Establishing Nitrogen Target Concentrations for Three Long Island Sound Watershed Groupings:

Embayments, Large Riverine Systems, and Western Long Island Sound Open Water

Subtask D. Summary of Existing Water Quality Data

Submitted to:

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Region 1 and Long Island Sound Office

Submitted by:

Tetra Tech, Inc.

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This Tetra Tech technical study was commissioned by the United States Environmental Protection Agency (EPA) to synthesize and analyze water quality data to assess nitrogen-related water quality conditions in Long Island Sound and its embayments, based on the best scientific information reasonably available. This study is neither a proposed Total Maximum Daily Load (TMDL), nor proposed water quality criteria, nor recommended criteria. The study is not a regulation, is not guidance, and cannot impose legally binding requirements on EPA, States, Tribes, or the regulated community. The technical study might not apply to a particular situation or circumstance, but it is intended as a source of relevant information to be used by water quality managers, at their discretion, in developing nitrogen reduction strategies.

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Introduction and Methods Overview

Tetra Tech contacted EPA-recommended water quality monitoring organizations, local monitoring organizations with established Quality Assurance Project Plans (QAPPs) (according to Vaudrey et al. 2013), and other water quality monitoring organizations recommended by local stakeholders to gather water quality data for Long Island Sound (LIS) and its embayments. Tetra Tech also queried the Water Quality Portal for additional water quality data.[1] Tetra Tech reviewed water quality monitoring datasets that met its EPA-approved QAPP requirements and organized those datasets in an Excel spreadsheet (Tetra Tech 2017). Datasets that did not meet Tetra Tech's EPA-approved QAPP requirements were not considered further for this project.

Table D-1 provides a list of organizations considered as data sources for water quality data and a brief description of the source of each organization's dataset. The organizations are listed first by the 14 organizations with data that will be potentially useful for stressor-response analysis to support development of recommended nitrogen target concentrations, and second by organizations with datasets considered but not selected (including the reasons why).

Table D-1. Monitoring Organizations Considered

Organization	Source
Data Sources Selected	
Connecticut Department of Energy and Environment (CT DEEP)	Provided by CT DEEP (Chris Bellucci) in December 2016.
EPA National Coastal Condition Assessment (EPA NCCA)	2006 data accessed from the Water Quality Portal in January 2017; 2010 data accessed from EPA's website[a] in January 2017.
EPA Region 1	Provided by EPA Region 1 (Dan Arsenault) in January 2018.
EPA Office of Research and Development (EPA ORD)[b]	Provided by EPA ORD (Jim Latimer) in January 2017.
Friends of the Bay	Provided by Friends of the Bay (Paul DeOrsay) in December 2016.
Harbor Watch Water Quality Monitoring Program of Earthplace (Harbor Watch)	Provided by Harbor Watch (Sarah Crosby) in January 2017.
Interstate Environmental Commission (IEC)	Provided by IEC (Robin Jazxhi) in December 2016.
National Oceanic and Atmospheric Administration Federal Research at Hunts Point (NOAA Hunts Point)	Provided by NOAA (Judy Yaqin Li) in March 2017.
New York City Department of Environmental Protection (NYC DEP)	Provided by NYC DEP (Beau Ranheim) in January 2017.[c]
Stony Brook University–Dr. Gobler's Laboratory	Provided by Stony Brook University (Christopher Gobler) in April 2017.
Suffolk County, NY	Provided by Suffolk County (Nancy Pierson) in January 2017.
University of Connecticut Embayment Research	Provided by Dr. Vaudrey in March 2017.
University of Connecticut Research Data	Provided by Dr. Yarish in March 2017.
University of Rhode Island Watershed Watch (URIWW) Compiled Data[d]	Provided by URIWW (Elizabeth Herron) and Clean Up Sound and Harbors (Fran Pijar) in January 2017.

[1] https://www.waterqualitydata.us/.

Organization	Source
Data Sources Considered but Not Selected	
Maritime Aquarium at Norwalk	Provided by Maritime Aquarium at Norwalk (Tom Naiman) in March 2017. Data were from cruises and did not include nutrient data.
University of Connecticut Researcher Datasets	Data downloaded from the University of Connecticut website.[e] Data are either included in the EPA ORD dataset or are out of the targeted temporal scope of this project.
Cedar Island Marina Research Laboratory	Data requested but not received. Some data from this organization were already included in the EPA ORD dataset.
Coalition to Save Hempstead Harbor	Limited data of interest.
Long Island Sound Integrated Coastal Observing System	Data requested but not received.
CT DEEP (Kelly Streich)	Data requested but not received.
Millstone Environmental Lab	No data available in a readily accessible format. An annual summary report was provided by Millstone Environmental Lab as a PDF.
Rocking the Boat	Data for one station were available within the geographic scope. However, data do not meet QAPP requirements. Data were unremarked, and nondetect results were not included with these data.
Bridgeport Regional Aquaculture Science and Technology Center	Data are stored with Maritime Aquarium at Norwalk, according to staff at Bridgeport Regional Aquaculture Science and Technology Center.
Northport Harbor Water Quality Protection Committee	No data of interest.
Oyster Bay/Cold Spring Harbor Protection Committee	Data are stored with Friends of the Bay, according to staff at Oyster Bay/Cold Spring Harbor Protection Committee.
Setauket Harbor Taskforce	No data of interest.
Manhasset Bay Protection Committee	No data of interest, and data were not collected under a QAPP.
The Yale School of Forestry and Environmental Studies (FES) and University of New Haven	Yale FES was included in the Vaudrey et al. (2013) community survey as not operating under an approved QAPP and not collecting nutrient data (only dissolved oxygen [DO] and physical). Data source not pursued further.
Town of Greenwich, Westchester County, and IEC	Reported by EPA as possible data sources for Byram River. Upon contact, no data of interest available.

[a] https://www.epa.gov/national-aquatic-resource-surveys/data-national-aquatic-resource-surveys.
[b] EPA ORD dataset includes compiled data from EPA, University of Connecticut researchers, and Cedar Island Marina Research Laboratory.
[c] NYC DEP dataset includes data that provide only a result. Results below the detection limit are not included. Tetra Tech will consider in subsequent analysis steps.
[d] URIWW dataset includes compiled data from Clean Up Sound and Harbors, Save the Bay, and Watch Hill Conservancy.
[e] http://www.lisrc.uconn.edu/eelgrass/index.html.

Tetra Tech and EPA worked collaboratively to determine which data sources to include in the analysis, based on applicability (whether the data are potentially useful for stressor-response analyses in estuarine waters), availability (whether the data have been provided and are in an accessible format), and quality (whether the data are of known and documented quality). Table D-2 outlines the overarching rationale for selection of water quality datasets.

Table D-2. Rationale for Selecting Water Quality Data

Applicability of Analysis	
Geographic Scope	Limited to embayments selected by EPA and delineated by Vaudrey et al. (2016) and the open water LIS.
Data Collection Period of Interest	The primary data collection period selected: 2006–2015. This period was chosen as the most recent 10-year period with complete annual water quality data to allow for interannual variability in the characterization of current water quality data loads and concentrations. In some cases, data are included in the final dataset that are outside the data collection period because they might prove useful for embayments with little to no data available for 2006–2015. For some of the stressor-response relationships, data outside the selected data collection period might prove useful for establishing relationships between nutrients and the response variables.
Parameters of Interest	Included the following parameters: nitrogen species, phosphorus species, chlorophyll *a* (chl *a*) (pheophytin free and uncorrected*), dissolved oxygen (DO), Secchi depth (SD), and other standard physical (e.g., temperature, pH, salinity, TSS) and biological parameters (e.g., light, algae, benthos, fish species), as available.
Selected Waters	Focus was on data for selected embayments, western LIS embayments, and the Connecticut, Housatonic, and Thames rivers. However, gathering as much water quality data as possible for nitrogen and potential response variables was important to inform empirical stressor-response modeling in estuarine waters. As resources allowed, water quality data were also collected for other embayments and open water areas of LIS to provide a gradient in conditions to inform empirical stressor-response modeling.
Data Availability	
Data Provided	Data provided to Tetra Tech in time for this summary.
Format	Data provided in a readily accessible format for analysis (e.g., a consistently formatted spreadsheet or database).
Data Quality	
Data Collected Under a QAPP	Data collected under a documented quality program.
Tetra Tech QAPP	Data met Tetra Tech's EPA-approved QAPP requirements (Tetra Tech 2017).
Metadata	Data accompanied by appropriate detailed metadata. Tetra Tech referred any questions of data interpretation to the data providers.

**Note:* Uncorrected refers to chlorophyll measurements uncorrected for pheophytin interference.

Tetra Tech received water quality data in formats ranging from a single spreadsheet to multiple spreadsheets and databases with highly variable organization. Within the project files, Tetra Tech preserved the original data in the form provided by each monitoring organization. To determine whether a dataset should be included, Tetra Tech reviewed each data source using the rationale described in Table D-2. Next Tetra Tech processed and organized the data in a standard format. Tetra Tech created one master file including all processed and organized data from 14 selected data sources (*Appendix D: LIS Water Quality Data*). In addition, Tetra Tech maintained processed files for each dataset separate from the master file. The master file contains an overall stations table, a sample-level data table in wide format (individual columns for each parameter), and a sample-level data table version in long format (all parameters in one column). The overall stations table includes a unique station name, station location coordinates, the selected embayments, monitoring organization, and a summary of key nutrient and response data availability for each monitoring station.

Tetra Tech did not include profile data or additional biological data (e.g., on algae, benthos, fish species) in the overall spreadsheet *Appendix D: LIS Water Quality Data*. These data remain in individual

processed spreadsheets for each organization. Complete documentation for each dataset is available upon request, including (1) individual original datasets provided by monitoring organizations; (2) individual processed datasets for each monitoring organization; and (3) detailed processing notes for each dataset. An overview of processing methods is provided in below.

To process the original data received, Tetra Tech extracted data from the original databases and spreadsheets and organized the data in a consistent format. Tetra Tech automated all data transformations (e.g., combining data from multiple tabs or spreadsheets) when possible and performed quality assurance (QA) checks to confirm accuracy of all processing steps. Tetra Tech organized the data from each data source into a standardized format of one worksheet for stations with a unique station identifier, location description, and latitude and longitude; and a second worksheet for the source's water quality data. Organizing data in a standardized format allows for easier comparisons during analysis. For example, in some cases, data were provided in a series of small separate tables by year or by station, which does not allow for easy comparison. Tetra Tech applied the following standardization rules to each dataset:

- Standardized site locations and names to include the monitoring organization and station name to ensure that each station name was unique when combining multiple datasets. Plotted station locations and confirmed missing coordinates or coordinates not matching the station description with the data provider. Standardized coordinates to decimal degrees.
- Embayment assignments were reviewed and modified when they were found to be erroneous based on where data points were located when plotted.
- Excluded blank fields and fields not of interest for this analysis from the processed and organized tables (e.g., parameters not of interest for this analysis, sample or lab notations, fields not populated).
- Standardized field names to a consistent naming format among different datasets to allow for combining fields among datasets (e.g., adjusting date and time combined in one column to two separate columns).
- Standardized formatting of provided data (e.g., changed mm-dd-yy to mm-dd-yyyy).
- Standardized parameter names to a master list of parameter names and included standard units in the name for each parameter (e.g., TN_mg/L). If the original units provided were not in standard units, units were converted (e.g., depth converted from feet to meters, nutrient concentrations converted from µmols to mg/L). Inconsistencies in parameter naming or interpretation were resolved with the data provider.
- Added a numeric sample ID that is unique among all datasets.
- Generated both long and wide formats of the processed and organized data for ease of further analysis. Some data were originally formatted in long formats and others in wide formats.

Depth codes were often available from the original source data and were maintained along with sample depth (when provided). Depth code values include S (surface), M (mid-water), NB (near-bottom), and B (bottom). In cases in which depth codes were not provided, Tetra Tech assigned water chemistry and chl *a* results from 1 m and shallower as surface samples and results deeper than 1 m as bottom samples. A simple surface or bottom designation is sufficient for cases in which depth was not originally provided because those sites are primarily located within embayments, where typically only two water chemistry or chlorophyll samples are available. When datasets included depth profile data for physical parameters (e.g., pH, salinity, temperature, and dissolved oxygen [DO]), those physical parameter values were paired with water chemistry and chl *a* values based on depth. Missing depths and sample times were filled in from neighboring values in the dataset when possible and recommended by the data provider.

In some cases, the parameter name included the depth code, so that information could be added to the depth code field.

Tetra Tech reset results reported as not detected or less than a reported value to one-half of the provided detection limit. Additionally, Tetra Tech added a qualifier column to track which samples included results that are less than the detection limit. Tetra Tech reviewed and interpreted QA comments associated with each sample, when included, to screen sample data from the processed and organized tables (e.g., holding time exceeded, blank contaminated). We did not include non-ambient monitoring data (wastewater effluent) or data not within open water embayments or the LIS (tributaries) in the data selected for analysis. Additionally, Tetra Tech performed a quick screening for erroneous values, nonnumeric results, and missing value codes (e.g., -99) and removed those values from the dataset. While some erroneous values were associated with QA comments questioning the data and would be removed based on the QA comments, Tetra Tech also identified some additional results that were not reasonable. For example, ambient water temperatures greater than 100 °C and pH in excess of 14 were removed from the dataset. As Tetra Tech further analyzed the data to make nitrogen target recommendations, we conducted a more detailed outlier analysis where needed (e.g., looking at reasonable ranges of DO in specific areas).

When nitrogen species, but not TN, were included in a dataset, Tetra Tech calculated TN by summing component N species data. When Photosynthetically Active Radiation (PAR) data were available, Tetra Tech used regression to calculate light attenuation (K_d) using data from 1 to 5 meters in depth. This depth range was used to limit the surface and bottom data discrepancies typical with these data. Tetra Tech matched values for K_d and Secchi depth (SD) with surface water chemistry and chlorophyll data.

As mentioned previously, Tetra Tech performed QA checks when processing and standardizing each dataset. Additionally, Tetra Tech coordinated with the original data provider, when necessary, to clarify and correct any inconsistencies observed.

Results

As described above, water quality monitoring data from 14 organizations were included in the analysis based on data applicability, availability, and quality. These data correspond to 586 monitoring stations within LIS, as shown in Figure D-1, in relation to the selected watershed groupings, open water, and other embayments. Maps included in this subtask illustrate watershed boundaries as delineated by Vaudrey, for which there are associated data. Portions of the maps that are not highlighted indicate that no loading data are available for a given area (e.g., the small portion of land between the Eastern and Western Narrows in Figure D-1). Table D-3 provides a summary, by monitoring organization, of the number of stations, data collection period, and number of samples available for key nutrient and response parameters (TN, TP, chl *a*, DO, and SD). Over 24,000 nutrient parameter samples (TN and TP) and 65,000 response parameter samples (chl *a*, DO, and SD) were processed. A sample for this summary is defined as one station, parameter, day, and depth combination. Nearly 90 percent of these samples were obtained from Connecticut Department of Energy and Environment (CT DEEP), Interstate Environmental Commission (IEC), New York City Department of Environmental Protection (NYC DEP), Suffolk County, and University of Rhode Island Watershed Watch (URIWW). CT DEEP and IEC data are largely from open water areas, while NYC DEP, Suffolk County, and URIWW sampling was targeted more to embayments.

Complete compiled results for these parameters as well as other physical and nutrient parameters (e.g., temperature, salinity, nitrate, ammonia) are included in the spreadsheet *Appendix D: LIS Water Quality*

Data. Profile data and additional biological data (e.g., on algae, benthos, fish species) are included in processed spreadsheets for each organization.

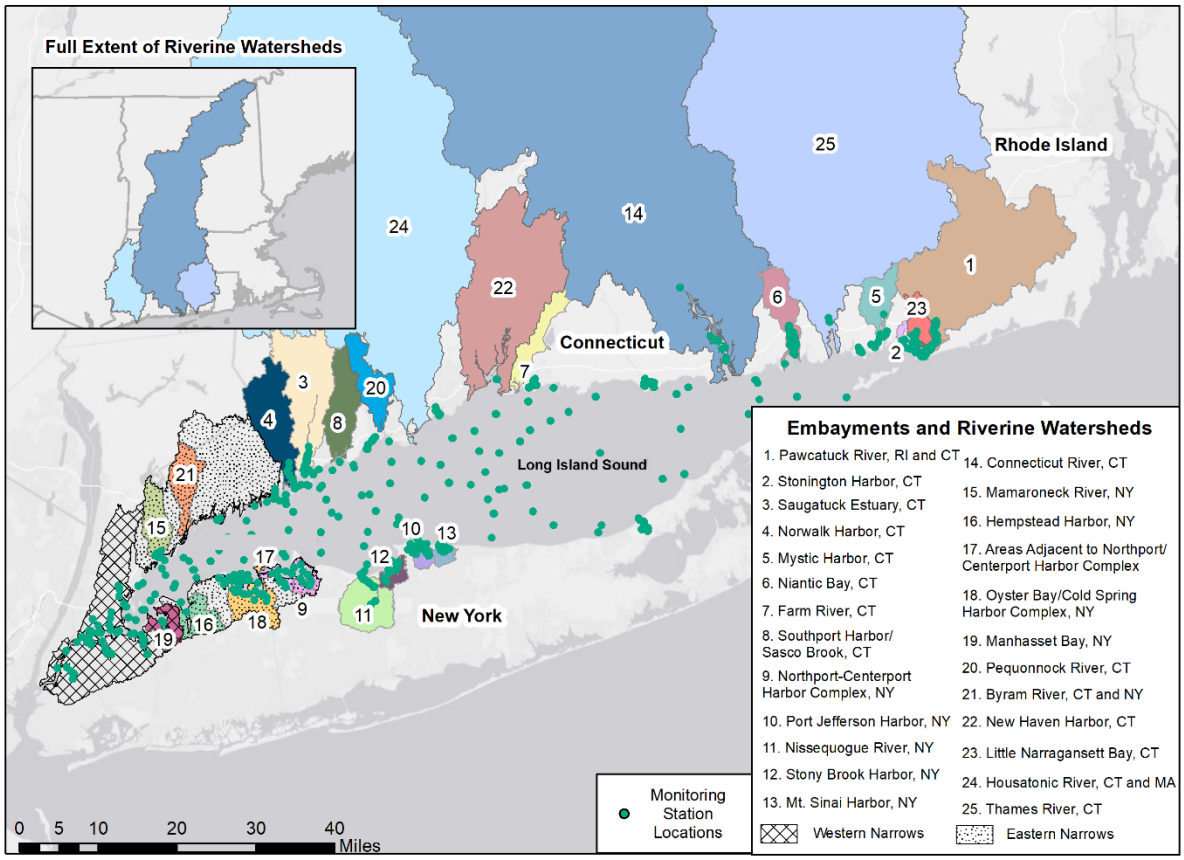

Figure D-1. Monitoring Stations within Watersheds Delineated by Dr. Jamie Vaudrey (University of Connecticut). Portions of the Maps that are Not Highlighted as Part of a Selected Watershed Indicate that No Loading Data are Available for a Given Area (e.g., the Small Portion of Land between the Eastern and Western Narrows).

Table D-3. Monitoring Organization Counts of Stations and Key Nutrient and Response Parameter Samples

Monitoring Organization	Number of Stations	Data Collection 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 Region 1	13	2017-2019	115	115	115	59	76
EPA ORD	152	2000–2009	88	0	448	1,320	580
Friends of the Bay	22	2008–2014	612	0	0	0	0
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	45	2006–2015	5,179	5,185	5,191	7,828	7,973

Monitoring Organization	Number of Stations	Data Collection Period	Number of Nutrient Samples		Number of Response Samples		
			TN	TP	Chl *a*	DO	SD
Stony Brook University–Dr. Gobler	6	2014–2016	0	0	216	216	210
Suffolk County	57	2006–2015	1,697	1,697	1,547	3,311	1,639
University of Connecticut (Vaudrey)	96	2013–2014[a]	269	0	140	530	19
University of Connecticut (Yarish)	3	2011–2016	0	0	0	0	33
URIWW	25	2007–2015	725	724	942	1,379	365
Total	**594**		**12,932**	**11,829**	**13,282**	**32,979**	**16,219**

[a] Data collected in 2011–2012 were not collected under an established QAPP and did not include indication of nondetect results. These data were not included in the analysis.

Table D-4 summarizes by embayment (selected and other), open water, and western LIS the number of stations and samples for nutrient and response parameter samples (TN, TP, chl *a*, DO, and SD). Of the 586 water quality monitoring stations processed for inclusion in the analysis, 72 percent were located within embayments and 28 percent were located in open water areas of LIS. More than 68 percent of the embayment stations were found within the 24 selected embayments. The western LIS, including open water and embayment areas, has data from 168 stations and 12 monitoring organizations.

Table D-4. Watershed Category Counts of Stations and Key Nutrient and Response Parameter Samples

Watershed Category	Number of Stations	Number of Nutrient Samples		Number of Response Samples		
		TN	TP	Chl *a*	DO	SD
Embayments	427	6,997	6,066	7,110	15,778	9,129
EPA-selected	*291*	*2,887*	*2,199*	*3,128*	*8,852*	*3,430*
Other	*136*	*4,110*	*3,867*	*3,982*	*6,926*	*5,699*
Open Water	167	5,935	5,763	6,172	17,201	7,090
Total	**588**	**12,840**	**11,737**	**13,190**	**32,943**	**16,164**
Western LIS	171	7,870	7,122	7,957	20,284	11,877
Eastern Narrows	*113*	*2,627*	*1,899*	*2,400*	*9,378*	*2,934*
Western Narrows	*58*	*5,243*	*5,223*	*5,557*	*10,906*	*8,943*

Table D-5 includes counts of stations and samples. Also provided in the table are the depths codes and data collection periods for which data were available. Depth codes were added to the data corresponding to surface (S), mid-water (M), near-bottom (NB), and B (bottom). Overall, we found a significant amount of data; however, it varies across the watershed groupings and open water. Of the 24 embayments, 9 embayments have at least 100 TN samples from 2006–2015. Pawcatuck River, RI; Oyster Bay/Cold Spring Harbor Complex, NY; Port Jefferson Harbor, NY; and the Northport-Centerport Harbor Complex, NY, all have more than 300 TN samples and associated response data largely provided by URIWW and Suffolk County. Monitoring data were available for Niantic Bay from EPA ORD and the University of Connecticut (Vaudrey), but largely prior to the primary temporal period of 2006–2015. Nutrient monitoring data were not available from Norwalk Harbor, CT, and no monitoring data of interest were available from the Byram River, CT/NY; Pequonnock River, CT; Farm River, CT; and

Southport Harbor/Sasco Brook, CT embayments. The Eastern and Western Narrows had significant water quality monitoring data available. The Connecticut River, CT embayment had limited data available from 11 monitoring stations in 2006 and 2017. The Thames River, CT embayment also had limited data from three monitoring stations from 2006–2010. The Housatonic River, MA/CT embayment had no monitoring data of interest available.

For the stressor-response model, described in Subtasks F/G, Tetra Tech used a hierarchical modeling approach to estimate relationships between nutrients and response variables. In hierarchical models, the parameters of the model are assumed to come from a distribution of similar models. For example, the slope and intercept of the simple linear relationship between nitrogen and chlorophyll in any one embayment can be seen as taken from a population of slopes and intercepts that relate nitrogen to chlorophyll for embayments in general. Embayments that are heavily sampled weight this global relationship more than less sampled ones, but they still both reflect an underlying general or global relationship represented by the average slope and intercept across all embayments. Using a hierarchical model, one starts with the global relationship and then weights it using local data, which adjusts the model for that embayment. The best estimate of the model for an unsampled embayment is the global model. Using this approach, Tetra Tech was able to provide models for less sampled or even unsampled embayments. Having data from as many embayments around LIS as possible, however, provides the most accurate results. To estimate target concentrations, Tetra Tech used a multiple-lines-of-evidence approach that includes values from the stressor-response modeling, along with values derived from scientific literature and distribution-based approaches.

Table D-5. Counts of Stations and Key Nutrient and Response Parameter Samples

Watershed	Depth Code[a]	Number of Stations	Data Collection Period	Number of Nutrient Samples		Number of Response Samples		
				TN	TP	Chl *a*	DO	SD
Pawcatuck River, RI and CT	S, M, B	52	2000–2015	334	312	642	890	309
Stonington Harbor, CT	S, M, B	5	2008–2015	77	71	73	138	0
Saugatuck Estuary, CT[b]	S, M, B	14	2006–2015	21	0	11	537	3
Norwalk Harbor, CT	S, B	10	2006–2015	0	0	0	1,368	541
Mystic Harbor, CT	S, M, B	6	2000–2015	114	112	104	222	2
Niantic Bay, CT[b]	S, M, B	65	2000–2014	112	0	281	706	259
Farm River, CT	N/A	0	N/A	0	0	0	0	0
Southport Harbor/Sasco Brook, CT[b]	N/A	0	N/A	0	0	0	0	0
Northport-Centerport Harbor Complex, NY[b]	S, B	11	2006–2016	332	332	356	713	376
Port Jefferson Harbor, NY	S, B	15	2006–2016	495	495	500	1008	522
Nissequogue River, NY	S, M, B	11	2006–2015	88	69	64	165	66
Stony Brook Harbor, NY	S, B	10	2006–2016	212	212	184	359	190
Mt. Sinai Harbor, NY	S, M, B	10	2006–2016	97	81	117	226	116
Little Narragansett Bay, CT	S, M, B	13	2008–2015	132	109	165	219	73
Eastern Narrows, CT and NY	S, M, NB, B	113	2003–2016	2,627	1,899	2,400	9,378	2,934
Western Narrows, NY	S, M, B	58	2006–2015	5,243	5,223	5,557	10,906	8,943
Eastern and Western Narrows (Combined), CT and NY	S, M, NB, B	171	2003–2016	7,870	7,122	7,957	20,284	11,877
Connecticut River, CT	S, M, B	11	2006–2018	83	83	83	25	76

Watershed	Depth Code[a]	Number of Stations	Data Collection Period	Number of Nutrient Samples		Number of Response Samples		
				TN	TP	Chl *a*	DO	SD
Other Embayments	S, M, B	136	2000–2015	4,110	3,867	3,982	6,926	5,699
Open Water	S, M, NB, B	167	2006–2016	5,935	5,763	6,172	17,201	7,090
Mamaroneck River, NY	S, M, B	8	2013–2014	35	0	15	56	4
Hempstead Harbor, NY	S, M, B	2	2006–2015	9	9	60	602	216
Huntington Bay, NY	S, B	2	2006–2015	77	77	73	154	79
Huntington Harbor, NY	S, B	5	2006–2016	147	147	180	330	186
Lloyd Harbor, NY	S, B	2	2006–2015	39	39	40	78	40
Oyster Bay/Cold Spring Harbor Complex, NY[b]	S, M, B	24	2008–2016	432	0	48	90	36
Manhasset Bay, NY	S, M, B	3	2006–2015	9	9	90	889	334
Pequonnock River, CT	S, B	1	2010	1	1	1	2	1
Byram River, CT and NY	N/A	0	N/A	0	0	0	0	0
New Haven Harbor, CT	S, M	2	2006	2	2	2	1	0
Housatonic River, MA and CT	N/A	6	2019	36	36	36	36	0
Thames River, CT	S, M, B	3	2006–2010	3	3	3	2	1

[a] Depth code values include S (surface), M (mid-water), NB (near-bottom), B (bottom), and N/A (not available).
[b] Includes multiple Vaudrey et al. (2016) embayments. See detailed description sections below.

The following summaries provide an overview of water quality data availability for each selected watershed grouping as well as for other water quality data used for analysis (open water and other embayments).

D.1 Pawcatuck River, RI and CT

Water quality monitoring data were available for the Pawcatuck River embayment from 3 monitoring organizations corresponding to 52 monitoring stations and 5,970 samples from 2000–2015. Data were provided by URIWW from 2007–2015 (4,583 samples), from EPA ORD from 2000–2004 (969 samples), and from University of Connecticut (Vaudrey) from the period 2013–2014 (418 samples).

