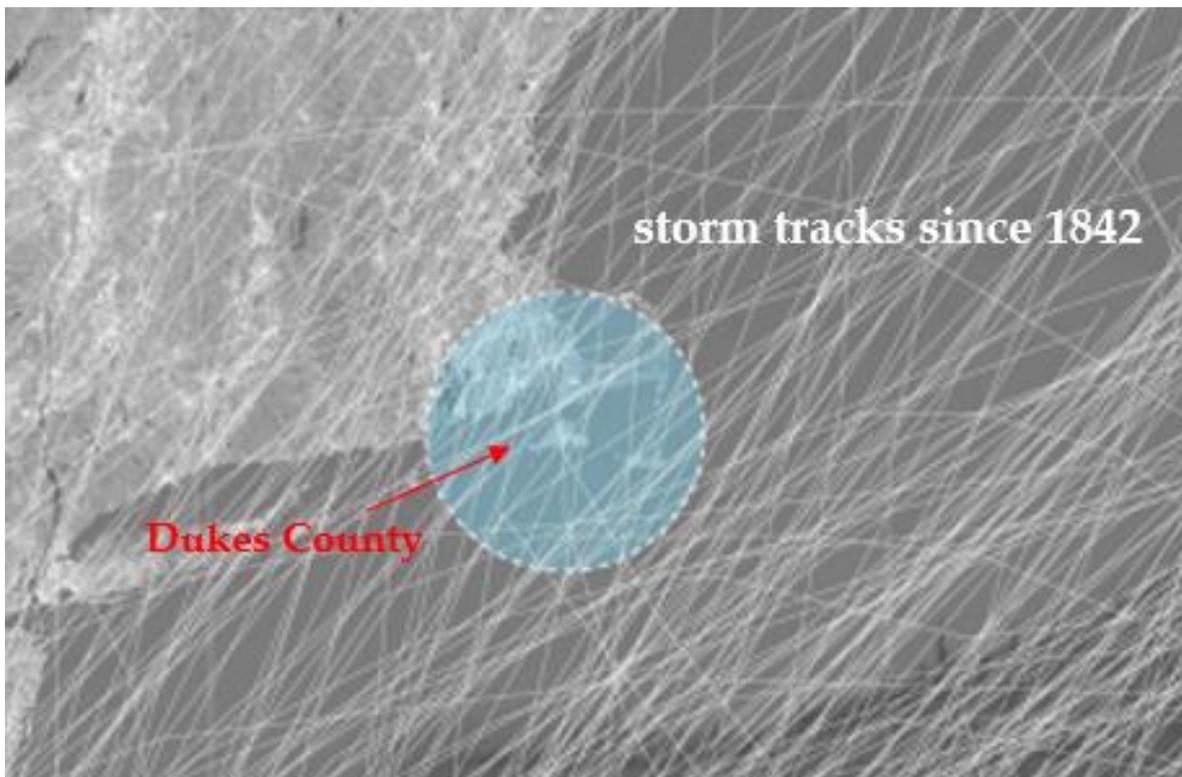


Dukes County Multi-Jurisdiction Hazard Mitigation Plan Update 2021



October 2021

Prepared by:

The Martha's Vineyard Commission

**In conjunction with the emergency managers and planning teams of
the seven Dukes County towns**

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ACKNOWLEDGEMENTS

This plan was prepared with the input and guidance of Hazard Mitigation Planning Teams representing the seven towns in Dukes County. Those representative planning teams were led by:

Aquinnah	Gary Robinson, (former) Emergency Manager (replaced by Forest Filler)
Chilmark	Tim Carroll, Town Administrator
Edgartown	Alex Schaeffer, Fire Chief
Gosnold	Seth Garfield, Fire Chief
Oak Bluffs	Chief Rose (succeeded by John Schilling in interim capacity), former Fire Chief
Tisbury	John Crocker (replaced Erik Meisner), Harbormaster
West Tisbury	Russell Hartenstine (replaced John Christensen), Emergency Manager

This report was prepared by staff of the Martha's Vineyard Commission:

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Dan Doyle, Special Projects Planner..... Editing, Research

Cover photo of storm surge by United States Geological Survey

EXECUTIVE SUMMARY

Development of a Hazard Mitigation Plan is important in order to prepare a community for the natural hazards that every community faces sooner or later. By being adequately prepared, the community has a chance to cut its losses, in terms of both safety and hardship. An approved Pre-Disaster Mitigation Plan brings the community eligibility for funding for implementation of the mitigation measures included in the plan.

The Hazard Mitigation Plan for the seven Dukes County towns was prepared by planning teams consisting of emergency managers and other stakeholders representing the seven towns. The towns include Aquinnah, Chilmark, Edgartown, Oak Bluffs, Tisbury and West Tisbury on Martha's Vineyard; and the Town of Gosnold, encompassing all of the Elizabeth Islands. Staff from the Martha's Vineyard Commission coordinated the planning and produced the report and maps. Funding for Aquinnah was provided by Massachusetts Municipal Vulnerability Preparedness (MVP).

Martha's Vineyard and the Elizabeth Islands are no strangers to natural hazards, particularly flood hazards. Hurricanes strike rarely, but with extensive damage done in a few short hours. Nor'easters strike more frequently, last longer, and are responsible overall for more damage and shoreline erosion and modification. Dam failure is a potential flood threat in the Town of West Tisbury alone. Heavy rainfall events have become prevalent and are expected to continue so. Drought is a potential threat to all the communities, particularly to those with public water supplies. Wildfire is a potential natural hazard, particularly where development meets forest land (the wildland-urban interface).

Vulnerability is determined by the threat of a natural hazard striking a particular location, and what level of intensity may be expected. As of February 27, 2020, 172 claims have been filed under the National Flood Insurance Program (NFIP), totaling \$1,786,323. Of that total, 17 properties have been responsible for 42 of those claims, and Section 4 outlines the types of properties which have suffered repetitive losses due to flooding. Critical facilities were identified, with many of those found to be vulnerable to flood damage. Most of the properties found vulnerable to flooding are critical water-dependent facilities such as ferry terminals.

Vulnerability to wildfire is determined by proximity of development to forested lands, and fuel type. Much of Martha's Vineyard is potentially vulnerable, and there is no wildfire management plan outside of the State Forest.

Planning to protect the towns includes shore protection strategies such as beach nourishment, drought mitigation in the form of improved water supply infrastructure, and an outreach campaign to better prepare homeowners and homeowners' associations with wildfire defense strategies.

Section 1. Introduction

Purpose:

A Hazard Mitigation Plan examines the hazards likely to impact the community, assesses the vulnerabilities associated with those hazards, and makes recommendations on ways to mitigate the negative effects of typical hazards.

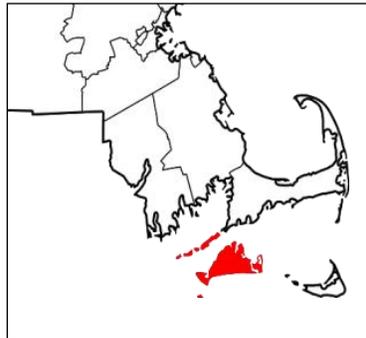
The actions recommended in the plan should translate into savings; fewer lives lost, less property destroyed, and minimal disruption to essential services. An additional impetus for planning is that communities with approved Hazard Mitigation Plans are eligible for federal funding for the implementation measures named in the plan.

The vulnerability assessments presented in Section 5 provide valuable numeric support for the communities needs for funding from FEMA and other sources.

In order to prepare a Hazard Mitigation Plan, hazards and critical facilities are identified, vulnerability assessed, and actions recommended mitigating the vulnerability. The first Hazard Mitigation Plan was approved in May, 2008. That plan was updated in 2015. This is an update to the 2015 plan.

Section 2. Community Profile

The seven towns of Dukes County consist of islands off the southeast coast of Massachusetts. All of the islands owe their origin to glacial activity, with resultant hilly, morainal areas of boulders, gravel, sand and clay, drained by a very few streams. The remainder of the land mass consists of outwash plains spreading out from the morainal areas. The outwash plains are flat or gently sloping lands made of highly porous sand and gravel. A number of great ponds are found where the outwash plains meet the sea, most fronted by barrier beaches. Travel to and between the islands and the mainland is entirely by boat or plane.



locus

Seven towns comprise Dukes County, including Martha's Vineyard and the Elizabeth Islands, lying several miles west across the waters of Vineyard Sound. Although the islands are perhaps best known as recreational destinations, there is also significant island life year 'round. The year 'round residents tend to be independent but with strong community interest and response in need. Most of the population inhabits the largest island, Martha's Vineyard. The Vineyard's year-round population of 17,000 swells to more than 79,000 on a summer day, when the Vineyard becomes a destination for summer residents, vacationers, and relentless multitudes of visitors.

Gosnold is the town that encompasses the Elizabeth Islands, a chain to the northwest of Martha's Vineyard. As of the 2010 census, the town population was 52, the least populous town in Massachusetts. Most of the residents live in the village on Cuttyhunk Island, while most of the land in Gosnold is owned by the Forbes family.

DRAFT Estimated Average Summer Population - (2010 Census)

	Aquinna	Chilmark	Edgartown	Oak Bluffs	Tisbury	West Tisbury	Total
Year-round	311	866	4,067	4,527	3,949	2,740	16,460
Guests of Year - round	102	281	1,265	1,415	1,262	848	5,173
Seasonal / Vacationers	1,708	5,762	16,342	11,243	6,144	4,803	46,002
Transients							
lodging rooms	18	106	1,114	786	396	56	2,476
on boats			408	504	600		1,512
camping					432		432
Day Trippers			500	3,000	2,500		6,000
Cruise Passengers				1,000			1,000
Total	2,139	7,015	23,696	22,475	15,283	8,447	79,055

- Year-round population as reported by 2010 US Census.
- Guests of Year-round residents estimated as an average of 0.70 person for each of the 7,329 year-round households
- Seasonal Residents / Vacationers include second-home owners and renters who visit for a week or more. They are estimated as an average of 4.77 people for each of the 9,644 seasonal housing units, based on the results of a survey carried out by the Oak Bluffs Planning Board. It is estimated that about two-thirds of these are seasonal residents.
- Transients stay on-island for less than a week. Estimations assume two people per room and 100% occupancy for July and August in the Island's 1238 lodging rooms, hotels, inns and B&Bs. The Edgartown, Oak Bluffs and Tisbury Harbor Masters estimated 3 or 4 people per boat and occupancy rates between 80% and 100% for the 468 boats that can be accommodated on slips and moorings in these three harbors. Camping is based on an average of 3 people per tent and 80% summer occupancy for the Island's 180 campsites in the MV Family Campground.
- Day Trippers arrive and leave the Vineyard on the same day. Estimates assume two-thirds of the peak passenger ferry ridership of 10,000 on peak summer days are day-trippers and the others stay for a longer period. Allocation among towns is based upon port of entry.
- Cruise Passengers are day trippers. Assumes one cruise ship with a capacity of 1,000 people in harbor on a peak day; in 2010, most cruise ships came in the spring and fall. Allocation among towns is based upon port of entry.
- Methodology by Christine Flynn.

Source: MVC, 2013

Note that the latest official census data is from 2010. The vulnerability assessments in Section 5 use estimates as recent as the 5-year average 2013-2017, for those estimates. The official census data is used here.

DUKES COUNTY POPULATION (2010 Census)			
Town	Total	American Indian (or combination)	
Aquinnah	311	114	36.7%
Chilmark	866	9	1%
Edgartown	4,067	68	1.7%
Gosnold	75	1	1.3%
Oak Bluffs	4,527	153	3.4%
Tisbury	3,949	85	2.2%
West Tisbury	2,740	42	1.5%
Total	16,535	472	2.9%

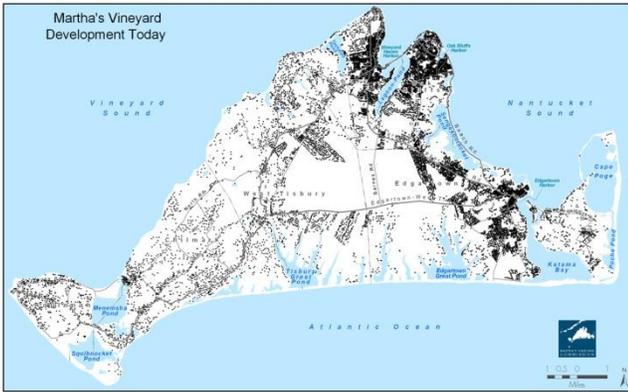
On Martha’s Vineyard, covering 87 square miles, the three “down-island” towns of Tisbury, Oak Bluffs and Edgartown are more densely inhabited and include village centers with modest commercial activities, much of which is focused on the waterfront of each.

The “up-island” towns of West Tisbury, Chilmark and Aquinnah are comparatively rural and sparsely populated.

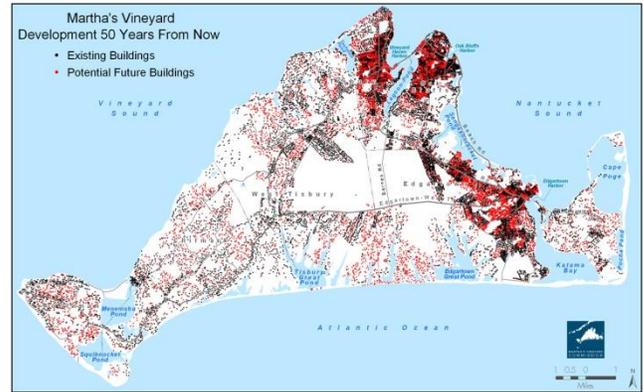
The Martha’s Vineyard Commission has identified how many houses are presently on the Vineyard and projected how many houses would be built on the Vineyard in the next forty-five years, if current zoning is maintained and past rates of construction continue. The pace of development has surged and receded in the past, but is fairly steady of late, and its steady pace is expected to continue for the next 5 years. Census data from 2020 should be available for the 2026 update.

Since the 2015 Update, development has continued in hazard prone zones. In sum, the communities across Dukes County are more vulnerable today than they were six years ago. Short of a moratorium or prohibition of development in these zones, nearly all forms of development compound vulnerability. More homes now exist in these areas, as do commercial structures in many municipalities. The increase is more striking in the residential sector. Furthermore, there has been a minor uptick in a couple indices within the County’s hazard index.

This heightened vulnerability has been somewhat offset by the 2016 codification of the 2013 preliminary Flood Insurance Rate Maps (pFIRMs), making flood insurance compulsory for hundreds of homeowners who now find their dwellings mapped in an expanded 100 year floodplain (the 2013 vintage was used in the 2015 vulnerability analysis). In turn, the consequences for these homes should they be flooded during a storm event have been mitigated through newly acquired insurance policies since the 2015 report. There also recent instances where the Martha’s Vineyard Land Bank has purchased properties in vulnerable zones with the dedicated purpose to undevelop the parcels’ structures, promote public access and return them to natural splendor. This eliminates the risk of hard assets for these sites, yet this scenario is far outpaced by development trends that continue to place infrastructure in high stakes zones.



Present development on Martha's Vineyard



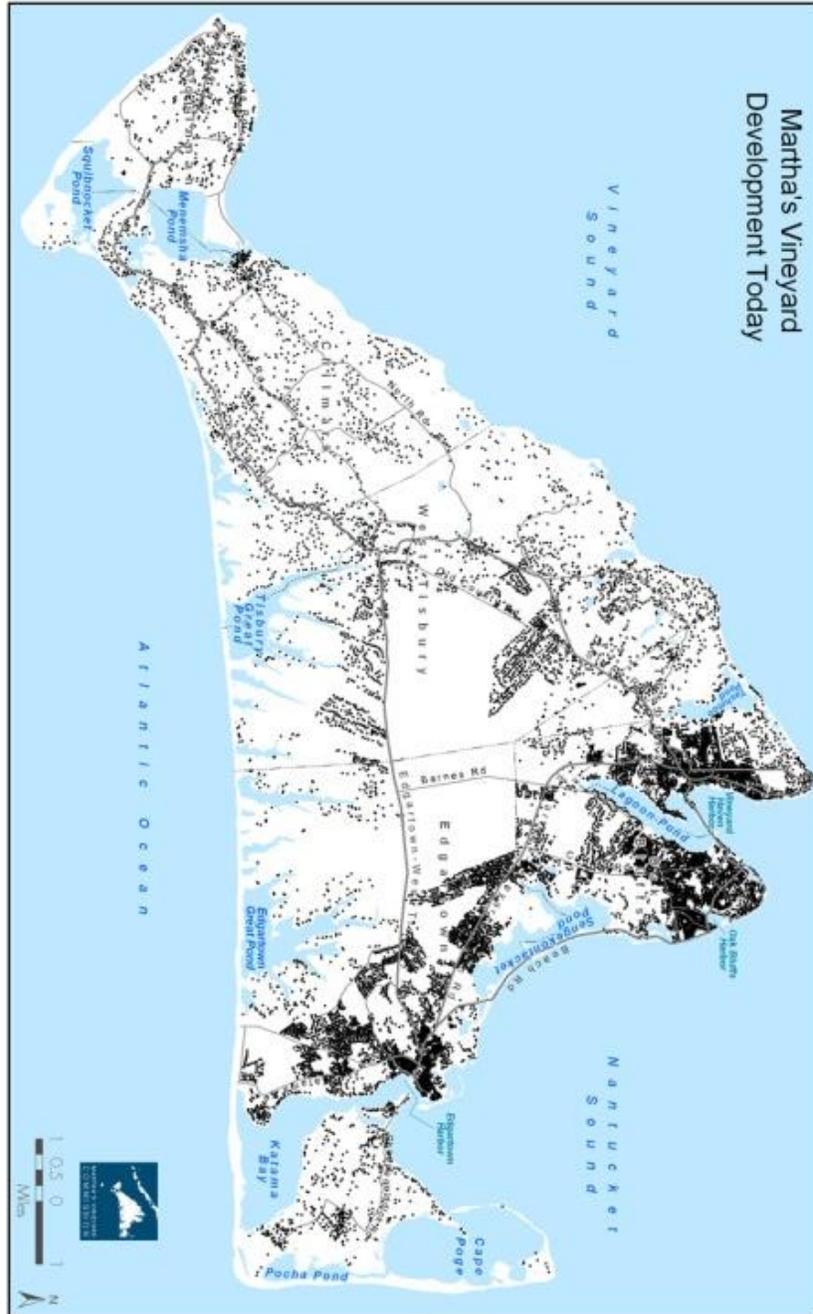
Projected development on Martha's Vineyard

The table below corresponds to the two maps above, showing the numbers represented by the above graphics. The maps are shown expanded in size on the following pages.

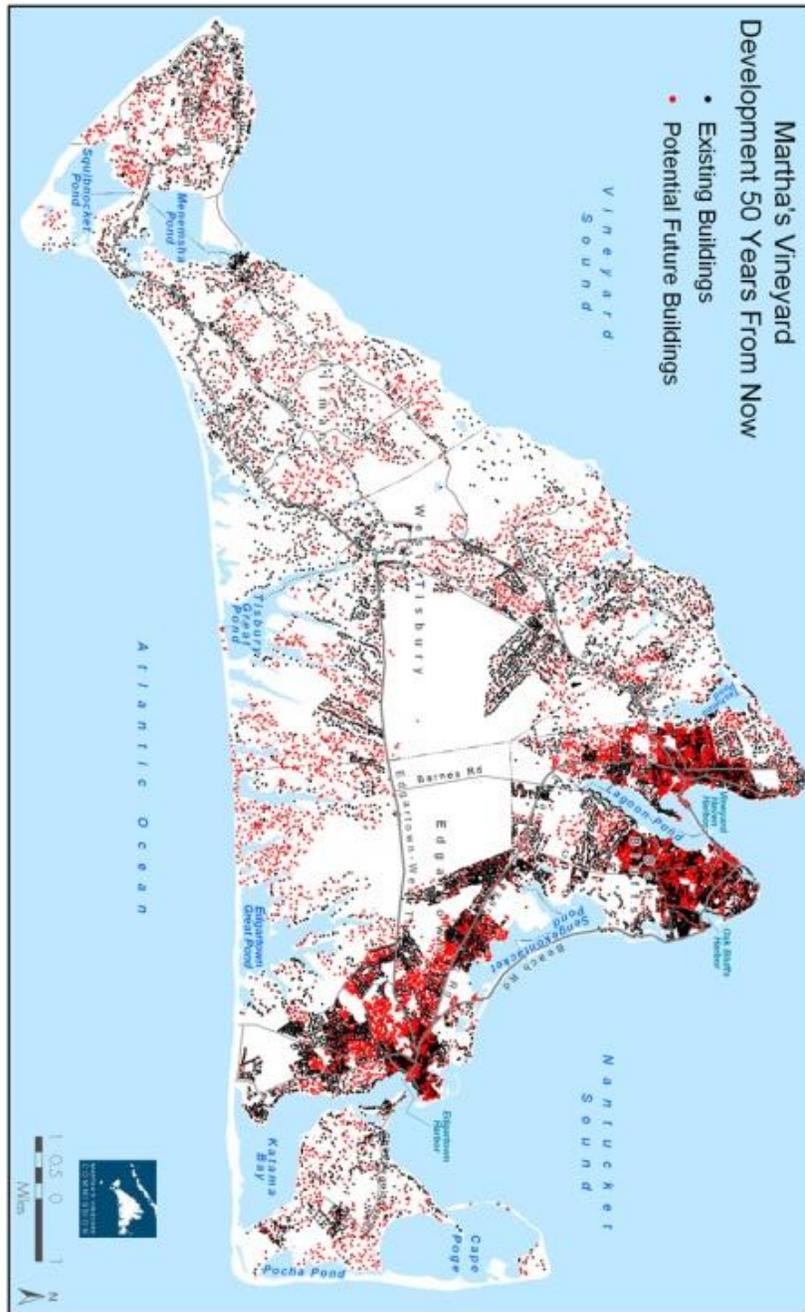
Projection of Future Development				
	<i>Houses Today</i>	<i>Projected New Houses in 45 Years</i>	<i>Projection in 45 Years</i>	<i>Projected Increase</i>
<i>Aquinnah</i>	503	450	946	89%
<i>Chilmark</i>	1,609	750	2,054	47%
<i>Edgartown</i>	5,233	2,944	7,561	56%
<i>Oak Bluffs</i>	4,378	1,342	5,159	31%
<i>Tisbury</i>	3,091	1,400	4,201	45%
<i>West Tisbury</i>	2,219	1,150	3,248	52%
	17,033	8,036	23,169	47%

Note: It does not account for limits on potential development on some properties from conservation restrictions or agricultural restrictions. Nor does it account for possible additional development on properties with comprehensive permits or zoning changes.

Martha's Vineyard Development to Date:



Martha's Vineyard Development projected 50 years.



Section 3. Plan Update Development

During the 5 years since the 2015 plan update, every opportunity was taken to present relevant parts of the plan and to promote the mitigation actions. By the end of the planning period, one mitigation action has surfaced as a great need with the support of all 7 towns. MVC is in the implementation phase of a grant issued by MEMA to complete a Community Wildfire Protection Plan for all 7 towns, with the outside wildfire planning expertise of a consultant (examples of this type of assessment may be found in Section 5 for Gosnold). Local match has been secured.

Much of the vulnerability data has not changed much since 2015, other than updating for buildings and people (estimates). The exceptions are the Sea Level Rise (SLR) assessments and Wildfire-Urban Interface. New SLR projection materials became available in April, 2020, and are used here. For wildfire risk, new land use data (enhanced imagery) issued in 2016 allowed for more insight into a town's true exposure.

The Planning Boards play the primary regulatory review role across the towns, while the Conservation Commissions, Zoning Boards of Appeals, and Historic District Commissions also play a role in certain types of developments. The Martha's Vineyard Commission regulates Developments of Regional Impact. There are numerous state and federal entities that have purview over certain developments depending on their respective location and scope.

Much of the plan development was accomplished through the Massachusetts MVP Program¹ (Municipal Vulnerability Preparedness), and the entities noted above frequently had representation at the program's workshops. Indeed, the events included a much wider assemblage of stakeholders than for the original and first update. The first plan was made with only emergency managers participating. No one else was interested or able to comfortably discuss unfortunate natural hazards. For the 2015 update, a wider net was cast. Town decision-makers were invited to participate, and did so; including Selectmen, Conservation Commissioners and staff, Fire and Police personnel, among others. For the 2021 update, the next step was to include more and more stakeholders, introducing the general public to hazard planning. Along came the Massachusetts MVP program.

The MVP framework was designed to do just what was planned for the 2021 update, involving members of the community outside the usual rarefied atmosphere of first responders and the hallowed halls of decision-makers. Neighboring town representatives, state program administrators, and regional leaders were often invited to these Community Resilience Building workshops. For instance, Aquinnah invited both town leadership in Chilmark and numerous Wampanoag Tribal members to their CRB workshop. This was particularly fitting given a number of municipal staff are also members of the Tribe. West Tisbury and Chilmark took an even more collaborative approach in achieving MVP certification as a joint, inter-municipal effort. The other towns did not document the same level of outreach but all of them were joined by regional entities operating across the locales.

¹ <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

All 7 Dukes County towns participated in the program, and the reports are referenced elsewhere in this text. The MVP workshops were particularly helpful in updating the prioritization of actions. Furthermore, the general public was invited to Listening Sessions for all seven towns; at these sessions they reviewed priority mitigation actions and had the chance to provide additional input toward this compilation.

In short, the report explains the important role other townspeople and local stakeholders played in their respective town community resiliency work by virtue of the State's Municipal Vulnerability & Planning CRB workshops. The list of individuals who participated in these workshops can be found in each [MVP Summary of Findings report](#).

The draft plan was made available on the MVC website on May 4, 2020. This draft was submitted to MEMA representatives on that same day. However, the draft that included the full vulnerability assessment was submitted to MEMA representatives on March 12, 2021, following a unanimous vote to approve the plan at the preceding day's Regional Emergency Managers meeting. MEMA and FEMA issued their formal Approval Pending Adoption on August 12, 2021 and the MVC website was then updated with that edition of the report. FEMA issued their final approval of the Plan on October 15, 2021, following the adoption of all seven towns within the County.

Section 4. Hazard Identification, Assessment, and Vulnerability

(Note: the vulnerabilities associated with each of these hazards are addressed town-by-town in the next section.)

FEMA defines a natural hazard as “an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss”².

Wind & Flood Related Hazards:

The flood-related hazards historically and potentially impacting Dukes County include hurricanes, nor’easters, coastal erosion and shoreline change, heavy rainstorms and thunderstorms, and dam breaches. The wind-related hazards include hurricanes, nor’easters, winter storms and tornadoes.

Coastal Storms (Nor’easters):

Nor’easters are low pressure centers with sustained winds of 10-40 mph and gusts up to 70 mph circulating in a counter-clockwise fashion in our hemisphere (just as hurricanes do). The storms are typically large in lateral extent, with a radius as much as 1,000 miles, and travel up the east coast with a speed of about 25 mph. Nor’easters are frequent visitors to our shores, striking at least once or twice in any year. In March of 2018 alone, there were three that pummeled the county. Although these storms don’t have the punch of hurricanes, they last longer, typically 3 days, as often the storms will stall over New England, bringing significant damage and peril.

There is often little warning to prepare for these storms, in comparison with the ample warnings that typically precede impending hurricanes. Because of greater frequency and duration, nor’easters have been responsible for more overall damage than hurricanes here. A number of Nor’easters are particularly well-remembered for their damage to our area, including the 1898 gale “The Portland Storm”, the Blizzard of ’78, the October ’91 storm “The Perfect Storm”, and the Blizzard of 2013 “Nemo”. Also, the Patriot’s Day storm of 2007 is remembered for breaching Norton Point Barrier Beach.

Significant modification of the coastline may take place during these storms, as evidenced by the breach that occurred at Norton Point Beach during the April 2007 storm, and by at least one other breach during a January 1886 storm. Some such breaches occur during hurricanes, but the ingredients are just as likely to be present during a nor’easter, with water piling up on the bay side of the barrier beach with enough hydraulic head to create an opening.

The duration is important in determining the damage wrought by these storms. Significant coastal erosion may take place if high tides and wave action continue for several days, as in the following photos taken at Sylvia State Beach on December 19 and 20, 1995.

² FEMA, First Edition 1997, *Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy*



Sylvia State Beach, December 19, 1995



Sylvia State Beach, December 20, 1995

Nor'easters most often strike in winter, and excessive snowfall may accumulate, although that is usually not an issue in our community. The Blizzard of '13, "Nemo", was an exception, involving both heavy snow and high winds and waters. Icing can be a very real danger to vessels and their crews, and has historically been responsible for significant loss of life, particularly in the heyday of coastal shipping, with a number of reports of sailors frozen in the rigging.

Henry Norton wrote this account of the 1898 Nor'easter, also known as the Portland Storm "The most disastrous storm ever known on the island commenced on Saturday night November 28, 1898, and before daybreak of the 29th one of the worst northeast snow blizzards was raging. Vineyard Haven harbor was for many ships a port of refuge from the storm. The next morning found over fifty in a wrecked condition. The number of lives lost were few in comparison with the number of ships destroyed, because of the bravery of Isaac C. Norton, Alvin H. Cleveland, Frank Golart, Stanley Fisher and F. Horton Johnson. Cleveland and Golart, with Norton as captain, dared the wind and sea in a dory. They first went out to the schooner Hamilton, which was ashore near the breakwater, rescuing five sailors. The boat was unable to make the western shore so they went across the harbor, landing near the Standard Oil tanks. The half-frozen sailors were taken to Chadwick's blacksmith shop where they were revived sufficiently to be conveyed to the Marine Hospital. A schooner was ashore near the old Norris wharf at Eastville. The people on land could see the men in the rigging. The dory was launched again, with Fisher, Johnson and Cleveland as crew, Norton in command. This time the dory was towed far to the windward of the schooner and let go by a tug. They managed to get to the Thurlow and save five men, one having frozen in the rigging. These sailors were taken to homes at Eastville where they received the best of care. By this time the storm was at its height, and against the judgment and protest of all, Norton, Cleveland and Golart went out the third time and rescued five more sailors, thereby showing the daring and bravery for which their forefathers were noted when they came to this cold and inhospitable climate and made their homes."³

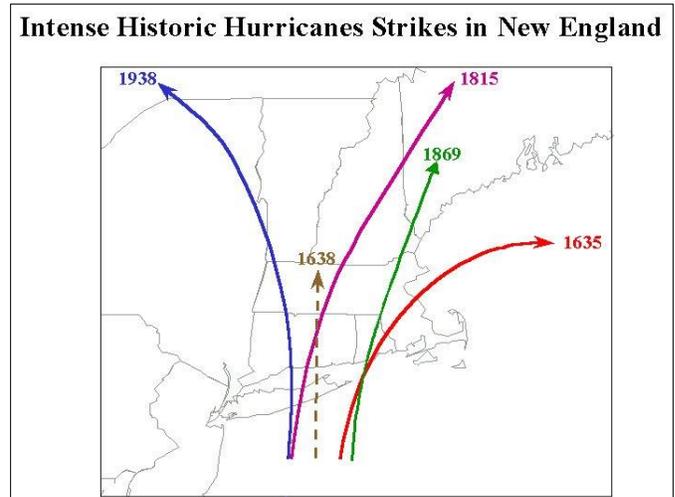
According to MEMA (Massachusetts Emergency Management Agency), there was one State of Emergency⁴ declared for a coastal storm, since 2015. This dangerous storm occurred on March 3-6, 2018.

³ *The History of Martha's Vineyard*, 1923, Henry Franklin (H.F.) Norton

⁴ <https://www.mass.gov/service-details/state-of-emergency-information>

Hurricanes and Tropical Storms (Tropical Cyclones):

Hurricanes and tropical storms are formidable storms, a number of which have visited the islands making up Dukes County. Hurricanes are powerful storms with winds of 74 – 200 MPH circulating counter-clockwise about a relatively calm eye. Tropical storms are the same (often literally the same storm varying in intensity) with wind speeds 39-73 MPH. North Atlantic hurricanes and tropical storms typically form in the Caribbean or off the coast of Africa and will continue to grow and strengthen as long as they are over water of at least 79 degrees surface temperature, drifting towards our East Coast on the Trade Winds until



Intense Historic Hurricane Strikes⁵

being steered to the north by the prevailing offshore winds. So, the storms which don't enter the Gulf of Mexico are turned up the East Coast, and the storms which reach the vicinity of Dukes County are frequently moving north at substantial speeds, which may add significant forward speed to the wind speed within the system. The forward speed of the 1938 (Great New England) hurricane is believed to have been in excess of 50 MPH. The most damage is likely on the right shoulder of the storm, eastward of the eye, where the forward speed adds to the wind speed. The speed with which the hurricanes move through our area increases the intensity, causing further damage, but also moves the storms quickly through and thus reduces the impacts when compared to the damage caused by a long-term pounding. Our area will typically be impacted with hurricane-force winds for about 6-12 hours.



Sandy trackline (Wikipedia)

In 2012, Hurricane Sandy formed in the Western Caribbean and reached Category 3 sustained winds of 115 mph before making landfall on the New Jersey coast as an extra-tropical cyclone. Many hurricanes tracking up the Atlantic coast tend to veer off into the ocean, but Sandy was diverted into the coast by conditions in the Jet Stream. Sandy's high winds and high water caused significant damage on Martha's Vineyard and the Elizabeth Islands even though landfall occurred several states away. The proximity of catastrophic damage was a humbling experience for Vineyarders, even as local damage was assessed.

⁵ <http://www.geo.brown.edu/georesearch/esh/QE/Research/CoastStd/NEHurric.htm>

The strength of a hurricane is rated by its wind speed, according to the Saffir/Simpson Scale:

Scale No. (Category)	Winds (mph)	Potential Damage
1	74-95	Minimal
2	96-110	Moderate
3	111-130	Extensive
4	131-155	Extreme
5	>155	Catastrophic

21st century⁶

“So far in the 21st century four tropical cyclones have made [landfall](#) in New England. The first was Tropical Storm Hermine in 2004 which affected southeastern Massachusetts with minimal damage. In 2006 Tropical Storm Beryl struck [Nantucket](#), again with minimal damage. Tropical Storm Barry in 2007 made landfall as a remnant extratropical storm which caused heavy rainfall and flooding. In 2009 Tropical storm Danny made landfall in New England as an extratropical storm. Hurricane Irene weakened to a tropical storm before striking Connecticut. It caused significant damage in New England, especially in Connecticut and Vermont. Hurricane Sandy did not make landfall in New England, but never-the-less caused severe local damage.

Storm	Category		Season	Date of landfall
	Peak intensity	Intensity at landfall		
Tropical Storm Hermine	Tropical Storm	Tropical Storm	2004	August 31, 2004
Tropical Storm Beryl	Tropical Storm	Tropical Storm	2006	July 21, 2006
Tropical Storm Barry	Tropical Storm	Extr. Storm	2007	June 4, 2007
Tropical Storm Danny	Tropical Storm	Extr. Storm	2009	August 29, 2009
Hurricane Irene	Category 3	Tropical Storm	2011	August 28, 2011”

Also, Hurricane Sandy, landfalling several hundred miles away, produced flooding from 10/27/12 – 11/8/12, such that a federal disaster declaration was made, including Dukes County⁷

⁶ http://en.wikipedia.org/wiki/List_of_New_England_hurricanes

⁷ *Commonwealth of Massachusetts State Hazard Mitigation Plan, 2013*, Prepared by The Massachusetts Emergency Management Agency (MEMA) and the Department of Conservation and Recreation (DCR)

HURRICANES IN SOUTHERN NEW ENGLAND (TWENTIETH CENTURY)⁸

NAME	DATE	INTENSITY
Unnamed	7/21/1916	CAT 1
Unnamed	9/21/1938	CAT 3
Unnamed	9/14-15/1944	CAT 3
Carol	8/31/1954	CAT 3
Edna	9/11/1954	CAT 3
Diane	8/18-20/1955	TS
Donna	9/12/1960	CAT 2
Belle	8/9-10/1976	CAT 1
Gloria	9/27/1985	CAT 2
Bob	8/19/1991	CAT 2
Bertha	7/12-13/1996	TS
Floyd	9/18/1999	TS

Records are available for the most recent hurricanes and tropical storms. Note that our area has not been visited by a category 3 storm since 1954. Significant development has occurred since that time, creating greater potential for safety and property risks.

In addition to the records, there’s anecdotal information (stories) that bring our collective memory back a few more years. Trap fisherman Captain Norman G. Benson told this tale of the intensity of the 1938 hurricane at Lambert’s Cove, undoubtedly referring to storm surge "Right at that moment, I see another big sea comin' in, much higher even than the first one. It was so big I never seen anythin' like it. I dropped the boat an' quick as I could I ran up a high bank just behind where I'd been standing. Even so, I got soaked by the wave, but I was high enough so it didn't knock me down. That sea took the boat I'd been hauling an' the bath house an' all the other boats, too. It tipped 'em up and raised 'em way up in the air an' crunched 'em all to pieces, an' when the wave went out, away they went, bath house an' boats an' all. And down along the whole Cove it was like that. It took six houses an' all the boats that had been there every single one of them. Next day, Franklin an' I walked the beach, an' we never found a trace — not even a trace o' them — not a stick!"⁹

To remember the earliest storms, we have only the stories, in stark contrast to the meticulous documentation of modern storms. In 1891, Sidney Perley wrote about damage from the “Gale” of 1815 (In the 19th century, the term “hurricane” was used interchangeably with “tornado”, and “Gale” referred to what we call a Hurricane.)“...caused more damage than any other since the settlement of the country....just how many lives were lost, many of them being those of husbands and fathers, and how much property was destroyed cannot be ascertained. Neither can anyone know how many fond hopes were forever blasted, how many changes in life and its plans were caused, nor the pain of body and heart that followed.” He wrote of the intensity of the wind “The gale swept away buildings of all sizes and varieties from churches to sheds, unroofed an exceedingly great number of others, and damaged many thousand more to a greater or less extent. On the roofs of some of the structures shingles were stripped off in rows

⁸ Vallee, D. *A Centennial Review of Major Landfalling Tropical Cyclones in Southern New England* (Available at www.erh.noaa.gov/er/box/tropical_cyclones.htm)

⁹ *Saltwater in My Veins*, 1972, Tales by Captain Norman G. Benson Trap Fisherman of Martha’s Vineyard as told to William L. Peltz 1972

from the eaves to the ridge-poles. In some places the air seemed to be full of shingles and fragments of timbers and boards, forced hither and thither by the blasts”... and of the tremendous numbers of trees felled “Probably New England never knew another season of such building activity as prevailed in 1817 and 1818, the logs having been sawed in the winter of 1815-16, and the lumber seasoned during the following summer”...and of the vessels lost “At New Bedford, all the vessels in the port, except two, were driven ashore, and several of them beaten to pieces. One ship was left on a wharf, and another one on one of the islands. All the warehouses on the lower wharves were swept off, many houses being injured, and four men and women perished.”

The most damaging and dangerous flood impacts by far are caused by storm surge. Storm surge waters come up very suddenly with the landfalling storm, with enough force to remove structures from their foundations and with enough surprise to endanger those unfortunate enough to be trapped by the quickly rising waters. In 1900, in what has come to be known as the “Galveston Hurricane”, the entire island city of Galveston, Texas was submerged by storm surge, taking about 8,000 lives. More recently, thousands of lives were taken by Hurricane Katrina in 2005. Closer to home, but farther back in our history, a powerful hurricane in 1635 brought storm surge measured at 20 feet in Boston. The new colonists who survived to rebuild must have harbored second thoughts about settling here. The perseverance of the settlements, with such calamity so soon after arrival, says a lot about the courage and determination of the settlers. Storm surge from the 1938 hurricane, known as the “Great New England Hurricane”, was about 9 feet in open areas and more like 15 feet in Narragansett Bay and Buzzards Bay, where the funnel-shaped topography compounded the surge with a sloshing affect.



In this USGS photo of storm surge, the damaging power of this type of flood is readily apparent.

Hurricanes have been responsible for significant coastal modification as well. It was during the “Gale” of September, 1815 that the location of the inlet to Lagoon Pond shifted from near Ferry Boat Island (named for the old crossing), at the other end of the barrier beach, to its present position at the drawbridge (Although known as the “Gale” of 1815, this storm was a hurricane. Writers of the day used the term “gale” for what we call a hurricane and “hurricane” interchangeably with “tornado”). Norton Point Beach, most recently breached by the April 2007 Nor’easter, has been repeatedly breached by hurricanes, in 1938 and 1954, and in 1991 (a minor breach that restored itself within several days).

Vulnerability to Coastal flooding from storms (hurricanes and Nor'easters):

According to the Massachusetts DCR Flood Hazard Management Program, the following National Flood Insurance Program policies are in effect and claims have been made for properties in Dukes County. Note that the costs for the NFIP are borne partially by the property owners and partially by the U.S. taxpayers at large.

POLICY STATISTICS AS OF FEBRUARY 27, 2020

Community	V-Zone	A-Zone	No. Policies	Total Coverage	Total Premium
Aquinnah	1	3	20	\$6,717,100	\$44,975
Edgartown	8	210	508	\$149,525,300	\$621,452
Gosnold	0	2	8	\$2,621,200	\$5,760
Oak Bluffs	6	89	237	\$76,679,200	\$447,885
Tisbury	4	71	166	\$54,502,600	\$355,505
West Tisbury	0	3	40	\$13,379,900	\$26,101
Totals:	19	378	979	\$303,425,300	\$1,501,678

Note: Chilmark does not participate in the NFIP and has 0 policies and claims.

LOSS STATISTICS AS OF FEBRUARY 27, 2020 (repeat claims documented through May 5, 2021)

Community	Losses #Claims	Payments Total Paid	Repetitive Loss (R.L. properties (resdt'l)	R.L. properties (non-resdt'l)
Aquinnah	3	\$23,517	1	0
Edgartown	37	\$650,870	3	1
Gosnold	1	\$2,215	0	0
Oak Bluffs	61	\$852,110	7	2
Tisbury	24	\$257,609	2	1
West Tisbury	0	0	0	0
Totals	172	\$1,786,323	13	4

Note:

Chilmark does not participate in the NFIP and has 0 policies and claims. As recently as September 1, 2015, the Board of Selectmen took a vote to remain outside of the NFIP program.¹⁰

During the discussion, the Selectmen and others focused on two main reasons to stay out:

- The Menemsha waterfront includes fishing shacks and facilities that would not retain the same character or charm if they were elevated, as would happen in the event of a major storm in a community with a floodplain by-law.
- Most of Chilmark’s homes are not vulnerable, and the Selectmen are opposed to subsidizing the risk of a few wealthy property owners with U.S. tax dollars.

¹⁰ <http://vineyardgazette.com/news/2015/09/08/chilmark-reaffirms-decision-not-join-federal-flood-program?k=vg5447f8da9364f>

It is interesting to note that 13 repetitive loss properties have been responsible for 42 of 171 claims (25%) and for 57% of the dollar value of the claims, all for private residences and businesses. In one case, five claims were filed for a single business property, totaling \$257,803.72.

In the following section, vulnerabilities are presented town-by-town. Note that there are two different flood hazard representations, both on the maps and in the statistical summaries. The 100-year and 500-year storm areas are those that would be covered by still flood waters, probably most relevant to a nor'easter type of storm. Those flood hazard areas are shown on the FIRM maps (Flood Insurance Rate Maps) and are used to price flood insurance policies and by others such as mortgage lenders to determine risk. The FIRM maps are used in the local Floodplain regulations that enable those communities to participate in the National Flood Insurance Program (NFIP). The maps have recently been updated to utilize better topography through the recently-available LIDAR data for our area. The updated flood elevation data reflect recent Sea Level Rise as well.

With the FIRM maps, there is no indication of the impacts of storm surge in the event of a landfalling hurricane. Storm surge vulnerability is addressed in the SLOSH maps. The SLOSH (Sea, Lake and Overland Surges from Hurricanes) maps were made by modeling storm surge, which is often the most destructive part of a hurricane and the first quick hit that would impact critical resources and imperil citizens very early and quickly in the event of a hurricane landfall in the area. Elevation at a particular location is only part of the storm surge vulnerability. Topography is very important in determining risk. Low-lying areas with long, gentle slopes are likely to be impacted by the funneling effect of the storm surge, almost like a tidal wave. This is readily apparent upon examination of the maps. An excerpt here shows the funneling effect of storm surge on the coves of Tisbury Great Pond, with the blue indicating inundation.

The SLOSH hazard areas are noted by hurricane category (1,2,3,4). These maps (see appendix) are models only, for planning purposes. The only true and accurate map of storm surge is made after the hurricane has come and gone.

In the statistical summaries to follow by town, vulnerabilities are examined with respect to both floodplain (100, 500-year storms, Nor'easters) and storm surge (hurricanes). Vulnerabilities of critical facilities were determined for both types of flooding, for all the towns. It is important to note that most of the flood-vulnerable facilities are water-dependent critical infrastructure such as ferry terminals. In addition, statistics were developed regarding numbers and assessed values of buildings vulnerable to storm surge, for all towns, and assessed values.



Excerpt of SLOSH map

Coastal Erosion and Shoreline Change:



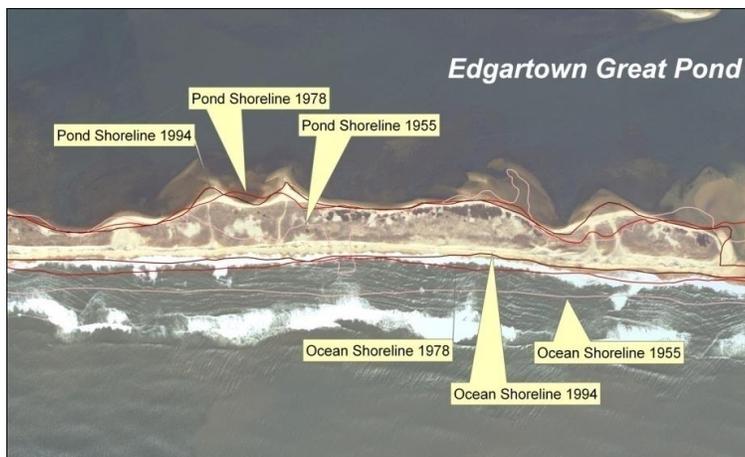
Although the more dramatic incidents of shoreline modification occur as results of violent storms, most erosion happens very quietly as the result of day-to-day coastal processes. Banks erode every day in response to wave action, rain runoff and inappropriate development. The unconsolidated sediments that make up a coastal beach are much more mobile, and beaches are features that change with each tide. Wave runup sets the sand in motion, and currents pick up the suspended sand and move it laterally

along the beach in a process called longshore transport. Beach sand moves offshore for the winter as well, when more intense wave action pulls the sand away from the beach into offshore bars, only to return with the more gentle waves of summer, to rebuild the beach. Erosion is most often not a life-threatening condition, but the economic impacts are significant in a community that relies on its harbors for almost all its transportation needs and where the prosperity of the inhabitants is linked very closely to the summer vacation industry. Above, the red line marks the former extent of popular Pay Beach in Oak Bluffs.

Coastal structures play an important role in the impacts of erosion. A number of important breakwaters and jetties have been constructed in the community, particularly in connection with navigation and harbor protection. Maintenance and improvement of these structures is critical to the infrastructure of the islands.

Vulnerability to Coastal Erosion and Shoreline Change:

Due to sea level rise and general subsidence of the land, most of the shoreline of Dukes County is erosional. Parts of Martha's Vineyard, in particular, are eroding faster than others. The north shore, including the north sides of Aquinnah, Chilmark, West Tisbury, and most of Tisbury and Oak Bluffs, is relatively stable, with headlands and bluffs of morainal sediments, losing a foot or so each year. The sandy south shore, however, experiences much more loss and movement of the unconsolidated sandy outwash plain sediments. Longshore transport takes sand from the Aquinnah and Chilmark bluffs and moves it along the coast to Muskeget Channel. Erosion rates on the south side range from a foot or so per year at the Gay Head cliffs to more than 10 feet per year at the Edgartown end. Some spots are more dynamic than others, apart from the overall outcome of the play between accretion (building up) and erosion (losing ground). Wasque Point



This shoreline in Edgartown loses about 10-12 feet every year.

on Chappaquiddick is a good example, with interaction in a breach-and-heal cycle at Norton Point barrier beach.

Although the south shore is more dynamic and loses more, it is really the more developed north shore harbors and beaches that are more vulnerable to damaging erosion, particularly where inlets have been stabilized by jetties that interfere with the longshore transport of sand, and must therefore be properly constructed and maintained. Much of the older infrastructure was built by the U.S. Army Corps of Engineers or the Commonwealth, and has not been properly maintained, or in some cases was never completed. An example is the stone dike on Canapitsit Beach, Cuttyhunk, Town of Gosnold, where the USACOE is returning some 40 years later with plans to complete this important project to protect the navigational channel into Cuttyhunk Harbor. In some cases, the older structures were not built with the best configuration to get the job done.

Examples are the Oak Bluffs Harbor jetties (below left), where reconfiguration of the dogleg on the northeast jetty would greatly improve the protection in the event of a storm, and Lake Tashmoo inlet (below right), where reconfiguration of the southernmost jetty could greatly improve storm protection afforded the boats sheltered there.



Shoreline change, Oak Bluffs Harbor entrance



Shoreline change in the area of Lake Tashmoo showing shorelines from 1955, 1978 and 1994 and 1978 (CZM data)

In the 2018 Mass. State Hazard Mitigation Plan¹¹, several shorelines are singled out as “coastal erosion hotspots”:

- Wasque Point, Edgartown
- Inkwell Beach, Oak Bluffs
- Barges Beach, Gosnold

¹¹ <https://www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan>

Dam Failures:

Hadlock Pond Dam, in Fort Ann, New York, failed in 2005. Similar in scale to our local sites, the pond was enlarged by the dam to 220 acres.

There were no casualties, but lots of property damage.



Damage from Hadlock Pond Dam failure, Fort Ann, NY

Although much of the terrain is well-drained outwash plain sediments, and streams are few, there are some dams in Dukes County, at least in West Tisbury and Chilmark, remnants of our early use of hydrologic power (for the colonists' mills).

Vulnerability to Dam Failures:

The Office of Dam Safety rates dams in accordance with what kind of damage could be done by failure:

Significant Hazard: Dams located where failure or misoperation may cause loss of life and damage home(s), industrial or commercial facilities, and secondary highway(s) or railroad(s) or cause interruption of service of relatively important facilities.

Low Hazard: Dams located where failure or misoperation may cause minimal property damage to others. Loss of life is not expected.

- There are 12 dams in West Tisbury; 11 are rated low to moderate risk and 1 is rated significant risk (Mill Pond Dam). Failure or misoperation of the Mill Pond Dam presents a risk to the adjacent Edgartown-West Tisbury Road.
- There are also 4 dams in Chilmark; all are rated low to moderate risk.

Heavy Rainstorms and Thunderstorms:

Heavy rain generates stormwater runoff that has significant potential for localized flooding and for erosion of beaches and other waterfront areas where the collection system outlets, particularly for systems which discharge directly to a water body with no treatment. The thunderstorms which are common in our area in the spring and summer may bring flash flooding and also damaging winds and lightning. According to the National Weather Service, a thunderstorm is severe if it produces hail at least 3/4 inch in diameter, brings winds of 58 mph or greater, or has the potential to produce a tornado.

Vulnerability to Heavy Rainstorms and Thunderstorms:

NOAA has recorded a number of severe hailstorms and thunderstorms with wind in our area. All occurred in spring or summer, with the exception of one thunderstorm which occurred in January, 1999

at Martha’s Vineyard Airport (a critical facility). Hailstorms were recorded in Tisbury in 1997 and in Oak Bluffs in 2000. Thunderstorms were recorded in Tisbury, Oak Bluffs, Edgartown and West Tisbury. According to NOAA, between 1973 and 2017, there have been 8 fatalities and 145 injuries in all of Massachusetts. Climate change has begun and will continue to bring about a change in precipitation patterns that includes more short-term droughts punctuated by heavy downpours. This is quite a change from the gentle summer rains that Vineyarders are used to. According to the International Panel on Climate Change¹², “Extreme precipitation events over most of the mid-latitude land masses and over wet tropical regions will very likely become more intense and more frequent by the end of this century, as global mean surface temperature increases”. According to MEMA in the State Hazard Mitigation Plan¹³, Southern New England experiences 10-15 days per year with severe thunderstorms. The following table is from the Massachusetts Climate Change Clearinghouse.

Projections for Heavy Rainfall¹⁴

Martha’s Vineyard Basin		Observed Baseline 1971-2000 (Days)	Projected Change in 2030s (Days)	Mid-Century Projected Change in 2050s (Days)	Projected Change in 2070s (Days)	End of Century Projected Change in 2090s (Days)
Days with Precipitation Over 1”	Annual	6.65	+0.31 to +1.75	+0.55 to +2.90	+0.50 to +3.12	+0.78 to +3.36
	Winter	1.22	-0.13 to +0.55	-0.05 to +0.62	-0.02 to +0.99	-0.04 to +1.18
	Spring	1.72	+0.22 to +0.61	+0.12 to +0.93	+0.34 to +1.04	+0.36 to +1.06
	Summer	1.82	-0.32 to +0.58	-0.04 to +0.76	-0.26 to +0.68	-0.41 to +0.68
	Fall	1.89	-0.26 to +0.75	-0.14 to +0.99	-0.17 to +0.86	-0.19 to +1.27
Days with Precipitation Over 2”	Annual	0.52	-0.01 to +0.37	+0.03 to +0.34	+0.05 to +0.45	+0.07 to +0.57
	Winter	0.08	-0.06 to +0.13	-0.05 to +0.14	-0.03 to +0.14	-0.02 to +0.24
	Spring	0.03	-0.01 to +0.10	-0.01 to +0.13	+0.00 to +0.12	-0.01 to +0.17
	Summer	0.25	-0.04 to +0.09	-0.01 to +0.12	-0.01 to +0.11	-0.02 to +0.17
	Fall	0.16	-0.03 to +0.14	-0.02 to +0.13	-0.01 to +0.16	-0.03 to +0.27
Days with Precipitation Over 4”	Annual	0.03	+0.00 to +0.02	-0.03 to +0.04	-0.03 to +0.06	-0.03 to +0.08
	Winter	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Spring	0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00	+0.00 to +0.00
	Summer	0.00	+0.00 to +0.02	+0.00 to +0.03	+0.00 to +0.02	+0.00 to +0.03
	Fall	0.03	-0.03 to +0.01	-0.03 to +0.03	-0.03 to +0.03	-0.03 to +0.07

The projections for expected number of days receiving precipitation over one inch are seasonably variable for the Martha’s Vineyard basin, fluctuating between loss and gain of days.

- The *winter* season is generally expected to see the highest projected increase.

¹² *Approved Summary for Policymakers, 2013, Contribution of Working Group 1 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

¹³ <https://www.mass.gov/files/documents/2017/01/mp/massachusetts-state-hazard-mitigation-plan.pdf>

¹⁴ <http://www.resilientma.org/>

- The *winter* season is expected to see an increase in days with precipitation over one inch of 0-1 days by mid-century, and of 0-1 days by the end of century.
- The *spring* season is expected to see an increase in days with precipitation over one inch of 0-1 days by mid-century, and of 0-1 days by the end of century.

Tornadoes, Waterspout, and Downbursts:

Tornadoes and waterspouts form when thunderstorms develop a spinning circulation that gets tipped upright. According to the State Hazard Mitigation Plan¹⁵, the most destructive tornado ever to strike New England was the Worcester tornado of 1953. With wind speeds of 200 to 260 mph, the F5 tornado took 94 lives and holds the rank of 20th deadliest tornado in the United States.

Tornado damage is measured by the Enhanced Fujita scale. The Enhanced F-Scale and Enhanced F-Scale Damage Indicators are illustrated following:

THE ENHANCED F-SCALE						
Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest ¼ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gusts (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over -200

¹⁵ <https://www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan>

ENHANCED FUJITA SCALE DAMAGE INDICATORS			
No.	Damage Indicator	No.	Damage Indicator
1	Small barns, frames outbuildings	15	School – 1-story elementary (interior or exterior halls)
2	One or two-family residences	16	School – junior or senior high school
3	Single-wide mobile home	17	Low-rise (1-4 story) building
4	Double-wide mobile home	18	Mid-rise (5-20) building
5	Apt, Condo, townhouse (3 stories or less)	19	High-rise (over 20 stories)
6	Motel	20	Institutional bldg. (hospital, govt. or university)
7	Masonry Apt. or motel	21	Metal building system
8	Small retail building (fast food)	22	Service station canopy
9	Small professional (Doctor office, Bank)	23	Warehouse (tilt-up walls or heavy timber)
10	Strip Mall	24	Transmission line tower
11	Large shopping mall	25	Free-standing tower
12	Large, isolated (big box) retail building	26	Free standing pole (light, flag, luminary)
13	Automobile showroom	27	Tree – hardwood
14	Automobile service building	28	Tree – softwood

Waterspouts are tornadoes that form over water, and are rare in our area. Harmless water devils are sometimes seen in our waters on hot days, similar to dust devils on land. More capable of damage, downbursts (including microbursts and macrobursts) are localized columns of sinking air, with wind speeds up to 75 mph.

