LONG ISLAND SOUND STUDY HABITAT RESTORATION INITIATIVE

ANNUAL SUMMARY FOR THE YEAR 2003

Technical Support for Coastal Habitat Restoration

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ANNUAL SUMMARY FOR THE YEAR 2003
TABLE OF CONTENTS

LIST OF FIGURES

LONG ISLAND SOUND STUDY HABITAT RESTORATION INITIATIVE -- Annual Summary for the Year 2003

BACKGROUND

This report summarizes the accomplishments of the Long Island Sound Study's (LISS) Habitat Restoration Initiative (HRI) for year 2003, the sixth year of implementation. The HRI is a bi-state, multi-organizational effort to restore estuarine coastal habitats in Connecticut and New York. The HRI members meet several times a year to discuss progress, share new technologies, and identify emerging issues. In 1997, the LISS HRI established the following goals:

- Restore the ecological functions of degraded and lost habitats;
- Restore at least 2000 acres of coastal habitats and 100 miles of riverine migratory corridor habitat over the next 10 years; and
- Use partnerships to accomplish the restoration objectives and to leverage limited state, local, and federal funds.

Potential restoration sites were identified through interviews with individuals knowledgeable with the states' ecosystems, and the public was provided an opportunity to nominate sites as well. These data have been compiled into a Habitat Restoration Geographic Information System, an Access database and were published in a brochure called "Restoring Long Island Sound's Habitats." Implementation of restoration projects began in 1998. Twelve priority coastal habitat types have been identified by the HRI members as particularly important to sustaining the living resources of the Long Island Sound ecosystem. These habitat types are Tidal Wetlands, Freshwater (non-tidal) Wetlands, Riverine Migratory Corridors, Submerged Aquatic Vegetation, Coastal Grasslands, Intertidal Flats, Estuarine Embayments, Coastal and Island Forests, Shellfish Reefs, Cliffs and Bluffs, Rocky Intertidal Zones, and Coastal Barriers, Beaches, and Dunes.

In 2000, eleven state, federal, municipal and non-governmental organizations signed a Memorandum of Understanding (MOU) that codified their commitment to work cooperatively on the LISS HRI goals. To view the MOU, please visit the LISS website: http://www.longislandsoundstudy.net/archive/misc/mou.pdf. For more information on the habitat restoration initiative, go to: http://www.longislandsoundstudy.net/habitatteam.htm.

The Long Island Sound Study plays a major role in habitat restoration by providing annual funding to the New York Department of Environmental Conservation's Bureau of Marine Resources and to the Connecticut Department of Environmental Protection's Office of Long Island Sound Programs (OLISP).

In New York, due to limited in-house capacity for construction projects, most restoration projects are being carried out by local governments who have received funding under the 1996 New York State Clean Air / Clean Water Bond Act, Environmental Protection Fund and other state, federal, and private grants. Projects receive technical and planning assistance from state staff, and other members of the Habitat Restoration Workgroup.

The OLISP provides a coordination function for habitat restoration efforts in Connecticut. To that end, four habitat teams have been formed which meet several times a year. These are Tidal Wetlands, Riverine Migratory Corridors, Coastal Barriers/Beaches/Dunes, and Eelgrass (Submerged Aquatic Vegetation). The teams, composed of representatives from federal and state agencies, scientists, and non-governmental organizations, establish annual work plans. The lead agency or organization varies from project to project.

2003 PROGRESS REPORT

Although the ultimate goal of habitat restoration is the implementation of projects, it can take several years of planning, design, obtaining permits and applying for grant funds before a project is ready for construction. For this reason, restoration acreages can vary considerably from year to year, and acreage alone is not a true measure of progress in the field of habitat restoration. Progress is reported by major habitat types with emphasis placed on completed projects. An introduction to each section is provided to summarize the overall work effort.

In calendar year 2003, significant progress was made toward the restoration goals. Four tidal wetland projects were completed, resulting in 8.5 acres restored. Three riverine migratory corridor projects were completed which now provide access to an additional 4.0 miles of migratory passageways for fish. Progress on other habitat types includes restoration of 1.5 acres of freshwater wetland, and 0.5 acres of coastal dunes. Additional progress on more than 55 other projects was made in such areas as securing funding, initiating engineering design, and conducting preliminary tidal studies.

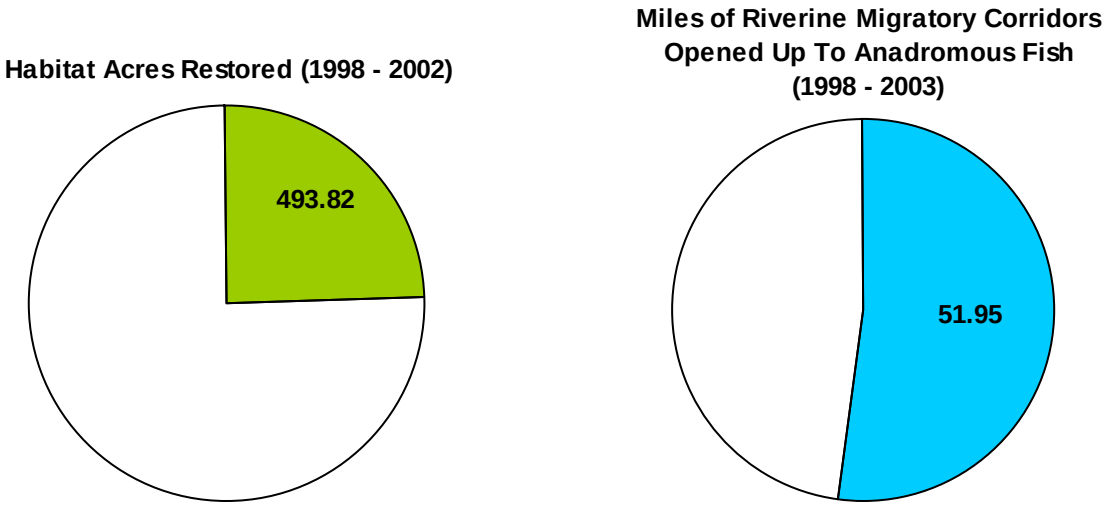


FIGURE 1. Acres and miles restored relative to HRI goals – we are currently at 24.5% and 51.95% of the goals of 2000 acres of coastal habitats and 100 river miles, respectively.

Other miscellaneous highlights include:

- The U.S. Fish and Wildlife Service completed and published a final report for their 2002 aerial survey of eelgrass in eastern LIS. Included with the report are a series of true-color vertical aerial photographs.
- The Long Island Sound Study's Habitat Restoration Team has completed and published *Technical Support for Coastal Habitat Restoration* – an informational manual to assist towns, non-profit agencies, and the general public with the restoration of coastal habitats. The manual is available electronically at: http://www.longislandsoundstudy.net/habitat/index.htm.

