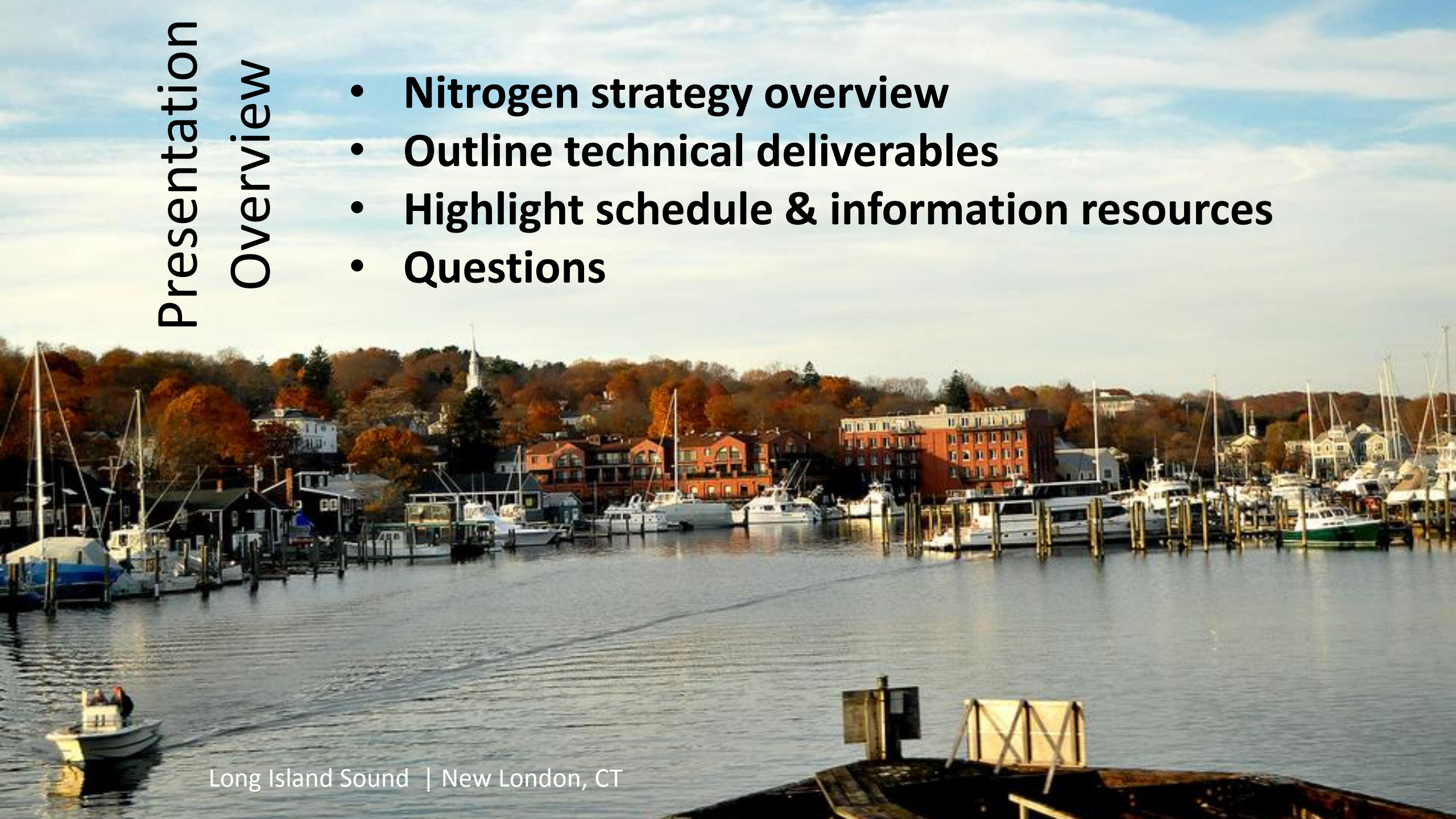
Long Island Sound
Nitrogen Reduction Strategy Overview

Public Webinar
November 8, 2017

Photo Credit: CTDEEP/Hammonasset Beach State Park, CT

Presentation Overview

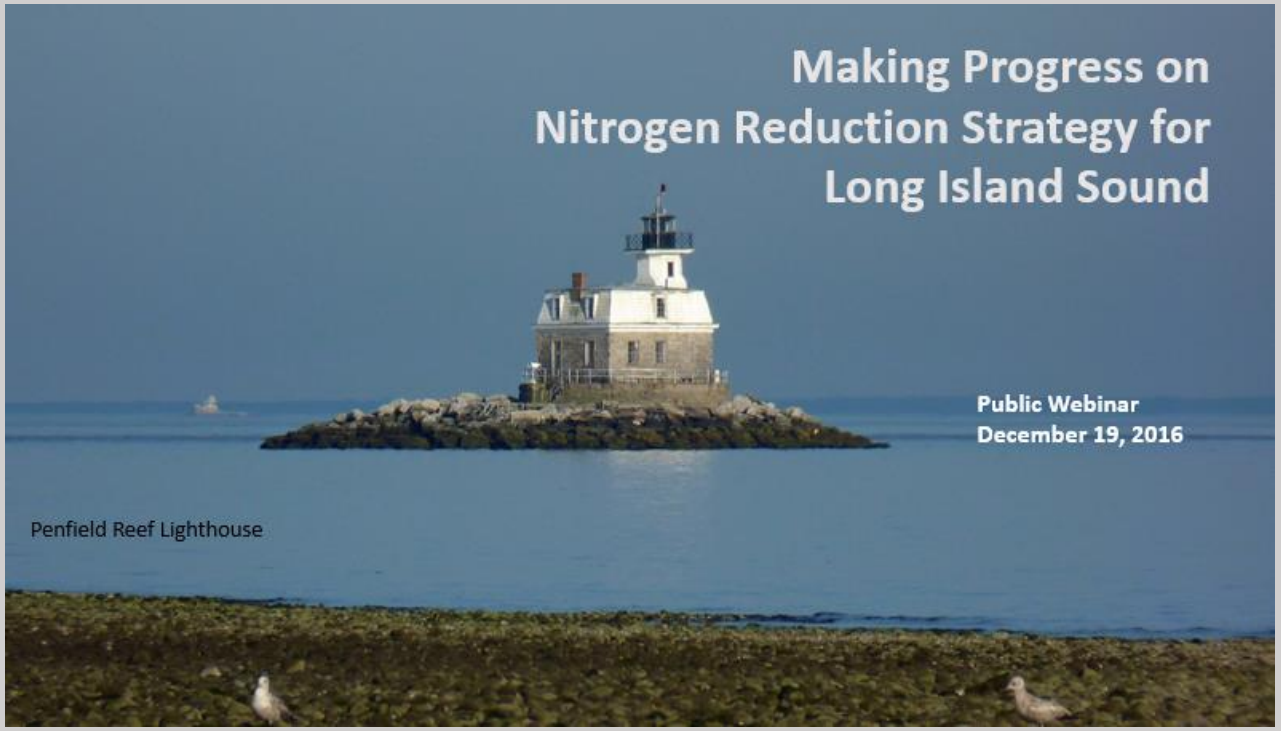
- **Nitrogen strategy overview**
- **Outline technical deliverables**
- **Highlight schedule & information resources**
- **Questions**



Long Island Sound | New London, CT

➢ December 19, 2016 Public webinar

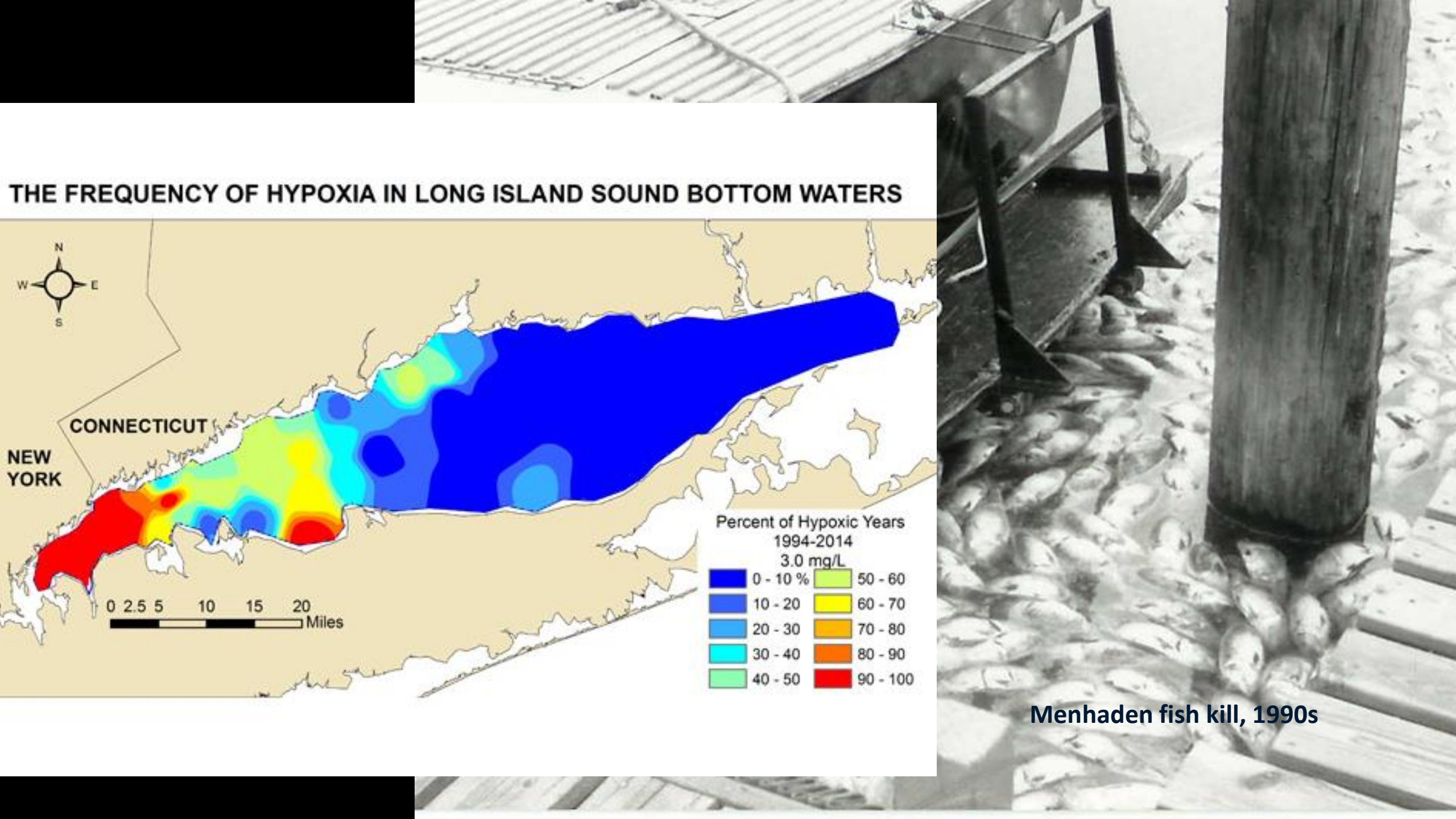
- LIS Total Maximum Daily Load (TMDL) and Implementation Progress
- Outline of Nitrogen Reduction Strategy
- Overview of contract