Vulnerability to Tornadoes:

Tornadoes are found all over the world, but not with the intensity and destruction known in the United States. Fortunately, this American icon tends to spare our part of the world, and Dukes County is at low risk for tornadoes. There is, however, record of a single tornado that struck in the Katama plains area of Edgartown in 1951. The last tornado creating an emergency declaration¹⁶ in Massachusetts was on June 1, 2011.

Tsunamis:

A tsunami is a series of traveling ocean waves of extremely long wavelength, usually caused by displacement of the ocean floor by seismic or volcanic activity, sometimes by underwater landslides. Because of the extremely long wavelength, these waves tower up into massive walls of water when they “feel bottom” approaching nearshore shallows. They can come onshore with waves as high as 100 feet.

Tsunami threats to our area may come from local earthquakes, earthquakes across the Atlantic, or landslides on the Canary Islands in the eastern Atlantic Ocean. Historically, runup was recorded in 1668,

¹⁶<https://www.mass.gov/service-details/state-of-emergency-information>

1755, and 1929 in the Boston area. In 1879, a wall of water appeared in the channel between Nantucket and Tuckernuck Islands, resulting in one injury.

Vulnerability to Tsunamis:

In the *2018 State Hazard Mitigation Plan*¹⁷, vulnerable lands and facilities are considered to be those **within 1 mile of the coast**. According to that Plan, the following vulnerabilities were estimated for Dukes County:

- Population Exposed to the Tsunami Hazard: 12,947 persons
- State-owned and Leased Buildings and Value: 5 bldgs. & \$10,269,171
- Critical Facilities: 2
- Bridges: 2 (1 State & 1 Local)
- General Building Stock Replacement Cost Value Exposed to the Tsunami Hazard: \$6,091,295

Extreme Temperatures: Although the Commonwealth of Mass. 2018 State Hazard Mitigation Plan addresses extreme high and low temperatures as a natural hazard, by some standards this will not be considered a significant threat to the Dukes County towns. Yet a 2.5 to 5.8 degree rise in temperatures could certainly pose a sizeable risk to the segment of our older population that lacks air conditioning. This will be despite the moderating influence of the Atlantic Ocean which makes local temperatures warmer in winter and cooler in summer, relative to the rest of the Commonwealth.

The temperature changes expected from climate change will also have marked impacts on flora, fauna and habitat. Growing seasons for crops, native and exotic plants, and the fauna relying on them, will all change. Loss of enough cold winter dormancy will, for instance, make for loss of cranberry growth. Unfortunately, cranberry plants do not produce berries without about 1,700 – 2,000 hours of chill (temperature between 32 and 45 degrees F). The need is described by the University of Massachusetts Cranberry Station: “Temperate fruit crops have a chilling requirement - the need for exposure to some number of hours of cold conditions - in order to properly develop flower buds and fruit. This chilling exposure also contributes to the development of winter hardiness...Chilling requirement for cranberry appears to be ~1700-2000 hours below 45F in MA field conditions¹⁸.” Projections for future cranberry growth are detailed in the Wampanoag Tribe of Gay Head (Aquinnah) Hazard Mitigation Plan Update 2019, because of the significance of cranberry harvest to the Tribe. Similar projections and assessments could tell similar unfortunate stories for other valuable species and for unwelcome species.

¹⁷ <https://www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan>

¹⁸ http://www.umass.edu/cranberry/cropinfo/ipmmessage_2012.html

Projections for change in temperature, below, are from the Massachusetts Climate Change Clearinghouse¹⁹

Projections of Changes in Temperature

Martha's Vineyard Basin		Observed Baseline 1971-2000 (°F)	Projected Change in 2030s (°F)	Mid-Century Projected Change in 2050s (°F)	Projected Change in 2070s (°F)	End of Century Projected Change in 2090s (°F)
Average Temperature	Annual	50.57	+1.78 to +3.34	+2.36 to +5.15	+2.73 to +7.40	+3.03 to +9.05
	Winter	32.43	+1.67 to +3.50	+2.36 to +5.17	+2.71 to +7.14	+3.00 to +8.68
	Spring	46.63	+1.50 to +3.02	+1.93 to +4.88	+2.29 to +6.62	+2.57 to +7.24
	Summer	68.8	+1.77 to +4.04	+2.64 to +5.83	+3.11 to +8.48	+3.63 to +9.86
	Fall	54.13	+1.83 to +3.62	+2.86 to +5.52	+2.75 to +7.94	+3.12 to +9.68
Maximum Temperature	Annual	58.82	+1.68 to +3.38	+2.21 to +5.11	+2.45 to +7.37	+2.77 to +8.91
	Winter	40.56	+1.45 to +3.47	+1.98 to +4.71	+2.40 to +6.84	+2.70 to +8.22
	Spring	54.9	+1.35 to +2.87	+1.72 to +4.61	+2.02 to +6.38	+2.21 to +7.11
	Summer	77.06	+1.66 to +4.02	+2.49 to +5.82	+3.02 to +8.37	+3.41 to +9.58
	Fall	62.48	+1.75 to +3.50	+2.70 to +5.51	+2.69 to +7.73	+2.91 to +9.69
Minimum Temperature	Annual	42.31	+1.89 to +3.41	+2.60 to +5.32	+3.01 to +7.44	+3.30 to +9.14
	Winter	24.3	+1.94 to +3.62	+2.71 to +5.61	+3.12 to +7.76	+3.47 to +9.19
	Spring	38.35	+1.52 to +3.21	+2.24 to +5.16	+2.40 to +6.85	+2.75 to +7.38
	Summer	60.53	+1.92 to +4.06	+2.80 to +5.87	+3.16 to +8.52	+3.84 to +9.96
	Fall	45.78	+1.86 to +3.70	+2.95 to +5.60	+2.81 to +8.08	+3.33 to +9.89

- The Martha's Vineyard basin is expected to experience increased average temperatures throughout the 21st century. Maximum and minimum temperatures are also expected to increase throughout the end of the century. These increased temperature trends are expected for annual and seasonal projections.
- Seasonally, maximum summer and fall temperatures are expected to see the highest projected increase throughout the 21st century.
 - Summer mid-century increase of 2.5 °F to 5.8 °F (3-8% increase); end of century increase of 3.4 °F to 9.6 °F (4-12% increase).
 - Fall mid-century increase of 2.7 °F to 5.5 °F (4-9% increase); end of century increase by and 2.9 °F to 9.7 °F (5-16% increase).
- Seasonally, minimum winter and fall temperatures are expected to see increases throughout the 21st century.
 - Winter mid-century increase of 2.7 °F to 5.6 °F (11-23% increase); end of century increase by 3.5 °F to 9.2 °F (14-38% increase).
 - Fall mid-century of 3 °F to 5.6 °F (6-12% increase); end of century increase of 3.3°F to 9.9°F (7-22% increase).

¹⁹ <http://resilientma.org/>

Winter-related Hazards:

Snow Events:

Winter storms in our area may be accompanied by rain or by snow, depending on the temperature. If the system stalls, snow may accumulate to troubling depths. A blizzard is a winter storm with sustained or frequent wind gusts to 35 mph or more, accompanied by falling or blowing snow reducing visibility to or below a quarter-mile. These conditions must be the predominant condition over a 3-hour period.

Vulnerability to Snow Events:

Snow events are rarely an issue for the islands. The winters of 2011-12 and 2013-4, and 2015 however, were exceptionally snowy. The last major winter storms in Massachusetts²⁰ were on January 1, 2011, February 8, 2013, January 26, 2015, and February 9, 2015. Although there are sometimes narrow bands of heavier snow even within the relatively small area of Martha's Vineyard and Gosnold, the overall vulnerability to snowfall is the same for the entire area.

Ice:

Ice storms are defined by liquid rain falling and freezing on contact with cold objects, creating ice build-ups of 1/4th inch or more that can cause severe damage. From 1998 to 2017, 28 ice storms occurred in Massachusetts²¹, between November and February, most frequently occurring in late December and early January. Ice storms could cause significant interruption of services such as electricity. Harbor ice can restrict ferry service by blocking the navigational channel, impacting delivery of vital goods and services such as food and fuel. That is a rare occurrence.

Vulnerability to Ice:

Because of the open configuration of Vineyard Haven Harbor, icing severe enough to restrict ferry service is rare. Icing may also be a factor in Edgartown Harbor, where the Chappaquiddick Ferry runs year 'round between Chappaquiddick and Edgartown proper, as the only means of travel, particularly since the April 2007 breach of Norton Point Barrier Beach.

Fire-related Hazards:

Drought:

Drought conditions exist when an area experiences an extended period of deficient water supply. The fire hazards associated with drought are closely associated with the time of year. Drought conditions in spring, when trees have not leafed out, may be particular cause for concern for wildfires.

²⁰ <https://www.mass.gov/service-details/state-of-emergency-information>

²¹ <https://www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan>

Vulnerability to Drought:

Vulnerability to drought is not a localized issue that can be pinpointed to a specific place or time. Unlike the more ephemeral natural hazards that quickly strike and leave, drought takes some time to establish itself and some time to depart. Drought levels intensify from normal conditions through the range of drought advisory, drought watch, drought warning and drought emergency. According to the Massachusetts Department of Conservation and Recreation²², the most recent local drought was part of a statewide event from July, 2016 to April, 2017.

In 2003, the Martha's Vineyard Commission produced *Martha's Vineyard Source Water Protection Project*, which assessed the needs for protection of the three major public water supplies on Martha's Vineyard, in part to be better prepared for emergencies like drought. The report recommended redundancy for the Oak Bluffs and Tisbury water supplies, to be prepared for emergencies, particularly establishing permission and infrastructure to cross the State Forest and possibly to drill wells there. The report recommended similar improvements for Edgartown, and also to add to the overall supply and infrastructure, which was not estimated to be adequate to meet the projected demand. In addition, the report recommended that plans be considered to bring public water supply to parts of Edgartown that are presently served by wells, and for the Town of West Tisbury to consider initiating its first public water supply service (The entire town is presently served by private wells). In order to meet existing demand and unable to use one well because of high iron content, Edgartown has reported pumping all available wells 17-24 hours per day in the summer, with no redundancy available in case of emergency, which condition is expected to continue²³, leaving Edgartown particularly vulnerable to emergencies like drought.

Wildfires:

We are less familiar with wildfires as a hazard, maybe thinking that they are more likely to occur in the vast western wildernesses of our nation. Wildfires have happened closer to home. In 1957, a fire burned 18,000 acres from Carver to Plymouth, burning all the way to the sea, which is the only reason that it stopped. In the first 6 hours, 12,500 acres burned at the rate of 53 acres/minute. For scale, the Martha's Vineyard State Forest is about 5,200 acres (Imagine an area more than twice the size of the State Forest burning in 6 hours). On Martha's Vineyard, between 1867 and 1929, there were 16 fires greater than 1,000 acres, including the largest (known) 12,000 acres in 1916, which burned from West Tisbury to Farm Neck, Ocean Heights and Edgartown. Since then, fires have generally been smaller, as evidenced by a number of brush fires in 2020 which firefighters snuffed out before much spread. The last big fire was in 1965, 1,200 acres from Great Plains to Katama.

This type of natural disaster would strike quickly and with potential for great loss of life and property.

²² <http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/drought-status.html>

²³ Superintendent Fred Dumont, Edgartown Water Department, 2007, personal communication

Vulnerability to Wildfire:

According to the *Commonwealth of Massachusetts State Hazard Mitigation Plan*²⁴ Massachusetts' forests are potential fuels for wildfires...."Particular areas at risk include the Southeastern area of Plymouth County, Cape Cod, and the Islands, where forested areas pose wildland fire and urban interface fire hazards. Sandy soils, which dry out quickly, increase the wildfire risk in this area". The table which follows, *Major fires of Martha's Vineyard, 1855-1999*, lists the major fires that have occurred on Martha's Vineyard, and their locations.

Major fires of Martha's Vineyard, 1855-1999²⁵

Year	Date	Size (ac)	Location
1855	4/7	large	Willis Plain
1864	4/27	4,000	near Lagoon (south central Martha's Vineyard)
1875	7/2	7-10,000	Quompacha Bottom
1883	8/12		Vineyard Haven town fire
1885	4/4	small	Gay Head-Chilmark boundary
1886	5/3	1,000	near Vineyard Haven
1889	3/25	4,000	Quampeche Bottom
1892	4/9	5-8,000	near Middletown
1894	June	large	location unknown
1900	4/27	5,000	Scrubby Neck toward Edgartown
1903	5/18		Inisfail Hotel
1909	7/23	10,000	on Plains
1914	12/25	1,200	western Great Plains to Katama (south eastern Martha's Vineyard)
1916	5/19	12,000	West Tisbury to Farm Neck, Ocean Heights, and Edgartown
1920	8/6		large Vineyard Haven fire
1926	5/14	6,400	West Tisbury toward Ocean Heights
1927	4/30	6,400	from Dr. Fisher Road to Edgartown
1927	5/24	6,400	from Dr. Fisher Road towards Edgartown
1928	4/28	small	Indian Hill Road
1929	4/6	2,500	Watcha to Tiah's Cove, Waldron's Bottom, to Oyster Pond
1929	5/4	2,560	Waldron's Bottom
1929	7/3	small	Tashmoo/Herring Creek
1930	5/10	200	West Chop
1930	5/17	5,000	between Edgartown and Oak Bluffs
1930	6/7	1,000	north to northeast through State Forest
1932			two fires in State Forest
1935	3/30	4,000	Edgartown Great Pond to Katama
1936			8 fires, none in State Forest
1937			Chappaquiddick
1939	4/1	4,000	Quompacha Bottom on Dr. Fisher Road to Vineyard Haven Road
1940	5/18	1,000	State Forest near Edgartown - Vineyard Haven Road
1942	5/27	350	Job's Neck Pond to Jayne's Cove
1942		1,200	near Edgartown Great Pond
1944		240	in State Forest

²⁴ <https://www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan>

²⁵ *The Modern and Historic Fire Regimes of Central Martha's Vineyard, Massachusetts*, 2002, A Thesis Presented by Adam Mouw

1946	4/20	5,120	Head of Tisbury Great Pond towards Edgartown/Oak Bluffs
1948	9/4	300	south & west towards Clevelandtown/Edgartown Airport
1951			10 fires on the Island
1954	4/10	1,000	between Bames Road, Wing Road and Edgartown-Vineyard Haven Road
1954	5/30	2,500	Tiah's Cove, West Tisbury to Edgartown
1954	7/17	100	Chappaquiddick near four comers
1957	4/20	35	near state highway at Deep Bottom
1957	5/4	100	North of Chilmark cemetery, toward Chilmark Pond
1958	6/14		east and north from State Forest
1959	4/25	25	between Old Courthouse Road and state Highway
1959	5/9	500	West Tisbury Road near Deep Bottom
1960	4/23	25	Katama
1963	10/26	300	Quampache Bottom to West Tisbury Road
1965	12/19	1,200	Great Plains to Katama
1971	5/15	20	Oklahoma, Tisbury
1975	4/26	50	Northeast from Edgartown dump
1976	1/1	85	Edgartown: Herring Creek Road to Katama Airfield
1987	8/1	20	Oak Bluffs behind Crosslands Nursery
1987	July	~8	State Forest
1999	July	~16	State Forest, along Edgartown-West Tisbury Rd.

MVC mapped the *Wildland Urban Interface (WUI)* as within 1,000 feet of lands with more than 50 contiguous acres of forest. A specialist is presently undertaking a far more extensive risk assessment for all seven towns. In addition to WUI, other variables impacting risk include fire history, assets at risk, crown fire activity, fireline intensity, flame length, and rate of spread.

Geologic-related Hazards:

Earthquakes:

There have been earthquakes recorded and remembered here. Sidney Perley wrote about the earthquake in 1638, the strongest of the seventeenth century, which shook the new settlements and probably the settlers too, particularly following so closely on the heels of the very intense hurricane of 1635:

“The shaking of the earth increased to such a violent extent that people could not stand erect without supporting themselves by taking hold of posts or pilings and other fixtures. Not only the mainland, but the islands in the ocean were shaken violently, and the vessels that rode in the harbors and those sailing along the coast were acted upon as if a series of tidal waves had passed under them...Earthquakes are always fearful and impressive, but the people of the time when this one occurred must have had many doubts and fears in their minds. They were not only superstitious, but this was a new and unknown world, which but a few years before was pictured with the most awful terrors.”²⁶

There has not been a major earthquake since. Quakes have been felt here as barely noticeable; similar to a large truck passing. An example is the New Brunswick earthquake of 1982, with a magnitude of 5.9 and lasting 30 seconds. It was felt on the islands as a mild rumble, as it was all over the coast of the Northeast U.S. and Canada.

²⁶ *Historic Storms of New England*, 1891, Sidney Perley

Earthquakes occur when a sudden release of energy in the Earth's crust creates seismic waves. The potential for damage is greatest closest to the epicenter and with a great magnitude of quake. The magnitude and the location of the epicenter are measured using seismometers. The magnitude is measured using the Richter scale, with the greatest in historic times measuring slightly over 9. There is no limit to the possible magnitude. Distance from the epicenter is an important factor in damage; distance being significant both laterally and in depth. Shallow earthquakes tend to cause more damage, for instance.

Vulnerability to Earthquakes:

Fortunately, Dukes County is at low risk for damaging earthquakes. Earthquakes may be felt at times, but our location is far from the fault zones where the more damaging quakes are produced. In addition, there is no exposed bedrock to shake. The islands are made up entirely of soft sediments.

Landslides:

Landslides occur when unstable areas slip, due to environmental factors such as rainfall or freeze/thaw action. This hazard is most problematic in developed areas where homes, businesses or roadways may be at risk.

Vulnerability to Landslides:

Minor landslides have occurred in the high sea cliffs of Aquinnah and Chilmark. This is most often due to freeze/thaw action, runoff, or undermining of the cliff by erosion. Fortunately, this type of hazard does not threaten developed parts of the planning area, and it is unlikely that these landslides would pose a safety hazard.

Sea Level Rise:

Sea level fluctuates in response to natural processes such as glaciation and plate tectonics, and in response to man-made influences on the atmosphere. Sea level is rising in our area, with the result that erosion is increasing, and that development and infrastructure in flood-prone areas is more and more at risk.

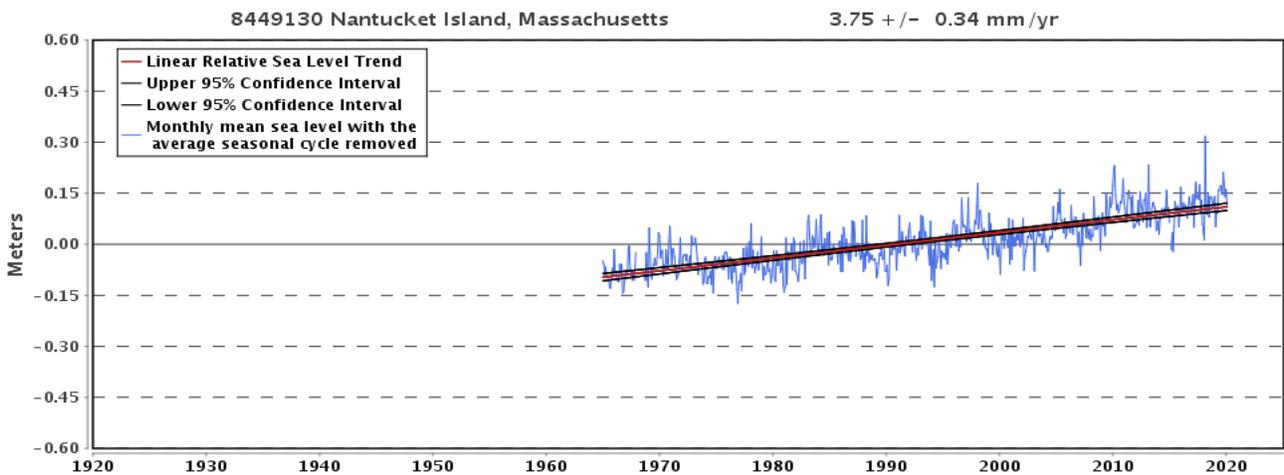
Vulnerability to Sea Level Rise:

For Martha's Vineyard and Gosnold, sea level has been rising since the retreat of continental glaciation some 12,000 years ago. In relatively recent time, sea level rise has accelerated in response to world-wide climate change. Stakeholders and decision-makers want cut and dry answers to the questions "How much?" and "When"? Unfortunately, the science of projection is imprecise. Reports and future projections seem to bring worse and worse news as the atmosphere continues to degrade.

The Record:

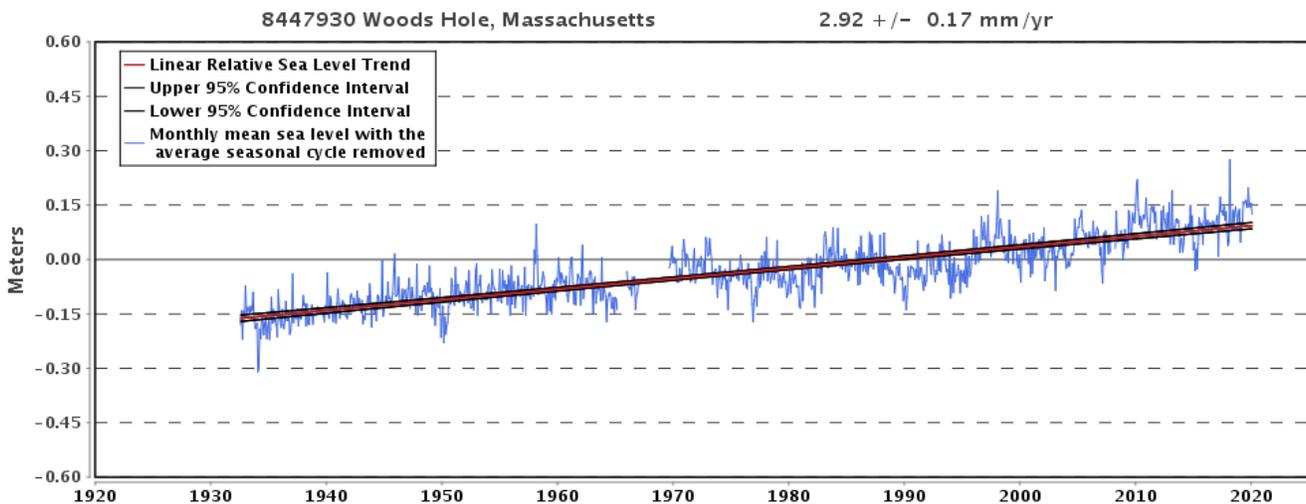
Locally, NOAA has tracked sea level since 1932 at Woods Hole and since 1965 at Nantucket. According to the data, sea level has risen 2.8 millimeters per year at Woods Hole between 1932 and 2012 and 3.75 mm per year at Nantucket between 1965 and 2019. The Woods Hole trend of 2.8 mm per year is 65% more than the world-wide rate of 1.7 mm per year for a similar time period. The Nantucket trend of 3.75 mm per year is 76% more than the world-wide measure of 2.0 mm for a similar time period. There should be no surprise that sea level rise in our part of the world is greater than world-wide. This is due to local subsidence, compared to emergence of other areas of the world.

Mean Sea Level Trend - 8449130 Nantucket Island, Massachusetts²⁷



The relative sea level trend is 3.75 millimeters/year with a 95% confidence interval of +/- 0.34 mm/yr based on monthly mean sea level data from 1965 to 2019 which is equivalent to a change of 1.23 feet in 100 years.

Relative Sea Level Trend 8447930 Woods Hole, Massachusetts²⁸



²⁷ http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8449130

²⁸ https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8447930

The relative sea level trend at Woods Hole is 2.92 millimeters/year with a 95% confidence interval of +/- 0.17 mm/yr based on monthly mean sea level data from 1932 to 2019 which is equivalent to a change of 0.96 feet in 100 years.

Projection:

The Intergovernmental Panel on Climate Change has met and reported on the status of climate change since 1990. I.P.C.C. reports are widely accepted and viewed as conservative. According to IPCC's Special Report on the Ocean and Cryosphere in a Changing Climate²⁹, global mean sea level will rise between .43 m and .84 m by 2100. Some other scientists anticipate more sea level rise than indicated by IPCC. Rahmstorf et al³⁰, acknowledge that the IPCC reports have been accurate as far as air temperature, but suggest that the rise in water temperature, which is what drives sea level rise (thermal expansion), has consistently exceeded the IPCC projections. They suggest that the IPCC projections for the future are similarly understated. Vermeer and Rahmstorf³¹ suggest sea level rise ranging from 75 to 190 cm (2.5 to 6.2 feet) for the period 1990 – 2100.

For planning purposes, it appears prudent to use the Rahmstorf projection. It also appears prudent to use the high emission scenario, because there has been no indication of emissions or energy consumption slowing down or even of the rate of acceleration slowing down world-wide. There isn't yet enough certainty about the likelihood of the various polar cap melting scenarios or their impacts to include a numeric estimate, although that is something that is certain to impact shorelines to some extent, possibly even catastrophically. There is also concern for possible additional sea level rise in our area due to climate-induced changes expected in the nearby Gulf Stream. The projections used here are meant as likely scenarios for use in mapping projections, not as enduring statements of fact. The projections provide a basis for predicting and illustrating the geographic extent of impacts. This should enable the towns and other stakeholders to include this longer-term component in planning for infrastructure investments. Adding at least 4.4 inches/100 years to the Rahmstorf projections to account for local subsidence, the projections for this plan are **18.2 inches by 2050 and 59.4 inches by 2100**. Note that increased acceleration of temperature increase is expected to cause sea level to rise about three times as much in the latter part of this century as in the first part.

The Martha's Vineyard Commission staff prepared a visualization of impacts of sea level rise, which was widely presented and distributed. The visualization appears on the following pages. The purpose is not to accurately project the timing of sea level rise, but rather to use plausible numbers to prepare the visual images that help decision-makers and stakeholders to appreciate the vulnerability that is coming.

²⁹ <https://www.ipcc.ch/srocc/>

³⁰ Rahmstorf et al, 2012, *Comparing climate projections to observations up to 2011* <http://iopscience.iop.org/1748-9326/7/4/044035/article>

³¹ Vermeer and Rahmstorf, 2009, *Global sea level linked to global temperature* <http://www.pnas.org/content/106/51/21527>

Visualizing Sea Level Rise Around Martha's Vineyard

Images prepared by Caitlin Michniewicz, MVC intern 2013

The 2015 update to the Pre-Disaster Mitigation Plan for Dukes County projects about a 1.5' rise in sea level by 2050 for the region and a 5' rise in Sea Level by 2100. The following images are of locations around Martha's Vineyard with predictions of what this type of change in sea level could look like. The images are used to show high tide level estimates.

Some projections show sea level rise added to typical flooding situations around the Vineyard. Those remind us that BOTH flooding and sea level rise will continue.

Some images represent water-dependent facilities such as ferry transfer bridges and boat launches. Planning for them will need to address the continued need to access land from the water (and vice versa).

Some images represent vulnerable infrastructure in the form of roads. Some difficult decisions lie ahead for the future disposition of these vulnerable roads.

NOAA's CANVIS program (available for free download) was used to produce the projected images.

The images are available in slide show format through the following link:

http://youtu.be/hFHgzQzd4_c

Water-dependent facilities are vulnerable to storms as well as to sea level rise, and need to maintain access to rising waters.



This road is the only access to Chilmark and Aquinnah and has been impacted by storm surge in past hurricanes. Rising waters will only add to the vulnerability to storm damage.



Nashaquitsa Pond, Chilmark



1.5' Sea Level Rise



5' Sea Level Rise



Squibnocket Beach, Chilmark

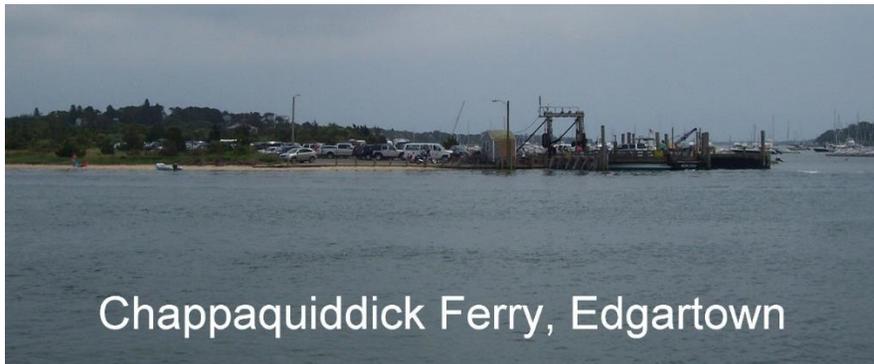
This town beach was only sandy at low tide. The Town of Chilmark has since wisely chosen retreat of the parking, along with removal of the stone revetment.



1.5' Sea Level Rise



5' Sea Level Rise



Chappaquiddick Ferry, Edgartown

The Chappaquiddick ferry will need continued access to the rising waters. The Chappy side is particularly vulnerable to rising sea level because of its flat terrain.



1.5' Sea Level Rise



5' Sea Level Rise



The Boulevard Landing, Edgartown

This popular boat beach is vulnerable due to its flat terrain. Options such as retreat would involve considerable long-range planning.



1.5' Sea Level Rise



5' Sea Level Rise



Dock Street, Edgartown

Typical flooding on Edgartown's waterfront



1.5' Sea Level Rise

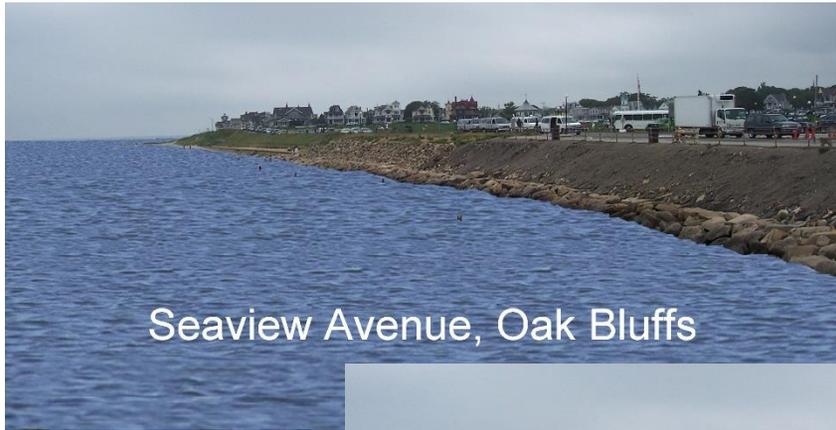
Edgartown's waterfront is the most vulnerable to sea level rise. Most of the infrastructure dates back to the whaling days, and flooding is a routine thing.



Dock Street, Edgartown



5' Sea Level Rise



Seaview Avenue, Oak Bluffs

Sea View Avenue should remain high and dry for some time. Sand supply for the adjacent beaches is and will remain an issue.



1.5' Sea Level Rise



5' Sea Level Rise

Oak Bluffs Harbor is surrounded by bulkhead and is less vulnerable to sea level rise than to storm damage.



Oak Bluffs Harbor Landing



1.5' Sea Level Rise



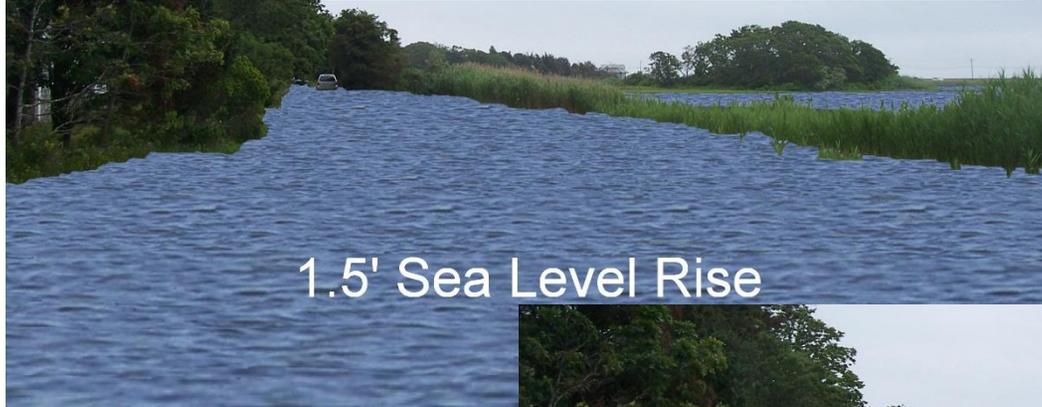
5' Sea Level Rise

Long range planning is needed for many of the most vulnerable roads. For some roads, with a grim prognosis, abandonment may be the only choice.





This road borders a saltmarsh. Decisions about the road will have to include consideration for landward retreat of the marsh.





Vineyard Haven Harbor

**Steamship Authority terminal -
This water-dependent facility provides the only
year 'round passenger and freight passage.**



1.5' Sea Level Rise



5' Sea Level Rise



Five Corners, Vineyard Haven

Typical storm flooding in this major intersection may cause drivers hesitation; nothing like the deterrence that is to come.



1.5' Sea Level Rise



Five Corners, Vineyard Haven



5' Sea Level Rise

This boat service facility straddles Beach Road. Sea level rise will add significantly to typical storm flooding.



Beach Road, Vineyard Haven



1.5' Sea Level Rise



5' Sea Level Rise

Sea Level Rise in a “bathtub” model does not present vulnerability as well as with a model that accounts for sea level rise while assessing vulnerability to flooding from coastal storms (nor’easters) or storm surge from hurricanes. Projections for the Dukes County area have become available, and are used to illustrate vulnerability in geographic extent. This is another helpful presentation, in addition to the elevation illustrations from Canvis (previous pages). Both illustrations are helpful, along with the numerical projections.

MassDOT has prepared more dynamic SLR projections – the MA Coast Flood Risk Model (MA FRM) that incorporates storm flooding - for a more useful vulnerability assessment. The model is described in “Assessing the vulnerability of MassDOT’s coastal transportation systems to future sea level rise and coastal storms, and developing conceptual adaptation strategies”, the report to be released.

Table 1/Figure 1. Sea level rise target values for Boston, MA (feet NAVD88) based on four National Climate Assessment global scenarios with associated probabilistic model outputs.

Relative mean sea level (feet NAVD88) for Boston, MA					
Scenario	Cross-walked probabilistic projections	2030	2050	2070	2100
Intermediate	Unlikely to exceed (83%) under RCP8.5	0.7	1.4	2.3	4.0
	<ul style="list-style-type: none"> Extremely unlikely to exceed (95%) under RCP4.5 Unlikely to exceed (83%) under RCP4.5 About as likely as not to exceed (50%) under RCP4.5 when accounting for possible ice sheet instabilities 				
Intermediate - High	Extremely unlikely to exceed (95%) under RCP8.5	0.8	1.7	2.9	5.0
	<ul style="list-style-type: none"> Unlikely to exceed (83%) under RCP4.5 when accounting for possible ice sheet instabilities About as likely as not to exceed (50%) under RCP8.5 when accounting for possible ice sheet instabilities 				
High	Extremely unlikely to exceed (99.5%) under RCP8.5	1.2	2.4	4.2	7.6
	<ul style="list-style-type: none"> Unlikely to exceed (83%) under RCP8.5 when accounting for possible ice sheet instabilities Extremely unlikely to exceed (95%) under RCP4.5 when accounting for possible ice sheet instabilities 				
Extreme (Maximum physically plausible)	Exceptionally unlikely to exceed (99.9%) under RCP8.5	1.4	3.1	5.4	10.2
	<ul style="list-style-type: none"> Extremely unlikely to exceed (95%) under RCP8.5 when accounting for possible ice sheet instabilities 				

The Sea Level Rise Projections used for the MA FRM model are closest to the High Scenario, below. Under this scenario, Dukes County might expect (using 2008 sea level as a baseline):

- 2.57 ft as of 2050
- 4.37 ft as of 2070

For each of the time horizons found in the model, the results are presented as 4 separate sets. In a given year, the likelihood that a site located within a vulnerability zone will flood is categorized as one of the following:

- >0% to <25%
- >=25% to <50%
- >=50% to <75%
- >=75%

Section 5. Vulnerability Assessments by Town

The maps illustrate the geographic extent of vulnerability. In some cases, only excerpts are shown here. The full sized maps are available on-line. Seeing the full extent is important for planning purposes.

The matrices of vulnerability highlight statistics on vulnerable persons and property. Property is identified both by numbers of buildings and by value. Persons are identified by population (2010 census) as well as by seasonal projection. Projections estimate vulnerability at buildout.

Vulnerability is represented for wildfire (wildland urban interface), flood (Nor'easter), storm (hurricane) and for sea level rise (SLR).

Vulnerability assessments were prepared and presented for each town, including the following assumptions:

Year Round Numbers from ACS 5-year average 2013-17							
	Aquinnah	Chilmark	Gosnold	Edgartown	Oak Bluffs	Tisbury	West Tisbury
Number of Year Round Housing Units	139	329	18	1597	1684	1442	930
Year Round Population Count	640	1117	34	4292	4675	4100	2417
<i>Avg Year-round per owner-occupied Unit</i>	4.47	3.4	2.14	2.69	2.95	3.27	2.48
<i>Avg Year-round per renter-occupied Unit</i>	4.97	3.26	----	2.42	1.83	1.92	3.11
<i>Avg Year-round per house Unit</i>	4.6	3.4	1.89	2.69	2.78	2.84	2.6
Estimate of Residential Seasonal Population based on ACS 5-year estimate (2013-2017)							
Number of Seasonal Housing Units	351	1293	196	3802	2974	1679	1243
Guest population of Year-rounders	97	230	13	1118	1179	1009	651
Seasonal Resident Population Count	1674	6168	935	18136	14186	8009	5929
Estimate of Total In-Season Population Count							
Total # Housing Units	351	1293	196	3802	2974	1679	1243
Total Population Count	2412	7515	982	23545	20040	13118	8997
<i>Avg In-season per House Unit</i>	4.92	4.63	4.59	4.36	4.3	4.2	4.14

Critical Facilities: Updated in 2019 by the MVC.

Data Sources and Methodology for HMP 2021 Analysis

Chris Seidel, Cartographer – Martha’s Vineyard Commission (MVC)

Prepared: February 11, 2021

Town Name abbreviations used in this document: AQ – Aquinnah; CH – Chilmark; ED – Edgartown; GS – Gosnold; OB – Oak Bluffs; TI – Tisbury; WT – West Tisbury

Data Sources - Hazards

FEMA Flood Zones – FEMA Effective Flood dFIRM as of July 2016

Hurricane Inundation – NOAA/Army Corps of Engineers Final SLOSH Model 2013

Wildfire Threatened Area – MVC 2020; *Definition:* Includes areas of a) pitch pine/scrub oak habitat; **OR** b) contiguous woodland; **OR** c) within 100ft of contiguous woodland → are considered within the ‘Wild & Urban Land Interface’ (or within an area which is at risk of being negatively impacted by wildfire). *Specifically:* From TNC’s vegetation data from early 2000s - Any pitch pine and scrub/shrub oak habitats were extracted from their larger dataset. From MassGIS Land Use/Land Cover data 2016. From that dataset I took Land Cover Class 9 (deciduous) & Class 10 (Evergreen) where General Use was any of the following: 2, 6, 7, 8, 9, OR Detailed Use was 39*, 13*, 44*.

Tsunami Threatened Area – 1 Mile from ocean coastline. Processed in 2020 by MVC. Coastline source was the town boundary files containing the detailed coastline. This land and coastline file was compiled by MassGIS. The coastline in this dataset is stated as representing the Mean High Water per MassGIS metadata.

<https://docs.digital.mass.gov/dataset/massgis-data-community-boundaries-towns>

Sea Level Rise/Climate Change Threatened Area – MA Coast Flood Risk Model – 2020 MassDOT, Woods Hole Group, UMass Boston. Datasets Include: A) Annual Coastal Flood Exceedance Probability (ACFEP); and B) Estimated Flood Depths for 1% ACFEP (represents the 100-year return period water surface elevation). Time Periods Include: (for datasets A & B) 1) Present Day (2008); 2) 2030; 3); 2050; 4) 2070

Data Sources – Infrastructure

Critical Facilities – Point & Linear Features – MVC 2020 - On screen digitized from most current aerial photo available at the time of digitization. Aerial photos from MassGIS or Google depending on the year. Identification of 'critical' facilities per the local emergency managers.

Structures – 2019 download of MassGIS roofpoint dataset (digitized from aerial photos). Most recent photo year analyzed: AQ 2017, CH 2016, ED 2017, GS 2017, OB 2016, TI 2016, WT 2016

Property Boundaries: AQ FY19 Cartographic Associates Inc (CAI), CH FY20 CAI, ED FY19 CAI, GS FY15 Sewell & Associates, OB FY20 Claus Goerges Consulting in GIS, TI FY20 CAI, WT FY20 CAI

Property Information: Assessed property values and use codes per each town's assessor. Fiscal year of source matches that of the town's property boundaries.

Data Sources – Assumptions

Population – American Community Survey (ACS) 5-year average (2013 – 2017).

Avg year-round (aka Off-Season) population per House Unit = (a)Total Town Population/Town

Occupied Housing Units

Avg In-Season (peak) population per House Unit is calculated as follows:

Vacant Housing Units per ACS (this is the assumed # of seasonal housing units)

(b) Guests of year-round residents = 0.7*Occupied Housing Units

(c) Seasonal resident population count = Vacant Housing Units * 4.77 (based on MVC survey analysis)

(d) Total In-Season (peak) Population Count = a + b + c

Average In-Season Population per House Unit = (d)/Total Housing Units

Replacement Cost of Existing Structures: The assessed property values for each property are provided as part of the Level 3 Parcel Data obtained from MassGIS. Some parcels have more than one assessed property record if there are multiple owners associated with a property (i.e. condos). Each of these owner property records includes a Use Code. Depending on the function of the structure, one parcel can have several different Use Codes. To facilitate data aggregation and simplification, each parcel was assigned only 1 overall Use Code by the MVC.

Once that use code was identified for each parcel, structures were linked to their parcel's property record(s) by [LOC_ID] and data were then aggregated by Town, General Use, and Hazard Sub-Category (i.e. FEMA VE Zone) and then the respective average assessed value per structure for that group was calculated. That average value was then multiplied by the total number of Existing Structures within that group to get the Total Assessed Impact Dollars for the group.

Replacement Cost Estimate – Critical Facilities – Point Features: Is the average building value of all buildings located on the same property as the critical facility. Other point facilities (i.e. bridge) replacement cost is approximated from varying sources depending on the type of facility/structure.

Replacement Cost Estimate – Critical Facilities – Linear Features: Detailed notes on these estimates and calculations are available in this document: Critical Linear Features HMP Impact3_2021_01.xlsx

Barrier Beach Renourishment (per foot) = **\$1,042**; from: Trembanis, Arthur C., Hugo R. Valverde, and Orrin H. Pilkey. "Comparison of Beach Renourishment Along the U.S. Atlantic, Great Lakes, Gulf of Mexico and New England Shorelines." Per http://www.beachapedia.org/Beach_Fill

Road Repair (per foot) = **\$205**; calculated from - PennDOT Maintenance and Preservation: <https://www.penndot.gov/about-us/Documents/PennDOT%20Road%20MaP%20Initiative.pdf> and American Road & Transportation Builders Association: <https://www.artba.org/about/faq/>

Seawall Repair (per linear foot) = **\$625**; calculated from - http://www.forgeeng.com/about_forum_qa1.php

Pier Repair/Rebuild (per linear foot) = **\$2778**; Total cost to repair local pier stated in this article. <https://www.mvtimes.com/2014/06/19/oak-bluff-fishing-pier-bathed-praise/>

Grass Airstrip Regrade Cost Estimate (per cubic yard) = **\$10.00**; <https://www.flyingmag.com/how-to-build-your-own-grass-strip/>

Drawbridge cost Estimate (per sq foot) = **\$1408**; based on info from these two sites: <https://www.fhwa.dot.gov/bridge/nbi/sd2019.cfm#b> and <https://www.tampabay.com/archive/1992/04/12/logic-numbers-favor-fixed-bridge-in-tarpon/>

Breakwater Cost Estimate (per linear foot) = **\$800**; <https://sedimentationpikesbay.weebly.com/cost-analysis.html#:~:text=The%20main%20issue%20is%20that%20construction%20costs%20for,to%20what%20the%20marinas%20already%20have%20in%20place>

Analysis Process

MassGIS roofprint polygons were converted to points (center of roof) and associated with their parcel's respective unique identifier [LOC_ID]. These **structure points** were analyzed against all hazard data layers to identify those structures at risk. Going forward, only structures having a roof square footage >400 sq ft are included in the counts of impacted structures.

The assessor's property **use codes** were generalized into Residential (1*), Industrial (4*), Commercial (3*), Exempt (9*), Mixed-use Residential (01*), Mixed-use Industrial (04*), and Mixed-use Commercial (03*), Other.

All summation output was processed in MS Access. The **number of existing structures affected** per hazard were grouped by Town, General Use, Hazard sub category (if applicable), and then the 'count' of [Structure_ID] was determined. The [Structure_ID] value is unique per structure.

The **total financial impact to existing structures** was tallied by using the structure's parcel [LOC_ID] and joining that to the assessor's assessed property table {Assessed_Merged}. Description of this calculation can be found in the preceding section "Replacement Cost of Existing Structures".

The **number of future structures impacted** was *approximated* as follows. For towns on Martha's Vineyard, the buildout analysis (performed in 2005 via CommunityViz software) was utilized. That analysis took into account developed structures, parcel size, open space/conserved land, and town zoning. The assumption was made that wetlands could be developed, no future open space acquisition was accounted for, and under-sized grandfathered lots could be developed. Based on minimum lot size per parcel and property set-backs per zoning, the possible future number of buildings were calculated. The CommunityViz software then generated GIS points for each future structure (placement was randomly placed on the respective parcel).

For the HMP of 2021, those 'future structures' (from the '05 build-out analysis) overlapping on existing open space/conserved land were removed from this current analysis. Then, the '05 Existing and Future buildings were IDed with any hazard(s) they intersected and a general use code was assigned to each of those structures based on current town zoning.

The Existing and Future Structures (from the '05 analysis) were aggregated by Town, Use, and Hazard Sub-category. The final number of Future Structures (post 2020) was calculated as follows: Future Structures (as of 2005) minus (Existing Structures of 2020 minus Existing Structures of 2005).

For Gosnold:

Wildland Urban Interface Hazard: There is Minimal presence of Wildland Urban Interface on all of Gosnold and assumed future development on Naushon wouldn't be in the inland areas where the WUI is located. Therefore, no future development would be impacted on Gosnold by wildfire.

Tsunami: The tsunami hazard impact area, 1 mile from the coastline, completely engulfs all of the Elizabeth Islands. Therefore the future buildout impact is the maximum predicted.

All other hazards: Used the 'Identity' analysis tool and found the percentage of the parcel within each of the sub-Hazard Categories and then multiplied that percentage by the total number of possible future buildings on the parcel to get the number of possible future buildings on that parcel within that hazard sub-category zone.

Buildout on Gosnold was determined by finding the vacant/non-open space parcels on Cuttyhunk that were greater than the minimum parcel size per town zoning. The area of those parcels was divided by the minimum area per town zoning and the resulting number was rounded down – this number represents the maximum buildout possible for that parcel. Based on local knowledge, some parcels had custom buildout numbers assigned. These parcels include: (1) the 'West End' on Cuttyhunk – only 9 future buildings can be developed there based on building envelope plans on file with the town; (2) Pasque Island - per assessor's data, there's a 10 acre vacant residential property but only 2 future buildings were assigned given the minimal development on this island, historically; (3) Naushon Island – per assessor's data, there are 3 vacant residential parcels but only a total of 6 future buildings were assigned given the minimal development on this island, historically.

The *approximated total financial impact to future structures* was tallied by multiplying the number of future impacted structures by the average assessed building value for that respective group ('group' is the aggregation by Town, Use, and Hazard sub-Category).

The number of **existing population and future population affected** is calculated by multiplying the number of structures by the population figures obtained, or approximated, from the American Community Survey 5-year average (2013-2017). See the Data Sources Assumptions section for more details on population data.

The **critical facilities**, point and linear features, were analyzed against the hazard areas to identify those facilities at risk. The **total financial impact** to structural critical facilities (i.e. police station) is the average assessed building value based on all buildings located on that parcel. This number is used since the assessed building value for a specific

building isn't within our database. For those point structures that don't fall within a property boundary (i.e. bridge), the total financial impact is approximated from various sources based on the type of facility.

Vulnerability to Future Natural Hazards:

Based on the identification and profile of the natural hazards that have occurred throughout the region over time, a vulnerability matrix has been developed. The following criteria, adapted from the Massachusetts Hazard Mitigation Plan developed by MEMA, were used for frequency characterization:

- Very Low Frequency: events that occur less frequently than once in 1,000 years (less than 0.1% per year)
- Low Frequency: events that occur from once in 100 years to once in 1,000 years (0.1 to 1% per year)
- Medium Frequency: events that occur from once in 10 years to once in 100 years (1% to 10% per year)
- High Frequency: events that occur more frequently than once in 10 years (greater than 10% per year)

The criteria used for severity characterization, based on past hazard events, include the following:

- Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, parks, etc.); contained geographic area (i.e., one or two towns); essential services (utilities, hospital, schools) not interrupted; no injuries or fatalities
- Serious: Scattered major property damage; some minor infrastructure damage; wider geographic area (several towns); essential services are briefly interrupted; some injuries and/or fatalities
- Extensive: Consistent major property damage; major damage to public infrastructure (taking up to several days for repair); essential services are interrupted from several hours to several days; many injuries and fatalities
- Catastrophic: Property and public infrastructure destroyed; essential services stopped; hundreds of injuries and fatalities

A vulnerability matrix was prepared for each community, using numeric points (one point for each step of higher frequency or impact) and the resulting scores were averaged for the following table of vulnerability for the overall area (Dukes County):

OVERALL VULNERABILITY FOR DUKES COUNTY TOWNS

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(rank by combining how much impact & how frequently this affects the community - average for all planning areas)(one point for each step of higher frequency or impact)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	high	large	serious	9
Erosion	high	large	serious	7.4
Dam Failures	very low	local	serious	1
Severe Rainstorms	medium	large	serious	8
Winter Storms (snow)	low	local	minor	4
Coastal Storms/Nor'easters	high	medium	serious	9.4
Hurricanes	medium	large	extensive	9
Wind-Related Hazards				
Hurricanes	medium	large	extensive	9.1
Coastal Storms	high	large	serious	9.1
Winter Storms (snow)	low	local	serious	5
Downspouts	very low	local	serious	3
Tornadoes	very low	local	serious	4.1
Fire-Related Hazards				
Drought	medium	medium	serious	6
Wildfires	low-medium	local	serious	6
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	very low	local	minor	3.6
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3.4
Sea Level Rise	high	large	serious	6.6

VULNERABILITY ASSESSMENTS FOR AQUINNAH

The Town of Aquinnah is the smallest town in the planning area, both in terms of area (5.4 square miles of land area) and of year 'round population 640 (as of the ASC 5-year average 2013-2017). Aquinnah (formerly known as Gay Head) is also the least commercially developed and has no town center. The sparse population is scattered across the rugged topography of this morainal land, with a density of 57.6 persons per square mile.

The maps illustrate the geographic extent of vulnerability. In some cases, only excerpts are shown here. The full sized maps are available on-line <https://www.mvcommission.org/climate-change>. Seeing the full extent is important for planning purposes.

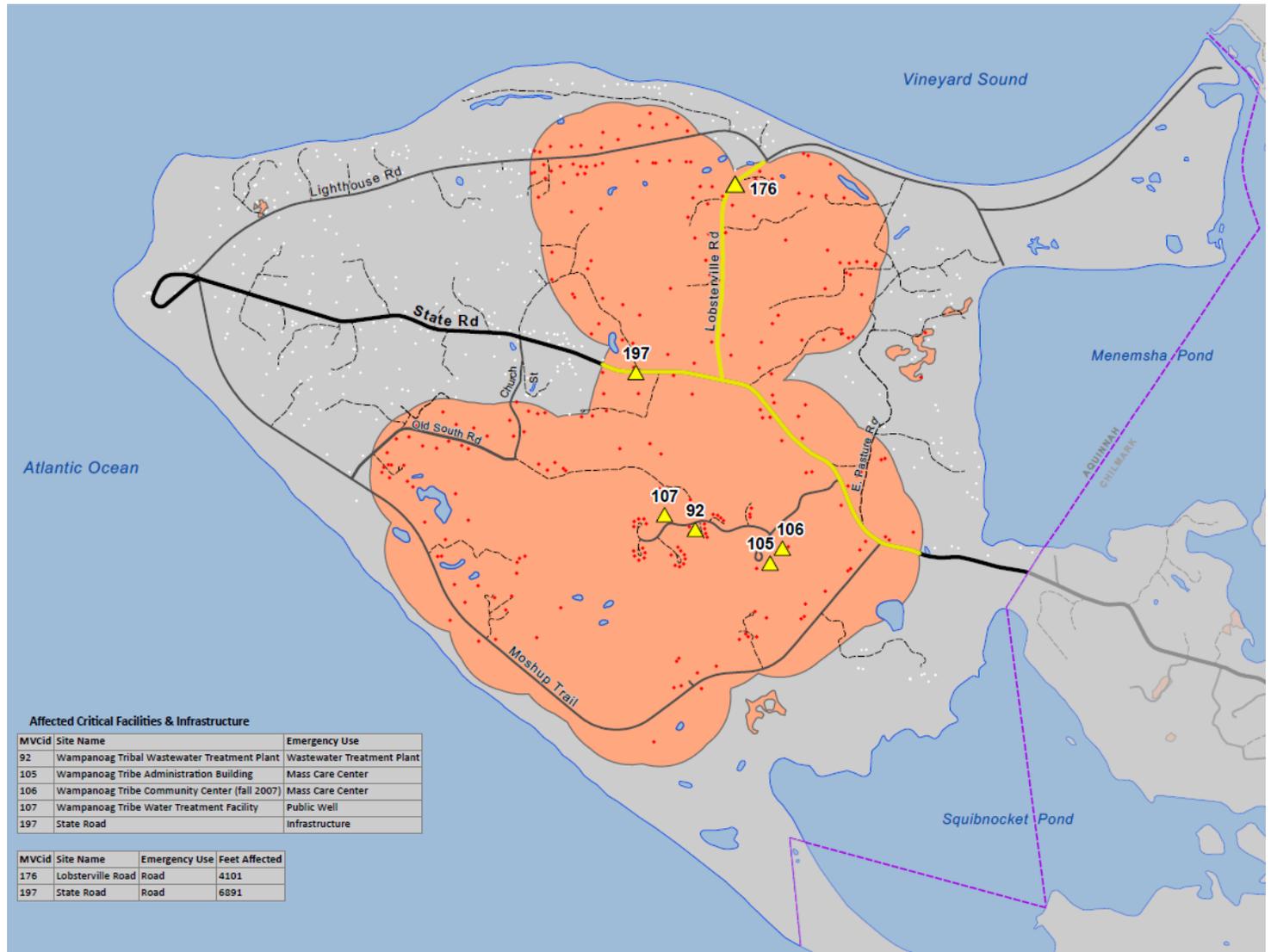
The matrices of vulnerability highlight the persons and property. Property is identified both by numbers of buildings and by value. Persons are identified by population (ASC 5-year average 2013-2017) as well as by seasonal projection. Projections estimate vulnerability at buildout.

Vulnerability is represented for wildfire (wildland urban interface), flood (Nor'easter), storm (hurricane), Sea Level Rise, and for tsunamis. Additional Sea Level Rise impacts are found appended to this document.

AQUINNAH WILDFIRE VULNERABILITY (Wildland Urban Interface)

Aquinnah is known for its wild landscape, but most of the terrain is made up of moors rather than forests. There are some significant fuel-rich areas of pitch pine and scrub oak.

Wildfire Threatened Area – The Wildland-Urban interface is shown in orange, with potentially affected infrastructure displayed in bright colors.



