Long Island Sound Study
A Partnership to Restore and Protect the Sound

Sea Grant CONNECTICUT Sea Grant NEW YORK

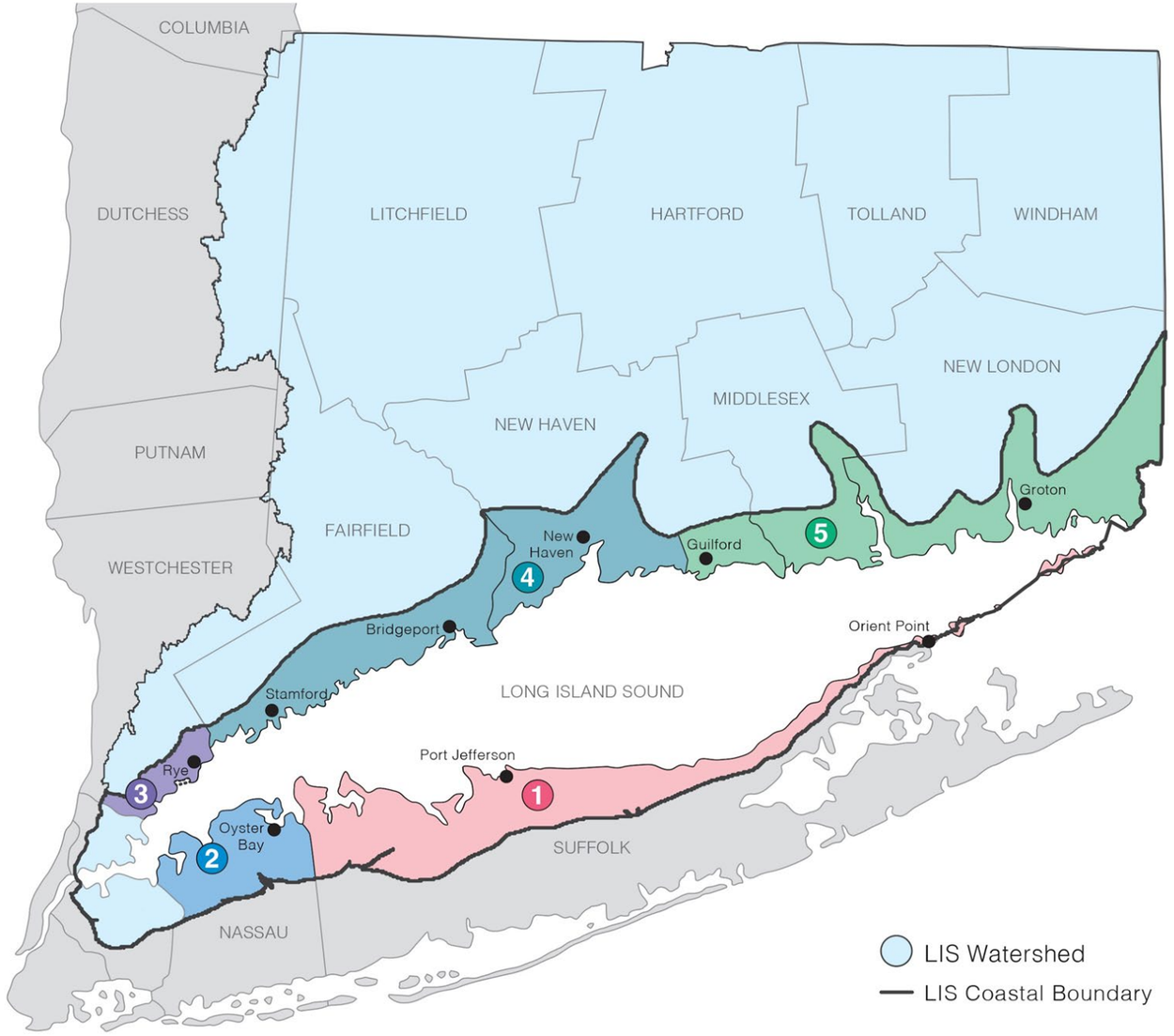
Photo credit: Elizabeth Hornstein

Long Island Sound Sustainable and Resilient Communities 3rd Annual Workshop: Resilience Tools Session

Tuesday, December 10, 2024 – 1:30-3:30 PM EST

The SRC Extension Professionals Team

Long Island Sound Study
A Partnership to Restore and Protect the Sound



Sustainable & Resilient Communities (SRC) Extension Professionals

1 Suffolk County
Elizabeth Hornstein

2 Nassau County
Sarah Schaefer-Brown

3 Westchester County
Sara Powell

4 Western CT
Deb Visco Abibou

5 Eastern CT
Sarah Schechter

Workshop Rules

Please keep your phones and audio on mute, and keep your camera off too!

Workshop will be recorded and made available to attendees afterward

We will be using interactive polls to gather feedback

Please use the chat for questions for speakers or technical issues

Please indicate the sector that best represents you:

0

Federal or state government
0%

Indigenous Nation or Community
0%

Local Government
0%

Nonprofit/NGO
0%

Watershed Organization
0%

Community Group
0%

Consultant
0%

Academia
0%

Interested Individual
0%

Have you attended other SRC workshops or trainings?

0

Yes

0%

No, this is my first time!

0%

What is your familiarity with federal, state, and local resilience tools?

0

I frequently use various resilience tools to assess climate impacts and help with planning

0%

I occasionally use resilience tools

0%

I rarely use resilience tools

0%

I have not used any resilience tools

0%

What is your familiarity with the Long Island Sound Resilience Resource Hub?

0

The Resource Hub is fantastic and I use it frequently!

0%

I occasionally use the Resource Hub

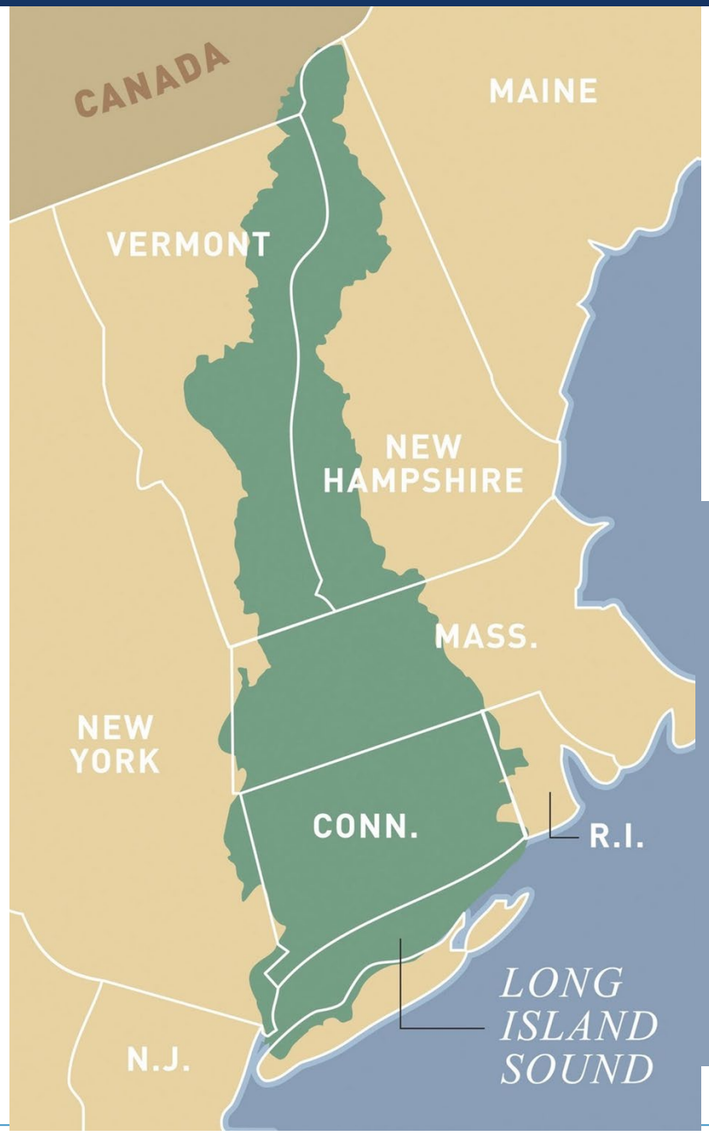
0%

I am familiar with the Resource Hub but have not used it much

0%

I had not heard about the Resource Hub

0%



Long Island Sound Study
A Partnership to Restore and Protect the Sound

2025 Comprehensive Conservation & Management Proposed Goals

1. Clean Waters & Healthy Watersheds
2. Thriving Habitats & Abundant Wildlife
3. Informed & Engaged Public
4. **Sustainable & Resilient Communities**

Outcomes of SRC Work

Long Island Sound Study
A Partnership to Restore and Protect the Sound

Goal: *Empower communities to plan for and respond to environmental challenges in ways that prioritize well-being for all.*

Informed Decision-Makers

Grow the number of municipal, nonprofit, and community leaders receiving training and support to increase capacity for adaptation to environmental challenges.

Community-Driven Resilience Planning

Increase the number of municipalities that identify key resilience priorities through local and/or regional community-driven planning processes.

Resilience Initiative Implementation

Implement initiatives to improve community resilience to flooding and other environmental challenges.

LIS Resilience Resource Hub: lisresilience.org

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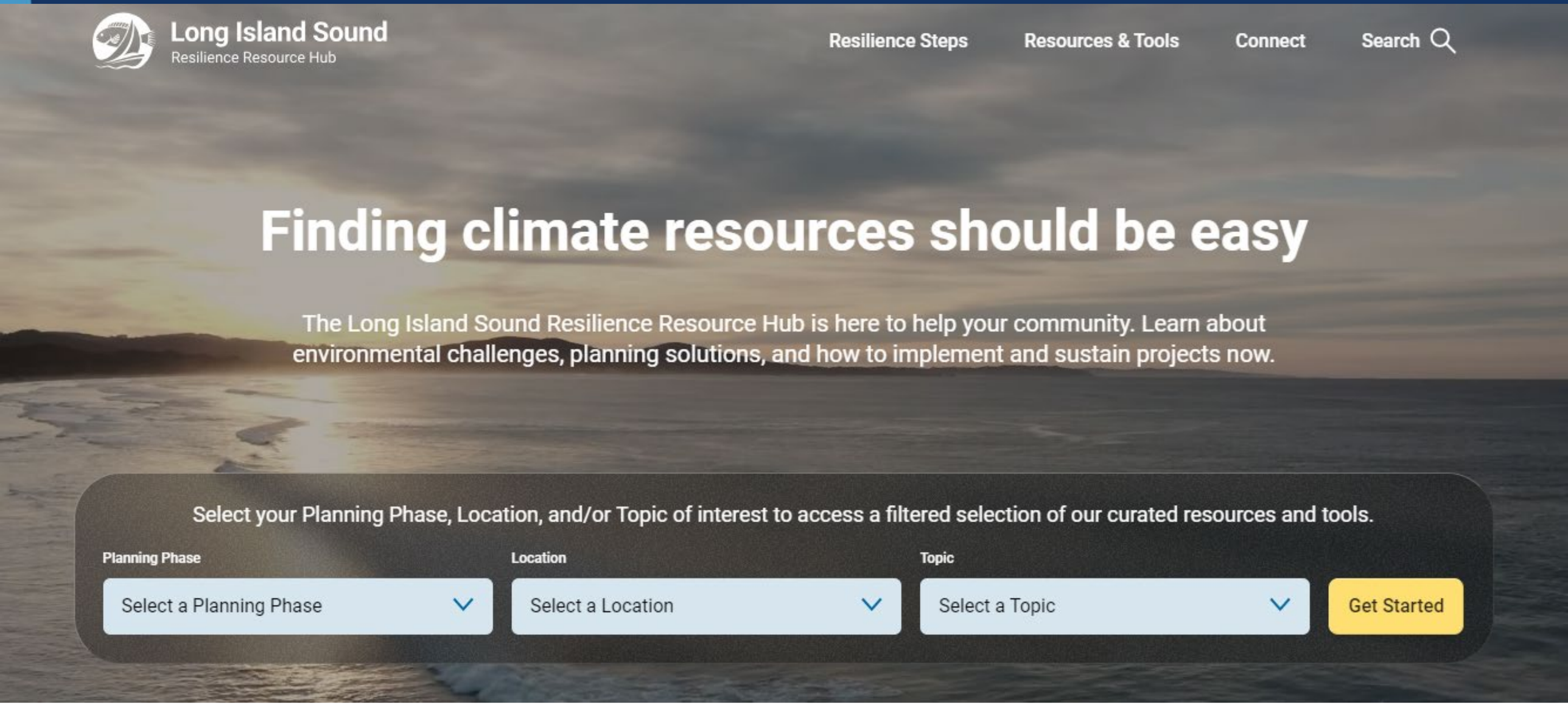


Agenda & Speakers

Long Island Sound Study
A Partnership to Restore and Protect the Sound

Compound Flood Risk Across Long Island Sound: An Interactive Mapping Tool for Informed Risk Management

Robin Glas, Hydrologist, U.S. Geological Survey - New York Water Science Center

Long Island Culverts and the Prioritization Mapping Toolkit

Enrico Nardone, Executive Director, Seatuck Environmental Association

Kaitlin Mattei, Conservation Project Manager, Seatuck Environmental Association

Road Stream Crossing Management Plans

Mike Jastremski, Watershed Conservation Director, Housatonic Valley Association

The Connecticut Watershed Model

Kathleen Knight, Long Island Sound Project Coordinator, Connecticut Department of Energy & Environmental Protection

What tools (if any) do you currently use to evaluate flooding impacts in your community?

0

Nobody has responded yet.

Hang tight! Responses are coming in.

USGS
science for a changing world

Compound flooding across Long Island Sound: an interactive mapping tool for informed risk management.

Robin Glas

Hydrologist

US Geological Survey, New York Water Science Center, Troy, NY

USGS
science for a changing world

Acknowledgements

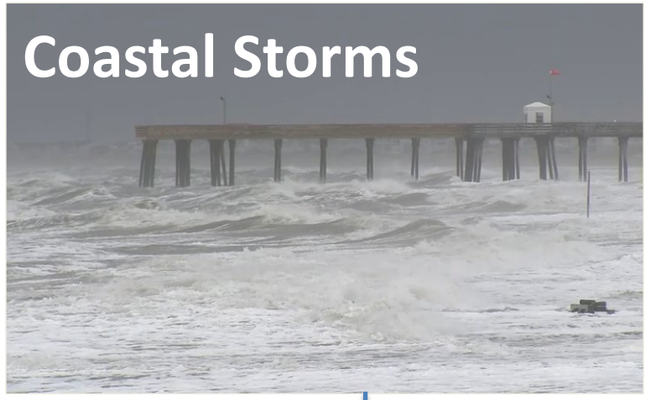
Kris Masterson
Liv Herdman
Rob Welk
Kalle Jahn
Janet Barclay
Salme Cook
Archi Howlader
Jack Monte

Long Island Sound Study

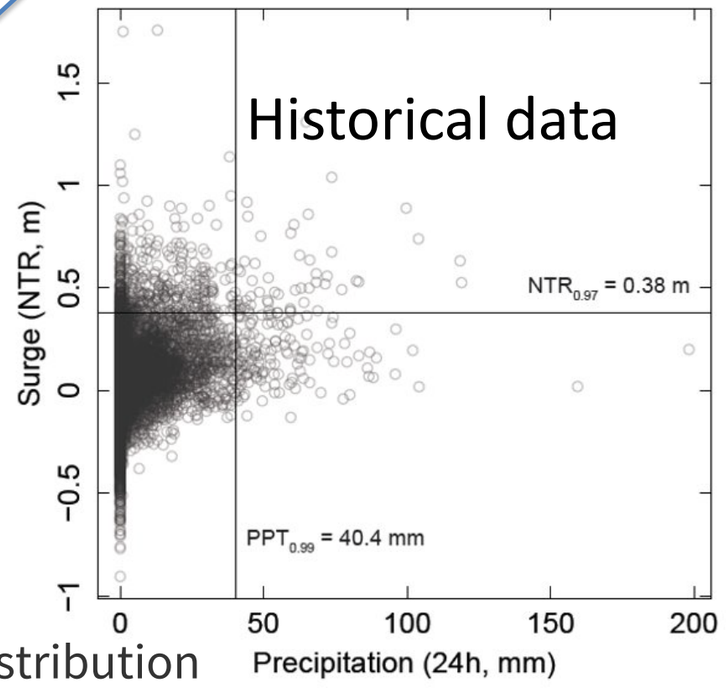
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Compound Flooding-

the co-occurrence of multiple flood drivers



Compound flood vulnerability index



USGS

Project objectives, overarching questions

- Are compound flood events an issue for Long Island Sound? How have these events occurred historically and how are they projected to change in the future?

- If these events were to hit in the near future, what geographic locations would be more affected than others?

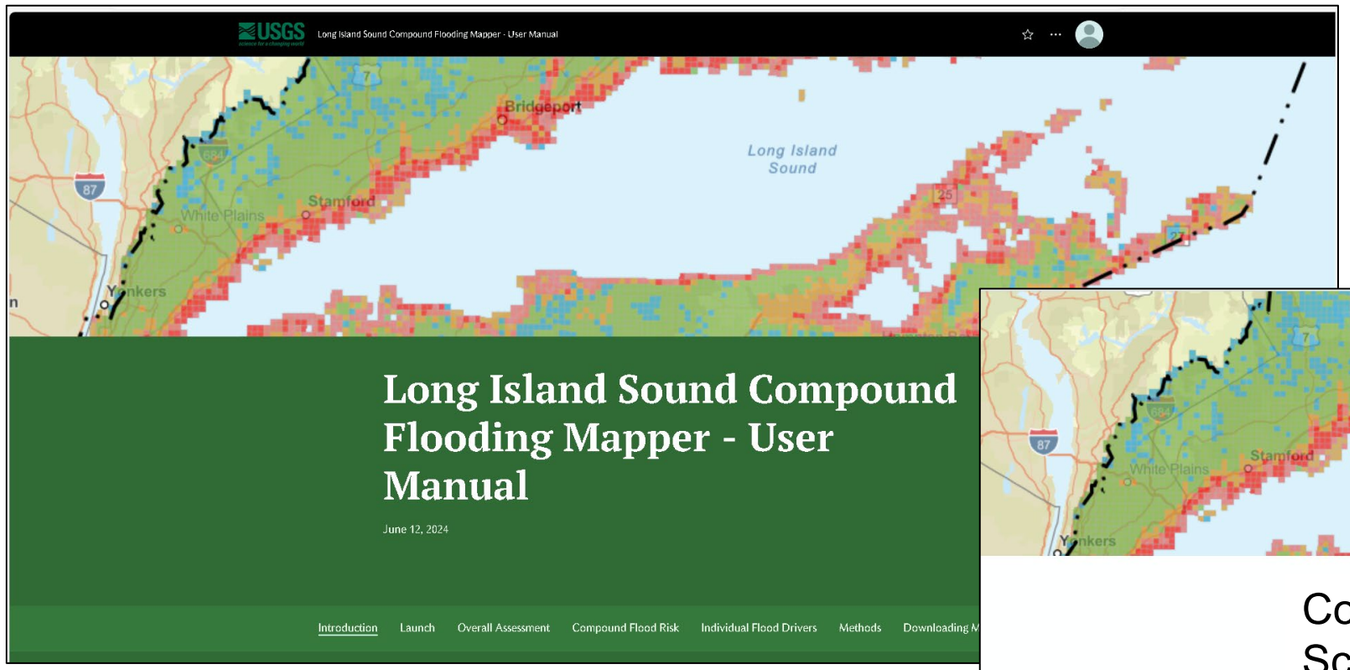
- **How to communicate the complexities of compound events to the public**

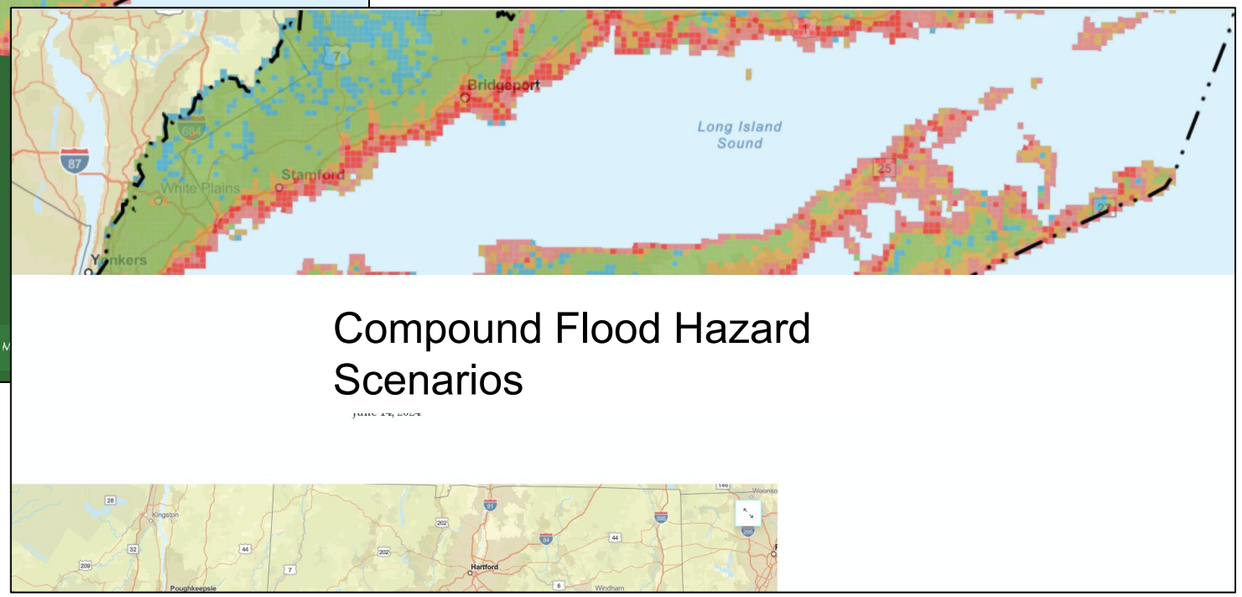
- **How managers can use the results from this mapping tool**

