Welcome

Weston & Sampson

neponset river
WATERSHED ASSOCIATION

MAPC
METROPOLITAN AREA PLANNING COUNCIL

MVP
Municipal Vulnerability Preparedness

Neponset River Watershed Regional Climate Adaptation Strategy and Flood Model

Flood Meeting #1

12.19.2022

MVP
Municipal Vulnerability Preparedness

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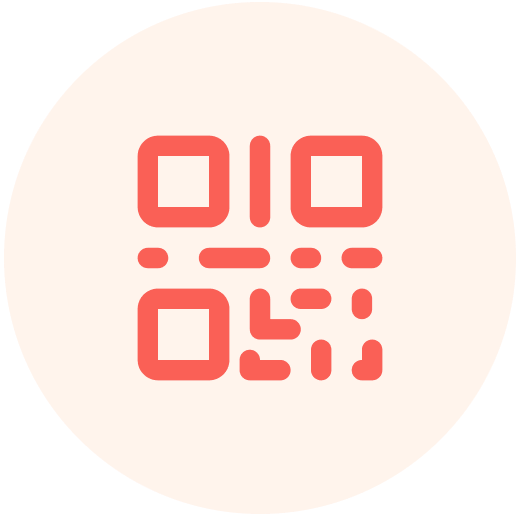

Join at slido.com
#NEPRWA

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Agenda

1:00	Welcome & Introduction *NepRWA and Weston & Sampson*
1:05	Update on Model Development *Indrani Ghosh, Resilience Senior Technical Leader, Weston & Sampson*
1:15	Reported Flood Issues in the Watershed *Jennie Moonan, Senior Project Manager, Weston & Sampson*
1:35	Discussion on Future Climate Scenarios *Indrani Ghosh, Resilience Senior Technical Leader, Weston & Sampson*
1:55	Flood Mitigation Strategies *Jennie Moonan, Senior Project Manager, Weston & Sampson*
2:15	Next Steps & Action Items *Kerry Snyder, Advocacy Director, Neponset River Watershed Association*
2:20	Last Questions & Discussion *NepRWA and Weston & Sampson*
2:30	Adjourn

Project Team and Partners

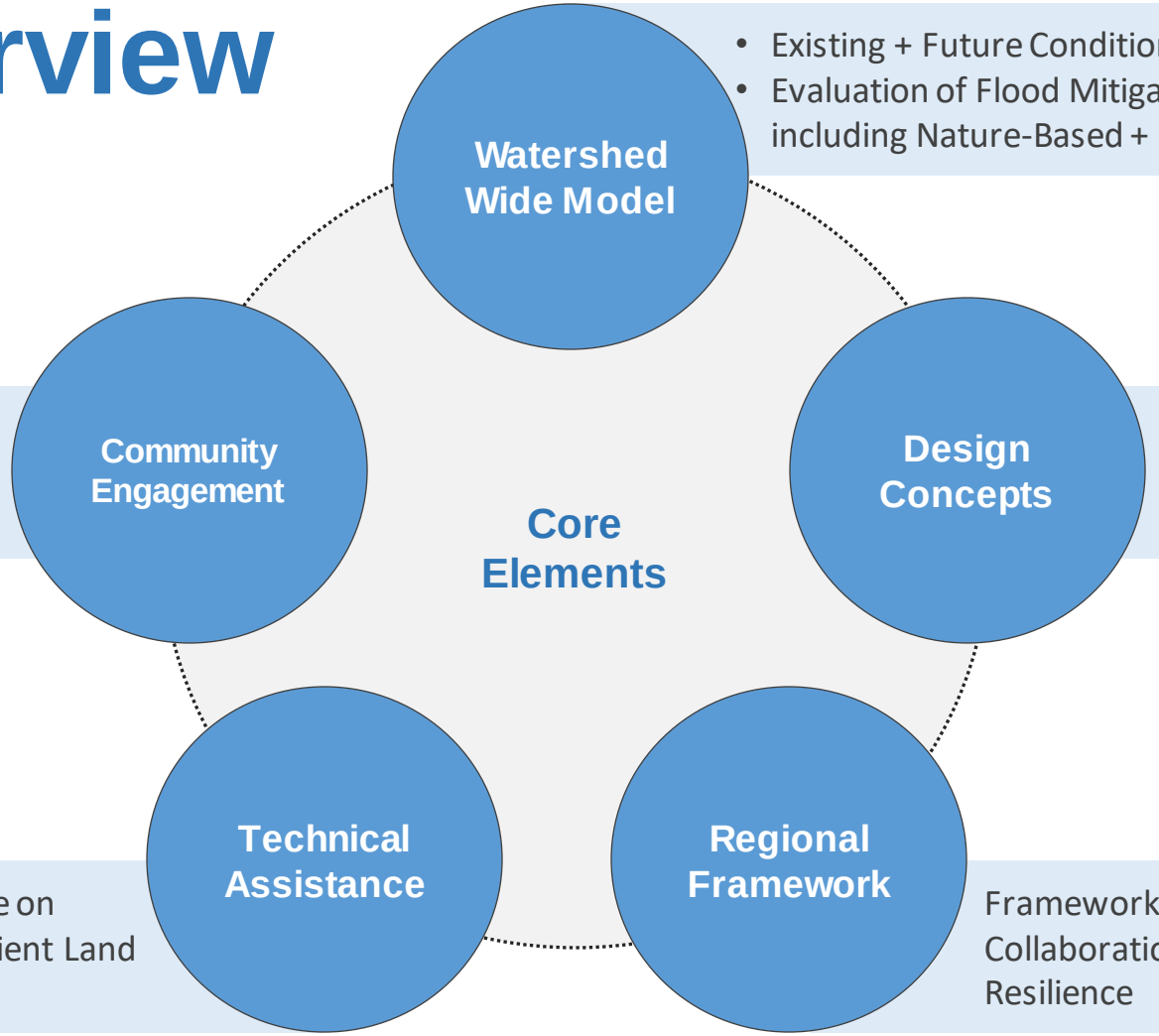
Project Team

- Neponset River Watershed Association
- Weston & Sampson Engineering
- Metropolitan Area Planning Council

Project Partners

- **Town of Dedham-Fiscal Agent**
- City of Boston
- Boston Water & Sewer Commission
- Town of Canton
- Town of Foxborough
- Town of Medfield
- Town of Milton
- Town of Norwood
- City of Quincy
- Town of Sharon
- Town of Stoughton
- Town of Walpole
- Town of Westwood

Project Overview & Status



- Existing + Future Conditions
- Evaluation of Flood Mitigation Solutions including Nature-Based + Regional

- Schools
- Environmental Justice Communities
- Stakeholders

Dedham's Manor Neighborhood

Technical Assistance on MAPC Climate Resilient Land Strategies

Framework for Regional Collaboration on Climate Resilience

Project Goals

Develop a climate planning tool consistent with the region (Charles and Mystic watersheds and Boston are ahead)

Develop shared understanding around future climate impacts and what to plan/regulate for

Engage watershed residents, particularly the climate vulnerable, in watershed scale planning

Provide Dedham with solutions in a targeted area & share lessons with partners

Strategizing together for long-term watershed-based collaboration

Update on Model Development

Indrani Ghosh, PhD

Resiliency Senior Technical Leader, Weston & Sampson

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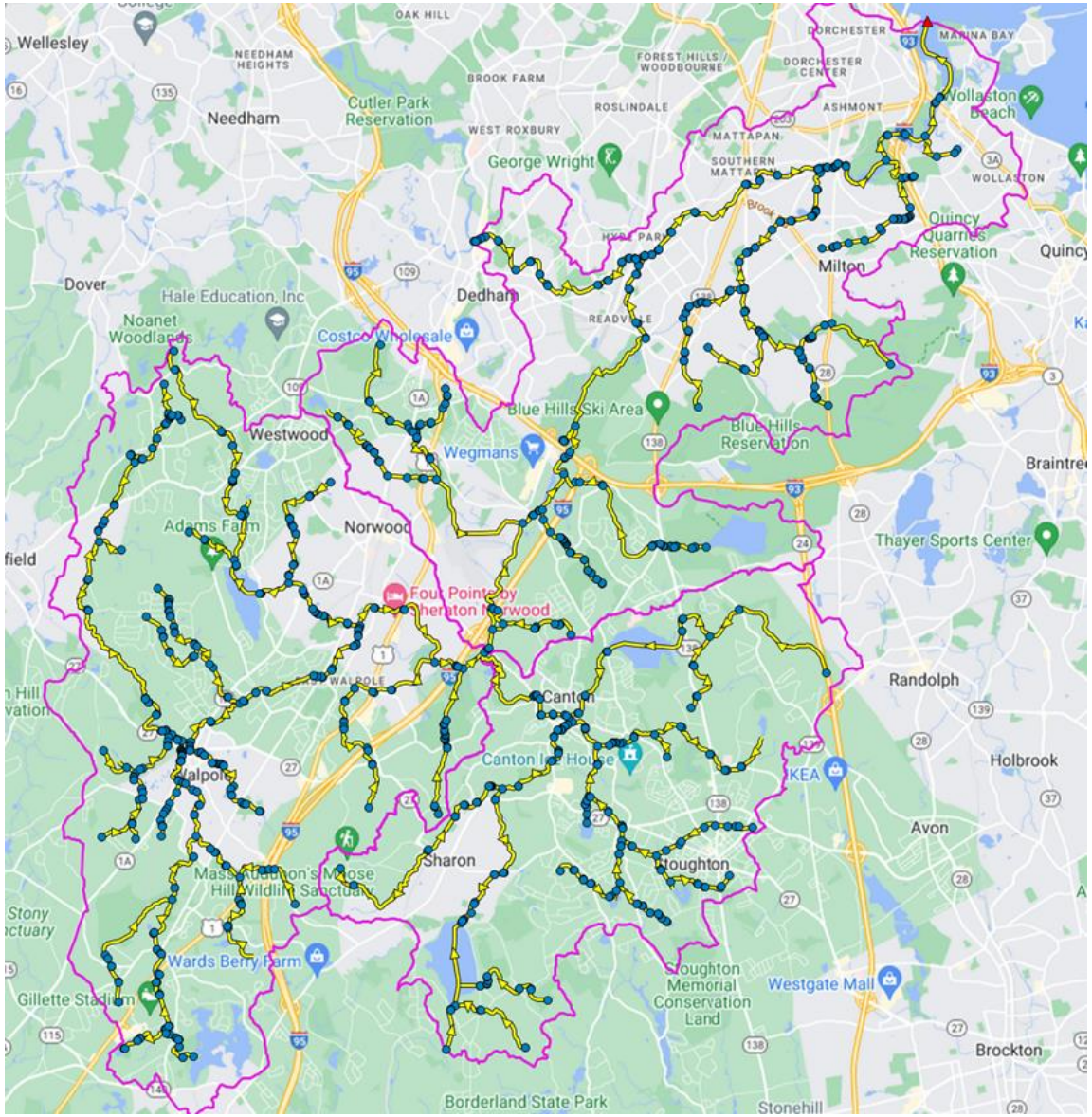
Work in Progress – Draft for Discussion

Preliminary Model Overview

- Area: 117.2 square miles
- Main Stem River: 157,000 linear feet
- Tributaries: 594,000 linear feet
- Conduits/pipes: 811,000 linear feet
- 50 dams
- 388 culverts

