Cumberland County Soil & Water Conservation District

# Building Resiliency Along Maine's Bluff Coastline

## Developing a Decision Tree and Coastal Stabilization Alternatives Along Maine's Casco Bay

Presented by Troy Barry, Fluvial Geomorphologist

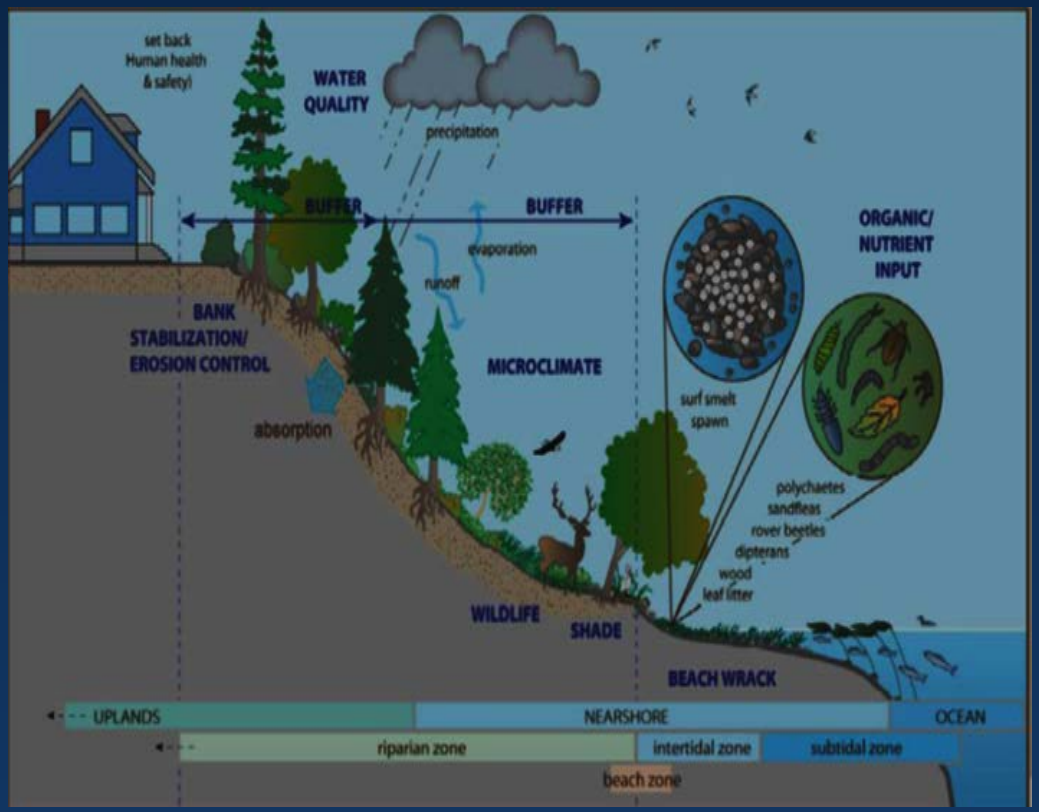
Introducing Green Infrastructure for Coastal Resilience May 17, 2017

# Building Resiliency Along Maine's Coastline

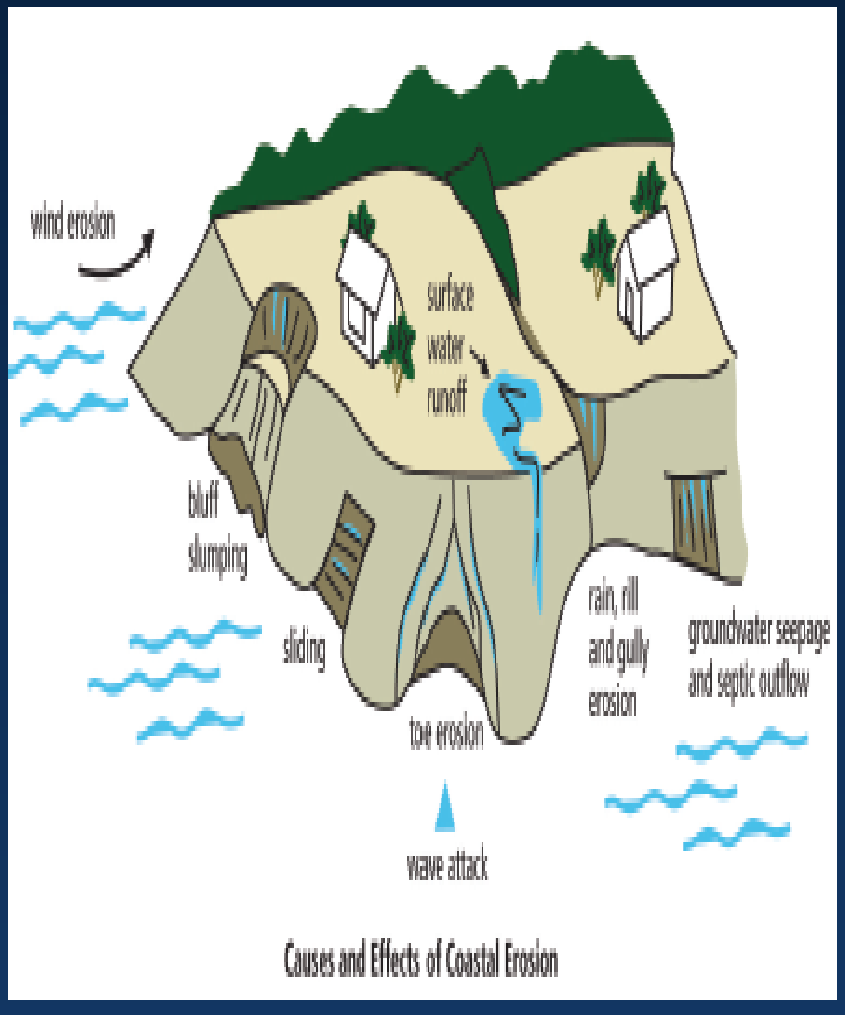
- Casco Bay Shorelines & Erosion
- Traditional Shoreline Stabilization Practices
- Case Studies
  - Upland - Riparian - Intertidal
- Living Shoreline or Soft Stabilization approach
  - Biomimicry
- Shoreline Management Assessment (SMA)

