CT DEEP NUTRIENT MANAGEMENT & EELGRASS TARGETS

Presentation to the LIS Eelgrass Collaborative
June 12, 2024

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Bureau of Water Protection and Land Reuse
Water Planning and Management Division

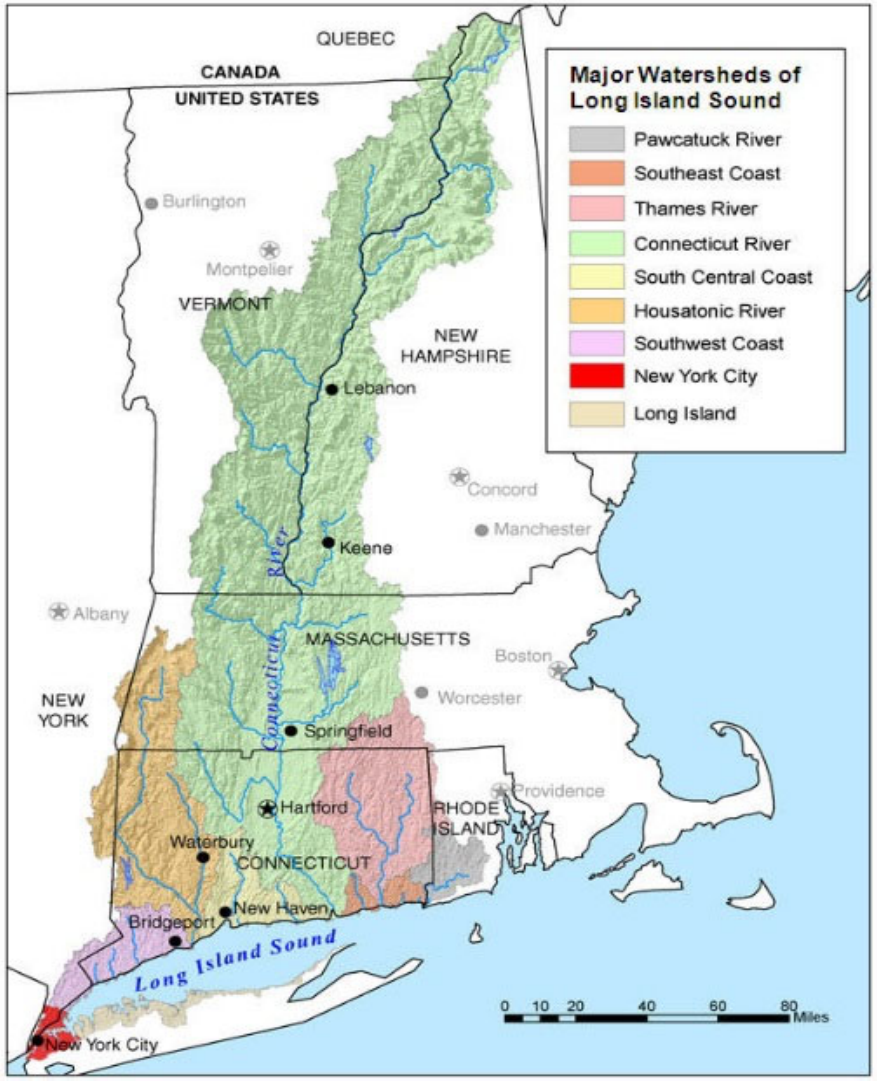
PRESENTATION AGENDA

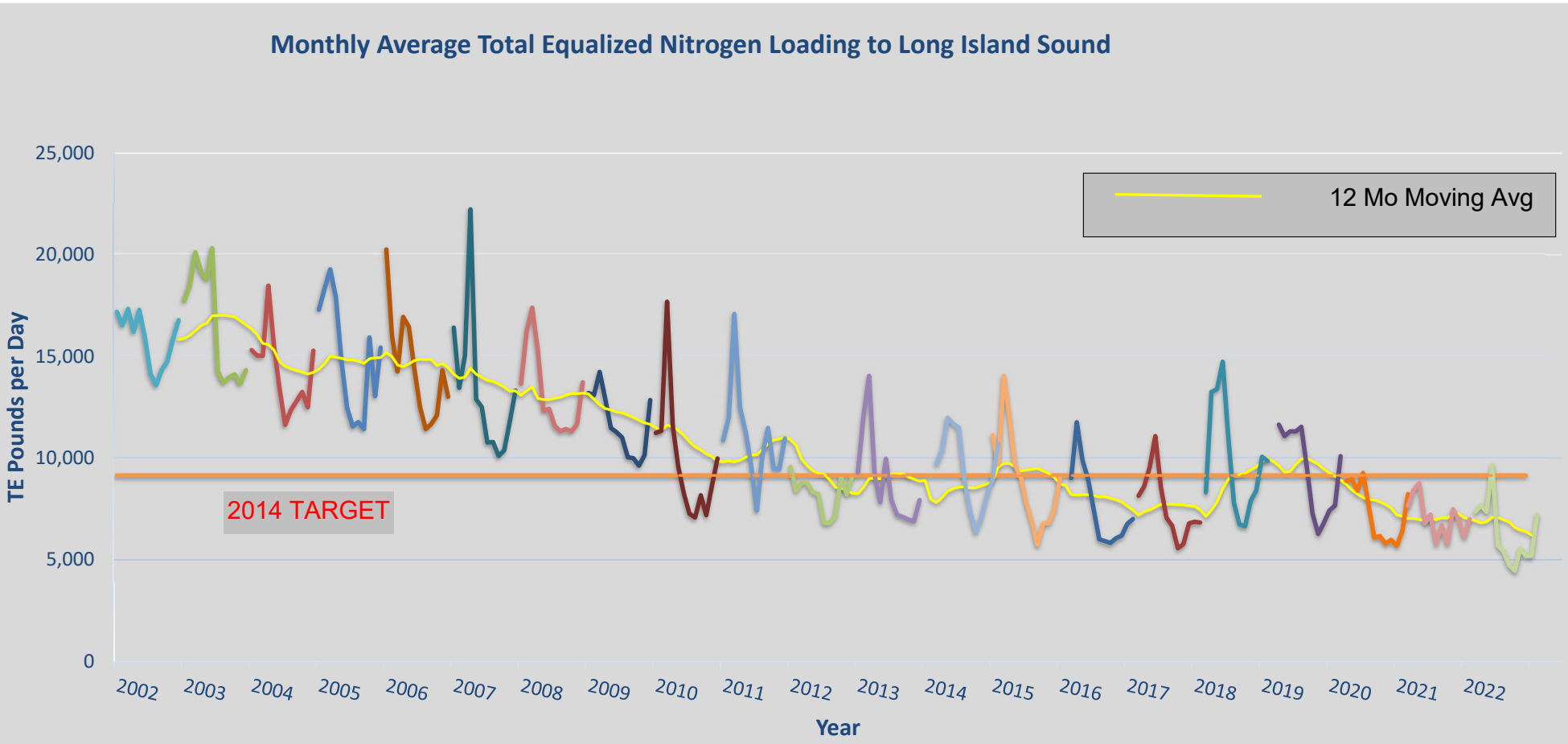
- **Nutrient Management Efforts for LIS and Embayments (Kelly)**
  - Total Maximum Daily Load (TMDL) with Corresponding WWTP Nitrogen Reductions
  - Second-Generation Nitrogen Strategy

- **Water Quality Targets for Embayments (Traci)**
  - Narrative and Numeric Standards
  - Approach to Relate Embayment WQ Targets to Nutrient Concentrations and Loads
  - Water Quality Planning