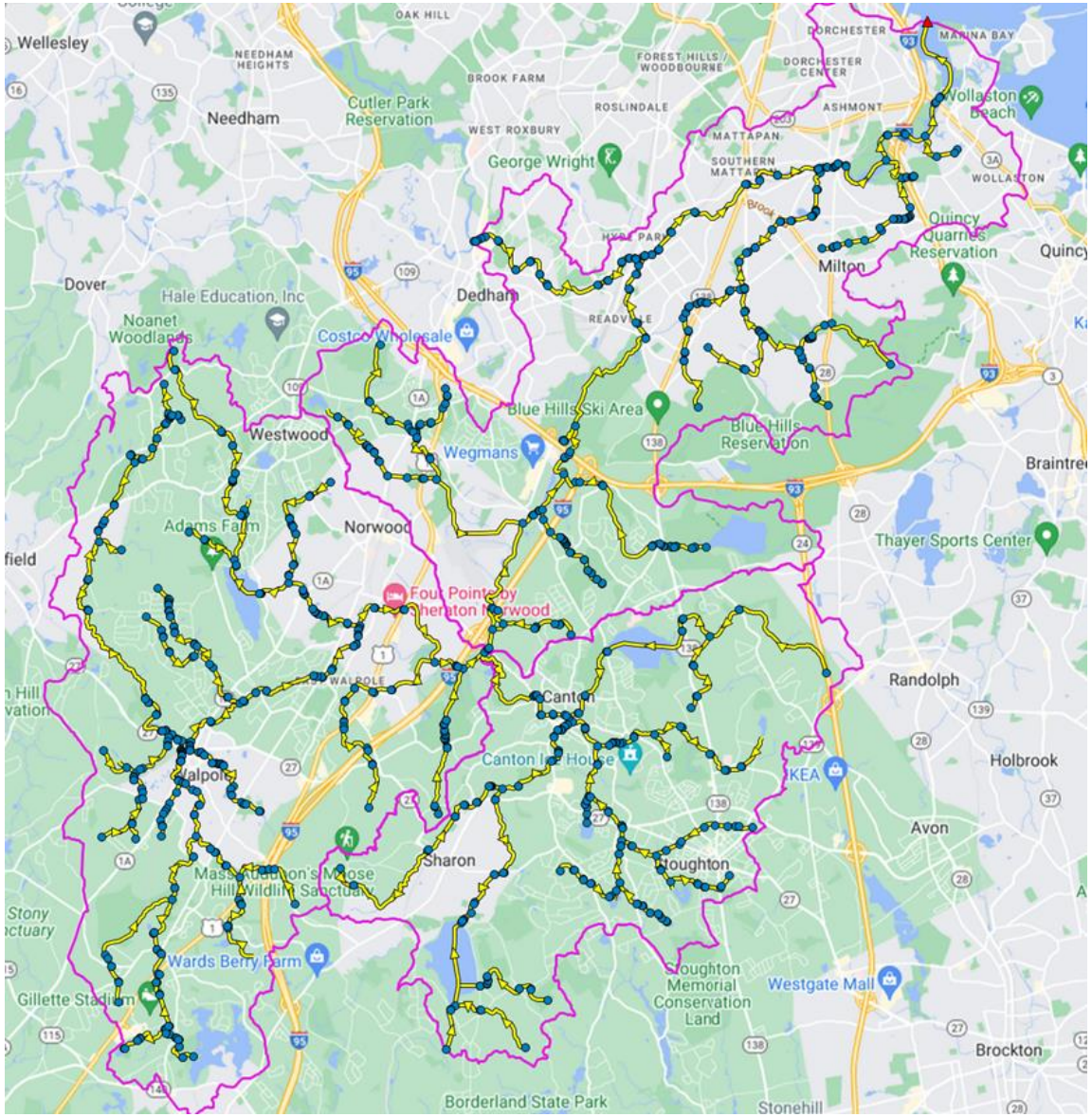
Subject to change as model progresses



Work in Progress – Draft for Discussion

Model Development

- 1-Dimensional
  - Neponset River geometry complete
  - Integrating GIS data from communities
  - On-going fieldwork to resolve data gaps
- 2-Dimensional
  - Processed Digital Elevation Model, including bathymetry

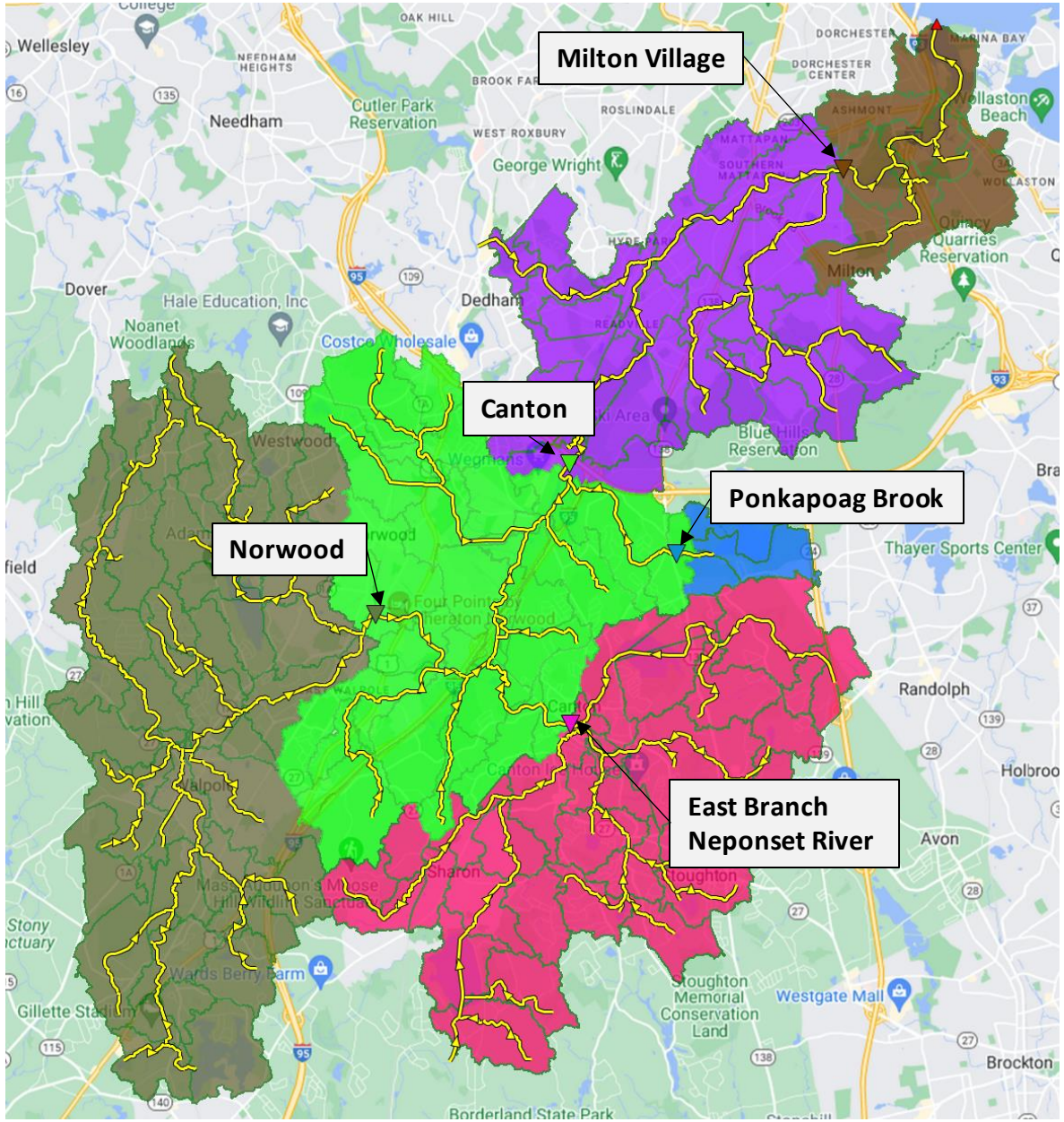


Work in Progress – Draft for Discussion

USGS Gage Locations for Model Calibration

Calibration to begin after 1D-2D model development (Jan 2023)

Location	USGS Gage ID	Available Period
Milton Village	011055566	10/2007 - Current
Canton	01105554	10/2007 - Current
Ponkapoag Brook	011055525	05/2016 - Current
Norwood	01105000	10/2007 - Current
East Branch Neponset River	01105500	10/2007 - Current



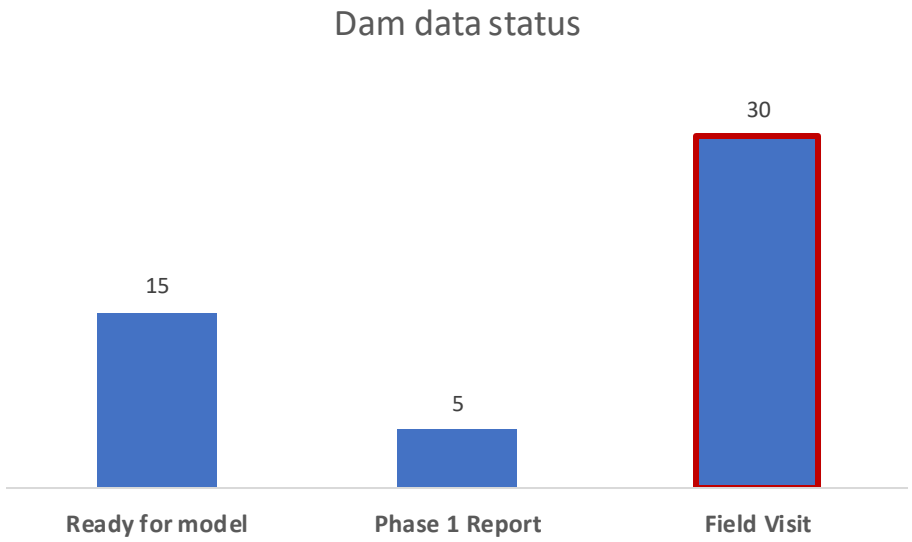
Work in Progress – Draft for Discussion

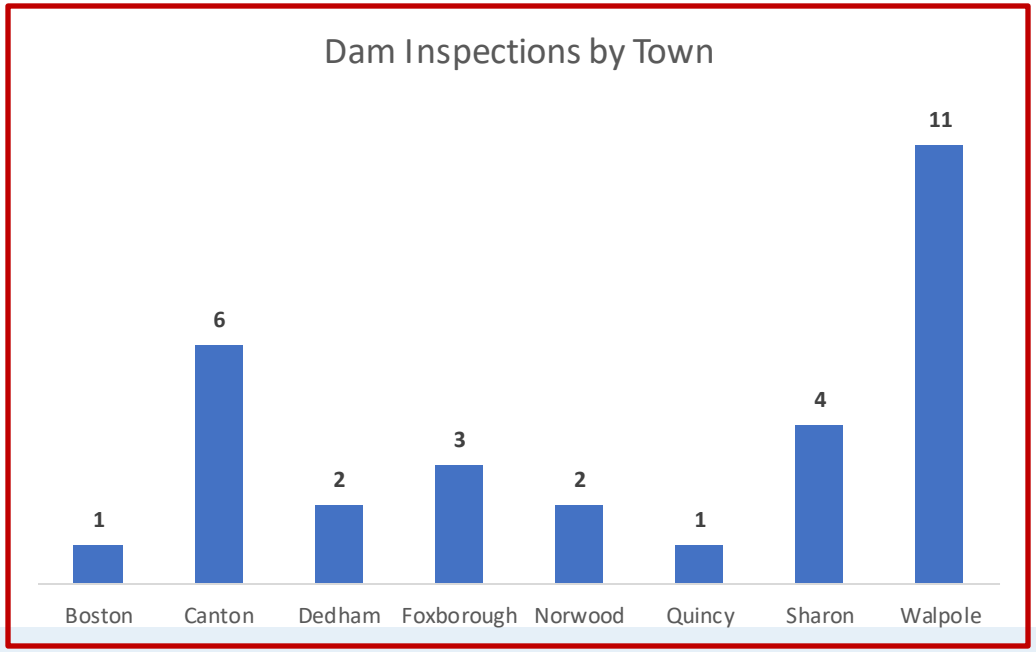
Data Gaps

Dams

- **Criteria**
  - Impound large waterbodies
  - Hydrologically significant in flow routing and flood impacts

- **50 dams to be included in the model**
  - 5 dams to reference information from MA Dam Phase I Inspection report
  - 30 priority dams for field investigations, will use Phase I if sites are inaccessible



