

# Manchester-by-the-Sea



## Municipal Vulnerability Preparedness (MVP) Public Listening Session

May 21, 7:15 pm. Town Hall – Board of Selectman’s Meeting

**Greg Federspiel** - Manchester-by-the-Sea Town Administrator

**Mary Reilly** - Manchester-by-the-Sea Grants Administrator

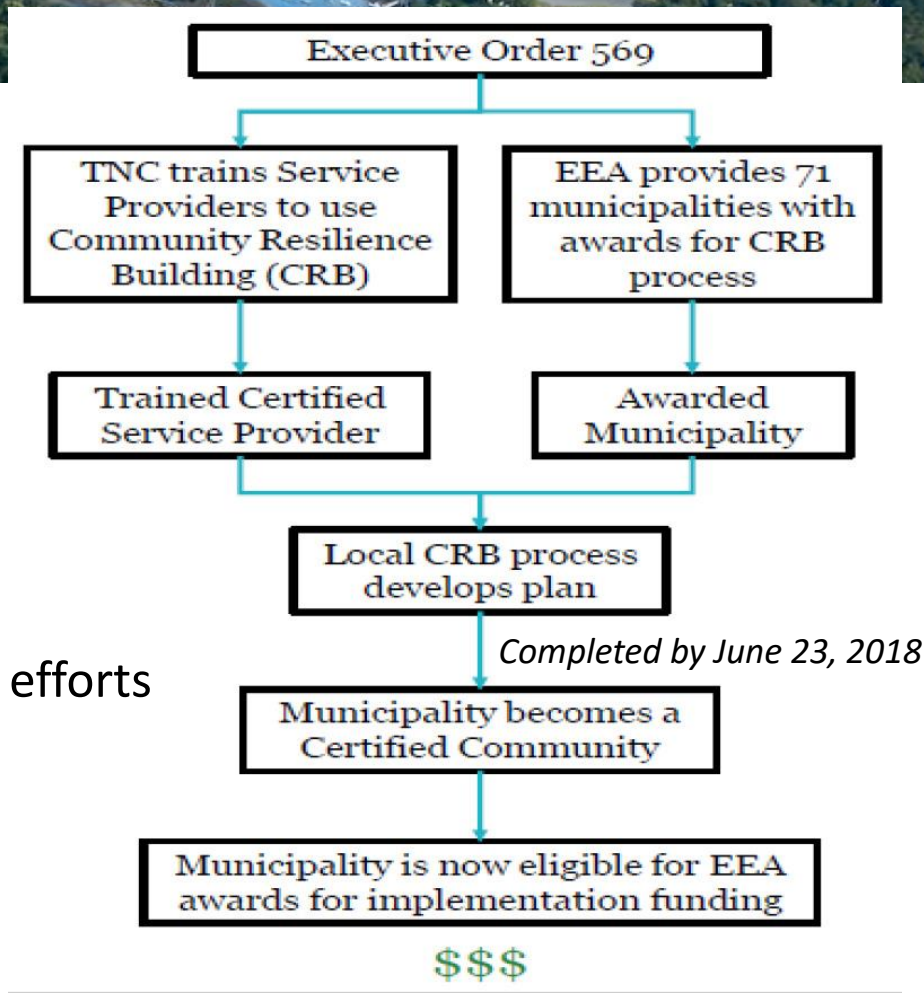
**Barbara Warren** - Salem Sound Coastwatch – MVP Provider

Core Team: Greg Federspiel, Mary Reilly, Sue Brown, Chris Bertoni,  
Jessica Lamothe, Lynn Atkinson, Tom Kehoe, Jori Everitt, Bion Pike,  
Joan Nesbit, Mike Carvalho



# Municipal Vulnerability Preparedness (MVP)

- **Community-led process** that employs local knowledge
- **Partnerships** and leveraging of existing efforts
- **Mainstream** climate change
- **Communities** as local innovators
- **Frame** coordinated statewide efforts.





# Manchester-by-the-Sea CRB Stakeholders

## Municipal Vulnerability Preparedness

2 Community Resilience Building Workshops  
at the Manchester Community Center

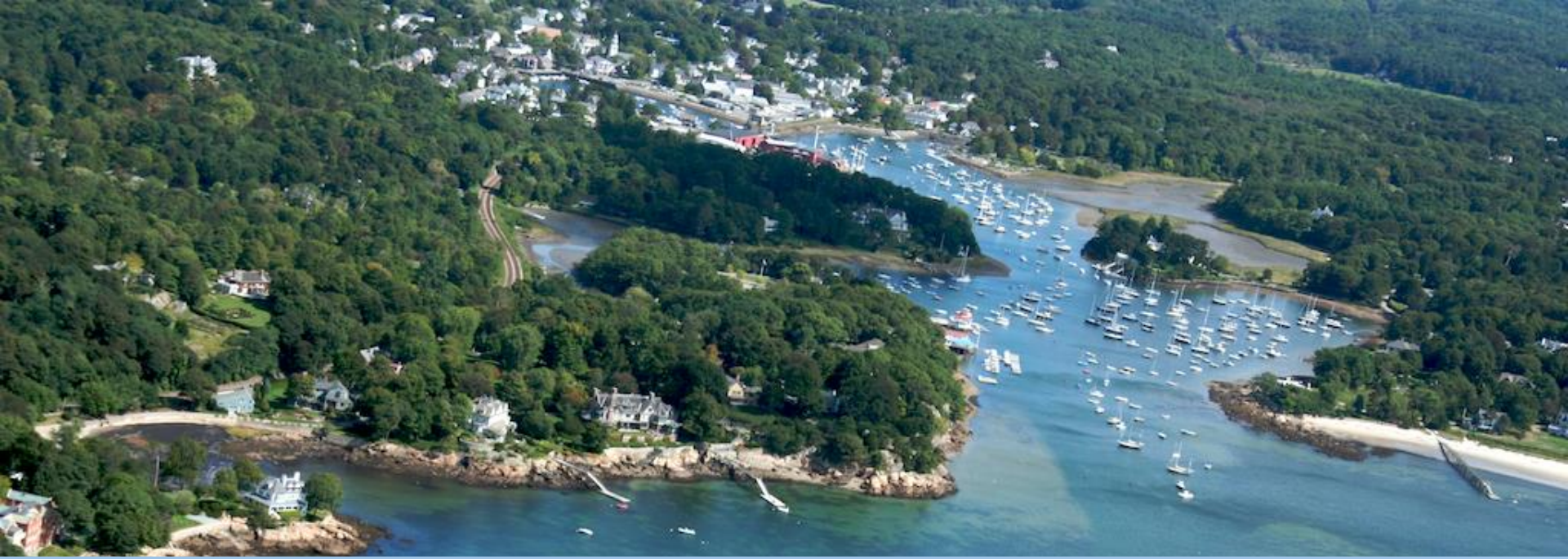
Saturday, March 24 - 24 participants

Tuesday, March 27 - 31 participants

Residents, Businesses

Town Employees, Town Committee Members





# Community Resilience Building Process (TNC)



## With Climate Change as the DRIVER

*State and local partnership to build resiliency to climate change*

1. Engage Community

2. Identify CC impacts and hazards

3. Complete assessment of vulnerabilities & strengths

4. Develop and prioritize actions

5. Take Action



An aerial photograph showing a coastal town with white buildings and a harbor filled with numerous sailboats. The town is surrounded by lush green trees and a winding road. The harbor is a mix of blue and brown water, indicating some sediment or shallow areas.

