



Town of Manchester-by-the-Sea



COMMUNITY RESILIENCE BUILDING WORKSHOPS SUMMARY OF FINDINGS

June 2018

Town of Manchester-by-the-Sea

Community Resilience Building Workshops

Summary of Findings

Overview

Manchester-by-the-Sea (Town) is a small coastal community with 5,132 residents (2010 census) consisting of approximately 5,000 acres, located in Essex County, approximately 32 miles north of Boston. Considered part of Cape Ann along the north shore of Massachusetts Bay, which includes the communities of Essex, Gloucester, Rockport, and Manchester-by-the-Sea, it is traversed by two state highways, Route 127 and Route 128, and the Rockport branch of the MBTA commuter rail line. It is linked with its neighboring Essex to the north and Hamilton to the northwest by two roads. Manchester-by-the-Sea also shares many natural resources with its regional neighbors. The Town is governed by a Board of Selectmen with a Town Administrator, operates under the open town meeting format and maintains a website at <https://www.manchester.ma.us/>.

Manchester-by-the-Sea has taken a proactive position to understand its flooding risk and design adaptive strategies to deal with climate change. Four years ago, the Manchester-by-the-Sea Coastal Resilience Advisory Group (CRAG)¹ was formed to work with Town staff and consultants on a series of resiliency projects to address the potential impacts of climate change on the Town. Under a FY14 FEMA Pre-Disaster Mitigation grant, the Town evaluated town-wide flooding impacts on community assets under current and future climate conditions using extreme precipitation values coupled with projections of sea level rise and storm surge for 2025, 2050 and 2100. This information was incorporated into a climate-vulnerability assessment and specific adaptation projects for the Town's 2018 FEMA Hazard Mitigation Plan. Under a FY15 Coastal Zone Management Coastal Resilience grant, the Town developed a detailed HEC-RAS² model of Sawmill Brook Watershed and used climate change data to identify potential flood mitigation solutions, including how culvert and channel modifications and green infrastructure could increase streamflow capacity in Lower Sawmill Brook. Removing the tide gate at Central Street and widening the bridge structure was recommended as the most effective flood mitigation project. Improvements will also restore fish passage and enable the Town to ecologically restore wetlands to the stream reach at Central Pond.

¹ CRAG formed for the Manchester-by-the-Sea FEMA Hazard Mitigation Plan Enhancement (2014) and includes Town and Grant Administrators, Police, Fire, DPW, Harbormaster, Conservation, and Planning; representatives from local stakeholder groups (Salem Sound Coastwatch, Manchester Coastal Stream Team, residents and businesses).

² HEC-RAS is a computer program that models the hydraulics of water flow: [Hydrologic Engineering Center's \(CEIWR-HEC\) River Analysis System](#)

Currently, the Town is working under an FY17 Massachusetts Environmental Trust grant to complete the physical studies needed to demonstrate the feasibility of widening the Central Street Bridge, removing the Central Street tide gate, and ecologically restoring natural habitats to the Central Pond reach of Sawmill Brook. The Draft report demonstrated that the restoration is feasible, and a FY19 MVP action grant was awarded to the Town to complete the restoration design.

For the past three years, the community has had extensive public working sessions and public engagement to develop a new Master Plan, which is currently in the recommendation stage. The timing of the Community Resiliency Building Workshops could not be better, because the MVP priority actions to address climate change impacts will be incorporated into all sectors of the Master Plan. A summary of current and recent planning efforts is provided in the Appendix.

The Community Resilience Building Workshop's central objectives were to:

- Define top local natural and climate-related hazards of concern;
- Identify existing and future strengthen and vulnerabilities;
- Develop prioritized actions for the Community;
- Identify immediate opportunities to collaboratively advance actions to increase resilience.



Community Resilience Building Workshops and Interviews

Because of the extensive resiliency work already completed by the Town and the CRAG over the past four years, it was agreed that the most productive use of the Municipal Vulnerability Preparedness (MVP) process was to be more inclusive – widening

participation. One hundred residents and business owners were personally invited by Core Team members to attend an MVP workshop. In addition, Manchester-by-the-Sea's MVP grant and the workshops were announced in the local newspaper, The Manchester Cricket; posted on the Town's website and advertised with flyers posted at Town Hall. Two Community Resilience Building (CRB) Workshops were held at the Manchester Community Center on Saturday morning March 24, 2018 (24 attendees) and Tuesday evening March 27, 2018 (31 attendees). Manchester-by-the-Sea's State Representative, Brad Hill and Senator, Bruce Tarr, each attended one of the workshops. The CRB workshops were well received with lively, engaged discussions by all. The workshops were followed by a public listening session at a special Board of Selectman's meeting at Manchester-by-the-Sea Town Hall on May 21, 2018. The meeting was televised by 1623 Studios, the organization that provides community programming for Cape Ann communities.

