

New Jersey Institute of Technology (NJIT) Technical Assistance to Brownfield Communities (TAB)

Creating Living Shorelines to Enhance Brownfield Sites Webinar

Elizabeth Limbrick, NJIT TAB (Moderator)

Laura Schwanof, RLA, NJIT TAB (GEI Consultants)

Frank McLaughlin - NJDEP

May 29, 2014

973-642-4165 (Hotline)

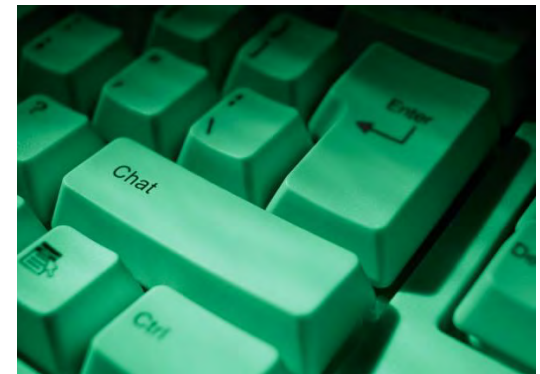
Webinar Overview

- ❑ Logistics
- ❑ NJIT TAB Overview
- ❑ Overview of Living Shorelines
 - ❑ 4 Guiding Principles for Design
 - ❑ Tools
- ❑ **Q&A Break**
- ❑ Case Study
 - ❑ Harrison Avenue Landfill Site, Cramer Hill, Camden, NJ
- ❑ **Q&A Discussion** / Wrap-Up



Logistics

- We will put all participants on mute
- Please submit questions using the chat window
- Webinar is scheduled for 1 hour
 - Web room will remain open at the end of the hour to answer questions
- The webinar will be recorded and will be posted on our website www.njit.edu/tab
- Technical Difficulties
 - use chat function
 - or call 973-642-4165



What is TAB?

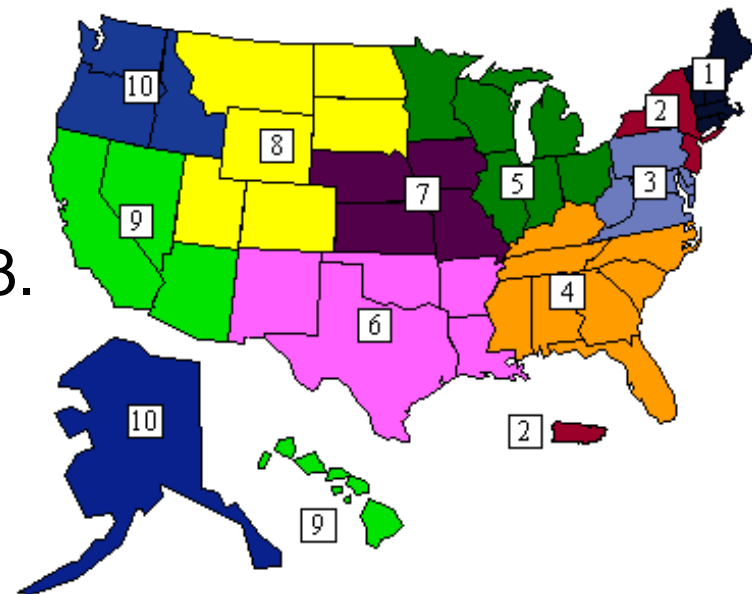
TAB is a technical assistance program, funded by the USEPA, which is intended to serve as an independent resource to communities and nonprofits attempting to cleanup and reclaim brownfields.

NJIT's TAB program covers communities in EPA Regions 1 and 3.

Refer to EPA's website for other regions:

http://epa.gov/brownfields/grant_info/tab.htm

Kansas State and CCLR



Who Can Receive NJIT TAB Assistance?

- ✓ Communities, regional entities and nonprofits interested in brownfields



What are NJIT TAB Services?

NJIT TAB can provide **free** assistance throughout the brownfield process,

- ▣ from getting started
- ▣ to staying on track
- ▣ to getting the job done.



All services must be **aimed at achieving Brownfields clean up and development** and be consistent with Region 1 and 3 programs.

Examples of NJIT TAB Services

- One-on-One Technical Assistance
- Review , Analysis, and Interpretation of Technical Reports
- Assistance with Procuring Consultants
- Brownfields Workshops
- Webinars



NJIT TAB CONTACT INFORMATION

NJIT TAB Hotline 973-642-4165 tab@njit.edu

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Meet the Presenters

- ❑ BSc SUNY Environmental Science & Forestry, Syracuse, NY
- ❑ NYS Licensed Landscape Architect (1994)
- ❑ 33 Experience - 10 years initially with USDA Soil Conservation Service/NRCS; Environmental Consulting EEA - GEI March 2012
- ❑ Broad ecological services background in botany, ichthyology, birds & mammals, water resources, environmental impact analysis, and specialized in wildlife habitat management, wetland enhancement, and vegetative shoreline stabilization



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Brownfields on Shorelines

- Historic industrial and commercial development along waterfronts.
- Driving Regulatory and Public Concerns
 - ▣ Coastal/shoreline Resiliency
 - Increased concern over flood and natural hazard protection and mitigation
 - Protection of property from erosion/sea level rise
 - ▣ Environmental Remediation
 - Regulatory requirements for environmental restoration



Goal: Increase Coastal Resiliency

- Initial Site Assessment Process
- 4 Guiding Principals for Design
- Tools for implementation – examine conventional, green and hybrid techniques
- Requisite follow-up to ensure project success
- Real-time application & case study
- Harrison Avenue Landfill Site, Cramer Hill Camden, NJ

What is a Living Shoreline?