# MASSACHUSETTS CLIMATE CHANGE PROJECTIONS

***Rising temperatures, changing precipitation, and extreme weather will continue to affect the people and resources of the Commonwealth throughout the 21<sup>st</sup> century.***

**Northeast Climate Science Center at the University of Massachusetts Amherst developed downscaled projections for changes in temperature, precipitation, and sea level rise for the Commonwealth of Massachusetts.**

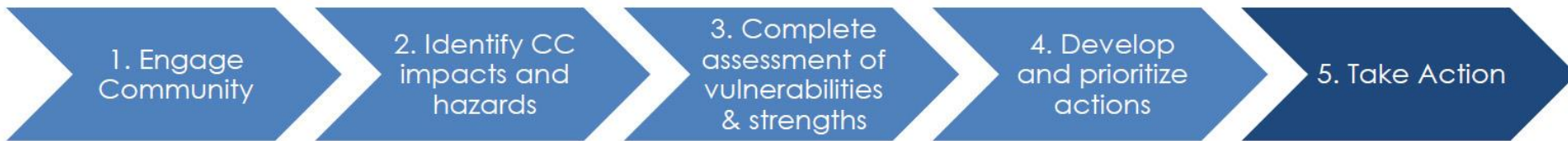
**The Executive Office of Energy and Environmental Affairs has provided support for these projections to enable municipalities to utilize a standard, peer-reviewed set of climate change projections that show how the climate is likely to change in Massachusetts through the end of this century.**

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# Stakeholder Process Community Resilience Building Workshop

*State and local partnership to build resiliency to climate change*



**4 HAZARDS**


**ASSETS**

**Vulnerability and Strength**

**ACTIONS**

Actions already identified in Manchester's planning or new ideas to advance longer-term positive outcomes.

Priority and Timeframe





# MVP Hazard CONSENSUS

## FOUR Top Priority Hazards

Coastal Flooding	Inland Flooding	Severe Weather	Drought
Sea Level Rise, Storm Surge	Increased Precipitation, Increased Frequency	Nor'easters, Hurricanes, Blizzards (high wind, extreme temperatures)	Extreme Heat, Wildfire

Both Coastal and Inland Flooding can result in erosion.

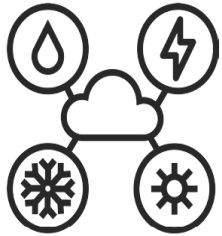
*Here is the context for these hazards being identified in the CRB Workshops.*





# COASTAL FLOODING

## Potential Effects of Climate Change



### SEA LEVEL RISE

Predictions for Sea Level Rise by **mid-century** range from **1.1 feet to 2.7 feet**.  
**Worse case for 2100 is a 9.7 feet of SLR.**

### MORE SEVERE STORMS

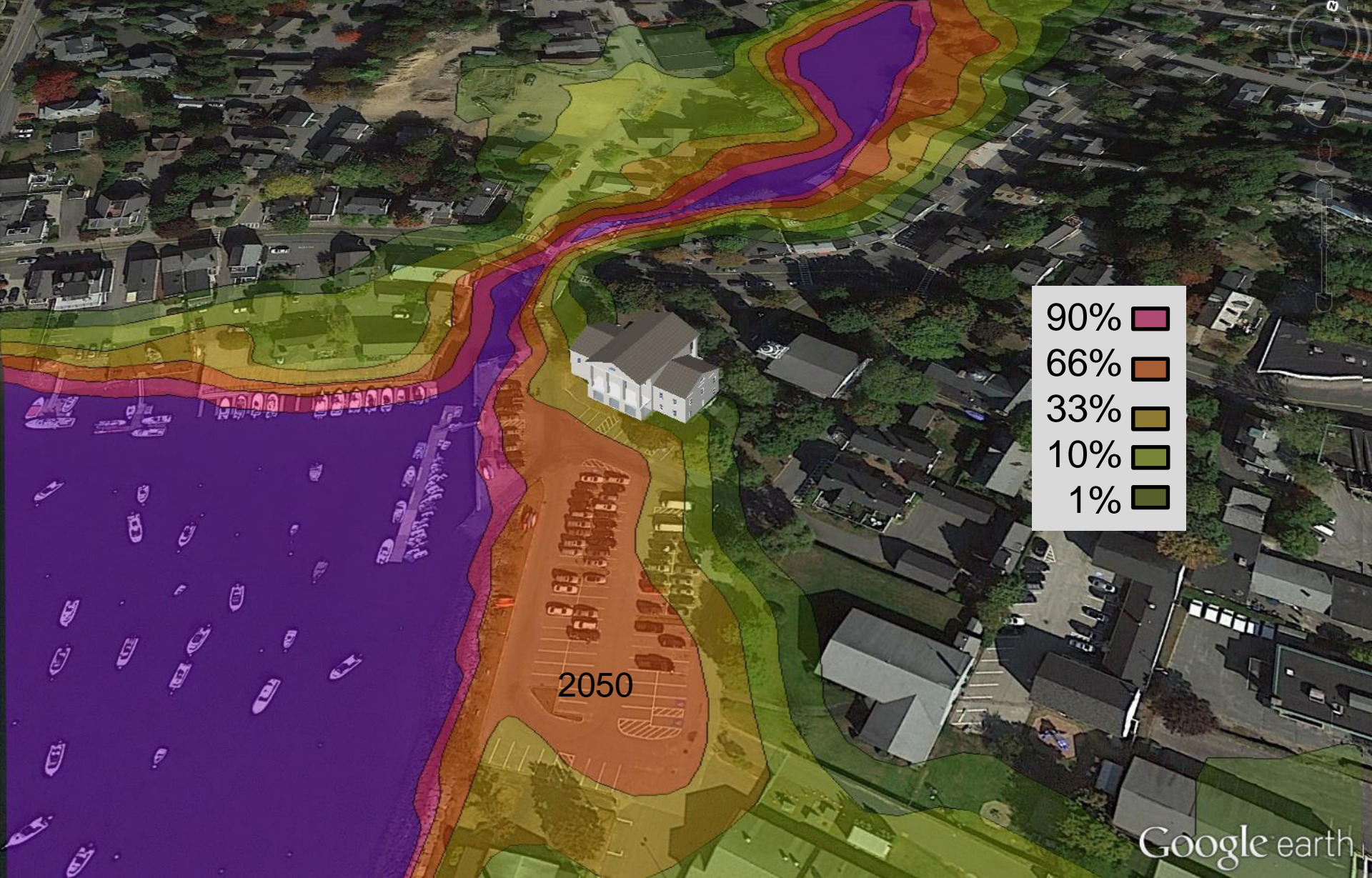
Climate change is likely to **increase frequency of severe storms**, including hurricanes and nor'easters. **More damaging Storm Surge to be expected.**