The MVP Provider, Barbara Warren – Salem Sound Coastwatch Executive Director, conducted interviews with the five members of the Board of Selectmen, which was fortunate since none were able to attend the workshops because of conflicting commitments. All five selectmen were born in and/or long-time residents of Manchester-by-the-Sea and highly value its coastal "quaint" community character. They noted the demographic shift that has resulted in less open space and larger structures often built on the coastal bank with little thought about coastal hazards or a changing climate. All were acutely aware of the impacts of inland and coastal flooding, concerned about the dire condition of the Central Street Bridge, and understood the threats of sea level rise and storm surge to the Town's critical infrastructure, especially the wastewater treatment plant. Although some admitted they did not completely understand the science of climate change, they all could reflect on experiences that they have had that they believe will worsen with climate change.

As their role as elected officials, they have to deal with challenges and choices – "all options have costs" – "talking money always gets political" – "decisions have implications." They are mindful that tax increases affect the residents and businesses, and they wish to maintain a level of affordability and diversity within the Town. At the same time, there is a concern that as climate change begins to impact the community more severely, property values and the property tax base will be affected³, making it even harder to meet the resiliency challenges.

Each discussed communications as an issue. One expressed the Select Board itself needed to have more opportunities to be informed beyond an executive summary. All wanted new information sharing channels to engage more of the community. Finally, they were pleased with Manchester-by-the-Sea's proactive pursuit of community resilience through the MVP process and designation. As one said, "Resilience is the Key" but we "Need to set the Vision."

³ Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate (2018). www.ucsusa.org/underwater

The operators of Manchester Marine and Crocker's Boat Yard were interviewed and both then participated in the workshops.

Crocker's Boat Yard demonstrated how experiencing a disaster, learning from the experience, and rebuilding in a more resilient manner served them well. Owner Skip Crocker spoke of his grandfather starting the business in 1946, "The Blizzard of '78 was the first and last time they have had to shut down business." Crocker's Boat Yard was storm proofed after the '78 experience. When the nor'easters of 2018 damaged so much of Manchester Harbor, they experienced some inconvenience but no significant damage.

Manchester Marine did experience flooding from the extreme high tide and storm surge on January 4, 2018, requiring major repairs. There was no previous history of this happening, but at the end of January, a lesser storm at an astronomical high tide brought the water to the front steps and into the parking lot, which has led to an elevation survey of the property as perhaps the first step to evaluating options to improve resiliency.

Both felt that communications between the Town and businesses could be better, although they spoke highly of Bion Pike, the harbormaster, and said he would be the person they go to for information.

Summary of Findings

Top Hazards and Vulnerable Areas - Manchester-by-the-Sea

During the CRB Workshops (March 2018), participants were presented with the latest climate projections developed for Massachusetts by the Northeast Climate Science Center at UMass-Amherst (resilientma.org) and then asked to identify the top four natural hazards for their community that will be driven by climate change. In addition, the inland and coastal flooding risks with climate change at 25, 50 and 100-year planning scenarios from Manchester-by-the-Sea's FEMA Hazard Mitigation Plan "Enhancement" study were shared with participants. Tighe & Bond provided maps of Location of Community Assets, Flood Zone Expansion, and Extreme Precipitation & Storm Surge, which are in the Appendix.

Having just experienced the 2018 winter with 4 nor'easters that left businesses and roadways flooded, seawalls in shambles, trees uprooted, and power outages, participants easily reached agreement that intense storms, storm surge, and coastal flooding, especially those coinciding with astronomically high tides, were serious hazards. With a warming world comes an increase in the frequency and intensity of storms and precipitation since "with every 1C° of warming, the air can hold 7% more moisture."⁴ Thus, inland flooding will continue to be a significant hazard.

