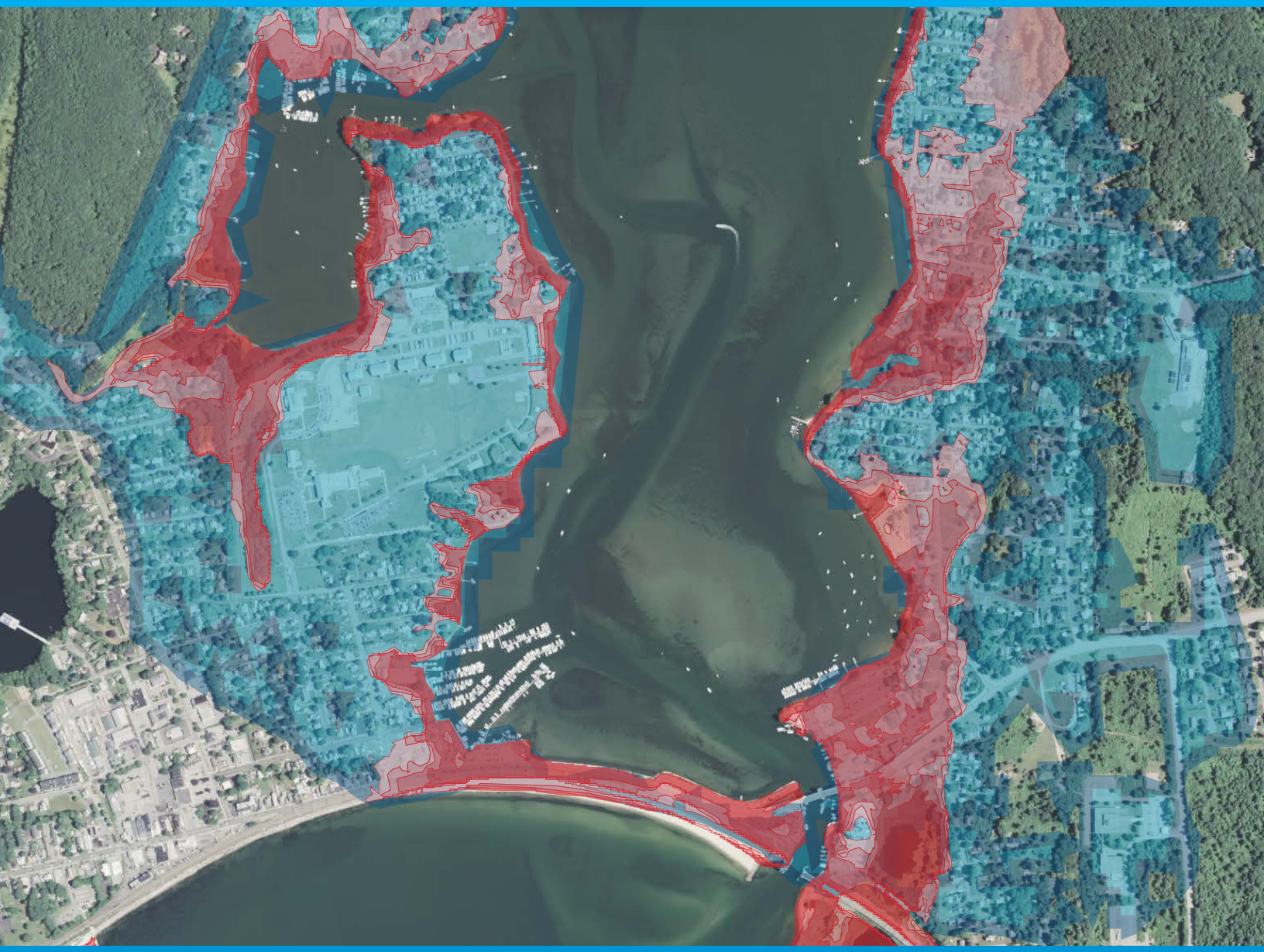
Niantic River Resilience Vision



Natural Solutions for Community Resilience Building in the Lower Niantic Watershed

The Nature Conservancy
Connecticut

Niantic River Resilience

Natural Solutions for Community Resilience Building in the Lower Niantic River.

The Nature Conservancy
Connecticut

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Acknowledgments

The Nature Conservancy sincerely thanks the following who provided invaluable insight and input throughout the project. Without your expertise, this document would not have been possible: Stephen Dwyer, Maureen Fitzgerald, Gary Goeschel; Don Landers, Abby Piersall, Judy Rondeau, and John Swenarton. The following document was partially funded by The Community Foundation of Eastern Connecticut.

March 2017

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Table of Contents

Note: The graphic content contained within are intended for conceptual visioning purposes amongst stakeholders. Site specific feasibility assessment would likely be required in accord with state and local ordinances and permits prior to implementation.

Introduction

The physical danger and financial risks posed to coastal communities are expected to significantly increase towards the latter part of the 21st century.

Coastal residents are no strangers to the physical danger and financial risk that comes from living in proximity to the ocean. Indeed, these wild and sublime environments have drawn people to the coasts for millennia. However, the increasing impacts of extreme weather and sea level rise now make it all the more important for coastal residents and governments to take a hard look at how their communities can continue to safely enjoy the benefits of the coast. Rising sea levels can create permanent inundation in developed areas while also reducing the overland distance between storm surges and homes, roads, schools, and businesses. Often the shoreline advancement caused by sea level rise comes at the expense of natural defenses such as dunes, marshes, and oyster reefs that help buffer storm energy and strengthen shorelines against erosion.

NASA

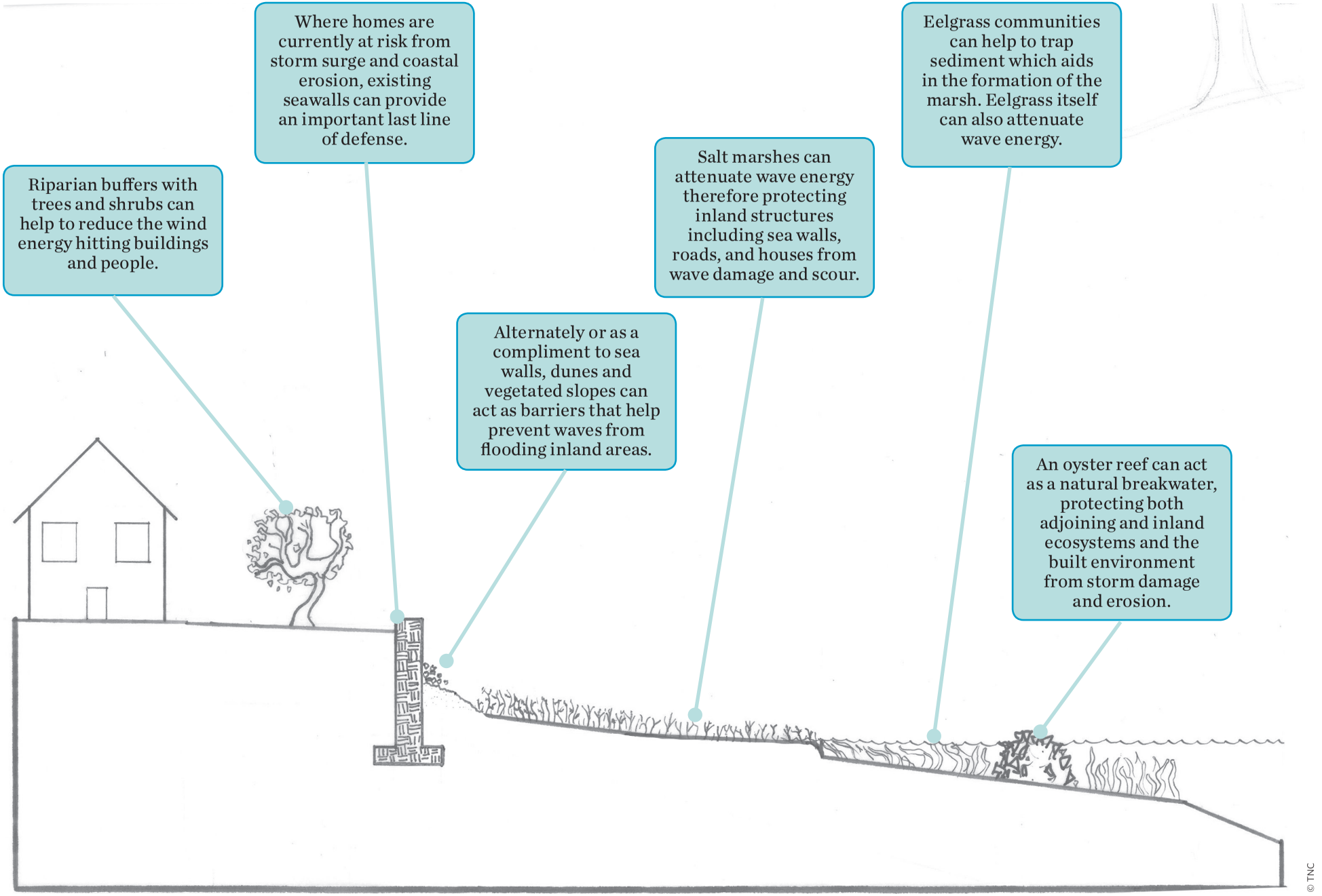
Tropical Storm Sandy in 2012 caused about $75 billion in damage.