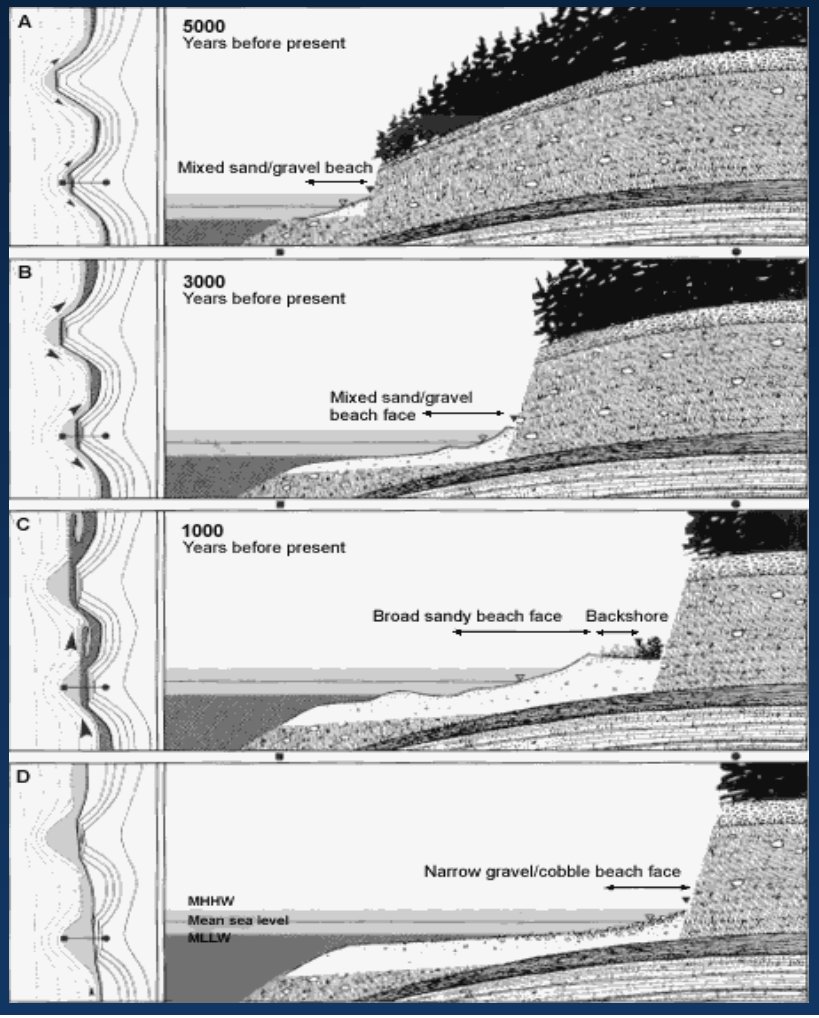
# Shoreline Types:

- Marsh
  - Balanced sediment input & vegetation
- Mudflat
  - Shallow nearshore
- Rock Dominated
  - Intermittent
- Sediment Bank
  - Riparian zone
- Pocket Beach
  - Shallow intertidal