**A 2- foot sea level rise would more than triple the frequency of coastal flooding across the Northeast, without any change in storms.**

**Regardless of whether these storms are getting stronger, they are occurring over an ocean that is fuller than it used to be. This all makes it easier for storms to push enough water onshore to cause flooding.**

Climate.gov: Nor'easters pummel the U.S. Northeast in late winter 2018 Author: [Tom Di Liberto](https://www.climate.gov/news-features/event-tracker/nor%E2%80%99easters-pummel-us-northeast-late-winter-2018) March 14, 2018  
<https://www.climate.gov/news-features/event-tracker/nor%E2%80%99easters-pummel-us-northeast-late-winter-2018>

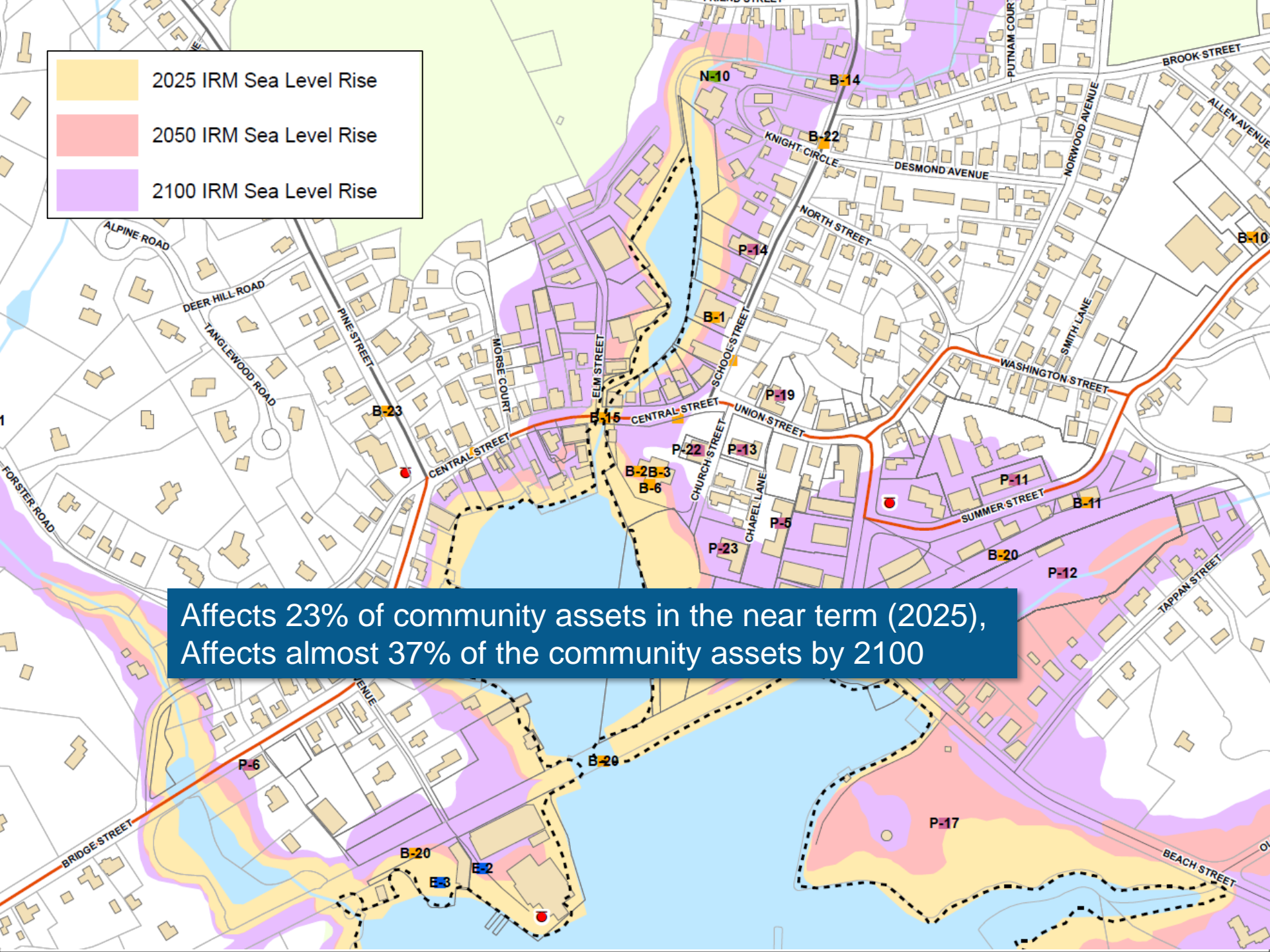
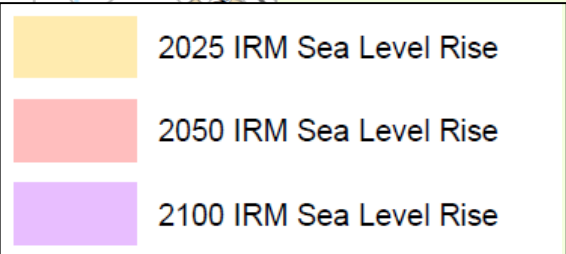




