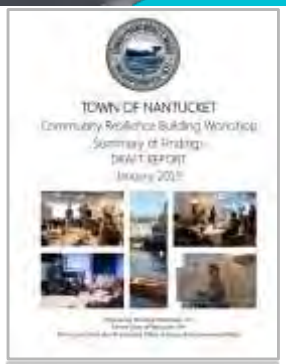

APPENDICES

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 Board

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RISKS AND HAZARDS ON NANTUCKET

PHOTO: HURRICANE SANDY.JASON GRAZIADEI

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WORKSHOP RESULTS

PRIORITY RISKS & HAZARDS ON NANTUCKET

TOP PRIORITY HAZARDS

as identified by workshop participants

- Coastal Flooding
- Severe Storms
- Sea Level Rise
- Erosion
- High Wind
- Wildfire and Drought

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COMMUNITY VULNERABILITIES AND STRENGTHS

PHOTO: WWW.NANTUCKET-MA.GOV

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VULNERABILITIES AND STRENGTHS

FEATURE CATEGORIES

INFRASTRUCTURE

- Roads
  - Inundation, Erosion, Bridge Washout
  - Snow drifting
- Connection to Mainland
  - Travel interruption from weather
  - Erosion risk at airport
  - Sea level rise risk at ferry terminals

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VULNERABILITIES AND STRENGTHS

FEATURE CATEGORIES

INFRASTRUCTURE

- Electric Utilities
  - Underwater cables, Candle Street substation, overhead & buried powerlines, transformers
  - Increasing Peak Load
- Water and Wastewater Utilities
  - Erosion risk at WWTP
  - Saltwater Intrusion into groundwater
  - Corrosion of infrastructure
  - Water leaking into sanitary sewer pipes

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VULNERABILITIES AND STRENGTHS

FEATURE CATEGORIES

INFRASTRUCTURE

- Municipal Facilities
  - Damage to records
  - Vehicles drive through saltwater during floods
  - Assets of concern:
    - Municipal fleet
    - Town Offices
    - Finance Department on Washington St

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VULNERABILITIES AND STRENGTHS

FEATURE CATEGORIES

INFRASTRUCTURE

- Emergency Services
  - Isolation and Fragmentation Concern
  - Assets
    - Fire Station
    - Two Satellite Garages
    - Police Department
    - Hospital - New Hospital under Construction
    - Nantucket High School
    - Emergency Alerts

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VULNERABILITIES AND STRENGTHS

FEATURE CATEGORIES

ENVIRONMENTAL

- Resources:
  - Great Ponds, Coastal Waters, Fisheries and Shellfisheries
  - Coasts, Beaches, Bluffs
  - Moorlands, Wildlife
- Benefits:
  - Draw residents, visitors, scientists
  - Recreation and aquaculture
  - Protection from waves and surge
- Risks:
  - Sea Level Rise, Erosion, Drought & Wildfire
  - Human-Caused Hazards

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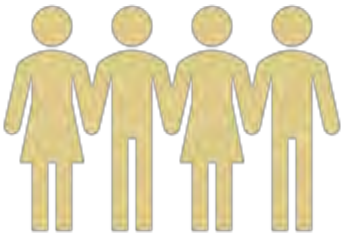
VULNERABILITIES AND STRENGTHS

FEATURE CATEGORIES

SOCIAL



- Disadvantaged Groups
  - Elderly group home (Our Island Home)
  - Homebound
  - Low/moderate income population
  - Homeless
  - Minority
  - Immigrant
- Historic Resources
  - Islandwide National Historic Landmark
  - Old Historic District
  - ‘Sconset District
  - Lighthouses

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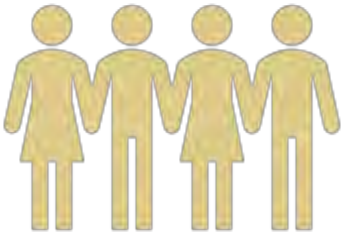
VULNERABILITIES AND STRENGTHS