The following sections summarize restoration projects completed in 2003 by the states of Connecticut and New York. The habitat types included are tidal wetlands, riverine migratory corridors, freshwater wetlands, coastal barriers, beaches, and dunes, and submerged aquatic vegetation.

TIDAL WETLAND RESTORATION

Four tidal wetland restoration projects were completed in 2003 for a total of 8.5 acres restored:

• Bar Beach Lagoon, North Hempstead, NY	0.8 acres
• Morris Creek Marsh, East Haven, CT	0.4 acres
• Juniper Point Restoration, Branford, CT	0.8 acres
• Stony Creek marsh, Branford, CT	6.5 acres
	8.5 acres of tidal marsh

Project summary pages follow.

Completed tidal wetland project acreage for 1998-2003 are presented in **Figure 2**.

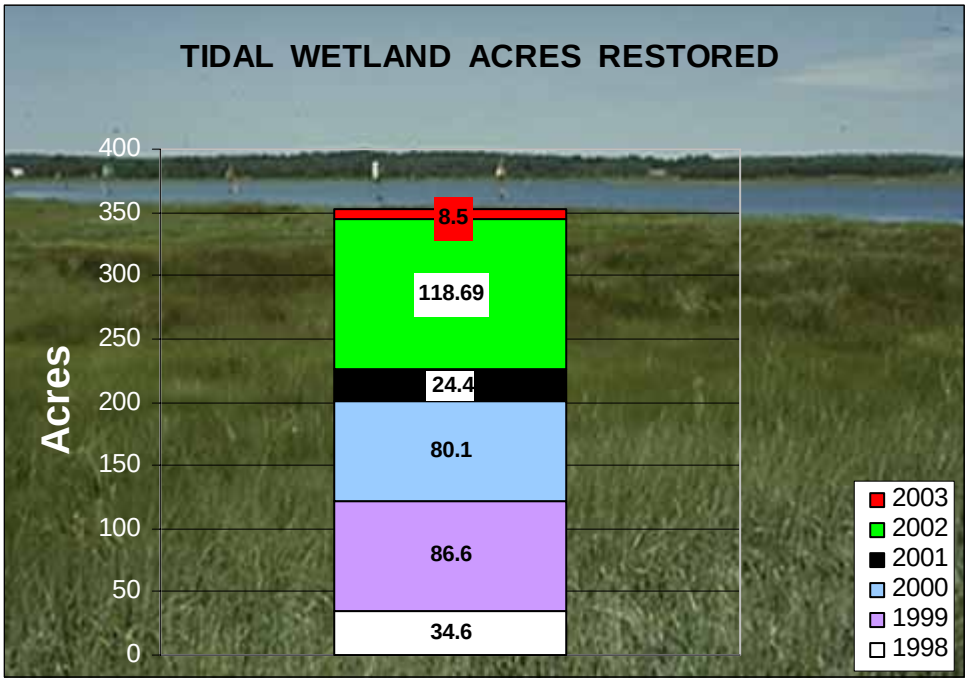


FIGURE 2. Acres of tidal wetlands restored (352.89 acres) between 1998–2003.

Many other projects were in various stages of development. Connecticut's 2003 habitat restoration workplan contained 29 tidal wetland projects, including *Phragmites australis* control efforts (see discussion on following page). Some of the highlights include:

- Lower Connecticut River marshes: Post-construction monitoring continued at the Lower Connecticut River marshes (Great Island, Upper Island, and Lieutenant River near the confluence with the Connecticut River). Second-year monitoring was undertaken by researchers from Connecticut College; funding was provided by the Long Island Sound License Plate Fund as administered by the Connecticut Department of Environmental Protection (CTDEP).
- Juniper Point: During restoration of the tidal marsh at Juniper Point, Branford, 0.8 acres of estuarine embayment were created by excavating a Phragmites-dominated area, then connecting it to tidal waters.
- Great Meadows: Construction began at Parcel 4 of the Stratford Land Development Corporation's mandated fill removal project in the Great Meadows tidal wetland complex in Stratford, CT.
- Lynde Point: CTDEP was awarded a grant for $80,000 through the U.S. Fish and Wildlife Service's National Coastal Wetlands Conservation Act grant program for marsh restoration at Lynde Point, Old Saybrook; the final design for the marsh restoration project also was completed.

- Great Meadows (Essex) and Lieutenant River (Old Lyme): Phragmites control in brackish tidal marshes began at the Great Meadows in Essex (20.9 acres) as well as along the banks of the Lieutenant River in Old Lyme, CT (35.5 acres).

In June 2003, a tidal wetland loss workshop, sponsored by New York State Department of Environmental Conservation with financial support from the Long Island Sound Study (LISS), was held at Stony Brook, NY, to share emerging issues and ideas regarding the loss of tidal wetlands in the Sound and to develop research, monitoring, and management recommendations. A workshop summary is available on the LISS website: (http://www.longislandsoundstudy.net/habitat/habitat_rest_wkshp_rpt03.pdf). The 2003 Long Island Sound Research Grant Program RFP included research recommendations from the workshop and two projects were funded. One such project is to evaluate the effects of nutrients on tidal wetlands; the other is to map tidal wetlands using satellite imagery.

Phragmites australis *Control & Evaluation of Restoration Techniques*

In marshes that are diked and drained, the non-native genetic strain (haplotype) of common reed (*Phragmites australis*) can become the dominant plant, in large part due to the reduced concentrations of salt and sulfides that are otherwise toxic for this grass. Phragmites invades these otherwise healthy, natural tidal marshes where the salinity is less than 18 parts per thousand (this includes brackish and tidal fresh marshes). The Connecticut Department of Environmental Protection (CTDEP) is conducting a series of experiments to control Phragmites, including manipulation of the hydromodifications caused by mosquito ditches.

One technique used to control this grass is application of the same herbicide that is used in the over-the-counter backyard weed herbicide. To date, CTDEP has found that single treatments of Glyphosate are only effective for a period of 5 years or so, after which additional treatment is required. In the case of the Connecticut River, many of the wetlands that are being invaded are designated as Wetlands of International Importance. Given the ecological significance of these wetlands, CTDEP is making a long-term commitment to control this invader. Since these treatments are not long lasting, the restoration effort is reported here, but the acreage of wetland treated with herbicide is not reported in the cumulative wetland restoration statistics.