Drought emerged as a concern – the first time this hazard has been stated as a priority. There was strong consensus by CRB workshop participants that there are significant future

⁴ Peter Stott, U.K. Met Office's Hadley Center for Climate Change

climate change concerns for the town's drinking water supply and sufficient water to fight potential wildfires during drought conditions.

Participants from the community easily reached consensus on the following top four natural hazards that may be intensified by climate change.

Top Hazards

Coastal Flooding – Storm Surge and Sea Level Rise (coastal erosion)

Inland Flooding due to Intense Precipitation (erosion)

Severe Storm Events: nor'easters, blizzards, hurricanes (extreme temperatures and high wind)

Drought – Extreme Heat and Wildfire

Areas of Concern – Vulnerable Areas and Attributes

Neighborhoods: Downtown, Senior Housing at The Plains and Newport Park Road Street, and streets in floodplains, e.g. Raymond, Beach, Proctor and Ocean Streets, Butler Avenue and Blue Heron Lane.

Ecosystems: Manchester Harbor; Sawmill Brook, Bennett Brook; all wetlands and brooks, woodlands, parks; beaches - Singing, Black and White; salt marshes at Chubb Creek, Kettle Cove, and Essex County Club.

Transportation: State Highway Route 127 in West Manchester; MBTA tracks, bridge and station; all other coastal roads subject to flooding - Raymond, Beach, Boardman, Bridge and School Streets.

Infrastructure: Central Street Town Hall with Police, Emergency Management, Dispatch, and Harbormaster; Wastewater Treatment Plant, Lincoln Street Well and Pumping Station, Gravely Pond Well, Central Street Bridge, Sawmill Brook culverts and bridges, Downtown Stormwater Drainage System, Fire Station, National Grid utilities, Verizon-switching station, and underground storage tanks.



Current Concerns and Challenges Presented by Hazards

Flooding was the most prevalent serious natural hazard identified by local officials in Manchester-by-the-Sea's 2018 FEMA Hazard Mitigation Plan (HMP). Manchester-by-the-Sea has many miles of coastline and the Sawmill Brook and its tributaries that drain rocky uplands, wetlands, forests, and developed residential areas before discharging to the Harbor through a narrow tide gate. Many areas of the town are located in FEMA flood zones and are subject to flooding during extreme storm events due to the combination of storm surge, hydraulic restrictions from culverts and the tide gate, stormwater runoff from impervious areas, channelized stream systems, and poor infiltration conditions. Residents, businesses and town employees understand that future impacts due to a changing climate, including increased precipitation and sea level rise, will exacerbate flooding. The CRB workshops reinforced this awareness and consensus.

The following table from Manchester's FEMA HMP with the addition of the four 2018 winter storms documents the natural hazard incidents that have been experienced locally (13 from 1938 - 1998; 15 from 2001 - 2018). The majority of events involved flooding.

Manchester-by-the-Sea FEMA Hazard Mitigation Plan 2018

Table 2.3. Historic Flooding Events and Local Impacts for Manchester-by-the-Sea		
Date	Type of Event	Local Impacts
September 21, 1938	The Great New England Hurricane - Cat 3	10-17 inches of rainfall and up to 20-foot storm surge.
September 15, 1944	The Great Atlantic Hurricane - Cat 1	11 inches of rain and up to 70-foot waves.
August 31, 1954	Hurricane Carol - Cat 2, followed by Edna	2 hurricanes struck within 12 days with 7 inches of rain causing stream flooding and streets washed out.
September 12, 1960	Hurricane Donna - Cat 2	10-20 inches of rain and 5-10-foot storm surge. Wettest tropical cyclone to impact New England.
March 1972	Severe Storms and Flooding	No information available.
February 1978	The Blizzard of '78 Most devastating Nor'easter in Massachusetts history.	Set all-time high water mark of 15.25 feet above Mean. 30 inches snowfall, with 20-foot drifts. Singing Beach seawall destroyed. 2 Repetitive Loss Claims in Manchester.
September 27, 1985	Hurricane Gloria - Cat 3	Arrival at low tide resulted in moderate storm surge.
March 31-April 7, 1987	Severe Storms and Flooding	Spring storms added 7 inches to already high river conditions to produce major flooding. 2 Repetitive Loss Claims in Manchester.
August 19-21, 1991	Hurricane Bob - Cat 3	4-7 inches of rain and storm surge impacts.
October 15-18, 1991	"The No-Name Storm" or "Perfect Storm" Nor'easter	25-foot waves on top of 4-foot high tide. Many coastal roads washed out. 9 Repetitive Loss Claims in Manchester
December 11-13, 1992	Nor'easter	Highest water levels 1-foot below record of 1978 (25 ft. dunes wiped out in Ipswich) and 6 inches of rain. 5 Repetitive Loss Claims in Manchester.

