Webcast sponsored by EPA's Watershed Academy

Implementing TMDLs and Trading Through the National Estuary Program

Darrell Brown, Chief, USEPA's Coastal Management Branch

Mark Tedesco, Director, USEPA's Long Island Sound Office

Gary Johnson, Senior Environmental Engineer, Connecticut DEP

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What We'll Cover

- **Overview of The National Estuary Program and lessons learned -- Darrell Brown**
- **Implementing the Long Island Sound TMDL: Flexibility through Effluent Trading -- Mark Tedesco**
- **Connecticut's Nitrogen Trading Program -- Gary Johnson**

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•NEPs established under Section 320

•NEPs had to apply, had to have local leadership and governor support

•NEP program our most successful watershed program

NEPs leverage funding

•The 28 NEPs around the Nation leveraged almost $10 for every $1 of CWA funds they received in FY 2004. Using our most conservative measures, we estimate that the NEPs generated $167 million from the $17 million in base funding provided (9.9:1 leveraging ratio). These resources allowed the NEPs to undertake substantial projects with significant on-the-ground results.

National Estuary Program (NEP)

- The National Estuary Program was established by Congress in 1987 - Section 320 of the CWA

- 2007 marks the 20th Anniversary of the NEP!
- The NEP's mission is to identify, protect, and restore estuaries of national significance
- Estuaries are the most biologically-productive ecosystems:
  - Over 75% of U.S. commercial fish catch and 80%-90% of U.S. recreational fish catch – estimated value $19 billion

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National Estuary Program Overview

- NEP is a model of a non-regulatory, stakeholder-driven, collaborative approach. The four cornerstones of which are:
  - Focus on watershed or ecosystem
  - Integration of good science with sound decision making
  - Collaborative problem solving
  - Involving the public

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Comprehensive Conservation Management Plan (CCMP)

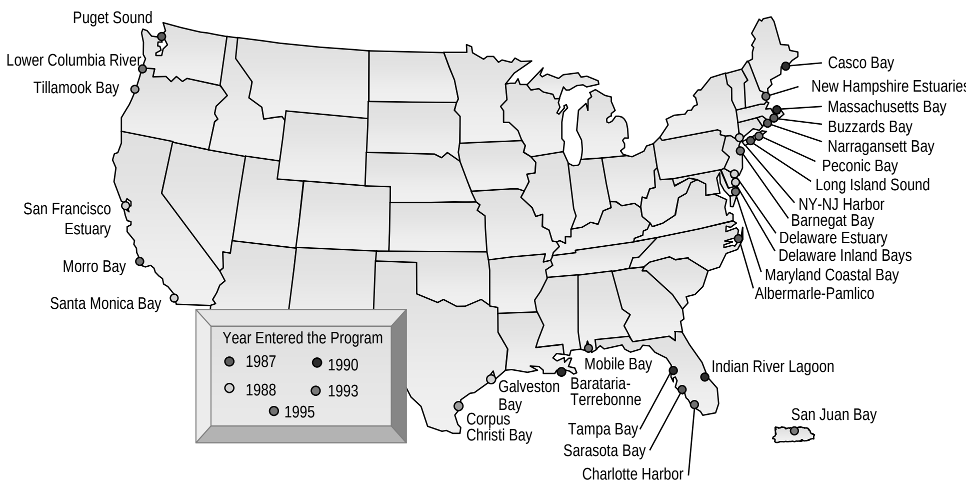
- NEP stakeholders develop Comprehensive Conservation Management Plan (CCMP) to address priority problems

- Each CCMP contains specific actions designed to protect the estuary and its resources – many actions call for implementation of the Clean Water Act at the local level (e.g., TMDLs)

- EPA approves each CCMP, then NEP partners (State, community, business, environmental, scientific representatives) implement the plans

There are currently 28 estuaries in the program, representing 19 States and Puerto Rico.

Estuaries in the Program



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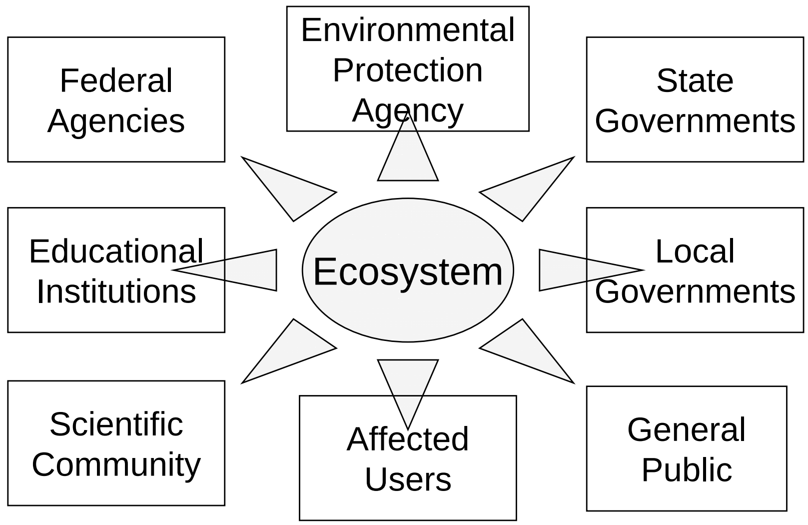
National Estuary Program: Ecosystem and Community Based



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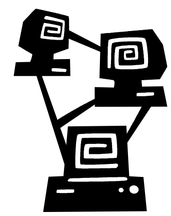
NEP Networks Work!

- Recent study* found the networks in NEP areas:
  - span more levels of government,
  - integrate more experts into policy discussions,
  - nurture stronger interpersonal ties between stakeholders, and
  - create greater faith in the procedural fairness of local policy



***Building Consensual Institutions: Networks and the National Estuary Program, M. Schneider et. al., American Journal of Political Science, Vol. 47. No 1, January 2003.**

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Making a Difference

Partners in the 28 National Estuary Programs are protecting estuaries by:

- Protecting and restoring habitat
- Working with farmers and homeowners to curb polluted runoff
- Protecting human health from pathogens
- Upgrading sewage treatment plants
- Installing and improving septic systems
- Educating and informing children and adults
- Encouraging public involvement in estuary protection

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<u>Restoring/Protecting Habitat (GPRA)</u>

•NEPs have protected or restored over 1,000,000 acres of habitat since 1987.

•In 2003 alone, approximately 118,000 acres were protected or restored.

Habitat and Leveraging Accomplishments

- Since 2000, NEPs have protected and/or restored approximately 1 million acres of habitat

- Since 2000, NEPs have averaged a leveraging ratio of 16:1

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Leveraging Funds Through the NEP – Lessons Learned

- Finance planning allows the NEPs to move from ad-hoc grants to strategic fundraising
- Diversifying funding sources provides a buffer and leads to greater leveraging opportunities
- Building the partnerships and public support necessary for leveraging takes time

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• Finance planning is a three-step process: establishing program priorities, identifying and evaluating funding options, and pursuing the most promising options.

➢Each NEP developed a finance plan in their CCMP and the NEPs are now updating the plans and integrating finance planning into their ongoing workplan process.

•Example of partnering leading to more leveraging opportunities: Narragansett Bay NEP successfully collaborated with the local nonprofit Save the Bay to obtain a $200,000 grant from Pew Charitable Trusts grant. Narragansett used a portion of these funds as match for a variety of other grants.

•The Partnership for the Delaware Estuary’s first direct mail appeal yielded only a handful of responses. Over the next few years the Partnership’s outreach efforts increased awareness of its projects and fundraising has raised hundreds of thousands of dollars.

NEP Lessons Learned

1. Community-based resource management can achieve results

2. Setting measurable environmental goals and indicators is important

3. Environmental and programmatic monitoring are critical

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Bullets below refer, in order, to each bullet in the slide.

•Citizen involvement is key. NEPs are catalysts to bring various stakeholders together (particularly important to engage   stakeholders early in the management process).

•NEP administrative structures are flexible in order to meet local needs and values. Structure and strategy can be modified in response to successes, failures, political realities, and unforeseen problems.

•They (1) allow environmental conditions and responses to restoration efforts to be monitored, (2) inform and involve the public, (3) provide information to establish restoration goals, and (4) calibrate and refine ecosystem models.

