Association of State Wetland Managers

Ecological Considerations in Wetland Mitigation Planning and Monitoring

FITZGERALD & HALLIDAY, INC.
Innovative Planning, Better Communities

April 18, 2019

US Army Corps of Engineers®
New England District

NEW ENGLAND DISTRICT COMPENSATORY MITIGATION GUIDANCE

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
REGULATORY DIVISION

9-7-2016

Permittee-Responsible Mitigation:
Wetland Creation

Key issues & challenges:

- High potential for failure / Poor performance
- Selection of suitable sites
- Long-term liability
- Costs / Financial Assurances

Permittee-Responsible Mitigation:
Wetland Restoration

- Address what caused historic adverse impact
- Consider endpoint of restoration and if current & near future physiographic conditions will sustain the restored site
- Restore natural processes

Permittee-Responsible Mitigation: Wetland Enhancement

- Manipulation of physical, chemical, or biological characteristics
- Goal is to heighten, intensify, or improve a specific aquatic resource function
- May gain a selected aquatic resource function, but may also lead to a decline in another function(s) / value(s)

Mitigation Planning & Monitoring Pitfalls

- Inappropriate design for site conditions
- Incorrect **depth, duration, timing** for sustaining hydrology
- Changing hydrologic conditions
- Planting mortality
  - Plant selection (more than just shopping for natives!)
  - Proper genetic stock
  - Herbivory (insects and animals)
- Invasive species
- Sedimentation & Erosion control

Ecological Considerations for Mitigation monitoring and Selection of Performance Metrics

- Use of non-native vs. native genotypes
- Role of symbiosis in community development
- Lack of pristine reference sites
- Creation of novel habitats will likely have less benefit to native spp.
- Replacing Functions & Values or cover type may not address all ecological impacts
- Role / Importance of special habitat attributes
- Dispersal ability and gene flow
- Natural mortality rates
- Role of abiotic v. biotic factors
- Role & timing of disturbance factors

Five Empirical Factors Influencing Wetland Plant Communities

1) Hydrology (upland v. wetland)

2) Soil pH (acidic vs. basic)

3) Soil Texture (organic vs. mineral)

4) Salinity (freshwater vs. saline)

5) Photoperiod (sunny vs. shade)

How Many Combinations of these Five Factors with Opposing (Mutually Exclusive) Variables are there?

- If **p** = no. of variables, and ***n*** = no. of factors,

  then total no. of combinations = $\mathbf{p}^{n}$

- 2 variables and 5 factors = 2^5 or 32 combinations

Question:

Does 32 combinations = 32 different plant communities?

Consider the variation that occurs along a continuum that influences plant ecology at the community level (zonation)

How many different natural wetland communities *do* occur in your state?

A) <15

B) >30

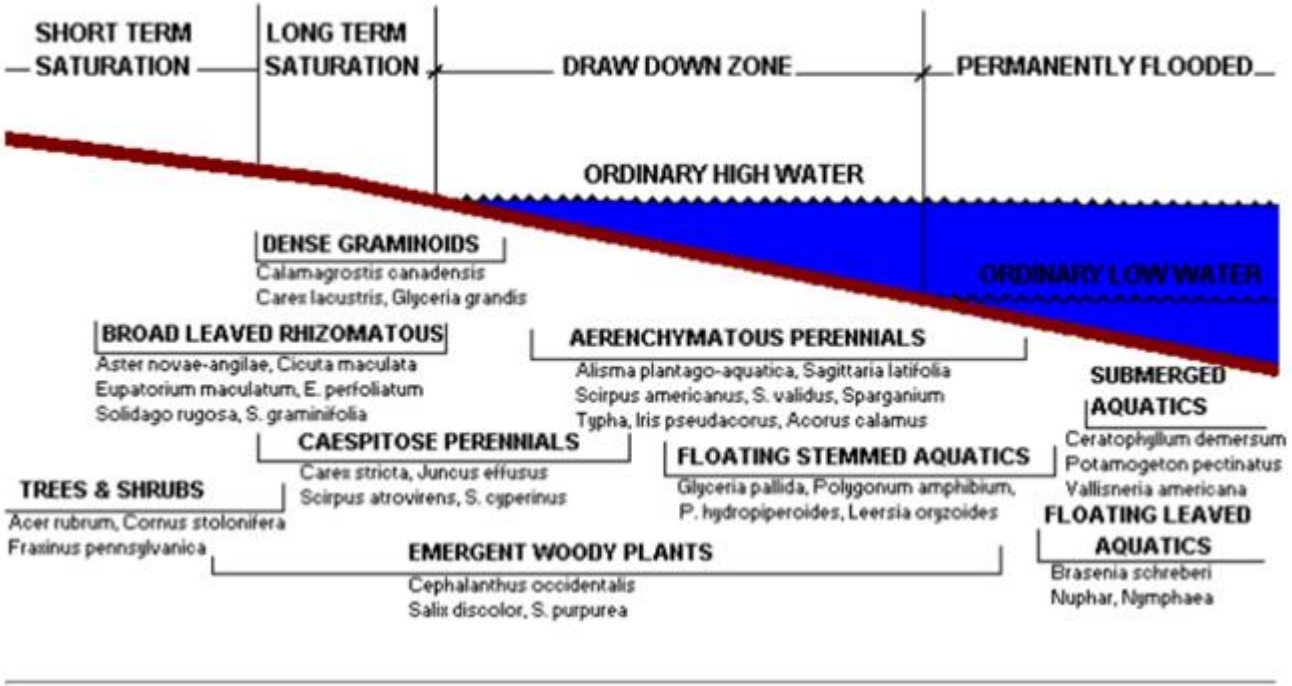
C) >60

D) >90?