Table 2.3. Historic Flooding Events and Local Impacts for Manchester-by-the-Sea

Date	Type of Event	Local Impacts
October 20-21, 1996	Severe storms and flooding	13 inches of rainfall in Essex County (7.89 in Boston). 5 Repetitive Loss Claims in Manchester.
June 13-18, 1998	Heavy rain and flooding	Flash flooding from June 12-14 > 8 inches in < 12 hours.
March 21-22, 2001	Nor'easter	High tides ran 2-3 feet above normal along east facing coastline. 8 Repetitive Loss Claims in Manchester.
February 2003	Presidents Day Storm	Astronomical high tide coincided with 15-foot seas to cause flooding along most of eastern Massachusetts coastline. 27.5 inches of snow recorded at Logan Airport.
March 31-April 2, 2004	Flooding	6 inches fell over several days. Flood waters caused many roads to be closed along the river and damaged nearby homes.
May 9-16, 2006	"Mother's Day Flood"	Extreme rainfall >12 inches. 6 feet of water on roadways alongside Sawmill Brook. School Street Bridge washed out. 150 homes damaged. Route 127 impassable. 10 Repetitive Loss Claims in Manchester.
April 15-20, 2007	"Patriot's Day Storm" Nor'easter	Worst coastal flooding coincided with evening high tide on April 17 (3.6 inches recorded at Logan Airport). 1 Repetitive Loss Claim in Manchester.
December 11-12, 2008	Severe winter storm	8-12 inches of snow fell in Manchester accompanied by 30-40 mph winds resulting in coastal flooding and structural damage.
March 12-16, 2010	Nor'easter	Record breaking rainfall (7.06 inches at Logan Airport) coastal flooding and 70 mph winds.
January 11-12, 2011	Nor'easter	Snow, high winds, and coastal flooding.
October 29-30, 2012	Nor'easter	Rare October snowstorm, icing, high winds.
February 8-10, 2013	Winter Storm Nemo - Nor'easter	24.9 inches of snow in Boston, hurricane-force winds, and 4.2 feet of storm surge.
January 26-28, 2015	Winter Storm Juno	24 inches of snow fell in Boston with 4-feet of storm surge and high winds.
January 4, 2018	Winter Storm Grayson	5-foot storm surge on top of extreme high tide of 11.6' at 12:36pm
March 1-3, 6-8, 12- 14 2018	3 - Nor'easters - Riley, Quinn, Skyla	Hurricane-force wind, unusually high tides and storm surges along the coast, destructive winds wind and downed trees, heavy snow and severe coastal flooding; blizzard conditions

Specific Categories of Concerns and Challenges

Manchester-by-the-Sea residents and businesses greatly value the Town's coastal community identity and do not want to lose the iconic Manchester-by-the-Sea character due to coastal erosion, sea level rise, storm surge or flooding. However, much of its critical Infrastructure is at lower elevations and are already subject to coastal and/or inland flooding.

Manchester-by-the-Sea's proactiveness led to the FEMA Hazard Mitigation Plan "Enhancement" grant that produced ten different Vulnerability and Risk Assessments and corresponding 4-page fact sheets. These fact sheets were available to CBR workshop participants and are included in the Appendix. Many participants did not have time to read the fact sheets before the breakout discussions, but it is interesting that their concerns and challenges often mirrored the Risk Assessments.

Sawmill Brook - Central Street Bridge, Tide Gate and Pond

Flooding occurs along the Sawmill Brook from Millets Creek at the headwaters to the Central Street tide gate at its entrance to Manchester Harbor.