In contrast to strictly spraying and mowing operations, projects that include significant modifications to marsh hydrology that result in long-term improvements in fish and wildlife habitat and Phragmites reduction are classified as restoration projects. For example, construction of a large-scale marsh restoration project on a 96.5-acre section of Great Island and Upper Island (part of the Lower Connecticut River tidal marsh complex) was completed in June of 2002. The project consisted of testing different combinations of treatments (creating ponds, plugging ditches, filling ditches, and herbiciding and mulching Phragmites) to determine the most effective method(s) for reducing the amount of Phragmites and enhancing fish and wildlife habitat. The goal of this project is to ultimately restore and enhance nearly 300 acres of degraded marsh habitat to a mixture of brackish meadows interspersed with shallow, open water areas, a condition that approximates the pre-ditched marsh environment. Some of the individual objectives of this work are to:

- stop the spread and significantly reduce the aerial extent of Phragmites;
- restore the vegetation mosaic that characterized these brackish tidelands prior to their invasion by Phragmites; and
- enhance the habitat value of the marsh system for birds, fish, and other wildlife.

Post-construction monitoring began immediately after project completion and has continued into 2003 with financial support from the Long Island Sound License Plate program. Additional monitoring is expected over the next several years as well. Funds from the License Plate grant have not yet been entirely spent, and the Long Island Sound Study has recently awarded the CTDEP with $46,270 for additional monitoring at this site. These funds will be used to hire the same researchers from Connecticut College to continue with their monitoring program for several more years.

BAR BEACH LAGOON TIDAL WETLAND RESTORATION

State: New York
Town: North Hempstead
Habitat Type: Tidal Wetland
Acres Restored: 0.8

Cause of Degradation: Releases of hazardous substances from contaminated fill at the Shore Realty Superfund Site.

Project Description: Salt marsh restoration by removing fill (comprised of pea gravel and sand), regrading, and *Spartina alterniflora* planting. The project is being integrated into an ongoing Hempstead Harbor Shoreline Trail Project initiated by the Town of North Hempstead and will be protected in perpetuity.

Implementation Partners: National Oceanic and Atmospheric Administration; U.S. Fish and Wildlife Service; Town of North Hempstead; New York State Department of Environmental Conservation; Private parties.

Funding Provided By: Consent agreement.

Photos courtesy of U.S. Fish and Wildlife Service.

MORRIS CREEK MARSH RESTORATION

State: Connecticut
Town: East Haven
Habitat Type: Tidal Wetland
Acres Restored: 0.4

Cause of Degradation: Unauthorized filling of tidal wetlands (salt marsh).

Project Description: Connecticut Department of Environmental Protection (CTDEP) enforcement staff discovered unauthorized fill had been placed in a small portion of the Morris Creek tidal wetlands. Approximately 500 cubic yards of fill and such items as cables, propane tanks, bulky trash, a boat keel, concrete, boulders, lumber, and other construction materials were removed from the marsh. The upland slope was graded to 2:1. An unauthorized culvert modification also was removed and restored to its original dimensions. The culvert change had not had time to degrade the wetland, so acreage of wetland beyond the fill removal is not counted toward total restoration goals.

Implementation Partners: CTDEP's Wildlife Division performed the restoration and clean-up activities. The Office of Long Island Sound Programs coordinated the enforcement action for the fill and culvert violations and prepared the Certificate of Permission for the restoration.

Funding Sources: Property owner was required to pay for the fill removal, culvert repair, and disposal of trash.

The photos above and at left show some of the larger pieces of debris that were disposed of on this tidal marsh.

Mechanical excavators remove the debris and fill, which were disposed of at a local landfill.

JUNIPER POINT TIDAL MARSH RESTORATION

State: Connecticut
Town: Branford
Habitat Type: Tidal Wetland
Acres Restored: 0.8 acres re-established; also, 0.8 acres of estuarine embayment were created*

Cause of Degradation: Historic fill had caused the loss of tidal wetland habitat.

Project Description: The restoration plan called for the removal of fill to create a large tidal 'pond' (which in this instance is being classified as 0.8 acres of estuarine embayment creation*) and a narrow perimeter of tidal wetland (0.8 acres). A 4-foot diameter pipe was installed through a berm to connect this complex to Long Island Sound and restore tidal flow.

The pond at this site was recently reconnected to Long Island Sound through the installation of a culvert under a berm. Fringing tidal marsh now surrounds this tidal pond.

Implementation Partners: A private contractor hired by the property owner.

Funding Provided By: Property owner.

*The Estuarine Embayment Creation portion of this project cannot be applied toward the Long Island Sound Study's 10-year habitat restoration goal.

STONY CREEK MARSH RESTORATION

State: Connecticut
Town: Branford
Habitat Type: Tidal Wetland
Acres Restored: 6.5

Cause of Degradation: Freshwater inputs from several town storm drains causing *Phragmites australis* to dominate the marsh surface, due to a drainage pipe whose invert elevation was too high. These freshwater inputs led to increased standing fresh water and marsh flooding. Stormwater run-off had washed upland sediments into the primary tidal creek that connected this marsh system to Long Island Sound.

Project Description: The upland sediments that had washed into the primary tidal creek were removed, and several secondary tidal creeks (and ponds) were created to improve tidal flow within the system. Although the pipe that provides a tidal connection to Long Island Sound was not modified, tidal exchange to the system and freshwater drainage were greatly improved by creating a better connection between the primary tidal creek and the pipe.

Implementation Partners: U.S. Fish and Wildlife Service – Stewart B. McKinney National Wildlife Refuge; Connecticut Department of Environmental Protection – Wildlife Division.

Funding Provided By: U.S. Fish and Wildlife Service – Partners for Wildlife Program.

WILSON COVE MARSH RESTORATION

State: Connecticut
Town: Norwalk
Habitat Type: Tidal Wetland
Acres Restored: 5.9 acres of adaptive management

Looking downstream across Route 136 in Norwalk, the darker-colored asphalt marks the location of the new 72-inch culvert installed under the road.

Cause of Degradation: This marsh has been diked and drained by a tide gate (gate was replaced in 1935, original date of installation is unknown). In the early 1980s, it was determined that the concrete vault chamber was askew. The Connecticut Department of Environmental Protection (CTDEP) suggested to the City of Norwalk that they remove the gate and the chamber, which was completed in 1986. The original culvert and berm, however, were left in place. It was later determined that this structure had no impact on the height of high tides but did impede drainage of stormwater. This marsh receives significant freshwater inflow and it was suspected that the impediment to drainage resulted in lower soil salinities that were allowing the invasive grass common reed (*Phragmites australis*) to persist on certain portions of the marsh. It also was determined that the culverts under Route 136 were an impediment to drainage.

