Local Planning to Advance Implementation of Living Shorelines at Municipal Properties

SALEM LIVING SHORELINE PROJECT CM Green Infrastructure for Coastal Resilience Grant COLLINS COVE LIVING SHORELINE DESIGN SALEM, MA Introducing Green Infrastructure for Coastal Resilience March 30, 2017







Photo Credit- Salem Sound Coastwatch and LightHawk

The Post-Industrial City







1700s into 1800s: Grist mills and early leather industry 1900: Industrial peak factories and railroads reshape landscape 1914: Great Salem Fire destroys much of city's core, debris used to expand landmass

1920s to 1980s: Industrial decline Today: Lowlying filled areas vulnerable to increasing flooding



Filled Tidelands



Local Planning Context





- Green Communities energy reduction
- Rosies Pond flood mitigation
- Green Infrastructure feasibility assessment
- Collins Cove Living Shoreline pilot project

Local Planning Context



New Derby Street Waterfront Park



New Derby Street Waterfront Park

expand facilities and programs • expand water-related programming • create open space & recreation facilities in dense neighborhoods that lack them • acquire key sites for visual access to the water

acquire open space in current and future flood

1es

City of Salem awarded

Massachusetts Coastal Zone Management Green Infrastructure for Coastal Resilience

Financial & Technical Resources to advance understanding & implementation of **natural approaches to mitigate coastal erosion & flooding problems**

December 2014 – June 2016 for shoreline assessment
 December 2016 – June 2017 design & permitting 1 site

Kathryn Glenn – CZM North Shore Regional Coordinator Julia Knisel – CZM Coastal Shoreline & Floodplain Manager

Living Shoreline Installations

= Natural "Green" Infrastructure

- Alternatives or enhancements to bulkheads, seawalls, or revetments
- Introduction of a naturalized edge using plants, sand/soil, and the limited use of hard structures

BENEFITS:

- Stabilizing the shoreline more resistant to erosion
- Reducing wave action with natural barriers
- Protecting surrounding riparian and intertidal environment
- Improving water quality via filtration of upland run-off
- Creating habitat for aquatic and terrestrial species

LIVING SHORELINES SUPPORT RESILIENT COMMUNITIES

Living shorelines use plants or other natural elements—sometimes in combination with harder shoreline structures—to stabilize estuarine coasts, bays, and tributaries.



One square mile of salt marsh stores the carbon equivalent of 76,000 gal of gas annually.



Marshes trap sediments from tidal waters, allowing them to fisheries habitat. grow in elevation as sea level rises.



Living shorelines improve water quality, provide increase biodiversity, and promote recreation.



Marshes and oyster reefs act as natural barriers to waves, 15 ft of marsh can absorb 50% of incoming wave energy.



Living shorelines are more resilient against storms than bulkheads.



33% of shorelines in the U.S. will be hardened by 2100, decreasing fisheries habitat and biodiversity.



Hard shoreline structures like **bulkheads** prevent natural marsh migration and may create seaward erosion.

The National Centers for Coastal Ocean Science | coastalscience.noaa.gov Some graphics courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/symbols/)

CZM Grant 1 The PROCESS

- 1. Municipal Shoreline Survey
- 2. Identify up to 10 possible sites
- 3. Chose 3 sites
- 4. Develop 3 Conceptual Designs



Created a Matrix to Determine Site Priority

Site Name	Kernwood Marin	McCabe Park	Furlong Park	Collins Cove - East	Collins Cove Park	Collins Cove Beac
Site ID	5	6	14	19	20	21
Criteria Scoring System: High (3); Medium (2); Low (1) Use number in cells.			10 10		E.	
Physical						
Natural shoreline	2	3	2	3	1	1
Flooding potential (FEMA & Storm surge maps)	1	1	3	3	3	2
Erosion impacts (extent, rate, cause and shoreline change)	2	1	1	3	2	2
Filled tidelands (shoreline change map & chapter 91 maps)	1	1	2	3	3	2
Low topography	1	3	3	3	1	2
Exposure to storm waves	1	2	2	1	1	2
Vulnerability to sea level rise	2	2	2	2	2	2
Potential for natural shoreline adaptation / resilence (landward migration or sediment accretion)	2	2	3	3	2	3
Biological		1	1		1	
Presence of marine & coastal resources (eelgrass, shellfish, salt marsh, etc.)	3	3	3	3	2	3
Restoration potential for coastal habitat	2	1	2	2	2	2
Social					-	
Public property	3	3	3	1	3	3
Residental impacts	1	1	3	2	3	3
Vulnerable population (elderly, schools, low income, hospitals)	1	1	2	2	3	3
Evacuation route / connector road	2	1	1	2	3	3
Recreational benefits	3	2	3	2	3	2
Historical & cultural significance	2	1	3	1	2	2
Economic						
Cost of gray infrastructure repair or installation (functional condition assessment)	2	2	2	2	3	3
Economic value (lost revenues for City, businesses, residents)	2	1	3	1	1	1
Cost of recovery to repair flooding impacts	2	2	2	2	3	3
Funding opportunities	2	1	3	1	3	3
Transferability to other coastal communities	3	1	3	2	3	3
TOTAL SCORE	40	35	51	44	49	50

28 Salem Municipal Site Profiles

Coastal Resilience - Living Shoreline, Salem, Massachusetts, 2015.

