



Maurice River and Johnson Creek Soil Bioengineering Stabilization and Restoration

Geosynthetics Conference
Charleston, South Carolina

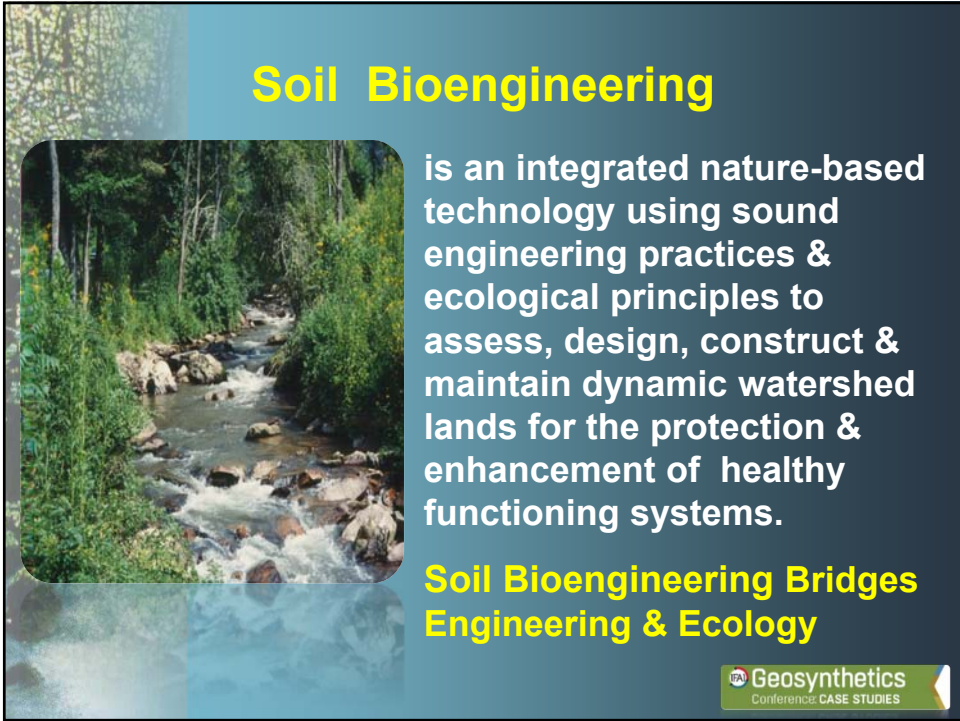
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March 9, 2020

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Soil Bioengineering



is an integrated nature-based technology using sound engineering practices & ecological principles to assess, design, construct & maintain dynamic watershed lands for the protection & enhancement of healthy functioning systems.

Soil Bioengineering Bridges Engineering & Ecology

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Vegetated Reinforced Soil Slope VRSS Systems

Highly Flexible, Advanced State of the Art” Channel Design Technology

- Provides Ecologically Diverse Foundations for Healthy Habitats on steep sites
- Enables Woody Plants to grow in Steep Slopes at > natural angle of repose (45 to 70 deg.)
- Useful in Narrow Corridors
- Fully Engineered Systems



Vegetated Reinforced Soil Slope



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CASE STUDY

Maurice River Ware Avenue Waterfront Millville, New Jersey

Project Type: Waterfront Improvements
Lineal Park along Ware Ave. & Maurice River w. New Public Marina

Riverbank Stabilization & Restoration

Construction: 2004

Agency: City of Millville, New Jersey

Funding Agency: Green Acres Grant
State of New Jersey



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Maurice River Ware Avenue Waterfront

Project Length: Phase I – 650' long
Phase II 2,000' long

Bank Heights: 9' to 15'

Tidal Influenced River System

Urban Setting – Commercial

Damaged / Failing Riverbank w. concrete,
asphalt rubble & scrub vegetation

unstable banks

aesthetically unpleasing w. little to no
riparian or aquatic habitat value

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Maurice River Ware Avenue Waterfront

Construction Challenges & Opportunities

Challenges: Tidal Influence: Twice daily 6' fluctuations

Narrow working corridor between river & Ware Avenue traffic

Endangered Migratory Fish Run (Alewife & Blue Herring) - No construction below SHW by March

Opportunities: Night construction to work around tides for foundation installation (MLW – SHW) & Less traffic

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Maurice River Ware Avenue Waterfront Millville, New Jersey



Project 2003

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Maurice River Ware Avenue Waterfront Environmental & Structural Requirements