Figure D-2 shows all monitoring station locations within and around the Pawcatuck River embayment. Table D-6 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-6 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-6, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

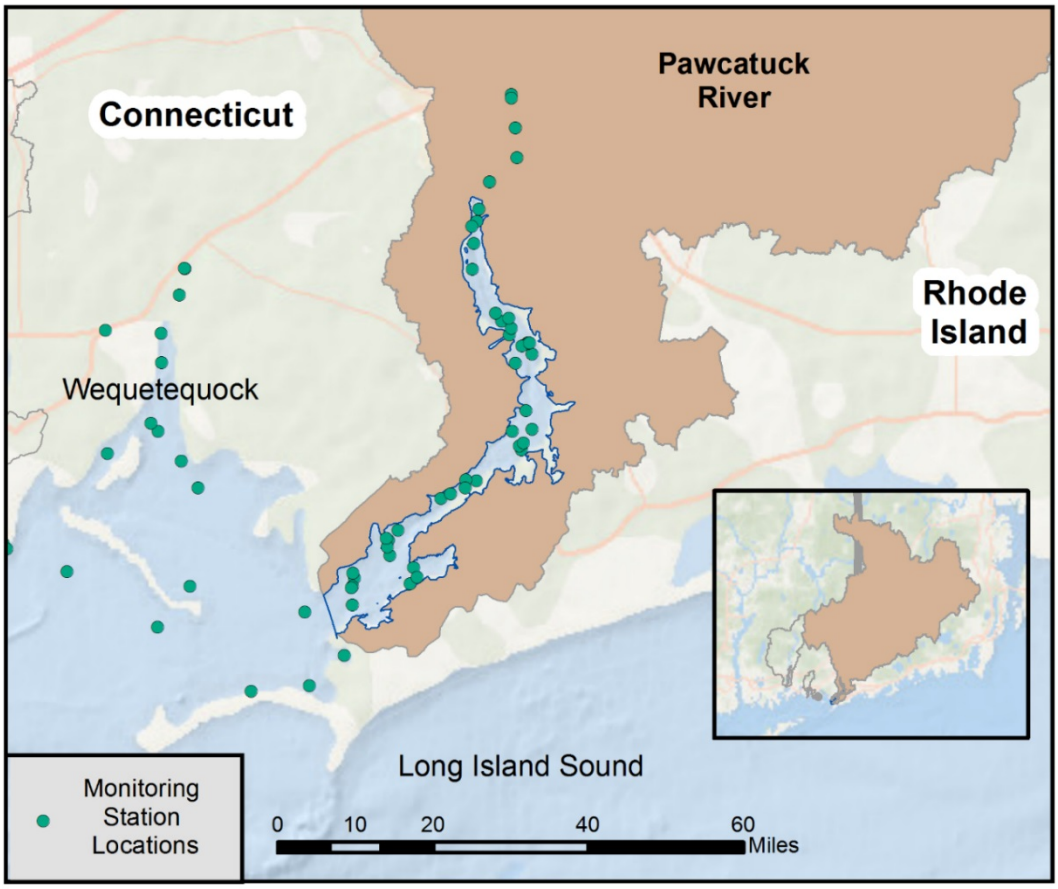

Figure D-2. Pawcatuck River, RI and CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-6. Parameter Counts of Stations and Samples for Pawcatuck River, RI and CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2000–2003	14	67	42	0	25	0.00	0.24	0.06
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2007–2015	6	248	55	0	193	0.01	0.03	0.02
DON_mgL	Dissolved organic nitrogen [mg/L]	2002–2003	5	17	11	0	6	0.15	0.34	0.26
NH3_mgL	Ammonia–nitrogen [mg/L]	2007–2015	6	313	74	0	239	0.01	0.12	0.05
NH4_mgL	Ammonium [mg/L]	2000–2003	14	78	47	0	31	0.00	0.09	0.01
NO2_mgL	Nitrite [mg/L]	2000–2003	8	13	5	0	8	0.00	0.76	0.30
NO23_mgL	Nitrate + nitrite [mg/L]	2000–2015	20	379	117	0	262	0.01	0.44	0.03
NO3_mgL	Nitrate [mg/L]	2003	3	6	5	0	1	0.02	0.27	0.09
PN_mgL	Particulate nitrogen [mg/L]	2013–2014	5	22	3	0	19	0.02	0.32	0.09
PO4_mgL	Phosphate–P [mg/L]	2013–2014	10	32	3	0	29	0.01	0.04	0.01
TDN_mgL	Total dissolved nitrogen [mg/L]	2002–2014	10	39	14	0	25	0.19	0.79	0.33
TN_mgL	Total nitrogen [mg/L]	2007–2015	11	334	76	0	258	0.29	0.92	0.47
TP_mgL	Total phosphorus [mg/L]	2007–2015	6	312	73	0	239	0.03	0.06	0.04
Response Parameters										
CHLA_µgL [a]	Chl *a* [µg/L]	2000–2004	18	103	66	0	37	1.91	27.30	6.80
CHLAC_µgL [a]	Chl *a*, pheophytin free [µg/L]	2007–2015	11	539	3	0	536	1.20	22.31	5.70
do_mgL	Dissolved oxygen [mg/L]	2000–2015	48	890	302	20	568	5.20	8.80	7.00
do_perc	Dissolved oxygen [% saturation]	2013–2014	10	60	20	20	20	44.91	127.27	91.55
Kd	Kd [m–1], computed from 1–5 m photosynthetically active radiation data	2000–2014	20	73	69	0	4	0.82	2.20	1.26
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2013–2014	3	4	0	0	4	4.50	1,172.99	329.09
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2013–2014	3	4	0	0	4	4.50	1,172.99	329.09
Seagrass_gm2	Seagrass [g m–2]	2013–2014	3	4	0	0	4	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2003–2014	10	309	15	0	294	0.88	2.50	1.30
Physical Parameters										
pH	pH	2007–2015	16	307	78	13	216	7.18	8.10	8.00
salinity_ppt	Salinity [ppt]	2000–2015	52	866	251	20	595	6.50	33.13	26.73
temp_C	Temperature [deg C]	2000–2015	52	940	298	20	622	14.00	23.50	20.40
TSS_mgL	Total suspended solids [mg/L]	2013–2014	5	11	3	0	8	1.91	9.09	3.96
Total		**2000–2015**	**52**	**5,970**	**1,630**	**93**	**4,247**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.2 Stonington Harbor, CT

Water quality monitoring data were available for the Stonington Harbor embayment from 2 monitoring organizations corresponding to 5 monitoring stations and 841 samples from 2008–2015. Data were provided by URIWW from 2008–2015 (749 samples) and from University of Connecticut (Vaudrey) from 2013–2014 (92 samples).

Figure D-3 shows all monitoring station locations within and around the Stonington Harbor embayment. Table D-7 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-7 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-7, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

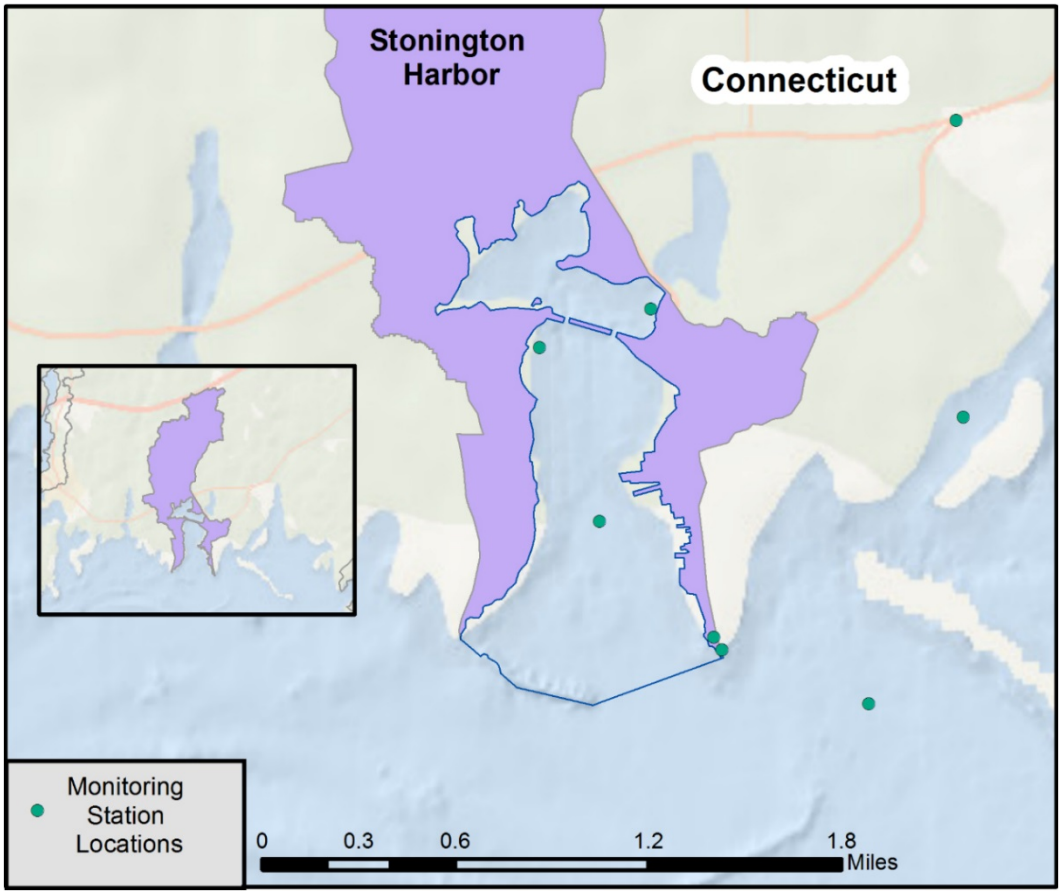

Figure D-3. Stonington Harbor, CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-7. Parameter Counts of Stations and Samples for Stonington Harbor, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2010–2015	2	41	19	0	22	0.01	0.04	0.03
NH3_mgL	Ammonia–nitrogen [mg/L]	2008–2015	3	70	28	0	42	0.01	0.09	0.05
NO23_mgL	Nitrate + nitrite [mg/L]	2008–2015	3	71	28	0	43	0.01	0.03	0.02
PN_mgL	Particulate nitrogen [mg/L]	2013–2014	2	6	0	0	6	0.03	0.26	0.11
PO4_mgL	Phosphate–P [mg/L]	2013–2014	2	7	0	0	7	0.02	0.06	0.04
TDN_mgL	Total dissolved nitrogen [mg/L]	2013–2014	2	6	0	0	6	0.12	0.16	0.14
TN_mgL	Total nitrogen [mg/L]	2008–2015	5	77	28	0	49	0.23	0.45	0.33
TP_mgL	Total phosphorus [mg/L]	2008–2015	3	71	28	0	43	0.03	0.06	0.04
Response Parameters										
CHLAC_µgL	Chl *a*, pheophytin free [µg/L]	2008–2015	5	73	4	0	69	1.82	6.22	3.70
do_mgL	Dissolved oxygen [mg/L]	2008–2015	5	138	44	4	90	5.50	8.03	6.80
do_perc	Dissolved oxygen [% saturation]	2013–2014	2	12	4	4	4	87.49	100.06	97.40
Physical Parameters										
pH	pH	2008–2015	5	71	26	4	41	7.80	8.00	7.95
salinity_ppt	Salinity [ppt]	2009–2015	4	58	21	4	33	22.78	33.50	32.00
temp_C	Temperature [deg C]	2008–2015	5	137	45	4	88	15.00	23.08	19.70
TSS_mgL	Total suspended solids [mg/L]	2013–2014	2	3	0	0	3	2.28	3.03	2.77
Total		**2008–2015**	**5**	**841**	**275**	**20**	**546**			

D.3 Saugatuck Estuary, CT[2]

Water quality monitoring data were available for the Saugatuck Estuary embayment from 2 monitoring organizations corresponding to 14 monitoring stations and 2,306 samples from 2006–2015. Data were provided by Harbor Watch from 2006–2015 (1,940 samples) for DO, salinity, and temperature (no nutrient data) and from University of Connecticut (Vaudrey) from 2013–2014 (366 samples).

Figure D-4 shows all monitoring station locations within and around the Saugatuck Estuary embayment. Table D-8 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-8 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-8, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

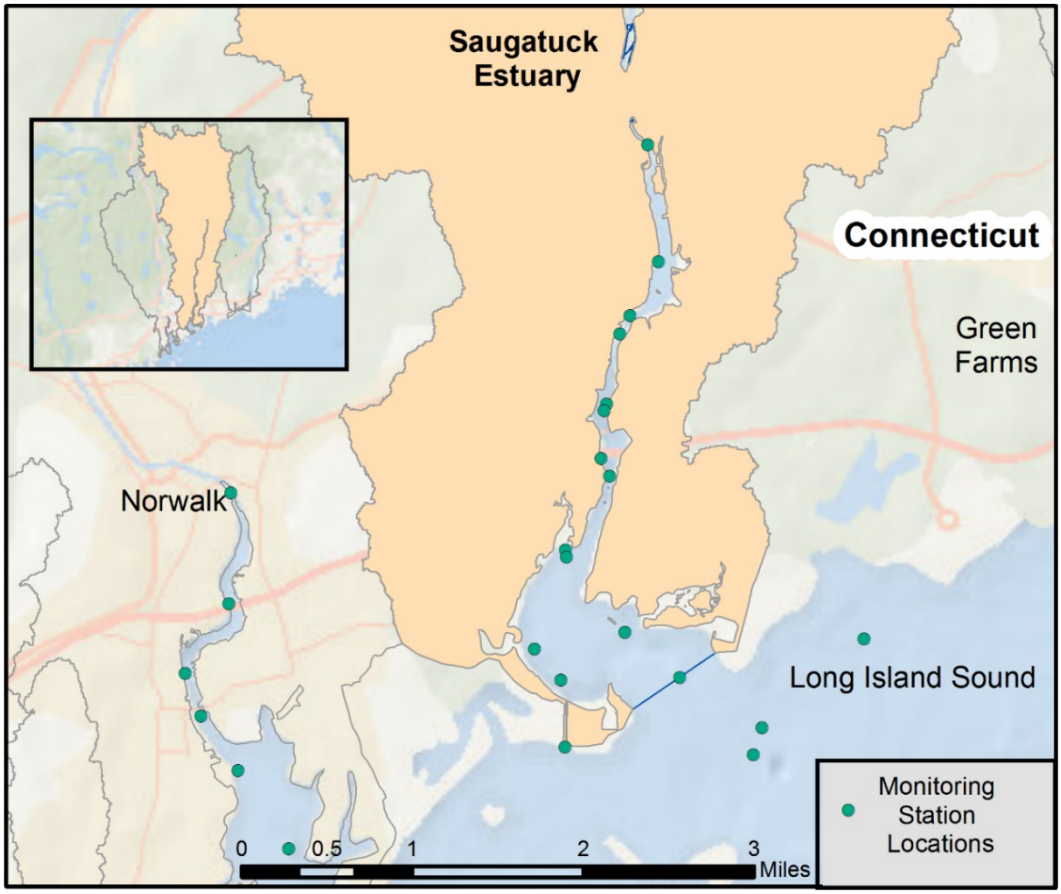

Figure D-4. Saugatuck Estuary, CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

[2] Includes two Vaudrey et al. (2016) embayments: Saugatuck River, CT and Saugatuck River, North, CT (freshwater).

Table D-8. Parameter Counts of Stations and Samples for Saugatuck Estuary, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
PN_mgL	Particulate nitrogen [mg/L]	2013–2014	4	21	3	0	18	0.07	0.37	0.21
PO4_mgL	Phosphate–P [mg/L]	2013–2014	8	29	3	0	26	0.02	0.10	0.06
TDN_mgL	Total dissolved nitrogen [mg/L]	2013–2014	4	21	3	0	18	0.19	0.72	0.26
TN_mgL	Total nitrogen [mg/L]	2013–2014	4	21	3	0	18	0.39	0.83	0.57
Response Parameters										
CHLAC_µgL	Chl *a*, pheophytin free [µg/L]	2013–2014	4	11	3	0	8	7.83	13.92	10.78
do_mgL	Dissolved oxygen [mg/L]	2006–2015	14	537	259	16	262	4.25	7.02	5.65
do_perc	Dissolved oxygen [% saturation]	2006–2015	14	537	259	16	262	56.87	96.14	76.27
Kd	Kd [m–1], computed from 1–5m photosynthetically active radiation data	2013–2014	2	4	0	0	4	0.74	1.11	0.86
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2014	1	1	0	0	1	4.59	4.59	4.59
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2014	1	1	0	0	1	4.59	4.59	4.59
Seagrass_gm2	Seagrass [g m–2]	2014	1	1	0	0	1	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2013–2014	2	3	0	0	3	1.31	1.86	1.54
Physical Parameters										
pH	pH	2013–2014	8	34	12	10	12	7.33	7.74	7.58
salinity_ppt	Salinity [ppt]	2006–2015	14	537	259	16	262	18.86	26.40	23.80
temp_C	Temperature [deg C]	2006–2015	14	537	259	16	262	20.60	24.80	22.70
TSS_mgL	Total suspended solids [mg/L]	2013–2014	4	11	3	0	8	4.32	14.72	5.51
Total		**2006–2015**	**14**	**2,306**	**1,066**	**74**	**1,166**			

D.4 Norwalk Harbor, CT

Water quality monitoring data were available for the Norwalk Harbor embayment from 1 monitoring organization corresponding to 10 monitoring stations and 6,013 samples from 2006–2015. Data were provided by Harbor Watch (6,013 samples).

Figure D-5 shows all monitoring station locations within and around the Norwalk Harbor embayment. Table D-9 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-9 is organized by all available parameters (response and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-9, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

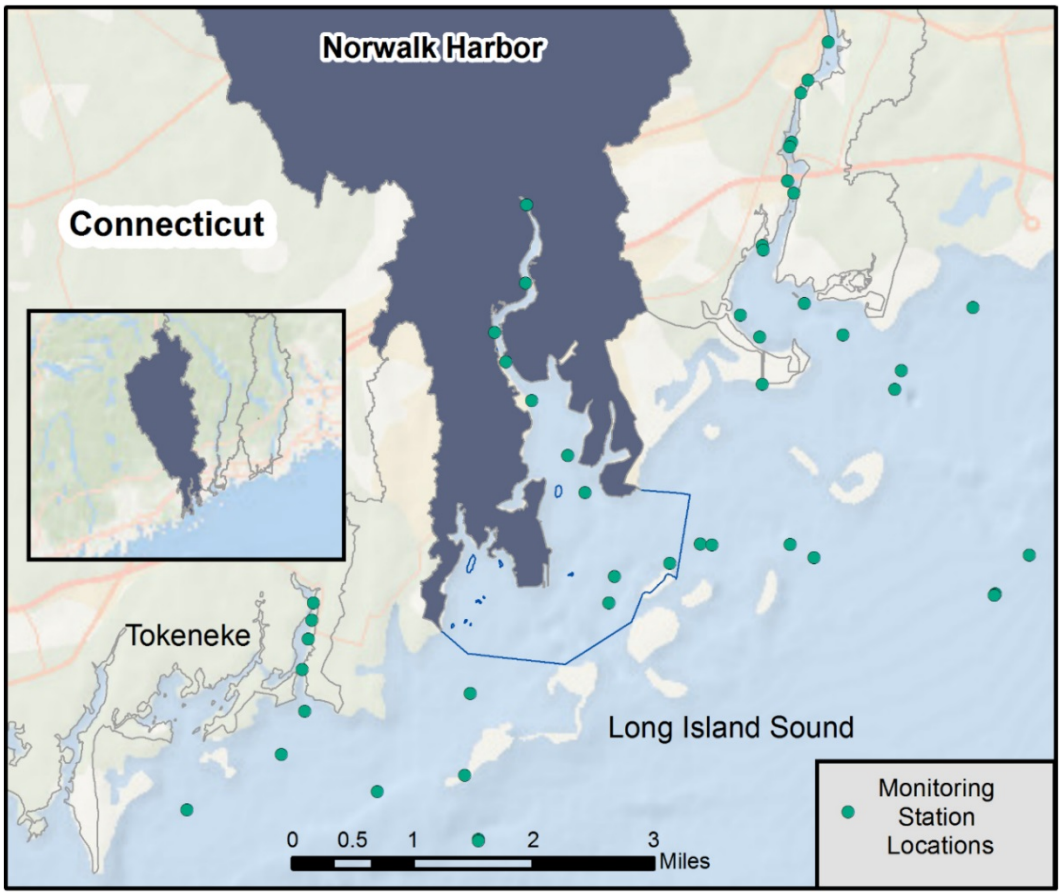

Figure D-5. Norwalk Harbor, CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-9. Parameter Counts of Stations and Samples for Norwalk Harbor, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Response Parameters										
do_mgL	Dissolved oxygen [mg/L]	2006–2015	10	1,368	682	0	686	2.24	7.48	5.26
do_perc	Dissolved oxygen [% saturation]	2006–2015	10	1,368	682	0	686	30.72	95.42	72.33
secchi_m	Secchi depth [m]	2006–2015	10	541	0	0	541	0.90	1.70	1.20
Physical Parameters										
salinity_ppt	Salinity [ppt]	2006–2015	10	1,368	682	0	686	22.40	27.10	25.00
temp_C	Temperature [deg C]	2006–2015	10	1,368	682	0	686	17.70	25.10	22.90
Total		**2006–2015**	**10**	**6,013**	**2,728**	**0**	**3,285**			

D.5 Mystic Harbor, CT

Water quality monitoring data were available for the Mystic Harbor embayment from 2 monitoring organizations corresponding to 6 monitoring stations and 1,376 samples from 2000–2015. Data were provided by URIWW from 2009–2015 (1,347 samples) and from EPA ORD from 2000–2004 (29 samples).

Figure D-6 shows all monitoring station locations within and around the Mystic Harbor embayment. Table D-10 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-10 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-10, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

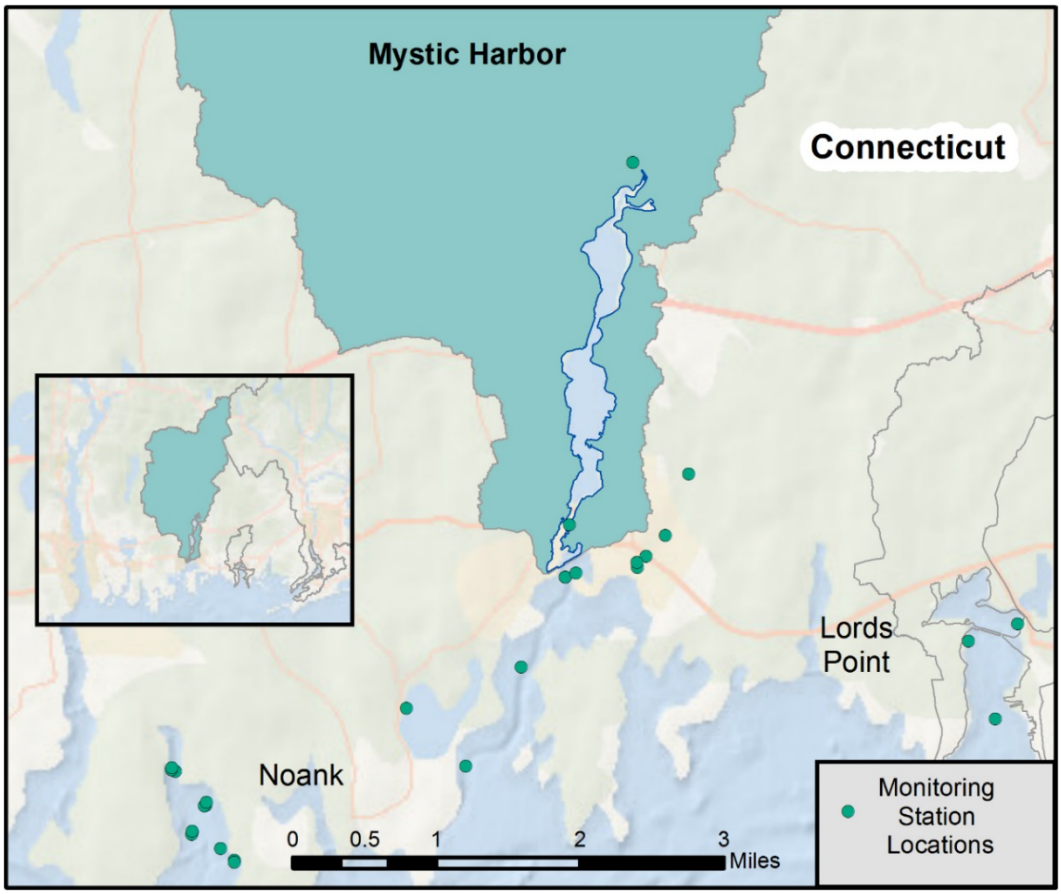

Figure D-6. Mystic Harbor, CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-10. Parameter Counts of Stations and Samples for Mystic Harbor, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2000–2004	3	3	0	0	3	0.03	0.09	0.06
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2010–2015	3	96	38	0	58	0.01	0.05	0.02
NH3_mgL	Ammonia–nitrogen [mg/L]	2009–2015	3	112	45	0	67	0.03	0.15	0.09
NH4_mgL	Ammonium [mg/L]	2000–2004	2	2	0	2	0	0.04	0.06	0.05
NO23_mgL	Nitrate + nitrite [mg/L]	2000–2015	6	116	44	2	70	0.01	0.07	0.02
TN_mgL	Total nitrogen [mg/L]	2004–2015	4	114	44	1	69	0.39	0.75	0.53
TP_mgL	Total phosphorus [mg/L]	2009–2015	3	112	44	0	68	0.03	0.08	0.05
Response Parameters										
CHLA_µgL[a]	Chl *a* [µg/L]	2000–2004	3	3	0	2	1	2.62	10.94	9.88
CHLAC_µgL[a]	Chl *a*, pheophytin free [µg/L]	2010–2015	2	101	0	0	101	2.90	17.00	8.50
do_mgL	Dissolved oxygen [mg/L]	2000–2015	5	222	82	0	140	5.10	7.95	6.60
secchi_m	Secchi depth [m]	2000–2001	2	2	0	2	0	1.02	1.18	1.10
Physical Parameters										
pH	pH	2009–2015	3	89	32	0	57	7.70	8.00	7.90
salinity_ppt	Salinity [ppt]	2000–2015	5	170	58	0	112	22.60	32.00	30.00
temp_C	Temperature [deg C]	2000–2015	5	231	80	0	151	15.40	25.00	20.00
TSS_mgL	Total suspended solids [mg/L]	2000–2004	3	3	0	2	1	5.20	17.20	6.00
Total		**2000–2015**	**6**	**1,376**	**467**	**11**	**898**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.6 Niantic Bay, CT[3]

Water quality monitoring data were available for the Niantic Bay embayment from 2 monitoring organizations corresponding to 65 monitoring stations and 5,830 samples from 2000–2014. Data were provided by EPA ORD from 2000–2004 (5,337 samples) and from University of Connecticut (Vaudrey) from 2013–2014 (493 samples).