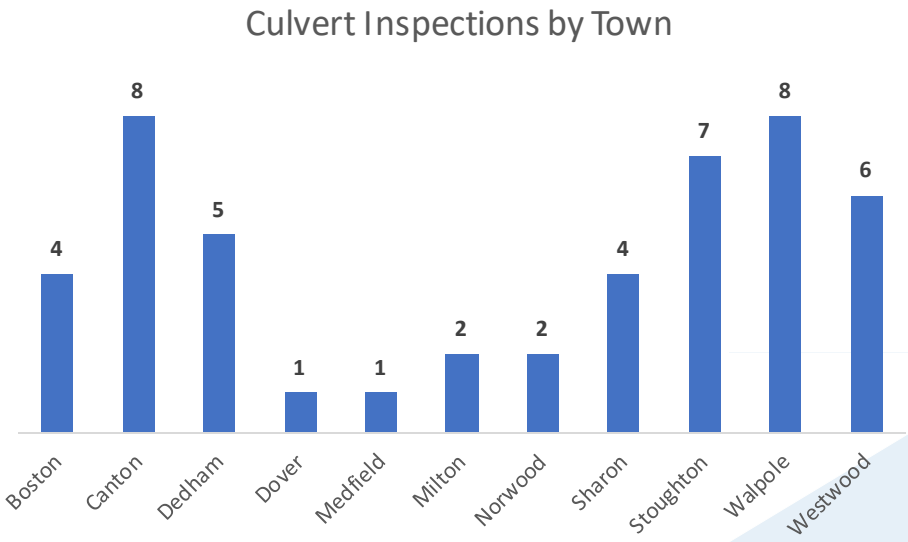


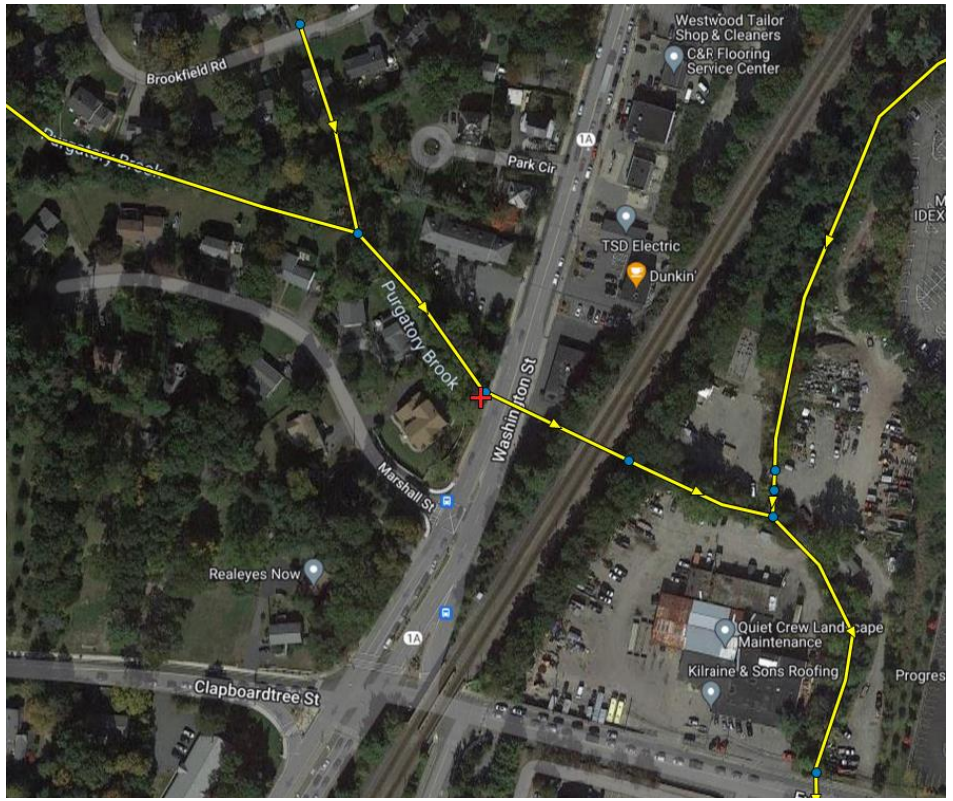
Work in Progress – Draft for Discussion

Data Gaps

Culverts

- **Criteria**
  - Critical locations that likely impact conveyance capacity or flood levels
  - No data from FEMA Flood Insurance Studies, NAACC, MassDOT, or community GIS
- **48 culvert crossings to be inspected**



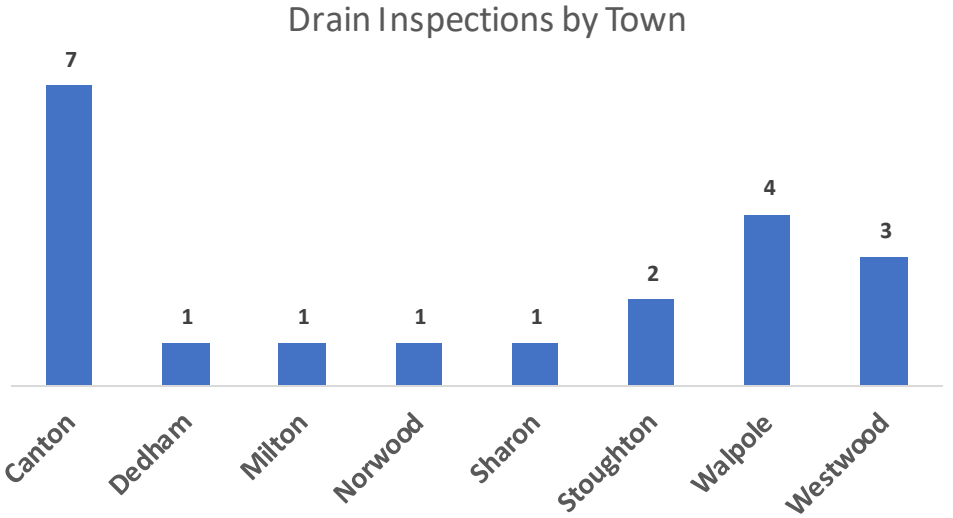


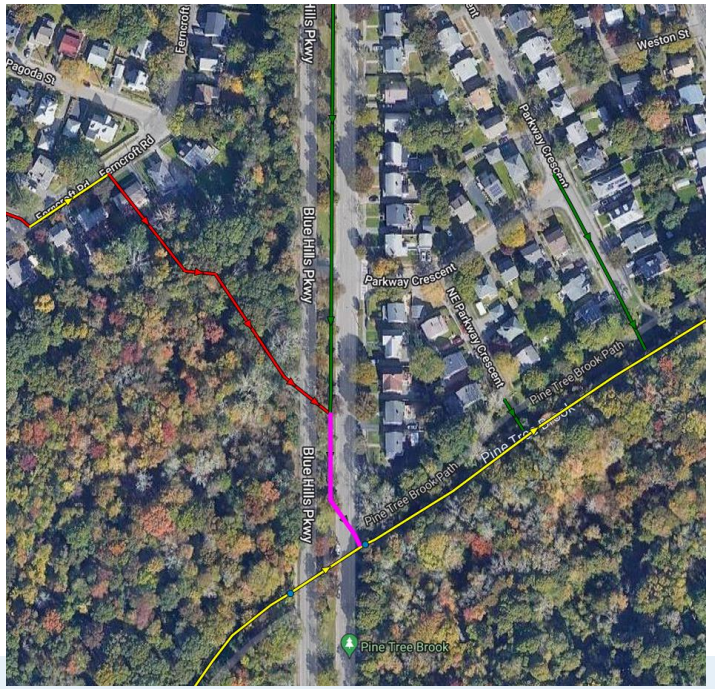
Example: Purgatory brook culvert crossing at Washington Street, Westwood

Data Gaps

Drains

- **Criteria**
  - Potentially larger diameter pipes
  - Significant upstream drain networks
  - Lack of data from adjacent pipes for interpolation
- **20 locations to be inspected**





Completed Field Work

Culvert inspection in Sharon

Culvert inspection in Walpole

Dam inspection in Canton

- Field Work Summary:
  - A total of 88 structures were visited in 3 days:
    - 46 dams
    - 42 culverts
  - The remaining 6 dams and 5 culverts are planned to be visited the week of December 19th
- Targeted drainage system connectivity will be observed the week of December 19th

Next Steps for Model Development

- Enter field data into model
- Complete model development by reconciling available GIS data with field data
- Calibrate and validate existing conditions model
- Simulate present and future storm scenarios – “no-action”
- Identification of watershed wide flood mitigation strategies
- Simulate present and future storm scenarios using watershed-wide strategies

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If your municipality conducts any major flood operations during or in advance of large storm events (i.e. draws down reservoirs, open gates, pumps, etc.), please enter your municipality's name.

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slido **results**

- Dedham
- Westwood - Mostly culvert checks no gates or pumps in our infrastructure
- No drawdowns or pumps Stoughton
- Ian Cooke. Willett pond is large and privately owned. They try to drawdown ahead of very major storms if we'll prediccted
- Medfield- Bobby Kennedy would be able to answer this specifically but I'm aware of one location at Danielson Pond where the boards are adjusted.
- Foxboro
- Boston Water and Sewer Commission
- Norwood (drawdown Ellis Pond for large events)

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Based on what you have heard so far, what would your primary goal be for the use of this model and its output?

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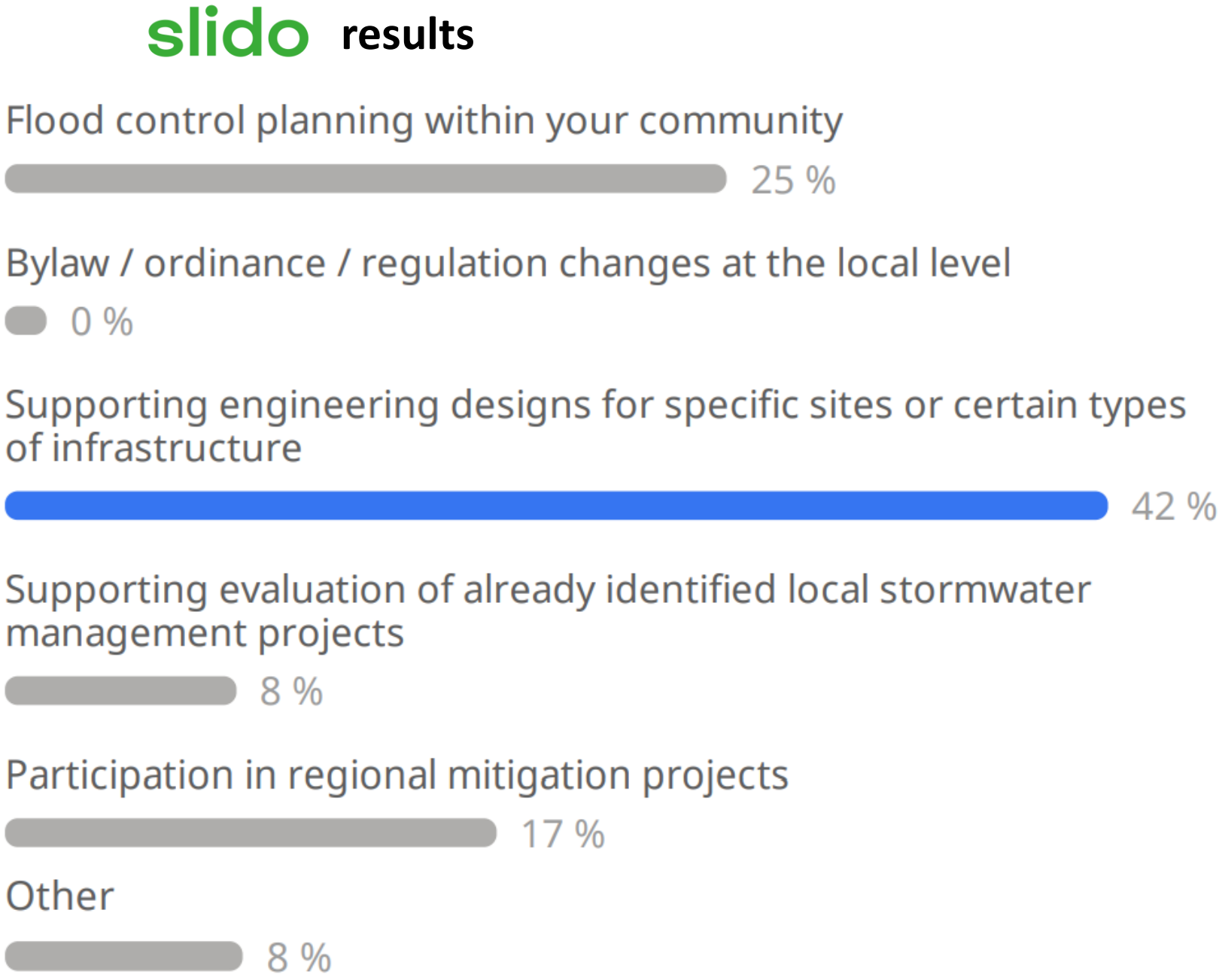
slido **results**



Poll Question #1

1:36 | 1 question | 24 of 30 (80%) participated

1. Based on what you have heard so far, what would your primary goal be for the use of this model and its output? (Single Choice) *

24/24 (100%) answered

Flood control planning within your community	(7/24) 29%
Bylaw/ ordinance/ regulation changes at the local level	(5/24) 21%
Supporting engineering designs for specific sites or certain...	(9/24) 38%
Supporting evaluation of already identified local stormwater...	(2/24) 8%
Participation in regional mitigation projects	(1/24) 4%
Other	(0/24) 0%