FEATURE CATEGORIES

SOCIAL



- Local Knowledge, Engagement, and Institutions
  - Neighborhood associations
  - Academic institutions and expertise
  - Coast Guard Facility
- Social Services
  - Our Island Home
  - Landmark House
  - Nantucket Interfaith Council
  - Local churches
  - Police Department homebound call list

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VULNERABILITIES AND STRENGTHS

FEATURE CATEGORIES

ECONOMIC

- Tourism
- Goods and materials from mainland
- Perceptions of island destination

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TOP PRIORITY ACTIONS

1. Resiliency Coordination

Establish a municipal "Resilience Coordinator" position with the following responsibilities:

- Facilitate and coordinate Town-wide resiliency initiatives (3b)
- Review existing and new Town Bylaws and Regulations to ensure consistency and efficiency
- Develop new resiliency policies (3a)
- Foster ongoing community resilience discussions within the community, including with the MVP workshop stakeholder group, through meetings and hosting subject-matter experts (12)

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TOP PRIORITY ACTIONS

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

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TOP PRIORITY ACTIONS

3. Tidal Wetland Restoration

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

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TOP PRIORITY ACTIONS

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.

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TOP PRIORITY ACTIONS

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:

- Through a "pavement management plan"
  - Development of alternate routes in case roads or bridges are rendered impassible
  - Identification and prioritization of sites for road relocations, elevations, and/or hardening
  - Identification and prioritization of sites for culvert or bridge upsizing or construction
- Water and wastewater utility system resiliency

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NEXT STEPS

- Incorporation of Public Feedback
- Integration with Other Plans
- MVP Certification and Funding Opportunities

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NEXT STEPS

MVP CERTIFICATION MAINTENANCE

Municipal Vulnerability Preparedness Program Yearly Progress Report

1. Top priority actions
2. Core Team meetings since Listening Session
   1. Revisions or updates to the original MVP Report
   2. Changes to MVP Core Team membership
3. Other work related to the MVP process or climate change resiliency.
   1. How have you used the workshop outcomes in other planning efforts?
4. Grants applied for or received to implement MVP actions
5. Other steps taken towards implementing priority actions
6. Potential next steps to advance priority actions during next FY
7. Difficulties or challenges identified through the MVP or while seeking to implement actions
   1. Steps identified to address these challenges
8. Data needs or information gaps that the state could help fill.

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WRAP UP

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Appendix I

Listening Session Notes and Comments

MVP Listening Session and Review of the Draft Workshop Report
Town of Nantucket
March 28, 2019

MVP Listening Session:

The Listening Session had approximately 15 participants from the public and Town Government. The sign-in sheet is attached at the end of this document. MVP Project Team members that participated include: Chuck Larson, Holly Backus and Greg Tivnan (from the Town) and David Murphy (Milone and MacBroom, Inc.).

Chuck Larson briefly introduced the purpose of the meeting. David Murphy presented the power point slides to summarize the outcome of the Community Resilience Building (CRB) workshop of January 8, 2019 and the corresponding content of the draft report.

General discussion points were as follows:

1. The timeframe for comments on the report is compressed because the Town would like to submit the report to the State by April 5, 2019.
2. Sara Bois noted that the CRB workshop resulted in actions that are representative of the stakeholder opinions. There is a concern that too much weight will be placed on these opinions, leading to actions that may not be well-aligned with scientific principles. The recommendation is to build narrative into Priority Action #1 (resilience coordination) to ensure that the new coordinator will screen actions from the MVP report and solicit expertise as needed and as appropriate. Chuck and David noted that this can be added to the report.
3. Attendees inquired how the subject matter of MVP action grants would be determined. Chuck explained that the grants are constrained to 12-month timeframes which would limit the breadth of each action funded by an action grant. They determined that the historic resources action was appropriate for application for the initial action grant. Going forward, the resilience coordinator and others will help determine which actions from the MVP report are appropriate for action grants.
4. Holly noted that 11 of 50 actions in the hazard mitigation plan are in various stages of execution. Rick Atherton asked how the public can see which actions are being executed, and noted that visibility will benefit the Town as well as the public. Chuck and Holly note that they would work on making the progress list visible.
5. Sara Bois noted that Mass Coastal Zone Management (CZM) grant applications are stronger when towns partner with local non-profit organizations such as land trusts. Chuck acknowledged this.
6. D. Anne Atherton noted that she is concerned about the quality of public engagement to the MVP process and resilience planning, and asked how draft reports could be issued relatively quickly. Greg responded that the Select Board has recently approved formation of a resilience committee and this would help bring the public more directly into the process.
7. D. Anne noted that the NCC planning committee would like to plan a resilience summit to discuss which strategies are available to the Town.
8. Attendees, Chuck, and Holly briefly discussed the June 2019 symposium. D. Anne noted that the keynote speaker had been announced.
9. Upon conclusion, Chuck noted that comments should be submitted to his email address by the middle of next week (April 3, 2019).

Written comments received for the MVP Workshop Report:
(Some comments were edited for brevity and clarity)

Emily Molden, emily@nantucketlandcouncil.org

- I encourage increased focus on Nantucket's management of coastal wetland resource areas, such as salt marshes, as a way to build resiliency into our landscapes.
- I also wanted to make sure there was enough focus included on the need for stormwater infrastructure upgrades

Sarah Bois, PhD, stbois@llnf.org

- Comments submitted by Dr. Sarah Bois, Director of Research and Education, Linda Loring Nature Foundation
- I understand that this report is a draft and represents the findings of the January meeting in which I participated. I also understand that this report and the opinions of the participants are being used as a basis for prioritizing grant requests from the state. There were many different members of the community present, with people representing different interests and varying areas of expertise. I am concerned about the weight that has been given to what amounts to opinions. In a general sense, I think the vulnerabilities, hazards, and assets all need to be supported by data and references. It is important to get public opinion, but for something as important and complex as coastal resiliency, we need to have data and information before moving forward with actions.
- I also do not feel that this report has been properly circulated to the group of participants at the January workshop. In the future, the Town of Nantucket (TON) needs to do a better job of following-up with participants, transparency of projects, and general information sharing regarding issues of climate change and coastal resiliency. Doing so would avoid duplication of efforts and potentially allow the TON to tap into local expertise and interested parties.
- More specific comments are as follows:
    - p. 8 When discussing key assets and systems, it is important to note that this list is by no means exhaustive. We need room in this document to add assets that were not brought up during the January meeting. Additional data should be used to support the list in Table 3. A map of these key infrastructure assets highlighted (roads, docks, airport, etc.) would help identify key locations with multiple assets to protect.
    - p. 10 Under "Terrestrial Resources", there is actually >50% of the island under conservation. A list of conservation groups (land trusts) may also be useful to include. It is important to note that most of the conservation land, while open to the public is, in fact, privately owned (Nantucket Conservation Foundation, for example). This may be important moving forward with resiliency actions as the TON will need to work with the various landowners should action need to be taken. In addition to the amount of conservation land, we need to mention the rarity of the types of land cover that exists on Nantucket as well as the amount of priority habitat as identified by the State. These data are all available on the Mass Natural Heritage and Endangered Species Program website (https://www.mass.gov/service-details/natural-heritage-gis-resources). Losing these species and/or habitats would mean a loss for the state and, in some cases, global biodiversity. We cannot underestimate these resources as assets to protect.

