

Executive Summary

Despite abundant scientific research that has been conducted in the Connecticut River estuary, no single study has consolidated information on the existence and condition of shoreline vegetated buffers and riparian areas that are known to be an important natural tool to counter the affects of nonpoint source water pollution. This investigation attempts to pull together both existing GIS data and field observations in an initial effort to produce a regional tool that can guide further resource protection – through the conservation of riparian buffers – in the Connecticut River estuary.

The *Connecticut River Estuary Regional Planning Agency, Gateway Commission* and *Tidewater Institute* – collaborators on this project -- have compatible and to some extent overlapping objectives within the Connecticut River estuary region. All three of these agencies/organizations combine to create an increasingly useful source of information and support to Estuary towns in the Connecticut River Valley. This study will be made available to the project area towns through the Regional Planning Agency in the town of Old Saybrook.

In addition to experiencing the Connecticut River and its major tributaries as only a small open boat can afford, this study also underscored both the extraordinary beauty and vulnerability of the lower Connecticut River region. The lower river is fortunate to have had, and continue to be the focus of considerable attention that has translated into a large percentage of intact shoreline, primarily through conservation land acquisition and conservation easements by federal, state and local organizations. While invasive species concentrations suggest that these conserved areas are not entirely free of threats, they are nonetheless serving the important role of protecting water quality of the Connecticut River through intact vegetated buffers. While large areas of the shoreline remain in marsh or woodland, currently developed and vacant parcels throughout these local communities continue to experience development pressure. The very thing that attracts new residents and leads to rising property values – the quality of life that can be realized living in close proximity to an exemplary natural resource – is also what will challenge

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the Gateway communities in the lower river to preserve what makes this valley so special.

To this end, this project is a starting point that, combined with numerous other studies and qualified resources available, can suggest future protection measures (see *Implementation and Future Steps*).

Several notable findings include the emergence of “hot spots” of restoration opportunities, many not surprisingly associated with existing developed areas. A number of these sites represent neighborhoods or associations that conceivably could facilitate outreach and education, preferably through or in conjunction with the local land trust, on the importance of and restoration or creation of riparian buffers. A large parcel – the former Connecticut Yankee nuclear power plant – presents an interesting possibility to restore riparian buffer where a stone revetment has historically been.

To the extent that the existing GIS data allowed, vacant parcel data revealed important findings about the existence of vacant private land parcels that, if protected, could add significantly to the vegetated buffers along the lower Connecticut River. Some of these parcels are large enough or strategic enough that if protected they would secure entire islands or protect critical tidal marsh complexes, such as Pratt and Post Cove in the town of Deep River.

Invasive species observations led to the conclusion that the top three most pervasive invasive plants in the riparian zone of the lower Connecticut River are bittersweet, purple loosestrife and, to the south, *Phragmites*, or common reed. A surprising, or perhaps sobering observation, was the existence of tree of heaven (*Ailanthus altissima*) throughout the project area and as far north as Haddam; some trees appearing to have become established in otherwise healthy riparian edges along the water. As explained further in this report, observations were strictly from the water (with few exceptions), making positive identification and complete observation tenuous at some sites. Decisions to earmark resources to control invasive species need to be well thought out, particularly

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in the riparian zone where disturbance is a natural process that can favor opportunistic plants.

Time did not allow investigation of sites that otherwise would have been good to survey, such as the mouth of Salmon River in East Haddam and the Lieutenant and Blackhall Rivers in Old Lyme.

To the extent that individual houses have been highlighted in this report to illustrate buffers, both good and in need of enhancement, our hope is that every illustration will be used for educational purposes only. Photographs of disturbed sites that have suffered extensive invasive species invasions may serve as demonstrations for the purposes of steering others to seek alternatives. The informational brochure *Protecting Water Quality with Vegetated Buffers in the Connecticut River Estuary* suggests only a few alternatives; clearly many more native plants for landscaping exist and hopefully will be the subject of continued education in the region.

For more information on this project, please feel free to contact the principal investigators below. We wish to thank the Long Island Sound Office of the Environmental Protection Agency (EPA) for the principal funding that made this study possible.

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Introduction

Since the early 1990's the Connecticut River and its estuary have received four national and international designations for its outstanding biological resources. The estuary harbors seven globally threatened species, and over forty state listed species, including the federally endangered shortnose sturgeon (*Acipenser brevirostrum*) and the intertidal plant, Parker's pipewort (*Eriocaulon Parkeri*). Among its abundant natural assets are its largely intact natural shoreline, harboring exemplary occurrences of salt, brackish and freshwater tidal marshes that are often fringed by small but important wooded riparian areas.