Despite the somewhat sheltered coastal geography of the Lower Niantic River, the region is not immune to the implications of rising sea levels and more frequent, intense, and longer-duration storms. Many of the homes and infrastructure on the River are built directly adjacent to the water with few natural buffers to protect from destructive waves. Furthermore, runoff-caused erosion can undermine the structural integrity of engineered, storm protection systems such as seawalls from the landward side.

Fortunately, engineers, designers, and restoration scientists are rapidly developing a suite of innovative techniques to strategically strengthen the capacity of coastal ecosystems to help protect people and property. These techniques also contribute to healthier ecosystems and the associated benefits of cleaner water, improved recreational opportunities and stronger local economies. In the following pages, the reader will learn about the particular vulnerabilities facing the communities of the Lower Niantic, specific actions property owners and towns can take to address these vulnerabilities, and how these actions can add up to a safer, healthier and more resilient whole.

RICHARD ALLAWAY, FLICKR

Erosion removes the natural protection provided by beach dunes and salt marshes and exposes hard structures to direct impacts and increased risk of structural failure.



Multiple lines of natural and man-made coastal defense reinforce one another to reduce erosion and protect against storm surge and sea level rise longer term.

Hurricane Flooding

Almost all of the coastal properties in the Lower Niantic are vulnerable to hurricane surge. Flooding also has the potential to hamper evacuation out of multiple neighborhoods.

Despite the sheltering effect of the Niantic embayment, many homes—being built directly on the waterfront—are at high risk to flooding from hurricanes and other coastal storms. Storm surge occurs when the high pressure edge of a hurricane pushes water up in front of it. As this "mound" of water approaches the shallower water of the coast, it forms a large wave which eventually breaks on shore sending water inland. Few homes adjacent to the Lower Niantic river are completely safe from storm surge flooding. Exceptions occur along the higher escarpments outside of the surge zones along parts of Niantic River Road and Oswegatchie Road (see opposite). However, even these property owners risk repeatedly losing their docks and other structures closer to the water. As sea levels continue to rise, however, risk from storm surge to all coastal properties will increase exposing more and more structures further and further inland.

KEVIN DENEAULT, TNC

This low point along Niantic River Road in the Avenues neighborhood could flood in a hurricane leading to homes cut off from the surrounding road network.

According to current models, a Category 1 or 2 Hurricane will cause flooding to several low-lying residential areas. These areas include homes directly south of the Boston Post Road Bridge in East Lyme, a few homes off of Quarry Dock Road, Saunders Point, and a large stretch of homes in the Avenues neighborhood of Waterford.

Even residents who do not live directly within these hurricane surge zones may be at risk if flooding were to cut off access to their homes and prevent evacuation or rescue. Areas vulnerable to becoming cut off by flooding include the northern stretch of Quarry Dock Road, Saunders Point, sections of the Avenues, and some residents south of Kiddie Beach in Waterford. Additionally, storm surge could flood many critical pieces of public infrastructure including Mago Point and State Highway 156. Depending on the culvert size and storm intensity, hurricane surge could potentially inundate Boston Post Road in Waterford, which could have impacts for emergency response throughout the region. A Category 3 (such as the 1938 Great New England Hurricane) or 4 Hurricane would significantly amplify the exposure of people and property around the entire circumference of the Niantic River.

Hurricane Categories

Hurricanes are classified into five categories based on wind speeds as defined by the Safir-Simpson Scale. Higher wind speeds correspond with higher wave energy and can help predict the extent of storm surge flooding. The potential storm surge flooding map show here represents statistical probabilities of surge extents taking into account varying wind directions, tides, and land elevation.

Legend

Hurricane Category

- 1
- 2
- 3
- 4

0 0.25 0.50 Miles

N

Sea Level Rise 2050s

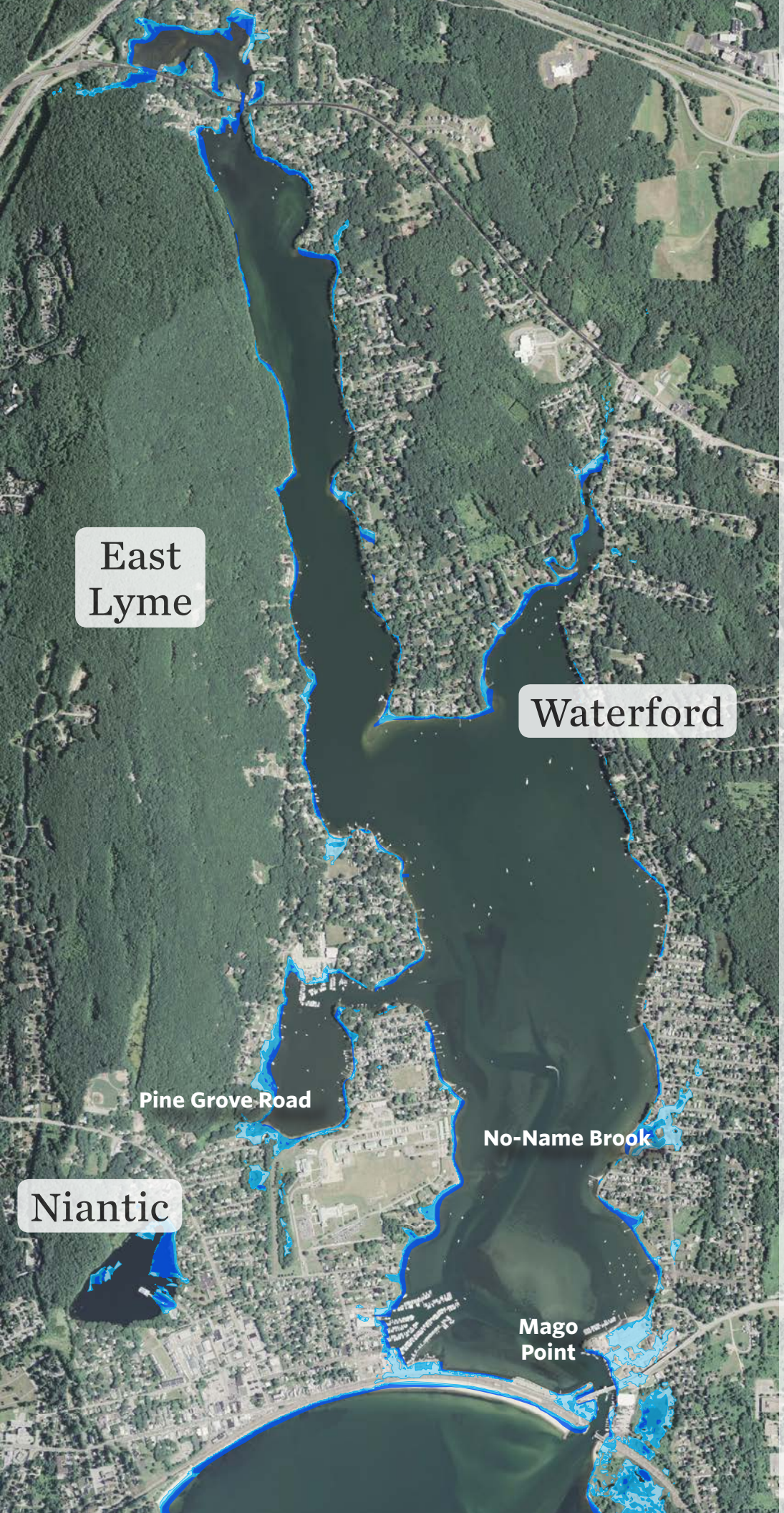
Sea level rise will most likely cause persistent and costly problems to neighborhoods and public space unless retreat or mitigation actions are taken.