The Town has focused energy and funding on finding solutions to this problem and the failing infrastructure at the Central Street Bridge. In March 2018, the Town received a \$500,000 MassDOT Small Bridge Grant to begin the design, permitting and construction of the Central Street Bridge. "In awarding the grant, the state noted that this bridge is in the most dire condition of any small bridge in Essex County."⁵ The Town's goals are to concurrently plan and design the new Central Street bridge/culvert and the Central Pond restoration to a tidally flushed riverine/marsh system. In June 2018, one of the first MVP Action Grants was awarded to Manchester-by-the-Sea for the Sawmill Brook Central Pond Restoration Design project. The Town residents demonstrated their commitment at the 2018 Town Meeting when \$400,000 was approved for Central Street / Sawmill Brook project match. Vulnerability and Risk Assessments for the Sawmill Brook and Central Street Dam are located in the Appendix.

⁵ Gregory Federspiel, Town Administrator. From the Town Administrator's Desk. The Manchester Cricket. Page 1. May 5, 2018.

Wastewater Treatment Plant

Manchester's Wastewater Treatment Plant (WWTP) serves half the Town. Adjacent to Manchester Harbor, it is entirely in the FEMA 100-year flood zone. The WWTP Vulnerability and Risk Assessment (see Appendix) and the 2015 CREAT Report⁶ both identified serious issues with WWTP's location. There are short-term adaptive flood proofing measures that should be started now, but for the long-term a comprehensive alternatives and cost/benefit analysis will be needed to determine the best course of action for the community.

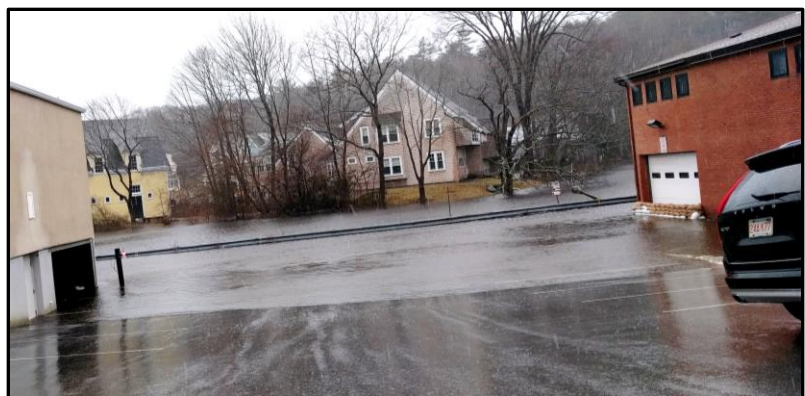


Manchester-by-the-Sea Downtown

Manchester-by-the-Sea's grocery store, pharmacy, hardware store, Community Center, American Legion Hall, Town Hall and Library, many churches, and the majority of its businesses and restaurants are located in the Downtown district, the Town's main economic center. Thus, participants were concerned for its long-term viability.

The Police Headquarters, Emergency Operations Center, Dispatch, and Harbormaster as well as the administrative offices are located in the Town Hall. The backside of the Town Hall is approximately at an elevation of 4-5 foot, faces the harbor, a parking lot and boat ramp. During the January 2018 Nor'easter, a 5-foot storm surge came up the boat ramp at an astronomical high tide flooding 8 cars in the lot and threatening operations at the Town Hall. The Fire Station (on the right), located between School Street and the Sawmill Brook Central Pond, was also impacted by floodwaters.

Vulnerability and Risk Assessments for Town Hall, Police and Emergency Operations; Downtown Businesses; and Fire Station are in the Appendix.



⁶ Environmental Protection Agency Climate Resilience Evaluation and Awareness Tool

Stormwater Infrastructure

The Vulnerability and Risk Assessment for Downtown Stormwater System determined that the system is undersized and surcharged from the ocean outfalls based on recent storm event flooding. With the prediction of more frequent intense precipitation, participants understood the importance of reducing the amount of runoff particularly to low lying areas and suggested green infrastructure incentives and creating more upstream stormwater storage.

Drinking Water Supply

There was strong consensus by CRB workshop participants that there are significant future climate challenges for the Town's drinking water supply. Some remembered severe forest fires in 1947 and the 1950's and were concerned that there would be sufficient water to fight wildfires if there were drought conditions. This is the first time drought was considered a priority hazard by the Town.

Manchester's Public Water System consists of the Gravelly Pond Water Treatment Facility; Gravelly Pond Reservoir with Round Pond Well used as an aid and the Lincoln Street Well Water Treatment Facility and Lincoln Street Well. The system has 37 miles of public water mains with the majority over 50 years old, some over 100. There is one Water Storage Facility at Moses Hill Standpipe with a capacity of 1.7 MGD.

