SOUTHEASTERN CONNECTICUT

CLEAN COASTAL HARBORS AND BAYS COMMUNITY ACTION PLAN

FINAL REPORT

JULY 2020

The Nature Conservancy

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CITATIONS

Drinkuth, H., Marguerite, C., Ruddock, K. (2020)

Southeastern Connecticut Clean Coastal Harbors and Bays Final Report.

The Nature Conservancy

Additional resources about this project can be found at:
https://www.liswaterquality.org/community-guidance/

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The Southeastern Connecticut Clean Coastal Harbors and Bays Community Action Plan is a collaborative, community-led project. It was managed and supported by The Nature Conservancy, Clean Up Sound and Harbors (CUSH) and the Mystic Aquarium.

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

The Nature Conservancy

RESEARCH
PROTECT OUR OCEANS
MYSTIC AQUARIUM

CUSH Inc.
Clean Up Sound and Harbors
Keeping Water Healthy

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EXECUTIVE SUMMARY

Degraded water quality caused by nitrogen pollution from wastewater, fertilizers and the atmosphere is among the Long Island Sound's most pressing ecological problems. Since 2001, Connecticut has made significant investments upgrading nitrogen treatment technologies at sewage treatment plants. This effort reduced the amount of nitrogen pollution entering the Sound by over 60%, generating improvements in the open waters of the western Sound where the size and duration of low-oxygen dead zones has diminished. Despite this progress, monitoring and research show that the reductions made at sewage treatment facilities to date are not enough to resolve water quality problems in LIS's coastal waters, rivers and harbors. Serious impacts like harmful algae blooms, fish kills and thick mats of seaweed plague coastal waters where people live, work and enjoy the Sound.

The Southeastern Connecticut Clean Coastal Harbors and Bays project is a collaborative community-based planning process designed to couple local knowledge and expertise with water quality monitoring and research to support healthy conditions in coastal waters. Using nitrogen loading model research, a diverse group of stakeholders assessed the relative contribution of nitrogen from wastewater, fertilizer and atmospheric deposition entering coastal waters. They then compared current water quality conditions and the characteristics, strengths and challenges of various nitrogen reduction options to identify key opportunities in the region. Through this process, participants established a set of local water quality objectives and identified and prioritized supporting actions including 1) building a collaborative communication network with consistent, clear and easily understood messages to reach new audiences and activate individuals to take clean water actions, 2) supporting municipal wastewater and stormwater infrastructure improvements, policy changes and adequate investment in clean water, and 3) promoting increased nutrient monitoring and data collection for establishing nitrogen reduction targets that restore and protect clean and healthy rivers, harbors and bays.

The Southeastern Connecticut Clean Coastal Harbors and Bays Community Action Plan provides a comprehensive list of prioritized actions – including on-the-ground projects and community engagement. The plan serves as a road map for local leaders involved in the process to advance clean water projects and strengthen public support for collective and individual actions that support healthy waters in Mystic River, Stonington Harbor, the Pawcatuck River and Little Narragansett Bay.

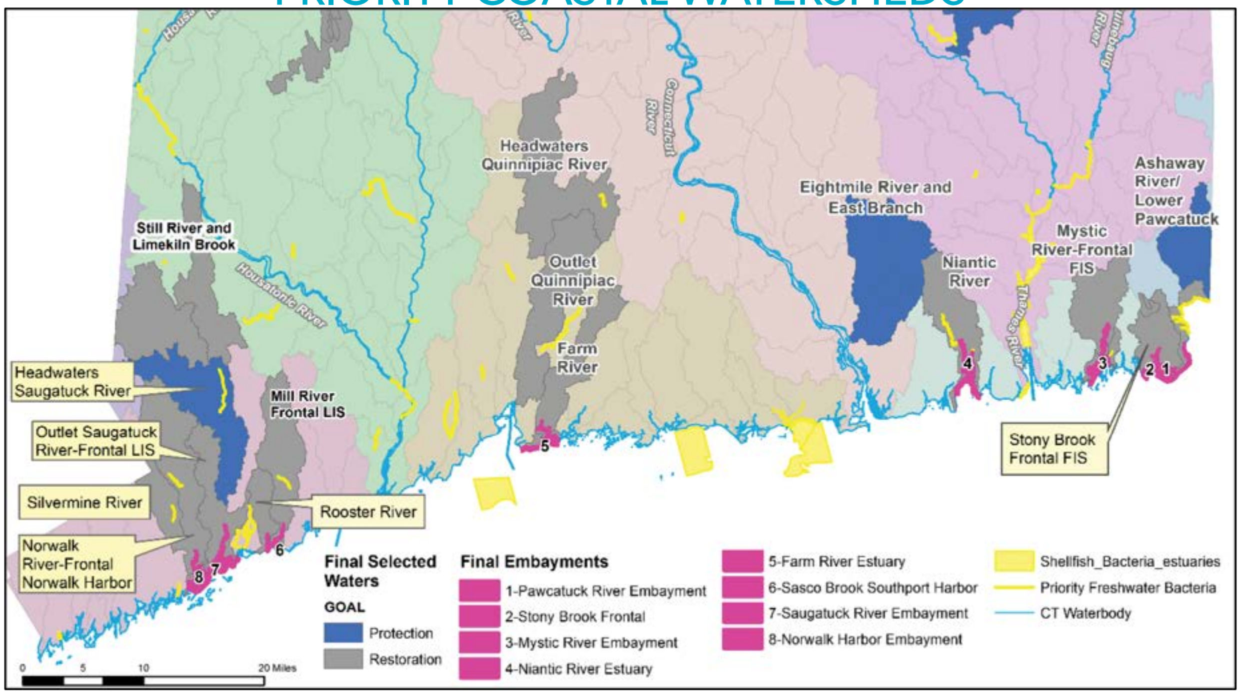
SECTION 1: NITROGEN ACTION PLANNING

Background & Project Objectives

For decades Long Island Sound (LIS) has been plagued by low oxygen zones, which occur in the western end of the Sound in the summer months. Connecticut, New York and the U.S. Environmental Protection Agency (EPA) set a target to reduce nitrogen from sewage treatment plants by 58.5%. Beginning in 2001, the states made coordinated investments to install nitrogen treatment technologies and achieved that milestone in 2017. In open waters of the Sound we are seeing improvements where the size and duration of low-oxygen dead zones has diminished, but monitoring and research show that the reductions made at sewage treatment facilities to date are not enough to resolve water quality problems in coastal waters, rivers and harbors. Since technology upgrades at treatment plants began, the amount of nitrogen from septic tanks and fertilizers making its way to Long Island Sound has stayed steady or increased. We're still seeing serious impacts like harmful algae blooms, fish kills and thick mats of seaweed appearing close to shore where people live, work and enjoy the Sound.

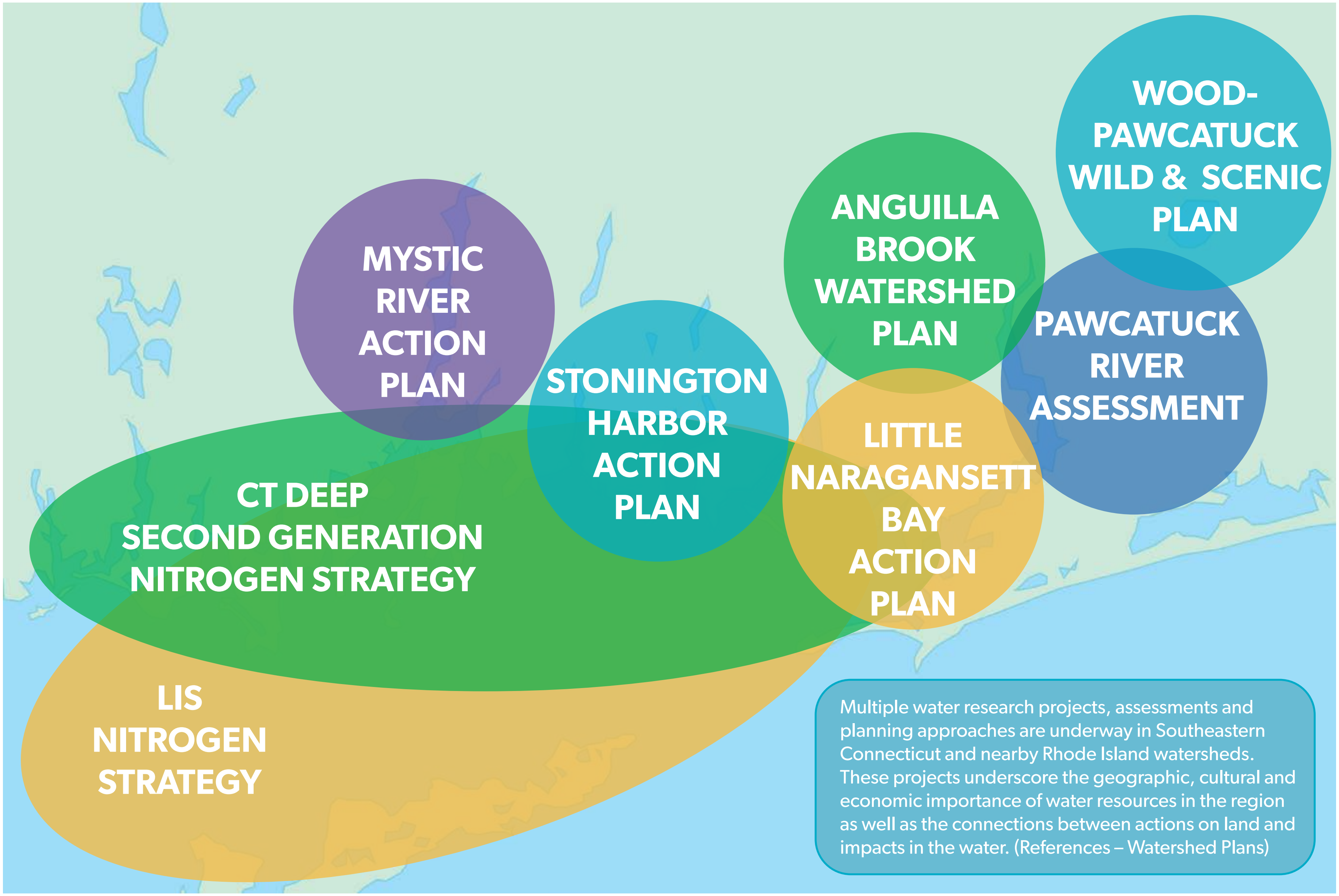
To address these challenges, in 2016, the EPA proposed the Long Island Sound Study Nitrogen Strategy (EPA, 2015) to establish pollution thresholds that protect important ecological resources and habitats – such as eelgrass – and further reduce nitrogen pollution in Long Island Sound's at-risk harbors and bays. Using these thresholds, states and communities can set pollution reduction targets, identify the sources and relative contributions of nitrogen pollution in their local watershed, and select and implement solutions to tackle the problem. Through an Integrated Water Resource Management planning process, the Connecticut Department of Energy and Environmental Protection (DEEP) selected eight coastal embayments – including Mystic River Embayment, Stony Brook/Frontal Fisher's Island Sound and the Pawcatuck River Embayment – for increased monitoring of impacts, nitrogen load research and development of nitrogen action plans as part of the state's Second Generation Nitrogen Strategy (CT DEEP, 2019).

PRIORITY COASTAL WATERSHEDS



Eight priority coastal embayments (magenta) were identified by CT DEEP in 2017 for increased monitoring, research and development of nitrogen action plans.

