Collins Cove to Willows Resilience Study

Workshop #2

February 27, 2023

RESILIENT TOGETHER

OUR BRIDGE TO A STRONGER TOMORROW

Salem Sound COASTWATCH

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WELCOME AND INTRODUCTION

Agenda

- Purpose of Workshop
- Overview of Collins Cove to Willows Resilience Study and Recap of Workshop #1
- Vulnerability and Risk Assessment Update and Preliminary Results
- Possible Resilience Options
- Emergency Response Plan Update
- Resilience Priorities
- Next Steps

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Salem Sound COASTWATCH

Purpose of Workshop

- Provide an update on the Study
- Share preliminary results from coastal and inland flooding vulnerability assessment
- Identify possible flood mitigation and climate adaptation options for the project area, and seek input from what you would like to see
- Interactive polls to inform and provide input for the next phase of the Study

Juniper Beach during December 23, 2022 storm

Why this Project?

Study area vulnerable to flooding:

Coastal

- Sea level rise (tides)
- Storm surge (wind)

Rainfall (aka stormwater or inland)

Coastal and rainfall together

This project is being funded in large part by a Municipal Vulnerability Preparedness (MVP) program Action Grant through the MA Executive Office of Energy and Environmental Affairs.

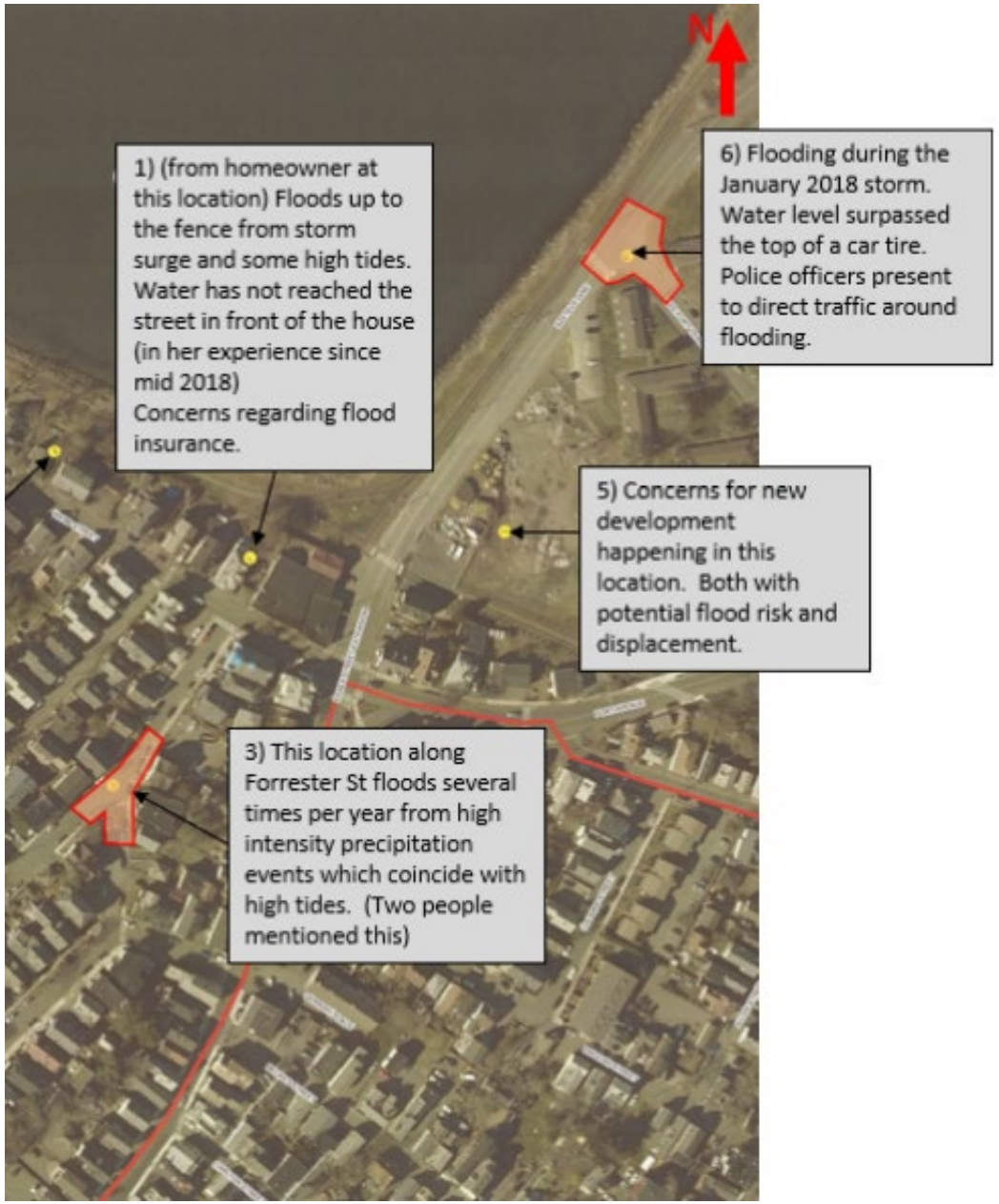
Project Objectives

- Assess flooding vulnerability and risk - now and future
- Find opportunities on city property for resilient measures
- Develop an emergency response and evacuation plan
- Create an implementation plan to increase resilience

For details, please visit Salem's Public Input page.
In your browser type "Salem Public Input" to find the **Salem, MA Engagement Hub** then scroll to Collins Cove to Willows Resilience Study

Recap of Workshop #1

- Main objective: Introduce study and collect feedback on current vulnerabilities, risks, and ideas for solutions
- Breakout stations for the following study area neighborhoods:
  - Bridge Street / East Collins Street
  - Webb Street / Common
  - Szetela Lane
  - Willows
  - Winter Island
- Participants identified areas where there has been observed flooding and shared general concerns and/or solutions



Poll Question #1:

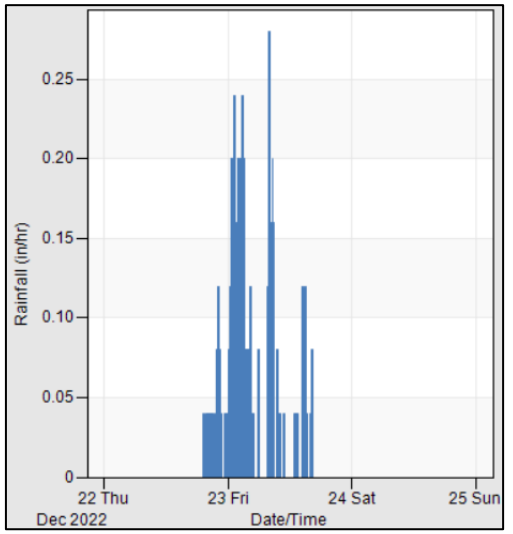
What neighborhood are you from?