Reported Flood Issues in the Watershed

Jennie Moonan, PE

Senior Project Manager, Weston & Sampson

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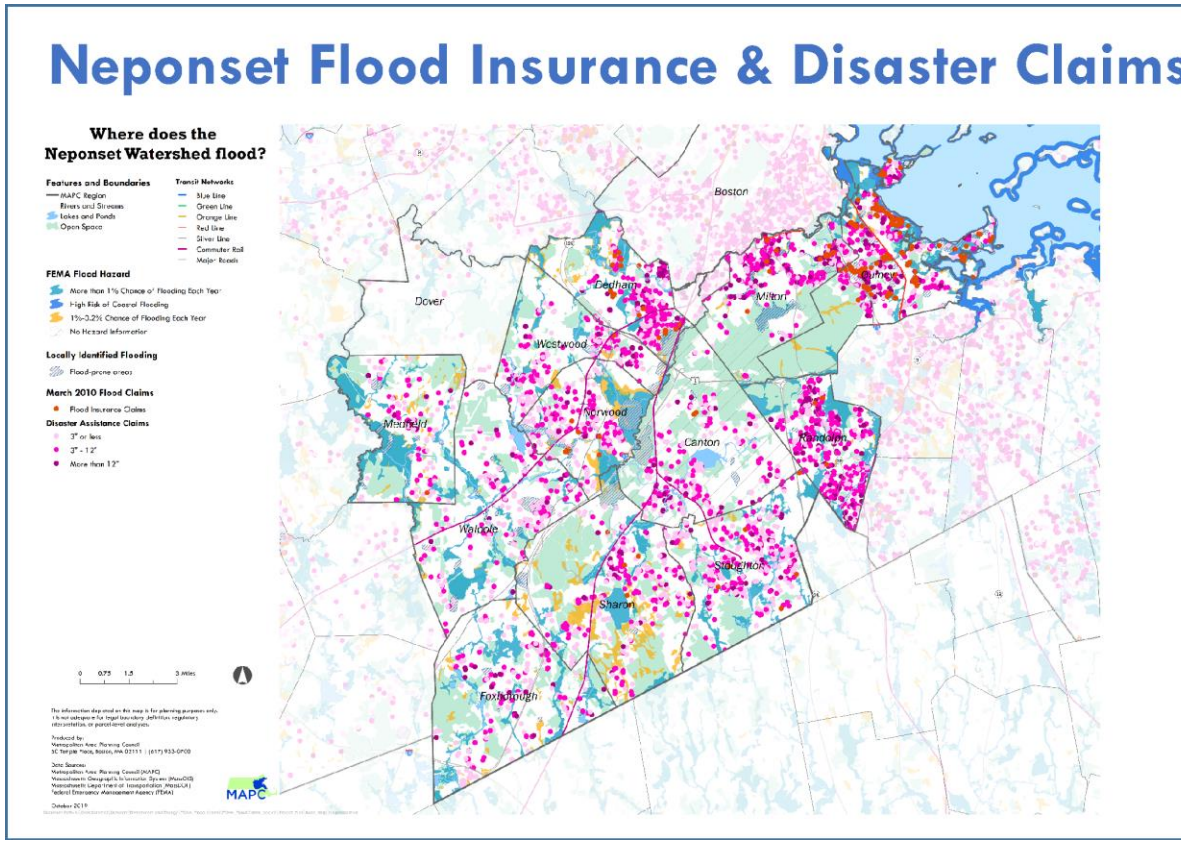
Overview

- **Gathered information from various sources**
  - Hazard Mitigation Plans
  - MVP Summary of Findings Reports
  - FEMA
  - Drainage Studies
  - Specific Flood Report
  - Misc. Plans (Climate Resilience, Master Plans, etc.)



Information is used for

- Understanding of flooding problems (where was flooding, how long lasted, how deep/area, cause, etc.)
- Calibration and validation of model for specific storms

We welcome any last input from your community.

Questions and or Discussion?

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Discussion on Future Climate Scenarios

Indrani Ghosh, PhD

Resiliency Senior Technical Leader, Weston & Sampson

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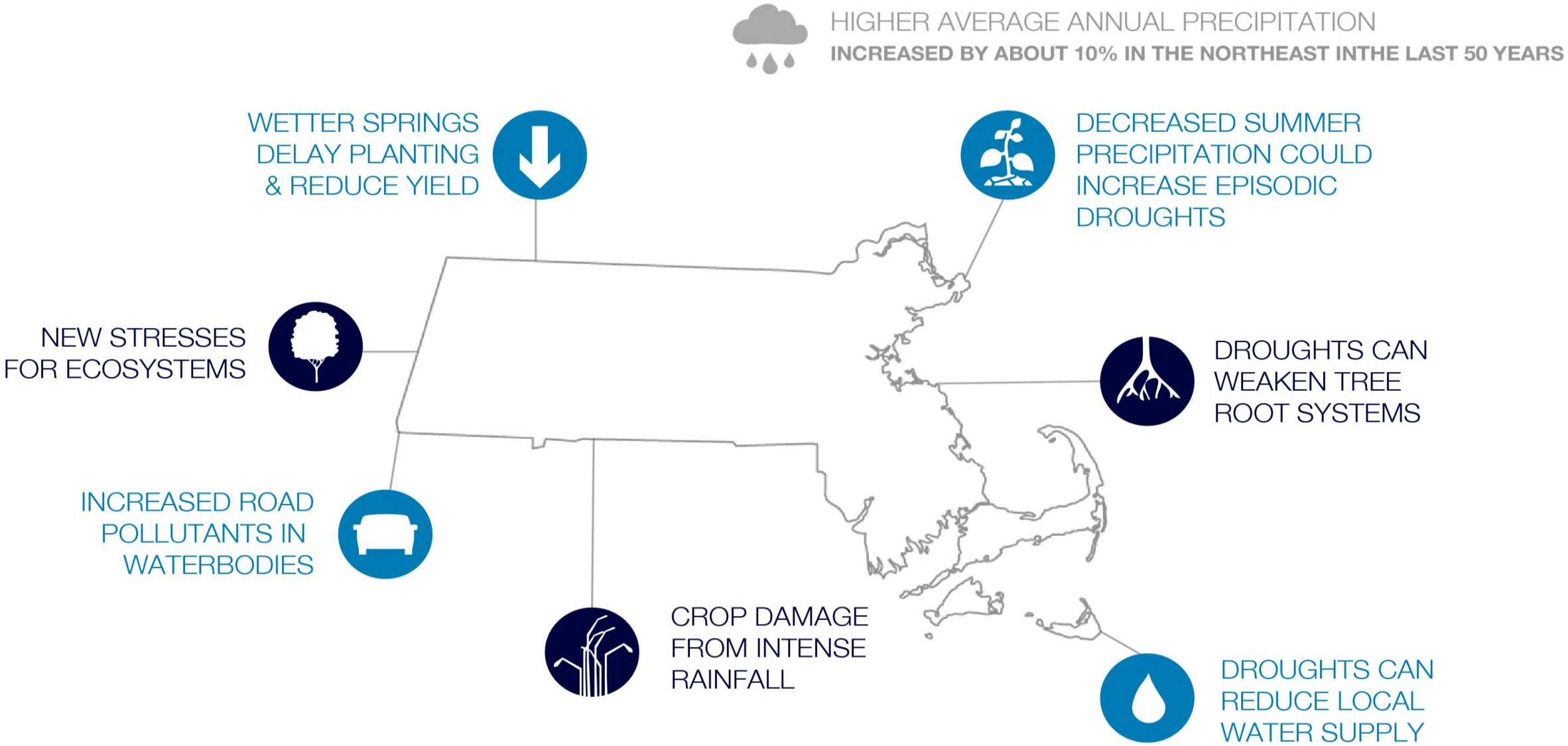
Impacts of Changing Precipitation



Historic Changes in Precipitation

CHANGES IN PRECIPITATION

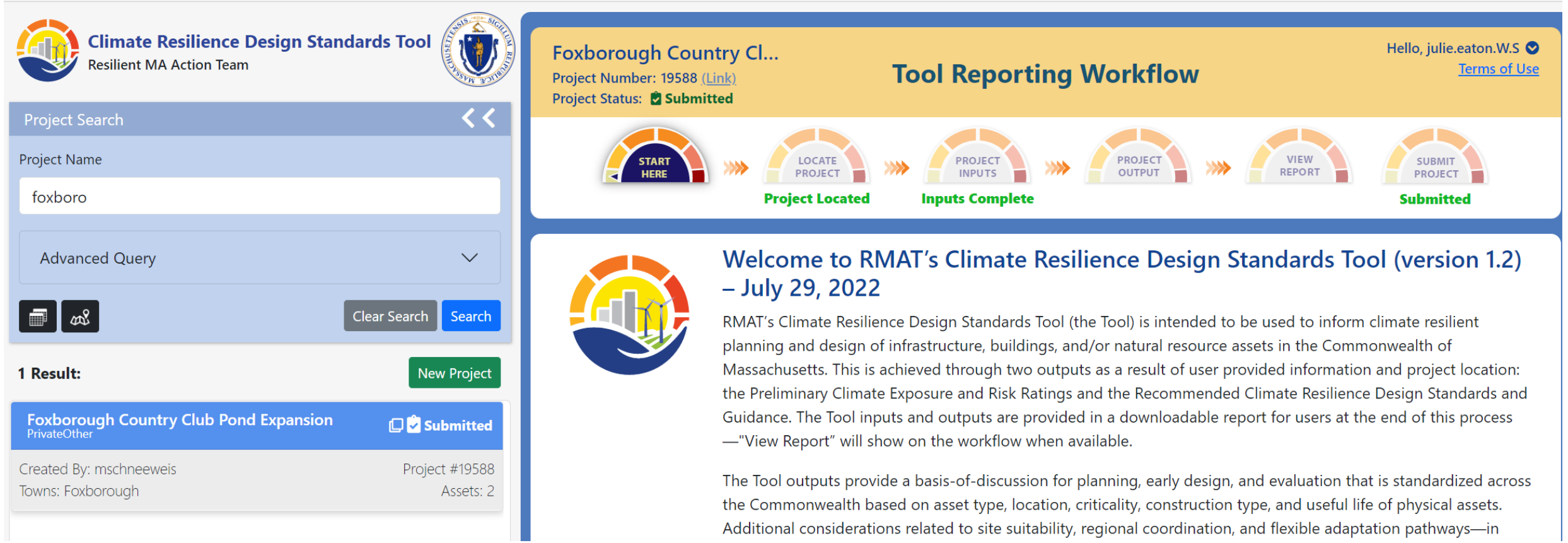
MORE **INTENSE & FREQUENT** EXTREME RAIN EVENTS

PRECIPITATION DURING
HEAVY EVENTS IN THE
NORTHEAST
INCREASED
BY MORE THAN
70%
BETWEEN 1958-2010

Sources: NOAA TP-40 (1961) and NOAA Atlas Volume 10 (2015)

ergy & Environmental Affairs. 2019. “Changes in Precipitation.” Massachusetts Climate Change Clearinghouse. Resilientma.org/changes/

Climate Resilience Design Standards Tool



Link to Tool website: https://resilientma.mass.gov/rmat_home/designstandards/

Climate Resilience Design Standards Tool

Environmental Justice

In Massachusetts, an Environmental Justice (EJ) neighborhood (census block group) is defined as meeting one or more criteria linked to the size of a census block group's minority populations, median household income, and language isolation. EJ neighborhoods typically include

Does this project fall within mapped Environmental Justice neighborhoods? No

Ecosystem Benefits

The purpose of this output is to provide an overall indication of the Ecosystem Service Benefits (ESB) provided by a project, through protection of natural resources and implementation of nature-based solutions. Natural systems and ecosystem services provide great economic value and social benefit,

Ecosystem Benefits Scores Moderate

Preliminary Climate Exposure Score

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. Click on the question mark to identify why your project location is receiving the exposure rating.