# Inundation Risk Model (IRM) shallow coastal flooding 2025, 2050

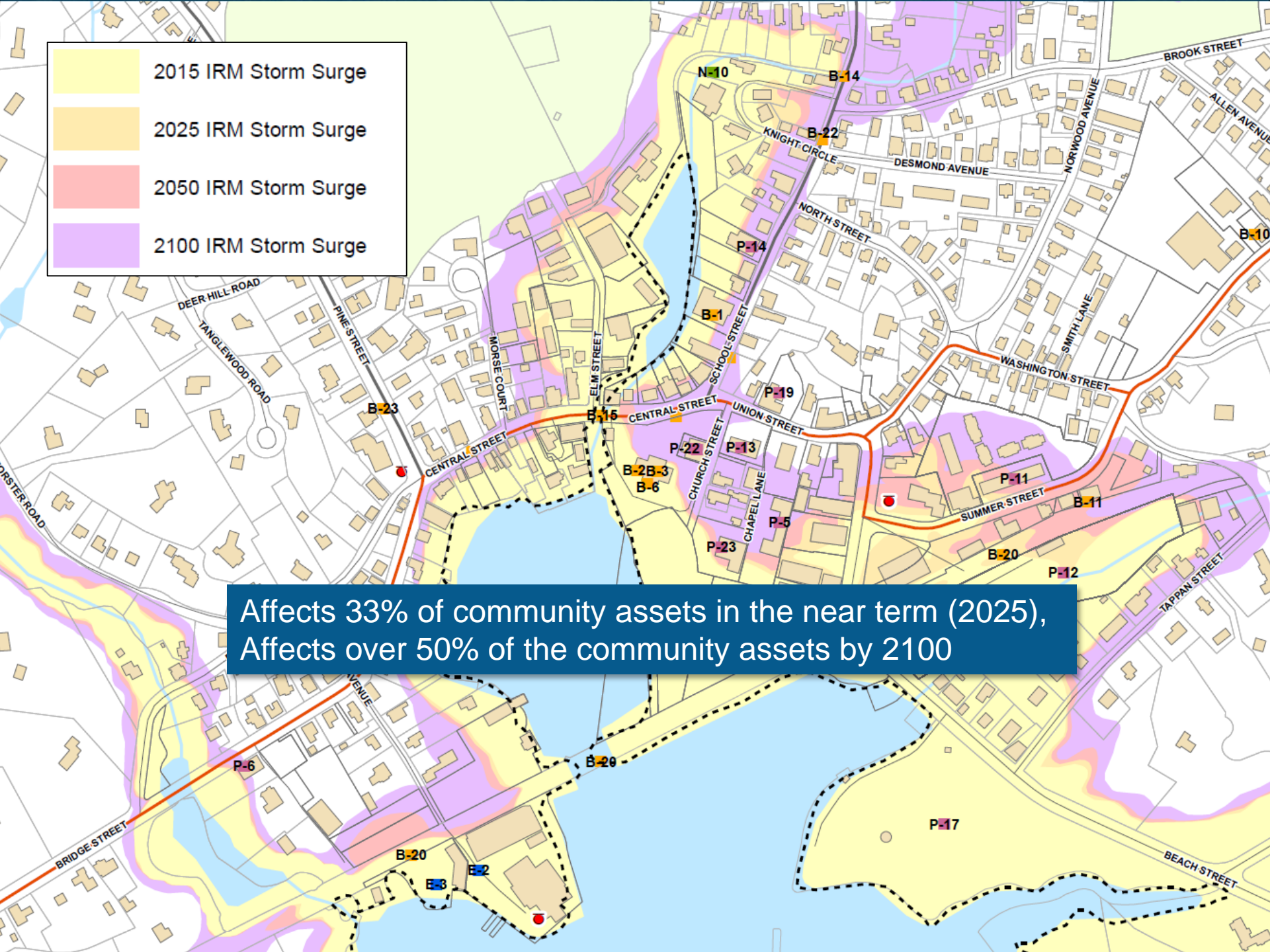
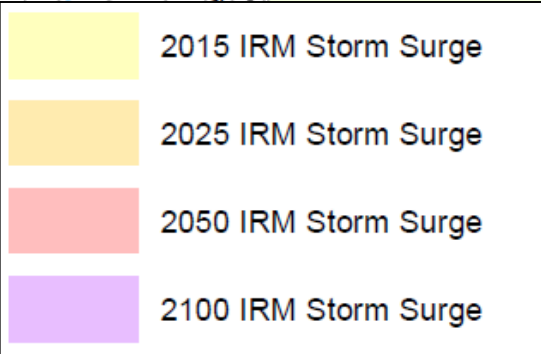
Technical Memorandum: *Potential Climate Change Impacts to Manchester-by-the-Sea, October 2015*





**Affects 23% of community assets in the near term (2025),  
Affects almost 37% of the community assets by 2100**

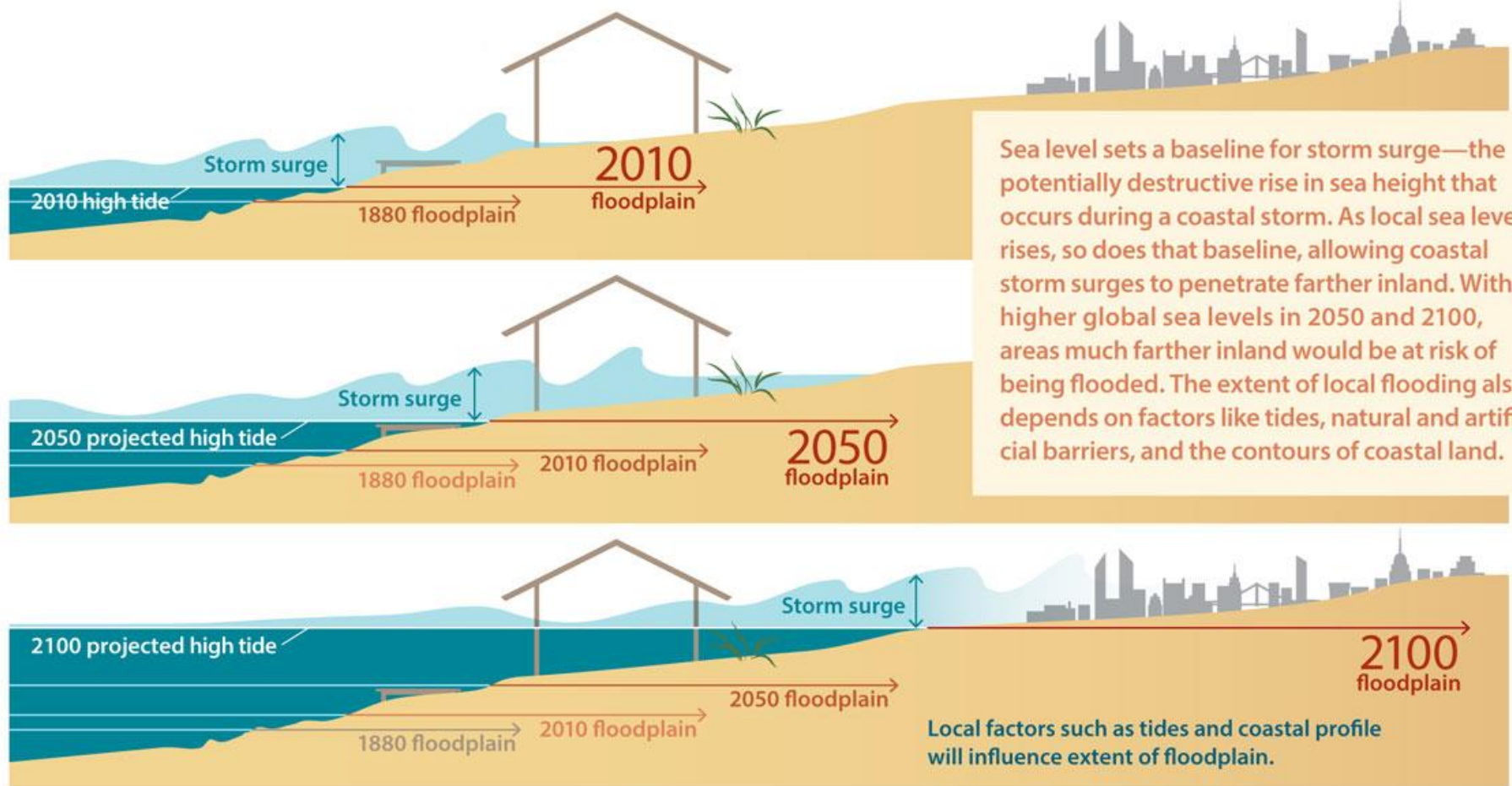




Affects 33% of community assets in the near term (2025),  
 Affects over 50% of the community assets by 2100