Gravelly Pond (MassDEP Source ID# 3166000- 01S), provides approximately 71% of Manchester's drinking water and is a 49 acres surface water reservoir located off Chebacco Road in Hamilton with a capacity of over 360 million gallons when full. The pond is replenished by rainfall, runoff and groundwater springs. The pond's watershed is relatively small and the ability of the pond to recharge or fill back up, is limited. The Round Pond Well (MassDEP Source ID# 3166000-03G) also off Chebacco Road supplements the Gravelly Pond supply. Approximately 89 million gallons were transferred in 2016. A recent Firm Yield found that "Gravelly Pond would not be able to meet the system demand without contribution from Round Pond Well No. 1."⁷ The Town's continuing promotion of water conservation was also recommended.

The second source, providing 28.9% of Manchester's drinking water, is the Lincoln Street Well (MassDEP Source ID# 3166000-01G), a 58-foot-deep, 500 GPM, gravel packed well located next to the Manchester-Essex Regional Middle and High Schools. Groundwater is pumped from a sand and gravel deposit that underlies the area.

In 2003, the Department of Environmental Protection published its Source Water Assessment Program (SWAP) Report for Manchester' Public Water Supply in which it noted that both the Lincoln Street Well and Gravelly Pond sources have land uses adjacent to the

⁷ Final Draft: Firm Yield Analysis of Gravelly Pond, March 2018. Tata & Howard No. 4819.

source that would be prohibited under today's regulations. The following are two of seven recommendations from the SWAP Report⁸:

1. Continue to inspect Zone A and Zone 1 areas regularly, and when feasible, remove prohibited non-water supply activities.
2. Develop and implement a groundwater and surface water supply protection plan.

Emergency Preparedness and Communications

Coming off a winter of four nor'easters and a devastating hurricane season for the Caribbean, participants voiced their concerns about how the Town would respond to more intense disasters in the future. The conversation covered the need for generator battery backup, greater use of Reverse 911 and a communications plan if cell towers went down and cell phones do not work. Participants felt that people needed to be prepared at home for at least 4 days without power; while some thought 30 days preparedness could be a possibility. When the discussion turned to emergency shelters, the only Town Planner who knew where Manchester's shelters were located. This led to conversations on the need for more effective communication channels that "bring the messages home to what's important to individuals locally," which echoed the comments of Selectmen during their interviews.

Commuter Rail System

Many residents use the commuter rail for work and consider it a positive aspect of living in Manchester. Even though they know the Town cannot improve the commuter rails resilience, they wanted their concerns known and suggested possible actions during the breakouts.

Road Network Vulnerability and Utilities Vulnerability

State highway, Route 127, sections of which are owned and maintained by the Town, is a major connector road traveling west to east across Manchester. Five areas along Rt. 127 currently experience localized flooding: Chubb Creek, Bennett Brook, Causeway Brook and at its branch, and Raymond Road. Vulnerability and Risk Assessment for Flood Risk Locations Along Route 127 is in the Appendix. Participants expressed the need to educate the public on evacuation routes and the importance of evaluating vulnerable roadways to determine potential improvements. Participants began to grapple with some of the consequences if or when some roads need to be abandoned.

As roads flood, underground utilities may be at risk. Participants wanted to see more hardening of electrical systems to reduce power outages, planning for redundancy and investigation into the feasibility of a micro/smart grid.

Manchester Harbor

The Harbor is an asset that spans the three categories: infrastructural, societal and

⁸ Manchester SWAP Report <https://www.mass.gov/files/documents/2016/08/qm/3166000.pdf>

environmental, and is a strength and a vulnerability. Therefore, increasing Manchester Harbor's resilience is a top priority. Because it is a mix of hardened and natural edges, reinforcing seawalls in the more densely developed inner Harbor while restoring natural areas such as Masconomo Park were considered challenges worth pursuing. The Sawmill Brook flows into the Harbor, as does the Downtown stormwater, so restoration and retrofits to these will improve the Harbor's water quality and reduce sedimentation. However, when 50-year and longer climate change planning scenarios are explored, a sea level rise/storm surge barrier across Manchester Harbor which would protect the inner Harbor and its multiple assets has become another option to explore. Vulnerability and Risk Assessment for Manchester Harbor is in the Appendix.