- p. 14. Environment. As a vulnerability, the environment is given short shrift in this report. I mentioned above the specifics of rare species, priority habitat, and biodiversity. The open space and conservation land are also big economic drivers for the island.
- p. 14 Disadvantaged groups. During the public presentation, this vulnerable group was downplayed as not being as significant as in other communities in Massachusetts. Looking at the data the school system has, we can see that Nantucket has some of the highest language diversity in the state. Not only are there many non-English speakers, it is much more than just Spanish. I do not think we can afford to downplay this major component to the Nantucket population – especially in the sense of vulnerability. These numbers are readily available through the Nantucket public school system.
- p. 16 Strengths. Natural Resources. In this section, I think it needs to be emphasized that the sheer amount of open space and conservation land is, itself, an asset. We have less impervious surfaces than in other areas allowing for better filtration of storm water, storm surge, and other effects of climate change. The authors do not seem to have an understanding of Nantucket's wetlands. There are many local experts with vast knowledge of the freshwater and saltwater wetlands on the island and how they function in the various parts of the island. We have detailed information about ownership, conservation status, health of individual marshes, and ecosystem functions. I think it is vitally important to include more information about Nantucket wetlands in this report.
- Again, I think it needs to be mentioned that our natural resources are huge economic drivers for the island for multiple reasons (e.g. birdwatching, hiking, boating, fishing, swimming, aquaculture, surfing, environmental education, etc.). They are an asset for their ecosystem services, aesthetic beauty, and provide the livelihood for many islanders.
- Recommendations. I am concerned that even though the group identified 10 actions, only five are being pursued for action by the TON.
- As part of resiliency coordination, some aspects of priority #8 should be put into that position. For example, that person should research experts in the field of coastal resiliency, perhaps in the form of a literature review, and keep up to date on what other communities are doing.
- Priority #3 is one of the highest rated priority, and yet, it is not given very much consideration in the report. I think the title should read more than just "restoration" as that does not encompass what was discussed. Tidal Wetland Protection and Restoration may be more appropriate. The emphasis should be on how we protect the asset we have (our tidal marshes), how we restore degraded marshes, and how we mitigate for and provide room for marshes that will be severely impact by rising sea levels. Again, there is a lot of local expertise that can be utilized for information and data gathering in this area.
- The consultants seemed not as interested or as knowledgeable about natural resources and, as such, these aspects of the report are short and lack details. Since this document represents an outline for grant writing and prioritization of town monies, I think the mentions of natural resources need to be expanded with more information.
- p. 21 "Cormac Coulter" should be "Cormac Collier"

Kelly Omand, kaomand@gmail.com

- I have been following the Coastal Resiliency process with both personal interest and as an ecologist for the Nantucket Conservation Foundation. I've been living on island (Surfside Dr, Rugged Rd, and now Kelley Rd in Polpis) and working for the NCF Science & Stewardship Department for just over 11 years. As a field ecologist, I've been observing a lot of local changes with increasing temps, rain events, changes in plant and animal phenology, erosion and coastal change/sea level rise. It is good to see that we are having this discussion become more mainstream so the general public can better understand what is going on and our options to deal with problems
- I attended one of the early workshops (last June?) and would have attended the release of this more detailed report but didn't hear about it until after the fact. So, I wanted to send some comments on what I've seen of the process, the report, and some feedback as a local ecologist and a "washashore" resident.
- Completing this initial phase of the process to be able to obtain grant funding is so important. I'm hoping that in the development of the CRP there will be a strong emphasis on scientific background, like using shoreline change data and expertise provided by the state, and obtaining more offshore mapping and sand budget data to understand what is going on with the immediate shoreline and mitigate risks. Hopefully there are a lot of "low hanging fruit" options that the town can fold into existing road repair and infrastructure plans so that we can get a head start at making innovative fixes. The Folgers Marsh and Sesachacha Pond sections of Polpis Rd come to mind as cases where redesign and update of the road and using the back marsh and associated wetlands as overflow with healthy plant communities will be very helpful.
- All the conservation and research orgs on the island are following these developments and we would love to provide archived data as well as local expertise. There are also many areas where we could potentially collect new datasets or team up with the town to analyze data. My specialty is plant ecology including native plant landscaping, restoration, and invasive plant management, issues that are all relevant to managing our natural areas for resilience in times of change. We are so fortunate to have open conservation land in many key parts of the island that can help us face these challenges thoughtfully and proactively.
- One comment specifically on the report, page 10, Coastal Resources. There is no "Shawmut Coastline" on Nantucket as far as I can tell. It's not a name in current usage, and I haven't found it on the 1869 Ewer map of Nantucket so I don't think it's historical either. I wonder if this was a carryover from a table used on another report? Maybe Boston?
- I hope that any future public meetings will be publicized more widely so that I can continue to follow this process and be involved as a citizen and as as an ecologist. An email blast notifying past commenters or people who have signed up as attendees at meetings, and a Town social media blast would be very helpful in keeping a cross-section of the public involved. Things are so busy and it is hard to keep track of everything.