These upland buffers serve important biological functions, including habitat for one of the state's highest concentrations of migratory birds, and other wildlife, reduction and incorporation of non-point source water pollution, shading and organic debris for aquatic organisms and increased groundwater recharge. In the southern portion of the project area, extensive tidal marshes serve as vegetated buffers to upland land use. Collectively, the vegetation that fringes the Connecticut River estuary are critical biological filters that, left intact, perform a vital role in maintaining water quality. The Connecticut River contributes seventy percent of the freshwater entering Long Island Sound; it is an integral component to the living marine resources of the Sound, itself an estuary of national importance.

The Connecticut River Riparian Mapping project has built upon existing GIS databases, including the DEP-funded dock study (2005)¹, aerial photography, and digitized municipal parcel information to identify and map the occurrences of riparian buffers within 150 feet of the main stem of the Connecticut River and its major tributaries. This work was done within the eight towns of the Gateway Conservation Zone: Haddam, East Haddam, Lyme, Old Lyme, Chester, Deep River, Essex and Old Saybrook.

¹ *Creation of a GIS Database Through Maps Produced Through Implementation Phase, Lower Connecticut River Dock Study: Creation of a General Plan (2005)*

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The deliverables from this project are designed to encourage a *regional perspective* about the opportunities for and importance of protecting and restoring riparian buffers in the Connecticut River estuary, and to assist landowners, residents and land use decision makers with local and regional land protection efforts. The final maps and educational brochure can be used to strengthen local efforts to protect, restore and educate residents by providing specific locations, and context, for action. The GIS data, maps and recommendations from this initiative will be made available to all the lower River communities through the Connecticut River Estuary Regional Planning Agency (CRERPA) and Tidewater Institute.

The final product includes a linked parcel and address database for all properties adjacent to the River (902 parcels), as well as the classification of parcels as existing protected, developed or vacant land. A digital photo-inventory has been generated to accompany the parcel database, recording existing buffer condition and documenting invasive species presence and extent, where possible.

Restoration opportunities have been identified and mapped according to several criteria: the opportunity to create a buffer where one currently does not exist, the opportunity to enhance an existing buffer, and the opportunity to address invasive species in the buffer area. General recommendations have included enhancing an existing or creating a new buffer by widening or infill planting, and invasive species reduction or elimination where feasible. Opportunities for education about the value and potential for buffer creation or enhancement, as well as invasive plant species information, abound in the project area.

Land parcels appropriate for protection in the lower river have been identified by their proximity to existing protected land (abutting existing or “in holdings” in larger protected areas), the opportunity to protect a currently unprotected large tract (>25 acres) that includes riparian area; protection of an area that would be key to mitigate upland land use or development, or where the riparian buffer has been eliminated or compromised. Protection is defined as outright purchase (through land protection organizations, the

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state, local land trusts or municipalities, Gateway Commission), conservation easements, or targeted education for private landowners.

Map Interpretation

MAP: Vacant Parcel Protection Opportunity

Map Information

- Protected Vacant Parcel Ownership
- Vacant Parcel Protection Opportunity
- Circled areas: town protection opportunity
- A – Infill, Protection would fill gap (in-holding) in existing protected area
- B – Parcel in close proximity to protected land
- C – Large unprotected parcel (25 acres or larger)
- D – Parcel protection could be key to mitigate existing development or where riparian buffer has been eliminated or compromised

Explanation

This map is intended to highlight where undeveloped (vacant) land parcels exist in the lower Connecticut River estuary that, if allowed to remain undeveloped or developed with sensitivity to the existing riparian buffer area, could enhance the estuary's overall riparian buffer protection. Protection could take the form of conservation acquisition, conservation easement on all or that portion of the parcel important to riparian buffer protection, or landowner education and/or stewardship management through a conservation organization.

Categories of vacant parcel ownership:

Connecticut River Gateway Commission: The Gateway Commission Conservation Zone extends from ridge top to ridge top on either side of the Connecticut River through the eight member towns of Haddam, East Haddam, Chester, Deep River Essex, Lyme, Old Lyme and Old Saybrook. The Conservation Zone represents 30,000 acres and thirty river miles from Long Island Sound. The Gateway Commission has been instrumental in the protection of approximately 1,000 acres in the Connecticut River estuary.

Land Trust: The eight lower Connecticut River estuary region communities each have a Land Trust. These local land trusts vary in size and activity level. Opportunities for riparian area land protection where local Land Trusts currently have holdings include Great Meadow in the town of Essex, and Goose and Calves islands in the town of Old Lyme.

Municipal: There are varying degrees of municipal ownership along the main stem Connecticut River towns. The town of Old Saybrook (and borough of Fenwick) appears to have the most municipal parcels in the riparian area of the eight project area towns.