•It's often a challenge to demonstrate a causal link between management actions and environmental results. However, tracking progress in both areas, and integrating them where possible, is crucial for maintaining stakeholder support and keeping management strategies on target.

•Nutrient over-enrichment, loss of habitat, alteration of freshwater inflow, contamination from pathogens & toxic chemicals, decline in fish & wildlife, and introduction of invasive species.

•Adaptive management (e.g. invasives, TMDLs, smart growth).

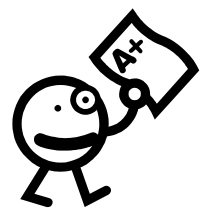
•Long-term financial planning is critical - need a wide variety of funding sources.

NEP Lessons Learned (cont.)

4. There are common coastal environmental problems and challenges

5. The NEPs are demonstrating the ability to address emerging issues

6. Obtaining sustainable levels of funding are key



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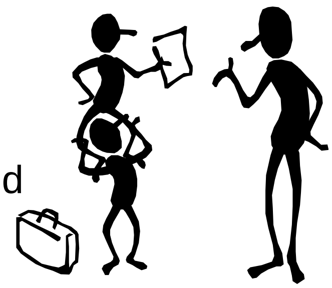
Key Lesson Learned: Partnerships Are Key

- EPA efforts complement and support work by a wide array of federal, State and local partners
- Federal agency coordination
- States, municipal government, landowners, and local watershed groups



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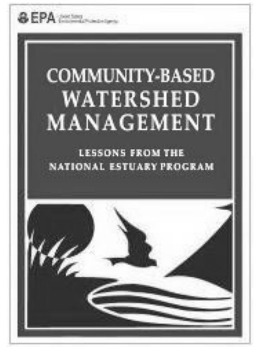
Community-Based Watershed Management Handbook

- Establishing governance structures
- Informing and involving people
- Fostering collaboration
- Using science
- http://www.epa.gov/neplessons



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Total Maximum Daily Loads (TMDLs)

- A TMDL is the amount of a specific pollutant that a waterbody can receive and still meet water quality standards.
- A TMDL is made up of the sum of all the point source loads (“wasteload allocation”) and load associated with nonpoint sources (“load allocation”).
- Thus **–** a TMDL is the allowable amount of a single pollutant from all contributing point and nonpoint sources that a waterbody can receive and still meet water quality standards

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TMDL/NEP Nexis

- NEP projects develop strategies to help attain or maintain water quality standards --and can combine several TMDLs under one plan
- Morro Bay Example
  - The NEP is the local watershed stakeholder organization for Morro Bay, and maintains a focus on improving water quality via TMDL implementation.
  - The CCMP is used for TMDL development both as a data source and as a TMDL implementation plan. Many of the adopted TMDLs look to specific Action Plans in our CCMP as the key steps towards achieving the TMDL, and cite the MBNEP as a primary implementer.
  - Morro Bay NEP monitoring program data has informed 303(d) listings, and is a primary ongoing data source for assessing the implementation progress of the adopted TMDLs for pathogens, sediment, and nutrients in the bay and watershed.

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Challenges of Developing TMDLs in Coastal Waters

- **Large watersheds**
- **Multi-jurisdictional watersheds**
- **Complex systems (tidal, stratified, open boundaries, sediment fluxes)**
- **Complex pollutants and ecosystem pathways**
  - **Nutrients, sediments, PCB, Mercury**
- **Differing schedules and priorities**
  - **Reflect State priorities, litigation driven**
- **Diverse WQSs, data, methodologies**

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Lessons Learned from the NEP

Efficiencies Achieved by Promoting the Watershed Approach

- **Monitoring and data collection**
- **Analyzing data and model development**
- **Efficient TMDL calculation and pollutant reduction targeting**
- **Consolidating document development and review**
- **Involving the Public early and often**
- **Implementing regulatory and voluntary controls**
- ***Achieving water quality standards as soon as possible at the least cost***

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Questions?

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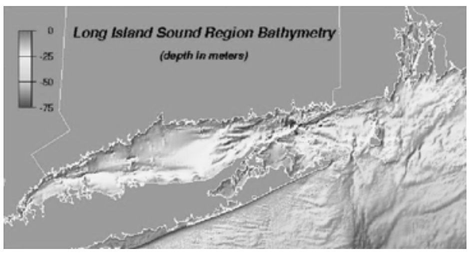
Implementing the Long Island Sound Nitrogen TMDL: Flexibility through Effluent Trading



Mark Tedesco, EPA Long Island Sound Office

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Presentation Topics

- LIS water quality status and trends
- TMDL for nitrogen control
- Use of watershed permits and trading
- Progress in nitrogen control

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What is the Long Island Sound Study?

LONG ISLAND SOUND STUDY

A Partnership to Restore and Protect the Sound

Sponsors

- US EPA
- CT Department of Environmental Protection
- NY State Department of Environmental Conservation

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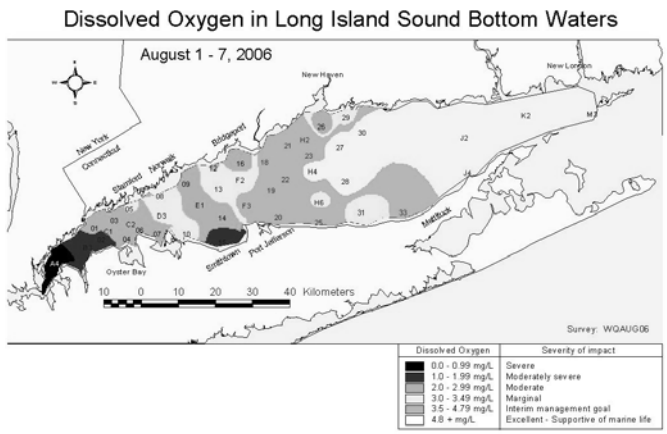
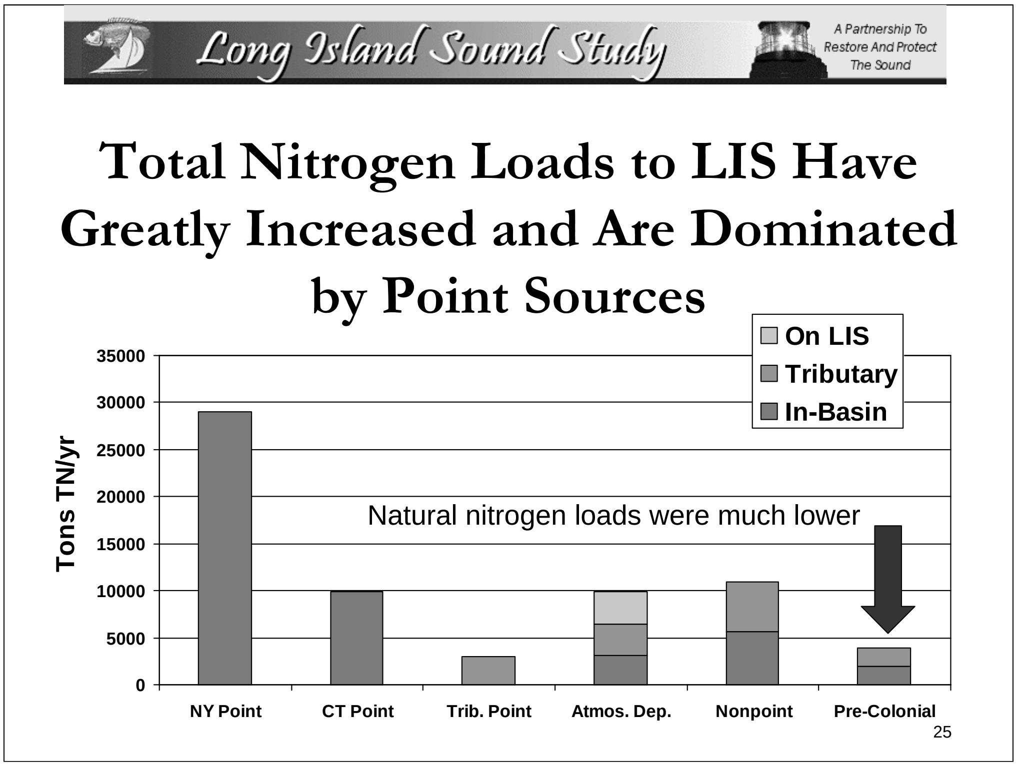
Hypoxia (Low Dissolved Oxygen) Results in Acute and Chronic Effects on Living Resources