While hurricane vulnerabilities can often be mitigated through building practices and natural and hard infrastructure, the permanent inundation that is expected to come with sea level rise will most likely require more radical changes in building footprints and land use. The three areas around the Lower Niantic where sea level rise will likely have the most profound effect are Pine Grove Road and the homes directly west off of Smith Cove, the area of The Avenues along "No-name" Brook, and Mago Point. For the residential areas off of Pine Grove Road and No-Name Brook, sea level rise will likely cause an increase in basement flooding and other chronic property impacts. At Mago Point, an increasingly saturated subsoil could create challenges for existing infrastructure and the siting of future buildings.

Perhaps most concerning however are the ways that higher sea levels can exacerbate existing vulnerabilities to storm surge. Increases in sea level rise will elevate the standing water height thus allowing routine tides and extreme storm surge to move further inland with higher volumes and potentially velocities. Most seawalls are constructed to the standards of current sea levels, which means that their efficacy will certainly decrease over time even with routine and permitted maintenance. Additionally, sea level rise can reduce the distance between the water and valuable property while drowning out natural wave buffers such as salt marshes, beaches, and mudflats.

CARY WHITE, TNC

Mago Point, a highly popular marina and site of proposed waterfront development will face increasing sea level inundation this century.



Legend

Sea Level Rise Projections

- **High** (99% Confidence)
- **Medium** (66%)
- **Low** (33%)

0 0.25 0.50 Miles

N

REFER TO CONNECTICUT COASTAL RESILIENCE TOOL:
HTTP://MAPS.COASTALRESILIENCE.ORG/CONNECTICUT/

Salt Marsh Advancement 2050s

As sea levels continue to rise, salt marsh will move further inland into the undeveloped areas around the Lower Niantic. Sea level rise will present challenges to existing built structures but also opportunities to increase habitat and contribute to the long-term resilience of shoreline communities and ecosystems.

Salt marshes exist on low-lying coastal lands that receive daily, tidal flooding. These are unique and highly productive habitats that provide nursery grounds for many marine fish species and feeding grounds for local and migratory birds. Salt marshes are also valuable to coastal property owners as their vegetation can absorb storm surge and prevent shoreline erosion. Additionally, because salt marshes only develop in low-lying, regularly flooded areas, discouraging development here has helped to keep people out of harm's way. Current marsh protection laws put in place in Connecticut during the 1970s have prevented much of the development that could have occurred in these areas. However, as sea levels continue to rise, favorable conditions for salt marsh will advance inland, converting existing dry, upland areas into regularly flooded marshes. By taking proactive measures today, local residents and municipalities can ensure that development is sensitive to the needs of advancing marshes. This will protect would-be property owners in these areas as well as those living inland via the buffering effects of future salt marsh. It is important to keep in mind that areas that are paved over or currently developed cannot transition into a marsh unless these hard structures are removed and the land restored.

Pine Grove Road currently acts as a berm, cutting off tidal flow between the Niantic River and the large wetland on the Army National Guard Property.

Despite the heavy development around the Niantic River, there are many areas where marsh can advance inland unencumbered by seawalls and development. For example, an existing freshwater wetland parallels Pine Grove Road in the Army National Guard Property. Though not currently connected to the River's salt water, this is the largest undeveloped piece of the coastal property on the embayment that will be inundated by sea level rise. Also, due to medium-density zoning around the River, many resident's yards could conceivably transition into marsh though this may require the elevating of certain homes.

Mago Point in Waterford is largely constructed with urban fill and therefore does not reflect the natural sediment transport processes of the River. This area will likely see increasing flooding as sea level continues to rise. Existing parking lots, artificial soil, and buildings may prevent this area from transitioning to salt marsh unless restorative action is taken to reinstall this protective natural infrastructure.

Legend

Salt Marsh Advancement Potential

- Available
- Limited

0 0.25 0.50 Miles

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REFER TO CONNECTICUT COASTAL RESILIENCE TOOL:
HTTP://MAPS.COASTALRESILIENCE.ORG/CONNECTICUT/

Coastal Habitat

Existing eelgrass and shellfish populations can aid in wave attenuation, improve water quality, and provide habitat for many other species. Protecting these resources will contribute to the health of the River and improve the viability of any future natural infrastructure projects.

In addition to salt marshes, aquatic marine ecosystems such as eelgrass and shellfish beds help to stabilize shorelines and dissipate wave energy. The extent and health of eelgrass beds have varied widely over the past few decades in the Niantic River. However, these beds constitute one of the few viable populations in Long Island Sound and remains a keystone species that strengthens the viability of shellfish and other aquatic organisms. These aquatic ecosystems are also critical to improving water quality and filtering sediment. The success of any future restoration efforts in this stretch of Niantic River is inextricably linked to the health of these ecosystems. The most stable eelgrass population appears to stretch across the center of the embayment from the entrance to Smith Cove to the Niantic River Road revetment; bisected by the boat channel. On the East Lyme side, the bed has extended from the midpoint of Saunders Point to the Army National Guard property. Smaller eelgrass populations once existed just south of Sandy Point and within Smith Cove, however these have not been seen since the early 1990s. Another population has been found just west of the Route 156 bridge and appears to be relatively stable.

MILLSTONE ENVIRONMENTAL LABORATORY

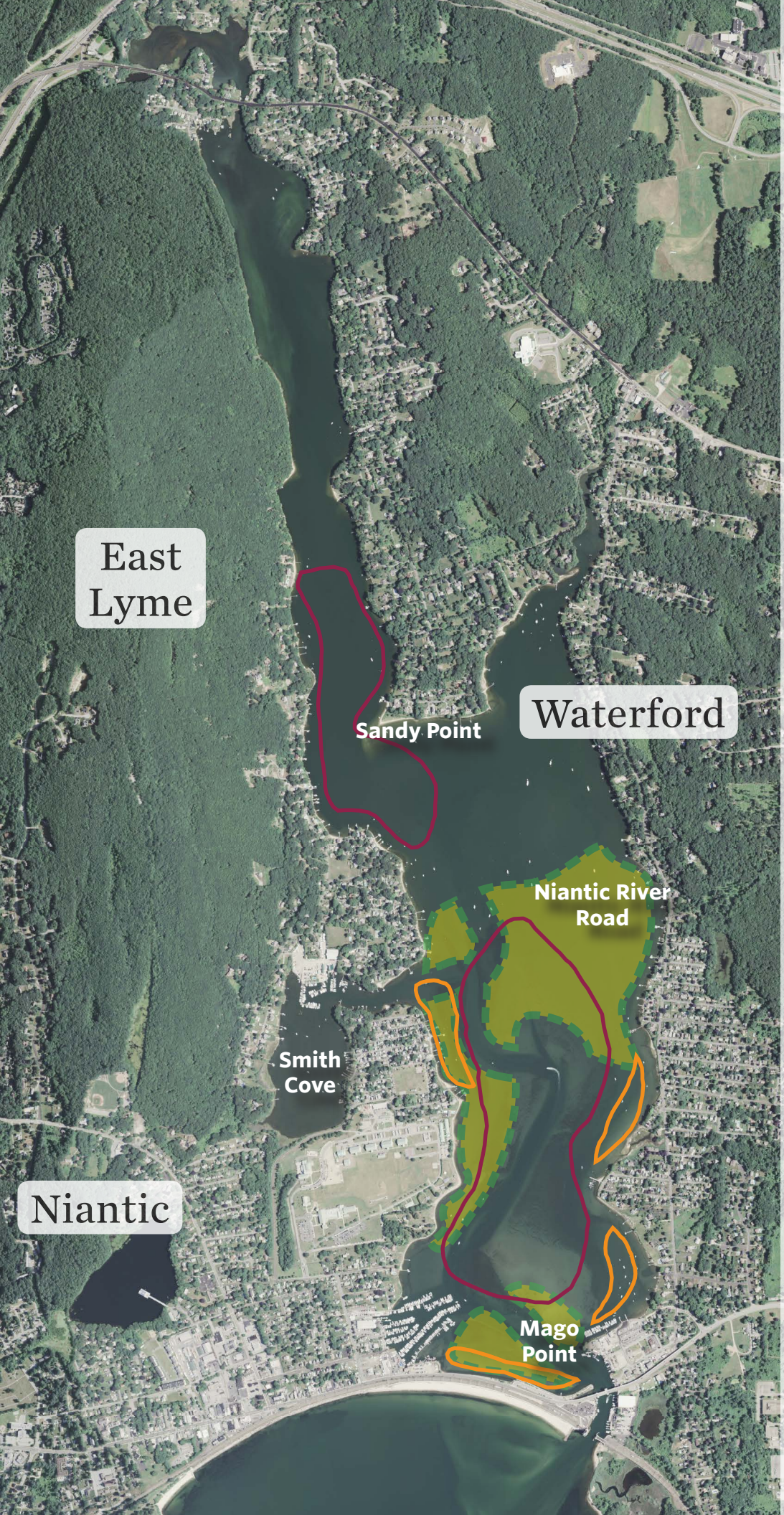
In addition to stabilizing aquatic sediment and reducing erosion, eelgrass provides habitat for a number of species of shellfish that help clean excess nutrients and toxic elements out of the water. Photo taken in the Niantic River.