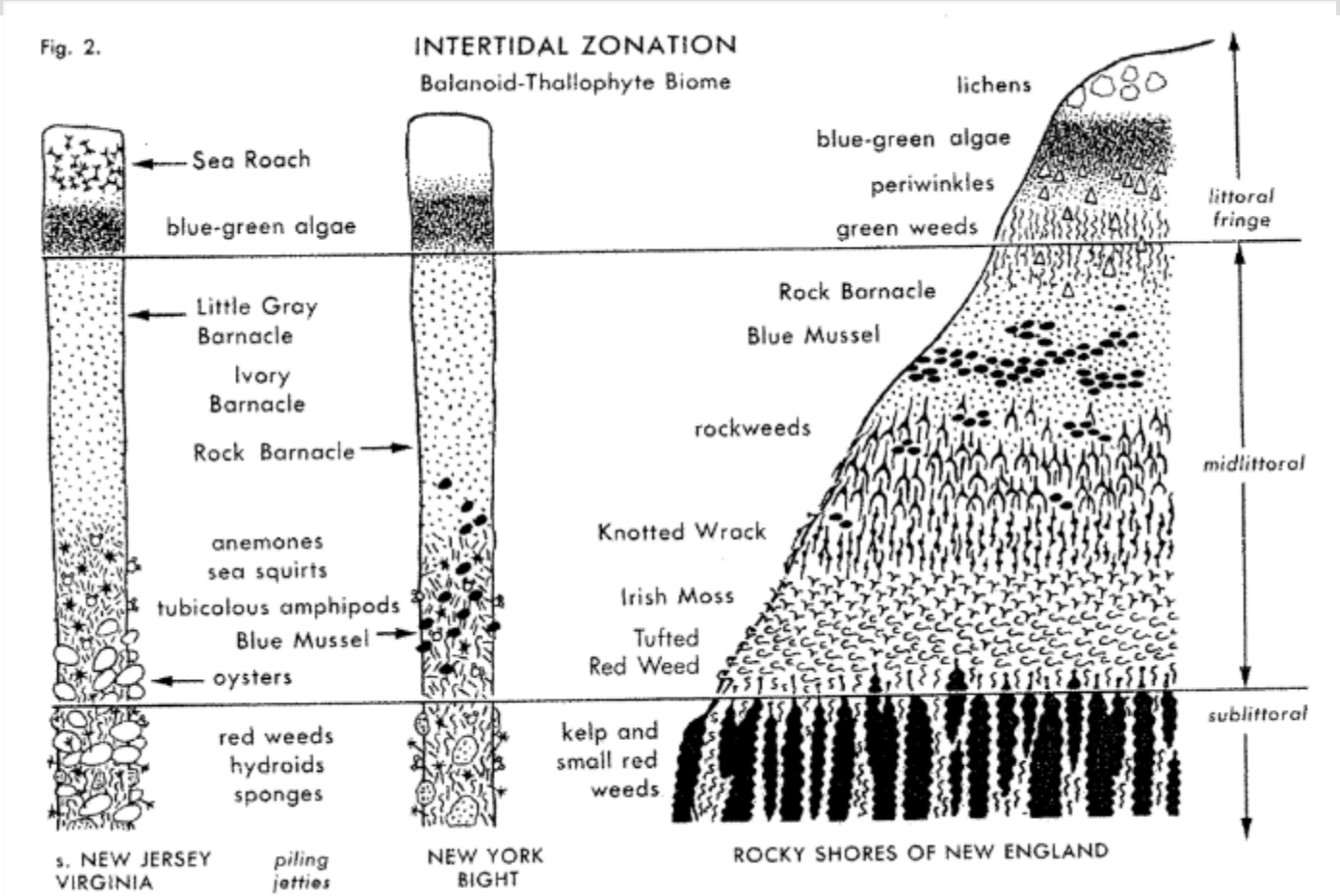
Variables re-visited

1) Hydrology:	Tidal vs. non-tidal; temporarily vs. permanently saturated; lotic vs. lentic, etc.
2) pH:	Basic, neutral, acidic
3) Soil Texture:	Organic vs. mineral; clay, silt, sand, loam
4) Salinity:	Saline, brackish, fresh
5) Photoperiod:	Shade, partial shade, full sun

Adaptive Modes and Wetland Zonation



Source: Southern Tier Consulting



Source: Gosner, 1978

New England Wetmix (Wetland Seed Mix)

- **SPECIES**: Fox Sedge (*Carex vulpinoidea*), Lurid Sedge (*Carex lurida*), Blunt Broom Sedge (*Carex scoparia*), Blue Vervain (*Verbena hastata*), Fowl Bluegrass (*Poa palustris*), Hop Sedge (*Carex lupulina*), Green Bulrush (*Scirpus atrovirens*), Creeping Spike Rush (*Eleocharis palustris*), Fringed Sedge (*Carex crinita*), Soft Rush (*Juncus effusus*), Spotted Joe Pye Weed (*Eupatorium maculatum*), Rattlesnake Grass (*Glyceria canadensis*), Swamp aster (*Aster puniceus*), Blueflag (*Iris versicolor*), Swamp Milkweed (*Asclepias incarnata*), Square-stemmed Monkey Flower (*Mimulus ringens*).