Seth Engelbourg, sengelbourg@llnf.org

- I applaud the town in taking proactive steps with regards to resiliency, vulnerability, and climate change. However, I feel that the report generated is lacking severely with regards to natural processes and ecosystem-level effects. The third highest action item outlined is Tidal Wetland

Restoration, yet only a vague paragraph indicating a strategy to restore and preserve this asset, has been included in the report. This section needs to be greatly expanded to suggest who will be responsible for creating and administering this strategy, what funding sources are available, and how the Town will address the real estate, infrastructural, and economic challenges of inland migration due to sea level rise as the report states. There also is a lack of discussion regarding the benefit of protecting and restoring non-wetland ecosystems. Particularly on an island that sees drastic coastal change, it is important to put aside as much open space as possible to plan for future contingencies while also conserving our native ecosystems. Lastly, many of the conservation organizations already are protecting wetlands. Since much of our coastal and tidal land is private, it is important to engage and/or formally designate a non-profit leader in the process through a public-private partnership.

- I also believe that this process places an overwhelming amount of emphasis on community opinion, rather than expert advice, engineering plans, and fiscal studies. Although the wishes of the identified stakeholders are valid, only a small percentage of them have a scientific background. It is important to involve other people with varying expertise, for instance energy, first response, etc. as this process has done, but I would have rather seen the possible action items constrained by feasibility as determined by experts in vulnerability and climate change planning. I do appreciate that the appendices included many well-researched figures and tables, however I feel that there is a disconnect between this data and the directives of the report.
- I acknowledge that completing this process qualifies Nantucket as an MVP community with increased access to grant opportunities, however I am concerned that the findings generated in this report will be overrepresented or constrain the approach the Town takes towards effective resiliency planning. This document, which reflects the will of the people, may be used as a supplement to scientifically rigorous climate change and/or resiliency research but should not be used in place of it. As someone who holds an MS in Environmental Conservation with a concentration in Water Resources and Sustainability, I urge the Town to base their planning decisions on science rather than collective opinion.

Jennifer Karberg, PhD, jkarberg@nantucketconservation.org

- The most important part of the plan is, of course the Action Items as these provide us leverage for grant applications, so I'm listed comments on that first and these comments are based on the actual discussion at the January meeting. Following that are comments that will hopefully provide more accuracy to statements made in the plan.
- Table 4: Top 10 Actions (pg: 17)
  - Ranked 3rd is Wetland Restoration which is a key component to providing community and coastal resiliency but this recommendation as written in the plan is very sparse compared to the discussion and recommendations made at the meeting. Recommendations within this heading should include:
    - Identify all current wetlands and potential wetland areas within coastal and flood zones. Town is a priority but other areas with infrastructure are important as well.
    - Identify ways to increase functionality of current wetlands to mitigate flood areas and storm surge locations.