Vulnerability and Risk Assessment Update and Preliminary Results: Existing Conditions

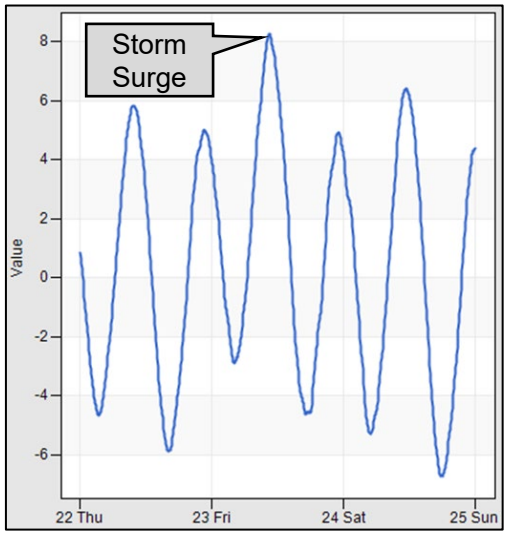
SWMM Model Development

- The model has been created with the goal of predicting current day flooding due to precipitation, astronomical high tides, and storm surge through mathematical equations which calculate a hydrologic (water on land) and hydraulic (flow through pipes) responses
- The model represents the City's existing drainage infrastructure (manholes, pipes, outfalls...), topography, and climate conditions (rainfall, tide cycles, storm surge)
- Model inputs (rainfall, tides) were downloaded from USGS and NOAA data sources
- Information used for model verification:
  - Resident input from the first public meeting
  - Field observations from the December 23, 2022, storm event
  - Additional information gathered during this meeting

Existing Conditions (EC) Model – December 23, 2022

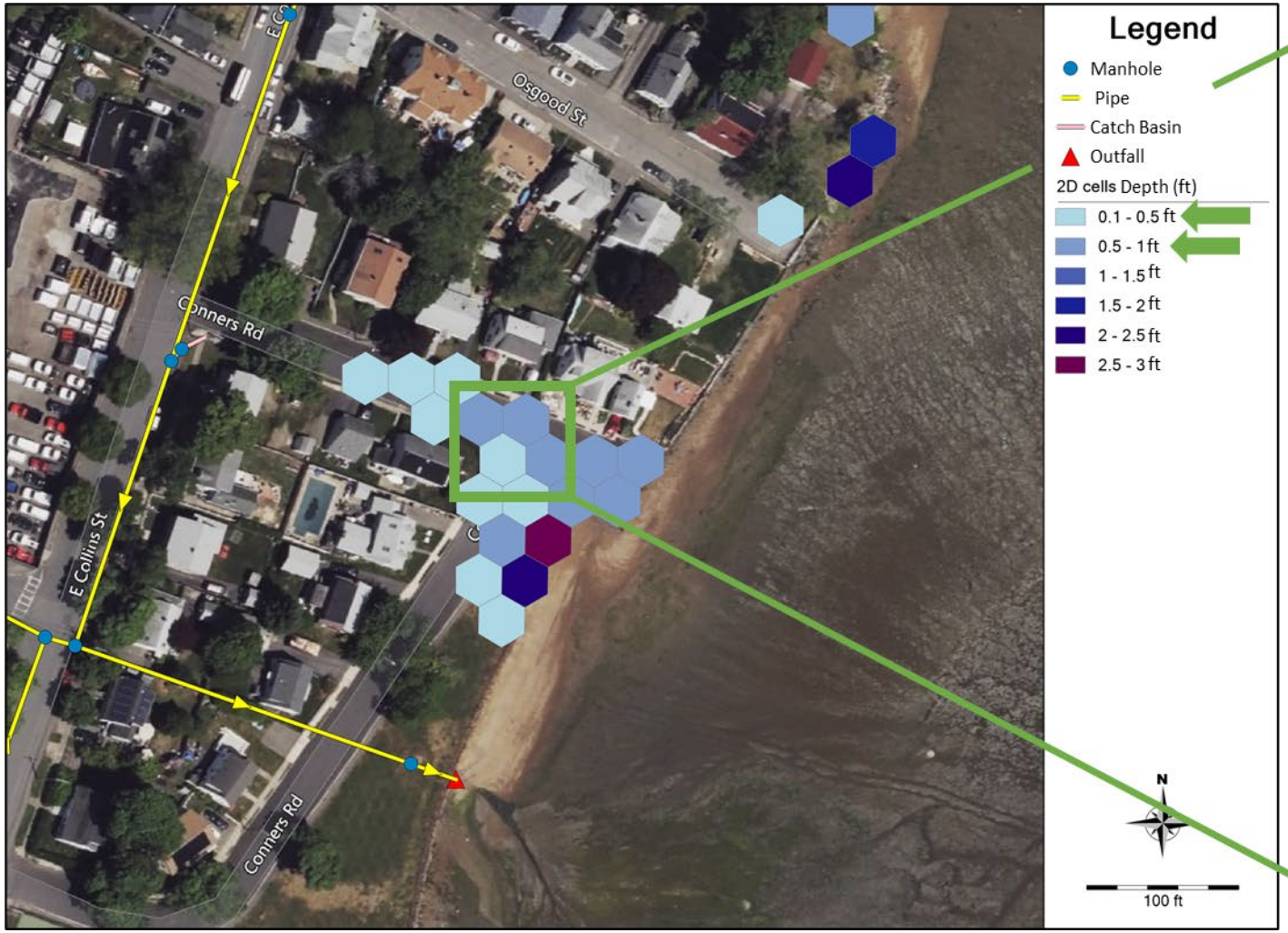


Measured Precipitation (1.35 in – 0.28 in/hr)