Source: http://newp.com/catalog/seed-mixes/#wetland

Seaward

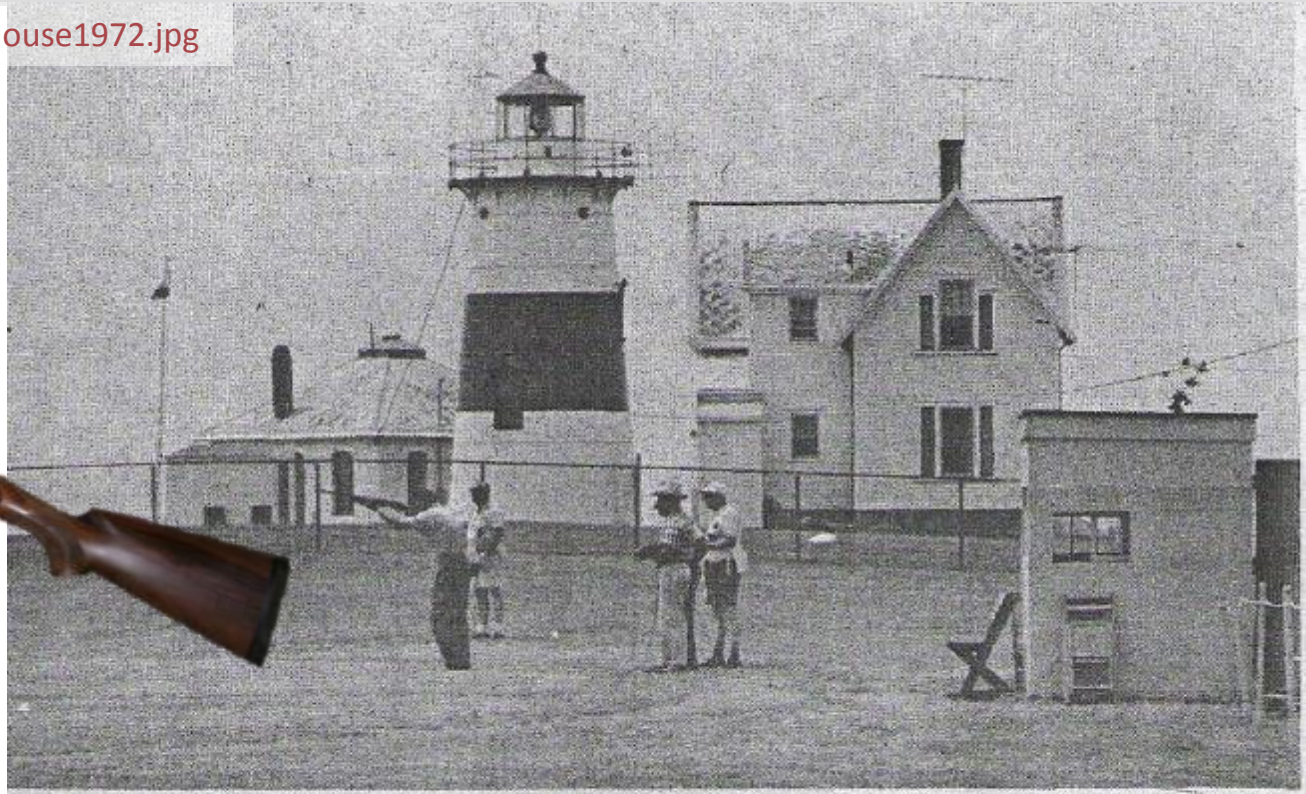
Landward

Source: Queen Elizabeth II Botanic Park Grand Cayman

Case Study: Lordship Pt, CT

Coastal Restoration at the former Remington Arms Gun Club

http://www.lordshiphistory.com/OpenHouse1972.jpg



Site of Open House

September 7, 1972

Remington Arms Gun Club in Lordship is the site of an open house on September 23, to observe National Hunting and Fishing Day. The program will begin 9:00 a.m., and continue until 5:00 p.m

Intertidal Lead Shot Remediation

Intertidal remediation resulted in loss of salt marsh. Subsequent replanting of cordgrass failed.

~2000 2011

Goals of Restoration Activities

- **Coastal Estuarine Restoration:** Create a Functional integrated coastal habitat
  1. Coastal woodland/shrubland
  2. Coastal grassland
  3. Coastal dune
  4. Fringe *Spartina* marsh