USGS

Compound Flood Risk Mapper

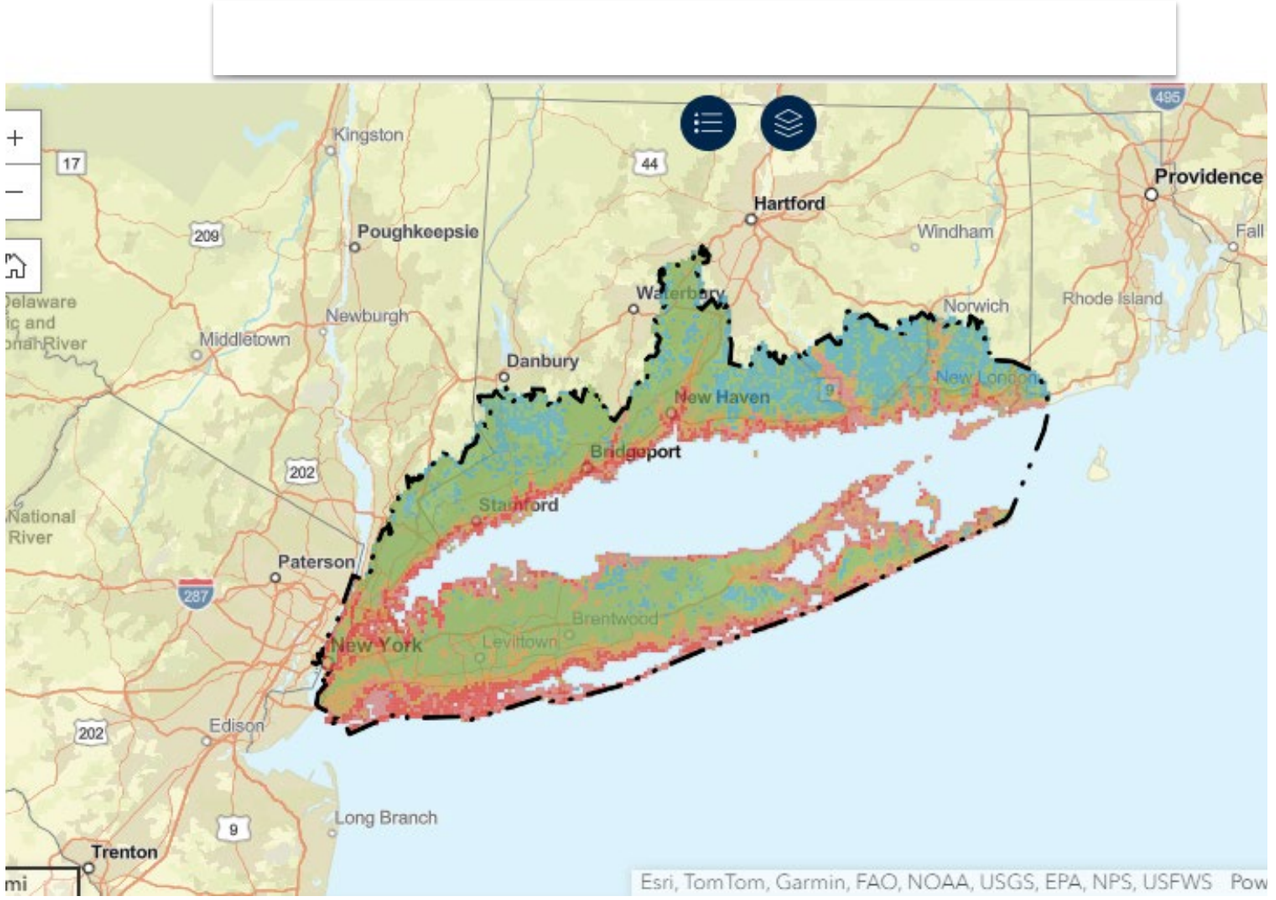
Preview of Tutorials/Story Maps





Overview of mapper tool

- **Area domain includes all of Long Island, and coastal contributing areas to LIS in southern CT**
- **All maps are aggregated to 900 m X 900 m grid cells**
- **Click on any grid cell to view the susceptibility to flash flooding, coastal flooding, groundwater flooding, and compound effects.**
- **Supplemental maps include sea level rise scenarios**

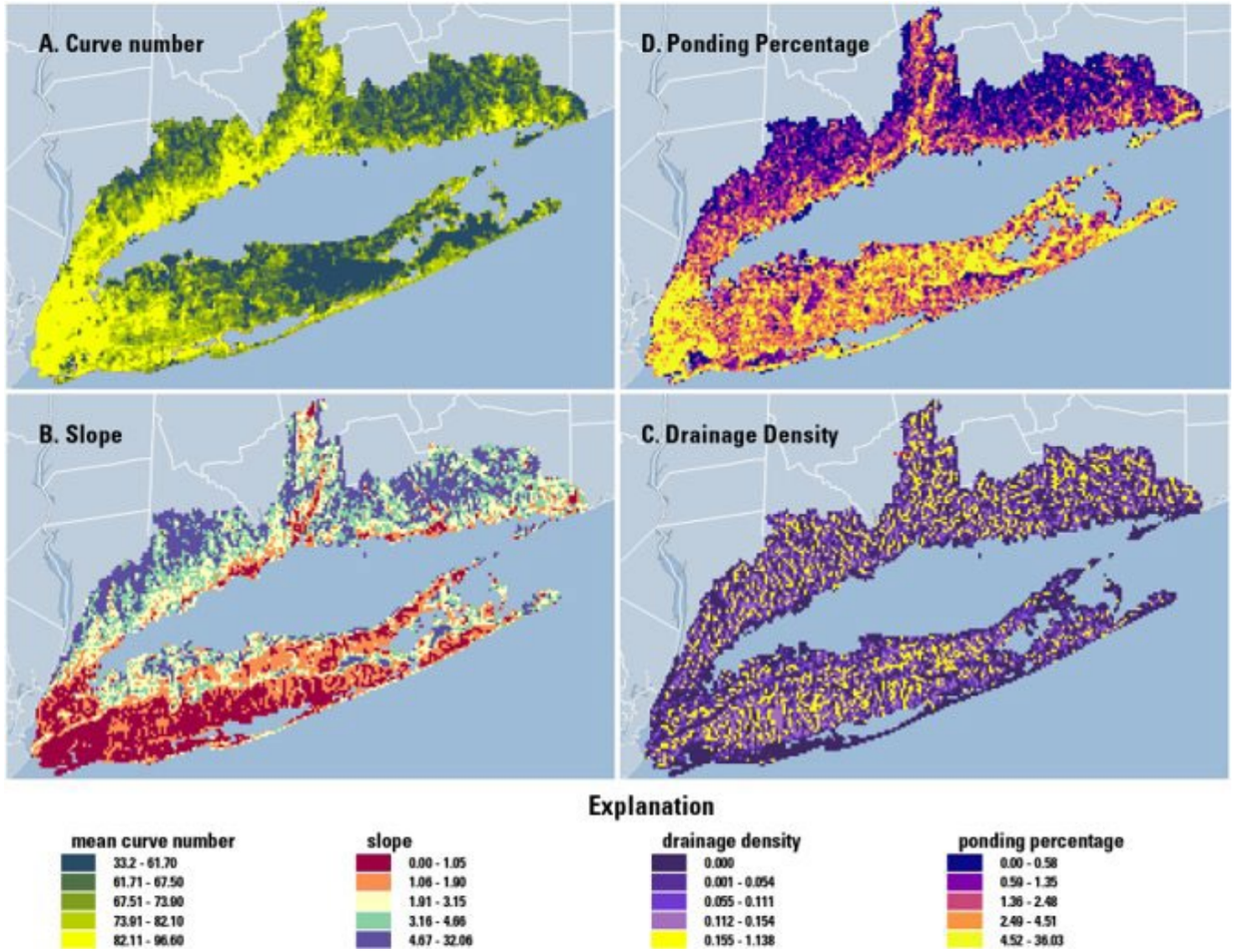


Rainfall susceptibility mapper

Pluvial flooding- high water levels caused by extreme rainfall, not necessarily in stream channels (flash flooding, street flooding)

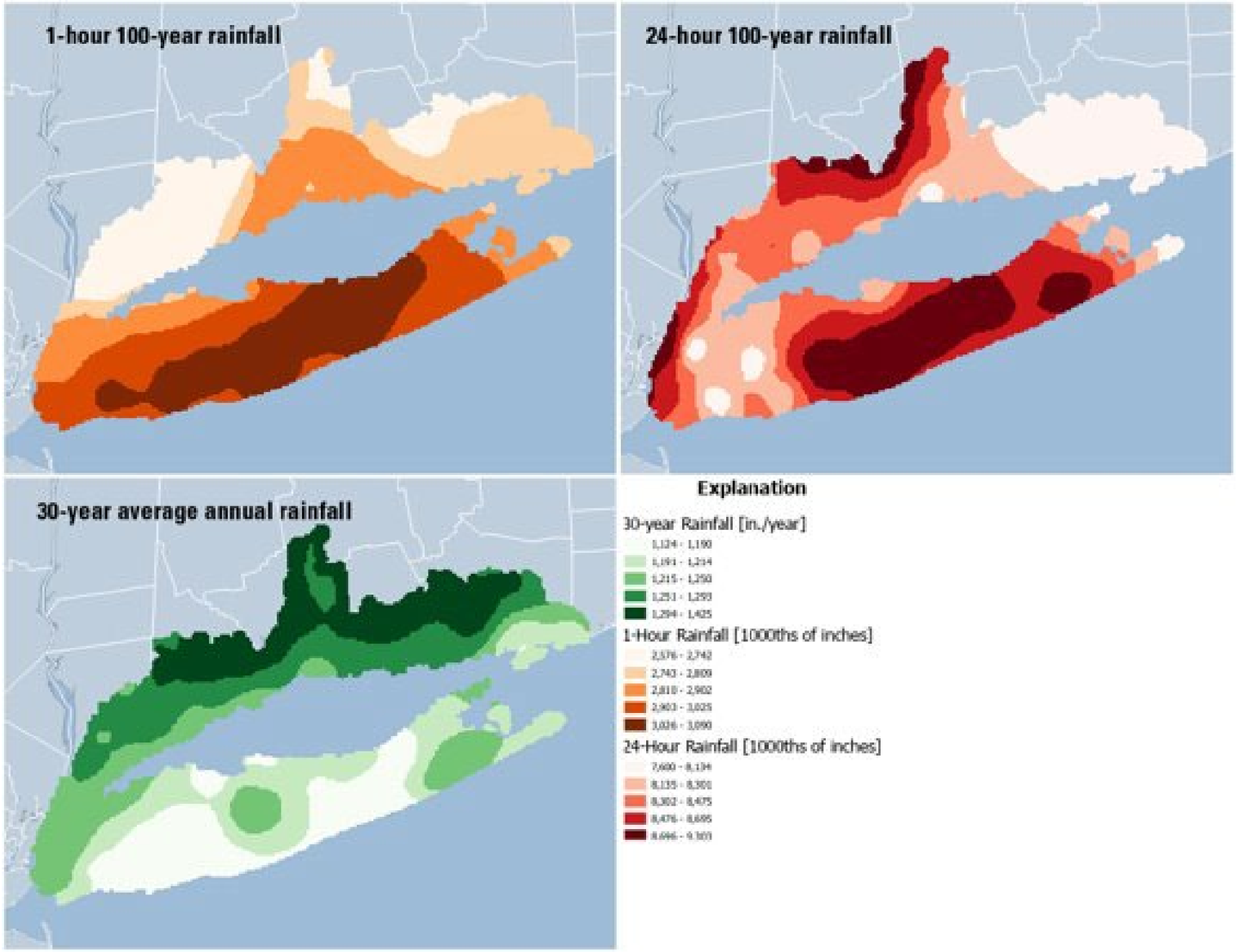
Dependent on land cover- where will the water run off or pond?

Underlying data that went into the mapper:

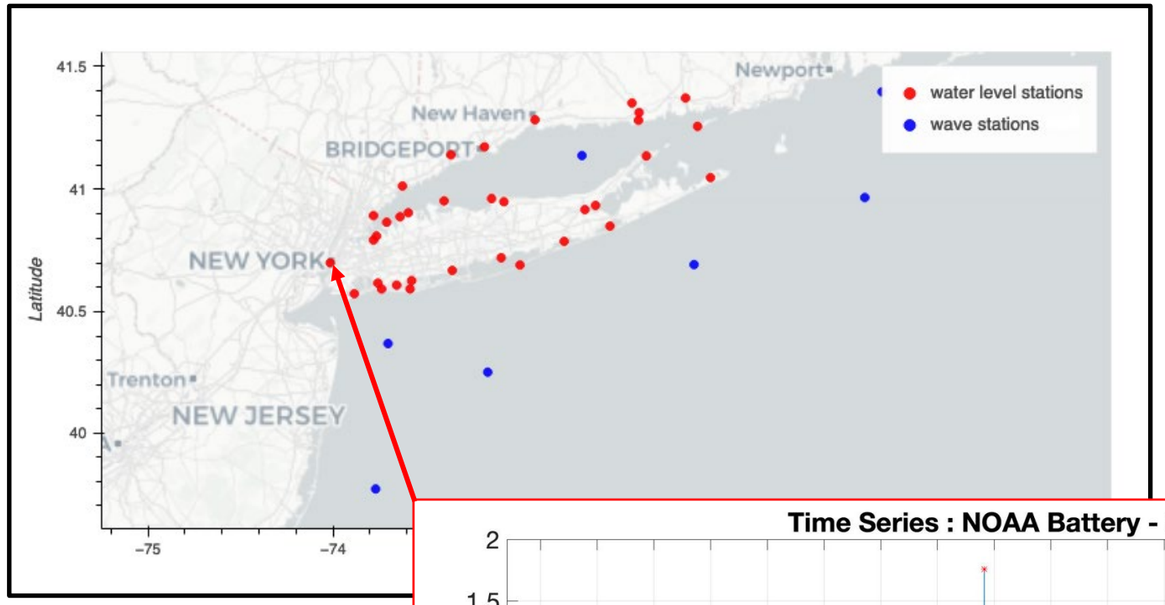


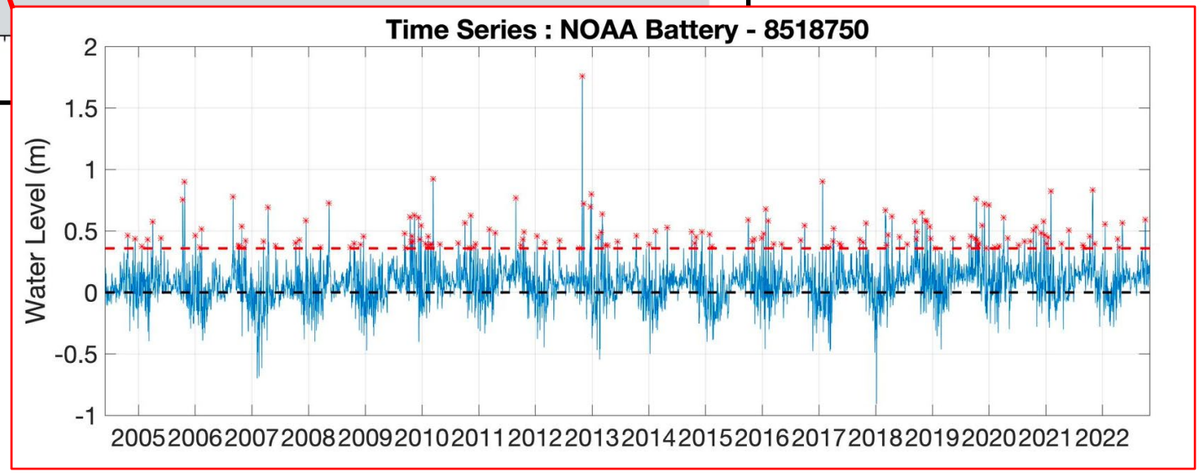
Rainfall susceptibility mapper

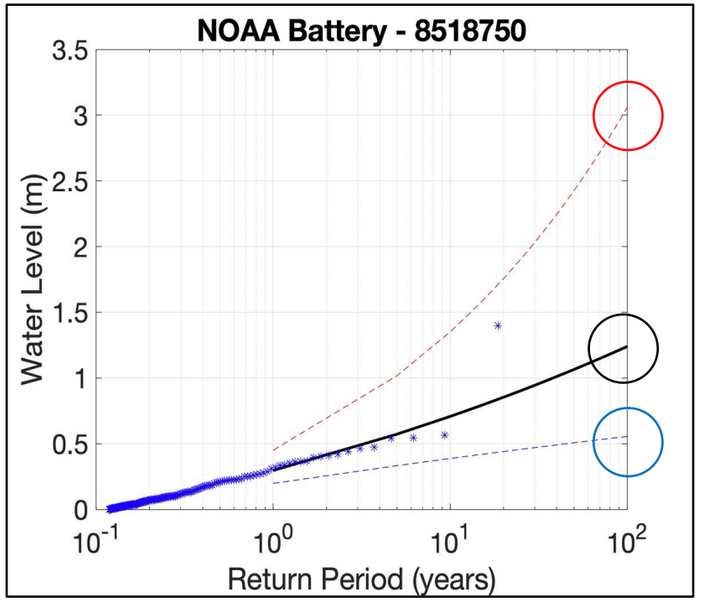
Underlying data, continued



Coastal Hazard Map Methodology



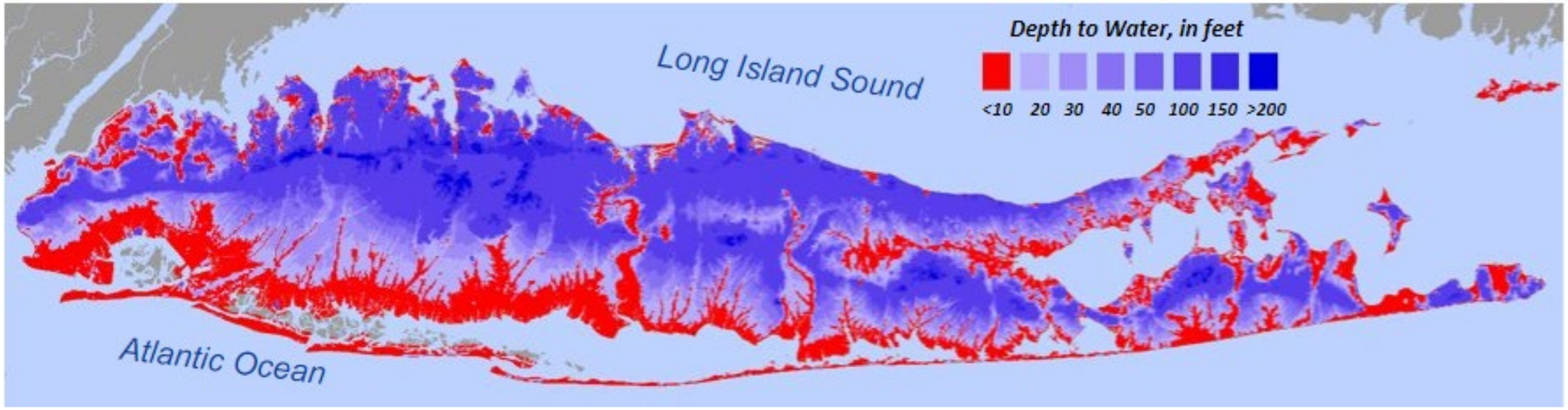




- Water Levels are projected onto the DEM via a smart bathtub algorithm
- A hazard score is assigned based on the frequency and area of inundation in a 900m grid cell

Groundwater/Shallow Water Table Inundation Hazard

- Within each 900m x 900m risk mapping cell, extract maximum simulated water table altitude (average conditions)
- Hazard calculated based on depth to water and presence of near surface infiltration-limiting soils. Maps of developed land use locations where groundwater may interact with subsurface infrastructure
- Same approach used for assigning hazard potential for future condition, using groundwater model simulation results with 6-feet SLR

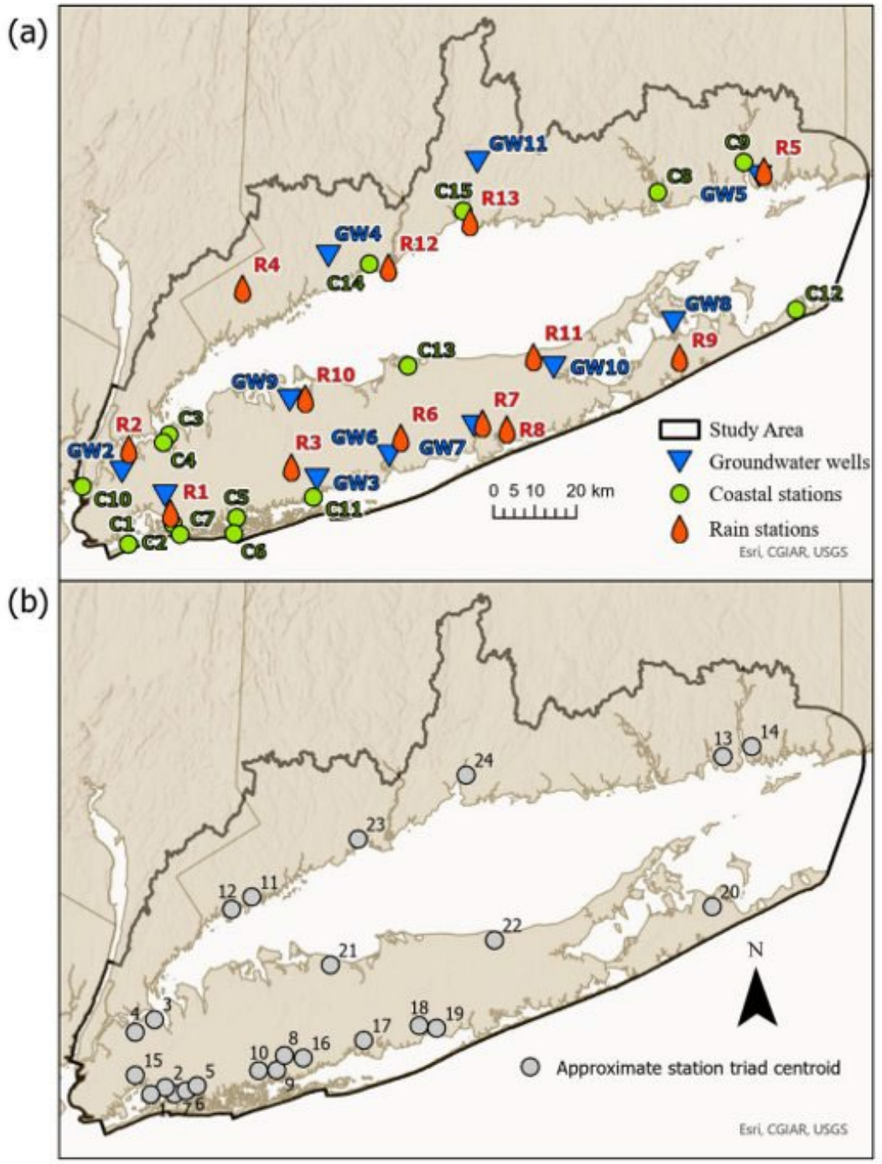


Compound Hazard

Return period shift- how many more times likely is a compound event to occur if we consider dependencies in the data?