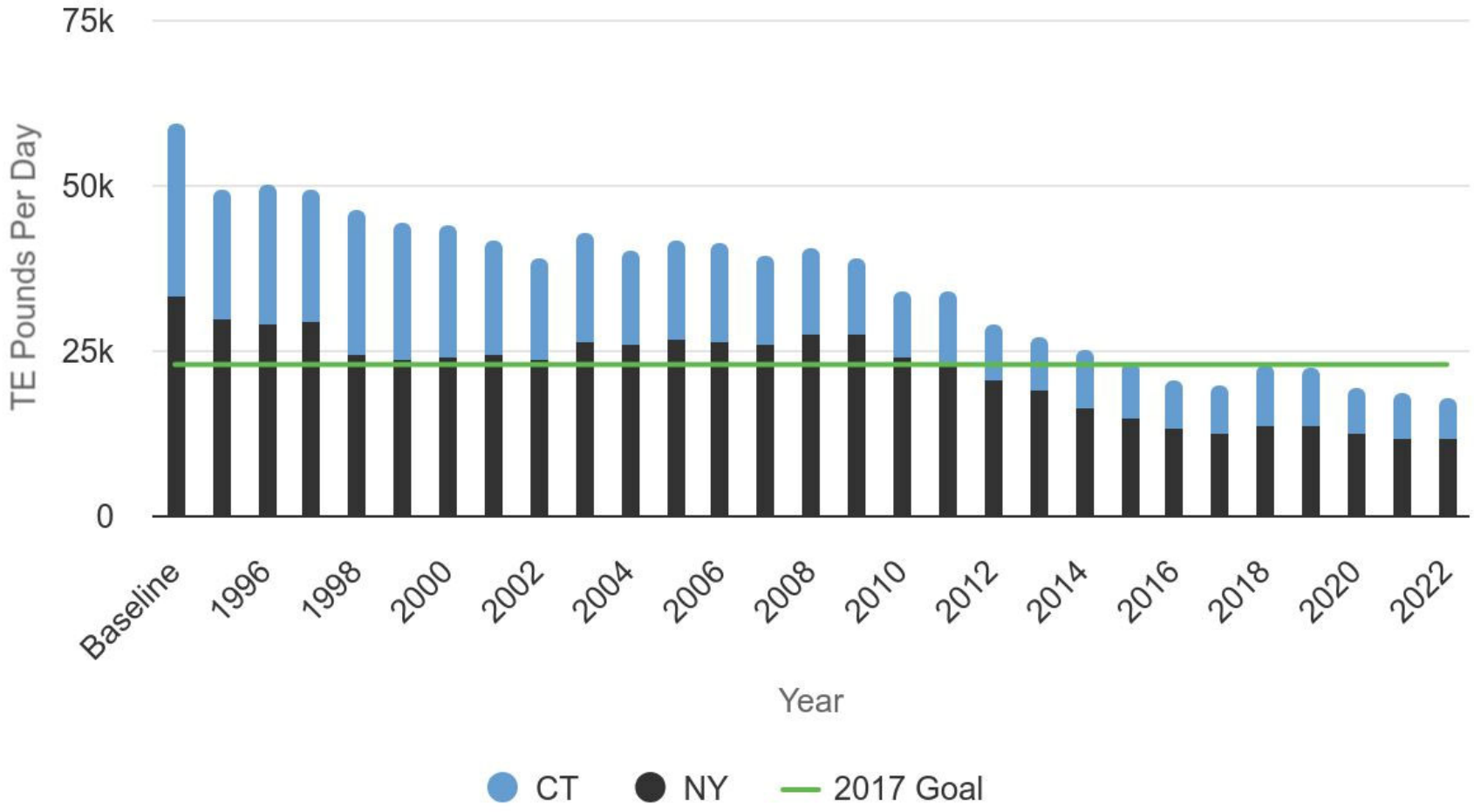
NITROGEN TMDL TO MEET DO STANDARDS IN LIS

- **58.5% Reduction in Total Point Source Nitrogen Loading**
- **25% Aggregate WWTP Reductions for Upstream States (MA, NH, VT)**
- **10% Reduction in NPS (across watershed)**
- **18% reduction Atmospheric NOx expected (CAA)**

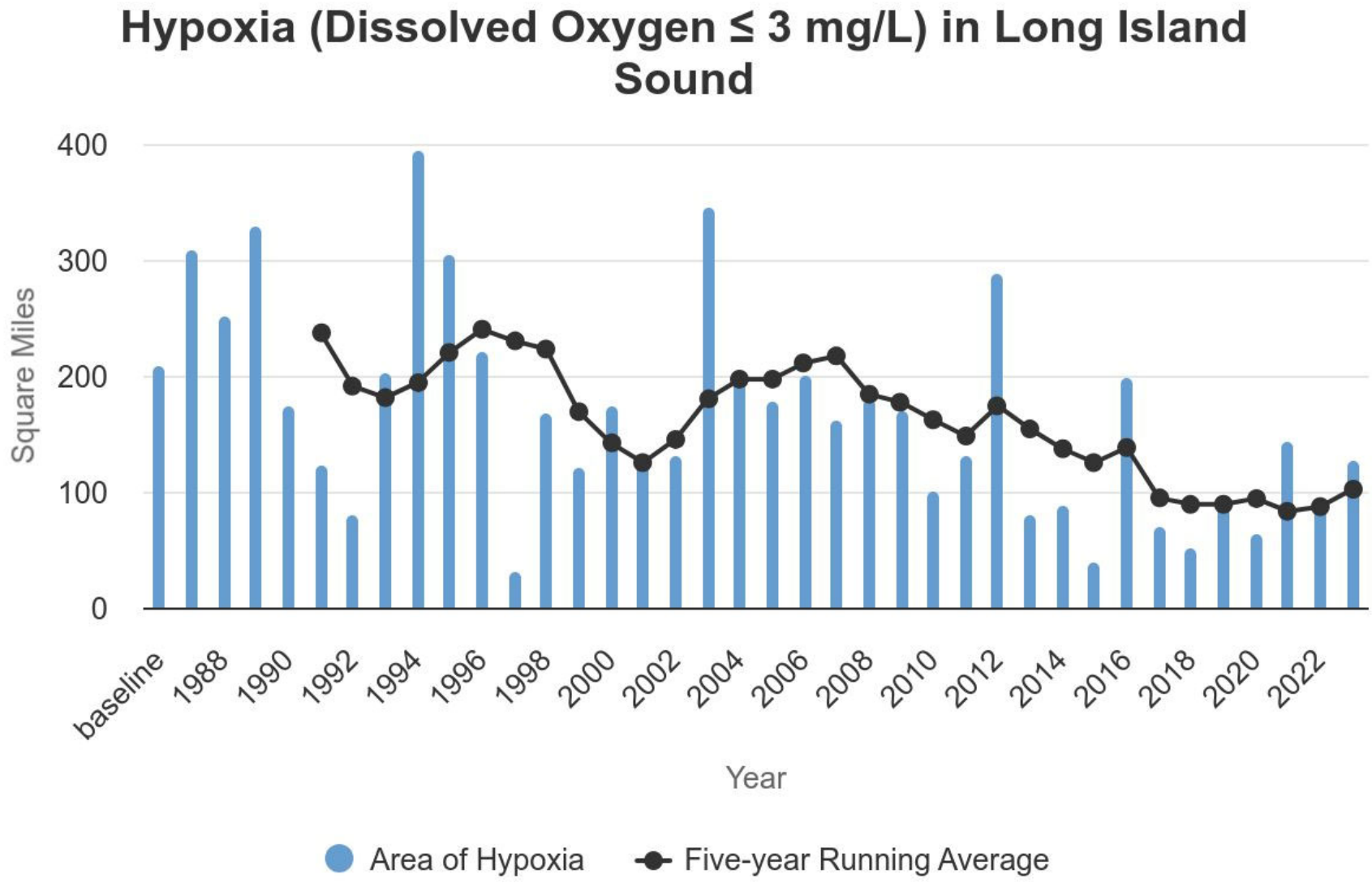



Monthly Average Total Equalized Nitrogen Loading to Long Island Sound
25,000
20,000
15,000
10,000
5,000
0
TE Pounds per Day
12 Mo Moving Avg
2014 TARGET
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year