Current Strengths and Assets

Manchester's responsive and committed leadership exhibited by elected officials, staff and residents is a current strength. The town leadership values the importance of designing and preparing for climate change because it understands what is at risk. The willingness of the community to engage in shaping Manchester's future is critical as they grapple with the challenges brought on by a changing climate. Ongoing collaboration and support amongst leadership, staff, residents and businesses will help to advance comprehensive, cost-effective approaches to resilience as identified in this Summary of Findings.

- Manchester's schools are a strength; none of the public schools are in flood hazard areas. Participants wanted the schools to make creating climate literate students an important goal.
- Manchester's environmental assets are all strengths while also being vulnerable. These assets include the harbor, beaches, salt marshes, eelgrass meadows, parks and open space.
- The community and leadership have a willingness to be proactive and communicate the value of investing in climate change projects vs no action.
- The community values maintaining Manchester's character, its natural resources and open spaces. Participants were supportive of natural land care and green infrastructure to encourage stormwater retention.
- The community and leadership are willing to explore resiliency options, to develop the data necessary to make informed decisions and seek new communication channels that involve residents and businesses.

Top Recommendations to Improve Resilience

A coastal community with much at risk based on the current and future projections, Manchester-by-the-Sea has taken a proactive position to understand and begin the process of designing adaptive strategies to deal with climate change hazards. The MVP process has

helped set a roadmap for building a more resilient, cohesive response to inland and coastal flooding, severe storms and drought.

Manchester's community resilience actions through the MVP designation will build understanding of the threats of sea level rise and storm surge to the Harbor and the Town's critical infrastructure, including the wastewater treatment plant and emergency services.

Already, resiliency projects concentrating on the Central Street bridge/culvert and Sawmill Brook restoration have moved forward with funding from a MVP Action Grant.

Manchester's MVP Plan will also inform the current Master Planning process and the following priority list, documented in Manchester's Master Risk Matrix (see Appendix), will help build momentum for the identified priority actions, when it is shared with residents, businesses and schools.

Highest Priority

- Complete evaluations of hydrology, hydraulic restriction and deteriorating condition of Central Street bridge to prepare for new bridge design, permitting and implementation.
- Implement restoration of Central Pond to improve flow and habitat value while providing flood mitigation for adjacent properties.
- Design, permit and implement the seven other Sawmill Brook projects already identified to reduce flooding and restore the Brook, working from downstream up the watershed.
- Evaluate and implement flood proofing of the Town Hall, Police, Dispatch, Emergency Preparedness and Harbormaster, e.g., moving vulnerable assets at least 3-feet above base flood level; flood proofing doors and openings; elevating electrical, mechanical and communications systems; and upgrading and relocating the generator to higher ground.
- Given the Wastewater Treatment Plant (WWTP) is in the FEMA 100-year flood zone, evaluate options: relocating, joining SESD, building a Harbor barrier, or protecting in place, i.e., building a floodwall and elevating. Evaluate condition and location of pump stations and onsite WWTP in other areas of town.
- Increase Manchester Harbor's resilience: protecting docks and piers, reinforcing seawalls in the more densely developed Inner Harbor; restoring natural areas; developing and implementing stormwater outfall retrofits to improve water quality and reducing sedimentation.

- Improve the Downtown Stormwater System, which is under capacity with surcharge from ocean outfalls, by retrofitting, promoting green stormwater infrastructure to reduce runoff and impervious surfaces, and creating more stormwater storage.
- Evaluate long-range possibilities including relocation of Town Hall, Police, Emergency Preparedness and Wastewater Treatment Plant and construction of a Manchester Harbor sea level rise/storm surge barrier to protect multiple assets including the Downtown.
- Enhance Emergency Preparedness by assuring the Town has enough back-up generators; encouraging the Town-wide use of Reverse 911; conducting more resident and visitor emergency preparedness education including location of shelters; assuring seniors can be evacuated; ensuring radio emergency communications are compatible with other systems.
- Educate the public on evacuation routes. Assess vulnerable roadways at risk of flooding to determine possible improvements: reinforcement, culvert sizing and elevation, for example, how to keep Beach Street and Route 127 open; consider what happens if a road needs to be abandoned.
- Working with National Grid and Verizon, conduct tree work to reduce storm damage; harden electrical systems to reduce power outages. Plan for redundancy and explore feasibility of a micro/smart grid.