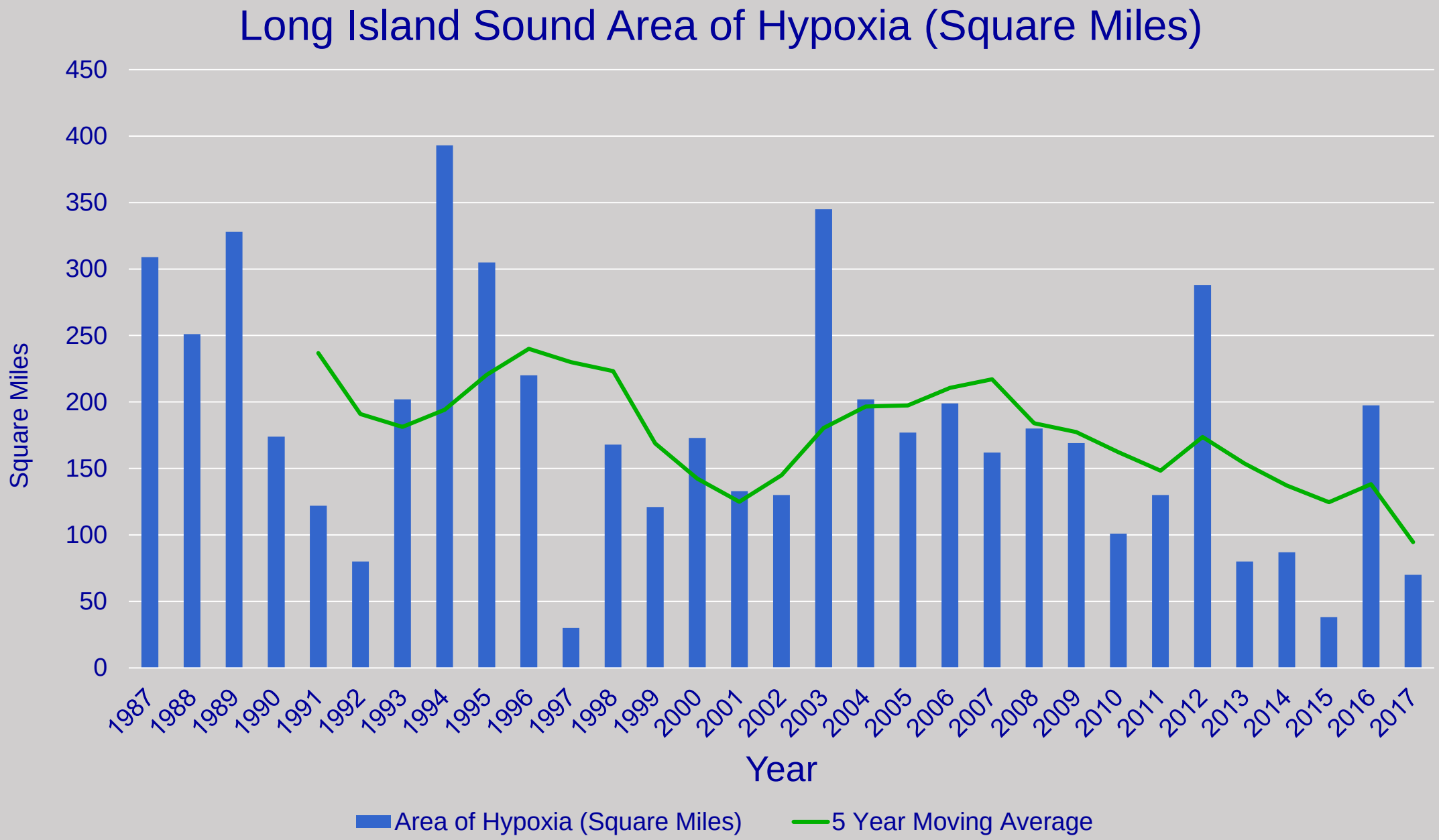
Available at: www.longislandsoundstudy.net

➢ February 26, 2016 Public webinar

➢ Public meetings – Spring 2016



Menhaden fish kill, 1990s


Long Island Sound Area of Hypoxia (Square Miles)
Square Miles
450
400
350
300
250
200
150
100
50
0
1987
1988
1989
1990
1991
1992
1993
1994
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1998
1999
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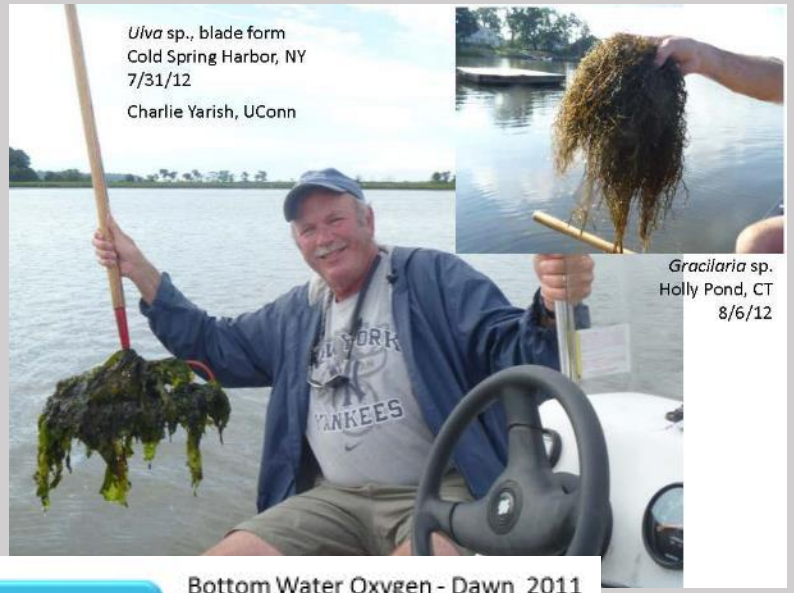
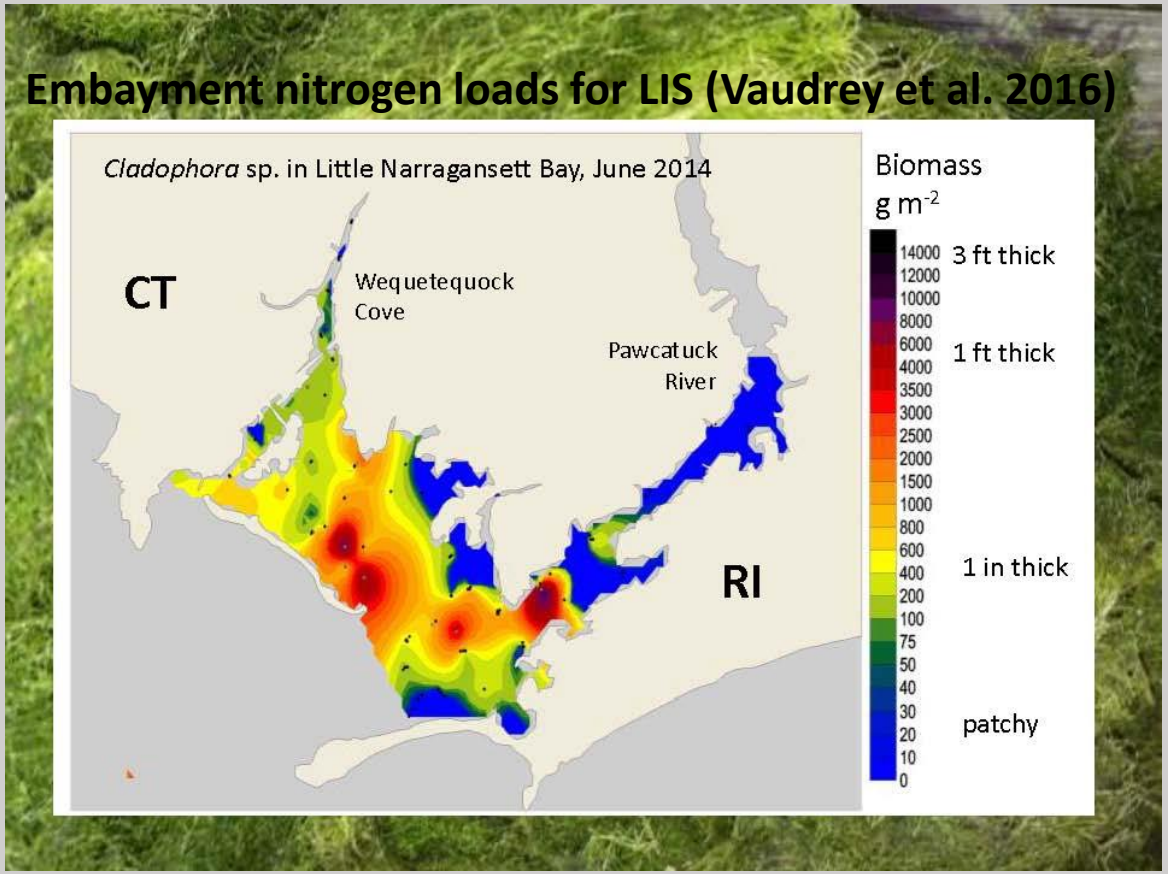
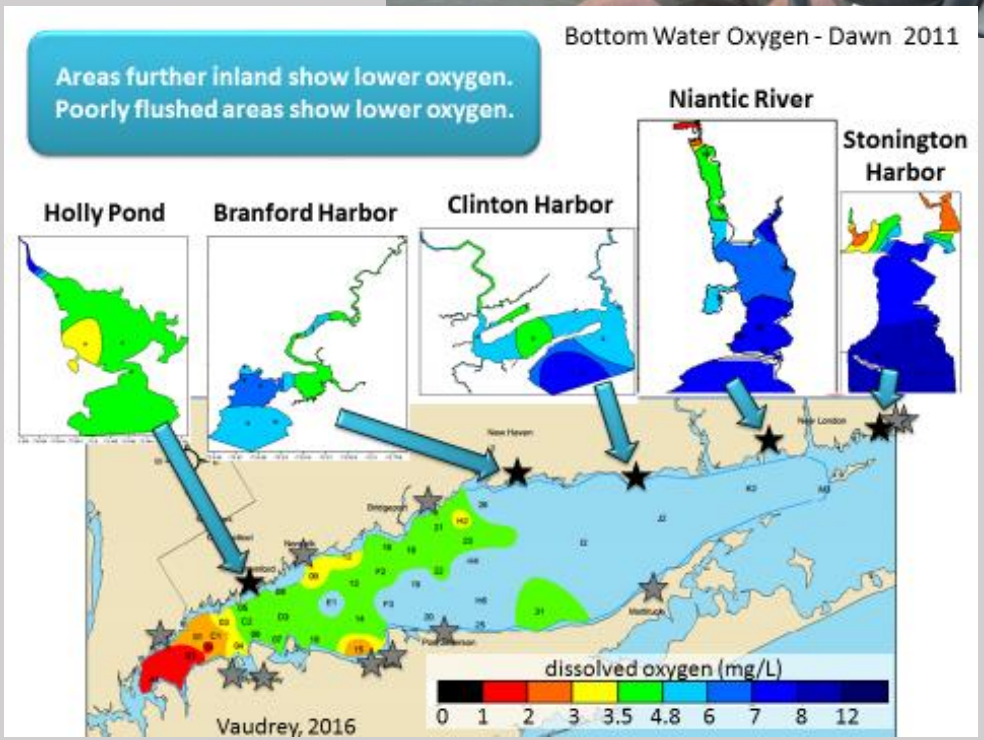
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Year
Area of Hypoxia (Square Miles)
5 Year Moving Average

Despite this good progress & positive trends, all the monitoring & modeling show that there is still more to do.







Review of Technical Methodology

USEPA

Tetra Tech Inc.