# Factors Contributing to weathering and erosion of bluffs



# Erosion Rates and Risk

Slight Erosion: 0-2 ft/y

Low Erosion: 2-4 ft/y

# Erosion Rates and Risk

Moderate Erosion: 4-8 ft/y

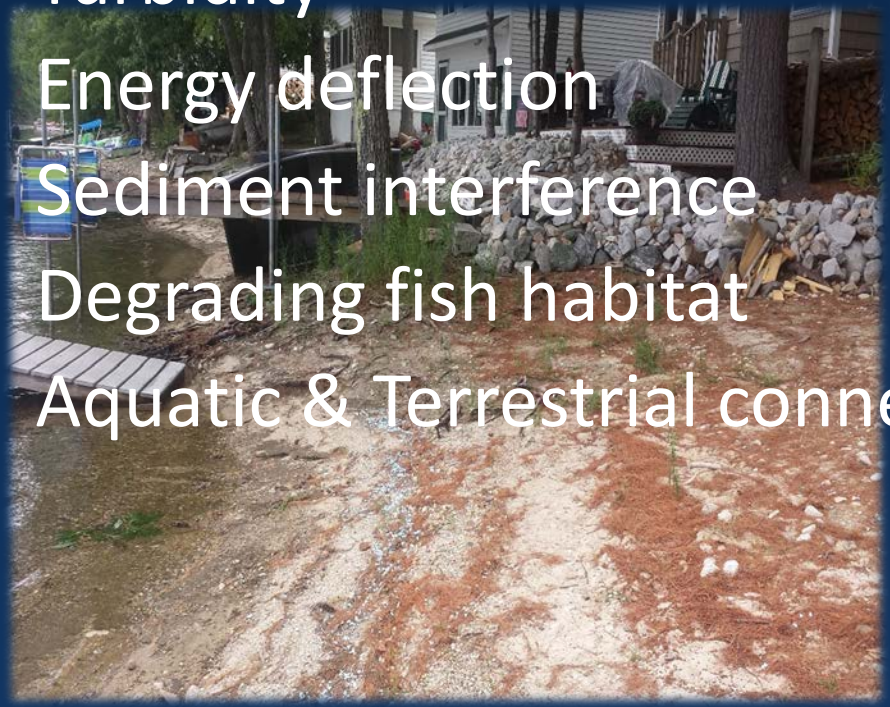
High Erosion: 8+ ft/y

# Traditional Stabilization Practices

- Riprap
- Bulkheads
- Jetties & Groins

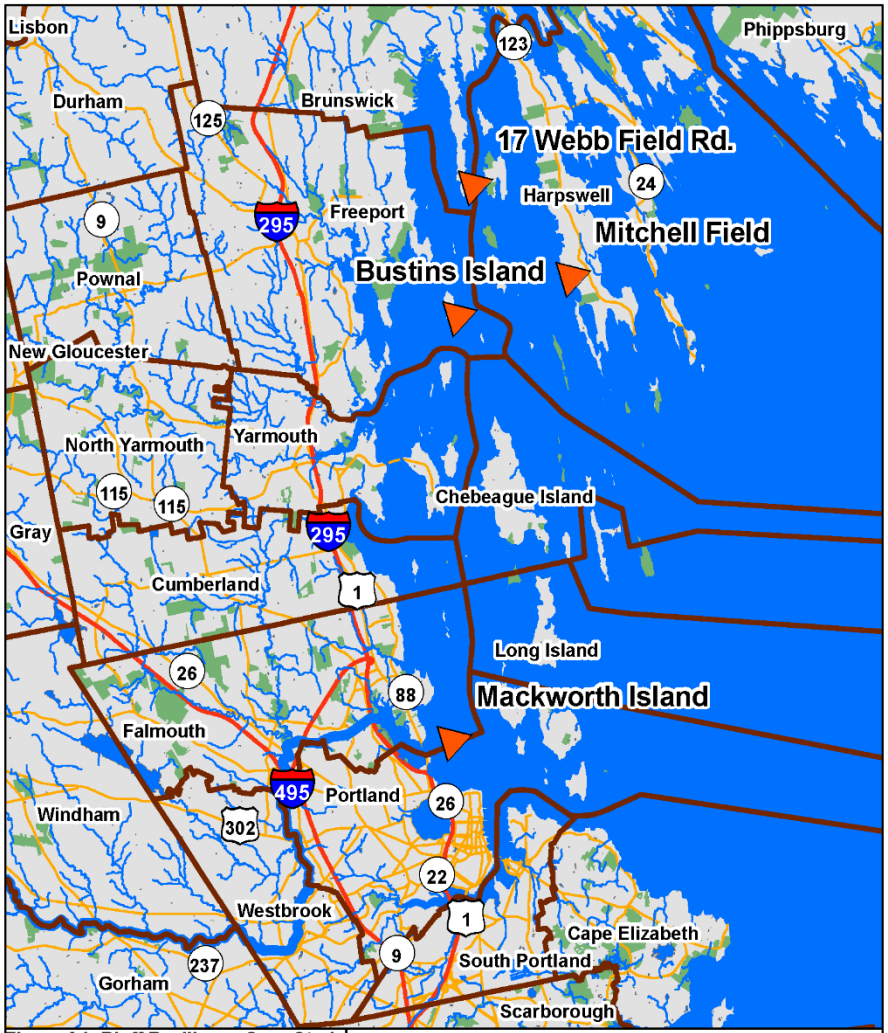
# Traditional Stabilization Changes

- Accelerated Erosion
- New deposition pattern
- Turbidity
- Energy deflection
- Sediment interference
- Degrading fish habitat
- Aquatic & Terrestrial connectivity loss



# Case Studies

- Bustins Island, Freeport
- Mitchell Field, Harpswell