## Storm Surge and High Tides Magnify the Risks of Local Sea Level Rise



Sea level sets a baseline for storm surge—the potentially destructive rise in sea height that occurs during a coastal storm. As local sea level rises, so does that baseline, allowing coastal storm surges to penetrate farther inland. With higher global sea levels in 2050 and 2100, areas much farther inland would be at risk of being flooded. The extent of local flooding also depends on factors like tides, natural and artificial barriers, and the contours of coastal land.

Local factors such as tides and coastal profile will influence extent of floodplain.





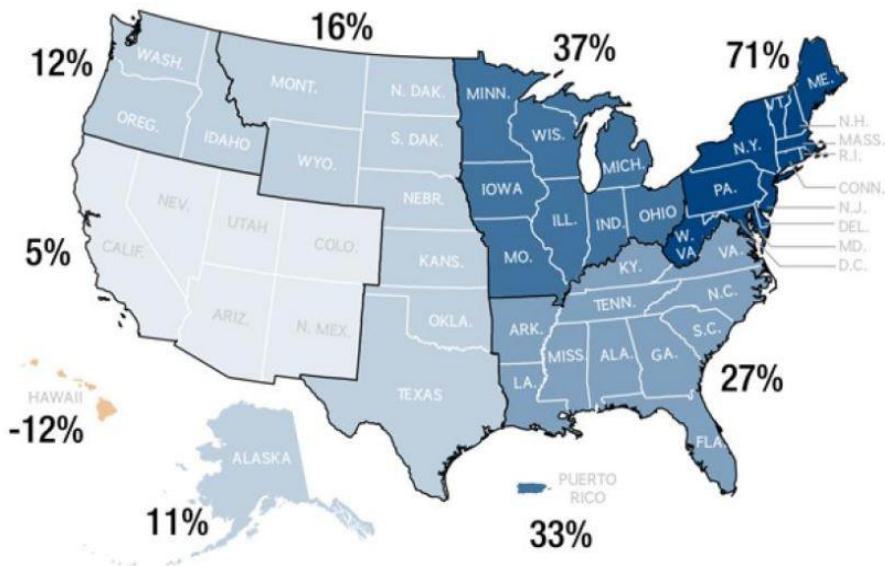
# INLAND FLOODING

## Changes in Heavy Precipitation

With every 1° C degree of warming, the air can hold 7% more moisture.

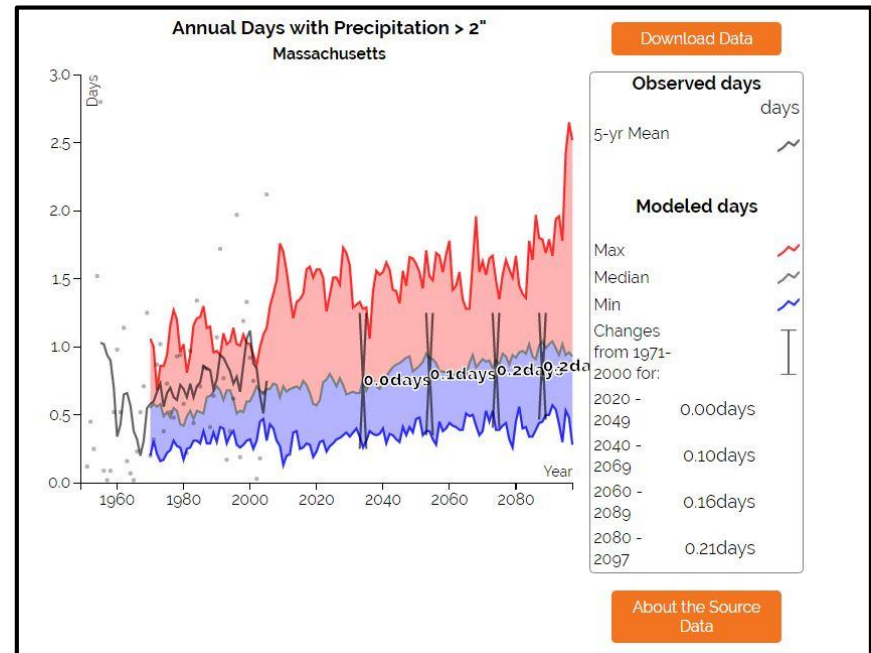
Peter Stott, U.K. Met Office's Hadley Center for Climate Change

### Projected Frequency of Future Extreme Precipitation Events in Massachusetts



Source: NECSC, 2017

### Annual Days with Precipitation >2"



Source: NCA 2014

**Climate Change: increase in Severe Storms bringing greater frequency of flood events.**



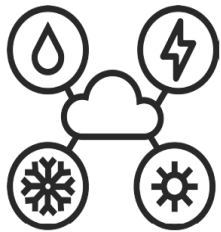
# Risk from Hazards to Key Community Assets

<b>RISK From Hazards</b>	<b>SHORT TERM (2025) % of community assets affected</b>	<b>LONG TERM (2100) % of community assets affected</b>
Sea Level Rise	23%	37%
Shallow Coastal Flooding	31%	45%
Storm Surge	33%	50%
Extreme Precipitation	40%	43%
Hurricane (Category 1 or greater)	59%	N/A



# AVERAGE AND EXTREME TEMPERATURE

## Potential Effects of Climate Change



**HIGHER  
EXTREME  
TEMPERATURES**

**# of days/ year with daily maximum temps > 90 °F  
increases by 31 days mid century, 68 days end of century.**

**HIGHER  
AVERAGE  
TEMPERATURES**

**Annual average temp. increase by 3 – 6 °F mid-century,  
4 – 10.8 °F by end of century.**

**First time DROUGHT recognized as  
a hazard for Manchester.**

Strong consensus by all CRB workshop participants that there are significant future climate change concerns for the town's drinking water supply and sufficient water to fight potential wildfires from drought conditions.