A few existing soft and hard shell clam beds lie in the River. One soft shell clam bed hugs the southwestern corner of Sandy Point while another sits just north of Mago Point. The four hard shell clam beds are situated around the mouth of the River, to the north of Mago Point, and around the entrance to Smith Cove. Any efforts to protect one's property from erosion and storm damage should first assess the existing protective services provided by these shellfish populations and take careful steps not to jeopardize the viability of these populations any further.

Finally, no discussion of shellfish in the Niantic would be complete without talking about the scallop. Today, one can find scallops throughout the River and they are a favorite of recreational and commercial fishermen. However, the species overall population is much smaller than its historic levels.

ERIKA NORTEMANN, TNC

Both hard and soft shell clams can be found in the Lower Niantic River.



Legend

Habitat Type

- Hard Shell Clam
- Soft Shell Clam
- Eelgrass Maximum Extent (1987-2016)

0 0.25 0.50 Miles

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Land and Water Use

The Lower Niantic and surrounding lands are widely enjoyed for a variety of uses including shellfishing, boating, seasonal and permanent residences, marinas, and commercial districts.

Over the past century, the seasonal communities surrounding the Lower Niantic rapidly grew and significantly altered the landscape. The village of Niantic in East Lyme is today a favorite summer destination with popular restaurants and shops. Many year-round residents now occupy the coastal neighborhoods such as Saunders Point in East Lyme and The Avenues in Waterford. Three marinas provide access for recreational boaters and are major economic engines within the watershed.

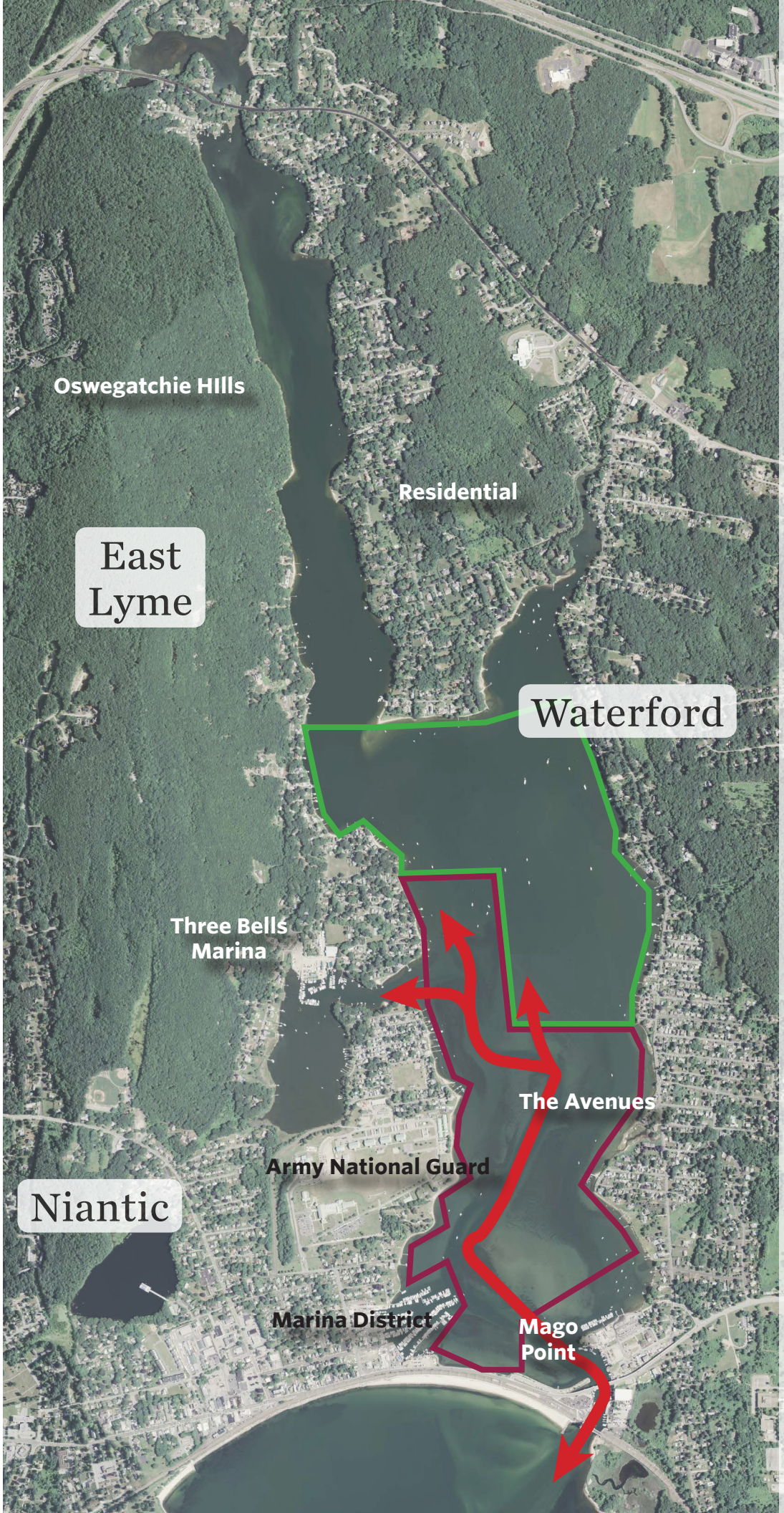
One affect of this development has been an increase in impervious surfaces such as roads, parking lots, and rooftops. These surfaces prevent rain and snow melt from infiltrating into the soil where plants and micro-organisms can remove excess quantities of nutrients such as nitrogen and phosphorus. According to the Niantic River Watershed Management Plan, nitrogen and bacteria are the two greatest threats to water quality in the River. Impervious surfaces can also concentrate sediment, which is then washed into the River, smothering aquatic habitat such as eelgrass. Taken together these examples of contaminated runoff from impervious surfaces fall under the umbrella of nonpoint source pollution. Any restoration of natural infrastructure such as salt marsh, eelgrass, and shellfish must address the effects of these pollutants in order to be successful longer term.

EAST LYME HISTORICAL SOCIETY

For most of its settled history, the Lower Niantic was home to abundant shellfish populations.

In addition to the land, the waters of the Lower Niantic have well-defined uses and jurisdictions. A dredged boat channel runs from the Amtrak bridge at the River's mouth up to Smith Cove. Along the way, the channel takes a left by Mago Point and the Niantic's Marina District. Two less-defined channels split off towards private boat moorings in the northern half of the embayment. Maintaining these channels are crucial to the continued enjoyment of the River for boaters. Natural infrastructure projects should be sited away from these channels to prevent conflict. However, if properly tested and permitted, spoils from future channel dredging could be reused to rebuild salt marsh and beach dunes.

For centuries the Lower Niantic has been a favorite location for subsistence, commercial, and recreational shellfishing. Today, the two largest shellfish jurisdictions are governed by the Waterford-East Lyme Shellfish Commission (WELSCO). The northern half of the embayment is opened year-round while the lower half is only opened from November to May. Any proposed alterations to the aquatic environment within these jurisdictions should be planned in consultation with WELSCO. Because natural infrastructure is designed to improve the overall health of the River, these projects can often be a win-win for property owners and those who enjoy the River's shellfish resources.