Wastewater Treatment Plant Point Sources-Nitrogen Trade Equalized (TE) Loads, 1995-2022



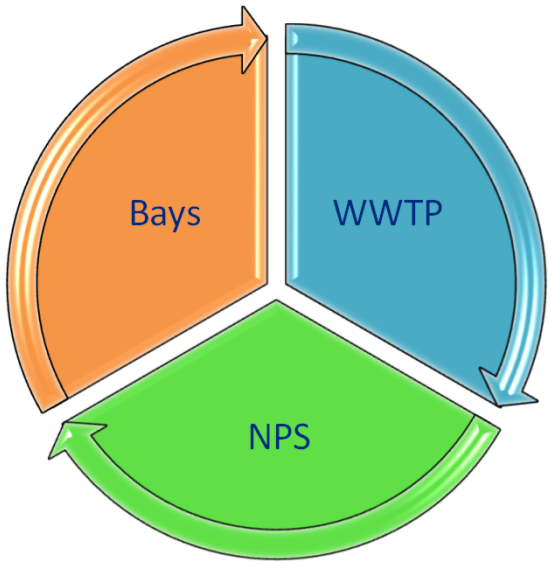
Source: https://longislandsoundstudy.net/ecosystem-target-indicators/nitrogen-loading/



Source: https://longislandsoundstudy.net/ecosystem-target-indicators/lis-hypoxia/

SECOND-GENERATION NITROGEN STRATEGY

1) Wastewater Treatment Plants
   - Complete new planned upgrades
   - Continue to operate trading program
2) Non-Point Sources and Reg Stormwater
   - Enhancements to regulatory and non-regulatory actions
3) Embayments
   - Outreach and Education
   - Prioritize embayments for analysis and TMDLs (or alternative action plans)
   - Study to assess OWTS nitrogen loading in Coastal watersheds



WASTEWATER TREATMENT PLANTS

❖**Continue to operate the Nitrogen Control Program for Long Island Sound**

- Re-Issued the GP for nitrogen discharges applicable to 78 wastewater treatment plants (1/1/2024 – 12/31/2029)
- Continue the Nitrogen Credit Trading Program
- Additional Nitrogen Reductions at WWTPs ~350 TE lbs./year since 2016 - 2022

❖***Phosphorus reductions at ~43 WWTPs*** *(non-tidal)*

Mattabaseett District Water Pollution Control Facility

NON-POINT SOURCE - AGRICULTURE

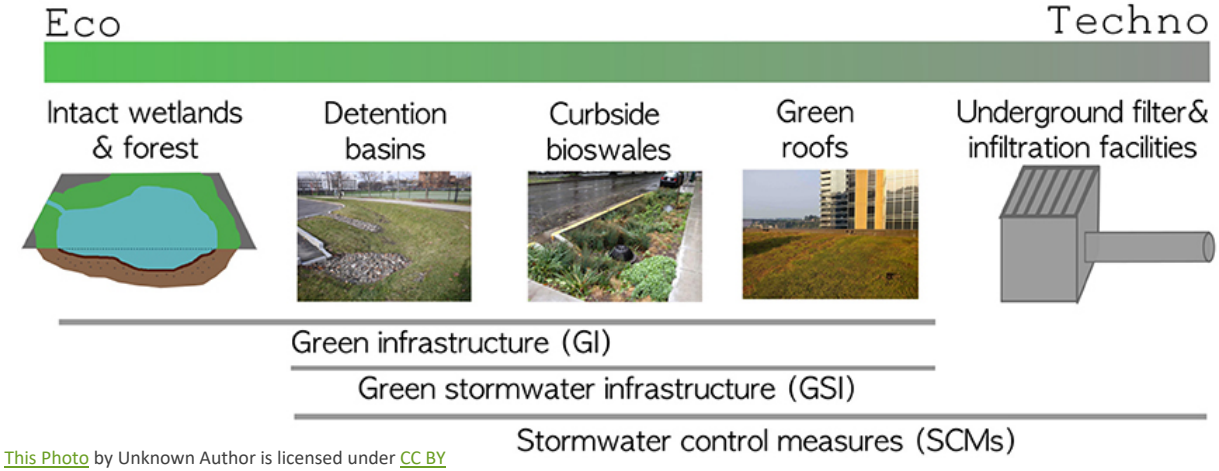
- **Issued CAFO* General Permit (1/1/23)**
- **Provide funds to eligible projects (Section 319)**
- **NRCS Coordination**
  - Continue Review of Nutrient Management Plans
  - Participate in the National Water Quality Initiative (NWQI)

*CAFO = Concentrated Animal Feeding Operations

STORMWATER MANAGEMENT

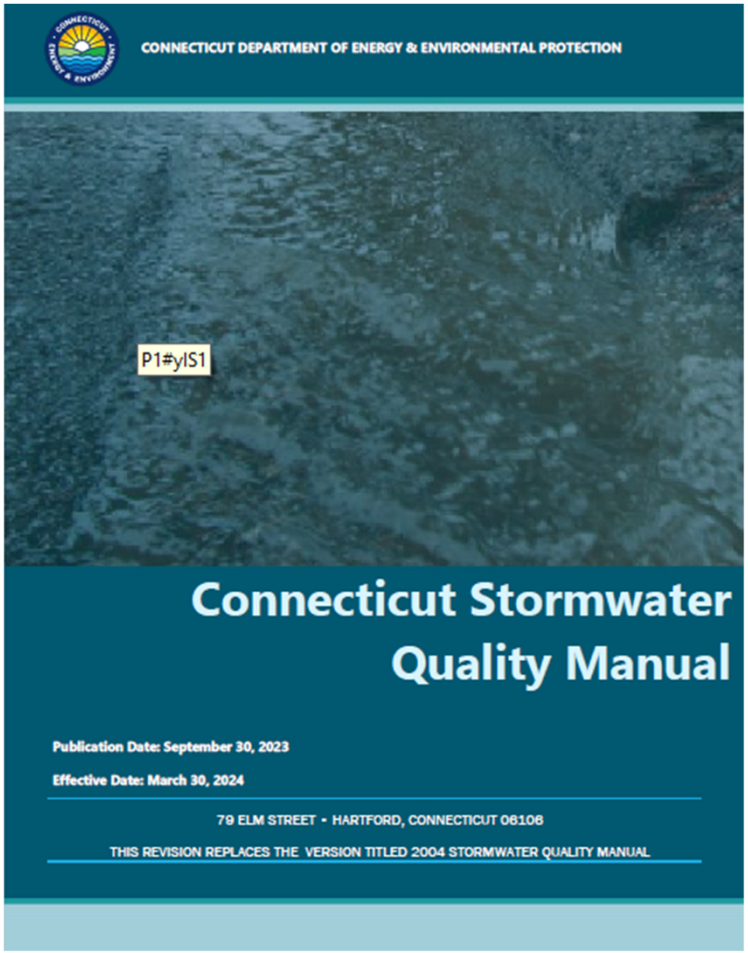
- **Enhanced the MS4* General Permit (2015)**
  - Included expanded coverage, conditions for runoff reduction and LID, and practices to address POCs including nitrogen (TMDLs and impaired waters),
  - Circuit rider to UConn CLEAR to provide outreach and technical support
  - Re-Issued MS4 General Permit (Exp. 9/30/25)
- **Issued DOT Stormwater General Permit (1/1/19)**
- **Developed support resources for MS4 communities**