LS ID #: 22a Site Name: Collins Cove Beach- Bike Path

Owner: Salem Site Address: Collins/Webb Streets

Habitats Present: Mudflat, salt marsh, sand

Constructed Environments: Buildings, sidewalk, street, sewage pipe, outfall

Dominant Material: Gravel, cobble, boulder, sand

Vulnerability: Flooding from storm surge and sea-level rise, potential overflow onto Essex and Webb Streets

Who/What at Risk: Homes, important transportation route, bike path, habitat loss

Map: https://www.google.com/maps/@42.5206891,-70.8856964,859a,20y,41.32t/data=!3m1!1e3

CZM Coastal Infrastructure Inventory and Assessment, 2007

Description/Summary of Site:

Sand/mud/gravel beach at the head of Collins Cove, paralleling Webb Street. Much of the land surrounding Collins Cove is filled tidelands. Beach is directly in front of highly used bike and walking path, domestic neighborhoods and H & A Propeller shop. Beach area is characterized by a boulder barrier which shows signs of wash-out from wave and tidal action, and sparse saltmarsh (pictures 1, 3). A sewer main is buried in the area between the path and the boulders.

Area has high potential for extreme flooding due to high storm surge and continued sea-level rise. Boulder and cobble barrier stretching along most of sandy/gravel beach showing signs of erosion from wash-out. Vulnerable to wave and tidal action.

Summary: See 22-b	CZM Caastal Infrastructure Inventory and Assessment, 2007		
*CZM assessment combined with Callins Cove 22b site	CZM ID: 064-042-000-003-100 CZM Grade: D		
Feasibility: High. Conceptual design	Date of Survey: 7/12/2007		
completed by Chester Engineers with	CZM Priority:	CZM Rating: Poor	
input from Salem Sound Coastwatch and Jeff Elie of the City of Salem.	FIRM Elevation: 13	FIRM Map Zone: V3	
	Estimated reconstruction francis \$2,007,720,00		

Salem Shoreline Experiencing Erosion



Other Places Fringing Salt Marsh Stable



Forest River Park – future site of Living Shoreline?

Ocean Side of City's Swimming Pool



6 patches of salt marsh – all behind boulders or bedrock

Conceptual Designs for 3 Living Shoreline Projects

chose 2 of the 4 general Focus Areas

- 1. Bio-engineering with biodegradable materials and plantings
- 2. Fringing salt marsh
 - 15 feet of marsh can absorb 50% of incoming wave energy

NOT

1. Natural oyster or mussel reef

2. Beach, berm & dune

CZM StormSmart Properties Fact Sheet 4: Bioengineering - Coir Rolls on Coastal Banks



Clean Up at Lead Mills Salem & Marblehead



Living Shoreline Installations



Delaware Estuary Living Shoreline Initiative

http://www.delawareestuary.org/ science-and-research/livingshorelines/delsi-tactic/



DelawareEstuary.org

Collins Cove Selected as 1 of the 3 Priority Sites



Awarded 2nd Massachusetts Coastal Zone Management <u>Coastal</u> <u>Resilience</u> Grant for design and permitting of Collins Cove

Salem Sound COASTWATCH With a CZM Green Infrastr

with a CZM Green Infrastructure for Coastal Resilience Grant





- 2. Identify up to 10 possible sites
- 3. Chose 3 sites
- 4. Develop 3 Conceptual Designs



Engineered design + permitting <

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Phase 3

Implementation of Living Shoreline

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Stakeholder Engagement Meetings



Making an ESRI Story Map http://arcg.is/2hWSXs3

Looking at Collins Cove Past Shallop Cove 1700 - 1800



1790 Salem Map of Collins Cove

1815 (June 17):

The *Essex Register* notes that "the Shallop Cove is continually filling up.

Great changes have taken place in the memory of the present generation and very great from the first settlement of the town.

It was at first their principal place for their Shallops; it is now without water at every fall of the tide."

c. 1650-1700: There are a **few dozen** houses along the Cove.

A **creek ran** from the Salem Common along present-day Forrester Street to the Cove.

1800: The Common is leveled and drained. The creek begins to disappear.



A Shallop

from a illustration by Ray Brown in "The Story of Our Merchant Marine" by Willis J. Abbot, 1919.

Filling of Collins Cove – railroads and sewerage

1815 (June 17):

The *Essex Register* continues:

Towards East Street, it is daily filling, from the sluices which conduct the water from the streets into it. The continuation of Webb Street into East Street... was formerly the only pass which the town had to the Neck, till it was **washed into the cove, by the action of the tide upon its banks...**"

Filling continues for Railroad



1874 – Map of the City of Salem Map - H. F. Walling - cropped



1820 Salem Map of Collins Cove

1848-49: The Essex Railroad builds a track across the bottom of the Cove, using gravel brought in from Danvers.

