USDA

United States Department of Agriculture

Natural Resources Conservation Services

Soil Bioengineering Webinar

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Streambank Stabilization

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USDA-NRCS Caribbean

OBJECTIVES

1. Identify two basic categories of protection measures
2. Define Soil Bioengineering
3. Describe selected bioengineering techniques
4. Present some bioengineering projects done by NRCS in PR

Streambank stabilization

Streambank stabilization consists of **restoring** and **protecting** banks of streams, lakes, estuaries, and excavated channels against scour and erosion by using vegetative plantings, soil bioengineering, and structural systems.

Categories of protection

1. **Reduce** the force of water against a streambank

2. **Increase** their resistance to erosive forces

Reduce the force of water

- Stormwater reduction
- Retention methods
- Grade reduction
- Design to reduce flow velocity

Increase streambank resistance

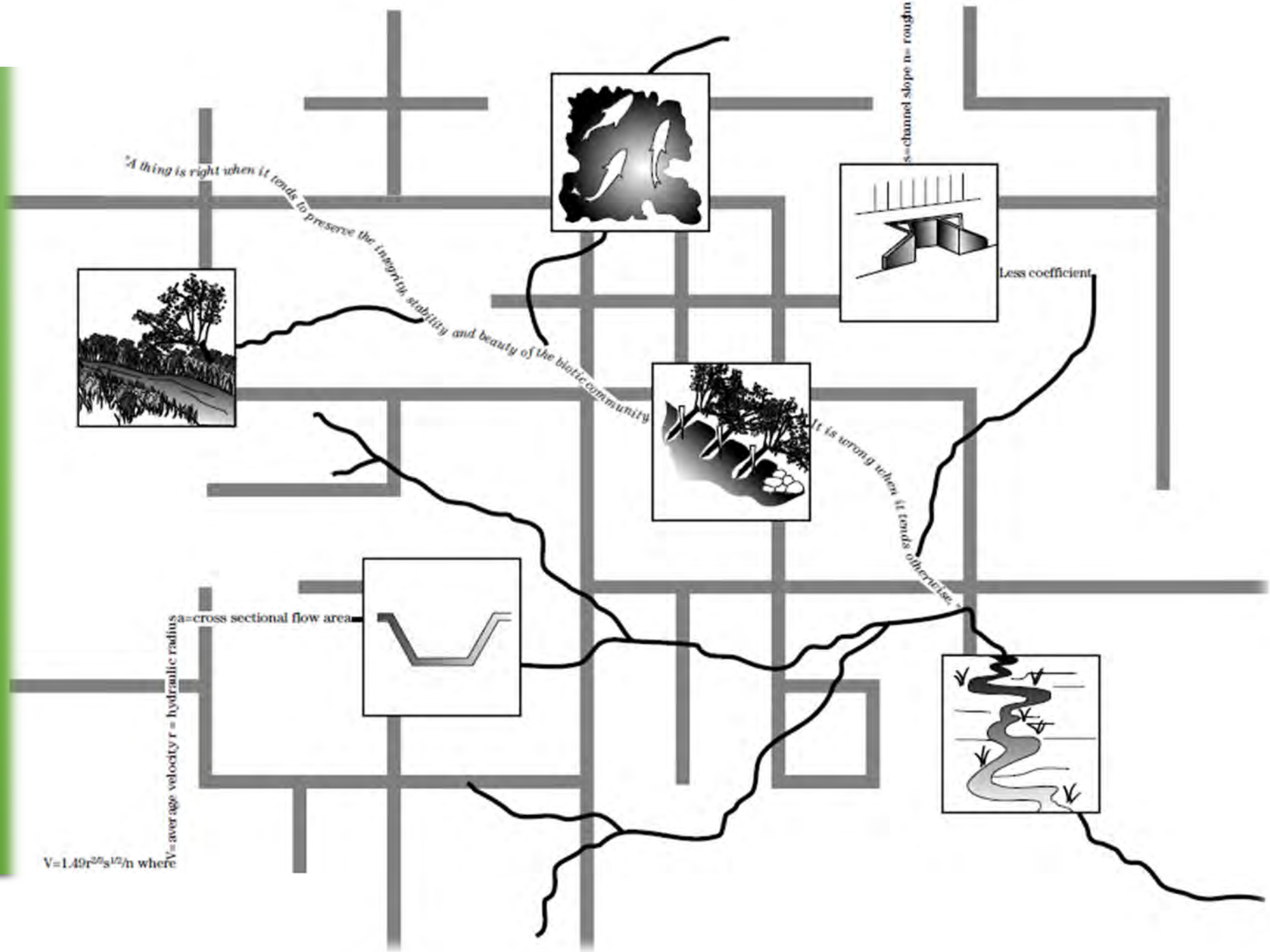
- Channels lining

  Grass, riprap, gabions, concrete, cellular concrete, erosion control blankets or other revetment designs.

Most designs that employ brushy vegetation, e.g., soil bioengineering protect from erosion in both ways.

Revetment designs do not reduce the energy of the flow significantly, so using revetments for spot protection may move erosion problems downstream.

Appropriate selection of streambank protection measures should vary in response to specific objectives and site conditions