For the larger map, see <https://www.mvcommission.org/climate-change>

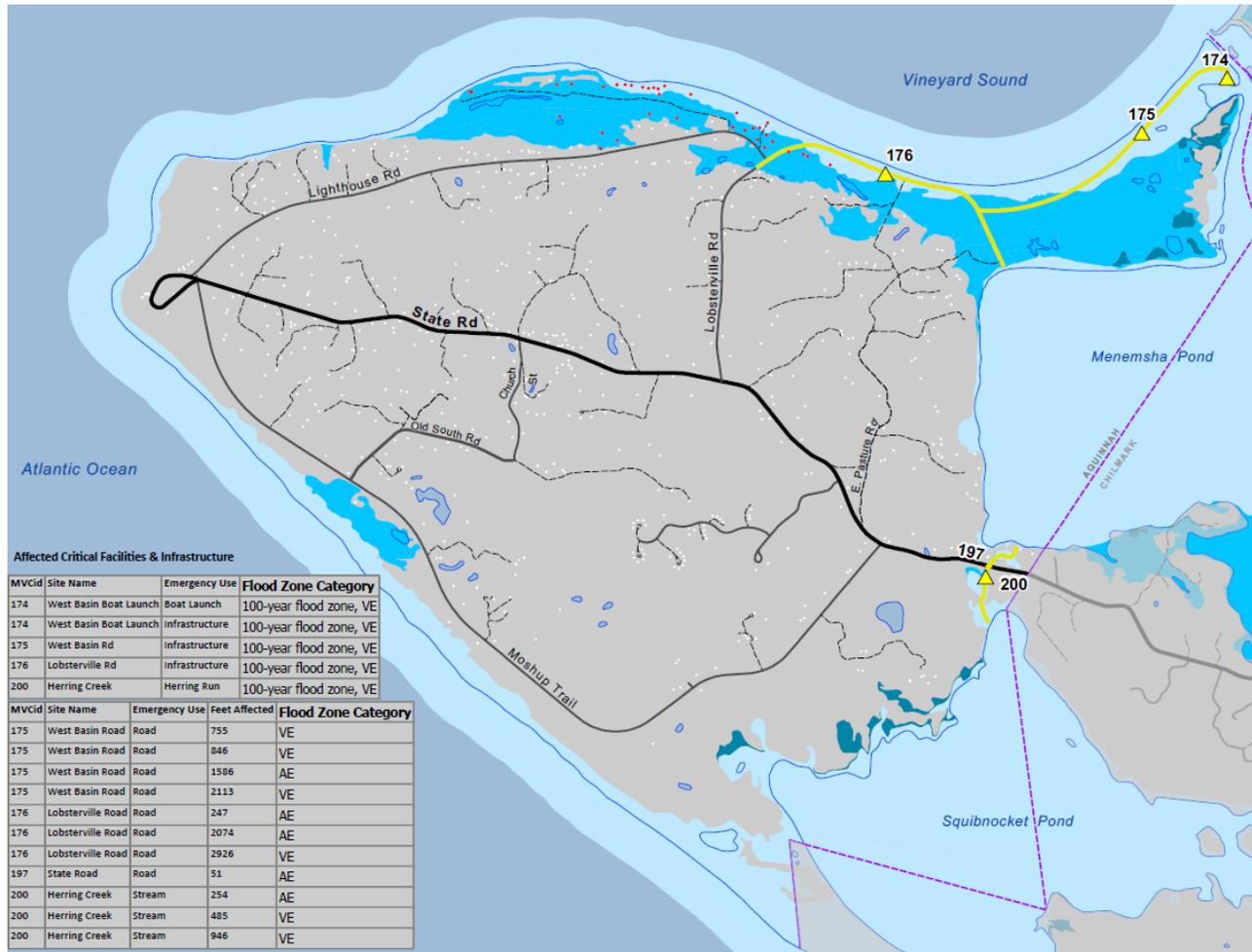
Wildland-Urban Interface Vulnerability for Aquinnah (Wildfire Vulnerability)

Developed Land				Undevel. Land				
Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value	# People (other)	# People (July-Aug)	# Buildings	Approx. Value

	4.6 per building	4.92 per building			4.6 per building	4.92 per building		
Commercial			2					
Mixed Use	9	10	2	\$769,100				
Municipal, Public, Non-profit			39	\$5,895,500				
Residential	990	1058	215	\$61,708,700	1206	1289	262	\$75,198,509

FLOOD VULNERABILITY FOR AQUINNAH (NOR'EASTER – TYPE STORM) 2016 FIRM

Powder blue represents the 100-year VE zone (wave heights > 3'). Teal represents the 100-year AE zone (wave heights < 3'). Dark blue shows the 500-year flood zone. For the larger map, see <https://www.mvcommission.org/climate-change>



FLOOD VULNERABILITY FOR AQUINNAH (NOR'EASTER – TYPE STORM)
Developed Land – based on flood data released in 2016

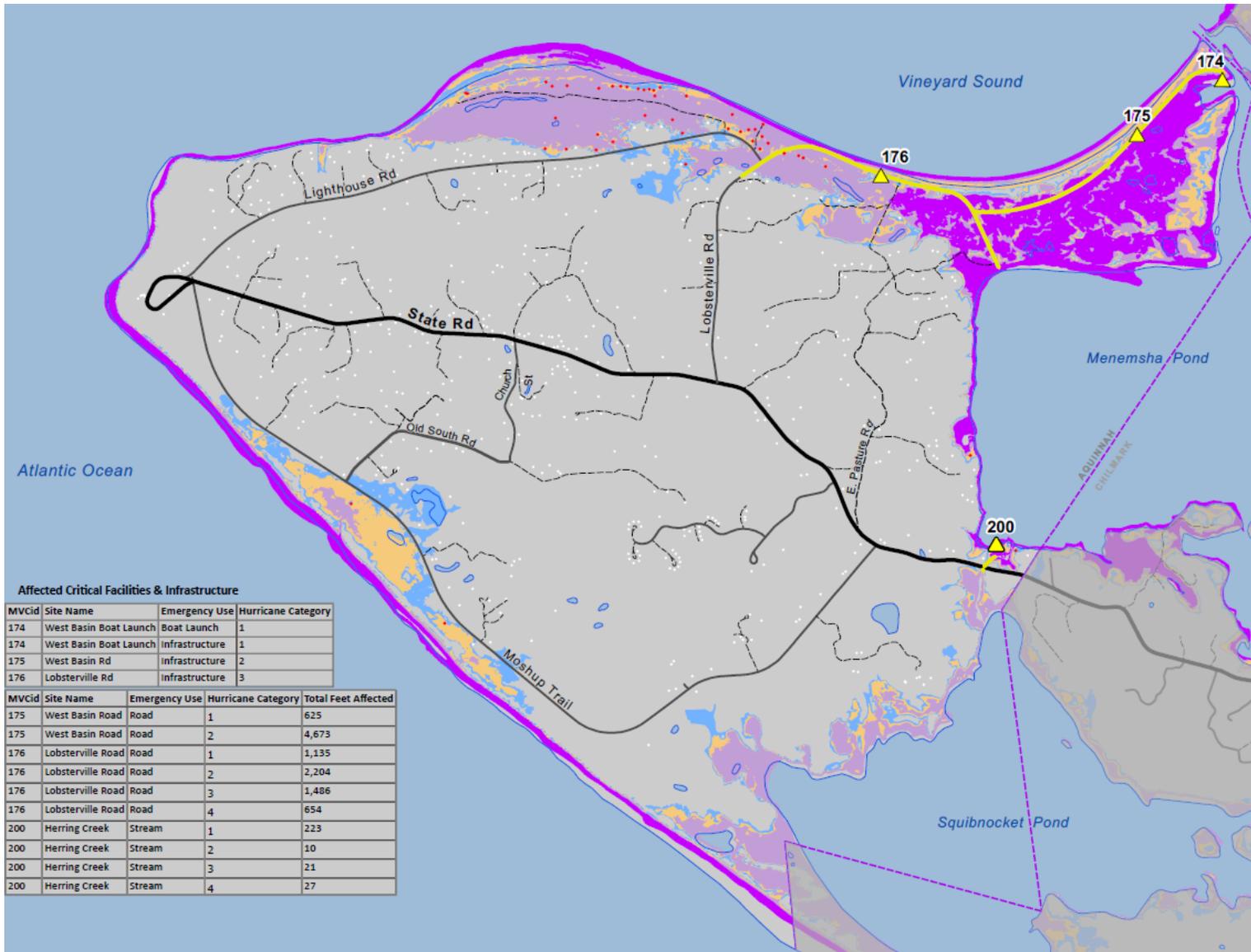
Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		4.60 per building	4.92 per building		
100 Year AE Zone	Residential	97	103	21	\$4,285,500
Velocity Zone (also 100yr)	Residential	64	69	14	\$2,696,500

Developable Land - based on flood data released in 2016

Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		4.60 per building	4.92 per building		
100 Year AE Zone	Residential	106	113	23	\$4,693,643
Velocity Zone (also 100yr)	Residential	138	148	30	\$5,778,214
Velocity Zone (also 100yr)	Commercial			5	\$1,020,357

STORM SURGE VULNERABILITY FOR AQUINNAH (HURRICANE) S.L.O.S.H. MAP

The colors in the Storm Surge legend grade in Hurricane intensity from Category 1 (dark purple) Category 4 (palest color). Bright color symbols represent affected infrastructure.



For the larger map, see <https://www.mvcommission.org/climate-change>

AQUINNAH HURRICANE INUNDATION VULNERABILITY (SLOSH) STORM SURGE
Based on data Released by the USACOE New England District in March 2013
Developed Land

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		4.6 per building	4.92 per building		
1	Residential	0	0	0	0
2	Residential	87	94	19	\$3,519,500
3	Residential	78	84	17	\$5,099,600
4	Residential	37	39	8	\$3,063,500

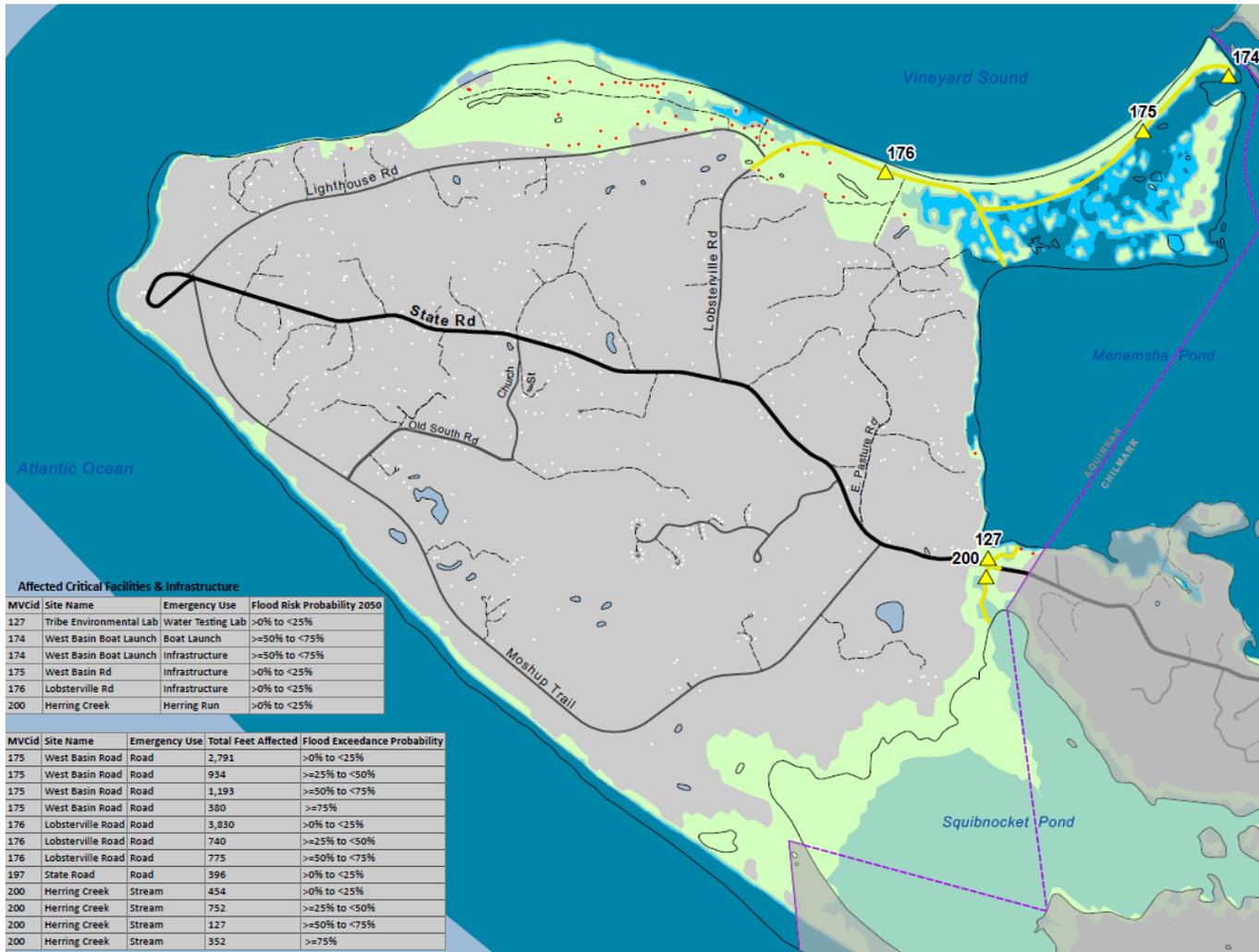
Developable Land

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		4.6 per building	4.92 per building		
1	Residential	14	15	3	\$555,711
2	Commercial	0	0	1	\$185,237
	Residential	239	256	52	\$9,632,316
3	Residential	60	64	13	\$3,899,694
4	Commercial	0	0	3	\$555,711
	Residential	60	64	13	\$4,978,188

AQUINNAH SEA LEVEL RISE VULNERABILITY

SLR of 2.57 ft by 2050 and likelihood of flooding in a given year

dark blue: $\geq 75\%$; light blue: $\geq 50\%$ to $< 75\%$; olive green: $\geq 25\%$ to $< 50\%$; light green $> 0\%$ to $< 25\%$



For the larger update map, see <https://www.mvcommission.org/climate-change>

AQUINNAH SEA LEVEL RISE VULNERABILITY

SLR Scenarios: 2.57 ft* (2050)

4.37 ft* (2070) featured in *SLR Flood Risk Model 2070* table in Appendix

*relative to 2008 baseline

** likelihood increments are omitted if there is no current infrastructure associated with the featured use in that zone and the buildout analysis did not yield future development sited within the zone in question for a given use

Likelihood in a given year**	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.14 per building	4.22 per building		
>0% to <25%	Commercial	0	0	1	\$184,000
>=25% to <50%	Commercial	0	0	0	\$0
>=75%	Commercial	0	0	0	\$0
>0% to <25%	Residential	221	236	48	\$12,058,900
>=25% to <50%	Residential	18	20	4	\$1,070,700
>=50% to <75%	Residential	0	0	0	\$0
>=75%	Residential	0	0	0	\$0

COASTAL EROSION AND SHORELINE CHANGE - Aquinnah

Pre-1978 homes near bluffs are difficult for the towns to regulate (grandfathered under the Wetlands Protection Act). There are 15 in Aquinnah.



AQUINNAH VULNERABILITY OF CRITICAL FACILITIES

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Aquinnah Town Hall	\$2,312,100	Yes	--	--	
Aquinnah Fire Department	\$2,312,100	Yes	--	--	
Aquinnah Police Department	\$2,312,100	Yes	--	--	
Wampanoag Tribal Wastewater Treatment Plant	\$217,100	Yes	Yes	--	
Wampanoag Tribe Administration Building	\$939,500	Yes	Yes	--	
Wampanoag Tribe Community Center (fall 2007)	\$939,500	Yes	Yes	--	
Wampanoag Tribe Water Treatment Facility	\$217,100	Yes	Yes	--	
Tribe Environmental Lab	\$184,000	--	--	--	
West Basin Boat Launch	\$0	Yes	--	2	VE (100 Year Flood Zone)
West Basin Rd	\$0	Yes	--	2	VE (100 Year Flood Zone)
Lobsterville Rd	\$0	Yes	--	4	VE (100 Year Flood Zone)
Cook's Spring	\$0	--	--	--	
State Road	\$0	Yes	Yes	--	
Herring Creek	\$0	--	--	--	VE (100 Year Flood Zone)

Critical Facilities - SLR

	SLR Present Probability	SLR Present Flood Depth	SLR 2030 Probability	SLR 2030 Flood Depth	SLR 2050 Probability	SLR 2050 Flood Depth	SLR 2070 Probability	SLR 2070 Flood Depth
Aquinnah Town Hall	--	--	--	--	--	--	--	--
Aquinnah Fire Department	--	--	--	--	--	--	--	--
Aquinnah Police Department	--	--	--	--	--	--	--	--
Wampanoag Tribal Wastewater Treatment Plant	--	--	--	--	--	--	--	--
Wampanoag Tribe Administration Building	--	--	--	--	--	--	--	--
Wampanoag Tribe Community Center (fall 2007)	--	--	--	--	--	--	--	--
Wampanoag Tribe Water Treatment Facility	--	--	--	--	--	--	--	--
Tribe Environmental Lab	--	--	--	--	>0% to <25%	--	>0% to <25%	--
West Basin Boat Launch	>=50% to <75%	>=5ft to <10ft	>=50% to <75%	>=10ft	>=50% to <75%	>=10ft	>=75%	>=10ft
West Basin Rd	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>=2.5ft to <5ft	>0% to <25%	>=2.5ft to <5ft	>=50% to <75%	>=5ft to <10ft
Lobsterville Rd	>0% to <25%	--	>0% to <25%	--	>0% to <25%	--	>0% to <25%	>0ft to 2.5ft
Cook's Spring	--	--	--	--	--	--	--	--
State Road	--	--	--	--	--	--	--	--
Herring Creek	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>=2.5ft to <5ft	>=25% to <50%	>=5ft to <10ft

Critical Linear Features - within Wildland/Urban Wildfire Threat Area

Category	Town	Name	Length ft	Estimated Repair Cost
Road	Aquinnah	State Road	6,891	\$1,409,582
Road	Aquinnah	Lobsterville Road	4,101	\$838,924

Critical Linear Features – FEMA Flood Zone

Category	Town	Name	FEMA Flood Zone	Length ft	Estimated Repair Cost
Road	Aquinnah	West Basin Road	AE	1,586	\$324,341
Road	Aquinnah	Lobsterville Road	AE	2,321	\$474,774
Road	Aquinnah	State Road	AE	51	\$10,517
Road	Aquinnah	West Basin Road	VE	3,713	\$759,428
Road	Aquinnah	Lobsterville Road	VE	2,926	\$598,423
Stream	Aquinnah	Herring Creek	AE	254	NA
Stream	Aquinnah	Herring Creek	VE	1,431	NA

Critical Linear Features – Hurricane Surge Impact

Category	Town	Name	Hurricane Category	Length ft	Estimated Repair Cost
Road	Aquinnah	Lobsterville Road	1	1135	\$232,245
Road	Aquinnah	West Basin Road	1	625	\$127,828
Road	Aquinnah	Lobsterville Road	2	2204	\$450,825
Road	Aquinnah	West Basin Road	2	4673	\$955,942
Road	Aquinnah	Lobsterville Road	3	1486	\$303,900
Road	Aquinnah	Lobsterville Road	4	654	\$133,694
Stream	Aquinnah	Herring Creek	1	223	NA
Stream	Aquinnah	Herring Creek	2	10	NA
Stream	Aquinnah	Herring Creek	3	21	NA
Stream	Aquinnah	Herring Creek	4	27	NA

Critical Linear Features – Tsunami Impact

Category	Town	Name	Length ft	Estimated Repair Cost
Road	Aquinnah	West Basin Road	5,298	\$1,083,770
Road	Aquinnah	Lobsterville Road	9,217	\$1,885,216
Road	Aquinnah	State Road	11,883	\$2,430,598

Future Vulnerability for the Town of Aquinnah

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(combine impact & frequency)(one point for each step of frequency or impact)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	medium	large	serious	8
Erosion	high	local	minor	6
Dam Failures	n/a	n/a	n/a	0
Severe Rainstorms	medium	large	serious	8
Winter Storms	low	local	minor	4
Coastal Storms/Nor'easters	medium	medium	extensive	9
Hurricanes	high	large	extensive	10
Wind-Related Hazards				
Hurricanes	medium	large	extensive	9
Coastal Storms	high	large	serious	9
Winter Storms	low	local	serious	5
Downspouts	very low	local	serious	3
Tornadoes	very low	local	serious	4
Fire-Related Hazards				
Drought	low	local	minor	4
Wildfires	low	local	minor	3
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	medium	local	minor	5
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3
Sea Level Rise	high	local	minor	6

VULNERABILITY ASSESSMENTS FOR CHILMARK

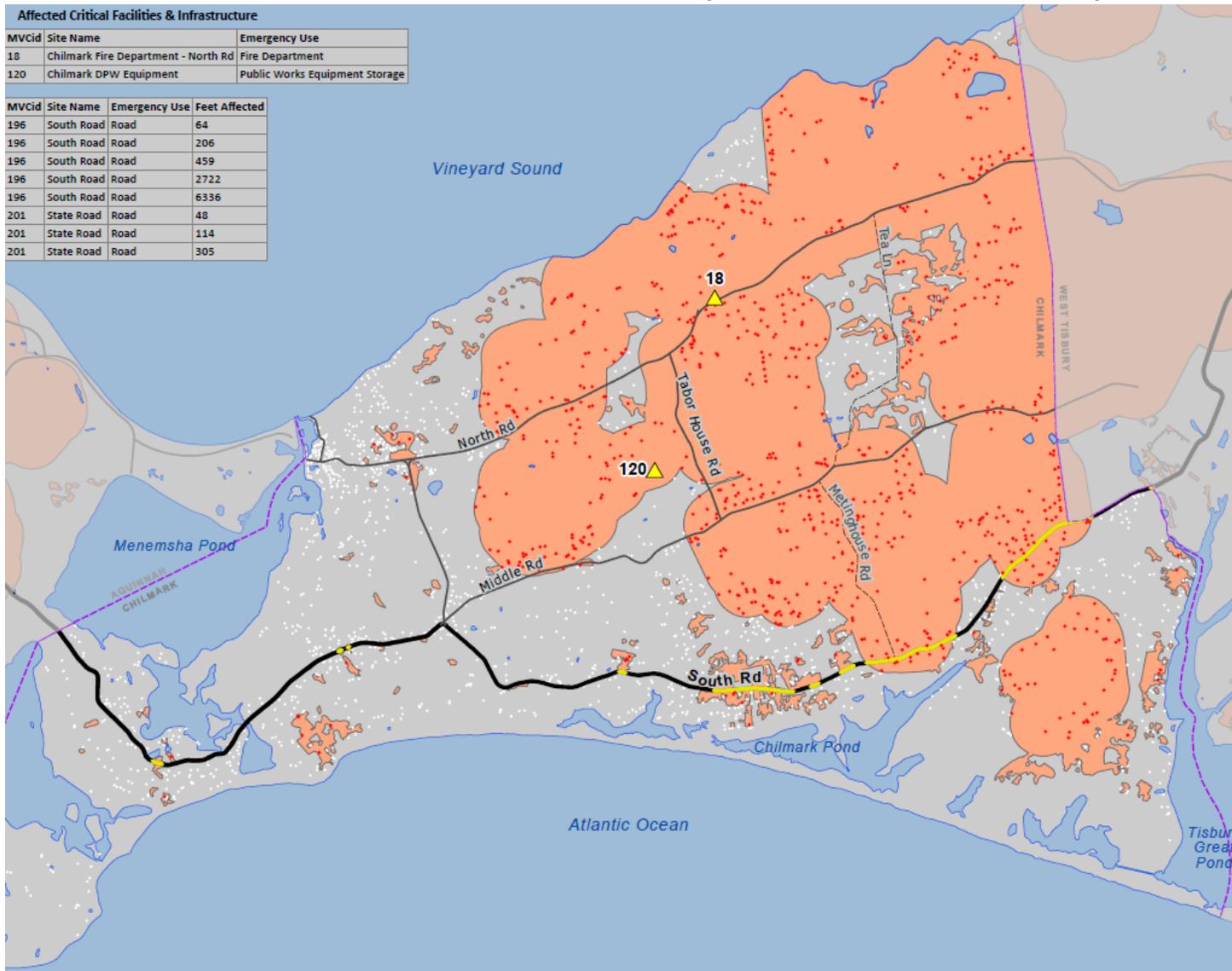
The Town of Chilmark includes a year 'round population of 1117 (ASC 5-year average 2013-2017) on a land area of 19.1 square miles, for a density of 58.5 persons per square mile. With 3-acre zoning, development has spread over the hilly morainal land, and property values are quite high. In 2005 the town boasted the highest average property value in the Commonwealth, with most of that cost based on the land value rather than the buildings. One exception is the closely-quartered fishing village of Menemsha, which includes a number of water-dependent facilities for the resident fishing fleet and visiting recreational craft in summer, and shore facilities such as fuel and restrooms.

The maps illustrate the geographic extent of vulnerability. Only excerpts are shown here. The full sized maps are available on-line <https://www.mvcommission.org/climate-change>. Seeing the full extent is important for planning purposes.

The matrices of vulnerability highlight the persons and property. Property is identified both by numbers of buildings and by value. Persons are identified by population as well as by seasonal projection. Projections estimate vulnerability at buildout.

Vulnerability is represented for wildfire (wildland urban interface), flood (Nor'easter), storm (hurricane), Sea Level Rise, and for tsunami. Additional Sea Level Rise impacts are found appended to this document.

CHILMARK WILDFIRE VULNERABILITY (Wildland Urban Interface)



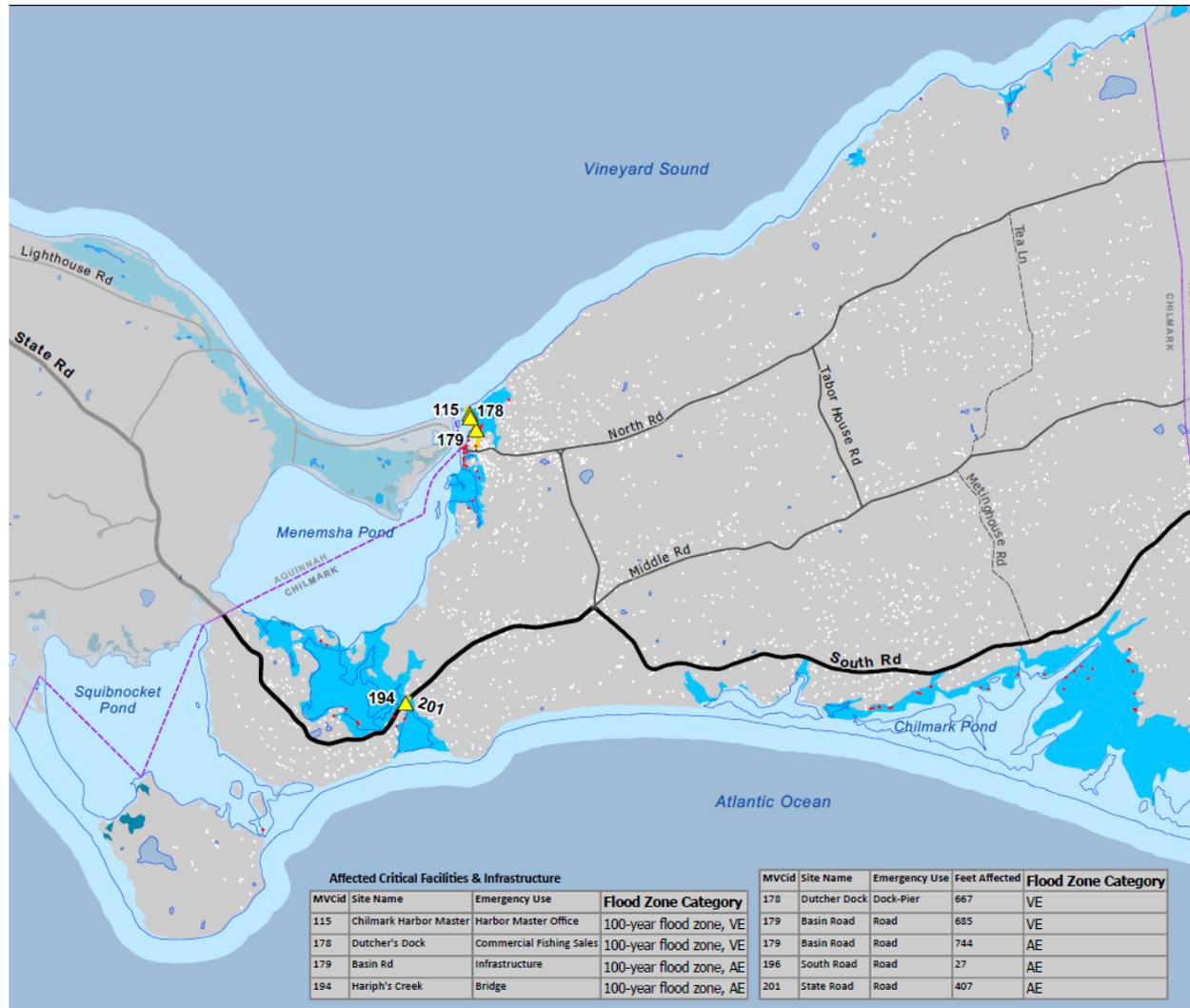
Wildfire Threatened Area – The Wildland-Urban interface is shown in orange, with potentially affected infrastructure displayed in bright colors. **For the larger map, see <https://www.mvcommission.org/climate-change>**

CHILMARK WILDFIRE VULNERABILITY (WILDLAND URBAN INTERFACE)

Developed Land					Undevel. Land			
Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value	# People (other)	# People (July-Aug)	# Buildings	Approx. Value

	3.4 per building	4.63 per building			3.4 per building	4.63 per building		
Commercial			1	\$245,600				
Municipal, Public, Non-profit			6	\$1,689,400				
Mixed Use	37	51	11	\$1,969,300				
Residential	2730	3725	804	\$415,406,400	740	1010	218	\$112,635,069

CHILMARK FLOOD VULNERABILITY (2016 FIRM) - Nor'Easter type Storm



Powder blue represents the 100-year VE zone (wave heights > 3'). Teal represents the 100-year AE zone (wave heights < 3'). Dark blue shows the 500-year flood zone. For the larger map, see <https://www.mvcommission.org/climate-change>

CHILMARK FLOOD VULNERABILITY
Based on Flood Data Released in 2016
Developed Land

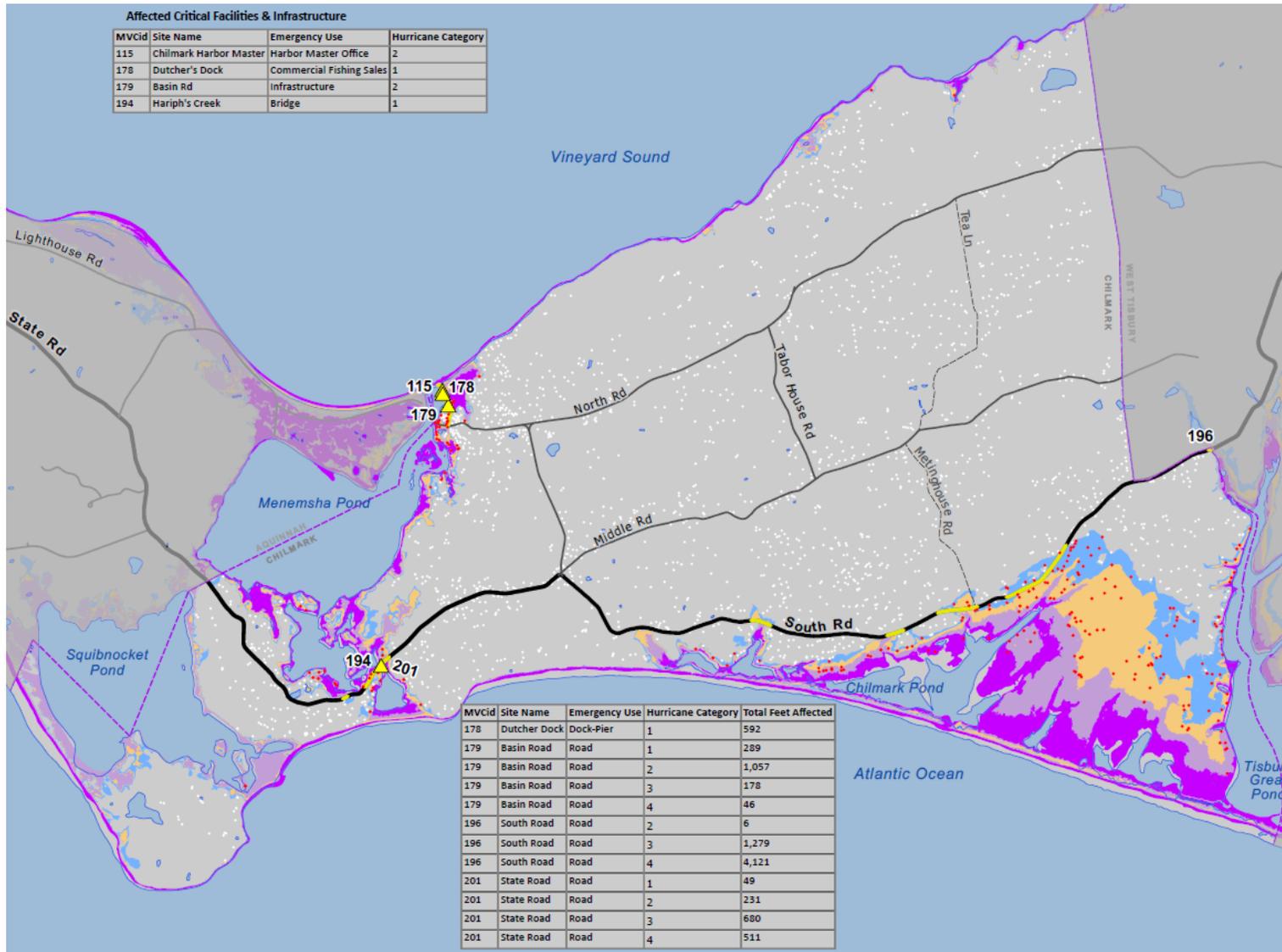
Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		3.4 per building	4.63 per building		
100 Year AE Zone	Residential	221	301	65	\$21,812,600
	Commercial			3	\$997,700
	Mixed use Residential	3	5	1	\$258,200
	Mixed use Commercial		5	1	\$625,000
Velocity Zone (also 100yr)	Residential	24	32	7	\$10,138,300
	Commercial	0	0	5	\$534,500
	Exempt (Municipal, Public, Non-profit)	0	0	1	\$71,100

CHILMARK FLOOD VULNERABILITY
Based on Flood Data Released in 2016
Developable Land

Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		3.4 per building	4.63 per building		
100 Year	Residential				
	Other			5	\$1,291,000
Velocity Zone (also 100yr)	Residential	61	83	18	\$26,069,914
	Other			1	\$258,200

STORM SURGE VULNERABILITY FOR CHILMARK (HURRICANE) S.L.O.S.H. MAP

The colors in the Storm Surge legend grade in Hurricane intensity from Category 1 (dark purple) to Category 4 (palest color). Bright color symbols represent affected infrastructure. For the larger map, see <https://www.mvcommission.org/climate-change>



CHILMARK HURRICANE INUNDATION VULNERABILITY (SLOSH)
Based on data Released by the USACOE New England District in March 2013
DEVELOPED LAND

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		3.4 per building	4.63 per building		
1	Commercial	0	0	1	\$172,700
	Residential	37	51	11	\$3,871,900
2	Commercial	0	0	7	\$1,359,500
	Exempt	0	0	1	\$71,100
	Mixed use Commercial	3	5	1	\$625,000
	Residential	153	208	45	\$18,647,800
3	Commercial	0	0	1	\$119,400
	Exempt	0	0	5	\$965,900
	Mixed use Commercial	7	9	2	\$984,800
	Mixed use Residential	10	14	3	\$549,900
	Residential	261	357	77	\$35,629,300
4	E	0	0	1	\$380,000
	MC	3	5	1	\$625,000
	R	272	371	80	\$68,291,400

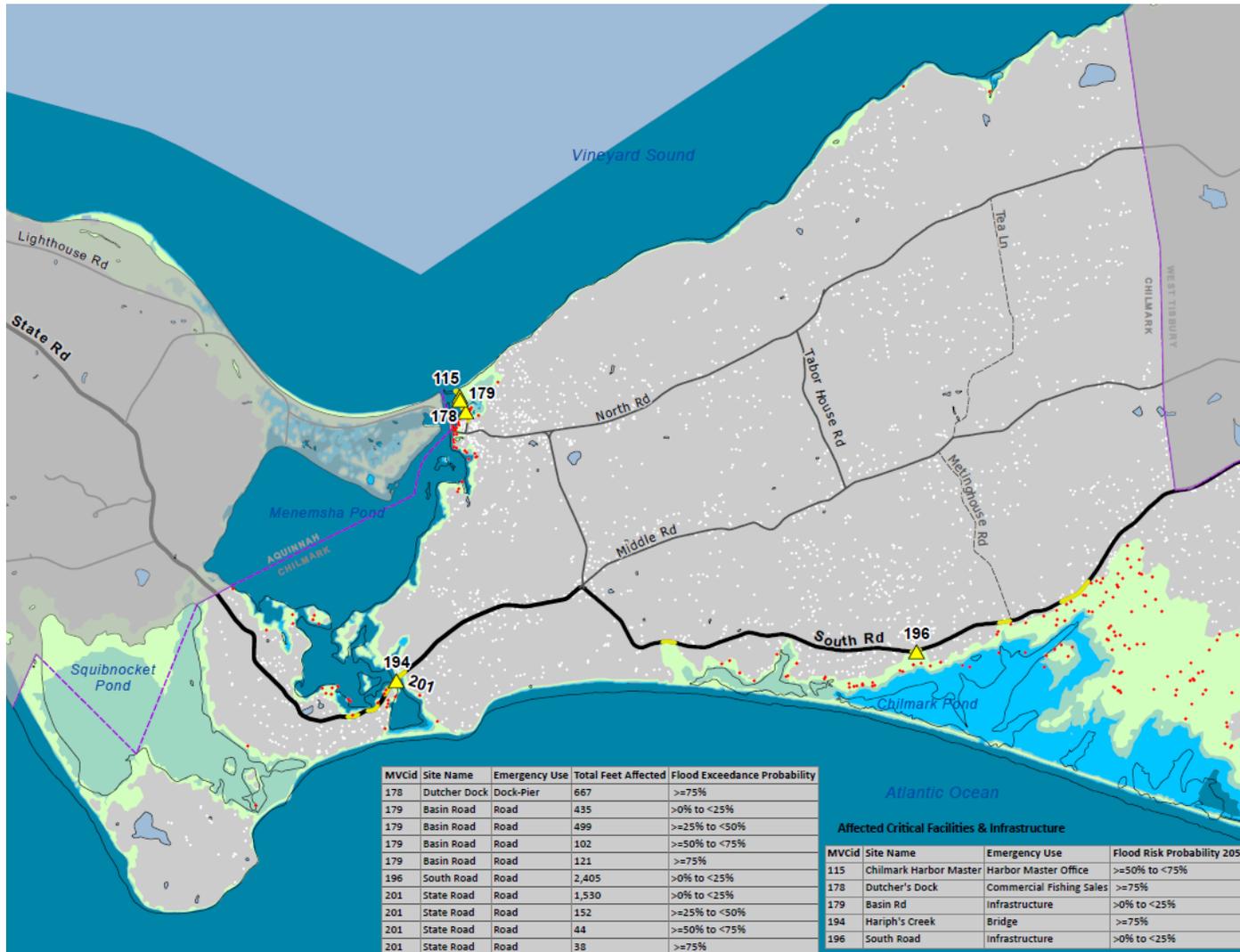
CHILMARK HURRICANE INUNDATION VULNERABILITY (SLOSH)
Based on data Released by the USACOE New England District in March 2013
DEVELOPABLE LAND

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		3.4 per building	4.63 per building		
1	Other	0	0	1	\$183,300
	Residential	163	222	48	\$16,895,564
2	Other	0	0	4	\$733,200
	Residential	61	83	18	\$7,459,120
3	Other	0	0	1	\$183,300
	Residential	78	107	23	\$10,642,518
4	Residential	20	28	6	\$5,121,855

CHILMARK SEA LEVEL RISE VULNERABILITY

SLR of 2.57 ft by 2050 and likelihood of flooding in a given year

dark blue: $\geq 75\%$; light blue: $\geq 50\%$ to $< 75\%$; olive green: $\geq 25\%$ to $< 50\%$; light green $> 0\%$ to $< 25\%$



For the larger map, see <https://www.mvcommission.org/climate-change>

CHILMARK SEA LEVEL RISE VULNERABILITY

SLR Scenarios: 2.57 ft* (2050)

4.37 ft* (2070) featured in *SLR Flood Risk Model 2070* table in Appendix

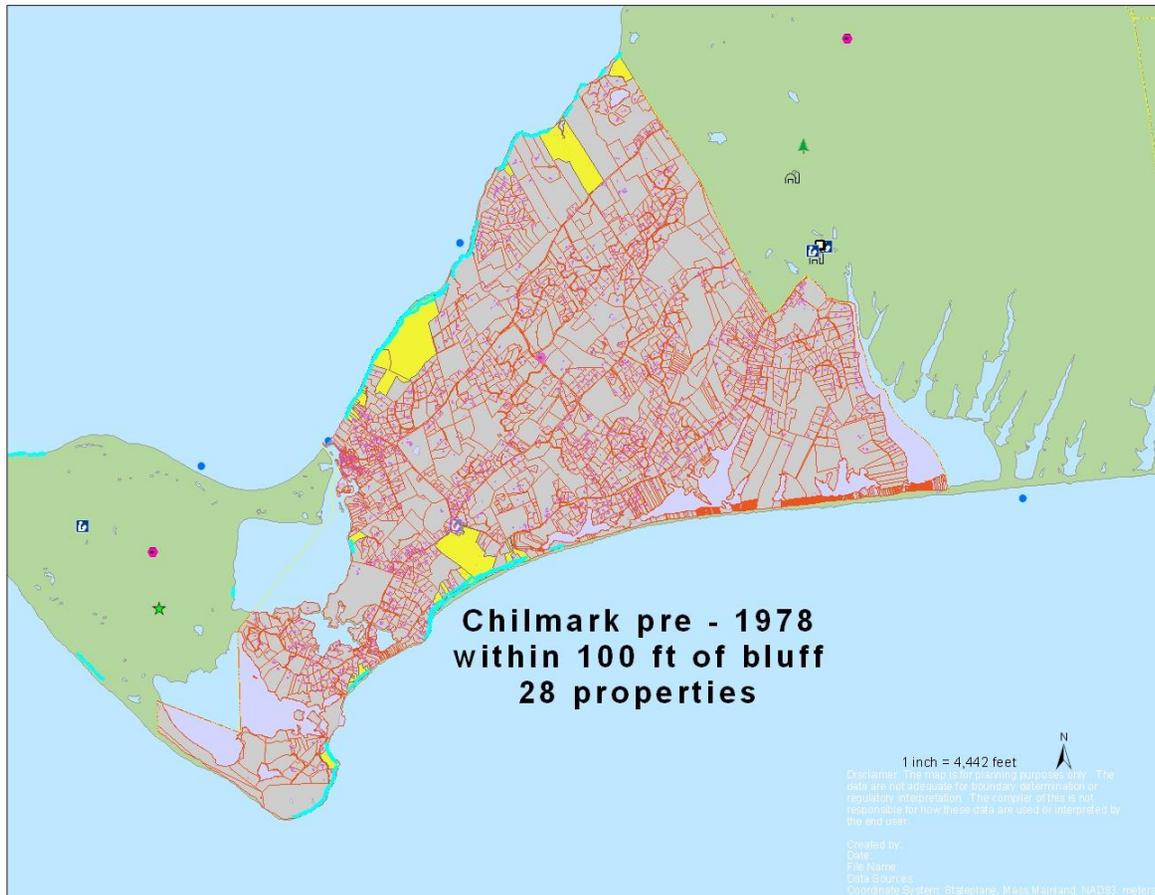
*relative to 2008 baseline

** likelihood increments are omitted if there is no current infrastructure associated with the featured use in that zone and the buildout analysis did not yield future development sited within the zone in question for a given use

Likelihood in a given year**	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.14 per building	4.22 per building		
>0% to <25%	Commercial	0	0	2	\$802,300
>=25% to <50%	Commercial	0	0	1	\$195,400
>=50% to <75%	Commercial	0	0	4	\$361,800
>=75%	Commercial	0	0	1	\$172,700
>0% to <25%	Exempt (Municipal, Public, Non-profit)	0	0	6	\$1,037,000
>0% to <25%	Mixed use Commercial	3	5	1	\$625,000
>0% to <25%	Mixed use Residential	7	9	2	\$291,700
>=25% to <50%	Other	0	0	0	\$0
>=50% to <75%	Other	0	0	0	\$0
>=75%	Other	0	0	0	\$0
>0% to <25%	Residential	601	820	177	\$95,037,300
>=25% to <50%	Residential	78	107	23	\$7,587,800
>=50% to <75%	Residential	24	32	7	\$3,432,500
>=75%	Residential	7	9	2	\$171,200

COASTAL EROSION AND SHORELINE CHANGE - Chilmark

Pre-1978 homes near bluffs are difficult for the towns to regulate (grandfathered under the Wetlands Protection Act). There are 28 in Chilmark (marked in yellow).



CHILMARK VULNERABILITY OF CRITICAL FACILITIES

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Chilmark Town Hall	\$1,711,800	Yes	--	--	--
Chilmark Police Station	\$333,900	Yes	--	--	--
Chilmark Fire Department	\$1,711,800	Yes	--	--	--
Chilmark Fire Department - North Rd	\$131,300	Yes	Yes	--	--
Chilmark Elementary	\$5,762,900	Yes	--	--	--
Chilmark Community Center	\$677,100	Yes	--	--	--
Menemsha Well	\$0	Yes	--	--	--
Chilmark Harbor Master	\$35,600	Yes	--	2	VE (100 Year Flood Zone)
Chilmark DPW Equipment	\$3,700	--	Yes	--	--
Dutcher's Dock	\$0	Yes	--	1	VE (100 Year Flood Zone)
Basin Rd	\$0	Yes	--	2	AE (100 Year Flood Zone)
Hariph's Bridge	\$0	Yes	--	1	AE (100 Year Flood Zone)
South Road	\$0	Yes	--	--	--
State Road	\$0	Yes	--	--	--

Critical Facilities - SLR

	SLR Present Probability	SLR Present Flood Depth	SLR 2030 Probability	SLR 2030 Flood Depth	SLR 2050 Probability	SLR 2050 Flood Depth	SLR 2070 Probability	SLR 2070 Flood Depth
Chilmark Town Hall	--	--	--	--	--	--	--	--
Chilmark Police Station	--	--	--	--	--	--	--	--
Chilmark Fire Department	--	--	--	--	--	--	--	--
Chilmark Fire Department - North Rd	--	--	--	--	--	--	--	--
Chilmark Elementary	--	--	--	--	--	--	--	--
Chilmark Community Center	--	--	--	--	--	--	--	--
Menemsha Well	--	--	--	--	--	--	--	--
Chilmark Harbor Master	>=50% to <75%	>=10ft	>=50% to <75%	>=10ft	>=50% to <75%	>=10ft	>=75%	>=10ft
Chilmark DPW Equipment	--	--	--	--	--	--	--	--
Dutcher's Dock	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Basin Rd	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft
Hariph's Bridge	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
South Road	--	--	>0% to <25%	--	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft
State Road	--	--	--	--	--	--	--	--

Linear Critical Facilities – Wildfire Impacts

Category	Town	Name	Length ft	Estimated Repair Cost
Road	Chilmark	South Road	9,787	\$2,001,933
Road	Chilmark	State Road	467	\$95,460

Linear Critical Facilities – FEMA Flood Impacts

Category	Town	Name	FEMA Flood Zone	Length ft	Estimated Repair Cost
Dock-Pier	Chilmark	Dutcher Dock	VE	667	\$1,852,118
Road	Chilmark	Basin Road	AE	744	\$152,145
Road	Chilmark	South Road	AE	27	\$5,555
Road	Chilmark	State Road	AE	407	\$83,287
Road	Chilmark	Basin Road	VE	685	\$140,204

Linear Critical Facilities – Hurricane Impacts

Category	Town	Name	Hurricane Category	Length ft	Estimated Repair Cost
Dock-Pier	Chilmark	Dutcher Dock	1	592.179332	\$1,644,943
Road	Chilmark	State Road	1	49.382619	\$10,101
Road	Chilmark	Basin Road	1	289.13719	\$59,142
Road	Chilmark	State Road	2	231.116812	\$47,274
Road	Chilmark	Basin Road	2	1057.232423	\$216,252
Road	Chilmark	South Road	2	5.578453	\$1,141
Road	Chilmark	Basin Road	3	178.073445	\$36,424
Road	Chilmark	State Road	3	679.998528	\$139,091
Road	Chilmark	South Road	3	1279.370142	\$261,689
Road	Chilmark	State Road	4	510.881761	\$104,499
Road	Chilmark	Basin Road	4	46.131391	\$9,436
Road	Chilmark	South Road	4	4121.388313	\$843,011

Critical Linear Facilities – Tsunami Impacts

Category	Town	Name	Length ft	Estimated Repair Cost
Dock-Pier	Chilmark	Dutcher Dock	667	\$1,852,118
Road	Chilmark	Basin Road	1,571	\$321,254
Road	Chilmark	South Road	17,078	\$3,493,251
Road	Chilmark	State Road	14,508	\$2,967,637

Town of Chilmark Future Vulnerability

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(combine impacts and frequency)(1 point for each step of frequency or impact)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	medium	large	serious	8
Erosion	high	local	minor	6
Dam Failures	very low	local	minor	3
Severe Rainstorms	medium	large	serious	8
Winter Storms	low	local	minor	4
Coastal Storms/Nor'easters	high	medium	extensive	10
Hurricanes	medium	medium	extensive	9
Wind-Related Hazards				
Hurricanes	medium	large	extensive	10
Coastal Storms	high	large	serious	9
Winter Storms	low	local	serious	5
Downspouts	very low	local	minor	3
Tornadoes	very low	local	serious	4
Fire-Related Hazards				
Drought	low	local	minor	4
Wildfires	low-minor	local	minor	4
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	medium	local	minor	5
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3
Sea Level Rise	high	local	minor	6

VULNERABILITY ASSESSMENTS FOR EDGARTOWN

Edgartown is the largest in land area of the towns in the County, with 27 square miles of land area and a year 'round population of 4,292 (ASC 5-year average 2013-2017) and a density of 159 persons per square mile.

Much of Edgartown's land area is very low and flat, made of unconsolidated outwash plain sediments that are susceptible to erosion. The south side of Edgartown experiences erosion at rates of 10-12 feet per year, and the low-lying plains with periglacial valleys are also highly susceptible to storm surge, with considerable risk to developed areas. Part of Edgartown lies on the nearby Island of Chappaquiddick, accessible by ferry year 'round, with associated transfer facilities to load vehicles. There have been times when Chappaquiddick has been accessible by 4-wheel drive vehicle across the barrier beach which sometimes connects Chappaquiddick to Edgartown proper, but an April 2007 storm breached the barrier, and the barrier is expected to remain open for at least 10-15 years in the future, during which time, ferry and boat travel are the only links to Chappaquiddick. Part of Edgartown is also in a direct line for wave action from Nor'easter storms, with potential for significant beach erosion and coastline modification.

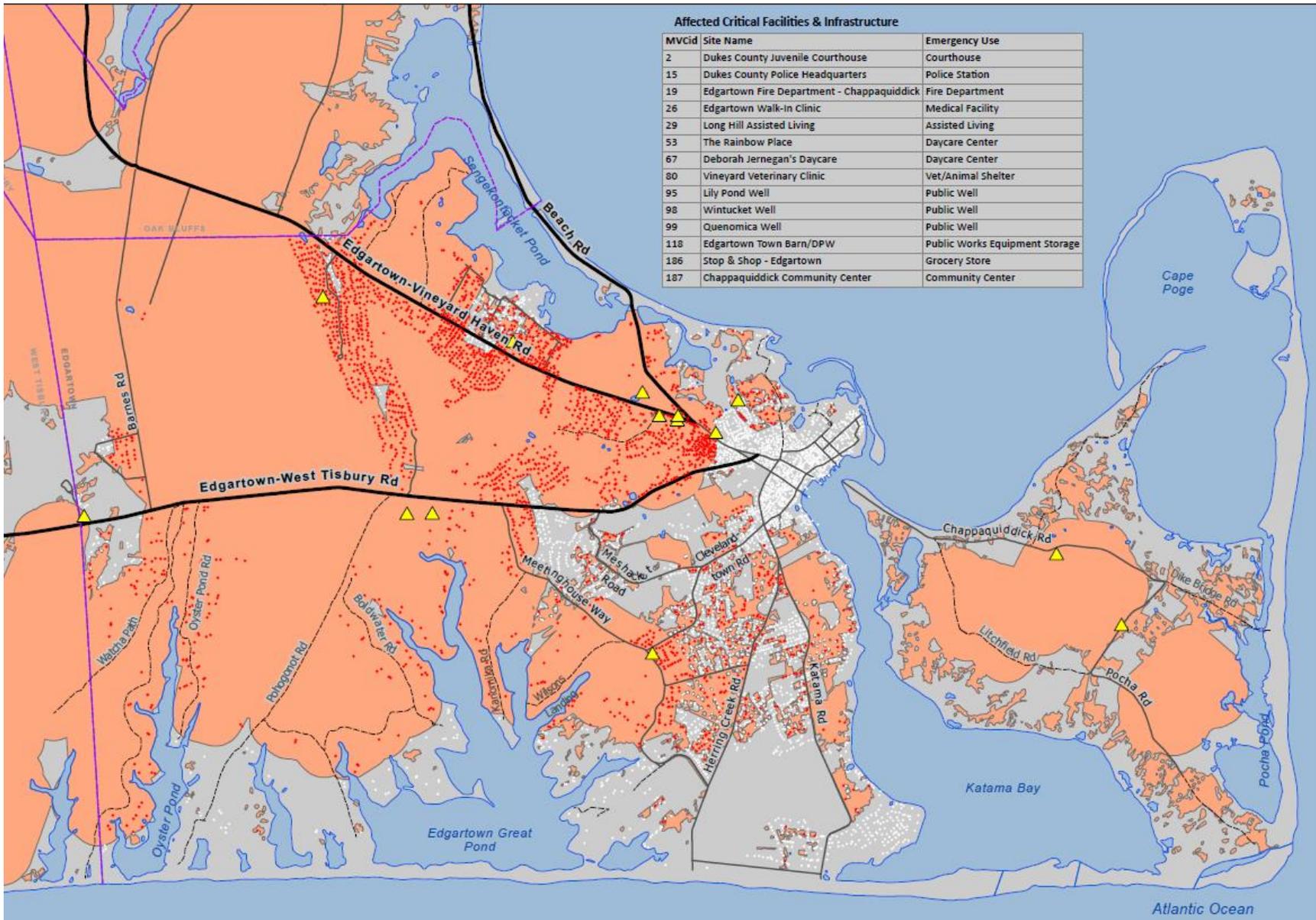
Much of the town is serviced by municipal water, and the infrastructure is such that there is not enough redundancy to protect the service from unfortunate events such as drought.

The maps illustrate the geographic extent of vulnerability. Only excerpts are shown below. The full sized maps are available on-line <https://www.mvcommission.org/climate-change>. Seeing the full extent is important for planning purposes.

The matrices of vulnerability highlight the persons and property. Property is identified both by numbers of buildings and by value. Persons are identified by population as well as by seasonal projection. Projections estimate vulnerability at buildout.

Vulnerability is represented for wildfire (wildland urban interface), flood (Nor'easter), storm (hurricane), Sea Level Rise, and for tsunami. Additional Sea Level Rise impacts are found appended to this document.