1. The pre-Colonial load probably is an overestimate

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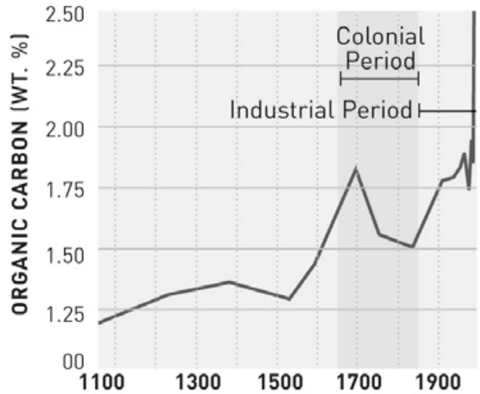
Increased Nitrogen has Increased Production

Burial of Carbon in Sediments has Increased

(so has biogenic silica from diatoms, and shells of forams)



Varekamp et al. 2004

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Eutrophication in LIS

Increased nitrogen discharge has increased production of algae. This is reflected in the increased amount of organic carbon buried in the sediments. Biogenic silica has increased as well, demonstrating that diatom production increased. Foraminifera (forams) are microscopic organisms that feed on diatoms. The shells of forams in the sediment have also increased. This increase in organic matter production has also increased rates of carbon oxidation, as evidenced from isotopic ratio work.

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Eelgrass has Declined from Historic Range

Historical eelgrass distribution by town

Current eelgrass distribution by town (in orange)

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LIS Eelgrass Survey 2002, US Fish & Wildlife Service

Eelgrass, *Zostera marina*, is the dominant submerged, rooted, vascular plant in Long Island Sound. Eelgrass once grew throughout the shallow waters of the Sound, but dramatically declined between 1931and 1932. While eelgrass recovered in the eastern Sound, it currently remains absent in the central and western Sound.

Now What?

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CWA Requirements for TMDLs

- **Identify "Water Quality Limited" Waters**
- **Specify Allowable Pollutant Loading**
  - Point Sources, Nonpoint Sources, Margin of Safety
- **Implement through:**
  - standards, criteria, classification
  - regulations, permits

Management Challenge

Clean Water Act ⟷ **Clean Water Acting**

Clean Water Act

- 305 (b) assessments
- 303 (d) listings
- TMDLs
- Permits
  - STPS, stormwater
- Nonpoint source controls

Clean Water Acting

- Community-based
- Visioning, consensus building
- Integrate social, economic, and env. Objectives
- Flexible use of tools
- Adaptive management

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Technical Challenges in TMDL Implementation and Assessment

- In-basin watershed
- Overall five state watershed
- Airshed

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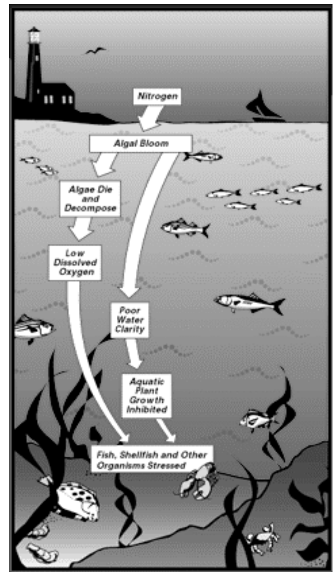
Key Issues Needed to be Addressed

- Attainment of water quality standards
- Technical basis for DO standard
- High cost burden for POTW upgrades
- Perceived equity between point and nonpoint sources
  - NYC vs. CT River
- Uncertainty in managing out-of-basin loads



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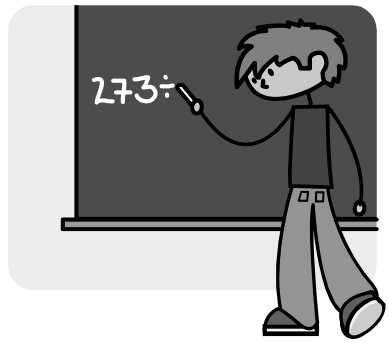
LIS Numerical Water Quality Modeling

- Develop numerical models to support assessment
  - Water Quality
  - Hydrodynamics
- Objectives:
  - assess effect of carbon and nitrogen inputs on dissolved oxygen balance
  - consider range of management scenarios



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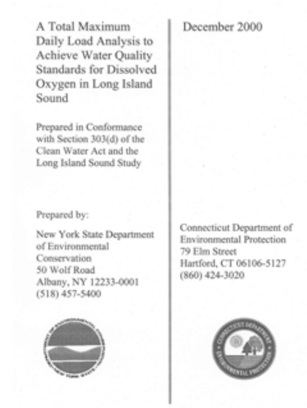
TMDL Approved April 2001

A 58.5% reduction from primary anthropogenic sources in CT and NY

- 10% reduction from urban and agricultural runoff (LA)
- Balance (64% in CT, 59% in NY) from point sources (WLA)


A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound

December 2000

Prepared in Conformance with Section 303(d) of the Clean Water Act and the Long Island Sound Study

Prepared by:

New York State Department of Environmental Conservation
50 Wolf Road
Albany, NY 12233-0001
(518) 457-5400

Connecticut Department of Environmental Protection
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3020

Modeling results predict significant water quality improvements

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I've often found that the 58.5%, 10% NPS for urban and Agricultural lands ONLY, and the 64% for CT point sources vs. 58.5% for NYC point sources, confuses everyone. What it boils down to, with all sources considered, is a 50% reduction in nitrogen loading from baseline. People can understand that it's a BIG change and that point source reductions are emphasized.

Key Implementation Issues

- **Cost estimates vary**
  - Incentive for dischargers to inflate
- **Lack of incentives to do more, sooner**
- **Disagreements over allocations**
- **Lack of collaboration**
  - Your permit, your problem
- **Phasing reductions over 15 years**
  - Available funding, planning and construction timelines

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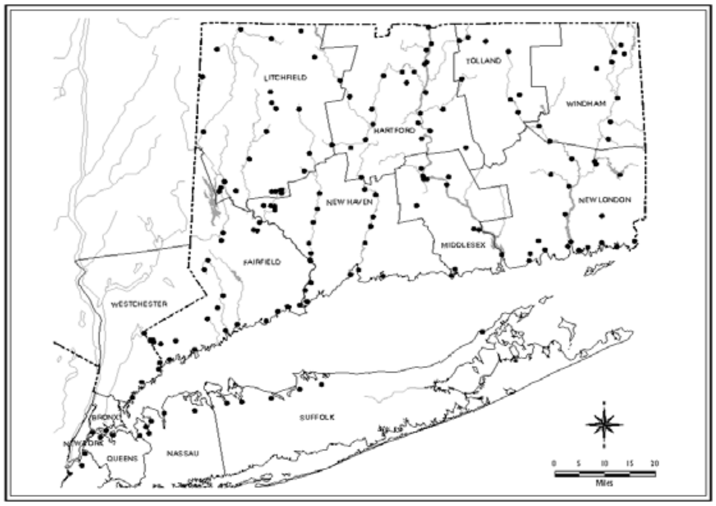
The TMDL Sets 108 Wasteload Allocations



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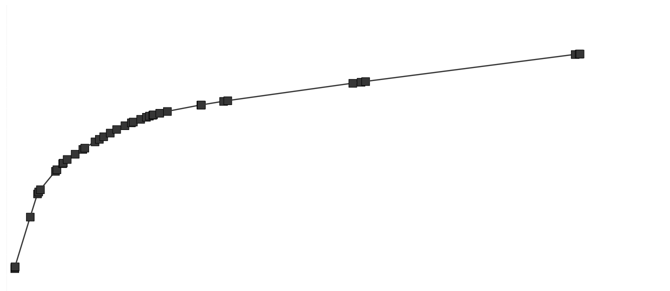
Efficient Use of Capital Possible but Difficult Through Traditional Allocation and Permitting Process



