An Improved Soil Layering Technique for Streambank Restoration

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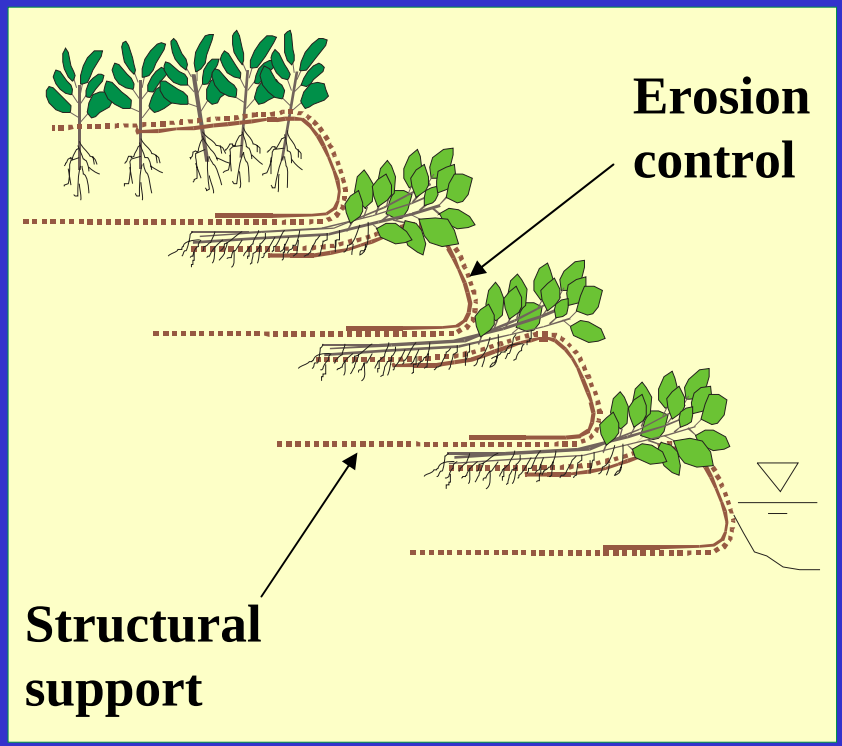
In Soil Bioengineered Streambanks

Phase I - Structural stability (support) and protection against erosion are provided by artificial means.

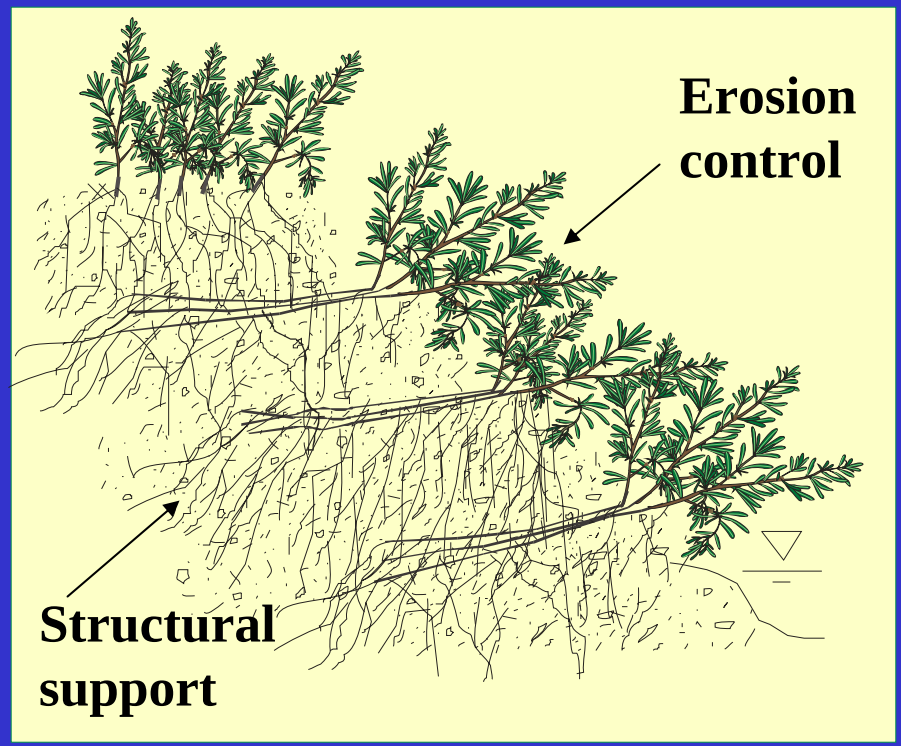
Phase II - Fully or partial structural stability (support) and protection against erosion come from natural vegetation.

Fabric wrapped soil lifts

Phase I



Phase II



A Typical Fabric Wrapped Soil Lift Application

A Typical Fabric Wrapped Soil Lift Application

Concerns of Fabric Wrapped Soil Lifts in Streambanks

- Inner fabric is too thin and degradation is too quick.
- Not enough abrasion resistance.

Findings of Recent Study on Fabric Wrapped Soil Lifts in Streambanks

Photo from FHWA-AK-RD-03-03

Inner fabric has deteriorated, and material has been transported out of the soil lift.

Findings of Recent Study on Fabric Wrapped Soil Lifts in Streambanks

Photo from FHWA-AK-RD-03-03

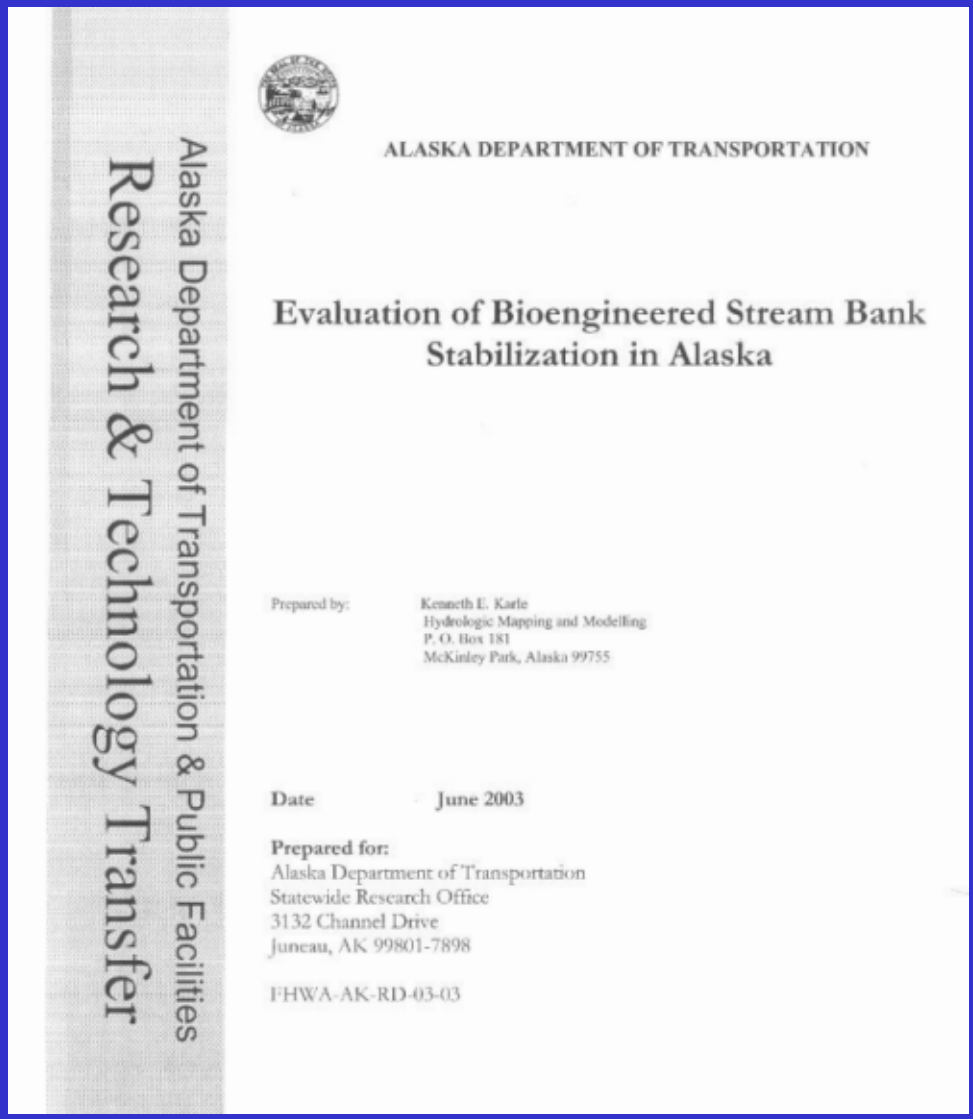
Inner fabric used inside the geogrid has deteriorated, and material has been transported out of the soil lift.

Findings of Recent Study on Fabric Wrapped Soil Lifts in Streambanks

Photo from FHWA-AK-RD-03-03

Failure due to erosion of the bank toe.