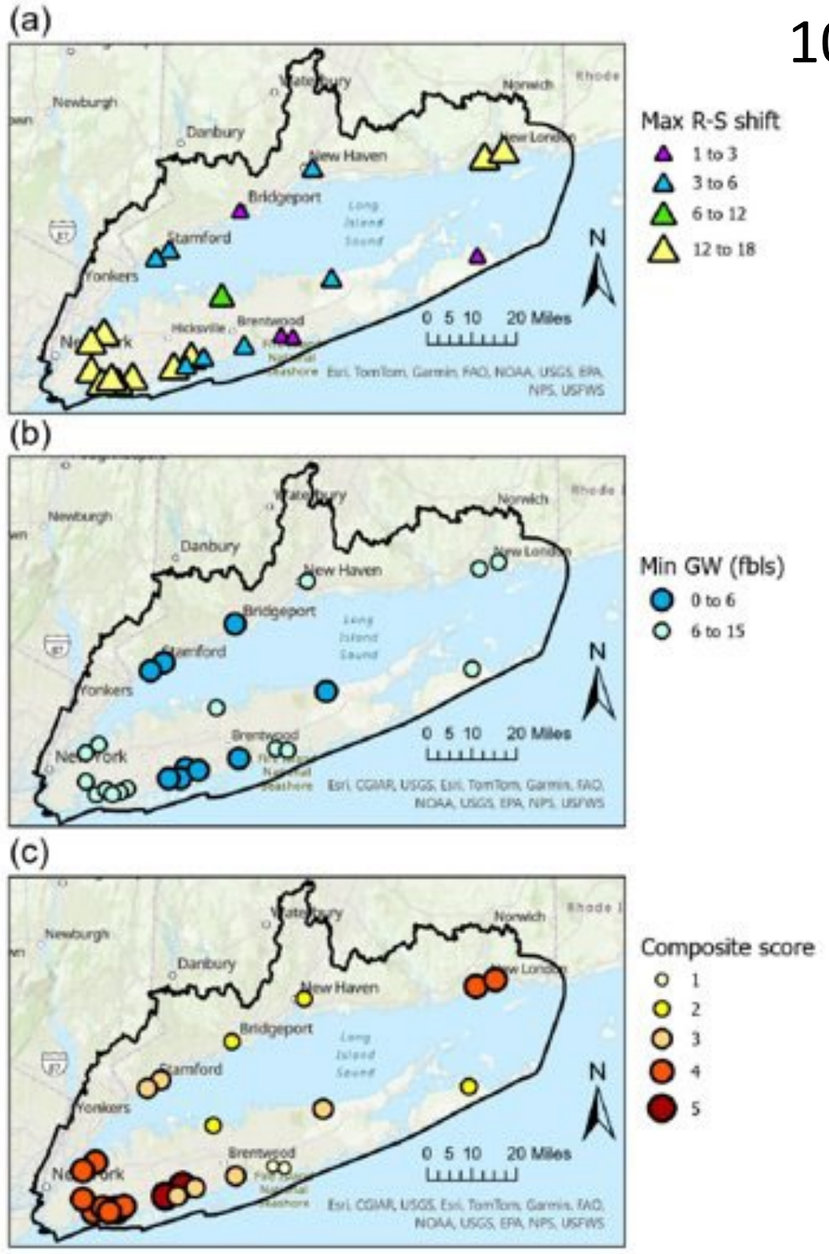
Combined with shallow monthly groundwater levels

= Composite score



Compound Hazard
Composite Score

Category	Range	Score
GW_{min}	(0,6]	2
	(6, 12]	1
$RPshift_{max}$	(0,3]	0
	(3,6]	1
	(6,12]	2
	(12,18]	3
	>18	4



[Demonstration of mapping tool [Provisional, not yet published]]

[Demonstration of StoryMaps [Provisional, not yet published]]

Is your community interested in learning more about the compound flood mapping tool and receiving in-depth training?

0

Yes

0%

Maybe

0%

No

0%

What additional information would be helpful for understanding flooding risks in your community?

0

Nobody has responded yet.

Hang tight! Responses are coming in.

Have you worked on culvert restoration projects?

0

(A) I have worked on many culvert restoration projects

0%

(B) I have worked on a few culvert restoration projects

0%

(C) I have never worked on a culvert restoration project

0%

For those that have worked on culvert restoration projects, have any of these projects involved efforts for aquatic connectivity (i.e fish passage?)

0

Yes

0%

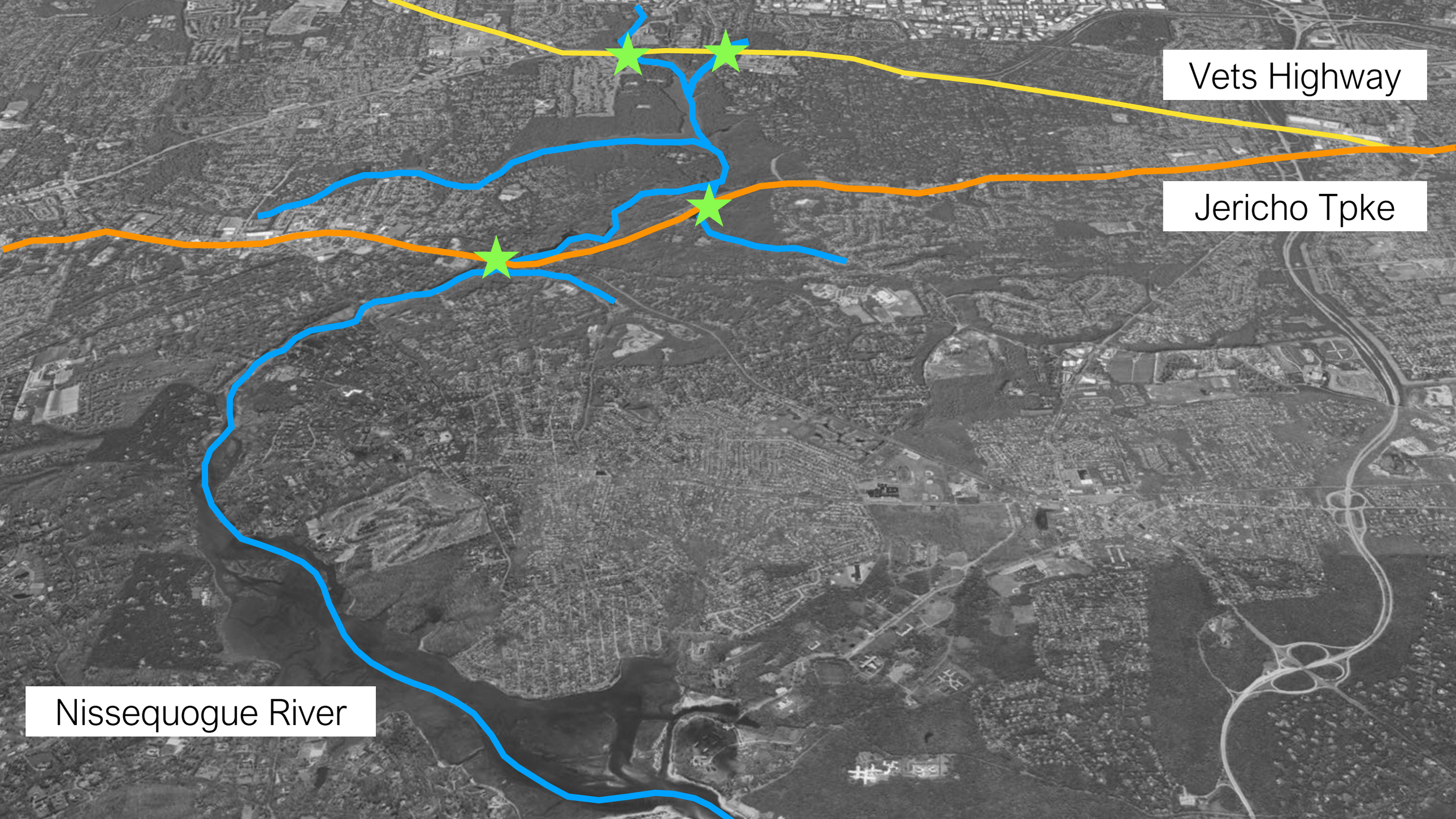
No

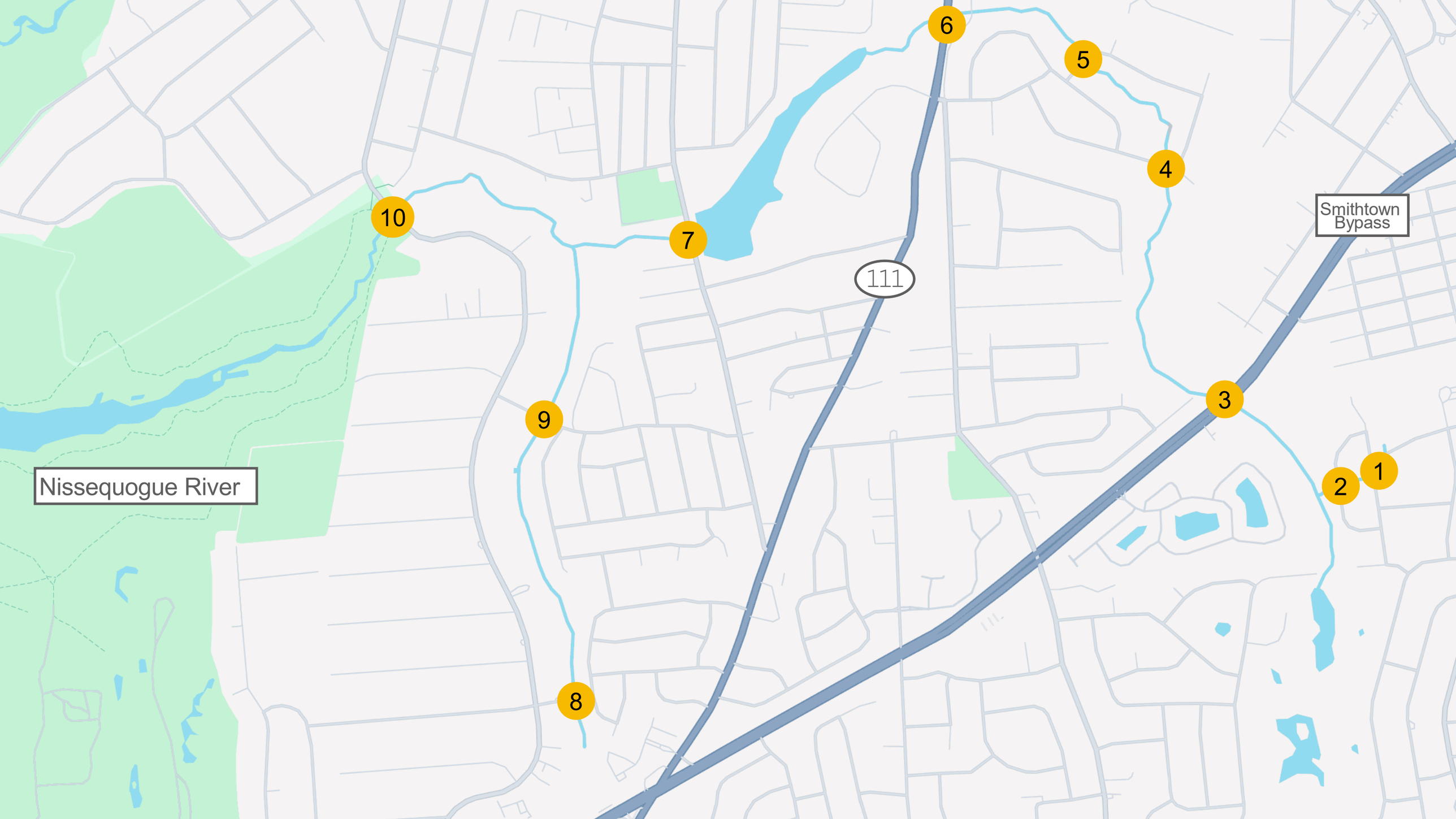
0%

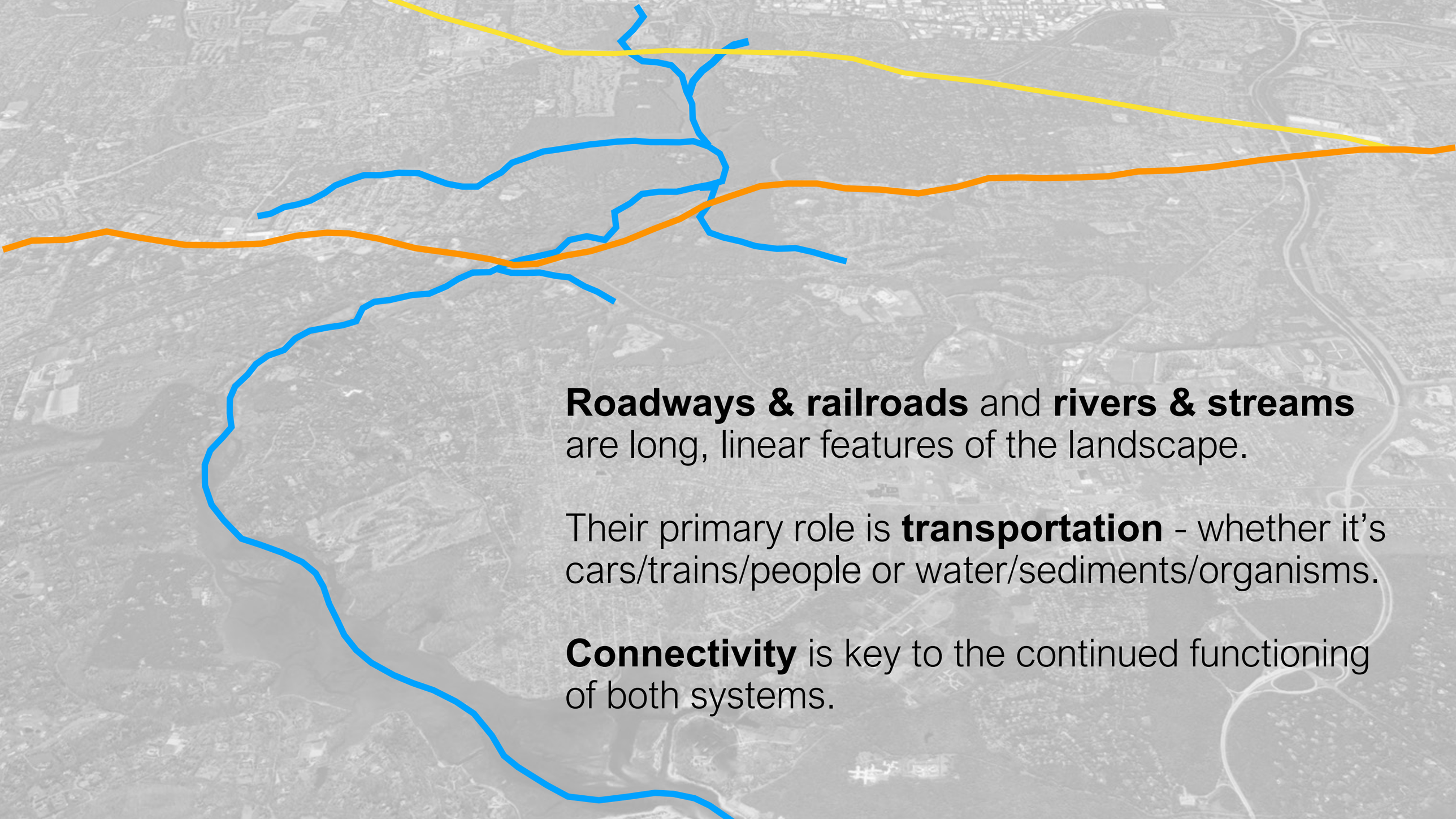
Road-Stream Crossing & Tidal Crossing Prioritization Tool

SEATUCK

Enrico Nardone, Executive Director
Kaitlin Mattei, Project Manager
Seatuck Environmental Association


Vets Highway
Jericho Tpke
Nissequogue River


6
5
4
10
7
111
Smithtown
Bypass
9
3
Nissequogue River
2
1
8



Roadways & railroads and **rivers & streams** are long, linear features of the landscape.

Their primary role is **transportation** - whether it's cars/trains/people or water/sediments/organisms.

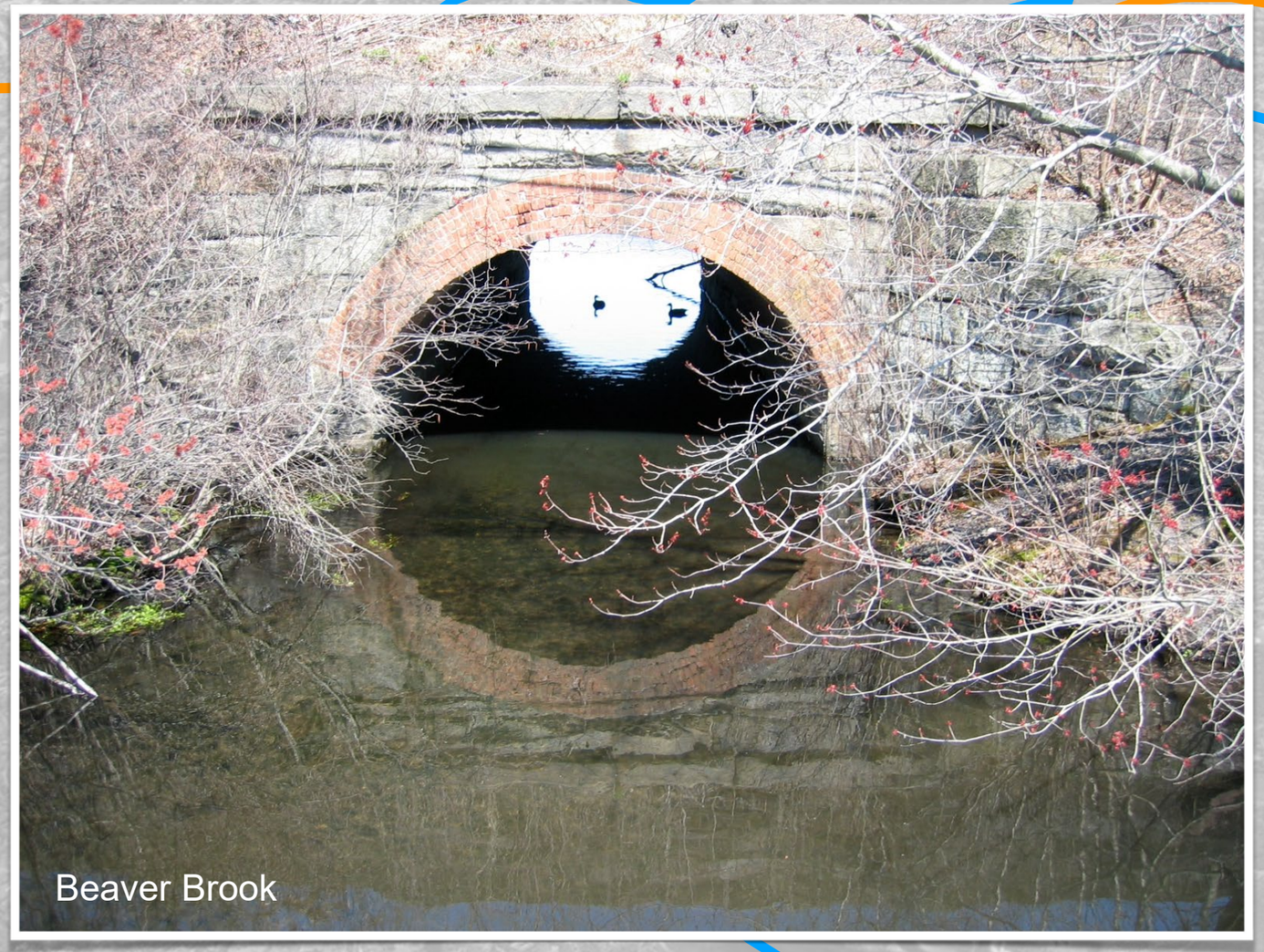
Connectivity is key to the continued functioning of both systems.

ROAD-STREAM CROSSINGS:
Where the Water Meets the Road

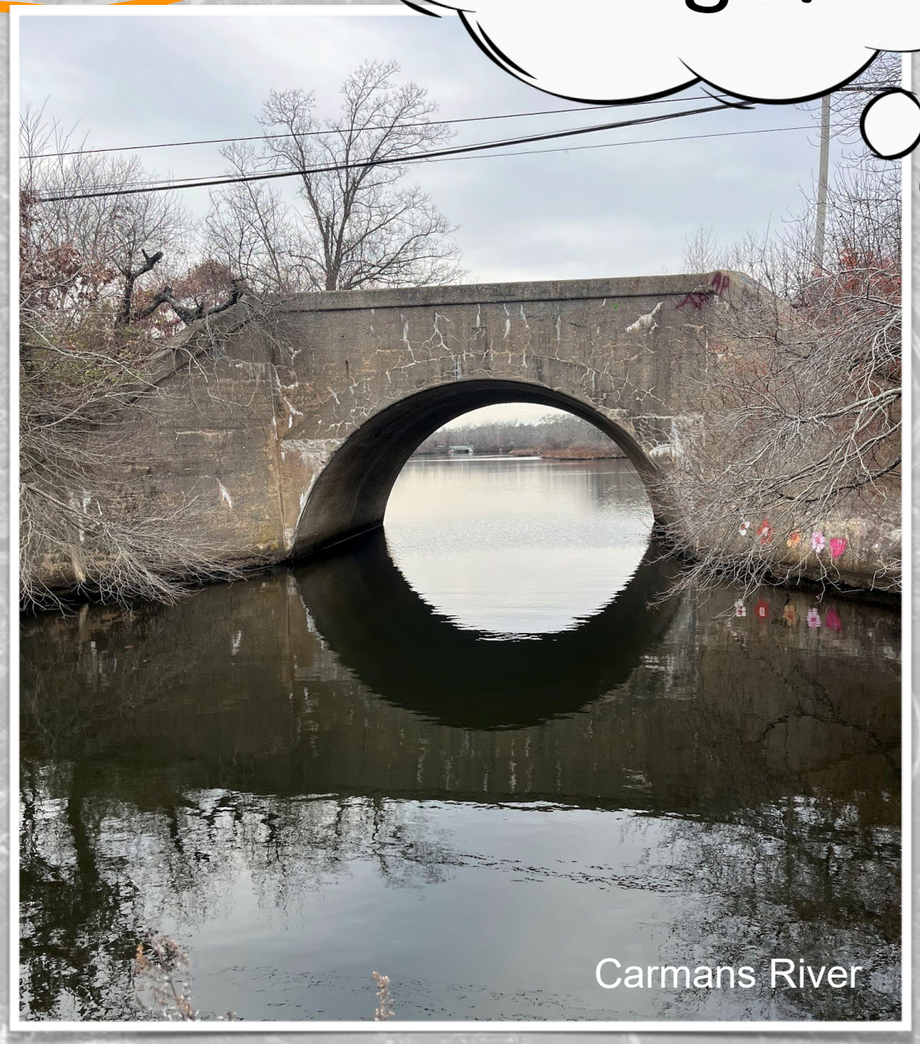
Culverts and **bridges** allow roads to pass over rivers, streams, tidal creeks and wetlands.