Coastal Erosion

Fringe *Spartina* Marsh at Milford Point

Dune Construction

Dec 2011

- Geotubes - underlying soft erosion control structures
- Beach Grass planting

Dune Installation

Jan 2012 to June 2012

“Hurricane” Sandy Oct 2012

Importance of ***Spartina*** Fringe Reefs

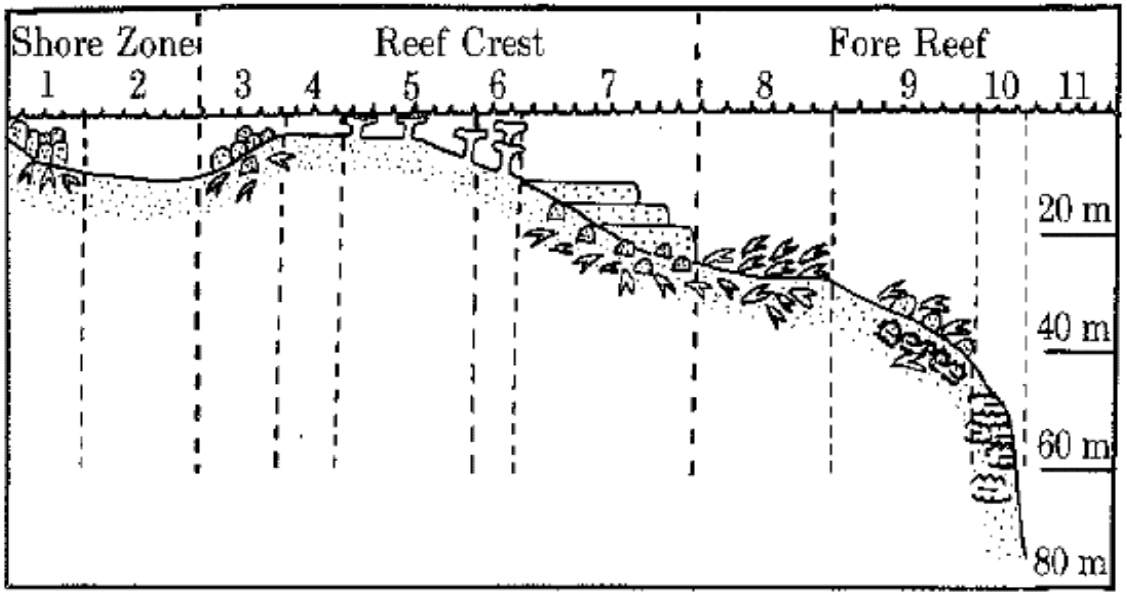


Fig. 4 Zonation of a composite Jamaican bank/barrier reef — cross section; coral colonies and vertical dimensions exaggerated.