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Solution: Use Flexibility and Market Forces to Achieve Efficient Allocations

- Set fifteen year goal with five year increments
- Allocate equal reductions to each management zone and discharger
  - Permits containing final limits and 15 compliance schedules
- Allow flexibility in how to achieve reductions within a zone and among facilities considering relative impacts (Trading ratios)
  - bubble permit (NY)
  - general permit (CT) and credit trading
- Commit to five-year evaluations to update TMDL

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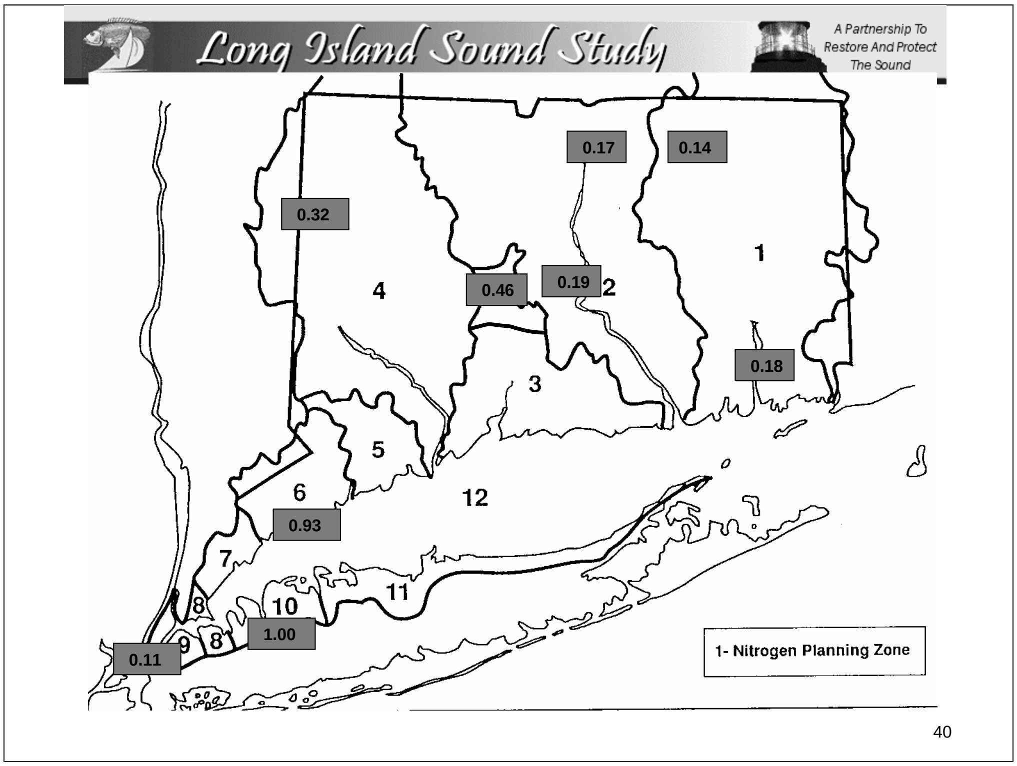
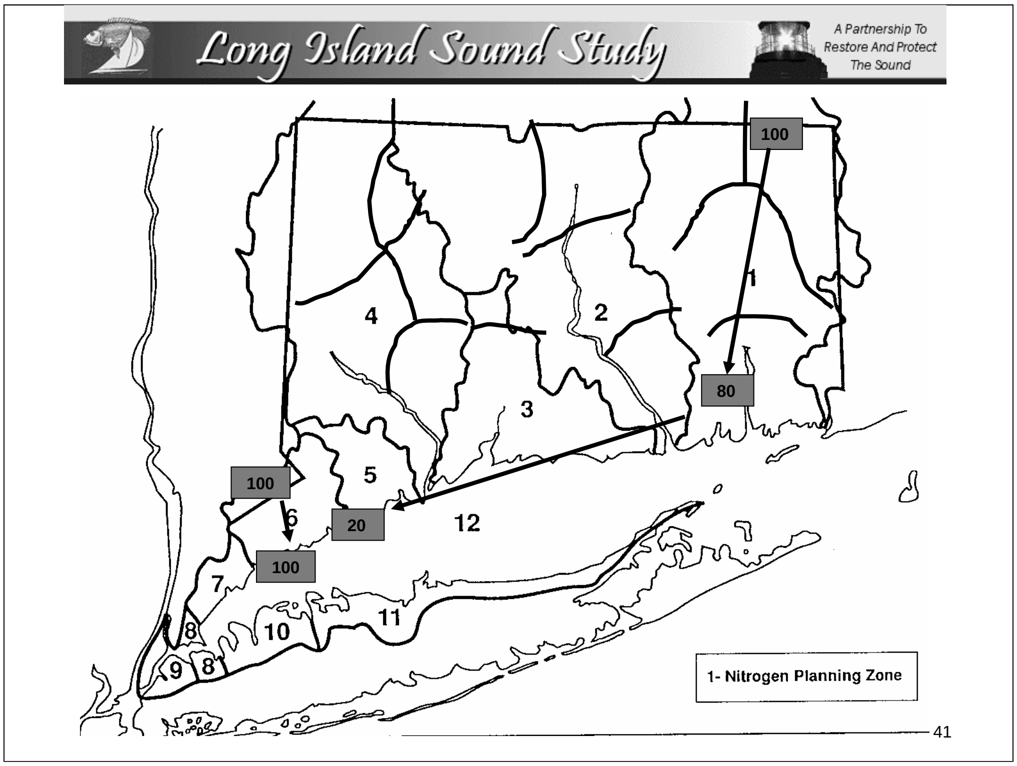
TMDL Trading Ratios

- **Adjustments in WLA allowed consistent with TMDL exchange ratios**
  - Watershed attenuation factors
  - Delivery to LIS

- **Derived from LIS water quality model and watershed calculations**



These exchange ratios are sound wide. Most people won't notice that, but if you want to clarify, Connecticut's NCE normalizes to zone six, which alters the ratios a little bit. IF we were to sell excess credits to NYC or other NY counties, these ratios would likely be used.



Note that most of the attenuation occurs in LIS! River attenuation is relatively modest (for those doubters about river attenuation processes).

New York Bubble Permits

- **Nitrogen "bubble" by management zone**
  - aggregate, annual limit for point sources within a zone
  - individual, annual limit based on facility's share of aggregate, annual load
  - Monitoring and reporting requirements
  - Compliance for 12-month rolling average
- **Final WLA phased in five-year increments**
- **Reallocation among zones allowed consist with TMDL equivalency factors**

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How it Works

- **Option of doing more at upper East River STPS and less at lower East River STPs**
  - 1.9:1.0 trading ratio
  - Being updated to 4:1 ratio based on new SWEM model
- **NYCDEP and NYSDEC modified consent order for Newtown Creek STP to eliminate nitrogen control**
  - Estimated savings of $600 million
- **NYCDEP and NYSDEC signed consent order on upper ER nitrogen control to meet TMDL**
  - Revised agreement in 2005

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Connecticut Public Act 01-180: An Act Concerning Nitrogen Reduction In Long Island Sound

- **Passed June 2001**
- **Authority to Issue a General Permit**
- **Establish a Nitrogen Credit Advisory Board**
- **Alternate Compliance Program**