- Mackworth Island, Falmouth
- 17 Webb Field, Brunswick



# Case Study 1: Bustins Island, Freeport


**Figure A2: Bustins Island Overview** See Appendix A for description

Disclaimer- Datasets represented here are not waranteed for completeness or accuracy by CCSWCD. This map is to be used for planning and demonstration purposes only.

Data: MEGIS, CCSWCD, ESRI, MGS.
Coordinates: NAD83, UTM Zone19N
Map: CCSWCD, May 2017
Drawn by Damon Yakovleff, CCSWCD

Bustins Sites
Sub-Watershed (Acres)
Stable
Unstable
Highly Unstable
Local Road

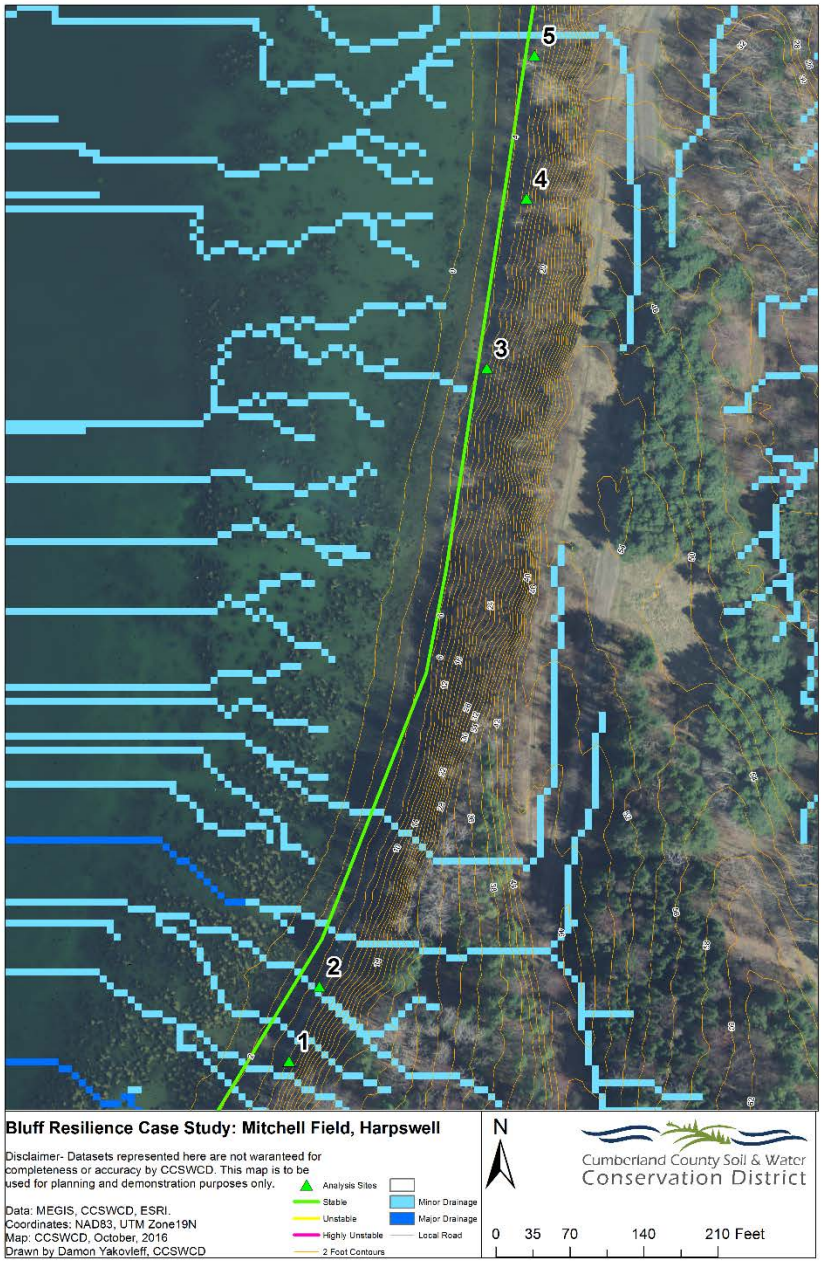
Cumberland County Soil & Water Conservation District