Figure D-7 shows all monitoring station locations within and around the Niantic Bay embayment. Table D-11 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-11 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-11, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

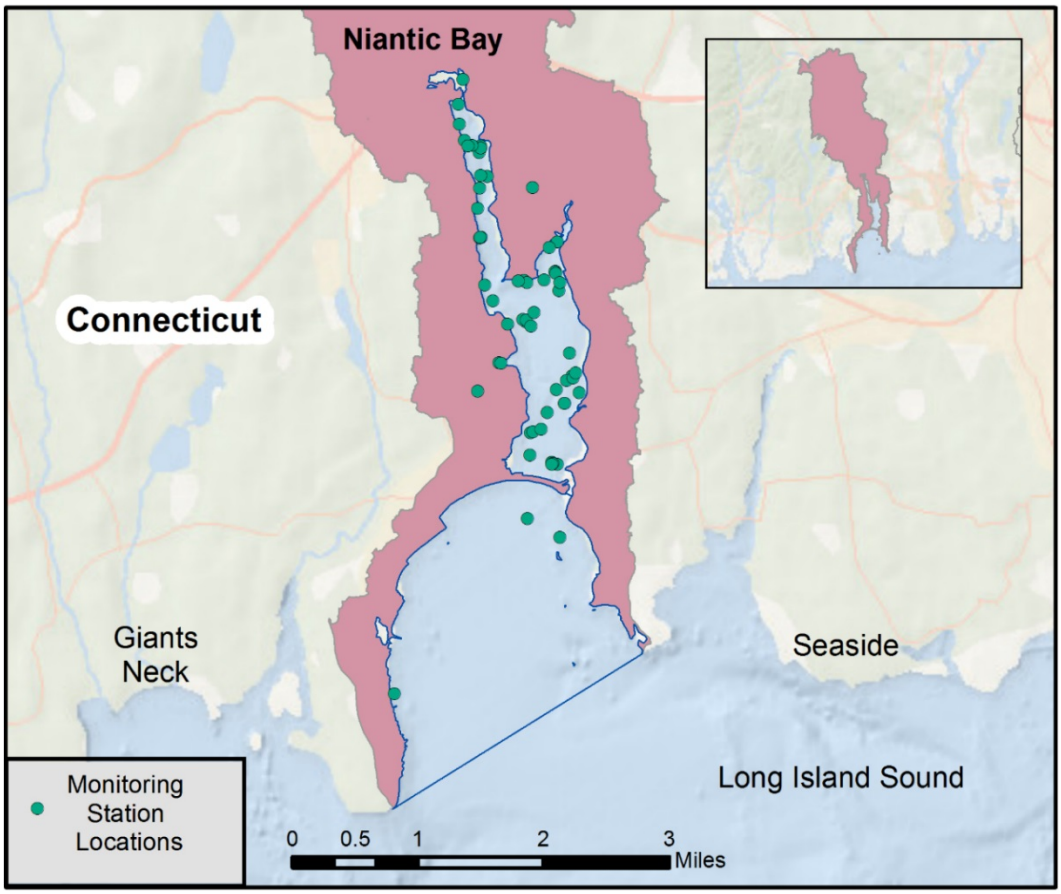

Figure D-7. Niantic Bay, CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

[3] Includes two Vaudrey et al. (2016) embayments: Niantic River, CT and Niantic Bay, CT.

Table D-11. Parameter Counts of Stations and Samples for Niantic Bay, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2000–2004	39	542	101	0	441	0.00	0.13	0.03
DON_mgL	Dissolved organic nitrogen [mg/L]	2002–2003	20	153	34	0	119	0.14	0.24	0.18
NH4_mgL	Ammonium [mg/L]	2000–2004	38	553	113	1	439	0.00	0.06	0.01
NO2_mgL	Nitrite [mg/L]	2003	7	65	34	0	31	0.00	0.01	0.00
NO23_mgL	Nitrate + nitrite [mg/L]	2000–2004	39	528	96	2	430	0.00	0.08	0.01
NO3_mgL	Nitrate [mg/L]	2003	7	68	35	0	33	0.00	0.05	0.00
PN_mgL	Particulate nitrogen [mg/L]	2013–2014	7	26	4	0	22	0.05	0.24	0.12
PO4_mgL	Phosphate–P [mg/L]	2013–2014	12	38	4	0	34	0.01	0.04	0.02
TDN_mgL	Total dissolved nitrogen [mg/L]	2002–2014	17	93	38	0	55	0.15	0.29	0.20
TN_mgL	Total nitrogen [mg/L]	2002–2014	18	112	4	1	107	0.17	0.38	0.26
Response Parameters										
CHLA_µgL[a]	Chl *a* [µg/L]	2000–2004	33	266	126	2	138	1.67	14.06	5.43
CHLAC_µgL[a]	Chl *a*, pheophytin free [µg/L]	2013–2014	7	15	4	0	11	1.80	6.99	3.37
do_mgL	Dissolved oxygen [mg/L]	2000–2014	64	706	508	21	177	4.18	9.30	7.23
do_perc	Dissolved oxygen [% saturation]	2013–2014	12	68	24	21	23	70.11	128.94	99.28
Kd	Kd [m–1], computed from 1–5m photosynthetically active radiation data	2000–2014	34	144	138	0	6	0.46	0.94	0.65
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2013–2014	7	8	0	0	8	4.36	106.11	6.72
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2013–2014	7	8	0	0	8	4.36	206.36	19.35
Seagrass_gm2	Seagrass [g m–2]	2013–2014	7	8	0	0	8	0.00	92.36	0.00
secchi_m	Secchi depth [m]	2002–2013	30	259	248	10	1	1.20	2.50	1.75
Physical Parameters										
pH	pH	2013–2014	12	44	16	13	15	4.27	8.01	6.33
salinity_ppt	Salinity [ppt]	2000–2014	64	1,057	532	21	504	24.70	31.70	29.70
temp_C	Temperature [deg C]	2000–2014	64	1,052	532	21	499	6.19	24.28	20.30
TSS_mgL	Total suspended solids [mg/L]	2000–2014	9	17	4	2	11	1.81	6.12	2.61
Total		**2000–2014**	**65**	**5,830**	**2,595**	**115**	**3,120**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.7 Farm River, CT

No water quality data were available for the Farm River embayment. Figure D-8 shows the Farm River embayment. To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used data from other embayments and open water. Refer to Subtasks F and G for additional information.

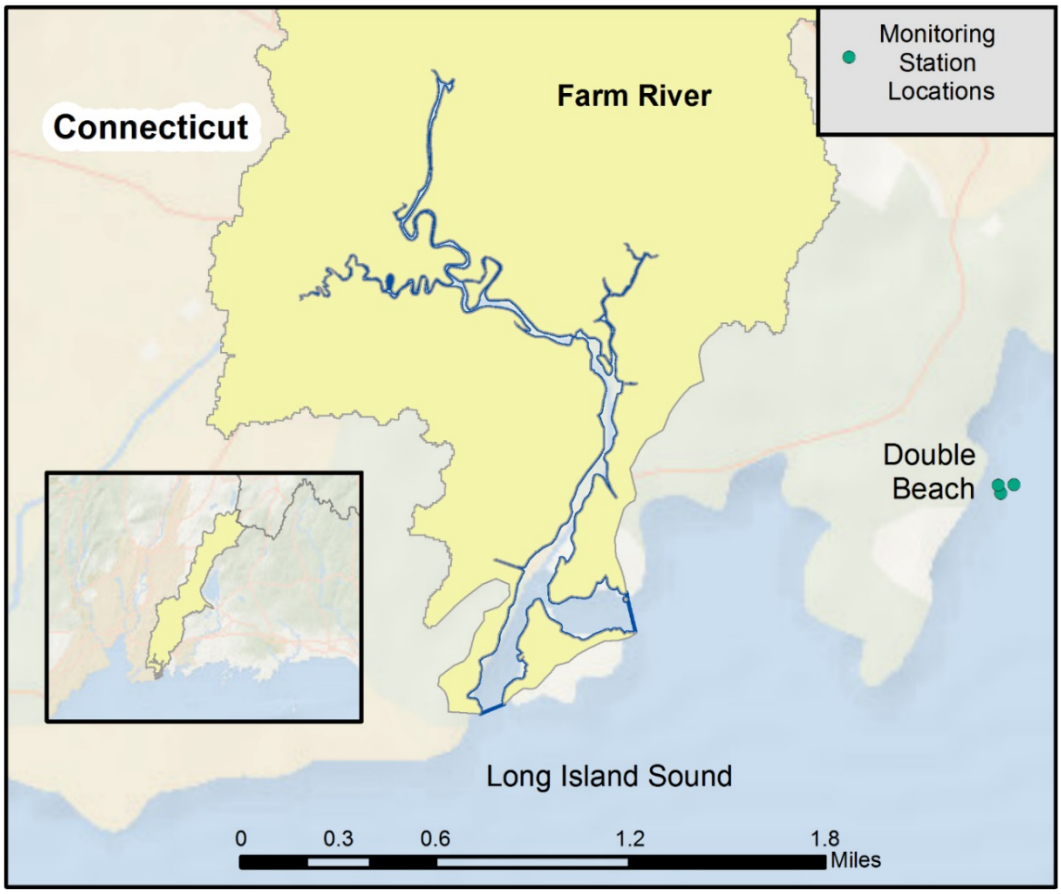

Figure D-8. Farm River, CT Embayment and Nearby Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

D.8 Southport Harbor/Sasco Brook, CT[4]

No water quality data were available for the Southport Harbor/Sasco Brook embayment. Figure D-9 shows the Southport Harbor/Sasco Brook embayment. To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used data from other embayments and open water. Refer to Subtasks F and G for additional information.

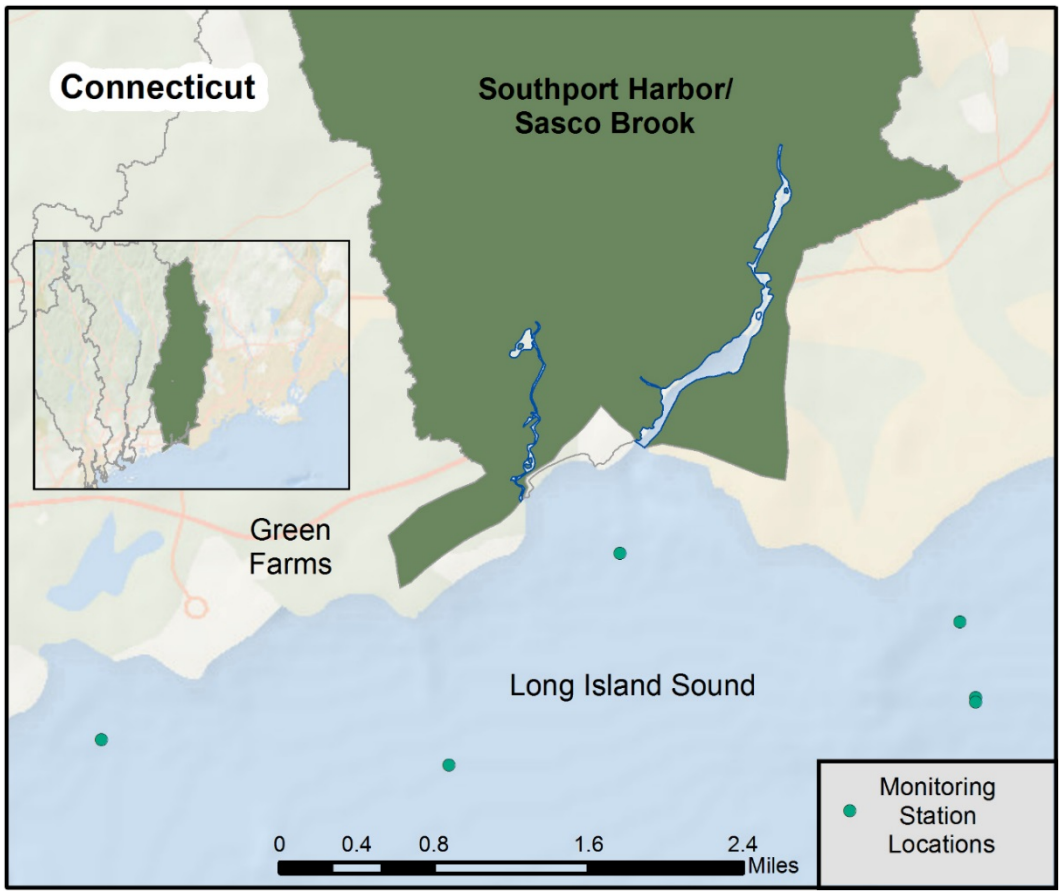

Figure D-9. Southport Harbor/Sasco Brook, CT Embayment and Nearby Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

[4] Includes two Vaudrey et al. (2016) embayments: Mill River, CT and Sasco Brook, CT.

D.9 Northport–Centerport Harbor Complex, NY[5]

Water quality monitoring data were available for the Northport–Centerport Harbor Complex embayment from 2 monitoring organizations corresponding to 11 monitoring stations and 5,649 samples from 2006–2016. Data were provided by Suffolk County from 2006–2015 (5,524 samples) and by Stony Brook University–Dr. Christopher Gobler from 2014–2016 (125 samples).

Figure D-10 shows all monitoring station locations within and around the Northport–Centerport Harbor Complex embayment. Table D-12 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-12 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-12, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

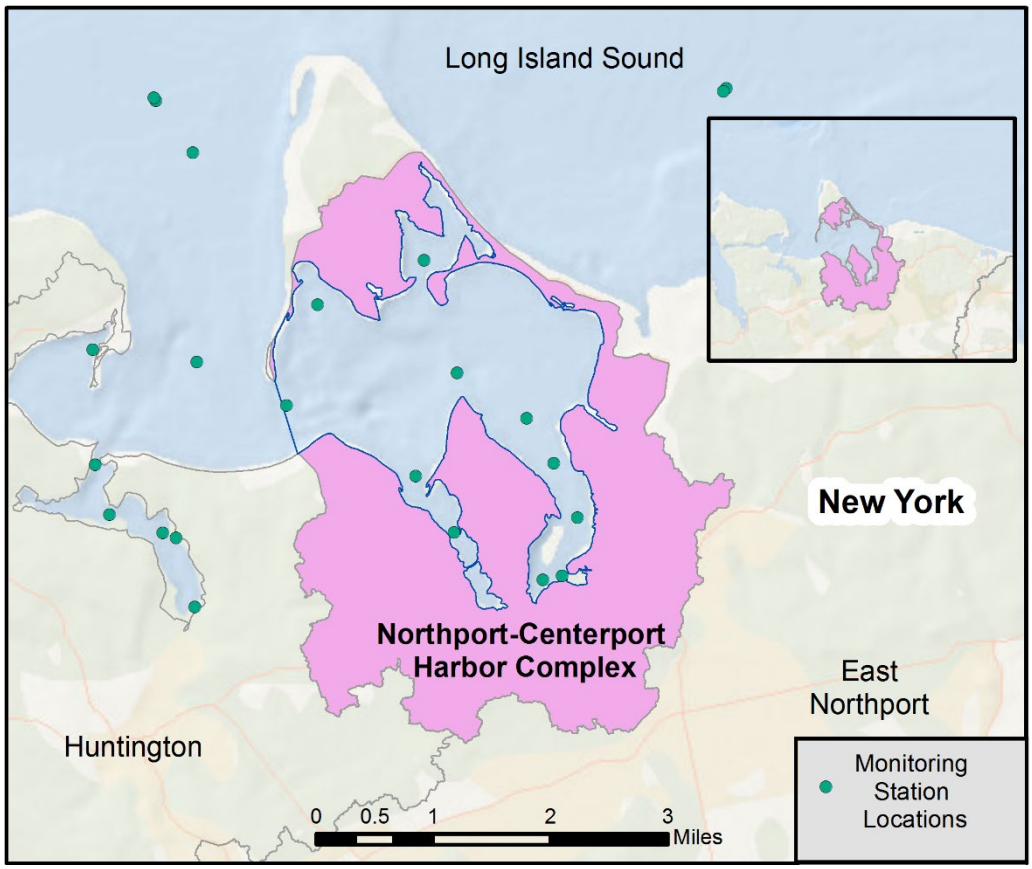

Figure D-10. Northport–Centerport Harbor Complex, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

[5] Includes three Vaudrey et al. (2016) embayments: Centerport Harbor, NY; Northport Bay, NY; and Northport Harbor, NY.

Table D-12. Parameter Counts of Stations and Samples for Northport–Centerport Harbor Complex, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	9	338	0	0	338	0.01	0.08	0.03
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	9	338	0	0	338	0.01	0.09	0.01
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	9	338	0	0	338	0.00	0.37	0.07
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	9	333	0	0	333	0.17	0.66	0.34
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	9	333	0	0	333	0.03	0.07	0.03
TN_mgL	Total nitrogen [mg/L]	2006–2015	9	332	0	0	332	0.22	0.67	0.40
TP_mgL	Total phosphorus [mg/L]	2006–2015	9	332	0	0	332	0.03	0.09	0.05
Response Parameters										
CHLAC_µgL[b]	Chl *a*, pheophytin free [µg/L]	2006–2015	10	356	30	0	320	1.69	25.59	6.72
do_mgL	Dissolved oxygen [mg/L]	2006–2016	11	713	368	0	339	5.70	12.30	8.40
secchi_m	Secchi depth [m]	2006–2016	10	376	30	0	340	0.91	2.74	1.52
Physical Parameters										
DOC_mgL	Dissolved organic carbon [mg/L]	2007	7	7	0	0	7	1.95	2.16	2.03
pH	pH	2010–2015	9	451	162	0	289	7.60	8.22	7.90
salinity_ppt	Salinity [ppt]	2006–2015	10	677	338	0	339	23.70	27.10	25.50
temp_C	Temperature [deg C]	2006–2016	11	694	355	0	339	5.20	23.60	14.75
TOC_mgL	Total organic carbon [mg/L]	2007	7	7	0	0	7	2.09	2.26	2.13
TSS_mgL	Total suspended solids [mg/L]	2006–2010	2	24	0	0	24	7.30	13.40	11.00
Total		**2006–2016**	**11**	**5,649**	**1,283**	**0**	**4,348**			

[a] Some data had missing depth information in the original source and, therefore, have no depth codes. In this case, adding together the three totals from *# of samples by depth* will not add up to the total for *# of samples*.
[b] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.10 Port Jefferson Harbor, NY

Water quality monitoring data were available for the Port Jefferson Harbor embayment from 2 monitoring organizations corresponding to 15 monitoring stations and 8,145 samples from 2006–2016. Data were provided by Suffolk County from 2006–2015 (8,021 samples) and by Stony Brook University–Dr. Christopher Gobler from 2014–2016 (124 samples).

Figure D-11 shows all monitoring station locations within and around the Port Jefferson Harbor embayment. Table D-13 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-13 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-13, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

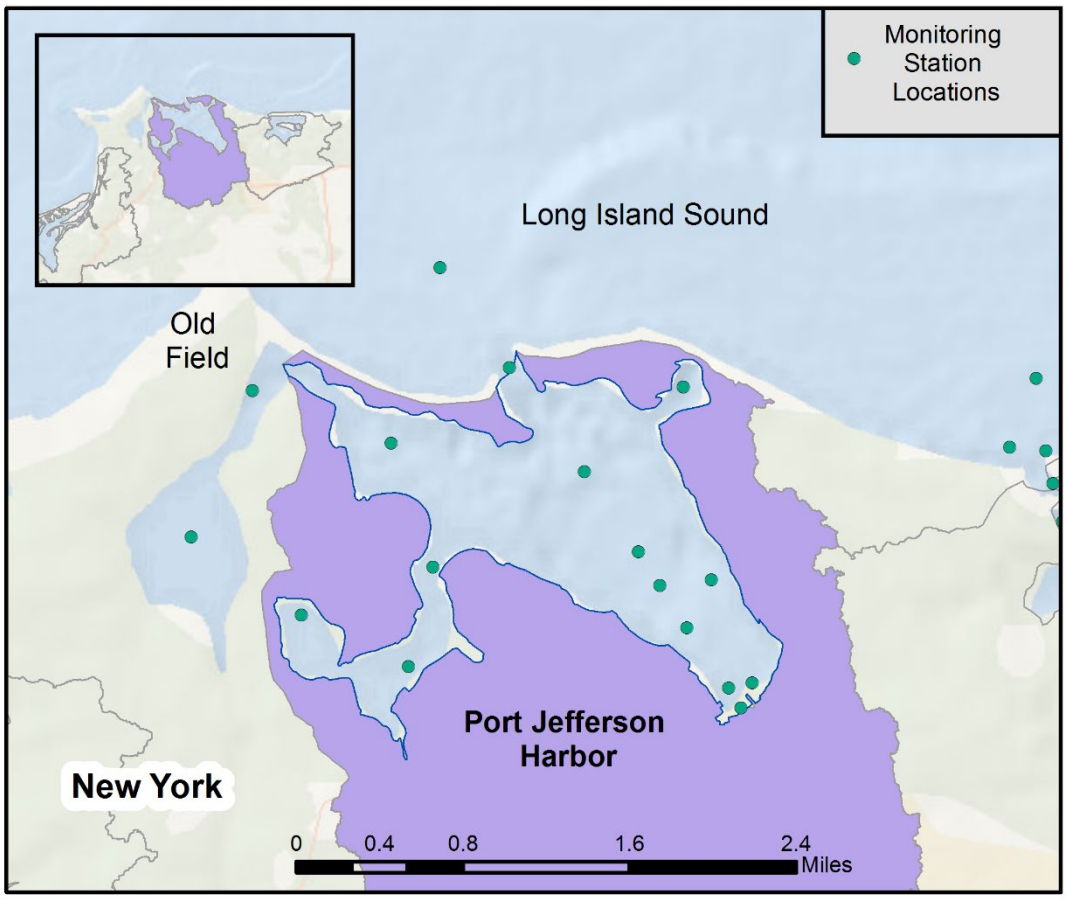

Figure D-11. Port Jefferson Harbor, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-13. Parameter Counts of Stations and Samples for Port Jefferson Harbor, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	14	495	0	0	495	0.01	0.08	0.03
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	14	484	0	0	484	0.01	0.06	0.01
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	14	495	0	0	495	0.00	0.29	0.02
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	14	495	0	0	495	0.13	0.51	0.25
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	14	495	0	0	495	0.03	0.06	0.03
TN_mgL	Total nitrogen [mg/L]	2006–2015	14	495	0	0	495	0.16	0.53	0.29
TP_mgL	Total phosphorus [mg/L]	2006–2015	14	495	0	0	495	0.03	0.07	0.03
Response Parameters										
CHLAC_µgL[b]	Chl *a*, pheophytin free [µg/L]	2006–2016	14	500	29	0	464	1.09	11.86	4.51
do_mgL	Dissolved oxygen [mg/L]	2006–2016	15	1,008	515	0	486	6.40	12.30	8.60
secchi_m	Secchi depth [m]	2006–2016	15	522	29	0	487	1.22	3.66	2.13
Physical Parameters										
DOC_mgL	Dissolved organic carbon [mg/L]	2007	11	11	0	0	11	1.81	1.91	1.84
pH	pH	2010–2015	12	622	237	0	385	7.80	8.30	8.00
salinity_ppt	Salinity [ppt]	2006–2015	14	973	486	0	487	24.90	28.10	26.70
temp_C	Temperature [deg C]	2006–2016	15	1,012	512	0	498	2.31	23.20	12.45
TOC_mgL	Total organic carbon [mg/L]	2007	11	11	0	0	11	1.80	2.08	1.90
TSS_mgL	Total suspended solids [mg/L]	2006–2009	4	32	0	0	32	2.75	21.90	10.50
Total		**2006–2016**	**15**	**8,145**	**1,808**	**0**	**6,315**			

[a] Some data had missing depth information in the original source and, therefore, have no depth codes. In this case, adding together the three totals from *# of samples by depth* will not add up to the total for *# of samples*.
[b] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.11 Nissequogue River, NY

Water quality monitoring data were available for the Nissequogue River embayment from 2 monitoring organizations corresponding to 11 monitoring stations and 1,361 samples from 2006–2015. Data were provided by Suffolk County from 2006–2015 (1,089 samples) and from University of Connecticut (Vaudrey) from 2013–2014 (272 samples).

Figure D-12 shows all monitoring station locations within and around the Nissequogue River embayment. Table D-14 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-14 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-14, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

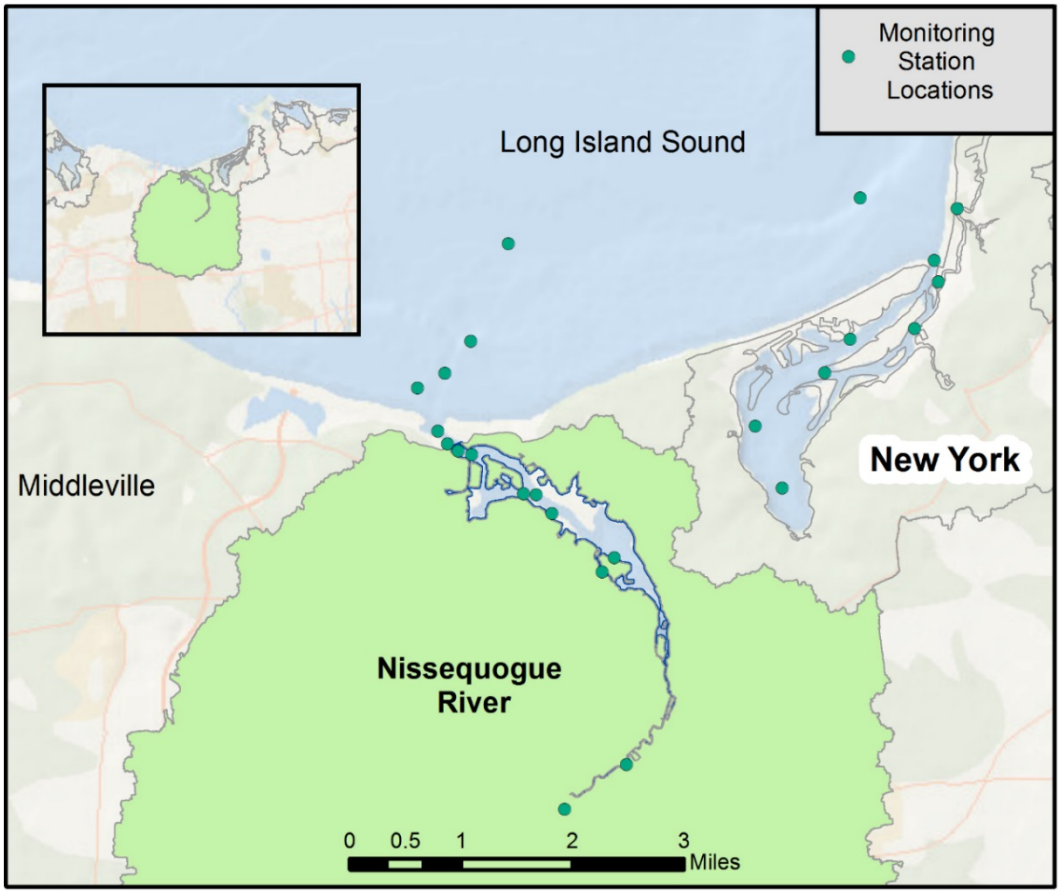

Figure D-12. Nissequogue River, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-14. Parameter Counts of Stations and Samples for Nissequogue River, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	3	69	0	0	69	0.01	0.07	0.04
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	3	66	0	0	66	0.01	0.06	0.03
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	3	69	0	0	69	0.02	0.28	0.11
PN_mgL	Particulate nitrogen [mg/L]	2013–2014	5	20	4	0	16	0.05	0.24	0.13
PO4_mgL	Phosphate–P [mg/L]	2013–2014	8	27	4	0	23	0.01	0.07	0.03
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	8	88	4	0	84	0.20	1.50	0.35
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	3	69	0	0	69	0.03	0.06	0.03
TN_mgL	Total nitrogen [mg/L]	2006–2015	8	88	4	0	84	0.23	1.64	0.38
TP_mgL	Total phosphorus [mg/L]	2006–2015	3	69	0	0	69	0.03	0.07	0.03
Response Parameters										
CHLAC_µgL	Chl *a*, pheophytin free [µg/L]	2006–2015	6	64	4	0	60	1.48	17.98	3.25
do_mgL	Dissolved oxygen [mg/L]	2006–2015	9	165	77	11	77	5.34	12.50	8.20
do_perc	Dissolved oxygen [% saturation]	2013–2014	6	33	11	11	11	62.16	94.94	70.45
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2014	3	3	0	0	3	0.00	93.92	0.00
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2014	3	3	0	0	3	30.80	114.42	102.52
Seagrass_gm2	Seagrass [g m–2]	2014	3	3	0	0	3	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2006–2015	3	66	0	0	66	1.52	3.05	2.13
Physical Parameters										
DOC_mgL	Dissolved organic carbon [mg/L]	2007	3	3	0	0	3	1.62	1.67	1.65
pH	pH	2010–2015	8	108	40	10	58	7.40	8.18	7.70
salinity_ppt	Salinity [ppt]	2006–2015	9	165	77	11	77	14.72	27.20	25.20
temp_C	Temperature [deg C]	2006–2015	9	165	77	11	77	4.40	23.16	15.40
TOC_mgL	Total organic carbon [mg/L]	2007	3	3	0	0	3	1.55	1.58	1.56
TSS_mgL	Total suspended solids [mg/L]	2006–2014	4	15	4	0	11	2.96	10.00	7.00
Total		**2006–2015**	**11**	**1,361**	**306**	**54**	**1,001**			

D.12 Stony Brook Harbor, NY

Water quality monitoring data were available for the Stony Brook Harbor embayment from 2 monitoring organizations corresponding to 10 monitoring stations and 3,294 samples from 2006–2016. Data were provided by Suffolk County from 2006–2015 (3,173 samples) and by Stony Brook University–Dr. Christopher Gobler from 2014–2016 (121 samples).