State: The State of Connecticut is a significant landowner in the lower Connecticut River estuary, including land that lies within the riparian area. There are a number of sites where private land infill protection would secure existing state land holdings, such as within the George Dudley Seymour State Park in the town of Haddam, parcels in proximity to Nott Island and Lord Cove in the town of Lyme, and the Great Island marsh complex in Old Lyme.

The Nature Conservancy (TNC): The conservation organization The Nature Conservancy owns or holds conservation easements on a significant number of parcels in the lower Connecticut River estuary. Land protection work in several key areas currently owned or managed by TNC would further protect riparian areas in the lower Connecticut

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River area. These include the Chapman Pond area in the town of East Haddam and the lower portion of Lord Cove in the town of Old Lyme.

Private Vacant: Each of the eight towns in the project area has opportunities for riparian area protection through existing vacant, privately owned land parcels. Notable parcels include: the Chapman Pond area in the town of East Haddam; a large unprotected land parcel north of Selden Island and at the southern mouth of Selden Creek in the town of Lyme; a number of parcels in Pratt and Post Coves in the town of Deep River, and Eustasia Island (town of Lyme); a number of parcels in Great Meadow and Falls River in the town of Essex; parcels associated with the southern Lord Cove marsh complex, including Goose and Calves islands; several parcels associated with the Great Island marsh complex, Duck and Black Hall rivers in the town of Old Lyme; several parcels associated with Beamon Creek and South Cove marshes in the town of Old Saybrook.

Private with Conservation Easement (or probable): Existing conservation easements may or may not lend themselves to additional protection opportunities, depending on the likelihood of an existing landowner with a conservation easement acting as a neighbor/advocate to other riparian landowners. The town of Lyme has the largest number of conservation easements in riparian areas, particularly in Hamburg Cove.

Analysis by Town:

Haddam: Several large areas of state ownership in Haddam and Middle Haddam each contain smaller vacant and unprotected parcels that, if protected, would fill in gaps in these otherwise intact land holdings. The largest of these opportunities lies to the north of Haddam Meadows State Park and represents significant Connecticut River riparian frontage. Several other reasonably large privately owned and unprotected parcels represent conservation opportunities in Middle Haddam.

East Haddam: The existing conservation site Chapman Pond, predominantly owned by The Nature Conservancy, contains a number of small, vacant and privately owned

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riparian lands along the Connecticut River. Protection of these parcels would fill gaps in this large conservation area. A vacant riverfront parcel also exists north of the Haddam Bridge.

Chester: Small but significant vacant unprotected land parcels exist along Chester's Connecticut River shoreline, including a parcel at the mouth of the densely developed Chester Creek, and several small parcels adjacent to Gillette's Castle, north of the Chester/Hadlyme ferry. Both of these area parcels contain riparian woodland that if protected could help mitigate riverfront development elsewhere in town.

Deep River: Pratt and Post coves, two high quality freshwater tidal marshes in the town of Deep River, represent a significant conservation land protection opportunity along the Connecticut River and one of its major tributaries. A number of vacant and unprotected parcels exist in close proximity to existing smaller undeveloped parcels owned by the land trust, the town and the Nature Conservancy. Other opportunities in Deep River include two large (>25 acres) vacant parcels along the Connecticut River main stem that are in close proximity to a densely developed residential area to the south.

Essex: The area of greatest potential private land protection to infill existing conservation lands occurs in Great Meadow, a significant stretch of tidal marsh northeast of the village of Essex. A number of smaller privately owned parcels in the Falls River area represent conservation opportunities to offset existing relatively dense residential development. To a lesser extent, similar vacant privately owned parcels exist in the South Cove area; their protection would allow these natural lands the opportunity to help mitigate nutrient enrichment in the surrounding waters.

Lyme: In the town of Lyme two notably large and unprotected parcels occur at the mouth of Selden Creek on the Connecticut River; their protection would add substantially to the acreage of conservation land in proximity to the state-owned Selden Island. Although often associated with the neighboring river town of Deep River, Eustasia Island is within the Lyme town boundary; it is currently privately owned and vacant and represents a

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conservation opportunity, particularly in light of the opportunities for land protection in the Pratt and Post cove areas of Deep River. Along the river main stem adjacent to Nott Island, four abutting private land parcels are in close proximity to and abut existing conservation lands in the Lord Cove marsh complex. North of Selden Island, a large (>25 acre) unprotected land parcel exists on the main stem of the Connecticut River, at the mouth of Whalebone Cove, a largely protected freshwater tidal marsh. Elsewhere in the town of Lyme, smaller privately owned land parcels along the main stem of the River and in Hamburg Cove represent opportunities to offset existing developed areas that are in close proximity, as well as add to existing protected lands in the area.