STRUCTURAL MEASURES – CONCRETE LINING

STRUCTURAL MEASURES – CONCRETE BAG MATTRESS

STRUCTURAL MEASURES – GABION WALLS

STRUCTURAL MEASURES – GABION MATTRESS

STRUCTURAL MEASURES – ROCK RIP RAP

MATON RIVER, CAYEY, PR
EWP RIPRAP PROJECT

SOIL BIOENGINEERING

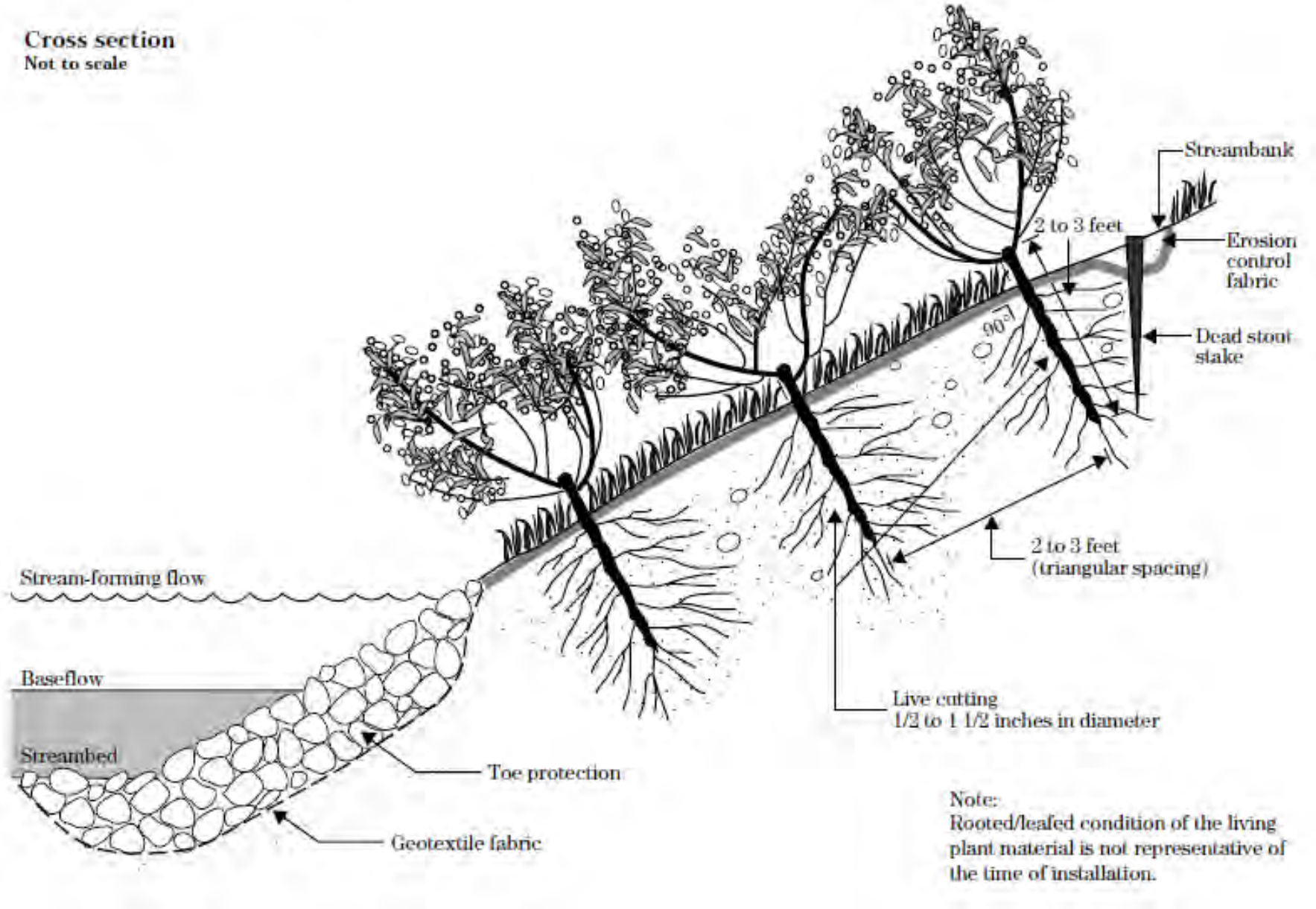
Soil Bioengineering System

- Soil bioengineering is a system of living plant materials used as structural components.
- Adapted types of woody vegetation (shrubs and trees) are initially installed in specified configurations that offer immediate soil protection and reinforcement.
- In addition, soil bioengineering systems create resistance to sliding in a streambank as they develop roots.

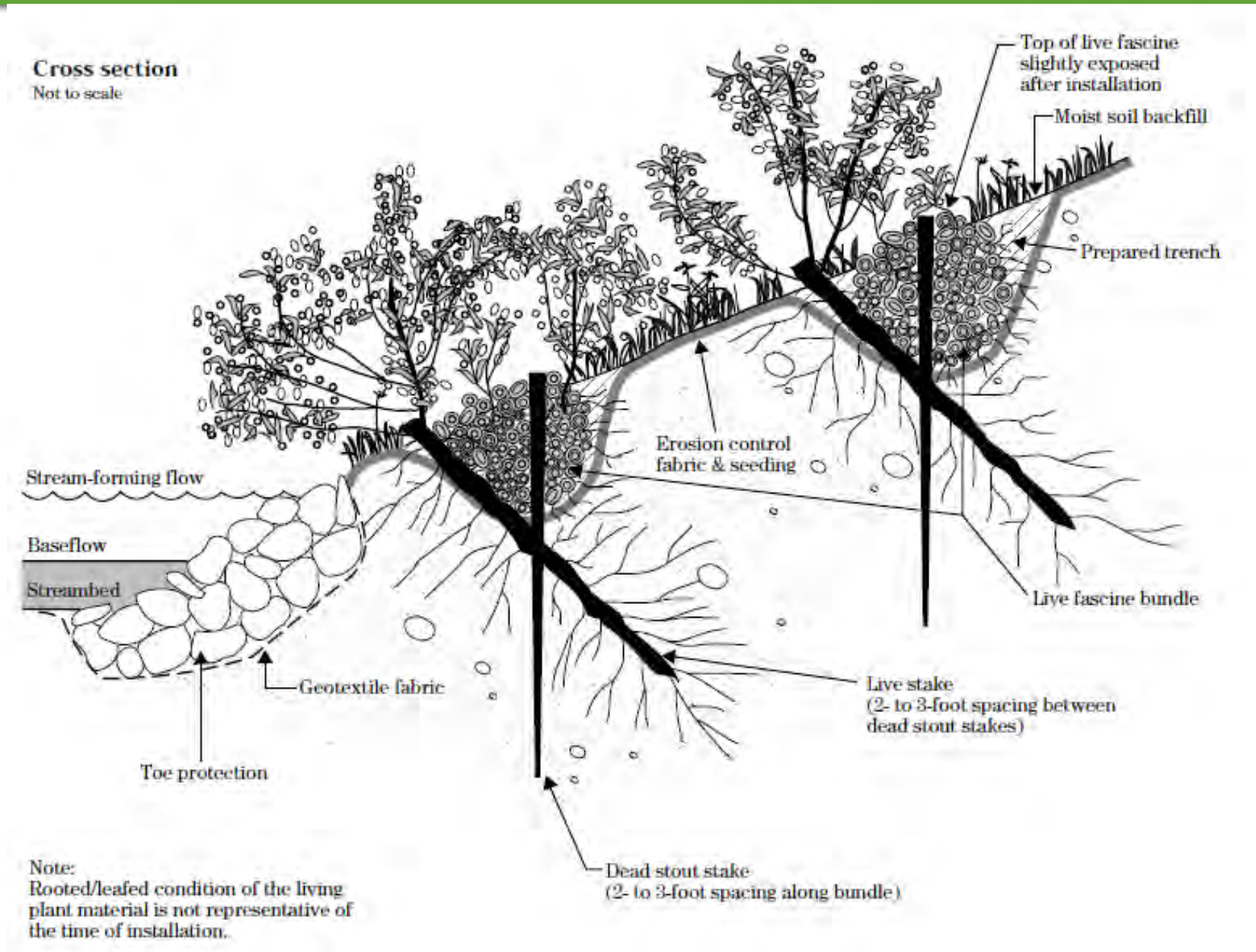
Why Soil Bioengineering ?

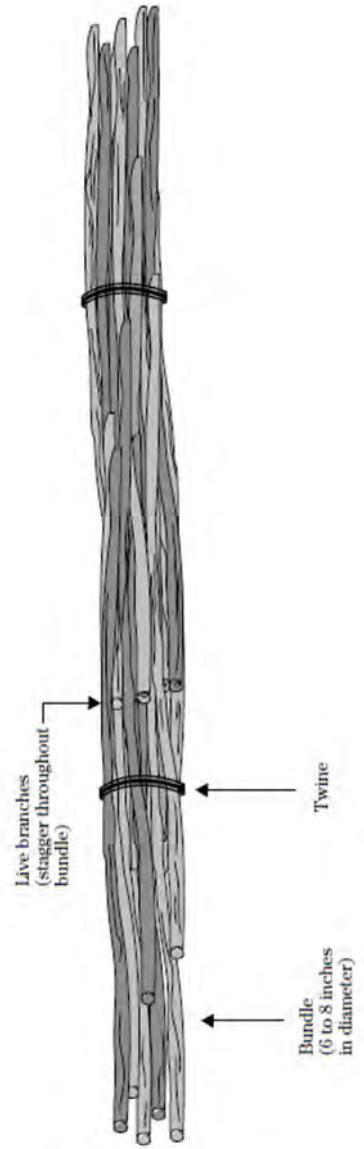
- Is self sustaining or reduce requirements for future human support;
- Use native, living materials for restoration;
- Restore the physical, biological, and chemical functions and values of streams;
- Improve water quality through reduction of temperature and chronic sedimentation problems;
- Provide opportunities to connect fragmented riparian areas;
- Retain or enhance the stream corridor system