Project Description: To eliminate impediments to tidal flow and stormwater discharge, the outlet culvert and berm were removed and an additional culvert was installed under Route 136. In places, rocks were removed along the channel upstream of the inlet to improve flows to and from the marsh. Since the original restoration of this marsh system took place in the 1980s, these actions are classified as adaptive management and the acres reported above cannot be counted toward the Long Island Sound Study's 10-year goal of 2000 acres of restored coastal habitats.

Implementation Partners: City of Norwalk (lead and construction); CTDEP – Office of Long Island Sound Programs and Wildlife Division (construction); CTDEP Division Services; National Oceanic and Atmospheric Administration – Northeast Restoration Center; Save the Sound; EPA Long Island Sound Study; Preserve the Wetlands (Norwalk); and Wilson Point Homeowners.

Funding Provided By: National Fish and Wildlife Foundation Program (via Iroquois Settlement Funds); City of Norwalk; Preserve the Wetlands; EPA 319 Funds; and NOAA / Save the Sound Challenge Grant.

Before (right) and after (below) photos of the main tidal creek at Wilson Cove marsh leading downstream to Long Island Sound. Though these images are taken at slightly different angles to one another, the results are clear – the rocks lining the channel were removed in the 1980s, and the Phragmites is now limited to a few stunted, isolated patches.

Installation of a new 72-inch diameter culvert under Route 136 helped improve drainage and tidal flow in the section of marsh upstream of the road. The increased salinity quickly stunted the growth and spread of *Phragmites australis*.

A close-up image of the upstream end of the new culvert is below.

RIVERINE MIGRATORY CORRIDOR RESTORATION

The Connecticut Riverine Migratory Corridor team, led by the Department of Environmental Protection (CTDEP) Inland Fisheries Division, completed three migratory fish projects resulting in habitat restoration that provided anadromous finfish access to an additional 4.0 river miles of migratory passageways. Fishways were built at Perry Bog and Lower Guilford Lake Dams; eelpasses were installed at Lower Millpond and Kinneytown Dams; and a culvert was replaced in the Shunock River (project pages follow). The completed eelpass projects did not result in additional miles opened that could be counted toward the Long Island Sound Study's restoration goals, however. The RMC team also worked on 26 other projects that were in various stages of development.

New York completed a number of riparian buffer restoration projects, which involved plantings for bank stabilization. New York's portion of the Long Island Sound shoreline presents significantly fewer opportunities for riverine migratory corridor restoration. However, those opportunities that do arise are very important to the overall health of migratory and riverine species, and in the reduction of sediment and nutrients reaching Long Island Sound. Because the projects described are riparian or streambank enhancements and not migratory fish restoration projects that consist of dam removals or fishway installations, the miles for New York's projects are not included in the totals for riverine migratory corridors.

The 10-year goal (1998–2007) for this habitat type is to open up 100 currently inaccessible river miles to diadromous fish. To date, 51.95 river miles have been restored through fish passage projects, such dam modifications or dam removal. River mileage for projects completed in 1998–2003 is presented in **Figure 3**.

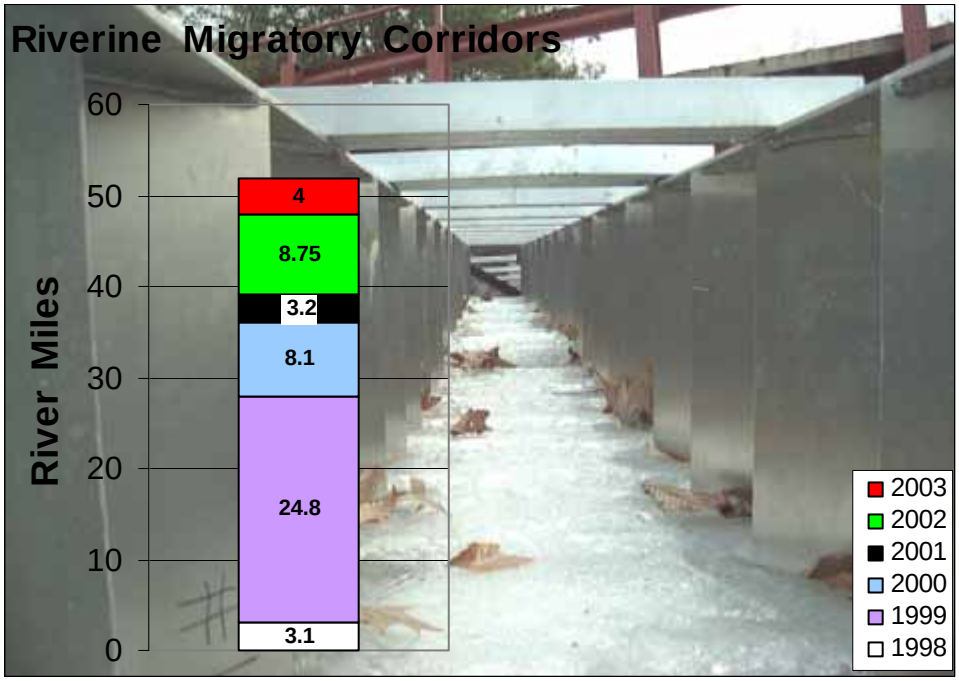


FIGURE 3. Cumulative river mileage (51.95 miles) for RMC projects completed between 1998–2004.

Highlights of progress for ongoing migratory fish passage projects include:

- Lower Guilford Lake Dam: Construction began on a hybrid fish-passage facility at Lower Guilford Lake Dam on the East River in Guilford, CT.
- West River: A tide study was completed and a Certificate of Permission was obtained from the CTDEP's Office of Long Island Sound Programs, approving the modification of a tide gate that would allow fish in the West River to pass underneath Congress Avenue in New Haven, CT.
- Taftville Dam: Final design was completed for a proposed Denil fishway on Taftville Dam in the Shetucket River, Norwich, CT.

PERRY BOG DAM FISHWAY

State: Connecticut
Town: Fairfield
Habitat Type: Riverine Migratory Corridor
Stream Name: Perry Bog Stream
Miles Restored: 0.5

Cause of Degradation: Construction of dam in Perry Bog Stream, Fairfield, CT, that impedes migration of fish, including the alewife, an estuarine species that spawns in freshwater.

Project Description: The previous water control structure at this small earthen dam was an impediment to fish passage. When the Town had to replace this structure, it requested a design that would pass fish. Paired slots which can accept weir boards were formed into the new concrete walls of the water outlet structure and a series of ascending pools were created. This pool-and-weir fishway allows fish to climb to the top of the new water control structure. The stream channel leading from the fishway down to the Mill River was cleared of deadfalls to expedite fish passage.

Targeted Fish Species: Alewife, American eel.

Implementation Partners: Town of Fairfield (lead); Connecticut Department of Environmental Protection - Inland Fisheries Division.

Funding Provided By: Town of Fairfield.