WATERSHED PLANS



Multiple water research projects, assessments and planning approaches are underway in Southeastern Connecticut and nearby Rhode Island watersheds. These projects underscore the geographic, cultural and economic importance of water resources in the region as well as the connections between actions on land and impacts in the water. (References – Watershed Plans)

PLANNING PROCESS

Critical steps in developing a Nitrogen Action Plan include assessing current pollution loads and setting nitrogen limits – or endpoints – that protect ecological health and human uses in coastal rivers, harbors and bays. Building the plan requires engaging and communicating with stakeholders to ensure there is support for technology and practice solutions.

By identifying the sources of land-based nitrogen pollution from human activity, community members and leaders can apply solutions where they will be most effective. Additionally, the plan should identify the cost of solutions and establish mechanisms to advance action – such as policies, incentives and finance methods. Tracking reduction progress and monitoring water quality conditions allows the plan to be adjusted, updated and improved to restore and sustain waters, now and for future generations.

The Southeastern Connecticut Clean Coastal Harbors and Bays project is a collaborative community planning process designed to couple local knowledge and expertise with water quality monitoring and research to support healthy conditions in coastal waters. The project, funded in part by an EPA Long Island Sound Futures Fund grant, was managed by The Nature Conservancy (TNC) with local support from Clean Up Sound and Harbors (CUSH) and the Mystic Aquarium. Objectives of the project are 1) develop a nitrogen reduction action plan that reflects specific community needs and 2) prioritize a set of pollution reduction projects and actions that help restore healthy conditions in coastal waters.

PROCESS

SECTION 2: ASSESS THE PROBLEM

Impacts and Threats

When excess nitrogen generated by a range of human activities enters the environment, it pollutes our air and water. Wastewater is discharged into rivers and coastal waters from sewage treatment plants or to groundwater from septic systems. Nitrogen from burning fossil fuels falls from the atmosphere to land and water in the form of rain or dust. Fertilizers from lawns, parks and fields or agriculture can wash off the land into streams or seep into groundwater. Too much nitrogen – known as eutrophication- in our rivers, harbors, bays and Long Island Sound can act as a fertilizer in the water, triggering the growth of algae. Rampant algae growth can set off a cascade of problems posing serious risks to coastal waters and human health.

Nitrogen pollution is not unique to Long Island Sound – it is a growing global problem. Low and declining oxygen levels in the open ocean and coastal waters driven by nitrogen pollution have been increasing for the past 50 years. More than 700 coastal areas around the globe are known to be impacted by eutrophication (WRI, 2020) or "dead zones" where marine life can't survive. Climate change and increased development intensify the problem as waters warm and more fertilizers, wastewater and air pollution are generated on land.


© CUSH

NOXIOUS SEAWEED

Nitrogen pollution can trigger rapid growth of seaweeds known as macroalgae. When these algae wash up on shore, they accumulate and rot, creating foul odors. In Stonington Harbor and Little Narragansett Bay, large mats of algae on the surface of the water often prevent people from paddling, swimming and enjoying the water in the summer.

SEAGRASS LOSS

Seagrass meadows are critical coastal habitats that provide food, shelter and nursery areas for all kinds of ocean life, including juvenile fish, bay scallops, lobster and flounder. Research led by The Nature Conservancy shows nitrogen pollution and warming water temperatures are the primary threats to seagrass in the Sound.

POOR WATER CLARITY

Fueled by excess nitrogen, millions and millions of phytoplankton – microscopic, single plant cells – rapidly accumulate. This growth reduces visibility and discolors the water, turning it to murky shades of brown, green and occasionally red. Harmful Algal Blooms (HABs)

In some cases, algal blooms can be harmful, producing neurotoxins that can kill fish or cause paralytic shellfish poisoning if people eat tainted shellfish. Harmful algal blooms are expanding globally, lasting longer, and increasing in levels of toxicity. Some have occurred recently in the bays and coastal waters off Long Island, Massachusetts and other areas.

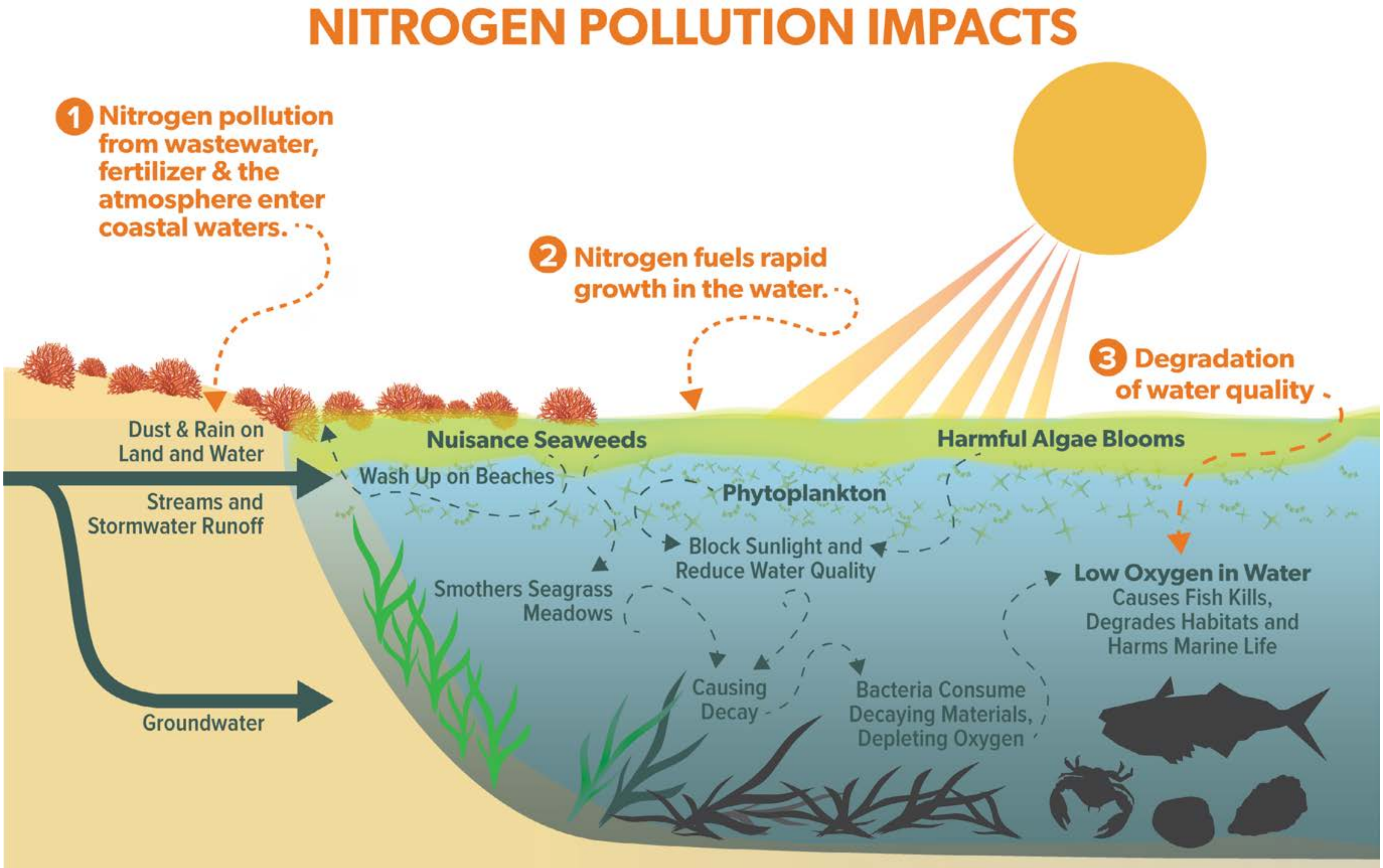
HYPOXIA/ANOXIA

Hypoxia occurs when oxygen levels in water are low. When oxygen is completely depleted, the condition is known as anoxia. During daylight hours, algae grow and reproduce through photosynthesis, producing oxygen as a byproduct, but at night they consume oxygen in the water. As they die and sink to the seafloor, decomposing algae are consumed by bacteria that deplete oxygen.

DEAD ZONES

Lack of dissolved oxygen in bays, harbors and coves suffocates bottom dwelling organisms and fish that are unable to escape these conditions.

HOW NITROGEN POLLUTES COASTAL WATERS



Mapping and Monitoring

Clean Up Sound and Harbors CUSH has promoted awareness and worked to eliminate nitrogen pollution, bacterial contamination and plastic waste in coastal waters for over a decade. In 2008, CUSH began sampling water quality in Stonington Harbor, Wequetequock Cove, Pequotsepos Cove and the Mystic River to measure indicators of eutrophication and ecological health. From 2008-2014 results of their monitoring at eleven sites showed four were considered poor, five were fair and only two — in well-flushed Stonington sites — were determined to be in good health. The report raised attention about water quality challenges in the region.

The Unified Water Study (UWS) is a water quality monitoring protocol designed to allow groups to collect comparable data on the environmental health of Long Island Sound harbors and bays. Launched in 2017 by Save the Sound, the UWS, tracks indicators of eutrophication including dissolved oxygen, water clarity, water temperature, salinity, Chlorophyll a and macrophytes – or seaweed. During the 2019 season, monitoring was conducted in Stonington Harbor and Alewife Cove by New England Science & Sailing Foundation and in Wequetequock Cove, Mystic River and Mystic Harbor by CUSH (STS, 2019).

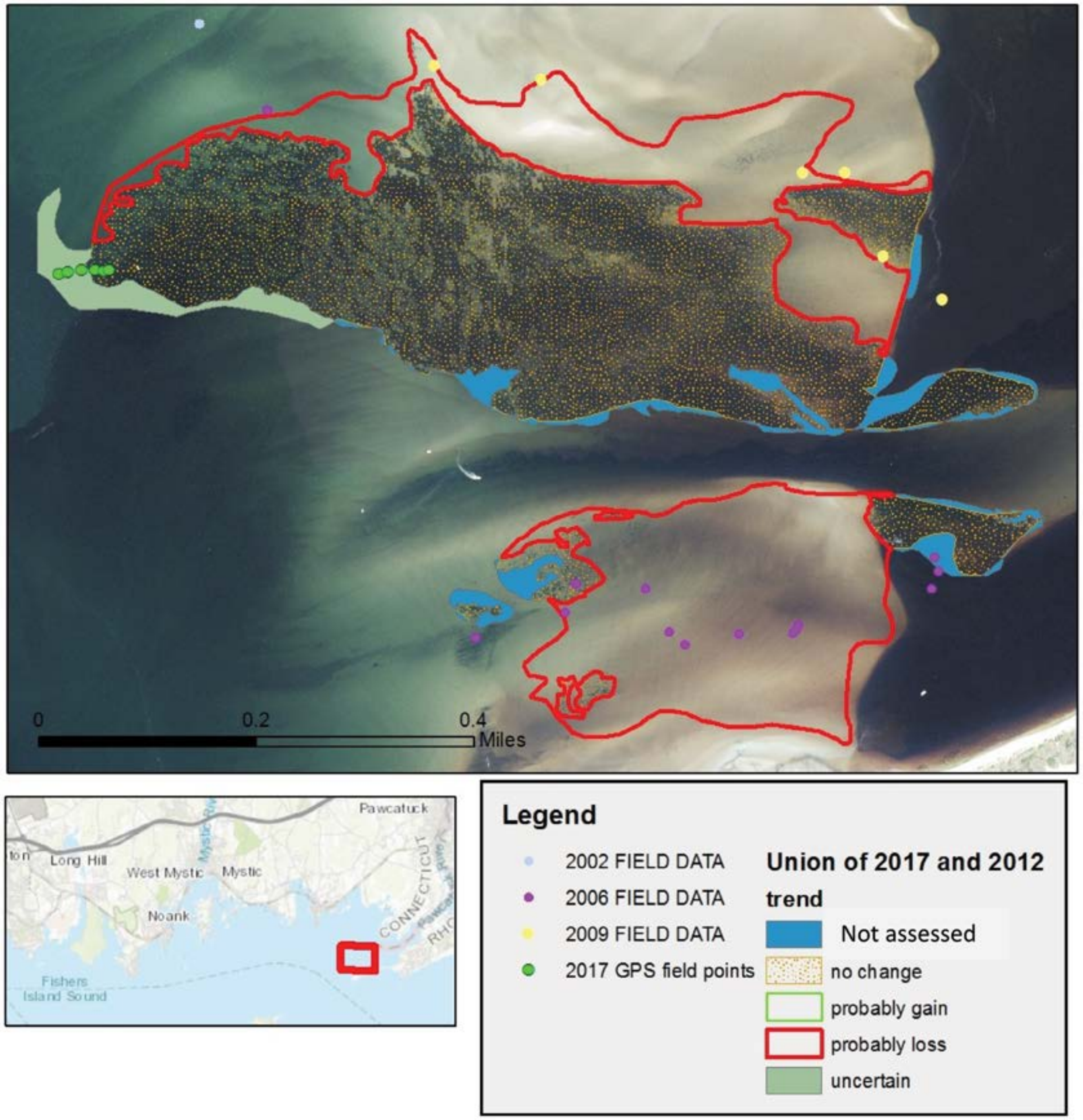
Seagrass meadows are critical coastal habitats that provide food, shelter and nursery areas for all kinds of ocean life, including juvenile fish, bay scallops, lobster and flounder. Nearly 90 percent of Long Island Sound's seagrass meadows have disappeared. Research led by The Nature Conservancy in 2011 shows nitrogen pollution and warming water temperatures are the primary threats to seagrass in the Sound (TNC, 2012).