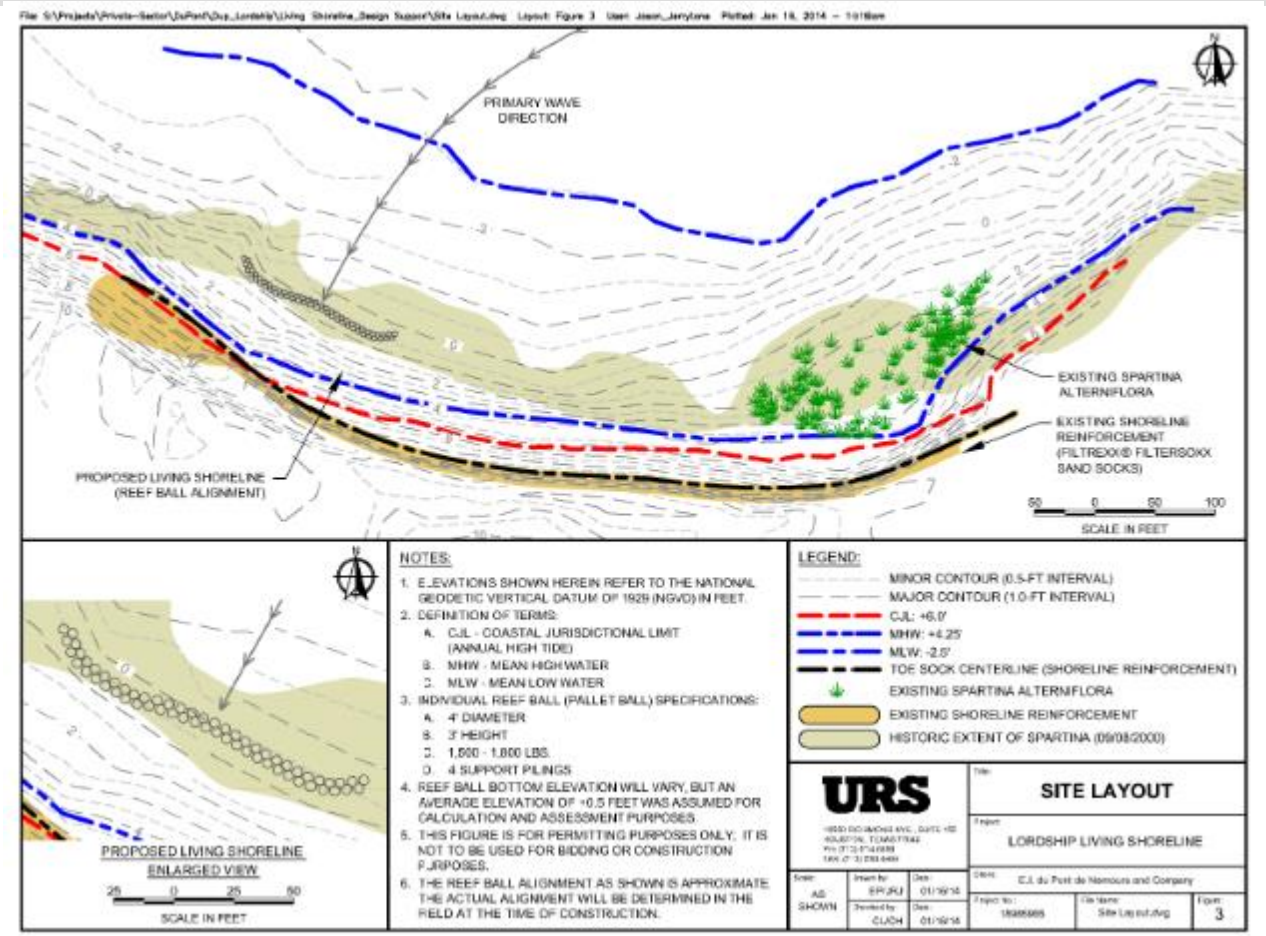
Kaplan, 1982

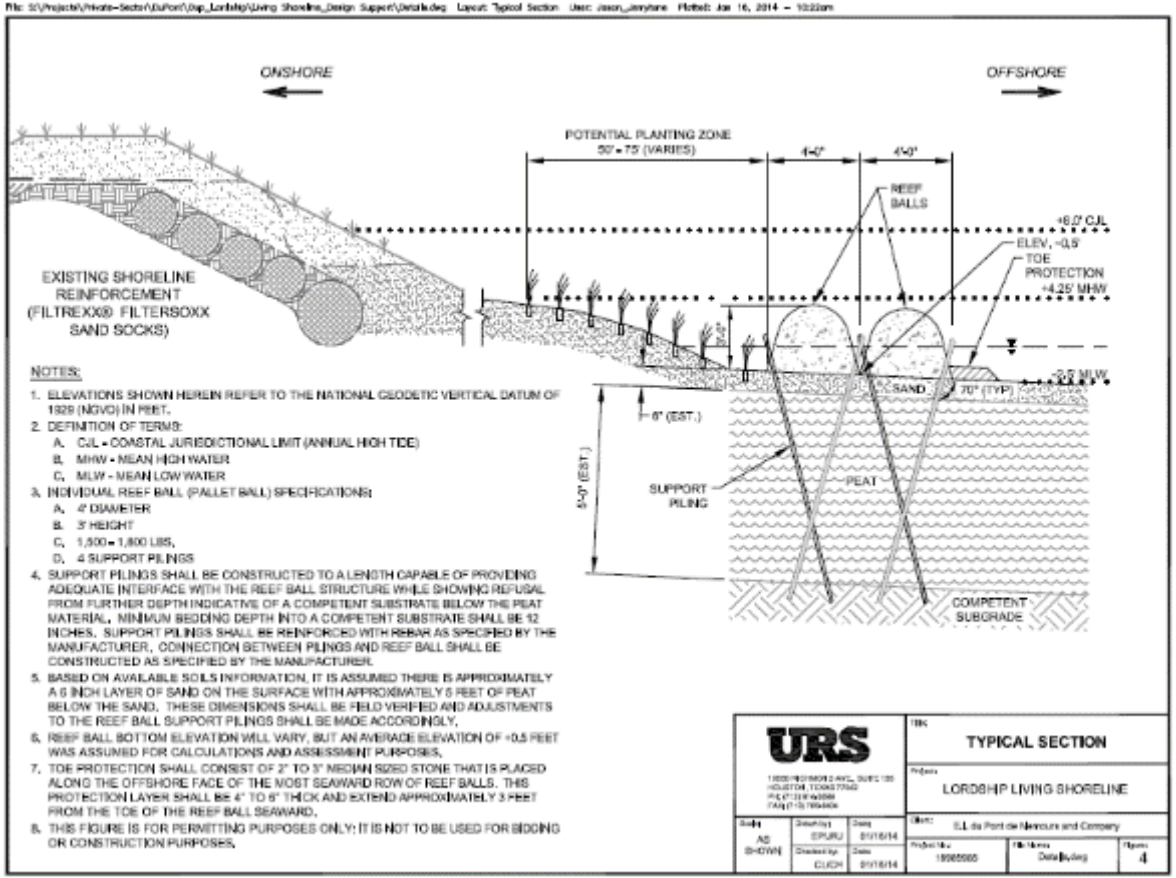
Goal of Restoration Activities (re-visited)

- **Coastal Estuarine Restoration:** Create a Functional integrated coastal habitat
  1. Coastal woodland/shrubland
  2. Coastal grassland
  3. Coastal dune
  4. Fringe *Spartina* marsh
  5. **Shellfish Reef**

Goals of Restoration Activities (re-phased)

- **Coastal Estuarine Restoration:** Create a Functional integrated coastal habitat
  1. Shellfish Reef
  2. Fringe *Spartina* marsh
  3. Coastal dune
  4. Coastal grassland
  5. Coastal woodland/shrubland