Old Lyme: Several sizable land parcels exist along the river's boundary in Old Lyme that are privately owned and vacant. Of these, most are situated within existing conservation areas, making their protection key to filling gaps in important conservation sites. Among these are the parcels at the southern end of Great Island; two parcels at the mouth of the Lieutenant River; a number of small parcels on Calves Island; a large parcel on Goose Island, and the southern portion of the Lord Cove complex. Several land parcels in the Black Hall River and Griswold Point areas are within close proximity to existing conservation lands. A large (>25 acre) privately owned and unprotected parcel along the Connecticut River in Lord Cove represents a rare conservation opportunity. Several smaller land parcels that are vacant and unprotected are located in areas of relatively dense development; their protection could help offset existing and potential future sources of nonpoint source pollution in the area.

Old Saybrook: In South Cove, two privately owned tidal marsh parcels that abut one another in the Beamon Creek area, if placed under conservation protection, would add significantly to existing protected land owned by the Land Trust and the State of Connecticut. Similarly, on the south shore of Saybrook point on South Cove, smaller tidal marsh parcels that are currently privately owned and not developed, if protected, could mitigate existing dense development in this area. In North Cove, south of Ragged Rock marsh and the historic railroad bed, two currently vacant tidal marsh parcels, if protected, would add to existing municipal, and to the north, Nature Conservancy and

State of Connecticut conservation lands at Ragged Rock. These two parcels would also help mitigate recent development in the North Cove area. These tidal marshes are important buffers to upland land use in developing coastal communities. A sizable vacant land parcel also exists in the Otter Cove area, on the northeastern boundary of the town with the Connecticut River; if protected, this land could also compensate for existing development in this area.

MAP: Invasive Species Evaluation

Map Information

- No invasives: not conclusive without on-site evaluation; appears to be free of targeted invasives
- Relatively few: feasible to eliminate if addressed promptly
- Moderate invasives: feasible to reduce and conceivably contain with targeted stewardship
- Significant invasives: represents a large percentage of buffer area; control would take considerable resources and time
- Current or recent restoration site (e.g. *Phragmites* control)

Explanation

This map reflects an overview of invasive species throughout the project area, as observed from the main stem of the Connecticut River. As such, the extent of invasion, and/or the diversity of invasive species were likely under-reported in areas. Where sites have been identified as town focus areas (circled) on the map, concentrations of at least one invasive species suggests that control efforts would best be focused at these sites.

General Invasive Plant Species Observations

- The top three most prevalent invasive plant species in the lower Connecticut River estuary region appear to be: *Phragmites* (common reed), bittersweet and purple loosestrife.
- At the southern portion of the project site, *Phragmites australis* is the dominant invasive, found in the tidal marshes that predominate there. Areas of known recent or current restoration efforts (Connecticut Department of Environmental Protection and others) have been identified. Although large-scale restoration projects are addressing many acres of tidal wetlands impacted by *Phragmites*, many opportunities exist for control efforts at the parcel level.
- Particularly in brackish waters, false indigo (*Amorpha fruticosa* L.) has formed extensive thickets in the riparian margins of the Connecticut River. Although listed in *Ipane*² as an invasive, this shrub has naturalized in many areas and efforts at its removal could be more destructive than containing it.
- Oriental Bittersweet (*Celastrus orbiculatus* Thunb.) is ubiquitous throughout the project area. The area of greatest concentration in the riparian zone appears to be Chapman Pond, including Rich and Lord Island, where mature trees can be found entirely covered with this vine.
- Tree of Heaven (*Ailanthus altissima*) is thought to have first appeared in the southern portion of the project area in 1985, following hurricane Gloria. It now occurs as far north as Haddam in the riparian area, and in places such as north of Hamburg Cove, and at Joshua Rock in the town of Lyme, it appears to have become established in otherwise healthy riparian areas that are largely free from other plant invasives.

² The Invasive Plant Atlas of New England (IPANE) Mehrhoff, L. J., J. A. Silander, Jr., S. A. Leicht, E. S. Mosher and N. M. Tabak. 2003. IPANE: Invasive Plant Atlas of New England. Department of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT, USA. URL: <http://www.ipane.org>

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- There is evidence of a large population of yellow iris (*Iris pseudacorus*) at the mouth of Selden Island/Creek. We did not observe this plant in flower and therefore may have under-reported its occurrence in the region.
- The largest concentration of purple loosestrife (*Lythrum salicaria*) appears to be in South Cove in the town of Essex. The primary dispersal site is Thatchbed Island; smaller populations occur on numerous parcels in the South Cove area.