Goal: Develop Nitrogen (N) loads to meet desired water quality conditions in the Long Island Sound (LIS)

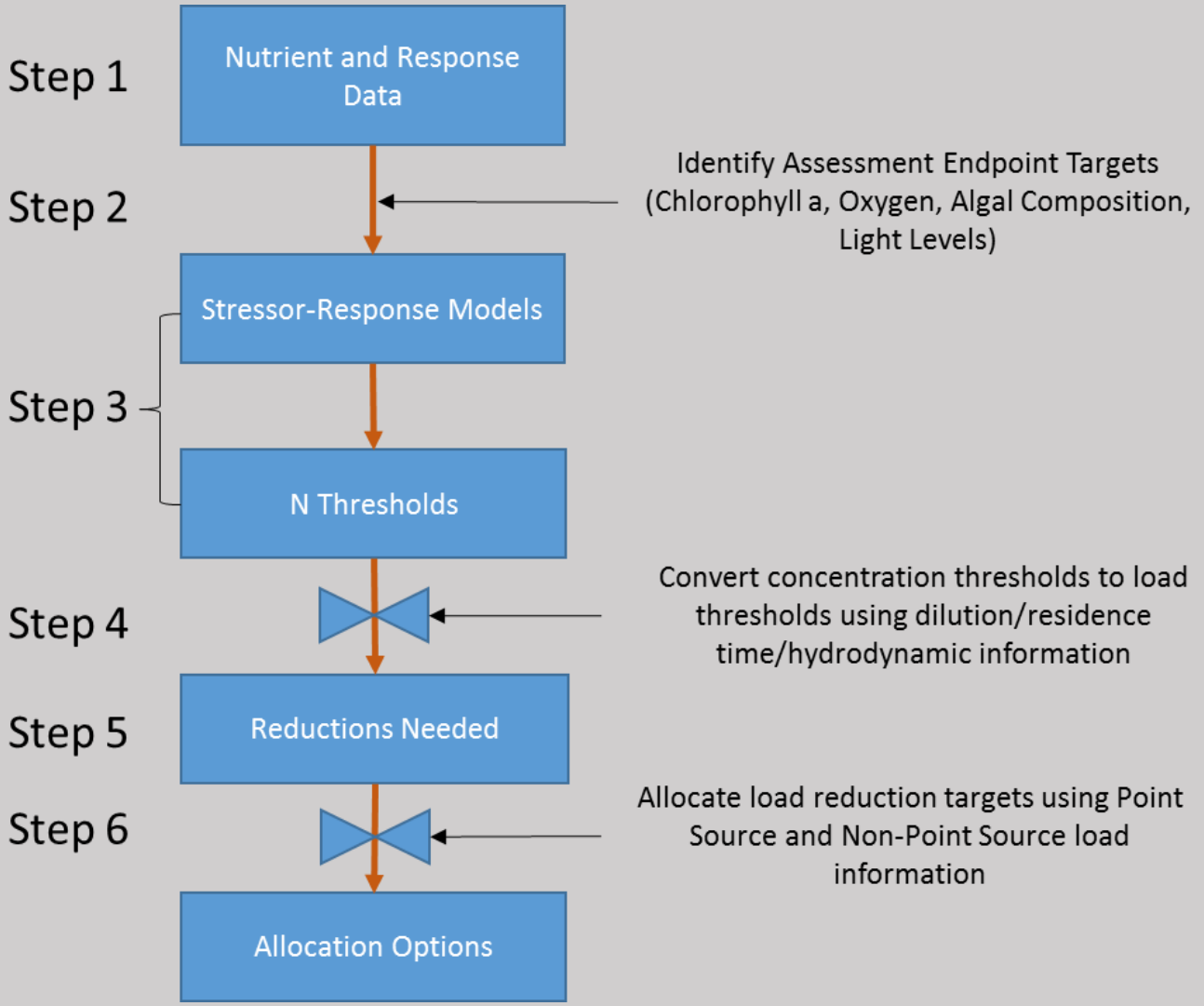
Coastal watersheds that directly drain to embayments or nearshore waters

Tributary watersheds that drain inland reaches

WLIS coastal watersheds with large, direct discharging wastewater facilities

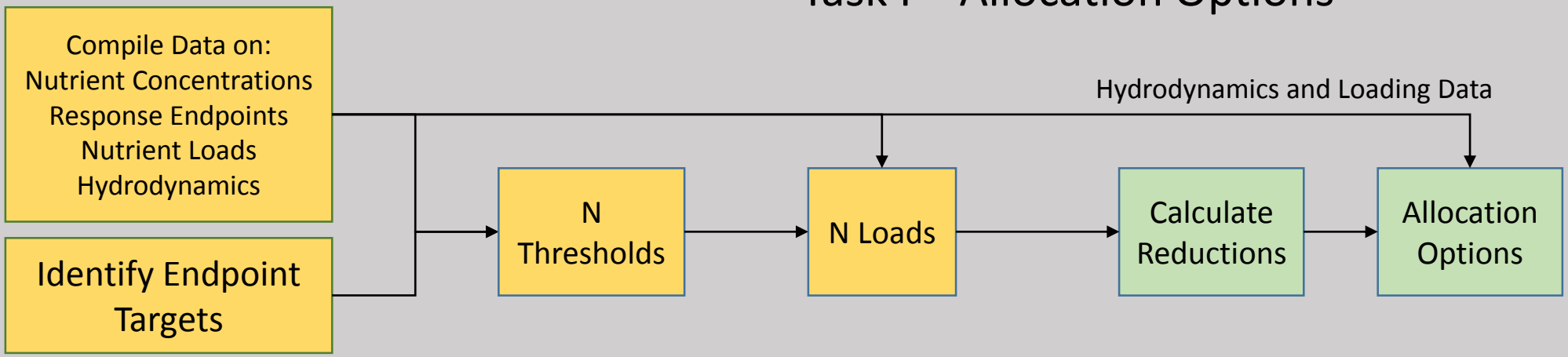
General Approach

- Reviewed Proposed Approach



General Approach

- Reviewed Steps
  - QAPP and Literature Review
  - Task A – Compile Embayment Loading Data
  - Task B – Compile Discharger Data
  - Task C – Compile Tributary Loading Data
  - Task D – Water Quality Data Summary
  - Task E – Hydrodynamic Modeling
  - Task F/G – Threshold Development
  - Task H – Load Reduction Calculation
  - Task I – Allocation Options

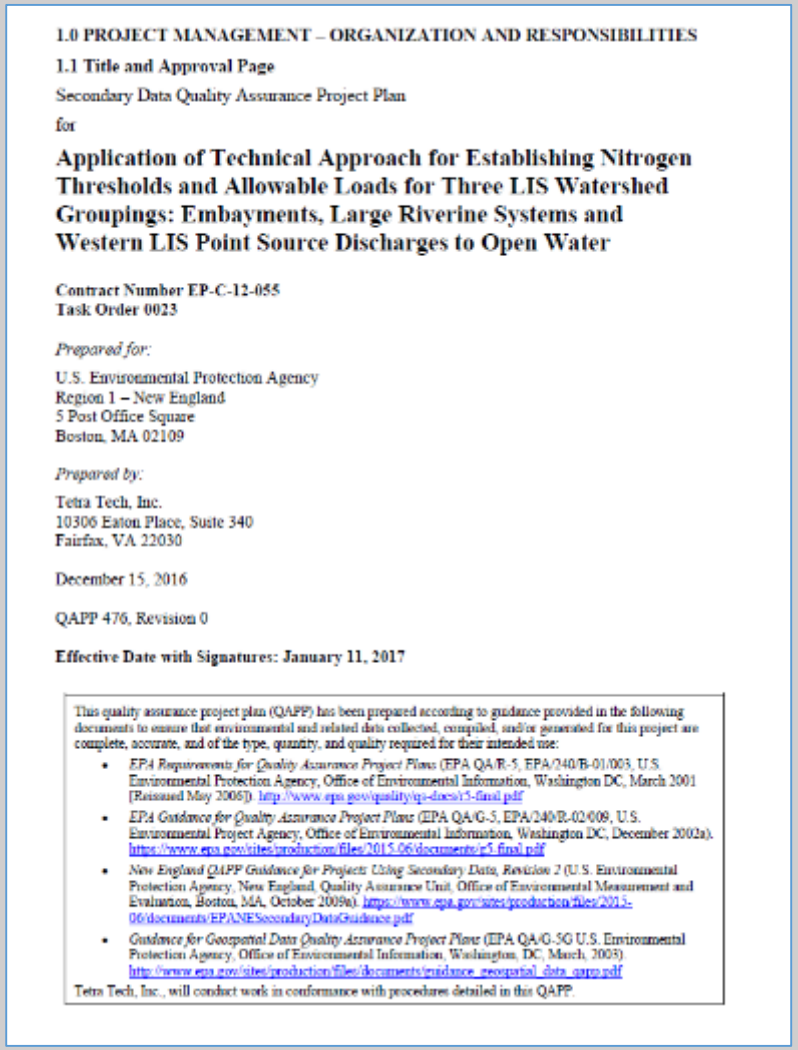


Fall 2017

Winter 2017-Spring 2018

Quality Assurance Project Plan (QAPP)

- Describes quality system Tetra Tech will implement to support EPA in establishing N thresholds
- Finalized January 11, 2017 (drives deliverables)



1.0 PROJECT MANAGEMENT – ORGANIZATION AND RESPONSIBILITIES

1.1 Title and Approval Page

Secondary Data Quality Assurance Project Plan

for

Application of Technical Approach for Establishing Nitrogen Thresholds and Allowable Loads for Three LIS Watershed Groupings: Embayments, Large Riverine Systems and Western LIS Point Source Discharges to Open Water

Contract Number EP-C-12-055
Task Order 0023

Prepared for:

U.S. Environmental Protection Agency
Region 1 – New England
5 Post Office Square
Boston, MA 02109

Prepared by:

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030

December 15, 2016

QAPP 476, Revision 0

Effective Date with Signatures: January 11, 2017

This quality assurance project plan (QAPP) has been prepared according to guidance provided in the following documents to ensure that environmental and related data collected, compiled, and/or generated for this project are complete, accurate, and of the type, quantity, and quality required for their intended use:

- *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, EPA/240/B-01/003, U.S. Environmental Protection Agency, Office of Environmental Information, Washington DC, March 2001 [Reissued May 2006]). http://www.epa.gov/quality/qs-docs/r5-final.pdf
- *EPA Guidance for Quality Assurance Project Plans* (EPA QA/G-5, EPA/240/R-02/009, U.S. Environmental Project Agency, Office of Environmental Information, Washington DC, December 2002a). https://www.epa.gov/sites/production/files/2015-06/documents/g5-final.pdf
- *New England QAPP Guidance for Projects Using Secondary Data, Revision 2* (U.S. Environmental Protection Agency, New England, Quality Assurance Unit, Office of Environmental Measurement and Evaluation, Boston, MA, October 2009a). https://www.epa.gov/sites/production/files/2013-06/documents/EPANESecondaryDataGuidance.pdf
- *Guidance for Geospatial Data Quality Assurance Project Plans* (EPA QA/G-5G U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, March, 2003) http://www.epa.gov/sites/production/files/documents/guidance_geospatial_data_qapp.pdf

Tetra Tech, Inc., will conduct work in conformance with procedures detailed in this QAPP.

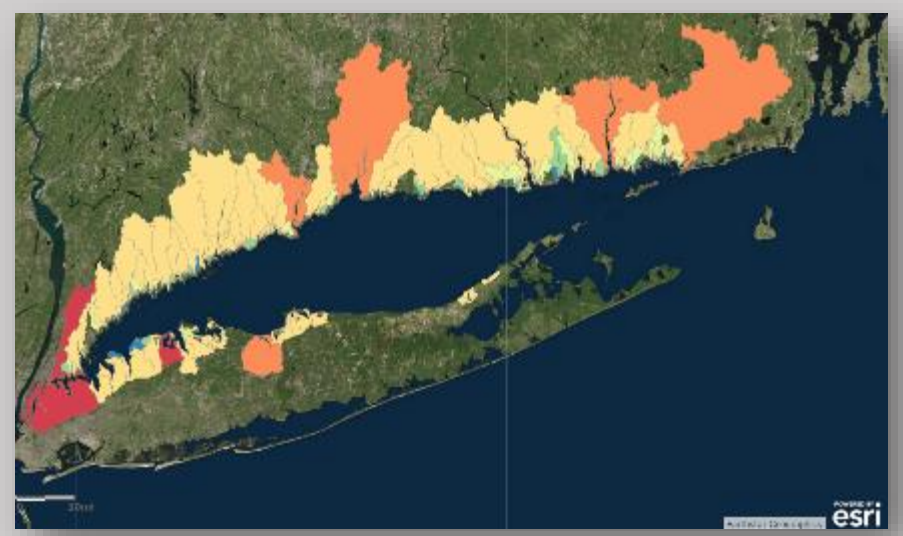
http://longislandsoundstudy.net/wp-content/uploads/2016/02/January-11-2017_TO-23-QAPP_LIS-N-Thresholds-and-Allowable-Loads.pdf

Literature Review Memo

- Clarifies science underlying technical approach and identifies data gaps
- Summary of:
  1. Data sources reviewed for priority watersheds
  2. Approach for deriving N thresholds
  3. Review of assessment endpoint targets (e.g., seagrass, DO)
- Finalized June 1, 2017