PRIMARY WAVE DIRECTION
EXISTING SPARTINA ALTERNIFLORA
EXISTING SHORELINE REINFORCEMENT (FILTREXX® FILTERSOXX SAND SOCKS)
PROPOSED LIVING SHORELINE (REEF BALL ALIGNMENT)
50 0 50 100
SCALE IN FEET
PROPOSED LIVING SHORELINE ENLARGED VIEW
25 0 25 50
SCALE IN FEET
NOTES:
1. ELEVATIONS SHOWN HEREIN REFER TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD) IN FEET.
2. DEFINITION OF TERMS:
A. CJL - COASTAL JURISDICTIONAL LIMIT (ANNUAL HIGH TIDE)
B. MHW - MEAN HIGH WATER
C. MLW - MEAN LOW WATER
3. INDIVIDUAL REEF BALL (PALLET BALL) SPECIFICATIONS:
A. 4' DIAMETER
B. 3' HEIGHT
C. 1,600 - 1,800 LBS.
D. 4 SUPPORT PILINGS
4. REEF BALL BOTTOM ELEVATION WILL VARY, BUT AN AVERAGE ELEVATION OF +0.5 FEET WAS ASSUMED FOR CALCULATION AND ASSESSMENT PURPOSES.
5. THIS FIGURE IS FOR PERMITTING PURPOSES ONLY; IT IS NOT TO BE USED FOR BIDDING OR CONSTRUCTION PURPOSES.
6. THE REEF BALL ALIGNMENT AS SHOWN IS APPROXIMATE. THE ACTUAL ALIGNMENT WILL BE DETERMINED IN THE FIELD AT THE TIME OF CONSTRUCTION.
LEGEND:
MINOR CONTOUR (0.5-FT INTERVAL)
MAJOR CONTOUR (1.0-FT INTERVAL)
CJL: +6.0'
MHW: +4.25'
MLW: -2.5'
TOE SOCK CENTERLINE (SHORELINE REINFORCEMENT)
EXISTING SPARTINA ALTERNIFLORA
EXISTING SHORELINE REINFORCEMENT
HISTORIC EXTENT OF SPARTINA (09/08/2000)
URS
SITE LAYOUT
LORDSHIP LIVING SHORELINE
C.J. du Pont de Nemours and Company
AS SHOWN
3



NOTES:

1. ELEVATIONS SHOWN HEREIN REFER TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD) IN FEET.
2. DEFINITION OF TERMS:
   A. CJL - COASTAL JURISDICTIONAL LIMIT (ANNUAL HIGH TIDE)
   B. MHW - MEAN HIGH WATER
   C. MLW - MEAN LOW WATER
3. INDIVIDUAL REEF BALL (PALLET BALL) SPECIFICATIONS:
   A. 4' DIAMETER
   B. 3' HEIGHT
   C. 1,500 - 1,800 LBS.
   D. 4 SUPPORT PILINGS
4. SUPPORT PILINGS SHALL BE CONSTRUCTED TO A LENGTH CAPABLE OF PROVIDING ADEQUATE INTERFACE WITH THE REEF BALL STRUCTURE WHILE SHOWING REFUSAL FROM FURTHER DEPTH INDICATIVE OF A COMPETENT SUBSTRATE BELOW THE PEAT MATERIAL. MINIMUM BEDDING DEPTH INTO A COMPETENT SUBSTRATE SHALL BE 12 INCHES. SUPPORT PILINGS SHALL BE REINFORCED WITH REBAR AS SPECIFIED BY THE MANUFACTURER. CONNECTION BETWEEN PILINGS AND REEF BALL SHALL BE CONSTRUCTED AS SPECIFIED BY THE MANUFACTURER.
5. BASED ON AVAILABLE SOILS INFORMATION, IT IS ASSUMED THERE IS APPROXIMATELY A 6 INCH LAYER OF SAND ON THE SURFACE WITH APPROXIMATELY 5 FEET OF PEAT BELOW THE SAND. THESE DIMENSIONS SHALL BE FIELD VERIFIED AND ADJUSTMENTS TO THE REEF BALL SUPPORT PILINGS SHALL BE MADE ACCORDINGLY.
6. REEF BALL BOTTOM ELEVATION WILL VARY, BUT AN AVERAGE ELEVATION OF +0.5 FEET WAS ASSUMED FOR CALCULATIONS AND ASSESSMENT PURPOSES.
7. TOE PROTECTION SHALL CONSIST OF 2" TO 3" MEDIAN SIZED STONE THAT IS PLACED ALONG THE OFFSHORE FACE OF THE MOST SEAWARD ROW OF REEF BALLS. THIS PROTECTION LAYER SHALL BE 4" TO 6" THICK AND EXTEND APPROXIMATELY 3 FEET FROM THE TOE OF THE REEF BALL SEAWARD.
8. THIS FIGURE IS FOR PERMITTING PURPOSES ONLY; IT IS NOT TO BE USED FOR BIDDING OR CONSTRUCTION PURPOSES.