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Use

- Recreational Shellfish Bed
- Recreational Shellfish Bed (Seasonal)
- Boat Channel

0 0.25 0.50 Miles

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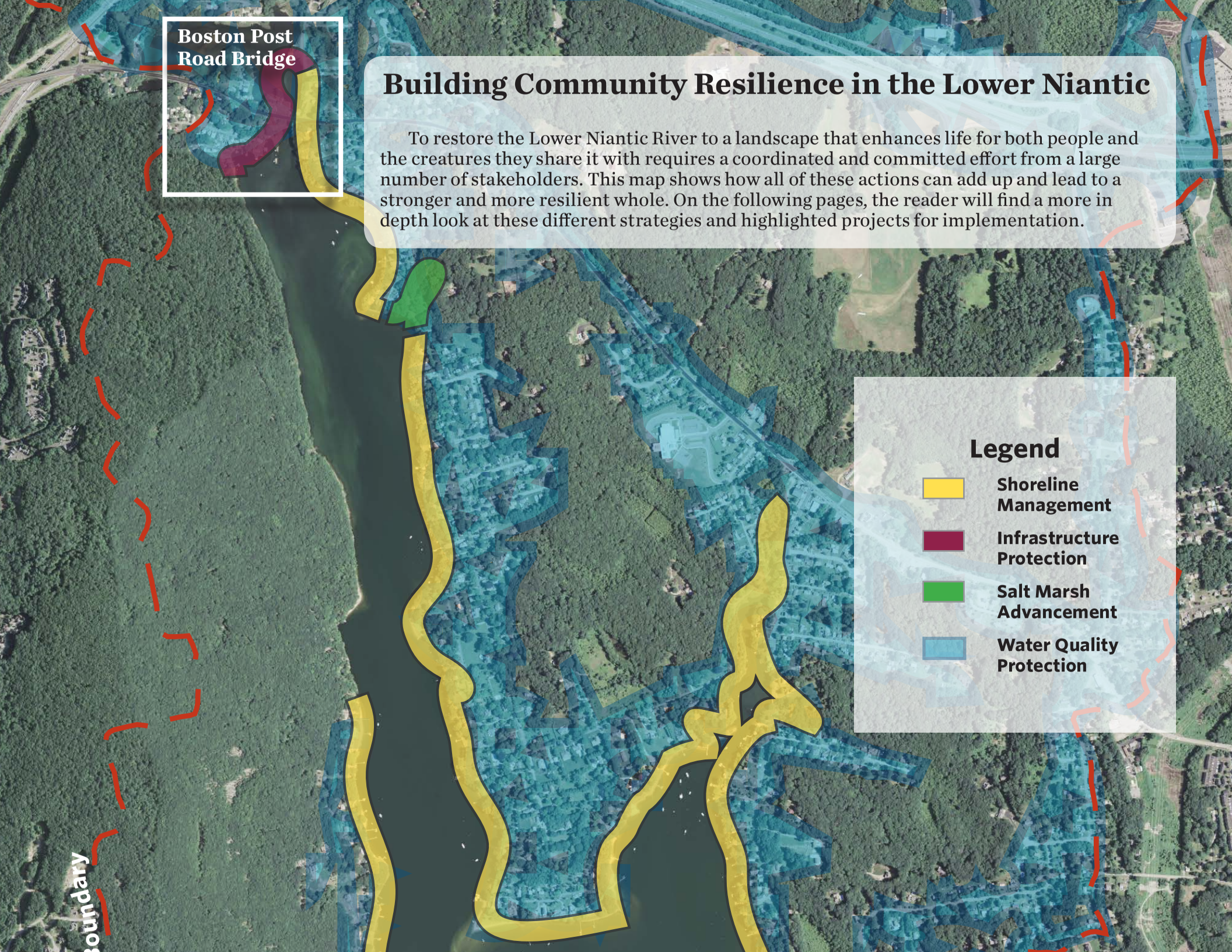
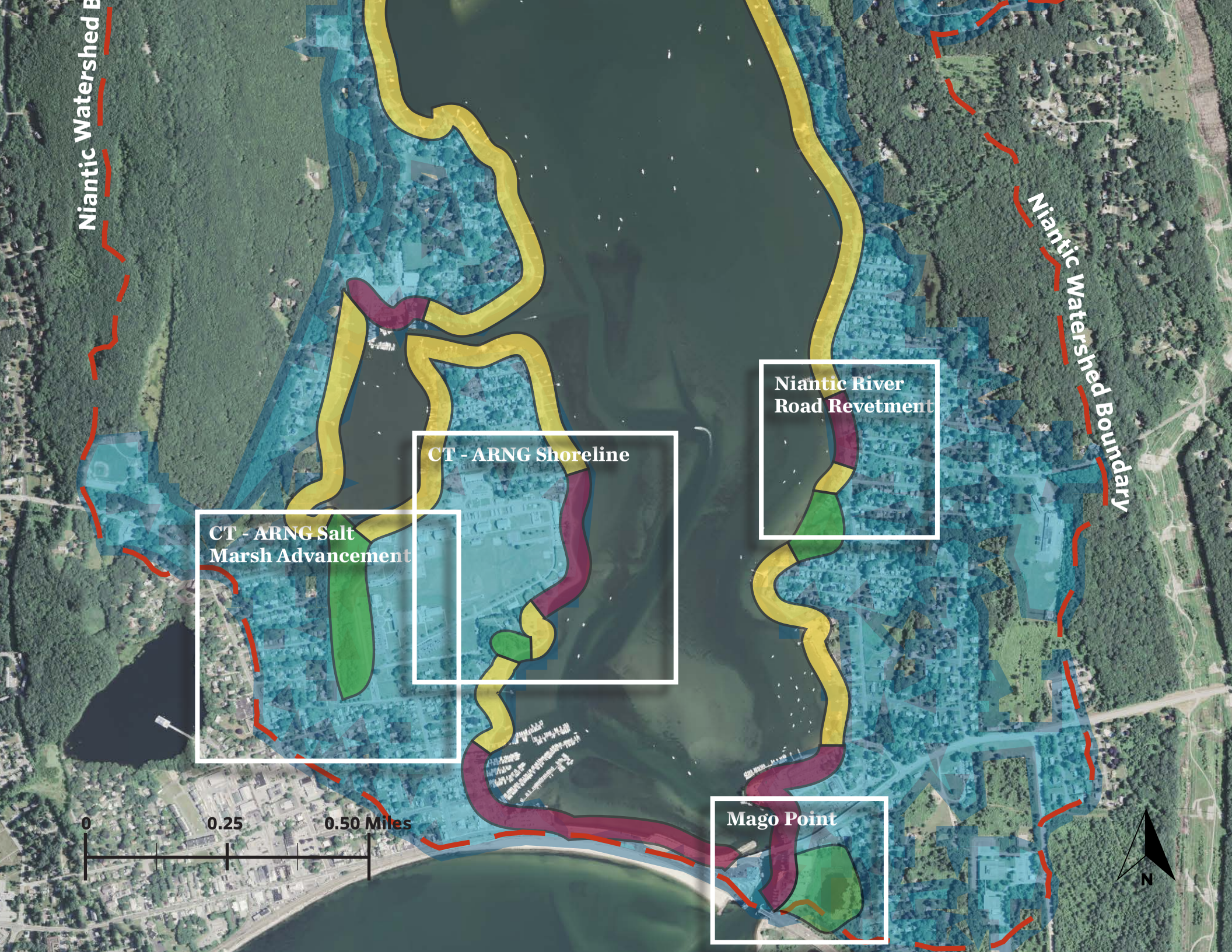

Boston Post Road Bridge
Building Community Resilience in the Lower Niantic
To restore the Lower Niantic River to a landscape that enhances life for both people and the creatures they share it with requires a coordinated and committed effort from a large number of stakeholders. This map shows how all of these actions can add up and lead to a stronger and more resilient whole. On the following pages, the reader will find a more in depth look at these different strategies and highlighted projects for implementation.
Legend
Shoreline Management
Infrastructure Protection
Salt Marsh Advancement
Water Quality Protection
Boundary


Niantic Watershed B
Niantic Watershed Boundary
Niantic River
Road Revetment
CT - ARNG Shoreline
CT - ARNG Salt
Marsh Advancement
Mago Point
0
0.25
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N

Shoreline Management

Intertidal enhancement projects can protect property owners from erosion and storm surge while improving other ecological functions in the River.

Much of the Lower Niantic's shoreline is occupied by seasonal and year-round residential properties. A truly robust restoration of the River must include contributions from a large portion of these property owners to be successful. Fortunately, there are many small-scale actions that residents can take to improve water quality and habitat while enhancing the visual appeal of their property and protecting their assets from erosion and storm damage.

Not all residents will face the same constraints or opportunities. Some have steep slopes adjacent to the water that they want to stabilize; others may occupy low-lying land that is particularly vulnerable to storm surge. Some may want access to their boats and beaches while others will want a more natural and densely vegetated shoreline. In all instances, even small shoreline plantings or oyster restoration will have a positive effect on the health of the River and local residents.