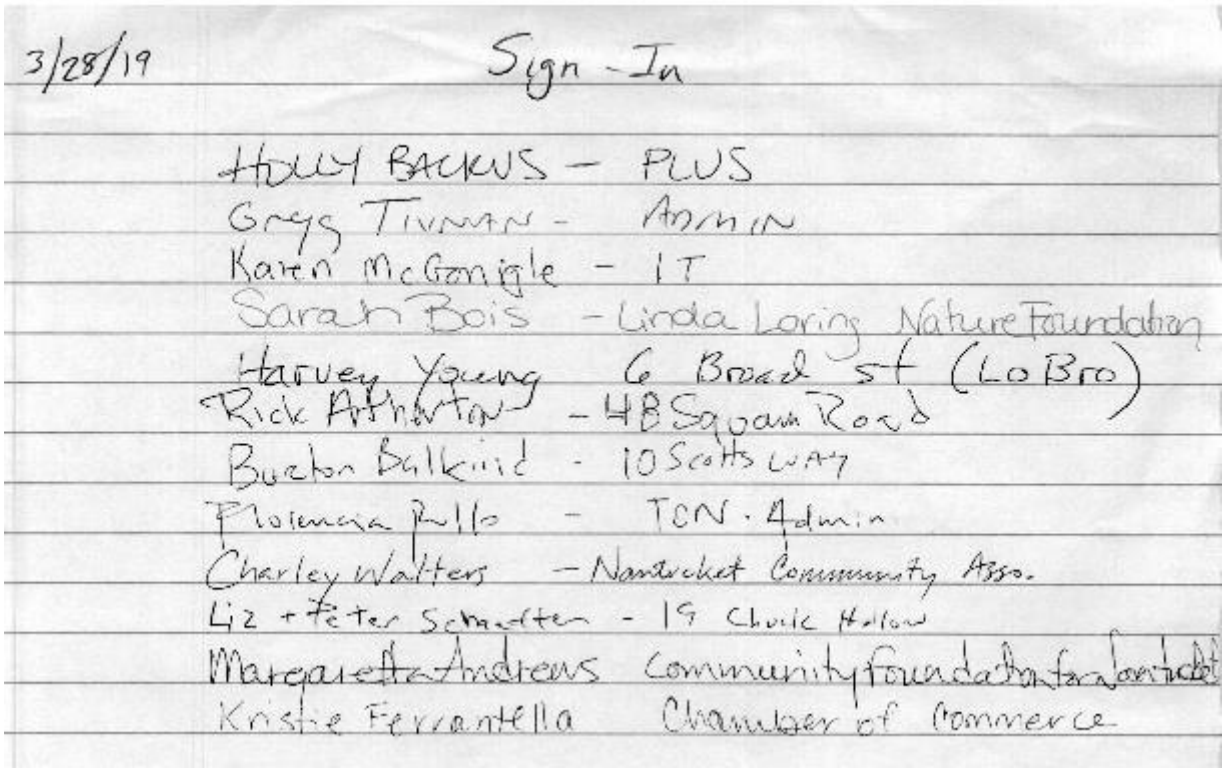
        - Identify places to create wetlands and/or open natural areas that will buffer storm surges and coastal flooding. Open natural areas can include grass parks that will retain flood waters during high tide events and storm surges (examples include the Land Bank park on Easy St).
        - Identify and protect current open, undeveloped areas that can be used to retain and mitigate flood waters.
- Vulnerabilities (pg: 14)
    - The Environmental Section of this was very broad brush and pared down compared to the information provided in the other sections and particularly compared to the discussions that were presented in the meeting. To capture both the discussion and the importance of environmental resources to the economy of Nantucket and as a resource to mitigate coastal vulnerability I would recommend adding more information under headings to this section:
        - Coastal Wetlands: Discuss the importance of salt marshes to mitigate storm surge and provide habitat to support Nantucket's fisheries. Vulnerability to sea level rise and severe storms. Loss from development and a limitation of this habitat to respond to sea level rise through migration due to surrounding development.
        - Rare Resources: Nantucket is home to federal and state-list rare plants, wildlife and insects as well as home to unique and globally rare habitats. Many of these places are located along the shore and in areas vulnerable to many of the hazards listed in this plan. In some cases, the Town and local homeowners are mandated by federal law to protect these resources.
        - Fisheries and Shellfish: These industries are both historically and currently important for Nantucket. Direct impacts to these resource areas come through impacts to our harbors through run off, over development, non-point source pollution as well as habitat destruction. Often loss of coastal habitats such as salt marshes and coastal wetlands can have strong negative impacts on fisheries and shellfish populations.
- Comments on the broad plan for both clarity and accuracy as it related to Nantucket specific events, locations and natural resources.
    - Pg4: Recent Hazard Events: The top paragraph of the page outlines hazards experienced as a result of the October 2017 storm, particularly on the West End of Nantucket and there are some inaccuracies in presenting the impacts of that storm. The storm did not "erode a channel that exposed Millie's bridge and its embankment to scour". Rather, extreme sand displacement filled in the pond and covered existing salt marsh causing daily tides to shift closer to the southwestern side of Millie's Bridge". Additionally, the bridge is not "more vulnerable to direct wave action". There is very little wave action on this area of Hither Creek even during storm events. It is, however now exposed to daily tidal fluctuations which may lead to scour although that has not yet been observed.
    - The rest of this paragraph goes on to discuss movement of houses resulting from erosion. This would be better served and better represent the discussion from the meeting by moving all of this to a new bullet section under Other Hazard Concerns. This bullet could focus on Coastal erosion impacting houses, roads and other infrastructure around the island.
    - Pg 8: The paragraph that highlights Downtown as the primary area of geographical concern needs to state that seas-level rise is one of the primary hazards.
- Table 3: Hazard-Relevant Assets and Systems
    - The Roads section is missing Wauwinet Rd and Madaket Rd

