

# Village Creek Saltmarsh Restoration Demonstration Project

**CIRCA Matching Funds**

**Final Report**

**December 17, 2017**

**Norwalk Land Trust**



Partially sponsored by a grant from the Connecticut Institute for Resilience and Climate Adaptation.  
More information about CIRCA can be found at [circa.uconn.edu](http://circa.uconn.edu).



# Village Creek Saltmarsh Restoration Demonstration Project

## Executive Summary

The Norwalk Land Trust (NLT), in conjunction with the Village Creek Harbor Corporation (VCHC), engaged the services of the environmental engineering firm Fuss & O'Neill (F&O) to study the feasibility of restoring the salt marsh in the Village Creek Estuary (Norwalk, CT). The broad objective was to determine the feasibility of restoring the degraded salt marshes with dredged materials from the established VC small-boat harbor situated within the Estuary. The specific objectives of the study were as follows: 1) to develop a preliminary site assessment; 2) to survey topographic and bathymetric conditions; 3) to characterize soil /sediment conditions; 4) to evaluate soil settling and compaction properties; 5) to develop conceptual design options, and, 6) to establish a baseline for site monitoring.

F&O conducted field assessments at the project site to evaluate the vegetative communities and to collect soil/sediment core samples for laboratory analysis (in support of restoration design). The existing salt marsh was photographically mapped and compared to historical photos to gauge the extent of prior vegetative cover and to identify areas for possible restoration. Finally, a conceptual design was developed to restore critical salt marsh areas with dredged sediment through "elevation enhancement" or "thin layer deposition," TLD).

The project was initiated in October 2016 and the final report was completed in November 2017. During the course of the study, informational meetings for the resident VC community were held to communicate the objectives of the project, and to solicit comments/input. Additionally, in May 2017, a poster was presented at the Municipal and Research Project Forum sponsored by the Connecticut Institute for Resilience and Climate Adaptation (CIRCA). On September 7<sup>th</sup> and 9<sup>th</sup>, 2017 two additional presentations at the Norwalk Maritime Aquarium provided a project overview and results to the Norwalk community.

A vegetation community survey was conducted to evaluate overall condition of the Village Creek salt marsh ecosystem. This vegetation survey was conducted in concert with a detailed elevation survey (bathymetric and topographic) to establish biobenchmarks specific to this salt marsh ecosystem.

The Village Creek salt marsh ecosystem exhibits conditions typical of a moderately degraded salt marsh located within a developed area. Historical photographs showed that salt marsh covered an area of approximately 87 acres in 1934. The vegetative cover only measures 29.5 acres today. The estuary, while relatively small in scale remains unique in its composition of coastal residential property, boat basin, beach, salt marsh, mud flats, protected wetlands, as well as industrial and commercial property. Like other areas of the Connecticut shoreline, the stakeholders reflect competing and divergent interests in the use, maintenance and management of the estuary.

A conceptual restoration design was proposed for some of the northern sections of the estuary. The preliminary design will inform the development of a long-term restoration plan and allow for; 1) the targeting of the most optimal areas for restoration, 2) the volumes of sediment that will be needed for each designated area, and, 3) the optimal elevations that need to be achieved to support marsh grass growth in supplemented areas.

## **Project Background and Context**

On March 16, 2017, a \$5,000 CIRCA grant was awarded to The Norwalk Land Trust (NLT) through the Matching Funds Program (UConn Subaward Agreement Number 158646). This funding was received in support of the National Fish and Wildlife Fund, Long Island Sound Futures Fund (NFWF-LISFF) Grant titled "Village Creek Saltmarsh Restoration Demonstration" EasyGrant ID 53608. The granting period was from October 15, 2016 to July 30, 2017. The grant objectives were met and the project was completed on October 15, 2017.

## **Project Description**

The project was the first step of a phased approach to restore degraded salt marsh in the Village Creek Estuary located in Norwalk, Connecticut. The work included a biological and topographical survey of the site, a comparison of the current state of salt marsh in the estuary with historical vegetative cover, an evaluation of the physical and chemical properties of the sediment, a proposal for the design of an operational project with consideration of regulatory constraints and environmental impacts, and, the establishment of a baseline system for monitoring the development of new vegetative cover after the completion of a salt marsh restoration program. The information generated from this work helped to determine the feasibility of saltmarsh restoration in the estuary and provide the foundation for a focused operational restoration program and increase the likelihood of achieving a measureable improvement in the environmental health, resiliency and quality of the estuary.