The Sound's shallow harbors and bays have historically been ideal environments for eelgrass (Zostera marina), a type of seagrass. Once fringed with seagrass meadows that sheltered important fishery species—including flounder, bay scallop and hard clam, today 90 percent of those meadows have disappeared. Research led by TNC in 2011 shows nitrogen pollution and warming water temperatures are the primary threats to seagrass in the Sound.

Around 1990, residents and scientists began tracking seagrass loss in Little Narragansett Bay. In recent years, high nitrogen loads, and poor flushing contributed to explosive growth of Cladophora macroalgae.

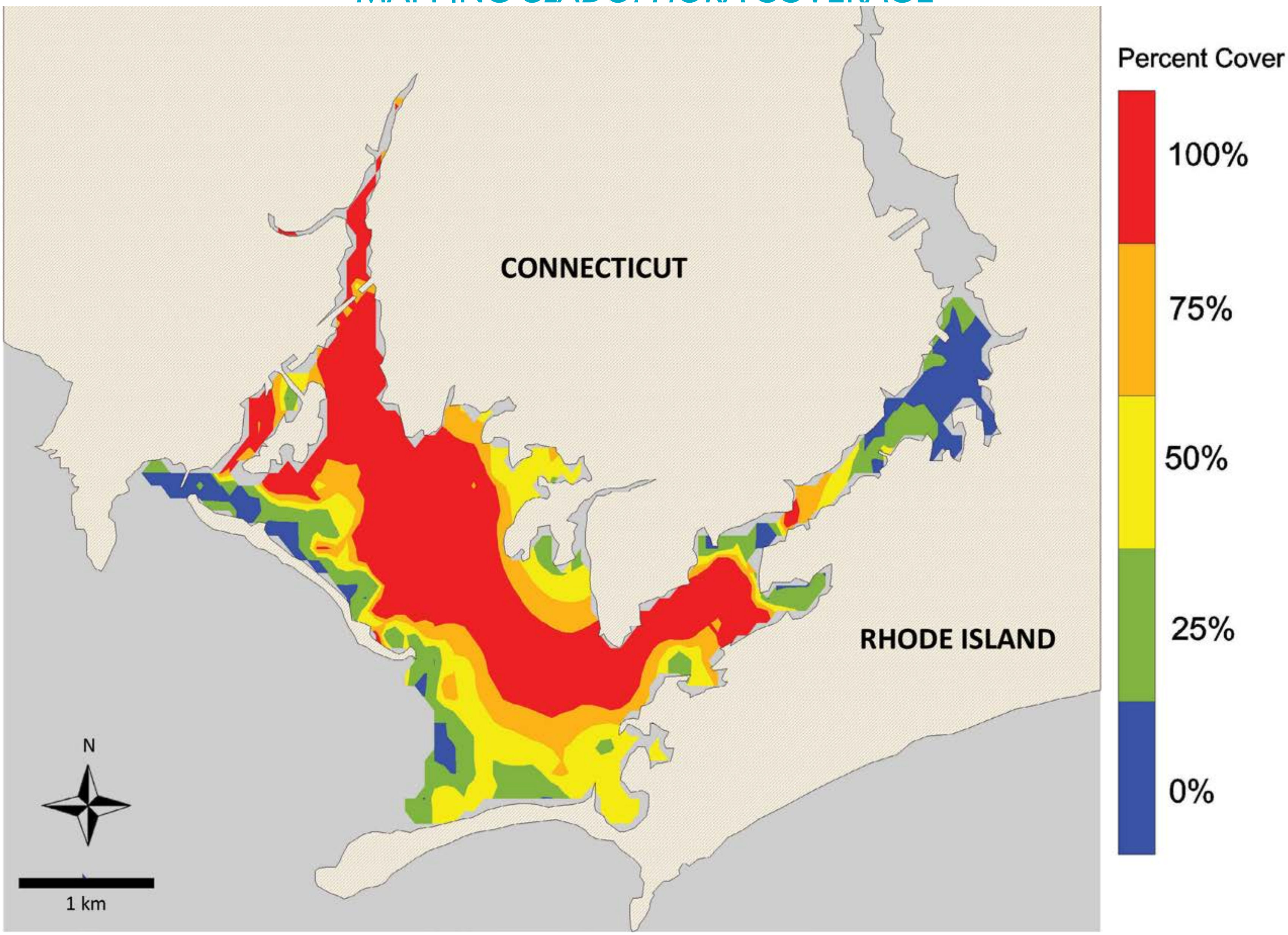
In Little Narragansett Bay this nuisance algae is contributing to a 43% decline of eelgrass between 2013-2017 (USFWS, 2018). During the summer of 2019, a new study mapping the extent of *Cladophora* algae in Little Narragansett Bay was conducted by the University of Connecticut and Save the Bay (Vaudrey 2020). Results of this research will help track response to changes in nitrogen loads and other environmental factors over time.

EELGRASS LOSS IN LITTLE NARAGANSETT BAY



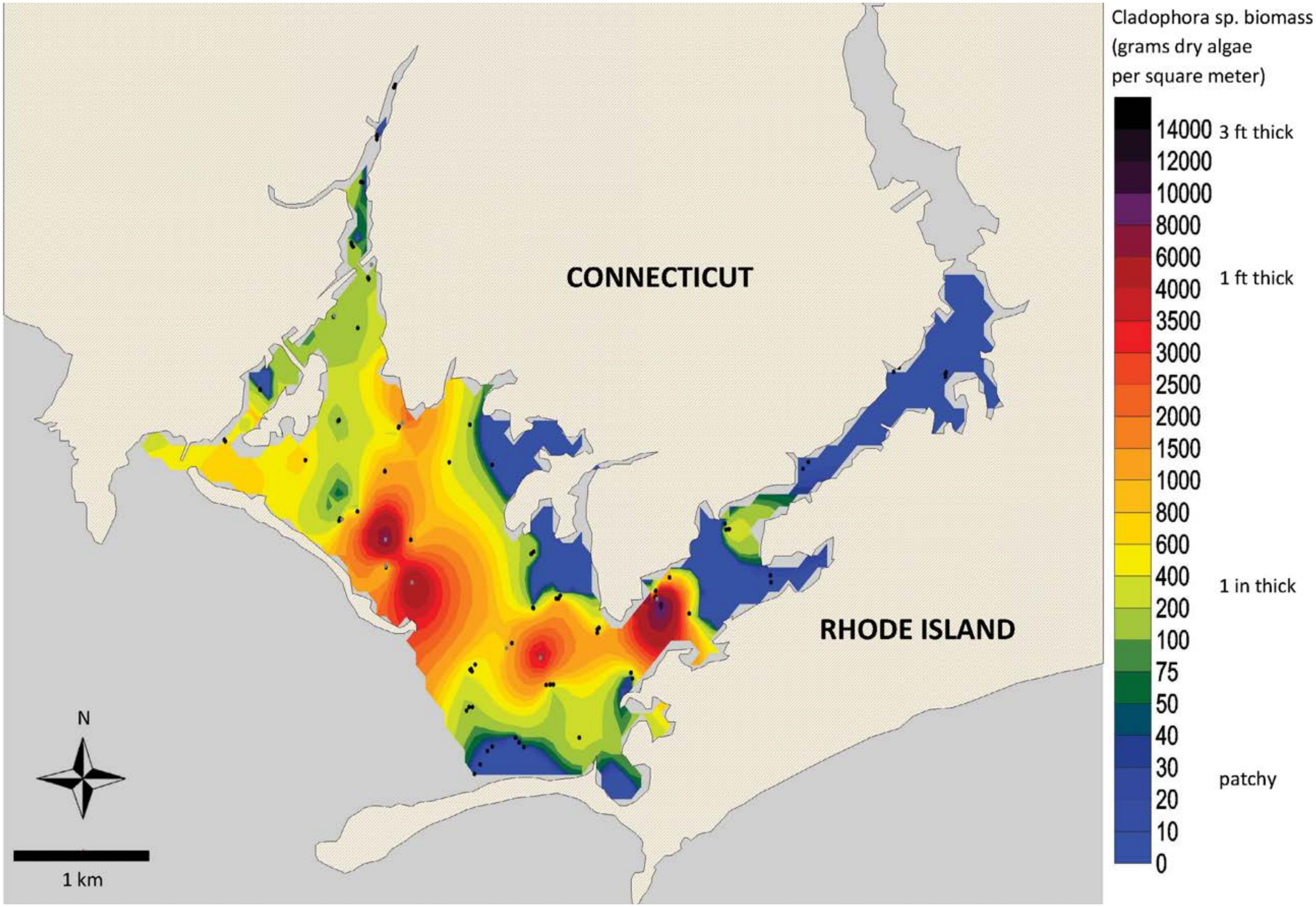
USFWS monitoring indicates eelgrass area in Little Narragansett Bay declined by 43 percent between 2012 and 2017.

MAPPING *CLADOPHORA* COVERAGE



Dostie, Amanda and Jamie Vaudrey (2014) Cladophora sp. percent cover in Little Narragansett Bay, July 8-10, 2014..

MAPPING *CLADOPHORA* BIOMASS



Dostie, Amanda and Jamie Vaudry (2014) Cladophora sp. biomass in Little Naragansett Bay, July 8-10, 2014. Black and grey points are sample locations. Grey were sampled by snorkeler, as the Cladophora was too deep to sample via grab.