Undersized, poorly designed, or failing infrastructure at these crossings restricts water flow and can lead to flooding, road closures, property damage, degraded natural systems and impaired water quality.

Road-Stream Crossings:
Where the Water Meets the Road


Beaver Brook

Culvert or Bridge?


Carmans River

ROAD-STREAM CROSSINGS:
Where the Water Meets the Road

ROAD-STREAM CROSSINGS:
Where the Water Meets the Road


Bellmore Creek


Mill River

Ideally, our transportation infrastructure should **not**:

1. Put roadways/railroads at risk of being impacted by storms, or
2. Degrade the ecological health and resiliency of our rivers and streams

Transportation Vulnerability:

- Risk of failure
- Criticality
- Climate resilience

Ecological Impacts:

- Perched culverts with excess drop at the outlet
- Undersized culverts create high water velocity, turbulence & outlet scour
- Debris accumulation at the culvert inlet
- Oversized culverts can create inadequate water depths

Ecological Impacts:

- Disconnect rivers & streams
- Fragment wildlife habitat
- Disrupt sediment/nutrient transport
- Block wildlife movement (aquatic, semi-aquatic and terrestrial)

The Solution?
Right-Sizing!

Road-Stream Crossings that:

1. Make roadways/railroads resilient to storm impacts
2. Allow waterways to act naturally; promote healthy & resilient rivers and streams

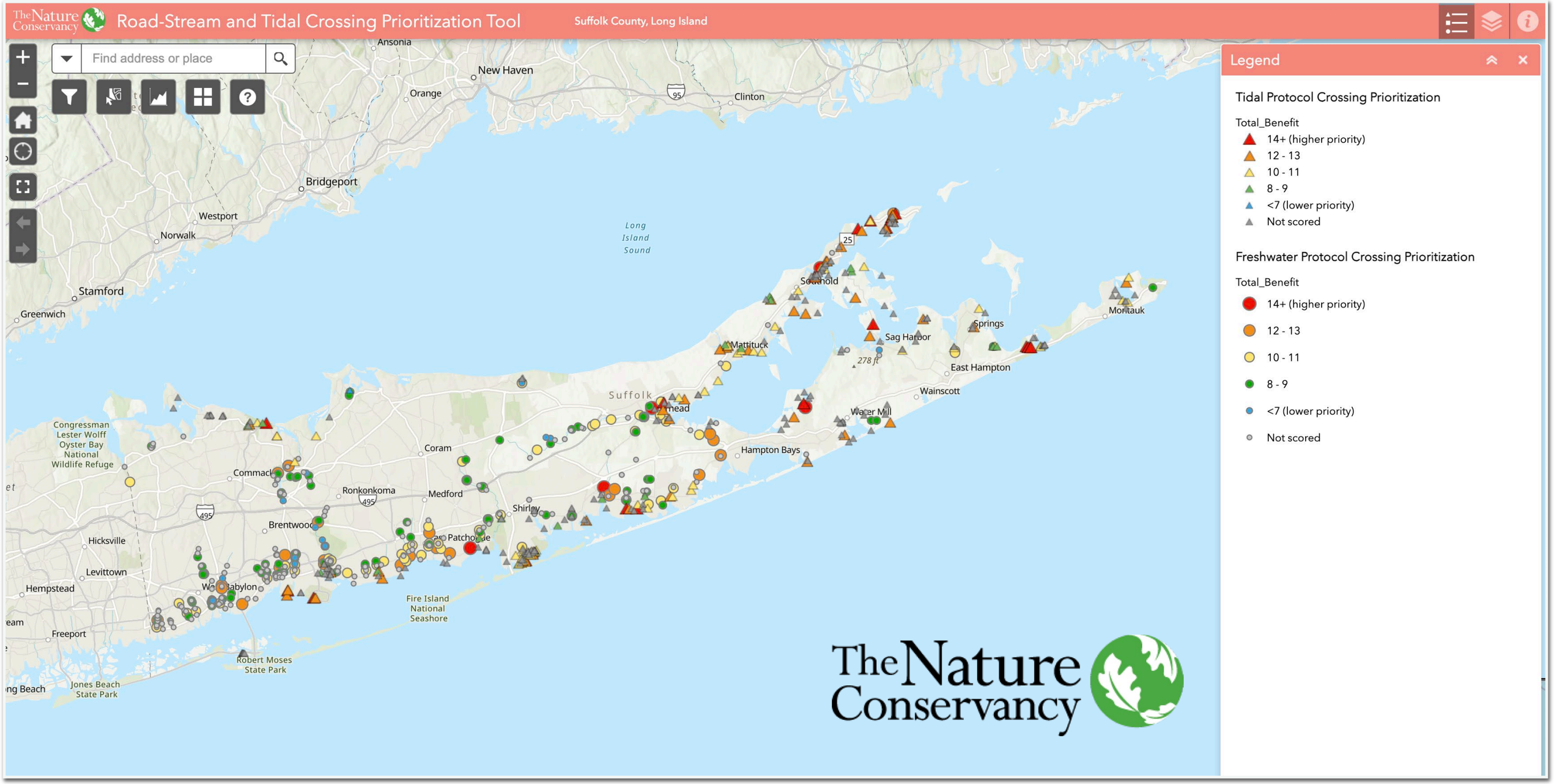
New Bridge Brook, Wilmington, NY


Potash Brook, Wilmington, NY
AUSABLE
Freshwater Center

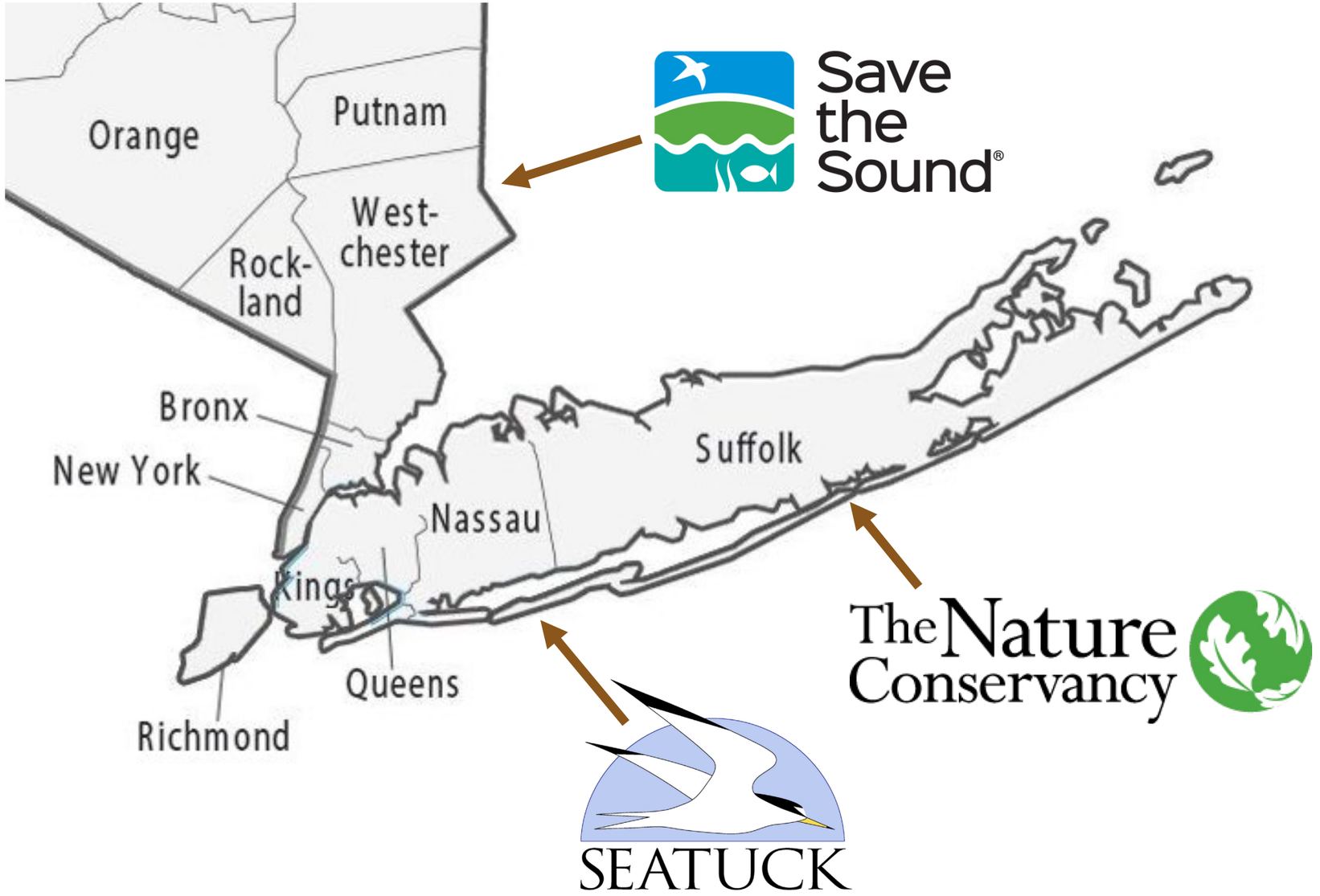

Pete Topping - Peconic Baykeeper


Pete Topping - Peconic Baykeeper

Road-Stream Crossing & Tidal Crossing Prioritization Tool



Road-Stream Crossing & Tidal Crossing Prioritization Tool



Would you use this toolkit (or for those outside NY, a toolkit like this one) to help locate priority sites for culvert restoration work?

0

Definitely!

0%

Maybe, but I need more information

0%

Unlikely

0%

This tool is not applicable to my work

0%

What additional information do you think would be helpful for this toolkit?

0

Nobody has responded yet.

Hang tight! Responses are coming in.

Road-Stream Crossing Management Planning in the Housatonic River Watershed

Mike Jastremski, Watershed Conservation Director
Housatonic Valley Association

CLEAN, COLD & CONNECTED

HVA
HVATODAY.ORG

CLEAN

Pollution doesn’t prevent communities, fish and wildlife from thriving

COLD

Communities, fish and wildlife are prepared for Climate Change

CONNECTED

Fish and wildlife are able to move freely along rivers and streams

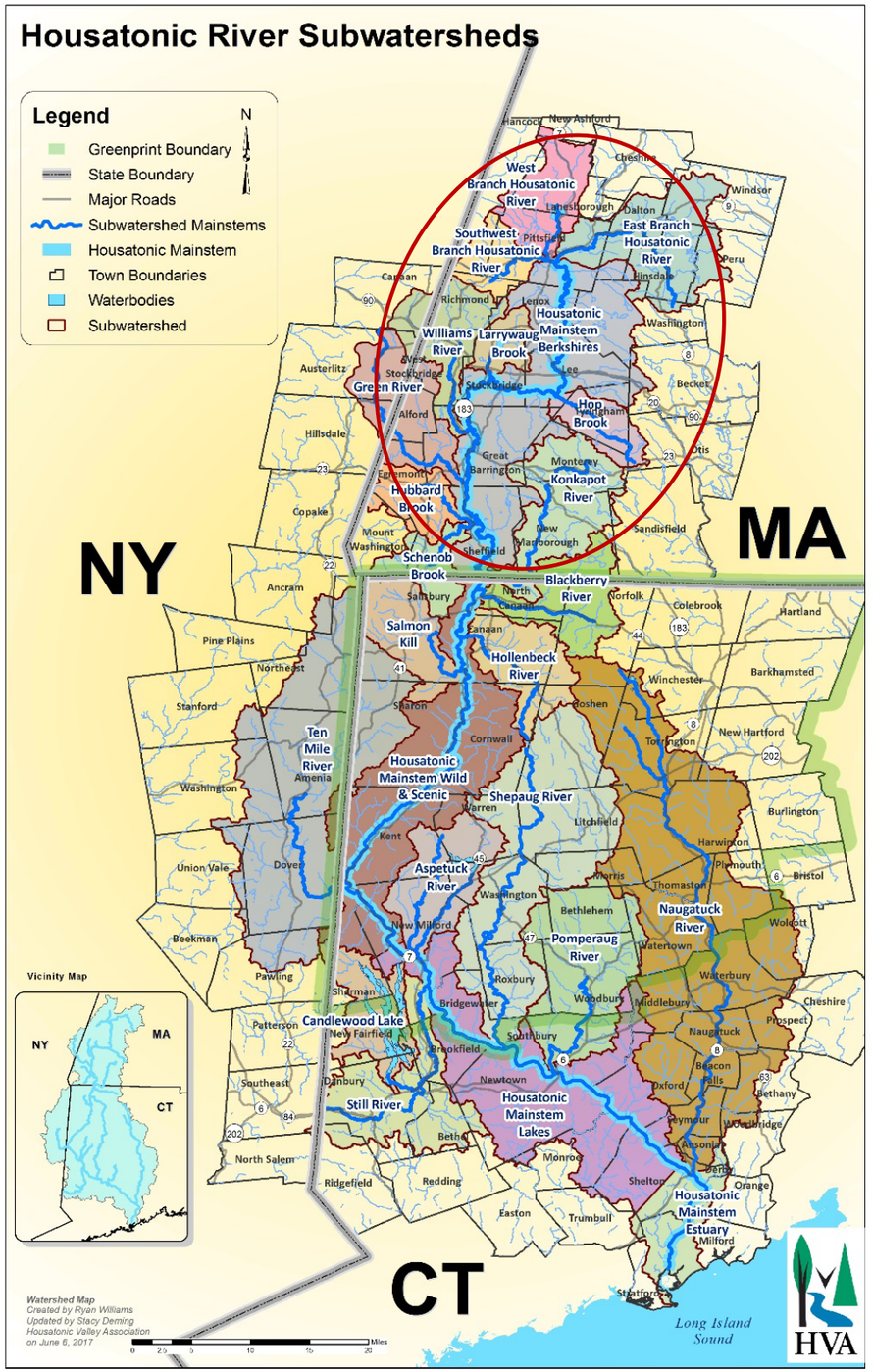
CONNECTED

Communities live well with their streams

Everyone has access to healthy waters, regardless of background or ability

RSC Assessment: Berkshires

- 2009-2012
- ~ 500 structures assessed



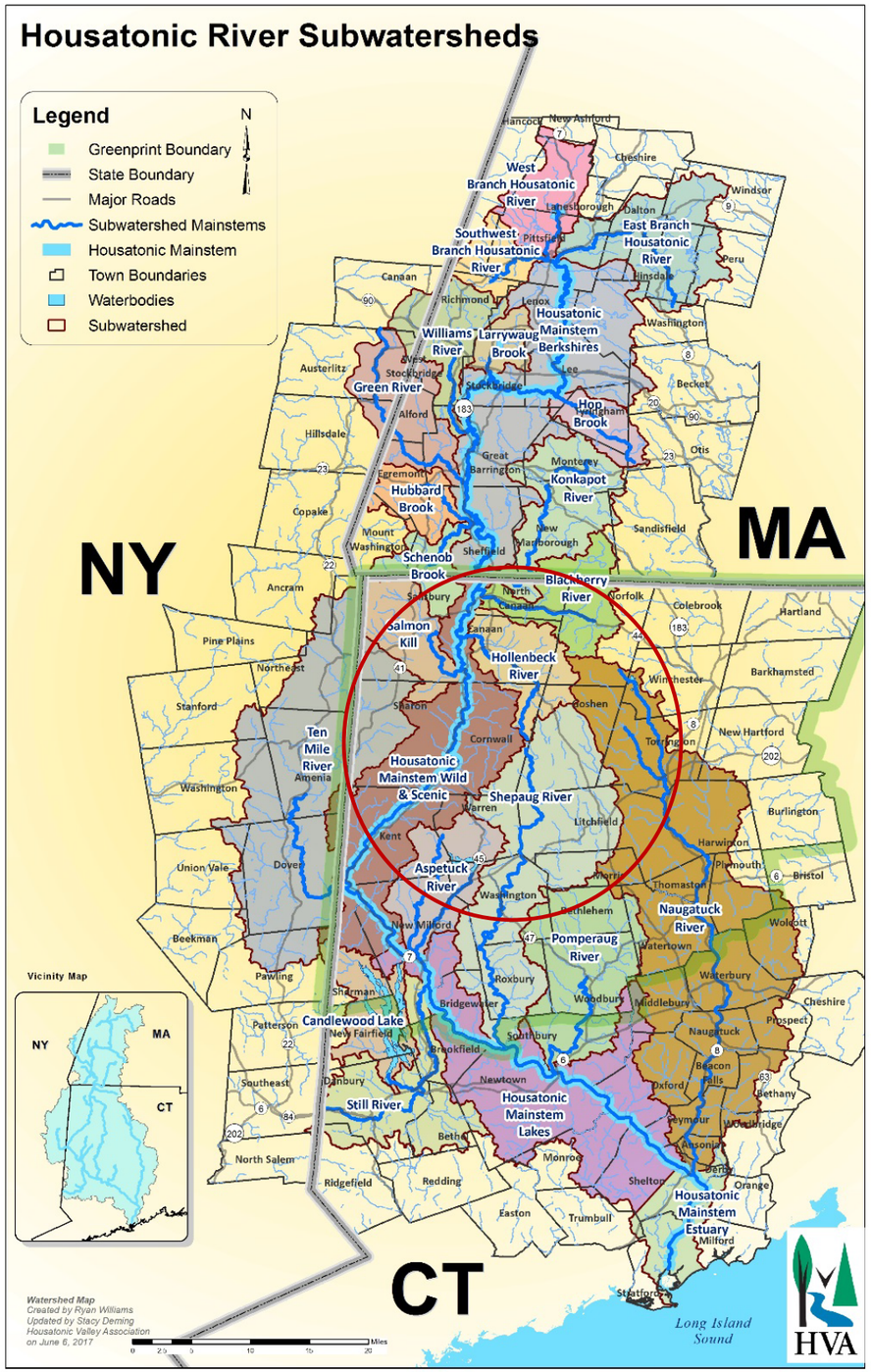
HOUSATONIC VALLEY ASSOCIATION

RSC Assessment: Berkshires

- Regional prioritization
- Two structures replaced, over 5 miles of EBT habitat reconnected
- What about the other 498 structures?

RSC Assessment: Litchfield Hills

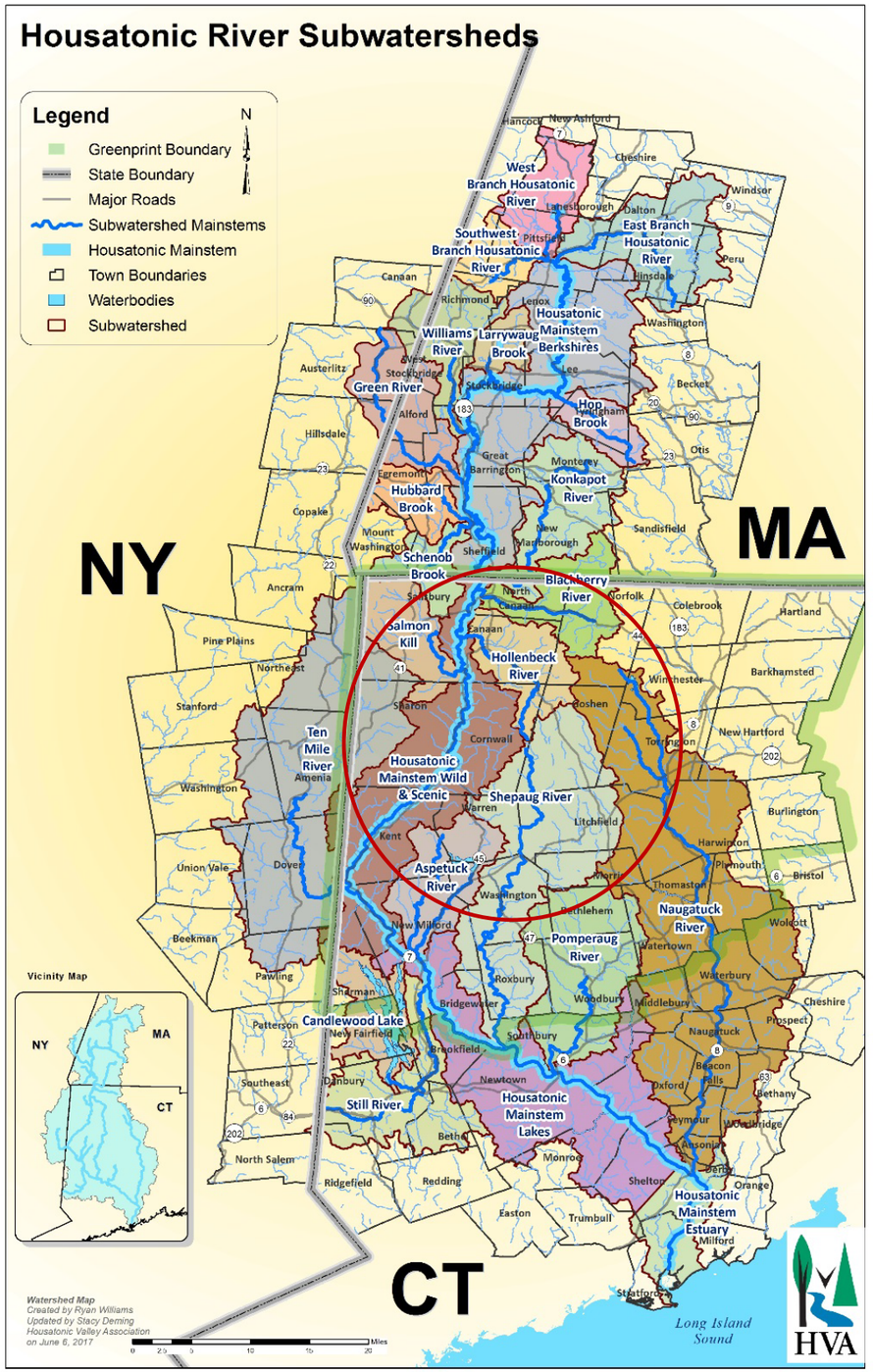
- How do we move assessment data towards action?
  - Engage key players in setting priorities
  - Provide technical assistance
  - Create a resource for securing funding



HOUSATONIC VALLEY ASSOCIATION

RSC Assessment in the Housatonic Watershed: Litchfield Hills

- 2012-2017
- ~ 800 structures assessed



HOUSATONIC VALLEY ASSOCIATION

Litchfield Hills Project

- Lessons learned from Berkshires:
  - Towns want a comprehensive inventory
  - Flood risk/condition are primary concerns

- Secured funding to develop a town-scale approach

- New partnership with UConn to model flood risk at culverts

HOUSATONIC VALLEY ASSOCIATION

Town-Scale Management Planning

- Combine modelling with local knowledge
- Collaboratively identify replacement projects
- Increase town capacity to replace problem culverts (technical skills, financing)
- Build relationships with communities