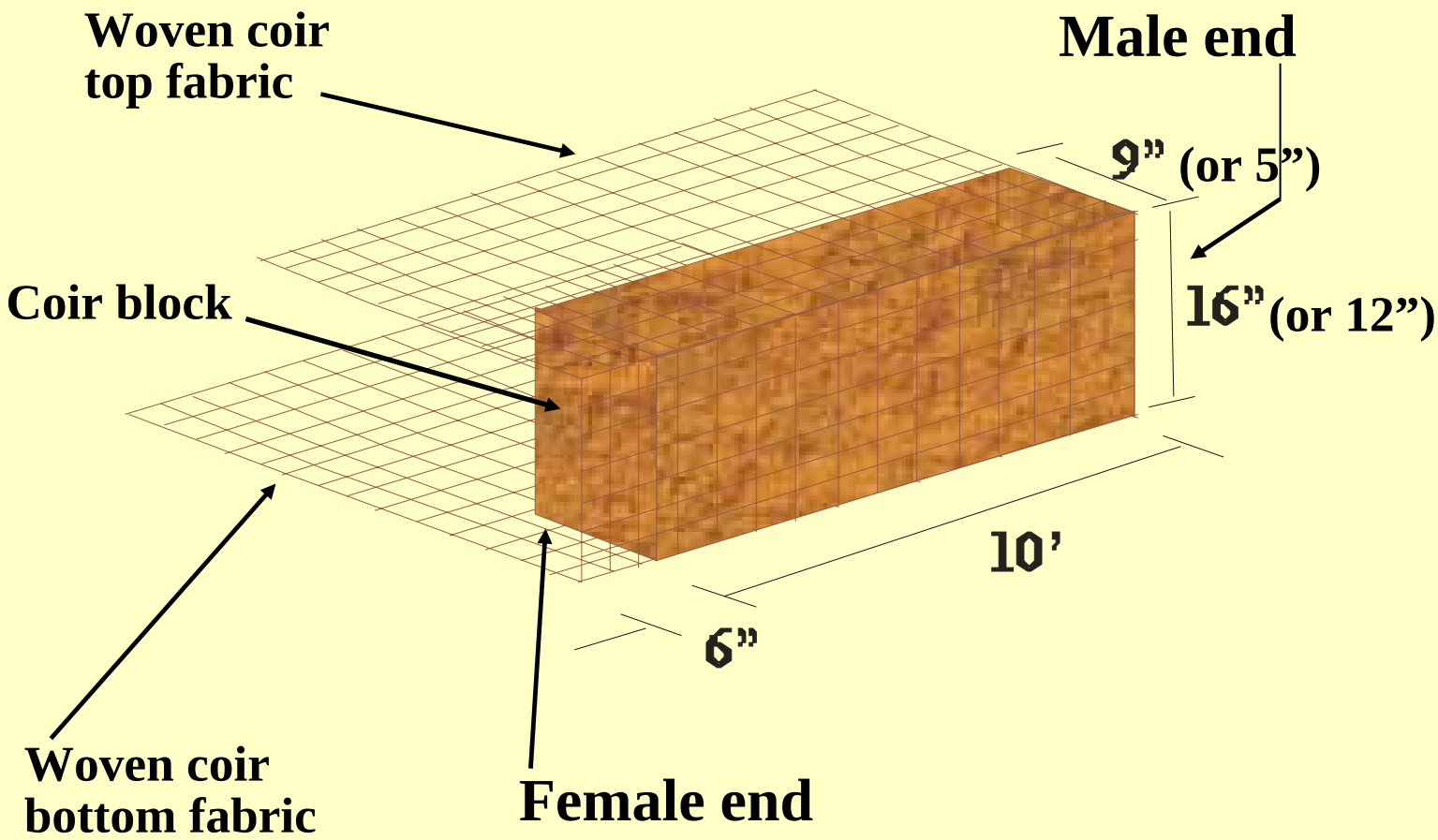
FHWA-AK-RD-03-03



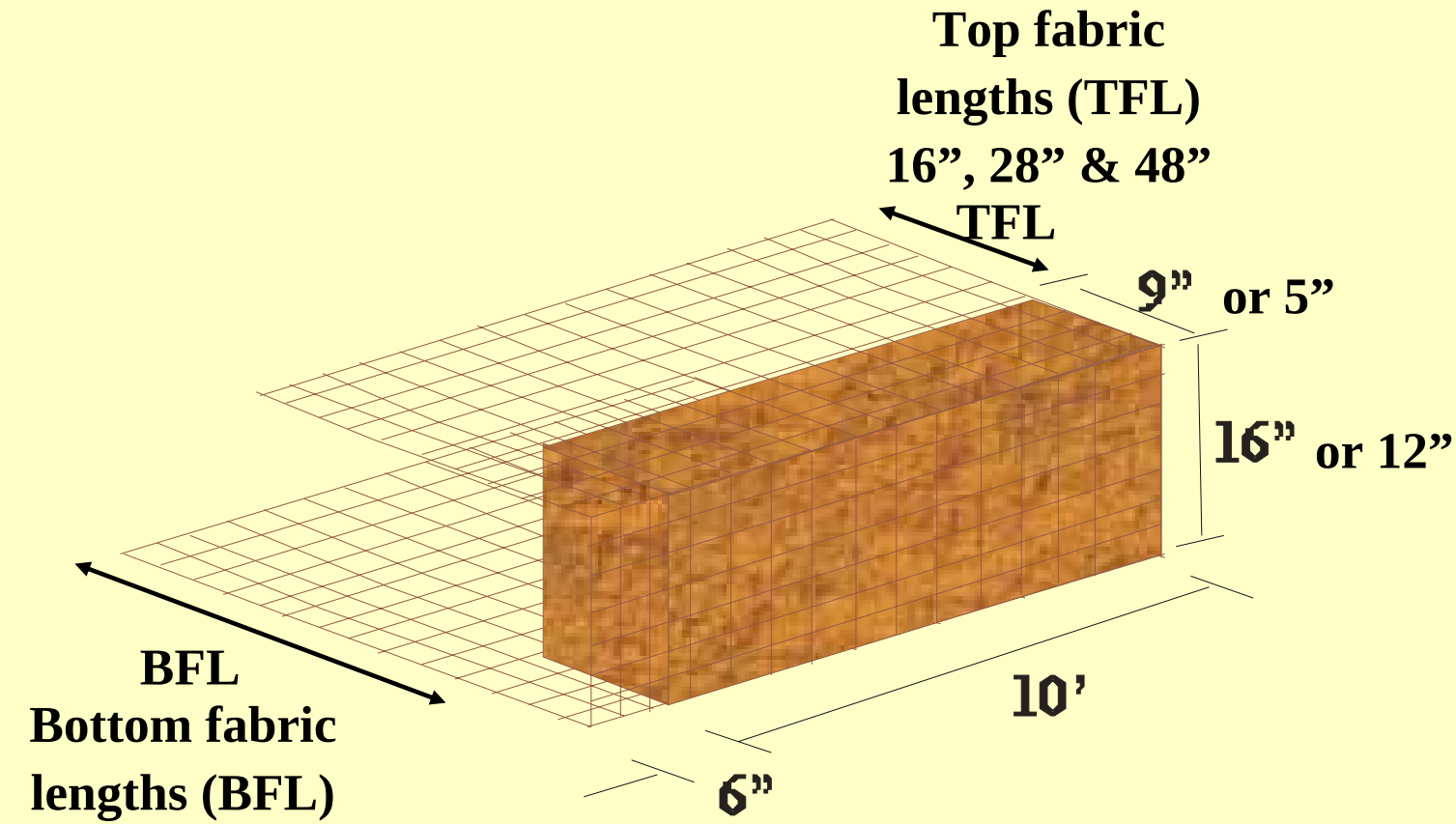
Objectives

1. Introduce the coir block system for soil bioengineering designs which will increase the long-term factor of safety in the designs.
2. Show improvements of the coir block system over existing coir fabric wrapped soil lifts.
3. Show various applications of the coir block system.

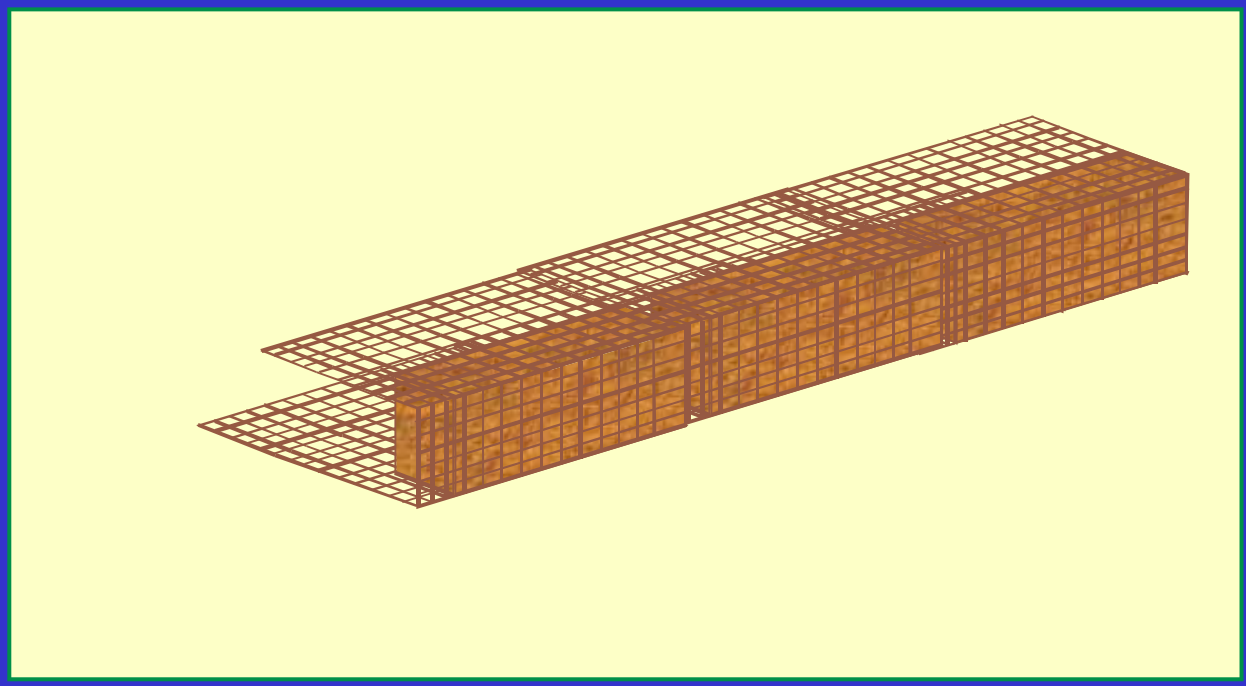
Coir Block System (BioD-Block)