Endpoint	Importance	Linkages to, or Effects of, Nutrients	Advantages	Disadvantages
Seagrass	• Valuable marine habitat • Primary food source for many organisms	• Spatial extent, density, and growth rates decline with decreased light transmittance • Light requirement usually 20–25% surface irradiance • Light transmittance decreases with decreased clarity in part due to excess phytoplankton or epiphytic biomass from increased nutrients	• Mechanism of nutrient impact mostly well-understood • Colonization depth (Z_c) useful indicator • Once Z_c goal is established, can use light requirements to infer water clarity requirement and water column chlorophyll a criteria • Historical depth of colonization could be used to infer reference water clarity	• Cofactors exist: salinity stress, food web change, dredging, propeller scarring, sediment loading, disease • Response to nutrients can be slow (especially recovery)

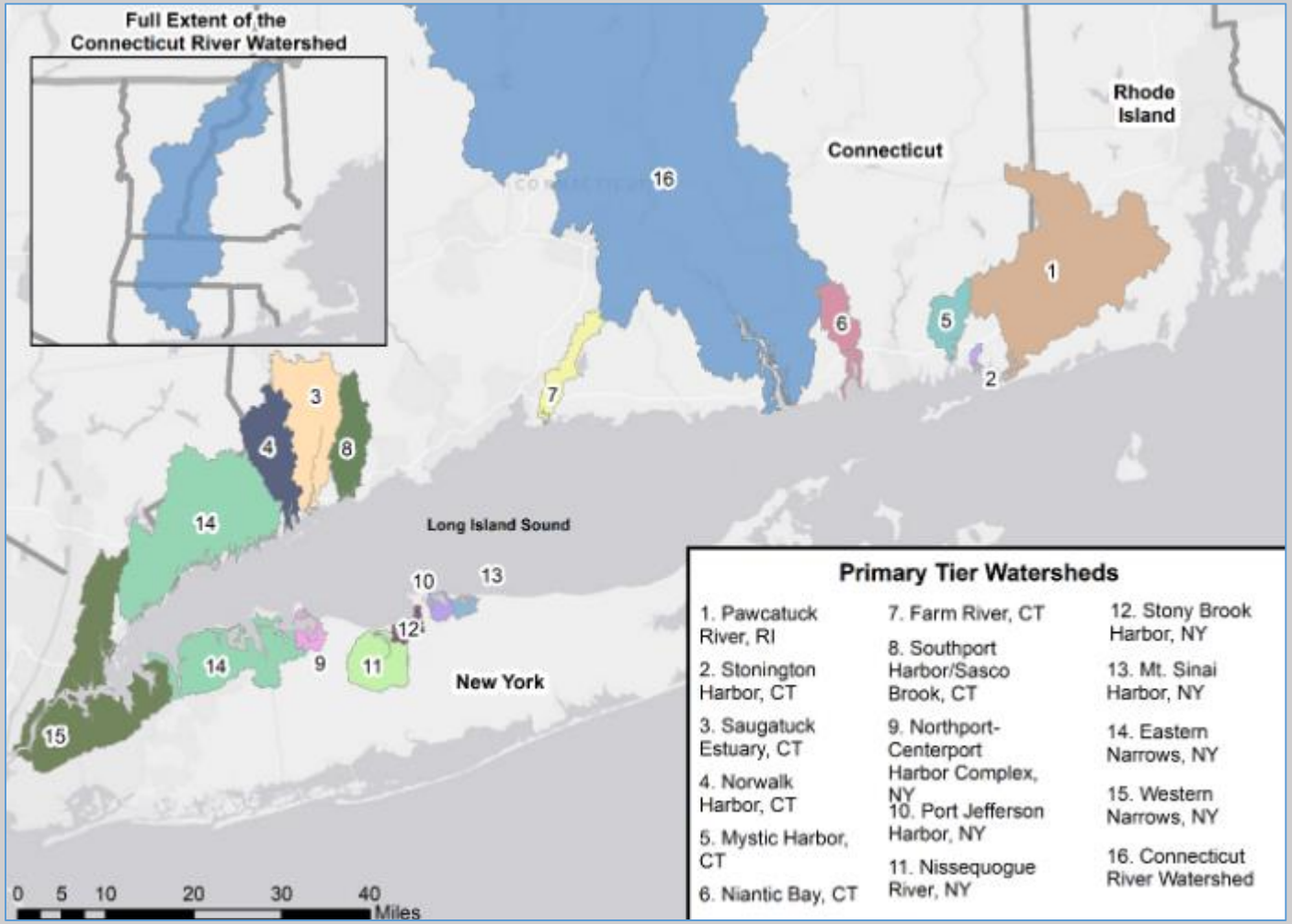
Draft Summary of Tasks A-C



- Purpose: summarize data compilation
  - Task A: Embayment Loadings
  - Task B: Point Source Loadings
  - Task C: Tributary Loadings
- Primary tier watersheds: 13 embayments, the CT River, and Western LIS (includes Eastern and Western Narrows)
- Finalized August 4, 2017

Task A. Embayment Loadings: Goal

- Estimate nitrogen loadings for 13 primary embayments and Western LIS



Task A. Embayment Loadings: Methods

- J. Vaudrey Nitrogen Loading Model
- TNC N loading model for Long Island
- Compiled and presented for each waterbody

- Range of N loads (kg N/y)
  - 13 primary embayments: 7,155 to 335,698
  - Eastern Narrows: 1,937,052
  - Western Narrows: 16,541,950

    99% from East River, NY 16,297,860

A.2 Stonington Harbor, CT

Figure A-2 shows a map of the Stonington Harbor watershed. Summary statistics are included in Table A-4.

Figure A-2. Stonington Harbor Watershed, CT

Table A-4. Summary Information for Stonington Harbor Watershed, CT

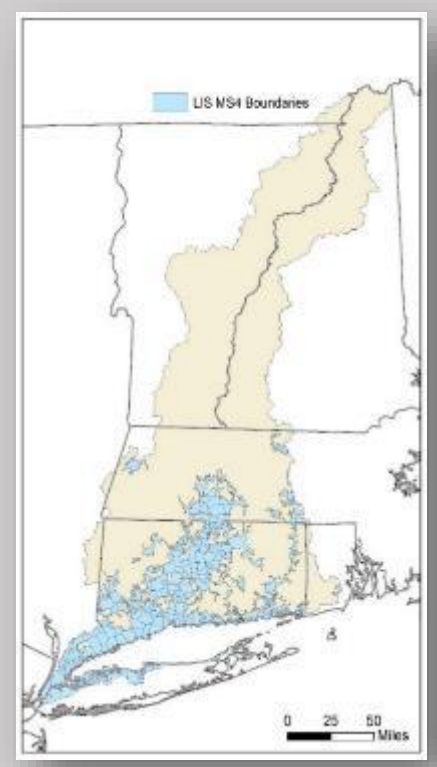
Total Drainage Area of Watershed (Vaudrey et al. 2016)	6.2 km²
Total Area of Priority Embayment (Vaudrey et al. 2016)	1.8 km²
Main Tributaries (ESRI 2017)	• Stony Brook
Residence Time (Abdelrhman 2005 derived)	• 2.5 days
Depth at MLLW (NOAA 2015)	• 2.4 m average • 6 m maximum
Land Use Characteristics (Vaudrey et al. 2016; CLEAR 2010 land use data)	• Developed: 23% (developed) • Forested: 53% (deciduous, coniferous, forested wetland) • Agricultural: 2% (agricultural field)
MS4s • New London • Stonington	Percent of watershed with MS4: 35%
Point Sources	• Stonington Borough WPCF: 663 kg N/year in 2015
Total Nitrogen Loading (Vaudrey et al. 2016)	• For entire embayment: 7,155 kg N/year • From atmospheric deposition: 3,061 kg N/year • From fertilizer: 1,131 kg N/year • From sewer: 2,070 kg N/year • From septic and cesspools: 894 kg N/year

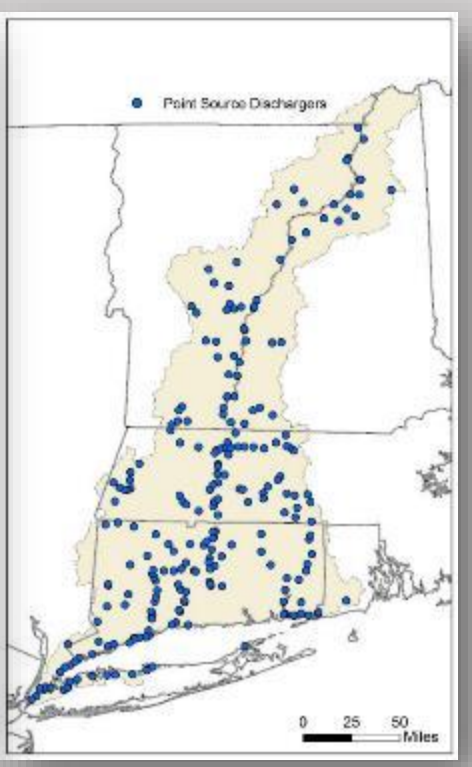
Task B. Point Source Loadings: Goal

- Estimate N contributions to LIS from regulated point source discharges
  - Wastewater plant discharges
  - Major industrial point source discharges
  - MS4 stormwater discharges

Task B. Point Source Loadings

- Point sources (Data from EPA, ICIS and USGS)
- MS4s (NY and WA – watershed models; CT – in development by state, NH/VT – no MS4s)
- 235 point source dischargers
  - Together discharged 19.2 million kg N/yr
- 340 regulated MS4s
  - 202 in CT, 86 in NY, 47 in MA, and 5 in RI
  - NY/MA loads: over 1.3 million kg N/yr