*MS4 = Municipal Separate Storm Sewer System



STORMWATER MANAGEMENT

- **Revised the 2004 Stormwater Quality Manual & 2002 Erosion and Sediment Control Guidelines (3/30/24)**
  - Improved consistency between the two documents (construction-phase and post-construction stormwater mgt.)
  - Updated information on Stormwater Structural BMPs
  - Improved consistency with CT DEEP stormwater general permit programs (post-construction stormwater mgt.)
  - Incorporated climate change and resilience considerations
  - Enhanced the usability of the manual



EMBAYMENTS

- Outreach and Education
  - **Project with UConn CLEAR to Communicate**
    - Eutrophication Susceptibility Study Results (Vaudrey et al. 2016)
    - Sources of Nitrogen and Best Management Practices
    - Solicited input for local level actions
- Onsite Wastewater Treatment Systems
  - **Continue Sewer Connections and Decentralized Projects**
  - **Conduct Onsite Wastewater Treatment System Study**
    - Inventory OWTS located in the lower half of Connecticut
    - Develop a nitrogen loading model for discharges from OWTS to groundwater
    - Visualize data within the model boundary and at the HUC12 level
    - Currently ground-truthing is underway

EMBAYMENTS

Prioritized Embayments

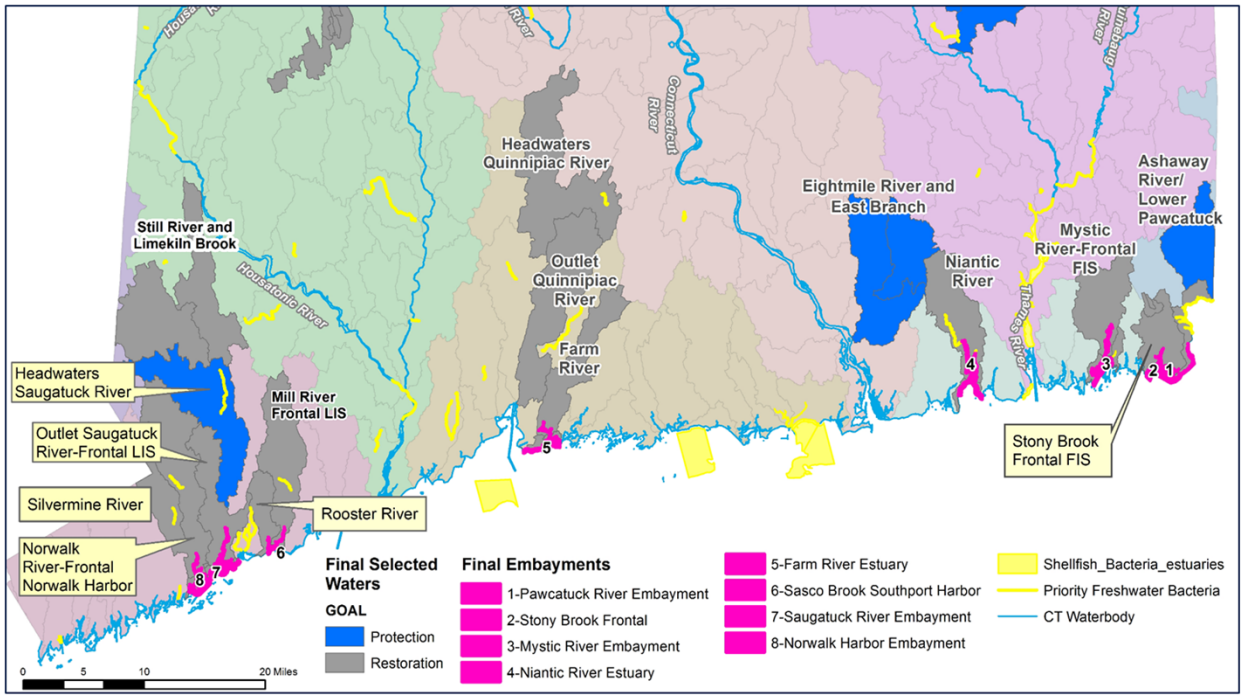
Integrated Water Planning Mgt.

Analysis

- Data Collection
- Modeling (Statewide & Bay Specific)

Develop Action Plans

- TMDLs
- Mitigation Plans

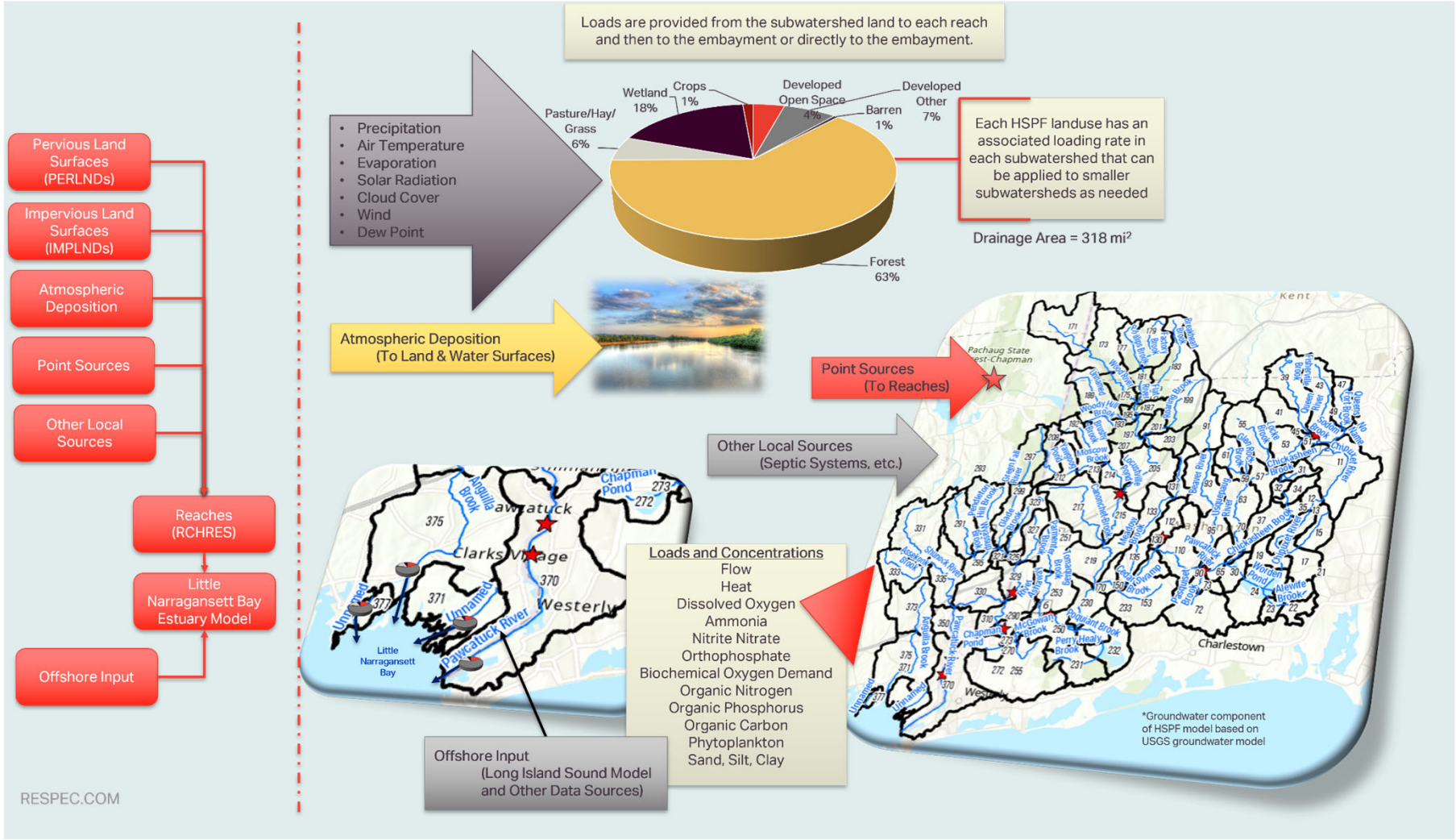


Integrated Water Planning Management 2

The new 10-year planning period spans from October 2022 through September 2032. IWPM 2 will entail the same general process as IWPM 1. CTDEEP is recommending refining the topics that were outlined in IWPM 1 with a robust emphasis on Environmental Justice and Climate Change and recommending no new topics for IWMP 2.