- Stabilize riverbank
- Improve water quality - fish migration
- Enhance aquatic & riparian habitat
- Improve River nature connection experience for Park users - Enhance Recreation opportunities
- Improve aesthetics
- Low maintenance solution

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Maurice River Ware Avenue Waterfront Environmental & Structural Improvements Plan

Riparian Habitat Enhancement:
Native woody & herbaceous plants

**Improve Park & River nature connection
experience & aesthetics via:**

- Woody & Herbaceous plant buffer
- Overlooks, Benches, Walking path &
New Marina (Jerry Lewis LA Millville, NJ)



Riverbank Stabilization & Restoration:
Reinforce banks, vegetate & stabilize w. Soil
bioengineering



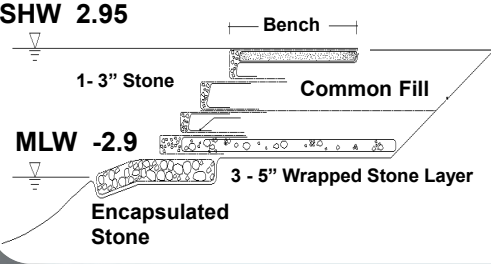
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Maurice River

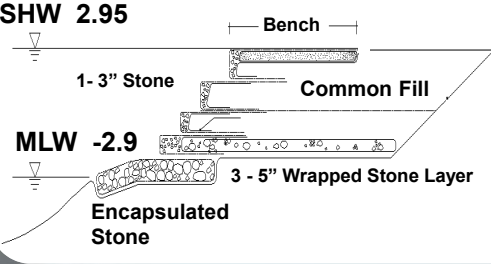
**Foundation: Geogrid & geotextile
wrapped stone & stone &
common fill lifts**





SHW 2.95



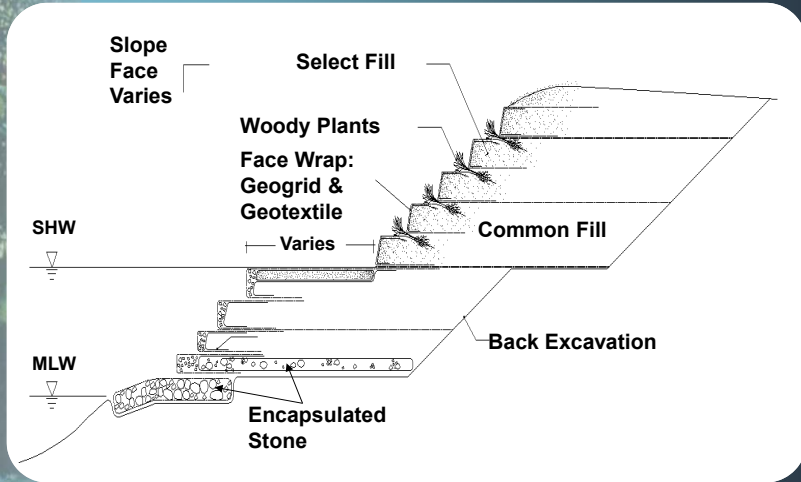
MLW -2.9





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Maurice River



Vegetated Reinforced Soil Slope (VRSS) System
 1.5H - 1V to .5H to 1V



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Maurice River



Geogrid, batter board & geotextile



Select & Common fill

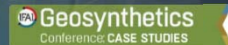


Secured geogrid & geotextile



Plant installation

Upper VRSS Wraps Installation Above SHW



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Maurice River





VRSS immediately after construction




Plant angles & density
 6 woody & 4 herbaceous
 plant species
 Spacing ranged 1.5' to 2' OC




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Maurice River Ware Avenue Waterfront

First Summer - 2005



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Maurice River

2003

2009 – 5th year of Development
Overhanging cover (fish habitat)

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**Maurice River Ware Avenue Waterfront
Millville, New Jersey**

J. Lewis

J. Lewis

2019 – 15th Year of Development

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**Maurice River Ware Avenue
Waterfront Millville, New Jersey**

Stabilization & Restoration Costs - Phase I


Winter/Spring construction 2003 – 2004

Total Construction Cost: \$ 365,000

\$560 per lineal bank foot / \$44 per sq. face foot

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**CASE STUDY
Johnson Creek**

Project Type: Highway, Bridge, Ramp
& Widening at McLoughlin Blvd. (99E),
Stream Relocation, Stabilization &
Restoration