“A shoreline management practice that provides **erosion control** benefits; protects, restores or enhances **natural shoreline habitat**; and **maintains coastal processes** through the strategic placement of plants, stone, sand fill, and other structural organic materials (e.g., biologs, oyster reefs, etc.).”

- NOAA Shoreline Glossary

“PROTECTS, RESTORES & ENHANCES NATURAL HABITATS & COASTAL PROCESSES...”



BEFORE:

Mid 1900's method of stabilizing shorelines using various forms of construction debris....

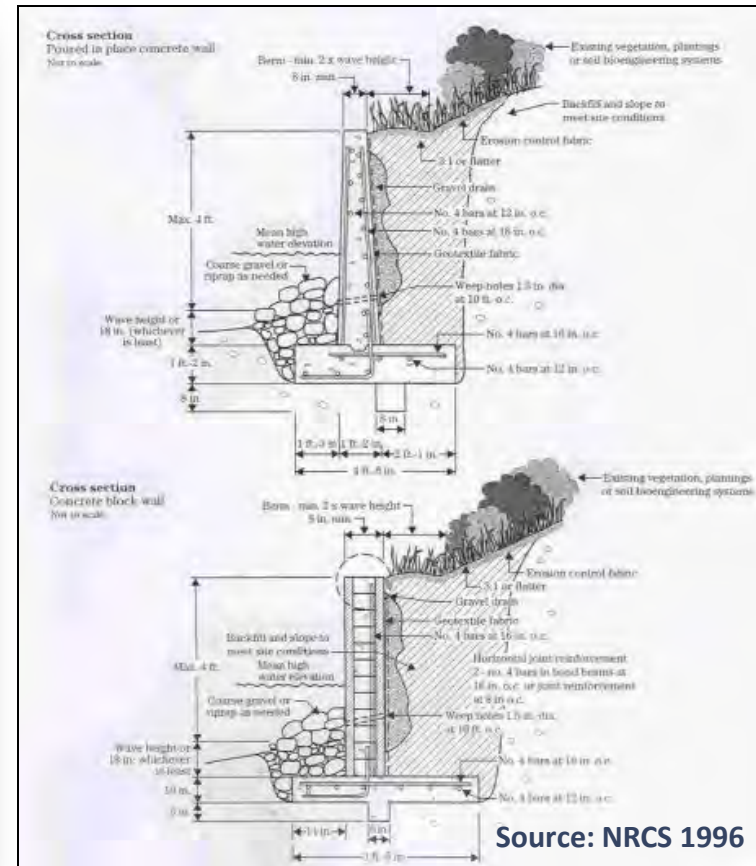
AFTER:

Replacing rubble with clean backfill, controlling toe erosion and restoring ecological function & value