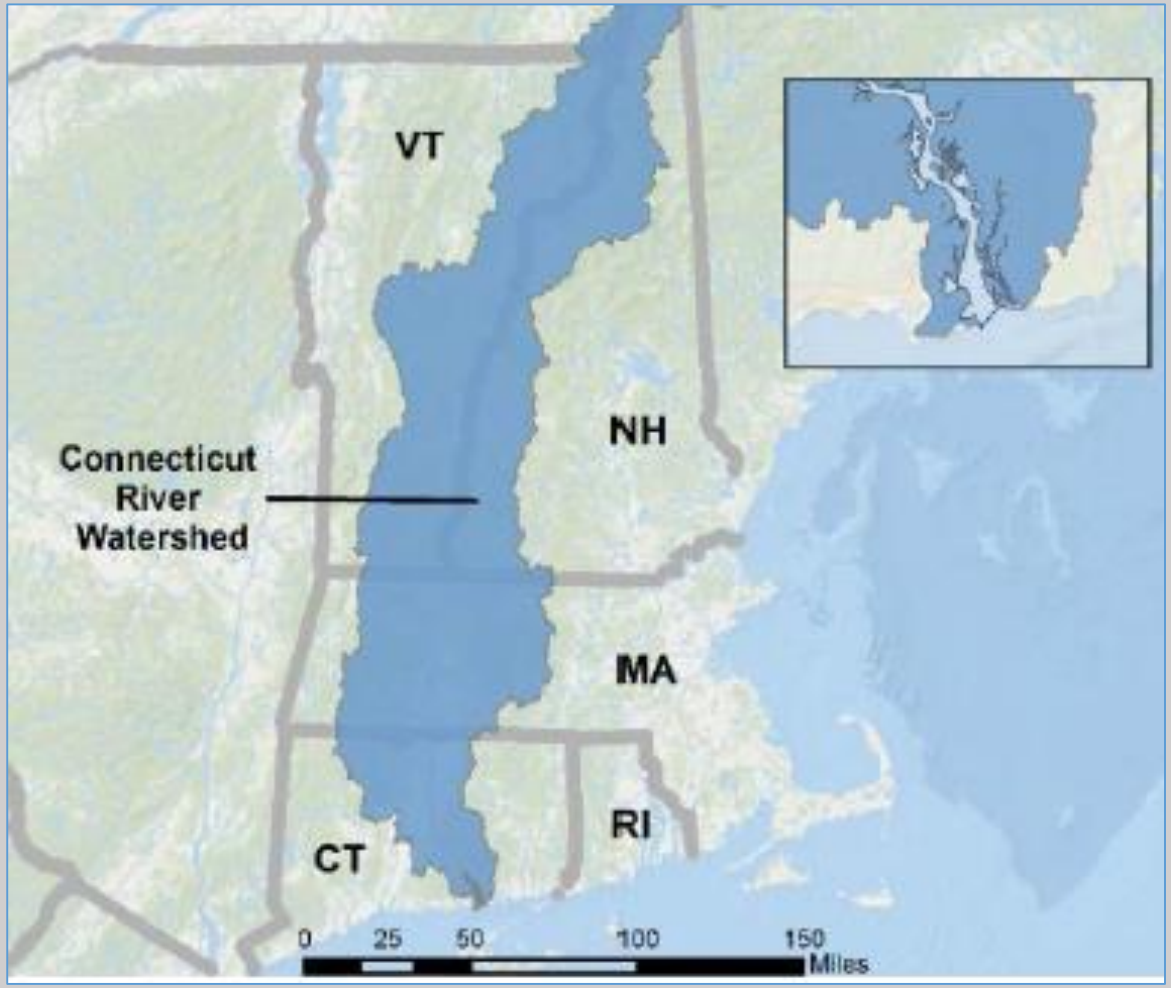




Facility (WN=Western Narrows; EN=Eastern Narrows; CRW=Connecticut River Watershed; PTW=Primary Tier Watershed)	NPDES ID	Embayment Watershed	Receiving Water	Design Flow (MGD)	Actual Flow (MGD)	Load (kg N/yr)	Concentration (mg/L)
Kimberly-Clark Corporation	CT0003212	N/A	Housatonic River	N/A	2.955	7,324	1.79
Ledyard WPCF PTW	CT0101681	Mystic River, CT	Seth Williams Brook	0.26	0.131	663	3.65
Litchfield WPCF	CT0100803	N/A	Bantam River	0.8	0.423	2,651	4.53
Manchester WPCF CRW	CT0100293	N/A	Hockanum River	8.25	5.33	48,543	6.58
Marsam Metal Finishing CRW	CTCIU0001	N/A	Unnamed Stream	N/A	0.005	182	27.23
Mattabasset WPCF CRW	CT0100307	N/A	Connecticut River	20	16.1	136,185	6.11
Meriden WPCF	CT0100315	New Haven Harbor, CT	Quinnipiac River	11.6	8.84	19,218	1.57
Middletown WPCF CRW	CT0100323	N/A	Connecticut River	6.75	3.63	83,003	16.52
Milford Beaver Brook WPCF	CT0100749	Housatonic River, CT	Housatonic River	3.1	1.45	8,449	4.21
Milford Housatonic WPCF	CT0101656	Housatonic River, CT	Housatonic River	8	5.76	43,407	5.44
Montville WPCF	CT0100935	Thames River, CT	Thames River	7.2	1.408	9,112	4.68
Naugatuck WPCF	CT0100641	N/A	Naugatuck River	10.3	5.341	30,153	4.08
New Canaan WPCF EN	CT0101273	Five Mile River,	Five Mile River	1.7	0.881	2,816	2.31

Task C. Tributary Loadings: Goal

- Estimate annual nitrogen loading from the CT River

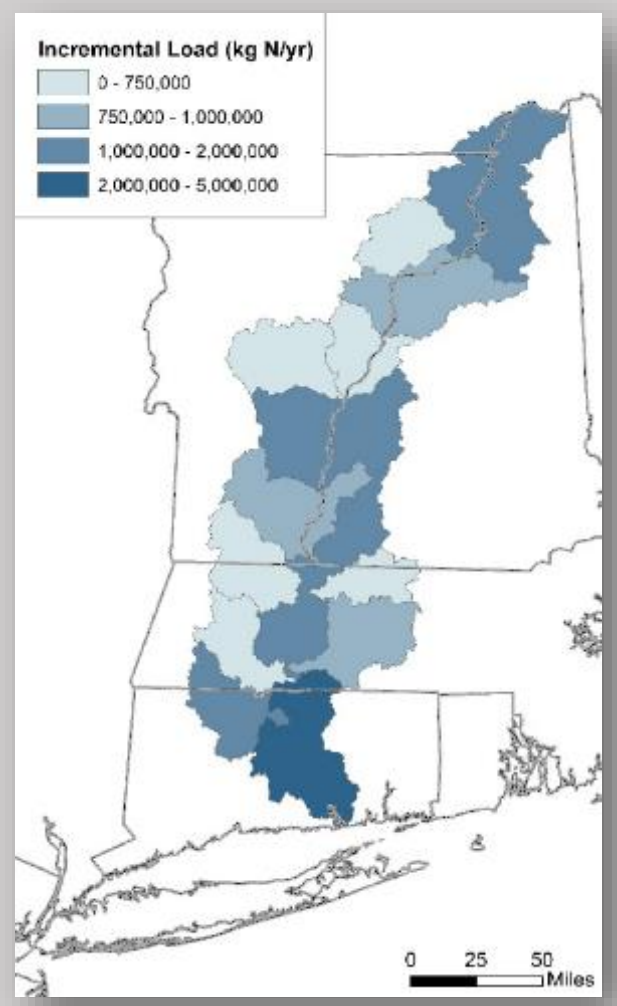


Task C. Tributary Loadings

- Data: USGS, NOAA, SPARROW, LIS TMDL, AVGWLF model, HSPF model

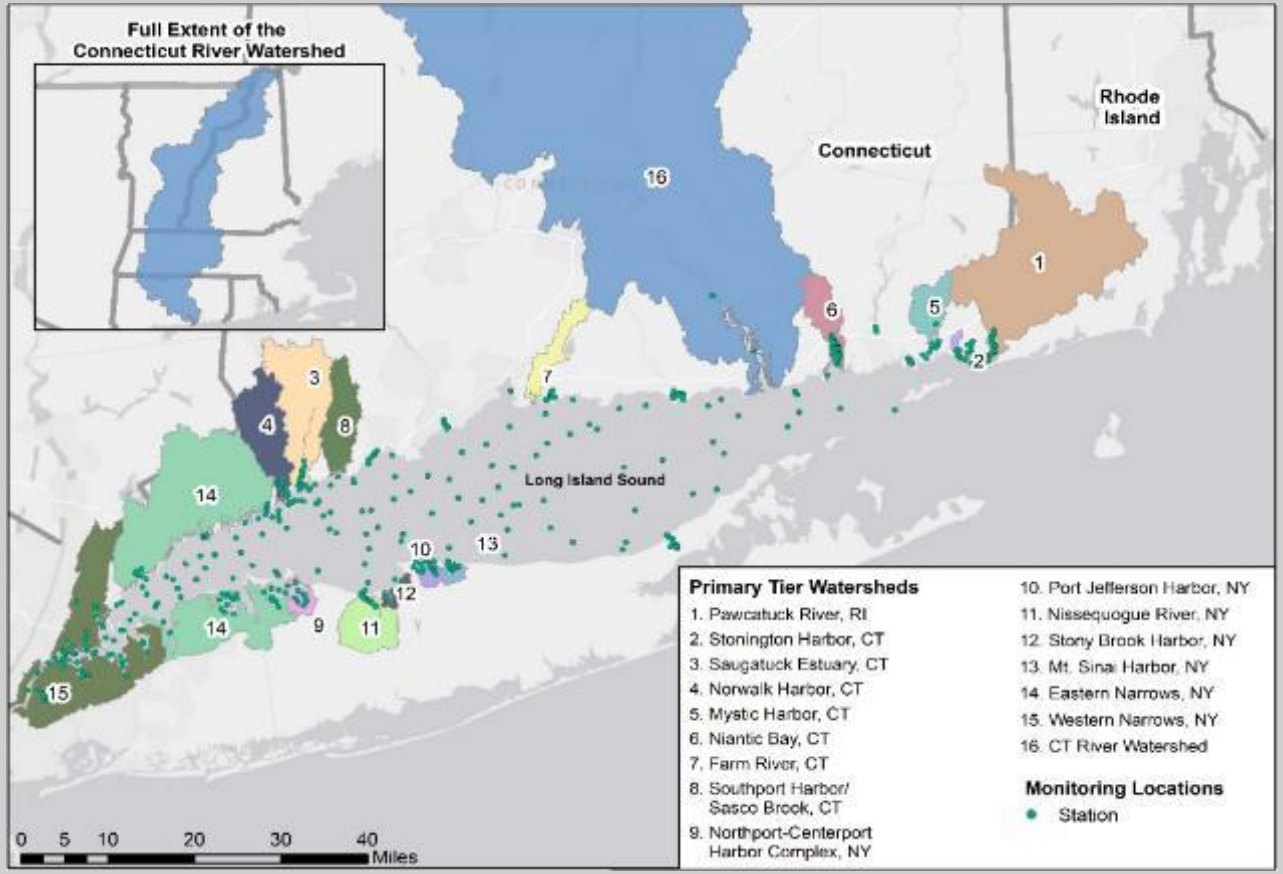
- Load estimates available at 3 spatial scales
  - Entire CT River watershed
  - Specific USGS gauges in the CT River watershed
  - Subwatersheds within the greater LIS watershed

- Load Range (kg N/y): 10,995,192 to 19,150,866
  - Average (±95% CI): 14,662,000±1,477,000



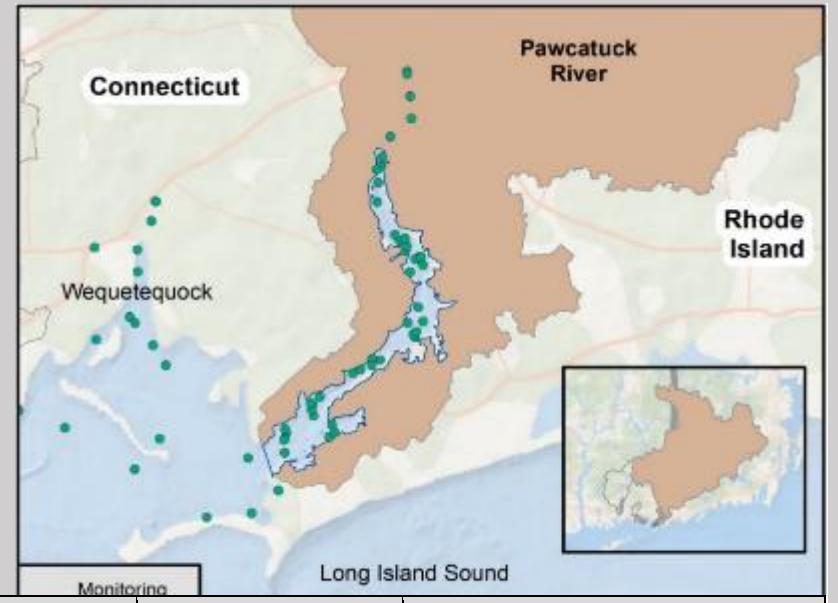
Task D. Water Quality Data: Goal

- Compile surface water quality data for entire LIS
- Apply in empirical modeling
- Finalized September 15, 2017