SOIL BIOENGINEERING TECHNIQUES – LIVE STAKE

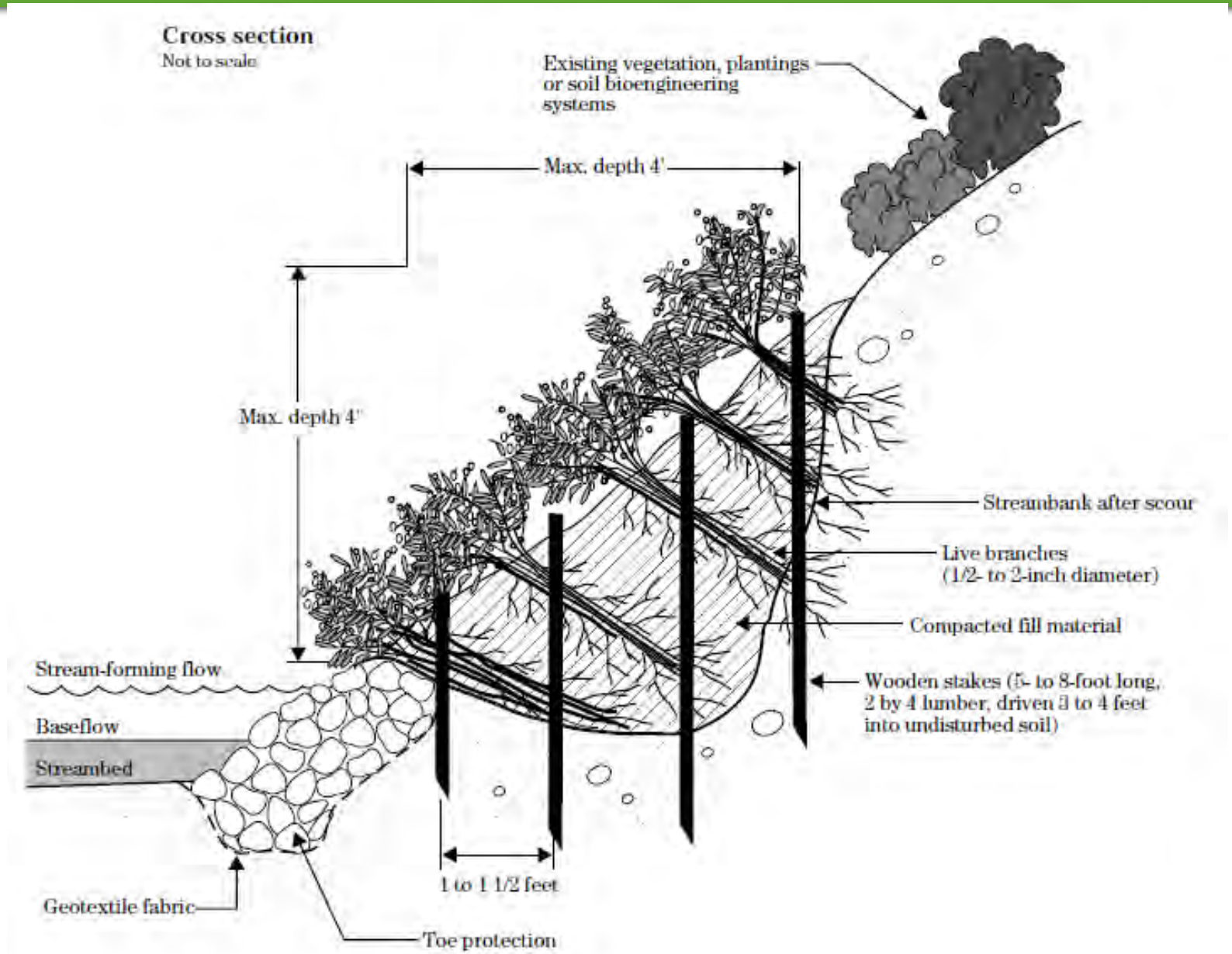


SOIL BIOENGINEERING TECHNIQUES – LIVE FASCINE

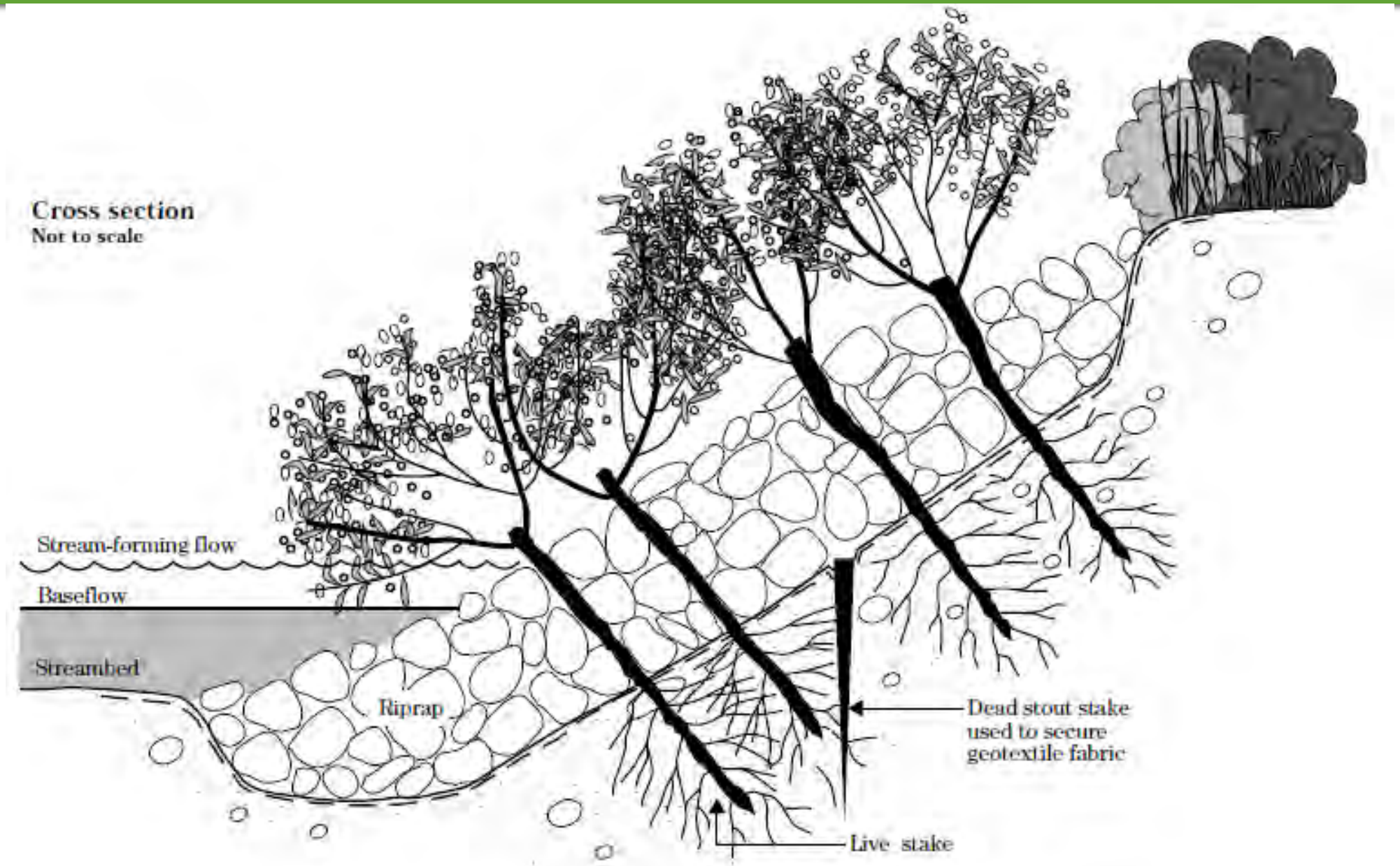




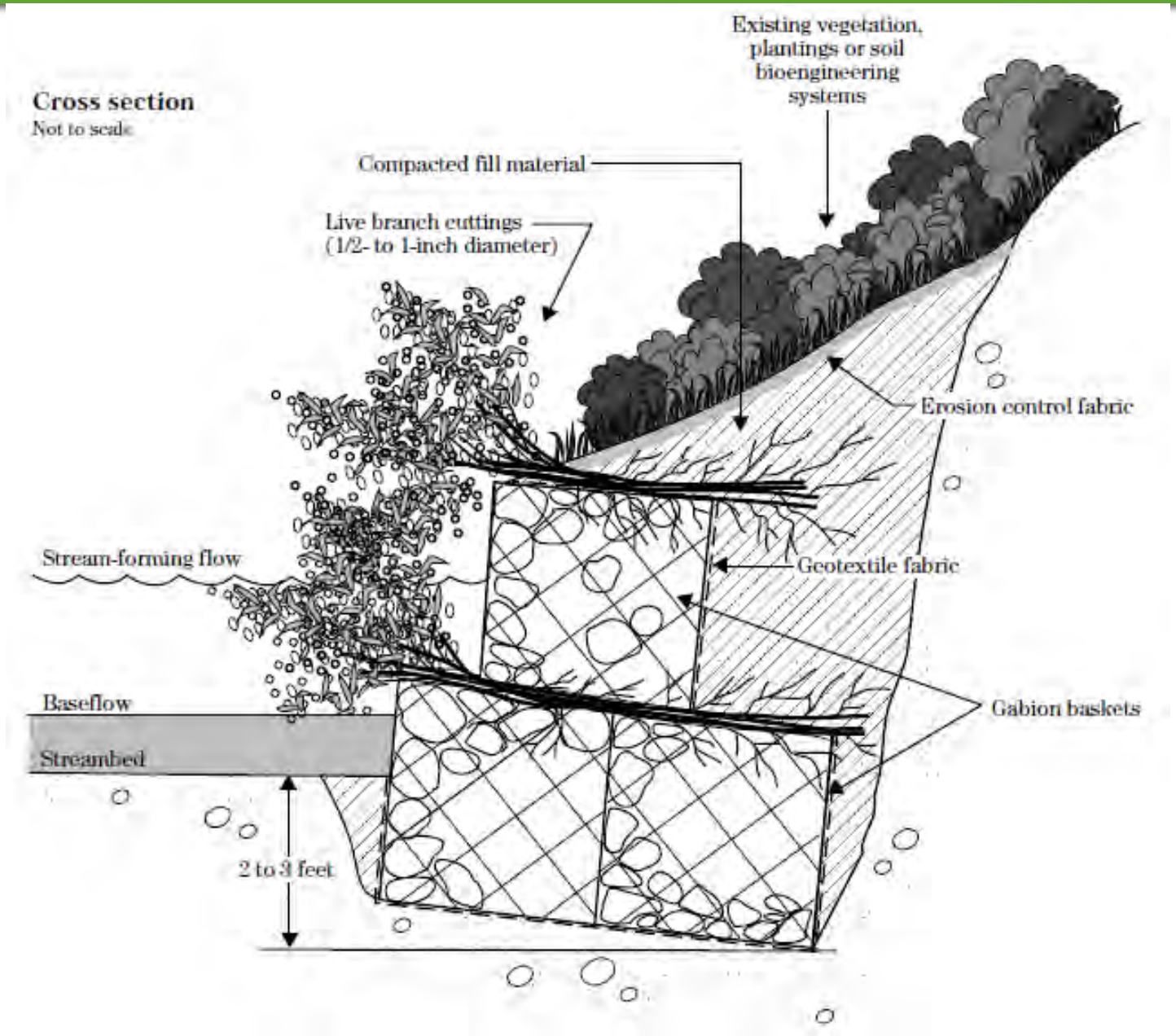
SOIL BIOENGINEERING TECHNIQUES – BRANCHPACKING