CONVENTIONAL SHORELINE STABILIZATION TECHNIQUES

- Erosion control; but no habitat or coastal processes benefits

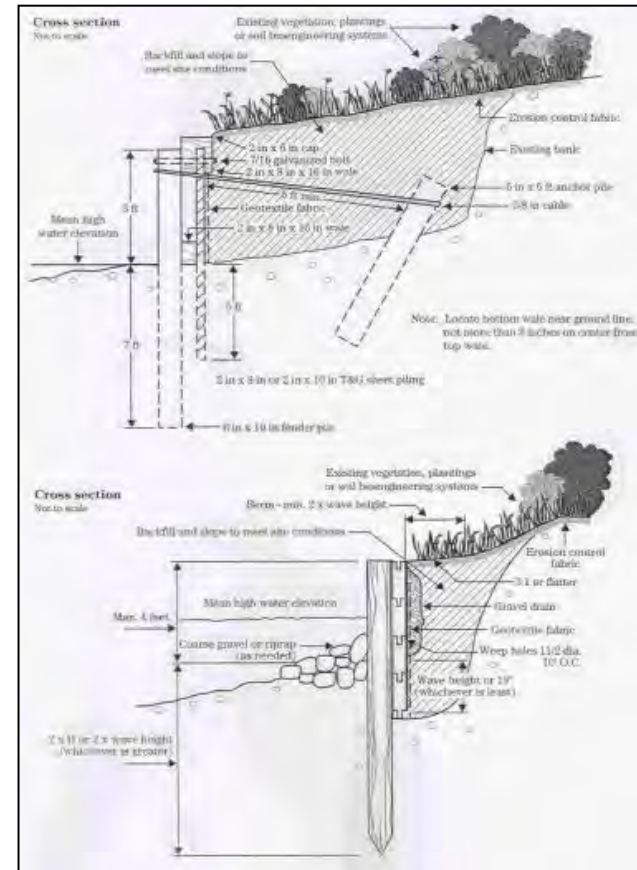


CONVENTIONAL SHORELINE STABILIZATION TECHNIQUES

- Erosion control; but minimal habitat or coastal processes benefits



**Timber or Sheet
Pile Bulkheads**

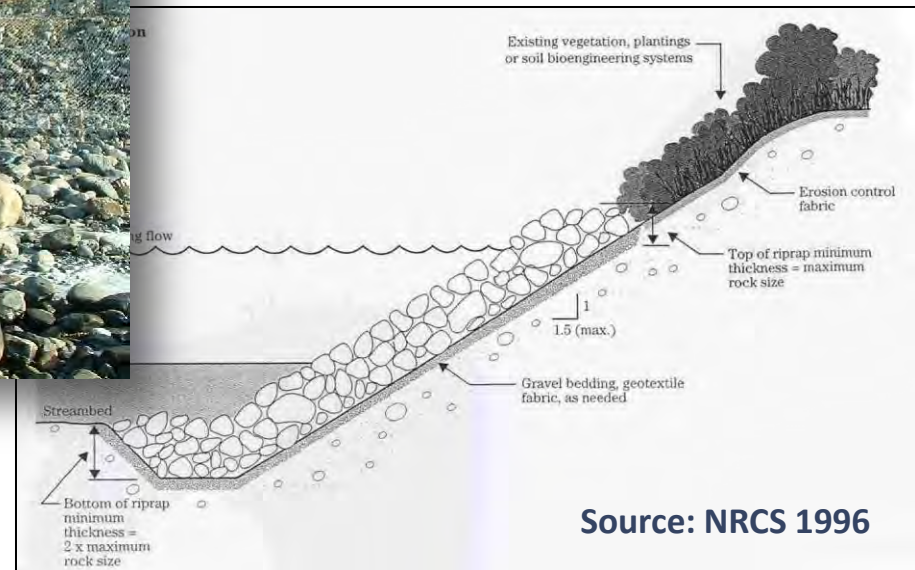


CONVENTIONAL SHORELINE STABILIZATION TECHNIQUES

- Erosion control & some habitat and coastal processes benefits



Rock Gabions



Source: NRCS 1996

Why? ...Consider Cost Benefits:

Treatment	Relative Complexity	Relative Cost
Conventional vegetation	Simple to Moderate	Low
Live Stake	Simple	Low
Joint Planting	Simple	Low
Live Fascines	Moderate	Moderate
Brushmattress	Moderate to complex	Moderate
Live Cribwall	Complex	High
Branchpacking	Moderate to complex	Moderate
Conventional bank armoring	Moderate to complex	Moderate to High

Table based on “Streambank Erosion Protection Treatment Relative Costs and Complexity”
(Fischenich and Allen 1999)

What works...what doesn't?

Vegetative Treatment Potential Rating Sheet

TABLE 1 VEGETATIVE TREATMENT POTENTIAL FOR ERODING TITLE SHORELINES IN THE MID-ATLANTIC STATES

DIRECTION FOR USE

1. Evaluate each of the first four shoreline variables and match the site characteristics of the variable to the appropriate descriptive category.
2. Place the Vegetative Treatment Potential (VTP) assigned for each of the four variables in the right hand column.
3. Obtain the Cumulative Vegetative Treatment Potential for variables 1, 2, 3 & 4 by adding the VTP for each.
4. If it is 23 or more, the potential for the site to be stabilized with vegetation is very good and the rest of the table need not be used. If it is below 23, go to step 5.
5. Determine the VTP for shoreline variables 5 through 9 and obtain the cumulative VTP for variables 1-9.
6. Compare the cumulative VTP score with the Vegetative Treatment Potential Scale at the bottom of this page.

SHORELINE VARIABLES	DIRECTION FOR USE The Vegetative Treatment Potential (VTP) is Located in Upper Left Hand of Each Category Box					VTP
1. Fetch: Average distance in miles of open water measured perpendicular to the shore and 45° either side of perpendicular to shore.	8 Less than 0.5 miles	7 0.5 thru 1.4 miles	4 1.5 thru 3.4 miles	2 3.5 thru 4.9 miles	0 over 5 miles see footnote 1/	
2. General shape of shoreline for distance of 200 yards on each side of planting site.	0 Coves	3 Irregular shoreline	0 Headland or straight shoreline			
3. Shoreline orientation: General geographic direction the shoreline faces.	0 Any orientation less than one-half mile fetch	3 West to North	2 South to West	1 South to East	0 North to East	
4. Boat traffic: Proximity of site to recreational & commercial boat traffic	5 None	3 1-10 per week within 1/2 mi. of shore	2 More than 10 per week within 1/2 mi. of shore	1 1-10 per week within 100 yds. of shore	0 More than 10 per week within 100 yds. of shore	
Cumulative Vegetative Treatment Potential for Variables 1, 2, 3 & 4 If this score is 23 or above, the potential for the site is very good and the rest of the table need not be used. If it is below 23, go to step 5 below.						
5. Width of Beach Above Mean High Tide in Feet	3 Greater than 10'	2 10' thru 7'	1 6' thru 3'	0 Less than 3'		
6. Potential width of Planting Area in Feet	2 More than 20'	2 20' thru 15'	1 14' thru 10'	0 Less than 10' Do Not Plant		
7. On Shore Gradient: slope from MHW to toe of bank	6 Below 8%	3 8 thru 14%	1 15 thru 20%	0 over 20%		
8. Beach Vegetation	3 Vegetation below toe of slope	0 No vegetation below toe of slope				
9. Depth of sand at Mean High Tide in inches	3 More than 10"	2 10" thru 3"	0 Less than 3"			

Cumulative Vegetative Treatment Potential for Variables 1-9

1/ Do not plant or see page 9 and figure 9 for possible exception.