EDGARTOWN WILDFIRE VULNERABILITY (Wildland Urban Interface)



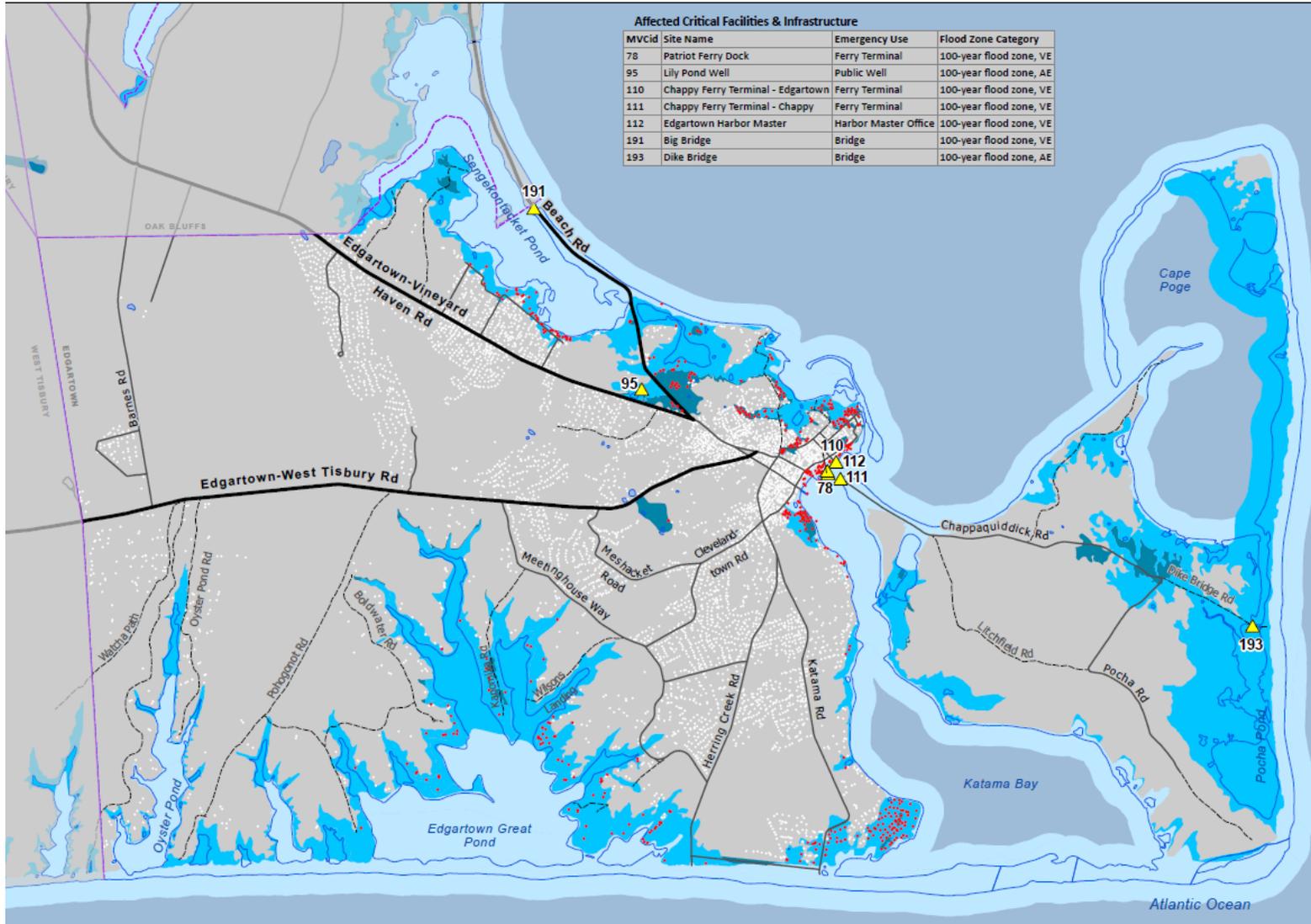
Wildfire Threatened Area – The Wildland-Urban interface is shown in orange, with potentially affected infrastructure displayed in bright colors. For the larger map, see <https://www.mvcommission.org/climate-change>

Edgartown Wildfire Vulnerability

Developed Land					Undevel. Land			
Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
	2.69 per building	4.36 per building			2.69 per building	4.36 per building		
Commercial			87	\$40,691,800				
Municipal, Public, Non-profit			20	\$5,772,900				
Industrial			1					
Mixed use Commercial	3	4	1	\$1,679,800				
Mixed use Residential	5	9	2	\$2,656,000				
Other			22	\$11,391,100			-17	
Residential	7009	11374	2608	\$1,346,152,700	2822	4579	1050	\$541,970,987

EDGARTOWN FLOOD VULNERABILITY (2016 FIRM MAP) - Nor'Easter- type storm flooding

Powder blue represents the 100-year VE zone (wave heights > 3'). Teal represents the 100-year AE zone (wave heights < 3'). Dark blue shows the 500-year flood zone. For the larger map, see <https://www.mvcommission.org/climate-change>



**Flood Vulnerability
Based on Flood Data 2016
Developed Land**

Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.69 per building	4.36 per building		
.2% annual flood	Residential	352	571	131	\$137,743,500
.2% annual flood	Commercial			3	\$2,182,800
.2% annual flood	Exempt (Municipal, Public, Non-profit)			1	\$0
100 Year AE	Exempt (Municipal, Public, Non-profit)	0	0	3	\$0
100 Year AE	Other	0	0	10	\$2,098,400
100 Year AE	Residential	847	1374	315	\$356,789,500
100 Year AE	Exempt (Municipal, Public, Non-profit)			4	\$0
100 Year VE	Commercial	0	0	31	\$22,680,400
100 Year VE	Exempt (Municipal, Public, Non-profit)	0	0	4	\$2,334,600
	Other	0	0	0	\$0
100 Year VE	Residential	159	257	59	\$70,734,700

**Edgartown Flood Vulnerability
Based on Flood Data 2016
Developable Land**

Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.69 per bldg	4.36 per bldg		
.2% annual flood	Other	0	9	2	\$419,680
.2% annual flood	Residential	54	87	20	\$21,029,542
100 Year AE	Other	0	0	7	\$1,468,880
100 Year AE	Residential	605	981	225	\$254,849,643
100 Year VE	Commercial	0	0	-18	\$0
100 Year VE	Other	0	0	21	\$4,406,640
100 Year VE	Residential	245	397	91	\$109,099,283

Edgartown Hurricane Inundation Vulnerability (SLOSH)
Based on data Released by the USACOE New England District in March 2013

Developed Land

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		3.4 per building	4.63 per building		
1	Commercial			14	\$17,214,800
	Exempt (Municipal, Public, Non-profit)			2	\$1,579,000
	Other			1	\$356,300
	Residential	148	240	55	\$57,928,700
2	Commercial			16	\$5,631,000
	Exempt (Municipal, Public, Non-profit)			5	\$2,334,600
	Residential	605	981	225	\$289,166,400
3	Commercial			20	\$25,550,600
	Exempt (Municipal, Public, Non-profit)			3	\$2,482,800
	Mixed use Residential	5	9	2	\$2,656,000
3	Other			11	\$2,984,400
3	Residential	1142	1853	425	\$488,934,400
4	Commercial			50	\$81,246,400
	Exempt (Municipal, Public, Non-profit)			7	\$6,760,400
	Mixed use Commercial	3	4	1	\$1,679,800
	Other			5	\$2,773,700
	Residential	1226	1989	456	\$505,814,400

Edgartown Hurricane Inundation Vulnerability (SLOSH)
Based on data Released by the USACOE New England District in March 2013

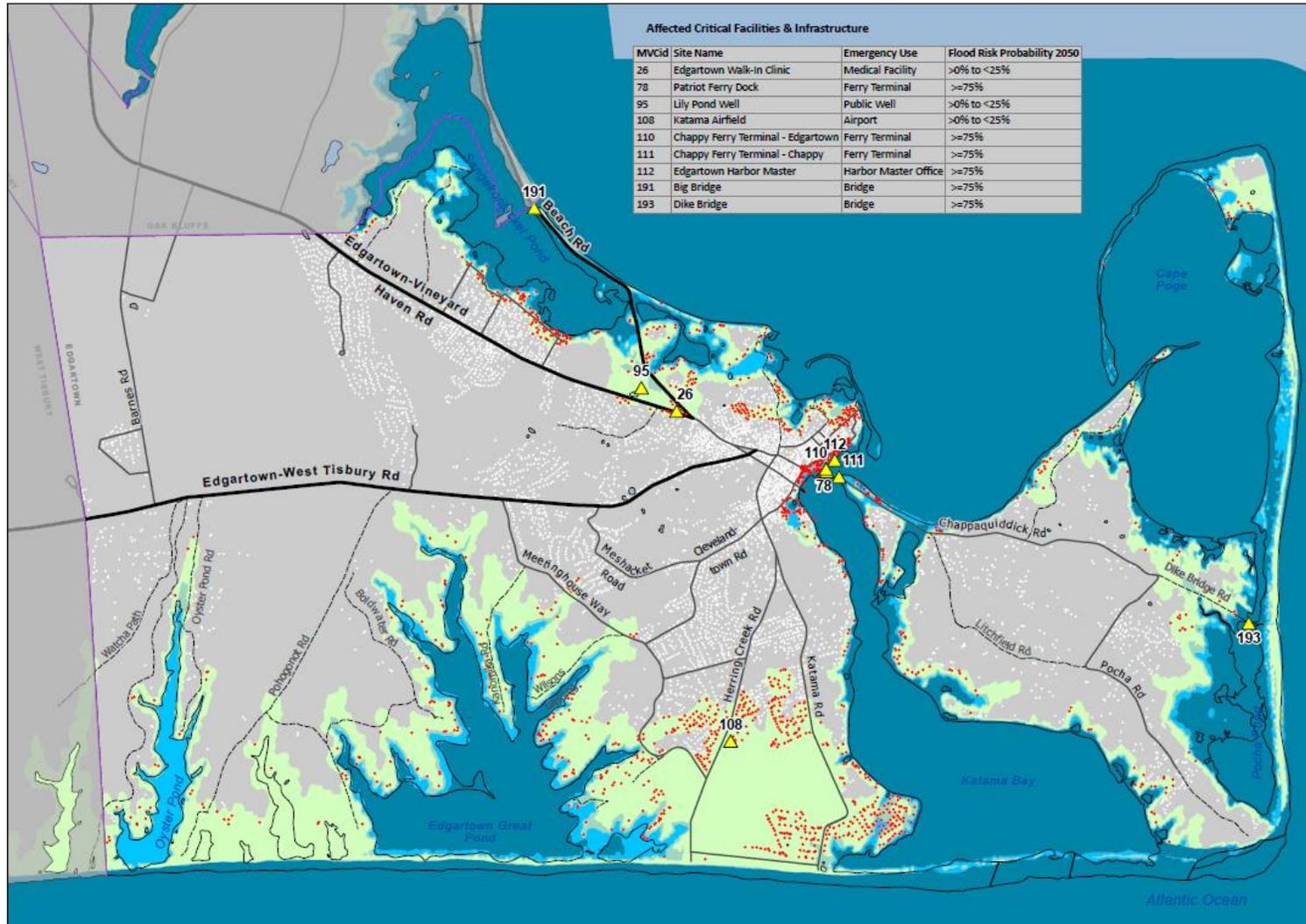
Potential Development

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		3.4 per building	4.63 per building		
1	Commercial			-4	
	Other			17	\$6,057,100
	Residential	554	898	206	\$216,969,313
2	Commercial			-12	
	Other			7	\$2,494,100
	Residential	282	458	105	\$134,944,320
3	Commercial			-18	
	Other			-10	
	Residential	24	39	9	\$10,353,905
4	Commercial			-23	
	Residential	153	249	57	\$63,226,800

EDGARTOWN SEA LEVEL RISE VULNERABILITY

SLR of 2.57 ft by 2050 and likelihood of flooding in a given year

dark blue: $\geq 75\%$; light blue: $\geq 50\%$ to $< 75\%$; olive green: $\geq 25\%$ to $< 50\%$; light green $> 0\%$ to $< 25\%$



For the larger map, visit: <https://www.mvcommission.org/climate-change>

EDGARTOWN SEA LEVEL RISE VULNERABILITY

SLR Scenarios: 2.57 ft* (2050)

4.37 ft* (2070) featured in *SLR Flood Risk Model 2070* table in Appendix

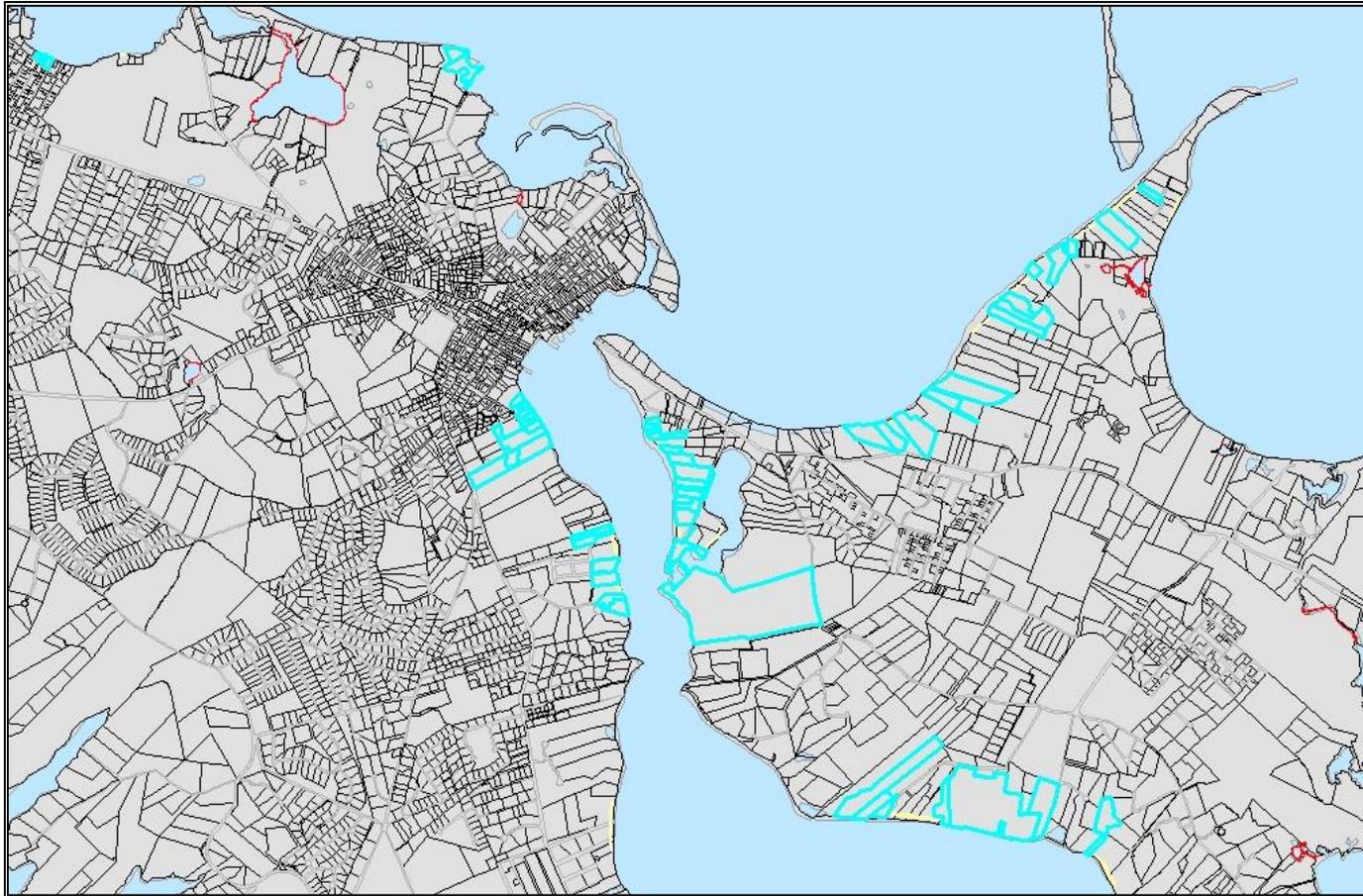
*relative to 2008 baseline

** likelihood increments are omitted if there is no current infrastructure associated with the featured use in that zone and the buildout analysis did not yield future development sited within the zone in question for a given use

Likelihood in a given year**	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
>0% to <25%	Commercial	0	0	28	\$61,471,800
>=25% to <50%	Commercial	0	0	9	\$8,091,400
>=50% to <75%	Commercial	0	0	15	\$13,454,800
>=75%	Commercial	0	0	9	\$8,864,500
>0% to <25%	Exempt (Municipal, Public, Non-profit)	0	0	14	\$4,132,900
>=25% to <50%	Exempt (Municipal, Public, Non-profit)	0	0	1	\$1,579,000
>=50% to <75%	Exempt (Municipal, Public, Non-profit)	0	0	3	\$2,334,600
>=75%	Exempt (Municipal, Public, Non-profit)	0	0	1	\$0
>0% to <25%	Mixed use Commercial	3	4	1	\$1,679,800
>0% to <25%	Mixed use Residential	5	9	2	\$2,656,000
>0% to <25%	Other	0	0	9	\$1,629,100
>=25% to <50%	Other	0	0	0	\$0
>=50% to <75%	Other	0	0	1	\$356,300
>=75%	Other	0	0	0	\$0
>0% to <25%	Residential	2,682	4352	998	\$1,005,413,400
>=25% to <50%	Residential	317	515	118	\$150,140,800
>=50% to <75%	Residential	156	253	58	\$53,907,600
>=75%	Residential	46	74	17	\$22,885,000

COASTAL EROSION AND SHORELINE CHANGE - Edgartown

Pre-1978 homes near bluffs are difficult for the towns to regulate (grandfathered under the Wetlands Protection Act). There are 55 in Edgartown.



EDGARTOWN VULNERABILITY OF CRITICAL FACILITIES

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Dukes County Courthouse	\$2,419,800	Yes	--	--	--
Dukes County Juvenile Courthouse	\$457,835	Yes	Yes	--	--
Edgartown Town Hall	\$2,271,100	Yes	--	--	--
Edgartown Police Station	\$4,605,300	Yes	--	4	--
Dukes County Police Headquarters	\$674,300	--	Yes	--	--
Edgartown Fire Department - Chappaquiddick	\$1,131,400	Yes	Yes	--	--
Edgartown Fire Department	\$4,605,300	Yes	--	--	--
Edgartown Walk-In Clinic	\$279,966	Yes	Yes	4	--
Long Hill Assisted Living	\$698,800	Yes	Yes	--	--
Edgartown Elementary	\$23,929,800	Yes	--	--	--
Martha's Vineyard Boys & Girls Club	\$1,356,100	Yes	--	--	--
The Rainbow Place	\$494,200	Yes	Yes	--	--
Patricia Waller's Day Care	\$0	Yes	--	--	--
Bea Lawry's Day Care	\$212,000	Yes	--	--	--
Deborah Jernegan's Day Care	\$426,300	--	Yes	--	--
Naomi Higgins' Day Care	\$419,200	Yes	--	--	--
Patriot Ferry Dock	\$0	Yes	--	1	VE (100 Year Flood Zone)
Vineyard Veterinary Clinic	\$614,800	Yes	Yes	--	--
Dukes County Jail	\$1,378,700	Yes	--	--	--
Lily Pond Well	\$0	Yes	Yes	2	AE (100 Year Flood Zone)
Wintucket Well	\$903,800	--	Yes	--	--
Quenomica Well	\$903,800	--	Yes	--	--
Katama Airfield	\$84,333	Yes	--	--	--
Chappy Ferry Terminal - Edgartown	\$0	Yes	--	1	VE (100 Year Flood Zone)
Chappy Ferry Terminal - Chappy	\$0	Yes	--	1	VE (100 Year Flood Zone)

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Edgartown Harbor Master	\$181,700	Yes	--	1	VE (100 Year Flood Zone)
Edgartown Town Barn/DPW	\$1,628,600	--	Yes	--	--
St Andrews Episcopal Church	\$951,000	Yes	--	--	--
Federated Church of Martha's Vineyard	\$1,433,900	Yes	--	4	--
Stop & Shop - Edgartown	\$0	Yes	Yes	--	--
Chappaquiddick Community Center	\$455,800	Yes	Yes	--	--
Big Bridge	\$0	Yes	--	--	VE (100 Year Flood Zone)
Dike Bridge	\$0	Yes	--	--	AE (100 Year Flood Zone)

Critical Facilities – SLR

	SLR Present Probability	SLR Present Flood Depth	SLR 2030 Probability	SLR 2030 Flood Depth	SLR 2050 Probability	SLR 2050 Flood Depth	SLR 2070 Probability	SLR 2070 Flood Depth
Dukes County Courthouse	--	--	--	--	--	--	--	--
Dukes County Juvenile Courthouse	--	--	--	--	--	--	>0% to <25%	--
Edgartown Town Hall	--	--	--	--	--	--	--	--
Edgartown Police Station	--	--	--	--	--	--	--	--
Dukes County Police Headquarters	--	--	--	--	--	--	--	--
Edgartown Fire Department - Chappaquiddick	--	--	--	--	--	--	--	--
Edgartown Fire Department	--	--	--	--	--	--	--	--
Edgartown Walk-In Clinic	--	--	--	--	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft
Long Hill Assisted Living	--	--	--	--	--	--	--	--
Edgartown Elementary	--	--	--	--	--	--	--	--

	SLR Present Probability	SLR Present Flood Depth	SLR 2030 Probability	SLR 2030 Flood Depth	SLR 2050 Probability	SLR 2050 Flood Depth	SLR 2070 Probability	SLR 2070 Flood Depth
Martha's Vineyard Boys & Girls Club	--	--	--	--	--	--	--	--
The Rainbow Place	--	--	--	--	--	--	--	--
Patricia Waller's Day Care	--	--	--	--	--	--	--	--
Bea Lawry's Day Care	--	--	--	--	--	--	--	--
Deborah Jernegan's Day Care	--	--	--	--	--	--	--	--
Naomi Higgins' Day Care	--	--	--	--	--	--	--	--
Patriot Ferry Dock	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Vineyard Veterinary Clinic	--	--	--	--	--	--	>0% to <25%	--
Dukes County Jail	--	--	--	--	--	--	--	--
Lily Pond Well	--	--	--	--	>0% to <25%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft
Wintucket Well	--	--	--	--	--	--	>0% to <25%	--
Quenomica Well	--	--	--	--	--	--	--	--
Katama Airfield	--	--	--	--	>0% to <25%	--	>0% to <25%	--
Chappy Ferry Terminal - Edgartown	>=75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=10ft
Chappy Ferry Terminal - Chappy	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Edgartown Harbor Master	>=75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=10ft	>=75%	>=10ft
Edgartown Town Barn/DPW	--	--	--	--	--	--	--	--
St Andrews Episcopal Church	--	--	--	--	--	--	--	--
Federated Church of Martha's Vineyard	--	--	--	--	--	--	--	--
Stop & Shop - Edgartown	--	--	--	--	--	--	--	--
Chappaquiddick Community Center	--	--	--	--	--	--	--	--
Big Bridge	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Dike Bridge	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft

***No Linear Critical Facilities were identified by Edgartown’s HMP representative.**

FUTURE VULNERABILITY FOR EDGARTOWN

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(combine impacts and frequency) (1 point for each step of frequency or impact)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	medium	large	serious	8
Erosion	high	large	serious	9
Dam Failures	very low	local	serious	0
Severe Rainstorms	medium	large	serious	8
Winter Storms	low	local	minor	4
Coastal Storms/Nor'easters	high	medium	extensive	10
Hurricanes	medium	large	catastrophic	10
Wind-Related Hazards				
Hurricanes	medium	large	extensive	9
Coastal Storms	high	large	serious	9
Winter Storms	low	local	serious	5
Downspouts	very low	local	serious	3
Tornadoes	low	local	serious	5
Fire-Related Hazards				
Drought	medium	medium	serious	8
Wildfires	high	large	extensive	10
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	very low	local	minor	3
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3
Sea Level Rise	high	medium	serious	8

VULNERABILITY ASSESSMENTS FOR GOSNOLD

The Town of Gosnold includes the entire Elizabeth Island chain. They are named Nonamesset, Uncatena, Weepecket, Naushon, Pasque, Nashawena, Penikese and Cuttyhunk. According to the ASC 5-year average 2013-2017, Gosnold had a year-round population of 34 on an area of 13 square miles of dry land, with a density of 2.6 persons per square mile. Settlement is centered, however, on the outermost island of Cuttyhunk, where most of the population resides. Ferry service for passengers and freight (no cars) is provided year 'round from New Bedford and in summer from Menemesha. Protection and functionality of harbor facilities are essential for the well-being of the residents.

The maps illustrate the geographic extent of vulnerability. In some cases, only excerpts are shown here. The full sized maps are available on-line <https://www.mvcommission.org/climate-change>. Seeing the full extent is important for planning purposes.

The matrices of vulnerability highlight the persons and property. Property is identified both by numbers of buildings and by value. Persons are identified by population (ASC 5-year average 2013-2017) as well as by seasonal projection. Projections estimate vulnerability at buildout.

Vulnerability is represented for wildfire (wildland urban interface), flood (Nor'easter), storm (hurricane), Sea Level Rise, and for tsunami. Additional Sea Level Rise impacts are found appended to this document.

GOSNOLD WILDFIRE VULNERABILITY

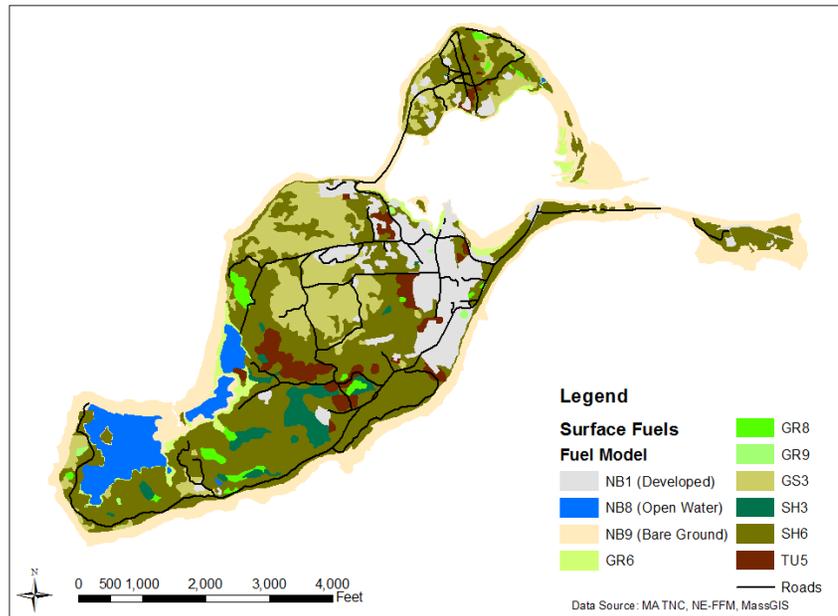
For the larger map, see <https://www.mvcommission.org/climate-change>



Wildfire Threatened Area – The Wildland-Urban interface is shown in orange, with potentially affected infrastructure displayed in bright colors.

The Cuttyhunk Community Wildfire Protection Plan, 2013, included data and analysis in planning wildfire management for Cuttyhunk Island, the population center of the Town of Gosnold (including the Elizabeth Islands). Surface fuels were mapped according to TNC classification. Flame lengths and rate of spread were then modeled.

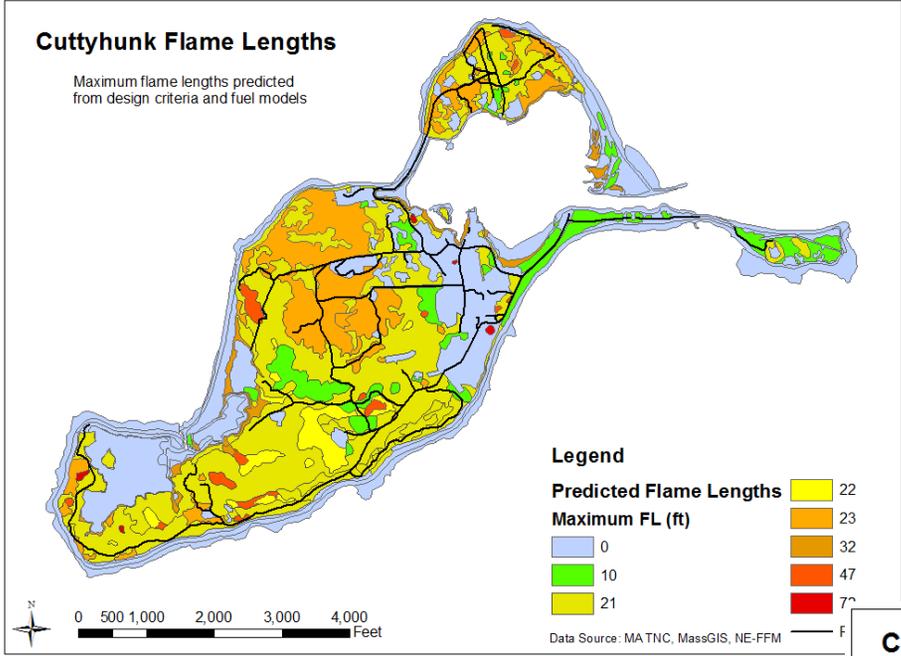
Surface Fuels for Cuttyhunk (left)



Fuel models by TNC vegetation class (below).

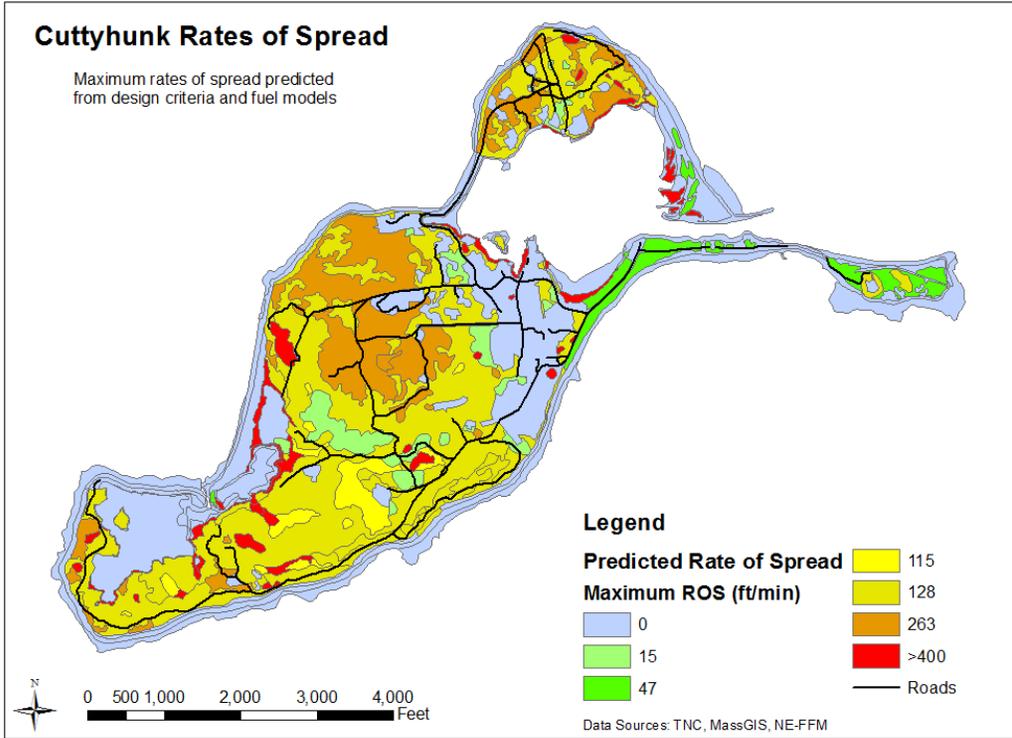
Fuel Model	TNC Classification	Location
GR6 – Moderate load grass	Salt Marsh	Westend Pond and Cuttyhunk Pond edges
GR8 – High load, very coarse grass	Shallow Marsh	Phragmites stands scattered across island
GR9 – Very high load grass	Deep Marsh	Phragmites stands scattered across island
GS3 – Moderate load grass-shrub	Sandplain/Panicum Grassland	Concentrated in the northwest end of the island
SH3 – Moderate load shrub	Shrub Swamps	Southern end of island around area of airstrip
SH6 – Low load shrub	Maritime/Coastal Shrubland	Majority of island
TU5 – Very high load timber-shrub	Successional Maritime Forest	Isolated stands of trees in center of island

from Cuttyhunk Community Wildfire Protection Plan, 2013



Cuttyhunk Flame Lengths (left)

Cuttyhunk Rates of Spread (below)

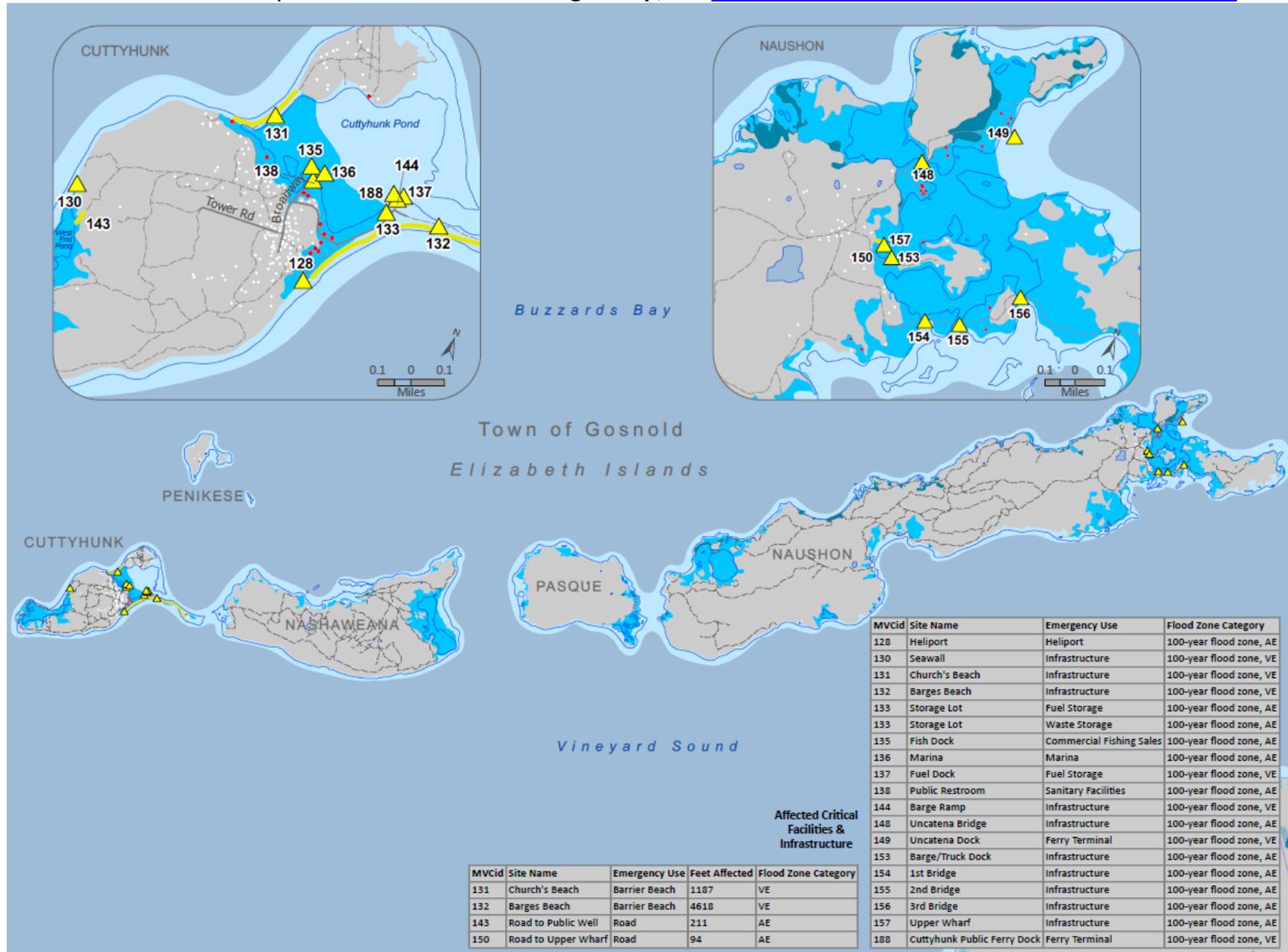


GOSNOLD Wildfire Vulnerability

Developed Land					Undevel. Land			Approx. Value
Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value	# People (other)	# People (July-Aug)	# Buildings	
	1.89 per building	4.59 per building			1.89 per building	4.59 per building		
Residential	7.68		4	\$1,077,716	?	?	?	?
Commercial					?	?	?	?
Industrial			1	\$24,500	?	?	?	?
Municipal, Public, Non-profit					?	?	?	?

GOSNOLD FLOOD VULNERABILITY (2016 FIRM) - Nor'Easter- type storm flooding

Powder blue represents the 100-year VE zone (wave heights > 3'). Teal represents the 100-year AE zone (wave heights < 3'). Dark blue shows the 500-year flood zone. For the larger map, see <https://www.mvcommission.org/climate-change>



**Gosnold Flood Vulnerability
Based on 2016 Flood Data**

Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
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Developed Land

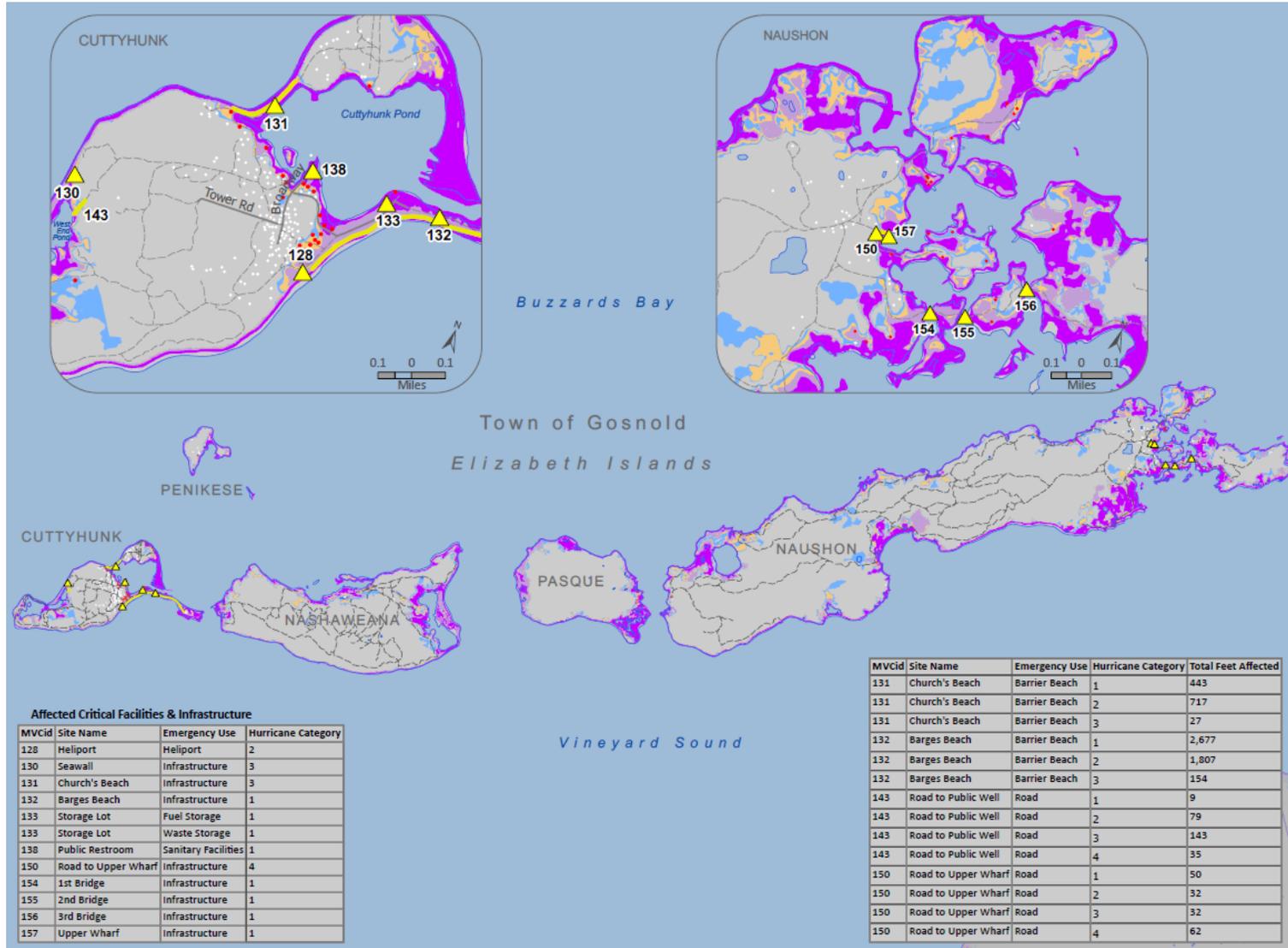
		1.89 per building	4.59 per building		
100 Year AE Zone	Exempt (Municipal, Public, Non-profit)	0	0	2	\$0
100 Year AE Zone	Residential	72	174	38	\$9,465,400
100 Year VE Zone	Exempt (Municipal, Public, Non-profit)	0	0	2	\$236,500
100 Year VE Zone	Residential	6	14	3	\$7,643,700

Developable Land

		1.89 per building	4.59 per building		
100 Year AE Zone	Residential	13	32	7	\$1,743,626
100 Year VE Zone	Residential	28	69	15	\$38,218,500

STORM SURGE VULNERABILITY FOR GOSNOLD (HURRICANE) S.L.O.S.H. MAP

The colors in the Storm Surge legend grade in Hurricane intensity from Category 1 (dark purple) to Category 4 (palest color). Bright color symbols represent affected infrastructure. For the larger map, see <https://www.mvcommission.org/climate-change>



GOSNOLD Hurricane Inundation Vulnerability (SLOSH)
Based on data Released by the USACOE New England District in March 2013
Developed Land

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		1.89 per building	4.59 per building		
1	Municipal, Public, Non-profit	0	0	2	\$33,200
1	Residential	15	37	8	\$7,455,100
2	Residential	40	96	21	\$8,778,400
3	Municipal, Public, Non-profit	0	0	1	\$203,300
3	Residential	23	55	12	\$8,507,000
4	Municipal, Public, Non-profit	0	0	1	\$46,700
4	Residential	25	60	13	\$9,369,800

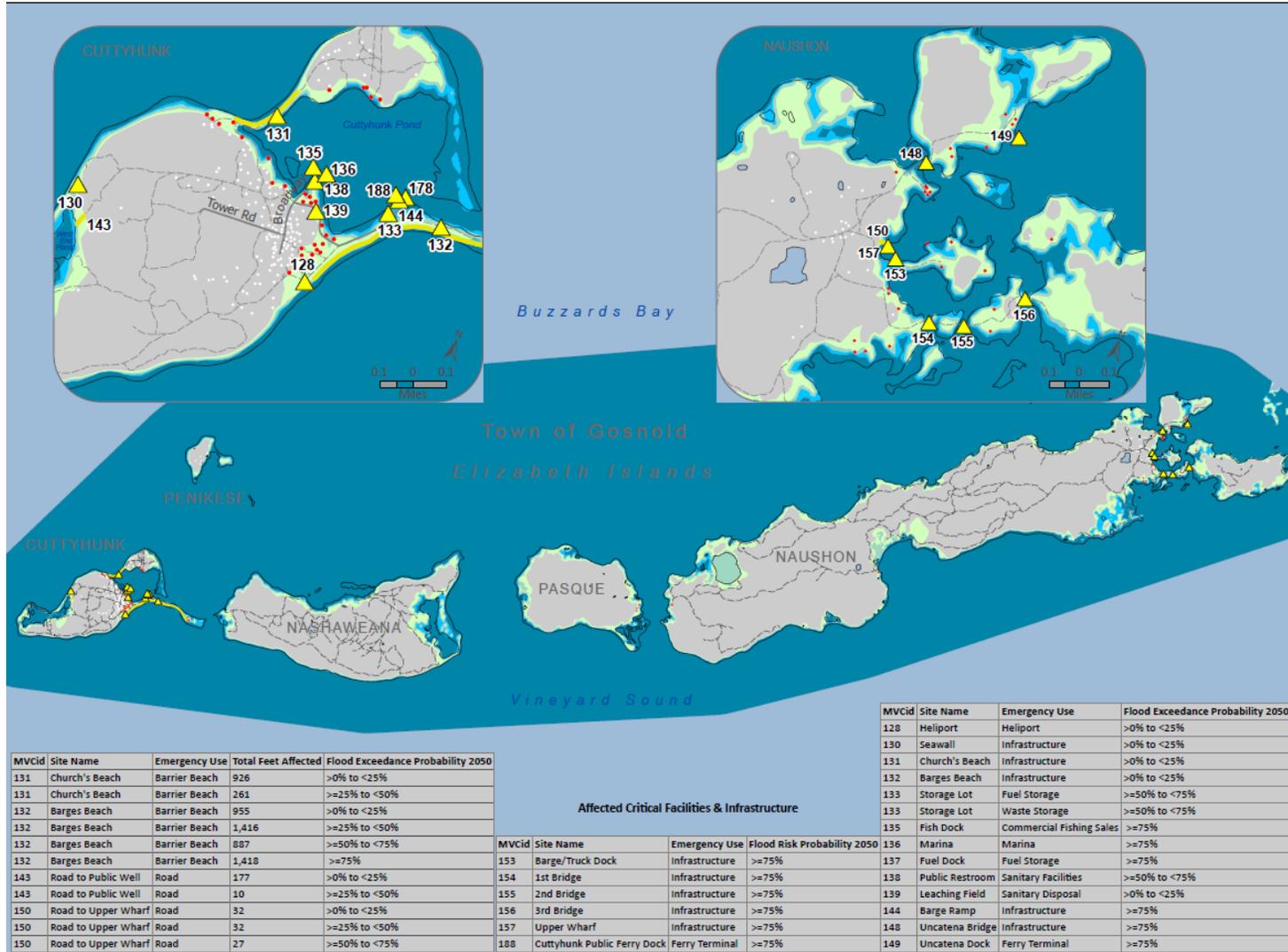
Developable Land – Future Potential Development

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		1.89 per building	4.59 per building		
1	Residential	26	64	14	\$13,046,425
2	Residential	8	18	4	\$1,672,076
3	Residential	2	5	1	\$708,917
4	Residential				

GOSNOLD SEA LEVEL RISE VULNERABILITY

SLR of 2.57 ft by 2050 and likelihood of flooding in a given year

dark blue: >=75%; light blue: >=50% to <75%; olive green: >=25% to <50%; light green >0% to <25%



For the larger map, see <https://www.mvcommission.org/climate-change>

GOSNOLD SEA LEVEL RISE VULNERABILITY

SLR Scenarios: 2.57 ft* (2050)

4.37 ft* (2070) featured in *SLR Flood Risk Model 2070* table in Appendix

*relative to 2008 baseline

** likelihood increments are omitted if there is no current infrastructure associated with the featured use in that zone and the buildout analysis did not yield future development sited within the zone in question for a given use

Likelihood in a given year**	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.14 per building	4.22 per building		
>0% to <25%	Exempt (Municipal, Public, Non-profit)	0	0	2	\$203,300
>=25% to <50%	Exempt (Municipal, Public, Non-profit)	0	0	1	\$46,700
>=50% to <75%	Exempt (Municipal, Public, Non-profit)	0	0	1	\$0
>=75%	Exempt (Municipal, Public, Non-profit)	0	0	2	\$33,200
>0% to <25%	Residential	85	206	45	\$11,528,000
>=25% to <50%	Residential	42	101	22	\$9,062,800
>=50% to <75%	Residential	11	28	6	\$7,886,500
>=75%	Residential	8	18	4	\$7,235,100

GOSNOLD VULNERABILITY OF CRITICAL FACILITIES

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Cuttyhunk Elementary	\$258,580	Yes	--	--	--
Penikese Island School	\$203,300	Yes	--	--	--
Gosnold Town Hall	\$258,580	Yes	--	--	--
Cuttyhunk Church	\$89,600	Yes	--	--	--
Cuttyhunk Heliport	\$0	Yes	--	2	AE (100 Year Flood Zone)
Cuttyhunk Airstrip	\$203,700	Yes	--	--	--
Cuttyhunk Well Seawall	\$0	Yes	--	3	VE (100 Year Flood Zone)
Church's Beach	\$0	Yes	--	3	VE (100 Year Flood Zone)
Barges Beach	\$0	Yes	--	1	VE (100 Year Flood Zone)
Cuttyhunk Storage Lot	\$0	Yes	--	1	AE (100 Year Flood Zone)
Cuttyhunk Fish Dock	\$0	Yes	--	--	AE (100 Year Flood Zone)
Cuttyhunk Marina	\$0	Yes	--	--	AE (100 Year Flood Zone)
Cuttyhunk Fuel Dock	\$0	Yes	--	--	VE (100 Year Flood Zone)
Cuttyhunk Public Restroom	\$0	Yes	--	1	AE (100 Year Flood Zone)
Cuttyhunk Leaching Field	\$0	Yes	--	--	--
Cuttyhunk Town Well	\$0	Yes	--	--	--
Cuttyhunk Power House	\$60,300	Yes	--	--	--
Cuttyhunk Solar Array	\$203,700	Yes	--	--	--
Road to Cuttyhunk Well	\$203,700	Yes	--	--	--
Barge Ramp	\$0	Yes	--	--	VE (100 Year Flood Zone)
Uncatena Bridge	\$0	Yes	--	--	AE (100 Year Flood Zone)
Uncatena Dock	\$0	Yes	--	--	VE (100 Year Flood Zone)
Road to Upper Wharf	\$160,780	Yes	--	4	--
Generator	\$160,780	Yes	--	--	--
Solar Farm	\$160,780	Yes	--	--	--
Barge/Truck Dock	\$0	Yes	--	--	AE (100 Year Flood Zone)
1st Bridge	\$0	Yes	--	1	AE (100 Year Flood Zone)
2nd Bridge	\$160,780	Yes	--	1	AE (100 Year Flood Zone)
3rd Bridge	\$0	Yes	--	1	AE (100 Year Flood Zone)
Upper Wharf	\$0	Yes	--	1	AE (100 Year Flood Zone)
Cuttyhunk Public Ferry Dock	\$0	Yes	--	--	VE (100 Year Flood Zone)

Critical Facilities - SLR

	SLR Present Probability	SLR Present Flood Depth	SLR 2030 Probability	SLR 2030 Flood Depth	SLR 2050 Probability	SLR 2050 Flood Depth	SLR 2070 Probability	SLR 2070 Flood Depth
Cuttyhunk Elementary	--	--	--	--	--	--	--	--
Penikese Island School	--	--	--	--	--	--	--	--
Gosnold Town Hall	--	--	--	--	--	--	--	--
Cuttyhunk Church	--	--	--	--	--	--	--	--
Cuttyhunk Heliport	>0% to <25%	--	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>=2.5ft to <5ft
Cuttyhunk Airstrip	--	--	--	--	--	--	--	--
Cuttyhunk Well Seawall	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft
Church's Beach	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>=2.5ft to <5ft
Barges Beach	>0% to <25%	>=2.5ft to <5ft	>0% to <25%	>=5ft to <10ft	>0% to <25%	>=5ft to <10ft	>=25% to <50%	>=5ft to <10ft
Cuttyhunk Storage Lot	>=25% to <50%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft
Cuttyhunk Fish Dock	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Cuttyhunk Marina	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Cuttyhunk Fuel Dock	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Cuttyhunk Public Restroom	>=25% to <50%	>=2.5ft to <5ft	>=50% to <75%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft
Cuttyhunk Leaching Field	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft
Cuttyhunk Town Well	--	--	--	--	--	--	--	--
Cuttyhunk Power House	--	--	--	--	--	--	--	--
Cuttyhunk Solar Array	--	--	--	--	--	--	--	--
Road to Cuttyhunk Well	--	--	--	--	--	--	--	--
Barge Ramp	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Uncatena Bridge	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Uncatena Dock	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Road to Upper Wharf	--	--	--	--	--	--	>0% to <25%	>0ft to 2.5ft
Generator	--	--	--	--	--	--	--	--
Solar Farm	--	--	--	--	--	--	--	--
Barge/Truck Dock	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
1st Bridge	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
2nd Bridge	>=50% to <75%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=10ft

	SLR Present Probability	SLR Present Flood Depth	SLR 2030 Probability	SLR 2030 Flood Depth	SLR 2050 Probability	SLR 2050 Flood Depth	SLR 2070 Probability	SLR 2070 Flood Depth
3rd Bridge	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Upper Wharf	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Cuttyhunk Public Ferry Dock	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft

Linear Critical Facilities – FEMA Flood Impacts

Category	Town	Name	FEMA Flood Zone	Length ft	Estimated Repair Cost
Barrier Beach	Gosnold	Church's Beach	VE	1,187	\$1,236,095
Barrier Beach	Gosnold	Barges Beach	VE	4,618	\$4,810,362
Road	Gosnold	Road to Public Well	AE	211	\$43,254
Road	Gosnold	Road to Upper Wharf	AE	94	\$19,281

Linear Critical Facilities – Hurricane Storm Surge Impacts

Category	Town	Name	Hurricane Category	Length ft	Estimated Repair Cost
Barrier Beach	Gosnold	Barges Beach	1	2676.969831	\$2,788,510
Barrier Beach	Gosnold	Church's Beach	1	443.479304	\$461,958
Barrier Beach	Gosnold	Church's Beach	2	716.610769	\$746,470
Barrier Beach	Gosnold	Barges Beach	2	1807.370836	\$1,882,678
Barrier Beach	Gosnold	Barges Beach	3	154.376792	\$160,809
Barrier Beach	Gosnold	Church's Beach	3	26.560995	\$27,668
Road	Gosnold	Road to Upper Wharf	1	49.761861	\$10,179
Road	Gosnold	Road to Public Well	1	8.810077	\$1,802

Category	Town	Name	Hurricane Category	Length ft	Estimated Repair Cost
Road	Gosnold	Road to Upper Wharf	2	32.329046	\$6,613
Road	Gosnold	Road to Public Well	2	79.048891	\$16,169
Road	Gosnold	Road to Public Well	3	143.016216	\$29,253
Road	Gosnold	Road to Upper Wharf	3	31.601133	\$6,464
Road	Gosnold	Road to Upper Wharf	4	62.465734	\$12,777
Road	Gosnold	Road to Public Well	4	35.196866	\$7,199

Linear Critical Facilities – Tsunami Impacts

Category	Town	Name	Length ft	Estimated Repair Cost
Airstrip	Gosnold	Cuttyhunk Airstrip	1,096	\$657,305
Barrier Beach	Gosnold	Church's Beach	1,187	\$1,236,095
Barrier Beach	Gosnold	Barges Beach	4,675	\$4,870,262
Road	Gosnold	Road to Public Well	2,015	\$412,235
Road	Gosnold	Road to Upper Wharf	696	\$142,375

FUTURE VULNERABILITY FOR GOSNOLD

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(combine impacts and frequency)(1 point for each step of frequency or impact)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	medium	large	serious	8
Erosion	high	large	minor	8
Dam Failures	n/a	n/a	n/a	0
Severe Rainstorms	medium	large	serious	8
Winter Storms	low	local	minor	4
Coastal Storms/Nor'easters	high	medium	extensive	9
Hurricanes	medium	large	extensive	9
Wind-Related Hazards				
Hurricanes	medium	large	extensive	9
Coastal Storms	high	large	serious	9
Winter Storms	low	local	serious	5
Downspouts	very low	local	serious	3
Tornadoes	very low	local	serious	4
Fire-Related Hazards				
Drought	medium	local	minor	5
Wildfires	low	local	minor	4
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	very low	local	minor	3
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3
Sea Level Rise	high	local	minor	6

VULNERABILITY ASSESSMENTS FOR OAK BLUFFS

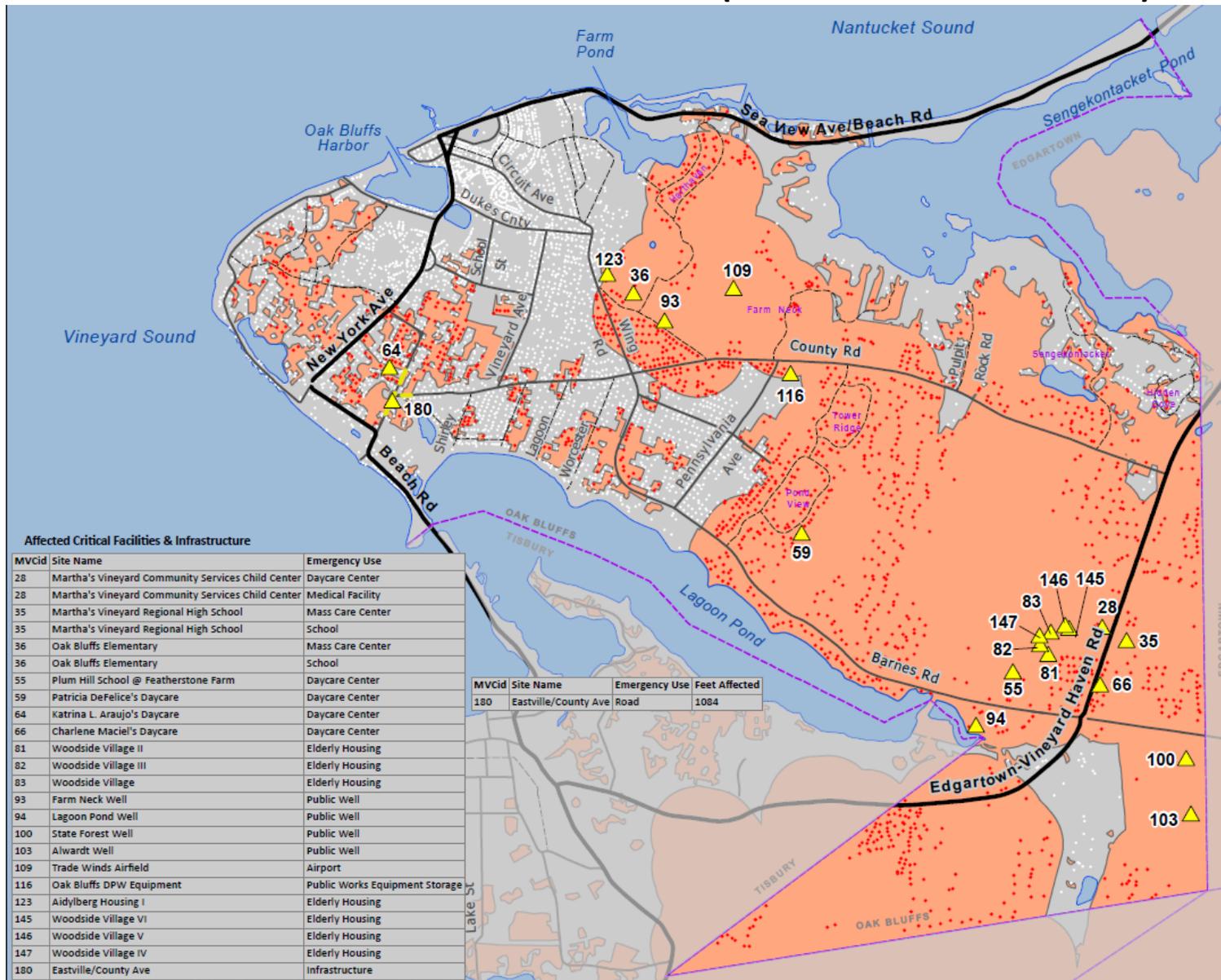
The Town of Oak Bluffs holds a year 'round population of 4,675 (ASC 5-year average 2013-2017) on an area of 7.4 square miles of dry land, with a density of 631.8 persons per square mile. In summer, population increases dramatically, including day passengers from ferries and cruise ships. On any summer day, there might be an estimated 22,452 people in the town. In summer, a number of ferries ply the waters, carrying passengers and freight to and from Oak Bluffs, including one terminal for cars and trucks. In summer, the compact harbor is most often filled with boats on moorings and docks. In winter, much of Oak Bluffs, including the East Chop bluff, the harbor and east-facing beaches are all exposed directly to wave action generated by Nor'easter storms, and subject to significant shoreline and bluff erosion.