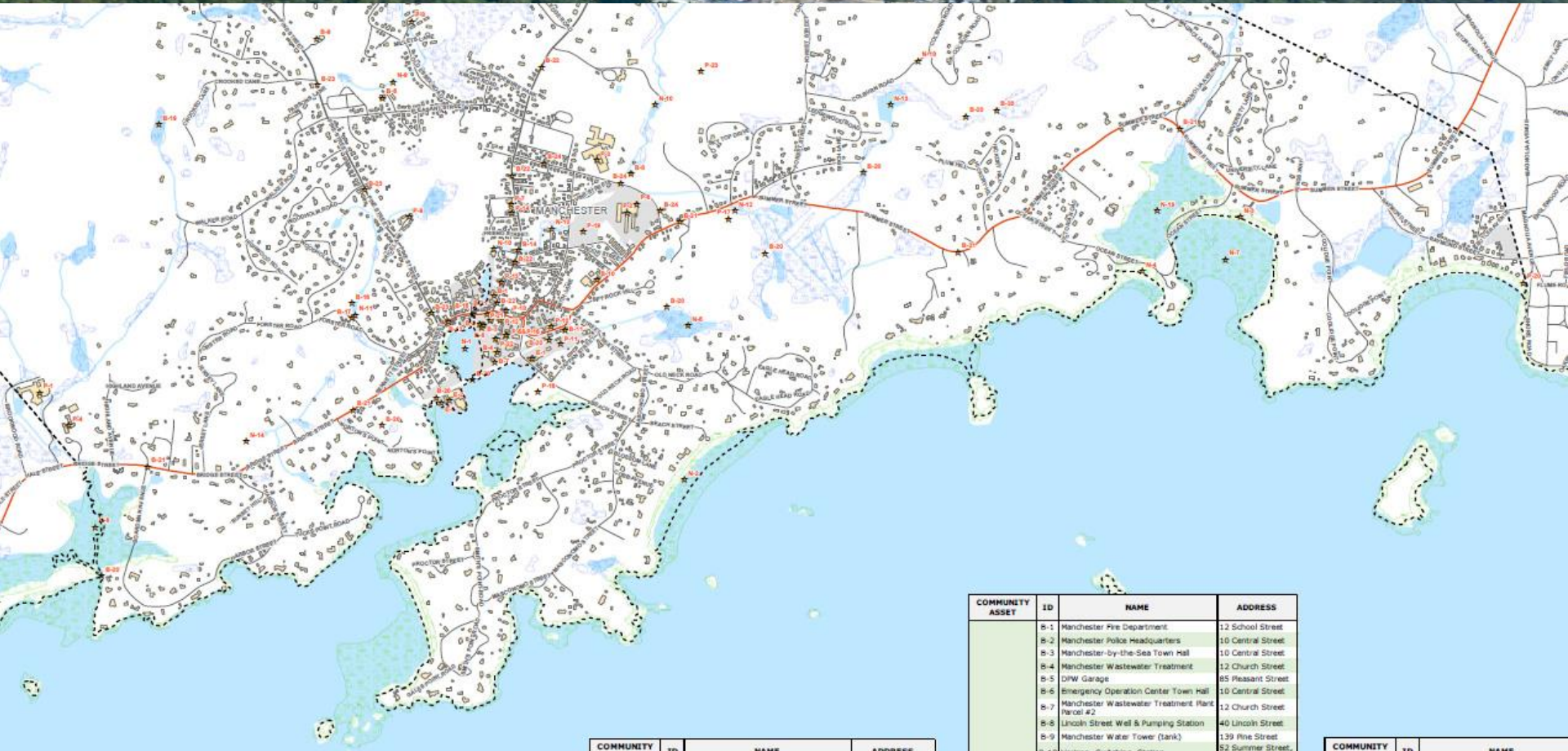
# Manchester-by-the-Sea

## Summary of Current Planning Efforts related to Hazard Mitigation

<b>Date of Plan</b>	<b>Status</b>	<b>Plan Name</b>	<b>Department Responsible</b>
2018	final	FEMA 5-year Hazard Mitigation Plan	Town Administrator
2018	ongoing	Master Plan (2018-2028)	Planning Department
2018	in progress	Sawmill Brook Restoration and Tide Gate Analysis	Conservation Department
2016	final	Sawmill Brook Culvert and Green Infrastructure Analysis	Conservation Department
2015	current	Comprehensive Emergency Management Plan	Police Department
2015	current	Comprehensive Wastewater Management Plan	Public Works Department
2015	final	Wastewater Treatment Plant Climate Resilience Evaluation Report	Public Works Department
2014	current	Open Space and Recreation 7-year Action Plan	Conservation Department
	yearly update	Capital Improvement Plan	Town Administrator
2010	final due 2018	Stormwater Management Plan	Public Works Department



# Community Assets



COMMUNITY ASSET	ID	NAME	ADDRESS
<b>Societal</b>	P-1	Brookwood Elementary School	1 Brookwood Road
	P-2	Manchester Memorial Elementary School	71 Lincoln Street
	P-3	Manchester Essex Regional Middle High School	36 Lincoln Street
	P-4	Landmark School	167 Bridge Street
	P-5	Magic Years Nursery School	3 Chapel Lane
	P-6	Hornet's After School Program	71 Lincoln Street
	P-7	Tara Montessori School	60 School Street
	P-8	The Plains Seniors Housing	The Plains Road
	P-9	Newport Park Seniors Housing	Newport Park Road
	P-10	Summer Street Apartments	12 Summer Road
	P-11	Manchester Community Center	Beach Street
	P-12	Manchester Public Library	15 Union Street
	P-13	First Baptist Church	20 School Street
	P-14	Sacred Heart Parish	58 School Street
	P-15	Congregational Chapel	Chapel Lane
	P-16	Masconomo Park	60 Beach St
	P-17	Sweeney Park	113 Summer St
	P-18	Manchester Historical Society	10 Union Street
	P-19	Coach Field Playground	Norwood & Brook
	P-20	Surf Park	Raymond Street
	P-21	First Parish Church	Town Common
	P-22	Manchester Masonic Bldg	26 Central street

COMMUNITY ASSET	ID	NAME	ADDRESS
<b>Infrastructural</b>	B-1	Manchester Fire Department	12 School Street
	B-2	Manchester Police Headquarters	10 Central Street
	B-3	Manchester-by-the-Sea Town Hall	10 Central Street
	B-4	Manchester Wastewater Treatment	12 Church Street
	B-5	DW Garage	85 Pleasant Street
	B-6	Emergency Operation Center Town Hall	10 Central Street
	B-7	Manchester Wastewater Treatment Park Parcel #2	12 Church Street
	B-8	Lincoln Street Well & Pumping Station	40 Lincoln Street
	B-9	Manchester Water Tower (Tank)	139 Pine Street
	B-10	Verizon Switching Station	52 Summer Street, Unit #
	B-11	National Grid	21 Summer Street
	B-12	Vulnerable USI's	
	B-13	Downtown Stormwater Drainage System	Central Street
	B-14	School Street Bridge	School Street
	B-15	Central Street Dam	Central Street
	B-16	Small Brook Dam	22 Forster Road
	B-17	Forster Road Dam	Forster Road
	B-18	Saw Mill Brook Dam	30 Mill Street
	B-19	Gorman Pond Dam	4 Old Wenham Way
	B-20	MBTA Tracks/Bridge	
	B-21	Route 127	
	B-22	School Street	
	B-23	Pine Street	
	B-24	Lincoln Street	
E-1	MBTA Station	Beach Street	
E-2	Manchester Marine	17 Ashland Ave	
E-3	Crocker's Boat Yard	15 Ashland Ave	