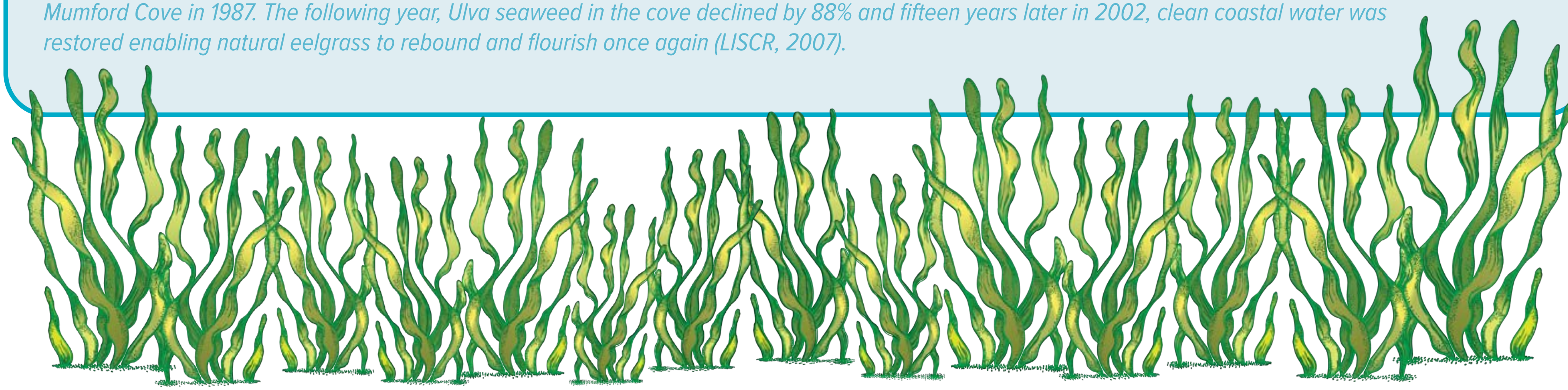
HEALTHY EELGRASS BEDS

Eelgrass off Fishers Island © Kristie Gianetto

RECOVERY IS POSSIBLE!

More than 3 million gallons of sewage per day was discharged into Mumford Cove from an old Navy housing facility, creating water conditions described as "pea soup" green.

Following sixteen years of appeals after a 1971 lawsuit brought by the Mumford Cove Association, the Town of Groton redirected the wastewater away from Mumford Cove in 1987. The following year, Ulva seaweed in the cove declined by 88% and fifteen years later in 2002, clean coastal water was restored enabling natural eelgrass to rebound and flourish once again (LISCR, 2007).



Pollution Loads and Sources

The Long Island Sound Nitrogen Loading Model (LIS NLM) developed by Dr. Jamie Vaudrey employs land use data coupled with characteristics of the Sound's coastal rivers, harbors and bays to estimate nitrogen loads from human activities and water bodies at greatest risk for exhibiting symptoms of eutrophication such as low dissolved oxygen, harmful algal blooms, macro algae and eelgrass loss (Vaudrey, et al, 2016).

The model uses population data, existing sewer areas and parcel maps to calculate estimated nitrogen loads from residential septic systems. Land cover types and predicted fertilizer application rates are used to estimate nitrogen from lawns, agriculture, parks and golf courses while calculated nitrogen pollution from atmospheric deposition that falls on the land in the form of precipitation or dust is added to the total load.

Vaudrey' s research indicates about half of the nitrogen from human activities in both the Pawcatuck and Mystic River watersheds comes from wastewater, but the total loads are significantly different. In the Pawcatuck River watershed, roughly 30% or 70,000 kg N/yr is discharged from sewage treatment and industrial plants, while the calculated load from septic systems is about 48,000 kg N/yr. In the Mystic River watershed, wastewater from sewage treatment represents 26% or 8,000 kg N/yr and septic systems about 25% or 7,800 kg N/yr.

The sources and relative contributions of nitrogen pollution from wastewater, fertilizer and atmospheric deposition (rain and dust) entering harbors and bays varies widely between watersheds, which underscores the importance of using a variety of tools and options to help communities target pollution with effective solutions. The LIS NLM is a useful tool decision makers can use to develop scenarios that estimate potential nitrogen load reductions associated with various actions such as reducing fertilizer applications and upgrading wastewater technologies. Scenario maps are help people visualize where different actions might be feasible and support water quality improvements.

The Pawcatuck River in Connecticut and Rhode Island is an important river with unique characteristics. It's large watershed spans both states and supports a wide variety of land uses from commercial downtowns and coastal marinas, to suburban neighborhoods and relatively rural agricultural lands and forests. With support from EPA and the Southeast New England Coastal Watershed Restoration Program (SNEP) the Connecticut Department of Environmental Protection (DEEP) and Rhode Island Department of Environmental Management (DEM) are collaborating to develop a water quality model for estimating and locating nutrient loads (CT DEEP, 2019). Results of this model will help state and municipal agencies establish and meet pollution targets.

Set Restoration End Points

Restoration endpoints are the water quality conditions - or goals - we want to restore or protect (EPA, 2018). These ecological endpoints are closely linked with community values and human uses of our harbors and bays.

Studies show people in Southeastern Connecticut value their coastal way of life. Boating, fishing, swimming, walking on the beach and delicious seafood are all crucial to maintaining a vibrant coastal economy that depends on tourism and recreation. Impacts of nitrogen pollution and fecal bacteria contamination threaten healthy water conditions and the activities people enjoy.

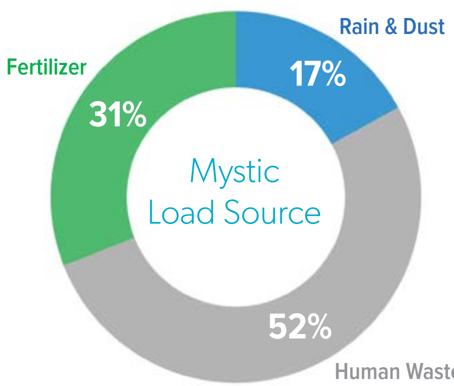
Eelgrass is a seagrass species that flourishes in low nitrogen environments, making it a good indicator of a healthy harbor or bay. Eelgrass provides important habitat for marine life and juvenile fishes and can dampen the impact of waves and storms, helping to protect coastal communities.

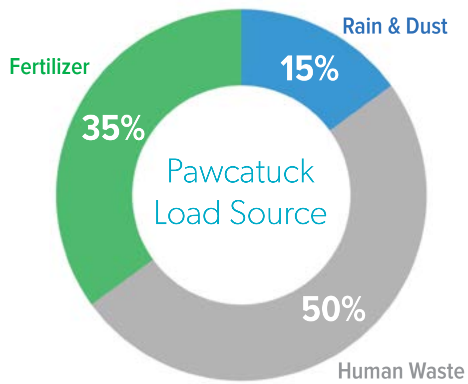
For eelgrass to thrive in Southeastern Connecticut harbors and bays it requires the right conditions including adequate water clarity for sunlight to reach the plants, lower nitrogen concentrations, and low volumes of seaweed that can smother seagrass meadows.

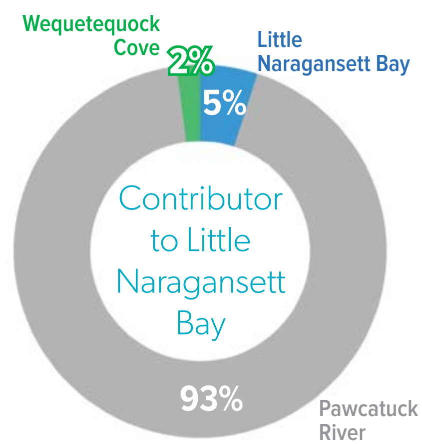
With this in mind, workshop participants prioritized achieving the following short-term goals in the next 3-10 years:

- Reduce the area and volume of Cladophora seaweed in the water and on beaches
- Reduce the frequency of algal blooms
- Improve water clarity
- Track down and reduce fecal bacteria contamination

Accomplishing these goals will help ensure conditions in the next 10-20 years include clear water, clean beaches free from rotting seaweed and bacterial contamination and healthy seagrass meadows that support enjoyable recreation, safe seafood and a vibrant coastal economy.







WE CAN: Reduce Nitrogen Pollution and Treat Sewage

TO ACHIEVE THESE RESTORATION ENDPOINTS:

THAT SUPPORT:

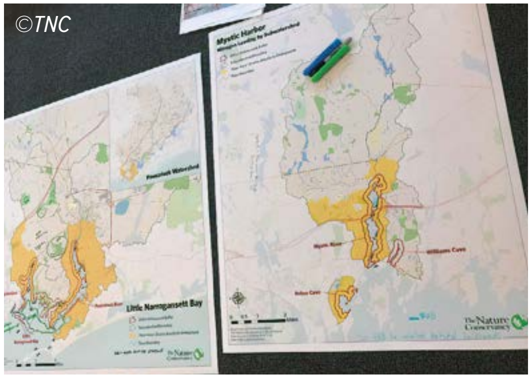
SECTION 3: BUILDING THE PLAN

Engage Stakeholders

Successful plans require engaging a variety of stakeholders to include diverse points of view, enhance public understanding of problems and encourage early and ongoing participation in solutions.

Between May 2019 and May 2020, more than 50 local and regional stakeholders participated in Southeastern Connecticut Clean Harbors and Bays workshops, attended in-person and on-line meetings and presentations, or provided opinions and feedback through surveys and focus groups.

The importance of engaging new stakeholders – beyond those already aware of or working on coastal water challenges – is a recurring and critical theme of this project. Stakeholder engagement and public communication activities underpin every priority action identified in this plan. Specific topics, audiences and communication channels are highlighted in the Communication Strategy.



Build Communication Strategy

A working group of thirteen state and regional stakeholders participated in two meetings over the summer of 2019 to develop a public engage and communication strategy. Primary objectives of the strategy include:

- Building and funding a collaborative network for communication and advocacy
- Developing targeted communications, images & visualization tools
- Establishing multiple media/ communication channel options – especially virtual and socially distant options
- Reaching key audiences to increase awareness of the challenges, build support for solutions and encourage improved policies and investment in clean water:
- Property owners
- Local and state public officials
- New stakeholders (not just the ones that are already convinced)

In March 2020, as the Covid-19 pandemic interrupted in person meetings, the Communication work group began holding remote meetings to refine and adjust priorities and identify opportunities for safe, socially distant, collaborative communication. Key priorities for remote engagement include:

- Describing the links between water management plans and projects in Southeastern CT
- Providing clear, compelling examples of the benefits of clean coastal water to raise public awareness and build support for positive environmental actions to protect and restore coastal harbors and bays and support community values:
    - Protect and Restore: Clear Water, Clean beaches & Healthy Seagrass
    - Support: Swimming, Fishing Boating, Safe Seafood & Vibrant Coastal Economies

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Set Nitrogen Reduction Targets

Research and monitoring help scientists and regulators estimate the amount of pollution a water body can tolerate while remaining safe for human uses such as swimming and fishing. Coastal habitats also have pollution thresholds. For instance, studies have shown seagrass health begins to decline when total nitrogen concentration in coastal waters exceeds 30 kilograms per meter per year (about 27 lbs/acre of water/year). Pollution concentration depends on several factors - such as land uses and area contributing to the water, the area and depth of water and the amount of tidal exchange. Large, open harbors can "flush" water out to the Sound much more quickly than small, constricted coves.

Understanding how sources and contributions of pollution vary between harbors and bays allows decision makers to set nitrogen targets that maintain or restore healthy water quality endpoints.

NITROGEN LOAD WE HAVE

ACTIONS
TO REDUCE NITROGEN

NITROGEN LOAD WE WANT

Difference = Reduction Target

Nitrogen Reduction Target is the difference between:

The nitrogen load we have (degraded water: algal blooms, noxious seaweed, low oxygen, fish kills)

And the nitrogen load we want (endpoints: clear water, clean beaches, healthy seagrass)

Identify Solutions and Barriers to Success

Proven solutions for managing wastewater and stormwater and reducing the impacts of fertilizers are available, yet in many communities across New England, development patterns and policies, historic land use practices, lack of funding and competing water management priorities – among other challenges – can present barriers to using effective technologies and practices.