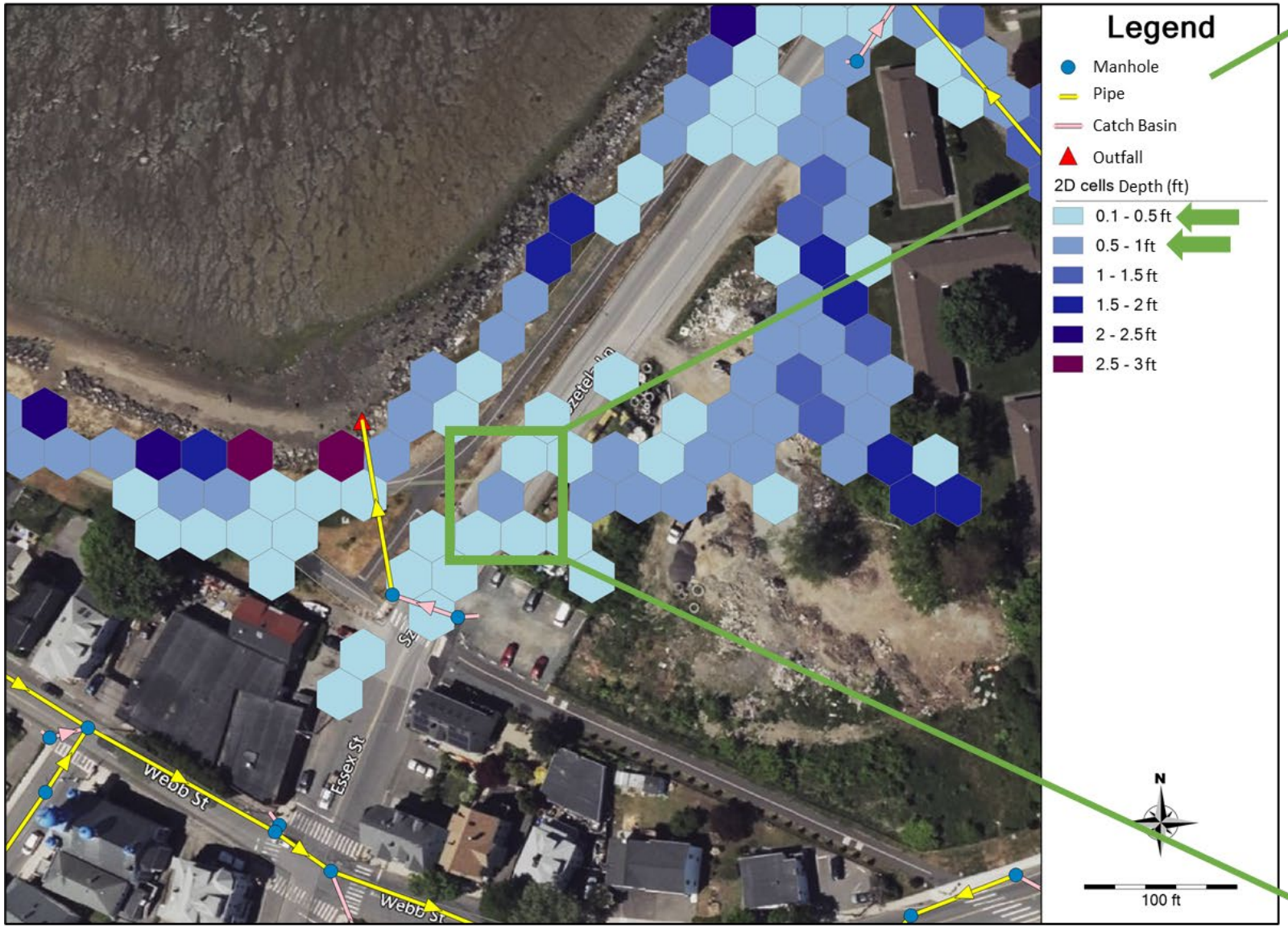


Measured Coastal Boundary Condition

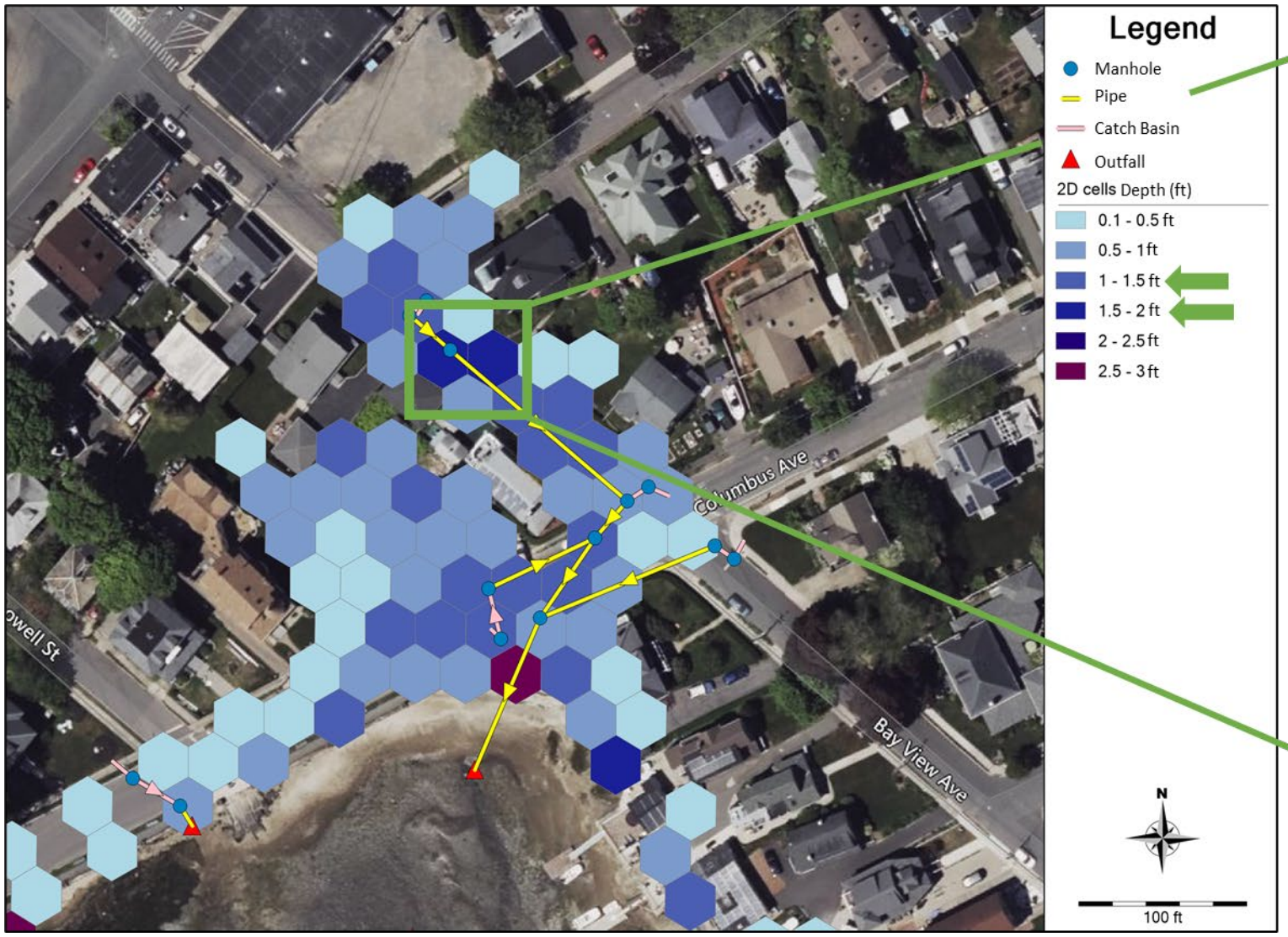
EC Model – Conners Road – December 23, 2022