2/ If tidal fluctuation is 2.5 feet or less, measure from MHW to toe of bank. If tidal fluctuation is over 2.5 feet, measure from MHW to toe of bank. See page 7 for more information.

3/ Refer to Table of Sand Deposition by Littoral Cells and use appropriate.

VEGETATIVE TREATMENT POTENTIAL SCALE		Potential of Site to be Stabilized with Vegetation
If the VTP is:	Between And	
40	33	Good
32	24	Fair
23	16	Poor
below 16		Do Not Plant

4 Guiding Principals

1. Consider the Length of Open Water or Fetch
2. Control Drainage
3. Determine the Natural Angle of Repose
4. Protect the Base of the Slope or Toe

#1 – Consider Length of Fetch



When vegetation alone just won't do...

#2 – Control Drainage



Both Overland Flow...



...and Subsurface Seeps

#3 – Natural Angle of Repose

Defined as the maximum slope at which loose solid material will remain in place without sliding and the slope remains stable...

...and the critical slope where vegetation used alone will provide long-term stabilization.



Modifying that angle will require some form of structural support.

#4 – Toe Protection is Critical



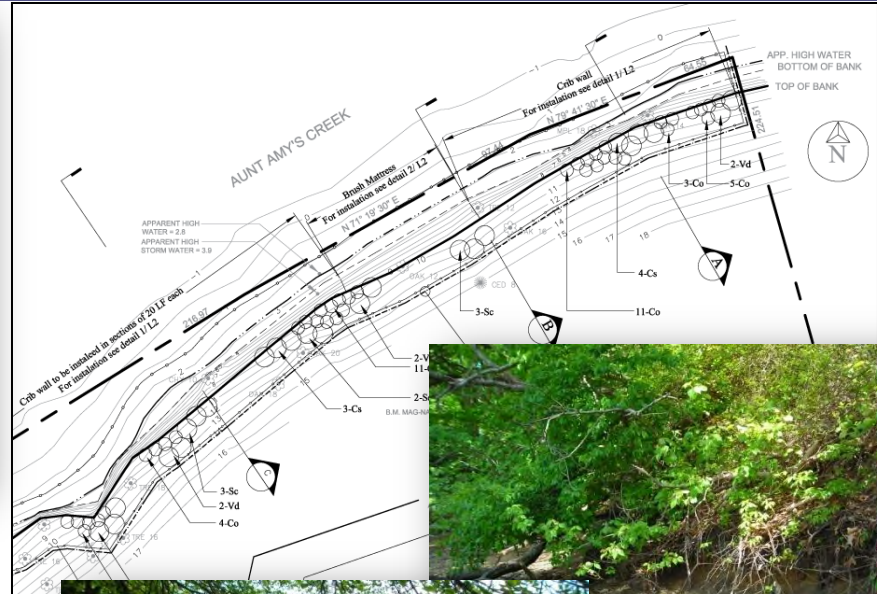
However, careful planning, selection and installation is equally important...



Choice of Treatment



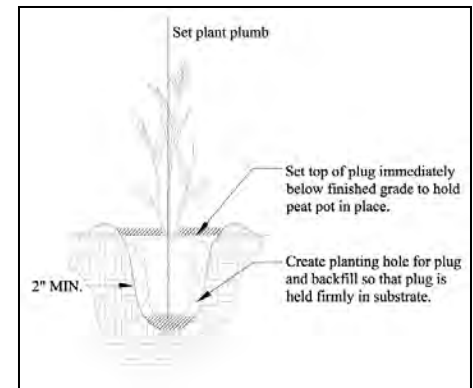
1. **Plants as Primary Support**
(5:1 and flatter)
2. **Plants with Erosion Control**
(5:1 to 3:1)
3. **Plants as Structural Support**
(3:1 to 2:1)
4. **Plants with Additional Structural Support**
(2:1 and steeper)



1. Plants as Primary Support



- 5:1 (horizontal: vertical) or flat ground
- Not seeded
- Low energy environment
- No concentrated surface flows (sheet flow only)



Planting Plugs



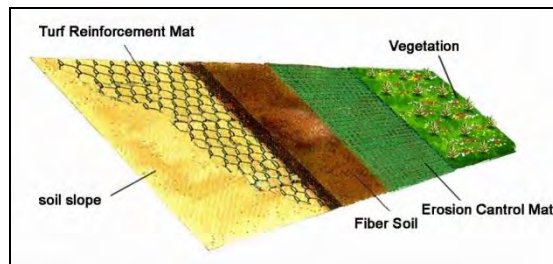
2. Plants With Erosion Control

- 5:1 to 3:1 (horizontal: vertical)
- Seeded
- Low energy environment
- Sheet flow only