Task D. Water Quality Data

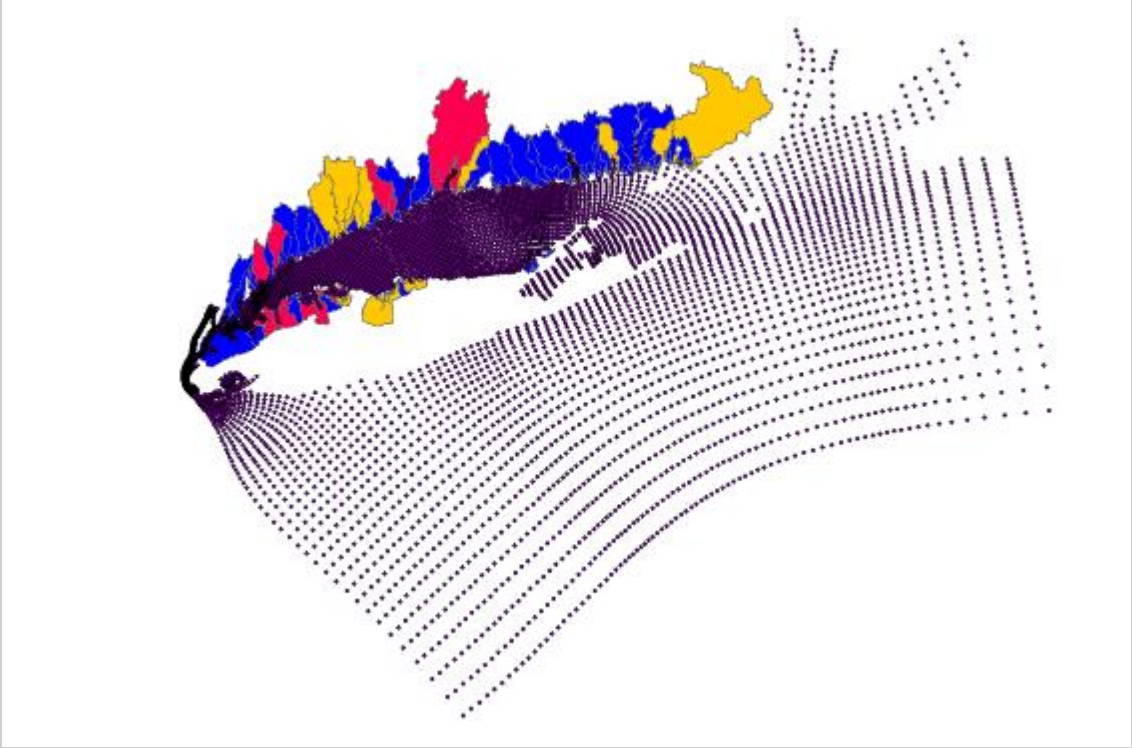
- Solicited data from broad range of sources (N=27)
- Screened for data requirements (applicability, availability, QA)
- >24,000 nutrient samples
- >61,000 response samples
- 554 stations
- Memo provided data details by waterbody



Monitoring Organization	Number of Stations	Time Period	Number of Nutrient Samples		Number of Response Samples		
			TN	TP	Chl *a*	DO	SD
CT DEEP	60	2006–2015	4,068	3,956	3,876	8,204	2,295
EPA NCCA	56	2006, 2010	54	53	54	72	23
EPA ORD	152	2000–2009	88	0	448	1,320	580
Harbor Watch	36	2006–2015	0	0	0	2,343	639
IEC	22	2006–2015	99	99	641	7,574	2,367
NOAA (Hunts Point)	1	2012	26	0	112	143	0
NYC DEP	46	2006–2015	5,267	5,272	5,278	7,828	7,976
Suffolk County	57	2006–2015	1,697	1,697	1,547	3,311	1,639
UConn (Vaudrey)	96	2013–2014[a]	269	0	140	530	19
UConn (Yarish)	3	2011–2016	0	0	0	0	33
URIWW	25	2007–2015	725	724	942	1,379	365
Total	**554**		**12,293**	**11,801**	**13,038**	**32,174**	**15,936**

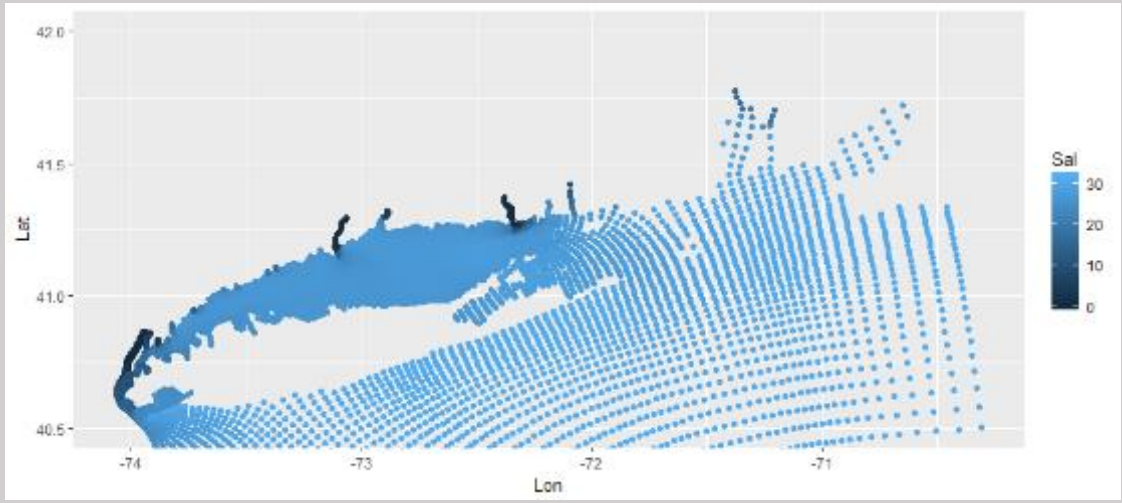
Task E. Hydrodynamics: Goal

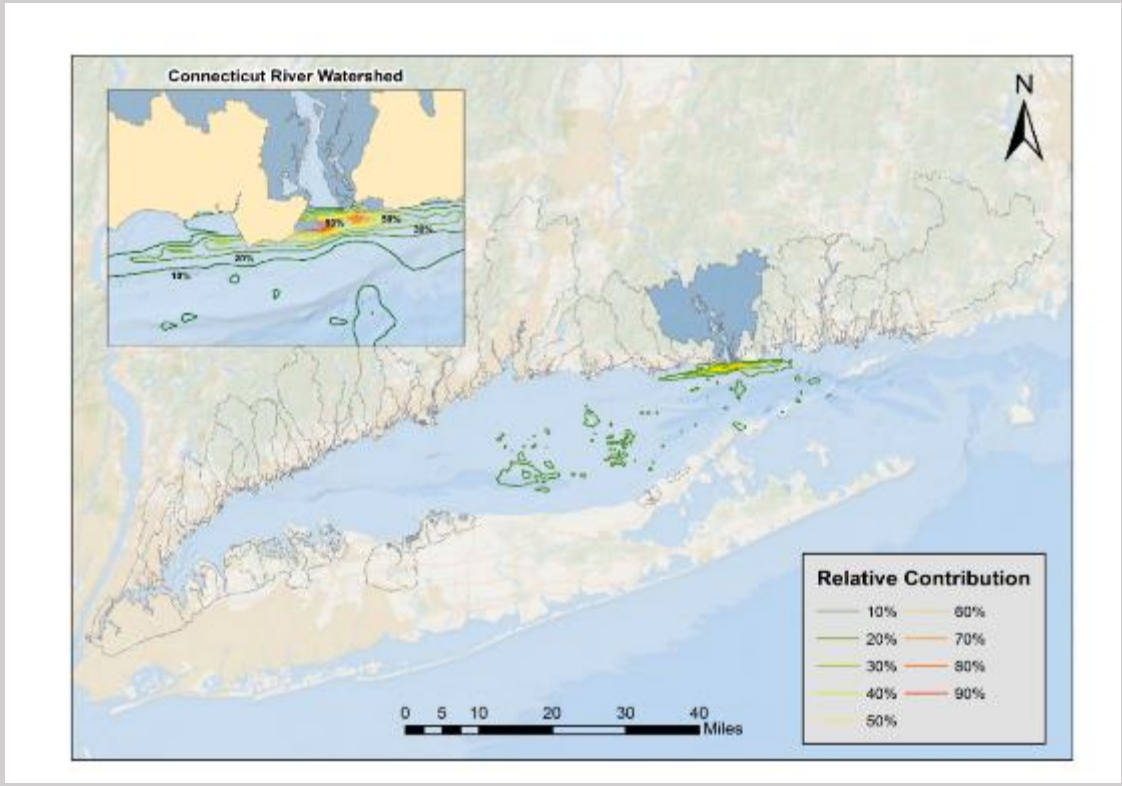
- Identify CT River area of influence and its contribution to LIS waters
- Calculate mixing between LIS open water and primary tier embayments
- Finalized October 20, 2017



Task E. Hydrodynamics

- Off-the-shelf model (NYHOPS)
- Salinity model used to estimate mixing
- Particle tracking routine used to estimate area of influence and contribution
  - Ranged: 0 to 11%





Task F/G. N Threshold Development: Goal

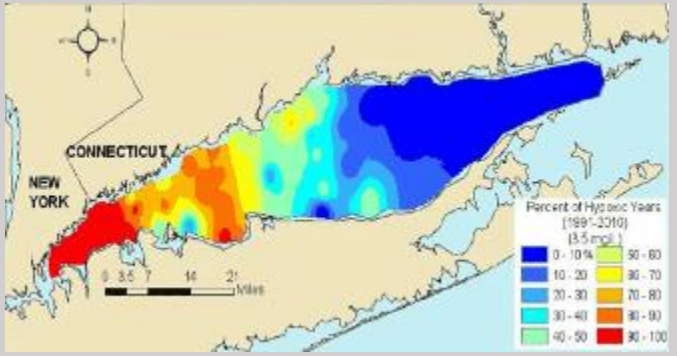
- Develop TN targets for each waterbody

- Protect:
  - Seagrasses (light)
  - Aquatic Life (DO)

- Release date: TBD

Seagrasses

Dissolved Oxygen



Task F/G. N Threshold Development

Multiple lines of evidence

- Literature
- Stressor-Response
- Distribution-based

Establishing Restoration Objectives for Eelgrass in Long Island Sound

Part II: Case Studies

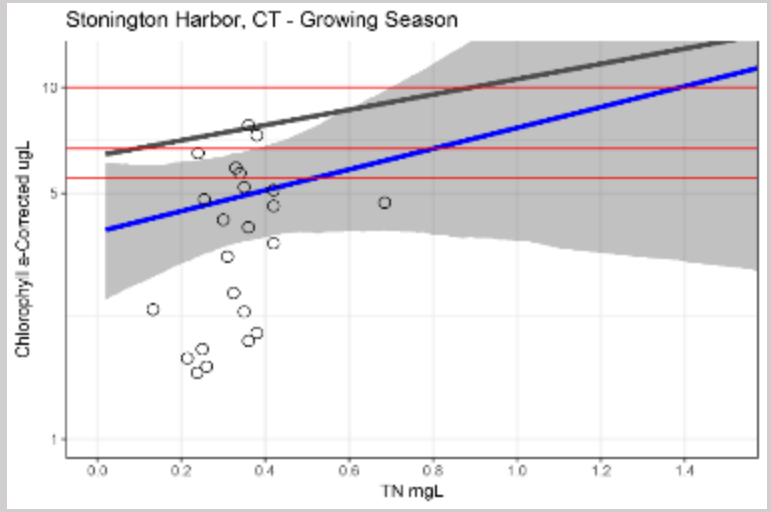
Final Grant Report to the Connecticut Department of Environmental Protection, Bureau of Water Protection and Land Reuse and the U.S. Environmental Protection Agency

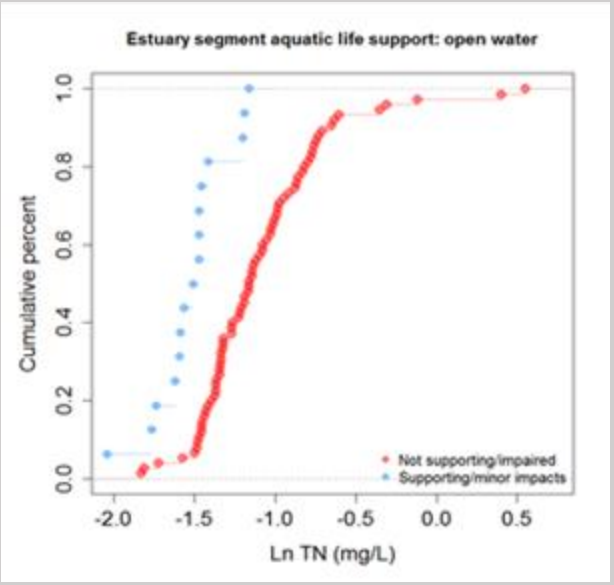
Funded by a Cooperative Agreement: LI-97107201, CDFA#66-437