BioD-Block


Top fabric
lengths (TFL)
16”, 28” & 48”
TFL
9” or 5”
16” or 12”
BFL
Bottom fabric
lengths (BFL)
28”, 56”, & 75”
10’
6”

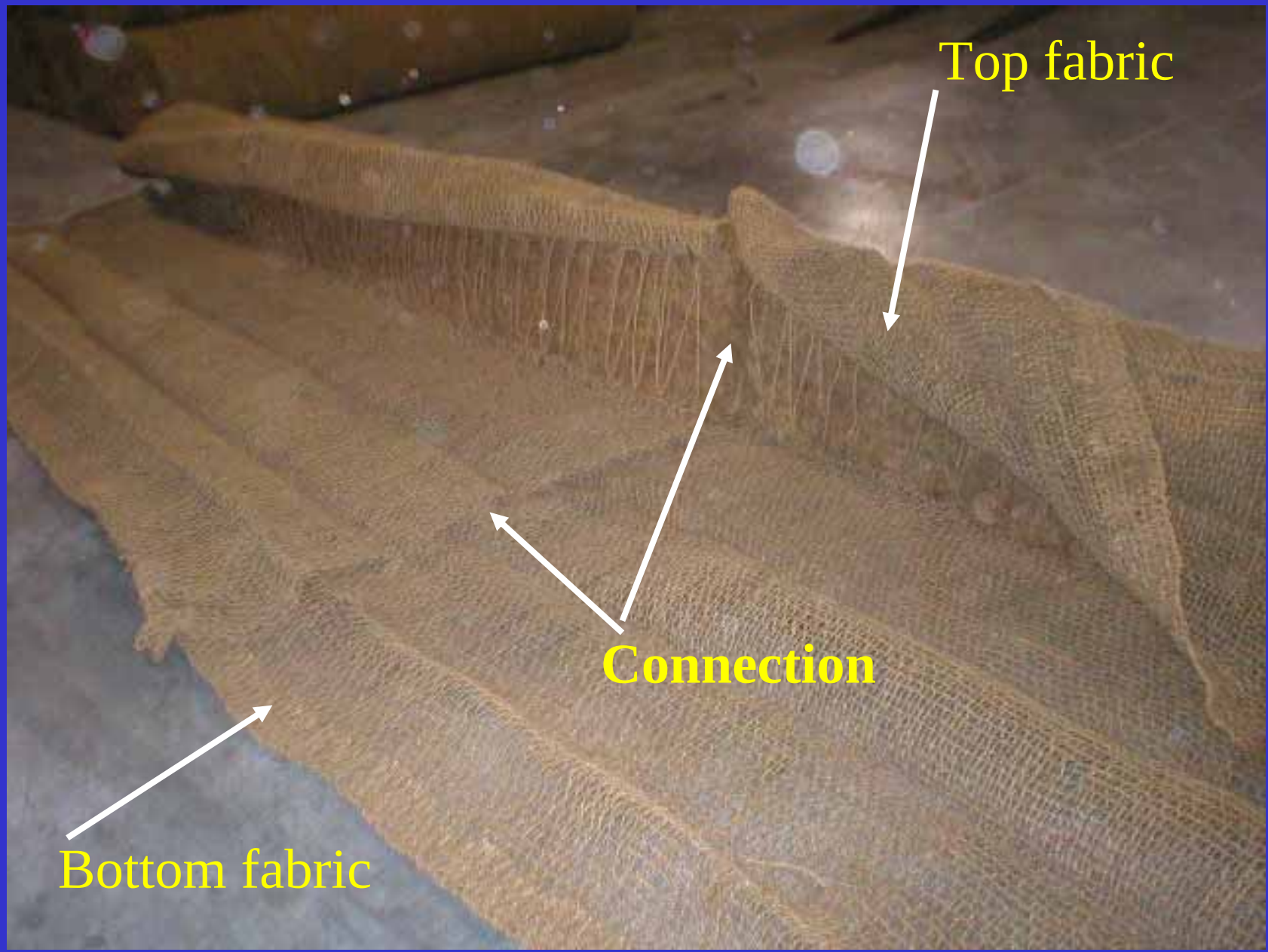
Connecting BioD-Blocks



Save valuable time during construction

Coir Block System (BioD-Block)

Two Connected BioD-Blocks - view from back



Two Connected BioD-Blocks - view from front

When installed, connections are structurally stable

Female end

Male end

Male end

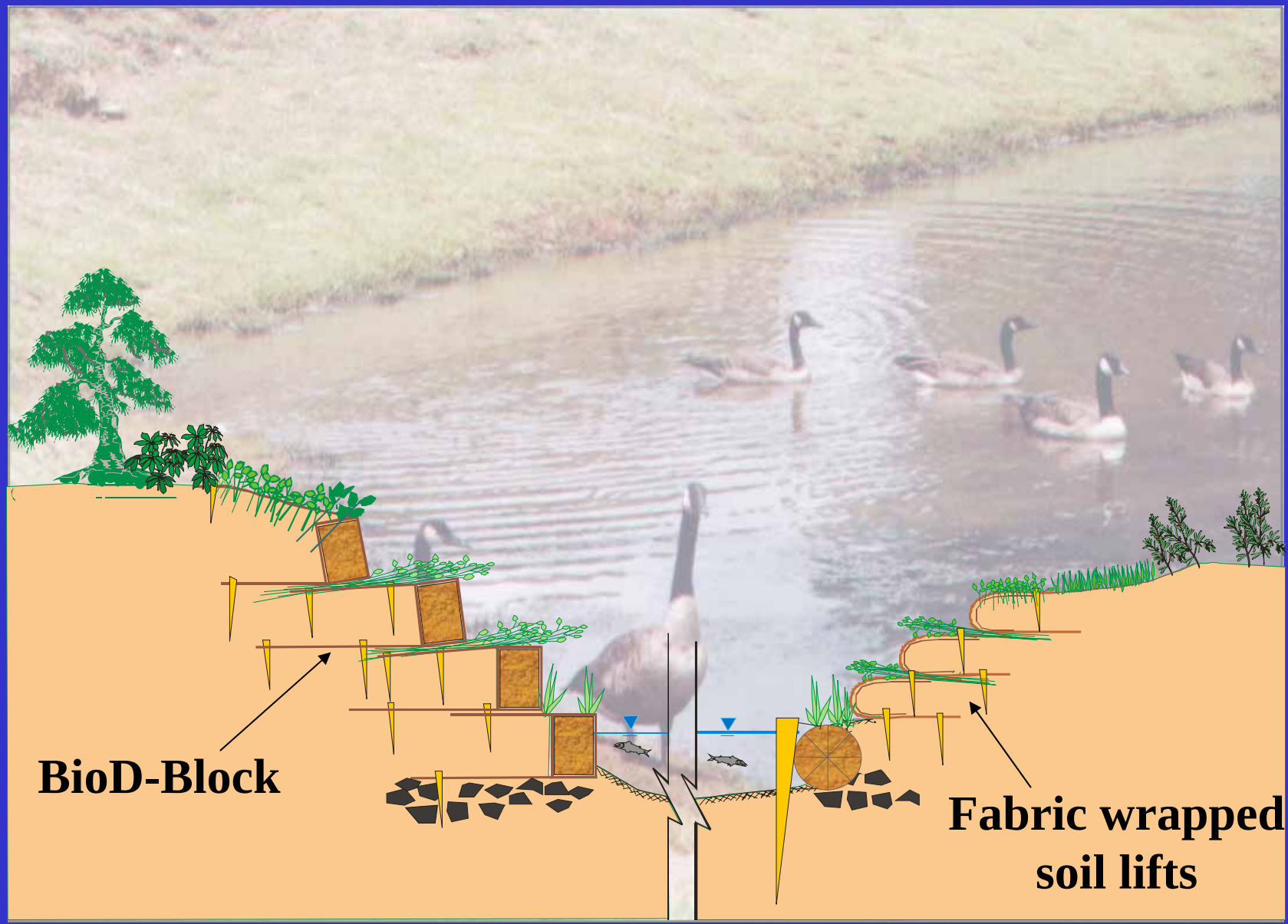
Female end

Male & Female end connection (view from back side)

Male & Female end connection (view from front side)