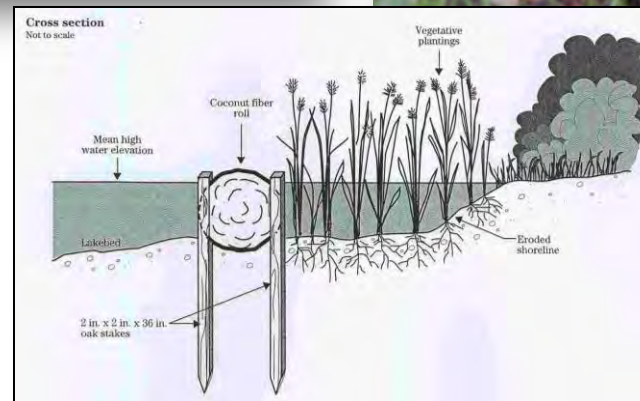
Erosion Control Blankets & Mats



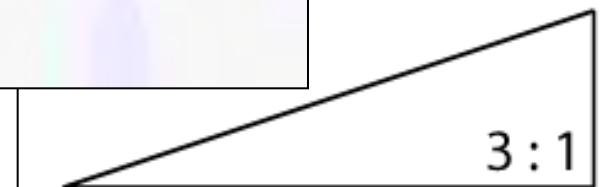
Coir Pallets



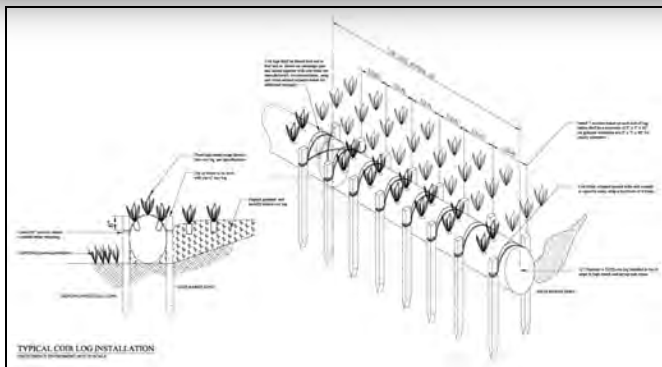
Hydro Mulching



Coir Logs



Coir Logs

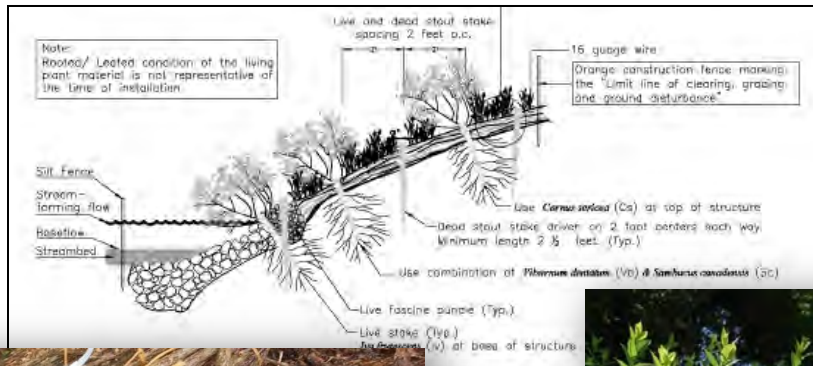


Tidal and Streambank Application for Toe Protection and Benched Plantings

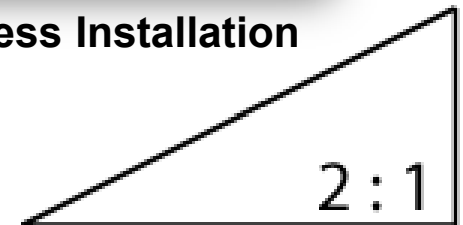


3. Plants as Structural Support

- 3:1 to 2:1 horizontal/ vertical
- Low to moderate energy environment
- Seeding may be included



Brushmattress Installation



Live Stakes

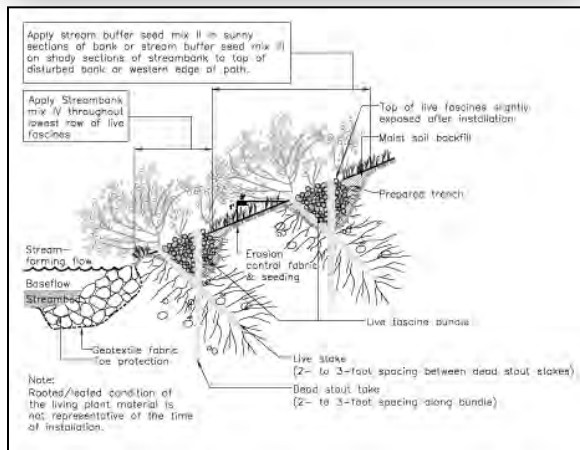


New Jersey's Science & Technology University

Technical Assistance for Brownfields

www.njit.edu/tab

Live Stakes & Fascines



Brushmattress

- Live Stakes
- Dead Stakes
- Fascine Bundles
- Galvanized Wire Webbing
- Seeds



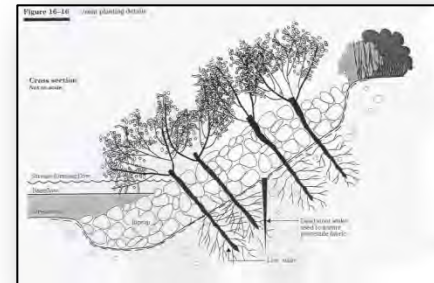
4. Plants With Additional Structural Support



Live Crib Walls

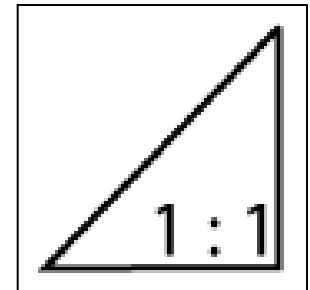
- **2:1 < Approaching Natural Angle of Repose**
- **Low to Moderate Energy Environments**

(On steeper slopes & high energy environments structural stabilization **MUST** predominate)



Vegetated Rip Rap

Source:
Terra Erosion Control Ltd.