1 inch = 333 feet

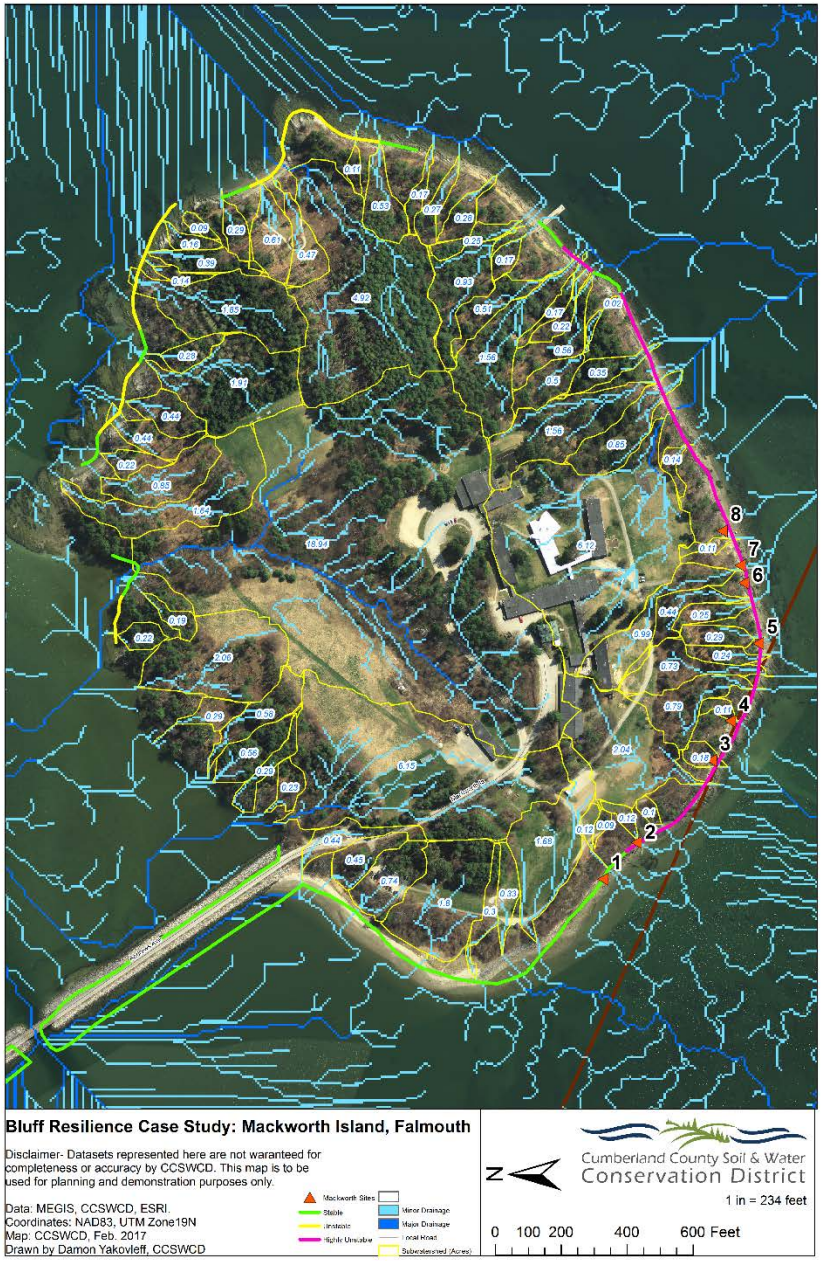
0 0.05 0.1 0.2 Miles

# Vegetation vs Riprap

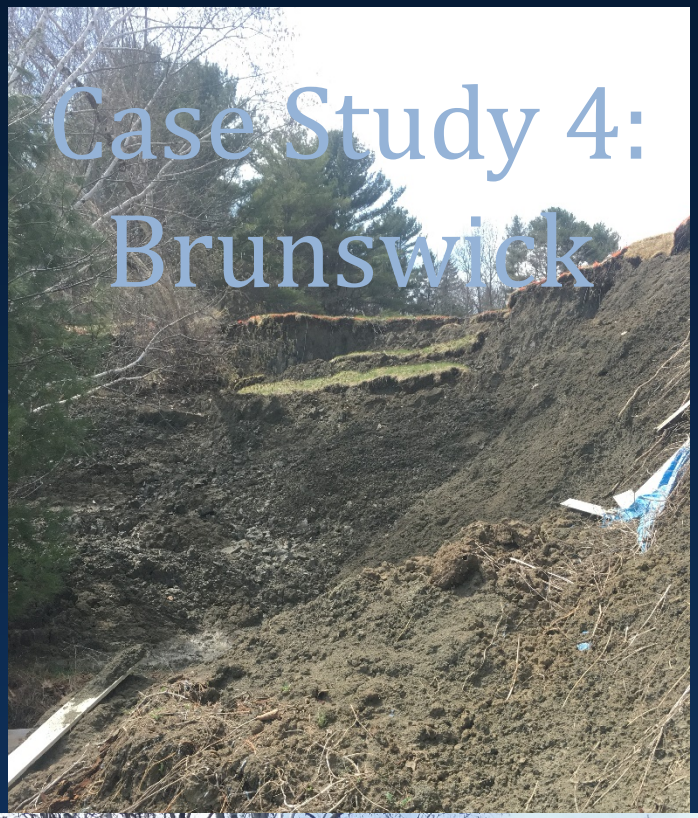
# Case Study 2: Mitchell Field

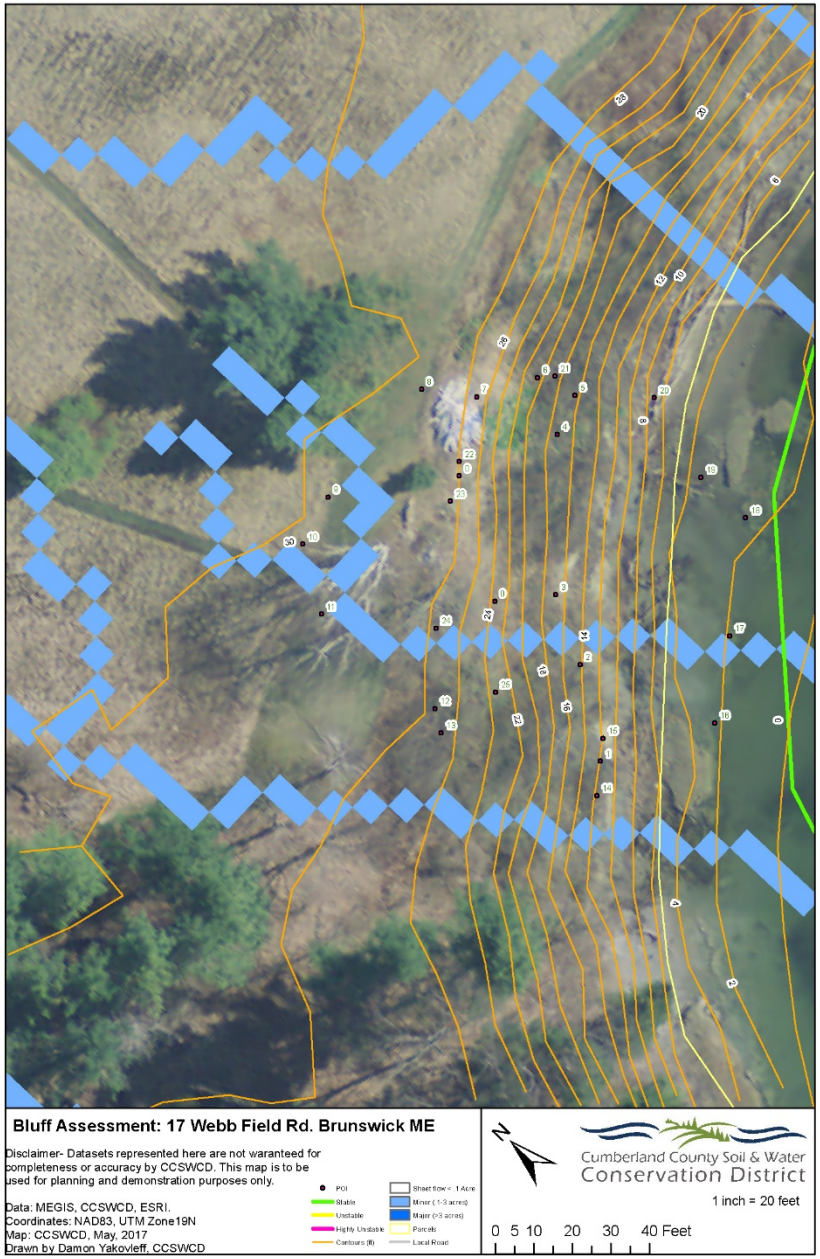


# Case Study 3: Mackworth Island



# Case Study 4: Brunswick





# Fluvial Geomorphic Principles

- Fluvial geomorphology - interactions between bluff form and fluvial processes
- Upland – Riparian – Intertidal are complex interrelationships
- Independent variables – upland discharge, geology, soils, landform, fetch, bathymetry and climate
- Dependent variables – bluff slope stability, width, height, pattern change through complex feedback mechanisms
- Changes in any independent variables or dependent variables initiate adjustment processes in one or more of the dependent variables

# Intent to provide guidance:

- Reconnaissance Level Assessment (RLA)
  - Desktop Review, Instability Rating
- Prediction Level Assessment (PLA)
  - Focus Areas: Upland – Riparian - Intertidal
- Design Level Assessment (DLA)
  - Conceptual Design
  - Living Shoreline and/or Soft Stabilization approach