## **Relation to CIRCA mission and priority areas**

The subject area of this project was the Village Creek Estuary in Norwalk Connecticut. The estuary includes a wide variety of built and natural environments typical of Long Island Sound coastal areas. The estuary contains natural healthy saltmarsh supporting aquatic and terrestrial species as well as providing a refuge and nursery for important Long Island Sound fish, shellfish and invertebrates. Some of these saltmarsh and coastal areas are owned and protected by the Norwalk Land Trust. The estuary is primarily bordered by residential property but other coastal areas include industrial zones, parking lots and commercial buildings. The center of the estuary is the Village Creek Harbor, a small facility with 50 slips for pleasure boats.

Storms have previously impacted all of the built and natural areas of the watershed mentioned above. Property damage occurs on an almost annual basis and rising sea levels, climate change and severe weather events are expected to increase the risk to the estuary. Some protection is afforded the coastal areas by established saltmarsh but much of the historical footprint of saltmarsh has been lost. The degraded saltmarsh areas however do not contribute to the protection of these resources. Instead, they provide a source of fine silt and contamination that chokes harbors and channels and increase suspended particulates in the surrounding waters through tidal washing. It is proposed that by restoring these degraded areas, we can enhance the established saltmarsh as a resource and refuge for wildlife and increase the resiliency of the coastal habitat and shoreline.

*CIRCA Strategy: Develop and deploy natural science, engineering, legal, financial and policy best practices for climate resilience.*

### Related Project Goals and Objectives:

The methodical, stepwise approach to this project is a strategy that could be employed to support other restoration efforts along the Connecticut shoreline. During the course of the project, the NLT communicated and collaborated with local, state and federal agencies such as the Norwalk Harbor Commission, Norwalk Maritime Aquarium, HarborWatch, CT-DEEP, NFWF-LISFF, UCONN, and CIRCA. Information developed in the course of the project improved our scientific understanding of the function of our estuary, and the challenges we will face to maintain the health and resiliency of the salt marsh as sea levels continue to rise due to climate change. This is one of the first efforts of this kind in Connecticut and the information generated will help to inform and improve the potential for success of other similar projects in the state. The information and experience generated during the project encompasses all of the components of the above CIRCA mission; The science developed in the course of the feasibility study will be available in the public domain, the proposed engineering and design will be discussed and reviewed with experts from CT-DEEP, ACOE and UCONN. The legal and policy implications are being monitored by CT-DEEP and will be evaluated during the ultimate planning and permitting phases. And the financial structure of the project from start to finish will be publicly available and provide a reference for future Long Island Sound projects.

*CIRCA Strategy: Undertake or oversee pilot projects designed to improve resilience and sustainability of the natural and built environment along Connecticut's coast and inland waterways.*

### Project Goals and Objectives:

The Village Creek Salt Marsh Demonstration Project, one of the first of its kind in Connecticut, is focused on an estuary that contains all of the critical components of a typical Long Island Sound coastal community; Residential property, commercial property, an industrial area, a recreational area (beach front), a small boat marina, healthy saltmarsh, degraded saltmarsh and mud flat. These natural and built components are also extremely sensitive and susceptible to damage and degradation from increasingly severe weather events due to climate change. The overall objective of the project is directly in line with the CIRCA Mission – Improved resilience and sustainability of the estuary. The survey work associated with the project documented the current level of vegetative cover and with respect to historical areas of salt marsh and how the existing marsh will be threatened due to the projected rise in sea level.

An operational salt marsh restoration project based on these findings will focus on the most appropriate areas for enhancement and restoration to improve the resiliency and function of the estuary.

*CIRCA Strategy: Create a climate literate public that understands its vulnerabilities to a changing climate and which uses that knowledge to make scientifically informed, environmentally sound decisions.*

### Project Goals and Objectives:

One of the benefits already being realized in the project is community education and outreach. All of the stakeholders in the estuary – commercial and residential property owners, the boating community, environmental organizations, state and local regulatory authorities were made aware of the development of the project. Several informational meetings were held for the Village Creek Community and the local Norwalk Community through a collaboration with Dr. David Hudson at the Norwalk Aquarium. Community outreach and education will be developed if the project moves forward to an

operational salt marsh restoration program. This could be accomplished by collaboration with the Norwalk Maritime Aquarium and the Science Department of Brian McMahon High School as well as the Norwalk Land Trust membership.

### **Project Outcomes/Lessons Learned**

To measure and evaluate the site, a detailed survey was undertaken using aerial mapping equipment on an unmanned aerial vehicle (UAV a.k.a. drone). Elevations were collected at centimeter accuracy across the Village Creek salt marsh and estuary. Vegetation survey sampling occurred along seven transects to catalog vegetative species composition and distribution at regular intervals along each transect. These transects will serve both as a baseline going forward and as long-term monitoring stations to facilitate future assessment of salt marsh cover (irrespective of a restoration program).