https://portal.ct.gov/DEEP/Water/Water-Quality/Integrated-Water-Planning-Management-Phase-2

EMBAYMENTS

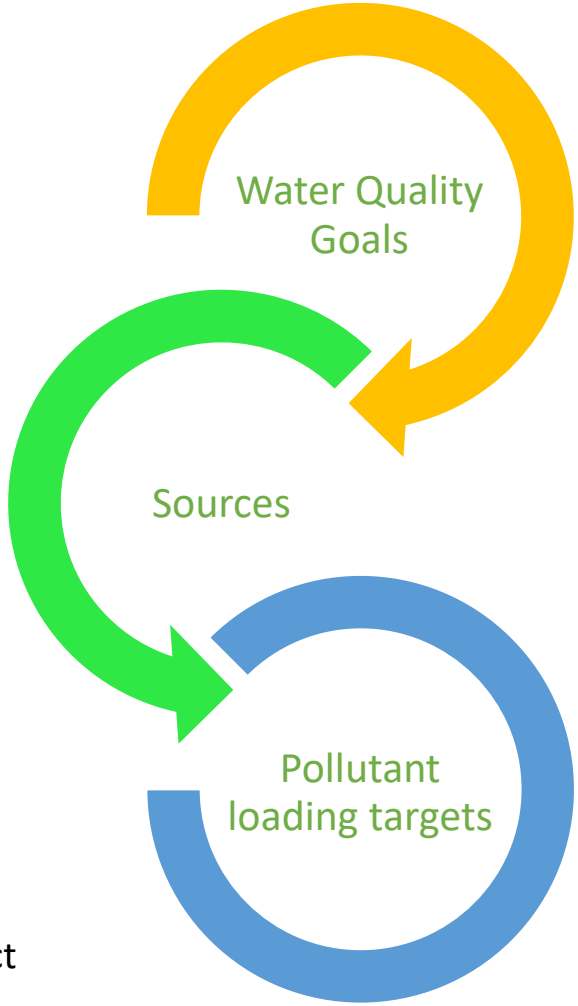

Loads are provided from the subwatershed land to each reach and then to the embayment or directly to the embayment.
Pervious Land Surfaces (PERLNDs)
Impervious Land Surfaces (IMPLNDs)
Atmospheric Deposition
Point Sources
Other Local Sources
Reaches (RCHRES)
Little Narragansett Bay Estuary Model
Offshore Input
Precipitation
Air Temperature
Evaporation
Solar Radiation
Cloud Cover
Wind
Dew Point
Wetland 18%
Crops 1%
Developed Open Space 4%
Developed Other 7%
Barren 1%
Pasture/Hay/ Grass 6%
Forest 63%
Each HSPF landuse has an associated loading rate in each subwatershed that can be applied to smaller subwatersheds as needed
Drainage Area = 318 mi²
Atmospheric Deposition (To Land & Water Surfaces)
Point Sources (To Reaches)
Other Local Sources (Septic Systems, etc.)
Loads and Concentrations
Flow
Heat
Dissolved Oxygen
Ammonia
Nitrite Nitrate
Orthophosphate
Biochemical Oxygen Demand
Organic Nitrogen
Organic Phosphorus
Organic Carbon
Phytoplankton
Sand, Silt, Clay
Offshore Input (Long Island Sound Model and Other Data Sources)
Little Narragansett Bay
Pawcatuck River
Charlestown
*Groundwater component of HSPF model based on USGS groundwater model
RESPEC.COM

Setting Water Quality Targets for Embayments "Preliminary Considerations"

The following slides include preliminary information that CT DEEP is considering to set water quality targets for embayments. This information is subject to change.

Water Quality Planning to Restore & Protect Water Quality

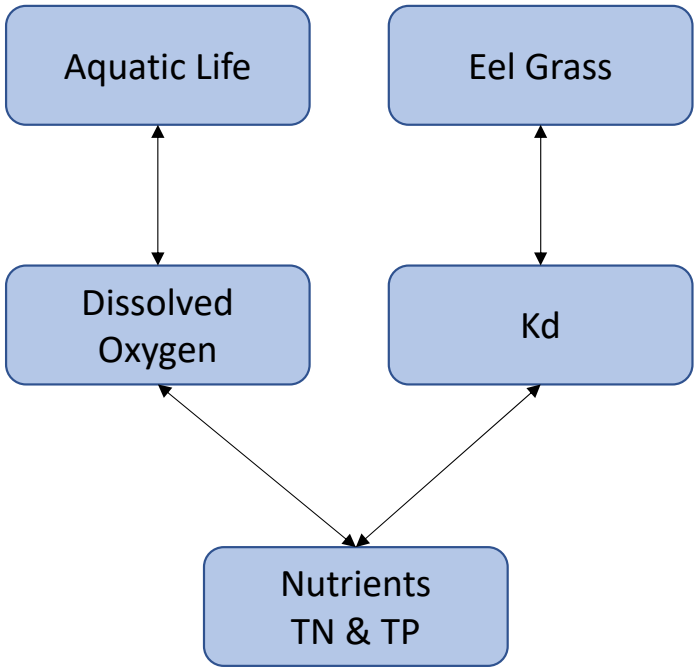
- A Water Quality Action Plan is a structured scientific evaluation of the water quality conditions within a water body
- It can be designed either to restore or protect water quality
- It links water quality goals to point & nonpoint sources that can affect water quality
- It identifies pollutant loadings needed to achieve goals
- TMDL* is a common type of WQ Action Plan



*TMDL : Total Maximum Daily Load Analysis included in the federal Clean Water Act

Applicable Water Quality Standards Provisions

- Coastal Marine Waters
  - Water Quality Classes SA and SB
  - Applicable Designated Use: Habitat for marine fish, other aquatic life & wildlife
- Nutrient Related WQ Standards & Criteria
  - Dissolved Oxygen Criteria
  - Biological Condition Narrative Criteria
  - Turbidity
  - Nutrient Narrative Criteria
  - Natural Conditions Standards



CT Dissolved Oxygen Water Quality Criteria

For Discrete Data:

- Calculate a decimal fraction for each range
  - Cumulative Fraction of Daily data = # fractional days in range / 30 days
  - Compare Cumulative Fraction with # Days Allowed

For Continuous Data:

Can be calculated using a 0.1 mg/l range

$DOi = 13.0 / (2.80 + 1.84e^{-0.10t_i})$

where:

DOi = allowable DO concentration (mg/l)
t_i = exposure interval duration in days
i = exposure interval

Numeric Water Quality Criteria

Table A. Dissolved Oxygen Chronic Cumulative Exposure Criteria for incremental ranges (0.5 mg/l and 0.3 mg/l) applicable to Class SA and SB waters.