# Instability Assessment Rating (PLA)

- 12 Parameters
- Good (1): 1-15
- Fair (2): 16-27
- Poor (3): 28-36

## INSTABILITY ASSESSMENT RATING DATA SHEET

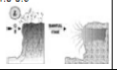
Shoreline: _____ Rater(s): _____

Bluff/Tidal Marsh/Mud Flat/Low Bank: _____ Date: _____

Photo(s): _____

| Overall Bluff Condition | Good | Fair | Poor |
|---|---|---|---|

### BLUFF ASSESSMENT

| | Category / Parameter / Measurement Method | Description of Bluff Condition | | | Rating (1/2/3) |
|---|---|---|---|---|---|
| | | Good (1) | Fair (2) | Poor (3) | |
| 1 | Hydrology / Runoff / Ponding | No alteration of upland drainage draining to project area. Drainage of bank has not been modified. | Minimal overland drainage changes above shoreline site. Does not adversely affect hydrology or result in concentrated flow (point discharge) | Surface drainage is reporting to the study site and has an adverse affect on bank site. Water is ponded above the bank. Seepage may be present. | |
| 2 | Hydrology / Runoff / Concentrated Flow | No apparent concentrated flow or channelized flow from adjacent land use | Some concentrated flow/channelizing directed to site, however, measures are in place to protect resources | Concentrated flow/channelization tobank site and no treatments are in place | |
| 3 | Hydrology / Runoff / Land Use Change | Upland area is primarily native vegetated (>70%) mix of shrubbery and trees. Trees larger than 12" diameter are a minimum of 20' from top of bank. | Land development occurring or active agricultural practices occurring in upland area, vegetated area 20 - 70%. 12" diamter trees 5-20' from top of bank. | Land use is urban or primarily active agricultural practices (> 70%), vegetated area <20%. 12" diamter trees 5' or less to top of bank, roots may be exposed. | |
| 4 | Hydrology / Runoff / Distance to Roads | No roads in or adjacent to site (20' or closer). No proposed roads in or adjacent to site in 10 year plan. | No roads in or adjacent to site (20' or closer). No more than one major road proposed in 10 year plan. | Roads located in or adjacent to site boundary (5-20') and/or roads proposed. | |
| 5 | Hydrology / Runoff / Seepage | Upland runoff as a result of rainfall patterns, geology, and soils does not result in seepage in bank. | Upland runoff as a result of rainfall patterns, geology, and soils results in seepage in < 10% of the bank | Upland runoff as a result of rainfall patterns, geology, and soils is resulting in seepage from > 10% of the bank. | |
| 6 | Geomorphology / Riparian Vegetation | >80% of contributing shoreline length has >25 ft corridor width - dense vegetation | 50 - 80% of contributing shoreline length has >25 ft corridor width - average vegetation | <50% of contributing shoreline length has >25 ft corridor width - low denisity vegetation | |
| 7 | Geomorphology / Sediment Supply | Low soil erosion - bank erosion shows no recent change or loss. There are few runnels/gulleys present on the bank face. | Moderate soil erosion. Bank erosion is occuring, visual change and loss. There are several runnels/gulleys on the bank face < 0.5' deep. | High soil erosion - bank erosion is occuring, change is measurable. There are numerous runnels/gulleys > 0.5' deep | |
| 8 | Bank Slopes | Slopes range from 3 to 8%.  | Slopes 8 to 20%.  | Slopes 20% and greater or undercut.  | |
| 9 | Bank Height vs. High Tide Elevation | High Tide Elevation is at or near Top of Bank  | High Tide Elevation is 1/3 below Top of Bank  | High Tide Elevation > 1/3 below Top of Bank  | |
| 10 | Soil Properties: Particle Size / Stratification | Bedrock and boulders make up the bank. Or, cohesive soil types (sand/gravel mix) mixed evenly.  | No bedrock or boulders, cohesive soils (sand/gravel mix) are dominant and mixed equally. Clay to very stony sandy loam.  | Soils are non-cohesive and/or highly stratified. Sand/gravel mix with larger percentage of sand, sandy loam, silt,  | |
| 11 | Density of Roots/Bank Surface Protection/% of Total Bank Height with Roots | Surface Protection = 80-100%. Root Density in Bank = 80-100%. Root depth/Bank Height = 1.0-0.9  | Surface Protection = 55-79%; Root Density = 55-79%; Root depth/Bank Height = 0.5-0.89  | Surface Protection < 55%; Root Density < 55%; Root depth/Bank Height < 0.5  | |
| 12 | Biology / Landscape Connectivity | Shoreline of project and adjacent area to project area has native bank and vegetation materials. No rip-rap or hardened structures installed. | Shoreline of project and adjacent area has native vegetation and bank materials but is impaired by invasives and/or rip-rap and/or hardened structure installed. | Shoreline of project and/or adjacent area is hardened by a concrete headwall, or rip-rap or other structure. Limited vegetation present. | |
| | | | | Total Ratings: | |