SOIL BIOENGINEERING TECHNIQUES – JOINT PLANTING



SOIL BIOENGINEERING TECHNIQUES – VEGETATED ROCK GABION



Success Story

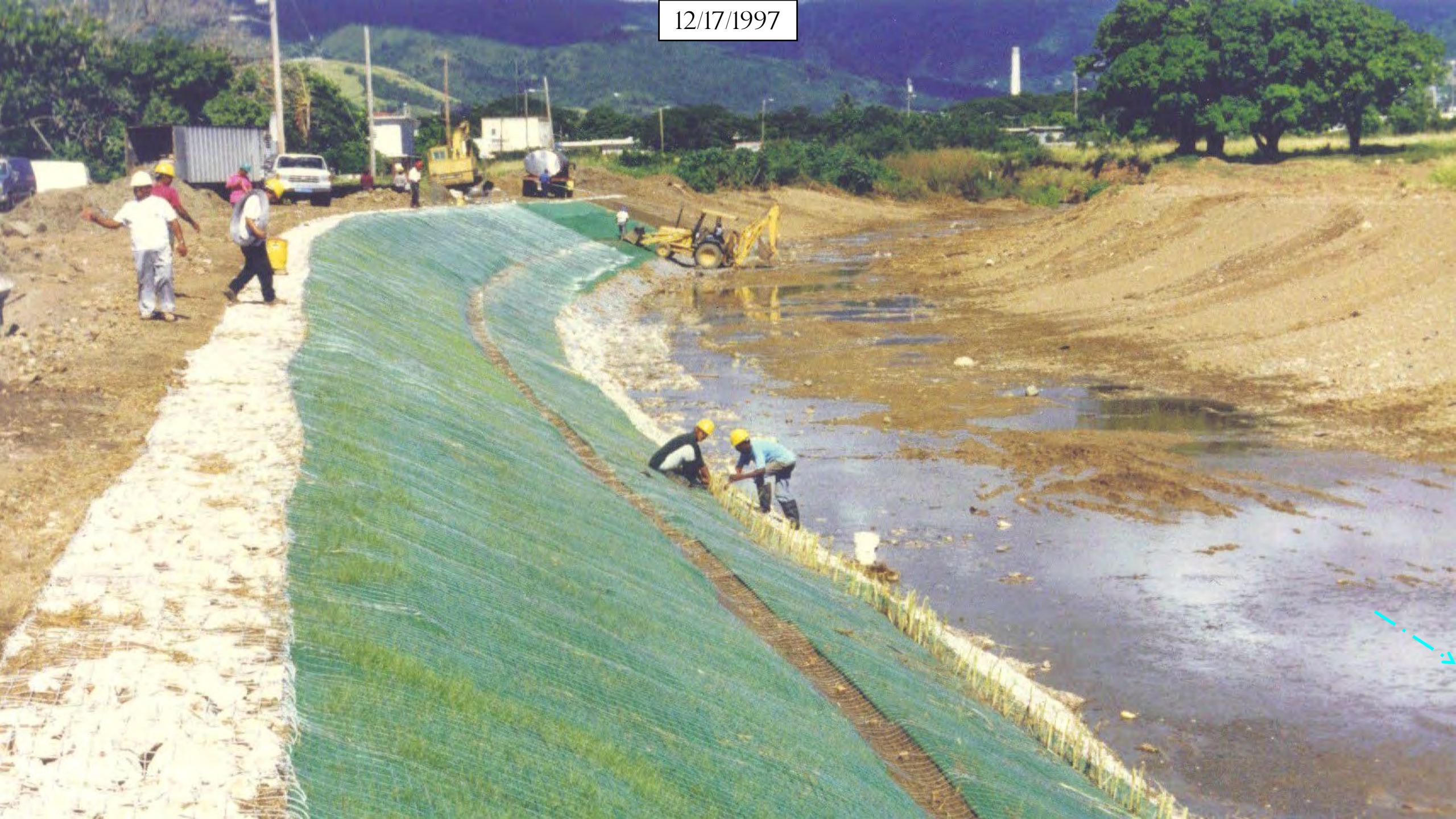
EWP Soil Bioengineering Nigua River, Arroyo, PR Completed 12/23/1997

(After Hurricane Hortense – 1996)