The maps illustrate the geographic extent of vulnerability. Only excerpts are shown here. The full sized maps are available on-line <https://www.mvcommission.org/climate-change>. Seeing the full extent is important for planning purposes.

The matrices of vulnerability highlight the persons and property. Property is identified both by numbers of buildings and by value. Persons are identified by population (ASC 5-year average 2013-2017) as well as by seasonal projection. Projections estimate vulnerability at buildout.

Vulnerability is represented for wildfire (wildland urban interface), flood (Nor'easter), storm (hurricane), Sea Level Rise, and for tsunami. Additional Sea Level Rise impacts are found appended to this document.

OAK BLUFFS WILDFIRE VULNERABILITY (Wildland Urban Interface)



Wildfire Threatened Area – The Wildland-Urban interface is shown in orange, with potentially affected infrastructure displayed in bright colors. For the larger map, see <https://www.mvcommission.org/climate-change>

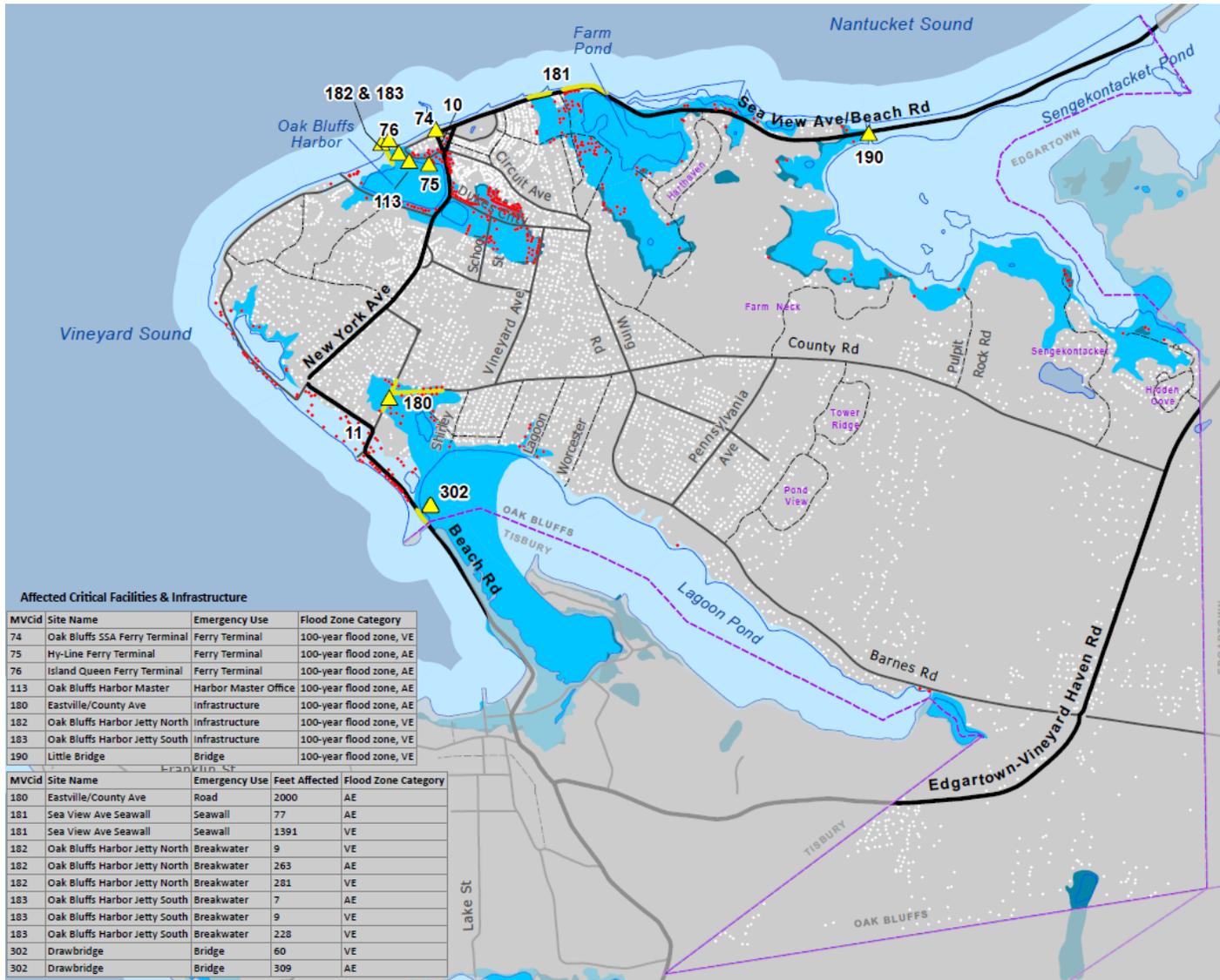
OAK BLUFFS Wildfire Vulnerability

Developed Land					Undevel. Land			
Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value	# People (other)	# People (July-Aug)	# Buildings	Approx. Value

	2.78 per building	4.3 per building			2.78 per building	4.3 per building		
Commercial			19	\$9,315,300				
Municipal, Public, Non-profit			55	\$102,753,500				
Industrial			4	\$5,183,100			-3	
Mixed use Commercial	14	22	5	\$808,200				
Mixed use Residential	50	77	18	\$5,163,500				
Other			16	\$2,422,900				
Residential	4084	6329	1471	\$529,456,700	1210	1876	436	\$156,929,382

Oak Bluffs FLOOD VULNERABILITY (2016 FIRM) - Nor'Easter- type storm flooding

Powder blue represents the 100-year VE zone (wave heights > 3'). Teal represents the 100-year AE zone (wave heights < 3'). Dark blue shows the 500-year flood zone. For the larger map, see <https://www.mvcommission.org/climate-change>



**Flood Vulnerability
Based on 2016 Flood Data**

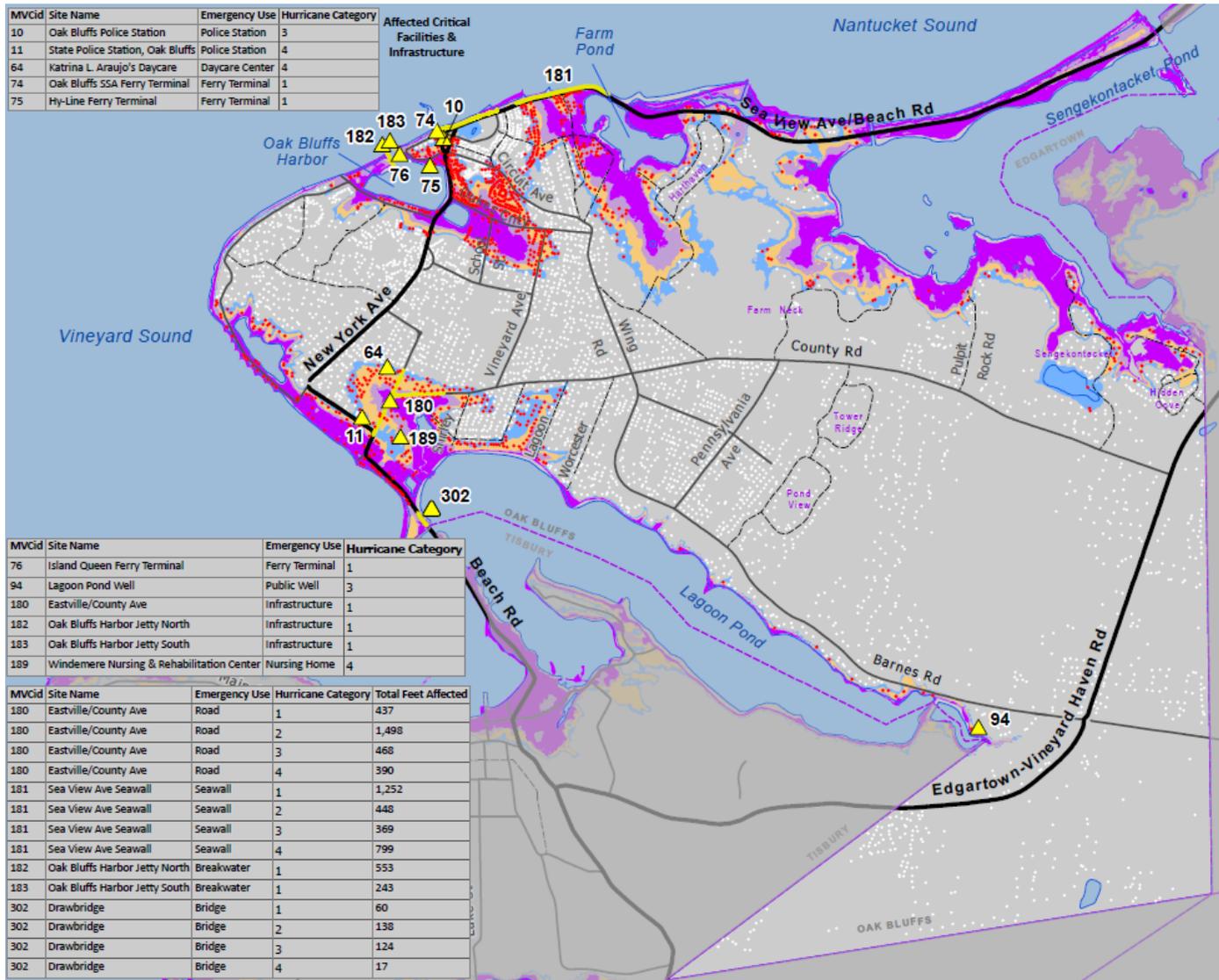
Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
Developed Land					
		2.78 per building	4.3 per building		
.2% Annual Chance Flood	Exempt (Municipal, Public, Non-profit)	0	0	1	\$284,000
.2% Annual Chance Flood	Residential	164	254	59	\$29,292,800
100 Year AE Zone	Commercial	0	0	21	\$14,743,100
100 Year AE Zone	Exempt (Municipal, Public, Non-profit)	0	0	8	\$1,868,800
100 Year AE Zone	Mixed use Commercial	8	13	3	\$1,492,100
100 Year AE Zone	Mixed use Residential	14	22	5	\$1,760,600
100 Year AE Zone	Residential	639	990	230	\$81,821,900
Velocity Zone (also 100yr)	Commercial	0	0	7	\$350,500
Velocity Zone (also 100yr)	Exempt (Municipal, Public, Non-profit)	0	0	4	\$734,900
Velocity Zone (also 100yr)	Residential	197	305	71	\$23,445,100

**OAK BLUFFS Flood Vulnerability at Buildout
Based on 2016 Flood Data
Developable Land**

Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.78 per bldg	4.3 per bldg		
100 Year AE Zone	Residential	242	374	87	\$30,950,023
100 Year AE Zone	Commercial			26	\$18,253,362
Velocity Zone (also 100yr)	Residential	139	215	50	\$16,510,634
Velocity Zone (also 100yr)	Commercial			-4	

STORM SURGE VULNERABILITY FOR OAK BLUFFS (HURRICANE) S.L.O.S.H. MAP

The colors in the Storm Surge legend grade in Hurricane intensity from Category 1 (dark purple) to Category 4 (palest color). Bright color symbols represent affected infrastructure. For the larger map, see <https://www.mvcommission.org/climate-change>



OAK BLUFFS Hurricane Inundation Vulnerability (SLOSH) from model
Released by the USACOE New England District in 2013
Developed Land

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		2.78 per building	4.3 per building		
1	Commercial	0	0	14	\$8,833,700
1	Exempt (Municipal, Public, Non-profit)	0	0	5	\$325,500
1	Mixed use Commercial	6	9	2	\$1,184,300
1	Mixed use Residential	6	9	2	\$525,000
1	Residential	316	490	114	\$35,815,600
2	Commercial	0	0	14	\$10,345,100
2	Exempt (Municipal, Public, Non-profit)	0	0	6	\$1,654,700
2	Mixed use Commercial	3	4	1	\$307,800
2	Mixed use Residential	8	13	3	\$1,235,600
2	Residential	428	663	154	\$57,910,700
3	Commercial	0	0	2	\$2,938,200
3	Exempt (Municipal, Public, Non-profit)	0	0	7	\$3,932,600
3	Mixed use Commercial	8	13	3	\$1,950,600
3	Mixed use Residential	6	9	2	\$753,700
3	Residential	938	1454	338	\$154,632,600

4	Commercial	0	0	19	\$97,661,900
4	Exempt (Municipal, Public, Non-profit)	0	0	7	\$2,574,700
4	Mixed use Commercial	22	34	8	\$5,261,900
4	Mixed use Residential	0	0	3	\$1,235,700
4	Other	17	26	6	\$217,000
4	Residential	891	1381	321	\$125,453,800

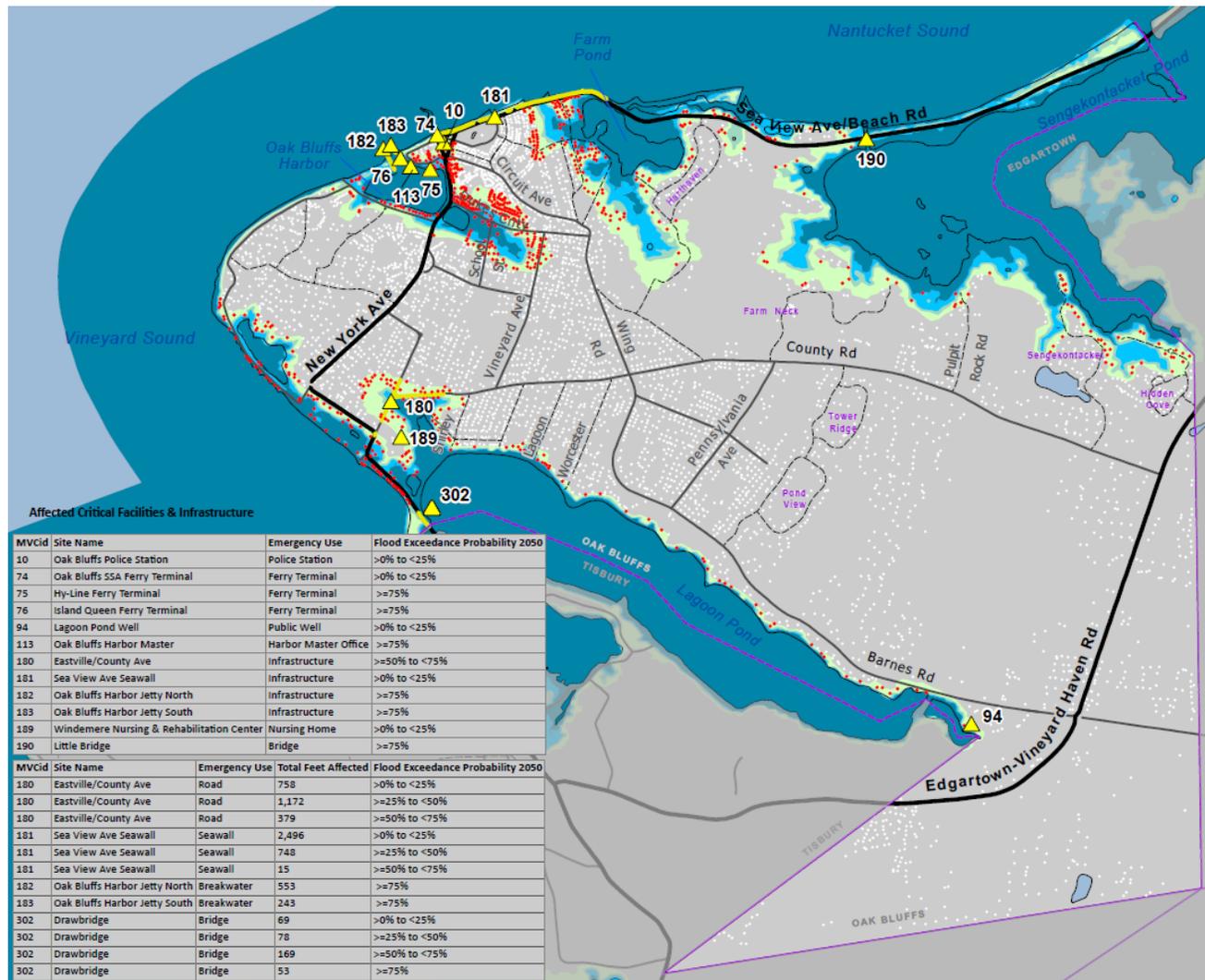
OAK BLUFFS Hurricane Inundation Vulnerability (SLOSH)
Based on preliminary data Released by the USACOE New England District in March 2013
Potential Development

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		2.78 per building	4.3 per building		
1	Commercial	0	0	13	\$8,202,721
1	Residential	283	439	102	\$32,045,537
2	Commercial	0	0	6	\$4,433,614
2	Residential	56	86	20	\$7,520,870
3	Commercial	0	0	22	\$32,320,200
3	Residential	53	82	19	\$8,692,365
4	Commercial	0	0	30	\$154,203,000
4	Residential	53	82	19	\$7,425,614

OAK BLUFFS SEA LEVEL RISE VULNERABILITY

SLR of 2.57 ft by 2050 and likelihood of flooding in a given year

dark blue: >=75%; light blue: >=50% to <75%; olive green: >=25% to <50%; light green >0% to <25%



For the larger map, see <https://www.mvcommission.org/climate-change>

OAK BLUFFS SEA LEVEL RISE VULNERABILITY

SLR Scenarios: 2.57 ft* (2050)

4.37 ft* (2070) featured in *SLR Flood Risk Model 2070* table in Appendix

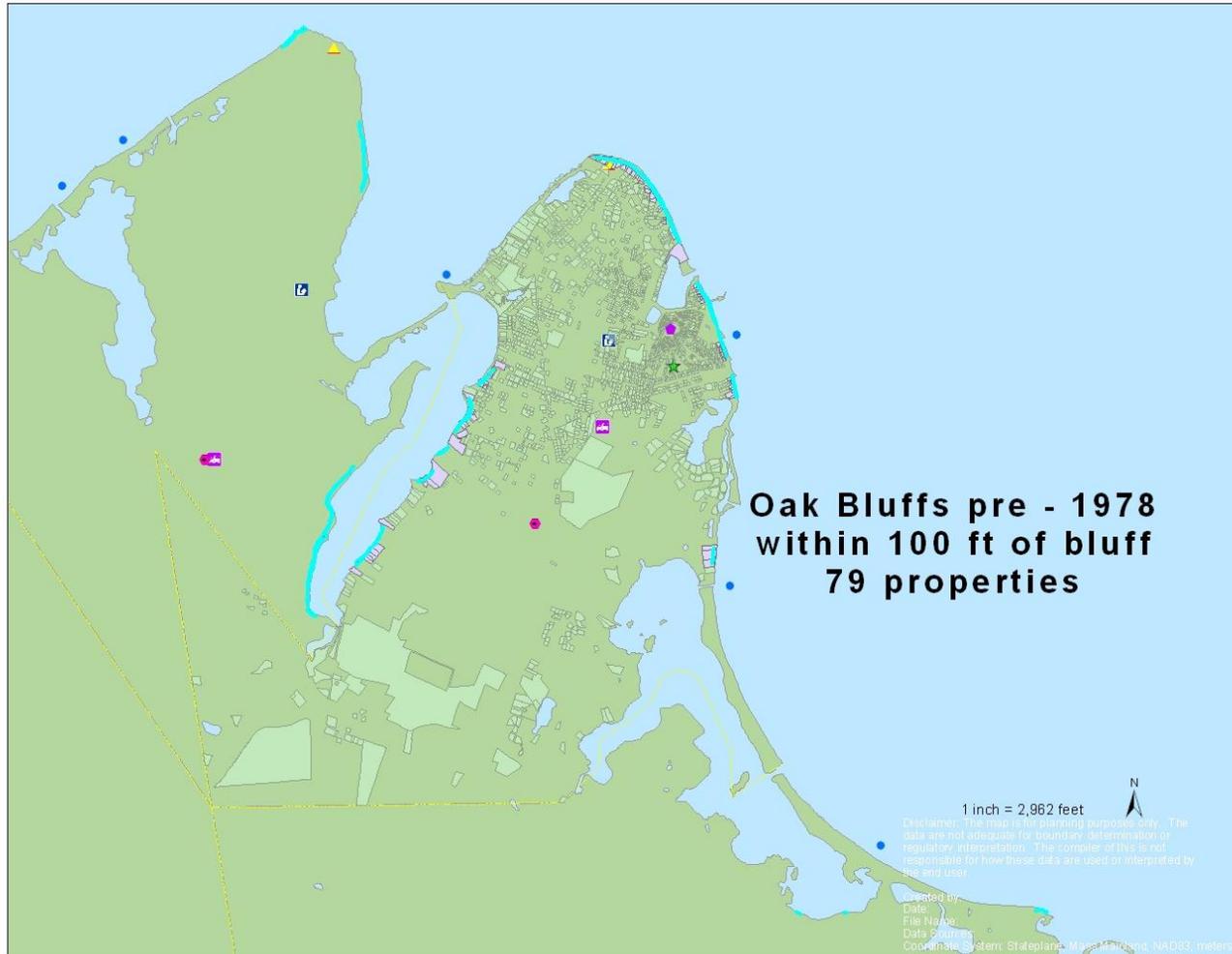
*relative to 2008 baseline

** likelihood increments are omitted if there is no current infrastructure associated with the featured use in that zone and the buildout analysis did not yield future development sited within the zone in question for a given use

Likelihood in a given year**	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
>0% to <25%	Commercial	0	0	8	\$9,738,700
>=25% to <50%	Commercial	0	0	8	\$10,039,600
>=50% to <75%	Commercial	0	0	14	\$9,318,600
>=75%	Commercial	0	0	5	\$1,483,200
>0% to <25%	Exempt (Municipal, Public, Non-profit)	0	0	11	\$4,002,700
>=25% to <50%	Exempt (Municipal, Public, Non-profit)	0	0	3	\$689,200
>=50% to <75%	Exempt (Municipal, Public, Non-profit)	0	0	5	\$936,800
>=75%	Exempt (Municipal, Public, Non-profit)	0	0	3	\$314,600
>0% to <25%	Mixed use Commercial	6	9	2	\$1,612,400
>=25% to <50%	Mixed use Commercial	3	4	1	\$307,800
>=50% to <75%	Mixed use Commercial	3	4	1	\$411,700
>=75%	Mixed use Commercial	3	4	1	\$772,600
>0% to <25%	Mixed use Residential	3	4	1	\$349,800
>=25% to <50%	Mixed use Residential	8	13	3	\$1,235,600
>=50% to <75%	Mixed use Residential	6	9	2	\$525,000
>0% to <25%	Other	0	0	2	\$217,000
>0% to <25%	Residential	1,310	2031	472	\$203,239,900
>=25% to <50%	Residential	219	340	79	\$28,874,800
>=50% to <75%	Residential	205	318	74	\$27,014,200
>=75%	Residential	125	194	45	\$12,759,000

COASTAL EROSION AND SHORELINE CHANGE – Oak Bluffs

Pre-1978 homes near bluffs are difficult for the towns to regulate (grandfathered under the Wetlands Protection Act). There are 79 in OAK BLUFFS.



OAK BLUFFS VULNERABILITY OF CRITICAL FACILITIES

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Oak Bluffs Town Hall	\$5,250,900	Yes	--	--	--
Oak Bluffs Police Station	\$1,737,400	Yes	--	3	--
State Police Station, Oak Bluffs	\$1,398,100	Yes	--	4	--
Oak Bluffs Fire Department	\$6,424,900	Yes	--	--	--
Martha's Vineyard Hospital	\$44,037,700	Yes	--	--	--
Martha's Vineyard Community Services Child Center	\$3,172,700	--	Yes	--	--
Martha's Vineyard Regional High School	\$45,693,300	--	Yes	--	--
Oak Bluffs Elementary	\$22,511,100	Yes	Yes	--	--
Plum Hill School at Featherstone Farm	\$452,400	--	Yes	--	--
Patricia DeFelice's Day Care	\$383,600	--	Yes	--	--
Katrina L. Araujo's Day Care	\$322,100	Yes	Yes	4	--
Joanne C. Lambert's Day Care	\$258,600	Yes	--	--	--
Charlene Maciel's Day Care	\$364,400	--	Yes	--	--
Jennifer Lynn Weiland's Day Care	\$244,400	Yes	--	--	--
Oak Bluffs SSA Ferry Terminal	\$314,600	Yes	--	1	VE (100 Year Flood Zone)
Hy-Line Ferry Terminal	\$0	Yes	--	1	AE (100 Year Flood Zone)
Island Queen Ferry Terminal	\$0	Yes	--	1	AE (100 Year Flood Zone)
Woodside Village II	\$3,052,300	--	Yes	--	--
Woodside Village III	\$1,343,200	--	Yes	--	--
Woodside Village	\$6,026,700	--	Yes	--	--
Oak Bluffs Wastewater Treatment Plant	\$0	--	--	--	--

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Farm Neck Well	\$67,900	Yes	Yes	--	--
Lagoon Pond Well	\$91,100	--	Yes	3	--
State Forest Well	\$0	--	Yes	--	--
Alwardt Well	\$0	--	Yes	--	--
Trade Winds Airfield	\$69,600	Yes	Yes	--	--
Oak Bluffs Harbor Master	\$0	Yes	--	--	AE (100 Year Flood Zone)
Oak Bluffs DPW Equipment	\$461,600	--	Yes	--	--
Aidylberg Housing I	\$785,200	Yes	Yes	--	--
Woodside Village VI	\$1,458,300	--	Yes	--	--
Woodside Village V	\$957,300	--	Yes	--	--
Woodside Village IV	\$1,578,300	--	Yes	--	--
Aidylberg Housing II	\$801,600	Yes	--	--	--
Eastville/County Rd	\$0	Yes	Yes	1	AE (100 Year Flood Zone)
Sea View Ave Seawall	\$0	Yes	--	--	--
Oak Bluffs Harbor Jetty North	\$0	--	--	1	VE (100 Year Flood Zone)
Oak Bluffs Harbor Jetty South	\$0	--	--	1	VE (100 Year Flood Zone)
Windemere Nursing & Rehabilitation Center	\$44,037,700	Yes	--	4	--
Little Bridge	\$0	Yes	--	--	VE (100 Year Flood Zone)

Critical Facilities - SLR

	SLR Present Probability	SLR Present Flood Depth	SLR 2030 Probability	SLR 2030 Flood Depth	SLR 2050 Probability	SLR 2050 Flood Depth	SLR 2070 Probability	SLR 2070 Flood Depth
Oak Bluffs Town Hall	--	--	--	--	--	--	--	--
Oak Bluffs Police Station	--	--	--	--	>0% to <25%	--	>0% to <25%	>0ft to 2.5ft
State Police Station, Oak Bluffs	--	--	--	--	--	--	--	--
Oak Bluffs Fire Department	--	--	--	--	--	--	--	--
Martha's Vineyard Hospital	--	--	--	--	--	--	--	--
Martha's Vineyard Community Services Child Center	--	--	--	--	--	--	--	--
Martha's Vineyard Regional High School	--	--	--	--	--	--	--	--
Oak Bluffs Elementary	--	--	--	--	--	--	--	--
Plum Hill School at Featherstone Farm	--	--	--	--	--	--	--	--
Patricia DeFelice's Day Care	--	--	--	--	--	--	--	--
Katrina L. Araujo's Day Care	--	--	--	--	--	--	--	--
Joanne C. Lambert's Day Care	--	--	--	--	--	--	--	--
Charlene Maciel's Day Care	--	--	--	--	--	--	--	--
Jennifer Lynn Weiland's Day Care	--	--	--	--	--	--	--	--
Oak Bluffs SSA Ferry Terminal	>0% to <25%	--	>0% to <25%	--	>0% to <25%	--	>0% to <25%	--
Hy-Line Ferry Terminal	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=10ft	>=75%	>=10ft

Island Queen Ferry Terminal	>=50% to <75%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=10ft	>=75%	>=10ft
Woodside Village II	--	--	--	--	--	--	--	--
Woodside Village III	--	--	--	--	--	--	--	--
Woodside Village	--	--	--	--	--	--	--	--
Oak Bluffs Wastewater Treatment Plant	--	--	--	--	--	--	--	--
Farm Neck Well	--	--	--	--	--	--	--	--
Lagoon Pond Well	--	--	--	--	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft
State Forest Well	--	--	--	--	--	--	--	--
Alwardt Well	--	--	--	--	--	--	--	--
Trade Winds Airfield	--	--	--	--	--	--	--	--
Oak Bluffs Harbor Master	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Oak Bluffs DPW Equipment	--	--	--	--	--	--	--	--
Aidylberg Housing I	--	--	--	--	--	--	--	--
Woodside Village VI	--	--	--	--	--	--	--	--
Woodside Village V	--	--	--	--	--	--	--	--
Woodside Village IV	--	--	--	--	--	--	--	--
Aidylberg Housing II	--	--	--	--	--	--	--	--
Eastville/County Rd	>0% to <25%	>=2.5ft to <5ft	>=25% to <50%	>=2.5ft to <5ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft
Sea View Ave Seawall	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>0ft to 2.5ft
Oak Bluffs Harbor Jetty North	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Oak Bluffs Harbor Jetty South	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Windemere Nursing & Rehabilitation Center	--	--	>0% to <25%	--	>0% to <25%	--	>0% to <25%	>0ft to 2.5ft
Little Bridge	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft

Linear Critical Facilities

Linear Critical Facilities – Wildfire Impacts

Category	Town	Name	Length ft	Estimated Repair Cost
Road	Oak Bluffs	Eastville/County Ave	1,084	\$221,681

Linear Critical Facilities – FEMA Flood Impacts

Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty North	AE	263	\$210,219
Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty South	AE	7	\$5,516
Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty North	VE	290	\$231,872
Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty South	VE	237	\$189,276
Bridge	Oak Bluffs	Drawbridge	AE	309	\$13,061,584
Bridge	Oak Bluffs	Drawbridge	VE	60	\$2,554,166
Road	Oak Bluffs	Eastville/County Ave	AE	2,000	\$409,180
Seawall	Oak Bluffs	Sea View Ave Seawall	AE	77	\$48,229
Seawall	Oak Bluffs	Sea View Ave Seawall	VE	1,391	\$869,443

Linear Critical Facilities – Hurricane Impacts

Category	Town	Name	Hurricane Category	Length ft	Estimated Repair Cost
Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty North	1	552.612777	\$442,090
Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty South	1	243.489314	\$194,791
Bridge	Oak Bluffs	Drawbridge	1	59.789804	\$2,526,321
Bridge	Oak Bluffs	Drawbridge	2	137.991645	\$5,830,613
Bridge	Oak Bluffs	Drawbridge	3	123.616479	\$5,223,214
Bridge	Oak Bluffs	Drawbridge	4	16.658721	\$703,887
Road	Oak Bluffs	Eastville/County Ave	1	436.895326	\$89,365
Road	Oak Bluffs	Eastville/County Ave	2	1498.311912	\$306,473
Road	Oak Bluffs	Eastville/County Ave	3	468.06121	\$95,740
Road	Oak Bluffs	Eastville/County Ave	4	389.907943	\$79,754
Seawall	Oak Bluffs	Sea View Ave Seawall	1	1252.42513	\$782,766
Seawall	Oak Bluffs	Sea View Ave Seawall	2	448.346549	\$280,217
Seawall	Oak Bluffs	Sea View Ave Seawall	3	368.606189	\$230,379
Seawall	Oak Bluffs	Sea View Ave Seawall	4	799.379045	\$499,612

Linear Critical Facilities – Tsunami Impacts

Category	Town	Name	Length ft	Estimated Repair Cost
Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty North	357	\$285,930
Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty South	62	\$49,490
Bridge	Oak Bluffs	Drawbridge	370	\$15,615,750
Road	Oak Bluffs	Eastville/County Ave	2,799	\$572,435
Seawall	Oak Bluffs	Sea View Ave Seawall	3,738	\$2,336,282
Breakwater	Oak Bluffs	Oak Bluffs Harbor Jetty North	357	\$285,930

OAK BLUFFS FUTURE VULNERABILITY

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(combine impacts and frequency)(1 point for each step of frequency or impact)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	medium	large	serious	8
Erosion	high	large	serious	9
Dam Failures	n/a	n/a	n/a	0
Severe Rainstorms	medium	large	serious	8
Winter Storms	low	local	minor	4
Coastal Storms/Nor'easters	high	medium	extensive	10
Hurricanes	medium	large	extensive	9
Wind-Related Hazards				
Hurricanes	medium	large	extensive	9
Coastal Storms	high	large	serious	9
Winter Storms	low	local	serious	5
Downspouts	very low	local	minor	3
Tornadoes	very low	local	serious	4
Fire-Related Hazards				
Drought	medium	medium	serious	8
Wildfires	medium	medium	serious	8
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	very low	local	minor	3
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3
Sea Level Rise	high	local	minor	6

VULNERABILITY ASSESSMENTS FOR TISBURY

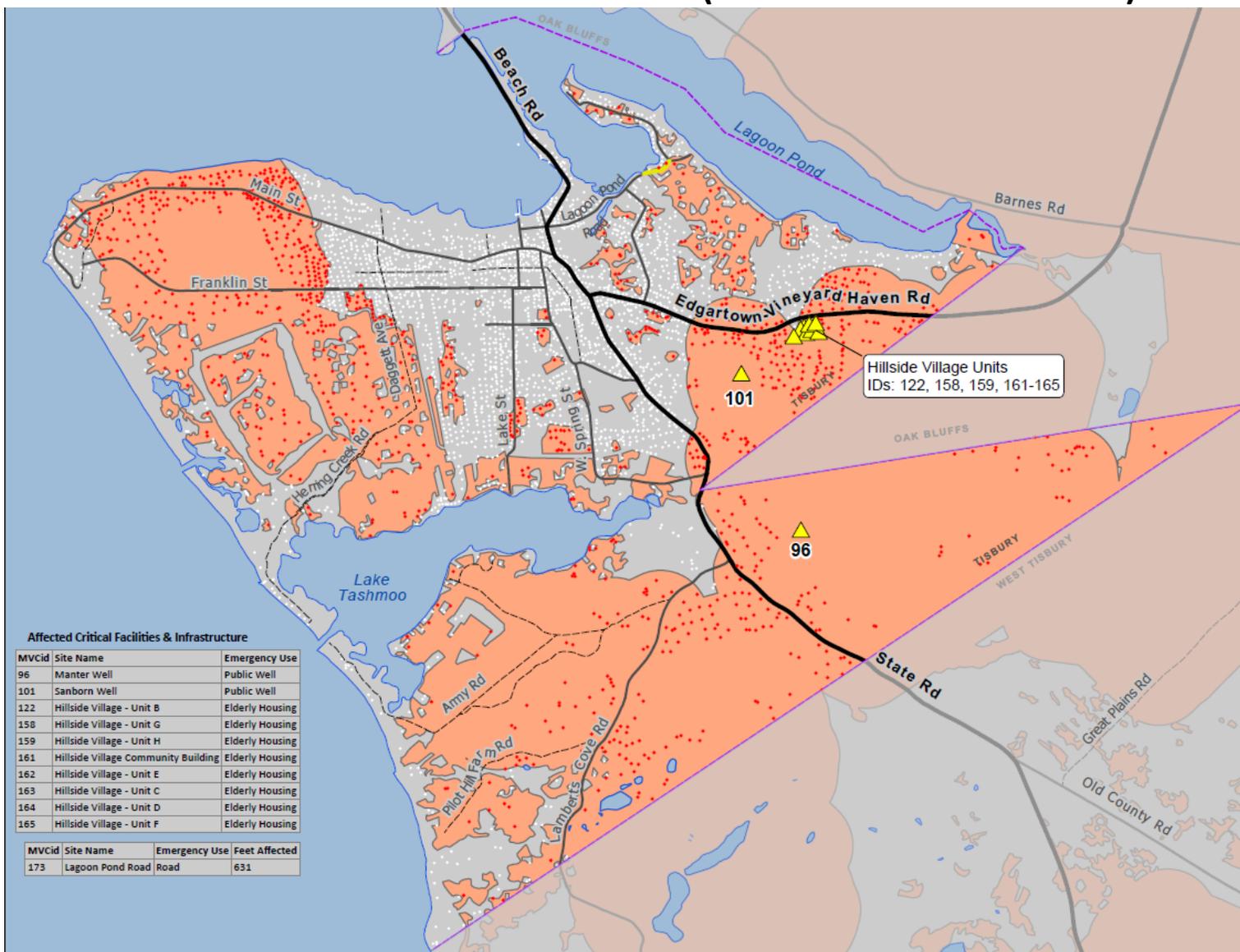
The Town of Tisbury has a year 'round population of 4,100 (ASC 5-year average 2013-2017) on a land area of 6.6 square miles of dry land, with a density of 621.2 persons per square mile. Most of the year 'round waterfront activity takes place in Tisbury. Vineyard Haven Harbor is open year 'round for ferry passengers, freight, and vehicles, and the waterfront facilities include boatyards, fuel, etc. The harbor is protected somewhat by the "Chops", the high bluffs of West Chop and East Chop that form the mouth of the outer harbor, which is otherwise open to Vineyard Sound. Commercial and recreational boats fill the inner harbor all summer, spilling out to the outer harbor (outside the breakwater) and into nearby Lagoon Pond. In summer, recreational boats also berth in Lake Tashmoo, on the northwest side of the town, where there are approximately 600 moorings.

The maps illustrate the geographic extent of vulnerability. In some cases, only excerpts are shown here. The full sized maps are available on-line <https://www.mvcommission.org/climate-change>. Seeing the full extent is important for planning purposes.

The matrices of vulnerability highlight the persons and property. Property is identified both by numbers of buildings and by value. Persons are identified by population (ASC 5-year average 2013-2017) as well as by seasonal projection. Projections estimate vulnerability at buildout.

Vulnerability is represented for wildfire (wildland urban interface), flood (Nor'easter), storm (hurricane), Sea Level Rise, and for tsunami. Additional Sea Level Rise impacts are found appended to this document.

TISBURY WILDFIRE VULNERABILITY (Wildland Urban Interface)



Wildfire Threatened Area – The Wildland-Urban interface is shown in orange, with potentially affected infrastructure displayed in bright colors. For the larger map, see <https://www.mvcommission.org/climate-change>

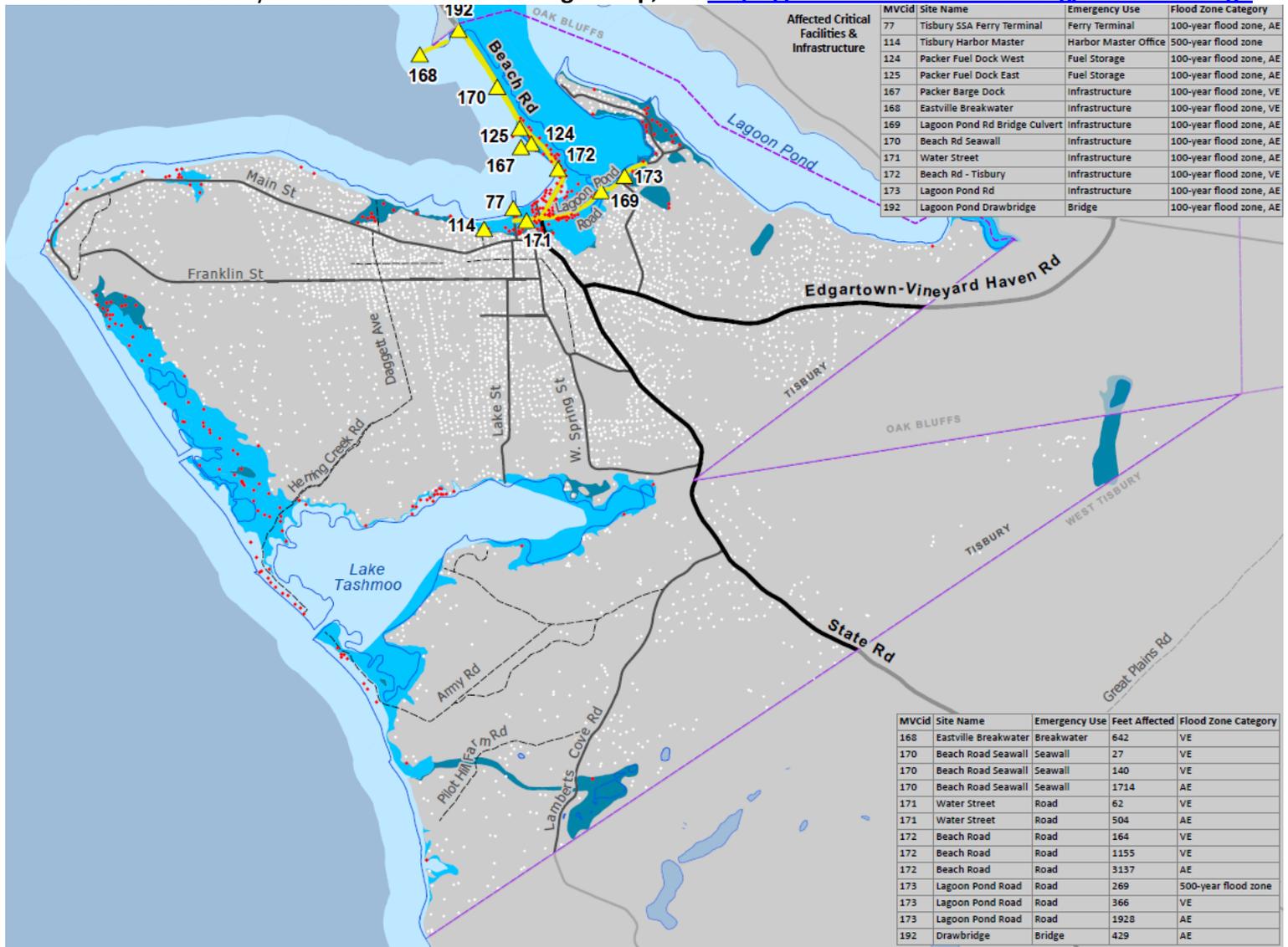
TISBURY Wildfire Vulnerability

Developed Land					Unlevel. Land			
Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value	# People (other)	# People (July-Aug)	# Buildings	Approx. Value

	2.84 per building	4.2 per building			2.84 per building	4.2 per building		
Commercial			23	\$11,314,600				
Municipal, Public, Non-profit			39	\$15,644,200				
Industrial			7	\$437,700			66	\$4,126,886
Mixed use Commercial	31	46	11	\$2,158,900				
Mixed use Residential	34	50	12	\$3,705,600				
Other			19	\$6,533,700				
Residential	2940	4346	1034	\$479,175,011	1001	1480	352	\$163,123,408

Tisbury FLOOD VULNERABILITY (2016 FIRM) - Nor'Easter- type storm flooding

Powder blue represents the 100-year VE zone (wave heights > 3'). Teal represents the 100-year AE zone (wave heights < 3'). Dark blue shows the 500-year flood zone. For the larger map, see <https://www.mvcommission.org/climate-change>



**Tisbury Flood Vulnerability
Based on 2016 Flood Data
Developed Land**

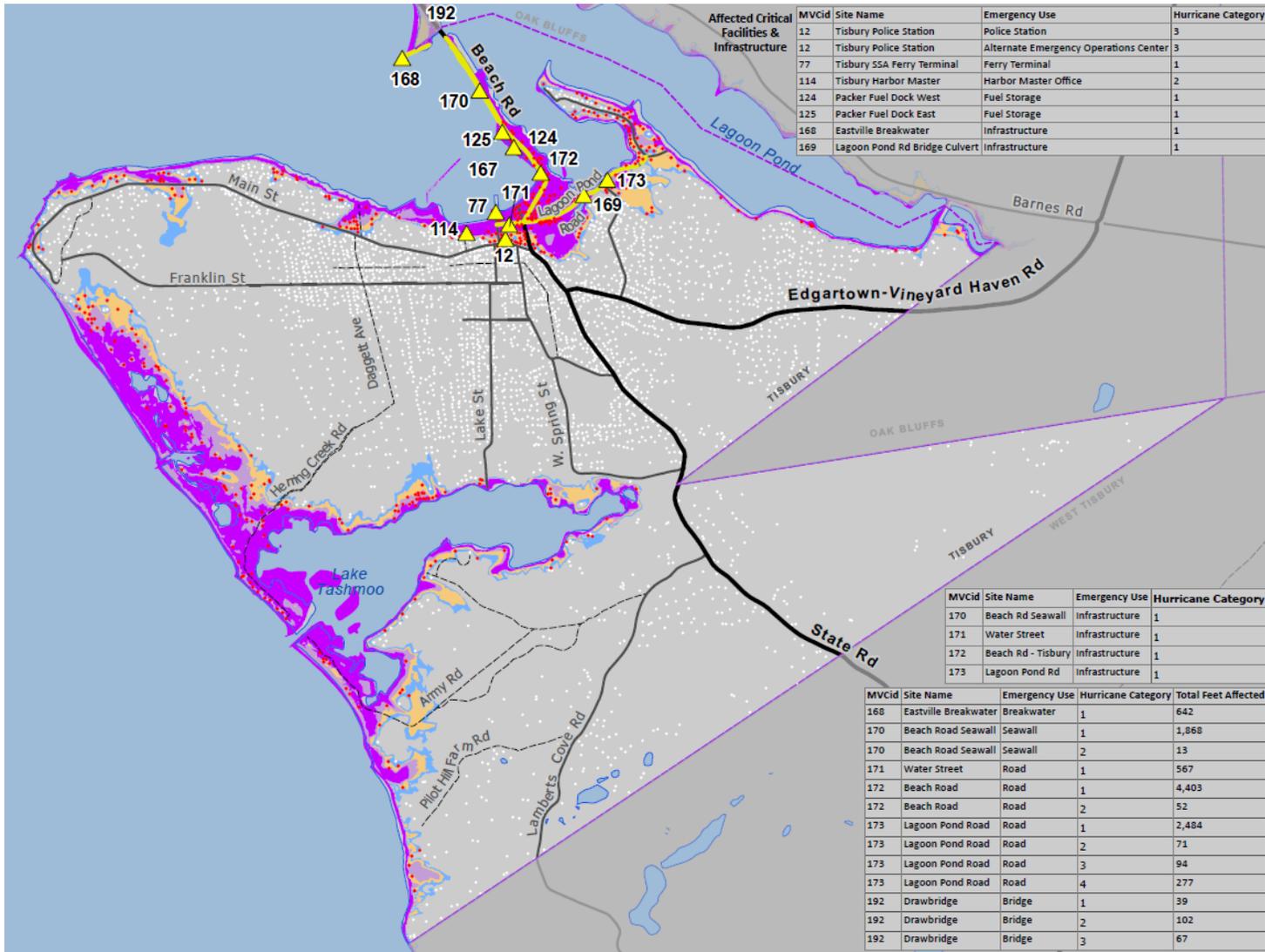
Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.84 per building	4.2 per building		
.2% Annual Chance Flood	Commercial	0	0	4	\$2,939,700
.2% Annual Chance Flood	Exempt (Municipal, Public, Non-profit)	0	0	2	\$3,038,100
.2% Annual Chance Flood	Mixed use Commercial	3	4	1	\$455,900
.2% Annual Chance Flood	Residential	142	210	50	\$29,417,300
100 Year AE Zone 100 Year AE Zone 100 Year AE Zone	Commercial	0	0	36	\$13,721,400
	Exempt (Municipal, Public, Non-profit)	0	0	8	\$5,341,900
	Mixed use Commercial	Mixed use Commercial	34	8	\$2,819,700
	Mixed use Residential	34	50	12	\$2,973,100
	Other	0	0	2	\$4,406,900
	Residential	242	357	85	\$61,705,400
Velocity Zone (also 100yr)	Commercial	0	0	18	\$6,603,400
	Mixed use Commercial	20	29	7	\$1,910,500
	Mixed use Residential	3	4	1	\$277,600
	Residential	131	193	46	\$32,654,300

**TISBURY Future Flood Vulnerability
Based on 2016 Flood Data
Developable Land**

Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.84 per building	4.2 per building		
100 Year AE Zone	Commercial			92	\$35,065,800
	Mixed use Commercial			-7	
	Residential	3	4	1	\$725,946
100 Year VE Zone	Commercial			30	\$11,005,667
	Other			1	\$2,203,450
	Residential	114	168	40	\$28,395,043
500 Year	Commercial			10	\$7,349,250
	Residential	28	42	10	\$5,883,460

STORM SURGE VULNERABILITY FOR TISBURY (HURRICANE) S.L.O.S.H. MAP

The colors in the Storm Surge legend grade in Hurricane intensity from Category 1 (dark purple) to Category 4 (palest color). Bright color symbols represent affected infrastructure. For the larger map, see <https://www.mvcommission.org/climate-change>



TISBURY Hurricane Inundation Vulnerability (SLOSH)
Based on data Released by the USACOE New England District in March 2013
Developed Land

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		2.84 per building	4.2 per building		
1	Commercial	0	0	51	\$19,799,100
1	Exempt (Municipal, Public, Non-profit)	0	0	7	\$4,394,600
1	Mixed use Commercial	40	59	14	\$3,726,000
1	Mixed use Residential	17	25	6	\$1,923,800
1	Other	0	0	1	\$818,700
1	Residential	182	269	64	\$38,825,200
2	Commercial	0	0	6	\$3,547,900
2	Exempt (Municipal, Public, Non-profit)	0	0	3	\$1,142,300
2	Mixed use Commercial	3	4	1	\$131,500
2	Mixed use Residential	20	29	7	\$1,746,600
2	Other	0	0	2	\$4,406,900
2	Residential	284	420	100	\$70,411,200
3	E	0	0	3	\$3,026,100
3	MC	20	29	7	\$4,155,800
3	MR	3	4	1	\$277,600
3	O	0	0	3	\$1,477,000

3	R	247	366	87	\$65,736,500
SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		2.84 per building	4.2 per building		
4	C	0	0	5	\$6,210,600
4	MC	14	21	5	\$2,380,000
4	MR	3	4	1	\$420,700
4	O	0	0	4	\$4,676,200
4	R	225	332	79	\$62,732,700

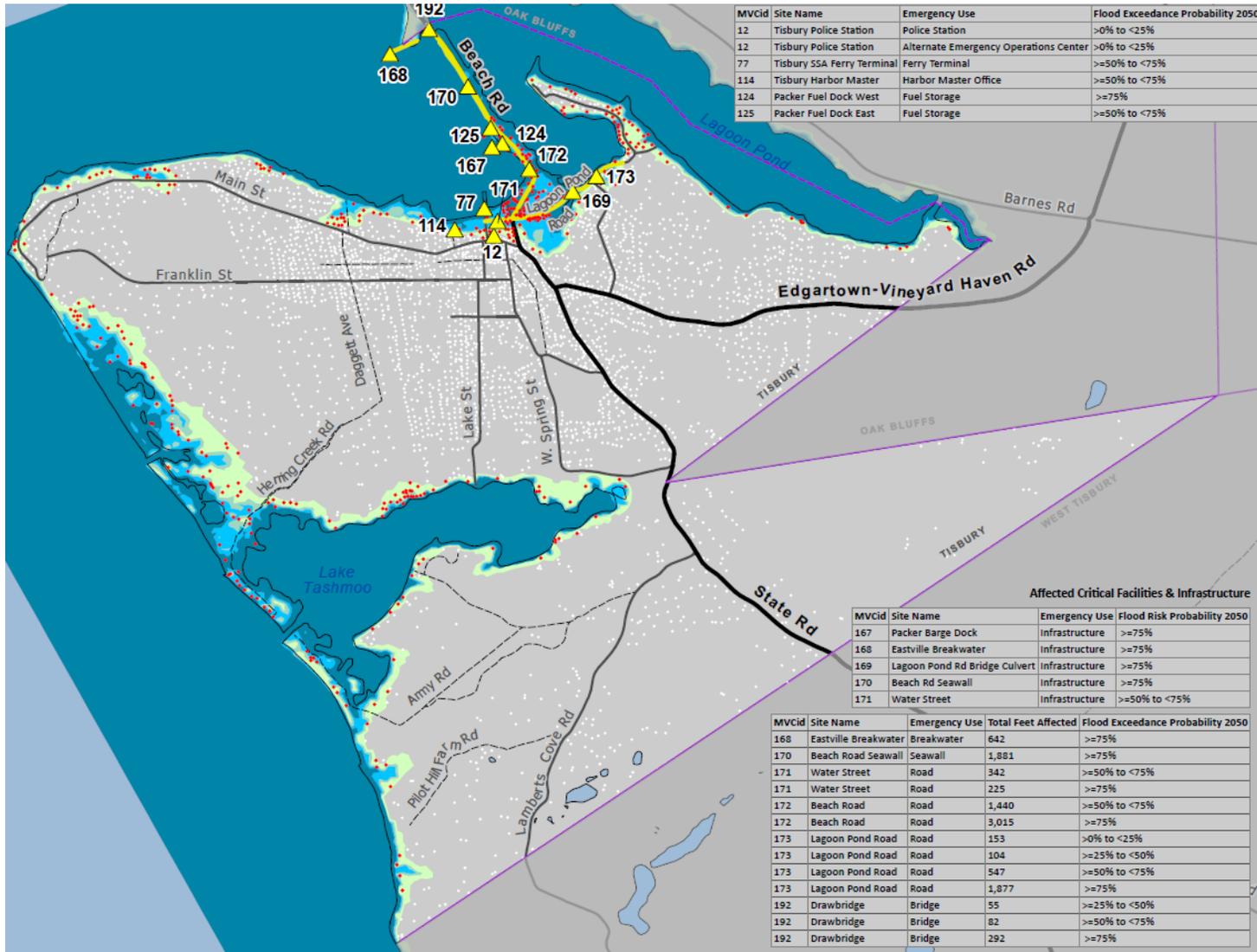
**TISBURY Hurricane Inundation Vulnerability (SLOSH)
2013 USACOE
Potential Development**

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		2.84 per blding	4.2 per building		
1	Commercial	0	0	104	\$40,374,635
1	Mixed use Commercial	0	0	-13	\$0
1	Residential	142	210	50	\$30,332,188
2	Commercial	0	0	25	\$14,782,917
2	Residential	0	0	-1	\$0
3	Commercial	0	0	20	\$11,826,333
3	Residential	45	67	16	\$12,089,471
4	Commercial	0	0	8	\$9,936,960
4	Residential	0	0	-2	\$0

TISBURY SEA LEVEL RISE VULNERABILITY

SLR of 2.57 ft by 2050 and likelihood of flooding in a given year

dark blue: >=75%; light blue: >=50% to <75%; olive green: >=25% to <50%; light green >0% to <25%



For the larger map, visit: <https://www.mvcommission.org/climate-change>

TISBURY SEA LEVEL RISE VULNERABILITY

SLR Scenarios: 2.57 ft* (2050)

4.37 ft* (2070) featured in *SLR Flood Risk Model 2070* table in Appendix

*relative to 2008 baseline

** likelihood increments are omitted if there is no current infrastructure associated with the featured use in that zone and the buildout analysis did not yield future development sited within the zone in question for a given use

Likelihood in a given year**	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
>0% to <25%	Commercial	0	0	4	\$5,956,600
>=25% to <50%	Commercial	0	0	5	\$5,947,600
>=50% to <75%	Commercial	0	0	26	\$9,822,900
>=75%	Commercial	0	0	24	\$8,449,700
>0% to <25%	Exempt (Municipal, Public, Non-profit)	0	0	4	\$3,973,400
>=50% to <75%	Exempt (Municipal, Public, Non-profit)	0	0	8	\$5,242,900
>=75%	Exempt (Municipal, Public, Non-profit)	0	0	2	\$294,000
>0% to <25%	Mixed use Commercial	17	25	6	\$3,804,000
>=25% to <50%	Mixed use Commercial	3	4	1	\$131,500
>=50% to <75%	Mixed use Commercial	23	34	8	\$2,688,200
>=75%	Mixed use Commercial	17	25	6	\$1,910,500
>0% to <25%	Mixed use Residential	11	17	4	\$697,300
>=25% to <50%	Mixed use Residential	11	17	4	\$1,049,300
>=50% to <75%	Mixed use Residential	9	13	3	\$986,200
>=75%	Mixed use Residential	9	13	3	\$1,226,500
>0% to <25%	Other	0	0	6	\$5,065,200
>=25% to <50%	Other	0	0	2	\$4,406,900
>=50% to <75%	Other	0	0	1	\$818,700
>=75%	Other	0	0	0	\$0
>0% to <25%	Residential	452	668	159	\$115,768,700
>=25% to <50%	Residential	188	277	66	\$43,979,000
>=50% to <75%	Residential	151	223	53	\$41,527,800
>=75%	Residential	45	67	16	\$3,682,600



COASTAL EROSION AND SHORELINE CHANGE - Tisbury

Pre-1978 homes near bluffs are difficult for the towns to regulate (grandfathered under the Wetlands Protection Act). There are 48 in TISBURY.