Analysis by Town:

Haddam: In Haddam and Middle Haddam there are areas of moderate invasives, although by and large this town's waterfront is in good shape. At Haddam Meadows State Park, on the west side of the Connecticut River, purple loosestrife occurs in potentially controllable populations, for example, south of the park boat launch. There are also isolated areas of loosestrife, intermixed with bittersweet and tree of heaven, at the mouth of Salmon Cove that would require concerted effort to control. In light of the good condition and intact nature of areas of Haddam riparian buffers, invasive species control efforts could constitute an opportunity to do work to prevent more significant future occurrences.

East Haddam: Similar to areas in Chester, bittersweet is the dominant overall invasive along the East Haddam river front, particularly in the Chapman Pond area, including Rich and Lord Islands. The most dramatic occurrences are on the islands, where this vine has reached into the canopy. Concerted effort would be required in this area to replace bittersweet; education to prevent further or new spread should be a part of any town effort.

Chester: Bittersweet, particularly where existing riparian vegetation has been removed or significantly reduced, constitutes a significant challenge to a number of parcels in the town of Chester. Concerted effort would be required in some of these areas to replace bittersweet; education to prevent further or new spread should be a part of any town effort.

Deep River: Although individual parcels provide opportunities to make gains in invasives control along the Deep River water front, the greatest opportunity for concentrated effort is in the Pratt and Post Cove areas. Purple loosestrife, and a relatively small but significant population of *Phragmites* at the mouth of Pratt Cove, constitutes the primary invasive plant threats to these freshwater tidal wetlands.

Essex: Two areas of concern exist in the town of Essex: loosestrife in South Cove and *Phragmites* in Great Meadow. Thatchbed Island, predominantly owned by the Land Trust, might be a good site for the *Purple Loosestrife Biological Control Program* spear-headed through the University of Connecticut³ before additional populations become more established on mainland parcels. Great Meadow is a large enough site to warrant control efforts by the state, or other federal or conservation partner.

Lyme: The extensive riverfront of the town of Lyme contains a large percentage of intact riparian buffer, much of which is remarkable free of invasive plant species. A notable exception is Lord Cove, where the riparian zone contains large populations of barberry, multiflora rose, bittersweet, honeysuckle and winged euonymus (a plant not included in the targeted list of invasives in this project). Although areas of this site are in conservation ownership, restoration would be costly and time consuming. *Ailanthus* trees occur in isolated areas where they could be eliminated (see locations under *General Observations*). Yellow iris is increasingly naturalizing in lower Connecticut River coves and could, with effort, be contained or eliminated.

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Old Lyme: The Great Island marsh complex and Calves Island have been the focus of DEP restoration efforts over the past five years. The southern tip of Lord Cove is part of a multi-partner restoration effort that includes the DEP and the Nature Conservancy. A number of individual parcels abutting the Connecticut River in the vicinity of Lord Cove and Great Island are suitable for small-scale invasive species control and education efforts.

Old Saybrook: *Phragmites* is the dominant invasive plant species in this community. Restoration efforts initiated through the DEP have begun in South Cove, and increasingly, private citizens and homeowners associations have hired outside consultants to do this work. The Land Trust has entered into a restoration initiative with the DEP that is slated to begin in 2007 and focus on South and North Coves. Ragged Rock marsh has been targeted by DEP for restoration work in the near future.

MAP: Riparian Buffer Restoration Opportunity

Map Information

- **Buffer is Intact**
Riparian area 25' or wider, acting as sufficient buffer to upland land use.
- **Buffer is Marsh**
Tidal marsh constitutes buffer; may or may not have restoration opportunity behind the marsh, but often lawns without other vegetated buffer directly abut marsh. Education opportunity.
- **Buffer would Benefit from Enhancement**
Riparian area less than 25' or because of upland land use, slope or other factor, would be significantly improved by enhancement, such as infill planting, reducing or eliminating shoreline hardening, or redesigning public access to water.
- **No Buffer: Restoration Opportunity**
Currently no buffer; opportunity exists to create useful buffer (through land-owner education).
- **Shoreline Hardening: Restoration Opportunity**

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Lawn or minimal buffer behind revetment or small-scale impervious boundary; opportunity to encourage buffer creation.

- **No Buffer: Restoration not likely (Commercial/Industrial)**

Currently no buffer; location, land use or other circumstance suggests that this is not a place to spend time trying to create a buffer.