URS

Title: TYPICAL SECTION

Project: LORDSHIP LIVING SHORELINE

Client: E.I. du Pont de Nemours and Company

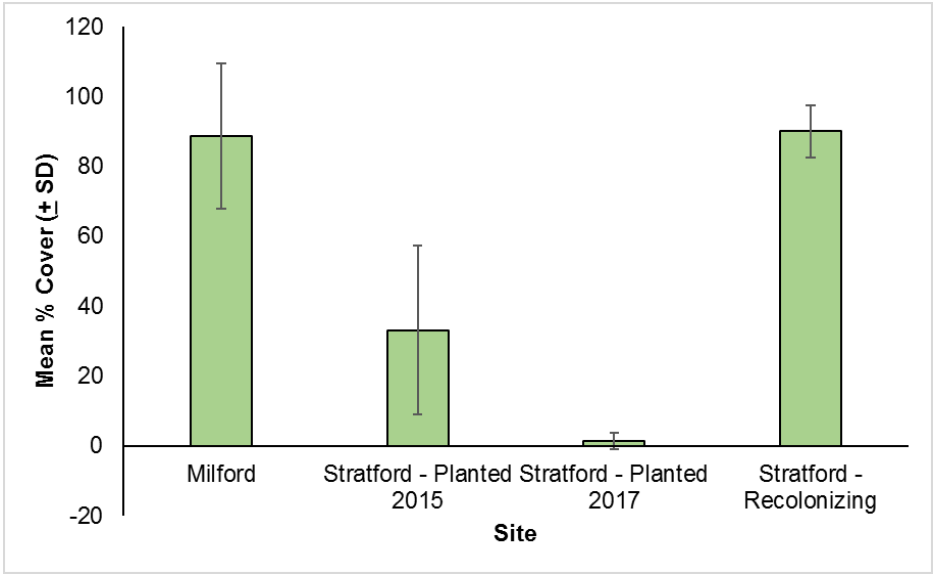
Scale: AS SHOWN | Drawn by: EPURU | Date: 01/16/14 | Checked by: CLICH | Date: 01/16/14

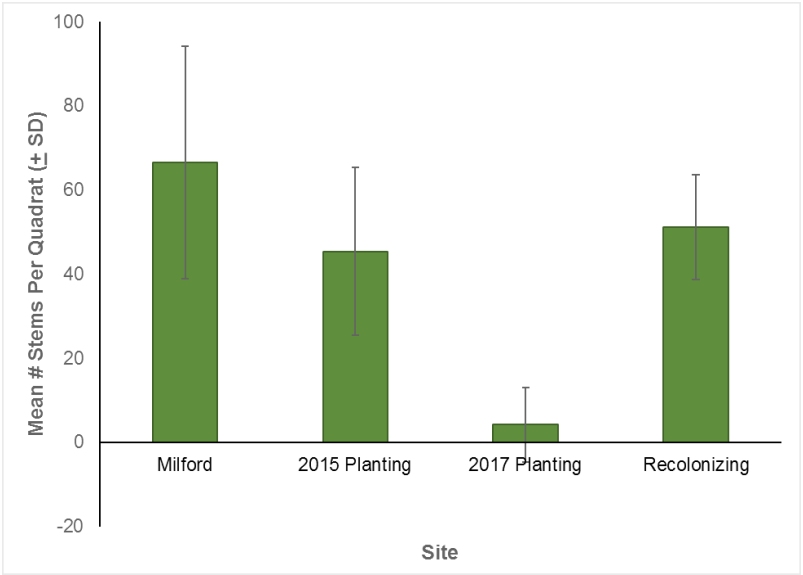
Project No.: 19985665 | File Name: Data\Dwg | Figure: 4

Stratford Point *Spartina* Marsh Restoration – What Performance Metrics are Suitable?
Year One Monitoring results

- Habitat (Qualitative - General observations regarding plant community development), & Quantitative Measurements including:
  - Vegetation structure (percent cover, stem density, stem height)
  - Vegetation conditions
- Bathymetric Response
  - Erosion / accretion - measured using a Real Time Kinematic (RTK) survey system
- Wetland Acreage
  - Extent of tidal wetland vegetation coverage

Stratford Point Coastal Restoration Site
Spartina Coverage (Left) and Density (Right) at Planted and Reference Plots





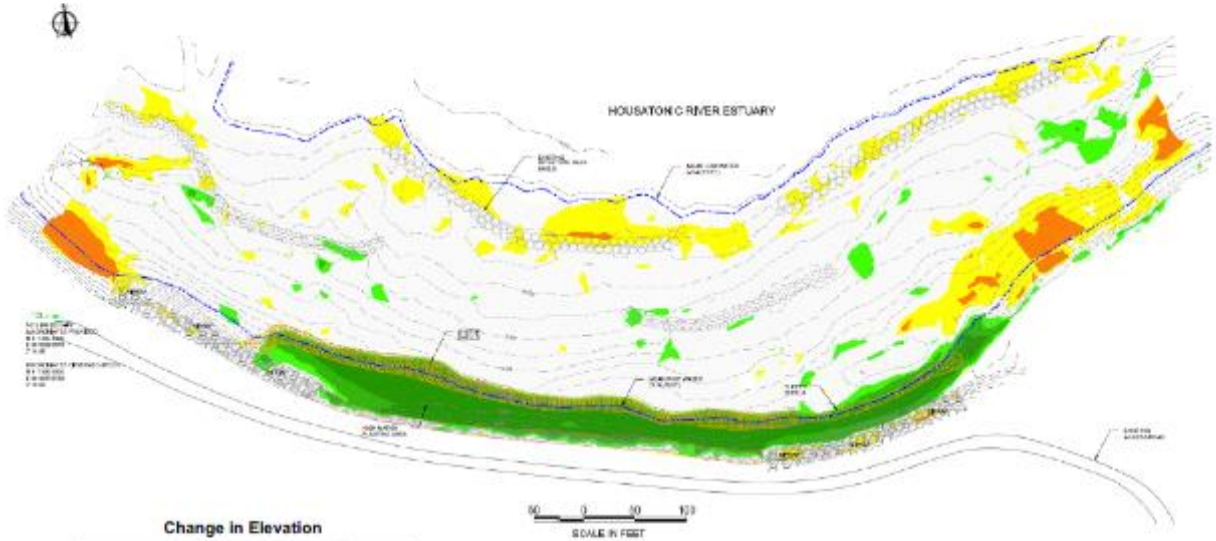
Source: Sacred Heart University. ILF Interim As-Built and Y1 Monitoring Report – Stratford Pt. Living Shoreline (J. Mattei, 2018)