Biobenchmarking of the Village Creek salt marsh reveals a traditional distribution of low-marsh to high marsh ecotones across elevations. *Spartina alterniflora* (smooth cordgrass) dominates a wide range of elevations (0.00 ft and 4.67 ft NAVD88) which is typical of this low salt marsh species. At the upper limits of the elevation range (3.27 to 4.67 ft NAVD88), *S. alterniflora* becomes stunted. Stunted *S. alterniflora* becomes interspersed with *Spartina patens* (salt marsh hay) and *Distichlis spicata* (salt grass). *S. patens* and *D. spicata* are considered high marsh species and occupy an elevation range between 3.67 and 4.42 ft NAVD88. Considerable areas of bare soil were observed in many locations where stunted *S. alterniflora*, *S. patens* and *D. spicata* were documented as the principal species. *Iva frutescens* (high tide bush) and *P. australis* (common reed) occupy elevations above 4.42 ft NAVD88.

In order to maximize future succession and establishment of high marsh plant communities and thereby increase future resiliency of this salt marsh against to sea level rise, it was recommended that the restoration approach should target the high end of the elevation ranges inhabited by desired vegetative species: 3.95 to 4.42 ft NAVD88 for *S. patens* and *D. spicata* and 4.50 to 5.85 ft NAVD88 for *I. frutescens*.

In addition to assessing the restoration area's salt marsh elevations and plant communities, six soil cores were collected to evaluate soil strata. In each core, the upper organic soil layer can be clearly distinguished from the reduced (gleyed) mineral sandy layer of the core. It was observed during the soil sampling process that the integrity of the peat has been significantly reduced. Specifically, the upper 2 - 3 inches of the peat layer consisted of a dense root mat. However, immediately below that upper few inches, the peat was not cohesive and had many small to medium voids. Anecdotally, walking on the marsh surface gave the impression that peat surface was tenuously firm, with the underlying peat structurally less stable. The exact cause and nature of this condition was not explored, However, future assessment of the marsh for TLD should consider this existing condition.

The soil data were assessed to estimate the amount of compaction that will occur as a result of placing dredged soil over the existing marsh surface. The thickness of the peat layer through the vegetated marshes along Village Creek and underlying sandy material is likely to provide a stable base upon which additional material may be placed. Based on strata (peat and mineral) thicknesses it is estimated that the potential compaction will be less than 0.5 inch from sediment placement depths of 6 inches or less, and up to approximately 1.5 inches of compaction for sediment placements depths equal to 12 inches.

Soil samples were collected and submitted for analysis of chemical constituents including metals, polycyclic aromatic hydrocarbons, Polycyclic biphenyls and Extractable Petroleum Hydrocarbons. Results were compared to CT-DEEP upland disposal standards. Results were also compared to concentrations of

each test parameter for the proposed dredge area. A review of the data indicated that there are elevated concentrations of metals in the salt marsh soils. These elevated concentrations were observed in the northern reaches of the Village Creek salt marsh. Concentrations were consistent with samples collected for dredging of the harbor and channel. In contrast, concentrations of parameters at the southern reaches of the Village Creek salt marsh were consistently lower than samples collected for dredging of the Harbor and channel. Consequently, it was recommended that plans for use of harbor dredge sediments for TLD should focus on the northern reaches of the Village Creek salt marsh in an effort to be consistent with CT DEEP beneficial reuse and anti-degradation policies.

In summary, it is both feasible and beneficial to relocate sediments dredged from the Village Creek harbor and channel to restore degraded salt marsh in the estuary. An operational program to use these sediments from periodic (6 to 10 year) maintenance dredging cycles would provide an alternative to open water disposal of materials in existing Long Island Sound disposal sites and improve the health, function and resiliency of the estuary in anticipation of rising sea levels.

### **Final Project Schedule & Budget Summary**

The project began on October 15, 2016 and was completed on July 30, 2017.

The total projected cost of the project was \$40,000. The final expenses were \$28,764.15

The primary grant award for this project came from the National Fish and Wildlife Federation's Long Island Sound Futures Fund. CIRCA provided a Matching Funds award of \$5,000.

## Salt Marsh Restoration Project Expenses

Fuss & O'Neil Engineering Contractor

Invoice date	Amount
5/24/17	\$7,020.00
7/14/17	\$6,302.50
8/18/17	\$9,459.50
9/16/17	\$1,526.00
10/18/17	\$3,009.00
Dec.2017 (anticipated)	\$763.00
Total Invoices from F&O	<b>\$28,080.00</b>
<b>Additional Expenses</b>	
CIRCA Workshop	
4-May-17	\$249.70
CT-DEEP Meeting	
24-Jul-17	274.45
Norwalk Aquarium Mtg	
7-Sep-17	80
Norwalk Aquarium Mtg	
9-Sep-17	80
	<b>\$684.15</b>
<b>Total Expenses</b>	<b>\$28,764.15</b>