Exit at the upstream end of the fishway leading into Perry Bog.

LOWER GUILFORD LAKE DAM FISHWAY

State: Connecticut
Town: Guilford
Habitat Type: Riverine Migratory Corridor
Stream Name: East River
Miles Restored: 0.75

Cause of Degradation: A 15-ft high private dam on the East River in Guilford prevents fish passage, especially with regard to anadromous fish.

Project Description: A hybrid fishway was constructed over the dam. Two stream channels are dammed to create the lake. There are short segments of these channels downstream of the dam before they converge. The eastern channel was regraded and a semi-natural fish bypass channel was constructed in-channel with boulders to make the steep channel less steep and more fish-passable. One unit of steeppass fishway was installed at two locations to get fish past particularly steep sections: one is a bedrock reach midway in the reach and the other is at the low spillway at the top of the reach.

Rocky ramp fishway leading up to the first of two aluminum steeppass units, visible in the background.

The fishway consists of a rocky ramp fishway built in the eastern branch of the stream, below one of the two dam spillways, and two separate sections of aluminum steeppass units. The dam is about one mile upstream of the Capello Dam, which had a fishway installed in 1994. The Lower Guilford Lake Dam consists of two concrete spillways separated by a rocky outcrop. The fishway was built downstream of the eastern spillway. A 14.2 acre pond is surrounded by year-round homes, which are owned by members of the lake association that owns the dam. The water quality is good and the lake is fed by the outflow from the Middle Guilford Lake, which might become a candidate for fish passage in the future.

Targeted Fish Species: Alewife, blueback herring, and sea-run brown trout.

Implementation Partners: Guilford Lakes Improvement Association (lead); American Rivers; Connecticut Department of Environmental Protection - Inland Fisheries Division; Yale University.

Funding Provided By: American Rivers (through a partnership grant from NOAA); Guilford Lakes Improvement Association.

ROMANELLA CULVERT REPLACEMENT

State: Connecticut
Town: North Stonington
Habitat Type: Riverine Migratory Corridor
Stream Name: Shunock River
Miles Restored: 2.75

Cause of Degradation: Improper installation of a culvert in the Shunock River, North Stonington, CT, blocked migrations of diadromous fish at some flows. Anadromous fish were able to pass only at high flows and American eel probably were not able to pass effectively at any flows. The downstream end of the twin culverts were 'perched' over one vertical foot above the surface of the river at the downstream end.

Project Description: One of the two culverts was removed completely and replaced with a large, commercial, pre-cast concrete box culvert set at the level of the existing stream channel. The other opening was retained. At normal flows, all water passes through the new culvert; at high flows, however, the old opening serves as an emergency spillway and passes storm flows.

Targeted Fish Species: Alewife, blueback herring, sea-run brown trout.

Implementation Partners: Mashantucket Indian Tribal Nation (lead); Connecticut Department of Environmental Protection - Inland Fisheries Division.

Funding Provided By: Mashantucket Indian Tribal Nation.

This box culvert recently installed under old quarry road is better designed to pass fish than the previous structure.

LOWER MILLPOND DAM EELPASS

State: Connecticut
Town: Old Lyme
Habitat Type: Riverine Migratory Corridor
Stream Name: Mill Brook
Miles Restored: 0.85 miles of passage for eels only; therefore, this project cannot be applied toward the Long Island Sound Study's 10-year habitat restoration goal.

Cause of Degradation: Construction of a barrier dam in Mill Brook, Old Lyme, CT, blocks the passage of American eels. A pre-existing fishway was installed in 1998.

Project Description: A pre-fabricated aluminum, trough-style eel pass was installed below the dam with its entrance adjacent to the entrance of the existing steeppass fishway for alewives. The trough has two substrates: Enkamat for glass eels and Akwadrain for elvers. The trough is covered for protection from predators and has one turn pool as well as a terminal holding tank into which the eels drop once they reach the top. Connecticut Department of Environmental Protection staff visit the eel pass daily in the spring and weekly in the summer and fall to remove the trapped eels, count them, and manually carry them to the top of the dam for release. Water is provided by a siphon and PVC plumbing to a spray bar.

Targeted Fish Species: American eel.

Implementation Partners: Connecticut Department of Environmental Protection - Inland Fisheries Division (lead); U.S. Fish and Wildlife Service - Connecticut River/Long Island Sound Ecoteam; Old Lyme Conservation Trust.

Funding Provided By: U.S. Fish and Wildlife Service – Flex Funds Program.

KINNEYTOWN DAM EELPASS

State: Connecticut
Town: Seymour
Habitat Type: Riverine Migratory Corridor
Stream Name: Naugatuck River
Miles Restored: 1.8 miles of passage for eels only; therefore, this project cannot be applied toward the Long Island Sound Study's 10-year habitat restoration goal.

Cause of Degradation: Construction of barrier dam in the Naugatuck River, Seymour, CT, blocks the passage of American eels. A pre-existing fishway was installed in 1999.

Project Description: A pre-fabricated aluminum, trough-style eel pass was installed below the dam with its entrance adjacent to the entrance of the existing Denil fishway for anadromous fishes. The trough is covered for protection from predators and has a terminal holding tank into which the eels drop once they reach the top. Connecticut Department of Environmental Protection staff visit the eel pass daily in the spring and weekly in the summer and fall to remove the trapped eels, count them, and manually carry them to the top of the dam for release. Water is provided by a siphon and PVC plumbing to a spray bar.

Targeted Fish Species: American eel.

Implementation Partners: Connecticut Department of Environmental Protection - Inland Fisheries Division (lead); U.S. Fish and Wildlife Service - Connecticut River/Long Island Sound Ecoteam; Kinneytown Hydroelectric Company, Inc.

Funding Provided By: U.S. Fish and Wildlife Service - Flex Funds Program.

FRESHWATER WETLAND RESTORATION (NON-TIDAL)

The term 'freshwater wetlands' is used collectively to describe the diverse range of non-saline (and non-tidally influenced) ponds, bogs, fens, swamps, and marshes found in the world. The U.S. Fish and Wildlife Service wetland classification system created by Cowardin et al. (1979)[1] categorizes freshwater wetlands in the United States as palustrine, lacustrine, or riverine systems. The classification system also addresses deep-water habitats where the substrate is predominantly non-soil and flooding is permanent, but those types of wetlands generally are not included in the Long Island Sound Study Habitat Restoration Initiative.

Palustrine Systems

Palustrine wetland systems are defined by Cowardin et al. (1979) as non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens; or they may be non-vegetated, shallow water areas (less than six feet deep) with no wave formed or exposed bedrock shoreline features. In order to be considered palustrine, these non-vegetated areas must be less than 20 acres in size.