(UCONN FRS#542190)

April 2008

By
Jamie M. P. Vaudrey, Ph.D.
Department of Marine Sciences
University of Connecticut
1080 Shennecossett Road
Groton, CT 06340
jamie.vaudrey@alum.wellesley.edu

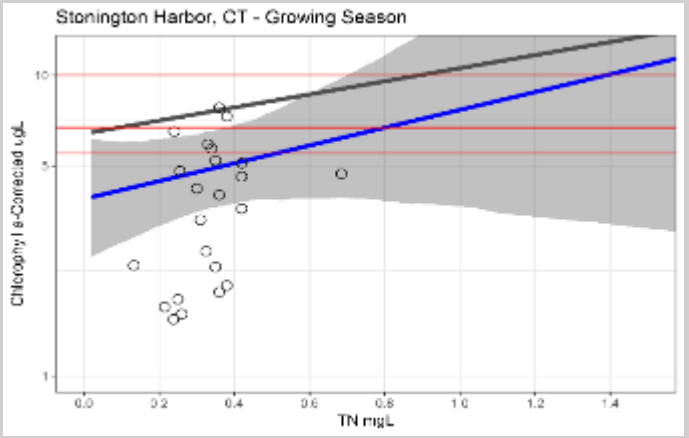




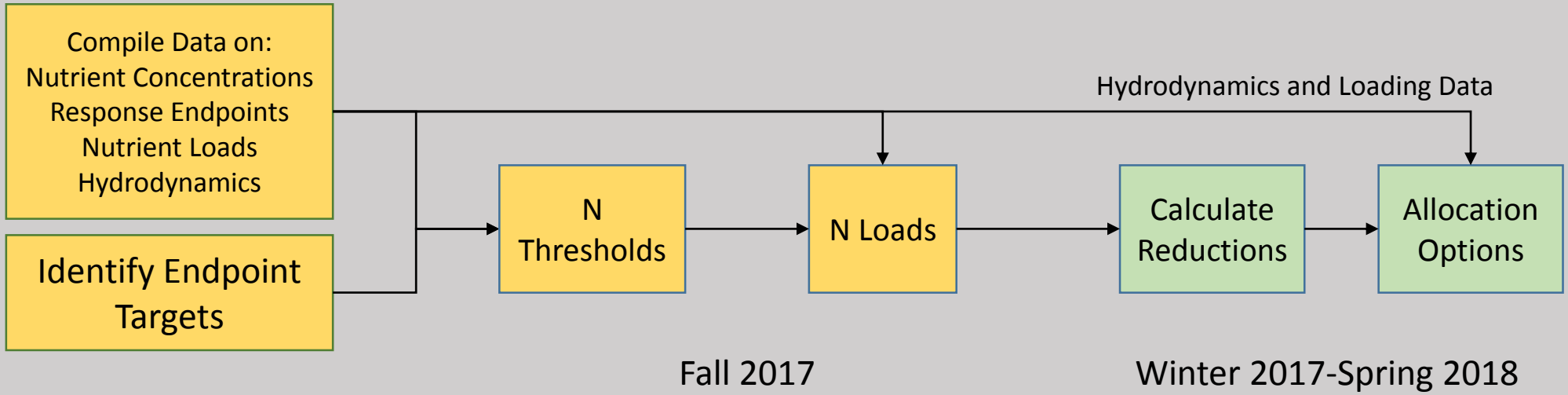
Task F/G. N Threshold Development

- Compiling tables for each primary tier water

Endpoint Parameter	Endpoint Target	Associated Parameter	Associated Target	Uncertainty	Threshold Method
k_d (m-1)		Chlorophyll a-corrected (µg/L)			Stressor-Response Model
DO (mg/L)		Chlorophyll a-corrected (µg/L)			Stressor-Response Model
Chlorophyll a-corrected (µg/L)		TN (mg/L)			Stressor-Response Model
		TN (mg/L)			Literature Review
		TN (mg/L)			Distribution Approach – All Embayments 25th percentile



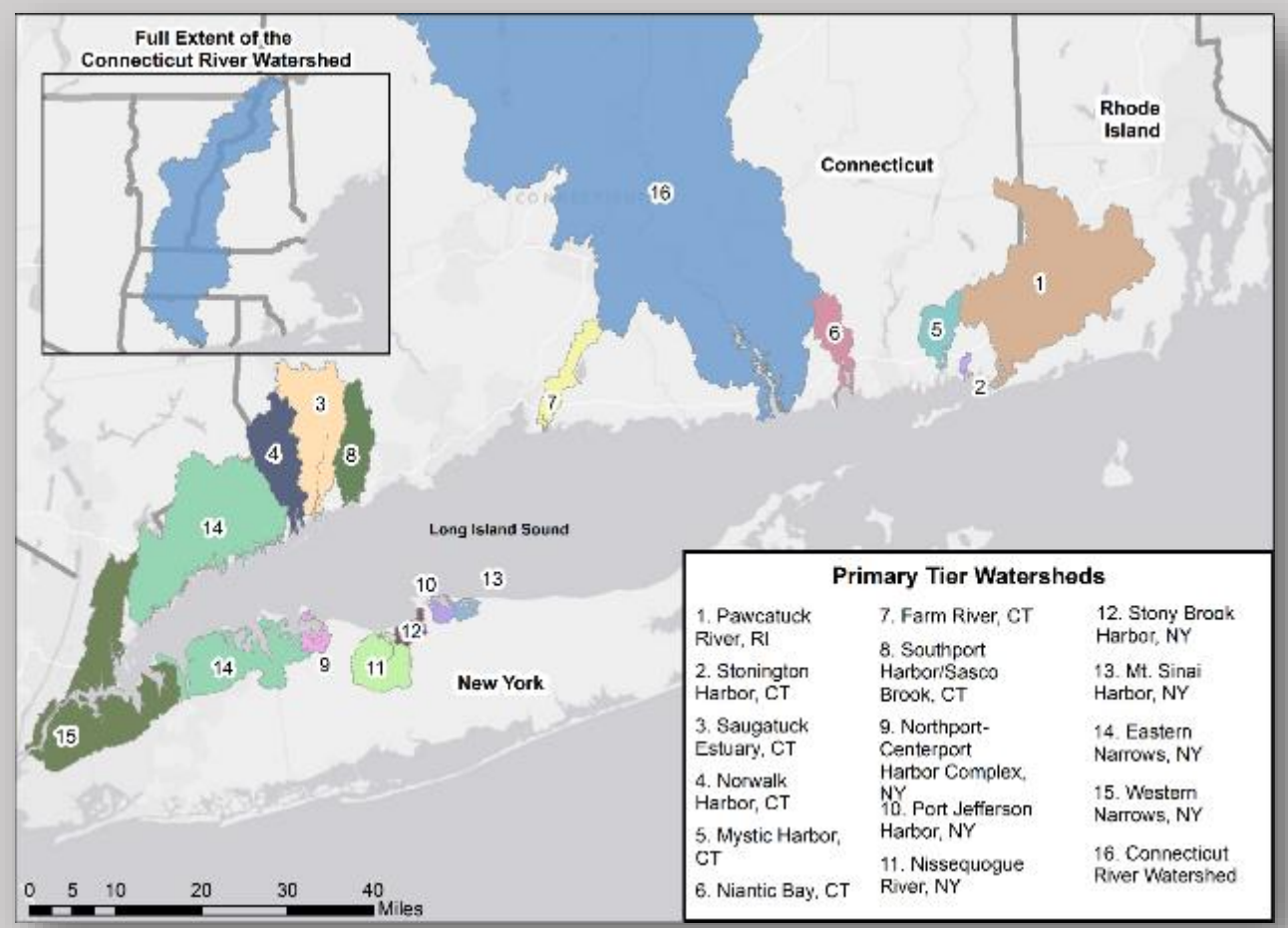
Next Steps



- Quantify Reductions

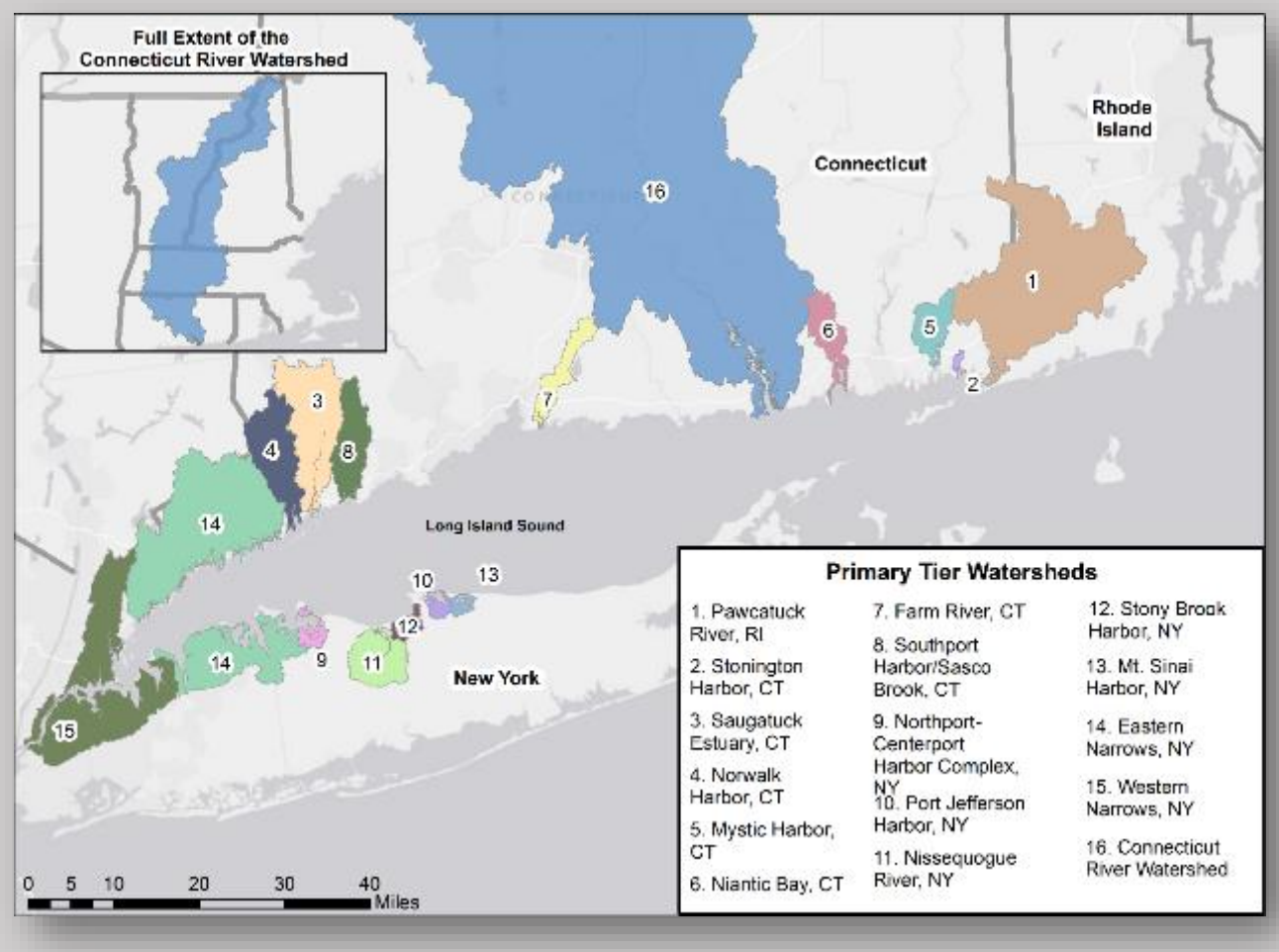
Task H: Quantifying Reductions

- Compare N thresholds to existing conditions
- Load/concentration based approaches
- Release Date: TBD