Since 2000, the state of Connecticut and municipalities have made significant investments upgrading nitrogen treatment at wastewater facilities. Upgrades continue in New York and increased nitrogen treatment at wastewater plants in neighboring states of Massachusetts and Rhode Island also present opportunities to improve conditions in Long Island Sound.

Throughout New England and New York, conventional septic systems designed nearly a century ago have been used to treat bacteria from human waste. Unfortunately, these systems are not always effective at treating nitrogen pollution before effluent enters groundwater – particularly in areas close to waterways or with high ground water – such as coastlines and lake shores.

New onsite septic system technologies, capable of safely removing far more nitrogen from human waste are available, but they are not currently permitted for installation at single family homes in Connecticut. Just as we upgraded wastewater treatment facilities in Connecticut to reduce nitrogen before it is discharged to waterways, we can use 21st century septic system technology to treat pollution before it enters groundwater and makes its way to harbors and bays.

Additionally, we can do a better job of managing the way we use fertilizers by changing landscaping and agricultural practices to protect and restore healthy coastal waters and capturing or buffering stormwater runoff before it enters streams and the Sound.

On October 17, 2019, thirty-five stakeholders – including scientists, state and regional water resource managers, local citizens and business owners – attended the second Southeastern-Connecticut Clean Coastal Harbors and Bays Workshop and the Mystic Aquarium.

Participants reviewed a set of nitrogen reducing technologies, management practices and behavior options adapted from the Cape Cod Commission Technology Matrix (CCC, 2020) and The Nature Conservancy's LIS Clean Coastal Water Solutions. Review of each practice includes nitrogen removal capabilities, average project costs over the expected lifespan, cost per pound of nitrogen removed, as well as strengths and weaknesses of each practice.


Bioswale, ©TNC


Wastewater Treatment, ©TNC


Fertilizer ©iStock

TECHNOLOGY OR PRACTICE SOLUTION

N Removal Potential (%)	How it Works	Average Cost ($)	Removal Efficiency ($/lb of N)
Manage Fertilizers 25-75%	Focuses on timing, amount and fertilizer application rates on lawns, golf courses, public parks & playing fields through campaigns, demonstration projects and local ordinances Promotes and incentivizes agricultural best management practices to reduce fertilizer application rate	Watershed-wide Campaign $50,000 - $100,000 Approx. $15 per household	$67-$250
Green Stormwater Infrastructure 25-40%	Reduces stormwater volume and the amount of nitrogen that reaches waterways using grassed channels, raingardens or bioswales. Added benefits: Can reduce inland flooding, capture bacteria and other contaminants in stormwater runoff and incorporate plants that attract pollinators.	Average Material and Installation Cost: $11,000 Operations and Maintenance: $200-$300 per year	$139
Advanced Septic System Technology 50-90%	Treats nitrogen using proprietary or nonproprietary septic system components or enhanced drain field to achieve a nitrogen concentration of between 10-13 mg/L before effluent enters groundwater	System Cost Range: $10,000-$40,000 Operations and Maintenance: $500-$3,200 per year	$580-$770
Advanced Wastewater Facility Treatment 50-81%	Treats wastewater to achieve a nitrogen concentration of 5 mg/L or less Eliminates nitrogen entering groundwater by increasing household connections within existing sewer service areas	Estimated Treatment Plant Upgrade Cost: $7-33 Million One-time Cost to Connect to Existing Sewer Line: $1,000-$6,000	$54 Avg. $/lb over over 10-year life span
Habitat Restoration N Removal Project Specific	Removes accumulated biomass or nutrient laden sediment supports recovery of nearshore habitats like eelgrass. Re-engineered and reconstructed bridge or culvert openings increase tidal exchange, decrease nitrogen residence time and lower nutrient concentration	Average Dredging Project Cost including Operations and Maintenance: $231/cu yard	N/A

NITROGEN REDUCTION TARGETS & ACTIONS

		TARGETS/CHANGE	BEHAVIOR/PRATICE	SUPPORTING ACTIONS	METRIC
NEAR-TERM GOALS	Fertilizer	**Reduce fertilizer load to harbors and bays by 50-100%** from, private lawns and turf, public parks, playing fields and golf courses	• Promote lawn and turf practices that reduce or eliminate fertilizer use • Require or incentivize lawn and turf practices that reduce nutrient pollution • Require or incentivize vegetated buffers	• Trainings • Demonstration projects • Lawn care & Pollinator Pathway campaigns • Policy changes • Incentive programs • Greenway Plans • Public Awareness Campaign	% households committed to best practices % parks, playing fields and golf courses applying no or less fertilizer # incentives or policies adopted # linear feet buffer installed # Greenways implemented # lbs. nitrogen reduced
NEAR-TERM GOALS	Fertilizer	**Reduce nitrogen load from agriculture by 50%**	• Install vegetated riparian buffers • Improve application timing • Increase healthy soil practices • Improve soil testing • Establish nutrient trading program • Manure management	• Policy changes • Health Soils Campaign • Incentive programs • Funding and finance	# policies adopted # management agreements # healthy soils practices adopted # healthy soils practices adopted # lbs. nitrogen reduced
NEAR-TERM GOALS	Stormwater	**Reduce nitrogen load from stormwater runoff** within 300 feet of waterways	• Require or incentivize installation of advanced septic systems capable of treating 50- 90% of nitrogen • Increase household connections in the Stonington/Pawcatuck sewer service area • Install Permeable Reactive Barriers	• Policy changes • Incentive programs • Demonstration projects • Funding and finance • Public Awareness Campaign	# Bioswales installed volume stormwater treated
LONG-TERM GOALS	Wastewater	**Reduce nitrogen load from septic systems by 50-90%** near harbors and bays Eliminate nitrogen and contaminant pollution from marine vessels	• Require or incentivize installation of advanced septic systems capable of treating 50- 90% of nitrogen • Increase household connections in the Stonington/Pawcatuck sewer service area • Promote Boat Pumpout Programs	• Demonstration projects • Policy changes • Oversight and Management • Incentive Programs • Funding and finance • Public Awareness Campaign	# systems upgraded # PRBs installed Volume groundwater treated # lbs. nitrogen reduced
LONG-TERM GOALS	Wastewater	**Enhance nutrient removal** at Westerly wastewater and industrial treatment plants	• Promote increased treatment requirements in discharge permits • Support state, federal and municipal investment in WTP upgrades	• Communication campaigns • Funding and Finance • Public Awareness Campaign	# permits approved $ funding invested # lbs. nitrogen reduced
LONG-TERM GOALS	Habitat	**Reduce** the volume of **seaweed and decayed biomass** in Little Narragansett Bay	• Develop and implement a bio-extraction or dredging plan to remove nuisance macro algae	• Research • Feasibility study • Permitting • Funding • Public Awareness Campaign	# plans Macro algae removed Acres of eelgrass

SECTION 4: TAKE NITROGEN REDUCTION ACTIONS

Identify Opportunities

Tackling nitrogen pollution from sources spread across the landscape is challenging, but the longer we wait to take steps – such as upgrading wastewater systems and reducing fertilizers – the harder and costlier it will be to fix the problem.

Because nitrogen pollution sources and coastal water conditions differ between communities, not all solutions are appropriate for every situation. With a variety of options, water managers and communities can target pollution sources and water quality challenges with effective solutions. Further, looking holistically at water challenges such as nitrogen pollution, fecal bacteria contamination, coastal and inland flooding as well as warming water temperatures makes it possible to identify multi-benefit solutions capable of addressing multiple community problems.

Workshop participants were asked to share their opinions and local knowledge by identifying and mapping

1. potential opportunities to advance nitrogen reducing technologies or practices,
2. any known water quality challenges such as algal blooms, flooding or bacteria problems, and
3. potential physical or geographic limitations to various technologies.

Key opportunities identified and mapped include:

Baseline and ongoing long-term water quality monitoring has been conducted throughout the region and can be used to measure response to pollution reduction over time. **Prioritize continuous dissolved oxygen monitoring in at-risk harbors and bays.**

Public support for reducing or eliminating lawn and turf fertilizer is very high. Several examples of organic landscaping and lawn/turf management projects – including recent promotion of Pollinator Pathways and rain gardens – provide excellent demonstration opportunities. Expanding projects to additional publicly accessible such as schools, parks and playing fields can help private property owners embrace healthy lawncare practices.

Support and incentive adoption of fertilizer and manure management best practices at farms across the region.

Promote aquaculture such as oyster farms and kelp farms and conduct bio-extraction research to **reduce the volume of nuisance seaweed** and improve conditions for healthy habitats like seagrass meadows to thrive.

Promote and prioritize multi-benefit stormwater management, resilience projects and vegetated buffers capable of reducing impacts of nutrient pollution and pathogens, enhancing resilience of habitats like eelgrass and shellfisheries and reducing community risks from flooding and storm surge. Several resiliency plans - including the Wood-Pawcatuck Watershed Flood Resiliency Management Plan, the Town of Stonington Coastal Resilience Plan and the Southeastern Connecticut Regional Resilience Framework Vision Project - have identified multi-benefit implementation projects.

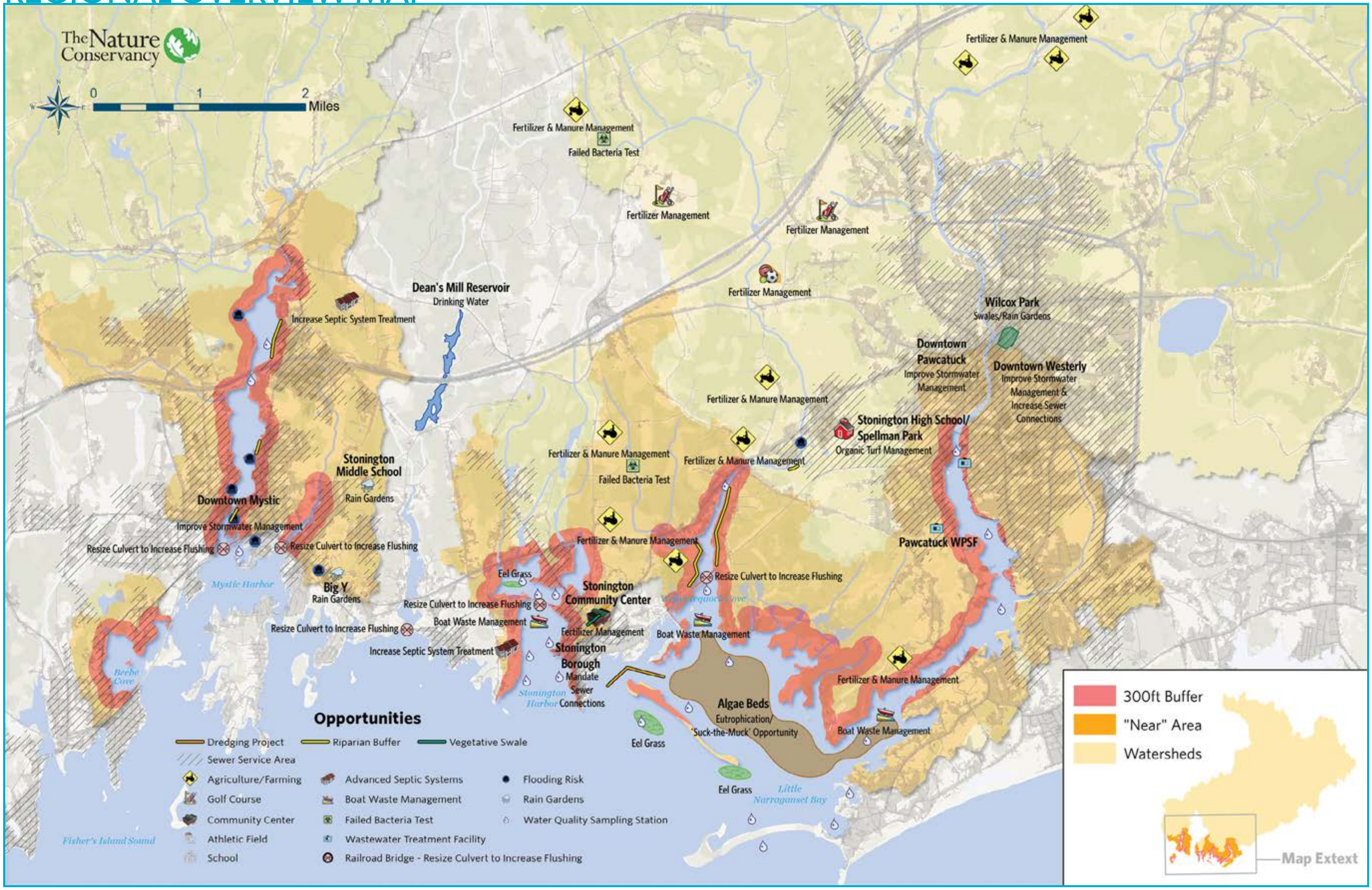
Resize rail crossings and road culverts to increase tidal flushing in restricted harbors and bays.