TISBURY VULNERABILITY OF CRITICAL FACILITIES

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Tisbury Town Hall	\$1,062,800	Yes	--	--	--
Tisbury Police Station	\$439,700	Yes	--	3	--
Tisbury Fire Department	\$3,831,100	Yes	--	--	--
Tisbury Walk-In Clinic	\$192,900	Yes	--	--	--
Tisbury Elementary	\$11,526,300	Yes	--	--	--
Vineyard Montessori	\$500,600	Yes	--	--	--
Tisbury Senior Center	\$842,100	Yes	--	--	--
American Legion	\$460,100	Yes	--	--	--
St. Augustine's Church	\$1,622,700	Yes	--	--	--
Grace Church	\$1,023,200	Yes	--	--	--
Christ United Methodist Church	\$613,150	Yes	--	--	--
Garden Gate Child Development Center	\$318,200	Yes	--	--	--
Donna Creighton's Day Care	\$677,500	Yes	--	--	--
K. Sally Devine's Day Care	\$219,300	Yes	--	--	--
Nancy Nevin's Day Care	\$334,100	Yes	--	--	--
Bernadette D. Ponte's Day Care	\$346,700	Yes	--	--	--
Micaela Hickman's Day Care	\$0	Yes	--	--	--
Tisbury SSA Ferry Terminal	\$0	--	--	1	AE (100 Year Flood Zone)
Tisbury Wastewater Treatment Plant	\$1,935,400	Yes	--	--	--
Manter Well	\$0	--	Yes	--	--
Sanborn Well	\$1,935,400	--	Yes	--	--
Tisbury Harbor Master	\$130,800	Yes	--	2	500 Year Flood Zone
Tisbury DPW Equipment	\$1,935,400	Yes	--	--	--
Margaret C. Love House	\$825,700	Yes	--	--	--
Hillside Village - Unit B	\$3,660,700	--	Yes	--	--

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
Packer Fuel Dock West	\$72,400	Yes	--	1	AE (100 Year Flood Zone)
Packer Fuel Dock East	\$330,000	Yes	--	1	AE (100 Year Flood Zone)
Henrietta Brewer House	\$966,400	Yes	--	--	--
Hillside Village - Unit G	\$1,356,700	--	Yes	--	--
Hillside Village - Unit H	\$874,400	--	Yes	--	--
Hillside Village Community Building	\$3,660,700	--	Yes	--	--
Hillside Village - Unit E	\$3,660,700	--	Yes	--	--
Hillside Village - Unit C	\$3,660,700	--	Yes	--	--
Hillside Village - Unit D	\$3,660,700	--	Yes	--	--
Hillside Village - Unit F	\$3,660,700	--	Yes	--	--
Packer Barge Dock	\$0	--	--	--	VE (100 Year Flood Zone)
Eastville Breakwater	\$0	--	--	1	VE (100 Year Flood Zone)
Lagoon Pond Rd Bridge Culvert	\$0	Yes	--	1	AE (100 Year Flood Zone)
Beach Rd Seawall	\$0	--	--	1	AE (100 Year Flood Zone)
Water Street	\$0	Yes	--	1	AE (100 Year Flood Zone)
Beach Rd - Tisbury	\$0	Yes	--	1	VE (100 Year Flood Zone)
Lagoon Pond Rd	\$0	Yes	--	1	AE (100 Year Flood Zone)
Lagoon Pond Drawbridge	\$0	Yes	--	--	AE (100 Year Flood Zone)

Critical Facilities - SLR

	SLR Present Probability	SLR Present Flood Depth	SLR 2030 Probability	SLR 2030 Flood Depth	SLR 2050 Probability	SLR 2050 Flood Depth	SLR 2070 Probability	SLR 2070 Flood Depth
Tisbury Town Hall	--	--	--	--	--	--	--	--
Tisbury Police Station	--	--	>0% to <25%	--	>0% to <25%	>0ft to 2.5ft	>0% to <25%	>=2.5ft to <5ft
Tisbury Fire Department	--	--	--	--	--	--	--	--
Tisbury Walk-In Clinic	--	--	--	--	--	--	--	--
Tisbury Elementary	--	--	--	--	--	--	--	--
Vineyard Montessori	--	--	--	--	--	--	--	--
Tisbury Senior Center	--	--	--	--	--	--	--	--
American Legion	--	--	--	--	--	--	--	--
St. Augustine's Church	--	--	--	--	--	--	--	--
Grace Church	--	--	--	--	--	--	--	--
Christ United Methodist Church	--	--	--	--	--	--	--	--
Garden Gate Child Development Center	--	--	--	--	--	--	--	--
Donna Creighton's Day Care	--	--	--	--	--	--	--	--
K. Sally Devine's Day Care	--	--	--	--	--	--	--	--
Nancy Nevin's Day Care	--	--	--	--	--	--	--	--
Bernadette D. Ponte's Day Care	--	--	--	--	--	--	--	--
Micaela Hickman's Day Care	--	--	--	--	--	--	--	--
Tisbury SSA Ferry Terminal	>=25% to <50%	>=2.5ft to <5ft	>=25% to <50%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft
Tisbury Wastewater Treatment Plant	--	--	--	--	--	--	--	--
Manter Well	--	--	--	--	--	--	--	--
Sanborn Well	--	--	--	--	--	--	--	--
Tisbury Harbor Master	>0% to <25%	>=2.5ft to <5ft	>=25% to <50%	>=2.5ft to <5ft	>=50% to <75%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft
Tisbury DPW Equipment	--	--	--	--	--	--	--	--
Margaret C. Love House	--	--	--	--	--	--	--	--

Hillside Village - Unit B	--	--	--	--	--	--	--	--
Packer Fuel Dock West	>=50% to <75%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=10ft
Packer Fuel Dock East	>0% to <25%	>=2.5ft to <5ft	>=25% to <50%	>=2.5ft to <5ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft
Henrietta Brewer House	--	--	--	--	--	--	--	--
Hillside Village - Unit G	--	--	--	--	--	--	--	--
Hillside Village - Unit H	--	--	--	--	--	--	--	--
Hillside Village Community Building	--	--	--	--	--	--	--	--
Hillside Village - Unit E	--	--	--	--	--	--	--	--
Hillside Village - Unit C	--	--	--	--	--	--	--	--
Hillside Village - Unit D	--	--	--	--	--	--	--	--
Hillside Village - Unit F	--	--	--	--	--	--	--	--
Packer Barge Dock	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Eastville Breakwater	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Lagoon Pond Rd Bridge Culvert	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft
Beach Rd Seawall	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=10ft
Water Street	>=25% to <50%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=10ft
Beach Rd - Tisbury	>=25% to <50%	>=5ft to <10ft	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=10ft
Lagoon Pond Rd	>=50% to <75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=5ft to <10ft	>=75%	>=10ft
Lagoon Pond Drawbridge	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft	>=75%	>=10ft

Linear Critical Facilities – Wildfire Impacts

Category	Town	Name	Length ft	Estimated Repair Cost
Road	Tisbury	Lagoon Pond Road	631	\$128,975

Linear Critical Facilities – Flood Impacts

Category	Town	Name	FEMA Flood Zone	Length ft	Estimated Repair Cost
Breakwater	Tisbury	Eastville Breakwater	VE	642	\$513,367
Bridge	Tisbury	Drawbridge	AE	429	\$18,129,777
Road	Tisbury	Lagoon Pond Road	500-year flood zone	269	\$55,106
Road	Tisbury	Water Street	AE	504	\$103,119
Road	Tisbury	Beach Road	AE	3,137	\$641,566
Road	Tisbury	Lagoon Pond Road	AE	1,928	\$394,418
Road	Tisbury	Water Street	VE	62	\$12,781
Road	Tisbury	Beach Road	VE	1,319	\$269,751
Road	Tisbury	Lagoon Pond Road	VE	366	\$74,931
Seawall	Tisbury	Beach Road Seawall	AE	1,714	\$1,070,961
Seawall	Tisbury	Beach Road Seawall	VE	167	\$104,551

Linear Critical Facilities – Hurricane Impact

Category	Town	Name	Hurricane Category	Length ft	Estimated Repair Cost
Breakwater	Tisbury	Eastville Breakwater	1	641.709195	\$513,367
Bridge	Tisbury	Drawbridge	1	39.35138	\$1,662,729
Bridge	Tisbury	Drawbridge	2	101.687918	\$4,296,658
Bridge	Tisbury	Drawbridge	3	67.055253	\$2,833,311
Road	Tisbury	Lagoon Pond Road	1	2483.894934	\$508,069
Road	Tisbury	Beach Road	1	4403.168186	\$900,648
Road	Tisbury	Water Street	1	566.623489	\$115,900
Road	Tisbury	Beach Road	2	52.161689	\$10,669
Road	Tisbury	Lagoon Pond Road	2	70.539555	\$14,429
Road	Tisbury	Lagoon Pond Road	3	93.999649	\$19,227
Road	Tisbury	Lagoon Pond Road	4	277.448345	\$56,751
Seawall	Tisbury	Beach Road Seawall	1	1867.697192	\$1,167,311
Seawall	Tisbury	Beach Road Seawall	2	13.123275	\$8,202

Linear Critical Facilities – Tsunami Impact

Category	Town	Name	Length ft	Estimated Repair Cost
Breakwater	Tisbury	Eastville Breakwater	304	\$243,099
Bridge	Tisbury	Drawbridge	214	\$9,034,945
Road	Tisbury	Water Street	567	\$115,900
Road	Tisbury	Beach Road	2,633	\$538,619
Road	Tisbury	Lagoon Pond Road	3,030	\$619,808

TISBURY FUTURE VULNERABILITY

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(combine impacts and frequency)(1 point for each step of frequency or impact)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	medium	large	serious	8
Erosion	high	large	serious	9
Dam Failures	n/a	n/a	n/a	0
Severe Rainstorms	medium	large	serious	8
Winter Storms	low	local	minor	4
Coastal Storms/Nor'easters	high	medium	extensive	10
Hurricanes	medium	large	extensive	9
Wind-Related Hazards				
Hurricanes	medium	large	extensive	9
Coastal Storms	high	large	serious	9
Winter Storms	low	local	serious	5
Downspouts	very low	local	minor	3
Tornadoes	very low	local	serious	4
Fire-Related Hazards				
Drought	medium	medium	serious	8
Wildfires	medium	medium	serious	8
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	very low	local	minor	3
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3
Sea Level Rise	high	local	minor	6

VULNERABILITY ASSESSMENTS FOR WEST TISBURY

The Town of West Tisbury has a year 'round population of 2,740 (2010 census) on a land area of 25 square miles of dry land, with a density of 109.6 persons per square mile. West Tisbury is the fastest growing town in Dukes County, but still doesn't have municipal water or sewer service. The north side of West Tisbury is hilly, morainal land and the south side is lowland made of unconsolidated outwash plain sediments that are highly susceptible to erosion and disappearing at the rate of about 7 feet per year. The south side is also punctuated by periglacial valleys that are susceptible to storm surge and to sea level rise.

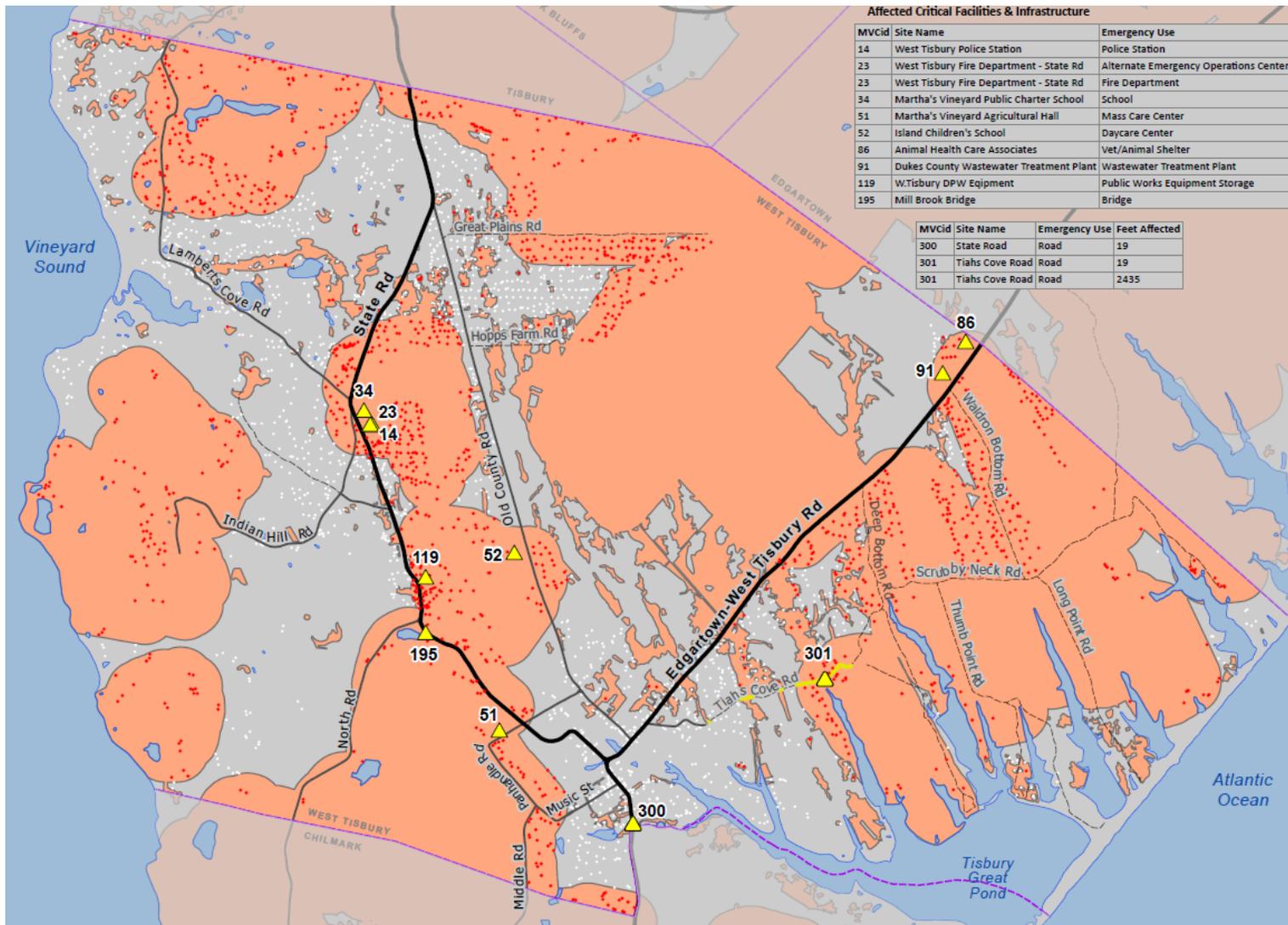
The maps illustrate the geographic extent of vulnerability. Only excerpts are shown here. The full sized maps are available on-line <https://www.mvcommission.org/climate-change>. Seeing the full extent is important for planning purposes.

The matrices of vulnerability highlight the persons and property. Property is identified both by numbers of buildings and by value. Persons are identified by population (ASC 5-year average 2013-2017) as well as by seasonal projection. Projections estimate vulnerability at buildout.

Vulnerability is represented for wildfire (wildland urban interface), flood (Nor'easter), storm (hurricane), Sea Level Rise, and for tsunami. Additional Sea Level Rise impacts are found appended to this document.

WEST TISBURY WILDFIRE VULNERABILITY (Wildland Urban Interface)

For the larger map, see <https://www.mvcommission.org/climate-change>



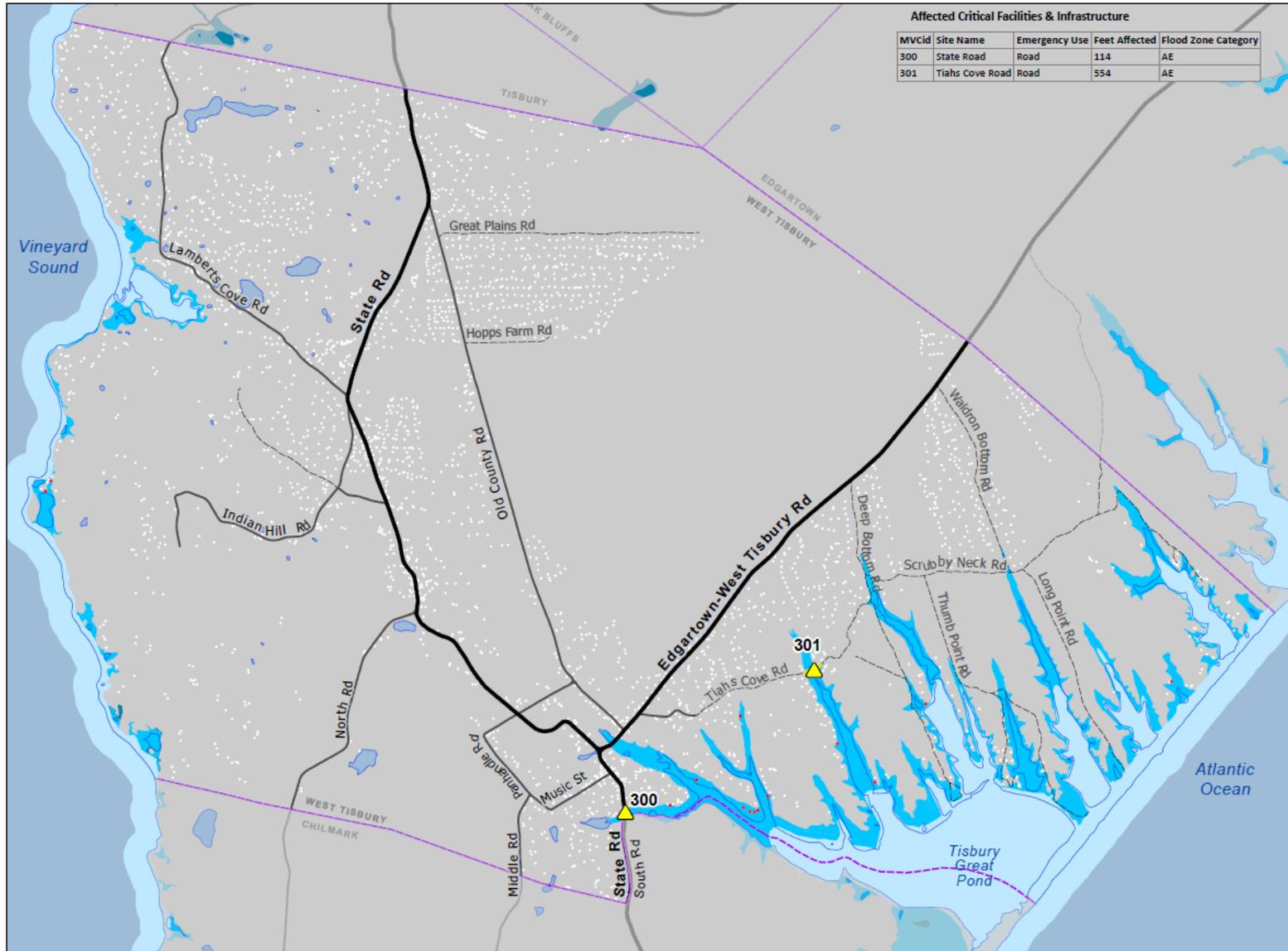
Wildfire Threatened Area – The Wildland-Urban interface is shown in orange, with potentially affected infrastructure displayed in bright colors.

WEST TISBURY Wildfire Vulnerability

Developed Land					Undevel. Land			
Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
	2.6 per building	4.14 per building			2.6 per building	4.14 per building		
Commercial			43	\$25,159,100				
Municipal, Public, Non-profit			41	\$12,737,500				
Industrial			5	\$254,000			4	\$203,200
Mixed use Commercial	81	128	31	\$8,120,200			-23	
Mixed Industrial	8	12	3	\$138,500				
Mixed use Residential	161	257	62	\$13,904,600				
Other			4	\$166,900				
Residential	3298	5254	1269	\$526,998,076	907	1445	349	\$144,934,853

West Tisbury FLOOD VULNERABILITY (2016 FIRM) - Nor'Easter- type storm flooding

Powder blue represents the 100-year VE zone (wave heights > 3'). Teal represents the 100-year AE zone (wave heights < 3'). Dark blue shows the 500-year flood zone. For the larger map, see <https://www.mvcommission.org/climate-change>



**Flood Vulnerability
Based on 2016 Flood Data
Developed Land**

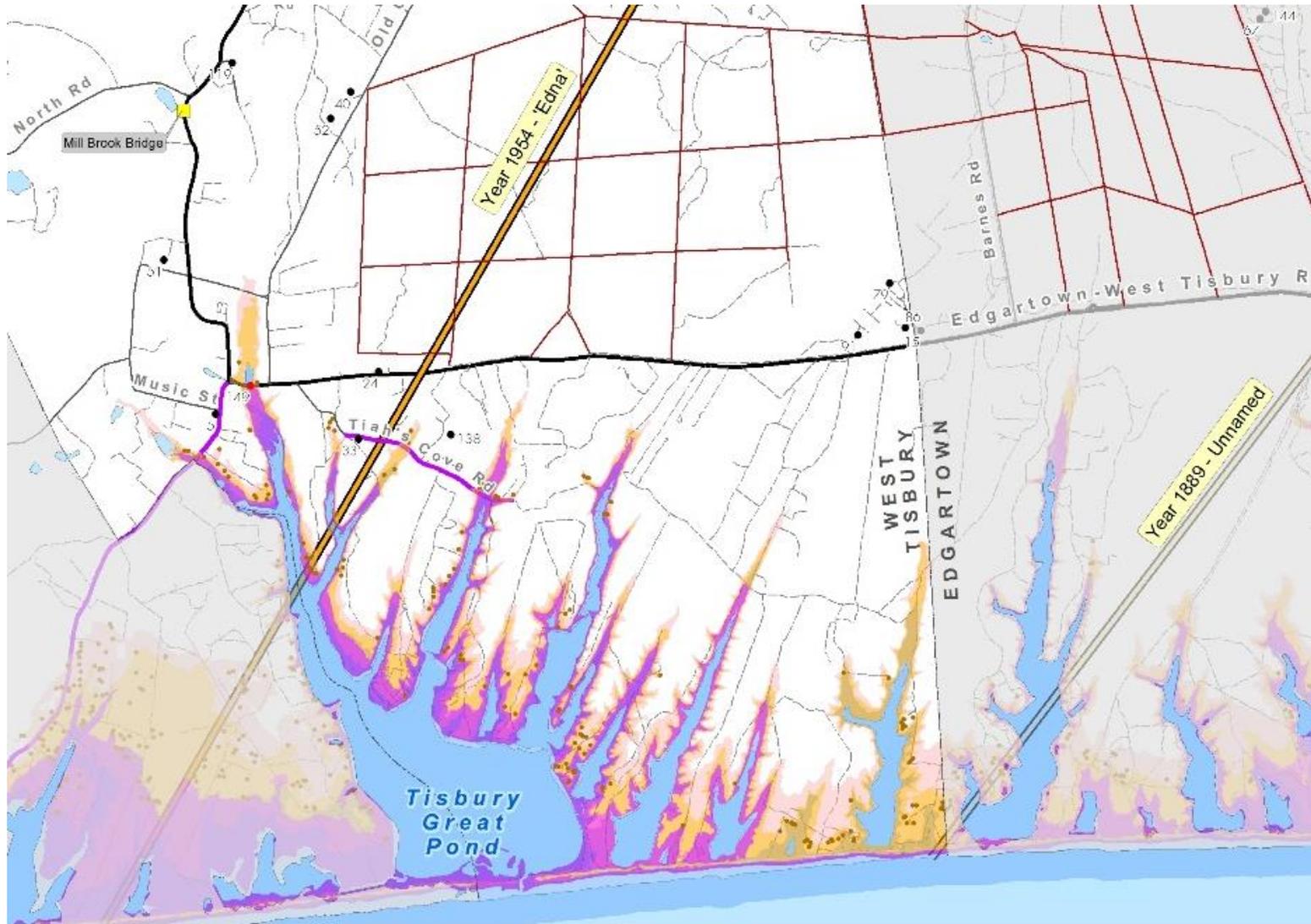
Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.6 per building	4.14 per building		
100 Year	Mixed use Commercial	3	4	1	\$680,700
	Residential	34	54	13	\$11,082,300

Developable Land

Flood Zone Category	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
		2.6 per building	4.14 per building		
100 Year AE Zone	Mixed use Commercial	0	0	-1	-\$680,700
100 Year AE Zone	Residential	81	128	31	\$26,427,023
Velocity Zone (also 100yr)	Residential	70	112	27	\$23,017,085

STORM SURGE VULNERABILITY FOR WEST TISBURY (HURRICANE) S.L.O.S.H. MAP

The colors in the Storm Surge legend grade larger map, see <https://www.mvcommission.org/climate-change>



**WEST TISBURY Hurricane Inundation Vulnerability (SLOSH)
2013 USACOE
Developed Land**

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		2.6 per building	4.14 per building		
1	Mixed use Commercial	3	4	1	\$680,700
2	Residential	39	62	15	\$8,165,600
3	Exempt (Municipal, Public, Non-profit)	0	0	4	\$438,100
3	Mixed use Residential	3	4	1	\$148,300
3	Residential	117	186	45	\$37,986,329
4	Commercial	0	0	1	\$359,500
4	Mixed use Residential	3	4	1	\$641,600
4	Residential	127	203	49	\$48,739,800

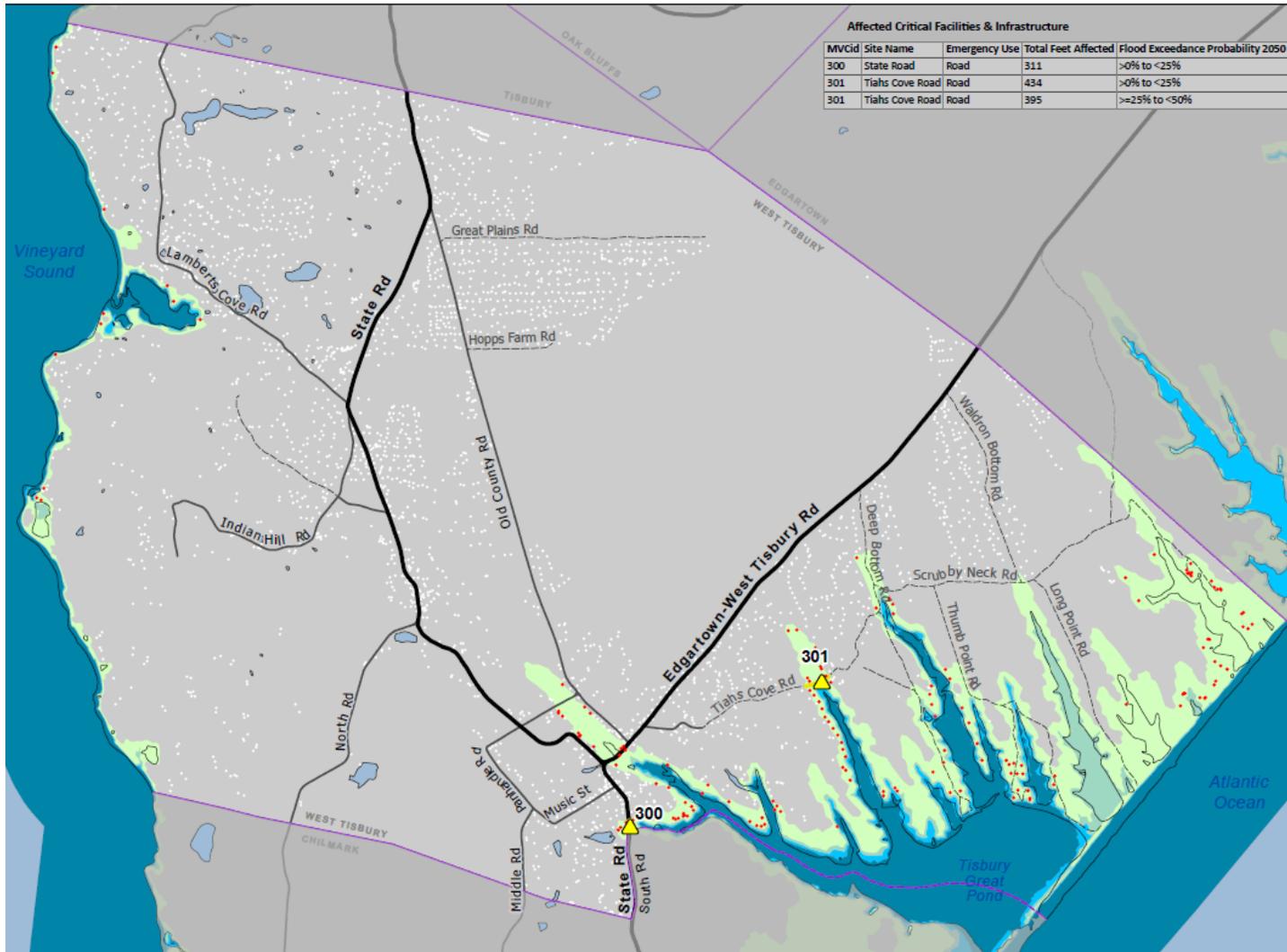
Potential Development

SLOSH cat.	Use	# People (other)	# People (July-Aug)	# Buildings	Approx. Value
		2.6 per building	4.14 per building		
1	Residential	34	54	13	\$7,076,853
2	Residential	44	70	17	\$9,254,347
3	Residential	96	153	37	\$31,233,204
4	Residential	101	161	39	\$38,792,902

WEST TISBURY SEA LEVEL RISE VULNERABILITY

SLR of 2.57 ft by 2050 and likelihood of flooding in a given year

dark blue: $\geq 75\%$; light blue: $\geq 50\%$ to $< 75\%$; olive green: $\geq 25\%$ to $< 50\%$; light green $> 0\%$ to $< 25\%$



For larger map, visit: <https://www.mvcommission.org/climate-change>

WEST TISBURY SEA LEVEL RISE VULNERABILITY

SLR Scenarios: 2.57 ft* (2050)

4.37 ft* (2070) featured in *SLR Flood Risk Model 2070* table in Appendix

*relative to 2008 baseline

** likelihood increments are omitted if there is no current infrastructure associated with the featured use in that zone and the buildout analysis did not yield future development sited within the zone in question for a given use

Likelihood in a given year**	Use	# People (other)	# People (July-Aug)	# Buildings	Approximate Value
>0% to <25%	Commercial	0	0	1	\$359,500
>0% to <25%	Exempt (Municipal, Public, Non-profit)	0	0	3	\$438,100
>=25% to <50%	Exempt (Municipal, Public, Non-profit)	0	0	1	\$0
>0% to <25%	Mixed use Commercial	3	4	1	\$680,700
>=50% to <75%	Mixed use Commercial	3	4	1	\$680,700
>0% to <25%	Mixed use Residential	5	8	2	\$789,900
>=25% to <50%	Mixed use Residential	3	4	1	\$181,400
>0% to <25%	Residential	369	588	142	\$90,700,700
>=25% to <50%	Residential	10	17	4	\$1,544,300
>=50% to <75%	Residential	5	8	2	\$2,000,900
>=75%	Residential	0	0	0	\$0

COASTAL EROSION AND SHORELINE CHANGE – West Tisbury

Pre-1978 homes near bluffs are difficult for the towns to regulate (grandfathered under the Wetlands Protection Act). There are 16 in WEST TISBURY.



WEST TISBURY VULNERABILITY OF CRITICAL FACILITIES

Site Name	Approx. Value	TSUNAMI	FIRE	Hurricane Category	FEMA Flood Zone
West Tisbury Police Station	\$4,029,300	--	Yes	--	--
West Tisbury Fire Department - State Rd	\$4,029,300	--	Yes	--	--
Martha's Vineyard Public Charter School	\$0	--	Yes	--	--
Martha's Vineyard Agricultural Hall	\$1,507,300	--	Yes	--	--
Island Children's School	\$354,800	--	Yes	--	--
Animal Health Care Associates	\$515,500	--	Yes	--	--
Dukes County Wastewater Treatment Plant	\$271,300	--	Yes	--	--
West Tisbury DPW Equipment	\$236,100	--	Yes	--	--
Mill Brook Bridge	\$0	--	Yes	--	--

Critical Facilities - SLR

There is no projected risk to Critical Facilities within West Tisbury owing to Sea Level Rise.

WEST TISBURY VULNERABILITY OF CRITICAL FACILITIES – LINEAR FEATURES

Critical Linear Features - FEMA Flood Zone Impact

Category	Town	Name	FEMA Flood Zone	Length ft	Estimated Repair Cost
Road	West Tisbury	State Road	AE	114	\$23,224
Road	West Tisbury	Tiah's Cove Road	AE	554	\$113,292

Critical Linear Features – Wildland Urban Interface

Category	Town	Name	Length ft	Estimated Repair Cost
Road	West Tisbury	State Road	19	\$3,818
Road	West Tisbury	Tiahs Cove Road	2,454	\$501,943

Critical Linear Features – Hurricane Storm Surge Impacts

Category	Town	Name	Hurricane Category	Length ft	Estimated Repair Cost
Road	West Tisbury	Tiahs Cove Road	2	640.710677	\$131,054
Road	West Tisbury	State Road	2	29.193689	\$5,971
Road	West Tisbury	State Road	3	185.544696	\$37,952
Road	West Tisbury	Tiahs Cove Road	3	495.442984	\$101,341
Road	West Tisbury	State Road	4	60.294457	\$12,333
Road	West Tisbury	Tiahs Cove Road	4	407.326807	\$83,317

WEST TISBURY FUTURE VULNERABILITY

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(combine impacts and frequency)(1 point for each step of frequency or impact)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	medium	large	serious	8
Erosion	high	medium	minor	7
Dam Failures	very low	local	serious	4
Severe Rainstorms	medium	large	serious	8
Winter Storms	low	local	minor	4
Coastal Storms/Nor'easters	high	medium	extensive	9
Hurricanes	medium	medium	serious	7
Wind-Related Hazards				
Hurricanes	medium	large	extensive	9
Coastal Storms	high	large	serious	10
Winter Storms	low	local	serious	5
Downspouts	very low	local	minor	3
Tornadoes	very low	local	serious	4
Fire-Related Hazards				
Drought	medium	medium	minor	6
Wildfires	high	medium	serious	8
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	very low	local	minor	3
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3
Sea Level Rise	high	medium	minor	7

Section 6. Hazard Mitigation

Having performed the data and analysis involved in assessment of vulnerabilities, the next step was to address those vulnerabilities with an action plan. In developing the following action plans, the Hazard Mitigation Planning Teams evaluated the hazard identification and analysis, the vulnerabilities and the existing protections to discover what goals and actions might be adopted to further lessen the impacts of natural hazards.

The first plan was produced with great cooperation and effort of a stalwart group of emergency managers from the Dukes County towns, and MVC staff. That first plan was an important step in working toward hazard mitigation, but produced limited results in implementation. Following adoption of the first Hazard Mitigation Plan, there was some implementation success. The Town of Edgartown secured 75% funding for retrofit of a vulnerable sewer station. When completed, the retrofit should greatly reduce the impacts of flooding there. The Town was awarded \$474,000. No other towns took advantage of the implementation grants available. On the planning side, there was no incorporation of mitigation strategies in other plans. For the 2015 update, outreach during the production phase was widened to include more town boards, organizations, and the public. This expansion was made in order to foster greater proprietorship and stewardship of the plan's mitigation measures, both structural and non-structural. More achievements included the retreat of Chilmark's vulnerable Squibnocket Beach parking, and some culvert work. For the 2021 update, the MVP planning sessions ensured that an even wider level of outreach was achieved.

Flood and Storm

Most Dukes County towns participate in the FEMA flood insurance program (NFIP) and have floodplain zoning by-laws associated with that program. Chilmark is the exception. That town does not participate in the program, doesn't have a floodplain by-law, and property owners are not eligible to purchase flood insurance through the NFIP program. As recently as September 1, 2015, the Chilmark Board of Selectmen took a vote to remain outside of the NFIP program.³²

During the discussion, the Selectmen and others focused on two main reasons to stay out:

- The Menemsha waterfront includes fishing shacks and facilities that would not retain the same character or charm if they were elevated, as would happen in the event of a major storm in a community with a floodplain by-law.
- Most of Chilmark's homes are not vulnerable, and the Selectmen are opposed to subsidizing the risk of a few wealthy property owners with U.S. tax dollars.

FIRM maps have been prepared for Chilmark, and are used for planning purposes. It should be noted that the floodplain by-laws required for participation in the insurance program are not as restrictive of overall development as are the Districts of Critical Planning Concern. The Vineyard towns have the Coastal District DCPC (District of Critical Planning Concern) and several DCPC's specific to individual ponds, harbors and shores. These DCPC regulations are, in most cases, more restrictive of overall

³² <http://vineyardgazette.com/news/2015/09/08/chilmark-reaffirms-decision-not-join-federal-flood-program?k=vg5447f8da9364f>

development than are the FEMA floodplain by-laws. The floodplain by-laws include standards for construction; whereas the Coastal District regulations limit overall growth and development in this vulnerable area.

Within the confines of regulation with floodplain by-laws, there is room for adjustment to make the by-laws somewhat more restrictive. The Town of Oak Bluffs upgraded its Floodplain Bylaw to a level of protection above and beyond the basics, perhaps a model for the other towns to consider. In 2009, Oak Bluffs became one of eight pilot communities in the Storm Smart Coast Program which is run by Massachusetts Coastal Zone Management (CZM) office. The goal for Oak Bluffs was to revise the bylaw to better protect the property, public health and natural resources within the Floodplain Overlay District. CZM staff provided assistance to a team of Oak Bluffs officials in order to revise the basic floodplain overlay district bylaw in place at that time, to better regulate development and land use. New regulations include stricter rules against new construction, additions and expanding impervious surfaces throughout most of the flood plain district. While regulations are more extensive in this update of the bylaws, guidelines are available on how and when to apply for special permits for unique circumstances in The Rules and Regulations for the Floodplain Overlay Zoning District document. The updated bylaws were passed at Town Meeting in May, 2010, after which the CZM representatives congratulated Oak Bluffs for its progressive work to protect residents, businesses and natural resources. For the next update of this plan, the other Dukes County towns may want to look at the Oak Bluffs improvements in the context of their own needs.

Wildfire and Drought

The 5,700-acre Manuel F. Correllus State Forest was created in 1908 as a refuge for the last remaining population of heath hen, and was managed as heath hen habitat until the last one died in 1932. Since then, management practices have left considerable areas of exotic pines that are dead and dying, providing significant fuel for wildfires.

A new Superintendent now manages the State Forest, where he has limited staff to assist with mowing regimes. Controlled burns have not been used in recent years. Grazing is used following mowing/brushcutting.

The Town of Gosnold completed its *Cuttyhunk Community Wildfire Protection Plan* in 2013, including an assessment of vulnerability and management recommendations for the Island of Cuttyhunk. The Town of Chilmark performed a similar assessment, determining Probability of Ignition. Funding has been requested for preparation of a similar wildfire management plan for all 7 towns of Dukes County. 25% local match has been secured.

Community (County-wide) Mitigation Goals:

OVERALL GOAL: To reduce the loss of or damage to life, property, infrastructure, and natural, cultural and economic resources from natural hazards.

- Protect critical public facilities and services from damage due to natural hazards.

- Ensure that critical infrastructure is protected from natural hazards.
- Promote strong natural shore defenses such as coastal beaches and dunes.
- Improve circulation for tidally restricted harbors, ponds and marshes.
- Develop programs and measures that protect residences and other structures from natural hazards.
- Develop mitigation strategies that consider area businesses, including marinas, and protect the economic vitality of the region.
- Protect and preserve irreplaceable cultural resources, particularly for recreation, located in hazard-prone areas.
- Support the communities with information concerning hazard mitigation funding opportunities, and assist the communities in the identification and development of specific mitigation projects.
- Increase each town's capacity for responding to a natural hazard event by promoting the adequate provision of emergency services capabilities.
- Increase awareness and support for natural hazard mitigation among municipalities, private organizations, and area residents through outreach and education.
- Discourage future development in vulnerable areas and encourage restoration of vulnerably-developed properties to more natural and defensible conditions or to open space.
- Reduce vulnerability to drought, by improving water supply infrastructure and by encouraging conservation measures such as low-maintenance landscaping.
- Support greater resiliency by developing and implementing climate change adaptation strategies.

Mitigation Categories: The actions have been organized by project staff, as recommended in the MEMA Community Planning Guide, into categories as follows:

Prevention: Activities including planning, zoning, District of Critical Planning Concern regulations, open space preservation, floodplain and wetland regulations, stormwater management, watershed protection measures and best management practices, erosion control, vegetation management for firewise strategies, and subdivision regulations

Protection: Activities including acquisition, building relocation, building elevation, flood-proofing and retrofitting, and insurance

Public information: Activities including providing informational mailings or workshops, education and technical assistance provided on disaster management and mitigation issues

Structural projects: Including dredging and beach nourishment, dune restoration, construction, maintenance of dams, floodwalls, channel improvements, drainage improvements, detention/retention basins

Emergency services: Including hazard recognition, emergency warning systems, emergency response, protection of critical facilities, and health and safety maintenance

Mitigation: those actions and projects which are in response to the April 2007 storm and Hurricane Sandy in 2012

Adaptation: those actions that promote adaptation to the impacts of climate change

A number of abbreviations are used here to represent agencies and programs as follows:

MVC	Martha’s Vineyard Commission
DCR	Department of Conservation and Recreation
USACOE	United States Army Corps of Engineers
FEMA	Federal Emergency Management Agency
MEMA	Massachusetts Emergency Management Agency
PDM	Pre-Disaster Mitigation
FMA	Flood Mitigation Assistance
HMGF	Hazard Mitigation Grant Program
NFIP	National Flood Insurance Program
WTGHA	Wampanoag Tribe of Gay Head (Aquinnah)
MVP	Municipal Vulnerability Preparedness
MassDOT	Massachusetts Department of Transportation

Prioritization of Mitigation Strategies

The actions were categorized by staff of the Martha’s Vineyard Commission and evaluated through a consensus-building process within the Hazard Mitigation Planning Team (Dukes County Emergency Managers) in order to establish priorities. Considerations used in evaluating priorities included: whether or not the strategy addresses vulnerable critical facilities or infrastructure; whether or not the strategy is intended to promote reduction in loss of lives or improved safety, or to reduce impacts to property; whether or not the strategy requires a capital expenditure. That process resulted in the ranking provided in the 2015 plan. For the 2021 update, prioritization has been updated by all 7 towns’ participation in a vulnerability planning project called *Municipal Vulnerability Program*³³, through the Commonwealth of Massachusetts’ Executive Office of Energy and the Environment. MVP planning provided helpful prioritization of both vulnerabilities and mitigation actions.

In developing the prioritization procedures, it is not the intent of the Hazard Mitigation Planning Team to direct that the initiatives be accomplished in their prioritized order. The purpose of the ranking is to indicate the overall importance of the project to local mitigation efforts. The accomplishment of an initiative will usually depend more on the availability of funds, than on how high or low it ranked compared to other initiatives. After a natural disaster event receives a presidential declaration and the Commonwealth of Massachusetts is designated as a result of the disaster, the Dukes County towns are then eligible for Hazard Mitigation Grant Program funding. At that time the Hazard Mitigation Planning Team will convene to analyze the damage that was sustained. Then in respect to current conditions, changes in policy and overall mitigation needs, the Hazard Mitigation Planning Team will prioritize a list of projects to be funded for the specific disaster.

Each action is scored individually and is based on weighted criteria developed by the Hazard Mitigation Planning Team and the MVP (below). The process to prioritize the mitigation actions is accomplished during joint meetings between Hazard Mitigation Team members and officials from the respective local agencies, and the MVP (Municipal Vulnerability Program) reports for the 7 towns.

³³ <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

Listed below are the criteria and weighted values:

Prioritization criteria

1. Does it represent a high, medium or low priority for mitigation in one or more MVP report? High = 30; Medium = 20; Low = 10
2. Does it promote the reduction of the loss of lives and increase public safety? Yes = 25 points; no = 0 points
3. Promote reduction in property damage? Yes = 20 points; no = 0 points
4. Funding needs and availability – no capital needed = 10 points

At their respective MVP program Community Resilience Building (CRB) workshops, participants from across the towns prioritized all identified actions by high, medium, or low for priority. Factors which influenced this prioritization included:

- Funding availability and terms
- Agreement on outstanding impacts from recent hazard events
- Necessity for advancing longer-term outcomes
- Contribution towards meeting existing local and regional planning objectives

After each documented action item was prioritized, workshop participants discussed and then closed ranks around highest priority action items across the infrastructure, society, and environment sectors. A representative from each of the workgroups then presented out to the plenary. There were instances where two groups documented the same action item, yet felt differently about the priority it should receive. An attempt was made to document the position of all groups in the final CRB resiliency matrices.

Since the Summary of Findings Reports have been issued, five of the seven towns have established designated committees with a primary focus toward resiliency. The remaining two towns have either an Energy Committee or a Long Range Planning Committee. They are both considering whether the purview of these committees are adequate or whether they should spell out a more decisive focus on resiliency. At the regional level, the Martha’s Vineyard Commission Climate Action Task Force has picked up steam since its formation in 2019, building out its working groups along the way. Energy Transformation, Education, Political Outreach, and Climate Resiliency are all afoot and active.

A key factor impacting the prioritization was also the ease with which an action could be implemented. Some actions were not perceived as extremely urgent, but they could raise the profile of resiliency as a broader community goal, while building momentum and buy in from community members. If such measures could be achieved within existing institutional frameworks and citizen-led efforts, they often moved up the priority ladder. In the HMP scoring rubric, this approach is reflected in points for “Funding needs & availability” while also impacting the points received for being featured in one or more MVP reports.

Many actions received a high priority ranking for the approach noted above, with the understanding that they cannot be assessed in a vacuum. Accomplishments in the form of low hanging fruit are sometimes a “necessity for advancing longer-term outcomes”, in that they generate enthusiasm, credibility, and as noted above, overall momentum. Conversely, some action items such as municipal buyouts of vulnerable properties may have a compelling benefit but are often prohibitively costly; such actions may have been assigned a lower priority ranking.

While “funding needs and availability” more squarely address the cost component of any cost-benefit reckoning, our rubric criteria that accounts for reduction in potential lives lost and property lost represents the more traditional benefits. Yet as we noted just above, the less tangible value associated with a cultural investment in resiliency cannot be underestimated and is reflected in a mitigation action’s ranking within the CRB/MVP matrix. To reiterate, this matrix is upstream of the HMP mitigation action scoring and ultimately has some bearing on the HMP score assigned to many of the actions in this report.

Presentation of Mitigation

The goals and actions were presented in PowerPoint format at the public sessions for the 2015 update and through the MVP process for the 2021 update. Town-by-town mitigation includes an existing protection matrix and a detailed action plan.

The first Mitigation is the community plan, followed by mitigation for each of the towns. The Teams chose the term “community” to represent County-wide items, rather than the more ubiquitous “regional”, in order to better foster cooperation.

Community (Seven Towns) Mitigation Action Items:

The Community Hazard Mitigation Planning Team developed and prioritized actions and strategies intended to meet the Community Goals.