DO Range (mg/l)		No. of Days Allowed
<4.8	≥ 4.5	30
<4.5	≥ 4.0	14
<4.0	≥ 3.5	7
<3.5	≥ 3.0	2

Light Availability

- Translation of Narrative Biological Conditions Standards
- Biological Condition
  - Water quality sufficient to support sustainable, diverse biological communities that may have some changes from natural conditions but have minimal changes in ecosystem function
- Turbidity
  - As associated with natural conditions and resulting from human activity provided appropriate treatment or Best Management Practices are used for control

Data and Approach Taken From EPA Nitrogen Strategy Subtasks Memos: Subtasks F/G Summary of Empirical Modeling & Nitrogen Target Concentrations October 1, 2020

Light Attenuation in Areas Suitable for Eel Grass

Amount of Surface lights required at Eel Grass Colonization Depth: 22%

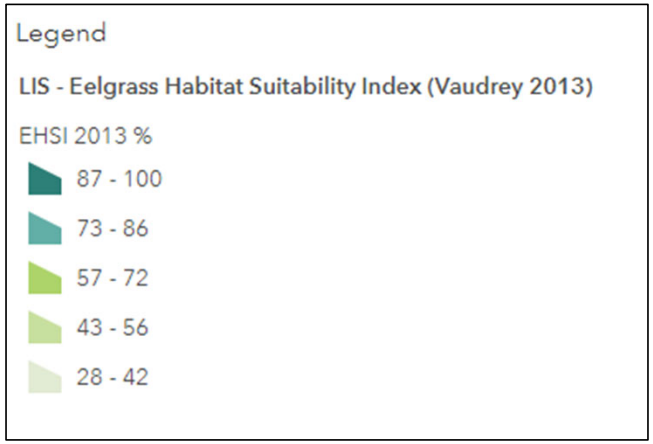
$K_d = \ln(i_z/i_o) \ / \ (-z)$

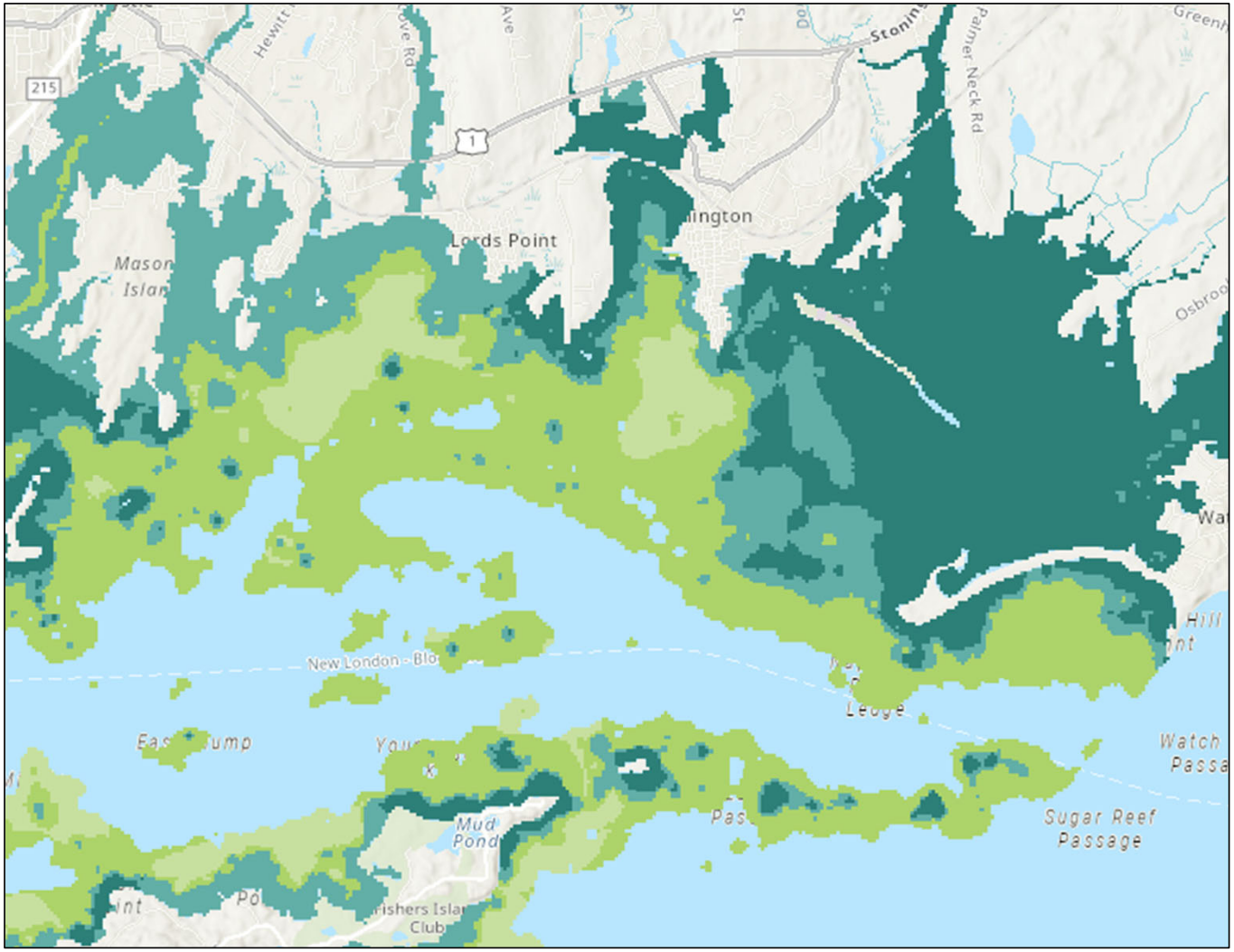
Where:

- K_d = light attenuation coefficient in m^{-1}
- I_z = light at depth
- I_o = light at surface
- Z = colonization depth

Pawcatuck River Embayment	
Colonization Depth (m)	K_d at 22% Light Requirement (m^{-1})
-0.70 (avg)	2.16
-4.94 (max)	0.31

Eel Grass Suitability





Considering Natural Conditions

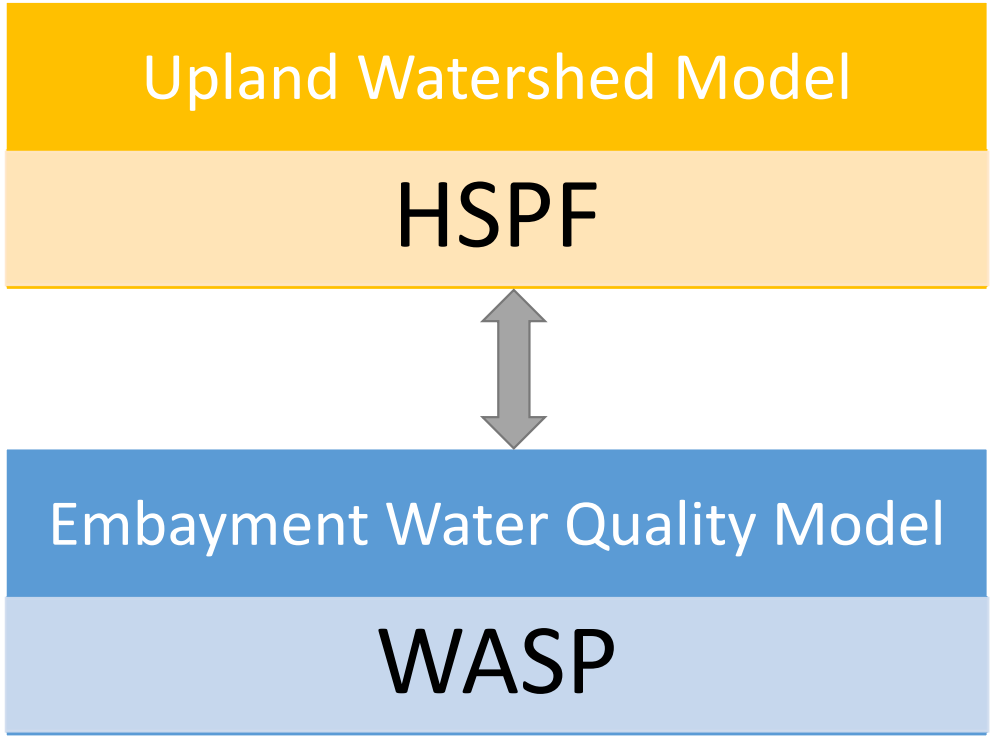
- Translation of Narrative Biological Conditions Standards
- Natural Conditions
  - Natural conditions are independent of Water Quality Standards
- Natural means environmental conditions and communities which are unaffected or minimally affected by human influences