Sewerage is a Public Nuisance



1944 Salem and Lynn Harbors, US Coast Survey - cropped

c. 1960-1973: The rail line is removed.

1869-73: **Sewers** are built. **All empty into Collins Cove**. (Salem City Documents, Street Commissioner's Reports)

1889-1890: Salem Board of Health in its annual report declares the **"Webb Street Basin"** (the water body between the shoreline and the rail line) **a sanitary nuisance.** In 1889, the Board reports that

"About 8000 cubic yards of gravel have been placed here by the [Boston and Maine] railroad, and some 600 loads of gravel, loam and other suitable filling exclusive of city ashes have been dumped here."

Fill work is completed the following year. This adds the land on the present-day "odd" side of Webb Street.

1935-36: The Collins Cove Playground, a WPA project, is planned and completed.

c. 1935-1940: City property along Almshouse Road and Fort Avenue is used for a city dump. In 1940 the city completes acquisition of privately held "flats" next to the dump. The WPA thickens the "neck" by filling in a roughly triangular area bounded by Almshouse Road and Fort Avenue. They begin a sea wall on its edge, but MA WPA programs are terminated before the wall is completed.



Collins Cove – Today walking and bike path along the water



- 1. Municipally owned and actively use by Salem residents
- 2. Bike and walking path eroding from wave action and continually needing repair
- Borders a row of houses and Webb Street
 important road for SESD and Power Plant
- 4. Filled tideland with lots of gravel deposited since 1800's







Collins Cove – After 11.8ft. King Tide on 11/16/2016



Salem Sound COASTWATCH COllins Cove – During hurricane Sandy 10/29/2012



Collins Cove – Spartina alterniflora and other salt marsh plants growing there now





Existing Conditions – Collins Cove, Salem

EXISTING VEGETATION

Limonium nashii (sea lavender)

Spartina patens (salt meadow cordgrass) and other salt marsh plants growing there now

Marsh Analysis and Planning Tool Incorporating Tides and Elevations





NOAA's <u>Center for Operational Oceanographic Products and Services (CO-OPS)</u>, partnering with the <u>National Geodetic Survey (NGS)</u> and the <u>National Centers for Coastal Ocean Science (NCCOS)</u>, developed an ArcGIS add-in tool MAPTITE for coastal restoration planning. MAPTITE aids in the selection of vegetation types for different restoration elevations based on a combination of a digital elevation model (DEM) derived from GPS observations, local tidal datums, and grass species tolerances.

https://tidesandcurrents.noaa.gov/maptite.html



Building a Living Shoreline

Using bio-engineering with biodegradable materials and plantings,

living shoreline will trap sediment and decrease erosion at low-moderate energy sites.



Permitting Process for a Living Shoreline Project

1. Wetland Delineation

- "Living shoreline demonstration" is not in the DEP wetlands regs
- "Limited restoration project" is not for shoreline protection or adaptation

- Must identify all resource areas: beach, salt marsh, coastal bank, etc.
- Must address performance standards for each under the WPA and coastal regs
- No Adverse Effect:
 - no increase in erosion
 - no decrease in volume or changing form of beach or downdrift i.e. cannot have loss of structure
- Clarify what is being altered and get it right the first time
- Need to "Thread the Needle"

Need Actual Survey of Site - Elevations



Wetland Delineation



Permitting a Living Shoreline Project

- <u>MEPA ENF</u> new fill in the v-zone! And other thresholds: alteration of more than half an acre
- MA Conservation Commission and DEP WPA, NOI
- <u>U.S. Army Corps General Permit</u> has a designation for ecological enhancement and shoreline stabilization without rock

http://www.usace.army.mil/Portals/2/docs/civilworks/nwp/2017/NWP_54_2017_final_Dec2016.pdf?ver=2017-01-06-125514-560

- <u>Chapter 91 license</u> WATER-DEPENDENT Chapter 91 project does not automatically trigger MEPA
- <u>401 water quality certification</u> (Section 401 of the federal Clean Water Act)



Coir Logs Stabilize Marsh Plantings – Collins Cove, Salem







FIGURE 6: Collins Cove Living Shoreline Layout Plan Google Earth 2016 Ortho Imagery

2013-2014 Sandy DEM Data Contours referenced to NAVD88 (feet)

Engineering Plans



Existing Conditions – Collins Cove, Salem

STA 8+00 (LOOKING NORTH)

Summary - Existing Conditions Collins Cove, Salem

Creating a Living Shoreline with green infrastructure

Potential to be a 20-foot wide Fringing Salt Marsh – 15 feet of marsh can absorb 50% of incoming wave energy

VIEW LOOKING WEST – Photo Rendering

Maintenance and Monitoring

- Makes SENSE to have a monitoring and maintenance plan
- Think about HOW this will be done and WHO

Questions and Comments

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Other 2 Priority Sites

Furlong Park along the North River

Juniper Cove along Columbus Avenue