Pilot test advanced septic system technologies in near coastal areas outside of sewer service districts. Connecticut can learn from AT experience in nearby Rhode Island and Long Island communities - particularly higher density, compact villages closest to harbors and bays where environmental response can be monitored.

Increase sewer connections and capacity in Stonington's Wastewater Treatment Facilities. The Town of Stonington recently approved a $10M bond for infrastructure improvements and a feasibility study of capacity at the Mystic and Stonington Wastewater Treatment Facilities.

Increase nutrient pollution removal at Westerly wastewater facilities. Promote increased treatment requirements and technology upgrades through permit renewals.

REGIONAL OVERVIEW MAP



Content presented in the regional overview map represents data input from technical experts and knowledgeable local stakeholders. It is intended as guidance and provided for informational purposes. Information is believed to be accurate, but accuracy is not guaranteed.

Mystic River Watershed

Targeting the Sources of Pollution

By understanding the source types and locations, decision makers can choose solutions that target and reduce pollution it at its source. Distinguishing zones is important because areas like the 300-foot buffer along the river (shown in red) and areas closer to the harbors and bays (shown in dark yellow) have a greater impact on coastal water.

Nitrogen removal scenarios help demonstrate where and how various behaviors and management practices can be used on land to reduce nitrogen pollution and support healthy conditions in the water.

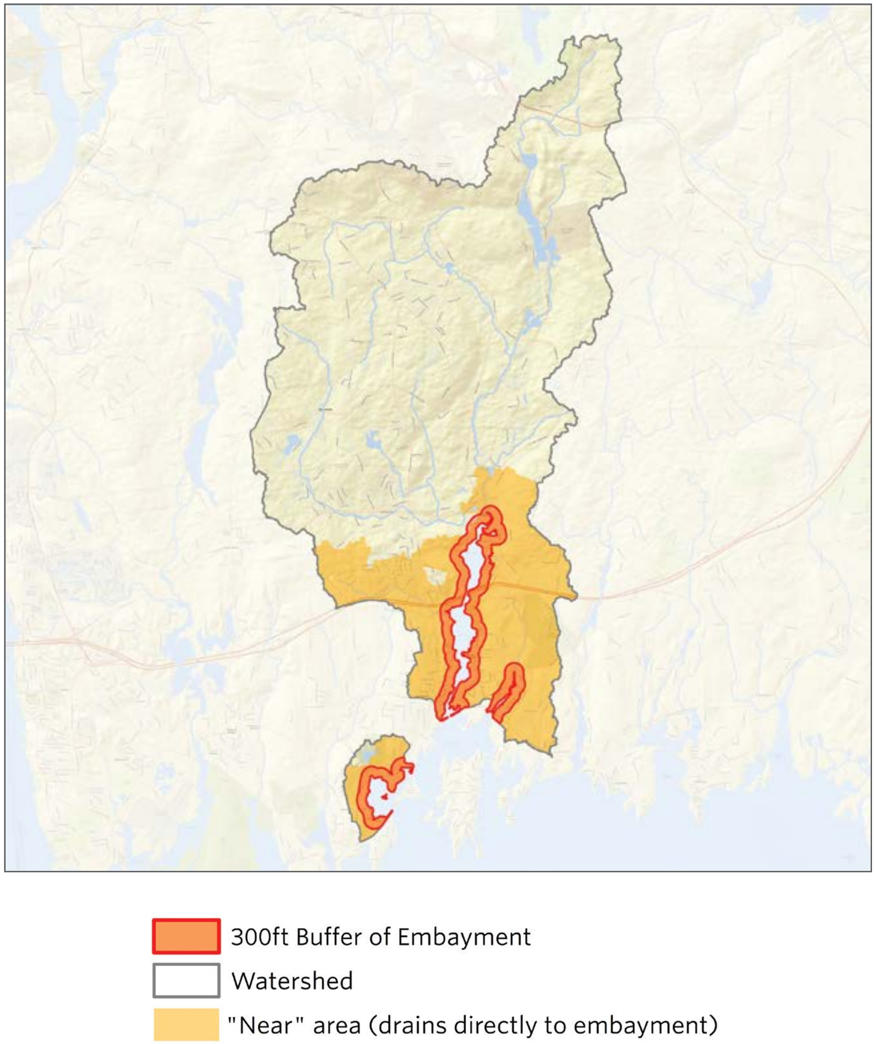
The Mystic River Watershed Nitrogen Loading Model shows a current estimated load of about 84,000 lbs. per year.

The Mystic River sewage treatment plant already operates at the highest nitrogen removal rate and has reached its full capacity. To further reduce nitrogen sources, management options must focus on fertilizers and septic systems.

Water quality monitoring indicates the Mystic River Harbor is experiences occasional algal blooms – particularly in constricted areas where tidal flushing is limited – but conditions in most of the harbor are healthy.

Cutting 50-100% of fertilizer use on lawns, parks and playing fields throughout the watershed and encouraging the use of vegetated buffers and rain gardens within 300 feet of waterways could help maintain healthy conditions in Mystic River. Buffers and rain gardens, known as green stormwater infrastructure (GSI), have the added benefit of reducing flooding impacts from rain events. Incorporating native pollinator attracting plants can reduce pollution while also increasing biodiversity.

Adding sewage treatment capacity and increasing the number of household hook ups in areas close to the river and harbor Harbor could further reduce nitrogen loads, while resizing rail crossings and culverts can help increase flushing and water exchange in constricted areas prone to algal blooms.

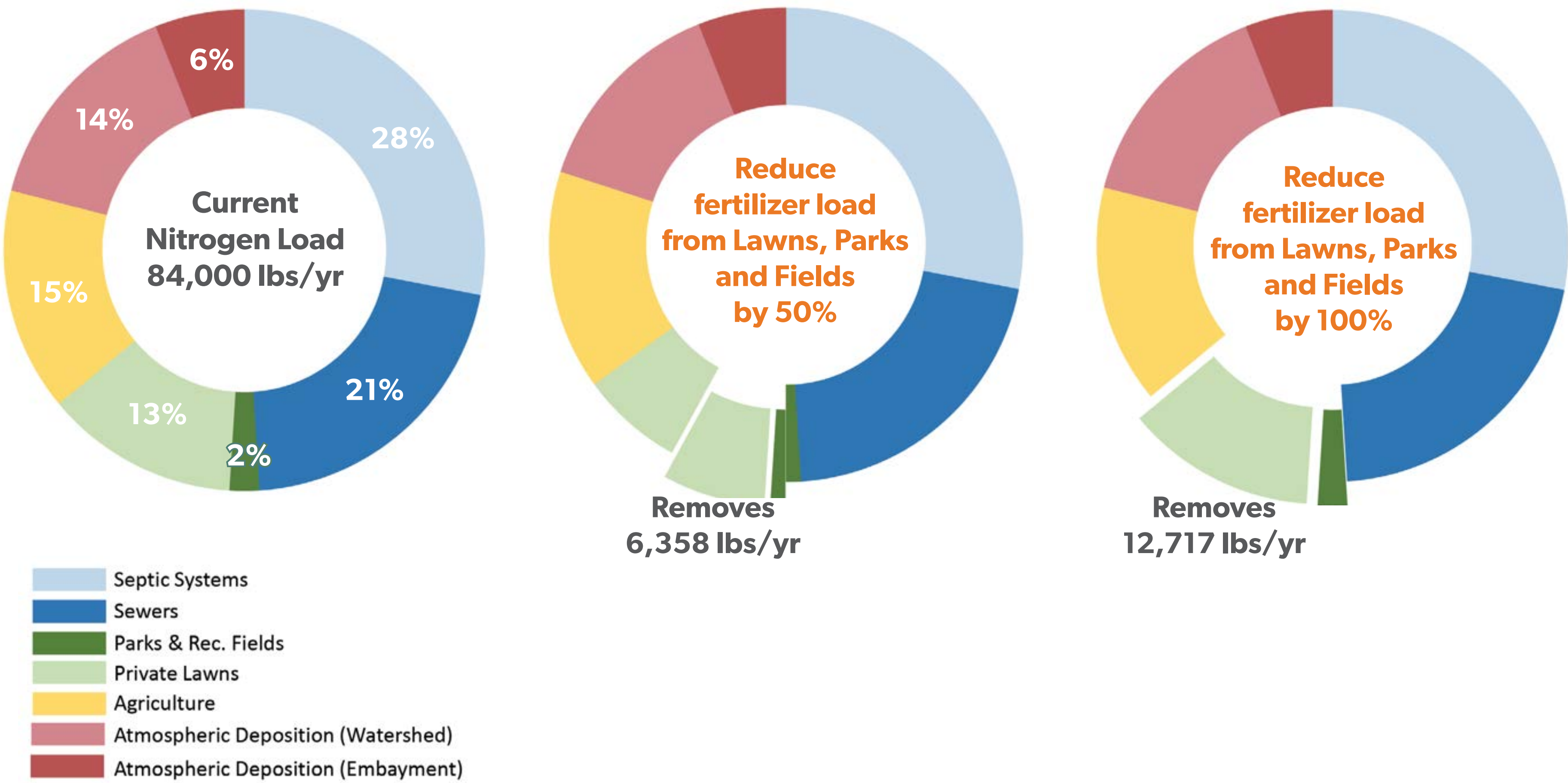


WATERSHED SNAPSHOT

- Watershed (Land) Area: 26 sq. miles
- Embayment (Water) Area: .46 Sq. miles
- Mystic River Length: 3.2 miles
- Main Tributaries: Whitford Brook, Haleys Brook
- Population: 56,361 (Density: 2,167/ sq. mile)
- Population on Septic: 31,197
- Stormwater Management Area: 34%
- Land use types:
  - Forested: 67%
  - Developed: 15%
  - Lawn and Turf: 9%
  - Agricultural: 6%
  - Water: 2%
  - Barren: 1%

Mystic River and Harbor

WATERSHED REDUCTION TARGET: 10-15%:



Stonington Harbor Watershed

Conditions, characteristics and nitrogen loads can vary significantly between Long Island Sound's coastal watersheds. Population, land use, development patterns and area of a watershed are all factors that contribute to the amount relative contribution of nitrogen from human sources. Considering multiple factors when evaluating pollution reduction options helps decision makers choose the "right" solution to fix the "right" problem.