Waves and boat wakes can erode sediment from underneath a seawall and undermine the wall's structural integrity over time. Natural breakwaters such as oyster reefs and restored shoreline vegetation can help protect against this "scour."

Shoreline Plants

Planting a coastal bank, slope, or dune with native plants can go a long way in reducing erosion naturally. The plants listed below are adapted for the particular soil types and climatic conditions of coastal Connecticut:

- Beach Plum (*Prunus maritima*)
- Pin Oak (*Quercus palustris*)
- Red Osier Dogwood (*Cornus sericea*)
- Sweet Pepperbush (*Clethra alnifolia*)
- Shadbush (*Amelanchier spp.*)
- Beach Grass (Ammophila breviligulata)
- Big Bluestem (Andropogon gerardii)

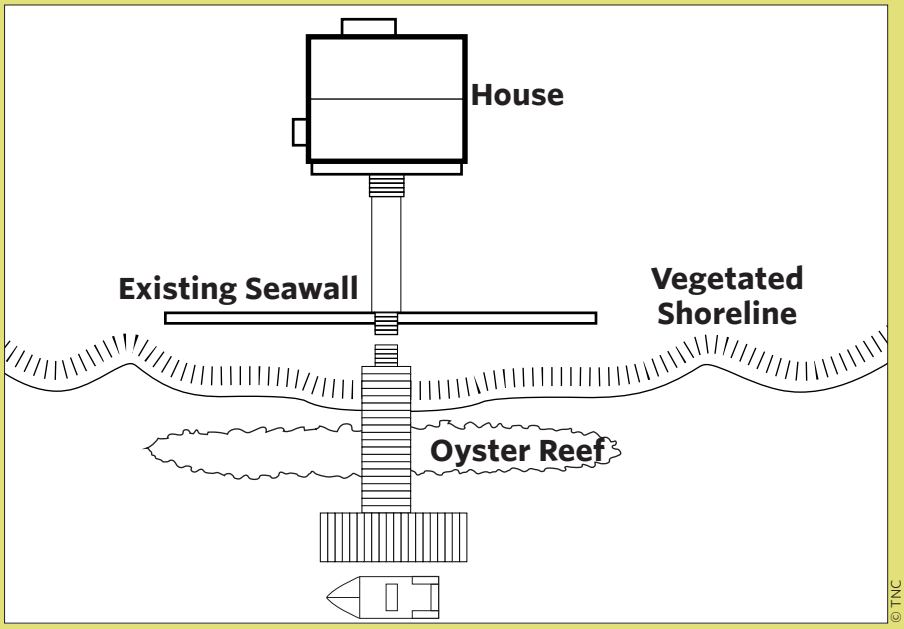
For more information regarding coastal landscaping refer to the *Connecticut Coastal Planting Guide* published by Connecticut Sea Grant and The University of Connecticut.

KENPEI, WIKIMEDIA COMMONS

Sweet Pepperbush thrives in wet to moist soils and produces a sweet late-summer fragrances from its white flowers.

Oyster Restoration

There are plenty of resources available regarding the best practices and techniques to restore natural habitat such as oyster beds or reefs (see "Resources" p. 31). Existing shorefront configuration can often be retrofitted with natural infrastructure in ways that protect a homeowner's property while simultaneously contributing to the overall resilience of the River's oyster populations and the larger ecosystem.



© TNC

Docks can block out the necessary light reaching vegetation. Where possible, homeowners should avoid having their docks go over areas they hope to revegetate. However, docks can also provide a safe and convenient way to pass over an oyster reef.

Infrastructure Protection

Using nature as an additive line of defense can increase the resilience of important town, state, and military-owned infrastructure.

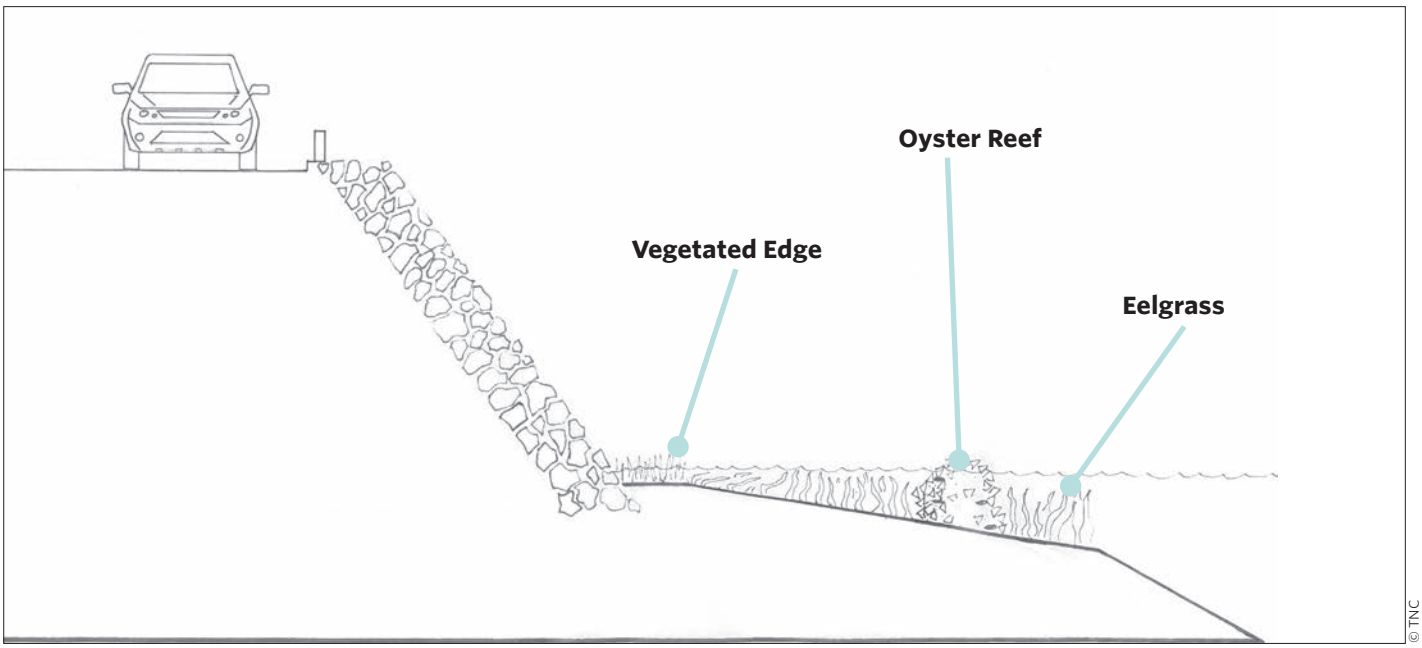
New and existing infrastructure around the River represents significant civic investments. While these projects are often engineered to very high standards, all coastal structures are at risk from catastrophic coastal events and structural degradation as sediment is eroded from beneath their footings and storm surge pounds their surfaces. At best, these risks mean increased maintenance costs; at worst, structural failure and potential loss of life. However, through the restoration of natural infrastructure, these structures can in some cases maintain a firm footing and reduce their exposure to wave energy.

A few potential projects of note where natural infrastructure additions would be applicable include: restoring vegetation around the new Boston Post Road bridge, constructing a living shoreline designed to protect the Niantic River Road revetment from scour (opposite), and using oyster reefs to further stabilize the Army National Guard beach from erosion (below). Permits are likely required to install and maintain projects of these types.

An oyster reef and re-vegetated edge with native plant species can further enhance shoreline stabilization efforts at the Army National Guard Base. There may also be space along this shoreline to accommodate salt marsh advancement.

CARY WHITE, TNC

The revetment along Niantic River road in Waterford is a critical piece of infrastructure that requires diligent maintenance over time due to the exposure from physical forces such as wind, ice, and waves that can weaken structures.