EC Model – Webb Street and Szetela Lane – December 23, 2022

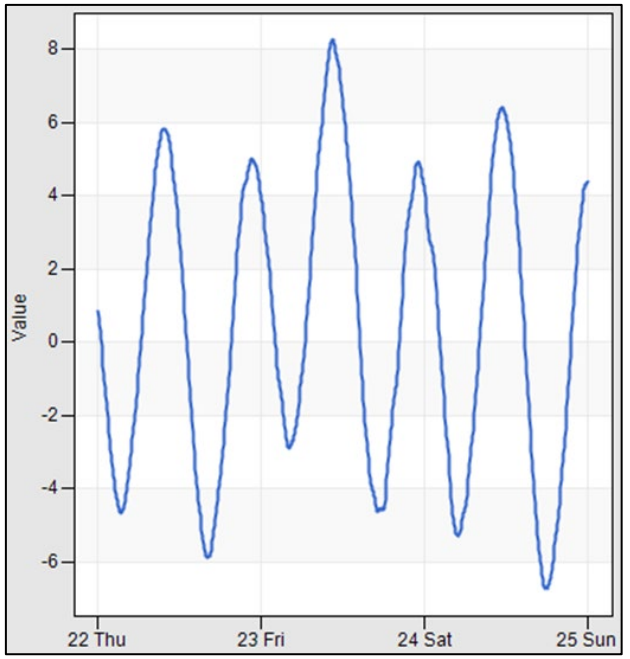


EC Model – Bay View Ave and Columbus Ave – December 23, 2022



Modeling Limitations

Observed Splash Overtopping Wall



Model Coastal Boundary Condition (NOAA)

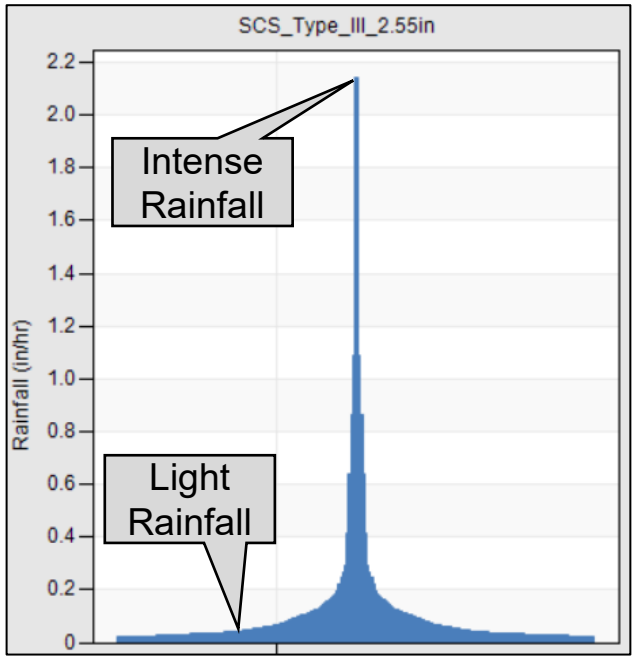
- While observed conditions at Juniper Beach consist of wave runup and splash overtopping the wall, the model doesn't reproduce this phenomenon.
- The model input is derived from NOAA data which is available in a 6-minute time increment.
- NOAA tidal gauges are located in deeper water and subject to less substantial wave action.

Poll Question #2a:

Do you think the present-day coastal driven flooding shown by this model is consistent with your general experience?

(Note: If your response is "No," please tell us why in the Q&A or during the discussion at the end of the workshop.)

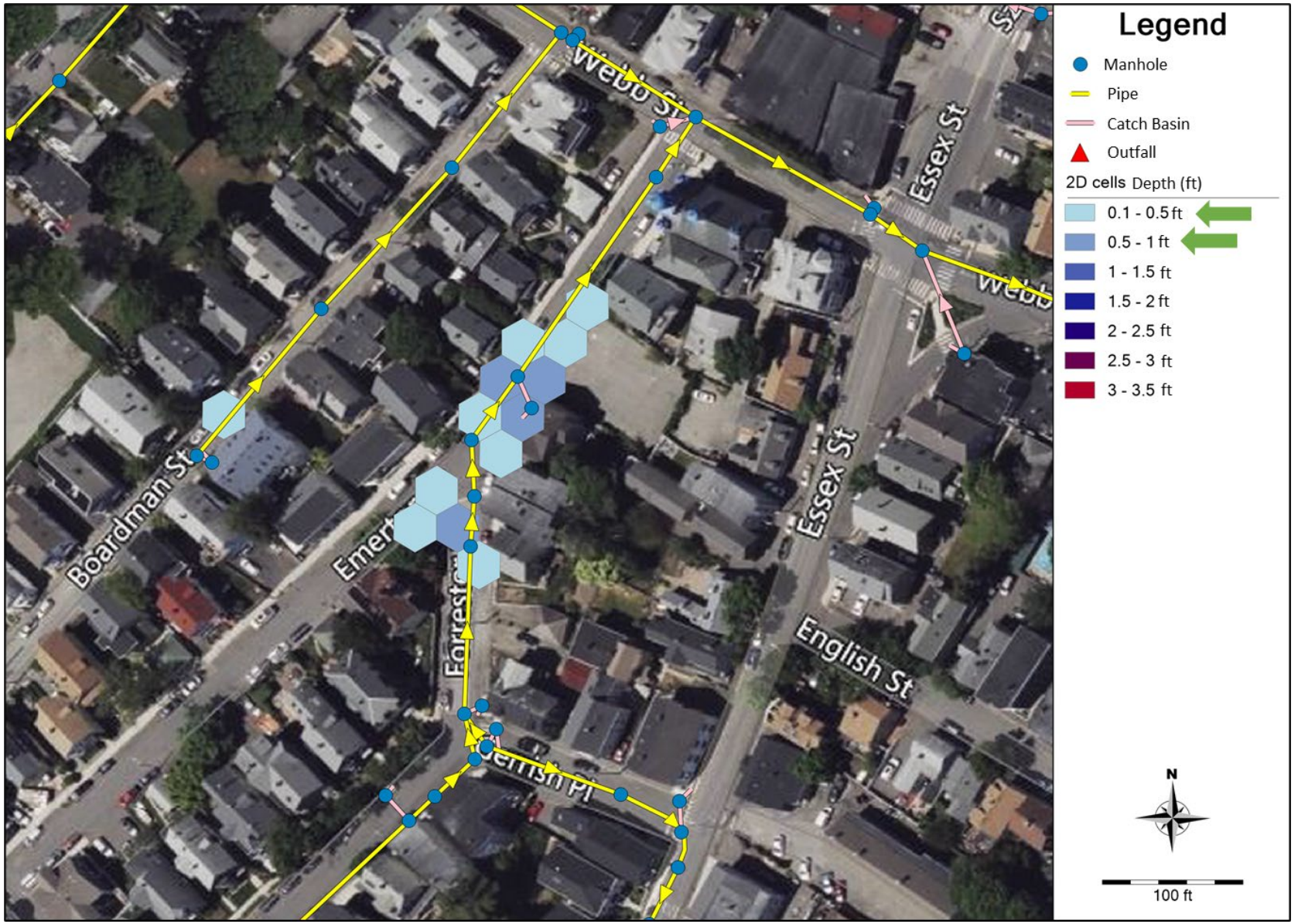
$\overline{\text{EC}}$ Model – 1-year 24-hour Rainfall Event – Average Tide Conditions



Rainfall Characteristics:
Depth: 2.55 in
Intensity: 2.14 in/hr

The peak of the rainfall occurs during an average tidal condition to assess the drainage infrastructure's ability to convey water without coastal impacts.