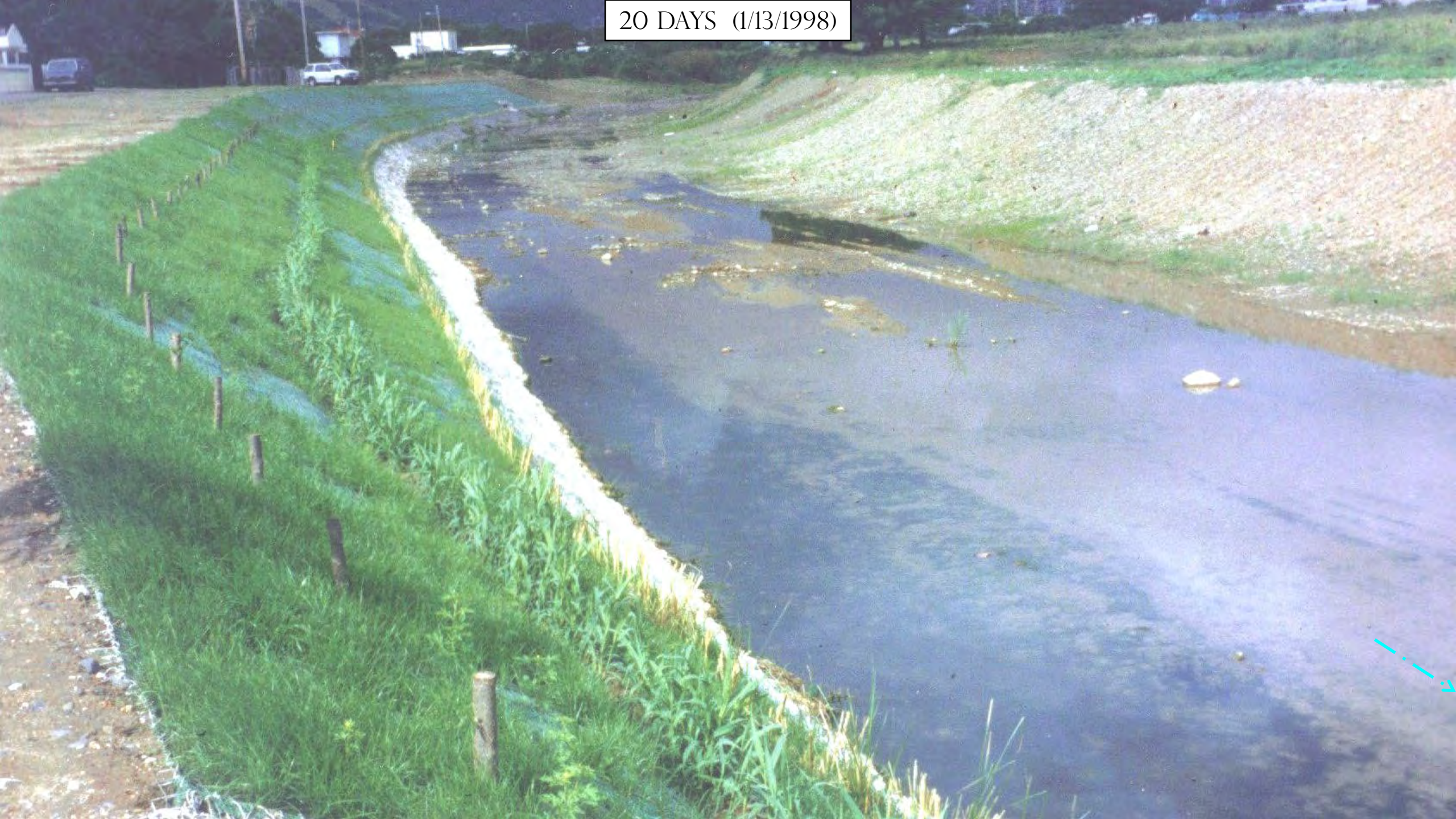
Nigua River, Arroyo, PR—EWP Soil Bioengineering Project

BEGINNING OF PROJECT (1997)