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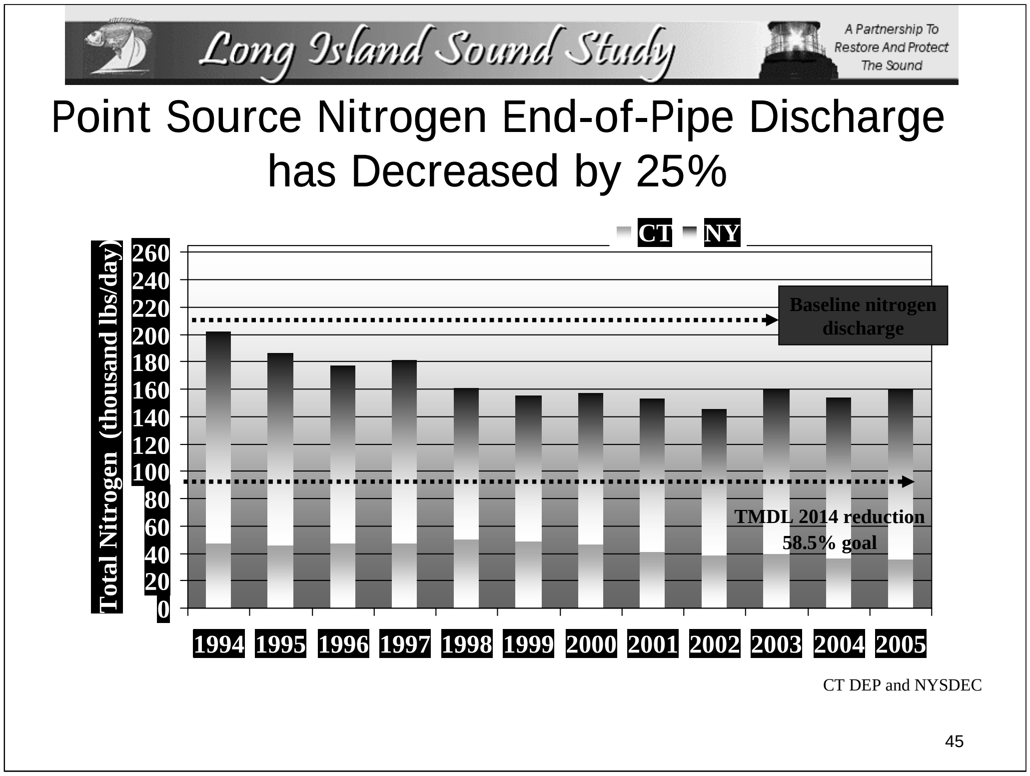
Legal authorities paved the way. General permit key to getting all treatment plans under one authority (repeated in the next slide), an independent NCAB gives the program legitimacy outside of the harsh world of DEP regulation, and it is truly an alternative to standard compliance procedures, which may have not fully met federal legalities. Thanks to EPA for whatever leniency was provided to make a sensible program work!

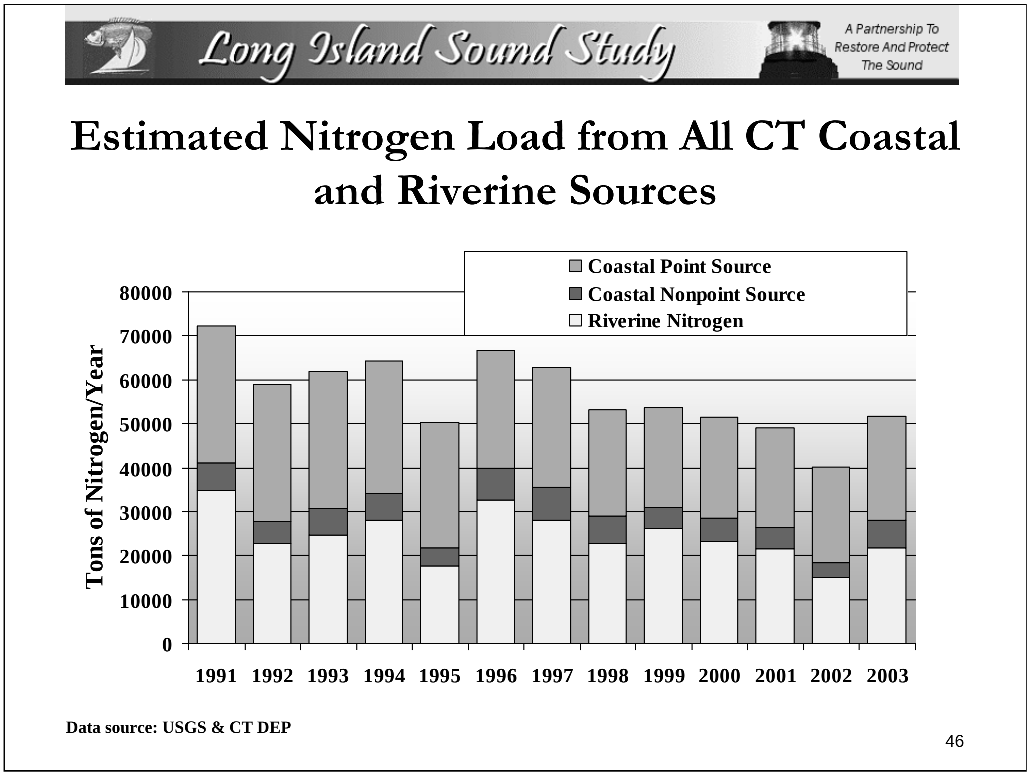


•Since 1990, the LISS has been implementing a phased plan to improve oxygen levels in the Sound by reducing nitrogen loads.

•In 1998, LISS adopted a 58.5 percent reduction target for nitrogen loads from human sources to the Sound over 15 years, with five and ten-year interim targets to assure steady progress.

•The states of Connecticut and New York are working to achieve the target through upgrades to sewage treatment plants, watershed protection to control nitrogen runoff, and reductions in nitrogen oxide emissions to the air. As a result, nitrogen discharges to Long Island Sound have decreased, reducing algae growth, and improving oxygen levels.

•As a result of upgrades to STPs, there has been a reduction of 25 percent in nitrogen End-of-Pipe discharges from STPs over the past 14 years. Factors such as wet years and STP process problems contribute to years of higher nitrogen discharge.



Nitrogen enters Long Island Sound from a variety of point and nonpoint sources - sewage

treatment plants within the coastal zone, nonpoint sources near the coast such as septic systems, stormwater runoff, and point source and nonpoint sources of nitrogen from the rivers that flow into CT – all a result of human activity. Nitrogen is also found as a natural component of the Sound's physical environment. The overall trend in the past decade has been decreasing nitrogen discharges from point and nonpoint sources.

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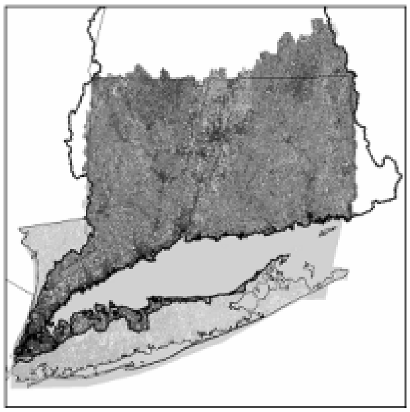
Developed Land Cover has Increased at the Expense of Forest



		1985 (%)	2002 (%)
Developed	■	18	21
Turf	□	5	5
Grasses	■	10	11
Forest	■	62	57
Water	■	3	3
Wetlands	■	1	1
Other	□	1	2

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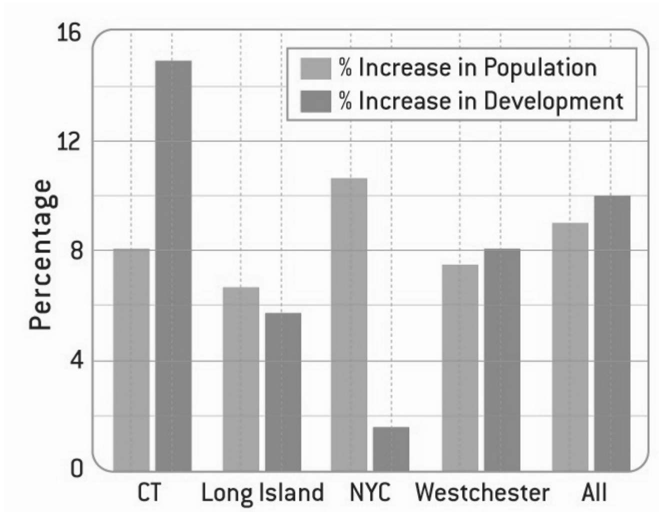
Forest cover has declined since 1985, according to the University of CT's Center for Land Use and Education and Research (CLEAR). Using satellite imagery, Clear identified a percent loss of forest cover from 62% to 57% in CT and the NY portion of the Sound's watershed, while developed land increased from 18% to 21%. From 1985 to 2002, 157 square miles of land had been developed in the Sound's watershed in NY and CT, while 231 square miles of forested land had been lost to other uses.