Figure D-13 shows all monitoring station locations within and around the Stony Brook Harbor embayment. Table D-15 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-15 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-15, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

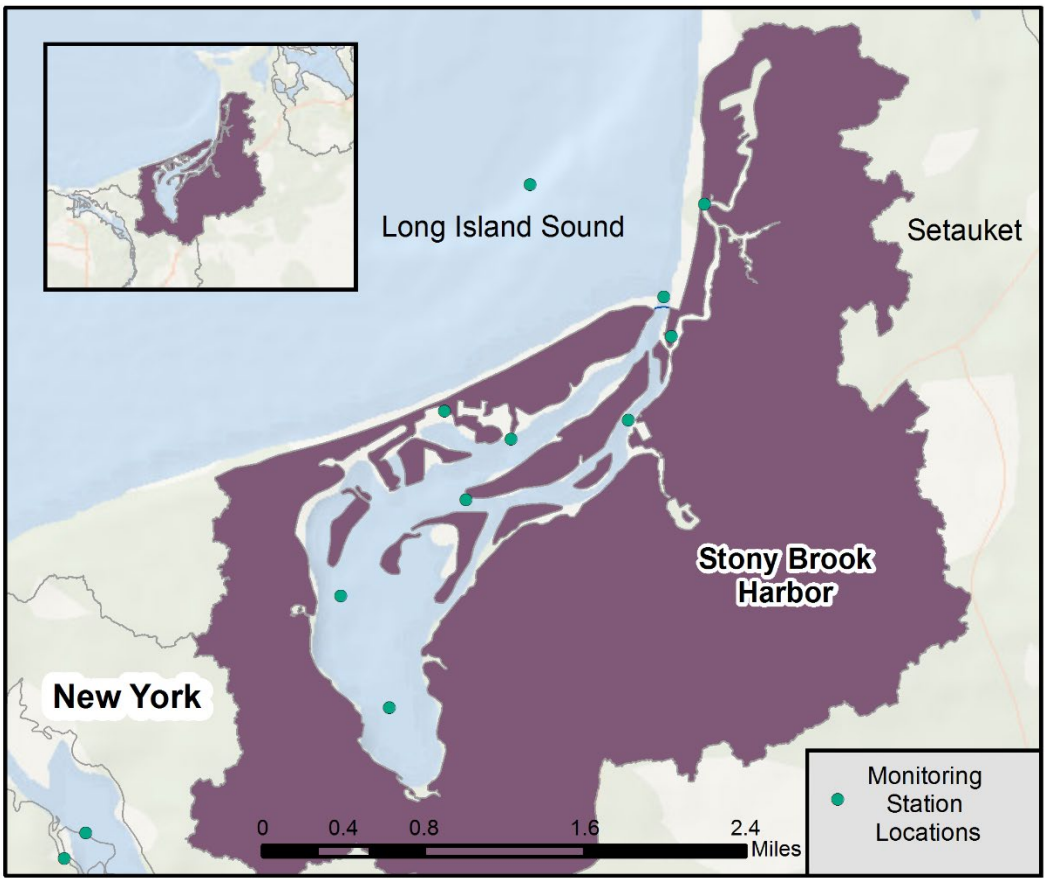

Figure D-13. Stony Brook Harbor, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-15. Parameter Counts of Stations and Samples for Stony Brook Harbor, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	9	205	0	0	205	0.01	0.07	0.04
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	9	206	0	0	206	0.01	0.05	0.01
NO2_mgL	Nitrite [mg/L]	2006–2007	2	11	0	0	11	0.01	0.02	0.01
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	9	207	0	0	207	0.00	0.18	0.05
NO3_mgL	Nitrate [mg/L]	2006	2	5	0	0	5	0.10	0.64	0.10
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	9	212	0	0	212	0.14	0.44	0.28
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	9	212	0	0	212	0.03	0.06	0.03
TN_mgL	Total nitrogen [mg/L]	2006–2015	9	212	0	0	212	0.14	0.46	0.31
TP_mgL	Total phosphorus [mg/L]	2006–2015	9	212	0	0	212	0.03	0.07	0.03
Response Parameters										
CHLAC_µgL[b]	Chl *a*, pheophytin free [µg/L]	2006–2015	8	184	23	0	154	1.63	10.43	3.53
do_mgL	Dissolved oxygen [mg/L]	2006–2016	10	395	179	0	209	6.20	12.70	8.90
secchi_m	Secchi depth [m]	2006–2016	8	190	21	0	164	1.22	3.35	1.98
Physical Parameters										
cond_µScm	Conductivity [µS/cm]	2011–2015	2	32	0	0	32	37,288.83	41,024.44	40,044.50
DOC_mgL	Dissolved organic carbon [mg/L]	2007	5	5	0	0	5	1.61	1.76	1.69
pH	pH	2006–2015	9	253	92	0	161	7.50	8.30	7.90
salinity_ppt	Salinity [ppt]	2006–2015	9	359	156	0	203	24.48	27.60	26.20
temp_C	Temperature [deg C]	2006–2016	10	376	169	0	205	3.5	23.9	14.6
TOC_mgL	Total organic carbon [mg/L]	2007	5	5	0	0	5	1.63	1.79	1.71
TSS_mgL	Total suspended solids [mg/L]	2006–2010	2	13	0	0	13	3.00	16.80	7.00
Total		**2006–2016**	**10**	**3,294**	**640**	**0**	**2,633**			

[a] Some data had missing depth information in the original source and, therefore, have no depth codes. In this case, adding together the three totals from *# of samples by depth* will not add up to the total for *# of samples*.
[b] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.13 Mt. Sinai Harbor, NY

Water quality monitoring data were available for the Mt. Sinai Harbor embayment from 3 monitoring organizations corresponding to 10 monitoring stations and 1,695 samples from 2006–2016. Data were provided by Suffolk County from 2006–2015 (1,333 samples), from Stony Brook University–Dr. Christopher Gobler from 2014–2016 (124 samples), and from University of Connecticut (Vaudrey) from 2013–2014 (238 samples).

Figure D-14 shows all monitoring station locations within and around the Mt. Sinai Harbor embayment. Table D-16 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-16 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-16, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

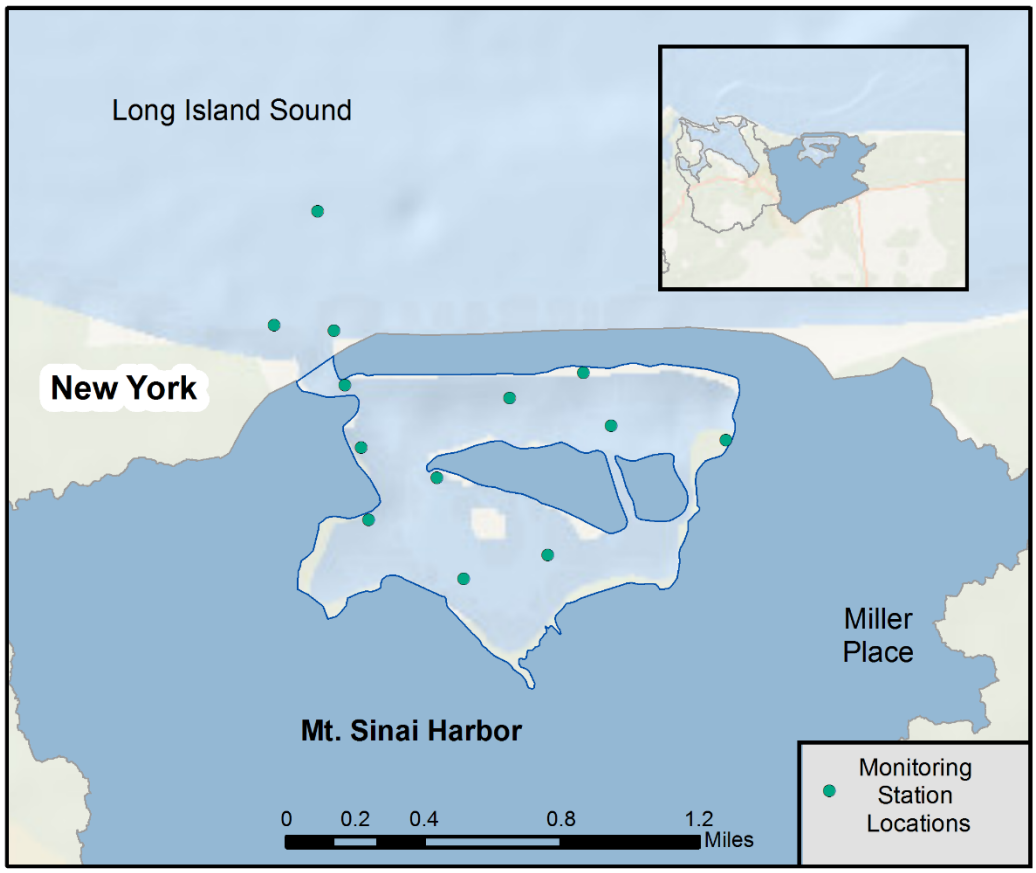

Figure D-14. Mt. Sinai Harbor, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-16. Parameter Counts of Stations and Samples for Mt. Sinai Harbor, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	4	81	0	0	81	0.01	0.07	0.02
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	4	77	0	0	77	0.01	0.06	0.01
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	4	81	0	0	81	0.00	0.17	0.04
PN_mgL	Particulate nitrogen [mg/L]	2013–2014	2	16	4	0	12	0.10	0.19	0.16
PO4_mgL	Phosphate–P [mg/L]	2013–2014	5	22	4	0	18	0.01	0.07	0.03
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	6	97	4	0	93	0.15	0.46	0.26
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	4	81	0	0	81	0.03	0.04	0.03
TN_mgL	Total nitrogen [mg/L]	2006–2015	6	97	4	0	93	0.19	0.50	0.33
TP_mgL	Total phosphorus [mg/L]	2006–2015	4	81	0	0	81	0.03	0.06	0.03
Response Parameters										
CHLAC_µgL[b]	Chl *a*, pheophytin free [µg/L]	2006–2016	7	117	32	0	78	1.09	10.00	4.79
do_mgL	Dissolved oxygen [mg/L]	2006–2016	10	226	119	9	91	4.80	13.75	7.85
do_perc	Dissolved oxygen [% saturation]	2013–2014	5	28	9	9	10	74.93	92.11	86.59
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2013–2014	3	5	0	0	5	0.00	626.96	1.73
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2013–2014	3	5	0	0	5	17.10	626.96	69.08
Seagrass_gm2	Seagrass [g m–2]	2013–2014	3	5	0	0	5	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2006–2016	5	116	29	0	81	0.91	3.35	2.10
Physical Parameters										
pH	pH	2010–2015	9	152	64	8	80	7.50	8.22	8.00
salinity_ppt	Salinity [ppt]	2006–2015	9	190	90	9	91	24.39	28.01	26.90
temp_C	Temperature [deg C]	2006–2016	10	206	104	9	91	2.35	23.44	14.85
TSS_mgL	Total suspended solids [mg/L]	2006–2014	3	12	4	0	8	5.91	10.39	8.96
Total		**2006–2016**	**10**	**1,695**	**467**	**44**	**1,162**			

[a] Some data had missing depth information in the original source and, therefore, have no depth codes. In this case, adding together the three totals from *# of samples by depth* will not add up to the total for *# of samples*.
[b] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.14 Eastern Narrows, CT and NY

Water quality monitoring embayment and open water data were available for the Eastern Narrows watershed from 9 monitoring organizations corresponding to 113 monitoring stations and 65,692 samples from 2003–2016. Data were provided by the following:

- CT DEEP (31,638 samples from 2006–2015)
- EPA NCCA (88 samples from 2006 and 2010)
- EPA ORD (63 samples from 2003)
- Friends of the Bay (612 samples from 2008–2014)
- Harbor Watch (1,296 samples from 2009 and 2012–2015)
- IEC (20,839 samples from 2006–2015)
- Stony Brook University–Dr. Christopher Gobler (375 samples from 2014–2016)
- Suffolk County (9,857 samples from 2006–2015)
- University of Connecticut (Vaudrey) (924 samples from 2013–2014)

Figure D-15 shows all monitoring station locations within and around the Eastern Narrows watershed. Table D-17 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, near bottom, middle, or surface). Table D-17 is organized by all available parameters (nutrient, response, and other physical) for the Eastern Narrows.

To determine protective target concentrations for the Eastern Narrows, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-17, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

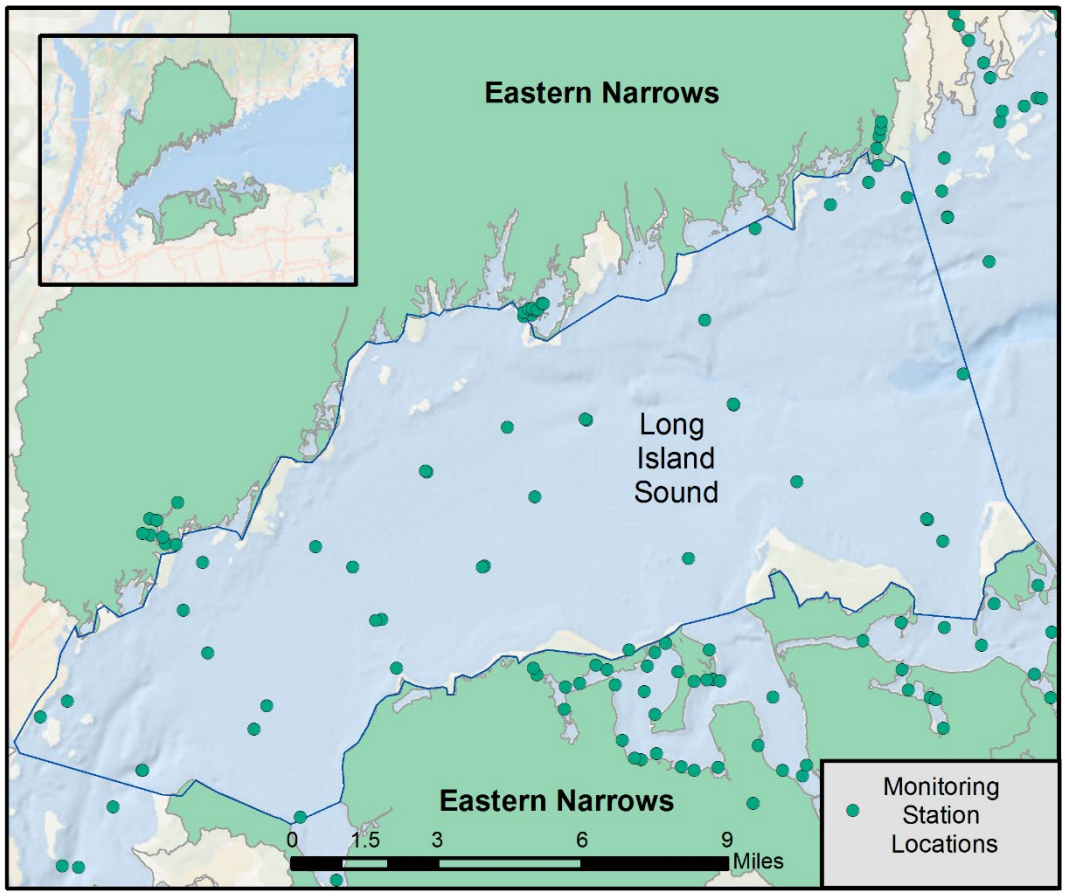

Figure D-15. Eastern Narrows, CT and NY Watershed and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-17. Parameter Counts of Stations and Samples for Eastern Narrows, CT and NY Watershed

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters											
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2006–2010	7	7	0	0	0	7	0.00	0.02	0.01
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	39	1,954	638	0	4	1,312	0.01	0.09	0.05
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	41	1,966	643	0	4	1,319	0.00	0.10	0.02
NO2_mgL	Nitrite [mg/L]	2006–2010	3	3	0	0	0	3	0.00	0.00	0.00
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	36	1,961	643	0	4	1,314	0.00	0.24	0.04
NO3_mgL	Nitrate [mg/L]	2006–2010	3	3	0	0	0	3	0.00	0.02	0.01
PN_mgL	Particulate nitrogen [mg/L]	2006–2015	31	1,414	655	0	4	755	0.04	0.21	0.08
PO4_mgL	Phosphate–P [mg/L]	2013–2014	21	80	12	0	0	68	0.02	0.14	0.08

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
PP_mgL	Particulate phosphorus [mg/L]	2006–2015	18	1,298	617	0	4	677	0.00	0.03	0.01
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	47	2,012	655	0	4	1,353	0.16	0.54	0.27
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	34	1,948	643	0	4	1,301	0.03	0.10	0.06
TN_mgL	Total nitrogen [mg/L]	2006–2015	76	2,627	1,236	0	4	1,387	0.24	1.93	0.41
TP_mgL	Total phosphorus [mg/L]	2006–2015	41	1,899	617	0	4	1,278	0.03	0.11	0.07
Response Parameters											
BOD_mgL	Biological oxygen demand [mg/L]	2015	7	42	0	0	0	42	1.50	6.01	3.42
CHLAC_µgL[b]	Chl *a*, pheophytin free [µg/L]	2006–2016	60	2,400	742	0	4	1,634	1.40	19.87	5.70
do_mgL	Dissolved oxygen [mg/L]	2003–2016	85	9,378	3,176	805	1,883	3,494	2.73	10.46	5.77
do_perc	Dissolved oxygen [% saturation]	2009–2015	27	436	202	0	36	198	53.18	98.16	75.64
Kd	Kd [m–1], computed from 1–5m photosynthetically active radiation data	2006–2015	17	1,316	0	0	0	1,316	0.39	0.80	0.62
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2013–2014	6	9	0	0	0	9	0.00	42.01	18.03
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2013–2014	6	9	0	0	0	9	5.04	169.69	30.15
PAR_AMB_µmolm2s	Ambient photosynthetically active radiation [µmol/m2/s]	2010	2	4	2	0	0	2	1,415.74	2,088.10	1,682.78
PAR_UW_µmolm2s	Underwater photosynthetically active radiation [µmol/m2/s]	2010	2	4	2	0	0	2	81.91	1,111.10	467.13
Seagrass_gm2	Seagrass [g m–2]	2013–2014	6	9	0	0	0	9	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2003–2016	60	2,934	86	0	9	2,819	1.20	3.10	1.83
Physical Parameters											
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2006–2015	18	1,344	643	0	4	697	0.32	1.32	0.62
DOC_mgL	Dissolved organic carbon [mg/L]	2006–2015	28	1,256	588	0	4	664	1.60	3.02	1.90
PC_mgL	Particulate carbon [mg/L]	2006–2015	18	1,351	643	0	4	704	0.30	1.28	0.52
pH	pH	2006–2015	62	6,417	1,969	386	1,628	2,434	7.43	8.20	7.80
salinity_ppt	Salinity [ppt]	2003–2015	82	9,389	3,132	795	1,884	3,578	24.00	27.80	26.30
Si_mgL	Dissolved silica [mg/L]	2006–2015	18	1,353	643	0	4	706	0.11	2.68	1.61
temp_C	Temperature [deg C]	2003–2016	85	9,454	3,186	795	1,887	3,586	8.70	23.40	20.90
TOC_mgL	Total organic carbon [mg/L]	2007	13	13	0	0	0	13	1.91	2.40	2.13

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
TSS_mgL	Total suspended solids [mg/L]	2006–2015	40	1,402	591	0	4	807	3.00	13.00	6.00
Total		**2003–2016**	**113**	**65,692**	**21,964**	**2,781**	**7,387**	**33,500**			

[a] Some data had missing depth information in the original source and, therefore, have no depth codes. In this case, adding together the four totals from *# of samples by depth* will not add up to the total for *# of samples*.
[b] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.15 Western Narrows, NY

Water quality monitoring embayment and open water data were available for the Western Narrows watershed from 5 monitoring organizations corresponding to 58 monitoring stations and 130,125 samples from 2006–2015. Data were provided by the following:

- EPA NCCA (49 samples from 2006 and 2010)
- IEC (13,144 samples from 2006–2015)
- NOAA (1,019 samples from 2012)
- NYC DEP (115,787 samples from 2006–2015)
- University of Connecticut (Yarish) (127 samples from 2011–2013)

Figure D-16 shows all monitoring station locations within and around the Western Narrows watershed. Table D-18 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-18 is organized by all available parameters (nutrient, response, and other physical) for the Western Narrows.

To determine protective target concentrations for the Western Narrows, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-18, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

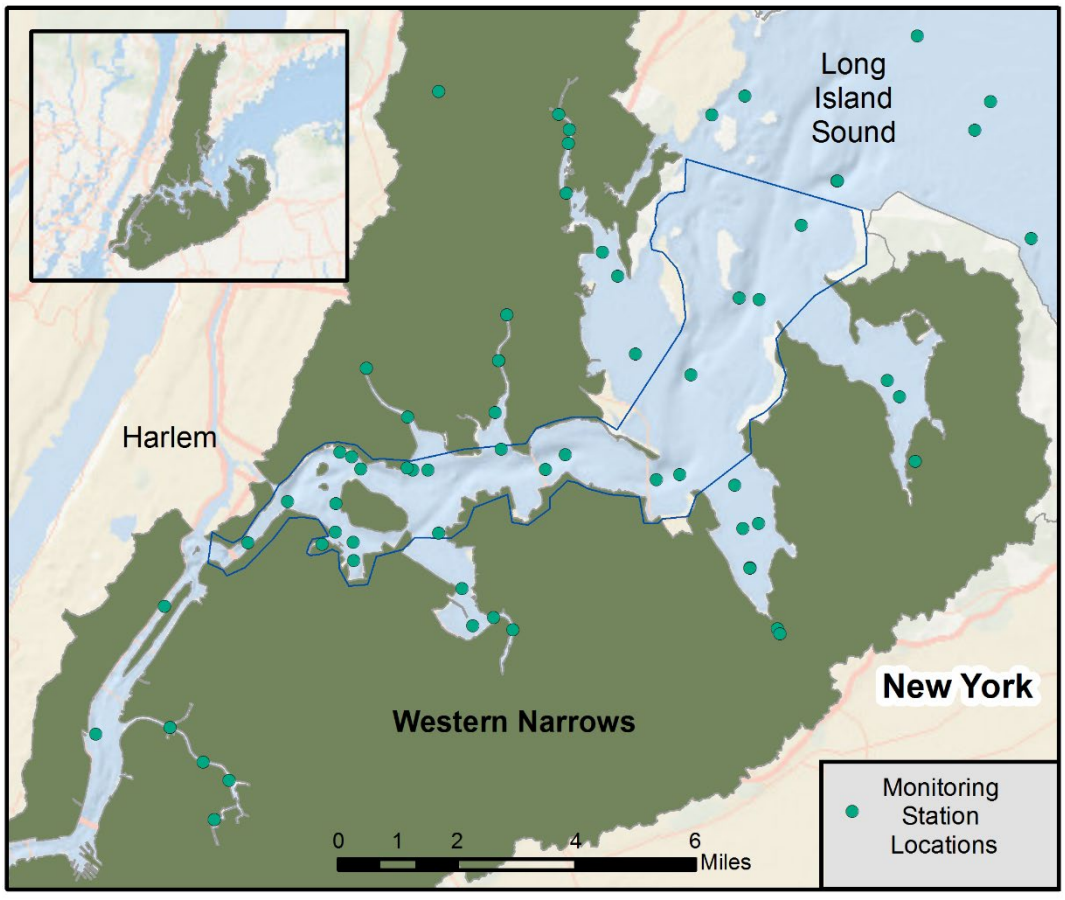

Figure D-16. Western Narrows, NY Watershed and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-18. Parameter Counts of Stations and Samples for Western Narrows, NY Watershed

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2010	1	2	0	0	2	0.10	0.31	0.21
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	42	4,076	0	0	4,076	0.06	0.19	0.13
NH3_mgL	Ammonia-nitrogen [mg/L]	2006–2015	42	5,219	0	0	5,219	0.10	0.63	0.33
NH4_mgL	Ammonium [mg/L]	2011–2013	1	23	3	0	20	0.00	0.52	0.22
NO2_mgL	Nitrite [mg/L]	2010–2012	2	18	3	0	15	0.03	0.07	0.05
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	43	5,231	0	0	5,231	0.10	0.53	0.28
NO3_mgL	Nitrate [mg/L]	2010–2012	2	18	3	0	15	0.10	0.35	0.17
PN_mgL	Particulate nitrogen [mg/L]	2014–2015	4	36	0	0	36	0.10	0.48	0.29
PO4_mgL	Phosphate-P [mg/L]	2011–2013	2	49	3	0	46	0.10	0.45	0.20
PP_mgL	Particulate phosphorus [mg/L]	2014–2015	4	36	0	0	36	0.02	0.09	0.05
TDN_mgL	Total dissolved nitrogen [mg/L]	2014–2015	4	36	0	0	36	0.30	0.75	0.50
TDP_mgL	Total dissolved phosphorus [mg/L]	2014–2015	4	36	0	0	36	0.11	0.24	0.15
TKN_mgL	Total Kjeldahl nitrogen [mg/L]	2006–2015	37	5,180	0	0	5,180	0.44	1.72	0.90
TN_mgL	Total nitrogen [mg/L]	2006–2015	43	5,243	0	0	5,243	0.67	2.11	1.23
TP_mgL	Total phosphorus [mg/L]	2006–2015	42	5,223	0	0	5,223	0.12	0.34	0.20
Response Parameters										
BOD_mgL	Biological oxygen demand [mg/L]	2015	4	24	0	0	24	1.50	6.84	4.19
CHLAC_µgL [a]	Chl *a*, pheophytin free [µg/L]	2006–2015	48	5,557	0	0	5,557	1.30	35.10	6.20
do_mgL	Dissolved oxygen [mg/L]	2006–2015	46	10,906	4,509	1,042	5,355	3.07	10.14	5.31
do_perc	Dissolved oxygen [% saturation]	2012	1	143	0	0	143	52.92	78.57	67.86
Kd	Kd [m-1], computed from 1-5m photosynthetically active radiation data	2010–2011	2	5	0	0	5	0.62	0.84	0.68
Light_perc	Light transmissivity [%Trans]	2009–2015	27	4,384	2,018	0	2,366	14.67	78.58	66.08
PAR_0.5m	Photosynthetically active radiation at 0.5 m	2012	1	65	0	0	65	4.65	104.54	43.57
PAR_1m	Photosynthetically active radiation at 1 m	2012	1	65	0	0	65	13.32	76.45	38.02
PAR_AMB_µmol m2s	Ambient photosynthetically active radiation [µmol/m2/s]	2010	1	4	2	0	2	674.64	1,434.10	1,085.68
PAR_µEsm2	Photosynthetically active radiation [µE/s m2]	2006–2015	31	5,857	2,742	0	3,115	0.00	2,242.80	41.33

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
PAR_UW_µmolm2s	Underwater photosynthetically active radiation [µmol/m2/s]	2010	1	4	2	0	2	0.23	743.32	100.75
PARF_µEsm2	Photosynthetically active radiation reference [400-700nm light] [µE/s m2]	2006–2015	22	2,721	0	0	2,721	476.89	2,128.30	1665.70
secchi_m	Secchi depth [m]	2006–2015	50	8,943	3,706	0	5,237	0.00	1.52	0.61
Physical Parameters										
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2014–2015	4	32	0	0	32	0.19	0.55	0.31
cond_µScm	Conductivity [µS/cm]	2006–2015	38	7,451	3,504	0	3,947	23,100.00	38,100.00	33,100.00
DOC_mgL	Dissolved organic carbon [mg/L]	2006–2015	41	5,193	0	0	5,193	2.37	4.22	3.18
PC_mgL	Particulate carbon [mg/L]	2014–2015	4	36	0	0	36	0.49	2.45	1.44
pH	pH	2006–2015	51	11,456	4,452	890	6,114	7.13	7.87	7.42
salinity_ppt	Salinity [ppt]	2006–2015	52	10,597	4,459	1,036	5,102	21.30	26.33	24.26
Si_mgL	Dissolved silica [mg/L]	2014–2015	4	36	0	0	36	0.32	2.38	1.38
SiO2_mgL	Silicon dioxide [mg/L]	2006–2015	37	5,905	719	0	5,186	0.81	4.10	2.23
SiO3_mgL	Silicate [mg/L]	2012	1	24	0	0	24	0.92	3.49	1.59
temp_C	Temperature [deg C]	2006–2015	52	10,626	4,470	1,038	5,118	8.25	23.77	21.17
TSS_mgL	Total suspended solids [mg/L]	2006–2015	47	8,912	3,614	0	5,298	4.80	27.00	11.00
TURB_NTU	Turbidity [nephelometric turbidity units]	2006–2015	34	753	0	0	753	1.69	51.61	7.98
Total		**2006–2015**	**58**	**130,125**	**34,209**	**4,006**	**91,910**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.16 Eastern and Western Narrows (Combined), CT and NY

Water quality monitoring embayment and open water data were available for the Eastern and Western Narrows watersheds from 12 monitoring organizations corresponding to 171 monitoring stations and 195,817 samples from 2003–2016. Data were provided by the following:

- CT DEEP (31,638 samples from 2006–2015)
- EPA NCCA (137 samples from 2006 and 2010)
- EPA ORD (63 samples from 2003)
- Friends of the Bay (612 samples from 2008–2014)
- Harbor Watch (1,296 samples from 2009 and 2012–2015)
- IEC (33,983 samples from 2006–2015)
- NOAA (1,019 samples from 2012)
- NYC DEP (115,786 samples from 2006–2015)
- Stony Brook University–Dr. Christopher Gobler (375 samples from 2014–2016)
- Suffolk County (9,857 samples from 2006–2015)
- University of Connecticut (Vaudrey) (924 samples from 2013–2014)
- University of Connecticut (Yarish) (127 samples from 2011–2013)

Figure D-17 shows all monitoring station locations within and around the Eastern and Western Narrows watersheds. Table D-19 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, near bottom, middle, or surface). Table D-19 is organized by all available parameters (nutrient, response, and other physical) for the Eastern and Western Narrows combined.