The Stonington Harbor Watershed at just 2.4 sq miles is about 10% the land area of the Mystic River Watershed, yet the estimated annual nitrogen load to Stonington Harbor, 19,011 lbs/year is about 23% of that entering Mystic River Harbor.

Monitoring shows water quality in Stonington Harbor currently supports swimming, boating and shellfish beds. A nitrogen reduction target of 15-20% from land-based activities will help ensure water remains clear and beaches stay clean — even as water temperatures increase.

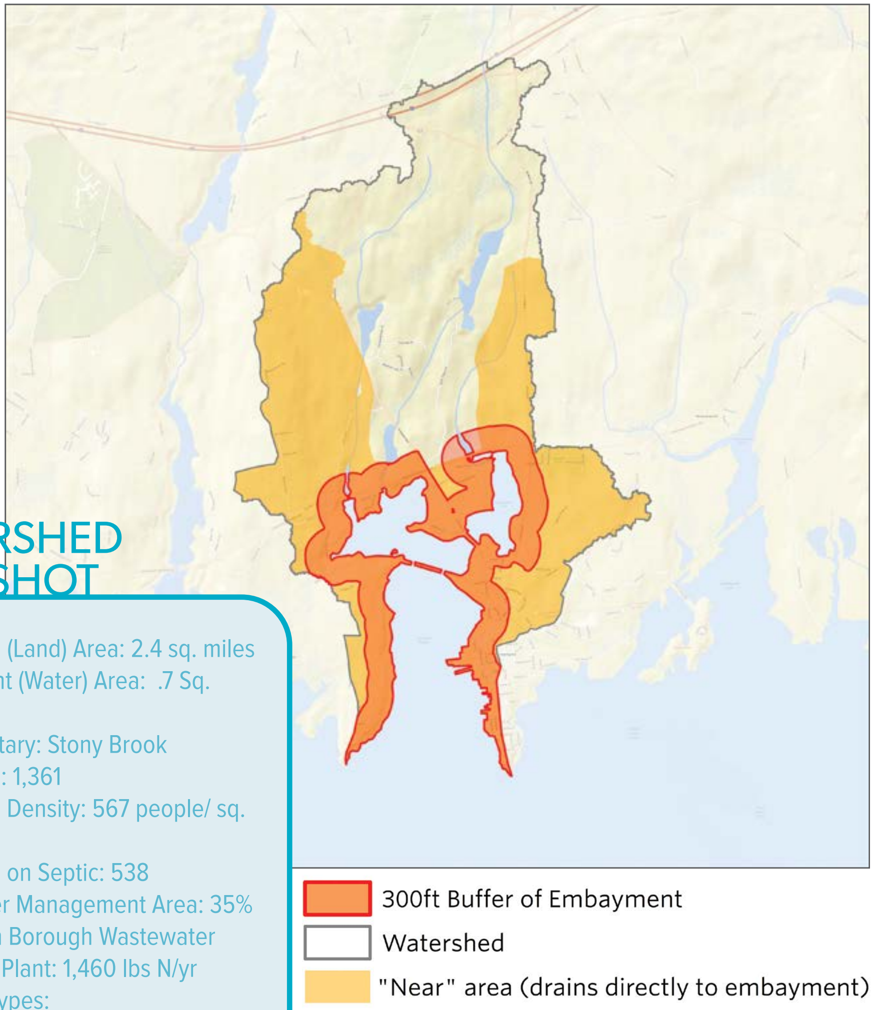
For many years, CUSH and Stonington residents have worked to demonstrate lawn and turf management practices at municipal buildings and parks.

Cutting 50-100% of fertilizer use on lawns, parks and playing fields by expanding healthy lawn care throughout watershed, developing a community plan to install greenways and incentivizing vegetated buffers on private land can help address polluted runoff while also increasing safe public access to the water and enhancing natural shorelines as sea level rises. Replacing grass lawns with native plants and pollinator gardens can decrease pollutants, reduce unwanted insects and strengthen food production in the region.

The Stonington Borough sewage treatment plant already operates at the highest nitrogen removal rate. Increasing the number of household connections to the sewage treatment plant or upgrading septic systems can reduce nitrogen pollution from wastewater.

In this scenario, we show that upgrading household septic systems within the near area (dark yellow) to treat 50% of nitrogen has nearly the same reduction impact as upgrading fewer systems to treat 90% of nitrogen in the 300-foot buffer area (red).

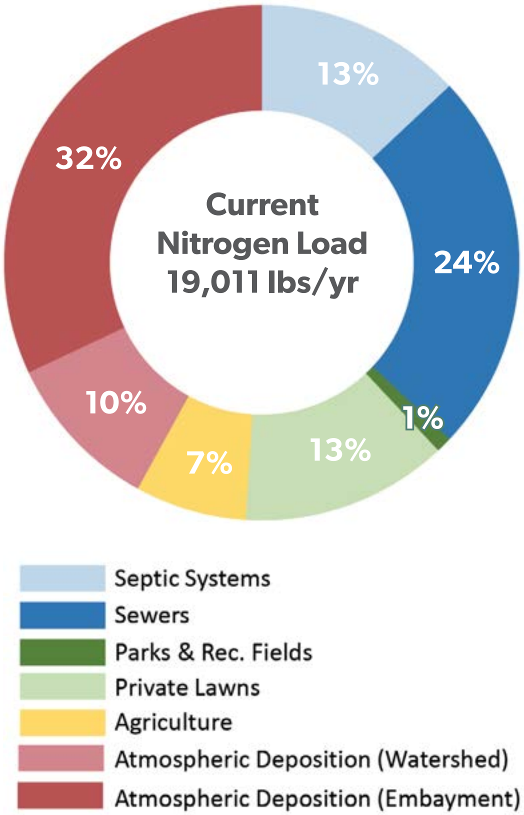
Because Stonington Harbor is valued location for aquaculture, workshop participants recommend exploring and testing options for nitrogen removal through bio-extraction – such as oyster harvesting and kelp farming.



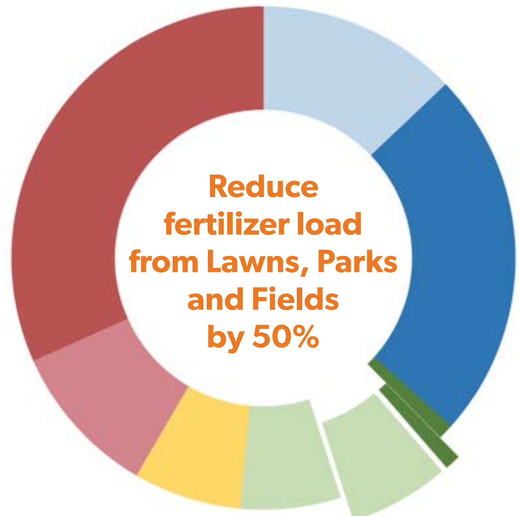
WATERSHED SNAPSHOT

- Watershed (Land) Area: 2.4 sq. miles
- Embayment (Water) Area: .7 Sq. miles
- Main Tributary: Stony Brook
- Population: 1,361
- Population Density: 567 people/ sq. mile)
- Population on Septic: 538
- Stormwater Management Area: 35%
- Stonington Borough Wastewater Treatment Plant: 1,460 lbs N/yr
- Land use types:
  - Forested: 53%
  - Developed: 24%
  - Lawn and Turf: 13%
  - Agricultural: 2%
  - Water: 7%
  - Barren: 1%

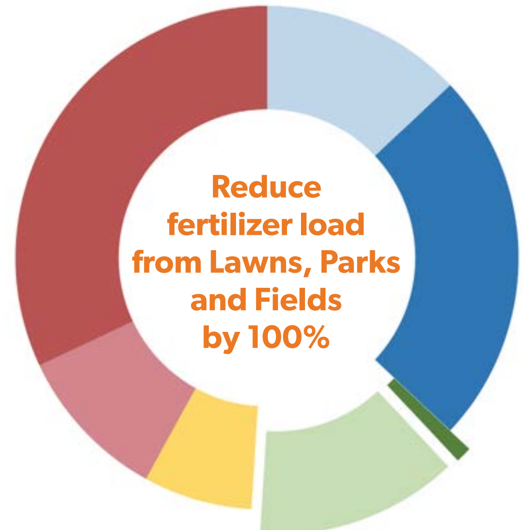
Stonington Harbor



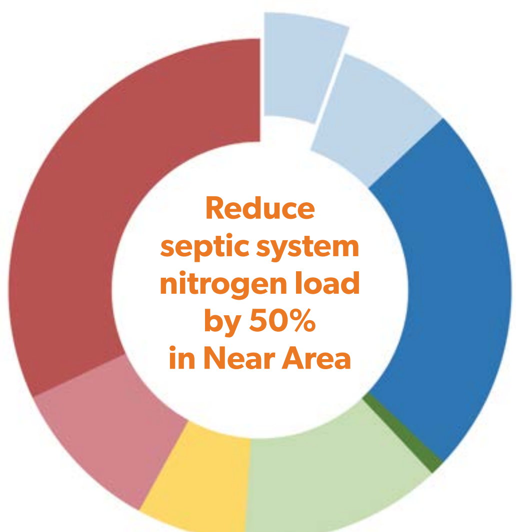
WATERSHED REDUCTION TARGET: 15-20%:



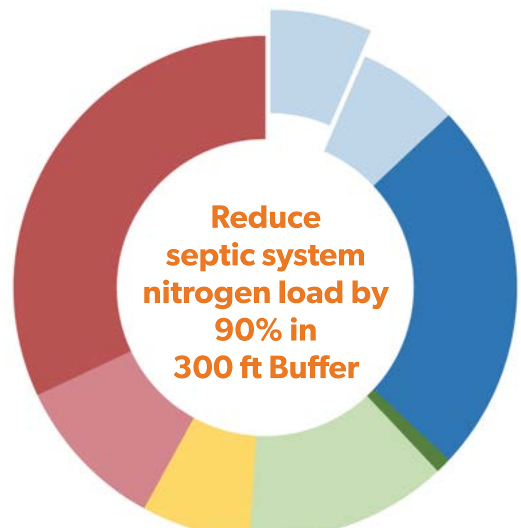
Removes 1,368 lbs/yr



Removes 2,736 lbs/yr



Removes 1,058 lbs/yr



Removes 1,116 lbs/yr

Pawcatuck River and Little Narragansett Bay Watershed

In recent years, Pawcatuck River, Little Narragansett Bay and Wequetequock Cove have shown multiple signs of degraded health associated with nitrogen pollution including loss of seagrass meadows, low oxygen and noxious seaweed blooms that often prevent people from paddling, swimming and enjoying the water in the summer.

When nitrogen pollution puts human health and economies at risk, taking multiple steps to reduce pollution may be necessary. A nitrogen reduction target of 35-60% can help restore healthy water quality, support natural recovery of habitats like seagrass and ensure our children and grandchildren can safely enjoy these harbors and bays in the future.

In this scenario, we see that reducing 50-100% of fertilizer from lawns and playing fields across the entire watershed and reducing 50% of agricultural fertilizer achieves a reduction of 8-22%. These reductions can be accomplished through behavior change campaigns, policy changes or incentives that may take decades to achieve.

To truly tackle nitrogen pollution and reverse degraded conditions in the Pawcatuck River, Little Narragansett Bay and Wequetequock Cove we must increase nutrient treatment in septic systems and wastewater treatment plants.