Live Crib Wall



Installation of Structure

Live Crib Wall



QUALITY CONTROL & QUALITY ASSURANCE

Build Into Contract:

- Professional Design Team
- Construction Observation
- Long Term Monitoring

Design Phase:

- Consider Long Term Performance Standards (85%-90% - If You Can't Meet It – Don't Propose It...)

Remember:

- Post Construction Monitoring Spans 2 to 5 Years (1 Year Guarantees May Not Be Adequate)



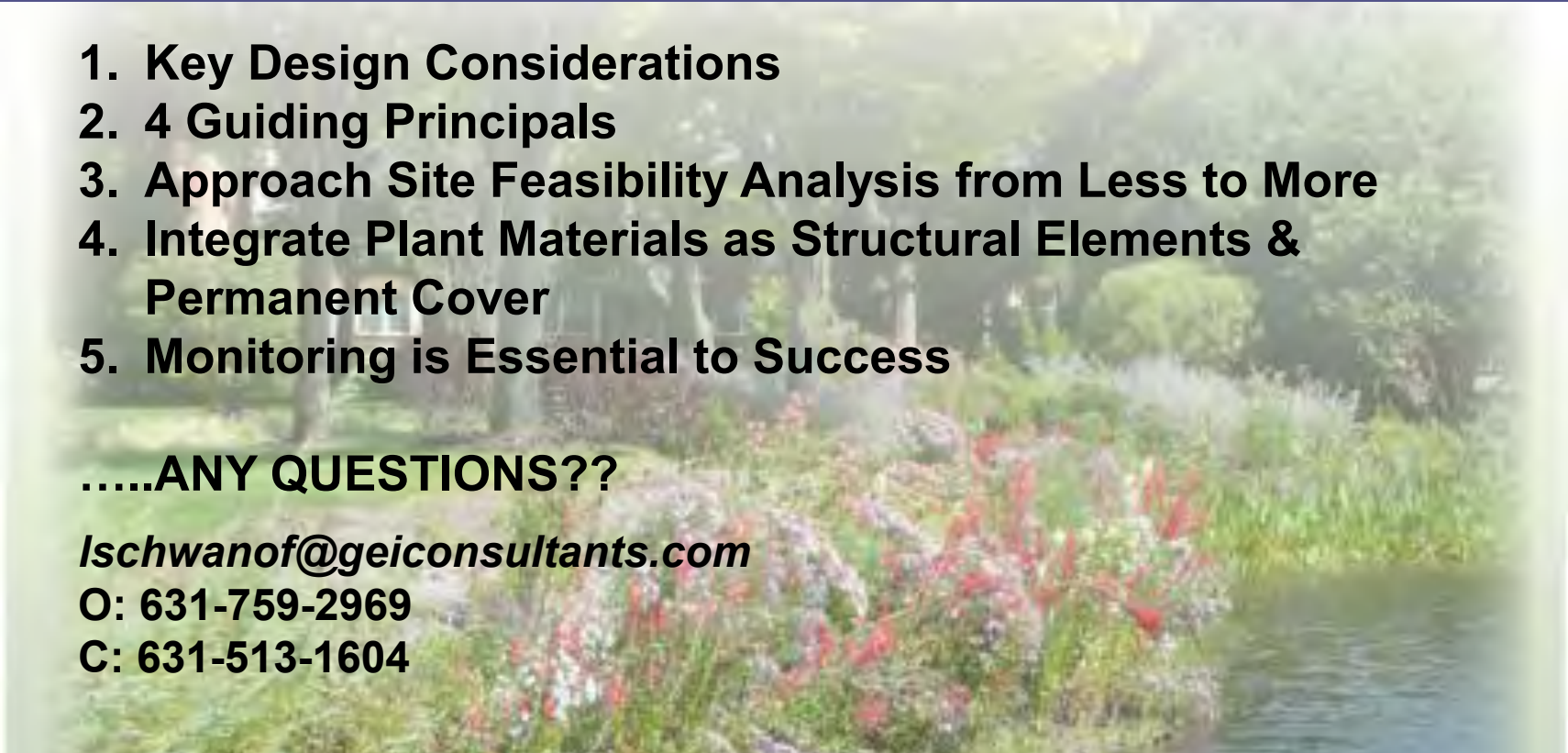
MULTIFUNCTIONAL LIVING SHORELINE:



- ✓ Flood control;
- ✓ Stormwater treatment;
- ✓ Wetland enhancement
- ✓ Shoreline retreat;
- ✓ Invasive plant removals



Part I Conclusion

- 
1. Key Design Considerations
 2. 4 Guiding Principals
 3. Approach Site Feasibility Analysis from Less to More
 4. Integrate Plant Materials as Structural Elements & Permanent Cover
 5. Monitoring is Essential to Success

.....ANY QUESTIONS??