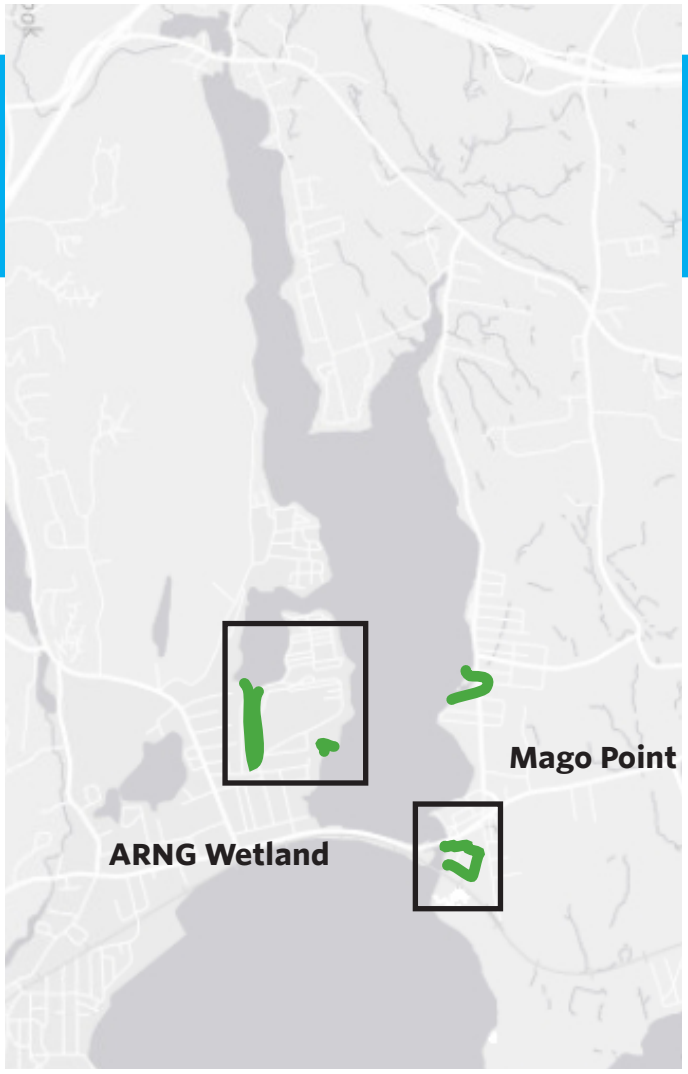


© TNC

By restoring the aquatic and semi-aquatic marine ecosystems, this piece of infrastructure can be more resilient to rising sea levels, erosion, and wave impacts. A "living shoreline" project that integrates diverse habitat types (vegetated edges, oyster reefs, eelgrass) would provide multiple lines of defense to the vulnerable Niantic River Road seawall (above).

Salt Marsh Advancement

Maintaining land available for salt marsh to advance into can ensure that the Lower Niantic remains a valuable ecosystem for decades to come.



In order for any of the proposed natural infrastructure projects to succeed, the Niantic watershed must maintain its ability to clean and filter the water entering the River. Before human development, these functions were naturally performed by salt marshes, wetlands, floodplains, and forests. However, as these ecosystems have declined and paved surfaces have expanded, the water entering the River reduces the ability of the ecosystem to support the shellfish stocks and aquatic vegetation that it once did. These functions can be restored both along the shoreline and higher up in the watershed.

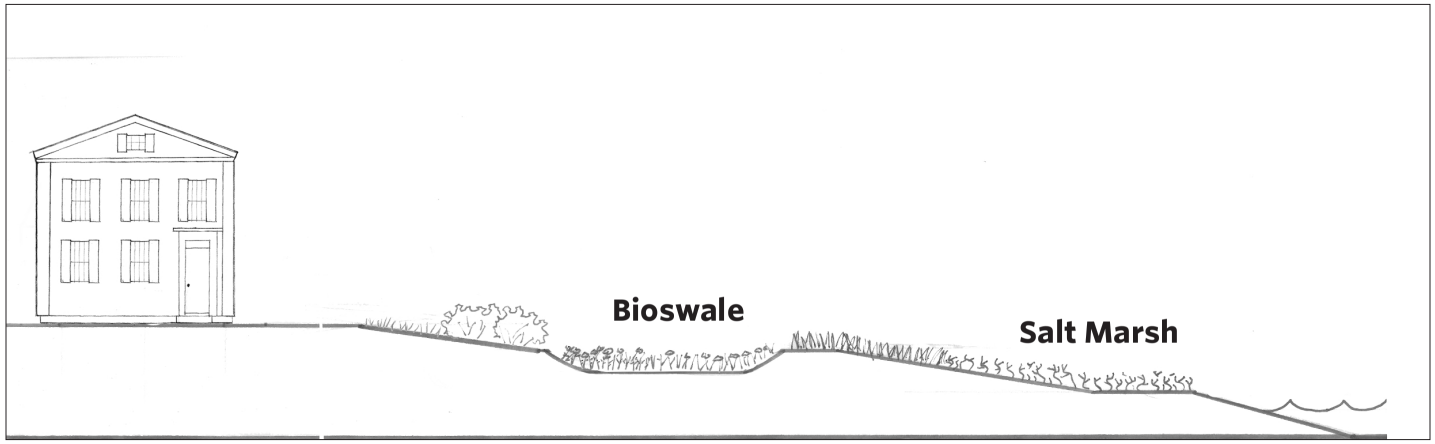
When restoring these ecosystem functions, planners and land managers should consider how sea level rise will likely reduce the extent of salt marsh unless allowances are made for salt water to advance into undeveloped areas. Mago Point and the Army National Guard wetland south of Pine Grove Road represent significant opportunities to expand the amount of salt marsh habitat in the River. In addition to these larger-scale efforts, other property owners in low-lying areas can assist salt marsh advancement in collaboration with natural resource managers, landscape architects, and environmental engineers.

Installing a culvert beneath Pine Grove Road can connect tidal flow to an existing wetland on Army National Guard land. This would help to clean water entering the cove and increase salt marsh habitat in the River over time.

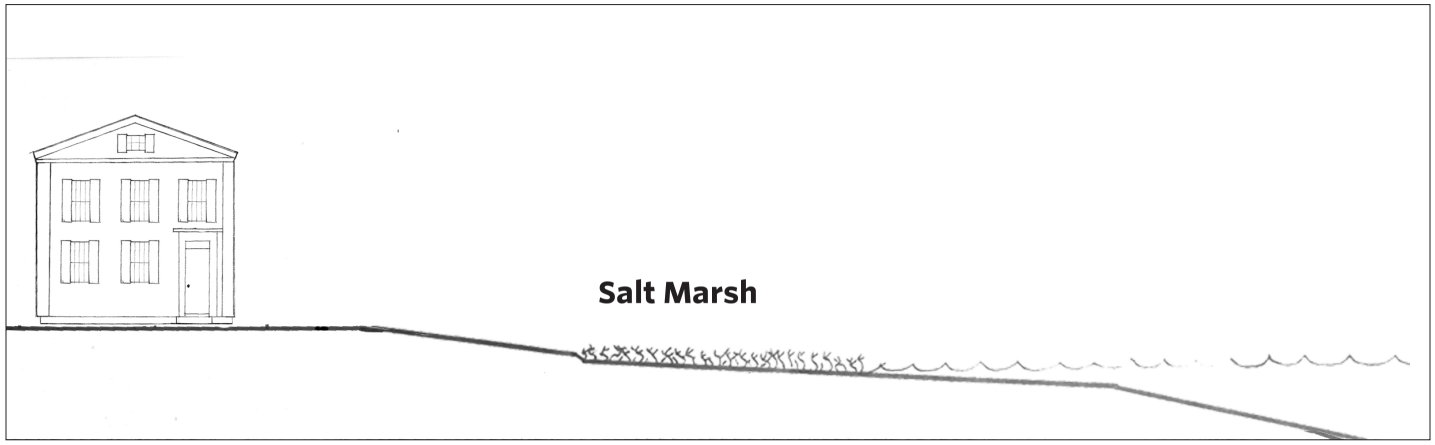
Salt Marsh Advancement

By strategically channeling in selected areas of the Mago Point peninsula, there is an opportunity to reconnect habitat, provide a public amenity, and accommodate local flooding and sea level rise. The opposite page shows how these adaptation efforts can be phased in with other forms of green infrastructure to keep pace with sea level rise.