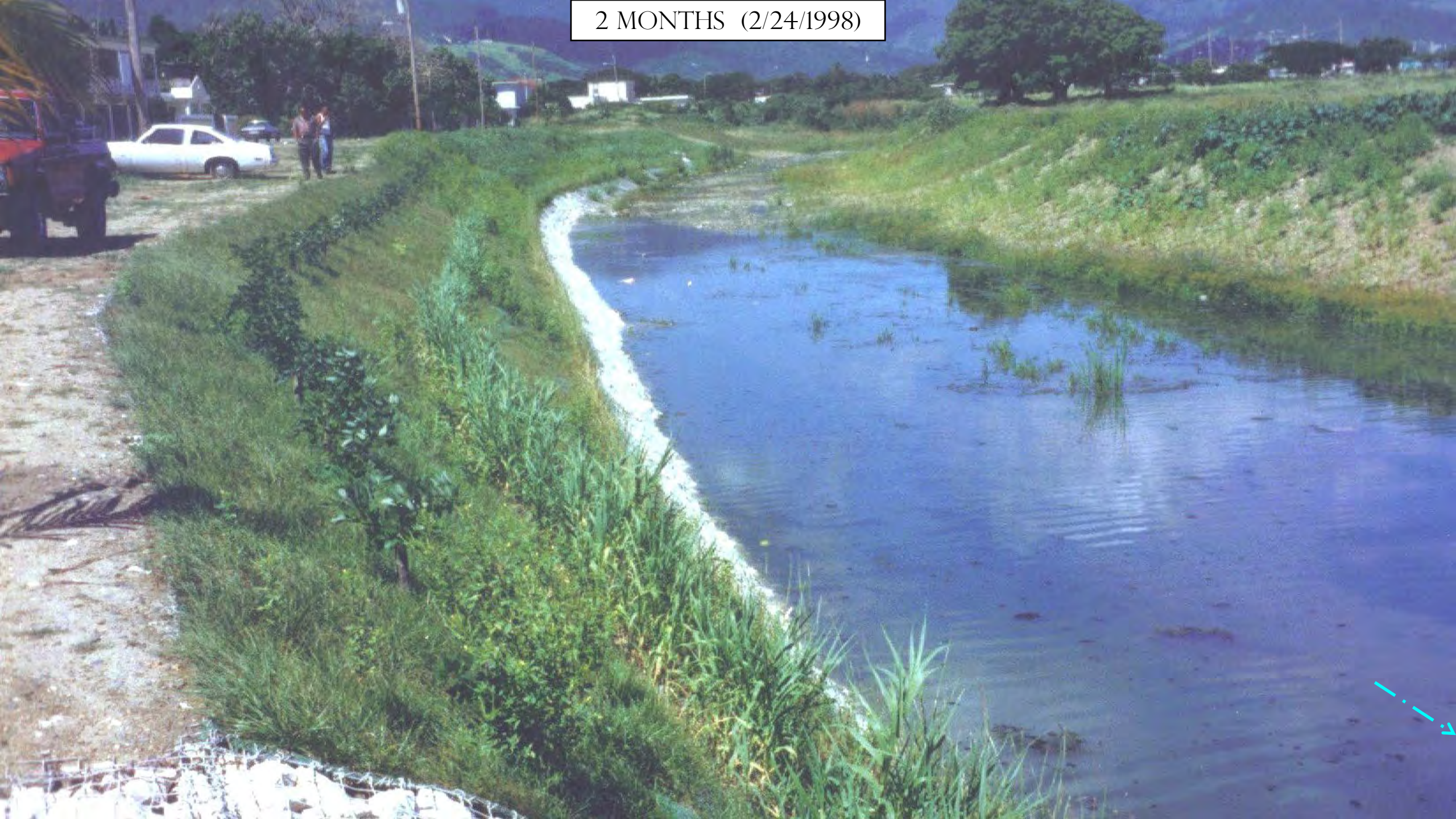
12/8/1997


12/17/1997

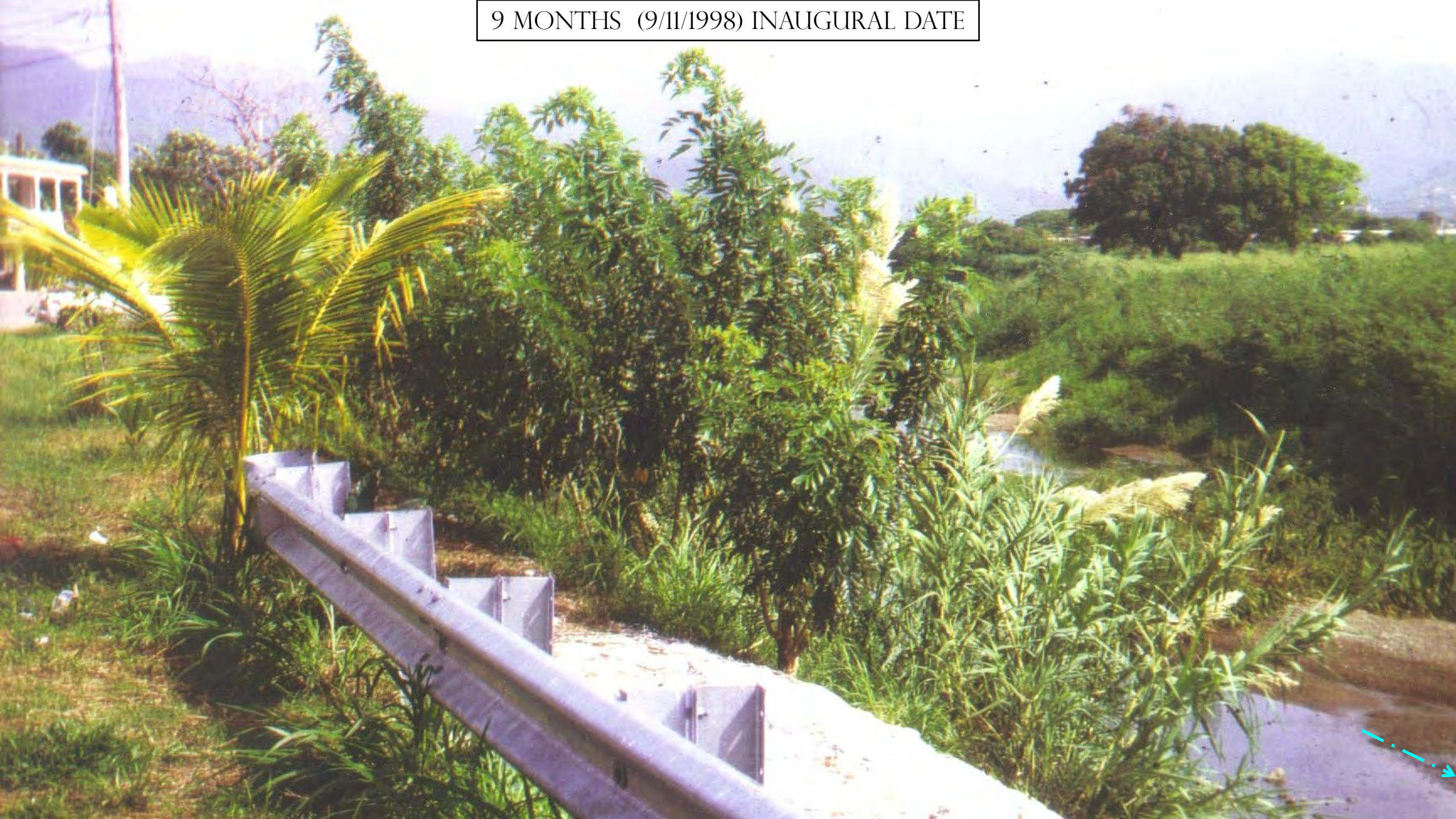
PROJECT COMPLETED 12/23/1997


20 DAYS (1/13/1998)

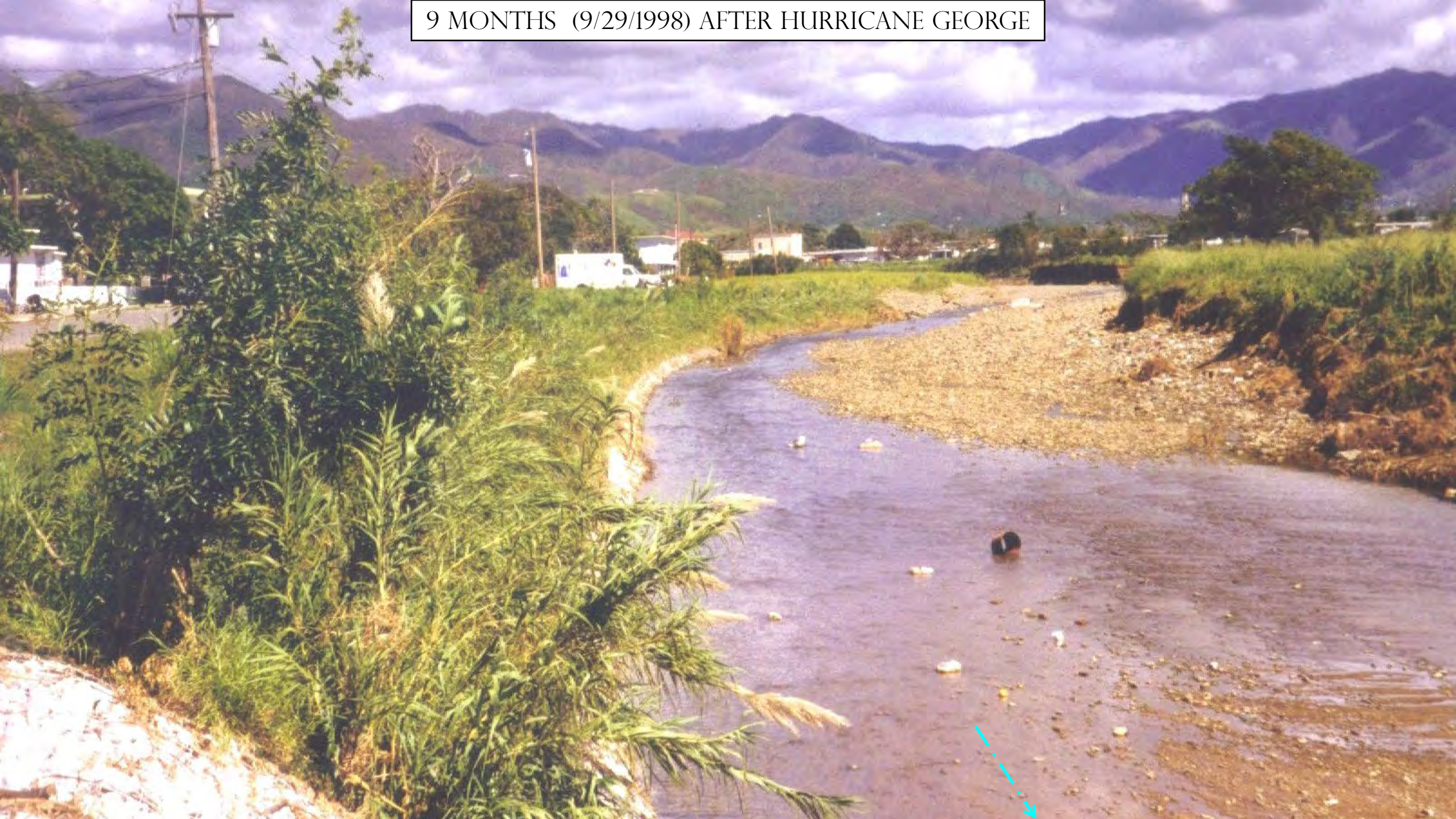
2 MONTHS (2/24/1998)