Lacustrine Systems

Lacustrine wetlands are wetlands and deep water habitats situated in a topographical depression or dammed river channel; lacking trees, shrubs, persistent emergent vegetation[2], emergent mosses or lichens with greater than thirty percent areal coverage; and with a total area larger than 20 acres. Certain wetlands smaller than 20 acres may be classified as lacustrine if there are active wave-formed or bedrock shoreline features making up all or part of the boundary, or if the deepest part of the basin exceeds 6.6 feet at low water (Cowardin et al., 1979). While lacustrine wetlands do occur within the project boundary in Westchester County and in Connecticut, for the purposes of this initiative, restoration will focus on the shorelines of these bodies of water where the classification shifts to palustrine.

Riverine Systems

Riverine communities are defined by Cowardin et al. (1979) as "all wetlands and deep water habitats contained within a channel" except those that are dominated by persistent emergent vegetation, trees or shrubs (palustrine), or have more than 0.5 ppt ocean-derived salinity (estuarine, marine). Community types are classified by the rate of water flow, which, in turn, dictates the substrate composition and faunal and vegetation types present. Although the Cowardin et al. system also includes tidally influenced, freshwater, non-persistent emergent riverbank vegetation, such as wild rice, all tidally influenced wetland restoration sites were included in the Tidal Wetlands Restoration chapter of this report.

Restoration Objectives

The major cause of wetland degradation is the alteration of the hydrology in the wetland system. This alteration may be caused by a number of activities such as draining, filling, and impounding. In the past, surface water supplies to wetlands have been diverted for drinking water reservoirs, flood control projects, cooling of industrial plants, and irrigation of crops. Other degradation may be caused by chemical inputs to wetlands, or invasion by exotic species. While degradation is caused by unique combinations of circumstances in each affected wetland, some general causes and restoration methods can be outlined. These methods include fill removal, invasive species control, relocation of excessive runoff, and other hydrological modifications.

[1] Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service, FWS/OBJ.79/31. Washington, D.C. 103pp.

[2] Persistent emergent plants are those that leave all or a visible portion of their foliage above the saturation zone or water surface during the dormant season. Conversely, non-persistent emergents are those plants that leave no portion of their foliage visible during the dormant season.

In New York, three freshwater wetland restoration projects were completed during 2003, for a total of 1.5 acres restored (project summary pages follow):

• Edith G. Read Park & Sanctuary, Rye, NY	0.25 acres
• Hutchinson River, New Rochelle, NY	1.0 acres
• Sheldrake River, Mamaroneck, NY	0.25 acres
	1.5 acres of freshwater wetlands

Several other projects were in various stages of development.

No freshwater wetland restoration projects were completed in Connecticut. The State of Connecticut currently has no program dedicated to the restoration of freshwater (non-tidal) wetlands.

LONG ISLAND SOUND WET MEADOW DEMONSTRATION PROJECT at EDITH G. READ NATURAL PARK & WILDLIFE SANCTUARY

State: New York
Town: Rye
Habitat Type: Freshwater Wetland
Acres Restored: 0.25 acres created

Cause of Degradation: This wet meadow was created next to the nature center building as a demonstrational/educational instrument.

Project Description: The meadow was created by excavating two feet of soil to create a shallow basin with gently sloping sides and planting the excavated area with native plants, including swamp milkweed (*Asclepias incarnata*), sedges, soft rush (*Juncus effusus*), and blue vervain (*Verbena hastata*). A semi-permeable membrane was installed underneath the middle (deepest) portion of the basin to slow the infiltration of water in that portion of the wet meadow.

Implementation Partners: Westchester County Planning Department, and Department of Parks, Recreation and Conservation.

Funding Provided By: Federal, New York State, and Westchester County governments.

Photos courtesy of Westchester County Planning Department.

HUTCHINSON RIVER FRESHWATER WETLAND RESTORATION

State: New York
Town: New Rochelle
Habitat Type: Freshwater Wetland
Acres Restored: 1

Cause of Degradation: Scour caused by stormwater discharge outfall pipe.

Project Description: The project included moving the discharge point out of the wetland and stabilizing the end of the pipe with stonework to disperse stormwater energy. The wetland was then restored by regrading the scour hole and planting it with native wetland vegetation. Several logs were deposited in the wetland to provide habitat for small animals. This resulted in a natural stormwater filtration system helping to clean and purify water in this area.

Implementation Partners: Westchester County Planning Department; New York State Department of State.

Funding Provided By: Federal, New York State, and Westchester County governments.

Photos courtesy of Westchester County Planning Department.

SHELDRAKE RIVER STREAMBANK STABILIZATION & RIPARIAN BUFFER RESTORATION

State: New York
Town: Mamaroneck
Habitat Type: Freshwater Wetland
Acres Restored: 0.25

Cause of Degradation: Erosion and loss of wildlife habitat due to urbanization.

Project Description: Westchester County regraded and revegetated the banks of the Sheldrake River and reinforced bridge pilings with stonework to prevent soil erosion during high water. The County also added ripples within the river and fencing to protect newly planted vegetation from foraging waterfowl, such as geese and ducks.

Implementation Partners: Westchester County Planning Department; Village of Mamaroneck; U.S. Department of Agriculture – Natural Resources Conservation Service; New York State Department of Environmental Conservation.

Funding Provided By: Federal, New York State, and Westchester County governments.

Photos courtesy of Westchester County Planning Department.

COASTAL BARRIERS, BEACHES, AND DUNES

In Connecticut, one dune restoration project was completed during 2003, which resulted in the restoration of 0.5 acres:

- Ocean Beach Park, New London, CT 0.5 acres dune restoration

Several other projects were in various stages of development. Highlights include:

• Lynde Point: Planning continued for the beachgrass transplantation project at the Lynde Point dunes, within the Borough of Fenwick in Old Saybrook, CT.

• Ocean Beach Park: The Coastal Barriers, Beaches, and Dunes restoration team helped the City of New London secure funding for dune restoration activities at Ocean Beach Park through the Wildlife Habitat Incentives Program (WHIP) of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). The award was in the amount of $9,880. Proposed activities include invasive weed removal, transplanting of American beachgrass (*Ammophila breviligulata*) and native shrubs, and, possibly, pedestrian-control structures such as educational/warning signs, dune fencing, and elevated wooden walkways to keep people off of the dunes.

• Waterfront Beach Park: The Coastal Barriers, Beaches, and Dunes restoration team also helped the Town of Waterford secure funding through WHIP. The award, in the amount of $11,305, was for dune restoration activities at Waterford Beach Park. Proposed activities are the same as those listed above for Ocean Beach Park.

No coastal barrier, beach, or dune restoration projects were completed in New York.