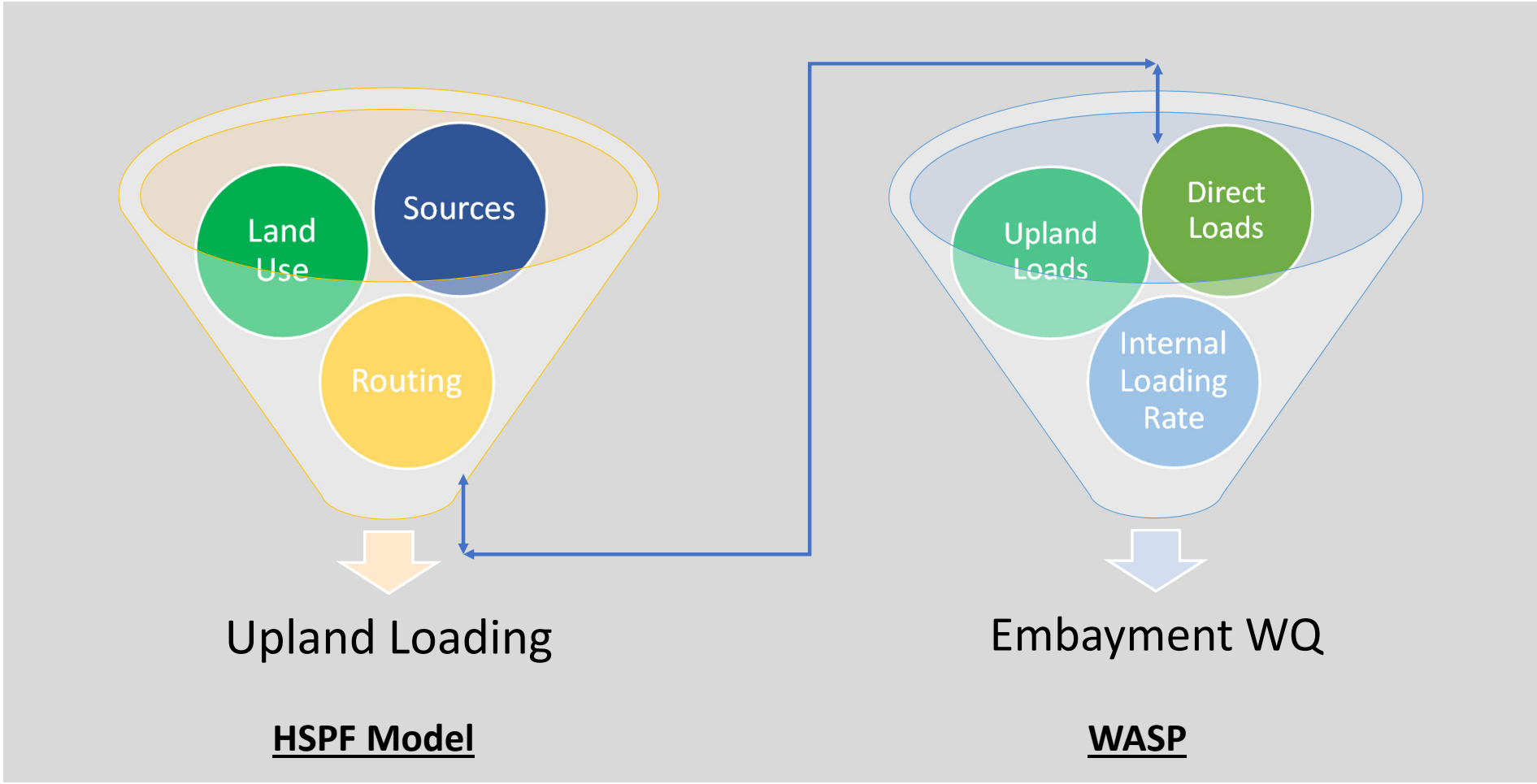
CT DEEP Modeling Approach to Relate Embayment WQ Targets to Nutrient Concentrations and Loads

Models

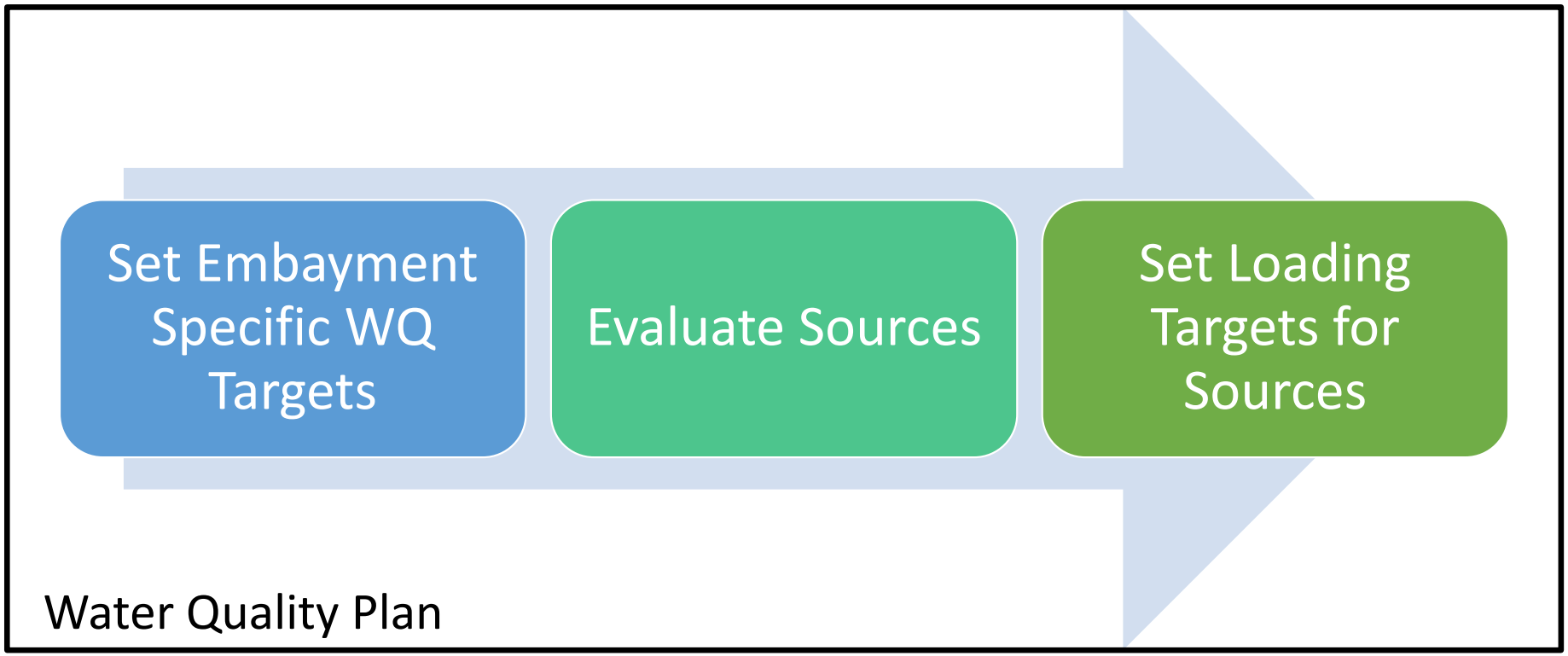
- Developed a watershed scale approach
- Focus on Nitrogen & Phosphorus and related parameters
- Uses data on water quality and sources