Town-Scale Management Planning Process

1. **Comprehensive field assessment**

Town-Scale Management Planning Process

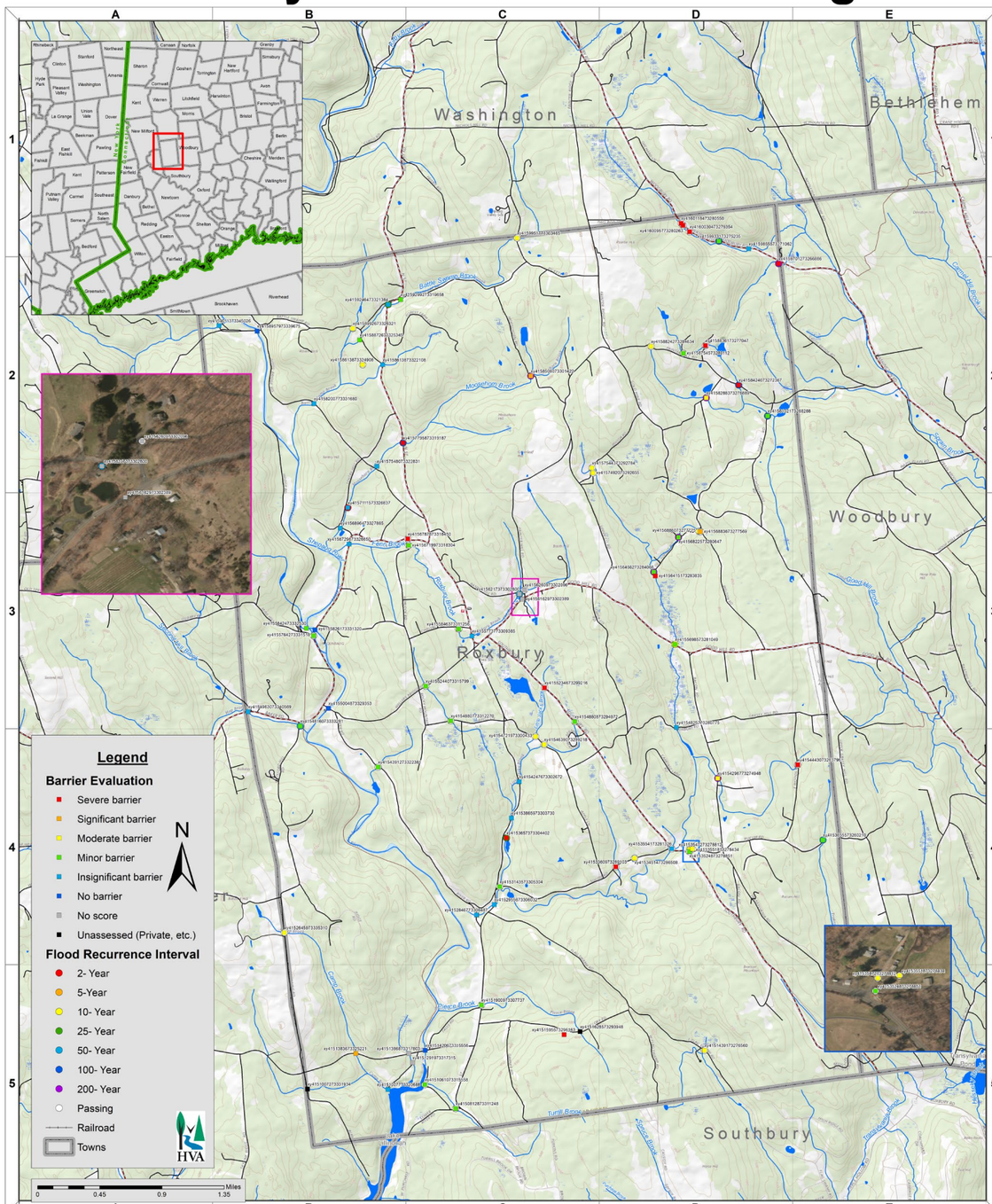
1. Comprehensive field assessment
2. **Flood Risk Analysis**

University of Connecticut
School of Engineering

Shen and Anagnostou, (2017). "A Framework to Improve Hyper-Resolution Hydrological Simulation in Snow-Affected Regions“. Journal of Hydrology 552 (2017) 1–12

Town-Scale Management Planning Process

1. Comprehensive field assessment
2. Flood Risk Analysis
3. **Create Road-Stream Crossing Inventory**



Town-Scale Management Planning Process

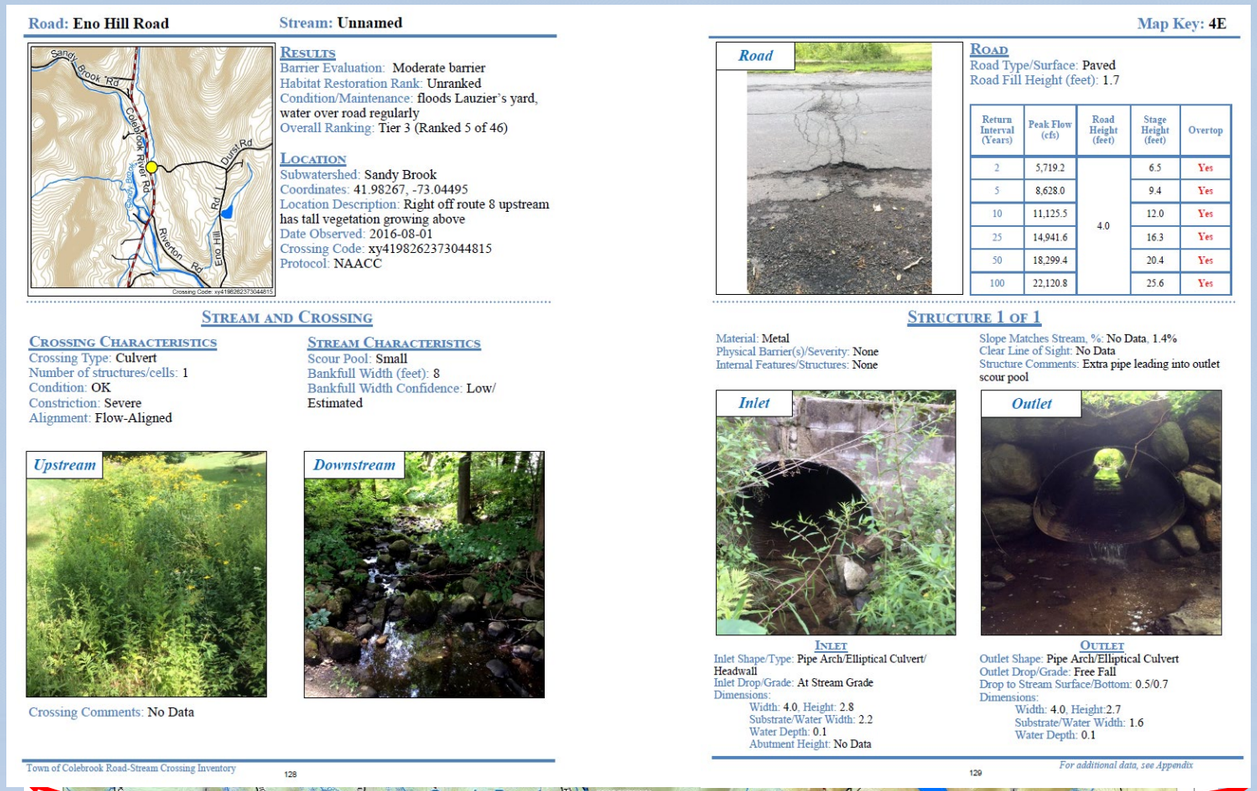
1. Comprehensive field assessment
2. Flood Risk Analysis
3. Create Road-Stream Crossing Inventory:
4. **Use Inventory to set priorities**

Town-Scale Management Plans

1. Comprehensive field assessment
2. Flood Risk Analysis
3. Create Road-Stream Crossing Inventory
4. Use Inventory to set priorities
5. **Demonstration Design Development**

Town-Scale Management Plans

1. Comprehensive field assessment
2. Flood Risk Analysis
3. Create Road-Stream Crossing Inventory
4. Use Inventory to set priorities
5. Demonstration Design Development
6. **Assemble draft Management Plan**



Road: Eno Hill Road **Stream:** Unnamed **Map Key:** 4E

Results
Barrier Evaluation: Moderate barrier
Habitat Restoration Rank: Unranked
Condition/Maintenance: floods Lauzier's yard, water over road regularly
Overall Ranking: Tier 3 (Ranked 5 of 46)

Location
Subwatershed: Sandy Brook
Coordinates: 41.98267, -73.04495
Location Description: Right off route 8 upstream has tall vegetation growing above
Date Observed: 2016-08-01
Crossing Code: xy4198262373044815
Protocol: NAACC

Stream and Crossing

Crossing Characteristics
Crossing Type: Culvert
Number of structures/cells: 1
Condition: OK
Constriction: Severe
Alignment: Flow-Aligned

Stream Characteristics
Scour Pool: Small
Bankfull Width (feet): 8
Bankfull Width Confidence: Low/ Estimated

Upstream

Downstream

Crossing Comments: No Data

Town of Colebrook Road-Stream Crossing Inventory 128

Road

Road
Road Type/Surface: Paved
Road Fill Height (feet): 1.7

Return Interval (Years)	Peak Flow (cfs)	Road Height (feet)	Stage Height (feet)	Overtop
2	5,719.2	4.0	6.5	Yes
5	8,628.0		9.4	Yes
10	11,125.5		12.0	Yes
25	14,941.6		16.3	Yes
50	18,299.4		20.4	Yes
100	22,120.8		25.6	Yes

Structure 1 of 1

Material: Metal
Physical Barrier(s)/Severity: None
Internal Features/Structures: None
Slope Matches Stream, %: No Data, 1.4%
Clear Line of Sight: No Data
Structure Comments: Extra pipe leading into outlet scour pool

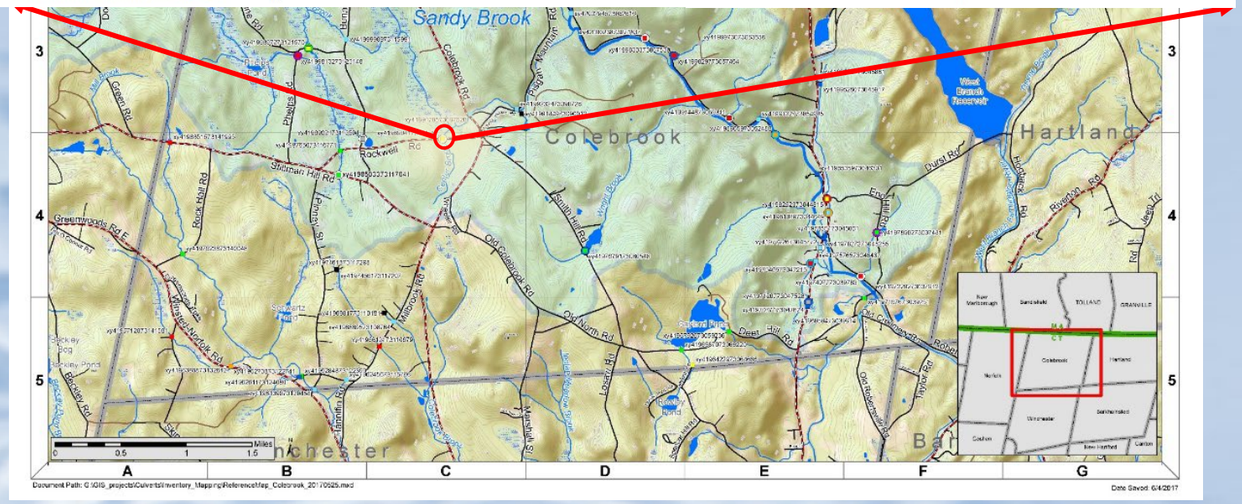
Inlet

Outlet

Inlet
Inlet Shape/Type: Pipe Arch/Elliptical Culvert/ Headwall
Inlet Drop/Grade: At Stream Grade
Dimensions:
Width: 4.0, Height: 2.8
Substrate/Water Width: 2.2
Water Depth: 0.1
Abutment Height: No Data

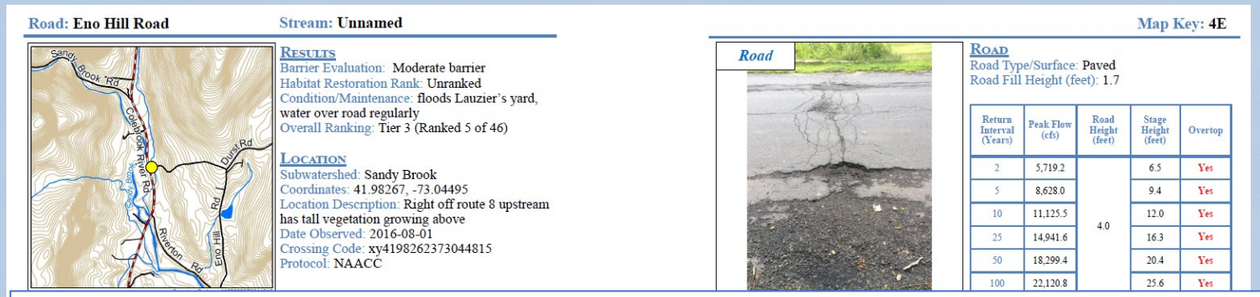
Outlet
Outlet Shape: Pipe Arch/Elliptical Culvert
Outlet Drop/Grade: Free Fall
Drop to Stream Surface/Bottom: 0.5/0.7
Dimensions:
Width: 4.0, Height: 2.7
Substrate/Water Width: 1.6
Water Depth: 0.1

For additional data, see Appendix 129



Town-Scale Management Plans

1. Comprehensive field assessment
2. Flood Risk Analysis
3. Create Road-Stream Crossing Inventory
4. Use Inventory to set priorities
5. Demonstration Design Development
6. **Assemble draft Management Plan**



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Habitat Restoration Rank: Unranked
Condition/Maintenance: floods Lauzier's yard, water over road regularly
Overall Ranking: Tier 3 (Ranked 5 of 46)

Location
Subwatershed: Sandy Brook
Coordinates: 41.98267, -73.04495
Location Description: Right off route 8 upstream has tall vegetation growing above
Date Observed: 2016-08-01
Crossing Code: xy4198262373044815
Protocol: NAACC

Road
Road Type/Surface: Paved
Road Fill Height (feet): 1.7

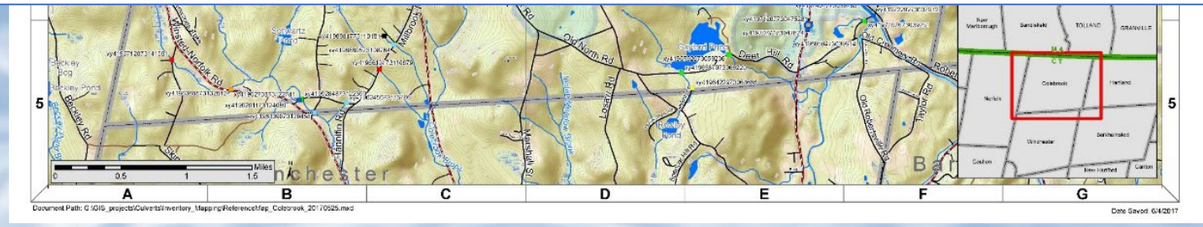
Return Interval (Years)	Peak Flow (cfs)	Road Height (feet)	Stage Height (feet)	Overtop
2	5,719.2	4.0	6.5	Yes
5	8,628.0		9.4	Yes
10	11,125.5		12.0	Yes
25	14,941.6		16.3	Yes
50	18,299.4		20.4	Yes
100	22,120.8		25.6	Yes

Top 7 Crossings for Flood Risk

Town Roads

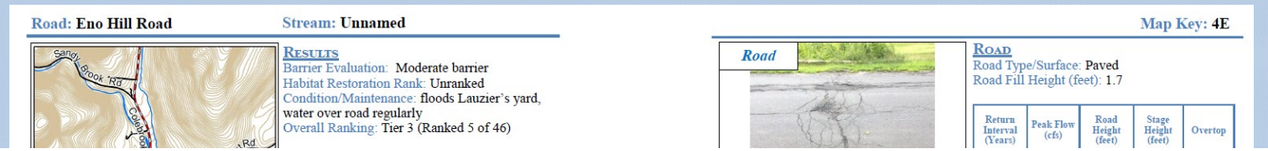
This chart is a summary of road-stream crossings with the shortest flood intervals (i.e. most likely to flood the road) based on modeling performed by the University of Connecticut. Note that only culverts within target watersheds—i.e. the Sandy Brook—were included in the model, and that this list only includes crossings on town-managed roads.[1]

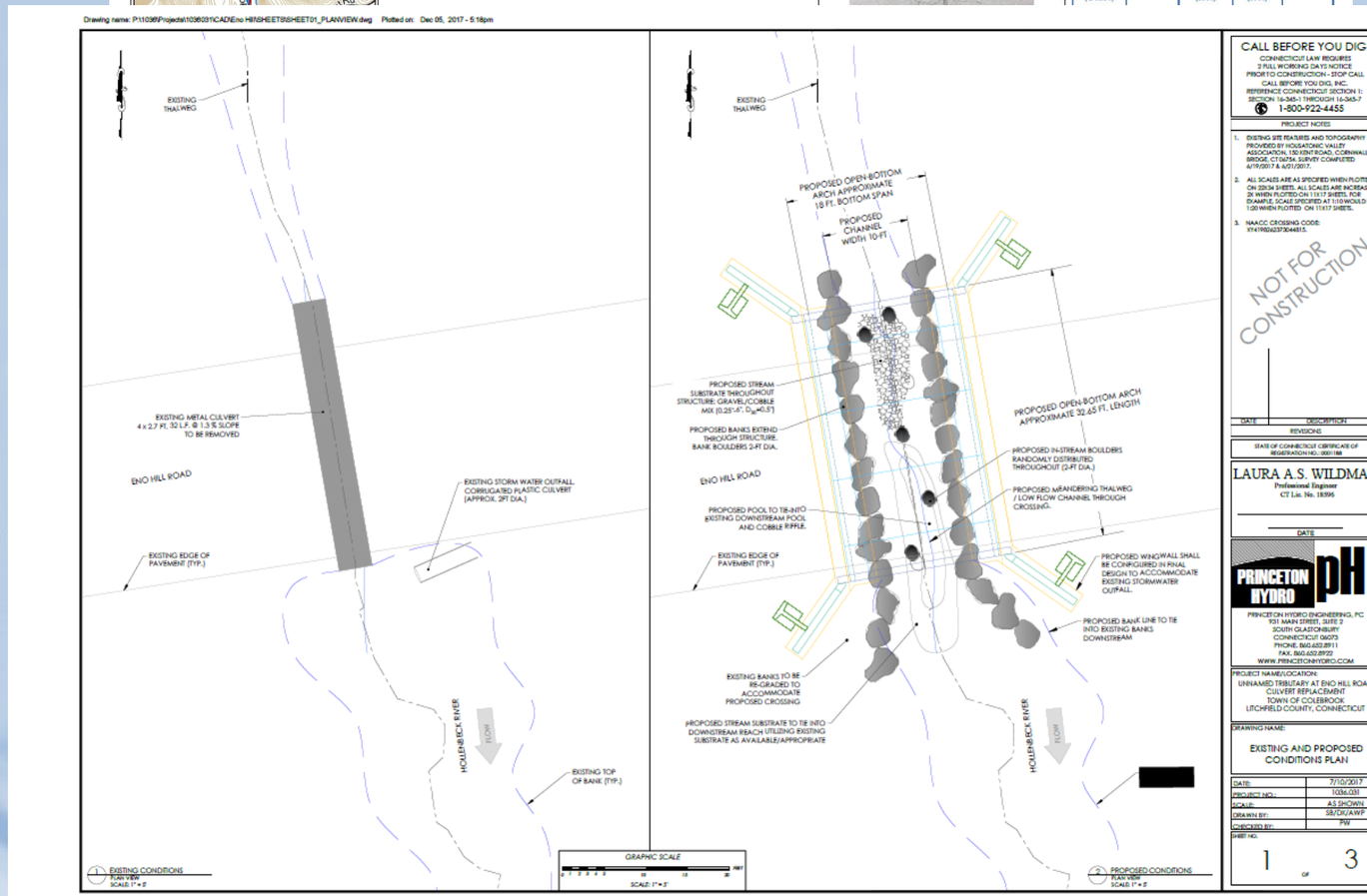
Photo	Flood Interval	Page #	Road	Map Key	Crossing Code
A	2-Year	128	Eno Hill Road	4E	xy4198262373044815
B	10-Year	58	Prock Hill Road	1B	xy4203285073120323
C	25-Year	92	Phelps Road	3B	xy4199897273121570
D	25-Year	108	Pisgah Mountain Road	3D	xy4200541673086675
E	50-Year	66	Fritz Road	1C	xy4203598273112543
F	100-Year	104	Sandy Brook Road	3D	xy4199830373067530
G	100-Year	124	Smith Hill Road	4D	xy4197679173080548

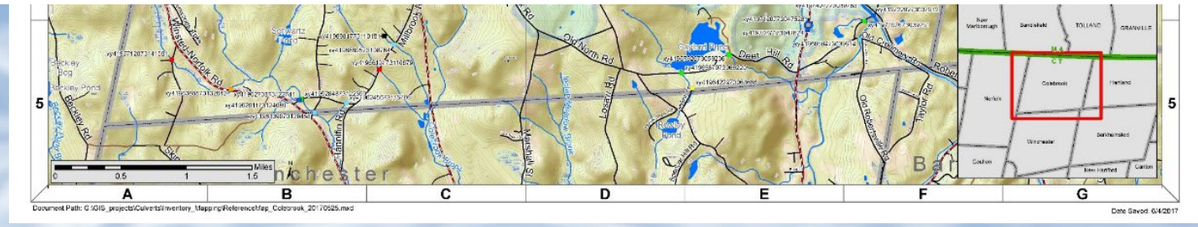


Town-Scale Management Plans

1. Comprehensive field assessment
2. Flood Risk Analysis
3. Create Road-Stream Crossing Inventory
4. Use Inventory to set priorities
5. Demonstration Design Development
6. **Assemble draft Management Plan**