- The Bridges section should be Bridges/Culverts as many of those areas identified are not actually bridges. Additionally, Eel Point Rd is mentioned? No bridges or culverts on Eel Point rd.
- Sea Level Rise needs to be added as a Hazard Threat to the following Assets or System: Ferries, Airport, Wildlife, and Historic/Cultural Resources. Coastal Flooding should be d to Great Ponds.
- The Asset: Solid Waste is confusing as this term is often used to refer to sewage. We would be better served using Trash/Recycling Streams
- Coastal Water resources: Nantucket Harbor should be listed.
- Fisheries and Shellfish should list all of Nantucket Harbor and Madaket Harbor as important island resources. Additionally, our near shore areas as well.
- Coastal Resources should list Sever storms as a Hazard Threat. Additionally, some specific locations are missing or non-existent. Shawmut Coastline does not exist on Nantucket. Monomoy, Shawkemo, Polpis and Coatue Coastlines can be removed and consolidated into Nantucket, Polpis and Madaket Harbor coastal areas. Additionally, Coastal sandplain grasslands (Nantucket's globally rare grasslands) should be added as a Coastal Resource.
- The Asset Wildlife should be Rare Wildlife and Plants and should include rare birds, insects, and plants at both the state and federal level.

Burton Balkind

- I wasn't able to attend the workshop in January, and tonight's presentation was very informative and the community feedback seemed on point. I particularly liked the 5 top priorities actions that were presented tonight.

Attendees at the MVP Listening Session



3/28/19 Sign-In

HOLLY BACKUS – PLUS
Greg Tivman – Admin
Karen McGonigle – IT
Sarah Bois – Linda Loring Nature Foundation
Harvey Young 6 Broad St (LoBro)
Rick Atherton – 48 Squam Road
Burton Balkind – 10 Scotts Way
Florencia Pullo – TCN · Admin
Charley Walters – Nantucket Community Asso.
Liz + Peter Schaeffer – 19 Chuck Hollow
Margaretta Andrews Community Foundation for Nantucket
Kristie Ferrantella Chamber of Commerce