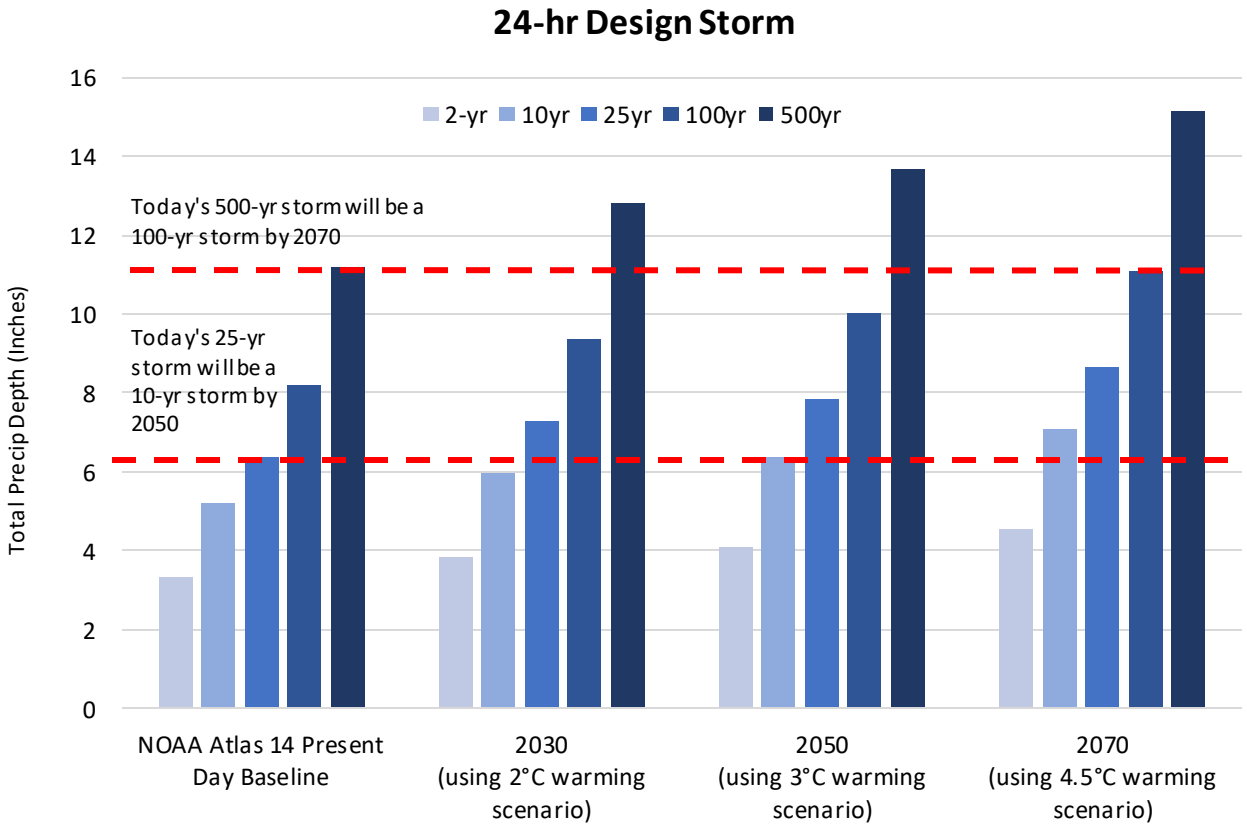
Sea Level Rise/Storm Surge Not Exposed

Extreme Precipitation - Urban Flooding Moderate

Extreme Precipitation - Riverine Flooding High

Extreme Heat High

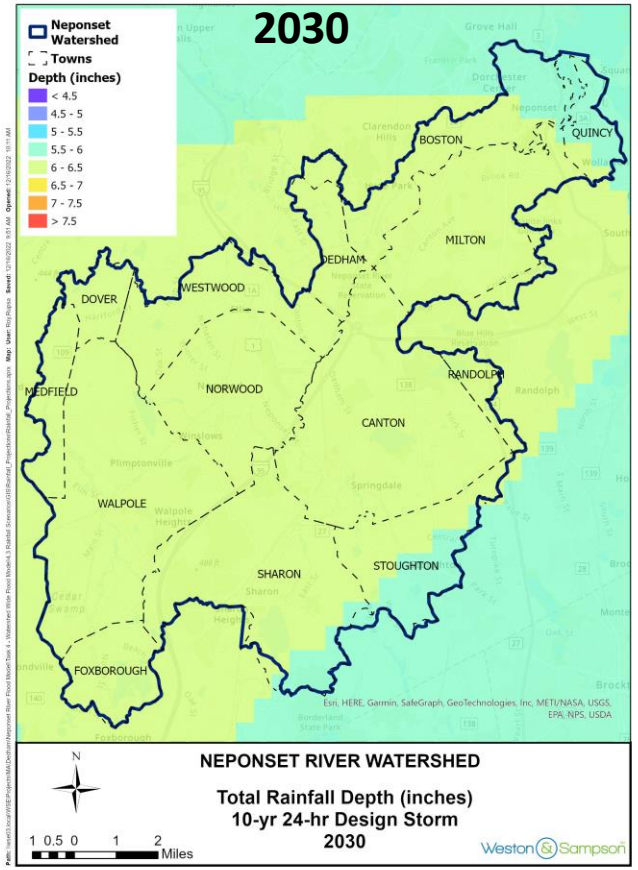
Future Rainfall Projections for Neponset River Watershed – 24-hr Duration Storms

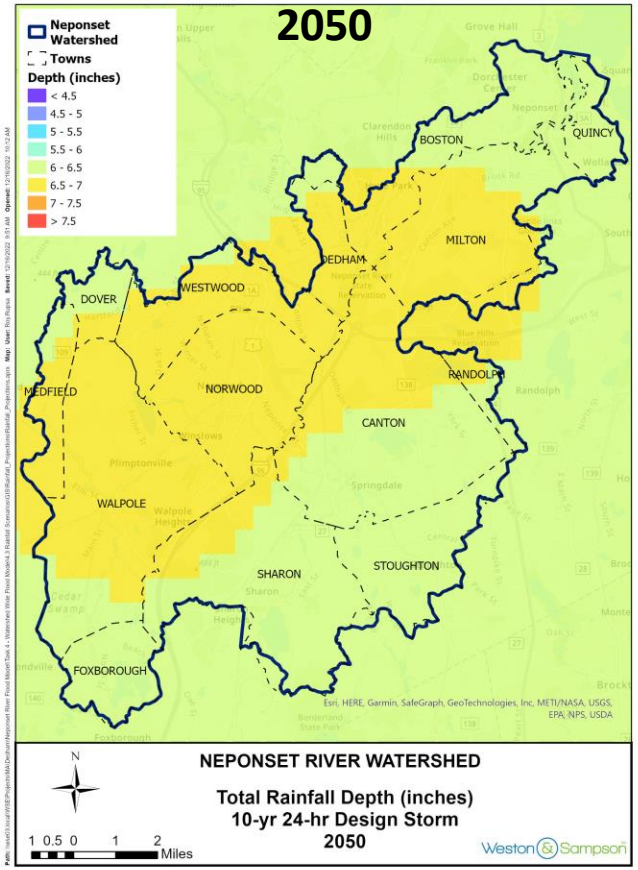


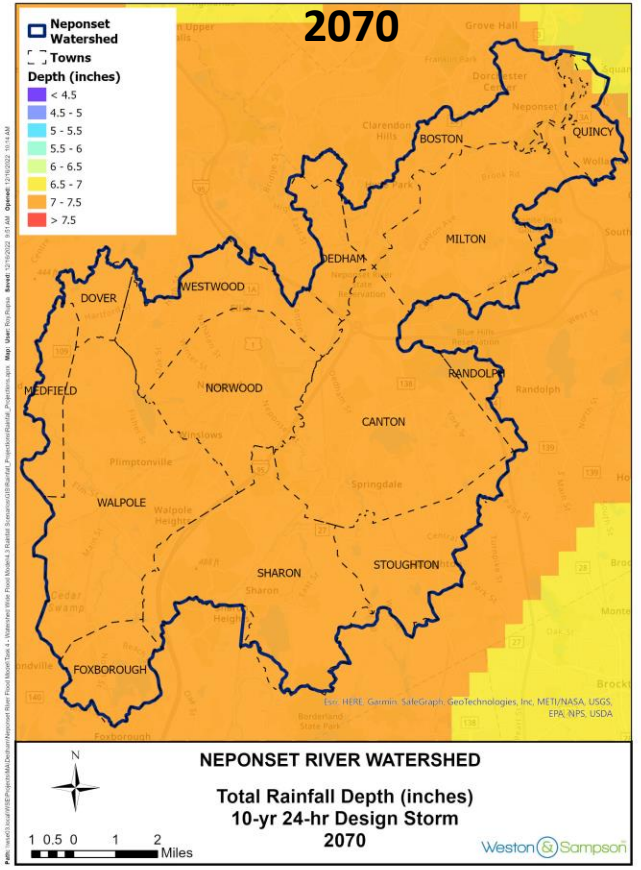
24-hr Design Storm Depth Predictions (inches)				
Return Period	NOAA Atlas 14 Present Day Baseline	2030 (using 2°C warming scenario)	2050 (using 3°C warming scenario)	2070 (using 4.5°C warming scenario)
2-yr	3.3	**3.8**	**4.1**	**4.5**
10-yr	5.2	**6.0**	**6.4**	**7.1**
25-yr	6.4	**7.3**	**7.8**	**8.7**
100-yr	8.2	**9.4**	**10.0**	**11.1**
500-yr	11.2	**12.8**	**13.7**	**15.2**

Future Rainfall Projections

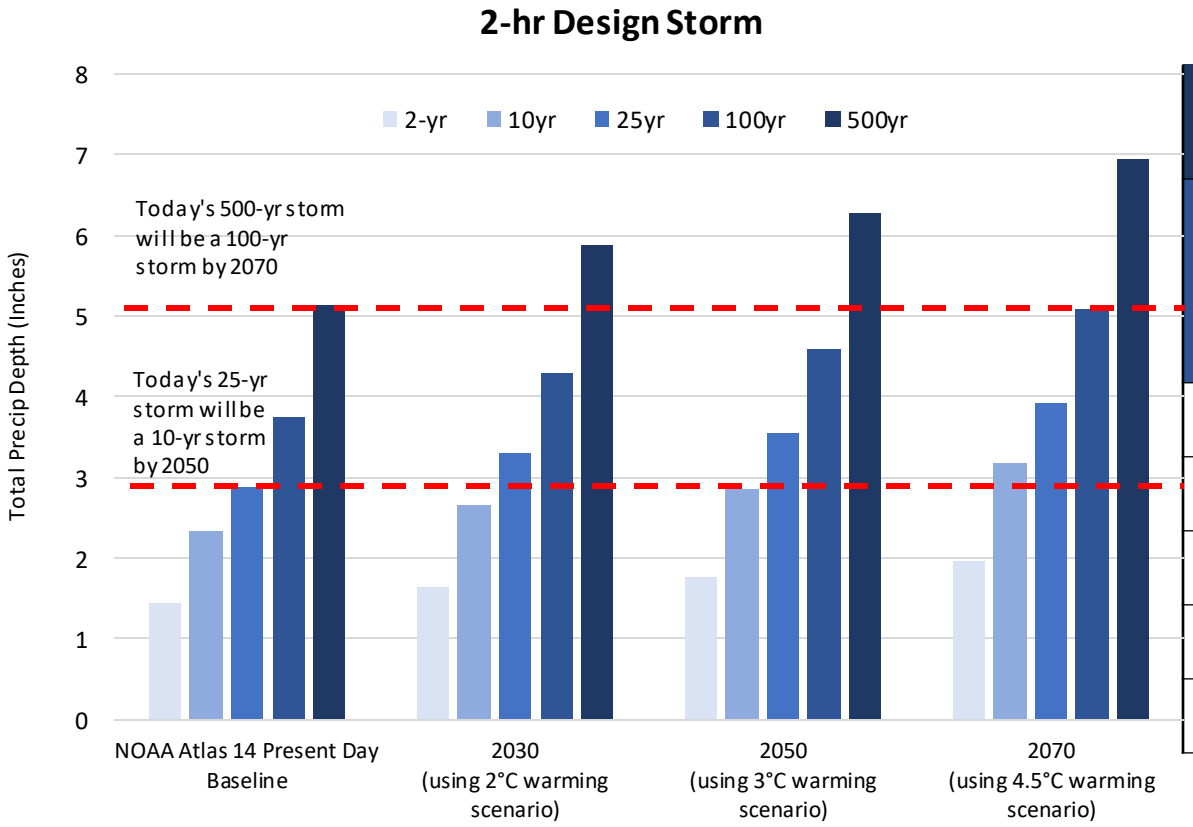
Variability in 10-yr 24-hr storm depths over the Watershed