Stratford Point - Extended Reef Creation & *Spartina* re-planting

December 2016 - 4 Months
Prior to Planting

September 2017 - 5 Months
After Planting

Figure 8: Bathymetric Response (June 2017 to December 2017)



Change in Elevation

Minimum Elevation	Maximum Elevation	Color
-5.00	-1.00	
-1.00	-0.50	
-0.50	-0.25	
-0.25	0.25	
0.25	0.50	
0.50	1.00	
1.00	5.00	

Stratford Point Coastal Restoration: An Ecosystem Approach

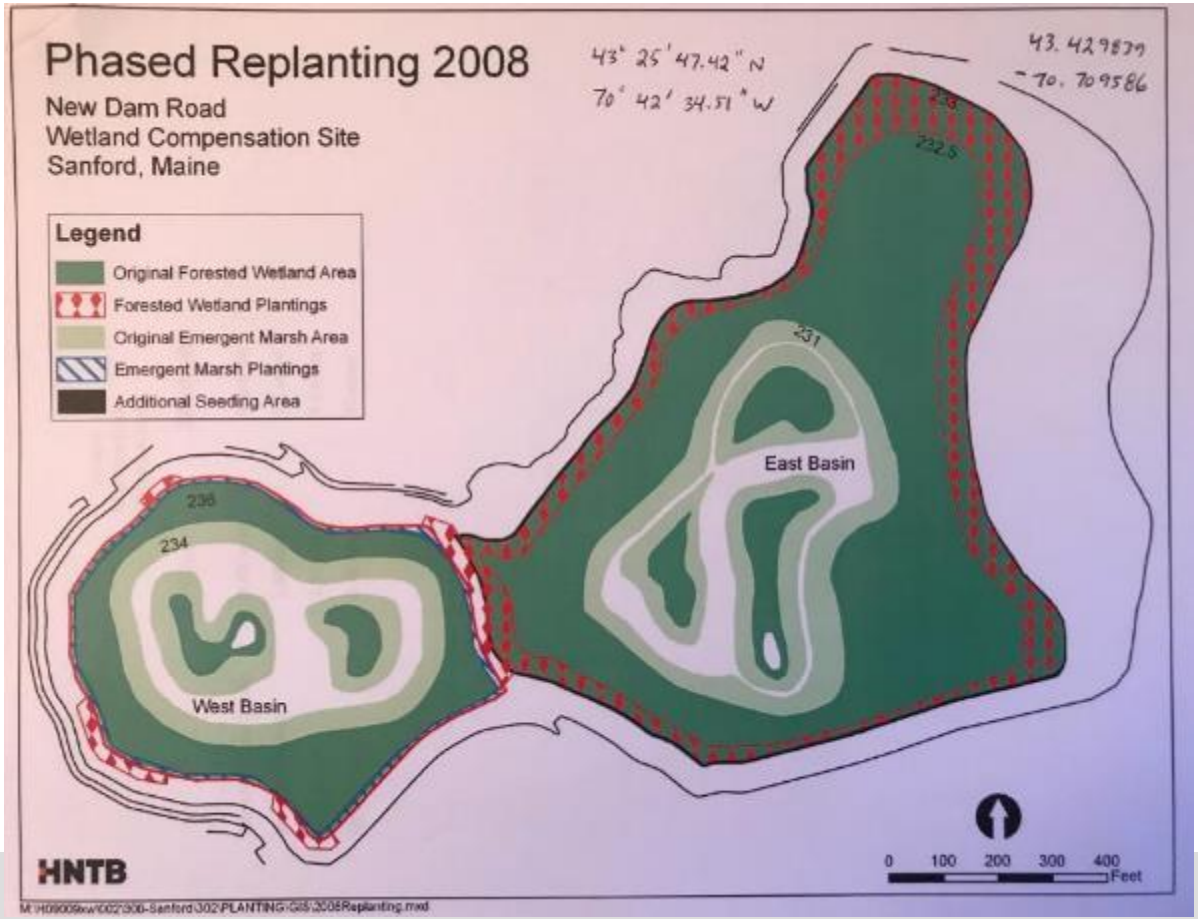
- Shoreline stabilization
- Habitat enhancement
- Sediment deposition from Housatonic River
- Nutrient sequestration
- Water filtration by plants/shellfish

Case Study No. 2:

New Dam Rd Wetland Compensation Site – Sanford, ME


279 New Dam Rd
Image U.S. Geological Survey
Google Earth

New Dam Road Compensation Site – Sanford, ME



New Dam Road Compensation Site – Sanford, ME

Cover Type	Goal (acres)	2006 Results (acres)
PFO/PSS	16.91	Negligible
PEM	5.98	1-2
PAB	2.57	2-3
POW	0.46	20

Source: HNTB, 2017 Presentation to SWS – New England Chapter


New Dam Rd
279 New Dam Rd

Questions?