9 MONTHS (9/11/1998) INAUGURAL DATE



9 MONTHS (9/29/1998) AFTER HURRICANE GEORGE



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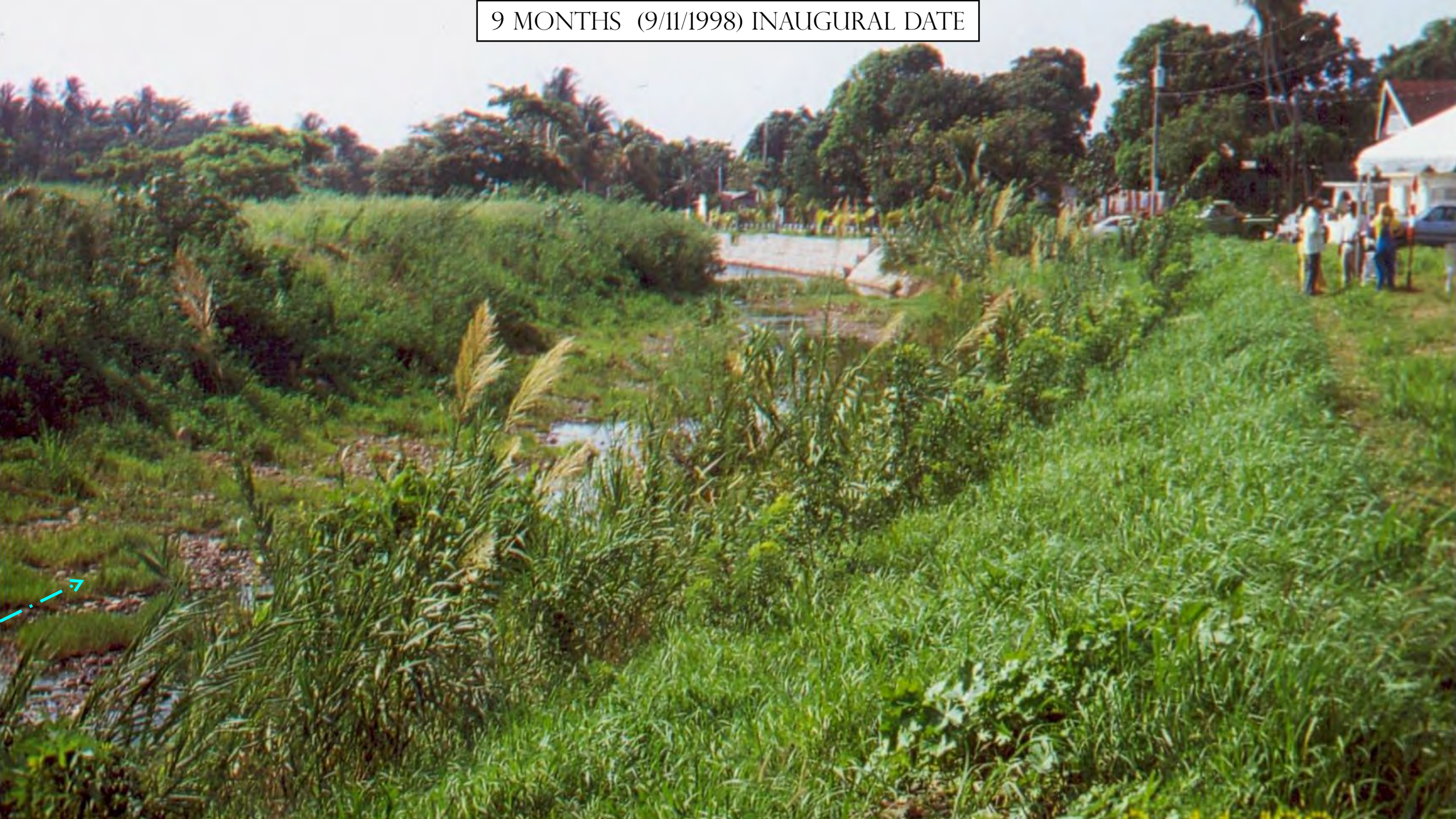

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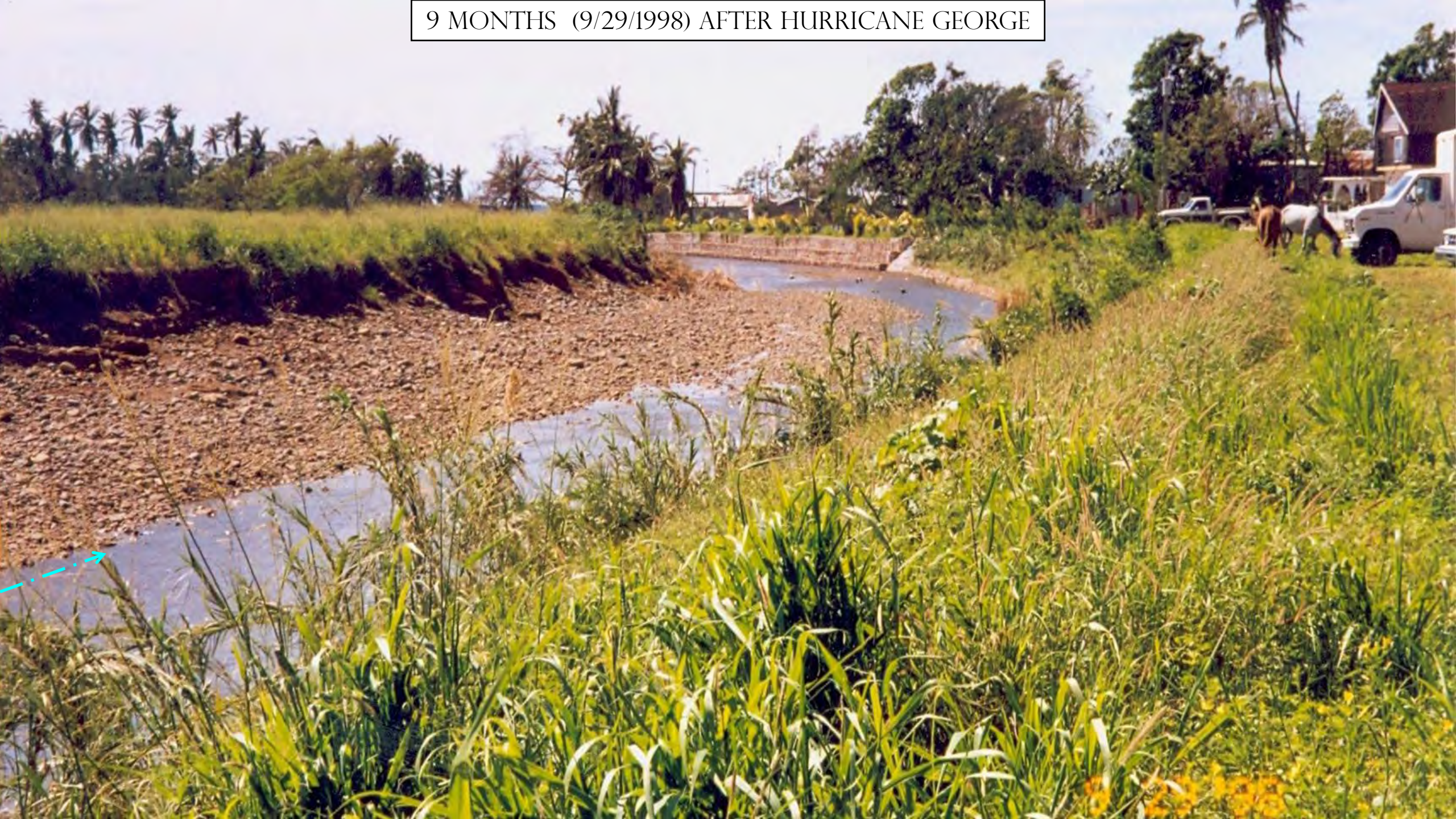


Success Story

EQIP Soil Bioengineering Loco River, Guanica, PR Susua Segment Completed 12/16/2015

Guanica Bay Coral Reef Protection Initiative – 2010

Rio Loco Streambank Protection, Susua Segment, Guanica, PR


2002
2004
2007
2010
2012
2014
Streambank Protection Project Started
2015
Sediment resulting from bank erosion
Loco River—Susua Segment
Guanica, PR
165m
2002
25m
2004
18m
2007
10m
2010
Area = 1,289 m2
Volume = 6,445 m3
Mass = 9,104 tons
Area = 1,242 m2
Volume = 6,210 m3
Mass = 8,771 tons
Area = 518 m2
Volume = 2,590 m3
Mass = 3,658 tons