To determine protective target concentrations for the Eastern and Western Narrows combined, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-19, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

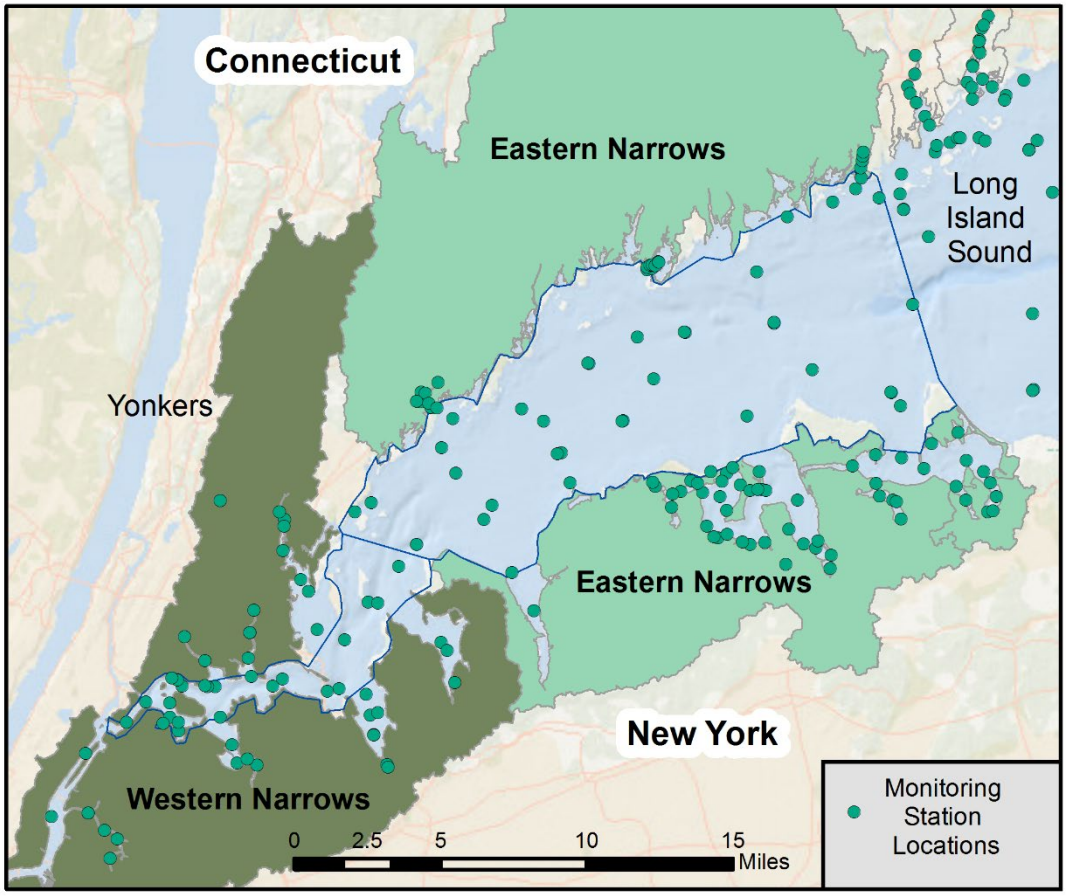

Figure D-17. Eastern and Western Narrows (Combined), CT and NY Watersheds and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-19. Parameter Counts of Stations and Samples for Eastern and Western Narrows (Combined), CT and NY Watersheds

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters											
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2006–2010	8	9	0	0	0	9	0.00	0.13	0.01
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	81	6,030	638	0	4	5,388	0.03	0.18	0.10
NH3_mgL	Ammonia-nitrogen [mg/L]	2006–2015	83	7,185	643	0	4	6,538	0.01	0.58	0.24
NH4_mgL	Ammonium [mg/L]	2011–2013	1	23	3	0	0	20	0.00	0.52	0.22
NO2_mgL	Nitrite [mg/L]	2006–2012	5	21	3	0	0	18	0.00	0.07	0.04
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	79	7,192	643	0	4	6,545	0.01	0.50	0.23
NO3_mgL	Nitrate [mg/L]	2006–2012	5	21	3	0	0	18	0.02	0.35	0.15

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
PN_mgL	Particulate nitrogen [mg/L]	2006–2015	35	1,450	655	0	4	791	0.04	0.22	0.08
PO4_mgL	Phosphate-P [mg/L]	2011–2014	23	129	15	0	0	114	0.03	0.30	0.12
PP_mgL	Particulate phosphorus [mg/L]	2006–2015	22	1,334	617	0	4	713	0.00	0.04	0.01
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	51	2,048	655	0	4	1,389	0.16	0.55	0.27
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	38	1,984	643	0	4	1,337	0.03	0.10	0.06
TKN_mgL	Total Kjeldahl nitrogen [mg/L]	2006–2015	37	5,180	0	0	0	5,180	0.44	1.72	0.90
TN_mgL	Total nitrogen [mg/L]	2006–2015	119	7,870	1,236	0	4	6,630	0.32	2.08	1.02
TP_mgL	Total phosphorus [mg/L]	2006–2015	83	7,122	617	0	4	6,501	0.06	0.31	0.17
Response Parameters											
BOD_mgL	Biological oxygen demand [mg/L]	2015	11	66	0	0	0	66	1.50	6.46	3.76
CHLAC_µgL[b]	Chl *a*, pheophytin free [µg/L]	2006–2016	108	7,957	742	0	4	7,191	1.35	30.20	6.10
do_mgL	Dissolved oxygen [mg/L]	2003–2016	131	20,284	7,685	805	2,925	8,849	2.90	10.28	5.50
do_perc	Dissolved oxygen [% saturation]	2009–2015	28	579	202	0	36	341	52.92	94.42	73.38
Kd	Kd [m-1], computed from 1-5m photosynthetically active radiation data	2006–2015	19	1,321	0	0	0	1,321	0.39	0.80	0.62
Light_perc	Light transmissivity [%Trans]	2009–2015	27	4,384	2,018	0	0	2,366	14.67	78.58	66.08
Macroalgae_gm2	Total macrophyte dry weight [g m-2]	2013–2014	6	9	0	0	0	9	0.00	42.01	18.03
Macrophyte_DW_gm2	Total macroalgae [g m-2]	2013–2014	6	9	0	0	0	9	5.04	169.69	30.15
PAR_0.5m	Photosynthetically active radiation at 0.5 m	2012	1	65	0	0	0	65	4.65	104.54	43.57
PAR_1m	Photosynthetically active radiation at 1 m	2012	1	65	0	0	0	65	13.32	76.45	38.02
PAR_AMB_µmolm2s	Ambient photosynthetically active radiation [µmol/m2/s]	2010	3	8	4	0	0	4	719.62	1,906.90	1,429.50
PAR_µEsm2	Photosynthetically active radiation [µE/s m2]	2006–2015	31	5,857	2,742	0	0	3,115	0.00	2,242.80	41.33
PAR_UW_µmolm2s	Underwater photosynthetically active radiation [µmol/m2/s]	2010	3	8	4	0	0	4	0.27	1,074.01	236.65
PARF_µEsm2	Photosynthetically active radiation reference [400-700nm light] [µE/s m2]	2006–2015	22	2,721	0	0	0	2,721	476.89	2,128.30	1,665.70
Seagrass_gm2	Seagrass [g m-2]	2013–2014	6	9	0	0	0	9	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2003–2016	110	11,877	3,792	0	9	8,056	0.00	2.13	0.91

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Physical Parameters											
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2006–2015	22	1,376	643	0	4	729	0.31	1.31	0.62
cond_µScm	Conductivity [µS/cm]	2006–2015	38	7,451	3,504	0	0	3,947	23,100.00	38,100.00	33,100.00
DOC_mgL	Dissolved organic carbon [mg/L]	2006–2015	69	6,449	588	0	4	5,857	1.81	4.10	3.00
PC_mgL	Particulate carbon [mg/L]	2006–2015	22	1,387	643	0	4	740	0.30	1.33	0.53
pH	pH	2006–2015	113	17,873	6,421	386	2,518	8,548	7.18	8.06	7.54
salinity_ppt	Salinity [ppt]	2003–2015	134	19,986	7,591	795	2,920	8,680	22.27	27.32	25.37
Si_mgL	Dissolved silica [mg/L]	2006–2015	22	1,389	643	0	4	742	0.11	2.68	1.61
SiO2_mgL	Silicon dioxide [mg/L]	2006–2015	38	5,905	719	0	0	5,186	0.80	4.07	2.22
SiO3_mgL	Silicate [mg/L]	2012	1	24	0	0	0	24	0.92	3.49	1.59
temp_C	Temperature [deg C]	2003–2016	137	20,080	7,656	795	2,925	8,704	8.55	23.60	21.01
TOC_mgL	Total organic carbon [mg/L]	2007	13	13	0	0	0	13	1.91	2.40	2.13
TSS_mgL	Total suspended solids [mg/L]	2006–2015	87	10,314	4,205	0	4	6,105	4.00	25.61	10.00
TURB_NTU	Turbidity [nephelometric turbidity units]	2006–2015	34	753	0	0	0	753	1.69	51.61	7.98
Total		**2003–2016**	**171**	**195,817**	**56,173**	**2,781**	**11,393**	**125,410**			

[a] Some data had missing depth information in the original source and, therefore, have no depth codes. In this case, adding together the four totals from *# of samples by depth* will not add up to the total for *# of samples*.
[b] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.17 Connecticut River, CT

Water quality monitoring data were available for the Connecticut River embayment from 3 monitoring organizations corresponding to 11 monitoring stations and 793 samples from 2006 and 2018. Data were provided by CT DEEP for 2006 (36 samples), EPA NCCA for 2006 (13 samples), and EPA Region 1 for 2017 (744 samples).

Figure D-18 shows all monitoring station locations within and around the Connecticut River embayment. Table D-20 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-20 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D-20, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

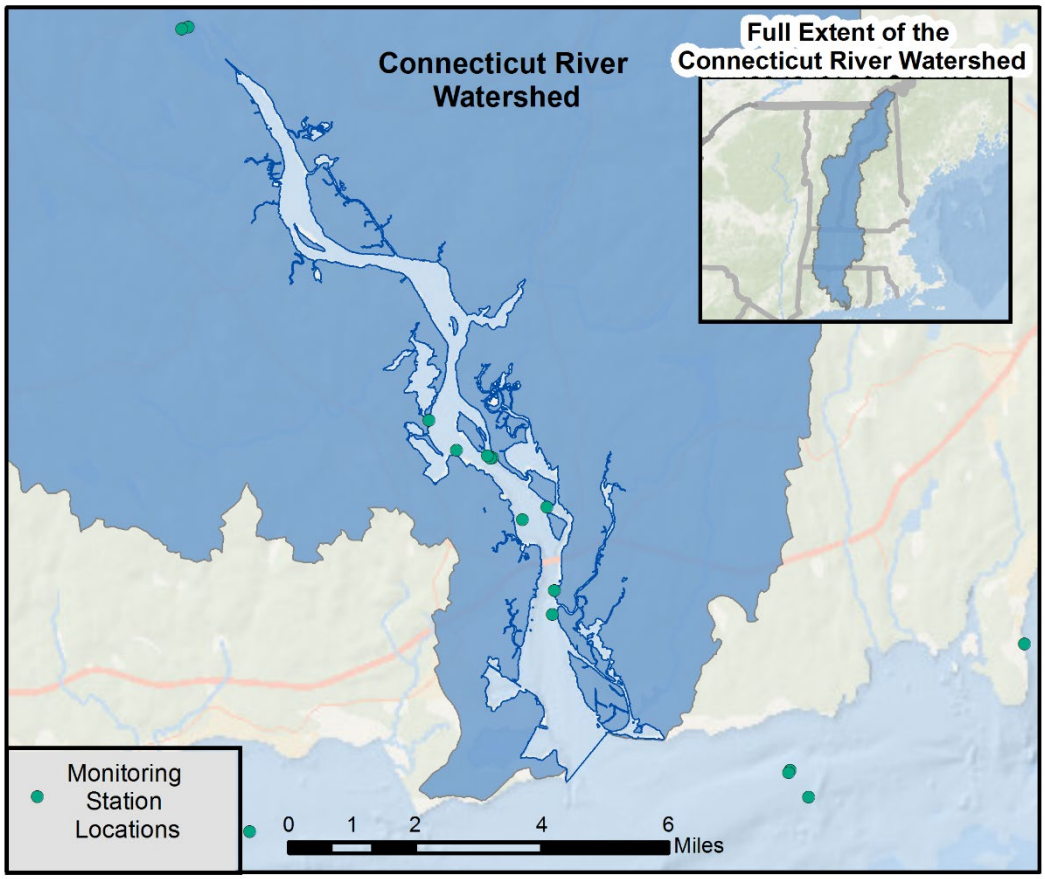

Figure D-18. Connecticut River, CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D-20. Parameter Counts of Stations and Samples for Connecticut River, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2006	2	2	0	0	2	0.44	0.47	0.46
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006	4	4	0	2	2	0.04	0.06	0.05
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2018	11	83	23	2	58	0.03	0.03	0.03
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2018	9	81	23	2	56	0.09	0.28	0.21
PN_mgL	Particulate nitrogen [mg/L]	2006	2	2	0	2	0	0.07	0.08	0.07
PP_mgL	Particulate phosphorus [mg/L]	2006	2	2	0	2	0	0.01	0.02	0.01
TDN_mgL	Total dissolved nitrogen [mg/L]	2006	2	2	0	2	0	0.69	0.70	0.69
TDP_mgL	Total dissolved phosphorus [mg/L]	2006	2	2	0	2	0	0.05	0.06	0.05
TN_mgL	Total nitrogen [mg/L]	2006–2018	11	83	23	2	58	0.37	0.71	0.44
TP_mgL	Total phosphorus [mg/L]	2006–2018	11	83	23	2	58	0.03	0.06	0.04
Response Parameters										
CHLA_µgL	Chl *a*, pheophytin free [µg/L]	2006–2018	11	83	23	2	58	2.10	20.00	6.00
do_mgL	Dissolved oxygen [mg/L]	2006–2017	9	25	23	2	0	7.72	8.67	8.15
do_perc	Dissolved oxygen [% saturation]	2006–2017	7	23	23	0	0	89.16	101.36	97.10
secchi_m	Secchi depth [m]	2006–2018	7	76	21	0	55	0.84	1.31	1.06
Physical Parameters										
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2006	2	2	0	2	0	0.35	0.39	0.37
cond_µScm	Conductivity [µS/cm]	2006–2017	7	23	23	0	0	925.20	15,981	8,892
DOC_mgL	Dissolved organic carbon [mg/L]	2006	2	2	0	2	0	5.03	5.33	5.18
PC_mgL	Particulate carbon [mg/L]	2006	2	2	0	2	0	0.48	0.56	0.52
pH	pH	2006–2017	7	23	23	0	0	7.49	7.74	7.65
salinity_ppt	Salinity [ppt]	2006–2017	9	25	23	2	0	0.19	9.43	4.04
Si_mgL	Dissolved silica [mg/L]	2006	2	2	0	2	0	5.64	5.77	5.71
temp_C	Temperature [deg C]	2006–2017	9	25	23	2	0	20.07	24.48	21.48
TSS_mgL	Total suspended solids [mg/L]	2006–2018	10	82	23	2	57	5.20	19.90	10.00
Total		**2006–2018**	**11**	**793**	**297**	**36**	**460**			

D.18 Other Data Used for Modeling

Other Embayments

Water quality monitoring data were available for other embayment stations throughout LIS from 9 monitoring organizations corresponding to 136 monitoring stations and 88,204 samples from 2000–2015. Data were provided by the following:

- EPA NCCA (4 samples from 2006 and 2010)
- EPA ORD (2,712 samples from 2000–2009)
- Friends of the Bay (200 samples from 2008–2014)

- Harbor Watch (1,112 samples from 2009–2015)
- IEC (3,284 samples from 2006–2015)
- NYC DEP (75,857 samples from 2006–2015)
- Suffolk County (3,086 samples from 2006–2015)
- University of Connecticut (Vaudrey) (701 samples from 2013–2014)
- URIWW (1,248 samples from 2008–2015)

Figure D-19 shows all other embayment monitoring station locations within and around LIS. Table D-21 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-21 is organized by all available parameters (nutrient, response, and other physical) for these embayments.

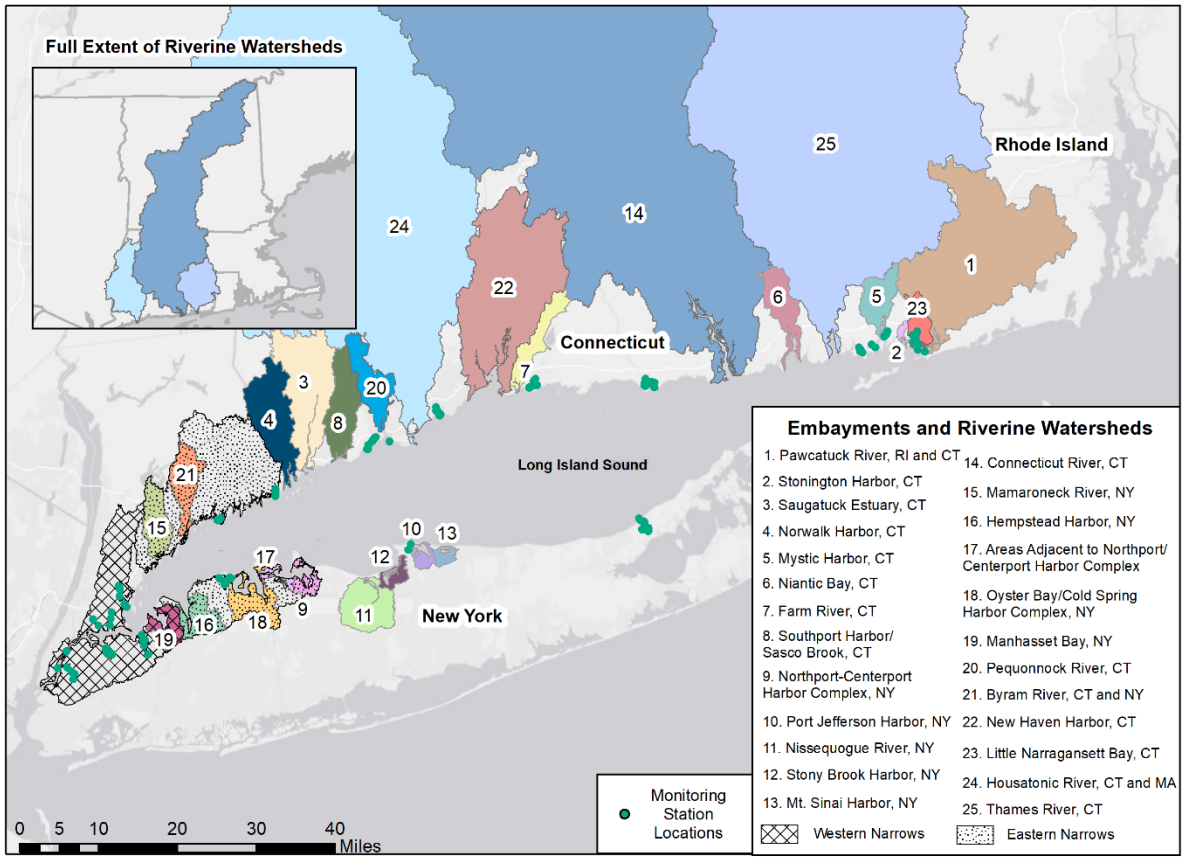

Figure D-19. Other Embayment Water Quality Monitoring Station Locations, as Delineated by Dr. Jamie Vaudrey (University of Connecticut). Portions of the Maps that are Not Highlighted as Part of a Selected Watershed Indicate that No Loading Data are Available for a Given Area (e.g., the Small Portion of Land between the Eastern and Western Narrows).

Table D-21. Parameter Counts of Stations and Samples for Other Embayment Data

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2000–2010	13	69	28	0	41	0.00	0.04	0.01
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	39	3,607	4	0	3,603	0.03	0.20	0.13
DON_mgL	Dissolved organic nitrogen [mg/L]	2002-2003	10	54	24	0	30	0.18	0.29	0.22
NH3_mgL	Ammonia-nitrogen [mg/L]	2006-2015	39	3,859	4	0	3,855	0.06	0.66	0.33
NH4_mgL	Ammonium [mg/L]	2000-2003	13	70	29	1	40	0.00	0.03	0.01
NO2_mgL	Nitrite [mg/L]	2003-2010	4	24	8	0	16	0.00	0.00	0.00
NO23_mgL	Nitrate + Nitrite [mg/L]	2000-2015	52	3,937	32	1	3,904	0.04	0.57	0.27
NO3_mgL	Nitrate [mg/L]	2003-2003	4	24	8	0	16	0.00	0.01	0.00
PN_mgL	Particulate Nitrogen [mg/L]	2013-2015	13	69	12	0	57	0.08	0.35	0.17
PO4_mgL	Phosphate-P [mg/L]	2013-2014	16	64	12	0	52	0.01	0.09	0.05
PP_mgL	Particulate Phosphorus [mg/L]	2014-2015	2	18	0	0	18	0.04	0.09	0.05
TDN_mgL	Total Dissolved Nitrogen [mg/L]	2002-2015	30	311	36	0	275	0.16	0.52	0.27
TDP_mgL	Total Dissolved Phosphorus [mg/L]	2006-2015	9	204	0	0	204	0.03	0.07	0.03
TKN_mgL	Total Kjeldahl Nitrogen [mg/L]	2006-2015	23	3,542	0	0	3,542	0.48	1.83	0.99
TN_mgL	Total Nitrogen [mg/L]	2006-2015	60	4,110	192	0	3,918	0.56	2.29	1.29
TP_mgL	Total Phosphorus [mg/L]	2006-2015	39	3,867	4	0	3,863	0.08	0.36	0.22
Response Parameters										
BOD_mgL	Biological Oxygen Demand [mg/L]	2015-2015	2	12	0	0	12	3.37	6.85	4.02
CHLA_µgL[a]	Chl *a* [µg/L]	2000-2010	17	76	23	1	52	1.71	9.24	3.94
CHLAC_µgL[a]	Chl *a*, pheophytin free [µg/L]	2006-2015	47	3,906	9	0	3,897	1.60	42.42	8.70
do_mgL	Dissolved oxygen [mg/L]	2000-2015	117	6,926	2,975	150	3,801	3.27	10.73	5.94
do_perc	Dissolved oxygen [% saturation]	2009-2015	19	360	169	26	165	52.64	97.20	75.04
Kd	Kd [m-1], computed from 1-5m Photosynthetically Active Radiation data	2010-2014	3	6	0	0	6	0.68	1.18	0.78
Light_perc	Light Transmissivity [%Trans]	2009-2015	20	2,776	1,216	0	1,560	19.68	77.35	61.81
Macroalgae_gm2	Total macrophyte dry weight [g m-2]	2013-2014	6	9	0	0	9	8.21	394.56	16.45
Macrophyte_DW_gm2	Total Macroalgae [g m-2]	2013-2014	6	9	189	0	0	8.21	394.56	16.45
PAR_uEsm2	Photosynthetically Active Radiation [uE/s m2]	2006-2015	20	3,665	1,648	0	2,017	0.00	2,343.20	49.71
PARF_uEsm2	Photosynthetically Active Radiation Reference [400-700nm light] [uE/s m2]	2006-2015	13	1,738	0	0	1,738	476.34	2,129.98	1,656.40
Seagrass_gm2	Seagrass [g m-2]	2013-2014	6	9	0	0	9	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2000-2015	75	5,699	2,226	305	3,168	0.00	1.52	0.61

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Physical Parameters										
BiSi_mgL	Biogenic Silica, polycarbonate filter digestion [mg/L]	2014-2015	2	16	0	0	16	0.20	0.52	0.30
cond_uScm	Conductivity [uS/cm]	2006-2015	21	4,575	2,074	0	2,501	22,300	37,500	32,600
DOC_mgL	Dissolved Organic Carbon [mg/L]	2006-2015	26	3,542	0	0	3,542	2.44	4.40	3.28
PC_mgL	Particulate Carbon [mg/L]	2014-2015	2	18	0	0	18	1.08	2.17	1.77
pH	pH	2006-2015	56	6,704	2,582	126	3,996	7.09	7.92	7.41
salinity_ppt	Salinity [ppt]	2000-2015	119	6,915	3,009	148	3,758	20.00	26.50	23.56
Si_mgL	Dissolved Silica [mg/L]	2014-2015	2	18	0	0	18	0.30	2.54	1.64
SiO2_mgL	Silicon Dioxide [mg/L]	2006-2015	23	3,981	437	0	3,544	0.90	5.18	2.39
temp_C	Temperature [deg C]	2000-2015	118	6,941	3,008	150	3,783	6.14	24.02	21.08
TOC_mgL	Total Organic Carbon [mg/L]	2007-2007	1	1	0	0	1	2.04	2.04	2.04
TSS_mgL	Total Suspended Solids [mg/L]	2000-2015	40	5,777	2,167	1	3,609	4.80	28.54	11.20
TURB_NTU	Turbidity [Nephelometric Turbidity Units]	2009-2015	24	696	0	0	696	1.70	54.50	8.60
Total		**2000–2015**	**136**	**88,204**	**21,936**	**909**	**65,359**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

Open Water

Water quality monitoring data were available for open water stations throughout LIS from 10 monitoring organizations corresponding to 167 monitoring stations and 164,154 samples from 2006–2016. Data were provided by the following:

- CT DEEP (95,846 samples from 2006–2015)
- EPA NCCA (766 samples from 2006 and 2010)
- Harbor Watch (946 samples from 2006–2015)
- IEC (23,906 samples from 2006–2015)
- NOAA (1,019 samples from 2012)
- NYC DEP (39,929 samples from 2006–2015)
- Suffolk (950 samples from 2006–2015)
- University of Connecticut (Vaudrey) (375 from 2013–2014)
- University of Connecticut (Yarish) (377 samples from 2011–2014 and 2016)
- URIWW (40 samples from 2015)

Figure D-20 shows all open water monitoring station locations within and around LIS. Table D-22 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, near bottom, middle, or surface). Table D-22 is organized by all available parameters (nutrient, response, and other physical) for the open water.