Town-Scale Management Plans

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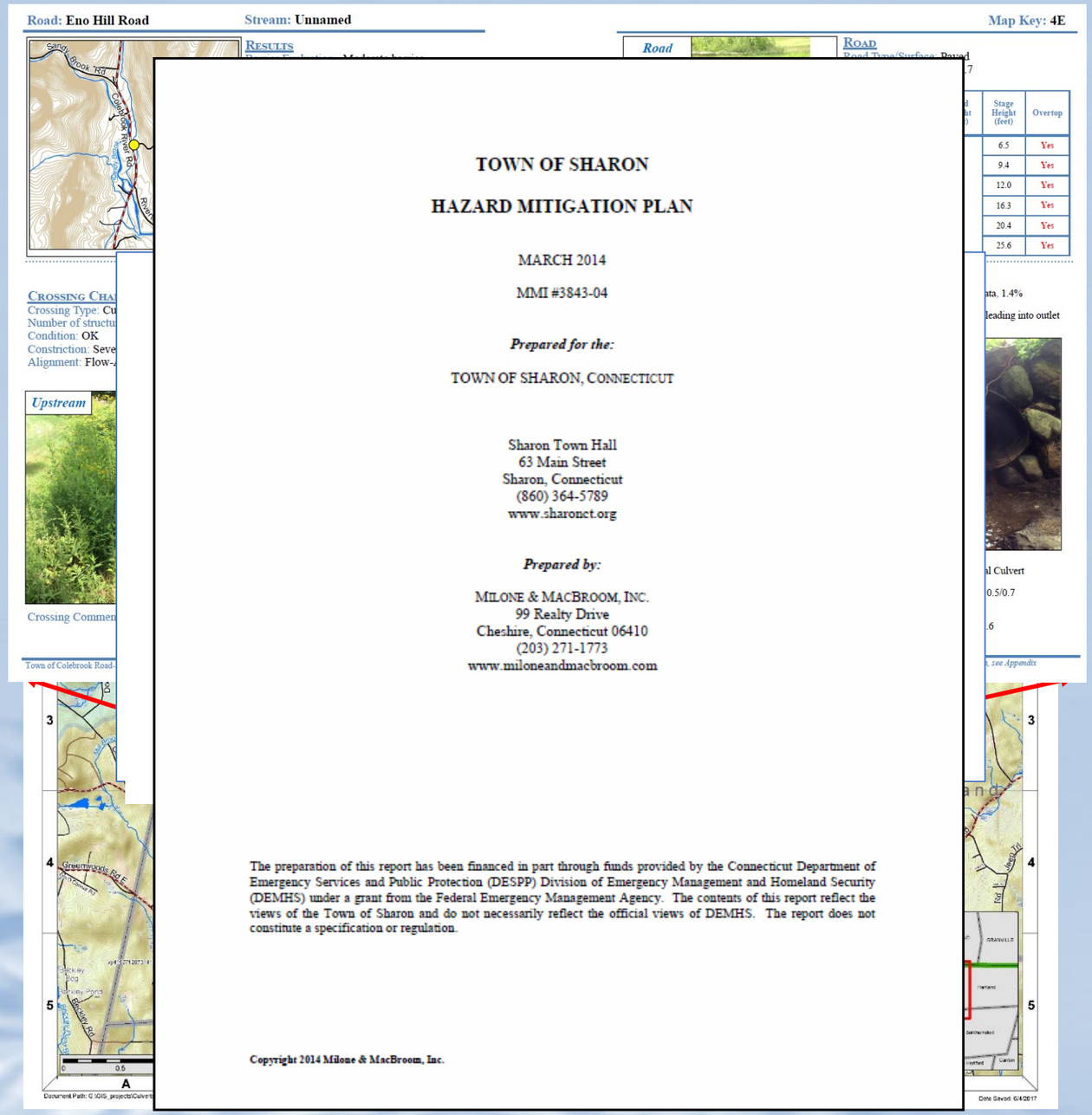


TOWN OF SHARON

HAZARD MITIGATION PLAN

MARCH 2014

MMI #3843-04

Prepared for the:

TOWN OF SHARON, CONNECTICUT

Sharon Town Hall
63 Main Street
Sharon, Connecticut
(860) 364-5789
www.sharonct.org

Prepared by:

MILONE & MACBROOM, INC.
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773
www.miloneandmacbroom.com

The preparation of this report has been financed in part through funds provided by the Connecticut Department of Emergency Services and Public Protection (DESPP) Division of Emergency Management and Homeland Security (DEMHS) under a grant from the Federal Emergency Management Agency. The contents of this report reflect the views of the Town of Sharon and do not necessarily reflect the official views of DEMHS. The report does not constitute a specification or regulation.

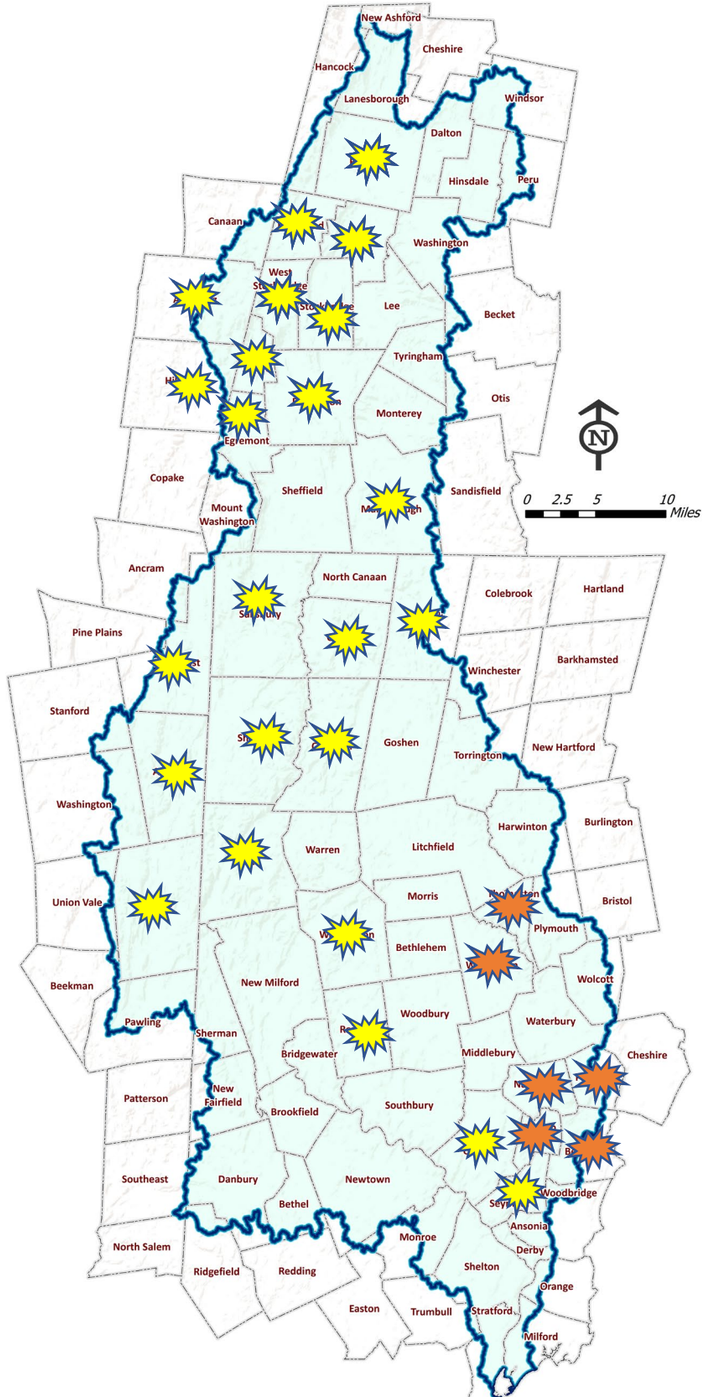
Management Plans completed – 24

Massachusetts, 9

New York, 3

Connecticut, 10

Management Plans in progress – 6, all in the Naugatuck Valley



Implementation

- Massachusetts:
  - Two projects completed
  - Four projects in permitting phase
  - One project in data collection phase

- Connecticut:
  - Two projects completed
  - Six projects in permitting phase
  - Five projects in data collection phase

- New York:
  - One project completed
  - One project in data collection phase

Mike Jastremski

Watershed Conservation Director

mjastremski@hvatoday.org

860.672.6678 ext. 109

Update of the Connecticut Watershed Model (CTWM)

Kathleen Knight, CTDEEP
Sustainable & Resilient Communities Workshop
December 10, 2024

Why CTWM?

Connecticut's 2nd Generation Nitrogen Strategy

https://portal.ct.gov/-/media/deep/water/lis_water_quality/nitrogen_control_program/2ndgennitrogenstrategypdf.pdf

Topic Areas

1. Wastewater Treatment Plants

2. NPS(ie Stormwater) Enhanced Efforts

3. Focus on Embayments

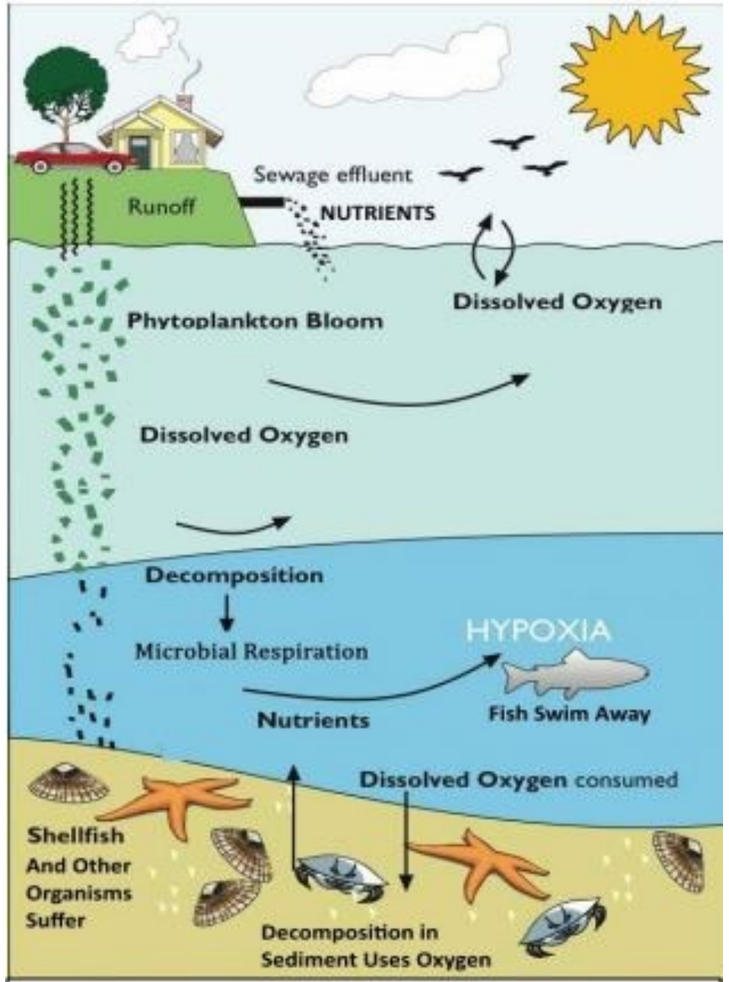
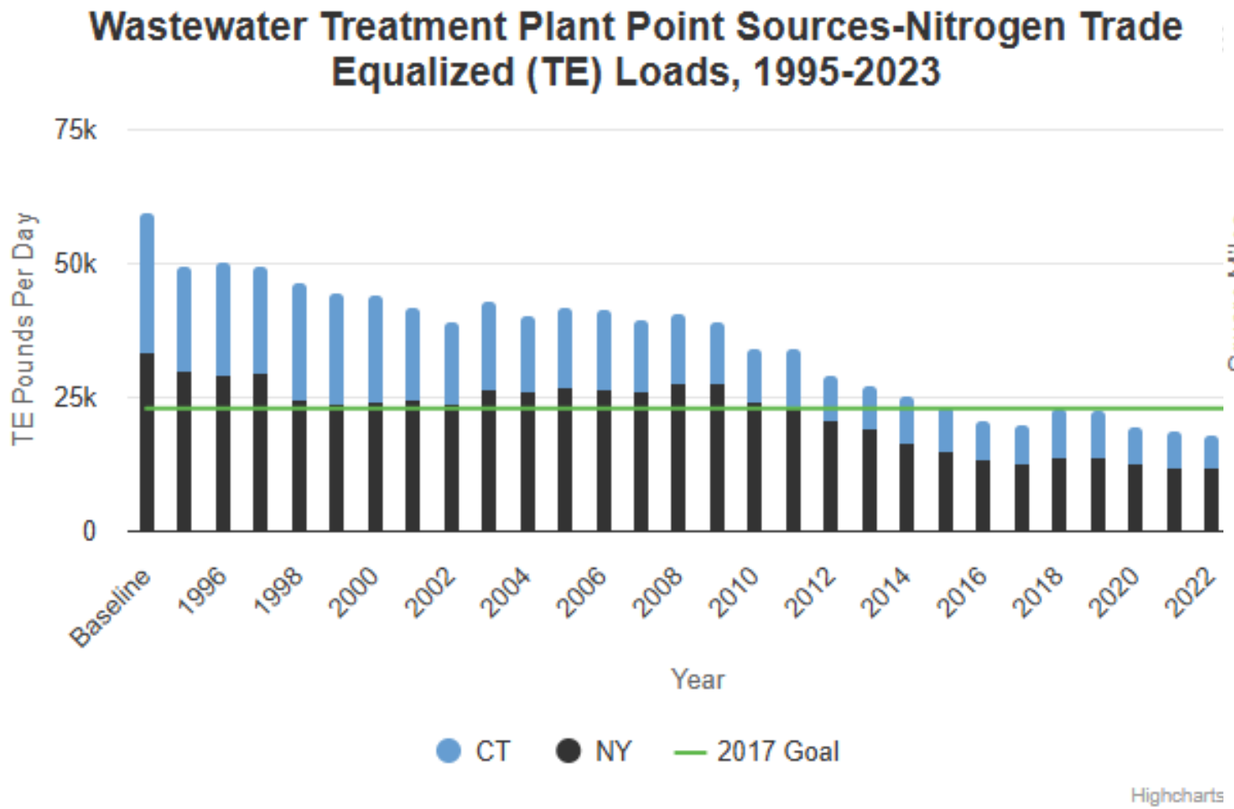


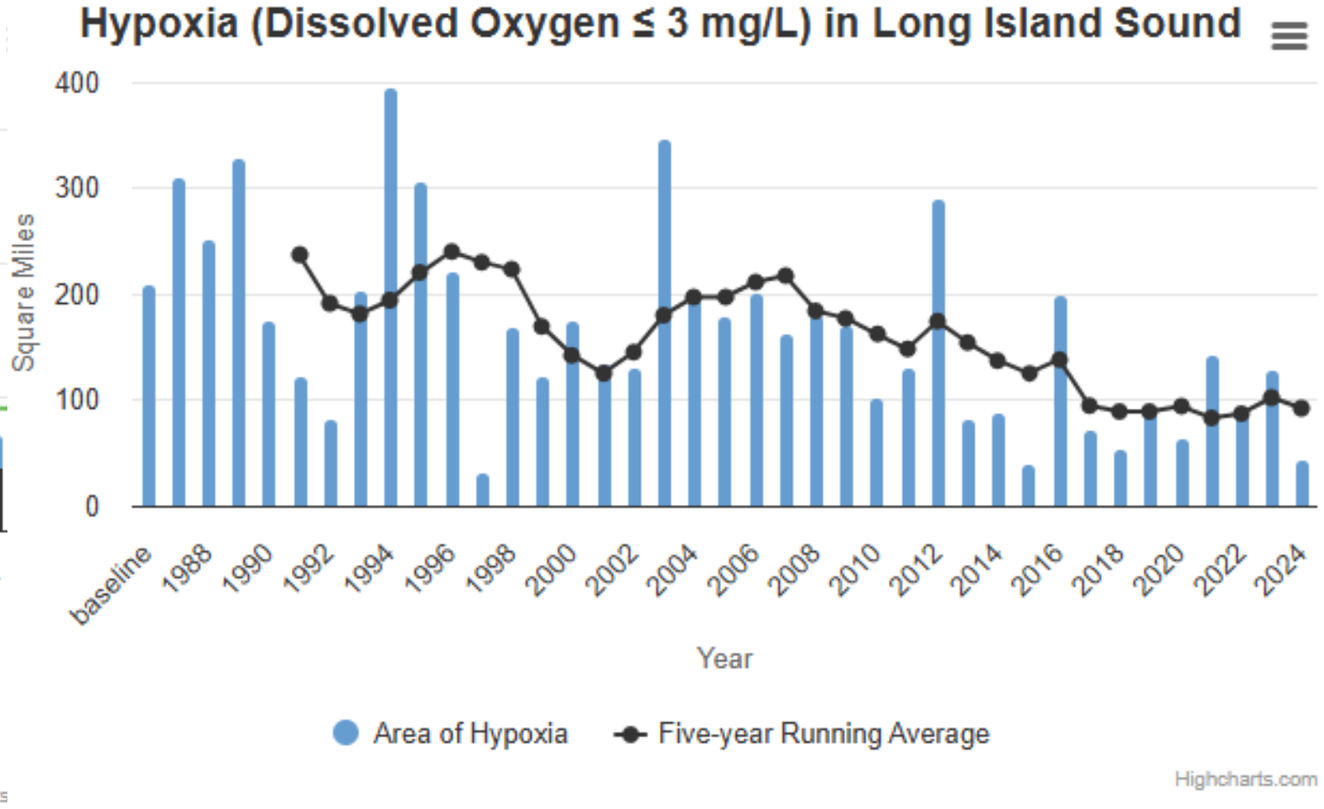
Figure 1 - Graphic of Nutrient (nitrogen) Transport and Fate in Seawater. Source: National Coastal Condition Report IV, EPA-B42-R-10-003 (April 2012), modified.

Why CTWM?

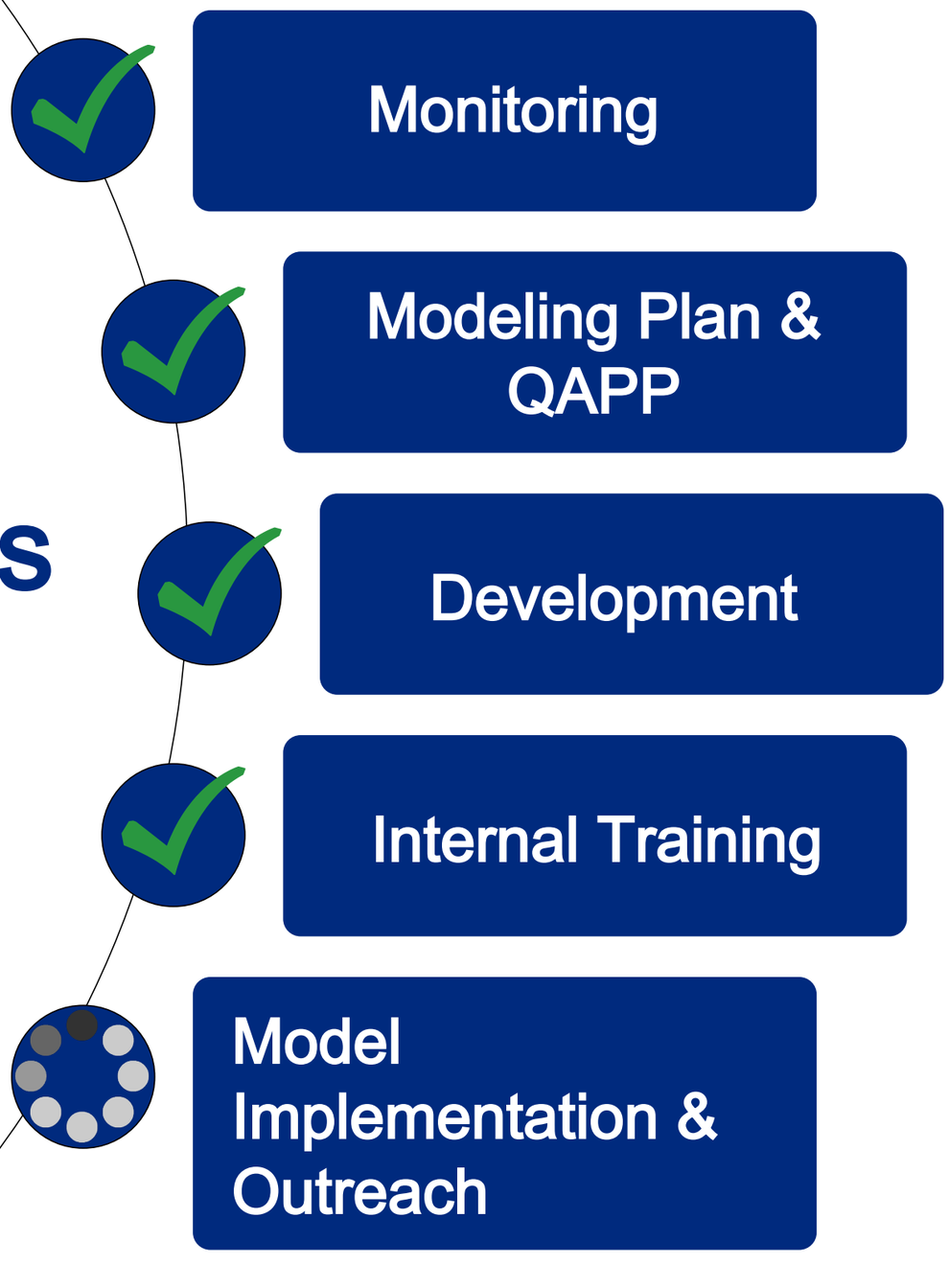
Progress and Opportunities

Tracking Nitrogen Load and Hypoxia Progress in Long Island Sound





Project Phases



Agenda

1. Planning and Monitoring
2. CTWM Development
3. CTWM Results Sneak Peak
4. Pawcatuck River Estuary Pilot
5. Modeling Linking
6. Model Outreach

CTWM Modeling Objectives

- **Spatial Scales**
  - Watershed: Hydrologic unit code (HUC) 12 maximum, ideally smaller scale
  - Bays: Accurately represent loads and provide outputs for linked models.