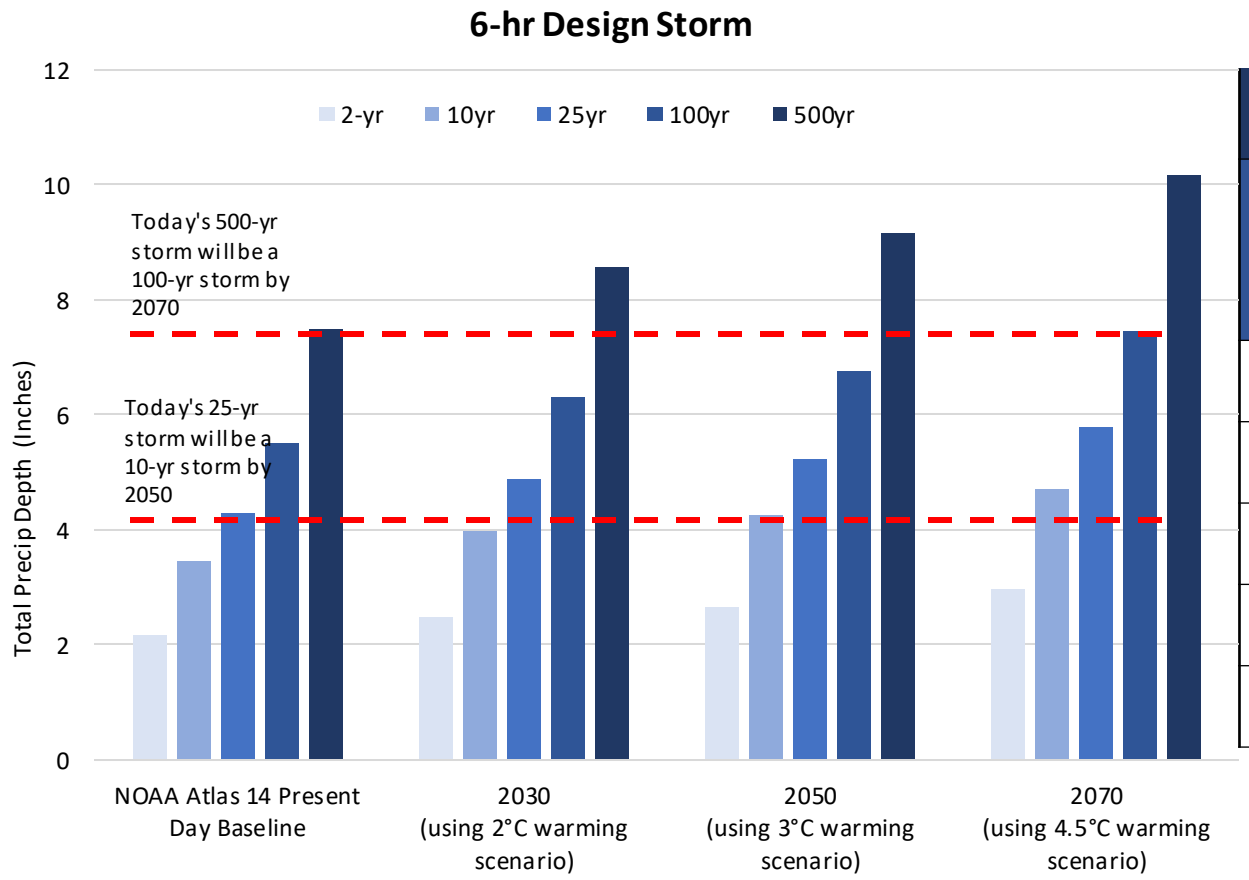


Future Rainfall Projections for Neponset River Watershed – Shorter Duration Storms



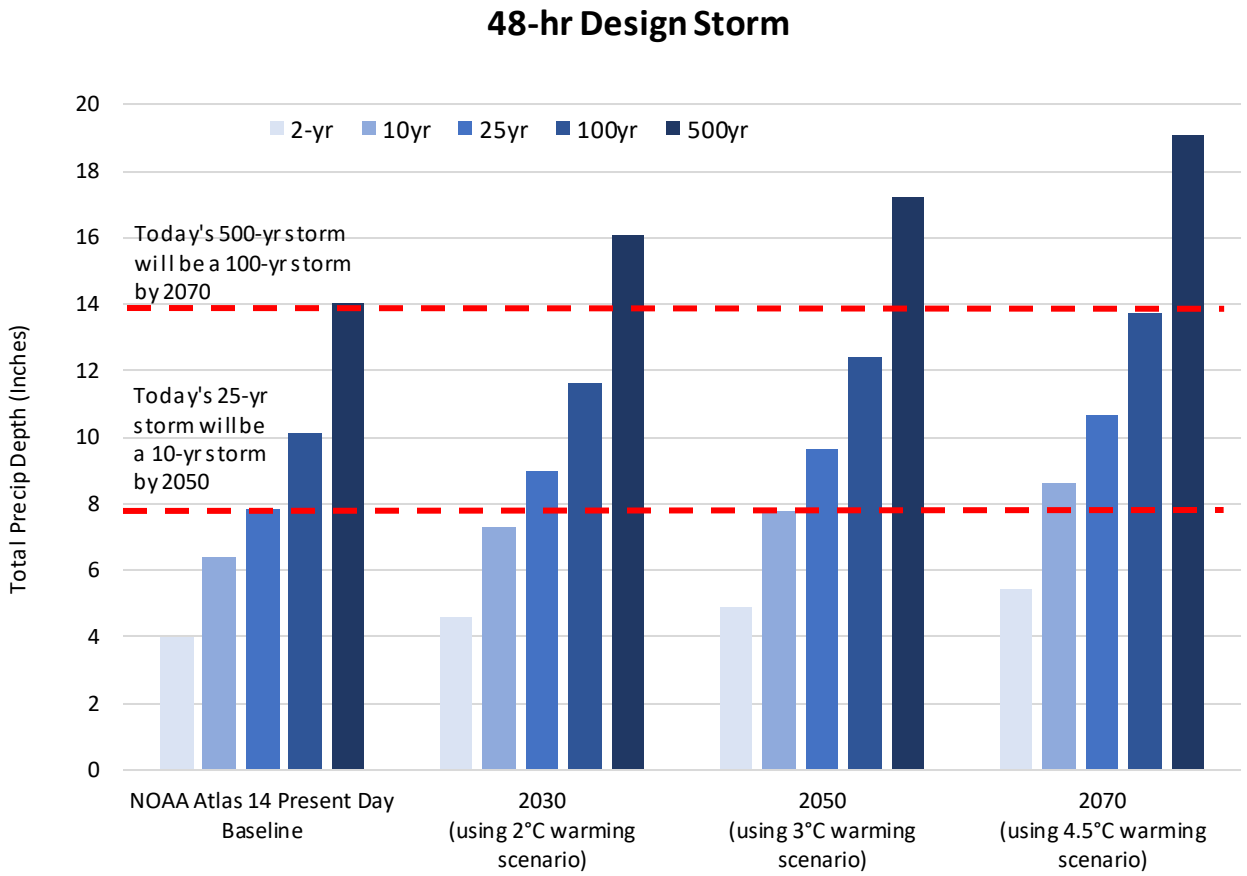
2-hr Design Storm Depth Predictions (inches)				
Return Period	NOAA Atlas 14 Present Day Baseline	2030 (using 2°C warming scenario)	2050 (using 3°C warming scenario)	2070 (using 4.5°C warming scenario)
2-yr	1.4	**1.7**	**1.8**	**2.0**
10yr	2.3	**2.7**	**2.9**	**3.2**
25yr	2.9	**3.3**	**3.5**	**3.9**
100yr	3.8	**4.3**	**4.6**	**5.1**
500yr	5.1	**5.9**	**6.3**	**7.0**

Future Rainfall Projections for Neponset River Watershed – Shorter Duration Storms



6-hr Design Storm Depth Predictions (inches)				
Return Period	NOAA Atlas 14 Present Day Baseline	2030 (using 2°C warming scenario)	2050 (using 3°C warming scenario)	2070 (using 4.5°C warming scenario)
2-yr	2.2	**2.5**	**2.7**	**3.0**
10yr	3.5	**4.0**	**4.2**	**4.7**
25yr	4.3	**4.9**	**5.2**	**5.8**
100yr	5.5	**6.3**	**6.8**	**7.5**
500yr	7.5	**8.6**	**9.2**	**10.2**

Future Rainfall Projections for Neponset River Watershed – Longer Duration Storms

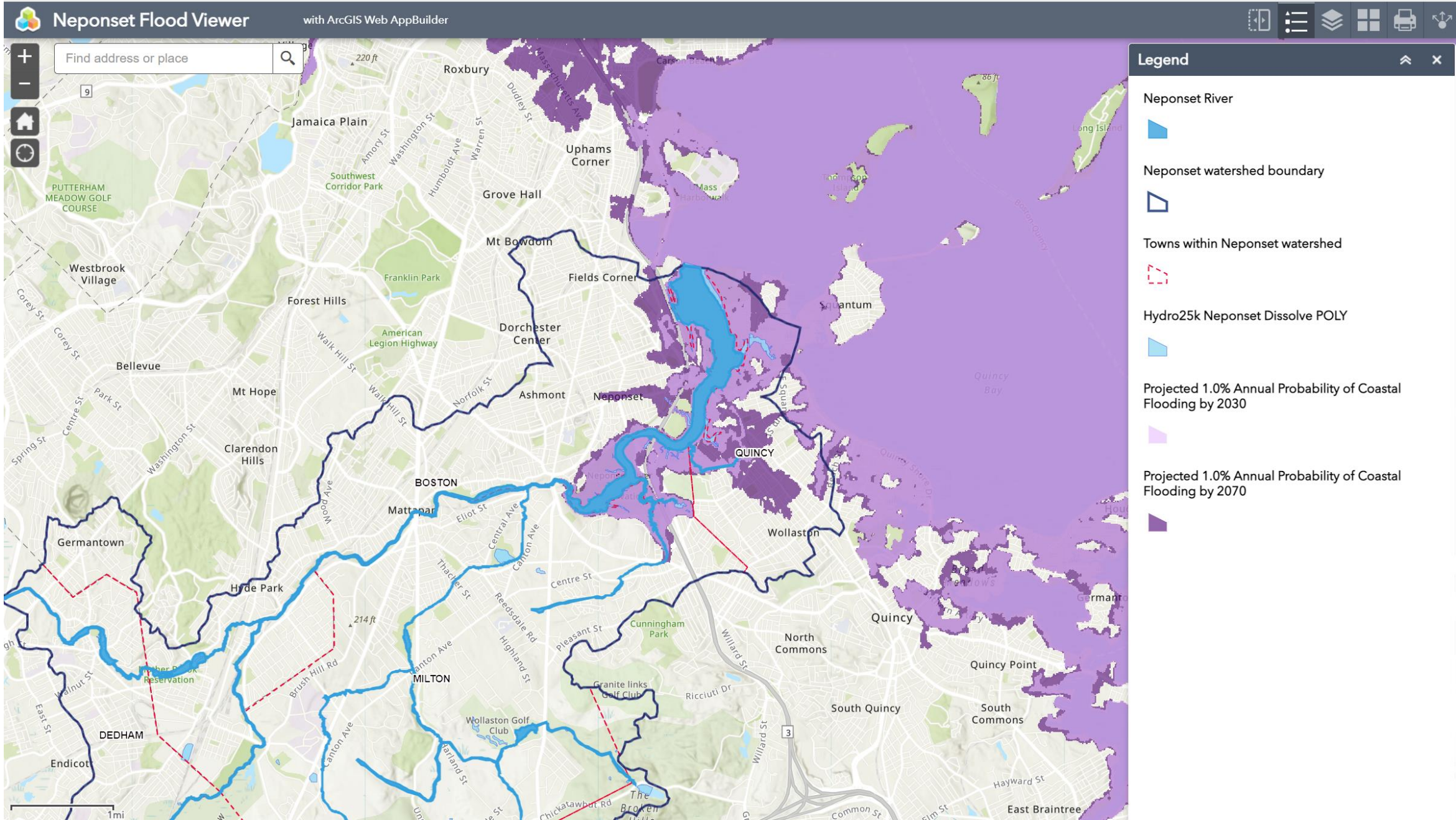


48-hr Design Storm Depth Predictions (inches)				
Return Period	NOAA Atlas 14 Present Day Baseline	2030 (using 2°C warming scenario)	2050 (using 3°C warming scenario)	2070 (using 4.5°C warming scenario)
2-yr	4.0	**4.6**	**4.9**	**5.4**
10yr	6.4	**7.3**	**7.8**	**8.6**
25yr	7.9	**9.0**	**9.6**	**10.7**
100yr	10.2	**11.6**	**12.4**	**13.8**
500yr	14.1	**16.1**	**17.2**	**19.1**