Construction: 1993 - 1994

Agency: Oregon Department of
Transportation (ODOT)

Location: Metropolitan Portland
Milwaukie, Oregon

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Johnson Creek

Existing & Partial Conventional Conditions

Length: 1,500 lineal feet

Bank Heights: 10' to 30'

Residential & industrial neighborhood

Conditions prior to ODOT clearing & associated construction activities

- Well vegetated banks & flood plain
- Healthy riparian zone
- Ecologically healthy system (salmon)

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Johnson Creek



Pre-Construction Conditions:
Stable aesthetically beautiful & ecologically
functioning urban stream (fish migration)

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Johnson Creek

Oregon DOT's Proposal

- Construct wider bridge & access ramp
- Relocate 1,500' of stream section
- Shorten stream & steepen gradient
- Design: Trapezoidal riprap channel lining

Johnson Creek Corridor Committee Concerns

- Water quality degradation
- Aquatic & riparian habitat losses
- High visibility – loss of vegetation/aesthetics
- Project could not be permitted (Fish migration)

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Johnson Creek

Construction Challenges & Opportunities

Challenges: Constricted working area – walls, bridges & low ramp

Work had to be completed in the winter due to salmonid fish migration

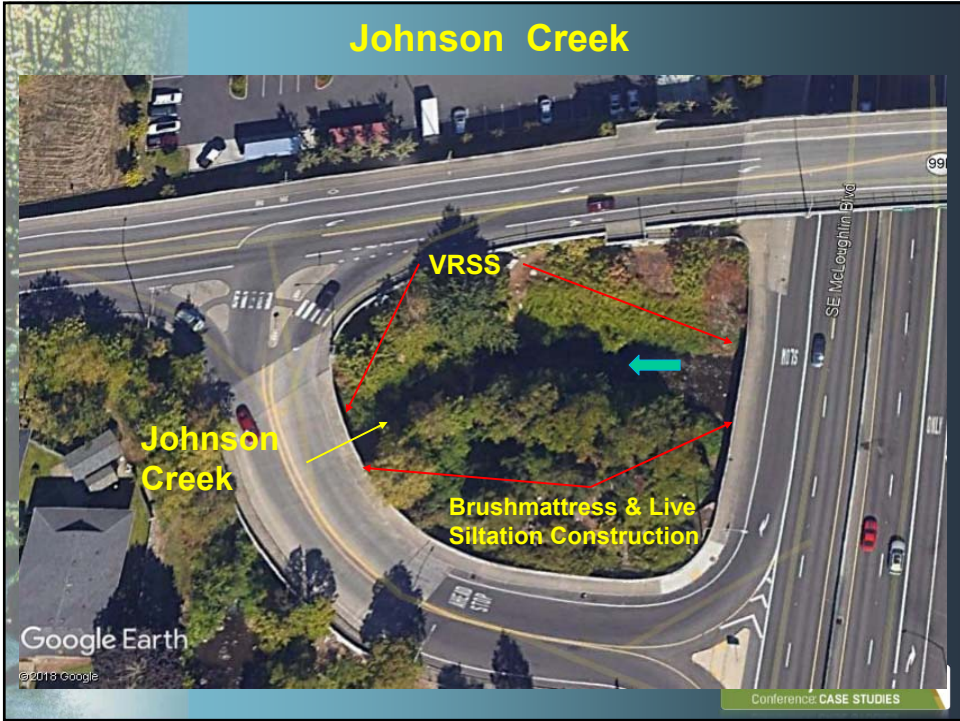
Opportunities: The existing on-site General Contractor constructed the project

Foundation was already in place

Harvesting sites were near by

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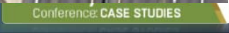
Johnson Creek