BioD-Blocks

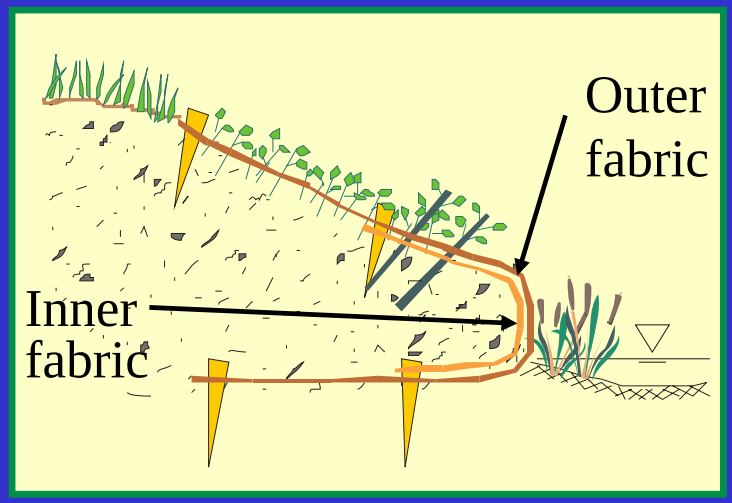
BioD-Blocks and Fabric Wrapped Soil Lifts



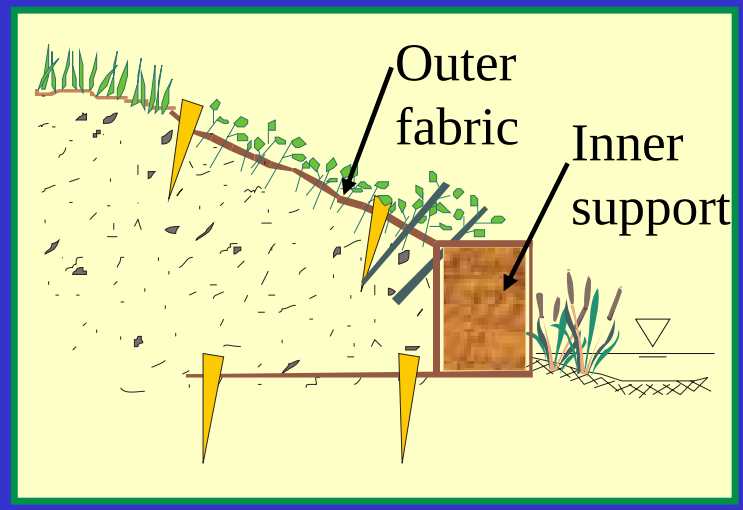
Improvements in BioD-Block applications over coir fabric wrapped soil layers

- **Long-term structural protection for the soil mass**
- **No need of an inner fabric in many situations**

Coir fabric wrapped soil layer



BioD-Block single layer



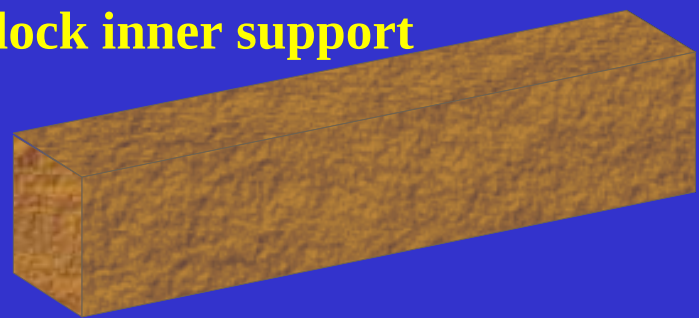
Outer fabric

Thin short-term inner fabric:

Coir stitched mat

Burlap

Strong & long lasting coir block inner support



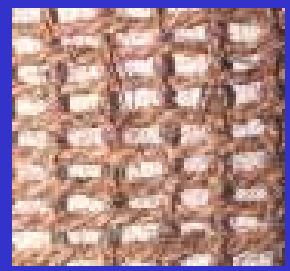
Improvements in BioD-Block applications over coir fabric wrapped soil layers

- **Long-term structural protection for the soil mass**
- **No need of an inner fabric in many situations**
- **Fabric strength in machine direction (MD) contributes to structural stability**

Coir fabric wrapped soil layers

Typical tensile strength = 98 lbs/in

CD

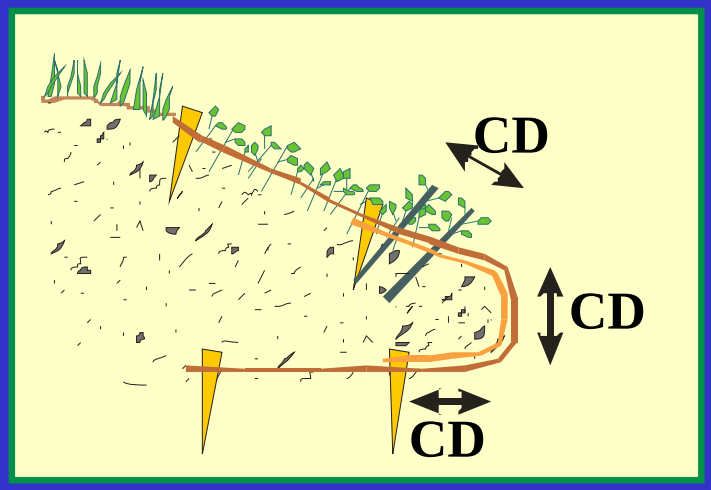


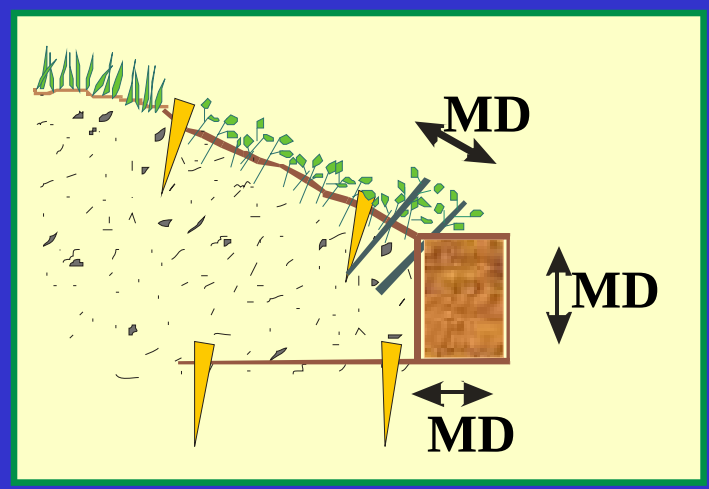
BioD-Block

Typical tensile strength = 145 lbs/in

MD

MD strength is about 50% more than CD strength

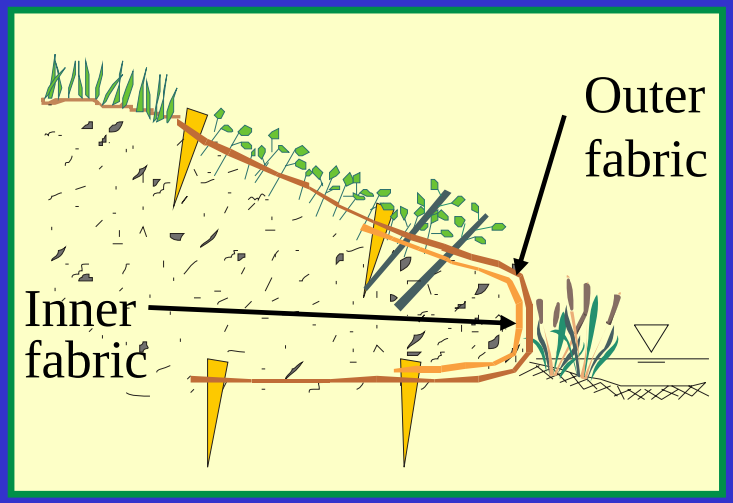




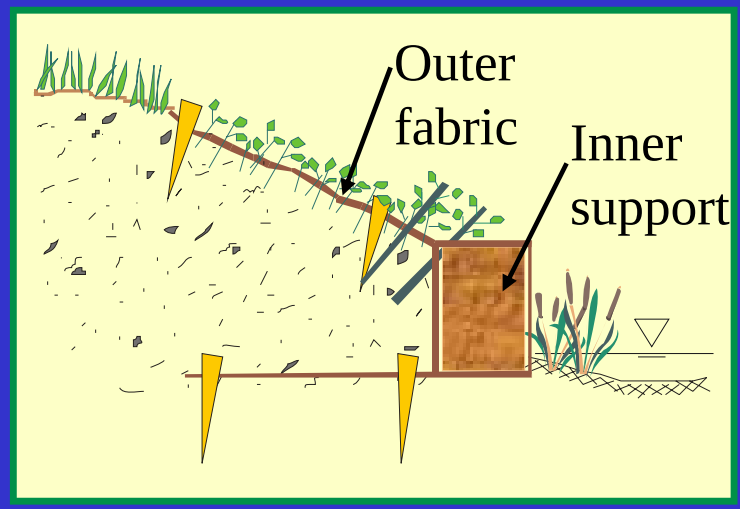
Improvements in BioD-Block applications over coir fabric wrapped soil layers

- **Long-term structural protection for the soil mass**
- **No need of an inner fabric in many situations**
- **Fabric strength in machine direction (MD) contributes to structural stability**
- **Easily maintain constant layer heights during and after construction**