COMMUNITY ASSET	ID	NAME
<b>Environmental</b>	N-1	Manchester Harbor
	N-2	Singing Beach
	N-3	Black Beach (Barrier Beach)
	N-4	White Beach (Barrier Beach)
	N-5	Eaglehead Swamps and Ponds
	N-6	Chubb Creek and marsh
	N-7	Kettle Cove and Clark Pond
	N-8	Cat Brook
	N-9	Millet's Swamp and Brook
	N-10	Sawmill Brook
	N-11	Bennet's Brook and Marsh
	N-12	Causeway Brook
	N-13	Dexter Pond
	N-14	Winthrop Field
	N-15	Beaverdam Swamp
	N-16	Cedar Swamp
	N-17	Maple Swamp
	N-18	Long Hill Conservation Area

The information contained on this map related to potential extent of inundation due to climate change is based on publicly available data and best available science and is subject to change as new data become available. Information is being provided only to help understand extent of possible future risk, and not for the purposes of construction regulations, flood insurance, actual



MANCHESTER-BY-THE-SEA

Top Priority Hazards

4 HAZARDS

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

Features	Location	Ownership	V or S	Coastal Flooding: Sea Level Rise, Storm Surge, Coastal Erosion	Inland Flooding: Intense Precipitation, Erosion	Severe Weather - Extreme Temps & High Wind: hurricanes, nor'easters, blizzards, thunderstorms	Drought & Extreme High Temperature	Priority	Time
								H - M - L	Short Long Ongoing

**Infrastructural**

Manchester Town Hall, Police, Emergency Operations, Dispatch, Harbor Master	10 Central Street	Town	V	Evaluate and implement flood proofing; move vulnerable assets 3-feet above base flood level (BFE); flood proof doors, openings; elevate electrical, mechanical and communications systems; upgrade generator and relocate to higher ground.				H	O/S
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**ASSETS at RISK**

**ACTIONS**

				Evaluate long-range possibilities to include relocation or sea level rise/storm surge barrier in Manchester Harbor to protect multiple assets.				H	L
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Sawmill Brook Central Street Bridge, Central Pond, upstream culverts and bridges	Central Street	Town	V	Complete evaluations of hydrology, hydraulic restriction and deteriorating condition of bridge; then move forward with design, permitting and implementation. Implement Sawmill Brook restoration at Central Pond to preserve flood storage, improve habitat value and provide flood mitigation for adjacent properties.				H	O
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				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.				H	O
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Wastewater Treatment System (WWTP)	12 Church Street	Town	V	Given the 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.				H	O/L
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Manchester Harbor		Town, Private, State, Federal	S/V	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.				H	O/L
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Downtown Businesses		Private	V	Study effects of hardening: where seawalls and raised roads are needed and where softening - green infrastructure - may help; with this understanding, update zoning for more green infrastructure incentives; encourage relocation of utilities from basements and lower elevations.	Encourage stormwater reuse; promote native plantings that do not require irrigation.			H	O/L
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Downtown Stormwater System		Town	V	Retrofit as needed while promoting green stormwater infrastructure to reduce runoff and impervious surfaces; create more stormwater storage.	Encourage stormwater reuse; promote native plantings including trees that do not require irrigation.			H	O/L
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Fire Station	12 School Street	Town	S/V	Evaluate options and then flood proof; upgrade and relocate generator to higher ground; repair brook abutment; evaluate what conditions would require relocation.	Determine alternative water sources options.			M	O/L
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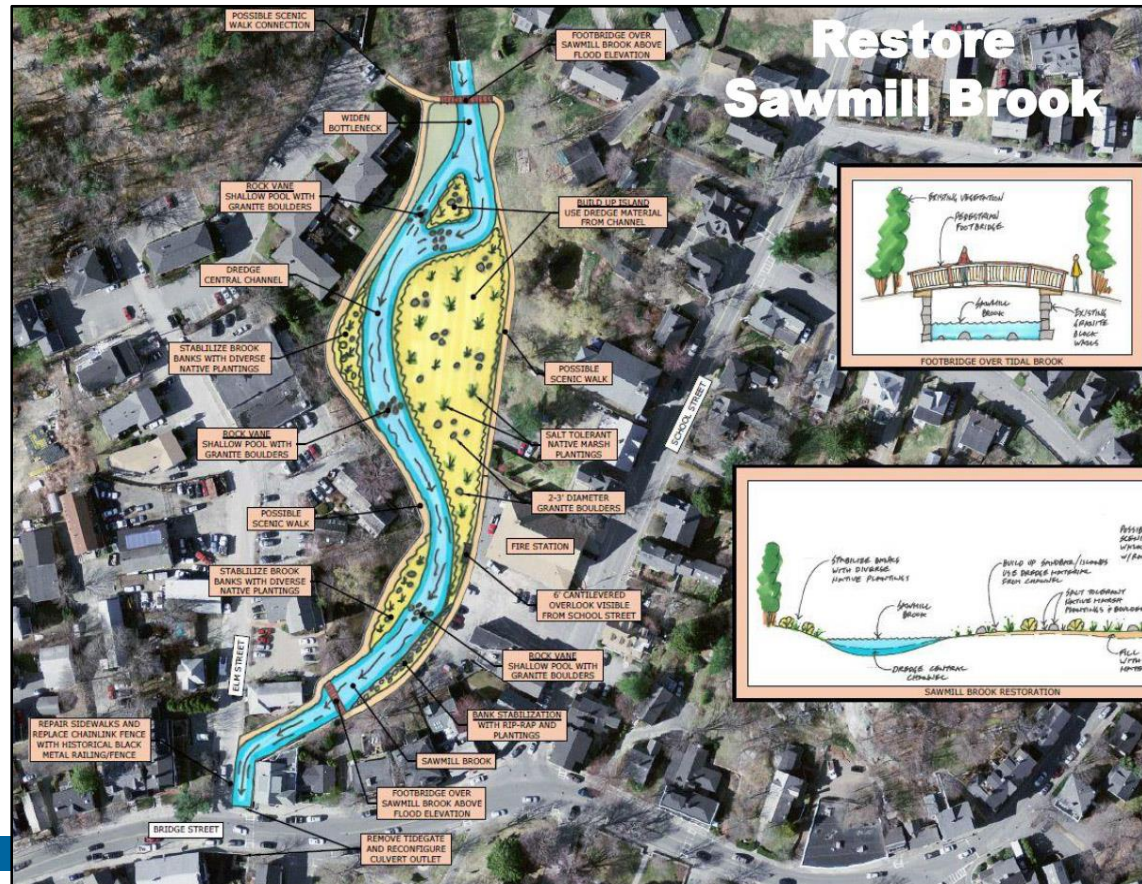
Drinking Water: Gravelly Pond, Round Pond, Lincoln Street Well	Chebacco Road, Hamilton; 40 Lincoln Street	Town	S/V	Conduct leak detection and maintain water mains; remove prohibited non-water supply activities from Zone A and Zone 1 when feasible.	Implement alternatives to municipal water use for irrigation; have water use restrictions in place with enforcement during droughts			M	O/L
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Roadways with Flood Risk		Town/State	V	Educate the public on evacuation routes; assess vulnerable roadways at risk of flooding to determine possible improvements: reinforcement, culvert sizing and elevation, e.g., how to keep Beach Street and Route 127 open; consider what happens if a road needs to be abandoned.	Conduct tree work to reduce storm damage.			H	O/L
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# Manchester-by-the-Sea's MVP Highest Priority Actions

- 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.