Explanation

The adequacy of the width of any given riparian buffer was considered on a site-by-site basis. Generally, riparian buffers that exist associated with residential development (the predominant type of land development along the Connecticut River main stem) do not meet ideal widths cited by most of the literature; i.e. a minimum of 100 feet. Depending on the slope, the existing land use, the condition of riparian vegetation and opportunity to enhance or expand the buffer (e.g., some buffers cannot physically be enlarged because of the location of the existing house), a category was assigned. In most cases, residential properties directly on the Connecticut River are of considerable financial value, and as such, property owners are likely interested in maximizing river views and access.

Therefore, balancing the environmental importance of riparian width and quality with private property objectives will be a necessary part of any outreach and education in the Connecticut River estuary region. The recommendation of a minimum 100-foot buffer has been made in the *Protecting Water Quality with Vegetated Buffers in the Connecticut River* educational brochure accompanying this report.

Intact Buffer refers to a vegetated margin directly adjacent to the main stem (or major tributary) that contains substantial density of vegetation to act as a buffer for overland flow of potentially polluted runoff, as well as sufficient rooted material to provide processing of ground water. This category does not refer to the quality of the riparian vegetation; a number of parcels contained substantial invasive species occurrences that provide good mechanical buffers.

Buffer is Marsh is a category referring to the southern portion of the project area where large occurrences of tidal wetlands act as buffers between upland land use and the waters

of the Connecticut River and its major tributaries. Although beyond the scope of this investigation, an opportunity exists to identify neighborhoods, associations and individual parcels where lawns directly abut these coastal marshes and target these landowners for education regarding the importance of adequate conservation buffers to the marsh.

No Buffer: Restoration Opportunity is a broad category that refers to parcels where riparian vegetation does not currently exist and restoration is a viable possibility. Often this refers to residential lawns that border the river, and where even minimal vegetated buffers would be an improvement.

Shoreline Hardening: Restoration Opportunity. Shoreline hardening takes a number of forms along the Connecticut River. Often boulders or riprap have been placed along shorelines that once supported riparian vegetation in an effort to stem erosion, build an embankment against river flooding, or create a bulkhead for access to the river. In several places, steel bulkheads have entirely replaced native shoreline. Revetments – stone or concrete facings that create an embankment – are substantial structures in some of the populated coves. Although it is questionable about the likelihood or utility of introducing vegetated buffers behind some of these structures, assignment of this category reflects optimism about the potential educational and water quality value of providing a vegetated buffer to offset what is often a maintained lawn behind these structures. Three parcels along the Connecticut River main stem have engineered gabion walls – bottomless metal fencing that is filled with stones – to contain steep or eroding slopes. [Refer to Lot 7, Old Saybrook; Lot 7, Chester; Lot 12, Lyme]. Gabions are largely considered to be expensive and short term slope stabilization solutions, and have no ecological value as riparian buffer or wildlife habitat.

No Buffer: Restoration not Likely. This category refers to existing commercial (e.g. marinas) and industrial areas along the Connecticut River. While enhancing some of these sites is a possibility, it is beyond the scope of this project.

Analysis by Town:

Haddam: At the southern end of the town of Haddam, both north and south of the Haddam Bridge, several properties have modified riverfronts. Furthest to the south a series of small private houses directly abut the Connecticut River. Most of these homes are close to the water and at low elevation, with modified shorelines and lawns that end at the waterfront. Collectively, an effort to create modest vegetated buffers in this community could provide positive water quality results, particularly if these homes have septic systems. Some riparian buffer exists on the property just south of the Haddam Bridge in Haddam; large riverfront trees remain. However, stone embankment and extensive docks have replaced much of the native riparian area on this parcel. The former Connecticut Yankee nuclear power plant has a significant stone revetment along a large stretch of the Middle Haddam waterfront. Although riparian vegetation exists in places behind this wall, it has been disconnected, biologically, from the Connecticut River. An opportunity may exist to modify this site, as the future of the de-commissioned plant is determined. The Higganum Center landing area has a number of private residential parcels that have been rock-lined along the riverfront. These shorefront modifications may be able to be restored, or enhanced, by the addition of modest vegetated buffers, particularly where lawns extend to the waterfront.

East Haddam: In the town of East Haddam, the downtown business area contains the greatest amount of shoreline hardening that replaces natural riparian vegetation. Where removal or modification of these structures is not possible, enhancing vegetated buffers directly behind these walls can provide for storm water infiltration and remediation of polluted runoff; this is particularly true where lawn or maintained landscapes are in close proximity to the riverfront. At the airport just south of downtown East Haddam, shoreline hardening takes the form of boulders set in place along the riverfront. Low native vegetation could be planted along this property boundary to enhance buffer capabilities; the amount of river frontage of this property would make buffer creation here a considerable environmental benefit.