Coir fabric wrapped soil layer



BioD-Block single layer

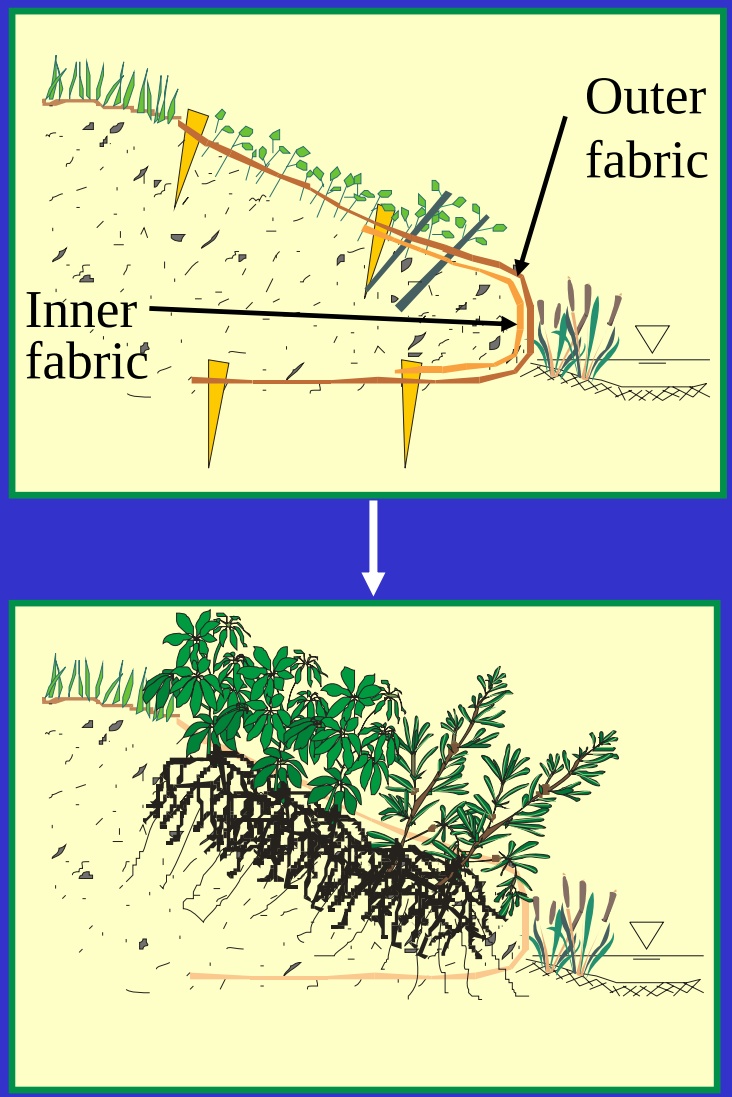


BioD-Blocks easily maintain constant layer heights during and after construction

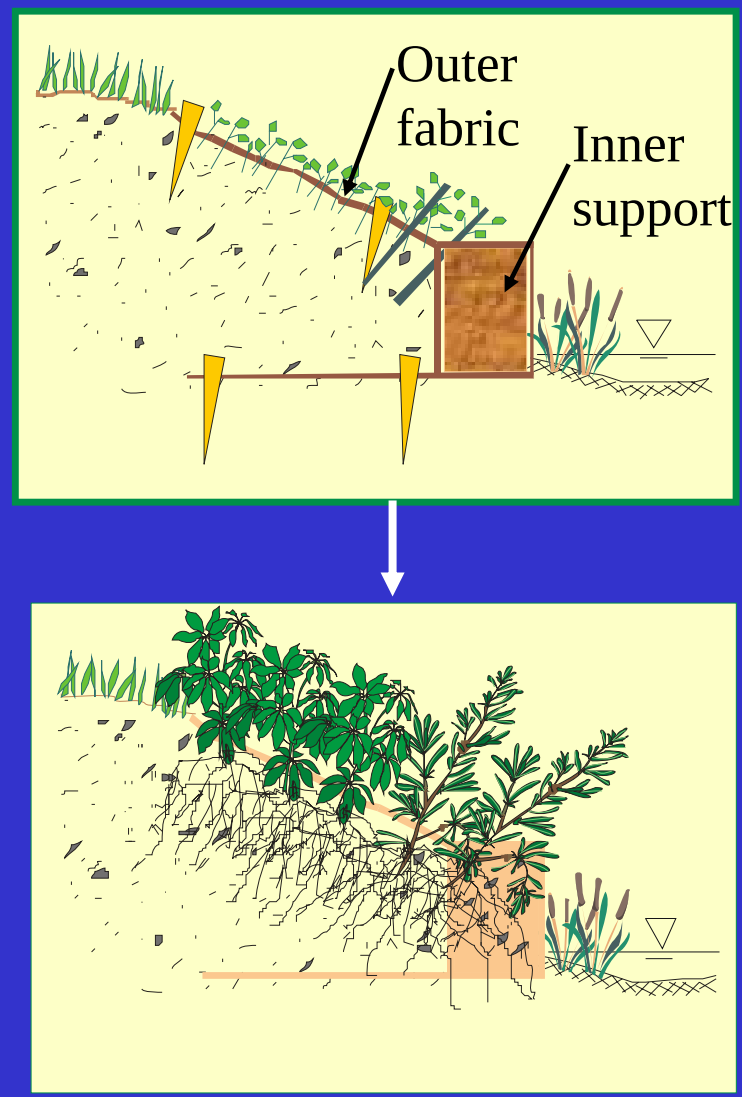
Improvements in Coir Block Systems over coir fabric wrapped soil layers

- **Long-term Structural protection for the soil mass**
- **No need of an inner fabric in many situations**
- **Fabric strength in machine direction (MD) contributes to structural stability**
- **Easily maintain constant layer heights during and after construction**
- **Upon installation, plant roots grow into BioD-Block and embeds it to soil mass**