# Vulnerability Risk Assessments

## Central Street Bridge



*Central Street Bridge/Tidal Gate*



*2050 Sea Level Rise*



*2050 Storm Surge*

- Mitigate flooding on Central Street, lower School and Town Hall Parking
- Address deteriorating conditions of seawall under Central Street
- Improve fish passage for federally listed rainbow smelt



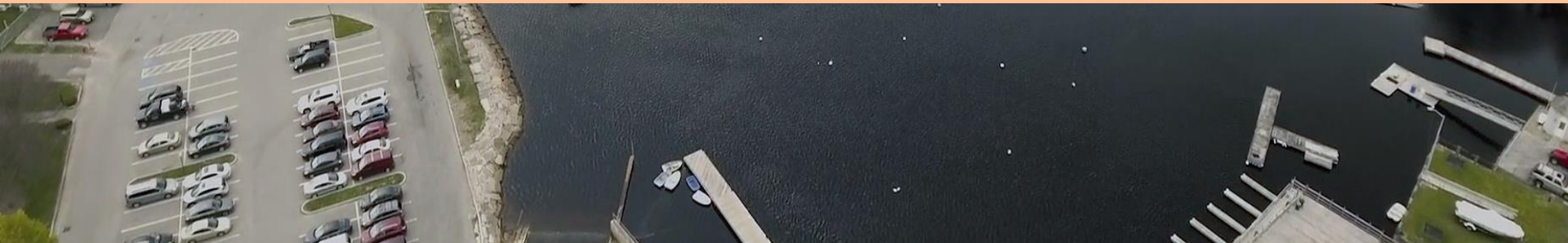






# Manchester-by-the-Sea's MVP Highest Priority Actions

- **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.
- **Increase Downtown resilience:** study effects of hardening: where seawalls and raised roads are needed and where softening - green infrastructure - may help; with this understanding, update zoning for more green infrastructure incentives; encourage relocation of utilities from basements and lower elevations.





# Manchester-by-the-Sea's MVP Highest Priority Actions

- 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 possibility of onsite WWTP in other areas of town.
- **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



March 2, 2018



# Vulnerability Risk Assessments Wastewater Treatment Facility



*Wastewater Treatment Plant*



*2050 Sea Level Rise*



*2050 Storm Surge*

- Provide uninterrupted treatment and be protected from damage due to climate change
- Protect all first floors, tank walls, and structural openings from 100-year flood damage
- Provide flood-proofing to one foot above 100-year flood level
- Protect critical facility equipment against damage 3 feet above 100-year flood level
- Maintain sufficient backup power for up to 3 days



# Manchester-by-the-Sea's MVP Highest Priority Actions

- **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.**





# Manchester-by-the-Sea's MVP Highest Priority Actions

- **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.
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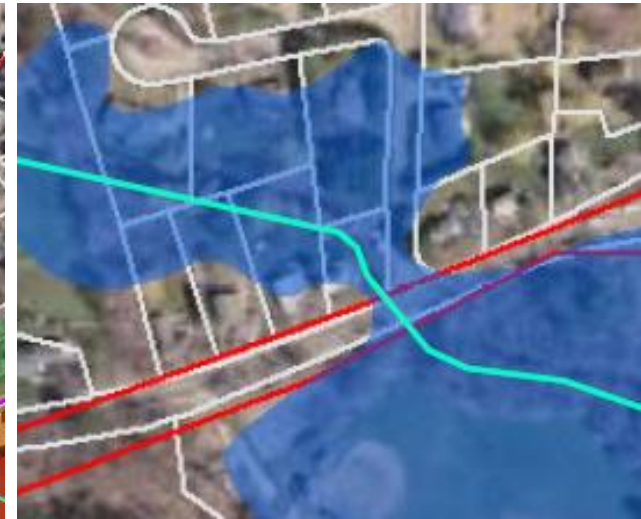
# Vulnerability Risk Assessments Route 127



*Storm Surge @ Chubs Creek*



*Storm Surge @ Bennett Brook*



*Upland Flooding @ Causeway Brook*

- Prevent flooding of Route 127 and mitigate damages
- Address potential roadbed undermining
- Address high groundwater and sea level rise impacts on drainage system
- Address sand/debris impacts on drainage system





# Manchester-by-the-Sea's MVP Moderate Priority Actions

- **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.
- **Encourage the State to 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 tank locations and elevate at least 3-feet above BFE.** Conduct toxics use reduction and business emergency preparedness planning to reduce risk.





# Manchester-by-the-Sea's MVP Moderate Priority Actions

- **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.





# Manchester-by-the-Sea's MVP Moderate Priority Actions

- **Plan for the resilience of Tuck's Point rotunda**, a "cultural icon".
- **Evaluate beach and salt marsh systems vulnerability**, understand beach erosion and landward migration to inform long-term policy.







# Manchester-by-the-Sea's MVP Moderate Priority Actions

- **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.**





# Manchester-by-the-Sea's MVP Lower Priority Actions

- **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, woodlands and houses.
- **Encourage protection, increase flood storage and buffers along brooks, and examine water use restrictions during droughts.**







# Contact Info Questions?

**We want to hear from you! Send an email with your ideas, thoughts, concerns by June 7 to**

**Mary Reilly, Grants Administrator**

- Phone: 978-525-6427
- Email: [reillym@manchester.ma.us](mailto:reillym@manchester.ma.us)



**JULY 2 – MVP Report posted on Town website.**

**Barbara Warren, Salem Sound Coastwatch Executive Director, MVP Provider**

- Phone: 978-741-7900
- Email: [barbara.warren@salemsound.org](mailto:barbara.warren@salemsound.org)

***State and local partnership to build resiliency to climate change***

1. Engage  
Community

2. Identify CC  
impacts and  
hazards

3. Complete  
assessment of  
vulnerabilities  
& strengths

4. Develop  
and prioritize  
actions

5. Take Action