- **Predict N, P, TSS, DO, Chl-a, Flow, Temp, Tracer**

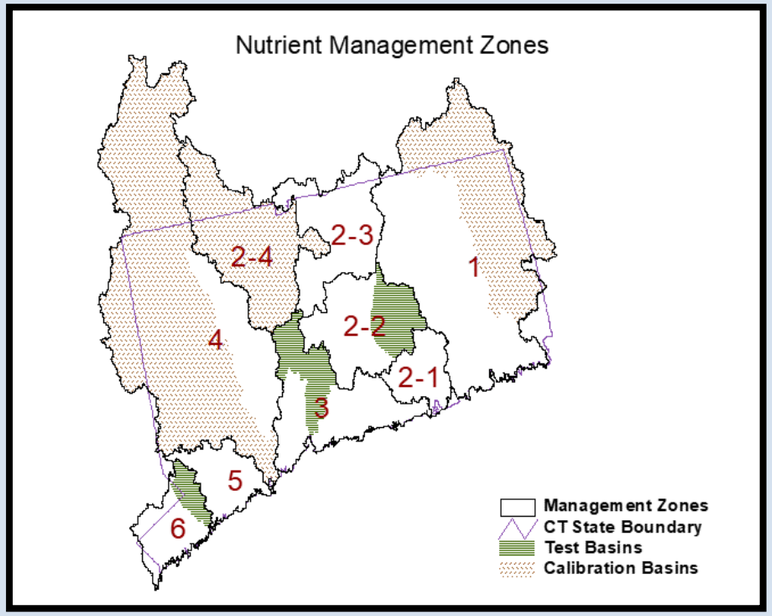
- **Provide input to other models or nest (LIS)**

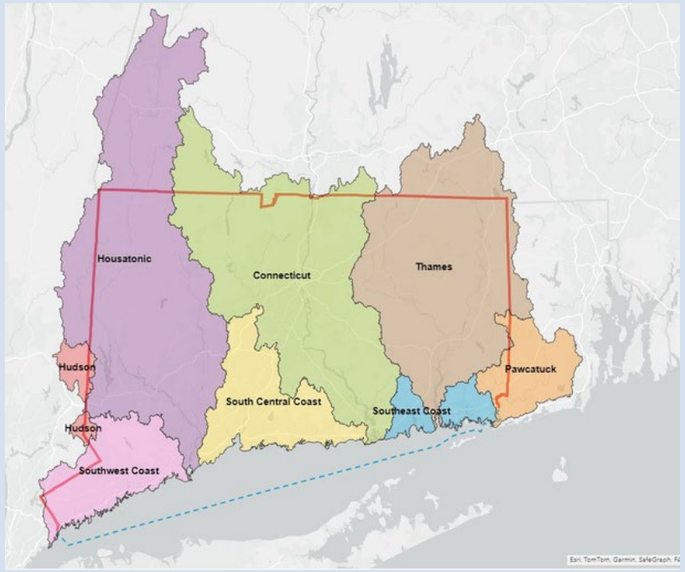
- **Simulate actual & predicted conditions, & management scenarios**

- **Accessible - Community Software - Supported**

CTWM (Past & Present)

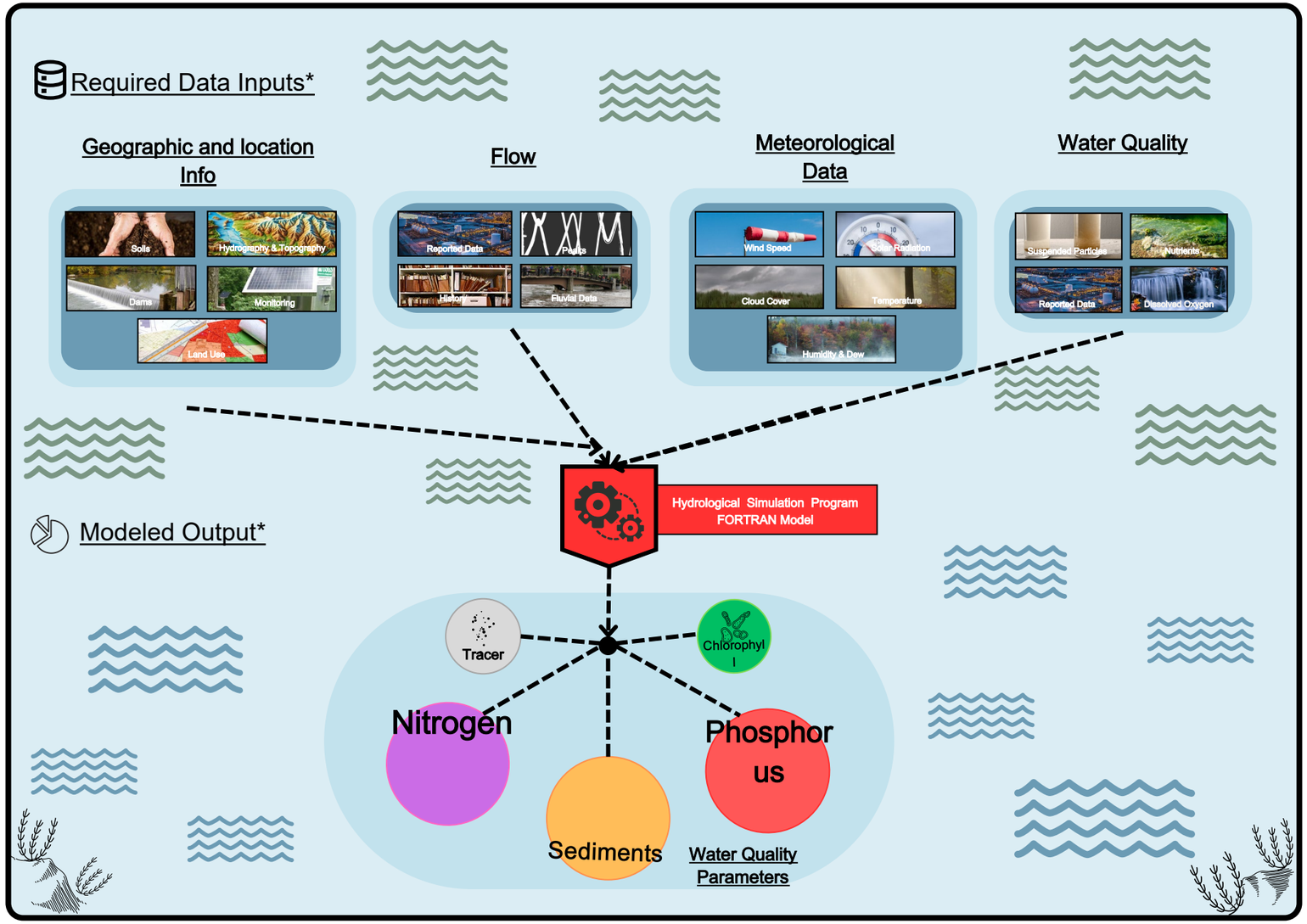
Original Hydrologic Simulation Program - FORTRAN (HSPF) calibration in 2002 Connecticut Watershed Model (CTWM)





Enhanced flow and Water Quality Monitoring for update to Connecticut Watershed Model (CTWM)

Connecticut Watershed Model (CTWM) - Simplified



*Modeled outputs are simplified for this graphic, more accurate information can be found in pages 8 & 9 of the Connecticut Statewide Watershed Modeling Quality Assurance Project Plan

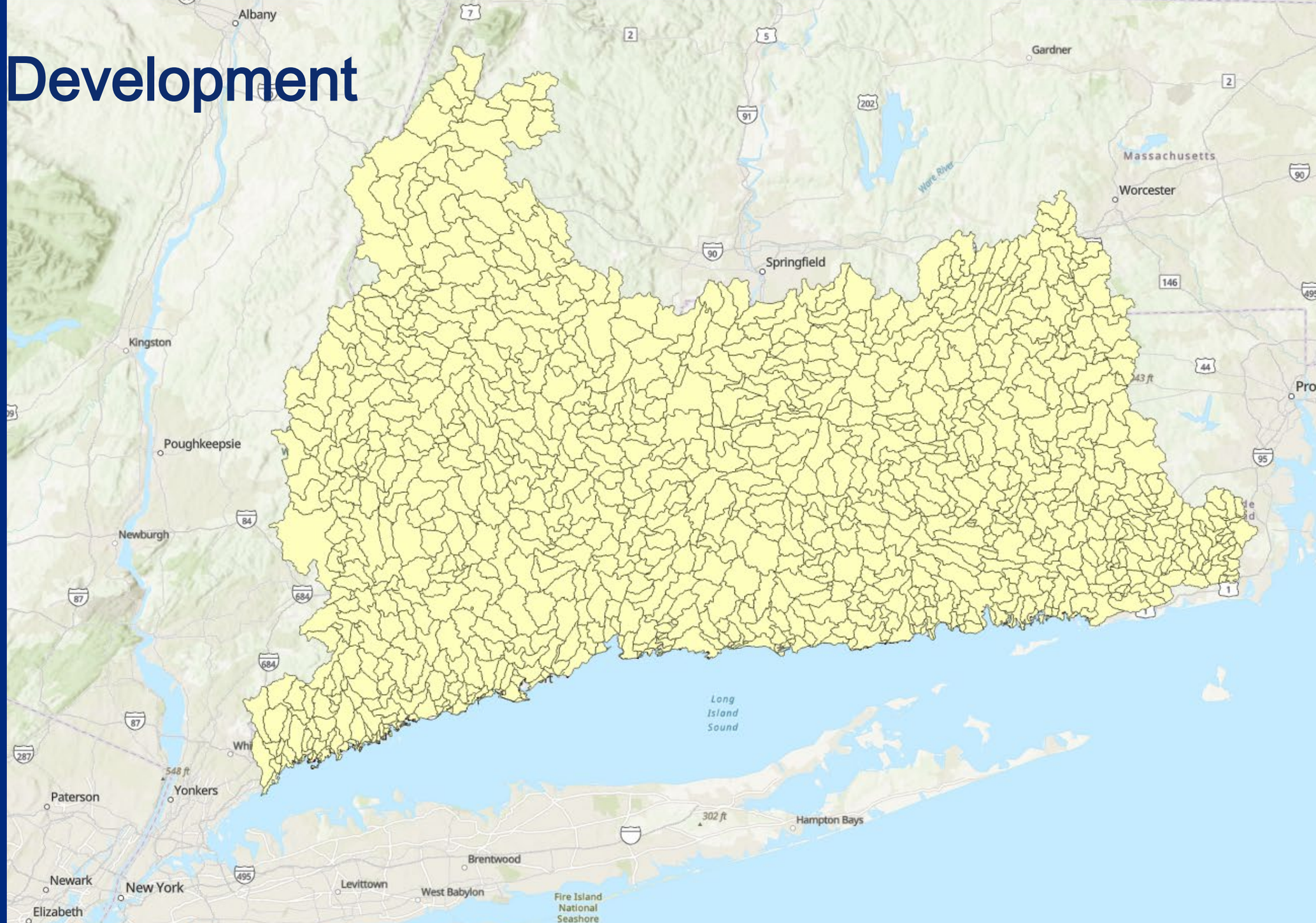
*Required data inputs are simplified for this graphic , more accurate information can be found in pages 15 - 17 of the Connecticut Statewide Watershed Modeling Quality Assurance Project Plan

CTWM - Partners

- **USGS -** United States Geological Service
- **RESPEC**
- **FEMA -** Federal Emergency Management Agency
- **CT DOT -** Connecticut Department of Transportation
- **USDA - NRCS -** Natural Resources Conservation Service
- **EPA LISO -** Environmental Protection Agency Long Island Sound Study
- **EPA R1 -** Environmental Protection Agency Region 1
- **EPA ORD-** Environmental Protection Agency Region Office of Research and Developement
- **RI DEM -** Rhode Island Department of Environmental Management
- **UCONN CLEAR -** Center for Land use Education And Research
- **UCONN-** University of Connecticut (CIRCA and other partners)

CTWM Development

1,091 subwatersheds for local use and regional use.



CTWM Development

1,091 subwatersheds for local use and regional use.

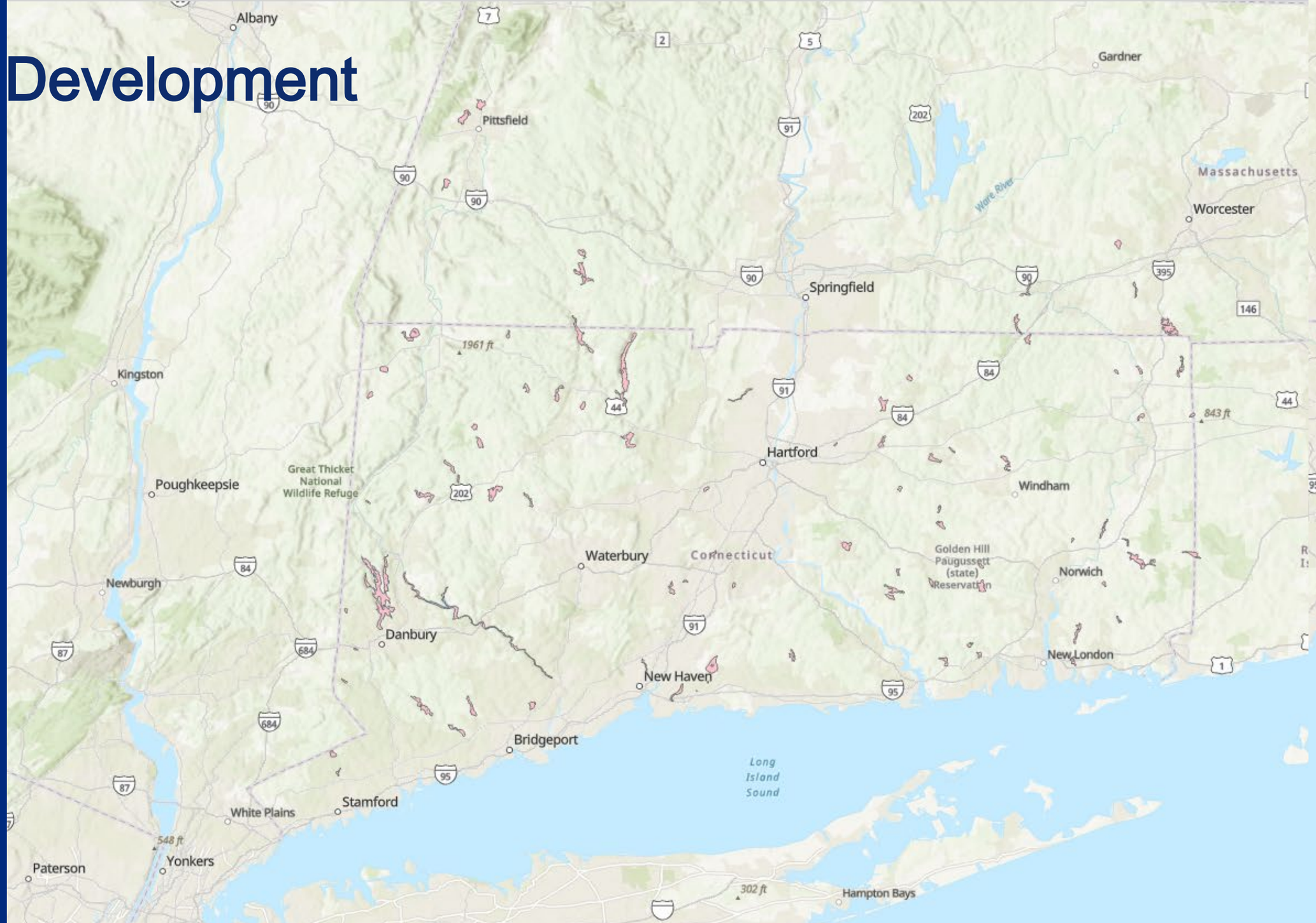
1,091 reaches for local use and regional use.

CTWM Development

1,091 subwatersheds for local use and regional use.

1,091 reaches for local use and regional use.

Just over 100 lakes and impoundments modeled



CTWM Development

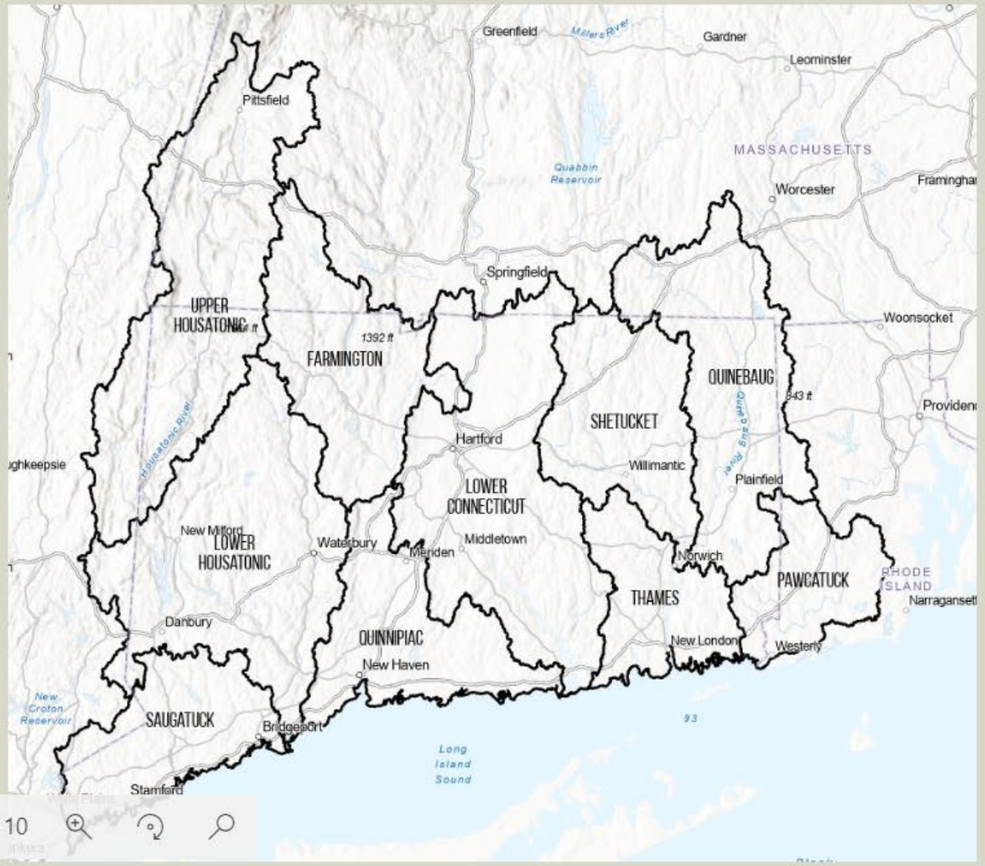
RESPEC

HSPF MODEL INPUT FILES READY

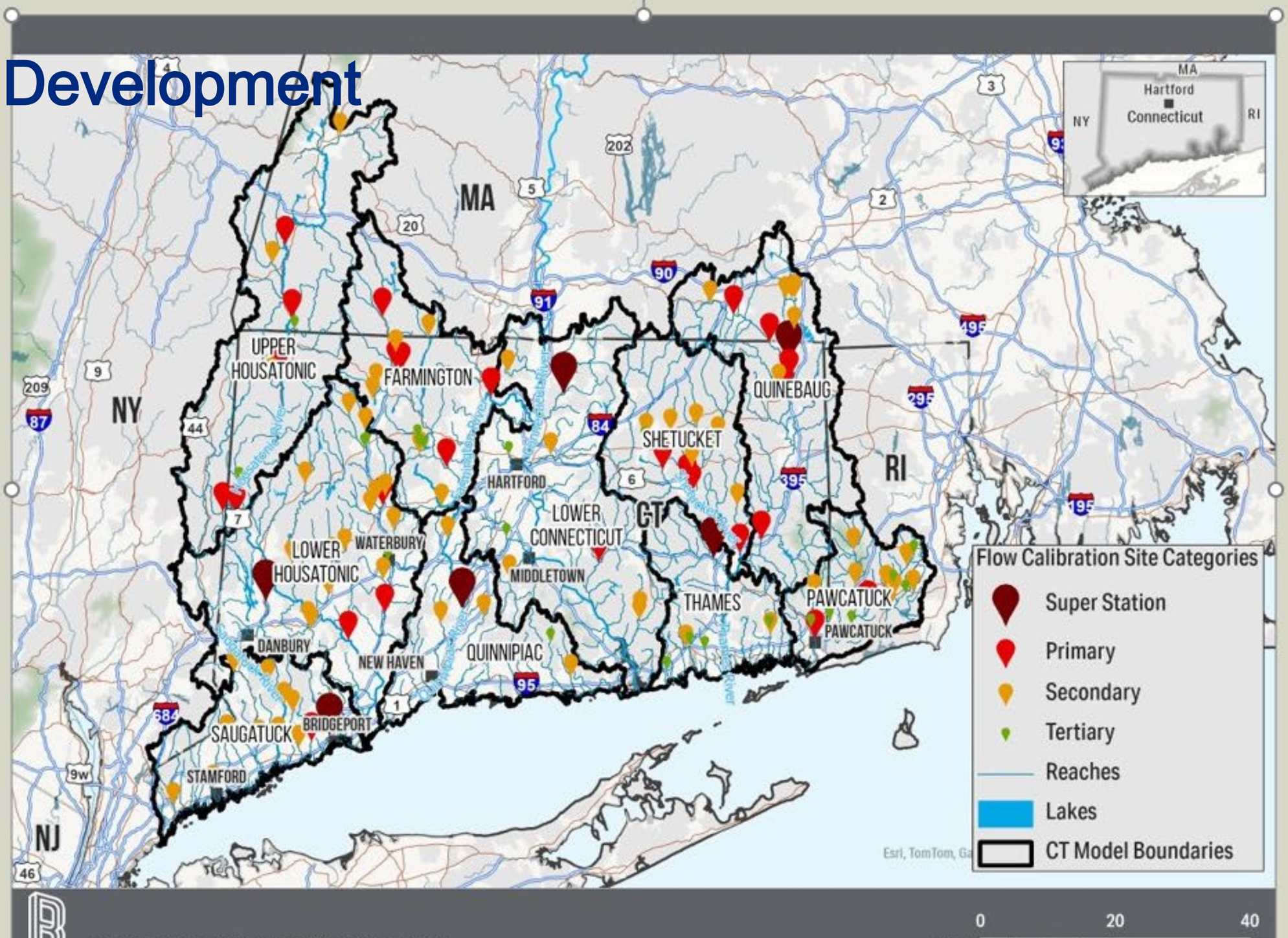
This PC › Nasuni (N:) › Projects › 04069_CTDEEP › HSPF_Models › CTWM22

Name	Date modified	Type	Size
FARMIN.uci	9/8/2022 12:03 PM	UCI File	1,924 KB
HOUSLO.uci	9/8/2022 12:04 PM	UCI File	3,124 KB
HOUSUP.uci	9/8/2022 12:07 PM	UCI File	2,574 KB
LOWCON.uci	9/8/2022 12:11 PM	UCI File	3,405 KB
PAWCAT.uci	9/2/2022 11:42 AM	UCI File	2,442 KB
QUINEB.uci	9/8/2022 12:35 PM	UCI File	2,777 KB
QUINNI.uci	9/8/2022 12:40 PM	UCI File	2,070 KB
SAUGAT.uci	9/8/2022 12:41 PM	UCI File	2,347 KB
SHETUC.uci	9/8/2022 12:44 PM	UCI File	2,262 KB
THAMES.uci	9/8/2022 12:44 PM	UCI File	1,883 KB

```
RUN
*** FARMINGTON RIVER WATERSHED

*** Simulates watershed and reach/lake processes for the contibuting portions of
*** Farmington Watershed (HUC8 XXXXXXXX)

GLOBAL
  FARMINGTON MODEL (FARMIN)
  START       1990/01/01 00:00  END    2021/12/31 24:00
  RUN INTERP OUTPT LEVELS    6    0
  RESUME     0 RUN     1                        UNITS    1
END GLOBAL

FILES
<FILE>  <UN#>***<----FILE NAME-------------------------------------------------->
MESSU       30   FARMIN.ech
WDM1        31   FARMIN_Met.wdm
WDM2        32   FARMIN_Sources.wdm
WDM3        33   Other.wdm
```



CTWM Development



CTWM Development

Added a resource since the QAPP which enabled us to make the 'very good' a higher bar to achieve.