Coir fabric wrapped soil layer

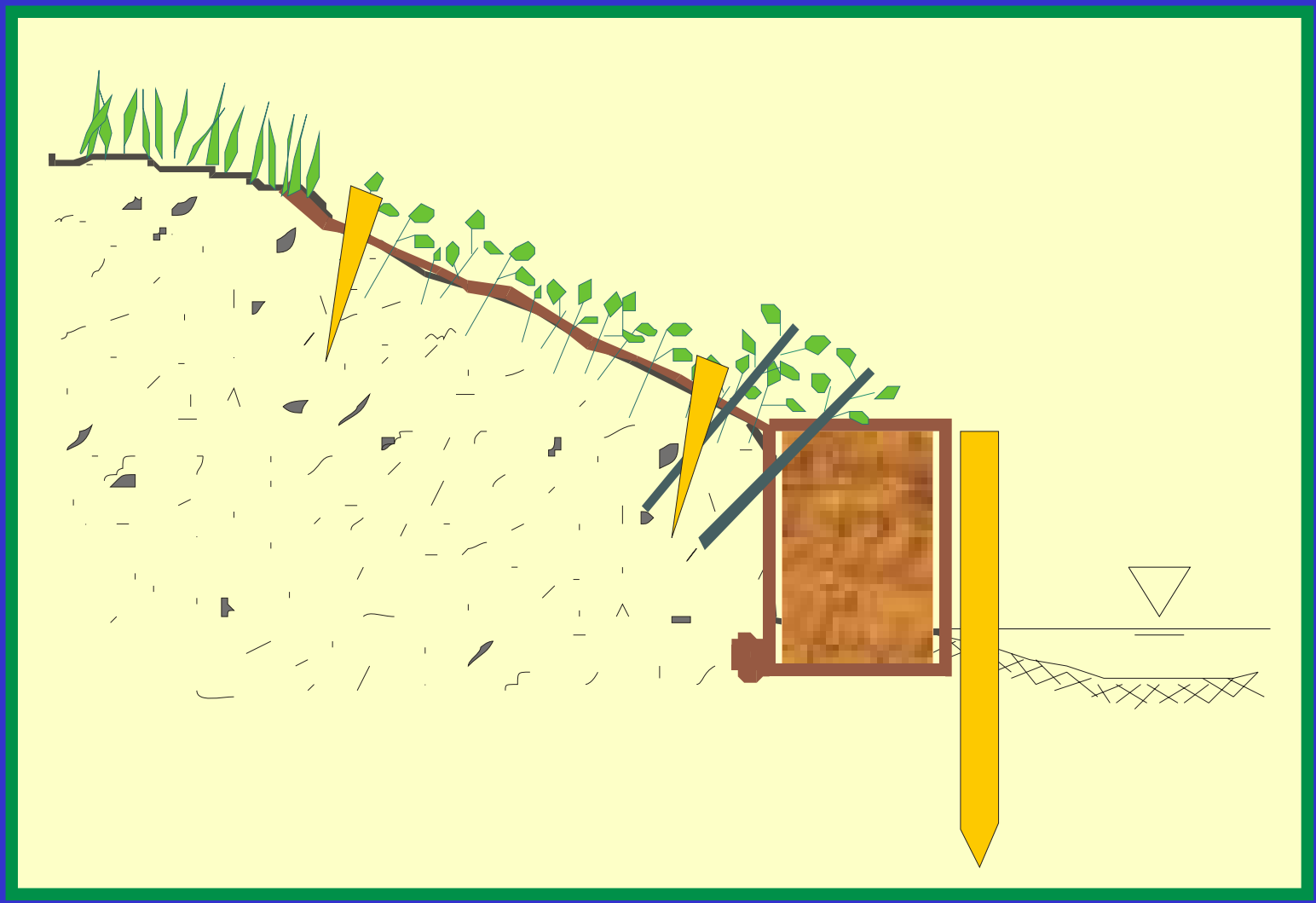


BioD-Block application



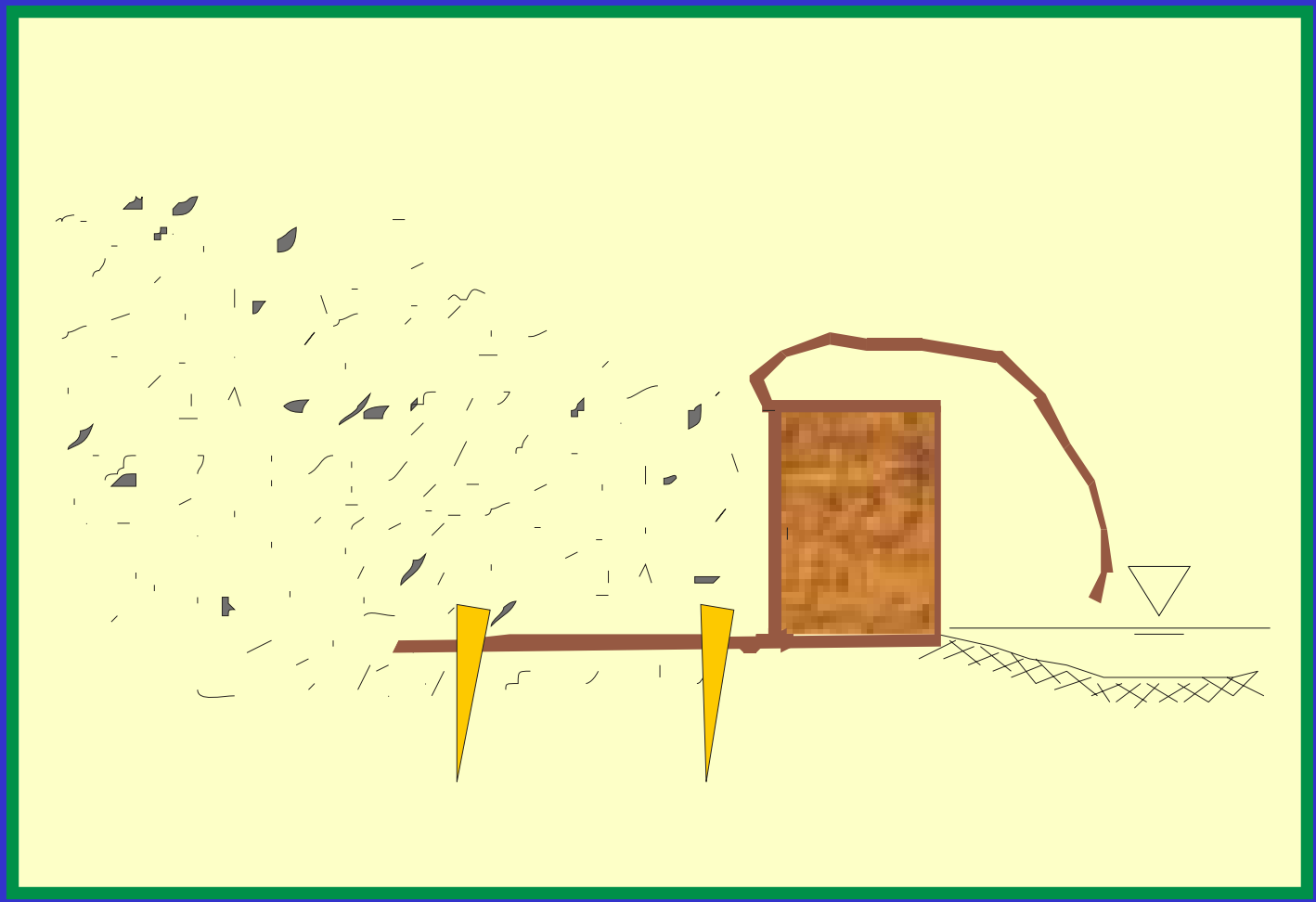
Designs using BioD-Block

BioD-Blocks in streambank restoration with no cut and fill



Designs using BioD-Block

BioD-Block in streambank restoration when reshaping and filling is required.



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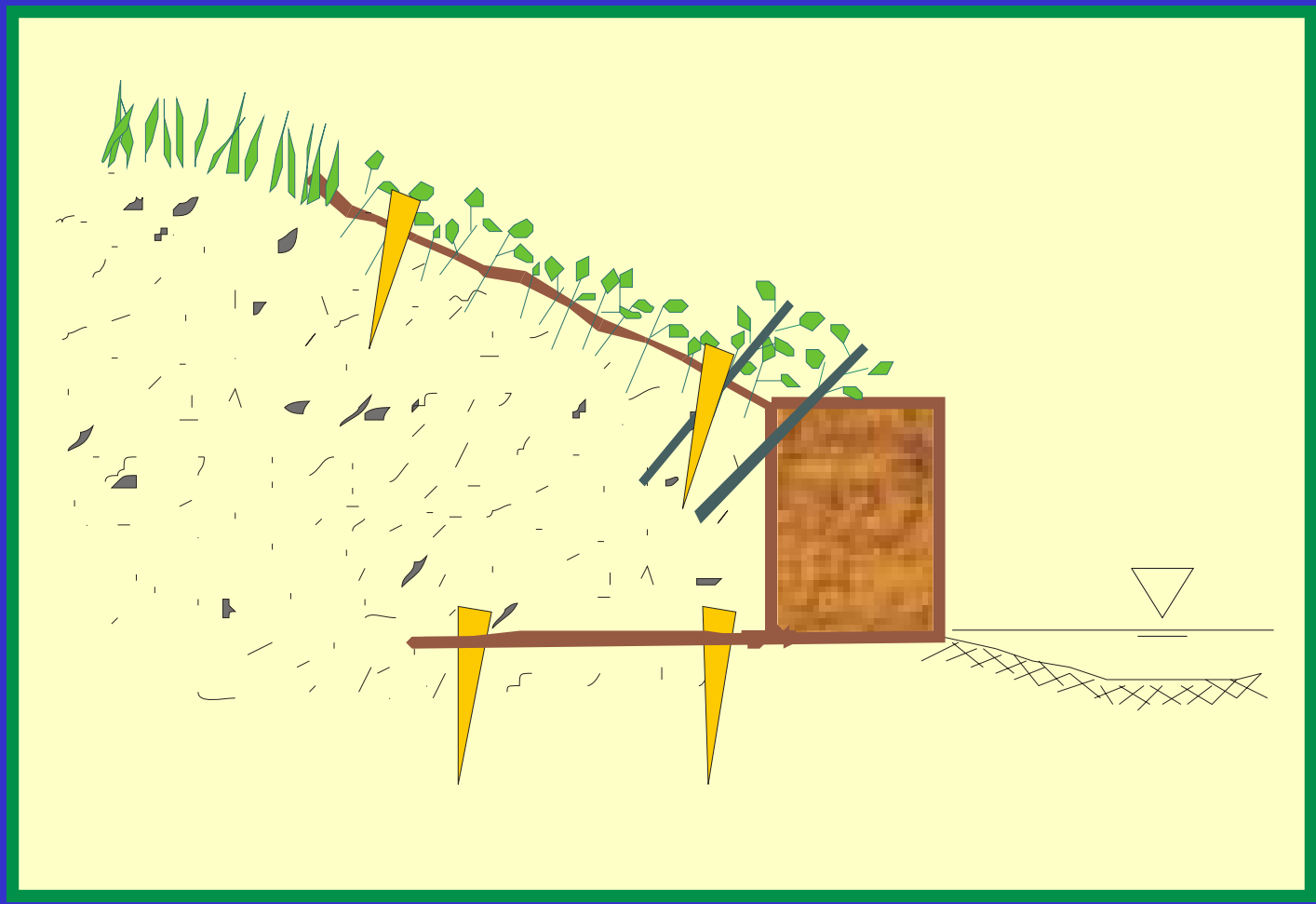
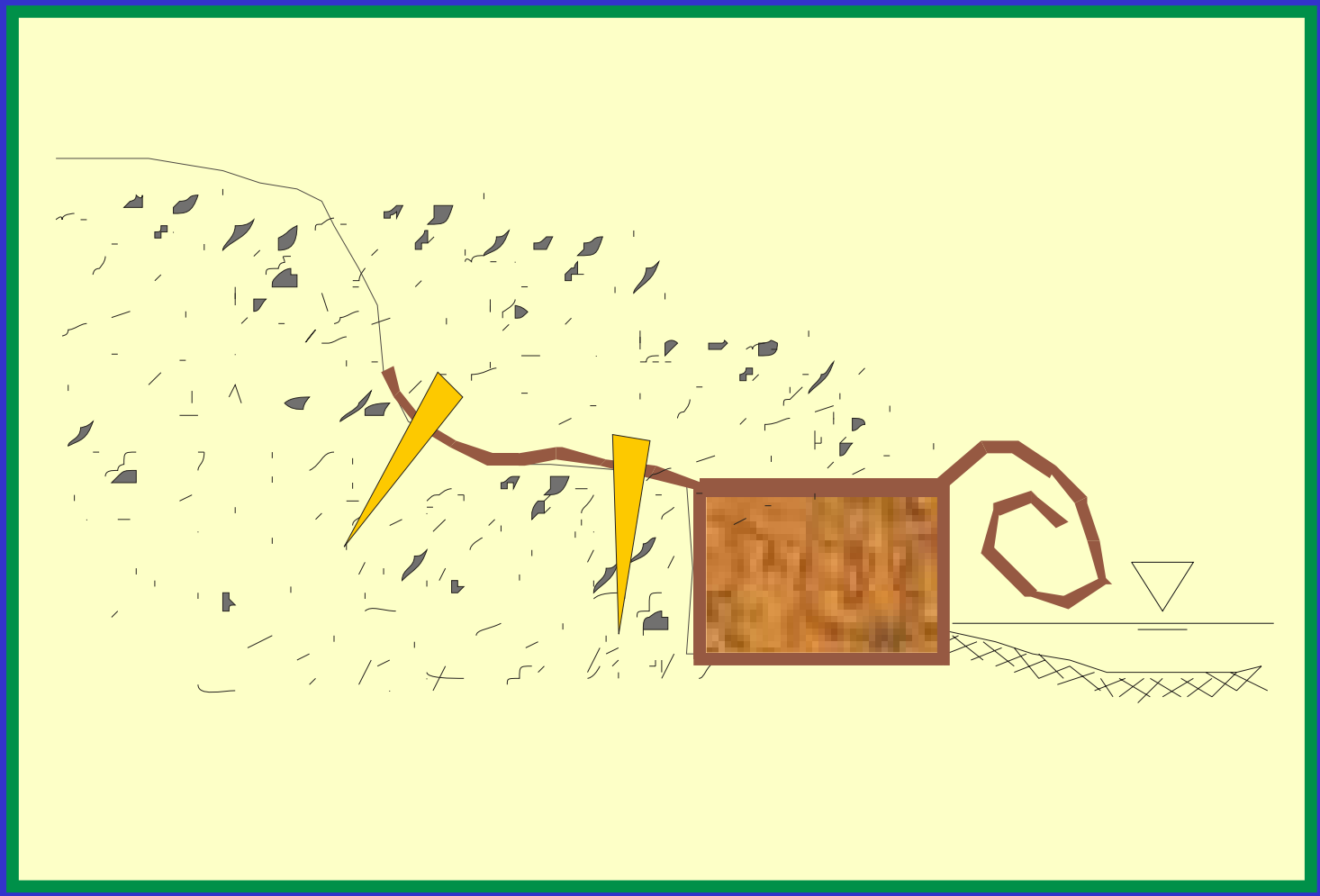