OCEAN BEACH PARK DUNE RESTORATION

State: Connecticut
Town: New London
Habitat Type: Dune
Acres Restored: 0.5

Cause of Degradation: Infestation by European dunegrass (*Leymus arenarius*), which spread very quickly after only a single growing season.

Project Description: After receiving a grant thru the Long Island Sound License Plate Program, the local community group Save Ocean Beach purchased beachgrass from a Connecticut nursery. The nursery did not supply the native American beachgrass (*Ammophila breviligulata*), unfortunately, but, rather, the highly invasive European dunegrass. Connecticut Department of Environmental Protection (CTDEP) identified the non-native dunegrass and contacted the City of New London with regards to the urgency to eradicate this weed. Save Ocean Beach organized a mechanical weed harvest; this left a significant number of rhizome fragments in the soil, however. The numbers of plants increased significantly the next spring. The Connecticut College Arboretum director recommended the use of Roundup as an effective alternative to physical removal, and Save Ocean Beach implemented an herbicide treatment. The native beachgrass then was transplanted around the viewing platform shortly afterwards.

Invasive plants such as European dunegrass, Japanese knotweed, and *Phragmites australis* were removed from this site, leaving behind the American beachgrass, switchgrass, and other species planted as part of a Long Island Sound Fund public access project.

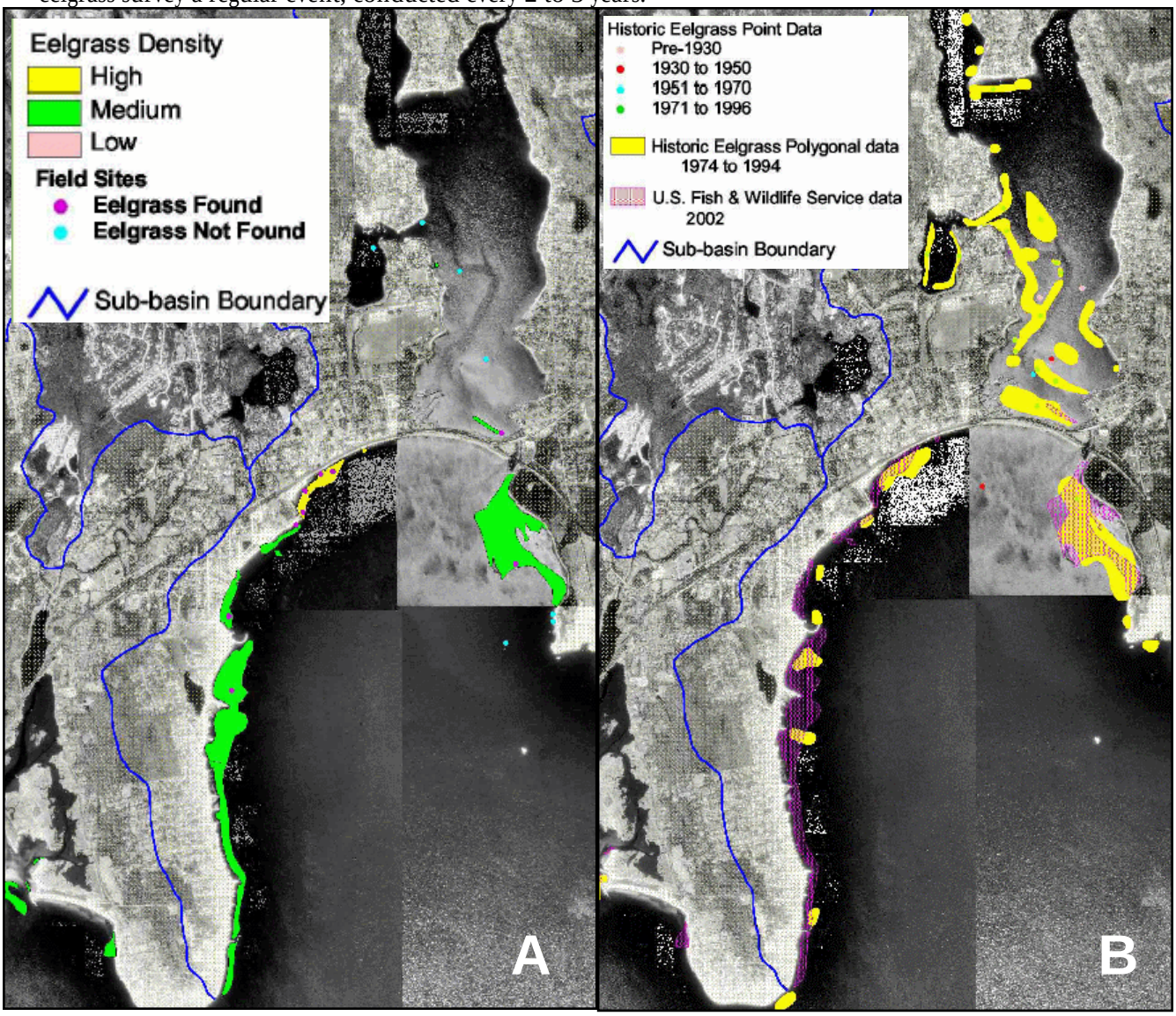
Implementation Partners: Save Ocean Beach; City of New London; Connecticut Department of Environmental Protection – Office of Long Island Sound Programs.

Funding Provided By: Save Ocean Beach.

SUBMERGED AQUATIC VEGETATION (SAV)

Eelgrass

In 2001, Connecticut Department of Environmental Protection (CTDEP) was awarded a grant by the EPA Long Island Sound Study to re-map eelgrass *(Zostera marina)* beds in eastern Long Island and Fishers Island Sounds in New York and Connecticut. The CTDEP used those funds to contract with the National Wetlands Inventory Program of the U.S. Fish and Wildlife Service to (a) acquire low-altitude aerial photography, (b) perform photointerpretation of eelgrass beds, and (c) ground-truth those areas interpreted as possible eelgrass beds. Aerial photography was conducted in mid-June, 2002. The results of this survey were compared with mapping of eelgrass that was done during 1993 and 1994 to identify trends (gains/losses) in Long Island Sound eelgrass beds, and potentially identify future restoration opportunities. A Geographical Information Systems (GIS) project with a final summary report for this survey was created (see figure below). An additional survey following the same procedure is planned for 2004 or 2005, with the goal of making this eelgrass survey a regular event, conducted every 2 to 3 years.



(A) Eelgrass beds in the Niantic River and Bay area during the 2002 aerial survey, giving shoot densities. (B) Eelgrass beds mapped in 2002 (purple) overlaying eelgrass beds mapped between 1974–1994. A trend seen in this figure (and throughout eastern Long Island Sound) is the recovery of eelgrass beds in the outer bays and in the Sound proper, while beds in the more protected and less tidally-flushed harbors and coves have not recovered. These inner harbors are subject to more direct upland runoff and its associated pollutants.