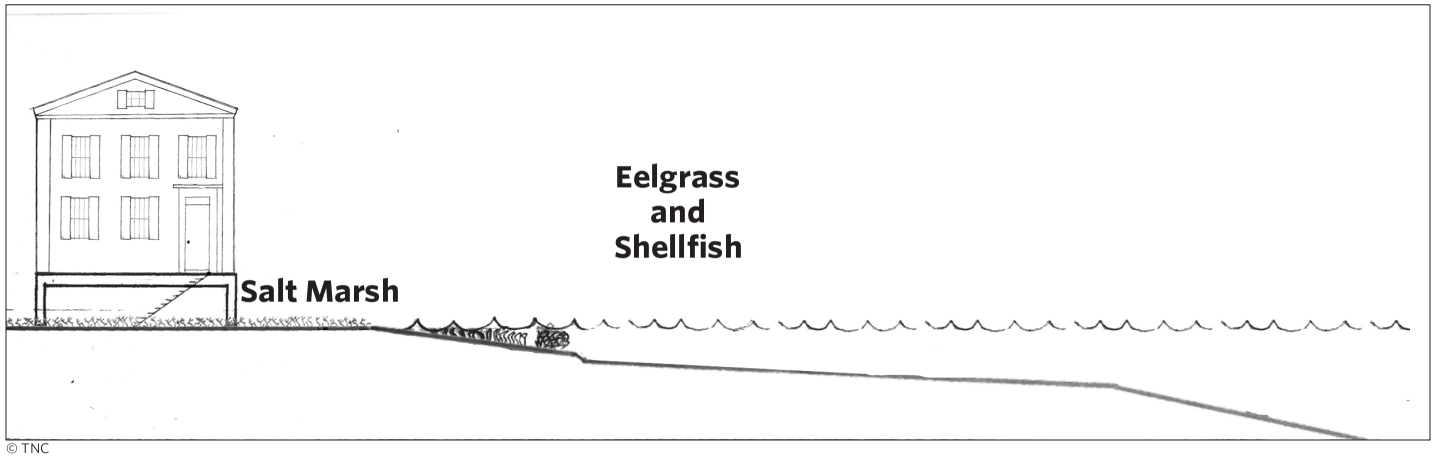
The conceptual design depicted above shows ways that managed salt marsh advancement can be incorporated into redevelopment efforts on Mago Point. Depending on the hydrological and ecological conditions, constructed channels can reestablish tidal flushing to the existing marsh south of Route 156. This will improve habitat, flood storage, and help reconnect pedestrians in Mago Point to their natural heritage.



At current sea levels, a planted buffer and/or bioswale between the built environment and the water will help to filter stormwater and reduce the vulnerability of buildings to wave damage.



As sea levels rise, existing vegetated buffers and bioswales be transitioned into salt marsh.

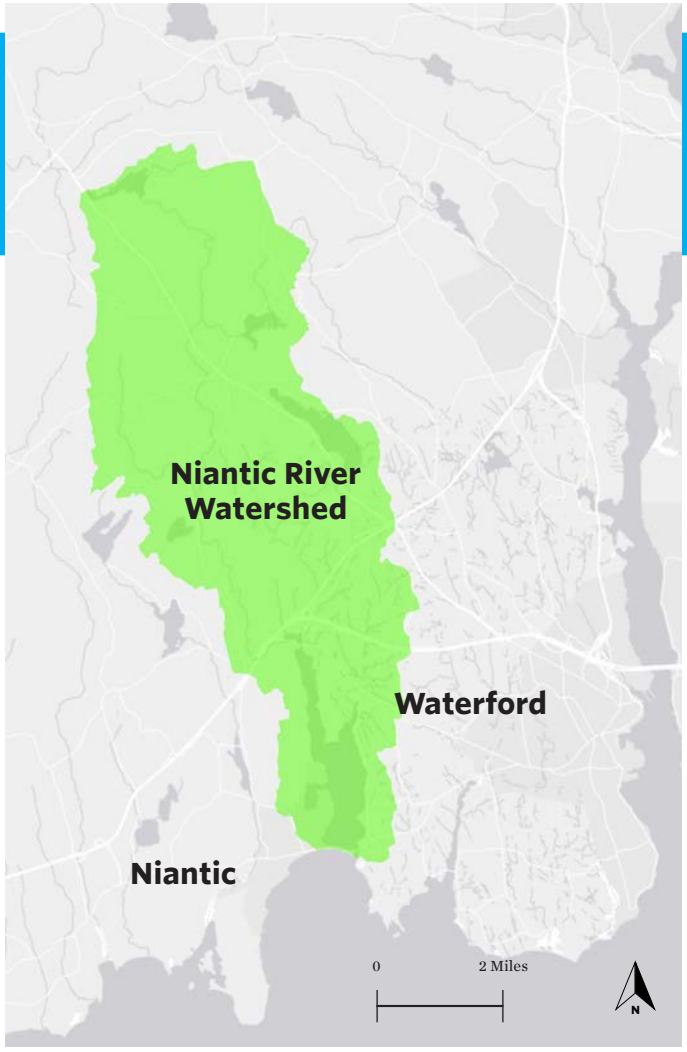


Eventually, sea levels will permanently inundate shorefront vegetation and buildings will need to be flood proofed, raised, or moved out of harms way. By "wet elevating" these structures, salt marsh can continue to advance inland beneath the building footprint.

Water Quality Protection

Existing and future green infrastructure projects in the Niantic Watershed help ensure that the water entering the River is clean and will support habitat regeneration and further restoration efforts.

The Eastern Connecticut Conservation District in partnership with the Millstone Environmental Lab, UCONN Avery Point, and the Niantic River Watershed Committee have already initiated a few projects in downtown Niantic and on Mago Point to improve the resilience of the Lower Niantic River region. Further up in the watershed, green stormwater projects have been undertaken by The Oswegatchie School, L&M Cancer Treatment Center, Sonalyst, Harvey's Windows and Doors, and Charter Oak Federal Credit Union. These projects go a long way towards improving the water quality and clarity in the River, which is vital for the viability of any natural infrastructure project.



ALISHA GOLDSTEIN, EPA

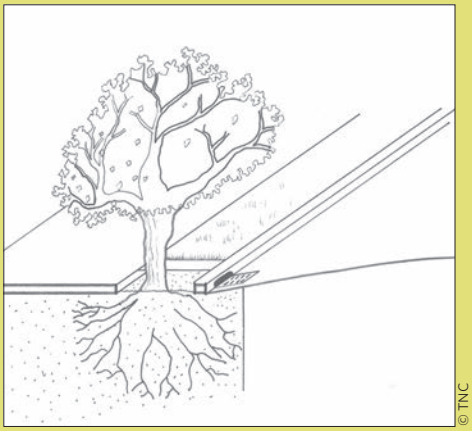
Bioswales are engineered water channels that intercept water before entering the stormdrain and river. By slowing the water down and incorporating wetland plants, these systems can help clean the water of suspended sediments and other pollutants such as nitrogen and phosphorus and enhance the aesthetics of a community.

Homeowners, marinas, and neighborhood associations can also contribute to the health of the watershed through reducing lawn fertilizers and pesticides and constructing simple rain gardens, bioswales (see callout box, opposite), and other innovative landscape techniques designed to naturally treat and infiltrate water running off of roads, parking lots, and rooftops.

Any stormwater flowing within the Niantic River watershed will eventually find its way into the Niantic River. As a result, these current and future green stormwater infrastructure projects will greatly improve the viability of future natural infrastructure including salt marsh, eelgrass, and shellfish designed to increase the overall resilience of the River's ecosystem.

Green Stormwater Infrastructure

In conventional stormwater management, water running off of paved surfaces and rooftops enters pipes or swales where it is flushed either directly into a local waterway or into detention basins where it slowly infiltrates in the ground water. Green stormwater infrastructure flips this dynamic and views water as a public resource rather than a nuisance. Instead of hiding a detention basin or a swale behind a building or neighborhood, these features are brought into public spaces and landscaped with attractive, water loving plants. By creating opportunities to slow water as it moves through the watershed, more is able to be filtered by the soil and taken up by plants. This both reduces the amount of untreated water entering waterbodies and improves the conditions for local upland ecosystems.



© TNC

Tree filters, like the one depicted here, are most appropriate in more highly developed areas where there is little space along the road for a more extensive swale or water retention area.

EASTERN CONNECTICUT CONSERVATION DISTRICT

Volunteers help plant a riparian buffer strip at Mago Point. This buffer is designed to prevent polluted stormwater running off of an adjacent parking lot from entering the River.

A Path Forward

From the days of settlement by the Pequot Tribe, through the boom days of the scallop industry in the 30s, to today's recreational and commercial uses, the Niantic River has always provided immeasurable value to those who lived along its banks. In the coming age of intense environmental change, the River's role in the human communities may be more important than ever. Healthy coastal ecosystems can protect against the threats of extreme weather, while healthy waters and an adaptable shoreline will allow these ecosystems to be resilient in the face of changing circumstances.

For the communities that share the River to fully realize the potential of its resources, municipalities and properties owners must take bold action both along the shoreline and throughout the watershed. The reader can think of this Resilience Vision as a next step in a conversation designed to fully integrate community and environmental wellbeing across the region. Our hope is that this document can help the communities create a clearer picture of the possibilities and how their work fits into a greater and more resilient whole

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