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Living Shorelines offer Sustainable Solutions, have Built-in Flexibility for Permanence and Support Biodiversity

Meet the Presenters



- NJDEP Brownfield Project Manager (2004-present)
- NJDEP Camden Collaborative Initiative (2013-present)
- NJDEP Hydrogeologist (1988-2003)
- BS Fairleigh Dickinson University, Chemistry (1985)
- MS Rutgers University, Geological Sciences (1988)
- MS Rutgers University, Environmental Sciences (2006)
- Adjunct Professor, Ramapo College (2008-present)

Frank McLaughlin

NJDEP Office of Brownfields Reuse

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Living Shorelines on Brownfields in Camden

Resiliency to Storm Events and Sea-Level Rise
Reconnect community to waterfront
Improved in-stream water quality
Enhanced ecological value
Economic and community development



Camden: old & deteriorated water infrastructure

...vulnerable to both stormwater & tidal flooding...

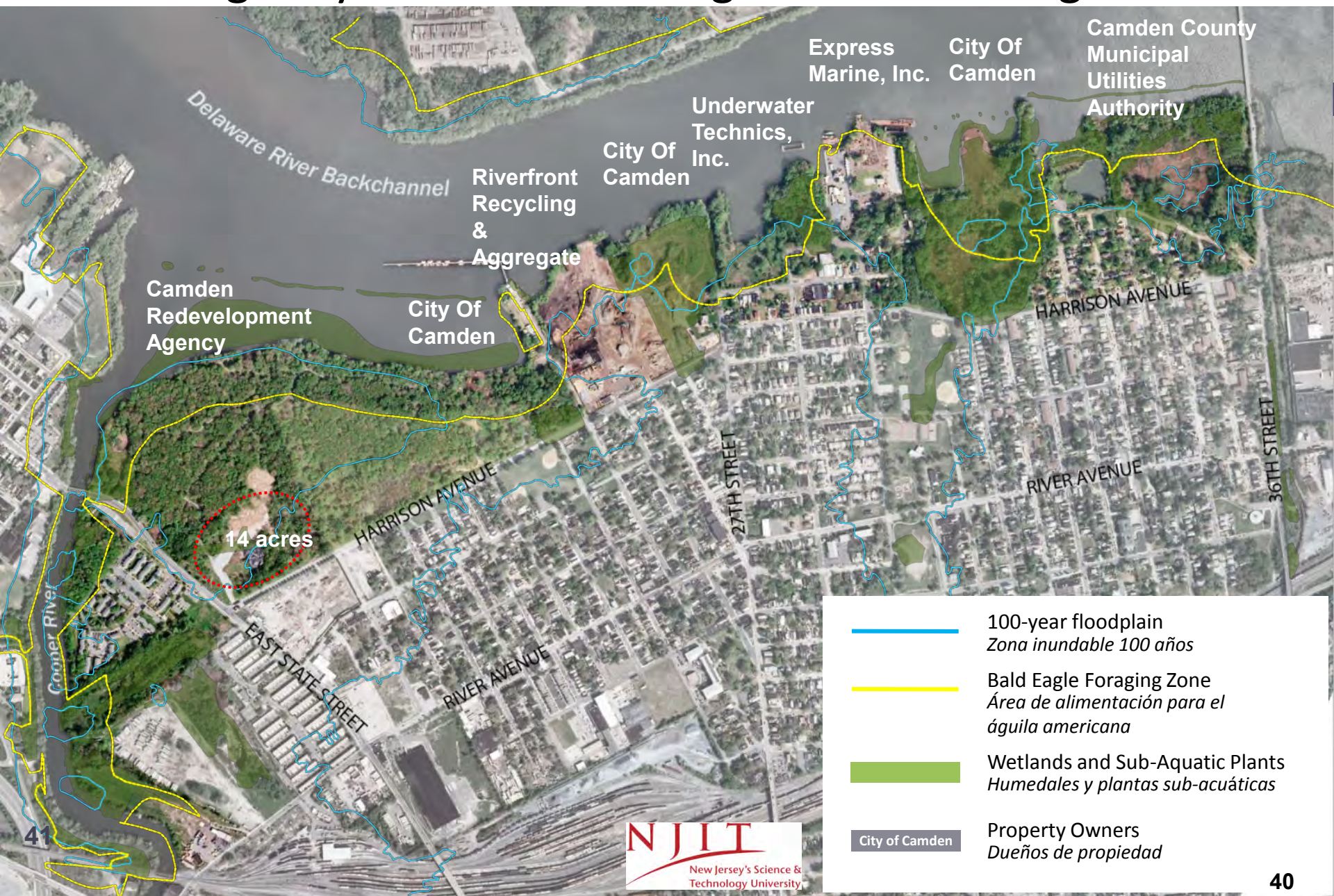







Residents ranked flooding as the #1 environmental problem in many of Camden's neighborhoods...



Cramer Hill (Camden, NJ)–Waterfront brownfields...