**PROPOSED COMMUNITY MITIGATION ACTIONS
FOR ALL OF DUKES COUNTY TOWNS**

Category of Action	Description of Action	Implementation Responsibility	Priority/Timeframe	Resources/Funding
Structural, prevention NEW	Reduce reliance on electrical grid and communications towers. Develop micro-grid(s) and communications backup such as batteries for DAS communications and stationing a C.O.W (communications on wheels) on Martha’s Vineyard	Eversource, communications carriers, Town and users	75 This should be planned within the next 5 years, executed within the next 10 years.	MVP, suppliers
Emergency Services NEW	Assessment of the town/county wide emergency communications	Towns, County	85 This should be done within the next 5 years.	MVP 25% match by town meeting appropriations
Prevention, adaptation NEW	Hire a full-time emergency response planner, to help coordinate among the towns and to reduce vulnerability from current dependence on volunteer responders.	Towns, County	85 This should be done within 1-3 yrs; funding for a P/T Emer. Response Planner was authorized by towns in ‘21	Covid Recovery funds; MVP
Prevention, adaptation NEW	Conduct a comprehensive supply chain vulnerability assessment.	Towns, SSA	85 This should be done within 5 years.	HMGP, PDM, MVP planning grants 25% match by SSA
Emergency services	Generators and other retrofits for emergency shelters	Towns	65 Ongoing/Continuous; Town-Tribe collaboration established in Aquinnah	PDM, HMGP, MVP 25% match by town meeting appropriations
Emergency services	Establish an MOU with the public service entities of all island towns and the Wampanoag Tribe of Gay Head (Aquinnah) to provide incident support, whereby the Dukes County Emergency Management Agency would provide the services of the vehicles, manpower, and emergency management computer program services etc. that are owned or managed by the Dukes County Emergency Management Agency.	County, towns, WTGHA	55 Cont’d from last Plan Update; This should be done within the next 5 years.	County

Public information	Establish a Dukes County Citizens Academy for the education of Martha's Vineyard residents, both full time and part time, in the areas of family and individual emergency preparation and response to natural and man-made hazards, including but not limited to hurricane preparedness, flood awareness, and wildfire risks.	County	55 Cont'd from last Plan Update; this should be done within the next 5 years, but the necessity may be precluded if enough local C.E.R.T. teams emerge.	County
Public information, Adaptation	Employ data-gathering (such as LIDAR), analysis and consensus-building to establish an Island-wide comprehensive plan for adaptations to climate change; ultimately, craft a county-wide Climate Action Plan (CAP)	MVC	85 Cont'd from last Plan Update; MVP program has awarded Phase 2 of 2 for CAP	HMGP, PDM, MVP 25% match by town meeting appropriations, in kind by MVC
Adaptation	Work with the Joint Transportation Committee to make long-range plans for public roads vulnerable to Sea Level Rise	Joint Transportation Committee, MassDOT, MVC	85 Cont'd from last Plan Update; recently released SLR data will augment this This should be done within the next 5 years	MassDOT
Protection, emergency services	Flood-proof or relocate selected critical facilities in the floodplain (other than water-dependent uses)	Towns Selectmen and Capital Programs Committees, Commonwealth	75 Cont'd from last Plan Update; design should be completed within the next 5 years.	FMA, HMGP, MVP 25% match by town meeting appropriations
Prevention	Review and possibly amend Coastal District DCPC and other overlay regulations for hazard mitigation, particularly in order to manage armorment of bluffs	MVC, Martha's Vineyard towns' planning boards	30 Cont'd from last Plan Update; this should be done within the next 5 years	PDM, HMGP, MVP 25% match in kind by MVC
Prevention NEW	Update boundaries of Coastal District DCPC to account for findings from recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model	Town, MVC	65	MVC
Structural, protection	Structural and non-structural retrofitting (e.g. storm shutters) of existing public or private structures	Private and public owners	45 Cont'd from last Plan Update; some design and permitting should be done	FMA, PDM, HMGP, MVP

			within the next 5 years, & possibly some construction.	25% match by town meeting appropriations, owners
Structural, Prevention	Beach nourishment, dredging and structural reconfiguration of inlet protections to improve natural defenses and circulation of storm surge waters, in order to minimize storm impacts; vegetation management for dune restoration.	Towns, County, USACOE	75 Ongoing/Continuous; some will be prioritized over others; ie. Menemsha channel is high priority, with a risk that should be mitigated within 3-5 yrs	PDM, HMGP, MVP 25% match by town meeting appropriations, County assessment
Structural	Increase capacity in adaptation to climate change, by incorporating 25-year storm calculations rather than 10-year volume into public and private infrastructure planning	Towns' DPWs and Highway Depts., MassDOT, private	75 Cont'd from last Plan Update; this should be done within the next 5 years	PDM, HMGP, MVP, MassDOT, towns, private 25% match by MassDOT, town meeting appropriations
Structural	Reduce flood impacts by identifying stormwater systems that have potential to discharge hazardous materials in the event of a storm or flood and installing an emergency shut-off system in each of those systems	Commonwealth and towns	45 Cont'd from last Plan Update; GIS data for sites storing hazardous materials has been assembled; this should be done within the next 5 years	HMGP, PDM, MVP 25% match by town meeting appropriations, MassDOT
Adaptation NEW	Reduce flood impacts by monitoring the condition of culverts under the Town's roads. Participate in "Adopt a Culvert" of Massachusetts' Stream Continuity Program ³⁴	Community action, State training	85 This should be set up and begun within 5 years.	MA Division of Ecological Restoration (DER) free training
Structural	Reduce flood impacts by identifying and correcting discharges from town and Commonwealth roadways where they cross streams, including: Mill Brook (West Tisbury portion), Tiasquam (West Tisbury portion), Black Brook (Aquinnah and West Tisbury), Smith Brook (Tisbury) and Witch Brook (West Tisbury)	Commonwealth and town DPW's	75 Cont'd from last Plan Update; this should be done within the next 5 years, at least in design.	HMGP, PDM, MVP 25% match by town meeting appropriations, Mas DOT

³⁴ <https://streamcontinuity.org/naacc/states/massachusetts>

Prevention	Map stormwater collection areas and discharges	Commonwealth and town DPW's, MVC	75 Cont'd from last Plan Update; some GIS data has been assembled since then	MassDOT, MVC, towns
Prevention	Hold informational sessions with the Planning Boards to encourage the incorporation of Low Impact Development Techniques in local subdivision regulations;	MVC, towns	35 Cont'd from last Plan Update; Oak Bluffs has incorporated some of these.	Staff
Prevention, drought mitigation NEW	Contract for a Community Wildfire Protection Plan (CWPP) for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update.	HMGP funds requested, local match secured.	85 This should be done within the next 5 years.	HMGP funds requested, local match secured.
Prevention	In order to reduce the impacts of drought and wildfire, establish an overall management plan for the State Forest, including establishment of specific procedures or Memoranda of Agreement regarding the transfer of land for new public water supplies and for easements to install water supply lines	DCR and State Forest Advisory Committee	85 Cont'd from last Plan Update; the initial phase of opening a dialog between the towns, MVC and new State Forest Superintendent should be done within the next year.	DCR
Drought Mitigation NEW	Identify town and private wells where the water depth allows for a hand pump to be used in the event of loss of power. Secure hand pumps.	Towns, homeowners	55 This should be done within the next 5 years.	MVP 25% match by town meeting appropriations
Structural	In order to lessen the impacts of drought and wildfire, establish plans and build infrastructure for water supply needs to alleviate future drought emergencies. Consider potential need for and options to provide water supply to areas with a development pattern that may not be compatible with continued private well water supplies or those with inadequate existing supplies in the event of emergencies such as drought and wildfire; build the necessary infrastructure.	Town Water Departments and District	75 Cont'd from last Plan Update; extensive dialogue should begin within 18 months. If this is a desirable solution, planning and permitting can begin within the next 5 years.	MVP 25% match by town meeting appropriations
Prevention	Manage vegetation to reduce the impacts of wildfire, including but not limited to the cutting, chipping and disposal	DCR, private and public owners	75 Cont'd from last Plan Update; this will be a	HMGP, PDM, MVP 25% match by DCR, owners

	(by shipment off-Island or by reuse as compost) of excess fuel materials in forest.		recommendation in forthcoming CWPP	
Prevention	Perform outreach to encourage the towns to revise local subdivision and building regulations to require fire-proof roofing materials in areas vulnerable to wildfire; and homeowners' association to include the same in covenants or in renewal of covenants, possibly including review by the Fire Chiefs.	Towns, MVC, private and public owners	85 Cont'd from last Plan Update; this will be a recommendation in the forthcoming CWPP, and will be discussed with all towns within the first year.	MVC
Emergency services	Develop a dedicated on-Island fire cache that would allow prescribed fire teams to respond on very short notice and conduct preventive prescribed burns.	DCR	75 Cont'd from last Plan Update; this will be a recommendation in the forthcoming CWPP; burn boss shortage in northeast inhibits a short turnaround	HMGP, PDM, MVP 25% match by DCR

**EXISTING PROTECTION MATRIX
FOR ALL OF DUKES COUNTY TOWNS**

Category of Action	Description of Action	Implementation Responsibility	Status as of 2021	Resources/Funding
Prevention	Work with federal and state agencies and their contractors to develop improved mapping and estimates of structures located within the 100-year floodplain	MVC, towns, FEMA contractor, MEMA	COMPLETED	FEMA
Prevention	Encourage Mass DOT and the towns to routinely clean and maintain drainage infrastructure.	Mass DOT, towns	Ongoing; Beach Road resurfacing project in Tisbury for 2022 includes commitment from MassDOT for more frequent drains cleaning & maintenance	Mass DOT, towns
Public information	Encourage the towns and others to participate in the DCR/Fire Wise Program	DCR, Towns, MVC	Ongoing; WT Climate/Energy C'tee has determined that program elements should be promoted but that formal documentation may be too onerous	DCR
Prevention, public information	Educate public and private landowners and homeowners' associations concerning the importance of techniques for defensible space to reduce the risk of wildfire, such as utilization of low-maintenance native landscaping and removing fuel in forested areas; also consider issues of access to and through the developments for fire-fighting; fund implementation	DCR, MVC	Ongoing; Community Wildfire Protection Plan (CWPP) will be released in draft form in late 2021.	DCR

Emergency services	Continue to support the Martha's Vineyard Medical Reserve Corps in partnership with the Island town Boards of Health, the Martha's Vineyard Hospital, the Wampanoag Tribe of Gay Head (Aquinnah), and the Cape & Islands Health Coalition and to continue to host the offices of the MVMRC	County, towns, WTGHA	Ongoing	County
Emergency services	Continue to work with the Island Boards of Health in their Emergency Dispensing Site and other program planning efforts for Pandemic outbreaks and other infectious disease outbreaks, both natural and man-made.	County, towns, WTGHA	Ongoing; Boards of Health have worked closely with one another, along with the county during the Covid pandemic; this has involved uniform messaging and highly frequent meetings	County
Emergency services	Continue to support the Martha's Vineyard Regional Emergency Planning Committee in their effort to foster a more regional approach to emergency and other planning.	County	Ongoing; funding for a Regional Emergency Manager's position will be a warrant article across numerous towns	County
Emergency services	Establish a regional center for emergency information collection, reception and dissemination before, during, and after disasters.	County	Ongoing conversation with county about identifying most strategic and practical site	County
Emergency services	Continue to expand and publicize the disaster warning system for visitors.		Ongoing; CERT efforts in Aquinnah & West Tisbury have prioritized this	County

AQUINNAH MITIGATION

Matrix of Existing Protection Prioritization of Actions Mitigation Matrix

EXISTING PROTECTION MATRIX AQUINNAH

Type of Existing Protection	Description	Area Covered	Status as of 2021	Improvements or Changes Needed
Town participation in the National Flood Insurance Program (NFIP)	Provides flood insurance for structures located in flood-prone areas	FEMA flood zones	Effective & Ongoing	None
Floodplain District Zoning Bylaw	Requires Flood Plain Permit for new construction, substantial improvement; addition of increased water, electric or septic systems to conform to rules and regs of Board of Health; alteration of landforms by Special Permit from ZBA; within V-Zone new construction to be located landward of Mean High Water and man-made alteration of sand dunes prohibited	Flood zones AE and VE as shown on Flood Insurance Rate Maps codified in 2016	Enforced by zoning official; effective & ongoing	None
Coastal District DCPC (District of Critical Planning Concern)	Underground utilities; height restrictions; special permit for construction within 200' of wetlands, waterbodies, beaches, dunes or crests of bluffs over 15' high, only fishing-related commercial structure within 100' of those features, for vehicular access wider than 12', or for pre-existing stone wall to be moved, removed or altered	Below 10-foot contour or within 500' of MHW or inland edge of beach or marsh grass, and most of seaward of State Road and Moshup Trail; except named tribal lands	Effective but could use updating Island-wide; recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model may augment this effort	Needs updating to address climate change adaptation, such as management of armoring
Gay Head Cliff Area DCPC	Special permit from Planning Board Plan Review Committee required for any development, includes site plan review; height restriction 18' for a pitched roof and 13' for a flat roof, up to 24' by special permit from PBPRC; no cut/no build zone within 150' of the crest of bluffs and cliffs; no further subdivision within the district	Cliffs and environs landward to Lighthouse Road and Moshup Trail	Effective	None
Moshup Trail DCPC	site plan review for special permit to construct any building, driveway, fence (or stone wall) or private parking area; existing stone walls protected; height restrictions; no clearing of vegetation > 100 square feet except by special permit with plan review; site design guidelines are available	lands adjacent to Moshup Trail and publicly visible	Effective	None

Town of Aquinnah DCPC	site plan review for most construction; specific regs for cutting, stone walls, etc	town-wide except named tribal lands	Effective	None
Rate of Development District	building permit limitation to 7 per year	town-wide, except for named tribal lands	Effective	None
Wild and Scenic North Shore DCPC	permitted uses- routine maintenance, uses such as recreational fishing and boating not involving the permanent placement of any new fill or structure; specially permitted uses - permanent placement of any fill or structure for municipal purposes or for purposes of commercial fishing, shellfishing or aquaculture; all other uses prohibited (including private piers)	waters and lands of north shore, lighthouse to lighthouse, extending 100' seaward from MLW	Effective	None
Fire-Wise Outreach	Outreach and to groups	Martha's Vineyard	CERT is focused on this effort and will take CWPP findings and help disseminate so property owners can mitigate risk	This program could use some support in order to reach more of the vulnerable homeowners
Emergency services	Generator for emergency area at Aquinnah Town Hall	Town of Aquinnah	Completed	Completed
Structural	Reduce flood impacts by identifying and correcting discharges from town and Commonwealth roadways where they cross streams, including but not limited to: Black Brook in Aquinnah (completed) and a culvert on Lobsterville Road, where flooding is a known problem.	Black Brook addressed by FEMA funding and the WTGHA Wampanoag Tribe of Gay Head(Aquinnah); Lobsterville addressed by SNEP funds and WTGHA	Completed	Long term needs for Lobsterville need to be addressed. The next storm could wash the road out again.
Structural	Keep the channel to Menemsha Pond dredged	ACOE Army Corps of Engineers – this is a federal channel	Completed 2019 – one round; channel and adjacent embankment in need of attention again	Completed; will need dredging as maintenance

PRIORITIZATION OF MITIGATION STRATEGIES

Prioritization of Mitigation Strategies

The actions were categorized by staff of the Martha's Vineyard Commission and evaluated through a consensus-building process within the Aquinnah Hazard Mitigation Planning Team in order to establish priorities. Considerations used in evaluating priorities included: whether or not the strategy addresses vulnerable critical facilities or infrastructure; whether or not the strategy is intended to promote reduction in loss of lives or improved safety, or to reduce impacts to property; whether or not the strategy requires a capital expenditure. That process resulted in the ranking provided in the 2015 plan. For the 2021 update, prioritization has been updated by Aquinnah's participation in a vulnerability planning project called *Municipal Vulnerability Program*³⁵, through the Commonwealth of Massachusetts' Executive Office of Energy and the Environment. MVP planning provided helpful prioritization of both vulnerabilities and mitigation actions.

In developing the prioritization procedures, it is not the intent of the Hazard Mitigation Planning Team to direct that the initiatives be accomplished in their prioritized order. The purpose of the ranking is to indicate the overall importance of the project to local mitigation efforts. The accomplishment of an initiative will usually depend more on the availability of funds, than on how high or low it ranked compared to other initiatives. After a natural disaster event receives a presidential declaration and the Commonwealth of Massachusetts is designated as a result of the disaster, the Dukes County towns are eligible for Hazard Mitigation Grant Program funding. At that time the Aquinnah Hazard Mitigation Planning Team will convene to analyze the damage that was sustained. Then in respect to current conditions in Aquinnah, changes in policy and overall mitigation needs, the Aquinnah Hazard Mitigation Planning Team will prioritize a list of projects to be funded for the specific disaster.

Each action is scored individually and is based on weighted criteria developed by the Hazard Mitigation Planning Team and the Aquinnah MVP (below). The process to prioritize the mitigation actions is accomplished during joint meetings between Hazard Mitigation Team members and officials from the respective local agencies, and the Aquinnah MVP (Municipal Vulnerability Program) report.

³⁵ <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

Listed below are the criteria and weighted values:

Prioritization criteria

1. Does it represent a high, medium or low priority for mitigation in the Aquinnah MVP report? High = 30; Medium = 20; Low = 10
2. Does it promote the reduction of the loss of lives and increase public safety? Yes = 25 points; no = 0 points
3. Promote reduction in property damage? Yes = 20 points; no = 0 points
4. Funding needs and availability – no capital needed = 10 points

Challenges: Aquinnah is a very small town with limited staffing and revenue. Funding is the main constraint for Aquinnah’s mitigation proposals. Funding is needed for engineering and design consultants as well as for construction.

**PROPOSED MITIGATION ACTIONS
FOR THE TOWN OF AQUINNAH (ALONG WITH ALL THE DUKES COUNTY COMMUNITY ACTIONS)**

Category of Action	Description of Action	Implementation Responsibility	Timeframe/Priority	Resources/Funding
Structural, drought mitigation NEW	Identify and protect artesian wells such as Cook’s Spring, as possible sources of potable water in case of drought and sudden loss of electricity. Replace the pipe and outlet as necessary to protect water quality.	Town, homeowners	55 This should be done within the next 5 years.	MVP
Drought Mitigation NEW	Identify town and private wells where the water depth allows for a hand pump to be used in the event of loss of power.	Town, homeowners	55 This should be done within the next 5 years.	MVP
Prevention, drought mitigation New/Enhanced	Complete CWPP (Community Wildfire Protection Plan) for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update; this will include Firewise strategies from 2015 mitigation actions.	MVC manages consultant; all relevant property owners implement	85 Plan approved by end of 2021. Implementation ongoing	HMGP funds awarded, local match secured.
Structural, prevention, drought mitigation	Install dry hydrants to pump pond water for firefighting. Require for some new (larger) subdivisions. Encourage elsewhere. If there is no pond nearby, install a water source.	Town fire department, private	75 Cont’d from last Plan Update; this will be a recommendation in the forthcoming CWPP and should be done within the next 5 years.	Town, private, MVP
Structural, prevention NEW	Reduce reliance on electrical grid and communications towers. Develop micro-grid(s) and communications backup such as batteries for DAS communications and stationing a C.O.W (communications on wheels) on Martha’s Vineyard	Eversource, communications carriers, Town and users	75 This should be planned within the next 5 years, executed within the next 10 years.	MVP
Structural, Emergency services	Retrofits for structural stability of emergency area at Aquinnah Town Hall; increase capacity for emergency response	Town contractor	55 Ongoing/Continuous; Climate Resiliency C’tee has built capacity through partnership with the Tribe; Designs should be completed within the next 5 years	HMGP, PDM, MVP

Structural NEW	Make approach to Hariph's Bridge more resilient	Mass DOT, Town of Chilmark, Tribe	70 This should be planned within the next 5 years, executed in the next 10.	MassDOT, Town, US Dept of Interior
Structural, mitigation NEW	Reduce erosion at Aquinnah Cliffs. Develop stormwater management plan (SWP); pilot infiltration wells in attempt to better control erosion	Town, Tribe	30 SWP completed within 2 years; design for infiltration plans completed within 5 years; well drilled within 10 years	Town, Dept of Interior
Structural	Reduce flood impacts by identifying and correcting discharges from town and Commonwealth roadways where they cross streams, including but not limited to a culvert on Lobsterville Road, where flooding is a known problem. There needs to be a long term plan for the Lobsterville culvert. Repairs have been made, but the next storm could make the road impassible again. Lobsterville Road is the only access to West Basin boat launch, a critical facility.	Commonwealth and Town of Aquinnah contractor	50 This design should be done within the next 5 years.	Mass DOT, MVP, towns, HMGP, PDM, WTGHA
Adaptation NEW	Reduce flood impacts by monitoring the condition of culverts under the Town's roads. Participate in "Adopt a Culvert" of Massachusetts' Stream Continuity Program ³⁶	Community action, State training	85 This should be set up and begun within 5 years.	MA Division of Ecological Restoration (DER) free training
Structural, Adaptation	Increase capacity in adaptation to climate change, by incorporating 25-year storm calculations rather than 10-year volume into regulations and public infrastructure planning	Town planning board and board of health, Mass DOT, private	65 Cont'd from last Plan Update; regulations should be amended within the next 2 years. High priority retrofits should be identified within 18 mos.	HMGP, PDM, MVP, Mass DOT, towns, private
Adaptation	Work with the Joint Transportation Committee and others to make long-range plans for public roads vulnerable to Sea Level Rise	Joint Transportation Committee, Mass DOT, MVC, towns	75 Cont'd from last Plan Update; recently released SLR data will augment this	Mass DOT

³⁶ <https://streamcontinuity.org/naacc/states/massachusetts>

Structural	Keep the channel to Menemsha Pond dredged & accessible	ACOE Army Corps of Engineers – this is a federal channel	55 Ongoing/Continuous; permitting should be completed ASAP; dredging as maintenance will persist; embankment on Aquinnah side in immediate need of repair	ACOE and perhaps U.S. Coast Guard
Prevention NEW/ ENHANCED	Update boundaries of Coastal District DCPC to account for findings from recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model	Town, MVC	65 This should be done within the next 5 years.	MVC

There are numerous actions related to wildfire risk reduction; their implementation may be impacted from the findings & recommendations of a Community Wildfire Protection Plan (CWPP), underway in 2021.

Challenges: Aquinnah is the smallest town on the island, with limited staffing and revenue. This has been compounded over the past 18 months for infrastructure projects as construction costs have risen significantly. For those actions involving volunteer boards or committees, there is the added factor that many of these actions represent initiatives that will take a great deal of their additional time. Funding is the main constraint for Aquinnah’s mitigation proposals that have not been completed and are being carried forward. Funding is needed for engineering and design consultants as well as for construction.

CHILMARK MITIGATION

Matrix of Existing Protection Prioritization of Actions Mitigation Matrix

EXISTING PROTECTION MATRIX CHILMARK

Type of Existing Protection	Description	Area Covered	Status as of 2021	Improvements or Changes Needed
Coastal District DCPC (District of Critical Planning Concern)	height and construction standards for inland zone, including site plan review; in shore zone, non-residential construction by special permit with site plan review and no residential construction	Below 10-foot contour or within 500' of MHW or inland edge of beach or marsh grass; includes the shore zone, from MLW to 100' inland of the inland edge of beach or marsh grass and 100' inland of the crest of a bluff >15' in height; the rest is the inland zone	Effective & ongoing but could use updating Island-wide; recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model may augment this effort	Needs updating to address climate change adaptation, such as management of armoring
Stonewall, Nashaquitsa and Menemsha Pond District	special permit required for municipal structures and fill for furthering the commercial fisheries or public access, for dredging activities other than those for navigational channels or to improve circulation for shellfish propagation, and non-municipal piers	Stonewall Pond, Nashaquitsa Pond, and the Chilmark side of Menemsha Pond, inland to MHW	Effective & ongoing	None
Wild and Scenic North Shore DCPC	permitted uses- routine maintenance, uses such as recreational fishing and boating not involving the permanent placement of any new fill or structure; specially permitted uses - permanent placement of any fill or structure for municipal purposes or for purposes of commercial fishing, shellfishing or aquaculture; all other uses prohibited (including private piers)	waters and lands of north shore, lighthouse to lighthouse, extending 100' seaward from MLW	Effective & ongoing	None

Squibnocket Pond District	Septic systems set back 500' from pond, 200' from other wetland, vertical separation from groundwater 6'; erosion and sedimentation plan for slope \geq 8%; new structures set back 200 from crest of bluff > 15' or inland edge of beach or marsh grasses; restricted uses and site plan review	Squibnocket Pond and adjacent lands	Effective & ongoing; enforced by Building and Zoning, SPDAC Advisory Committee	Effective
Wildfire Mitigation	Model of Probability of Ignition	All island towns	CWPP will include something approximating this modeling; draft report nearing completion	
Fire-Wise Outreach	Outreach and response person on Martha's Vineyard 24/5; outreach to groups and available for response	Martha's Vineyard	CWPP will include recommendations for property owners; MVC will publicize CWPP findings	This program could use some support in order to reach more of the vulnerable homeowners
Prevention	Encourage Mass DOT and the Town to routinely clean and maintain drainage infrastructure	Mass DOT, Town	Ongoing; MassDOT has committed to more routine cleaning down island; this may provide precedent amounting to local leverage	Mass DOT, Town
Prevention	Recommendations in the Probability of Ignition report	Town	CWPP will include recommendations to reduce likelihood of ignition	HMGP, PDM
Structural	Relocation of Squibnocket Beach parking area, renegotiation of lease, removal of revetment	Town consultant, private owners	Completed	Town, private

Note: Chilmark does not participate in the National Flood Insurance Program.

PRIORITIZATION OF MITIGATION STRATEGIES

The actions were categorized by staff of the Martha's Vineyard Commission and evaluated through a consensus-building process within the Chilmark Hazard Mitigation Planning Team in order to establish priorities. Considerations used in evaluating priorities included: whether or not the strategy addresses vulnerable critical facilities or infrastructure; whether or not the strategy is intended to promote reduction in loss of lives or improved safety, or to reduce impacts to property; whether or not the strategy requires a capital expenditure. That process resulted in the ranking provided in the 2015 plan. For the 2021 update, prioritization has been updated by Chilmark's participation in a vulnerability planning project called *Municipal Vulnerability Program*³⁷, through the Commonwealth of Massachusetts' Executive Office of Energy and the Environment, with the neighboring Town of West Tisbury. MVP planning provided helpful prioritization of both vulnerabilities and mitigation actions.

In developing the prioritization procedures, it is not the intent of the Hazard Mitigation Planning Team to direct that the initiatives be accomplished in their prioritized order. The purpose of the ranking is to indicate the overall importance of the project to local mitigation efforts. The accomplishment of an initiative will usually depend more on the availability of funds, than on how high or low it ranked compared to other initiatives. After a natural disaster event receives a presidential declaration and the Commonwealth of Massachusetts is designated as a result of the disaster, the Dukes County towns are eligible for Hazard Mitigation Grant Program funding. At that time the Chilmark Hazard Mitigation Planning Team will convene to analyze the damage that was sustained. Then in respect to current conditions in Chilmark, changes in policy and overall mitigation needs, the Chilmark Hazard Mitigation Planning Team will prioritize a list of projects to be funded for the specific disaster.

Each action is scored individually and is based on weighted criteria developed by the Hazard Mitigation Planning Team and the Chilmark MVP (below). The process to prioritize the mitigation actions is accomplished during joint meetings between Hazard Mitigation Team members and officials from the respective local agencies, and the West Tisbury and Chilmark MVP (Municipal Vulnerability Program) report³⁸.

Listed below are the criteria and weighted values:

Prioritization criteria

1. Does it represent a high, medium or low priority for mitigation in the Chilmark MVP report? High = 30; Medium = 20; Low = 10
2. Does it promote the reduction of the loss of lives and increase public safety? Yes = 25 points; no = 0 points
3. Promote reduction in property damage? Yes = 20 points; no = 0 points
4. Funding needs and availability – no capital needed = 10 points

³⁷ <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

³⁸ <https://www.mass.gov/files/documents/2018/10/19/2017-2018-mvp-planning-grant-report-chilmark-west-tisbury.pdf>

**PROPOSED MITIGATION ACTIONS
FOR THE TOWN OF CHILMARK
(ALONG WITH ALL THE COMMUNITY ACTIONS)**

(Note: Chilmark does NOT participate in the National Flood Insurance Program)

Category of Action	Description of Action	Implementation Responsibility	Timeframe/Priority	Resources/Funding
Structural, protection	Beach nourishment, dredging and structural reconfiguration of inlets and inlet protections to improve natural defenses and circulation, in order to minimize storm impacts (appropriateness to be determined by Board of Selectmen on a case-by-case basis)	DCR, County, town Highway, USACOE, Mass DOT	20 Cont'd from last Plan Update; vegetation management may proceed immediately; design for structural improvements within 3-5 years	DCR, Mass DOT, towns, County, USACOE
Structural, prevention NEW	Reduce reliance on electrical grid and communications towers. Develop micro-grid(s) and communications backup such as batteries for DAS communications and stationing a C.O.W (communications on wheels) on Martha's Vineyard	Eversource, communications carriers, Town and users	75 This should be planned within the next 5 years, executed within the next 10 years.	MVP
Structural	Rehabilitate Menemsha parking lot drainage.	Town highway, consultant	50 Cont'd from last Plan Update; Designs should be completed within the next 3 years	Town
Adaptation NEW	Professional and Technical planning for Menemsha against Storm Surge and Sea Level Rise	Town, consultant	85 Planning should take place in the next 3-5 years; Implementation will be incremental (some within 10 yrs, others will be generational)	MVP
Structural	Rehabilitate South Road stormwater drainage.	Town Highway with consultant, private owners, Mass DOT	75 Cont'd from last Plan Update; did not get considered as a TIP project; should be completed within 5 years if JTC votes to prioritize or the State takes the initiative	Town, private, Mass DOT

Structural NEW	Make approach to Hariph's Bridge more resilient	Mass DOT, Town, Tribe	75 This should be planned within the next 5 years, executed within the next 10 years.	MassDOT, Town, US Dept of Interior
Prevention	Update subdivision and other regulations to keep drainage from private roads from flowing onto South Road.	Town planning board	85 Cont'd from last Plan Update; this should be done within the next 2 years if PB makes it a priority	town
Structural, prevention	Increase capacity in adaptation to climate change, by incorporating 25-year storm calculations rather than 10-year volume into regulations and public infrastructure planning	Town planning board, board of health, Highway, Mass DOT, private	45 Cont'd from last Plan Update; regulations should be amended within the next 2 years.	Mass DOT, towns, private
Adaptation	Work with the Joint Transportation Committee and others to make long-range plans for public roads vulnerable to Sea Level Rise	Joint Transportation Committee, Mass DOT, towns	55 Cont'd from last Plan Update; recently released SLR data should augment this and should be done within the next 2 years.	Mass DOT, MVP
Structural, prevention	Install 8,000 gallon holding tank for Menemsha public water supply	Town Highway and Fire, private	75 Cont'd from last Plan Update; installation should happen within the next 2 years.	MVP
Structural, prevention	Install dry hydrants to pump pond water for firefighting. Required for some new subdivisions. Encourage elsewhere. If there is no pond nearby, install a water source.	Town Highway and Fire, private	75 Ongoing/Continuous; this will be a recommendation in the forthcoming CWPP and should be done within the next 5 years, as new subdivisions are approved. Progress has been made	Town, private, MVP
Emergency services NEW	Hand pumps or other methods independent of the grid for accessing private well water	Town Highway and Fire, private	75 This should be done within the next 5 years.	Town, private, MVP

Prevention, drought mitigation NEW	Contract for a wildfire management plan for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update.	HMGP funds requested, local match secured.	75 This should be done within the next 5 years.	HMGP funds requested, local match secured.
Prevention	Review and possibly amend Coastal District and other overlay regulations for hazard mitigation, particularly the Coastal District for management of armorment of bluffs	MVC, Town planning board	30 Cont'd from last Plan Update; this should be done within the next 5 years.	MVP
Prevention ENHANCED	Update boundaries of Coastal District DCPC to account for findings from recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model	Town, MVC	65 This should be done within the next 5 years.	MVC
Prevention	Map stormwater collection areas and discharges	Commonwealth and Town Highway, MVC	55 Cont'd from last Plan Update; some GIS data assembly has taken place since then. This should be done within the next 3 years.	Mass DOT, MVC, Town
Structural ENHANCED/REFINED	Reduce flood impacts by identifying and correcting discharges from town and Commonwealth roadways where they cross streams, including: Mill Brook (Chilmark portion), Tiasquam (Chilmark portion), Fulling Mill Brook, Paint Mill Brook, and Roaring Brook (all in Chilmark), Turtle Brook, 2 unnamed stream crossings in the Great Rock Bight area, and unnamed stream flowing along portion of North Road that extends from the Menemsha Cross Road to Menemsha village. The road surface at each crossing should be adjusted during repaving to divert as much runoff as possible into roadside vegetation before it reaches the road crossing.	Commonwealth DPW and town Highway	75 This should be done within the next 5 years, at least in design.	Mass DOT, Town, MVP
Structural	Reduce flood impacts by identifying stormwater systems that have potential to discharge hazardous materials in the event of a storm or flood and installing an emergency shut-off system in each of those systems	Mass DOT, Town Highway	45 Cont'd from last Plan Update; GIS data for sites storing hazardous materials has been assembled; this should be done within the next 5 years.	Mass DOT, Town, MVP
Structural	Reduce damaging volume of direct stormwater discharges to beaches and surface waters by infiltration of those segments	Mass DOT, Town Highway	85	Mass DOT, Town, MVP

	of the systems where infiltration is possible back in the watershed, particularly in the vicinity of Menemsha.		Cont'd from last Plan Update; this should be done within the next 5 years.	
Prevention	Review and possibly revise local subdivision regulations for stormwater management to lessen the impacts of flooding	MVC, Town planning board	55 Cont'd from last Plan Update; this should be done within the next 5 years.	Town
Prevention	Hold informational sessions with town boards to encourage the incorporation of Low Impact Development Techniques in local subdivision regulations	MVC, Town planning board	55 Cont'd from last Plan Update; this should be done within the next 5 years.	Town
Prevention, drought mitigation New/Enhanced	Complete CWPP (Community Wildfire Protection Plan) for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update; this will include Firewise strategies & recommendations to mitigate areas where ignition has a high likelihood from the 2015 actions	MVC manages consultant; all relevant property owners implement	85 Plan approved by end of 2021. Implementation ongoing	HMGP funds awarded, local match secured.
Prevention	Encourage Mass DOT and the Town to routinely clean and maintain drainage infrastructure	Mass DOT, Town	85 Ongoing	Mass DOT, Town

There are numerous actions related to wildfire risk reduction; their implementation may be impacted from the findings & recommendations of a Community Wildfire Protection Plan (CWPP), underway in 2021.

Challenges: Chilmark is a very small town with limited staffing and revenue. This has been compounded over the past 18 months for infrastructure projects as construction costs have risen significantly. For those actions involving volunteer boards or committees, there is the added factor that many of these actions represent initiatives that will take a great deal of their additional time. Funding is the main constraint for Edgartown's mitigation proposals that have not been completed and are being carried forward. Funding is needed for engineering and design consultants as well as for construction. Chilmark does not participate in the National Flood Insurance Program.

EDGARTOWN MITIGATION

Matrix of Existing Protection Prioritization of Mitigation Strategies Mitigation Matrix

EXISTING PROTECTION MATRIX EDGARTOWN

Type of Existing Protection	Description	Area Covered	Status as of 2021	Improvements or Changes Needed
Town participation in the National Flood Insurance Program (NFIP)	Provides flood insurance for structures located in flood-prone areas	FEMA flood zones	Effective	None, but the Town could look at the Oak Bluffs 2010 update in the context of Edgartown's needs
Floodplain District Zoning Bylaw	Requires Flood Plain Permit for new construction, substantial improvement; addition of increased water, electric or septic systems to conform to rules and regs of Board of Health; alteration of landforms by Special Permit from ZBA; within V-Zone new construction to be located landward of Mean High Water; within AO zones residential structures elevated	Flood zones as shown on Flood Insurance Rate Map dated July 6, 2010	Enforced by Building Official; effective & ongoing	None
Coastal District DCPC (District of Critical Planning Concern)	height and construction standards for inland zone, including site plan review; no residential construction in shore zone; underground utilities except by special permit; septic 200' from salt water body; minimum separation 200' between septic; septic at least 5' above groundwater; septic 600' from public water supply and 200' from private well; private well 200' from salt water body; no road > 10' except by special permit	Below 10-foot contour or within 500' of MHW of ocean or pond > 10 acres; includes the shore zone, from MLW to 100' inland of the inland edge of beach or marsh grass and 100' inland of the crest of a bluff >15' in height; the rest is the inland zone; excludes village waterfront	Effective & ongoing but could use updating Island-wide; administered by building inspector, special permit by planning board with site plan review by site review committee	Needs updating to address climate change adaptation, such as management of armoring
Edgartown Ponds Area DCPC	Restrictions on uses, no dwellings in first 100' and special permit from Planning	Lands and waters adjacent to south shore great ponds within	Effective & ongoing; administered by	None

	Board for most uses there including additions of more than 10% to existing; restrictions on hazardous materials	700' of a coastal water body > 10 acres or the ocean, or within 300" streams and wetlands draining into ponds; zones to 100', to 200' and remainder	Building Official with special permit by Planning Board with site plan review	
Cape Pogue DCPC	Prohibits subdivision, non-municipal piers, more than one dwelling on a lot, use of turf chemicals; special permit from Planning Board for any development, includes site review	Cape Pogue Bay, Poucha Pond and surrounding lands	Effective & ongoing; administered by Building Official, Police Chief, and Harbormaster with special permit by Planning Board with a site review committee	None
Surface Water District	Site plan review and special permit from Planning Board for most uses requiring facilities such as piers	All town waters seaward of Mean High Water	Effective & ongoing; administered by Planning Board	None
Fire Breaks in State Forest	Fire breaks maintained by grazing, brush breaking, controlled burns	Within Manuel F. Correllus State Forest	DCR: new Superintendent for State Forest recently hired to augment staff commuting from mainland	Need continued management
Fire-Wise Outreach	Outreach and response person on Martha's Vineyard 24/5; outreach to groups and available for response; some of these strategies will be referenced in the forthcoming CWPP	Martha's Vineyard	DCR; this work will be augmented by a CWPP currently underway	This program could use some support in order to reach more of the vulnerable homeowners
Structural	Retrofit Dock Street sewer substation for flood resiliency.	Town	COMPLETED	Project funded 75% through HMGP

PRIORITIZATION OF MITIGATION STRATEGIES

The actions were categorized by staff of the Martha's Vineyard Commission and evaluated through a consensus-building process within the Edgartown Hazard Mitigation Planning Team in order to establish priorities. Considerations used in evaluating priorities included: whether or not the strategy addresses vulnerable critical facilities or infrastructure; whether or not the strategy is intended to promote reduction in loss of lives or improved safety, or to reduce impacts to property; whether or not the strategy requires a capital expenditure. That process resulted in the ranking provided in the 2015 plan. For the 2021 update, prioritization has been updated by Edgartown's participation in a vulnerability planning project called *Municipal Vulnerability Program*³⁹, through the Commonwealth of Massachusetts' Executive Office of Energy and the Environment. MVP planning provided helpful prioritization of both vulnerabilities and mitigation actions.

In developing the prioritization procedures, it is not the intent of the Hazard Mitigation Planning Team to direct that the initiatives be accomplished in their prioritized order. The purpose of the ranking is to indicate the overall importance of the project to local mitigation efforts. The accomplishment of an initiative will usually depend more on the availability of funds, than on how high or low it ranked compared to other initiatives. After a natural disaster event receives a presidential declaration and the Commonwealth of Massachusetts is designated as a result of the disaster, the Dukes County towns are eligible for Hazard Mitigation Grant Program funding. At that time the Edgartown Hazard Mitigation Planning Team will convene to analyze the damage that was sustained. Then in respect to current conditions in Edgartown, changes in policy and overall mitigation needs, the Edgartown Hazard Mitigation Planning Team will prioritize a list of projects to be funded for the specific disaster.

Each action is scored individually and is based on weighted criteria developed by the Hazard Mitigation Planning Team and the Edgartown MVP (below). The process to prioritize the mitigation actions is accomplished during joint meetings between Hazard Mitigation Team members and officials from the respective local agencies, and the Edgartown MVP (Municipal Vulnerability Program) report.

Listed below are the criteria and weighted values:

Prioritization criteria

1. Does it represent a high, medium or low priority for mitigation in the Edgartown MVP report? High = 30; Medium = 20; Low = 10
2. Does it promote the reduction of the loss of lives and increase public safety? Yes = 25 points; no = 0 points
3. Promote reduction in property damage? Yes = 20 points; no = 0 points
4. Funding needs and availability – no capital needed = 10 points

³⁹ <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

**PROPOSED MITIGATION ACTIONS
FOR THE TOWN OF EDGARTOWN
(ALONG WITH ALL THE COMMUNITY ACTIONS)**

Category of Action	Description of Action	Implementation Responsibility	Timeframe/Priority	Resources/Funding
Adaptation NEW	Develop a beach management plan for town beaches, particularly East Beach, Fuller Street Beach, Norton Point Beach and State Beach	Town, TTOR, County, DCR	60 Management plan should be developed within the next 5 years	MVP
Adaptation NEW	Conduct a long-term feasibility study to maintain accessibility through Edgartown Harbor	Town	40 Within 3-5 years	MVP
Structural, protection	Beach nourishment, dredging and structural reconfiguration of inlets and inlet protections to improve natural defenses and circulation, in order to minimize storm impacts, particularly regarding the circulation in and out of Edgartown Harbor; vegetation management for dune restoration	DCR, County, Town Highway, USACOE, Mass DOT	50 Cont'd from last Plan Update; vegetation management may proceed immediately; design for structural improvements within 3-5 years	HMGP, PDM, DCR, Mass DOT, Town, County, USACOE 25% match by town meeting appropriations, County, Mass DOT, DCR
Prevention	Fire breaks in State Forest maintained by grazing, brush breaking, controlled burns	DCR	75 Ongoing; need continued management	Need continued management
Prevention, drought mitigation New/Enhanced	Complete CWPP (Community Wildfire Protection Plan) for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update; this will include Firewise strategies from 2015 mitigation actions.	MVC manages consultant; all relevant property owners implement	85 Plan approved by end of 2021. Implementation ongoing	HMGP funds awarded, local match secured.
Adaptation NEW	Perform a wastewater and sewer infrastructure assessment, with a suggestion of upgrading or retrofitting vulnerable facilities.	Town	85 Within the next 5 years.	HMGP, PDM, town, MVP

Structural	Retrofit sewer substation at the corner of Dunham Road and South Water Street for flood resiliency.	Town highway and wastewater departments	75 Cont'd from last Plan Update; complete within the next 5 years.	HMGP, PDM, town, MVP
Emergency Services NEW	Evaluate all existing utility infrastructure and possible improvements.	Town, utilities	75 Within the next 5 years	HMGP, PDM, MVP
Emergency Services NEW	Develop and coordinate an Island/County wide comprehensive emergency preparedness, response and recovery plan.	Towns, County, MVC	85 Within 3-5 years	MVP
Emergency Services NEW	Create a shelter plan and install air conditioning in the Edgartown School, purchase additional beds and supplies	Town	45 Within 2-3 yrs; a new 200 kw generator was installed at the school in Nov. 2018	MVP; FEMA generator was funded under PDM-16 program
Structural, prevention	Increase capacity in adaptation to climate change, by incorporating 25-year storm calculations rather than 10-year volume into regulations and public infrastructure planning	Town highway planning board and board of health, Mass DOT, private	75 Cont'd from last Plan Update; regulations should be amended within the next 2 years;	HMGP, PDM, Mass DOT, towns, private 25% match in kind by MVC, Mass DOT
Adaptation	Work with the Joint Transportation Committee and others to make long-range plans for public roads vulnerable to Sea Level Rise; to prioritize alternatives of elevation, relocation or abandonment	Joint Transportation Committee, Mass DOT, towns	60 Cont'd from last Plan Update; recently released SLR data should augment this & should be done within the next 2 years.	Mass DOT
Emergency Services NEW	Purchase a generator for the Chappaquiddick Community Center as a shelter and Critical Facility	Chappaquiddick Island Association, private	55 Within the next 5 years	HMGP, PDM, MVP
Adaptation NEW	Create an advisory group, conduct a feasibility study for increasing the resilience of the Chappaquiddick Ferry infrastructure; to allocate funds for long-term resiliency management, and to identify alternative solutions which may include the re-engineering and/or relocation of the ferry.	Town, ferry owner	75 This should be undertaken, at least in planning, within the next 5 years.	MVP

Structural, protection, emergency services	Retrofit two ferry landings for Chappaquiddick Ferry: a manual chain hoist for each side to raise or lower the transfer bridges in the event of storm-induced prolonged power outage	Private owner	75 Cont'd from last Plan Update; this should be done within the next 5 years. 2021 CZM report has identified short and longer term measures for the landings	HMGP, FMA 25% match by private owner, town meeting appropriation
Structural, protection, emergency services	Retrofit Chappaquiddick Ferry facilities on both sides to lessen the impacts of storm damage: replace diesel fuel tank with flood-proof tank, anchor buildings on both sides, elevate electric circuits, emergency generators to power ramps and spotlights short-term	Private owner	75 Cont'd from last Plan Update; this should be done within the next 5 years. 2021 CZM report has identified short and longer term measures for the landings	HMGP, FMA 25% match by private owner, town meeting appropriation
Structural	Purchase a redundant third boat for the Chappaquiddick Ferry in the event of storm damage, install a storm mooring for it in Caleb's Pond or other secure berth	Private owner	75 Cont'd from last Plan Update; this should be done within the next 5 years.	HMGP, PDM 25% match by private owner, town meeting appropriation
Structural, protection	Install dolphins off corners of Chappaquiddick Ferry slips to fend off impact of rough landings due to vastly increased tidal flow following breach of Norton Point barrier beach	Private owner	75 Cont'd from last Plan Update; this should be done within the next 5 years.	HMGP, FMA 25% match by private owner, town meeting appropriation
Structural	Reduce flood impacts by replacing culvert that currently restricts stormwater flow in and out of Trapp's Pond with one adequately sized and designed to lessen flood impacts	Commonwealth and Town highway	60 Cont'd from last Plan Update; this should be done within the next 5 years, at least in design.	Mass DOT, HMGP, PDM 25% match by Mass DOT
Structural	Reduce damaging volume of direct stormwater discharges to beaches and surface waters by infiltration of those segments of the systems where infiltration is possible back in the watershed	Town highway, Mass DOT	75 Cont'd from last Plan Update; this should be done within the next 5 years.	HMGP, PDM 25% match by Mass DOT, town highway
Structural, Protection, Prevention NEW	Mitigate erosion in areas adjacent to Big Bridge owing to stormwater runoff, wave refraction, and other factors	MassDOT, County, Town	55 Designs should be complete within 12-18 months;	MassDOT Bridge Rehab/Repair

			mitigation implemented 2-4 years	
Prevention, drought mitigation NEW	Contract for a wildfire management plan for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update.	HMGP funds requested, local match secured	85 This should be done within the next 5 years.	HMGP funds requested, local match secured.
Prevention	In order to reduce the impacts of drought and wildfire, establish an overall management plan for the State Forest, including establishment of specific procedures or Memoranda of Agreement regarding the transfer of land for new public water supplies and for easements to install water supply lines	DCR and State Forest Advisory Committee	85 Cont'd from last Plan Update; the initial phase of opening a dialog between the town fire and water departments, the MVC and the new State Forest Superintendent should be done within the next year.	DCR
Structural	In order to reduce the impacts of drought and wildfire, install new public water supplies and water supply lines within the State Forest	Town Water Department	75 Cont'd from last Plan Update; if DCR agrees to consider this (although it's not recreational), design should be completed within the next 5 years, and possibly construction.	MVP 25% match by DCR, town water department
Structural	In order to lessen the impacts of drought and wildfire, establish plans and build infrastructure for water supply needs to alleviate future drought emergencies. The Town of Edgartown has great need for water supply beyond the capacity of the existing Edgartown wells, in addition to needs for redundancy to be prepared for emergencies such as drought	Town Water Department	75 Cont'd from last Plan Update; permitting for new facilities should be done within the next 5 years. Forthcoming CWPP should identify prospective sites	MVP 25% match by town water department
Structural	Consider potential need for and options to provide water supply to areas with a development pattern that may not be compatible with continued private well water supplies, or those with inadequate existing supplies in the event of emergencies such as drought and wildfire, particularly in the Arbutus Park, Ocean Heights and southern Katama Plains areas and Chappaquiddick; build the necessary infrastructure.	Town Water Department	75 Cont'd from Last Plan Update; extensive dialogue should begin within 18 months; if this is a desirable solution, planning and	MVP 25% match by town meeting appropriation

			permitting can begin within the next 5 years.	
Prevention ENHANCED	Update boundaries of Coastal District DCPC to account for findings from recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model	Town, MVC	45 This should be done within the next 5 years.	MVC

There are numerous actions related to wildfire risk reduction; their implementation may be impacted from the findings & recommendations of a Community Wildfire Protection Plan (CWPP), underway in 2021.

Challenges: Edgartown is a small town with limited staffing and revenue. This has been compounded over the past 18 months for infrastructure projects as construction costs have risen significantly. For those actions involving volunteer boards or committees, there is the added factor that many of these actions represent initiatives that will take a great deal of their additional time. Funding is the main constraint for Edgartown’s mitigation proposals that have not been completed and are being carried forward. Funding is needed for engineering and design consultants as well as for construction.

GOSNOLD MITIGATION

**Matrix of Existing Protection
Mitigation Strategies Illustrated
Mitigation Matrix
Prioritization of Actions**

EXISTING PROTECTION MATRIX GOSNOLD

Type of Existing Protection	Description	Area Covered	Status as of 2021	Improvements or Changes Needed
Floodplain District Zoning Bylaw		Flood zones AE and VE as shown on Flood Insurance Rate Maps codified in 2016	Effective & ongoing	None
Participation in the NFIP flood insurance program		FEMA flood zones	Effective	None
Wildfire Management Plan (graphic below)	Cuttyhunk has adopted a wildfire management plan and is an NFPA Federal Firewise Community. Mowed firebreaks, prescribed burning, road clearance and/or widening measures are ongoing.	Cuttyhunk Island	Effective & ongoing; a CWPP is currently underway for all of Dukes County, and will account for the remaining islands of Gosnold	Wildfire Management Plan should be prepared town-wide.
Structural	The Fish Dock was recently rebuilt, the Ferry Dock is new, and the Fuel Dock was recently redecked.	Cuttyhunk Harbor	Vulnerable to SLR; recently secured MA Coast Flood Risk Model could help calibrate design elevation level	Elevation should be raised in adaptation to SLR, as part of future storm repairs.
Structural	The Ferry Dock was redecked about 15 years ago, and some piling work was done. 3 bridges and a causeway are structurally sound. The barge ramp is in good condition.	Naushon Harbor	The causeway is frequently overwashed. The barge ramp is vulnerable to SLR and surrounded by lowlands.	The causeway elevation should be raised. Retreat should be planned and executed for the barge ramp.
MOU are in place for emergency response from several larger communities.	Memoranda of Agreement (MOUs) are in place for police with New Bedford and all the Martha's Vineyard towns; for fire and EMS with New Bedford and Dartmouth; Naushon is on the Dukes County pager system	Entire Town of Gosnold	Effective & ongoing	Naushon needs a new brush breaker arrangement.

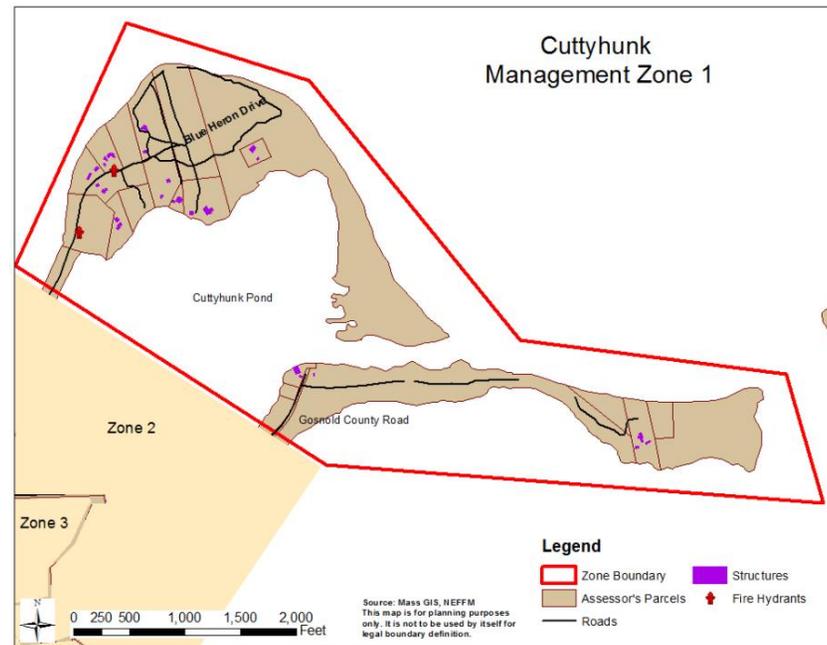
	and has an informal agreement for EMS services with Falmouth.			
Adaptation, emergency response	Cuttyhunk and Naushon both produce their own power, rather than rely on the grid.	Cuttyhunk and Naushon produce solar power, reducing diesel consumption significantly	Effective & ongoing; this is more critical than ever given contract with propane delivery company is set to expire & will not be renewed	Cuttyhunk powerhouse is vulnerable to rainstorms.

Wildfire Mitigation

(from Cuttyhunk Community Wildfire Protection Plan, 2013)

Zone 1:

- Firewise treatments on individual properties/structures

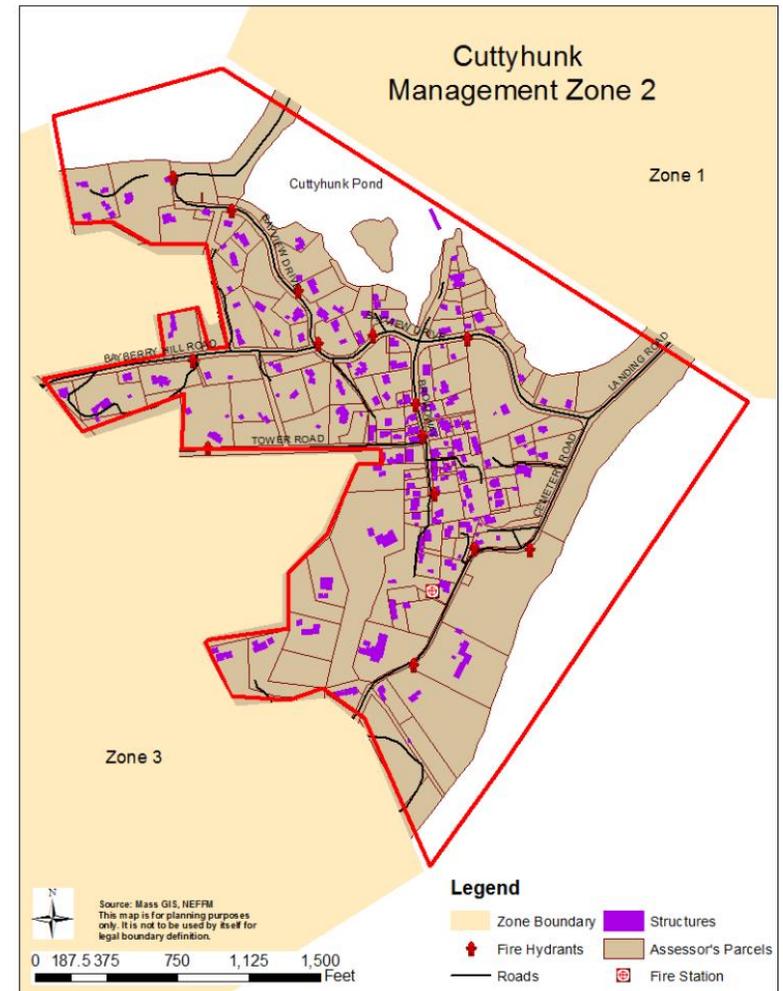


Wildfire Mitigation (from Cuttyhunk Community Wildfire Protection Plan, 2013)

Zone 2:

Firewise treatments on individual properties/structures

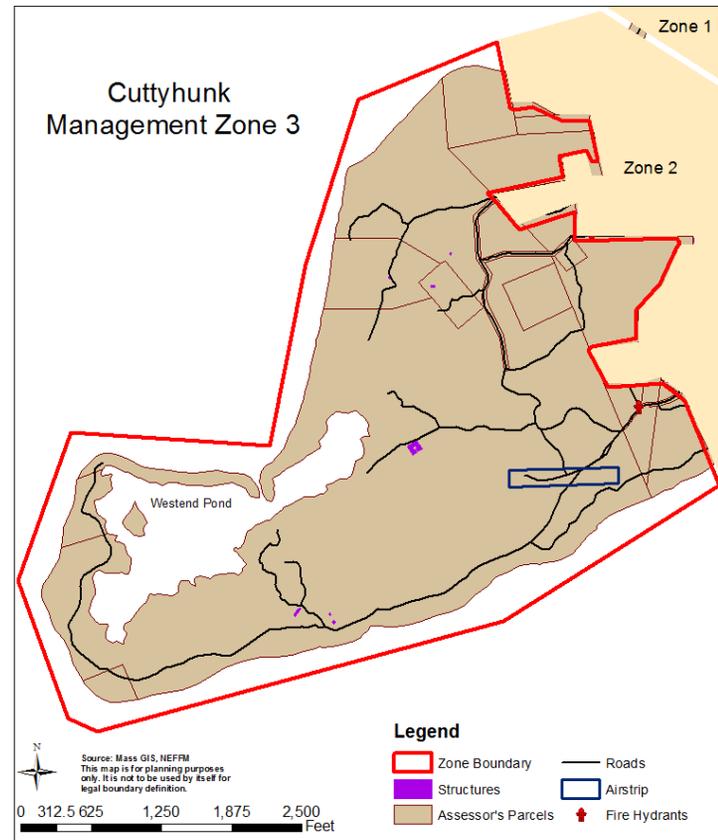
- Mowed firebreak 15' (for egress) to 80' (for suppression) wide separating Zone 2 from western end of island
- Possible prescribed burning in certain areas of Zone 2



Wildfire Mitigation (from Cuttyhunk Community Wildfire Protection Plan, 2013)

Zone 3:

- Firewise treatments on individual properties/structures
- Prescribed burning in uninhabited areas and along firebreak
- Road clearance/widening to improve access for emergency vehicles



PRIORITIZATION OF MITIGATION STRATEGIES

The actions were categorized by staff of the Martha's Vineyard Commission and evaluated through a consensus-building process within the Gosnold Hazard Mitigation Planning Team in order to establish priorities. Considerations used in evaluating priorities included: whether or not the strategy addresses vulnerable critical facilities or infrastructure; whether or not the strategy is intended to promote reduction in loss of lives or improved safety, or to reduce impacts to property; whether or not the strategy requires a capital expenditure. That process resulted in the ranking provided in the 2015 plan. For the 2021 update, prioritization has been updated by Gosnold's participation in a vulnerability planning project called *Municipal Vulnerability Program*⁴⁰, through the Commonwealth of Massachusetts' Executive Office of Energy and the Environment. MVP planning provided helpful prioritization of both vulnerabilities and mitigation actions.

In developing the prioritization procedures, it is not the intent of the Hazard Mitigation Planning Team to direct that the initiatives be accomplished in their prioritized order. The purpose of the ranking is to indicate the overall importance of the project to local mitigation efforts. The accomplishment of an initiative will usually depend more on the availability of funds, than on how high or low it ranked compared to other initiatives. After a natural disaster event receives a presidential declaration and the Commonwealth of Massachusetts is designated as a result of the disaster, the Dukes County towns are eligible for Hazard Mitigation Grant Program funding. At that time the Gosnold Hazard Mitigation Planning Team will convene to analyze the damage that was sustained. Then in respect to current conditions in Gosnold, changes in policy and overall mitigation needs, the Gosnold Hazard Mitigation Planning Team will prioritize a list of projects to be funded for the specific disaster.

Each action is scored individually and is based on weighted criteria developed by the Hazard Mitigation Planning Team and the Gosnold MVP (below). The process to prioritize the mitigation actions is accomplished during joint meetings between Hazard Mitigation Team members and officials from the respective local agencies, and the Gosnold MVP (Municipal Vulnerability Program) report⁴¹.