Task I: Allocation Options

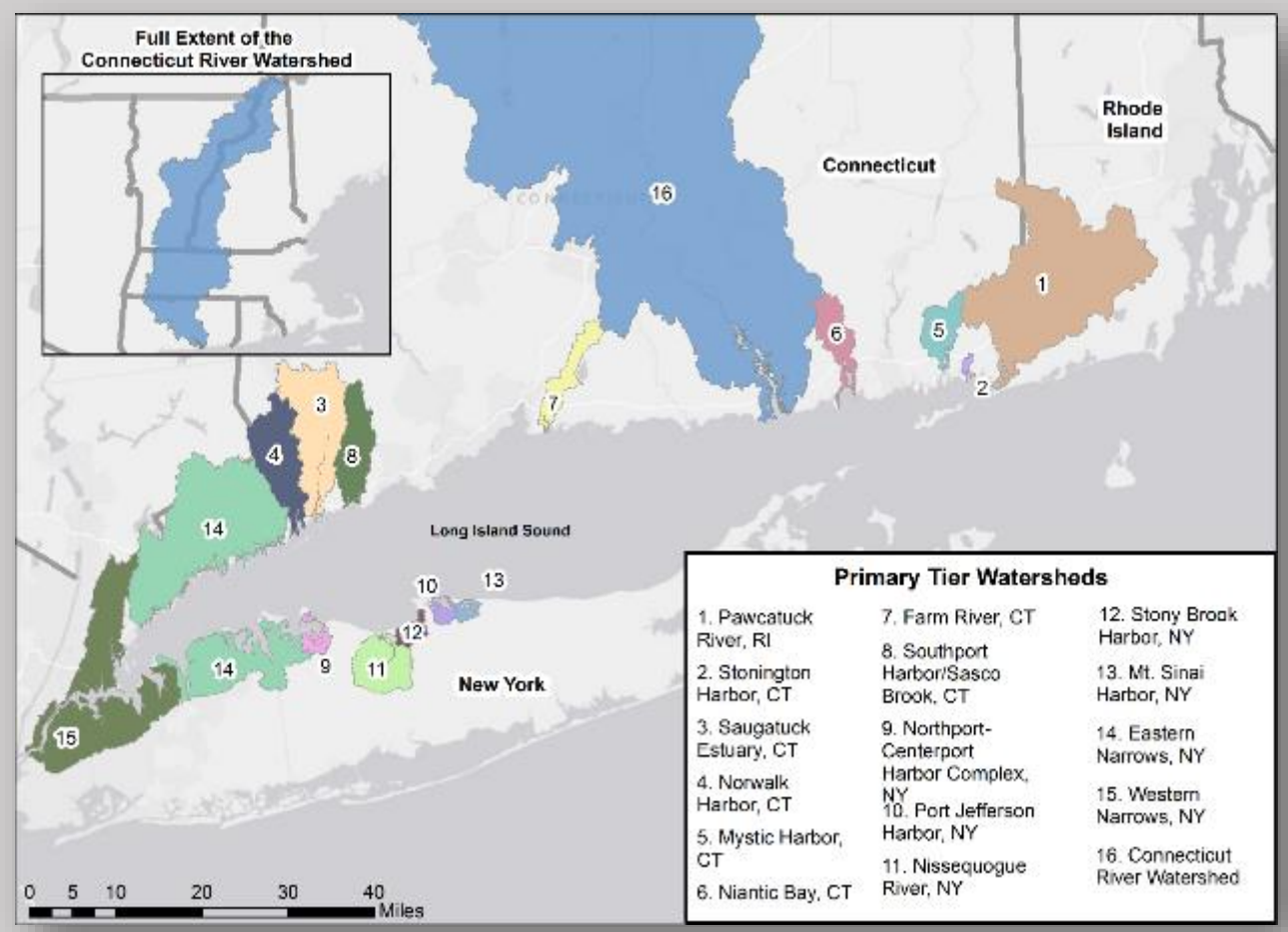
- Only Embayments
- Review dominant loads
- Review reduction options
- Release date: TBD



Primary Tier Watersheds

1) Connecticut River Watershed

2) Western Long Island Sound



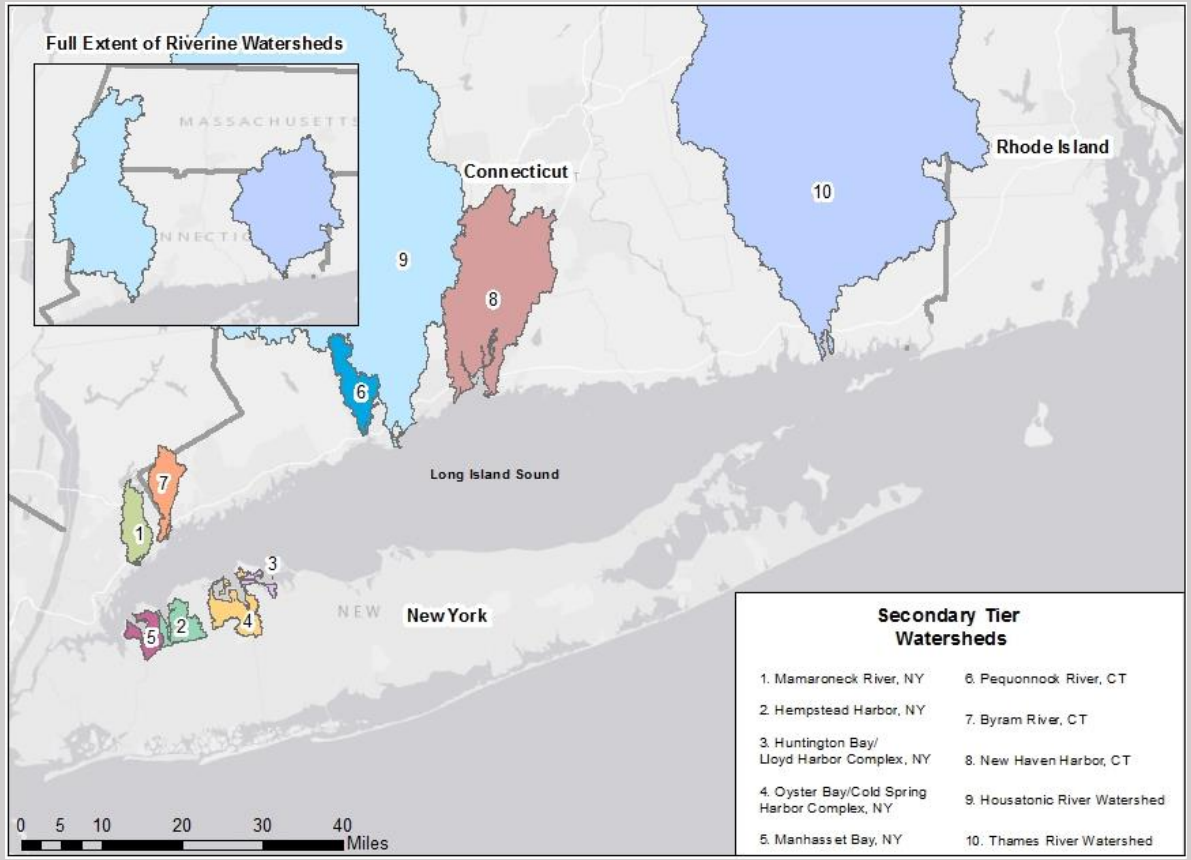
3) Embayments:

- Stonington Harbor / Pawcatuck River
- Saugatuck Estuary
- Norwalk Harbor
- Mystic Harbor
- Niantic River
- Farm River
- Southport Harbor / Sasco Brook
- Northport-Centerport Harbor
- Port Jefferson Harbor
- Nissequogue River
- Stony Brook Harbor
- Mt. Sinai Harbor

Secondary Tier Watersheds

Large River Systems:

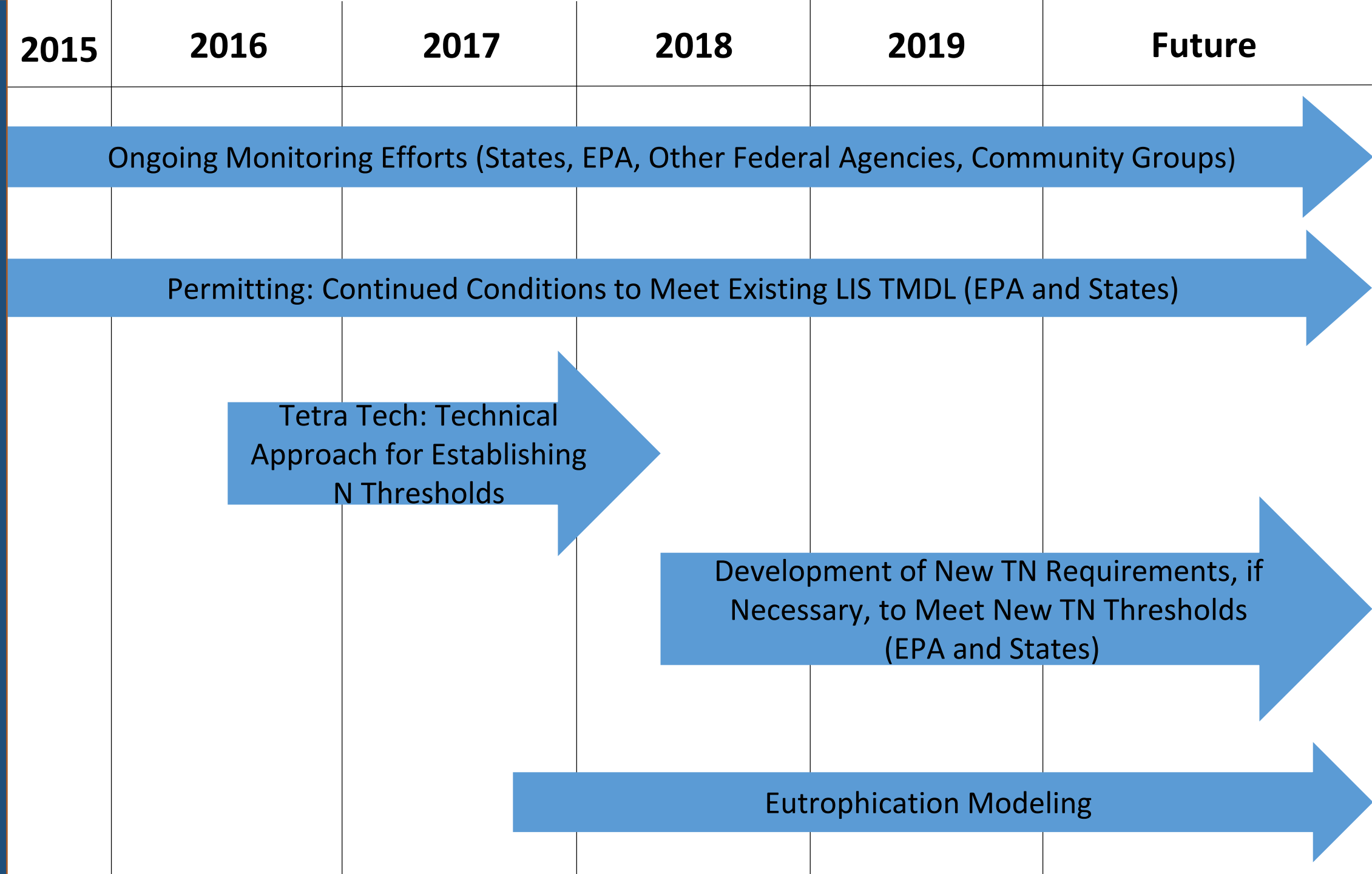
- Housatonic River
- Thames River



Embayments:

- Mamaroneck River
- Hempstead Harbor
- specific areas adjacent to Northport/Centerport (Huntington Bay and Lloyd Harbor)
- Oyster Bay – Cold Spring Harbor Complex
- Manhasset Bay
- Pequonnock River
- Byram River
- New Haven Harbor

EPA Long Island Sound Nitrogen Reduction Strategy



Stay Informed

http://longislandsoundstudy.net/issues-actions/water-quality/nitrogen-strategy/

Posting:

- Meeting announcements
- Presentation slides
- Review schedule
- View major reports
- Provide technical comment

Questions and Discussion

www.longislandsoundstudy.net