Calibration results:

- *83% of Locations Very Good*
- *4 Locations Good*
- *1 Site Satisfactory*
- *Only 1 site fell below the very good category for bias with regards to storm events.*

Table 3-2. Monthly Performance Ratings for Streamflow Calibration and Validation

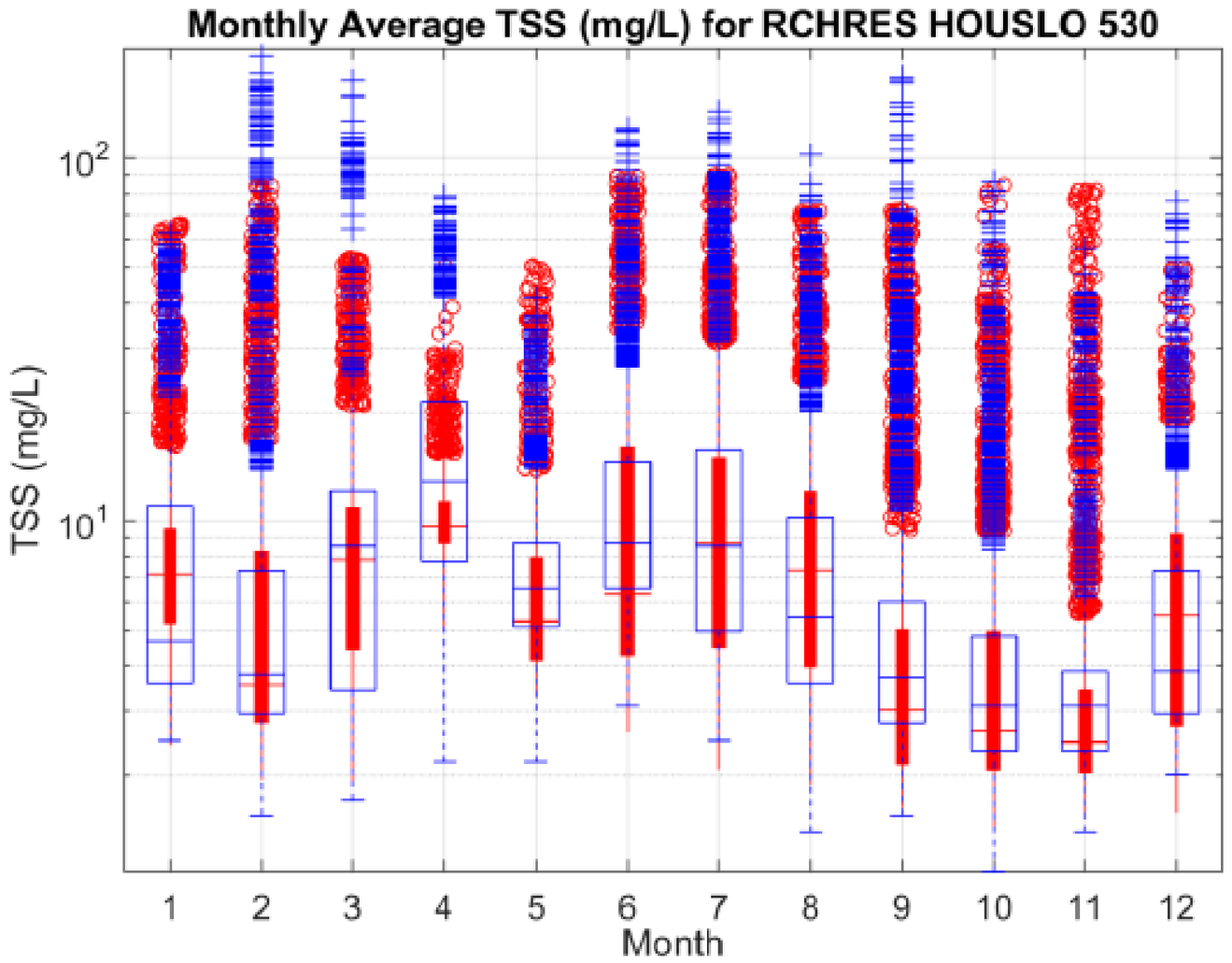
Continuous Streamflow Performance Metric	Reference	Performance Rating Value Ranges			
		Very Good	Good	Satisfactory	Unsatisfactory
Daily R^2	Donigian, 2000	> 0.80	0.70 – 0.80	0.60 – 0.70	< 0.60
Monthly R^2	Donigian, 2000	> 0.85	0.75 – 0.85	0.65 – 0.75	< 0.65
Monthly NSE	Moriasi et al., 2007	> 0.75	0.65 – 0.75	0.50 – 0.65	< 0.50
Percent Error (PBIAS)	Donigian, 2000	< 10	10 – 15	15 – 25	> 25
	Moriasi et al., 2007	< 10	10 – 15	15 – 25	> 25

Calibration Parameter	Reference	Performance Ratings for Ranges of PBIAS Values			
		Very Good	Good	Satisfactory	Unsatisfactory
Sediment	Donigian [2000]	< 20	20–30	30–45	>45
	Moriasi et al. [2007]	<15	15-30	30-55	>55
Water Temperature	Moriasi et al. [2007]	< 7	8–12	13–18	>18
Nutrients, N and P	Donigian [2000]	< 15	15–25	25–35	>35
	Moriasi et al. [2007]	<25	25-40	40-70	>70

CTWM Development

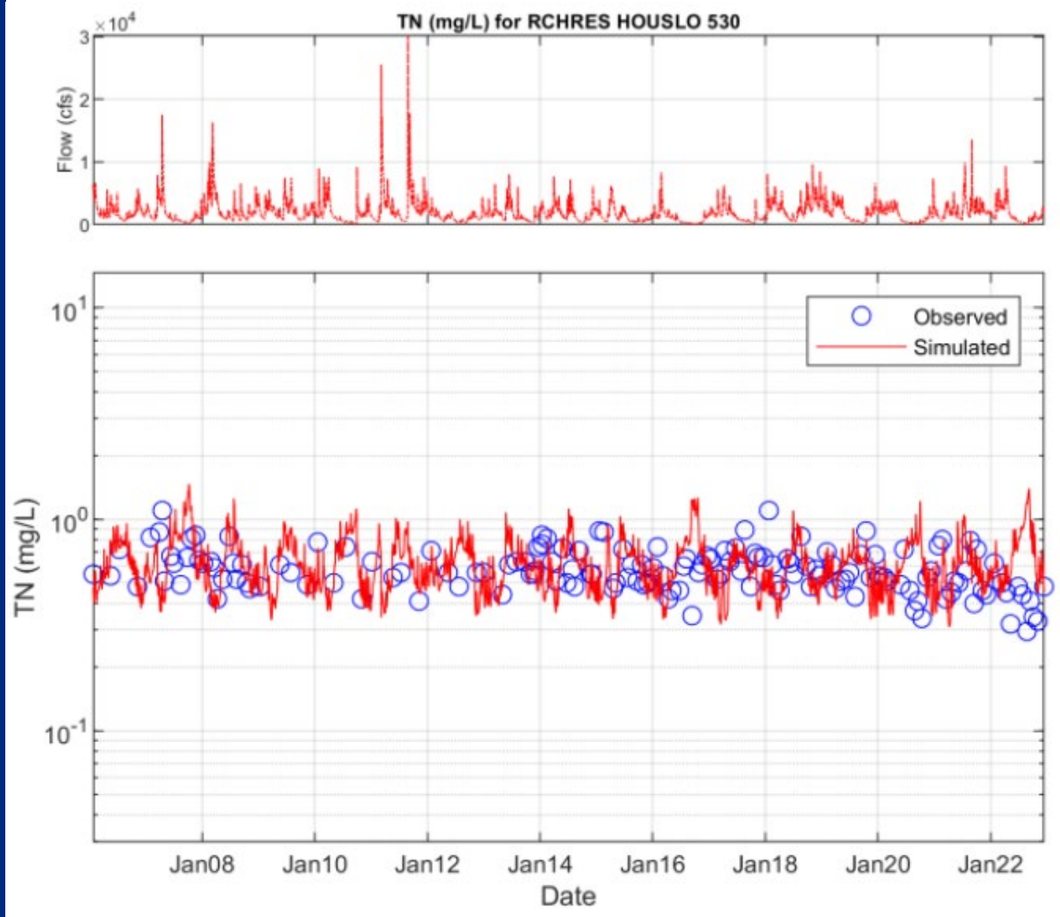
TSS and Turbidity Relationship developed to assist TMDL development consistent with water quality standards.

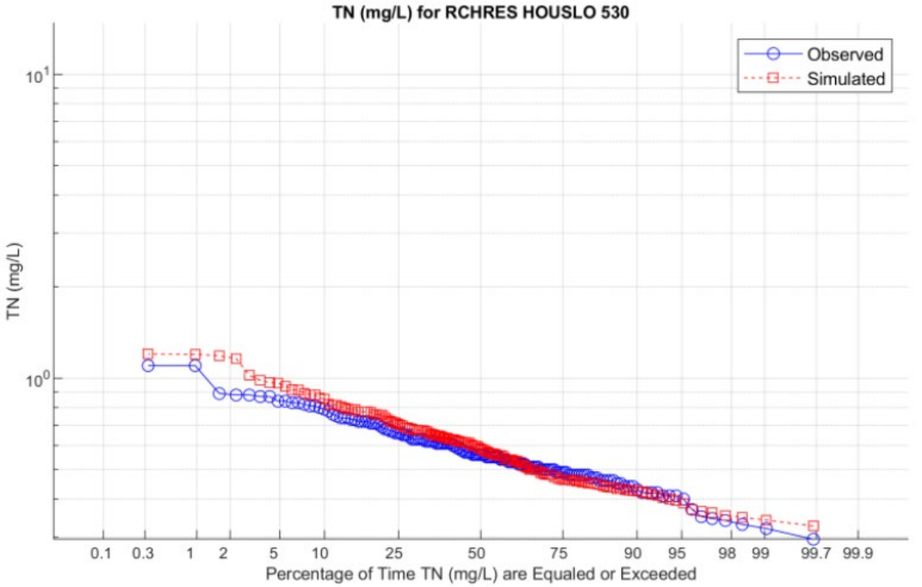
Example plot of TSS observations (blue) and simulated (red)

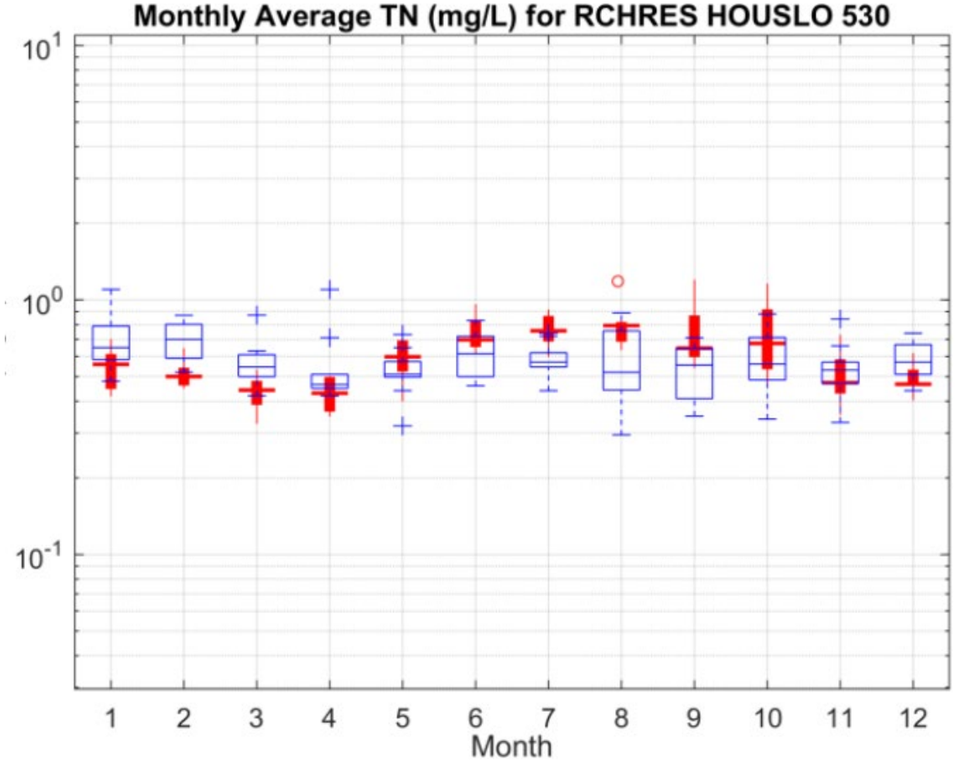


CTWM Development

Example plots of TN observations (blue) and simulated (red)







CTWM Development

Scenario Application Manager (SAM)

- *Change Landcover*
- *Adjust septics*
- *Add bioretention*
- *Add denitrifying ditches*
- *Add constructed wetlands*
- *Change flow conditions*
- *Add cover crops*
- *Evaluate point sources*
- *Evaluate different climatic conditions*
- *and so much more*

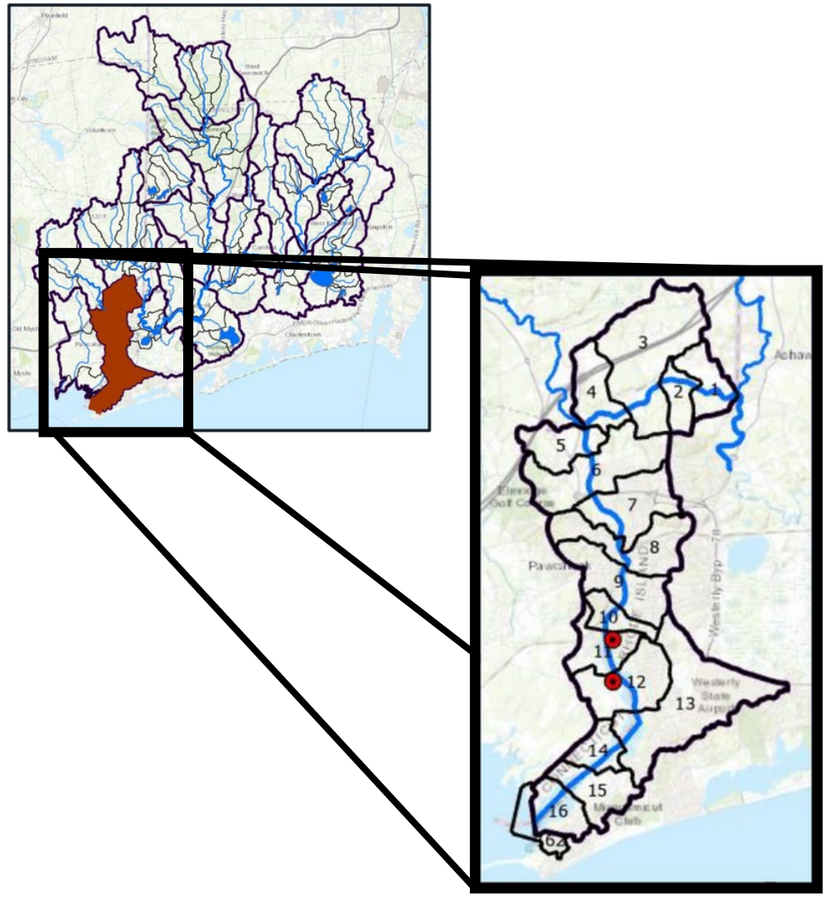
CTWM Development

A third tool that was developed in parallel with the development is the **WQMod link.**

Table 5-1. Linkage Between HSPF Model Outflow Constituents and WASP System Constituents

HSPF Outflow Constituent	Constituents Included in the WASP Eutrophication Model	WASP System Type	Notes
ROVOL	Flow	N/A	—
TAM-OUTTOT	Total Ammonia	NH-34	—
NO3-OUTTOT	Nitrate-Nitrite	NO3O2	Add HSPF NO_3 and NO_2 for WASP System NO3O2
NO2-OUTTOT			
PO4-OUTTOT	Dissolved Inorganic Phosphorus	D-DIP	—
N-TOTORG-OUT	Dissolved Organic Nitrogen	ORG-N	Assumed factor to disperse dissolved and detrital nitrogen
	Detrital Nitrogen	DET-N	
P-TOTORG-OUT	Dissolved Organic Phosphorus	ORG-P	Assumed factor to disperse dissolved and detrital phosphorus
	Detrital Phosphorus	DET-P	
C-TOTORG-OUT	Detrital Carbon	DET-C	—
N/A	Total Detritus	TOTDE	Calculated by WASP
BODOUTTOT	$CBOD_u$ – Watershed	CBODU	—
N/A	$CBOD_u$ – Point Source	CBODU	Obtained from WDM
N/A	$CBOD_u$ – Biological	CBODU	Calculated by WASP
DOXOUTTOT	DO	DISOX	—
ROSED-SAND	Sand	SOLID	—
ROSED-SILT	Silt	SOLID	—
ROSED-CLAY	Clay	SOLID	—
PHYTO-OUT	Phytoplankton	PHYTO	—
N/A	Benthic Algae	MALGA	Calculated by WASP
N/A	Benthic Algae Nitrogen	MALGN	
N/A	Benthic Algae Phosphorus	MALGP	
ROHEAT	Water Temperature	WTEMP	—

N/A = Not Applicable.



CTWM Next Steps

Outreach

1. Reviewing Results

2. Preparing Report

3. Developing Materials for Co-Creation Workshops

4. Workshop hosting!

5. Re-evaluate

CTWM Next Steps

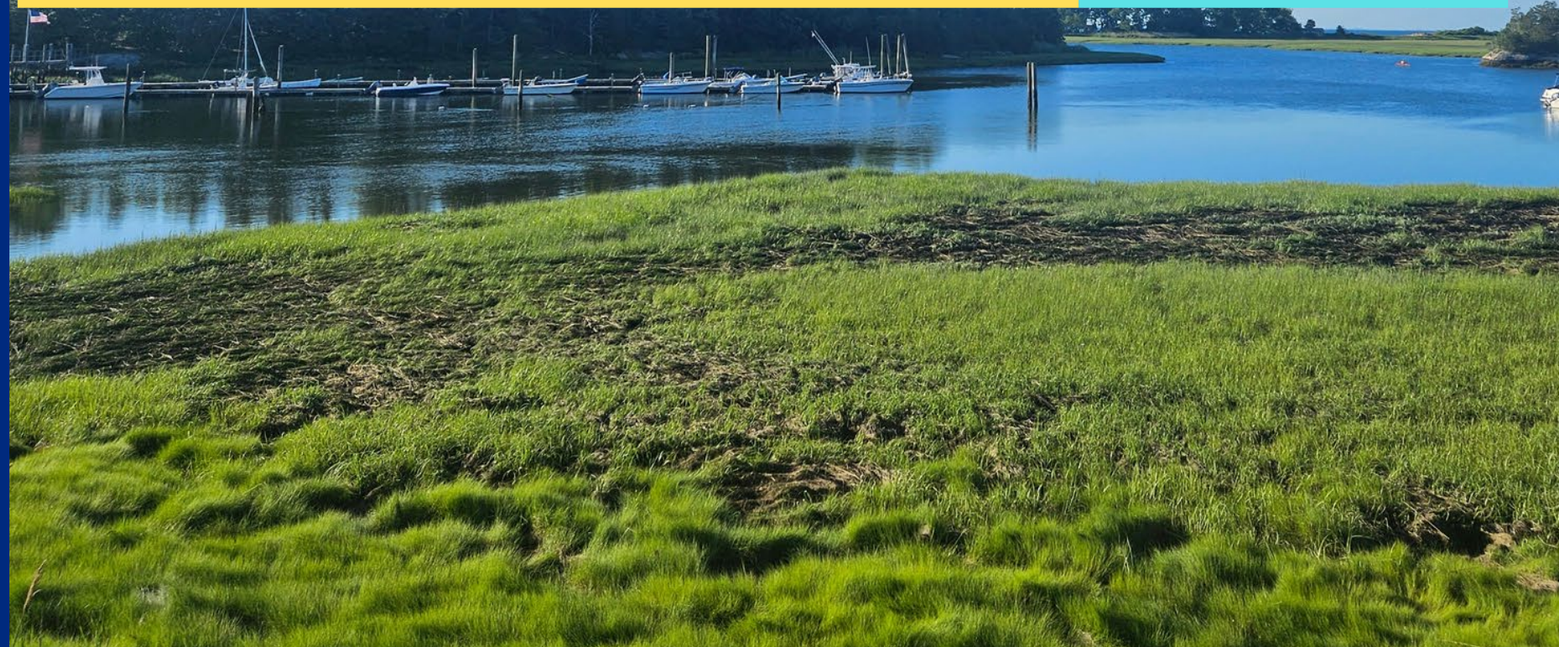
Linking Models

1.Statewide Embayment Modeling Scheme ✓

2.Data Evaluation and Recommendations (2 Bays) ✓

3.Develop Models for Four Priority Embayments

- *Norwalk Harbor and Mystic River*
- *Saugatuck River and Southport Harbor*



CTWM Next Steps

Join us!

Kathleen.Knight@ct.gov

Huge thank you to our partners and Long Island Sound Study for funding support.

FIN.

Glossary

- NPS - Non-Point Sources
- WQ - Water Quality
- TMDL -Total Maximum Daily Load plan
- OWTS - Onsite Wastewater Treatment System
- LIS - Long Island Sound
- CTWM - Connecticut Watershed Model
- WASP - Water Quality Analysis Simulation Program
- HSPF - Hydrologic Simulation Program - FORTRAN
- WWTP - Waste Water Treatment Plant
- SAM - Scenario Application Manager

Web Resources

CTDEEP Second Generation Nitrogen Strategy:
https://portal.ct.gov/DEEP/Water/LIS -Monitoring/LIS-Hypoxia-and-Nitrogen-Reduction-Efforts
Niantic River Estuary Study:
http://vaudrey.lab.uconn.edu/research/#active
Pawcatuck River Project:
https://portal.ct.gov/DEEP/Water/TMDL/Pawcatuck -Watershed-Nutrient-Project
United States Geological Survey – Groundwater:
https://www.usgs.gov/centers/new -england-water/science/development -a-regional-scale-model-simulate-groundwater-flow-and?qt-science_center_objects=0#qt -science_center_objects
United States Geological Survey - Embayments:
https://www.usgs.gov/centers/new -england-water-science-center/science/embayment -monitoring-support-nutrient-management#overview

CTWM Project page coming soon!

To what extent did this session provide you with new knowledge that will help with community resilience planning?

0

I found this session very informative and will be using one or more of these tools in my work!

0%

I found this session informative but I still need more information to understand how I can use these tools.

0%

I found this session informative but I am not sure if I will use these tools.

0%

I did not learn new or useful information from this session.

0%

Are there other resilience tools that you would like to learn more about?

0

Nobody has responded yet.

Hang tight! Responses are coming in.

Long Island Sound Study
A Partnership to Restore and Protect the Sound

Sea Grant CONNECTICUT Sea Grant NEW YORK

Photo credit: Sarah Schaefer-Brown

Thank you!

LIS Resilience Resource Hub: lisresilience.org