EC Model – Rainfall Event – Forrester Street



EC Model – Rainfall Event – Bridge Street

EC Model – Rainfall Event – Bay View Ave and Columbus Ave

Poll Question #2b:

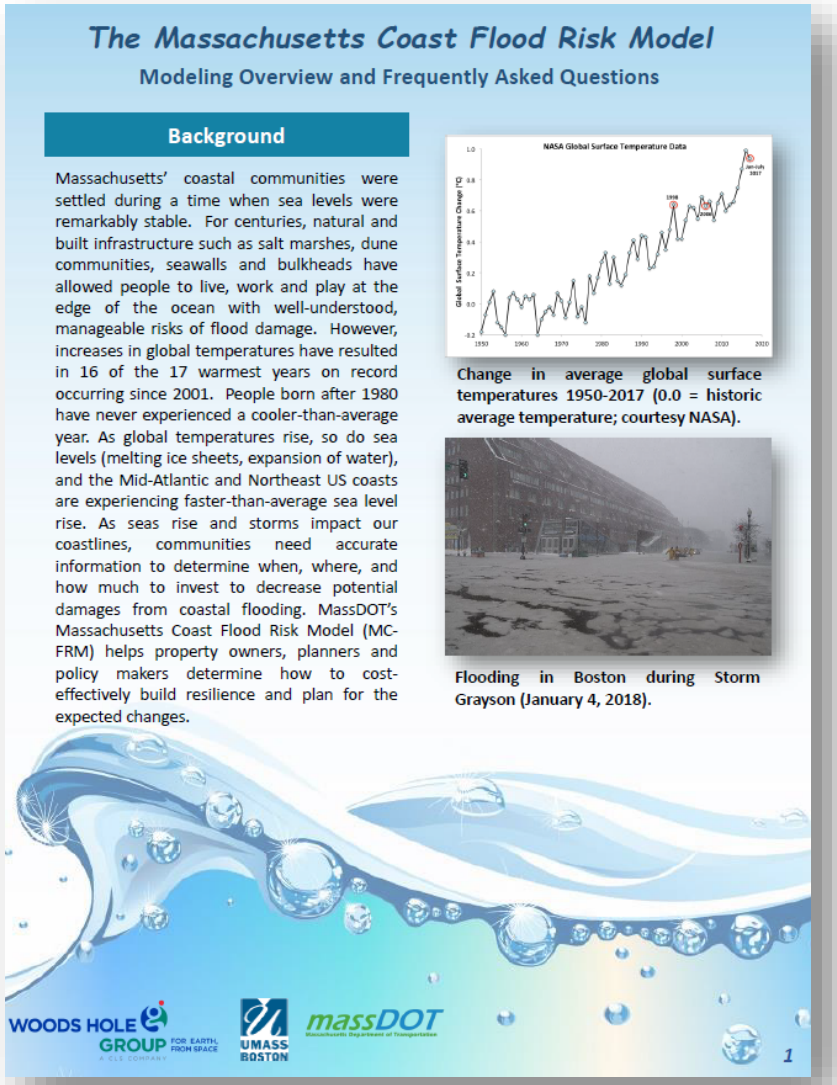
Do you think the present-day rainfall driven flooding shown by this model is consistent with your general experience?

(Note: If your response is "No," please tell us why in the Q&A or during the discussion at the end of the workshop.)

Vulnerability and Risk Assessment Update and Preliminary Results: Future Conditions

Introduction to the Massachusetts Coast Flood Risk Model (MC-FRM)

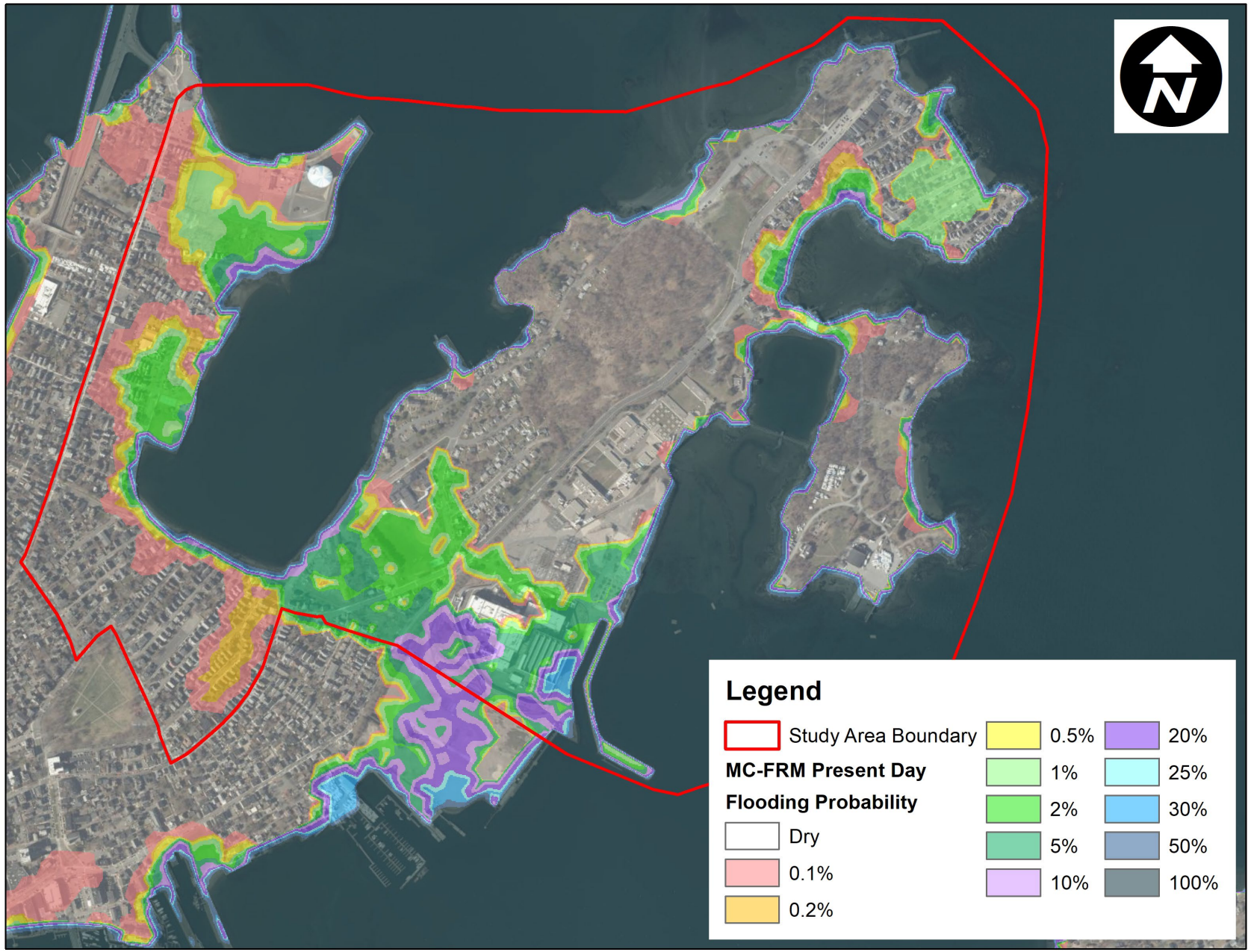
- Considered the best available coastal modeling that is readily available for the entire coastline of the state
- Use of MC-FRM data for climate adaptation planning is encouraged by the State
- Probabilistic model where results are derived by simulating thousands of storms (hurricanes, nor'easters) and accounts for sea level rise
- It DOES NOT include flooding caused by rainfall that does not drain adequately to a water body
- Results available for Present Day, 2030, 2050, and 2070
- Has been used for other resilience projects in Salem, and is being used for the coastal flooding analysis for this study