Moderate Priority

- Evaluate Fire Station resilience options and then flood proof: upgrade and relocate generator to higher ground, repair brook abutments, and evaluate what conditions would require relocation.
- Protect drinking water supply from Gravelly Pond, Round Pond, Lincoln Street Well by removing prohibited non-water supply activities from Zone A and Zone 1 when feasible. Develop and implement a groundwater and surface water supply protection plan to include working with other towns for land protection, conservation easements and well-head protection.
- Ensure drinking water supply sustainability by maintaining water mains and conducting leak detection. Implement alternatives to municipal water use for irrigation and have water use restrictions in place with enforcement during droughts.
- Examine options for a more resilient commuter rail: elevate rails, move out of the coastal area, have alternatives such as a water taxi and bus system.

- Evaluate fuel tanks locations and elevate at least 3-feet above BFE. Conduct toxics use reduction and business emergency preparedness planning to reduce risk.
- Plan for the resilience of Tuck's Point Rotunda, a "cultural icon."
- Evaluate beach and salt marsh systems vulnerability to inform long-term policy and understand beach erosion and retreat.
- Monitor and evaluate sustainability options at Singing Beach including shoreline protection and restoration, water and wastewater disposal for the bathhouse, and parking lot green infrastructure.
- Update zoning and regulations to improve protection, conservation and restoration of brooks and wetlands. Incentivize increased floodwater storage capacity and green infrastructure.

Lower Priority

- Increase Manchester Harbor's resilience by protecting its eelgrass.
- Protect Town's parks, undeveloped land and conservation area. Manage tree canopy. Increase flood storage.
- Assure adequate water for fighting wild fires to protect parks, open space including woodlands and homes.
- Encourage protection, increase flood storage and buffers along brooks, and examine water use restrictions during droughts at the Essex County Club.

Next Steps

The Town is committed to continue its work on resilience building. The FY18 MVP action grant awarded the Town for the Central Pond/Sawmill Brook restoration design will move forward one of the top priorities, simultaneously with the feasibility study of widening the Central Street Bridge and removing the Central Street tide gate. In addition, the Town's new Master Plan will be completing the recommendation stage at which time the MVP priority actions to address climate change impacts will be incorporated into all sectors of the Master Plan. Ongoing collaboration and support amongst leadership, staff, residents and businesses will help to advance comprehensive, cost-effective approaches to resilience as identified in this MVP Summary of Findings.

CRB Workshop Participants:

See Supplemental Files.

Report Citation:

Warren B., M. Reilly and G. Belfit (2018) Town of Manchester-by-the-Sea Community Resilience Building Workshop Summary of Findings. Salem Sound Coastwatch, Tighe & Bond, Town of Manchester-by-the-Sea, Massachusetts.

CRB Workshop Project Team: Organization, Name, Role:

Salem Sound Coastwatch – Barbara G. Warren, (MVP Provider and Lead Facilitator)
Manchester-by-the-Sea Grants Administrator – Mary Reilly, (Project Manager)
Tighe & Bond – Gabrielle Belfit, Senior Environmental Scientist, (MVP mapping services)

Manchester-by-the-Sea Core Team Members

Greg Federspiel (Town Administrator), Mary Reilly (Grants Administrator), Sue Brown (Planner), Chris Bertoni (Conservation Agent), Bion Pike (Harbormaster), Tom Kehoe (Emergency Preparedness & Selectman), Coastal Resilience Advisory Group: Jessica Lamothe, Lynn Atkinson, Jori Everitt, and Manchester Coastal Stream Team members: Joan Nesbit, Mike Carvalho.

Workshop Facilitators and Scribes: Mary Reilly, Sue Brown, Jori Everitt, Jessica Lamothe, Lynn Atkinson, Mike Carvalho, and Salem Sound Coastwatch staff: Susan Yochelson, Jack Nessen, Emily Flaherty, Megan Podeszwa, Alex Lacy, Sam Feinberg.

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Supplemental Files:

- 1. Manchester-by-the-Sea Summary of Current Planning Efforts related to Hazard Mitigation**
- 2. Community Assets and Massachusetts Climate Change Projections**
- 3. Base Map and supporting risk maps used for participatory mapping exercise**
- 4. CRB Workshop Presentation**
- 5. MVP Listening Session Presentation**
- 6. Vulnerability and Risk Assessments**
- 7. MVP Workshop Invitees and Attendees**