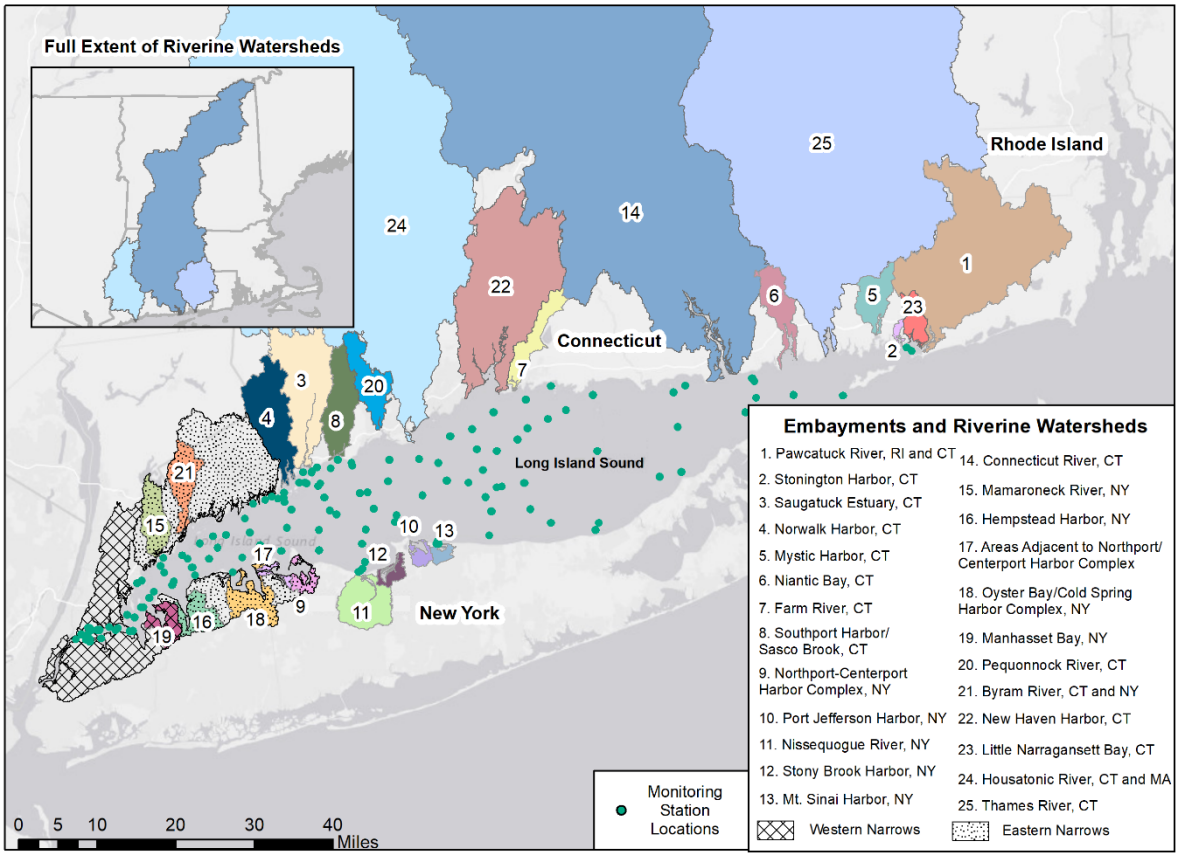

Figure D-20. Open Waters Water Quality Monitoring Station Locations, as Delineated by Dr. Jamie Vaudrey (University of Connecticut). Portions of the Maps that are Not Highlighted as Part of a Selected Watershed Indicate that No Loading Data are Available for a Given Area (e.g., the Small Portion of Land between the Eastern and Western Narrows).

Table D-22. Parameter Counts of Stations and Samples for Open Waters Data

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters											
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2006–2010	47	49	0	0	0	49	0.01	0.08	0.03
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	99	4,951	2,013	0	17	2,921	0.02	0.11	0.05
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	105	5,879	2,030	0	17	3,832	0.00	0.36	0.02
NH4_mgL	Ammonium [mg/L]	2011–2014	3	75	3	0	0	72	0.00	0.36	0.05
NO2_mgL	Nitrite [mg/L]	2006–2012	33	73	3	0	0	70	0.00	0.05	0.03
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	79	5,892	2,031	0	17	3,844	0.00	0.32	0.07
NO3_mgL	Nitrate [mg/L]	2006–2012	29	69	3	0	0	66	0.00	0.20	0.03
PN_mgL	Particulate nitrogen [mg/L]	2006–2015	47	4,162	2,034	0	17	2,111	0.03	0.14	0.06
PO4_mgL	Phosphate–P [mg/L]	2011–2014	12	135	12	0	0	123	0.02	0.29	0.08
PP_mgL	Particulate phosphorus [mg/L]	2006–2015	39	4,018	1,974	0	17	2,027	0.00	0.03	0.01

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	50	4,226	2,036	0	17	2,173	0.14	0.36	0.21
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	42	4,190	2,026	0	17	2,147	0.03	0.09	0.05
TKN_mgL	Total Kjeldahl nitrogen [mg/L]	2006–2015	14	1,638	0	0	0	1,638	0.38	1.43	0.74
TN_mgL	Total nitrogen [mg/L]	2006–2015	111	5,935	2,038	0	17	3,880	0.20	1.18	0.34
TP_mgL	Total phosphorus [mg/L]	2006–2015	101	5,763	1,977	0	17	3,769	0.04	0.19	0.08
Response Parameters											
BOD_mgL	Biological oxygen demand [mg/L]	2015	7	42	0	0	0	42	1.50	5.84	3.20
CHLAC_µgL[a]	Chl *a*, pheophytin free [µg/L]	2006–2015	116	6,172	1,937	0	17	4,218	1.00	13.08	3.20
do_mgL	Dissolved oxygen [mg/L]	2006-2015	150	17,201	5,647	2,098	2,378	7,078	3.17	10.45	5.93
do_perc	Dissolved oxygen [% saturation]	2007–2015	22	392	119	0	12	261	58.85	112.25	84.02
Kd	Kd [m–1], computed from 1–5m photosynthetically active radiation data	2006–2015	78	3,728	0	0	0	3,728	0.32	0.75	0.53
Light_perc	Light transmissivity [%Trans]	2009-2015	7	1,608	802	0	0	806	10.71	79.92	70.71
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2013–2014	3	4	0	0	0	4	0.00	16.46	0.00
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2013–2014	3	4	0	0	0	4	28.67	54.07	44.91
PAR_0.5m	Photosynthetically active radiation at 0.5 m	2012	1	65	0	0	0	65	4.65	104.54	43.57
PAR_1m	Photosynthetically active radiation at 1 m	2012	1	65	0	0	0	65	13.32	76.45	38.02
PAR_AMB_µmolm2s	Ambient photosynthetically active radiation [µmol/m2/s]	2010	19	42	21	0	0	21	170.70	1,672	859.88
PAR_uEsm2	Photosynthetically active radiation [uE/s m2]	2006–2015	11	2,192	1,094	0	0	1,098	0.00	2,133.98	23.10
PAR_UW_µmolm2s	Underwater photosynthetically active radiation [µmol/m2/s]	2010	19	41	20	0	0	21	0.01	723.60	32.30
PARF_uEsm2	Photosynthetically active radiation reference [400-700nm light] [uE/s m2]	2006–2015	9	983	0	0	0	983	479	2,122.68	1,675.70
Seagrass_gm2	Seagrass [g m–2]	2013–2014	3	4	0	0	0	4	0.00	34.39	0.00
secchi_m	Secchi depth [m]	2006–2016	113	7,090	1,480	0	0	5,610	0.00	3.10	1.60
Physical Parameters											
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2006–2016	39	4,121	2,025	0	17	2,079	0.22	1.14	0.52
cond_uScm	Conductivity [uS/cm]	2006–2015	17	2,876	1,430	0	0	1,446	24,350	38,700	33,900
DOC_mgL	Dissolved organic carbon [mg/L]	2006–2015	52	5,659	1,971	0	17	3,671	1.50	3.50	1.90
PC_mgL	Particulate carbon [mg/L]	2006–2015	39	4,128	2,025	0	17	2,086	0.27	0.95	0.43
pH	pH	2006–2015	122	12,433	4,136	1,111	2,034	5,152	7.28	8.16	7.66

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth				Values		
					Bottom	Near Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
salinity_ppt	Salinity [ppt]	2006–2015	158	17,428	5,753	2,086	2,379	7,210	23.88	28.30	26.46
Si_mgL	Dissolved silica [mg/L]	2006–2015	39	4,133	2,027	0	17	2,089	0.14	2.44	1.11
SiO2_mgL	Silicon dioxide [mg/L]	2006–2015	14	1,924	282	0	0	1,642	0.68	3.07	1.92
SiO3_mgL	Silicate [mg/L]	2012	1	24	0	0	0	24	0.92	3.49	1.59
temp_C	Temperature [deg C]	2006–2015	157	17,443	5,757	2,086	2,381	7,219	6.72	23.18	20.39
TOC_mgl	Total organic carbon [mg/L]	2007	2	2	0	0	0	2	1.61	1.70	1.66
TSS_mgL	Total suspended solids [mg/L]	2006–2015	94	7,238	3,414	0	17	3,807	3.00	19.00	7.00
TURB_NTU	Turbidity [nephelometric turbidity units]	2010–2015	10	57	0	0	0	57	1.45	10.69	3.90
Total		**2006–2016**	**167**	**164,154**	**58,120**	**7,381**	**9,439**	**89,214**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.19 Mamaroneck River, NY

Water quality monitoring data were available for the Mamaroneck River embayment from 1 monitoring organization corresponding to 8 monitoring stations and 446 samples from 2013–2014. Data were provided from the University of Connecticut (Vaudrey).

Figure D–21 shows all monitoring station locations within and around the Mamaroneck River embayment. Table D–23 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–23 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–23, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

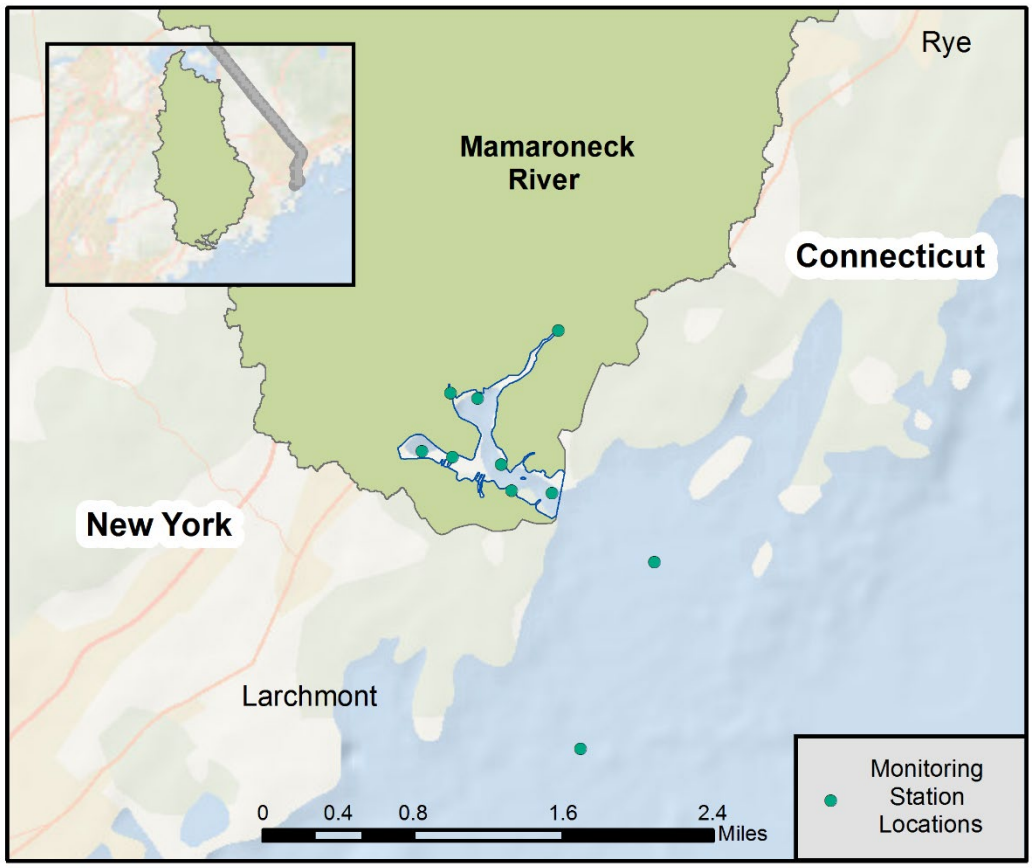

Figure D–21. Mamaroneck River, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–23. Parameter Counts of Stations and Samples for Mamaroneck River, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
PN_mgL	Particulate nitrogen [mg/L]	2013–2014	6	35	4	0	31	0.07	0.42	0.18
PO4_mgL	Phosphate–P [mg/L]	2013–2014	8	40	4	0	36	0.02	0.16	0.09
TDN_mgL	Total dissolved nitrogen [mg/L]	2013–2014	6	36	4	0	32	0.26	1.19	0.40
TN_mgL	Total nitrogen [mg/L]	2013–2014	6	35	4	0	31	0.45	1.40	0.74
Response Parameters										
CHLAC_ugL	Chl *a*, pheophytin free [ug/L]	2013–2014	6	15	4	0	11	2.15	23.83	7.43
do_mgL	Dissolved oxygen [mg/L]	2013–2014	8	56	20	16	20	3.29	6.46	4.91
do_perc	Dissolved oxygen [% saturation]	2013–2014	8	56	20	16	20	44.35	82.83	65.05
Kd	Kd [m–1], computed from 1–5m photosynthetically active radiation data	2013–2014	2	4	0	0	4	0.68	0.93	0.84
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2013–2014	2	2	0	0	2	8.24	24.51	16.38
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2013–2014	2	2	0	0	2	8.44	26.33	17.39
Seagrass_gm2	Seagrass [g m–2]	2013–2014	2	2	0	0	2	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2013–2014	2	4	0	0	4	1.47	2.21	1.80
Physical Parameters										
pH	pH	2013–2013	8	32	12	8	12	7.49	7.72	7.58
salinity_ppt	Salinity [ppt]	2013–2014	8	56	20	16	20	15.19	27.05	25.77
temp_C	Temperature [deg C]	2013–2014	8	56	20	16	20	21.13	22.96	22.29
TSS_mgL	Total suspended solids [mg/L]	2013–2014	6	15	4	0	11	1.69	6.21	3.43
Total		**2013–2014**	**8**	**446**	**116**	**72**	**258**			

D.20 Hempstead Harbor, NY

Water quality monitoring data were available for the Hempstead Harbor embayment from 1 monitoring organization corresponding to 2 monitoring stations and 2,760 samples from 2006–2015. Data were provided by IEC.

Figure D–22 shows all monitoring station locations within and around the Hempstead Harbor embayment. Table D–24 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–24 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–24, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

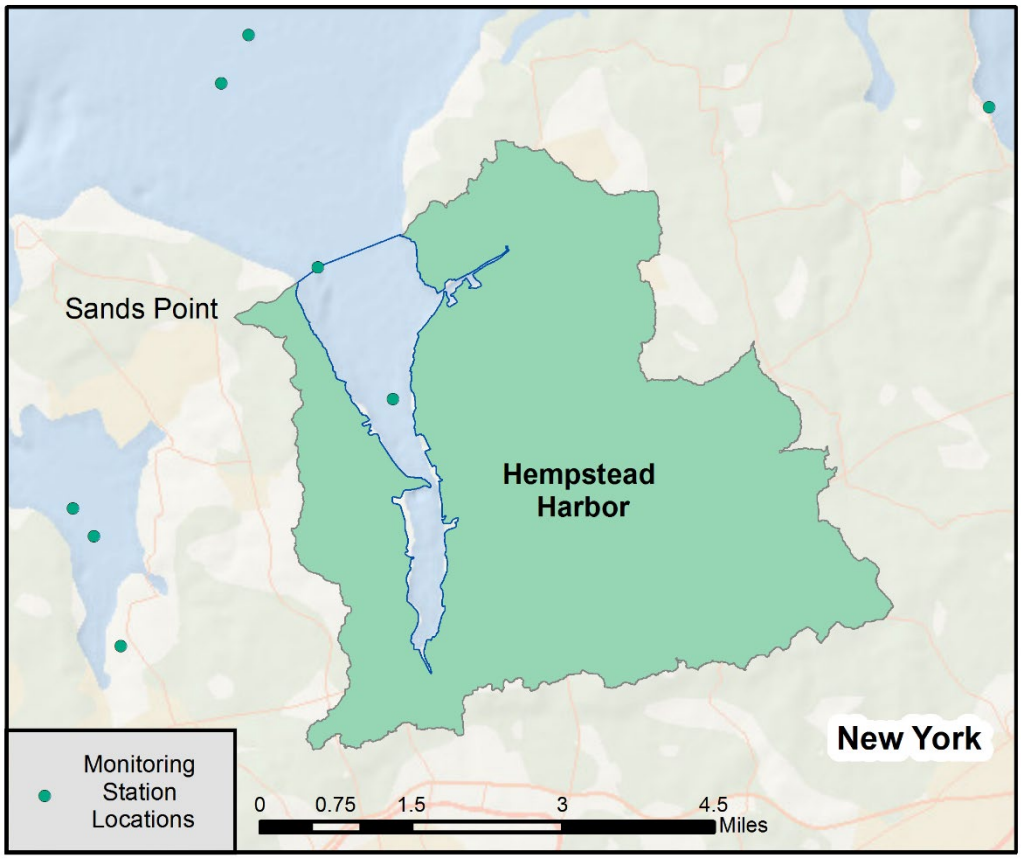

Figure D–22. Hempstead Harbor, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–24. Parameter Counts of Stations and Samples for Hempstead Harbor, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2014–2015	1	9	0	0	9	0.04	0.10	0.07
NH3_mgL	Ammonia–nitrogen [mg/L]	2014–2015	1	9	0	0	9	0.01	0.04	0.01
NO23_mgL	Nitrate + nitrite [mg/L]	2014–2015	1	9	0	0	9	0.00	0.08	0.01
PN_mgL	Particulate nitrogen [mg/L]	2014–2015	1	9	0	0	9	0.29	0.43	0.37
PP_mgL	Particulate phosphorus [mg/L]	2014–2015	1	9	0	0	9	0.05	0.11	0.07
TDN_mgL	Total dissolved nitrogen [mg/L]	2014–2015	1	9	0	0	9	0.25	0.35	0.33
TDP_mgL	Total dissolved phosphorus [mg/L]	2014–2015	1	9	0	0	9	0.08	0.17	0.11
TN_mgL	Total nitrogen [mg/L]	2014–2015	1	9	0	0	9	0.55	0.78	0.67
TP_mgL	Total phosphorus [mg/L]	2014–2015	1	9	0	0	9	0.15	0.30	0.18
Response Parameters										
CHLAC_ugL [a]	Chl *a*, pheophytin free [ug/L]	2014–2015	2	60	0	0	60	7.27	30.30	16.91
do_mgL	Dissolved oxygen [mg/L]	2006–2015	2	602	205	181	216	2.30	8.90	5.32
secchi_m	Secchi depth [m]	2006–2015	2	216	0	0	216	0.91	3.02	1.50
Physical Parameters										
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2014–2015	1	8	0	0	8	0.16	0.43	0.25
BOD_mgL	Biological oxygen demand [mg/L]	2015–2015	1	6	0	0	6	3.74	6.75	5.07
DOC_mgL	Dissolved organic carbon [mg/L]	2014–2015	1	9	0	0	9	2.44	3.65	3.12
PC_mgL	Particulate carbon [mg/L]	2014–2015	1	9	0	0	9	1.51	2.89	2.20
pH	pH	2007–2015	2	530	181	157	192	7.40	8.10	7.76
salinity_ppt	Salinity [ppt]	2006–2015	2	602	205	181	216	23.23	27.70	25.80
Si_mgL	Dissolved silica [mg/L]	2014–2015	1	9	0	0	9	0.64	2.07	1.58
temp_C	Temperature [deg C]	2006–2015	2	604	205	182	217	19.40	23.90	22.40
TSS_mgL	Total suspended solids [mg/L]	2014–2015	2	24	0	0	24	4.02	20.52	11.90
Total		**2006–2015**	**2**	**2,760**	**796**	**701**	**1,263**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.21 Areas Adjacent to the Northport–Centerport Harbor Complex, NY

Figure D–23 shows a map of the Huntington Bay, Huntington Harbor, and Lloyd Harbor watersheds.

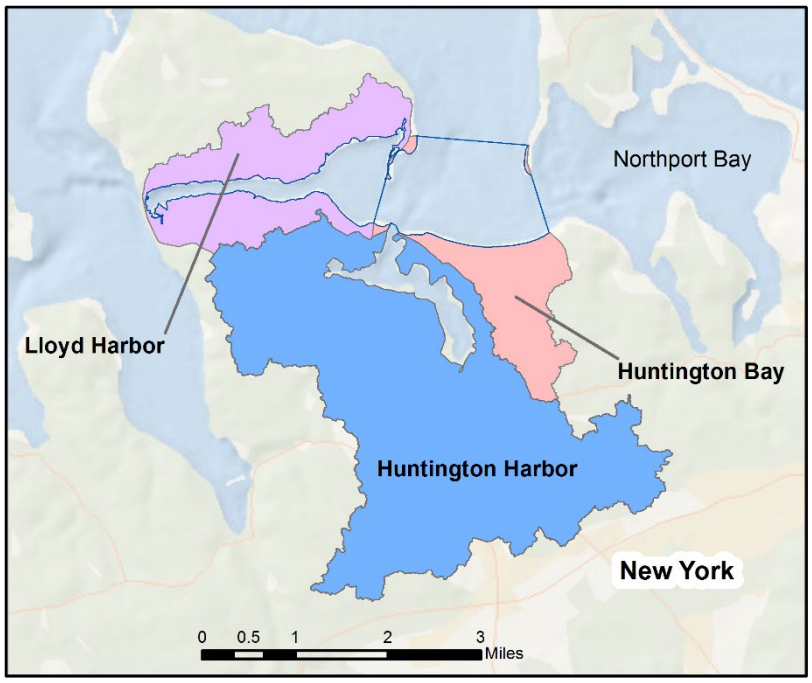

Figure D–23. Huntington Bay, Huntington Harbor, and Lloyd Harbor Watersheds, NY

Huntington Bay, NY

Water quality monitoring data were available for the Huntington Bay embayment from 1 monitoring organization corresponding to 2 monitoring stations and 1,275 samples from 2006–2015. Data were provided by Suffolk County.

Figure D–24 shows all monitoring station locations within and around the Huntington Bay embayment. Table D–25 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–25 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–25, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

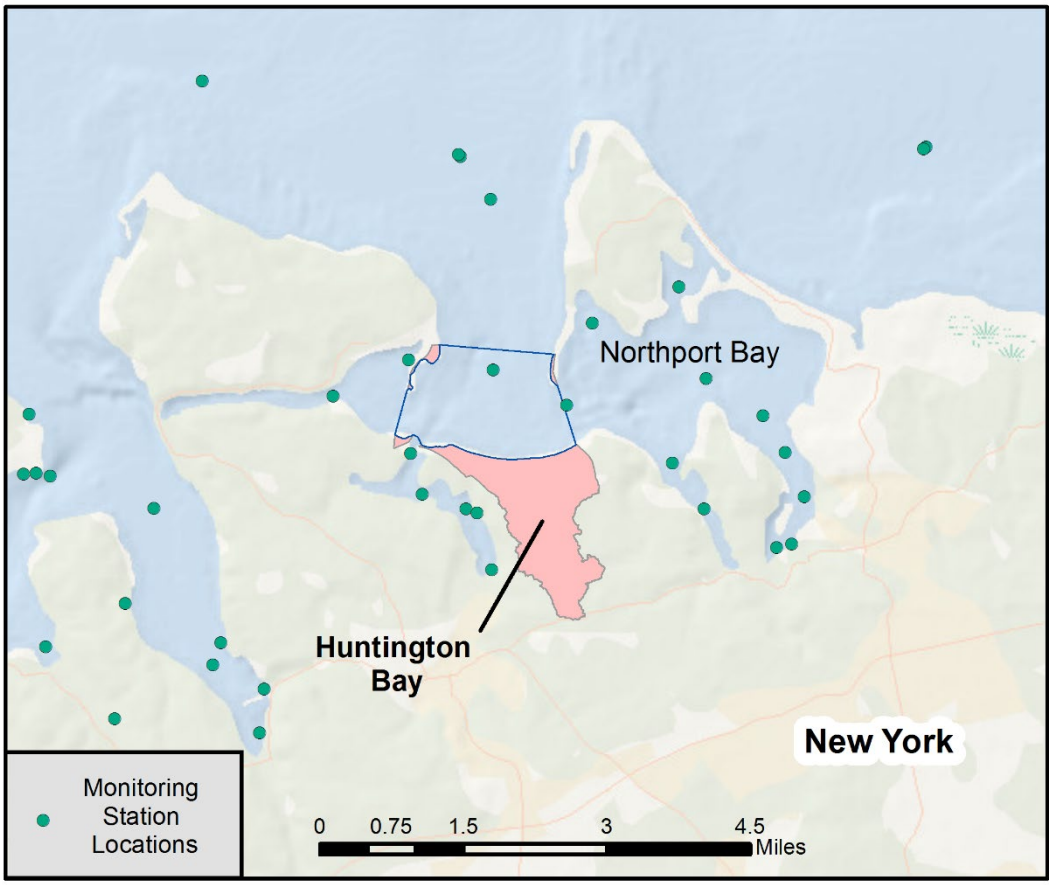

Figure D–24. Huntington Bay, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–25. Parameter Counts of Stations and Samples for Huntington Bay, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	2	79	0	0	79	0.01	0.09	0.04
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	2	79	0	0	79	0.01	0.08	0.01
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	2	79	0	0	79	0.00	0.17	0.01
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	2	77	0	0	77	0.14	0.45	0.26
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	2	77	0	0	77	0.03	0.08	0.03
TN_mgL	Total nitrogen [mg/L]	2006–2015	2	77	0	0	77	0.18	0.49	0.29
TP_mgL	Total phosphorus [mg/L]	2006–2015	2	77	0	0	77	0.03	0.09	0.03

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Response Parameters										
CHLAC_ugL	Chl *a*, pheophytin free [ug/L]	2006–2015	2	73	0	0	73	1.78	11.04	4.87
do_mgL	Dissolved oxygen [mg/L]	2006–2015	2	154	77	0	77	6.33	12.00	8.20
secchi_m	Secchi depth [m]	2006–2015	2	79	0	0	79	1.49	3.35	2.44
Physical Parameters										
DOC_mgL	Dissolved organic carbon [mg/L]	2007	2	2	0	0	2	1.80	1.81	1.81
pH	pH	2010–2015	2	100	35	0	65	7.77	8.20	7.90
salinity_ppt	Salinity [ppt]	2006–2015	2	154	77	0	77	24.83	27.70	26.10
temp_C	Temperature [deg C]	2006–2015	2	154	77	0	77	4.20	22.54	14.70
TOC_mgL	Total organic carbon [mg/L]	2007	2	2	0	0	2	1.86	1.87	1.87
TSS_mgL	Total suspended solids [mg/L]	2006–2010	1	12	0	0	12	2.75	10.90	6.00
Total		**2006–2015**	**2**	**1,275**	**266**	**0**	**1,009**			

Huntington Harbor, NY

Water quality monitoring data were available for the Huntington Harbor embayment from 2 monitoring organizations corresponding to 5 monitoring stations and 2,556 samples from 2006–2016. Data were provided by Suffolk County from 2006–2015 (2,431 samples) and Stony Brook University—Dr. Christopher Gobler from 2014–2016 (125 samples).