Designs using BioD-Block

BioD-Block in streambank restoration when minimum cutting and some filling is required.



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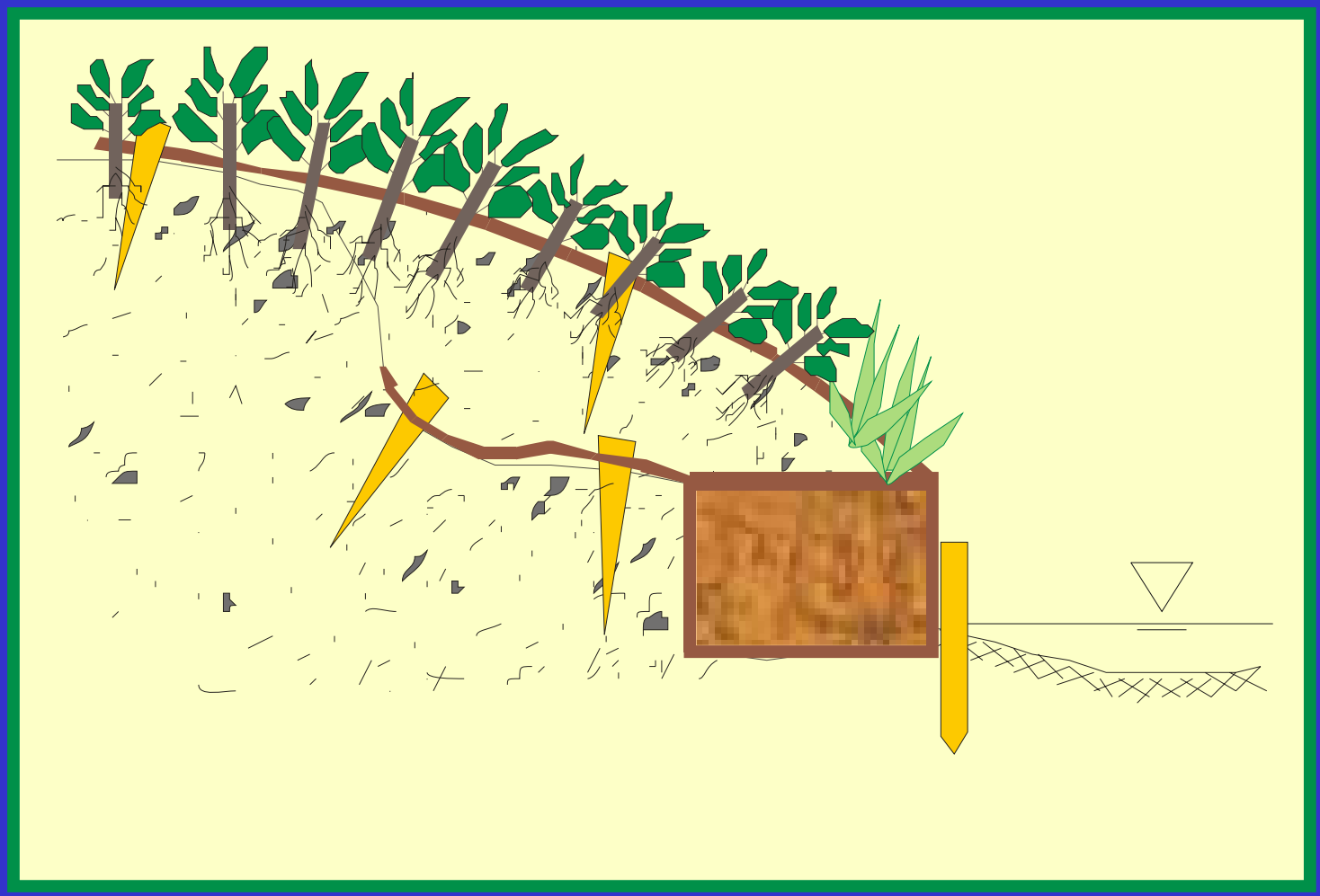
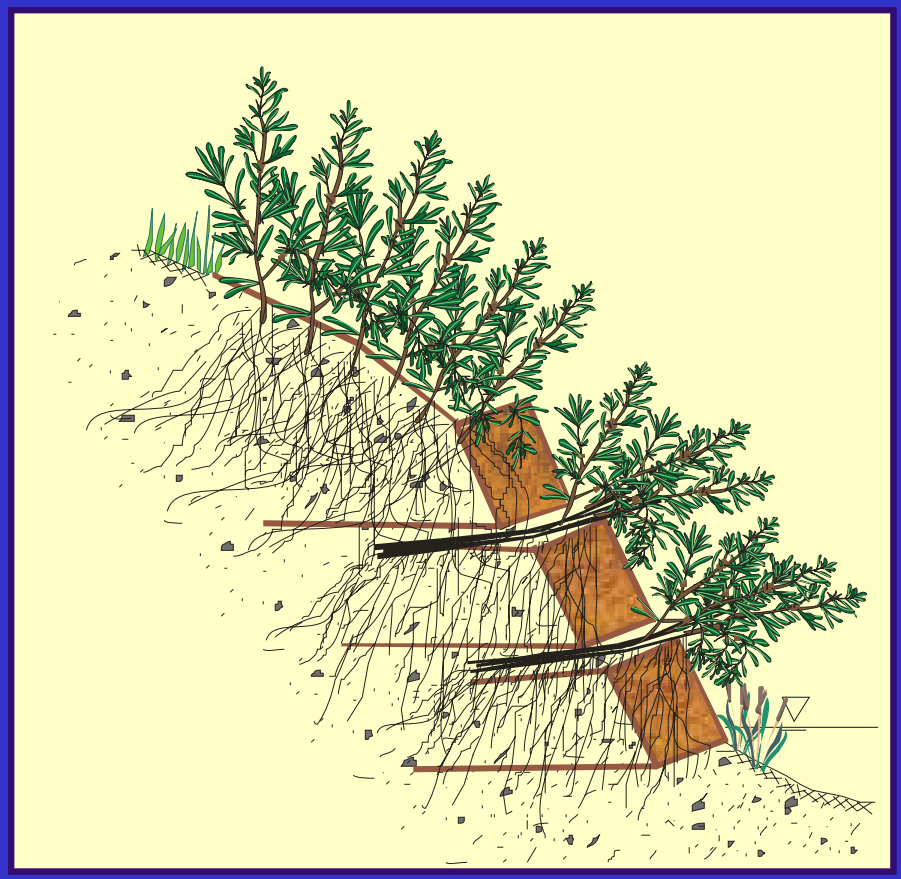
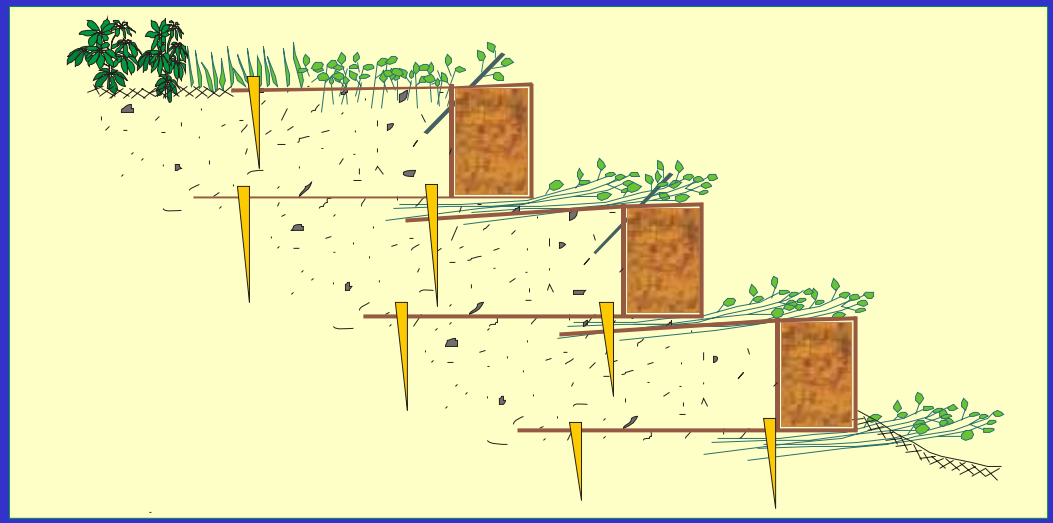


Designs using BioD-Block

Multi-layer BioD-Block application in a streambank restoration.