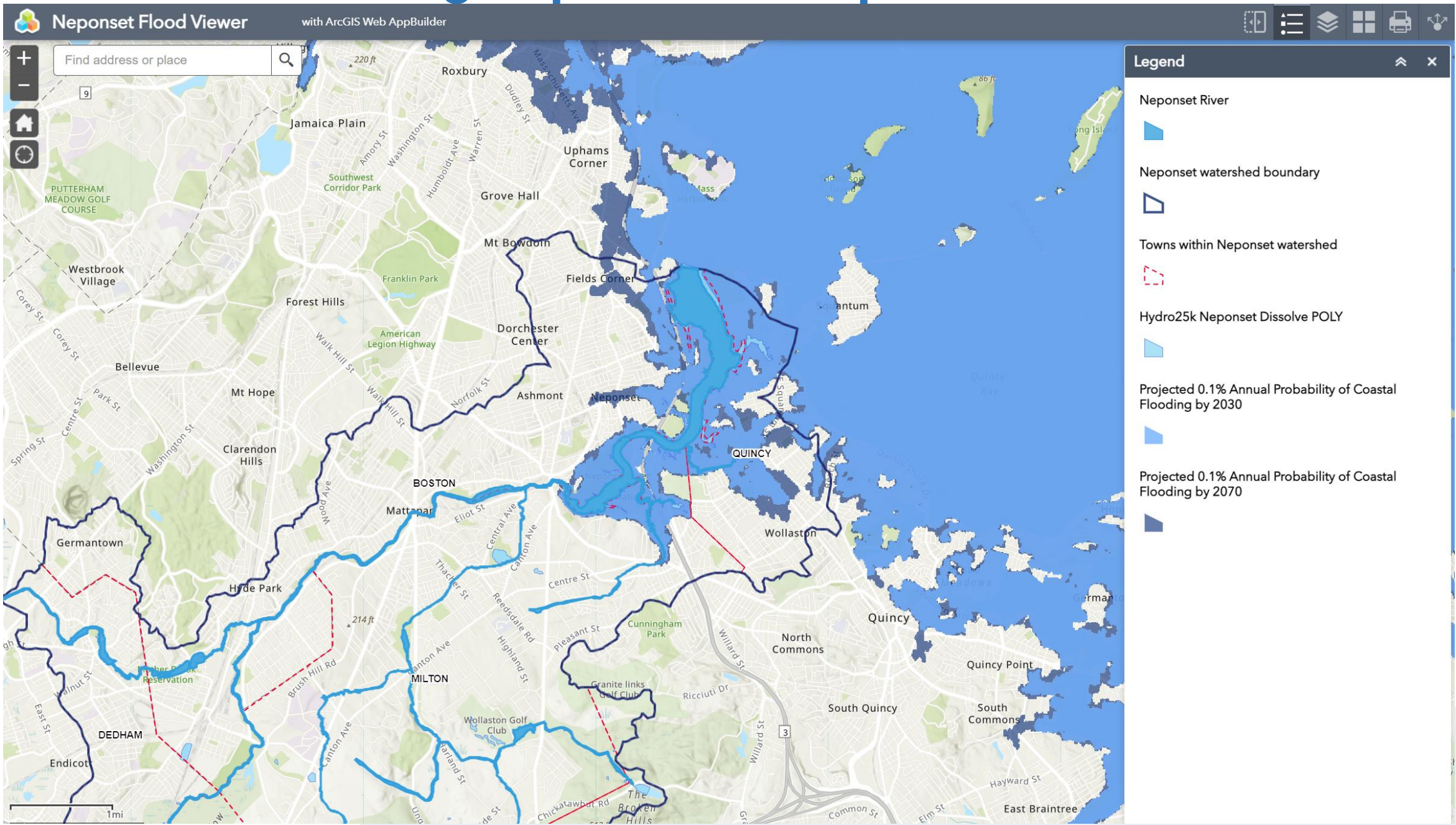
Future Rainfall Projections for Neponset River Watershed

Storm Types	Pros	Cons
24-hr duration storms	**Consistent design use** (stormwater standards/regs)	Ignores lots of different storm types
Shorter duration storms	Often drive local scale impacts (neighborhoods, intersections, parking lots)	**Unrealistic results** at watershed scale
Longer duration storms	**Stress test** on large ponds/wetlands that usually shield downstream	Irrelevant in watersheds with little storage, often occur as a result of unusual storm patterns
Back-to-back events	**Stress test** on ability to empty flood storage post-event	Pre-saturated soil conditions can be **difficult to model reliably**
Historic storms (e.g., May 2006, March 2010)	**Supports public outreach**, represents worst case	Often result from unusual storm patterns; **long model run-times**

Future Coastal Flooding Impacts for Neponset River Watershed



Future Coastal Flooding Impacts for Neponset River Watershed



Future Planning Horizons for Neponset River Watershed

Planning Horizon	Pros	Cons
2030 (2020-2049)	**Consistent** with other State and regional planning efforts	**Too imminent**, essentially can be considered as present
2050 (2040-2069)	Consistent with more recent State planning efforts, good **intermediate** planning horizon that may be aligned with capital planning efforts	Not used in nearby watershed planning projects (e.g. Mystic River Watershed, Charles River Watershed)
2070 (2060-2089)	Consistent with other State and regional planning efforts, **within useful life of new infrastructure**	May seem too far out, larger uncertainties in future climate scenarios
2090 (2080-2099)	Recently available through Cornell's projections as adopted in the Climate Resilience Design Standards Tool	Farther out in the future, larger uncertainties in future climate scenarios, no coastal flood impacts data available yet

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What planning horizons would you like to consider for this model?

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slido **results**

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What storm events would you like to consider for this model?

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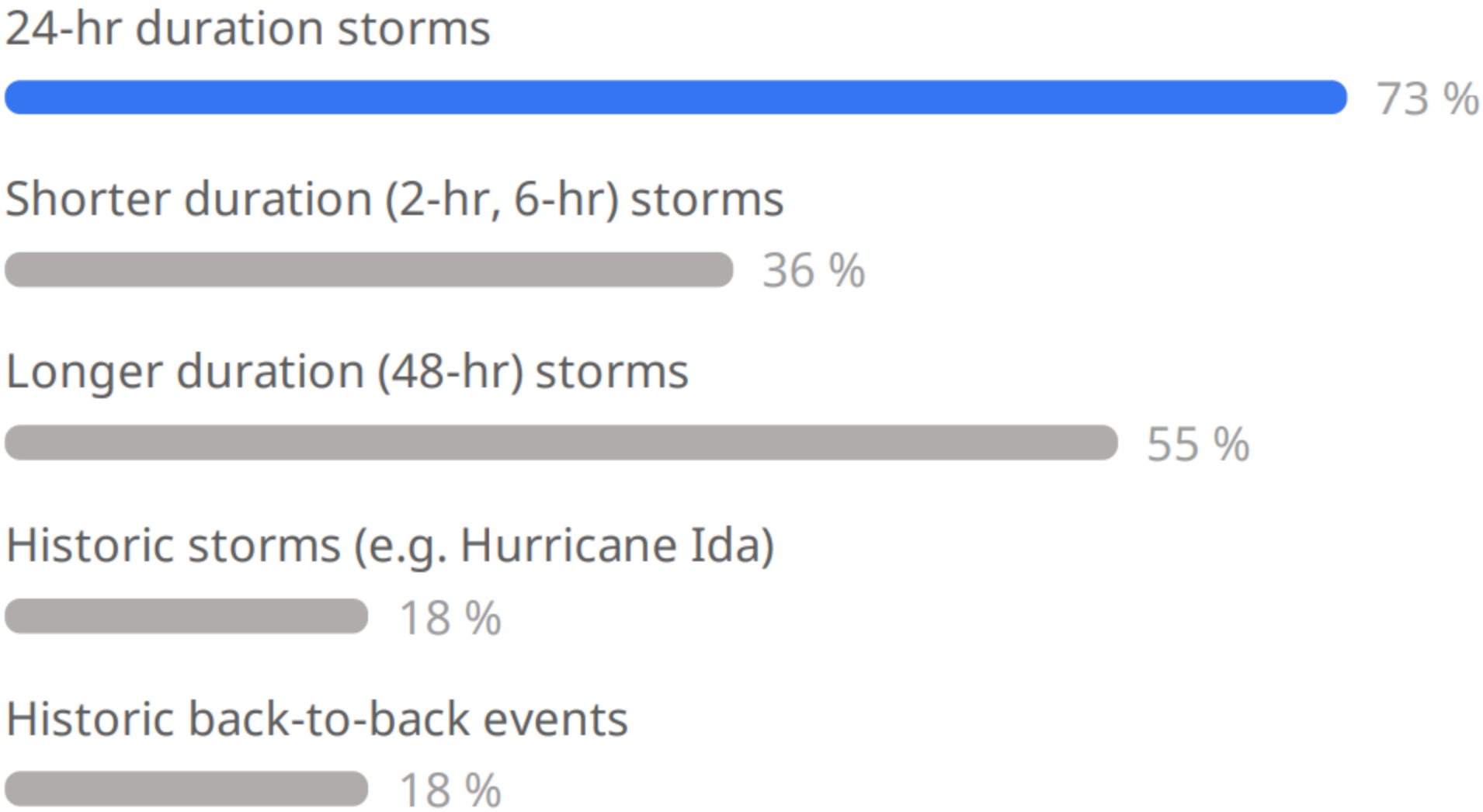

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Would you prefer that future scenarios simulate inland rainfall combined with coastal flooding?

ⓘ Start presenting to display the poll results on this slide.

slido **results**

Flood Mitigation Strategies

Jennie Moonan, PE

Senior Project Manager, Weston & Sampson

Indrani Ghosh, PhD

Resiliency Senior Technical Leader, Weston & Sampson

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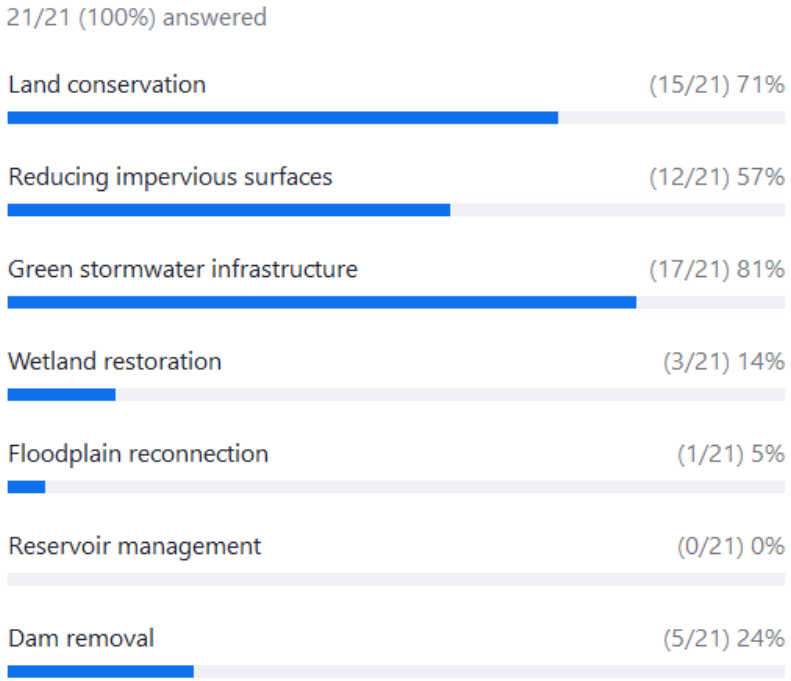
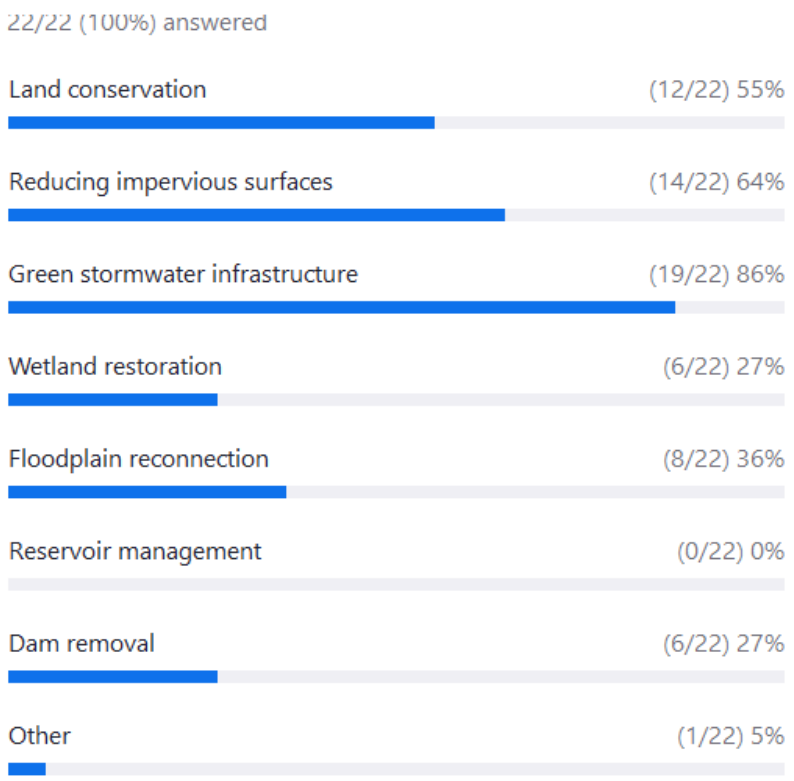
Results from Kickoff Meeting

What nature-based solutions *are you currently pursuing* within your community?