EXIT RIFFLE RAMP

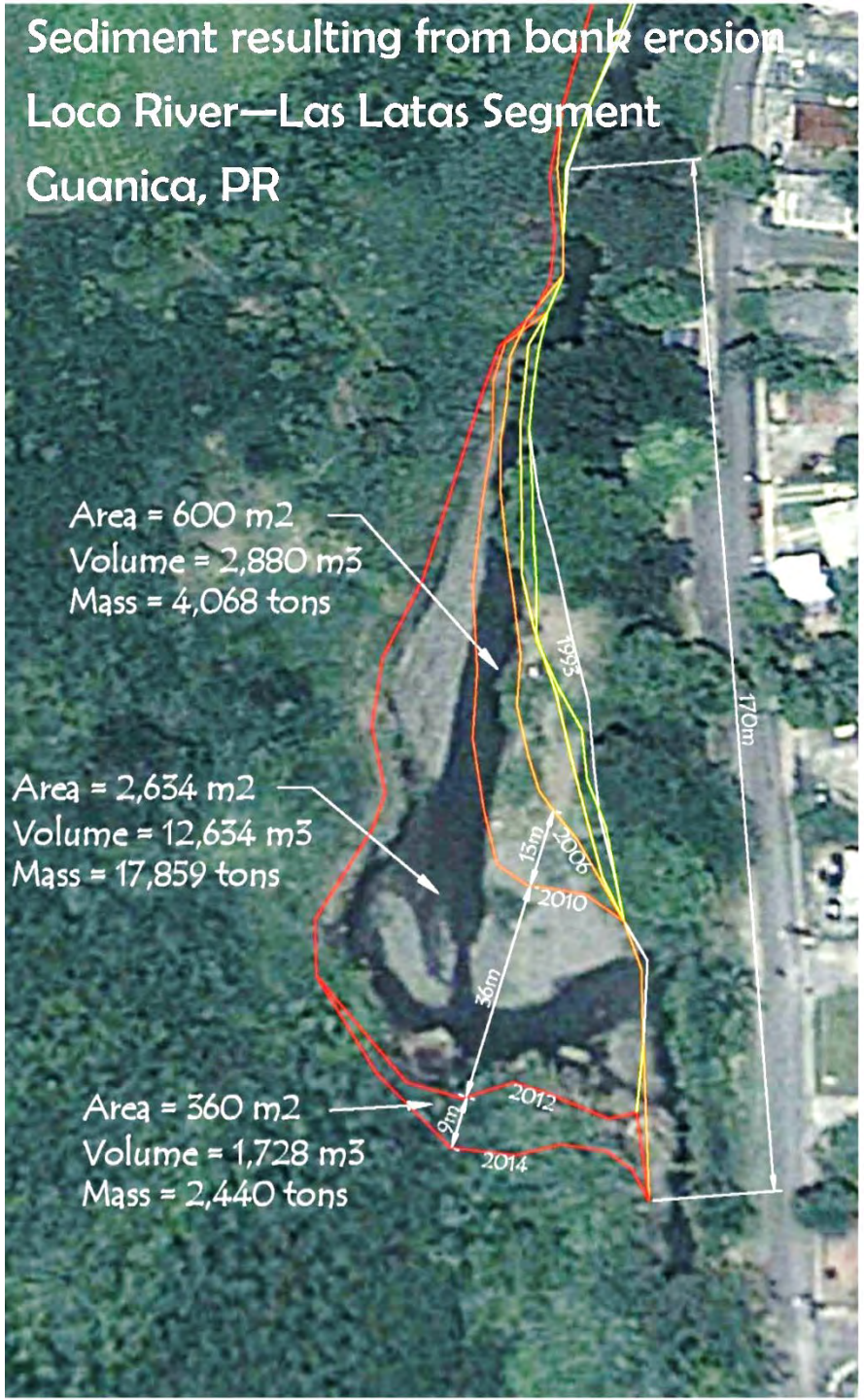
ROCK STREAM BARBS

Success Story

EQIP Soil Bioengineering Loco River, Guanica, PR Las Latas Segment Completed 9/28/2015

Guanica Bay Coral Reef Protection Initiative – 2010

Rio Loco Streambank Protection, Las Latas Segment, Guanica, PR


Sediment resulting from bank erosion
Loco River—Las Latas Segment
Guanica, PR
Area = 600 m2
Volume = 2,880 m3
Mass = 4,068 tons
Area = 2,634 m2
Volume = 12,634 m3
Mass = 17,859 tons
Area = 360 m2
Volume = 1,728 m3
Mass = 2,440 tons
1995
2006
2010
2012
2014
15m
36m
9m
170m

“A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise.”

Aldo Leopold

REFERENCES

USDA - Natural Resources Conservation Service
NEH Part 650 - Engineering Field Handbook
Chapter 16 Streambank and Shoreline Protection
https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17553.wba

USDA - Natural Resources Conservation Service
NEH Part 650 - Engineering Field Handbook
Chapter 18 Soil Bioengineering for Upland Slope Protection and Erosion Reduction
https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17555.wba

USDA - Natural Resources Conservation Service
NEH Part 653 - Stream Corridor Restoration: Principles, Processes, and Practices
https://directives.sc.egov.usda.gov/

USDA - Natural Resources Conservation Service
Part 654 - Stream Restoration Design
https://directives.sc.egov.usda.gov/

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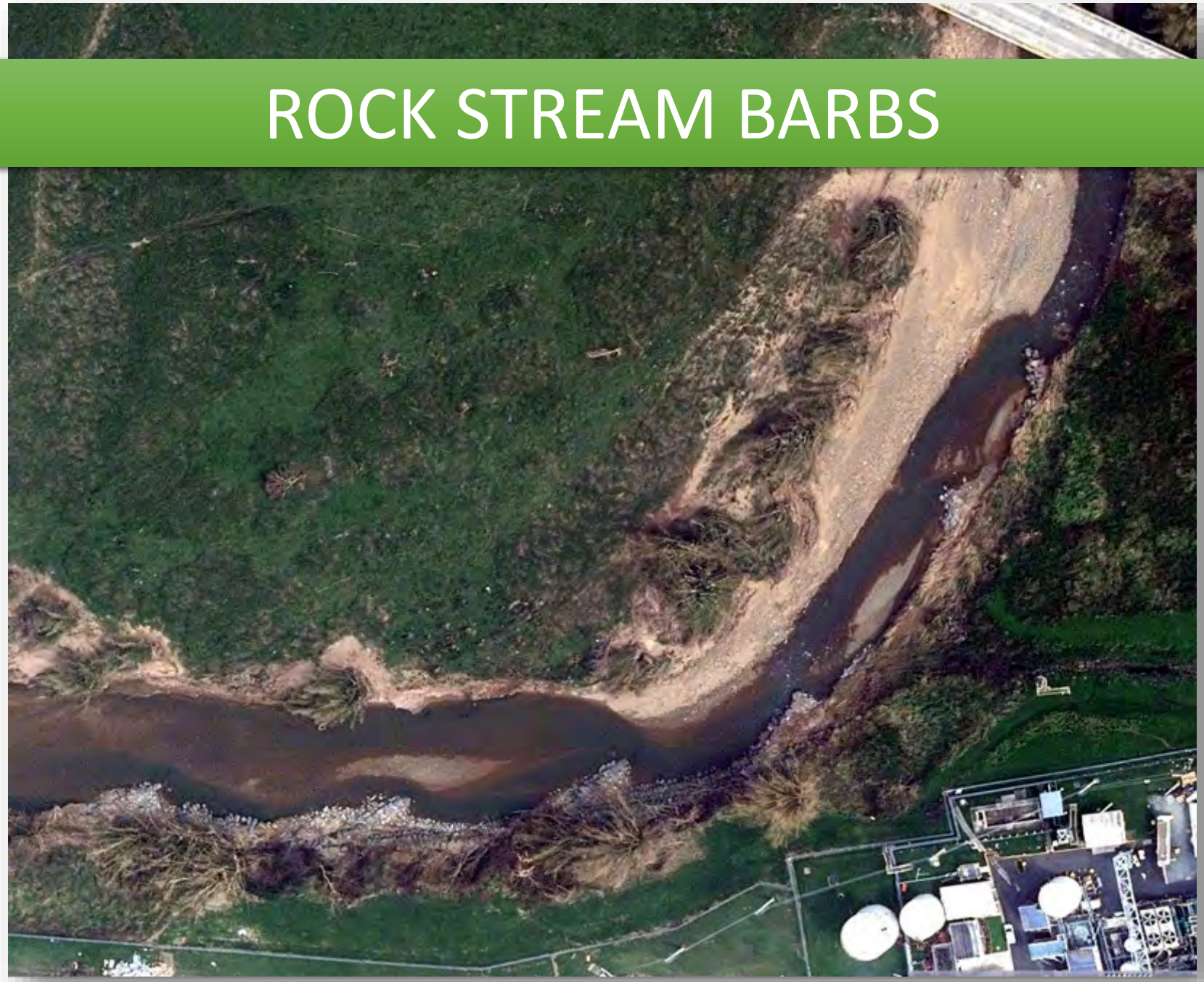
ROCK STREAM BARBS



LIVE BRUSH MATTRESS REVETMENT

GRADE STABILIZATION STRUCTURE (DROP)