Development has Outpaced Population (1985-2002)



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In CT, development has increased at nearly twice the rate of population since 1985, an indicator of sprawl-type development, while in New York City, population increased faster than development.

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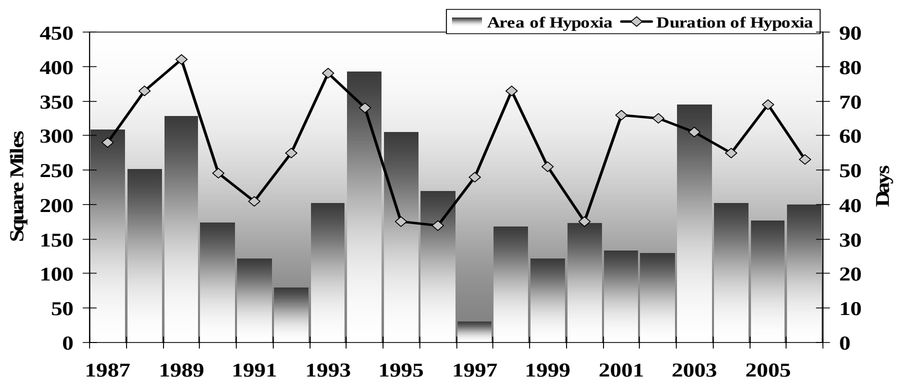
There are Annual Variations in the Maximum Area and Duration of Hypoxia, Primarily Due to Weather

Hypoxia is defined as less than 3.0 mg/l



CT DEP LIS Water Quality Monitoring Program

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The maximum area of hypoxia has averaged 203 square miles from 1987 through 2005, with a low of 30 square miles in 1997 and a high of 393 square miles in 1994. The duration of hypoxia has averaged 58 days during that same period, with a low of 34 days in 1996 and a high of 82 days in 1989. When data is applied to graph format it is evident there is a cycle of peaks and lows every 4 to 5 years. While 2003 was the second worse year area-wise, 2004 & 2005 were closer to the average at 202 and 177 square miles and 55 & 69 days respectively.

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What Can We Learn from Empirical N Loading – N Concentration – DO Relationships?

Composite of Axial Stations – Average Change over 15 Years

- **Total Nitrogen Load Trend Down by 28%**
- **Surface TN Conc. Trend Down by 14%**
- **Bottom TN Conc. Trend Down by 24%**
- **Surface Chlorophyll-a Conc. Trend Down by 16%**
- **Bottom Dissolved Oxygen Trend Up by 9%**

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Lesson: Need to Integrate CWA Tools and Authorities to Meet Watershed Restoration Objectives

- Flexibility, persistence, focus on outcomes, strong public support
- Focus on developing solutions and solving problems in the broader context of restoring water quality and meeting CWA objectives

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Questions?

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Be Sure to Sign Up for Our Next Webcast on March 28th!

 + 

+ UNITED STATES ENVIRONMENTAL PROTECTION AGENCY =

Topic -- Key EPA Internet Tools for Watershed Management

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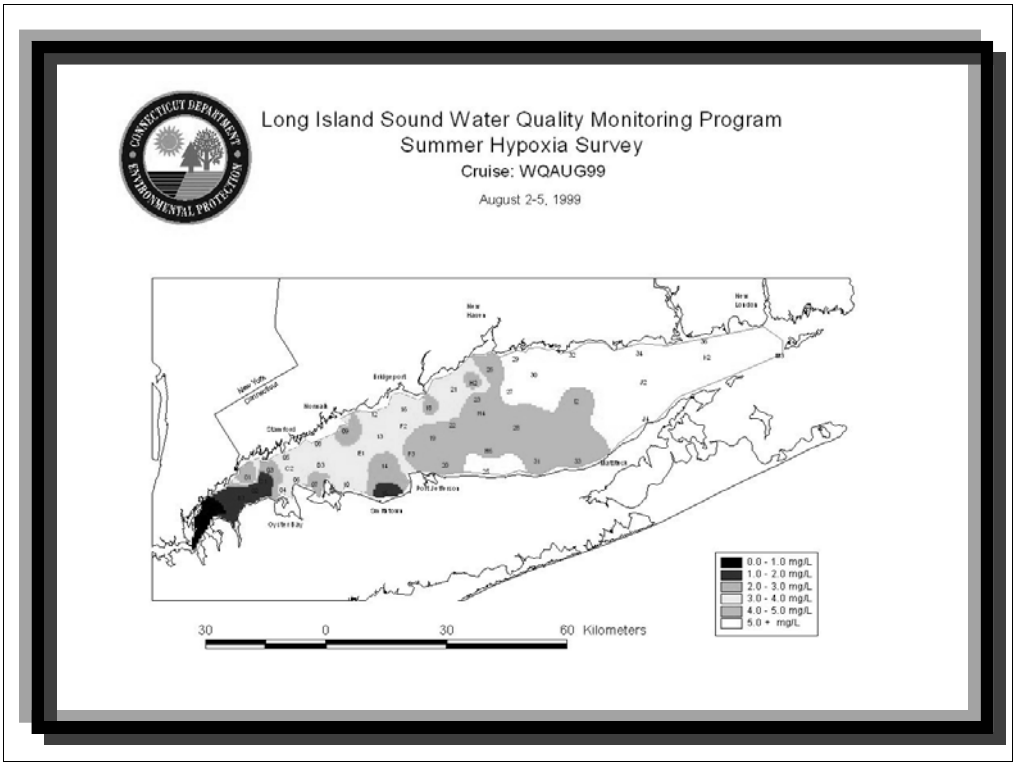
CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION

Connecticut's Nitrogen Trading Program

To Achieve the TMDL for Long Island Sound

Gary Johnson, CT DEP


Long Island Sound Water Quality Monitoring Program
Summer Hypoxia Survey
Cruise: WQAUG99
August 2-5, 1999
0.0 - 1.0 mg/L
1.0 - 2.0 mg/L
2.0 - 3.0 mg/L
3.0 - 4.0 mg/L
4.0 - 5.0 mg/L
5.0 + mg/L
30 0 30 60 Kilometers

Initial TMDL Allocations 2000 Starting Point

The initial loading to Long Island Sound from all municipal facilities combined was established in the draft TMDL at: **48,709 lbs/day**

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Final TMDL Allocations 2014 Ending Point

The TMDL requires the loading to Long Island Sound from all municipal facilities combined be reduced to:
17,774 lbs/day

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Traditional NPDES Implementation:

- Your Pipe
- Your Permit
- Your Problem

- High Compliance Cost
- High Non-Compliance Cost
- Rewards The Last

Difficult to Implement

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Alternative Trading Implementation:

- Our Pipe
- Our Permit
- Our Problem

- Lower Compliance Cost
- Lower Non-Compliance Cost
- Rewards The First

Incentive to Provide Treatment

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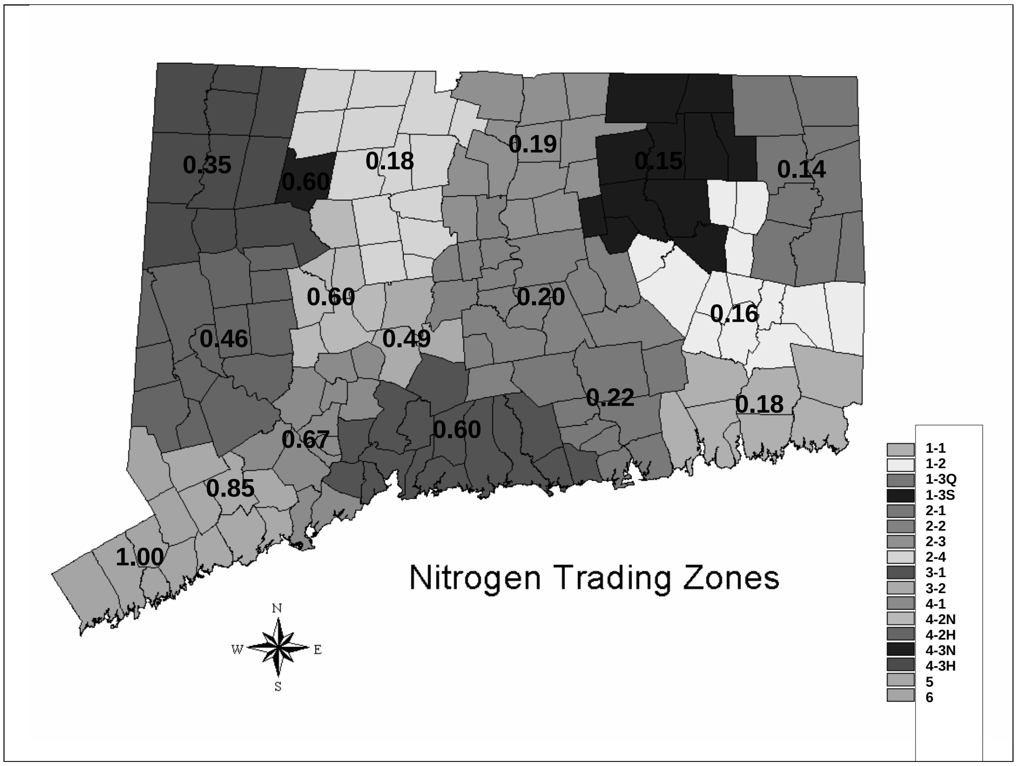
0.35
0.60
0.18
0.19
0.15
0.14
0.60
0.20
0.16
0.46
0.49
0.22
0.18
0.67
0.60
0.85
1.00
Nitrogen Trading Zones
N
W
E
S
1-1
1-2
1-3Q
1-3S
2-1
2-2
2-3
2-4
3-1
3-2
4-1
4-2N
4-2H
4-3N
4-3H
5
6

How Trading Works

- Setting Permit Limits
- Determining Value of Credit
- Executing Trades

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Setting Permit Limits
Buyers = Sellers

- Project End of Pipe Load from each POTW in year 1 of permit period
- 'Equalize' End of Pipe Load for geography (e-factor)
- Sum Equalized Loads to Statewide Total
- Set limit for each POTW based on their assigned "fair share" percentage allocation of the statewide total
- Iterate process for permit years 2-5 accounting for planned completion of treatment upgrades
- Check to confirm on-track to meet 2014 goal

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Value of a Credit

Cost of Nitrogen Treatment

divided by

Pounds of Nitrogen Removed

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Cost of Treatment

Capital Cost = Annual Repayment Amount for CWF Loan
($1M loan = $61,160 / yr)

O&M Cost = Based on Surveys of Project Facilities

Total Cost = Capital Cost + O&M Cost

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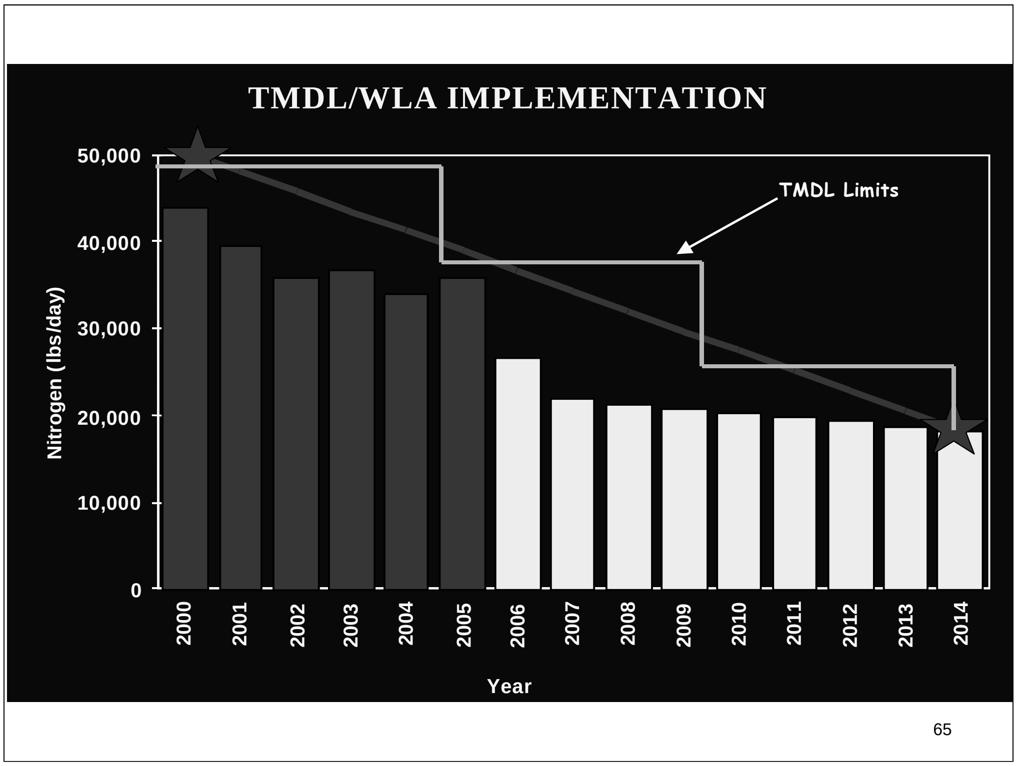
TMDL/WLA IMPLEMENTATION
50,000
40,000
30,000
20,000
10,000
0
Nitrogen (lbs/day)
TMDL Limits
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year
65

Connecticut Nitrogen Removal Projects Completed to Date

- A total of 37 Nitrogen Removal Projects have been completed in Connecticut at POTWs
- Projects ranged from low cost retrofits to full facility reconstruction
- Projects have ranged in cost from $200,000 to $59,000,000 for nitrogen removal
- A over $150,000,000 of State CWF funds have been utilized for nitrogen removal in Connecticut

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Low Cost Nitrogen removal Projects

- Projects utilized existing tanks and modified existing treatment process to remove nitrogen
- New Haven's 40 MGD facility was modified for nitrogen removal for $8,200,000
- Total nitrogen discharge has been <7mg/l

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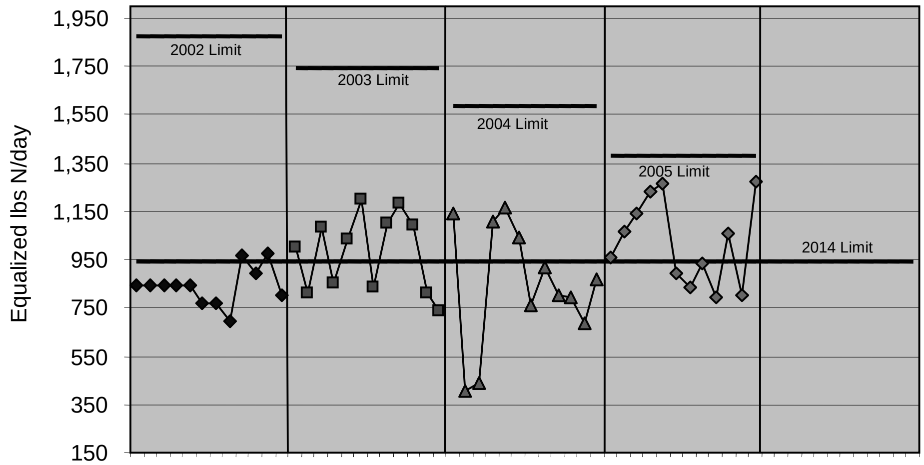
<u>New Haven</u> (40 mgd) Nitrogen Loading to Western Long Island Sound Based on Monthly Equalized Loading