Chester: A combination of marinas and steep slopes in the town of Chester underscore the importance of maintaining healthy existing riparian areas, in addition to enhancing buffers where it is possible. Shoreline hardening may or may not be able to be modified; vegetation behind these structures, particularly lawns, can be amended by the creation of riverside vegetated buffers that contain, for example, native shrubs, herbaceous plants and perennials and small trees. Steep slopes are particularly vulnerable to erosion that can be reduced by establishing shoreline vegetation.

Deep River: In the town of Deep River, several large residential home developments have significantly impacted riparian buffers in recent years. Several properties in the River Road area would benefit from riparian buffer re-creation; others could be enhanced by infill planting of native floodplain trees and shrubs. Steep slopes in the southern river front area of Deep River make riparian vegetation protection important to prevent shoreline erosion.

Essex: Many private residential parcels bordering South Cove and parts of North Cove in Essex have modified waterfronts that include low stonewalls and lawns directly behind them. Opportunities abound for modifications that include creating or enhancing vegetated buffers that could, collectively, provide a significant amount of filtering capacity to offset the potential for polluted runoff. The creation of these buffers does not have to reduce, but rather can enhance water views. Similarly, water access can be accommodated while also enhancing waterside buffers. North of Great Meadow, several private residential parcels would benefit from the creation of river front buffers, particularly where large lawns slope to the shoreline.

Lyme: Several areas in Lyme are suitable targets for restoration and enhancement of riparian buffers: Hamburg Cove, the Brockway Landing area, and property at Ely Ferry road. Although many properties in Hamburg Cove have exemplary vegetated buffers, other parcels have stone revetments and maintained lawns. Where steep slopes exist on the northeast shore of Hamburg Cove, the lack of understory vegetation on otherwise

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wooded banks could contribute to overland water flow directly into the cove. Similarly, at the mouth of Hamburg Cove, understory vegetation has been removed from woodlands where small slopes can contribute storm water and eroded soil. In most of these examples, the addition of modest amounts of vegetation could provide considerable benefit. At Brockway Landing, low stone walls define river front parcels. Where property owners may be unwilling, adjacent to the Connecticut River channel, to remove these containment walls, modest additions of buffer vegetation could help remediate the potential for pollutants from maintained lawns directly behind these walls.

Old Lyme: Despite a large riverfront, Old Lyme contains surprisingly few areas where vegetated buffers need improvement. Most are associated with lawns that end directly at the waterfront with little or no buffer area where one could easily be created. At the DEP Marine Fisheries building, shoreline hardening takes the form of concrete and stone walls, some of which delineates public access areas that are maintained as lawn. Native landscaping at this site could serve the dual purpose of enhancing the buffer behind these walls as well as providing an opportunity for public education. Several private parcels, including the Old Lyme marina, would benefit from enhanced buffer areas behind stone waterfronts.

Old Saybrook: In the town of Old Saybrook, opportunities for riparian restoration are largely associated with residential shoreline development, particularly in North Cove, Otter Creek, and parcels near the mouth of Hyde Creek. Many of these parcels have low stone walls at the water's edge that are bordered by lawns. Ideally, shoreline hardening would be removed to permit a shoreline that includes native marsh or upland vegetation. Realistically, property owners can be encouraged to modify existing conditions to include buffer areas directly behind walls to encourage storm water infiltration. In the Otter Cove area, riverfront properties would benefit from enhancement that includes increasing the width and diversity of vegetated buffers, particularly where lawns and especially lawns that slope toward the river occur.

Methodology

The field component of this project was completed over two field seasons (2005, 2006). Small boats were used on the Connecticut River to navigate the twenty-two miles from Long Island Sound to the northern boundary of the towns of Haddam and East Haddam on the Middletown border. Site conditions were evaluated with the assistance of color aerial photographs (NASA, digital .5 meter pixel resolution, 2004) and black and white aerial photographs (CT DOT digital ortho-photography, .8 foot pixel resolution, 2004) and a compact 5 mega-pixel digital camera was used to take site photographs. Digital parcel information was recovered from the project area towns using Computer Aided Mass Appraisal (CAMA) data, where available, and linked through an access database to field information and photographs.

It is important to note, particularly when looking at the map parcels, that our evaluation dealt only with the riparian buffer; that portion of the parcel directly abutting the main stem and major tributaries of the Connecticut River. Therefore, when a parcel on a map is highlighted for action along the river, the rating is based only on the condition of the riparian buffer and not the upland portion of the property. Exceptions to this are when the upland land use has direct bearing on the buffer, such as a marina or the location or scale of development. This may be important when considering protection action for a parcel; it may be possible to place a conservation easement on a small portion of an existing parcel, versus the entire lot. In the town of Haddam, gaps in parcel data reflect where the railroad track directly abuts the Connecticut River and the town did not represent these parcels in their GIS parcel data set.