VRSS

Johnson Creek

Brushmattress & Live Siltation Construction

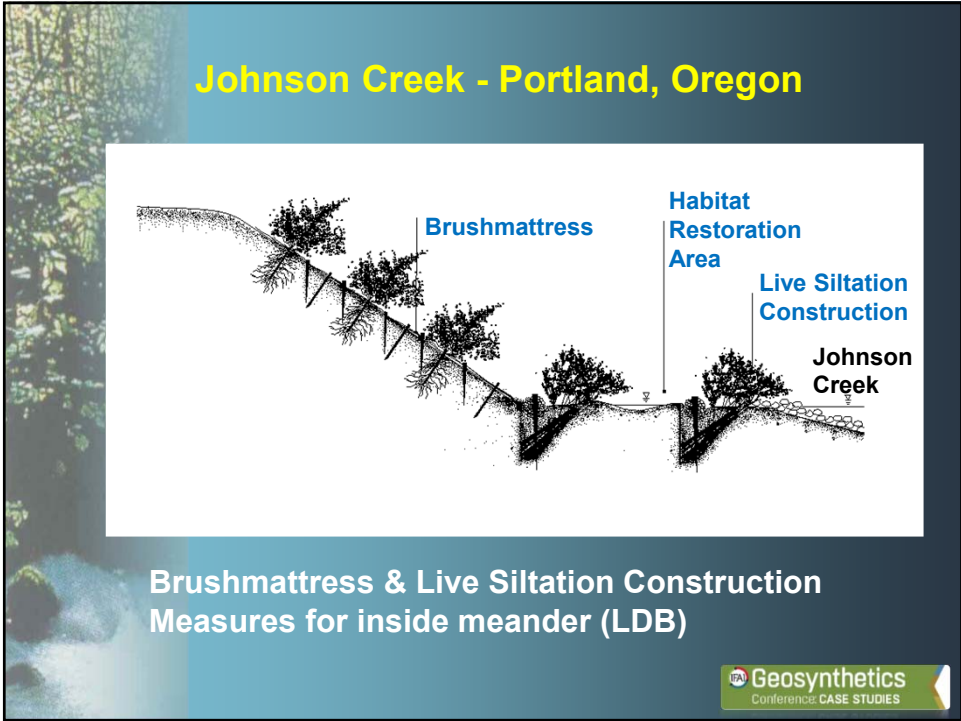
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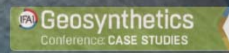
Johnson Creek

Oregon DOT Clearing & Construction 1993

Vegetative Reinforced Soil Slope (VRSS)

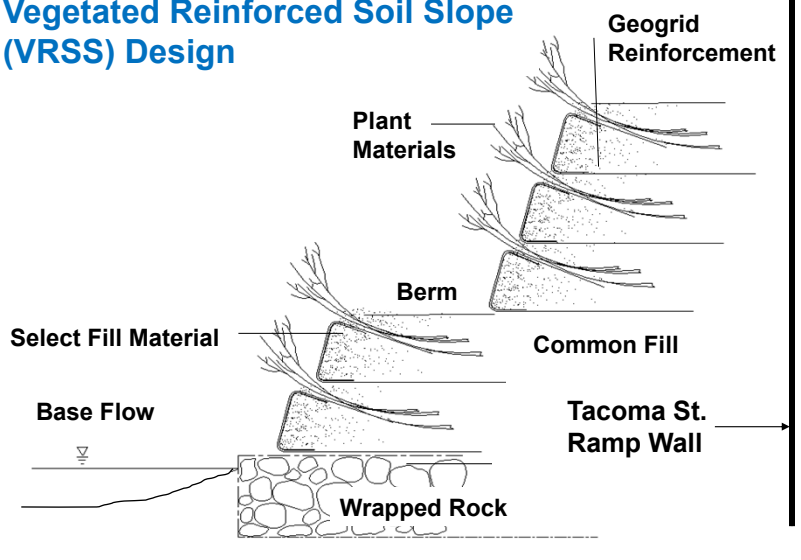


Right Descending Bank



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Vegetated Reinforced Soil Slope (VRSS) Design



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Johnson Creek

Batter Boards, Geotextile, Geogrid & soil Installation

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Johnson Creek

Completing Frontal Secondary/primary Geogrid Wrap: Pulling Geogrid over compacted fill material in preparation for live branches / container plants

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Johnson Creek
VRSS Development

Spring 1994, flood of record, immediately after construction

Summer 1994

Habitat 1995

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Johnson Creek
Vegetated Reinforced Soil Slope (VRSS) Development

1993

6th Season 2000

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Johnson Creek

Stabilization & Restoration Costs

Winter/Spring Construction 1993 - 1994

Costs varies by system:

LDB - \$100 per lineal bank foot:
BM/LSC

RDB - \$ 400 per lineal bank foot: VRSS

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Summary

Soil Bioengineering Technology offered a synergistic composite design with considerable function improvement over either conventional or ecological methods used alone as demonstrated by these projects.

These projects are a testament to the strength & long-term endurance soil bioengineering living VRSS structures provide on waterways.

Thank You