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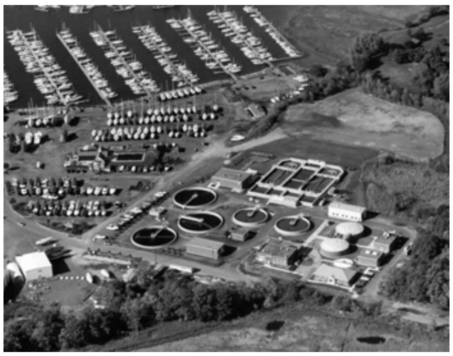
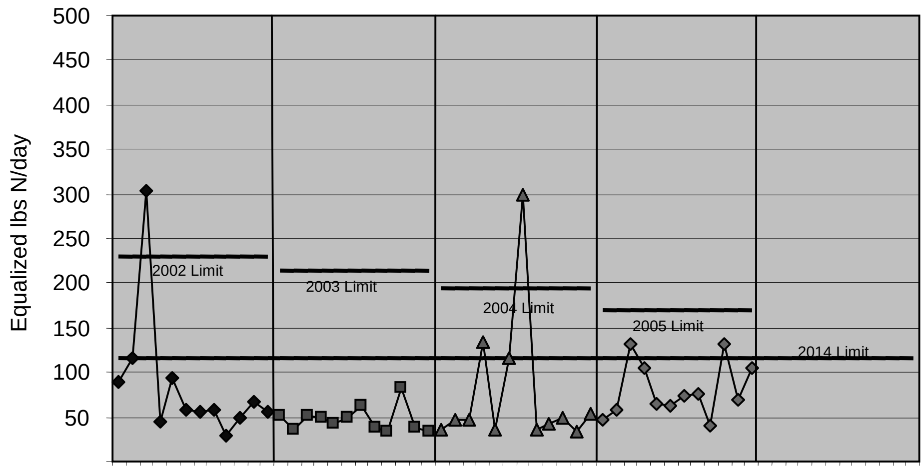
Other Projects Have Required a Full Reconstruction



- **The Branford POTW was fully reconstructed for a cost of $21,230,000**
- **The facility operates with a nitrogen discharge of <4mg/l total nitrogen**

Branford (5 mgd) Nitrogen Loading to Western Long Island Sound Based on Monthly Equalized Loading



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Nitrogen Removal Projects Have Utilized Innovative Technologies

- These processes have allowed for a lower cost approach to nitrogen removal
- POTWs were able to also save energy through process optimization at the same time.
- Energy reduction grants were made available from the electrical utility to help pay for improvements

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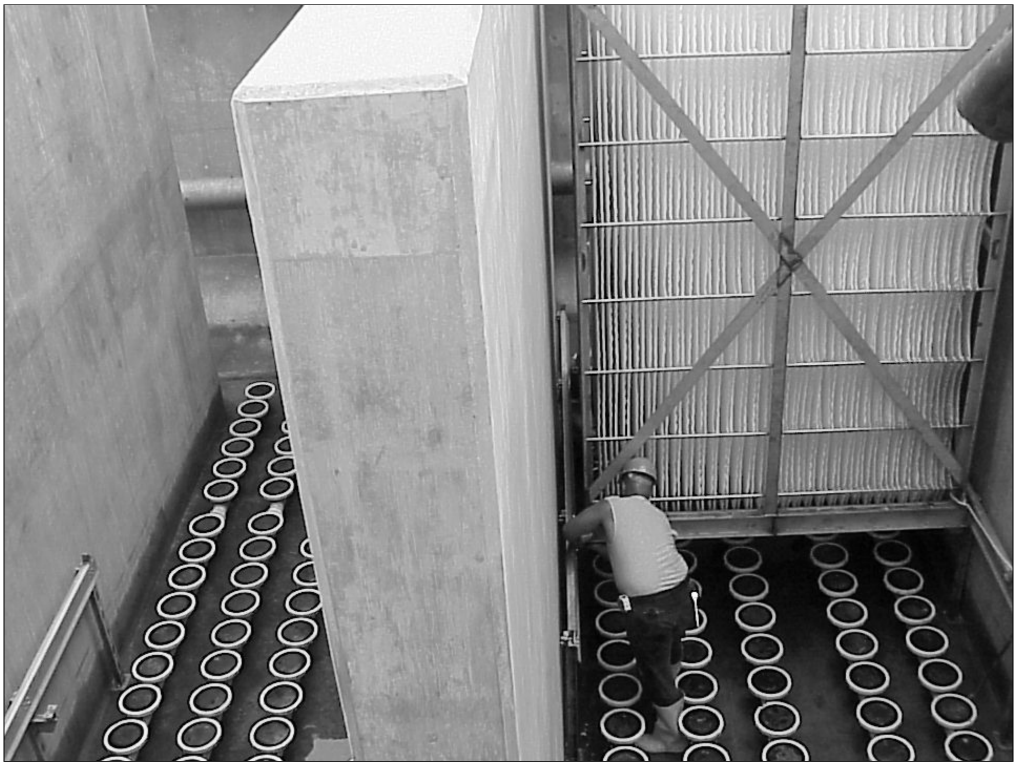
PUMP CHAMBER NO.2



Typical Costs for Retrofit Nitrogen Removal Projects

- For small plants <1 mgd to 3 mgd averaged $500,000 per mgd
- Larger plants 5 mge to > 10 mgd have averaged $160, 000 per mgd

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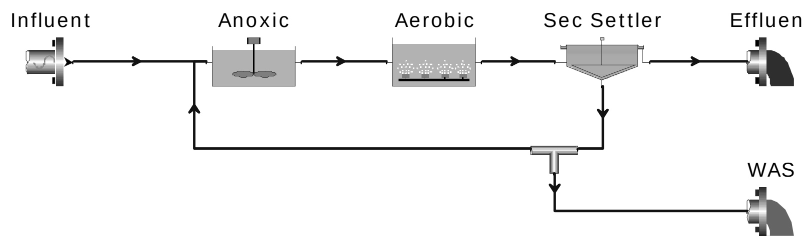
A Facility Nitrogen Removal Study is the First Step to Assessing Needs

- Studies can be accomplished in a short time frame of six months or less
- Computer models can reduce time and project cost through simulations



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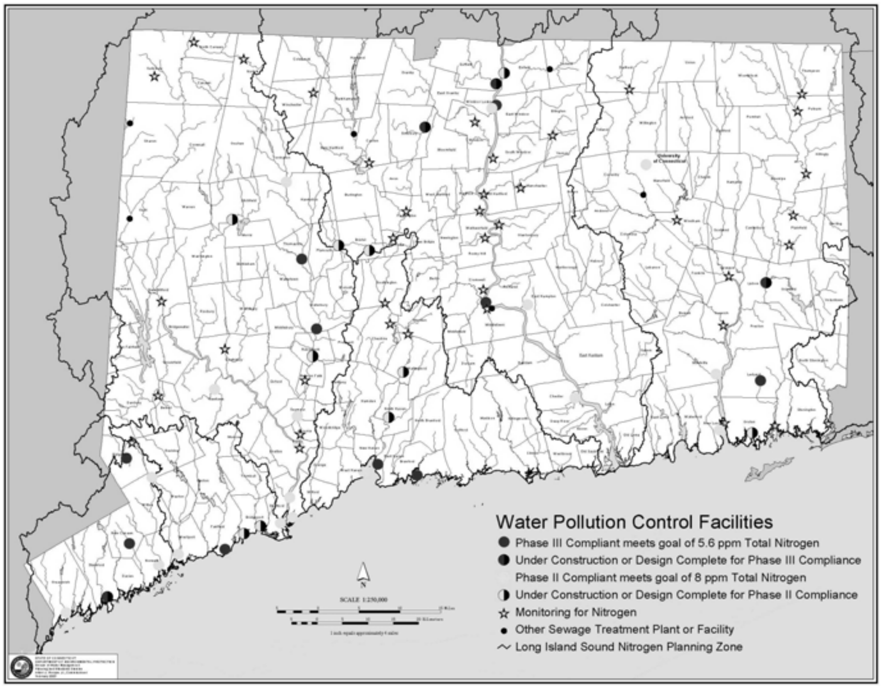
Water Pollution Control Facilities
Phase III Compliant meets goal of 5.6 ppm Total Nitrogen
Under Construction or Design Complete for Phase III Compliance
Phase II Compliant meets goal of 8 ppm Total Nitrogen
Under Construction or Design Complete for Phase II Compliance
Monitoring for Nitrogen
Other Sewage Treatment Plant or Facility
Long Island Sound Nitrogen Planning Zone
N

Questions?

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