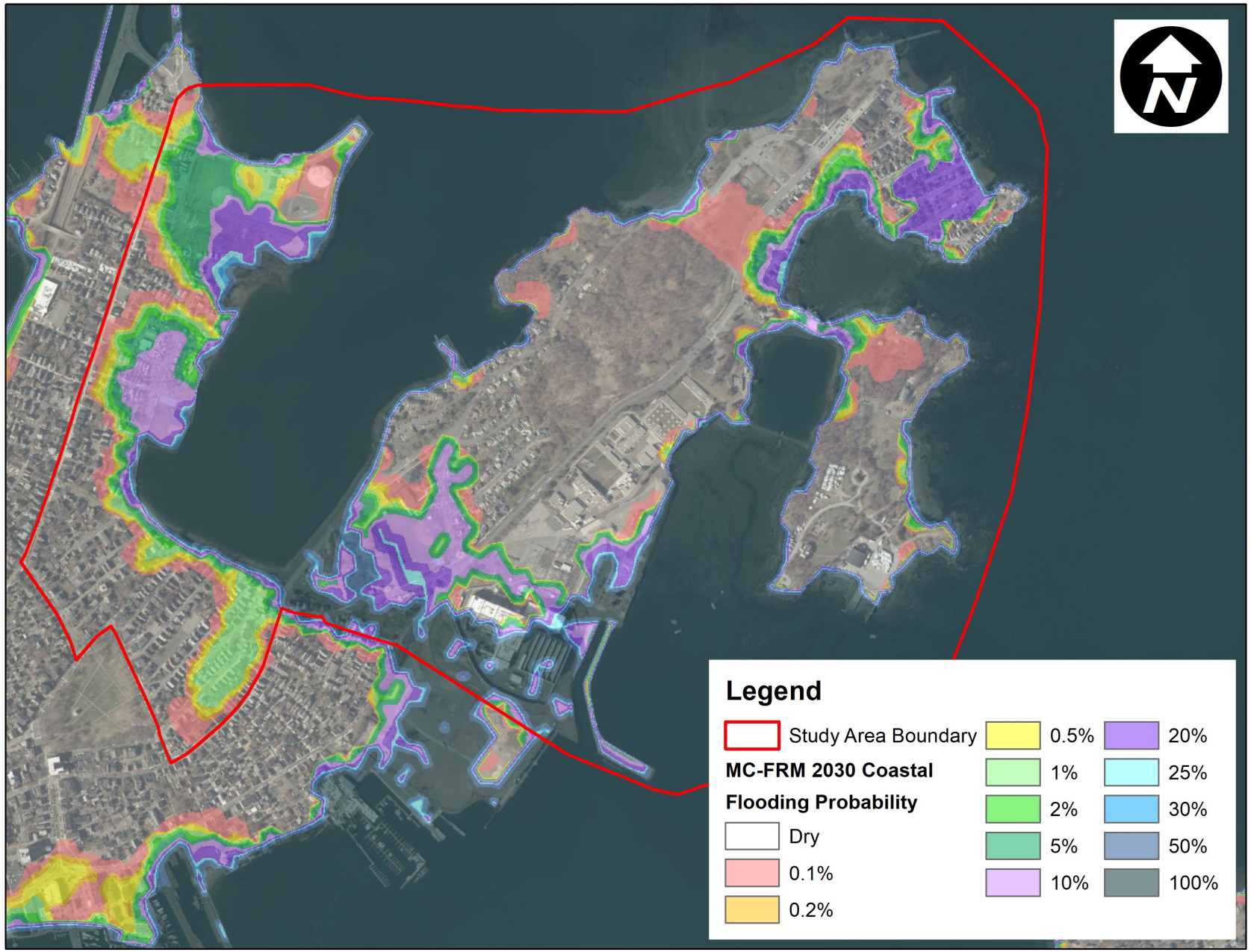
MC-FRM Annual Coastal Flood Exceedance Probabilities

- Defined as the probability of flood water inundating the land surface at a particular location
  - High probability areas are at greater coastal flood risk
  - Low probability areas are less likely to be inundated by a coastal flood event
- Example: A building located within the 2% coastal flood exceedance probability zone would have 2% chance (50-year return period) of flooding
- In other words, this location has a 2% chance of being flooded during a coastal storm in any given year