What nature-based solutions *are you interested in pursuing* through this project?



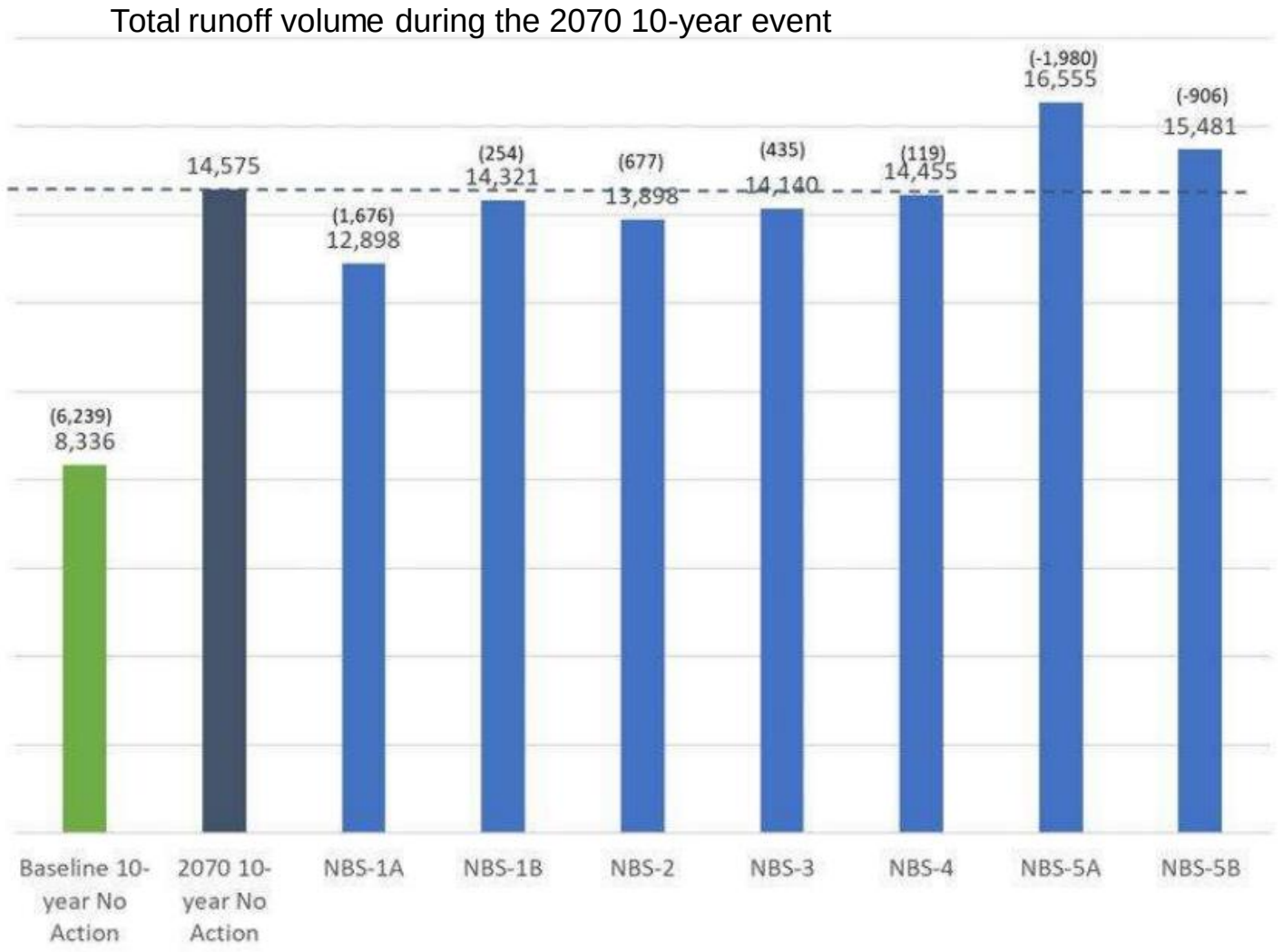
Charles River Watershed-Wide Strategies

Category	Phase 1	Phase 2
Green Stormwater Infrastructure	GSI stores 2" from half of all impervious cover (36,893 acres)	GSI stores the 2-yr 2070 event from 50% of all impervious area
	Storage on large public properties (280 sites)	Target all large buildings & parking lots (public & private) for rooftop infiltration/disconnection (>5 acres) to store the difference between the (2070) 25-yr & 2-yr
Reduce Impervious Cover	10% reduction	25% reduction
Upland/Pond Storage (operations & additional storage)	Increase overflow elevations at 22 sites	Add sites (14 sites, >20 ac.) & increase storage volume
Wetland Restoration	-	Increase wetland area around existing wetlands; increase of 20%
Land Conservation	50% of remaining undeveloped/ unprotected land is developed	15% of remaining undeveloped/ unprotected land is developed
Regulatory	-	Store the difference between (2070) 25-yr & 2-yr for 50% of assumed "new development"
Dam Removal	-	Remove municipal-owned recreation dams (excluding State-owned and active flood control dams)

Charles River Watershed-Wide Strategies

Watershed-Wide NBS Strategies Summary: Watershed-Wide

Storing the 2-yr storm by 2070 from half of the impervious cover in the watershed is likely to have the greatest flood reduction potential



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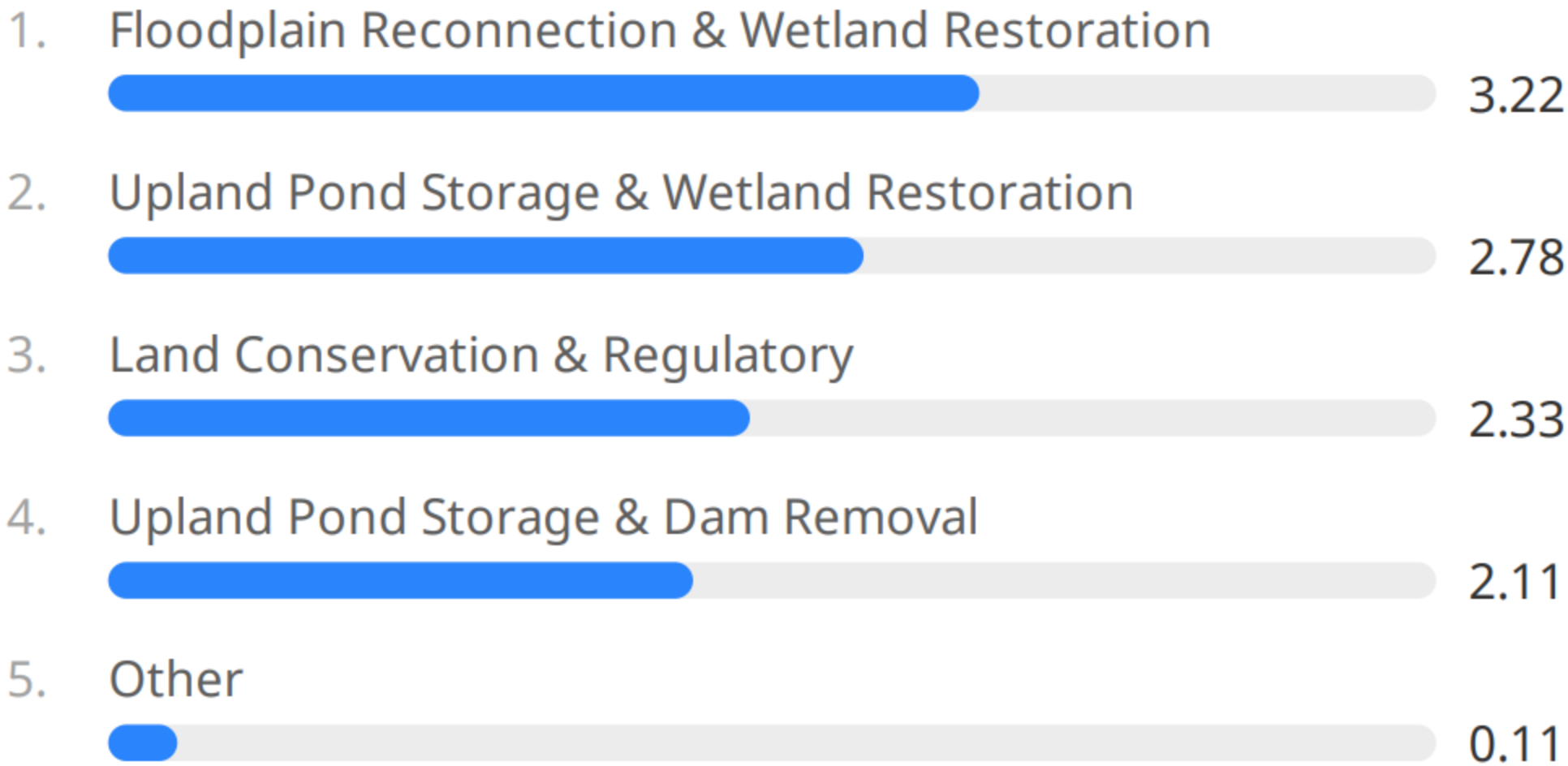
Based on what you have heard, what combination(s) of watershed wide strategies are you interested in evaluating with this model?

ⓘ Start presenting to display the poll results on this slide.

slido **results**



Site Specific Solutions in Dedham's Manor Neighborhood

- Model development has also progressed in this area
- Dedham will be receiving site-specific solutions (green, grey, and combination)
- This will demonstrate how the regional model can be used for a community and/or neighborhood

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Weston & Sampson℠
MAPC METROPOLITAN AREA PLANNING COUNCIL
THE TOWN OF DEDHAM
MVP


Mattapan
Quincy
Hyde Park
Milton
Dedham
Westwood
Dover
Medfield
Norwood
Randolph
Canton
Walpole
Stoughton
Sharon
Foxborough

Questions?

Next Steps & Action Items

MVP
Municipal Vulnerability Preparedness

Next Steps & Action Items

NepRWA & Weston & Sampson

MVP
Municipal Vulnerability Preparedness

Support Project Needs

- **Take Post-Meeting Survey**
  - Will be distributed following this meeting
  - Responses due by Friday Jan 6th Deadline

- **Last Chance for input on known flooding**
  - Can be submitted via post-meeting survey or individual data form

- **Publicize survey for public to provide input**
  - https://survey123.arcgis.com/share/ca207e88dd264cdbb918d297c38b21c7?lang=en

Reminder: Attend Scheduled Meetings

Meeting	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June
Meetings for Municipal Staff										
Project Kickoff	**9/21/22**									
Flood Meeting 1				**12/19/22**						
Framework Meeting 1					**X**					
Flood Meeting 2							**X**			
Framework Meeting 2							**X**			
Technical Assistance on MAPC Muni Adaptation Kit								**X**		
Flood Meeting 3									**X**	
Meetings for the Public										
EJ Focus Group				**12/8/22**						
Public Meeting #1					**1/24/23 evening**					
Public Meeting #2									**X**	

Reminder: Match

Cash Match **(In Progress – invoices have been sent by NepRWA – payment due by 12/31/22)**

In-Kind Match

- **Track ALL STAFF TIME** in online form monthly https://neponset-my.sharepoint.com/:x:/g/personal/staff_neponset_org/EcaOArguC8VBoxGe9LhDe-wBG_HYuFx2Yd_76H_XizuiUw?e=Xm87Jg

- Be sure to include all costs, not just salary (*i.e.*, cost of taxes, health, other benefits). Instructions and guidance included on first page of tracking form.

- Be as detailed as possible to inform monthly progress reports to MA MVP Program

Last Questions?

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Thank You

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