# Shoreline Assessment Management (SMA)

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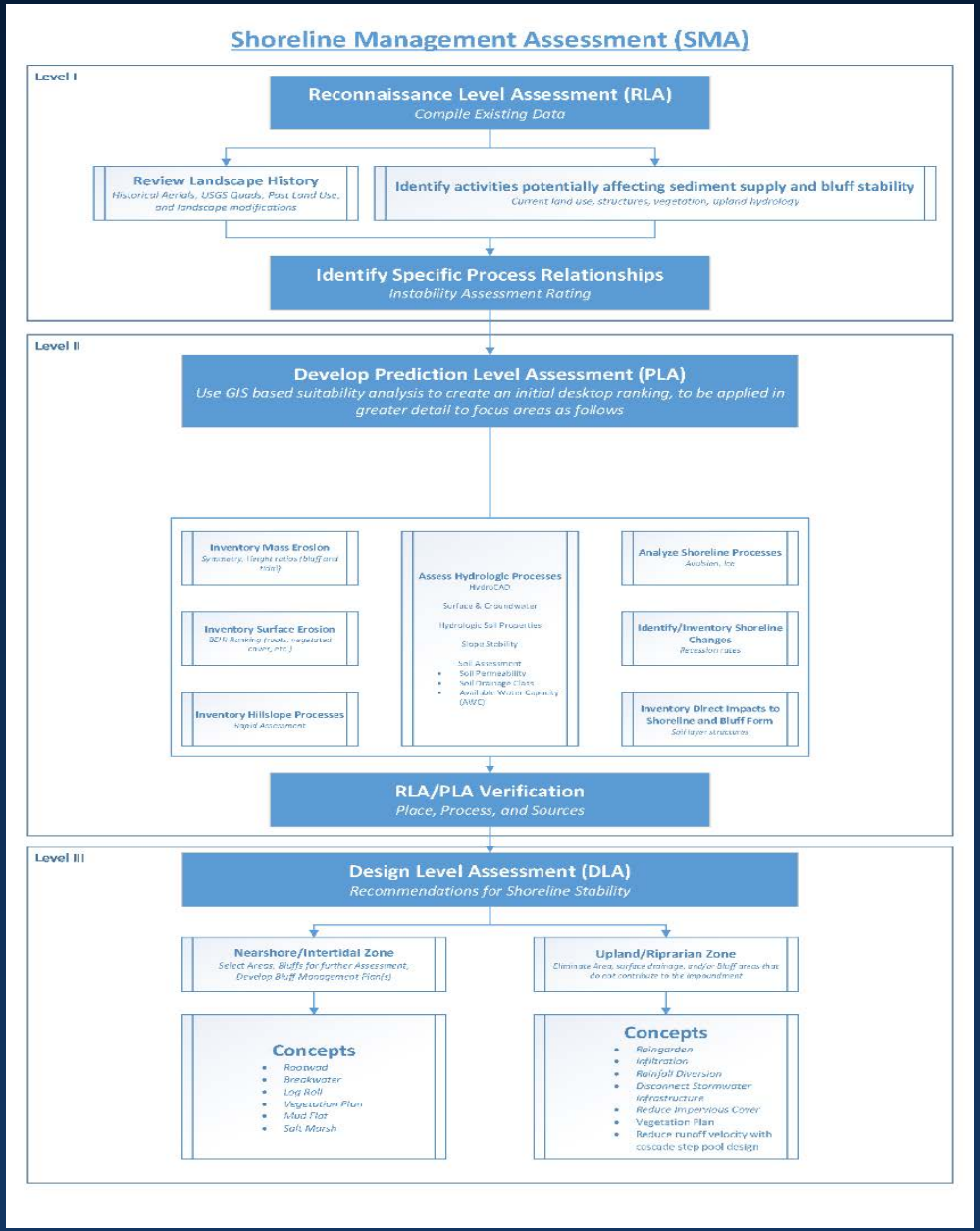
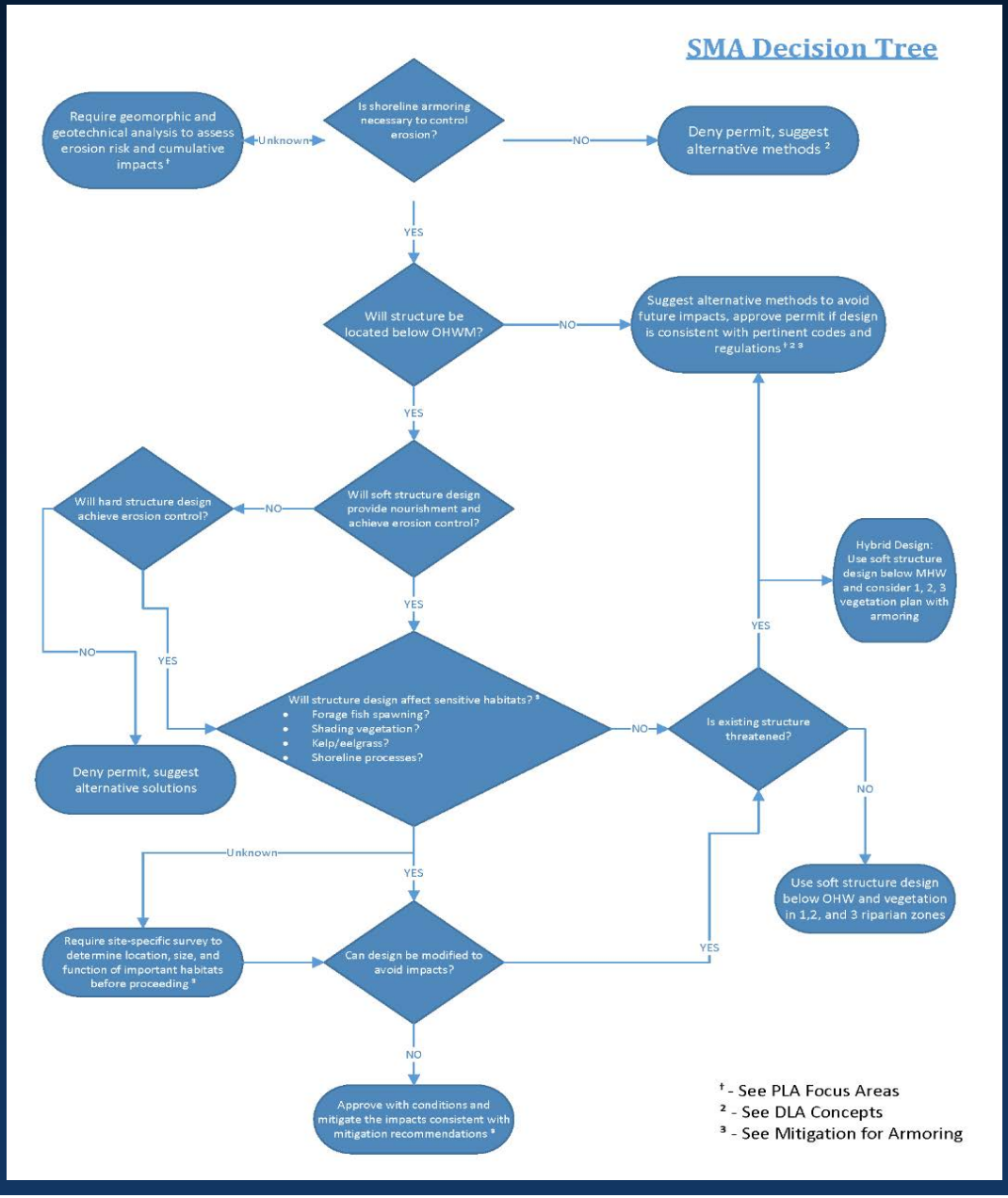