Water Chestnut Removal

Hockanum, Connecticut, and Podunk Rivers; Trout Brook

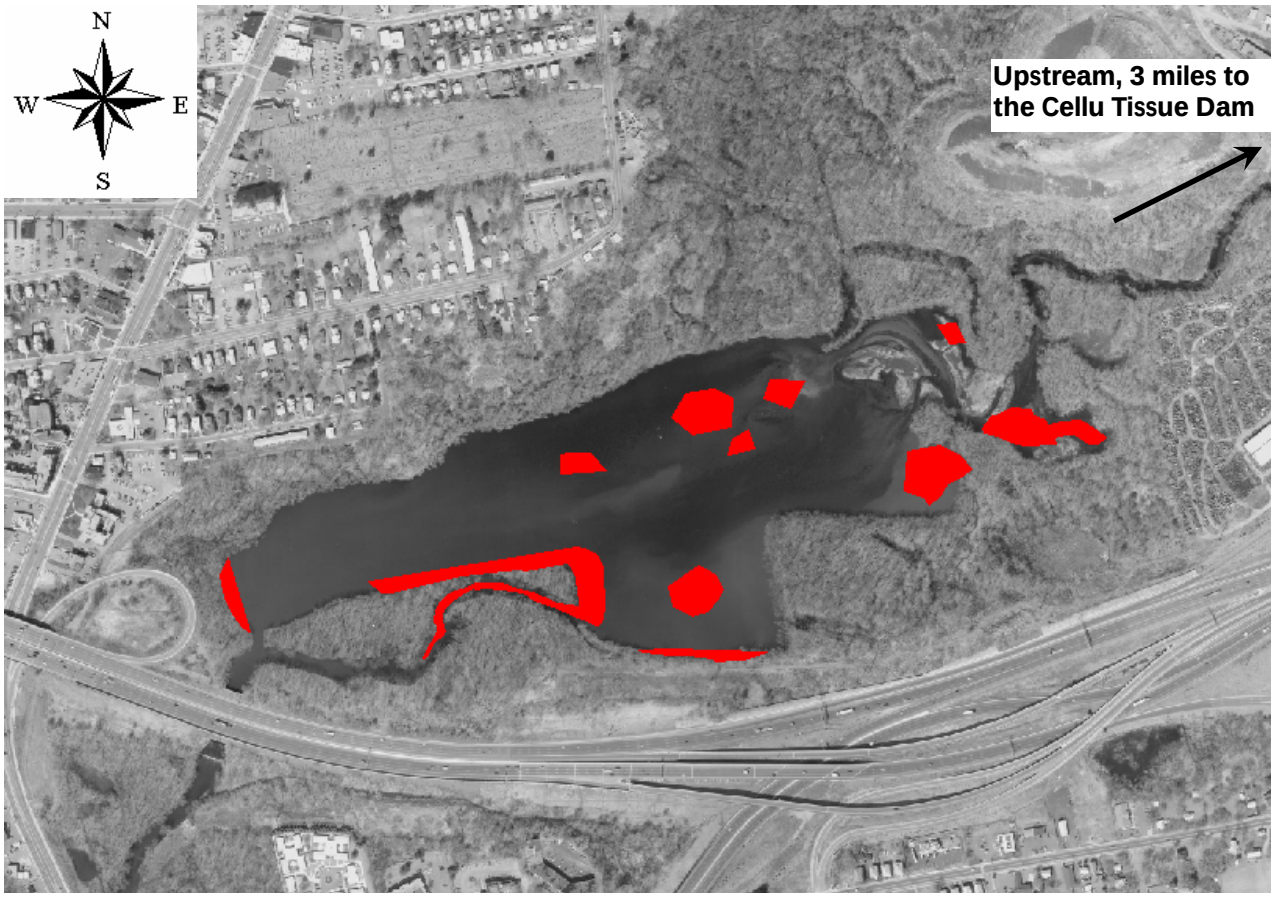
CTDEP completed a fifth year of control efforts for the highly invasive aquatic plant, water chestnut (*Trapa natans*). Water chestnut was first documented in Connecticut in 1999 when it was discovered in Keeney Cove, a freshwater tidal cove of the Connecticut River in Glastonbury. Infestations since have been discovered in the Hockanum River (East Hartford), Vinton's Millpond in the Podunk River (South Windsor), Trout Brook (West Hartford), and in two private ponds in the eastern and western parts of Connecticut. Although these infested sites are well outside the Long Island Sound Study Project area, there is a real possibility that the weed could spread to the tidal coves of the lower Connecticut River.

The trend of declining populations of water chestnut experienced over the last few years did not continue into 2003 at two locations. Water chestnut reappeared in Vinton's Millpond in moderately-sized patches and rebounded aggressively at two dense patches in the Hockanum River near the Cellu Tissue Dam. The population at the Hockanum River site was so dense that it seemed as if no prior control efforts had been made there. Fortunately, these patches were small enough to be removed by hand. The estimated biomass (wet-weight), however, still was rather high for this location, much higher than in 2002: an estimated 35,000 pounds, mostly from within two isolated patches. Only 3,000 pounds were found scattered throughout the remaining 20 acres of this impoundment. After not having been spotted in Vinton's Millpond in 2002, a total of 5,000 pounds of water chestnut were removed this year. The cause of this water chestnut re-emergence remains unknown – perhaps some environmental cue triggered the majority of remaining dormant seeds in the seed bank to germinate all at once.

The Trout Brook water chestnut infestation did not expand in size this year; however, it did not contract, either. Approximately 2000 pounds were removed this year, which was the same as in 2002. The Keeney Cove site did improve once again–only 260 pounds of water chestnut were found and removed in 2003.

Water Chestnut Expansion

A new infestation of water chestnut was found in another impoundment of the Hockanum River. Also in East Hartford, this impoundment is behind the Town Hall and adjacent to Martin Park, just three miles downstream of the Cellu Tissue Dam. Many small and several moderately-sized patches of water chestnut were encountered. In all, approximately 6300 pounds of the weed were harvested from this impoundment, which also is known locally as East Hartford Lake. A drop in biomass is expected for next year as these plants were removed well before their seeds had the opportunity to mature.



This image demonstrates the patchy distribution of the recently discovered water chestnut infestation in a large impoundment of the Hockanum River behind the East Hartford Town Hall. Plant density varies widely within the highlighted areas, and, fortunately, most of these patches have only a few scattered plants in them. This site is approximately 3 miles downstream of the once heavily infested impoundment created by the Cellu Tissue Dam.