Listed below are the criteria and weighted values:

Prioritization criteria

5. Does it represent a high, medium or low priority for mitigation in the Gosnold MVP report? High = 30; Medium = 20; Low = 10
6. Does it promote the reduction of the loss of lives and increase public safety? Yes = 25 points; no = 0 points
7. Promote reduction in property damage? Yes = 20 points; no = 0 points
8. Funding needs and availability – no capital needed = 10 points

⁴⁰ <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

⁴¹ <https://www.mass.gov/files/documents/2018/10/19/2017-2018-mvp-planning-grant-report-gosnold.pdf>

**PROPOSED MITIGATION ACTIONS
FOR THE TOWN OF GOSNOLD
(ALONG WITH ALL THE COMMUNITY ACTIONS)**

Category of Action	Description of Action	Implementation Responsibility	Timeframe/Priority	Resources/Funding
Structural,	Improve storm damage prevention for entrance to Cuttyhunk Harbor by extending the USACOE riprap by 1,000 ft along the southern/eastern stretch of Canapitsit barrier beach	USACOE	85 Cont'd from last Plan Update; the design should be completed within the next 5 years. Permitting is the limiting factor in the timeframe.	USACOE, HMGP, PDM, MVP 25% match by town meeting appropriation
Prevention, NEW	Beach nourishment, dredging to protect Cuttyhunk Harbor Entrance Channel	Dredging is responsibility of USACOE. Beach nourishment is not favored for town funds (prefer structural)	85 Dredging as needed.	USACOE, HMGP, PDM, MVP 25% match by town meeting appropriation
Prevention, drought mitigation New/Enhanced	Complete CWPP (Community Wildfire Protection Plan) for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update; a Wildfire Protection Plan was already completed for Cuttyhunk in 2013	MVC manages consultant; all relevant property owners implement	85 Plan approved by end of 2021. Implementation ongoing	HMGP funds awarded, local match secured.
Structural, adaptation NEW	To protect the channel, modify the east end of Barges Beach, outside the limits of the designated barrier beach, by reconfiguring or armoring. This could achieve permitting without proposing construction on the barrier beach itself (barred by Massachusetts Executive Order).	USACOE, Town	75 Feasibility should be researched within the next 5 years.	HMPG, PDM, MVP, USACOE 25% match by town meeting appropriation
Structural NEW	Elevate Fish Dock, Fuel Dock, and Ferry Dock as maintenance and repairs are done	Town	75 Within 5-10 years	FEMA, MA Seaport Economic Council, MVP, Town
Structural NEW	Elevate bridges and causeway	Town	65 Within 5-10 years	FEMA, MA Seaport Economic Council, MVP, Town

Structural, adaptation, protection of Cuttyhunk Harbor Entrance NEW	To protect the channel, modify Copicut Neck jetty by elevation and/or extension of the jetty.	USACOE, Town	65 Feasibility should be researched within the next 5 years.	HMPG, PDM, MVP, USACOE 25% match by town meeting appropriation
Adaptation, protection of Cuttyhunk Harbor NEW	To protect the harbor from overwash, enhance Church's Beach. Consider participation in a future pilot program to mine sand in the vicinity, for beach nourishment.	Town	75 Feasibility should be researched within the next 5 years.	HMPG, PDM, MVP, CZM 25% match by town meeting appropriation
Structural, adaptation NEW	Elevation of docks on Cuttyhunk (Fish Dock, Ferry Dock) and on Naushon (Ferry Dock and (Uncateena Dock)	Town, private	85 Elevation should be included whenever repairs or maintenance are undertaken.	HMGP, PDM, MVP 25% match by town meeting appropriation, private funds
Structural, adaptation NEW	Devise and execute plans for retreat for the barge ramps on Cuttyhunk and Naushon, vulnerable to SLR	Town, private	75 Plans at least should be produced within 5 years.	HMGP, PDM, MVP 25% match by town meeting appropriation, private funds
Prevention NEW	A mobile trailer or truck is needed for moving the dumpsters and contents from the Cuttyhunk transfer station, at the dock, in the event of an approaching hurricane.	Town	20 This should be done within 5 years.	MVP 25% match by town meeting appropriation
Structural, adaptation NEW	The causeway joining Naushon and Nonamesset Islands (in series with 2 bridges) routinely overwashes and should be elevated to accommodate SLR.	Town, private	75 This should be undertaken, at least in design, within 5 years.	HMGP, PDM, MVP 25% match by private funds
Structural, adaptation NEW	There needs to be a plan for retreat for the propane tanks at the Cuttyhunk waterfront, vulnerable to SLR.	Town, propane supplier	10 This should be undertaken within 5 years.	HMGP, PDM, MVP
Adaptation NEW	Plan for elevation of vulnerable roads providing access to waterfront facilities; consider retreat for others such as Cemetery Road on Cuttyhunk.	Town, private	65 Planning should be underway within 5 years.	HMGP, PDM, MVP planning grants

Adaptation NEW	Review zoning to allow for elevation above traditional New England look, particularly for water-dependent facilities.	Town	75 Discussion should begin within 5 years.	HMGP, PDM, MVP planning grants
Emergency NEW	A mobile generator of about 7500 W, and connections, should be provided to share between Town Hall and Cuttyhunk Church for emergencies.	Town	65 This should be purchased within 5 years.	HMGP, PDM, MVP 25% match by town meeting appropriation
Emergency NEW	Designate one helicopter landing site on Naushon, such as Mansion House Meadow, to avoid confusion in emergencies.	Town, private	55 This should be done within 5 years.	
Emergency NEW	Naushon had an informal arrangement for a small brush breaker, no longer available from the Town of Falmouth. A new arrangement should be discovered and secured.	Town	75 This should be done within 5 years.	
Prevention, drought mitigation NEW	Protect Cuttyhunk public water supply and sole source aquifer. Bring a groundwater protection district bylaw to town meeting for adoption.	Town	85 This should be done within 5 years.	HMGP, PDM, MVP planning grants
Prevention, drought mitigation NEW	The bulkhead protecting the Bog keeps saltwater intrusion out of the Cuttyhunk public water supply. Vulnerable to SLR, the bulkhead will need a plan for retreat designed and executed.	Town	55 Discussion could continue in the next 5 years.	HMGP, PDM, MVP 25% match by town meeting appropriation
Structural	Reduce flood impacts by identifying stormwater systems that have potential to discharge hazardous materials in the event of a storm or flood and installing an emergency shut-off system in each of those systems	Town	45 Cont'd from last Plan Update; this should be done within 5 years.	HMGP, FMA. MVP 25% match in kind by town appropriation
Structural, prevention	Increase capacity in adaptation to climate change, by incorporating 25-year storm calculations rather than 10-year volume into regulations and public infrastructure planning	Town planning board and board of health, contractors, private	45 Cont'd from last Plan Update; regulations should be amended within the next 2 years	HMGP, PDM, MVP 25% match by town meeting appropriation and private funds
Structural, Adaptation New	An engineered solution is needed for the Cuttyhunk Power House, where rainwater washes through. The 25-year rainstorm should be used for calculations, rather than the 10-year, in order to adapt to climate change.	Town	45 This should at least be designed within the next 5 years.	HMGP, PDM, MVP 25% match by town meeting appropriation

Structural, Adaptation NEW	An engineered solution is needed for roads vulnerable to heavy rainstorms; on Cuttyhunk, Road to the Water Supply Control, Tower Road, and the corner of Broadway and Bayview Drive (at the infiltration pond); on Naushon, the road from Upper Wharf to Downtown, connecting with waterfront transportation and emergency response. The 25-year rainstorm should be used for calculations, rather than the 10-year, in order to adapt to climate change.	Town, private	45 This should at least be designed within the next 5 years.	HMGP, PDM, MVP 25% match by town meeting appropriation and private funds
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Challenges: Gosnold is the smallest town in the Commonwealth. In turn, it has limited staffing and revenue. This has been compounded over the past 18 months for infrastructure projects as construction costs have risen significantly. For those actions involving volunteer boards or committees, there is the added factor that many of these actions represent initiatives that will take a great deal of their additional time. **However,** permitting is the main constraint for Gosnold’s highest priority mitigation proposals. Protection of Cuttyhunk Harbor is particularly challenged by permitting issues. Funding is also needed for engineering and design consultants, as well as for construction.

OAK BLUFFS MITIGATION

Matrix of Existing Protection Mitigation Matrix Prioritization of Mitigation Strategies

EXISTING PROTECTION MATRIX OAK BLUFFS

Type of Existing Protection	Description	Area Covered	Status as of 2021	Improvements or Changes Needed
Town participation in the National Flood Insurance Program (NFIP)	Provides flood insurance for structures located in flood-prone areas	FEMA flood zones	Effective & ongoing	None
Floodplain District Zoning Bylaw	Prohibits any new construction of residential or non-residential structures in zones V, VE or AO. Repair of substantially damaged structures, additions which increase floor area, and any increase of impervious surfaces on residential lots are also all prohibited in these zones, as well as any removal or storage of soil, sand or other mineral substance or use of soil as structural support a structure. Installation of a basement is prohibited from all zones. Special permits may be granted for repair of substantially damaged structures and new construction if located landward of the reach of the mean high tide in V, VE and AO zones. Special Permits may also be granted for new construction, additions and repairs in A and AE zones and increases of impervious surfaces and storage and disposal of soils may be permitted if a registered professional engineer certifies there will be no increase in wave-runup, deflection or channelization of flood waters or increase in velocity of flows. Special permits may be granted in any part of the Floodplain	Flood zones AE and VE as shown on Flood Insurance Rate Maps codified in 2016	Enforced by zoning official; effective & ongoing	Recently updated, protective regulations adopted by Town Meeting May 2010

	District for restoration and repairing of nationally registered historic places, coastal resource areas, existing septic systems, existing impervious surfaces and foundations. Water dependent structures and beach and dune nourishment also may be allowed by special permit.			
Coastal District DCPC (District of Critical Planning Concern)	height and construction standards for inland zone, including site plan review; no residential construction in shore zone; existing health in shore zone allowed; septic 200' from salt water body; minimum separation 200' between septic; septic at least 5' above groundwater; septic 600' from public water supply and 200' from private well; private well 200' from salt water body; no road > 10' except by special permit	Below 10-foot contour or within 500' of MHW of ocean or pond > 10 acres and all land within 100' of streams and wetlands flowing into great ponds; except around West Chop just land below 10' contour and faces of bluffs >15'; excludes developed area between Highland Dr (East Chop) and Canonicus Ave (near Farm Pond); segments include the shore zone, from MLW to 100' inland of the inland edge of beach or marsh grass and 100' inland of the crest of a bluff >15' in height and within 100' of streams or wetlands draining into a great pond; the rest is the inland zone	Effective & ongoing but could use updating Island-wide; recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model may augment this effort; district is administered by Board of Health, Building Inspector, Special Permit by Planning Board with site plan review by site review committee	Needs updating to address climate change adaptation, such as management of armoring; particularly in Oak Bluffs the boundary for the East Chop bluff doesn't manage land uses on top of and just landward of the bluff
Sengekontacket Pond DCPC	Water quality monitoring program; density 1 SFR/60,000 sf; growth restricted to 75 dwelling units/3 years with up to 15 more in a year by special permit from ZBA	Lands and waters adjacent to Sengekontacket Pond	Not Enforced; administered by Board of Health, Building Official with special permit by ZBA	Enforce the regulations, possible expansion to include Edgartown side
Oak Bluffs Harbor DCPC	Site plan review, special setbacks, special permit by zba for a privately-owned marina in B1; in R2 prohibits boat yards	Oak Bluffs Harbor and adjacent lands, covers B1, R1 and R2 zoning districts	Effective & ongoing; administered by Building Official with	None

	and boat services, conversion of SFR to more than 2 families, hotels, rooming houses, semi-detached 2-family dwellings		special permit by Zoning Board of Appeals with a site review committee	
Lagoon Pond DCPC	Density restrictions; pier regulations	Lagoon Pond and inland 1500'	Effective & ongoing; administered by Board of Health and Conservation Commission	None
Fire-Wise Outreach	Outreach and response person on Martha's Vineyard 24/5; outreach to groups and available for response	Martha's Vineyard	DCR; this work will be augmented by a CWPP currently underway	This program could use some support in order to reach more of the vulnerable homeowners
Structural, protection, mitigation	<p><u>North Bluff Seawall Repair and New Boardwalk</u> Rebuild 730' of seawall, rehabilitate 730' of rip-rap (and construct new boardwalk) to provide enhanced protection from coastal storms and wave wash-over for public infrastructure and private properties. This site is a critical transportation link between the harbor and the Steamship Authority terminal.</p> <p><u>Beach Nourishment and Groin & Jetty Rehabilitation: North Bluff Beach</u> Comprehensive beach nourishment program along approximately 3,950 linear feet of shoreline along Sea View Ave Extension/Sea View Ave. shoreline. Implementation will provide protection to existing coastal banks, crucial infrastructure and adjacent private properties, and restore/enhance four Town beaches. Existing jetties at entrance to Oak Bluffs Harbor and several timber and stone groins to be maintained/rehabilitated as part of nourishment program to ensure stability of nourished areas. (North Bluff Beach Completed)</p>		North Bluff Seawall Repair, new Boardwalk, and groin rehabilitation completed; MVP grant award has funded recreation/beach nourishment of a previously eroded beach; beach access is widely used	

Prioritization of Mitigation Strategies

The actions were categorized by staff of the Martha’s Vineyard Commission and evaluated through a consensus-building process within the Oak Bluffs Hazard Mitigation Planning Team in order to establish priorities. Considerations used in evaluating priorities included: whether or not the strategy addresses vulnerable critical facilities or infrastructure; whether or not the strategy is intended to promote reduction in loss of lives or improved safety, or to reduce impacts to property; whether or not the strategy requires a capital expenditure. That process resulted in the ranking provided in the 2015 plan. For the 2021 update, prioritization has been updated by Oak Bluffs’ participation in a vulnerability planning project called *Municipal Vulnerability Program*⁴², through the Commonwealth of Massachusetts’ Executive Office of Energy and the Environment. MVP planning provided helpful prioritization of both vulnerabilities and mitigation actions.

In developing the prioritization procedures, it is not the intent of the Hazard Mitigation Planning Team to direct that the initiatives be accomplished in their prioritized order. The purpose of the ranking is to indicate the overall importance of the project to local mitigation efforts. The accomplishment of an initiative will usually depend more on the availability of funds, than on how high or low it ranked compared to other initiatives. After a natural disaster event receives a presidential declaration and the Commonwealth of Massachusetts is designated as a result of the disaster, the Dukes County towns are eligible for Hazard Mitigation Grant Program funding. At that time the Oak Bluffs Hazard Mitigation Planning Team will convene to analyze the damage that was sustained. Then in respect to current conditions in Oak Bluffs, changes in policy and overall mitigation needs, the Oak Bluffs Hazard Mitigation Planning Team will prioritize a list of projects to be funded for the specific disaster.

Each action is scored individually and is based on weighted criteria developed by the Hazard Mitigation Planning Team and the Oak Bluffs MVP (below). The process to prioritize the mitigation actions is accomplished during joint meetings between Hazard Mitigation Team members and officials from the respective local agencies, and the Oak Bluffs MVP (Municipal Vulnerability Program) report.

Listed below are the criteria and weighted values:

Prioritization criteria

1. Does it represent a high, medium or low priority for mitigation in the Oak Bluffs MVP report⁴³? High =30; Medium =20; Low =10
2. Does it promote the reduction of the loss of lives and increase public safety? Yes = 25 points; no = 0 points
3. Promote reduction in property damage? Yes = 20 points; no = 0 points
4. Funding needs and availability – no capital needed = 10 points

⁴² <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

⁴³ <https://www.mass.gov/files/documents/2019/07/11/Oak%20Bluffs%20Report.pdf>

**PROPOSED MITIGATION ACTIONS
FOR THE TOWN OF OAK BLUFFS
(ALONG WITH ALL THE COMMUNITY ACTIONS)**

Category of Action	Description of Action	Implementation Responsibility	Timeframe/Priority	Resources/Funding
Structural, protection, mitigation ENHANCED	<p>Beach nourishment, dredging and structural reconfiguration of inlets and inlet protections to improve natural defenses and storm circulation, to protect infrastructure on shore and recreational/cultural beach facilities, in order to minimize storm impacts:</p> <p><u>Beach Nourishment and Groin & Jetty Rehabilitation: Jetty Beach, Pay Beach & Inkwell (North Bluff Beach completed)</u> Comprehensive beach nourishment program along approximately 3,950 linear feet of shoreline along Sea View Ave Extension/Sea View Ave. shoreline. Implementation will provide protection to existing coastal banks, crucial infrastructure and adjacent private properties, and restore/enhance four Town beaches. Existing jetties at entrance to Oak Bluffs Harbor and several timber and stone groins to be maintained/rehabilitated as part of nourishment program to ensure stability of nourished areas. (Need permits & funding)</p> <p><u>Protect State Beach, Sea View Avenue & Sengekontacket Pond</u> Dredge Sengekontacket Pond and use dredge material for beach nourishment on State Beach to enhance recreational opportunities and protect against storm surge, erosion and sea level rise. (Need permits for some portions of pond & funding)</p> <p><u>MA Coastal Infrastructure Inventory and Assessment</u> Reinforce/rebuild seawalls and other coastal structures if structures are failing. (Need engineering, permits & funding if stabilization is needed)</p>	DCR, County, Town Highway, Mass DOT	50 Vegetation management may proceed immediately; design for structural improvements within 3-5 years	HMGP, DCR, Mass DOT, Town, County, PDM 25% match by Mass DOT, town meeting appropriation, DCR

Prevention ENHANCED	Update boundaries of Coastal District DCPC to account for findings from recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model	Town, MVC	65 This should be done within the next 5 years.	MVC
Adaptation NEW	Plan for retreat/abandonment of East Chop Drive where it is low-lying and/or where the bluff is threatened. Plan for use of alternative roads.	Town, private owners	65 This discussion should take place within the next 5 years.	Town, private
Structural, protection	Reconfiguration of armorment for vulnerable part of East Chop bluff for better storm damage protection, to protect the town-owned road at the top of the bluff	Town	45 Cont'd from last Plan Update; this already has engineering plans and has been permitted	HMGP, PDM (25% match by Town); project has been identified for further review by FEMA under PDM-19, and as of this plan update is going through EHP review
Adaptation NEW	Long term stabilization of the seawall from SSA to Farm Pond, possibly extending south across Farm Pond to protect emergency access to Harthaven, State Beach and inland areas including Oak Bluffs School.	Town, MassDOT	50 Within 2-4 years	MassDOT
Adaptation NEW	Raise the Lagoon Pond causeway to protect Upper Lagoon Pond and the town well (collaborate with Tisbury).	Towns	55 Within 10-15 years	MVP
Adaptation	In order to lessen the impacts of sea level rise, prioritize and plan for vulnerable infrastructure for retreat, armorment, or abandonment. Even without sea level rise, several major roads are in the velocity zone: Beach Road, lower East Chop Drive, Portions of Sea View Avenue (by Farm Pond and State Beach Barrier Beach system). The 100 year flood zone covers all but one access road to the hospital (and one access road is in the velocity zone). Develop plan to address flooding/wash-out of coastal roads.	Town highway, Selectmen	85 Cont'd from last Plan Update; long term planning should commence within 2-3 years; short term recommendations should include findings from forthcoming Storm Tide Pathways report.	Town, MVP
Adaptation	Work with the Joint Transportation Committee and others to make long-range plans for public roads vulnerable to Sea Level Rise	Joint Transportation Committee, Mass DOT, towns	85 Cont'd from last Plan Update; recently released	Mass DOT

			SLR data should augment this & should be done within the next 2 years.	
Prevention	<u>Develop Wetlands Bylaw regulations for Vegetation and update regulations for Land Subject to Coastal Storm Flowage</u> Strengthen Oak Bluffs Wetlands Bylaw to protect against flooding and storm damage.	Town Conservation Commission	10 Cont'd from last Plan Update; this should be done within the next 5 years.	Town
Prevention	Identify sources of beach nourishment material for use as protection against storm surge, erosion and sea level rise. (Need funding to purchase nourishment material if sources are identified)	Town Conservation Commission, highway	10 Cont'd from last Plan Update; some dredge spoils have been applied to select beaches; a broader look will continue over the next 5 years.	Town
Prevention ENHANCED	Revise the Coastal District regulations to require a restriction on additions to or replacement of pre-1978 buildings that would stipulate that the new development is not "grandfathered" as in the Wetlands Protection Act regarding armorment of a bluff. (Could alternatively fit in the Town Wetlands By-Law)	Town planning board, MVC	60 Ongoing/Continuing; this should be done within the next 5 years.	MVC, PDM 25% match in kind by MVC
Prevention ENHANCED/ REFINED	Ask MVC to revise the Coastal District boundary to include the top of East Chop bluff (presently includes only the face of the bluff). Possible expansion to include the developed area from Canonicus to East Chop Drive as well.	Town planning board, MVC	60 This should be done within the next 5 years.	MVC
Structural	In order to prevent storm damage, engineering and construction needed to retrofit 3 vulnerable sewer pump stations: Sunset Lake (relocate controls to operate remotely), Our Market parking lot (elevate control panel and relocate to landward side of bathrooms), elevate or relocate the control panel at the corner of School St./Dukes County Ave.	Town Wastewater Dept.	50 Cont'd from last Plan Update; this should be done within the next 5 years.	HMGP, PDM 25% match by town wastewater department
Structural	In order to lessen the impacts of increased heavy rainstorms, construct/reconstruct stormwater facilities to the 25-year standard rather than 10-year.	Town highway, Mass DOT	45 Cont'd from last Plan Update; This should happen over the next 5-10 years	HMGP, PDM 25% match by Mass DOT, in kind by town highway

Prevention	In order to lessen the impacts of increased heavy rainstorms, revise stormwater standards to the 25-year standard rather than 10-year.	Town planning board and board of health	55 Cont'd from last Plan Update; regs should be amended within the next 2 years	Town
Structural	Retrofit drainage in the vicinity of Waban Park/Inkwell Beach to prevent further beach erosion by stormwater discharge as occurred during the April 2007 storm	Mass DOT	55 Cont'd from last Plan Update; this should be done within the next 3-5 years, at least in design.	HMGP,FMA, PDM 25% match by Mass DOT
Structural	Reduce damaging volume of direct stormwater discharges to beaches and surface waters by infiltration of those segments of the systems where infiltration is possible back in the watershed	Town highway, Mass DOT	55 Cont'd from last Plan Update; this should be done within the next 5 years.	HMGP, FMA, PDM 25% match by Mass DOT
Structural	Replace the culvert that currently restricts stormwater flow in and out of Farm Pond with one adequately sized and designed. Although the proposed 16-foot culvert would slightly increase the flood elevation for surrounding homes, flood waters would be able to recede faster and thus lessen water damage overall. Add the storm gate that was dropped from the previous plans.	Mass DOT	50 Cont'd from last Plan Update; this should be done within the next 5 years and is a priority of the new town administrator	Mass DOT, MA Wetlands Restoration Program
Prevention, adaptation NEW	Hire a full-time emergency response planner, to help coordinate among the towns and to reduce vulnerability from current dependence on volunteer responders.	Towns	85 This should be done within 1-3 yrs; funding for a P/T Emer. Response Planner was authorized by towns in '21	MVP
Emergency response NEW	Create a backup solar battery pack at the town landfill (capped).	Town	75 Within 1-3 years; contingent upon Eversource approval of solar project at that site & upgrades to that part of the grid	MVP

Prevention, drought mitigation New/Enhanced	Complete CWPP (Community Wildfire Protection Plan) for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update; this will include Firewise strategies from 2015 mitigation actions.	MVC manages consultant; all relevant property owners implement	85 Cont'd from last Plan Update; CWPP should be approved by end of 2021; implementation will be ongoing	HMGP funds awarded, local match secured.
Prevention	In order to lessen wildfire vulnerability, clear a 100-foot firebreak between the Southern Woodlands and vulnerable residences.	M. V. Land Bank	45 Cont'd from last Plan Update; CWPP recommendations will likely impact this initiative and its timeframe	HMGP, M.V. Land Bank, PDM 25% match (by M.V. Land Bank?)
Prevention	In order to reduce the impacts of drought and wildfire, establish an overall management plan for the State Forest, including establishment of specific procedures or Memoranda of Agreement regarding the transfer of land for new public water supplies and for easements to install water supply lines	DCR and State Forest Advisory Committee	55 Cont'd from last Plan Update; the initial phase of opening a dialog between the town fire and water departments, the MVC and the new State Forest Superintendent should be done within the next year.	DCR
Structural	In order to reduce the impacts of drought and wildfire, install new public water supplies and water supply lines within the State Forest	Town Water District	55 Cont'd from last Plan Update; if DCR agrees to consider this (although it's not recreational), design should be completed within the next 5 years, and possibly construction.	HMGP, PDM 25% match by DCR
Structural	In order to lessen the impacts of drought and wildfire, establish plans and build infrastructure for water supply needs to alleviate future drought emergencies. The Town of Oak Bluffs, nearly at buildout, should focus its attention on redundancy plans in response to potential emergencies such as drought.	Town Water District	85 Cont'd from last Plan Update; design and permitting should be underway within the next 5 years.	HMGP, PDM 25% match by town water district

There are numerous actions related to wildfire risk reduction; their implementation may be impacted from the findings & recommendations of a Community Wildfire Protection Plan (CWPP), underway in 2021.

Challenges: Oak Bluffs is a small town with limited staffing and revenue. This has been compounded over the past 18 months for infrastructure projects as construction costs have risen significantly. For those actions involving volunteer boards or committees, there is the added factor that many of these actions represent initiatives that will take a great deal of their additional time. Funding is the main constraint for Oak Bluffs' mitigation proposals that have not been completed and are being carried forward. Funding is needed for engineering and design consultants as well as for construction.

TISBURY MITIGATION

Matrix of Existing Protection Mitigation Matrix Prioritization of Mitigation Strategies

EXISTING PROTECTION MATRIX TISBURY

Type of Existing Protection	Description	Area Covered	Status as of 2021	Improvements or Changes Needed
Town participation in the National Flood Insurance Program (NFIP)	Provides flood insurance for structures located in flood-prone areas	FEMA flood zones	Effective & ongoing	None
Floodplain District Zoning Bylaw	Requires Flood Plain Permit for new construction, substantial improvement; addition of increased water, electric or septic systems to conform to rules and regs of Board of Health; alteration of landforms by Special Permit from ZBA; within V-Zone new construction to be located landward of Mean High Water; within AO zones residential structures elevated	Flood zones AE and VE as shown on Flood Insurance Rate Maps codified in 2016	Enforced by Building Official; effective & ongoing	None
Coastal District DCPC (District of Critical Planning Concern)	height and construction standards for inland zone, including site plan review, may be modified by special permit from ZBA; no residential construction in shore zone; Special Permit by ZBA in shore zone for non-residential structures or for additions to existing residential structures ≤ 500 sf with no increase in plumbing or septic; septic 200' from salt water body; minimum separation 200' between septic; septic at least 5' above groundwater; septic 600' from public water supply and 200' from private well; private well 200' from salt water body; no road > 10' except by special permit	Below 10-foot contour or within 500' of MHW of ocean or pond > 10 acres, includes more lands around Lake Tashmoo and all of West Chop; excludes working waterfront; includes the shore zone, from MLW to 100' inland of the inland edge of beach or marsh grass and 100' inland of the crest of a bluff >15' in height; the rest is the inland zone; excludes village waterfront	Effective & ongoing but could use updating Island-wide; recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model may augment this effort; administered by Board of Health, building inspector, special permit by ZBA	Needs updating to address climate change adaptation, such as management of armoring
Lagoon Pond DCPC	Density restrictions; pier regulations	Lagoon Pond and inland 1500'	Effective & ongoing; administered by Board of Health and Conservation Commission	None

Vineyard Haven Harbor DCPC	Harbor Use Permit required for most uses	Vineyard Haven Harbor	Effective & ongoing; administered by Board of Selectmen	None
Wild and Scenic North Shore DCPC	permitted uses- routine maintenance, uses such as recreational fishing and boating not involving the permanent placement of any new fill or structure; specially permitted uses - permanent placement of any fill or structure for municipal purposes or for purposes of commercial fishing, shellfishing or aquaculture; all other uses prohibited (including private piers)	waters and lands of north shore, lighthouse to lighthouse, extending 100' seaward from MLW	Effective & ongoing	None
Fire-Wise Outreach	Outreach and response person on Martha's Vineyard 24/5; outreach to groups and available for response	Martha's Vineyard	DCR; this work will be augmented by a CWPP currently underway	This program could use some support in order to reach more of the vulnerable homeowners
Structural, protection, emergency services	Relocation of Fire/Ambulance Departments out of floodplain	Town	completed	
Structural, protection	Hardened utilities – electric lines on Main St, Union St., Beach St., and Water St.	Town	Conduit completed; Beach Road Transportation Improvement Program (TIP) project plans to harden electrical utilities; no plans for streets yet	Town
Emergency services	Generator for Tisbury School, which is the primary shelter in town	Town	completed	
Emergency services	foam trailer for fighting ethanol-based fires	Town	completed	
Structural	Reduce flood impacts by identifying and correcting discharges from town and Commonwealth roadways where they cross streams, including: Smith Brook in Tisbury. The road surface at each crossing should be adjusted during repaving to divert as much runoff as possible into roadside vegetation before it reaches the road crossing.	Town DPW	60 Emergency replacement of culvert completed in 2019 following culvert collapse owing to sinkholes	

Prioritization of Mitigation Strategies

The actions were categorized by staff of the Martha’s Vineyard Commission and evaluated through a consensus-building process within the Tisbury Hazard Mitigation Planning Team in order to establish priorities. Considerations used in evaluating priorities included: whether or not the strategy addresses vulnerable critical facilities or infrastructure; whether or not the strategy is intended to promote reduction in loss of lives or improved safety, or to reduce impacts to property; whether or not the strategy requires a capital expenditure. That process resulted in the ranking provided in the 2015 plan. For the 2021 update, prioritization has been updated by Tisbury’s participation in a vulnerability planning project called *Municipal Vulnerability Program*⁴⁴, through the Commonwealth of Massachusetts’ Executive Office of Energy and the Environment. MVP planning provided helpful prioritization of both vulnerabilities and mitigation actions.

In developing the prioritization procedures, it is not the intent of the Hazard Mitigation Planning Team to direct that the initiatives be accomplished in their prioritized order. The purpose of the ranking is to indicate the overall importance of the project to local mitigation efforts. The accomplishment of an initiative will usually depend more on the availability of funds, than on how high or low it ranked compared to other initiatives. After a natural disaster event receives a presidential declaration and the Commonwealth of Massachusetts was designated as a result of the disaster; the Dukes County towns are eligible for Hazard Mitigation Grant Program funding. At that time the Tisbury Hazard Mitigation Planning Team will convene to analyze the damage that was sustained. Then in respect to current conditions in Tisbury, changes in policy and overall mitigation needs, the Tisbury Hazard Mitigation Planning Team will prioritize a list of projects to be funded for the specific disaster.

Each action is scored individually and is based on weighted criteria developed by the Hazard Mitigation Planning Team and the Tisbury MVP (below). The process to prioritize the mitigation actions is accomplished during joint meetings between Hazard Mitigation Team members and officials from the respective local agencies, and the Tisbury MVP (Municipal Vulnerability Program) report⁴⁵.

Listed below are the criteria and weighted values:

Prioritization criteria

1. Does it represent a high, medium or low priority for mitigation in the Tisbury MVP report? High = 30; Medium = 20; Low = 10
2. Does it promote the reduction of the loss of lives and increase public safety? Yes = 25 points; no = 0 points
3. Promote reduction in property damage? Yes = 20 points; no = 0 points
4. Funding needs and availability – no capital needed = 10 points

⁴⁴ <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

⁴⁵ https://www.tisburyma.gov/sites/tisburyma/files/uploads/tisbury_mvp_report_reduced.pdf

**PROPOSED MITIGATION ACTIONS
FOR THE TOWN OF TISBURY
(ALONG WITH ALL THE COMMUNITY ACTIONS)**

Category of Action	Description of Action	Implementation Responsibility	Timeframe/Priority	Resources/Funding
Prevention, adaptation NEW	Conduct a comprehensive supply chain vulnerability assessment.	Town, SSA	85 This should be done within 5 years.	HMGP, PDM, MVP planning grants 25% match by SSA
Adaptation NEW	Increase community education and outreach with regard to climate change hazards, emergency preparedness and sheltering options.	Town	85 This should be done within 5 years.	HMGP, PDM, MVP planning grants 25% match by town meeting appropriation
Adaptation NEW	Review town regulations and identify changes that could mitigate future impacts of climate change.	Town	85 This should be done within 5 years.	HMGP, PDM, MVP planning grants 25% match by town meeting appropriation
Prevention, drought mitigation New/Enhanced	Complete CWPP (Community Wildfire Protection Plan) for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update; this will include Firewise strategies from 2015 mitigation actions.	MVC manages consultant; all relevant property owners implement	55 Plan approved by end of 2021. Implementation ongoing	HMGP funds awarded, local match secured.
Prevention Enhanced	Update boundaries of Coastal District DCPC to account for findings from recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model	Town, MVC	65 Ongoing/Continuing; this should be done within the next 5 years.	MVC
Structural, protection	Harden utilities – electric lines on Main St, Union St., Beach St., and Water St.	Eversource, Town	30 Cont'd from last Plan Update; this will likely be a generational project given the cost involved	Town, property owners, potential cost sharing arrangement

Structural, adaptation NEW	Identify and prepare to initiate harbor improvements (e.g. breakwater extensions) to protect downtown areas and the harbor.	Town, SSA, USACOE	85 Planning should continue in the next 5 years.	HMGP, PDM, MVP planning grants, USACOE 25% match by SSA
Structural, protection	Beach nourishment, dredging and structural reconfiguration of inlets and inlet protections to improve natural defenses and circulation, in order to minimize storm impacts, particularly to reconfigure the southern jetty at Lake Tashmoo to provide better protection for the town mooring field and private boatyard in the pond; vegetation management for dune restoration	DCR, County, Town DPW, USACOE, Mass DOT	75 Cont'd from last Plan Update; vegetation management may proceed immediately; design for structural improvements within 3-5 years	HMGP, PDM, DCR, Mass DOT, Town, County, USACOE, MVP 25% match by DCR, Mass DOT, County, town meeting appropriation
Structural	Dredging in the harbor to provide better access to critical harbor facilities in the event of a storm and for storm damage prevention	Town Selectmen, USACOE	75 Ongoing/Continuous; this should be done within the next 5 years, at least in design; CZM-funded harbor resiliency report by Applied Coastal will augment this	HMGP, PDM, MVP 25% match by Steamship Authority
Structural, protection	Hardened utilities – electric lines on Main St, Union St., Beach St., and Water St.	Town DPW	Cont'd from last Plan Update; conduit completed, no utilities in as yet; This should be done within the next 5 years.	Town
Structural	Retrofit main sewer pump station and generator in town parking lot on Water St. for storm resiliency and SLR	Town DPW	20 Cont'd from last Plan Update; this should be done within the next 5 years, at least in design.	HMGP, PDM, MVP 25% match by sewer revenues, town meeting appropriation
Structural, adaptation	Retrofit sewer pump station in SSA lot for resiliency.	SSA (Woods Hole, Martha's Vineyard and Nantucket Steamship Authority)	50 Cont'd from last Plan Update; this should be done in the next 5 years, at least in design.	SSA, HMGP, PDM 25% match by SSA

Prevention	Develop a prognosis and suitable plan for Beach Road and the adjacent seawall.	Town DPW and Selectmen, Mass DOT	40 Cont'd from last Plan Update; this should be done within the next 5 years; CZM-funded harbor resiliency report by Applied Coastal will augment this	Town, Mass DOT
Prevention	Ensure that outdoor storage materials are secured from creating a flood hazard.	Town DPW and Harbormaster, private	40 Cont'd from last Plan Update; some progress has been made; this should be done within the next year.	Town, private
Adaptation NEW	Identify and begin to undertake roadway improvements that improve resiliency to coastal flooding, storm surge and SLR, particularly: <ul style="list-style-type: none"> • Water St. from 5 corners to Union St. • Beach Rd. from 5 corners to the Drawbridge • Lagoon Pond Rd. from 5 corners to Hines Point. 	Town, MassDOT	85 Planning focus for the next 5 years	HMGP, PDM, MVP 25% match by town meeting appropriation, MassDOT
Adaptation	Work with the Joint Transportation Committee to make long-range plans for public roads vulnerable to Sea Level Rise	Town, Joint Transportation Committee, MassDOT	85 Cont'd from last Plan Update; recently release SLR data should augment this; this should be done within the next 5 years.	HMGP, PDM, MVP 25% match by town meeting appropriation, MassDOT
Adaptation NEW	Develop a comprehensive stormwater management plan for the community.	Town, MassDOT	85 This should be begun within 5 years.	HMGP, PDM, MVP 25% match by town meeting appropriation, MassDOT
Structural, prevention	Increase capacity in adaptation to climate change, by incorporating 25-year storm calculations rather than 10-year volume into regulations and public infrastructure planning	Town planning board and board of health, MassDOT, private	85 Cont'd from last Plan Update; regs should be amended within the next 2 years. Construction should begin immediately for	HMGP, PDM, MassDOT, towns, private 25% match by MassDOT, town meeting appropriation

			any public drainage project within the next 5 years.	
Structural	Reduce flood impacts by identifying and correcting discharges from town roadways where they cross streams; the road surface at each crossing should be adjusted during repaving to divert as much runoff as possible into roadside vegetation before it reaches the road crossing.	Town DPW	75 Cont'd from last Plan Update; this should be done within the next 5 years, at least in design.	HMGP, PDM, MVP 25% match by town meeting appropriation
Structural	Reduce damaging volume of direct stormwater discharges to beaches and surface waters by infiltration of those segments of the systems where infiltration is possible back in the watershed	Town DPW, Mass DOT	75 Cont'd from last Plan Update; this should be done within the next 5 years.	HMGP, PDM, MVP 25% match in kind by town DPW, MassDOT
Prevention, drought mitigation, adaptation NEW	Contract for a wildfire management plan for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update.	HMGP funds requested, local match secured.	55 Cont'd from last Plan Update; CWPP should be approved by end of 2021; implementation will be ongoing	HMGP funds requested, local match secured.
Prevention, drought mitigation, adaptation	In order to reduce the impacts of drought and wildfire, establish an overall management plan for the State Forest, including establishment of specific procedures or Memoranda of Agreement regarding the transfer of land for new public water supplies and for easements to install water supply lines	DCR and State Forest Advisory Committee	55 Cont'd from last Plan Update; the initial phase of opening a dialog between the town fire and water departments, the MVC and the new State Forest Superintendent should be done within the next 5 years.	DCR
Structural, adaptation	In order to reduce the impacts of drought and wildfire, install new public water supplies and water supply lines within the State Forest	Town Water Department	55 Cont'd from last Plan Update; if DCR agrees to consider this (although it's not recreational), design should be completed within the	MVP 25% match by DCR, town water department

			next 5 years, and possibly construction.	
Structural, adaptation	In order to lessen the impacts of drought and wildfire, establish plans and build infrastructure for water supply needs to alleviate future drought emergencies. The Town of Tisbury, nearly at buildout, should focus its attention on redundancy plans in response to potential emergencies such as drought or wildfire.	Town Water Department	55 Cont'd from last Plan Update; design and permitting for this should be underway within the next 5 years.	MVP 25% match by town water department
Structural	Consider potential need for and options to provide water supply to areas with a development pattern that may not be compatible with continued private well water supplies or those with inadequate existing supplies, in the event of emergencies such as drought and wildfire; build the necessary infrastructure.	Town Water Department	55 Cont'd from last Plan Update; extensive dialogue should begin within 18 months; if this is a desirable solution, planning and permitting can begin within the next 5 years.	MVP 25% match by town water department

There are numerous actions related to wildfire risk reduction; their implementation may be impacted from the findings & recommendations of a Community Wildfire Protection Plan (CWPP), underway in 2021.

Challenges: Tisbury is a small town with limited staffing and revenue. This has been compounded over the past 18 months for infrastructure projects as construction costs have risen significantly. For those actions involving volunteer boards or committees, there is the added factor that many of these actions represent initiatives that will take a great deal of their additional time. Funding is the main constraint for Tisbury's mitigation proposals that have not been completed and are being carried forward. Funding is needed for engineering and design consultants as well as for construction.

WEST TISBURY MITIGATION

Matrix of Existing Protection
Mitigation Matrix
Prioritization of Mitigation Strategies

EXISTING PROTECTION MATRIX WEST TISBURY

Type of Existing Protection	Description	Area Covered	Status as of 2021	Improvements or Changes Needed
Town participation in the National Flood Insurance Program (NFIP)	Provides flood insurance for structures located in flood-prone areas	FEMA flood zones	Effective & ongoing	None
Floodplain District Zoning Bylaw	Requires Flood Plain Permit for new construction, substantial improvement; addition of increased water, electric or septic systems to conform to rules and regs of Board of Health; alteration of landforms by Special Permit from ZBA; within V-Zone new construction to be located landward of Mean High Water; within AO zones residential structures elevated	Flood zones AE and VE as shown on Flood Insurance Rate Maps codified in 2016	Enforced by Building Official; effective & ongoing	None
Coastal District DCPC (District of Critical Planning Concern)	height and construction standards for inland zone, including site plan review; no residential construction in shore zone; underground utilities except by special permit; special permit for road wider than 10'; special permit for alteration of bank or stream; perc test required for subdivision; for new lots average of 300' between septics or 5 per 1500' of shoreline; septic 200' from water body; septics at least 7' above groundwater if perc faster than 5 min/inch and 5' if slower than 5 min/inch; septics 600' from public water supply and 200' from well; separation well from saltwater body 200'	Below 10-foot contour or within 500' of MHW of ocean or pond or within 100' streams or wetlands draining into coastal ponds > 10 acres; includes the shore zone, from MLW to 100' inland of the inland edge of beach or marsh grass and 100' inland of the crest of a bluff >15' in height; the rest is the inland zone	Effective but could use updating Island-wide; recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model may augment this effort; administered by Board of Health, Building Inspector, Special Permit by ZBA with site plan review by Plan Review Board	Needs updating to address climate change adaptation, such as management of armoring

Wild and Scenic North Shore DCPC	permitted uses- routine maintenance, uses such as recreational fishing and boating not involving the permanent placement of any new fill or structure; specially permitted uses - permanent placement of any fill or structure for municipal purposes or for purposes of commercial fishing, shellfishing or aquaculture; all other uses prohibited (including private piers)	waters and lands of north shore, lighthouse to lighthouse, extending 100' seaward from MLW	Effective & ongoing	None
Dr. Fisher Mill DCPC	Special permit for alteration of mill; prohibits destruction or removal of any part of the mill or dam	Within 150' of Dr. Fisher Mill	Effective & ongoing; administered by Planning Board	None
Fire Breaks in State Forest	Fire breaks maintained by grazing, brush breaking, controlled burns	Within Manuel F. Correllus State Forest	DCR; recently hired Superintendent will be assisted by staff that commutes from the mainland	Need continued management; this program could use some funding support
Fire-Wise Outreach	Outreach and response person on Martha's Vineyard 24/5; outreach to groups and available for response	Martha's Vineyard	DCR; this work will be augmented by a CWPP currently underway	This program could use some support in order to reach more of the vulnerable homeowners
Structural	Work with DCR Office of Dam Safety, dam owners and the Town to ensure that significant hazard dams are inspected according to the prescribed schedule, that up-to-date evacuation plans are in place, and that needed repairs are implemented in a timely fashion.	Town, private owners	Ongoing; an Emergency Action Plan for Mill Pond Dam was completed in 2020 that defines responsibilities and provides procedures for identifying unusual and unlikely conditions, which may endanger the dam	Town, private owners
Structural	Work with the DCR Office of Dam Safety and the Town to ensure that DCR records are up-to-date and reflect work accomplished by the Town and private parties to inspect, repair, maintain and renovate dam structures.	Town, private owners, DCR Office of Dam Safety	Ongoing; Mill Pond Dam safety report submitted to DCR Office of Dam Safety in 2020.	Town, private owners, DCR Office of Dam Safety

Prioritization of Mitigation Strategies

The actions were categorized by staff of the Martha's Vineyard Commission and evaluated through a consensus-building process within the West Tisbury Hazard Mitigation Planning Team in order to establish priorities. Considerations used in evaluating priorities included: whether or not the strategy addresses vulnerable critical facilities or infrastructure; whether or not the strategy is intended to promote reduction in loss of lives or improved safety, or to reduce impacts to property; whether or not the strategy requires a capital expenditure. That process resulted in the ranking provided in the 2015 plan. For the 2021 update, prioritization has been updated by West Tisbury's participation in a vulnerability planning project called *Municipal Vulnerability Program*⁴⁶, through the Commonwealth of Massachusetts' Executive Office of Energy and the Environment, with the neighboring Town of Chilmark. MVP planning provided helpful prioritization of both vulnerabilities and mitigation actions.

In developing the prioritization procedures, it is not the intent of the Hazard Mitigation Planning Team to direct that the initiatives be accomplished in their prioritized order. The purpose of the ranking is to indicate the overall importance of the project to local mitigation efforts. The accomplishment of an initiative will usually depend more on the availability of funds, than on how high or low it ranked compared to other initiatives. After a natural disaster event receives a presidential declaration and the Commonwealth of Massachusetts is designated as a result of the disaster, the Dukes County towns are eligible for Hazard Mitigation Grant Program funding. At that time the West Tisbury Hazard Mitigation Planning Team will convene to analyze the damage that was sustained. Then in respect to current conditions in West Tisbury, changes in policy and overall mitigation needs, the West Tisbury Hazard Mitigation Planning Team will prioritize a list of projects to be funded for the specific disaster.

Each action is scored individually and is based on weighted criteria developed by the Hazard Mitigation Planning Team and the West Tisbury and Chilmark MVP (below). The process to prioritize the mitigation actions is accomplished during joint meetings between Hazard Mitigation Team members and officials from the respective local agencies, and the West Tisbury and Chilmark MVP (Municipal Vulnerability Program) report⁴⁷.

Listed below are the criteria and weighted values:

Prioritization criteria

1. Does it represent a high, medium or low priority for mitigation in the West Tisbury MVP report? High = 30; Medium = 20; Low = 10
2. Does it promote the reduction of the loss of lives and increase public safety? Yes = 25 points; no = 0 points
3. Promote reduction in property damage? Yes = 20 points; no = 0 points
4. Funding needs and availability – no capital needed = 10 points

⁴⁶ <https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

⁴⁷ <https://www.mass.gov/files/documents/2018/10/19/2017-2018-mvp-planning-grant-report-chilmark-west-tisbury.pdf>

**PROPOSED MITIGATION ACTIONS
FOR THE TOWN OF WEST TISBURY
(ALONG WITH ALL THE COMMUNITY ACTIONS)**

Category of Action	Description of Action	Implementation Responsibility	Timeframe/Priority	Resources/Funding
Structural, prevention NEW	Reduce reliance on electrical grid and communications towers. Develop micro-grid(s) and communications backup such as batteries for DAS communications and stationing a C.O.W (communications on wheels) on Martha's Vineyard	Eversource, communications carriers, Town and users	75 This should be planned within the next 5 years, executed within the next 10 years.	MVP, provider
Emergency services NEW	Hand pumps or other methods independent of the grid for accessing private well water	Town Highway and Fire, private	75 This should be done within the next 5 years.	Town, private, MVP
Prevention, drought mitigation NEW	Contract for a wildfire management plan for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update.	HMGP funds requested, local match secured.	85 This should be done within the next 5 years.	HMGP funds requested, local match secured.
Prevention ENHANCED	Update boundaries of Coastal District DCPC to account for findings from recently secured Sea Level Affecting Marsh Migration Model & MA Coast Flood Risk Model	Town, MVC	65 This should be done within the next 5 years.	MVC
Prevention, drought mitigation New/Enhanced	Complete CWPP (Community Wildfire Protection Plan) for all 7 Dukes County towns. Incorporate strategies into the 2026 update or an amendment to the 2021 update; this will include Firewise strategies from 2015 mitigation actions.	MVC manages consultant; all relevant property owners implement	85 Plan approved by end of 2021. Implementation ongoing	HMGP funds awarded, local match secured.
Structural	Work with DCR Office of Dam Safety, dam owners and the Town to ensure that significant hazard dams are inspected according to the prescribed schedule, that up-to-date evacuation plans are in place, and that needed repairs are implemented in a timely fashion.	Town, private owners	50 Ongoing	DCR, Town, private owners
Structural	Work with the DCR Office of Dam Safety and the Town to ensure that DCR records are up-to-date and reflect work accomplished by the Town and private parties to inspect, repair, maintain and renovate dam structures.	Town, private owners, DCR Office of Dam Safety	50 Ongoing; Mill Pond Dam safety report submitted to	Town, private owners, DCR Office of Dam Safety

			DCR Office of Dam Safety in 2020.	
Structural, adaptation	Consider potential need for and options to provide water supply to areas with a development pattern that may not be compatible with continued private well water supplies or those with inadequate existing supplies, in the event of emergencies such as drought and wildfire; build the necessary infrastructure.	Town Selectmen	75 Cont'd from last Plan Update; extensive dialogue should begin within 18 months; if this is a desirable solution, planning and permitting can begin within the next 5 years.	MVP 25% match in kind by town, construction match by town meeting appropriation
Prevention	In order to reduce the impacts of drought and wildfire, establish an overall management plan for the State Forest, including establishment of specific procedures or Memoranda of Agreement regarding the transfer of land for new public water supplies and for easements to install water supply lines	DCR and State Forest Advisory Committee	85 Cont'd from last Plan Update; the initial phase of opening a dialog between the town fire and water departments, the MVC and the new State Forest Superintendent should be done within the next year.	DCR
Structural	In order to reduce the impacts of drought and wildfire, install new public water supplies and water supply lines within the State Forest	Oak Bluffs, Tisbury, Edgartown Water Departments	75 Cont'd from last Plan Update; if DCR agrees to consider this (although it's not recreational), design should be completed within the next 5 years, and possibly construction.	MVP 25% match by DCR, town appropriations
Prevention	Use town regulations to prevent subdivision covenants from restricting homeowners from using fire-wise roofing materials such as asphalt.	Town planning board	85 Cont'd from last Plan Update; this should be done within the next year.	
Adaptation	Work with the Joint Transportation Committee to make long-range plans for public roads vulnerable to Sea Level Rise	Joint Transportation Committee, Mass DOT	85 Cont'd from last Plan Update; recently released SLR data should augment this effort; this should be	Mass DOT

			done within the next 5 years.	
Prevention, structural	Establish South Road as a critical facility from town line to town line, and parts of Tiah's Cove Road, and prioritize their storm protection and adaptation to rising sea level.	Town highway, Mass DOT	85 Cont'd from last Plan Update; this should be done within the next 5 years	Mass DOT
Adaptation NEW	Update zoning and development regulations at all levels to require more responsible stormwater management, onsite where possible	Town	85 This should be done within 5 years.	HMGP, PDM, MVP planning grants 25% match by town meeting appropriation
Structural	Reduce flood impacts by identifying and correcting discharges from Town and Commonwealth roadways where they cross streams, including: Mill Brook (West Tisbury portion), Tiasquam (West Tisbury portion), Black Brook (West Tisbury), and Witch Brook (West Tisbury). The road surface at each crossing should be adjusted during repaving to divert as much runoff as possible into roadside vegetation before it reaches the road crossing.	Mass DOT and Town highway	75 Cont'd from last Plan Update; GIS data will continue to be assembled, and should be done within the next 5 years; some design work should be completed within 2-4 years	Mass DOT, Town, HMGP, PDM 25% match by Mass DOT, town meeting appropriation
Structural, prevention	Increase capacity in adaptation to climate change, by incorporating 25-year storm calculations rather than 10-year volume into regulations and public infrastructure planning	Town planning board, board of health and highway, Mass DOT, private	75 Cont'd from last Plan Update; regs should be amended within the next 2 years. Construction should begin immediately for any public drainage project within the next 5 years.	HMGP, Mass DOT, town, private 25% match by Mass DOT, town meeting appropriations
Structural ENHANCED/ REFINED	Priester's Pond Dam The pond level should be recorded continuously so that water flow and spillway capacity can be measured after every major storm event. An operation and maintenance manual should be developed. The brush on the entire dam should be cut yearly and the condition of the spillway and the masonry wall on the upstream face be determined and repairs made as necessary.	Town highway	20 This should be done within the next year, and every year thereafter.	HMGP, PDM, MVP (annual cost about \$2,000) 25% match in kind by town highway

Structural ENHANCED/ REFINED	<p>Mill Pond Dam</p> <p>The brush on the upstream and downstream faces should be cut yearly and the condition of the spillway planks should be determined and replaced if necessary. (annual cost about \$2,000)</p> <p>Areas of potential erosion from road runoff should be protected with asphalt aprons.</p> <p>A simple static and seismic stability analysis of the dam should be done. (cost about \$5,000)</p> <p>An operation and maintenance manual should be developed.</p> <p>An emergency action plan for an alternative travel route should be prepared by the West Tisbury Emergency Planning Group.</p> <p>New – Consider options such as dredging.</p>	Town highway	20 This should be done within the next year, and every year thereafter.	HMGP, PDM, MVP (annual cost of recommended analyses and maintenance about \$3,000) 25% match in kind by town highway
Structural ENHANCED/ REFINED	<p>For Looks Pond Dam</p> <p>All saplings, vines and trees located on any part of the dam should be cut and removed from the site, especially near the primary and auxiliary spillways (the roots will rupture or crack the adjacent cement concrete). General or standard Dam Engineering practice calls for a tree-clear area extending 10 feet from the dam.</p> <p>Replace stoplogs within the auxiliary spillway</p>	Private owner	20 This should be done within the next year, and every year thereafter.	HMGP, PDM, MVP 25% match by private owner

There are numerous actions related to wildfire risk reduction; their implementation may be impacted from the findings & recommendations of a Community Wildfire Protection Plan (CWPP), underway in 2021.

Challenges: West Tisbury is a very small town with limited staffing and revenue. This has been compounded over the past 18 months for infrastructure projects as construction costs have risen significantly. For those actions involving volunteer boards or committees, there is the added factor that many of these actions represent initiatives that will take a great deal of their additional time. Funding is the main constraint for West Tisbury’s mitigation proposals that have not been completed and are being carried forward. Funding is needed for engineering and design consultants as well as for construction.

Section 7. Implementation, Evaluation, Monitoring and Update

The action plan has a community (all seven towns) component as well as outlining actions and projects to be undertaken by the individual towns. Both responsibility and potential funding sources have been noted, and it is understood that availability and securing of funding is very likely to affect the outcome of many of the proposals. Each action or project proposed in the action plan will be implemented by the party or parties noted in the action plan as being responsible. The action plan will be coordinated with other town and community priorities, as well as with mitigation goals of Commonwealth and federal agencies. Such coordination will improve access to technical assistance, provide broader support for implementation and reduce duplication of effort.

The first plan was produced with great cooperation and effort of a stalwart group of emergency managers from the Dukes County towns, and MVC staff. That first plan was an important step in working toward hazard mitigation, but produced limited results in implementation. Following adoption of the first Hazard Mitigation Plan, there was some implementation success. The Town of Edgartown secured 75% funding for retrofit of a vulnerable sewer station. When completed, the retrofit should greatly reduce the impacts of flooding there. The Town was awarded \$474,000. No other towns took advantage of the implementation grants available. On the planning side, there was no incorporation of mitigation strategies in other plans. For the 2015 update, outreach during the production phase was widened to include more town boards, organizations, and the public. This expansion was made in order to foster greater proprietorship and stewardship of the plan's mitigation measures, both structural and non-structural. For the 2021 update, there was an even wider net cast. The update prioritizations relied heavily on the community-based MVP planning sessions.

Hazard mitigation information from our 2015 plan has been shared with the Dukes County Joint Transportation Committee for incorporation in the Regional Transportation Plan for Martha's Vineyard and to help prioritize TIP (Transportation Improvement Program) projects that will lessen the impacts of natural hazards. Specifically, our Joint Transportation Committee is revising their scoring criteria to formalize the emphasis placed on contending projects which promote resiliency.

Similarly, findings from the 2015 update were central to pursuing grant funding for a Community Wildfire Protection Plan (CWPP); MVC secured funding through a FEMA award in collaboration with other island stakeholders. The HMP findings gave us the footing to craft a competitive application, while the CWPP work itself will generate momentum and investment to advance the report's recommendations.

Between the 2015 HMP update and this release, the town of Oak Bluffs completed their Master Plan. The 2015 HMP is cited on several occasions in the final document and it is credited with helping form the prism through which resilience is viewed across town departments. It was also a central plank of the town's Climate Action Plan. Two more towns (Tisbury and Edgartown) are revisiting their master plans and this update to the HMP has already been referenced as a key document in forming the reports' background data element.

Hazard mitigation information from this plan is available to the town governments, who are encouraged to incorporate the findings in their local master plans, open space plans or harbor plans as they may be updated. The plan is available on the Martha's Vineyard Commission website:

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

Because the Martha's Vineyard Commission has been entrusted with development of this plan, the Commission will continue to take responsibility for evaluating, monitoring and updating the plan, using the following procedures:

- The Community Hazard Mitigation Planning Teams will remain functional after adoption of the plan. Meetings of the Planning Teams are open to the public and are advertised on the Commission website, where minutes are posted. Many of the meetings are televised on the local access station MVTV.
- The first evaluation will take place within one year, in the Spring of 2022, and will be performed by distributing a survey to the members of the Community Hazard Mitigation Planning Teams, with a face-to-face meeting called as needed in accordance with the comments. The team and project staff will together review the status of actions, projects and funding options, as well as note any new projects that may have become significant. Should the team find it necessary to update the plan; that will be done.
- Following the first year's evaluation, the plan will be evaluated at least every two years, with the next such evaluation to take place in the Spring of 2024, and to be formally updated every five years, with the next such formal update to take place in 2026.
- Notwithstanding the scheduled evaluations and updates, the plan will be evaluated in the wake of a disaster, should one occur in Dukes County, and will be updated as needed in response to unexpected changes in conditions that may arise.



SLOSH map from the 2008 plan at the Chappaquiddick Fire Station

Outreach was and remains an important part of the success of the plan. The maps were particularly appreciated by first responders and planners. The maps were presented to the towns on paper and also readily accessible on the MVC website. The 2021 planning materials were widely distributed as well.

APPENDIX

Materials found on [MVC website](#).