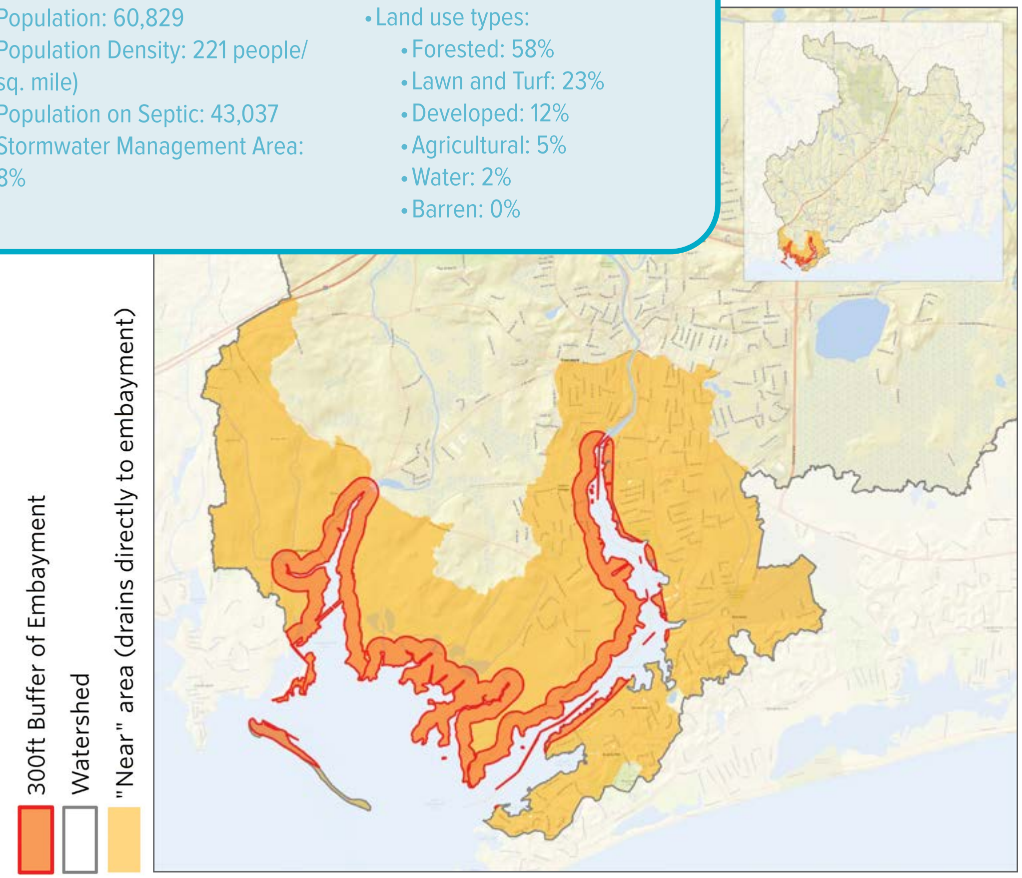
In this watershed, Rhode Island has made great strides to upgrade household septic systems near marine waters (dark yellow and red). Treating 50-90% of nitrogen from household septic systems before it enters groundwater can significantly reduce nitrogen pollution to harbors and bays.

In Connecticut — the Stonington/Pawcatuck treatment plant already operates at the highest nitrogen removal rate. Increasing the number of household connections to the sewage treatment plant can reduce nitrogen pollution from wastewater.

The highest impact and quickest approach for reduction in Little Narragansett Bay is to upgrade treatment technology to cut nitrogen pollution by at least 50% from the Westerly wastewater treatment facility and Kenyon Industries.

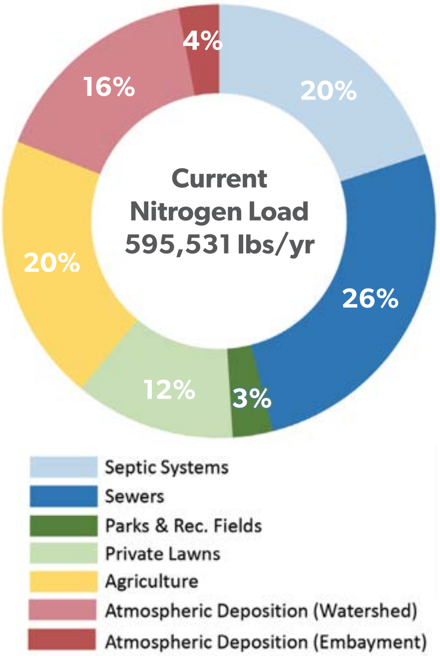
WATERSHED SNAPSHOT

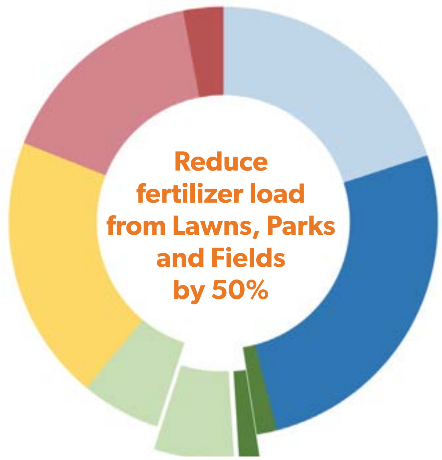
- Watershed (Land) Area: 275 sq. miles
- Embayment (Water) Area: 2.6 Sq. miles
- Rivers: Pawcatuck River, Wequetequock River
- Main Tributaries: Ashaway River, Wood River
- Population: 60,829
- Population Density: 221 people/sq. mile)
- Population on Septic: 43,037
- Stormwater Management Area: 8%
- Stonington/Pawcatuck Wastewater Treatment Plant: 4,015 lbs N/yr
- Kenyon Industries, Inc 58,765 lbs N/yr
- Westerly Wastewater Treatment Plant: 106,580 lbs N/yr
- Land use types:
  - Forested: 58%
  - Lawn and Turf: 23%
  - Developed: 12%
  - Agricultural: 5%
  - Water: 2%
  - Barren: 0%



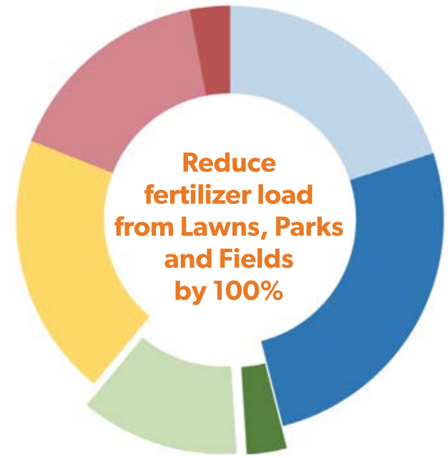
Little Narrgansett Bay (Pawcatuck River)

WATERSHED REDUCTION TARGET: 35-60%

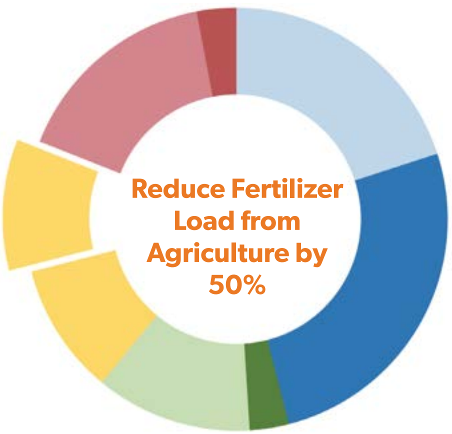




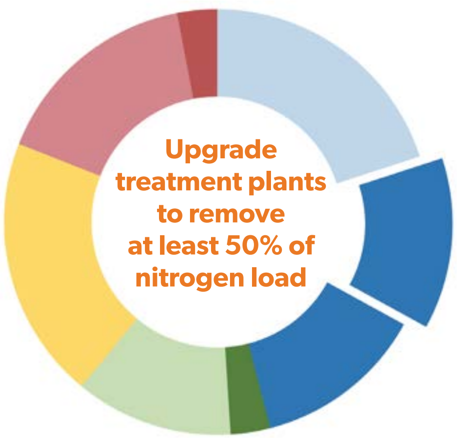
Removes
45,829 lbs/yr



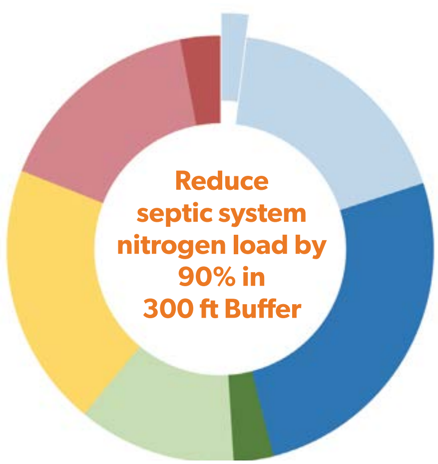
Removes
91,657 lbs/yr



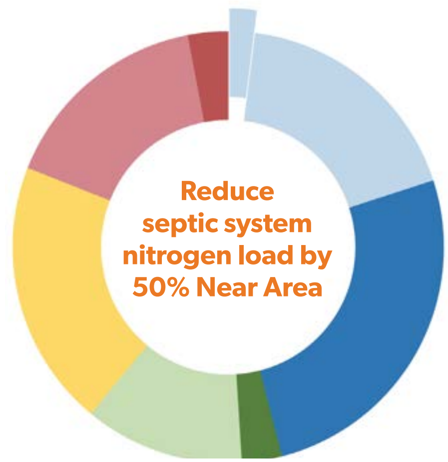
Removes
58,386 lbs N/yr



Removes
76,995 lbs N/yr



Removes
6,613 lbs/yr



Removes
6,370 lbs/yr

SECTION 5
CONCLUSION and Next Steps

The assessment and actions presented in The Southeastern Connecticut Clean Coastal Harbors and Bays Community Action Plan report were collaboratively generated by local and regional stakeholders over a twelve-month period. This plan provides a road map for local leaders to build public awareness and support for collective and individual actions while advancing projects that restore and protect healthy waters in Mystic River, Stonington Harbor, the Pawcatuck River and Little Narragansett Bay.

From changing development patterns, population variability and economic uncertainty - to climate shifts and habitat loss - Connecticut's coastal water resources face many challenges. To solve these problems, residents business owners and policymakers must work together to adapt and improve the way we manage and value our water.

The recommendations and prioritized list of actions in this report represent a vision and key opportunities for successfully restoring and maintaining the harbors, bays and coves of Southeastern Connecticut.

By reducing nitrogen pollution and treating sewage, we can protect clear water, clean beaches and healthy habitats to ensure our waters remain safe for swimming, boating, fishing and seafood and continue to support a thriving coastal economy now – and for generations to come.

Mystic, CT, Photo Credit: iStock

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Section 3

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Long Island Sound Study

A Partnership to Restore and Protect the Sound

The Southeastern Connecticut Clean Coastal Harbors and Bays project was supported in part by a Long Island Sound Futures Fund Grant from the U.S. Environmental Protection Agency's Long Island Sound Office and administered by the National Fish and Wildlife Foundation (grant ID: 61430). The findings, recommendations and views expressed in this report are those of the authors and workshop participants; they do not necessarily reflect those of the sponsors.

The Southeastern Connecticut Clean Coastal Harbors and Bays Community Action Plan is a collaborative project designed to reflect specific community needs and prioritize local nitrogen pollution reduction actions that protect and restore healthy conditions in the Mystic River, Stonington Harbor, Pawcatuck River and Little Narragansett Bay. This project was managed and supported by The Nature Conservancy, Clean Up Sound and Harbors (CUSH) and the Mystic Aquarium.