It quickly became apparent that riparian buffers at the northern end of the project area give way to tidal marshes in the southern portion. We adjusted the criteria to reflect a new category (marsh as buffer) in an effort to identify where a tidal marsh acts as a buffer to upland land use. It would be useful, perhaps as a follow up, to take a closer look (possibly through aerial photographs) at neighborhoods where lawns or other land uses

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suggest that targeted educational outreach about buffers would be useful. Many marshes that fringe residential neighborhoods are bordered by lawns.

The project focused exclusively on the main stem of the Connecticut River and 150' up major tributaries. Not all tributaries were recorded, however; sites were selected, in part, based on previous data collected for the 2005 Dock Study (CRERPA). Hamburg Cove was recorded because of its level of development, while Salmon Cove was not because of its relative lack of development. Islands were, generally, not examined, because they are largely undeveloped and many are in conservation ownership.

Much of the information gathered can be viewed as subjective. Although we tried to be consistent through the assignment of distinct categories, variations are bound to occur. Where a parcel contained some good buffer and some poor buffer, or shoreline hardening, the score reflects the worst condition, in order to capture where work needs to be done. All field forms have been preserved, and where questions of interpretation or grey areas exist, notes may help clarify the reason for a particular score.

The invasive species evaluation is, as proposed, a broad stroke; it is intended to identify large areas of possible restoration or troubled hotspots. Species targeted for observation were based on the *Non-Native Invasive and Potentially Invasive Vascular Plants in Connecticut*⁴, from the Invasive Plant Atlas of New England (IPANE), listed as widespread and invasive, and suggestions from Les Mehrhoff (UConn) and Ken Metzler (CT DEP). Most of the invasives evaluation was done from the River and therefore it was not always possible to identify the diversity or extent of species. Photographs taken were used to help answer questions about invasives, and in some instances, sites were ground-truthed, but realistically time and private property did not permit extensive on-site investigation. The easiest invasive species to identify were bittersweet, *Phragmites*, false indigo, purple loosestrife and tree of heaven. Places such as Lord Cove, which was ground-truthed, confirmed the additional presence of extensive barberry and winged

⁴ Mehrhoff, L. J., K. J. Metzler, and E.E. Corrigan. 2003. Center for Conservation and Biodiversity, University of Connecticut, Storrs.

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euonymus which otherwise would be difficult to see from the River. This suggests that, even though we did not record many occurrences of several invasives species, such as barberry, it would be necessary to ground truth to confirm the presence or absence of these species.

Implementation and Future Steps

Ideally this information will be used by the project area communities, local land use decision makers, land trusts and regional planning and conservation organizations to address regional opportunities for land protection and stewardship. The report, maps and digital photographs and GIS data will be available through the Connecticut River Estuary Regional Planning Agency (CRERPA), and Tidewater Institute will target to work in conjunction with the Connecticut River Gateway Commission to distribute the informational brochure and possibly create a program for local land use commissions about this information.

On-going work in 2007 through Tidewater Institute and CRERPA, specifically the *Ground-Truthing Project* (funded by the National Fish and Wildlife Foundation), will work with Gateway towns to identify, link and target protection of vacant parcels in the lower Connecticut River watershed. The Riparian Mapping Project is complementary to the Ground-Truthing Project and the riparian brochure is a useful educational tool.

Next steps for riparian protection in the Connecticut River estuary could entail a targeted mailing of the riparian brochure and follow-up. A number of neighborhood and condominium associations exist throughout the region – Otter Cove in Old Saybrook, Camp Bethel in Haddam, the Essex Cemetery Association – that lend themselves to group gatherings and an outreach presentation to learn more about riparian buffers. Similarly, the Gateway Commission is interested in revisiting their recommended zoning standards for the lower Connecticut River communities, specifically to strengthen protection of riparian buffers. This project is a logical point of departure for this endeavor.

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Opportunities also exist to share this project with other regions and natural resource professionals that may be interested in investigating riparian buffer conditions in their communities. To this end, the investigators hope to submit a project abstract and present these findings at several public conferences in the coming year.

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Appendices

- CD-1 Field Maps (Essex, Lyme, Old Lyme, Old Saybrook)
- CD-2 Field Maps (Chester, Deep River, Haddam, East
 Haddam) Final Maps, GIS Shape File, Work Maps
- CD-3 Photos
- CD-4 Protecting Water Quality with Vegetated Buffers in the
 Connecticut River Estuary (Educational Brochure)

Aerial Photos by town

Folded Educational Brochures (20 Copies)

Field Form, Invasive Plant Field Form

Captioned Photos

Large Maps (rolled)