Figure D–25 shows all monitoring station locations within and around the Huntington Harbor embayment. Table D–26 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–26 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–26, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

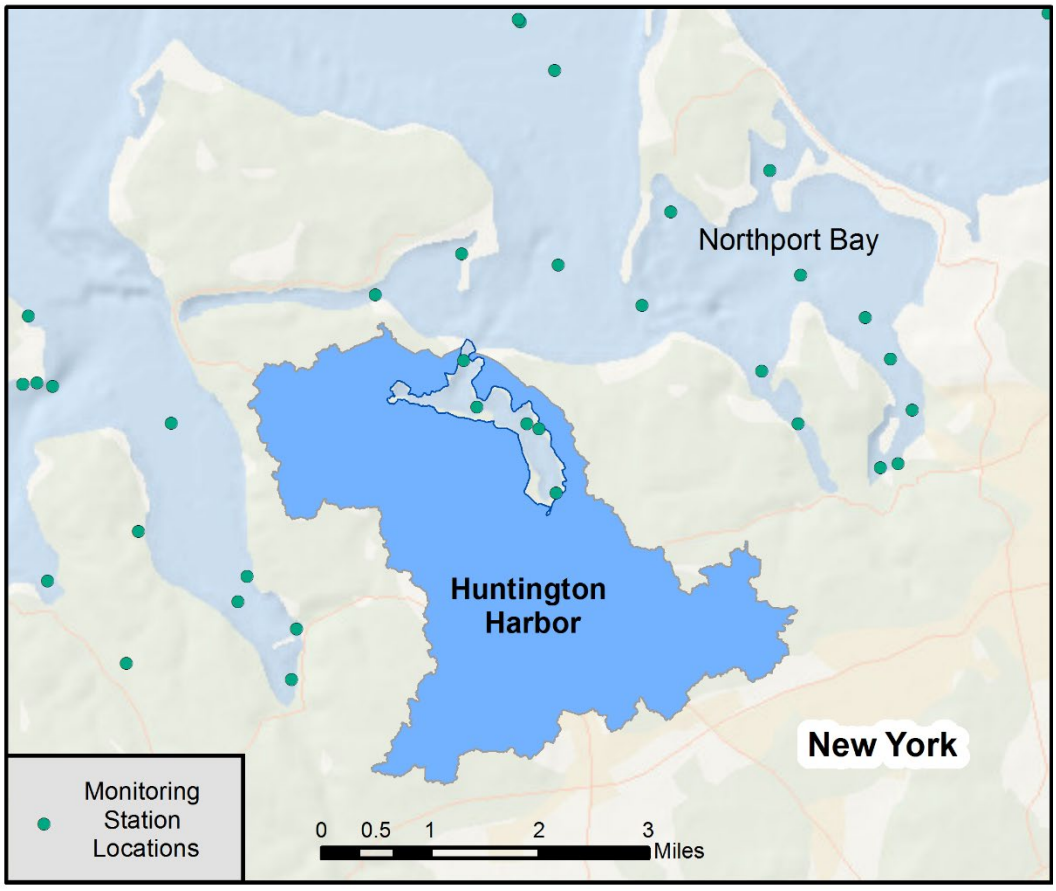

Figure D–25. Huntington Harbor, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–26. Parameter Counts of Stations and Samples for Huntington Harbor, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	4	150	0	0	150	0.01	0.08	0.04
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	4	150	0	0	150	0.01	0.13	0.05
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	4	150	0	0	150	0.00	0.55	0.16
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	4	147	0	0	147	0.19	0.82	0.40
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	4	147	0	0	147	0.03	0.08	0.03
TN_mgL	Total nitrogen [mg/L]	2006–2015	4	147	0	0	147	0.25	0.84	0.44
TP_mgL	Total phosphorus [mg/L]	2006–2015	4	147	0	0	147	0.03	0.09	0.05
Response Parameters										
CHLAC_ugL[b]	Chl *a*, pheophytin free [ug/L]	2006–2016	5	180	28	0	145	1.71	25.40	8.78
do_mgL	Dissolved oxygen [mg/L]	2006–2016	5	330	175	0	148	4.28	12.40	8.20
secchi_m	Secchi depth [m]	2006–2016	5	186	28	0	151	1.22	2.74	1.68
Physical Parameters										
DOC_mgL	Dissolved organic carbon [mg/L]	2007	3	3	0	0	3	2.30	2.79	2.49
pH	pH	2010–2015	4	200	72	0	128	7.50	8.20	7.90
salinity_ppt	Salinity [ppt]	2006–2015	4	294	147	0	147	23.36	26.90	25.30
stationDepth_m	Station depth [m]	2006–2015	4	150	0	0	150	3.96	6.40	5.11
temp_C	Temperature [deg C]	2006–2016	5	310	164	0	146	4.98	23.80	17.05
TOC_mgL	Total organic carbon [mg/L]	2007	3	3	0	0	3	2.11	2.62	2.27
TSS_mgL	Total suspended solids [mg/L]	2006–2010	1	12	0	0	12	2.75	18.40	7.00
Total		**2006–2016**	**5**	**2,556**	**614**	**0**	**1,921**			

[a] Some data had missing depth information in the original source and, therefore, have no depth codes. In this case, adding together the three totals from *# of samples by depth* will not add up to the total for *# of samples*.
[b] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

Lloyd Harbor, NY

Water quality monitoring data were available for the Lloyd Harbor embayment from 2 monitoring organizations corresponding to 2 monitoring stations and 649 samples from 2006–2015. Data were provided by EPA NCCA from 2010 (22 samples) and Suffolk County from 2006–2015 (627 samples).

Figure D–26 shows all monitoring station locations within and around the Lloyd Harbor embayment. Table D–27 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–27 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–27, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

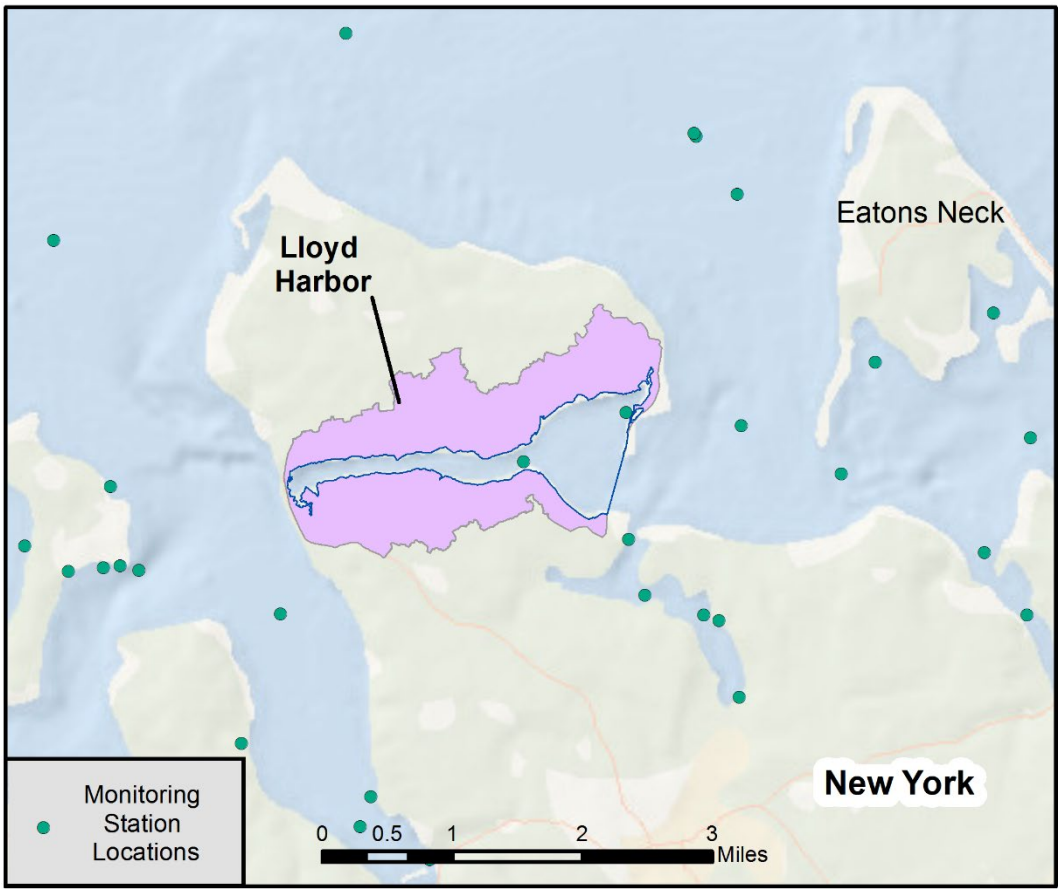

Figure D–26. Lloyd Harbor, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–27. Parameter Counts of Stations and Samples for Lloyd Harbor, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2010	1	1	0	0	1	0.01	0.01	0.01
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2015	1	39	0	0	39	0.01	0.07	0.04
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2015	2	40	0	0	40	0.01	0.09	0.01
NO2_mgL	Nitrite [mg/L]	2010	1	1	0	0	1	0.00	0.00	0.00
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2015	2	40	0	0	40	0.00	0.19	0.02
NO3_mgL	Nitrate [mg/L]	2010	1	1	0	0	1	0.01	0.01	0.01
TDN_mgL	Total dissolved nitrogen [mg/L]	2006–2015	1	38	0	0	38	0.14	0.50	0.27
TDP_mgL	Total dissolved phosphorus [mg/L]	2006–2015	1	38	0	0	38	0.03	0.07	0.03
TN_mgL	Total nitrogen [mg/L]	2006–2015	2	39	0	0	39	0.22	0.54	0.31
TP_mgL	Total phosphorus [mg/L]	2006–2015	2	39	0	0	39	0.03	0.08	0.05
Response Parameters										
CHLAC_ugL[a]	Chl *a*, pheophytin free [ug/L]	2006–2015	2	40	0	0	40	1.50	12.09	4.74
do_mgL	Dissolved oxygen [mg/L]	2006–2015	2	78	39	0	39	6.54	12.43	8.60
Kd	Kd [m–1], computed from 1–5m photosynthetically active radiation data	2010	1	1	0	0	1	1.41	1.41	1.41
PAR_AMB_umolm2s	Ambient photosynthetically active radiation [umol/m2/s]	2010	1	2	1	0	1	1,657.50	2,161.06	1,909.28
PAR_UW_umolm2s	Underwater photosynthetically active radiation [umol/m2/s]	2010	1	2	1	0	1	375.24	1,200.36	787.80
secchi_m	Secchi depth [m]	2006–2015	2	40	0	0	40	1.07	2.30	1.75
Physical Parameters										
DOC_mgL	Dissolved organic carbon [mg/L]	2007	1	1	0	0	1	2.30	2.30	2.30
pH	pH	2010–2015	2	52	19	0	33	7.70	8.20	7.90
salinity_ppt	Salinity [ppt]	2006–2015	2	78	39	0	39	24.37	27.10	25.70
temp_C	Temperature [deg C]	2006–2015	2	78	39	0	39	4.48	24.13	14.65
TOC_mgL	Total organic carbon [mg/L]	2007	1	1	0	0	1	2.43	2.43	2.43
Total		**2006–2015**	**2**	**649**	**138**	**0**	**511**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.22 Oyster Bay/Cold Spring Harbor Complex, NY

Water quality monitoring data were available for the Oyster Bay/Cold Spring Harbor Complex embayment from 3 monitoring organizations corresponding to 24 monitoring stations and 944 samples from 2008–2016. Data were provided by University of Connecticut (Vaudrey) from 2013–2014 (407 samples), from Friends of the Bay from 2008–2014 (412 samples), and from Stony Brook University—Dr. Christopher Gobler from 2014–2016 (125 samples).

Figure D–27 shows all monitoring station locations within and around the Oyster Bay/Cold Spring Harbor Complex embayment. Table D–28 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–28 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–28, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

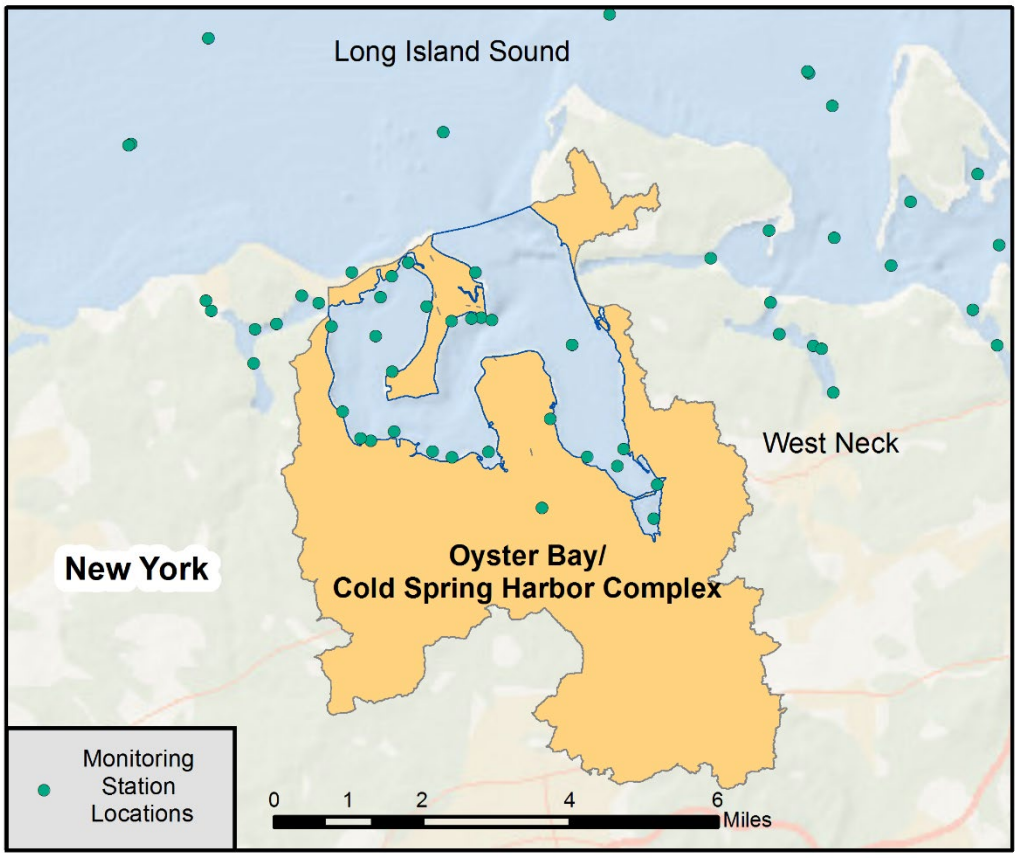

Figure D–27. Oyster Bay/Cold Spring Harbor Complex, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–28. Parameter Counts of Stations and Samples for Oyster Bay/Cold Spring Harbor Complex, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth[a]			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
PN_mgL	Particulate nitrogen [mg/L]	2013–2014	5	20	6	0	14	0.15	0.29	0.20
PO4_mgL	Phosphate–P [mg/L]	2013–2014	11	32	6	0	26	0.03	0.14	0.07
TDN_mgL	Total dissolved nitrogen [mg/L]	2013–2014	5	20	6	0	14	0.16	0.41	0.20
TN_mgL	Total nitrogen [mg/L]	2008–2014	17	432	411	0	21	0.31	3.16	1.64
Response Parameters										
CHLAC_ugL[b]	Chl *a*, pheophytin free [ug/L]	2013–2016	4	48	34	0	7	9.32	30.25	13.51
do_mgL	Dissolved oxygen [mg/L]	2013–2016	10	90	46	18	19	0.00	6.14	5.25
do_perc	Dissolved oxygen [% saturation]	2013–2014	9	54	18	18	18	67.87	89.70	75.29
Macroalgae_gm2	Total macrophyte dry weight [g m–2]	2013–2014	4	7	0	0	7	0.00	44.06	18.03
Macrophyte_DW_gm2	Total macroalgae [g m–2]	2013–2014	4	7	0	0	7	10.97	189.22	39.96
Seagrass_gm2	Seagrass [g m–2]	2013–2014	4	7	0	0	7	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2014–2016	1	36	28	0	1	0.85	1.70	1.15
Physical Parameters										
pH	pH	2013–2014	9	54	18	18	18	7.69	8.19	7.84
salinity_ppt	Salinity [ppt]	2013–2014	9	54	18	18	18	27.22	27.84	27.47
temp_C	Temperature [deg C]	2013–2016	10	71	35	18	18	22.50	24.55	23.15
TSS_mgL	Total suspended solids [mg/L]	2013–2014	3	12	6	0	6	6.09	11.68	8.29
Total		**2008–2016**	**24**	**944**	**632**	**90**	**201**			

[a] Some data had missing depth information in the original source and, therefore, have no depth codes. In this case, adding together the three totals from *# of samples by depth* will not add up to the total for *# of samples*.
[b] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.23 Manhasset Bay, NY

Water quality monitoring data were available for the Manhasset Bay embayment from 1 monitoring organization corresponding to 3 monitoring stations and 4,033 samples from 2006–2015. Data were provided by IEC.

Figure D–28 shows all monitoring station locations within and around the Manhassett Bay embayment. Table D–29 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–29 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–29, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

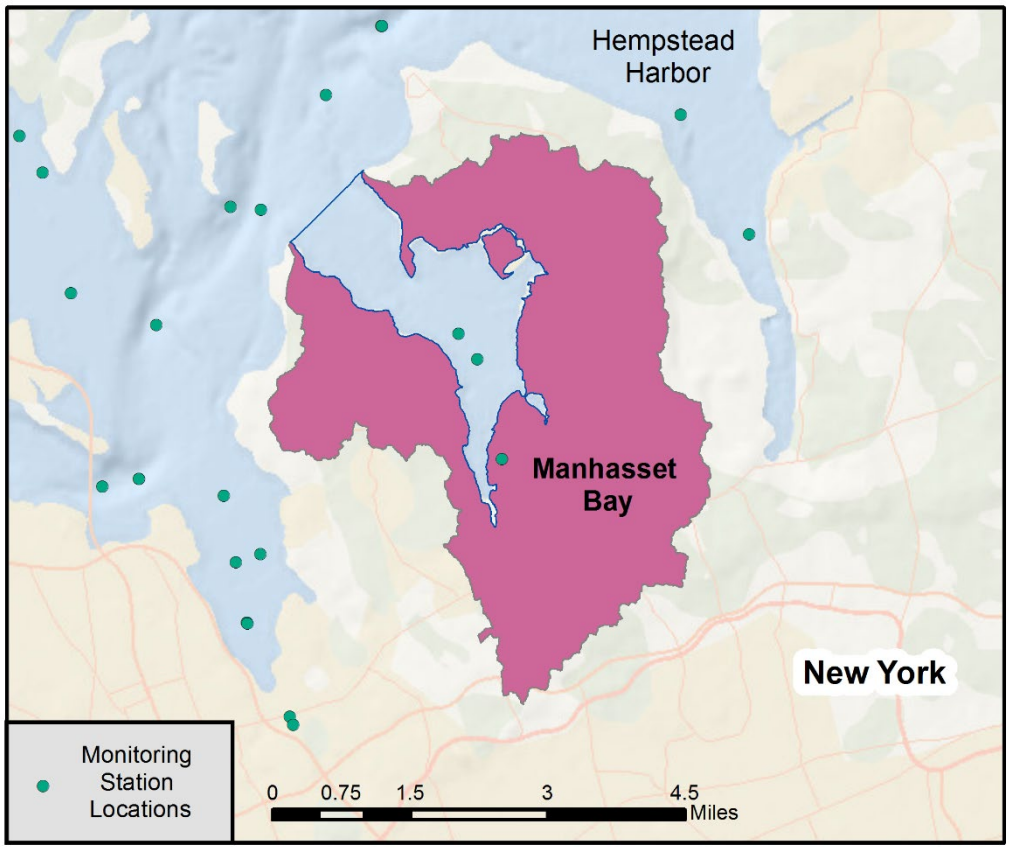

Figure D–28. Manhasset Bay, NY Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–29. Parameter Counts of Stations and Samples for Manhasset Bay, NY Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2014–2015	1	9	0	0	9	0.06	0.16	0.14
NH3_mgL	Ammonia–nitrogen [mg/L]	2014–2015	1	9	0	0	9	0.01	0.13	0.05
NO23_mgL	Nitrate + nitrite [mg/L]	2014–2015	1	9	0	0	9	0.01	0.09	0.02
PN_mgL	Particulate nitrogen [mg/L]	2014–2015	1	9	0	0	9	0.33	0.51	0.37
PP_mgL	Particulate phosphorus [mg/L]	2014–2015	1	9	0	0	9	0.05	0.10	0.07
TDN_mgL	Total dissolved nitrogen [mg/L]	2014–2015	1	9	0	0	9	0.29	0.72	0.40
TDP_mgL	Total dissolved phosphorus [mg/L]	2014–2015	1	9	0	0	9	0.08	0.22	0.19
TN_mgL	Total nitrogen [mg/L]	2014–2015	1	9	0	0	9	0.68	1.25	0.77
TP_mgL	Total phosphorus [mg/L]	2014–2015	1	9	0	0	9	0.16	0.31	0.24
Response Parameters										
BOD_mgL	Biological oxygen demand [mg/L]	2015	1	6	0	0	6	4.16	8.16	5.60
CHLAC_ugL [a]	Chl *a*, pheophytin free [ug/L]	2014–2015	3	90	0	0	90	7.27	41.62	18.35
do_mgL	Dissolved oxygen [mg/L]	2006–2015	3	889	321	234	334	2.61	8.82	5.26
secchi_m	Secchi depth [m]	2006–2015	3	334	0	0	334	0.90	3.00	1.20
Physical Parameters										
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2014–2015	1	8	0	0	8	0.18	0.49	0.33
DOC_mgL	Dissolved organic carbon [mg/L]	2014–2015	1	9	0	0	9	2.66	4.71	3.21
PC_mgL	Particulate carbon [mg/L]	2014–2015	1	9	0	0	9	1.22	2.59	1.92
pH	pH	2007–2015	3	784	283	205	296	7.34	8.20	7.69
salinity_ppt	Salinity [ppt]	2006–2015	3	887	319	234	334	22.80	27.20	25.30
Si_mgL	Dissolved silica [mg/L]	2014–2015	1	9	0	0	9	0.29	2.36	1.65
temp_C	Temperature [deg C]	2006–2015	3	891	323	234	334	20.20	24.10	22.70
TSS_mgL	Total suspended solids [mg/L]	2014–2015	3	36	0	0	36	6.50	22.05	13.80
Total		**2006–2015**	**3**	**4,033**	**1,246**	**907**	**1,880**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.24 Pequonnock River, CT

Water quality monitoring data were available for the Pequonnock River embayment from 1 monitoring organization corresponding to 1 monitoring station and 22 samples from 2010. Data were provided by EPA NCCA.

Figure D–29 shows the Pequonnock River embayment. To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used data from other embayments and open water. Refer to Subtasks F and G for additional information.

Table D-30 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-30 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

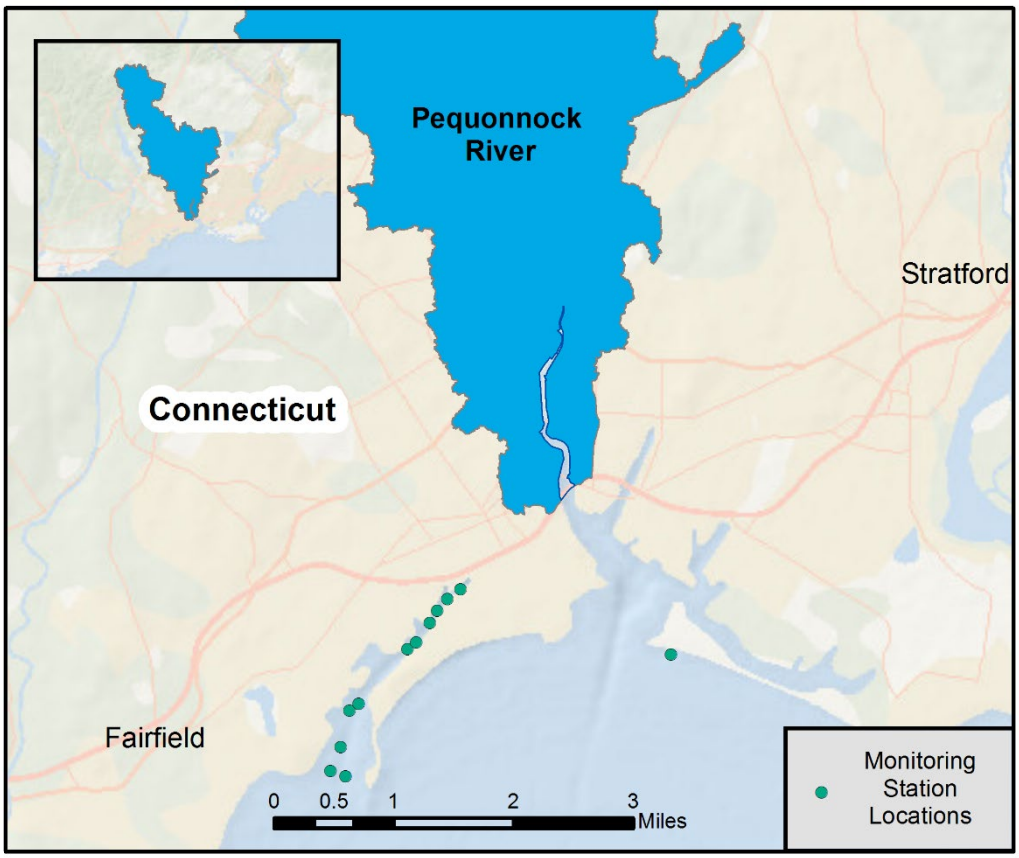

Figure D–29. Pequonnock River, CT Embayment and Nearby Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–30. Parameter Counts of Stations and Samples for Pequonnock River, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2010	1	1	0	0	1	0.00	0.00	0.00
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2010	1	1	0	0	1	0.04	0.04	0.04
NH3_mgL	Ammonia–nitrogen [mg/L]	2010	1	1	0	0	1	0.00	0.00	0.00
NO23_mgL	Nitrate + nitrite [mg/L]	2010	1	1	0	0	1	0.00	0.00	0.00
TN_mgL	Total nitrogen [mg/L]	2010	1	1	0	0	1	0.25	0.25	0.25
TP_mgL	Total phosphorus [mg/L]	2010	1	1	0	0	1	0.07	0.07	0.07
Response Parameters										
CHLAC_ugL [a]	Chl *a*, pheophytin free [ug/L]	2010	1	1	0	0	1	6.80	6.80	6.80
do_mgL	Dissolved oxygen [mg/L]	2010	1	2	1	0	1	6.45	6.85	6.65
Kd	Kd [m–1], computed from 1–5m photosynthetically active radiation data	2010	1	1	0	0	1	0.96	0.96	0.96
PAR_AMB_umolm2s	Ambient photosynthetically active radiation [umol/m2/s]	2010	1	2	1	0	1	394.33	403.33	398.83
PAR_UW_umolm2s	Underwater photosynthetically active radiation [umol/m2/s]	2010	1	2	1	0	1	70.51	184.95	127.73
secchi_m	Secchi depth [m]	2010	1	1	0	0	1	1.47	1.47	1.47
Physical Parameters										
pH	pH	2010	1	2	1	0	1	7.69	7.72	7.70
salinity_ppt	Salinity [ppt]	2010	1	2	1	0	1	16.39	16.67	16.53
temp_C	Temperature [deg C]	2010	1	2	1	0	1	24.02	24.18	24.10
Total		**2010**	**1**	**22**	**6**	**0**	**16**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.25 Byram River, CT and NY

No water quality data were available for the Byram River embayment. Figure D–30 shows the Byram River embayment. To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used data from other embayments and open water. Refer to Subtasks F and G for additional information.