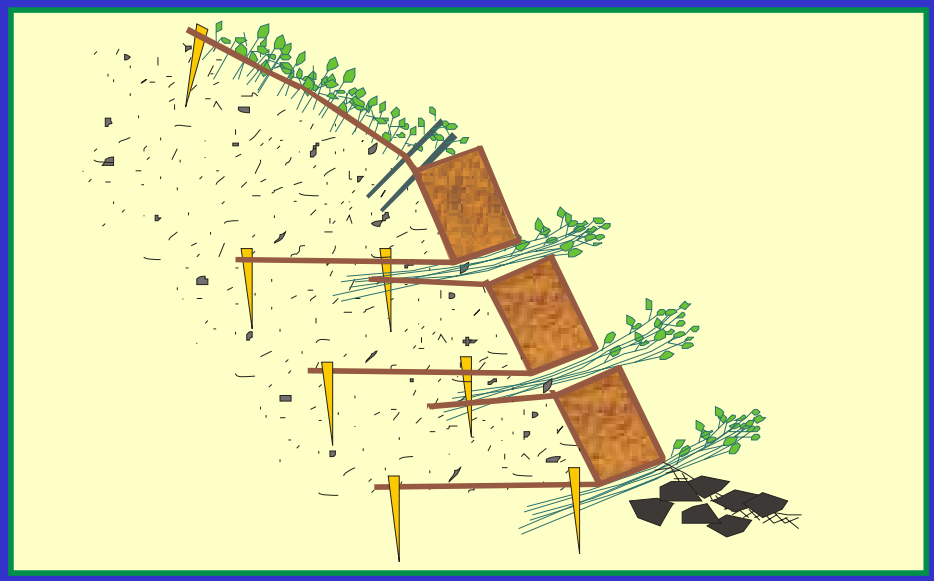
Designs using BioD-Block



Alternative design with BioD-Block.

Designs using BioD-Block

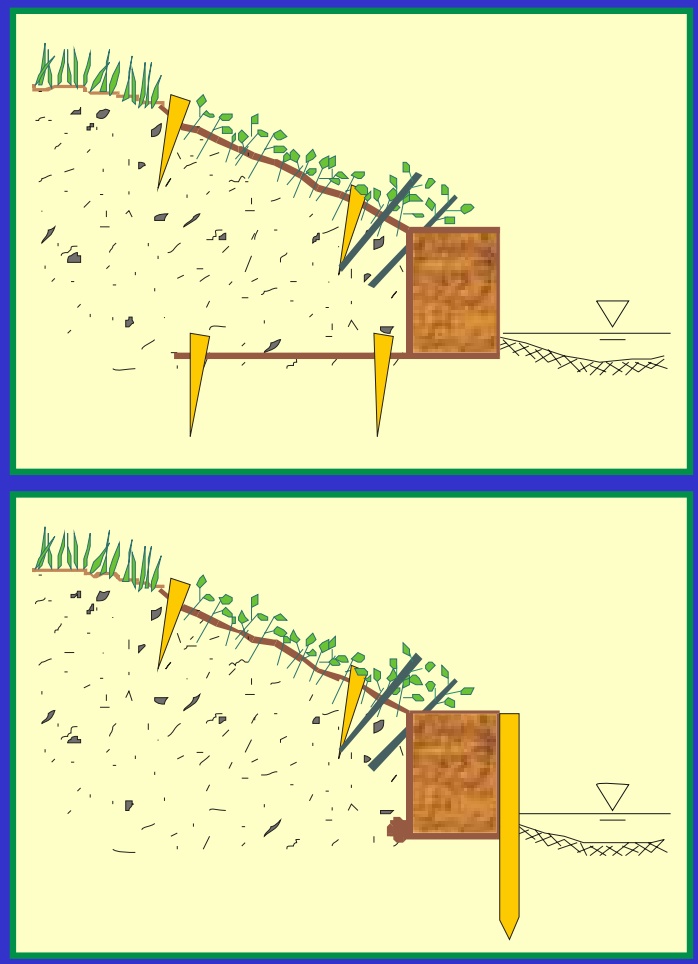
Multi-layer Coir fabric wrapped soil layer project.



Alternative design with BioD-Block.

Designs using BioD-Block

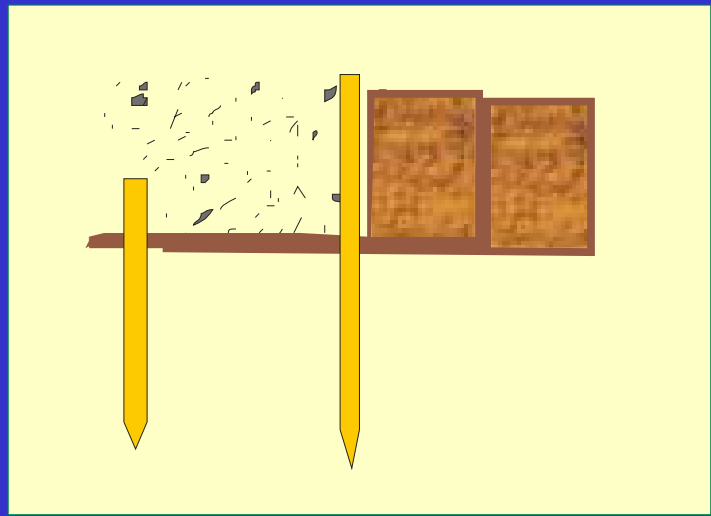
Single-layer Coir Roll (log) with ECB on the slope.



Alternative designs with BioD-Block.

Designs using BioD-Block

Coir Roll (log) installation in a marshy land.



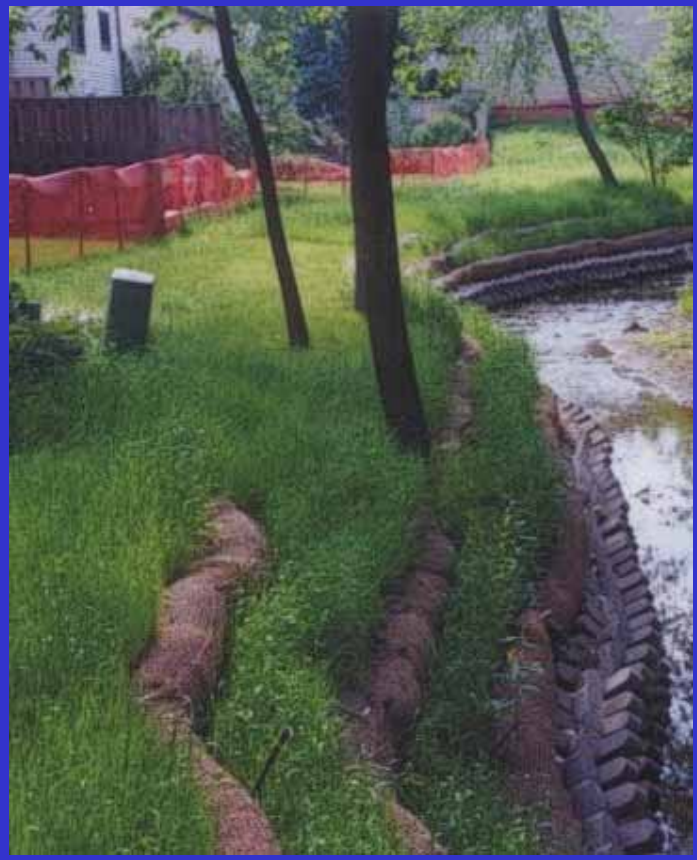
Alternative designs with BioD-Block.

Applications of BioD-Block

Applications of BioD-Block

Designed by Ted Gray & Associates, IL

Applications of BioD-Block



Designed by Ted Gray & Associates, IL

Applications of BioD-Block

Designed by Questa Engineering Corporation, CA

8 months later

2 years later

Applications of BioD-Block

Designed by Massachusetts Municipal Wholesale Electric Company, MA

Applications of BioD-Block

Designed by Tetra Tech, WA

Applications of BioD-Block

Designed by CH2M Hill, GA

Thank you