- Models are calibrated & validated for existing conditions
- Models then used to identify embayment nutrient concentrations under current, reference & target WQ conditions

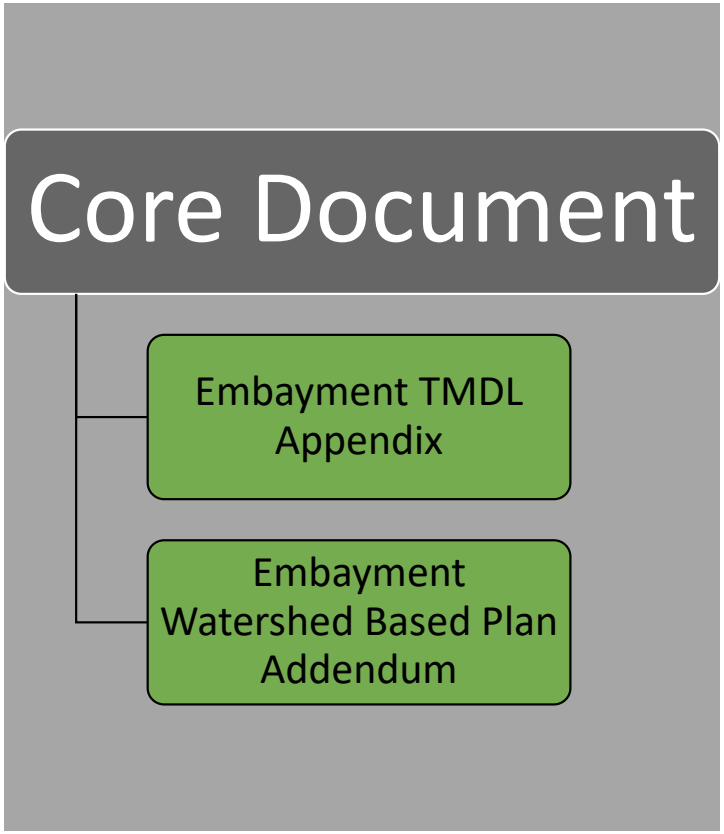



Land Use
Sources
Routing
Upland Loads
Direct Loads
Internal Loading Rate
Upland Loading
Embayment WQ
HSPF Model
WASP

Water Quality Planning Process



Future Water Quality Planning Documents



Core Document (applies Statewide, CTDEEP)

- Contains general information on required elements for TMDLs and Watershed Based Plans
- Includes reference & resource materials to assist implementation

TMDL Appendix for Individual Embayments (CTDEEP)

- Watershed Specific Appendices consistent with TMDL requirements

Watershed Plan Addendum for Individual Embayments (Recommended)

- Developing Watershed-Based Plan Addendum to streamline process
- Include EPA's 9-Element components not fully covered in Core document or TMDL Appendix
- Focus on Implementation Activities

Resources

To receive information via email on Water Quality Planning activities from CTDEEP, sign up for the Water Quality ListServ:

[Water Quality Planning ListServ (ct.gov)]

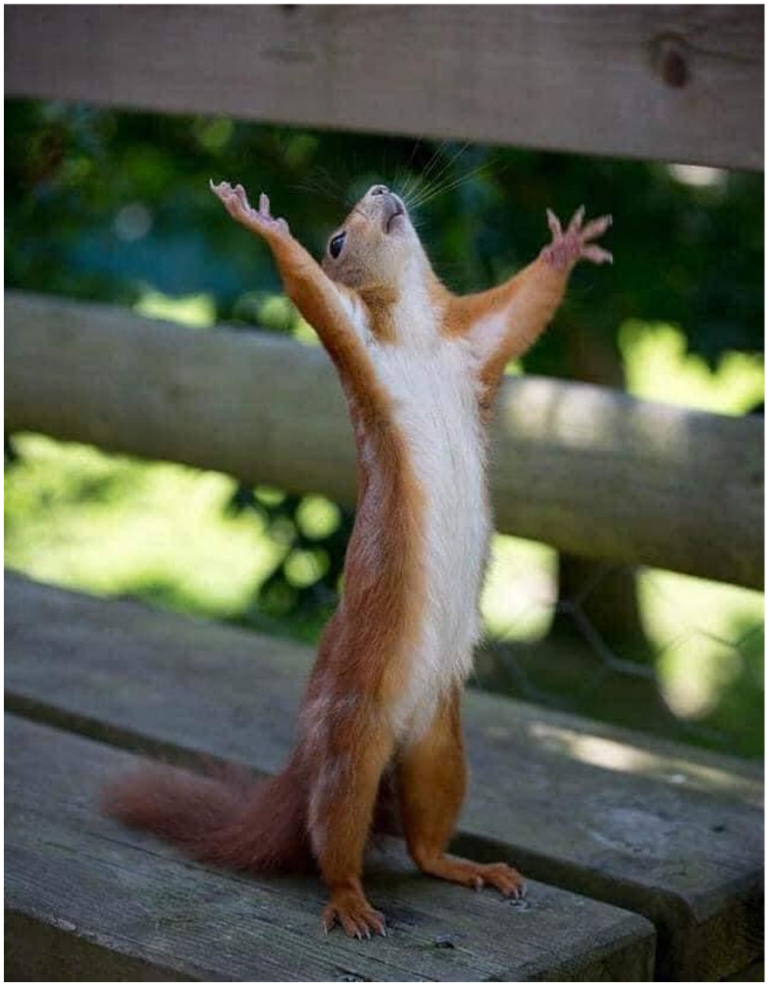
As projects progress, there will be public informational meetings and opportunities for public review and comment

[CT DEEP Pawcatuck Watershed Nutrient Project Website]

SNEP Grant

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SNEP Southeast New England Program



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Long Island Sound Hypoxia and Nitrogen Control Efforts:

https://portal.ct.gov/DEEP/Water/LIS-Monitoring/LIS-Hypoxia-and-Nitrogen-Reduction-Efforts

Municipal and DOT Stormwater:

https://portal.ct.gov/DEEP/Water-Regulating-and-Discharges/Stormwater/Municipal-Stormwater

Stormwater Management:

https://portal.ct.gov/DEEP/Water-Regulating-and-Discharges/Stormwater/Stormwater-Management

Connecticut Stormwater Quality Manual:

https://portal.ct.gov/DEEP/Water-Regulating-and-Discharges/Stormwater/Stormwater-Manual

Guidelines for Erosion and Sediment Control:

https://portal.ct.gov/DEEP/Water/Soil-Erosion-and-Sediment-Control-Guidelines/Guidelines-for-Soil-Erosion-and-Sediment-Control

Stormwater Pollution Management in CT (interactive map):

https://ctdeep.maps.arcgis.com/apps/MapSeries/index.html?appid=355b12efb86b41de82ed8059b4f2bb2c

Embayment Nutrient Water Quality Demonstration Project:

CT DEEP Pawcatuck Watershed Nutrient Project Website