# SMA Decision Tree

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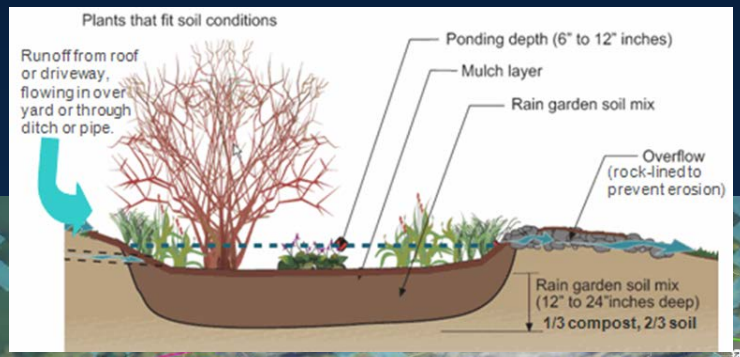
# Ecological Advantages of Living Shorelines

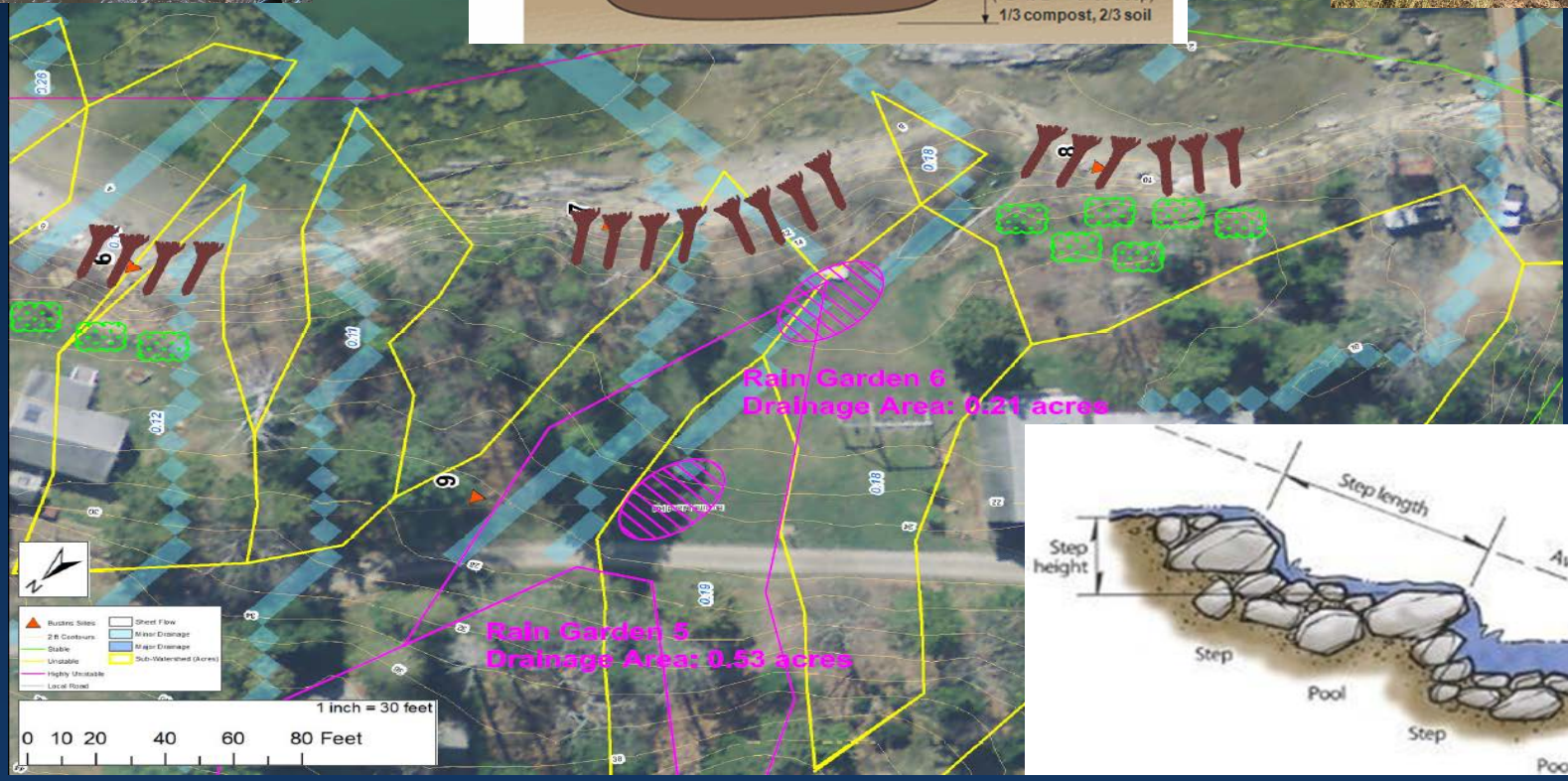
- Shallow water habitat = higher abundance and diversity of aquatic species both nearshore and offshore.
- Maintain a link between aquatic and upland habitats, providing shoreline access for wildlife and recreation.
- Maintains natural aesthetic.

# Physical Advantages of Living Shorelines

- Improve water quality by settling sediments and filtering pollution.
- Absorb wave energy, storm surge and flood waters.
- Maintain natural shoreline dynamics and sand movement.
- Costs comparable to “structural” options

# Conceptual Biomimicry



# Living Stabilization

- What works for ME
  - Each site is unique
    - RLA-PLA-DLA
  - Ecological & Physical advantages
  - Project implementation, Collaboration & Monitoring
- Guidelines

Cumberland County Soil & Water Conservation District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