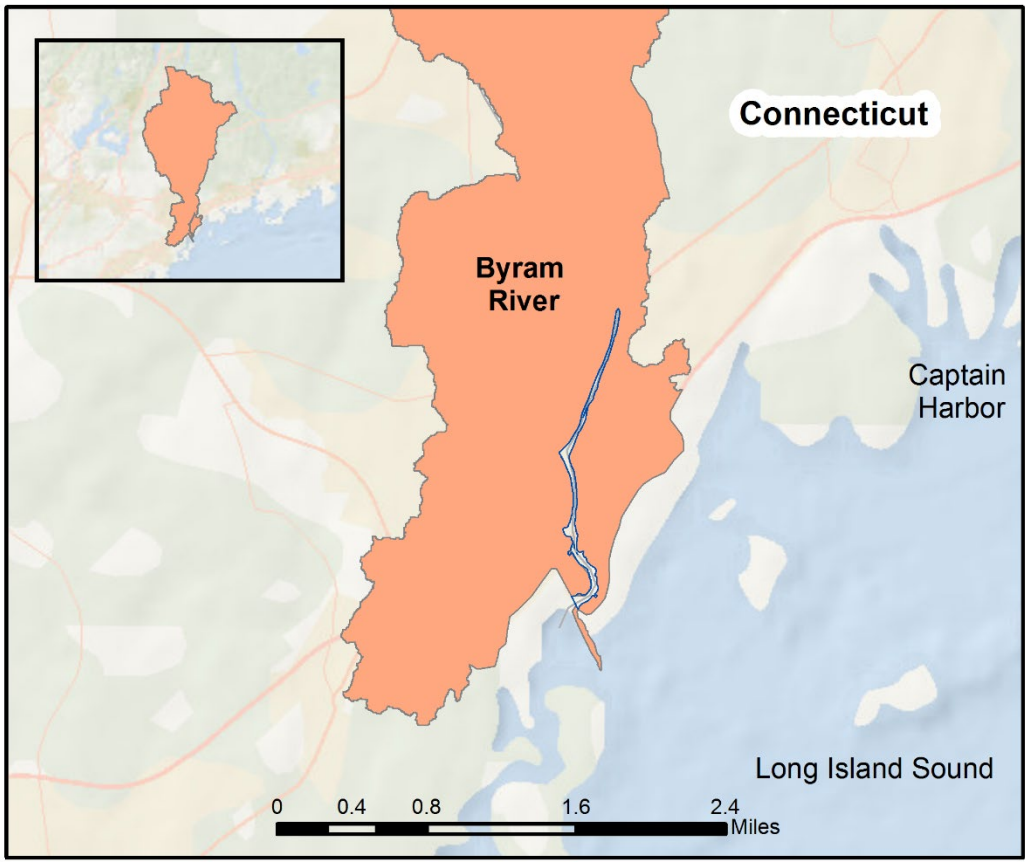

Figure D–30. Byram River, CT and NY Embayment. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

D.26 New Haven Harbor, CT

Water quality monitoring data were available for the New Haven Harbor embayment from 2 monitoring organizations corresponding to 2 monitoring stations and 24 samples from 2006. Data were provided by CTDEEP (18 samples) and EPA NCCA (6 samples).

Figure D–31 shows all monitoring station locations within and around the New Haven Harbor embayment. Table D–31 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–31 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–31, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

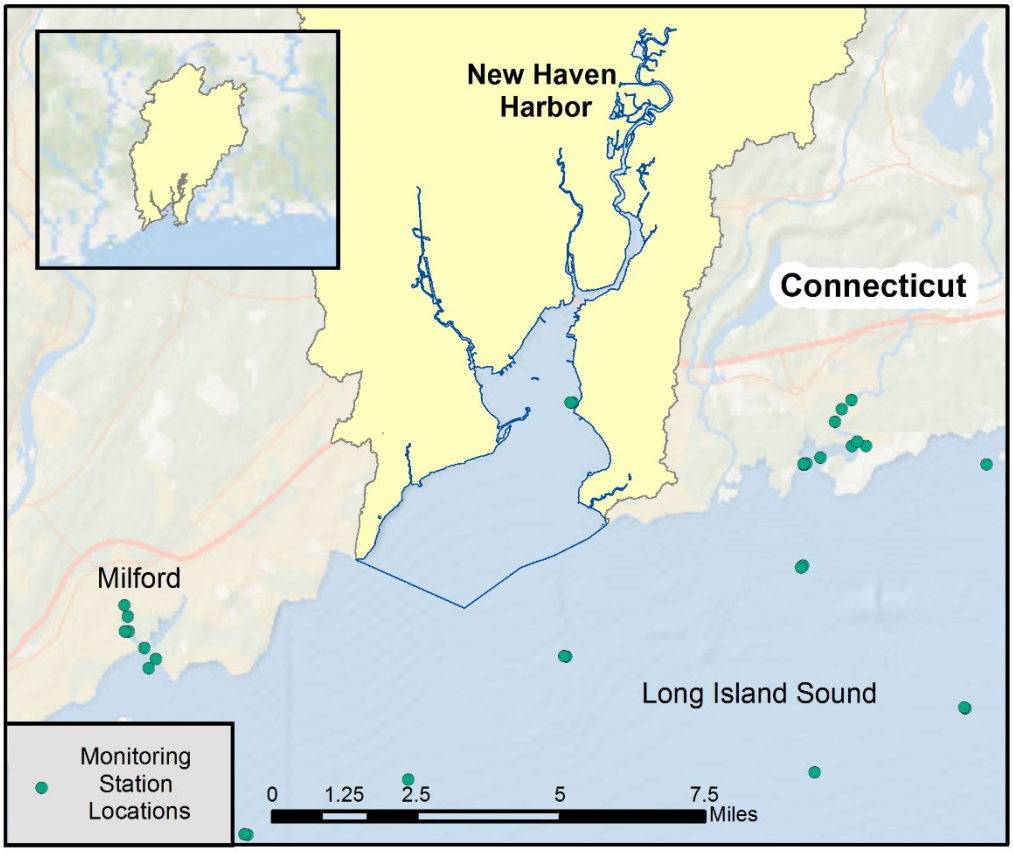

Figure D–31. New Haven Harbor, CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–31. Parameter Counts of Stations and Samples for New Haven Harbor, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2006	1	1	0	0	1	0.02	0.02	0.02
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006	2	2	0	1	1	0.05	0.05	0.05
NH3_mgL	Ammonia–nitrogen [mg/L]	2006	1	1	0	1	0	0.00	0.00	0.00
NO23_mgL	Nitrate + nitrite [mg/L]	2006	1	1	0	1	0	0.02	0.02	0.02
PN_mgL	Particulate nitrogen [mg/L]	2006	1	1	0	1	0	0.19	0.19	0.19
PP_mgL	Particulate phosphorus [mg/L]	2006	1	1	0	1	0	0.03	0.03	0.03
TDN_mgL	Total dissolved nitrogen [mg/L]	2006	1	1	0	1	0	0.22	0.22	0.22
TDP_mgL	Total dissolved phosphorus [mg/L]	2006	1	1	0	1	0	0.07	0.07	0.07
TN_mgL	Total nitrogen [mg/L]	2006	2	2	0	1	1	0.41	0.41	0.41
TP_mgL	Total phosphorus [mg/L]	2006	2	2	0	1	1	0.10	0.10	0.10
Response Parameters										
CHLA_ugL	Chl *a* pheophytin free [ug/L]	2006	2	2	0	1	1	14.12	14.12	14.12
do_mgL	Dissolved oxygen [mg/L]	2006	1	1	0	1	0	9.41	9.41	9.41
Physical Parameters										
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2006	1	1	0	1	0	1.60	1.60	1.60
DOC_mgL	Dissolved organic carbon [mg/L]	2006	1	1	0	1	0	3.48	3.48	3.48
PC_mgL	Particulate carbon [mg/L]	2006	1	1	0	1	0	1.09	1.09	1.09
salinity_ppt	Salinity [ppt]	2006	1	1	0	1	0	25.34	25.34	25.34
Si_mgL	Dissolved silica [mg/L]	2006	1	1	0	1	0	0.76	0.76	0.76
temp_C	Temperature [deg C]	2006	1	1	0	1	0	21.32	21.32	21.32
TSS_mgL	Total suspended solids [mg/L]	2006	2	2	0	1	1	12.50	12.50	12.50
Total		**2006**	**2**	**24**	**0**	**18**	**6**			

D.27 Little Narragansett Bay, CT and RI

Water quality monitoring data were available for the Little Narragansett Bay embayment from 2 monitoring organizations corresponding to 13 monitoring stations and 1,686 samples from 2008–2015. Data were provided by URIWW (1,311 samples) and University of Connecticut (Vaudrey) (375 samples).

Figure D–32 shows all monitoring station locations within and around the Little Narragansett Bay embayment. Table D–32 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–32 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–32, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

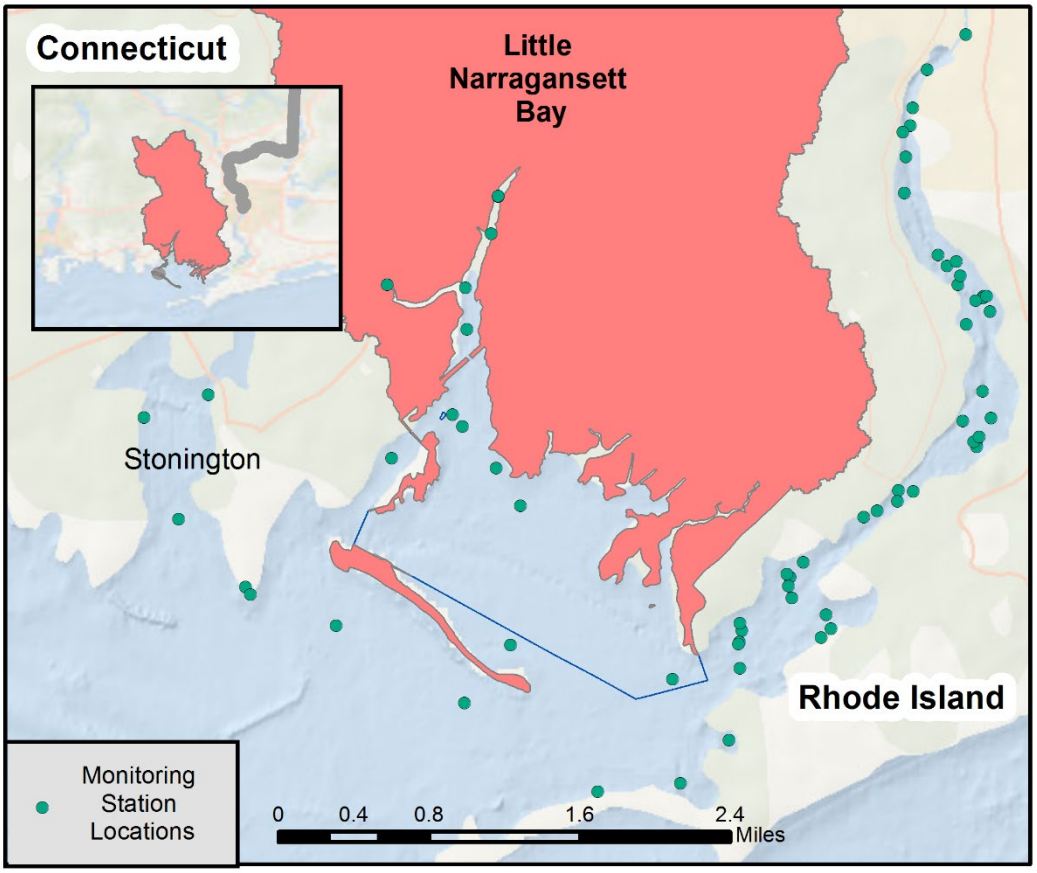

Figure D–32. Little Narragansett Bay, CT and RI Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–32. Parameter Counts of Stations and Samples for Little Narragansett Bay, CT and RI Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIP_mgL	Dissolved Inorganic Phosphorus [mg/L]	2008–2015	5	83	6	0	77	0.004	0.03	0.02
NH3_mgL	Ammonia-nitrogen [mg/L]	2008–2015	5	109	6	0	103	0.01	0.07	0.04
NO23_mgL	Nitrate + Nitrite [mg/L]	2008–2015	5	110	6	0	104	0.01	0.06	0.01
PN_mgL	Particulate Nitrogen [mg/L]	2013–2014	6	23	2	0	21	0.09	0.41	0.16
PO4_mgL	Phosphate-P [mg/L]	2013–2014	8	27	2	0	25	0.01	0.02	0.01
TDN_mgL	Total Dissolved Nitrogen [mg/L]	2013–2014	6	23	2	0	21	0.16	0.40	0.24
TN_mgL	Total Nitrogen [mg/L]	2008–2015	11	132	8	0	124	0.26	0.78	0.40
TP_mgL	Total Phosphorus [mg/L]	2008–2015	5	109	6	0	103	0.02	0.10	0.04
Response Parameters										
CHLAC_ugL	Chlorophyll a, pheophytin free [ug/L]	2008–2015	10	165	2	0	163	2.00	19.36	5.40
do_mgL	Dissolved oxygen [mg/L]	2008–2015	12	219	20	16	183	3.37	7.82	6.32
do_perc	Dissolved oxygen [% saturation]	2013–2014	8	48	16	16	16	40.66	94.43	77.40
Kd	Kd [m-1], computed from 1-5m Photosynthetically Active Radiation data	2013–2014	3	6	0	0	6	0.42	1.10	0.81
Macroalgae_gm2	Total macrophyte dry weight [g m-2]	2013–2014	5	10	0	0	10	30.72	1068.08	133.31
Macrophyte_DW_gm2	Total Macroalgae [g m-2]	2013–2014	5	10	0	0	10	30.72	1064.32	133.31
Seagrass_gm2	Seagrass [g m-2]	2013–2014	5	10	0	0	10	0.00	0.00	0.00
secchi_m	Secchi depth [m]	2008–2014	2	73	0	0	73	1.00	1.80	1.31
Physical Parameters										
pH	pH	2008–2015	12	111	14	8	89	7.48	8.10	7.95
salinity_ppt	Salinity [ppt]	2008–2015	12	184	27	16	141	23.68	32.00	29.38
temp_C	Temperature [deg C]	2008–2015	12	220	20	16	184	14.49	25.64	21.13
TSS_mgL	Total Suspended Solids [mg/L]	2013–2014	6	14	3	0	11	1.70	7.03	3.72
Total		**2008–2015**	**13**	**1,686**	**140**	**72**	**1,474**			

[a] Chl *a* values are not based on paired samples of uncorrected and pheophytin free chl *a*; therefore, the values cannot be compared. Pheophytin free versus uncorrected chl *a* samples were collected at different sample locations (surface versus bottom) and times.

D.28 Housatonic River, MA and CT

Water quality monitoring data were available for the Housatonic River embayment from 1 monitoring organizations corresponding to 6 monitoring stations and 504 samples from 2019. Data were provided by EPA OEP.

Figure D–33 shows the Housatonic River embayment. Table D-33 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D-33is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used data from other embayments and open water. Refer to Subtasks F and G for additional information.

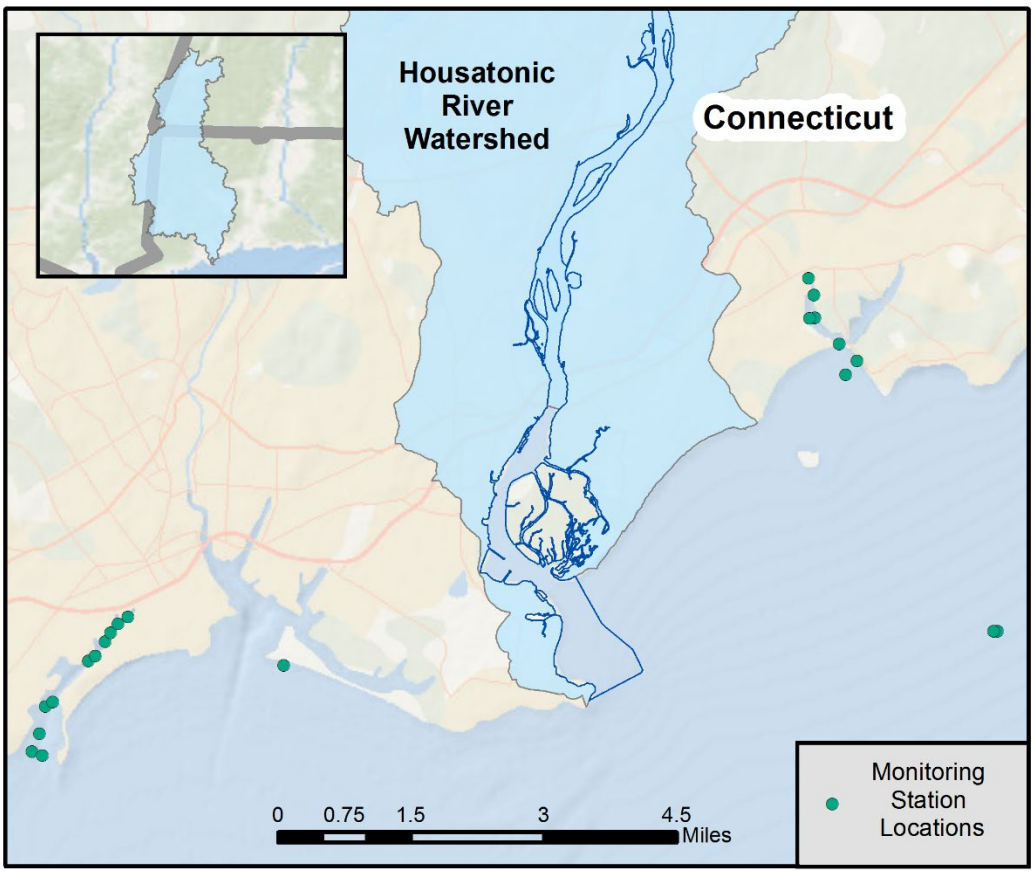

Figure D–33. Housatonic River, MA and CT Embayment and Nearby Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–33. Parameter Counts of Stations and Samples for Housatonic River, MA and CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
NH3_mgL	Ammonia–nitrogen [mg/L]	2019	6	36	0	0	36	0.03	0.12	0.03
NO23_mgL	Nitrate + nitrite [mg/L]	2019	6	36	0	0	36	0.06	0.42	0.31
TN_mgL	Total nitrogen [mg/L]	2019	6	36	0	0	36	0.32	0.77	0.56
TP_mgL	Total phosphorus [mg/L]	2019	6	36	0	0	36	0.03	0.09	0.06
Response Parameters										
CHLA_ugL	Chl *a* pheophytin free [ug/L]	2019	6	72	0	0	72	1.40	15.9	4.20
CHLA_rfu	Chl *a* [rfu]	2019	6	36	0	0	36	0.39	2.93	0.93
do_mgL	Dissolved oxygen [mg/L]	2019	6	36	0	0	36	5.65	9.44	7.58
do_perc	Dissolved oxygen [% saturation]	2019	6	36	0	0	36	71.60	98.20	84.20
Physical Parameters										
pH	pH	2019	6	36	0	0	36	7.56	7.93	7.72
salinity_ppt	Salinity [ppt]	2019	6	36	0	0	36	0.53	18.68	5.73
cond_µScm	Conductivity [µS/cm]	2019	6	36	0	0	36	871	30,157	10,058
temp_C	Temperature [deg C]	2019	6	36	0	0	36	15.02	25.30	19.85
TSS_mgL	Total suspended solids [mg/L]	2019	6	36	0	0	36	4.55	9.50	6.25
Total		**2019**	**6**	**504**	**0**	**0**	**504**			

D.29 Thames River, CT

Water quality monitoring data were available for the Thames River embayment from 2 monitoring organizations corresponding to 3 monitoring stations and 45 samples from 2006–2010. Data were provided by CTDEEP from 2006 (15 samples) and EPA NCCA from 2006–2010 (30 samples).

Figure D–34 shows all monitoring station locations within and around the Thames River embayment. Table D–32 summarizes by parameter the data collection period for which data were available, the number of stations, and the number of samples, by both total and depth (bottom, middle, or surface). Table D–32 is organized by all available parameters (nutrient, response, and other physical) for this embayment.

To determine protective target concentrations for this embayment, as described in Subtasks F and G, Tetra Tech used a subset of the available paired data from Table D–32, as well as additional data from other embayments and open water. Refer to Subtasks F and G for additional information.

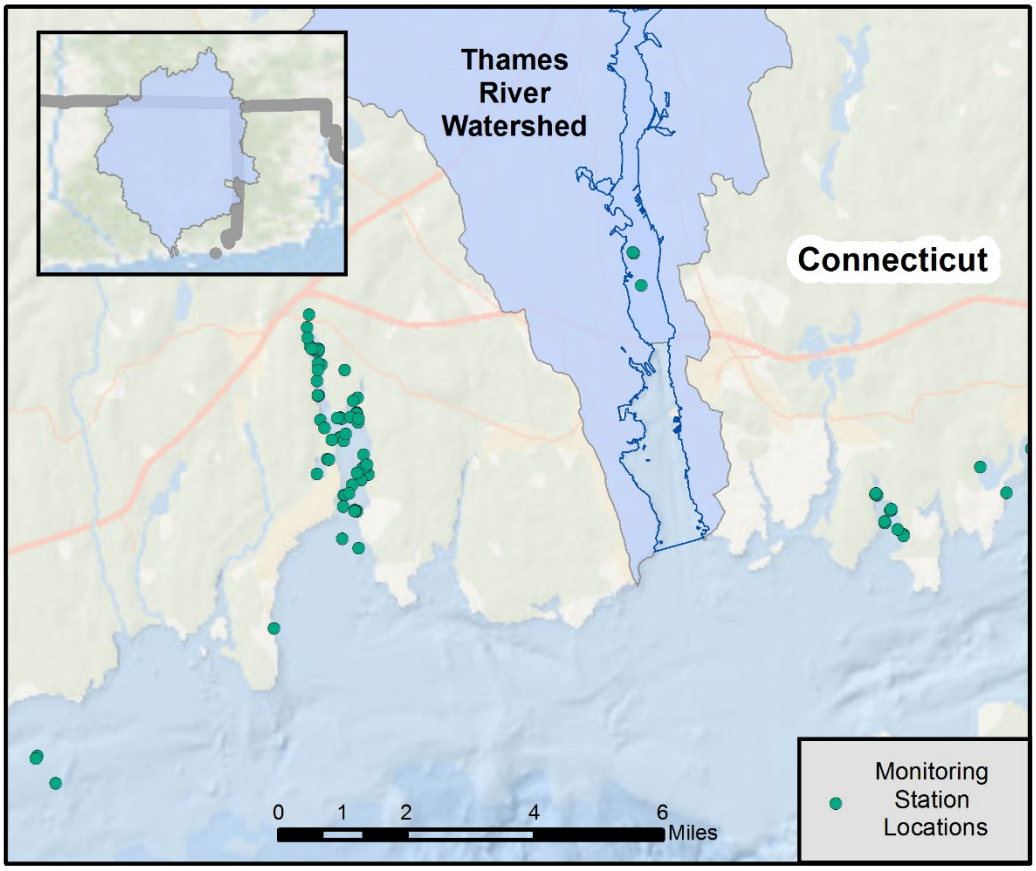

Figure D–34. Thames River, CT Embayment and Water Quality Monitoring Station Locations. Watershed Boundaries are Those Delineated by Dr. Jamie Vaudrey (University of Connecticut).

Table D–34. Parameter Counts of Stations and Samples for Thames River, CT Embayment

Parameter Name in Database	Parameter Description	Data Collection Period	# of Stations	# of Samples	# of Samples by Depth			Values		
					Bottom	Middle	Surface	10th Percentile	90th Percentile	Median
Nutrient Parameters										
DIN_mgL	Dissolved inorganic nitrogen [mg/L]	2006–2010	2	2	0	0	2	0.05	0.08	0.06
DIP_mgL	Dissolved inorganic phosphorus [mg/L]	2006–2010	3	3	0	1	2	0.03	0.04	0.04
NH3_mgL	Ammonia–nitrogen [mg/L]	2006–2010	3	3	0	1	2	0.03	0.03	0.03
NO2_mgL	Nitrite [mg/L]	2010	1	1	0	0	1	0.01	0.01	0.01
NO23_mgL	Nitrate + nitrite [mg/L]	2006–2010	2	2	0	1	1	0.02	0.07	0.05
NO3_mgL	Nitrate [mg/L]	2010	1	1	0	0	1	0.01	0.01	0.01
PN_mgL	Particulate nitrogen [mg/L]	2006	1	1	0	1	0	0.07	0.07	0.07
PP_mgL	Particulate phosphorus [mg/L]	2006	1	1	0	1	0	0.01	0.01	0.01
TDN_mgL	Total dissolved nitrogen [mg/L]	2006	1	1	0	1	0	0.25	0.25	0.25
TDP_mgL	Total dissolved phosphorus [mg/L]	2006	1	1	0	1	0	0.04	0.04	0.04
TN_mgL	Total nitrogen [mg/L]	2006–2010	3	3	0	1	2	0.31	0.32	0.32
TP_mgL	Total phosphorus [mg/L]	2006–2010	3	3	0	1	2	0.05	0.06	0.05
Response Parameters										
CHLA_ugL	Chl *a pheophytin free* [ug/L]	2006–2010	3	3	0	1	2	6.29	10.24	10.24
do_mgL	Dissolved oxygen [mg/L]	2010	1	2	1	0	1	5.91	6.35	6.13
Kd	Kd [m–1], computed from 1–5m photosynthetically active radiation data	2010	1	1	0	0	1	0.52	0.52	0.52
PAR_AMB_umol m2s	Ambient photosynthetically active radiation [umol/m2/s]	2010	1	2	1	0	1	481.62	641.74	561.68
PAR_UW_umol m2s	Underwater photosynthetically active radiation [umol/m2/s]	2010	1	2	1	0	1	39.76	150.64	95.20
secchi_m	Secchi depth [m]	2010	1	1	0	0	1	1.90	1.90	1.90
Physical Parameters										
BiSi_mgL	Biogenic silica, polycarbonate filter digestion [mg/L]	2006	1	1	0	1	0	0.41	0.41	0.41
DOC_mgL	Dissolved organic carbon [mg/L]	2006	1	1	0	1	0	3.24	3.24	3.24
PC_mgL	Particulate carbon [mg/L]	2006	1	1	0	1	0	0.50	0.50	0.50
pH	pH	2010	1	2	1	0	1	7.90	7.94	7.92
salinity_ppt	Salinity [ppt]	2010	1	2	1	0	1	27.80	28.56	28.18
Si_mgL	Dissolved silica [mg/L]	2006	1	1	0	1	0	2.05	2.05	2.05
temp_C	Temperature [deg C]	2010	1	2	1	0	1	20.44	20.72	20.58
TSS_mgL	Total suspended solids [mg/L]	2006	2	2	0	1	1	3.50	3.50	3.50
Total		**2006–2010**	**3**	**45**	**6**	**15**	**24**			

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Tetra Tech. 2017. *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*. Prepared for U.S. Environmental Protection Agency Region 1 by Tetra Tech, Inc., Fairfax, VA.

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Appendix D: LIS Water Quality Data

See Excel file.