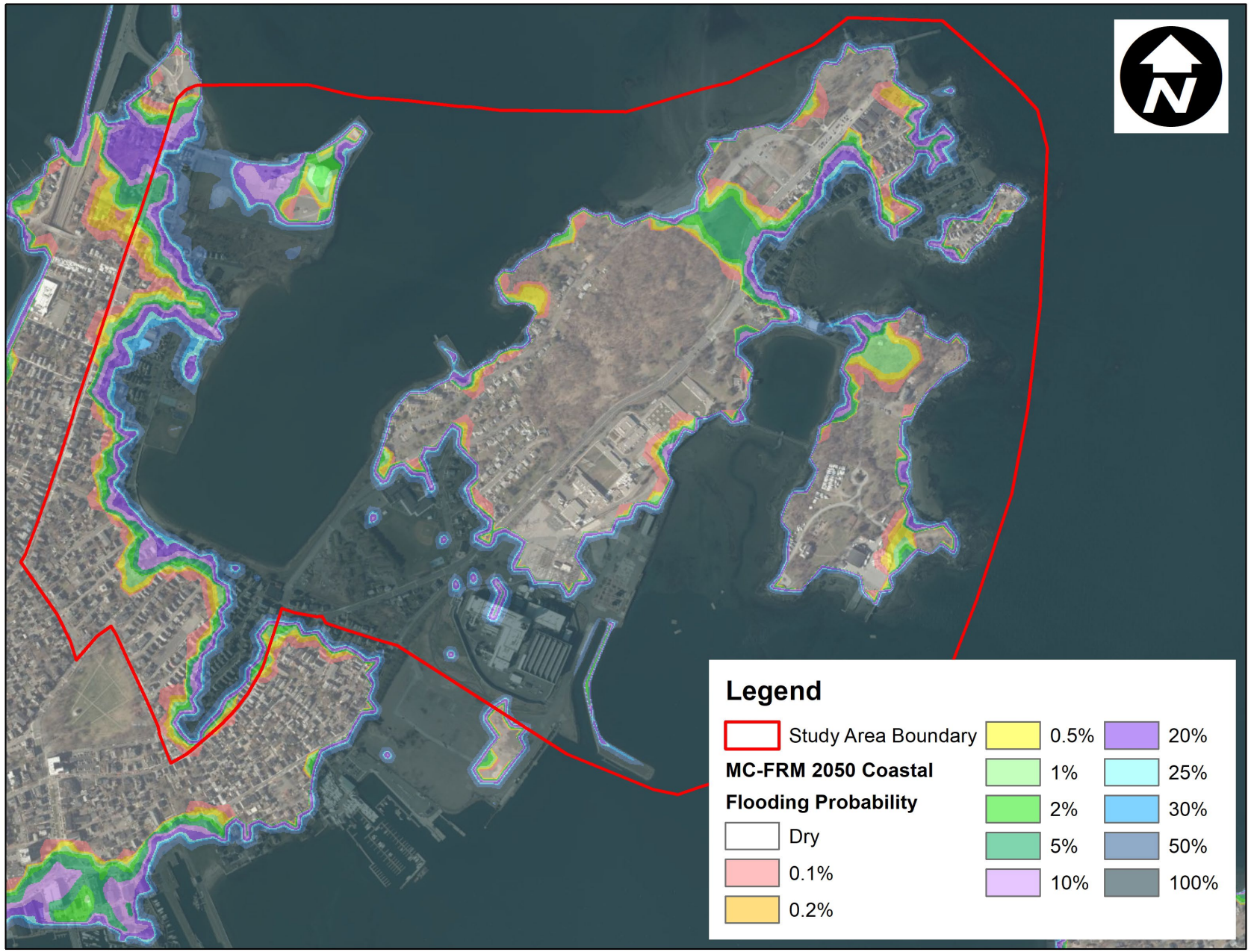
Present Day Annual Probability of Flooding



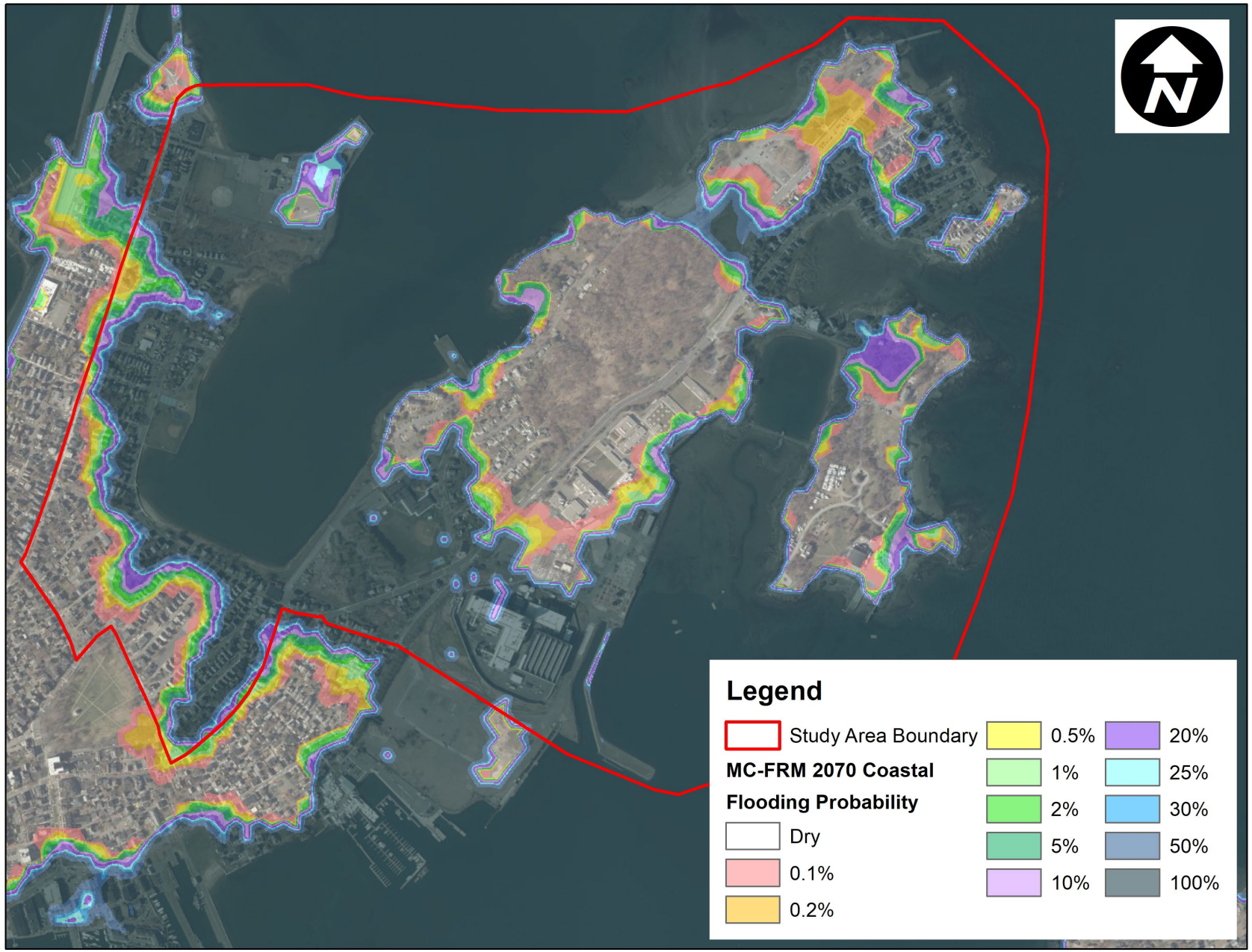
2030 Annual Probability of Flooding



2050 Annual Probability of Flooding



2070 Annual Probability of Flooding



MC-FRM Design Flood Elevations

- Part of a “Level 2” MC-FRM data release
- Represent Maximum Wave Crest Elevation values for 2030, 2050, and 2070
- A more accurate version of MC-FRM coastal flooding depth data to support planning and design efforts
- Available for six annual exceedance probability levels ranging from 0.1% to 5%
- Does not account for “freeboard”
- The MC-FRM is based on the sea level rise scenario corresponding to the high emissions scenario Representative Concentration Pathway (RCP) 8.5 scenario (i.e., conservatively high)
  - 1.2 feet by 2030
  - 2.4 feet by 2050
  - 4.2 feet by 2070

Key Flooding Locations

Key Flooding Location: Connors Road

Key Flooding Location: Webb Street and Szetela Lane

Key Flooding Location: Bay View Avenue and Columbus Avenue

Possible Resilience Options

- Developing a toolkit of resilience options that can be implemented for coastal parks
- Will serve as a resource for future climate resilience projects for Salem and other coastal municipalities
- Identifies key design components for each option and a case study
- Organized into four sections:
  1. Non-structural measures
  2. Stormwater management
  3. Nature-based shoreline protection
  4. Structural flood risk reduction measures
- Resilience options for buildings and roads are not included, but will be discussed in the overall project report

Thirteen coastal public spaces are located within the study area

Poll Question #3:

How do you use the public spaces in the project area? What functionality do you not want to lose as a result of projected flooding or proposed adaptation measures?