Ecologically-valuable area & great fit for living shorelines



-  100-year floodplain
Zona inundable 100 años
-  Bald Eagle Foraging Zone
Área de alimentación para el águila americana
-  Wetlands and Sub-Aquatic Plants
Humedales y plantas sub-acuáticas
-  City of Camden
-  Property Owners
Dueños de propiedad





Harrison Ave Landfill: *Largest Site in Camden; Confluence of Delaware & Cooper Rivers*

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Harrison Ave Landfill: Site Conditions



85 acres; operated 1952-1971

Municipal Solid Waste

No landfill cover (*leaf litter 'cap'*)

Mature vegetation (*40-60 years*)

Endangered species

(eagles, FW mussels, fish)

~1 mile river frontage (*2 rivers*)

In Cramer Hill neighborhood

**Largest site in city & valuable
ecological tract...**

...Vision & Plan for Reuse...

Solid Waste Landfill Closure Alternatives:

Subtitle D

Alternative Cap



(NOTE: for large landfills >50 acres)

Typical Closure: ~\$250,000/acre

LF Gas System: ~\$25,000/acre

Annual O&M: ~\$40,000 (early)

No Beneficial Reuse



Closure: \$100,000-200,000/acre

LF Gas System: not required

Annual O&M: ~\$10,000 (early)

Beneficial Reuse for Community



Harrison Ave Landfill Reuse: Salvation Army Community Center ...plans for waterfront park & greenway with living shoreline

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Constructed Wetlands

Living Shoreline

Bioretention Basins

Kroc Center
(opens October 2014)

Green Remediation Techniques:

Use of Local Dredge Material for Cap
Alternate (Permeable/Vegetative) Cap

Green Infrastructure Elements:

Permeable / Water infiltration Cap
~1.1-acre constructed wetlands
2000 feet bioretention basins
>25 million gallons annually of
stormwater management

no connection to adjacent CSO...

Restoration of Riparian Corridor:
living shoreline & wetlands creation

Project Partners:

Salvation Army Camden/Kroc Found.
Camden Redevelopment Agency
NJ Dept. of Environmental Protection
Cramer Hill Community Dev't Corp
Cooper's Ferry Partnership
US Environmental Protection Agency

Harrison Ave Landfill: Existing 'Naturalized' Shoreline

Provides living shoreline model, materials & 'seeds' for success

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Delaware River Mussel Surveys



- Abundant & important
- 7 different species
- Several sites sampled
- Filtration: millions gallons/day



Main Line Health

Health & Science

MONDAY, JANUARY 17, 2011

SECTION D

The Philadelphia Inquirer

WWW.PHILLY.COM



Surprising survivors

In an urban stretch of the Delaware River, a researcher found imperiled species of freshwater mussels, valuable as aquatic vacuum cleaners.

By Sandy Bauers
INQUIRER STAFF WRITER

If not for the heat of a summer day, one of the major biological finds in the Delaware River in recent years might not have occurred.

It was June, and researchers were scouring the banks and shallows of the river between Trenton and Philadelphia for evidence of freshwater mussels, important water-filtering organisms that are becoming increasingly hard to find in the region's streams.

Danielle Kreeger, science director of the nonprofit Partnership for the Delaware Estuary, had spotted shells along the banks during a wetlands project, and she wanted to see



Researcher Danielle Kreeger unexpectedly found seven species of mussels — two thought to be locally extinct — in the river.

if live mussels were in the river nearby. So far, no luck.

But Kreeger, who was out on the river in a boat, got hot. Putting on her mask and snorkel, she slipped into the river and swam through the murky water toward the bottom. Suddenly, she saw them. The riverbed was studded with mussels. They weren't the edible kind, but it was better still — a seven-species mother lode including two species thought to be locally extinct. One, the tidewater mussel, hasn't been seen in this area for more than half a century. The discovery bodes well for the mussels and the river itself.

"I stayed underwater for quite a while," See **MUSSELS** on D2



The newfound mussel species include (from left) creeper; yellow lampmussel; and ellipto.



Harrison Ave Landfill: Living Shoreline Design Elements



Recontour & Replant Shoreline

Enhance Existing Mussel Beds & Submerged Aquatic Vegetation

Landfill consolidation...

Creates Tidal Stream + Wetlands

*Mussels...filter 4.6 million gallons water/day
& remove 6.1 tons particulates/day*



Harrison Ave Landfill: Living Shoreline Restoration Concept



DRAFT for discussion only





Harrison Ave Landfill: Living Shoreline Restoration

'Resilient' Remediation & benefits extend beyond site...



Landfill consolidation provides...

Added Value to Community

access to waterfront

open space & recreation

education / stewardship

reduces tidal flooding

Enhanced natural resources

Water quality benefits

New mussel habitat could...

filter 4.6 million gallons water/day

& remove 6.1 tons particulates/day

Vision realized...landfill transformed into assets

Kroc Community Center & neighborhood re-connected to waterfront...
living shoreline protects from tidal flooding & improves water quality & habitat



Brownfields to Living Shorelines in Camden: PHOENIX PARK

Connects Waterfront South to river
Creates 5.5-acres of open space
manages >5 million gallons of stormwater
(Funding: NJ Environmental Infrastructure Trust)

CCMUA Sewage Treatment Plant

Phoenix Park



Phoenix Park Living Shoreline Conceptual Design
Prepared by the Partnership for the Delaware Estuary 2014



Living Shorelines Webinar

Final Wrap Up Q&A/Discussion

NJIT TAB CONTACT INFORMATION

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