(Note: If your response is "Other," please tell us in the Q&A.)

Non-Structural Measures

“Measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education” (United Nations Office for Disaster Risk Reduction, n.d.)

Land Acquisition

Open Space Preservation

Public Education

Stormwater Management

Onsite Flood Storage
(Above Ground)

Permeable Surfaces

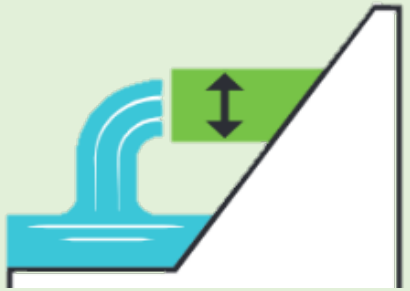
Rain Gardens

CULTEC, Inc.

Onsite Flood Storage
(Below Ground)

Red Valve Company, Inc.

Backflow Prevention

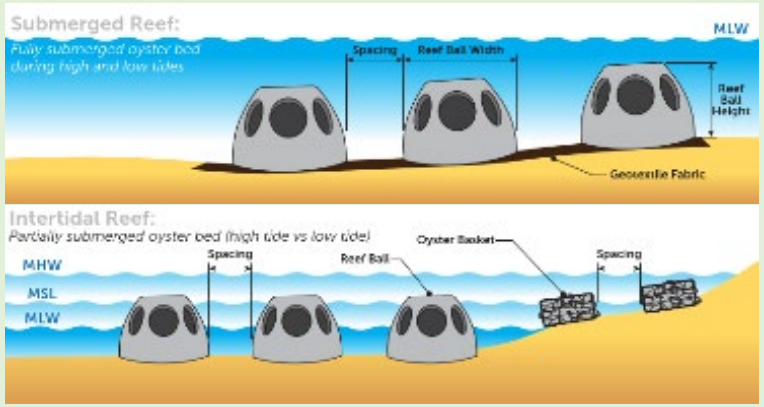


Increased Stormwater
Pipe Capacity

Bioretention Basin

Nature-Based Shoreline Protection

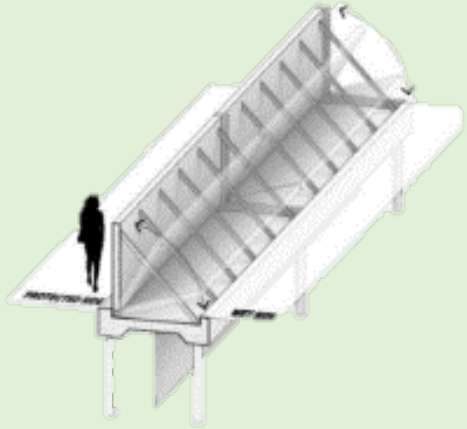
Vegetated Living Shorelines



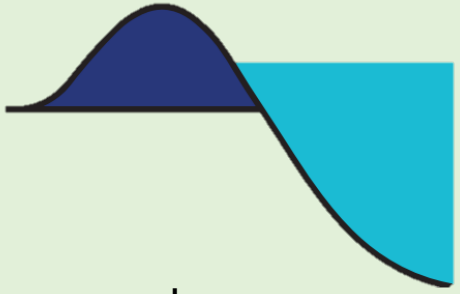
Oyster Reef Enhancement

Beach/Dune Restoration

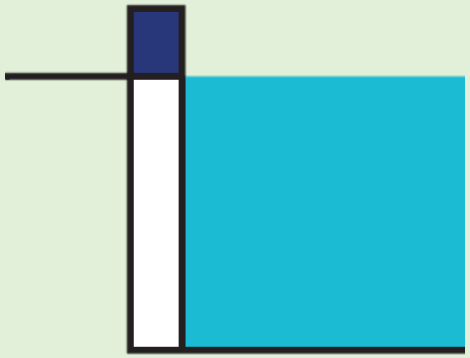
Structural Flood Risk Reduction Measures



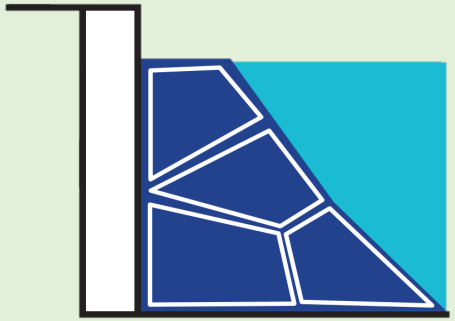
Deployable Barriers



Levee



Bulkhead Or Seawall:
Construction Or Raising



Revetment

Poll Question #4:

What resilience options do you like and are you interested in seeing in the project area?

(Note: You can select more than one option. Expand in the Q&A if you have thoughts on specific locations in the project area.)

Emergency Response Plan Update

- Salem has Comprehensive Emergency Management Plan (CEMP) that is at a citywide-scale
- An extreme weather emergency response plan is being prepared as part of this project
- Will be tailored to the project area and complement the CEMP
- Will look at how projected flooding conditions might impact evacuation routes

Considering the entire project area is within a hurricane evacuation zone, it is critical that proper preparation is in place

Poll Question #5:

What resilience issue is most important to you?

(Note: Expand in the Q&A if you have thoughts on specific locations in the project area.)

Next Steps

- **Walk & Talk:** Saturday, March 18th @ 9:30 am
  - Collins Cove, meet at Bentley School

- **Walk & Talk:** Sunday, April 16th @ 4:00pm
  - Which study area would you like us to highlight next? Please put your "vote" in the Q&A.

- **Future Events this Spring:**
  - Collins Cove Living Shoreline planting
  - Winter Island Rain Garden clean up
  - Pop-up events

- **Interviews:**
  - Please reach out to SSCW (info@salemsound.org) if you'd like to be part of our stakeholder interviews!

Poll Question #6:

Which option would you prefer for Workshop #3, which will be held in May 2023?

THANK YOU FOR YOUR PARTICIPATION!

Please post questions in the Q&A

Remember to share comments & photos on:

publicinput.com/CollinsCove2Willows