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WATER CANADA THE COMPLETE WATER MAGAZINE

Polymer Enhanced BMPs in Stormwater Management and Erosion Control

Seva Iwinski

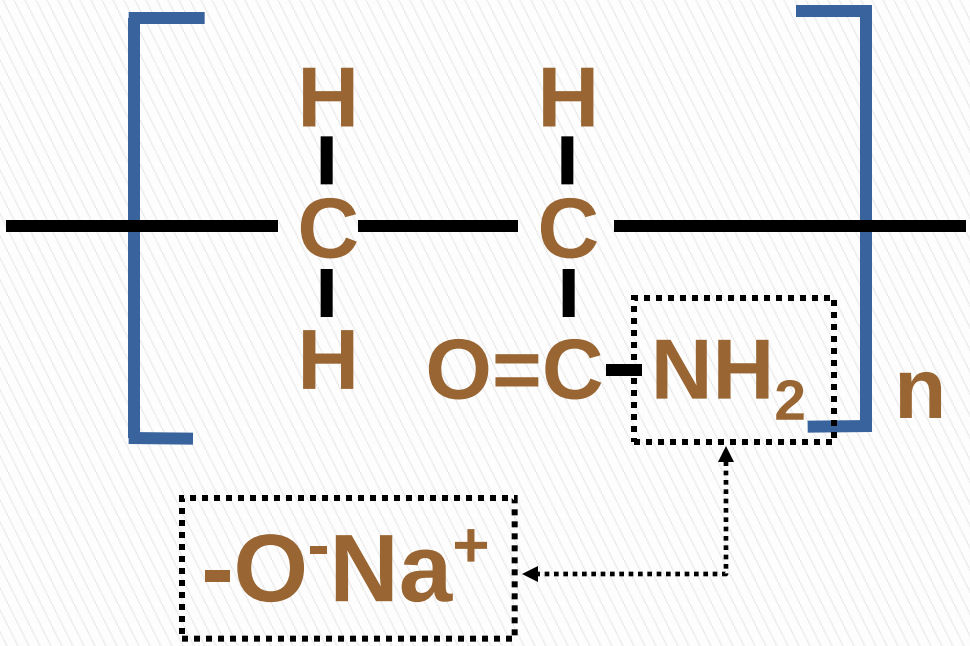
Applied Polymer Systems, Inc.

TRIECA

2015

Anionic Polyacrylamide (PAM)

- PAM is a polymer of acrylamide (AMD) monomers
- Erosion PAMs are 12 to 24 Mg/mole & >150,000 chained monomers/molecule
- Erosion PAMs have <0.05% unreacted AMD



USDA ARS

NWISRL
Kimberly, ID

Anionic PAM is the active ingredient. Only products using water soluble anionic PAM as the active polymer ingredient should be used. Products containing a synthetic cationic polymer or chitosan should not be used due to their higher toxicity to aquatic organisms.

-Anionic Polyacrylamide Application Guide for Urban Construction in Ontario

Prepared by Toronto and Region Conservation

June 2013

http://sustainabletechnologies.ca/wp/wp-content/uploads/2013/02/Polymer-Guide-Final_NewFormat.pdf

Although cationic polymers are effective flocculants and do reduce turbidity, their positive charges make them toxic to aquatic organisms when dissolved in water. Consequently they should not be used as flocculants in stormwater that runs off the land into natural waterbodies. However, anionic polymers, which carry a negative charge, are not toxic.

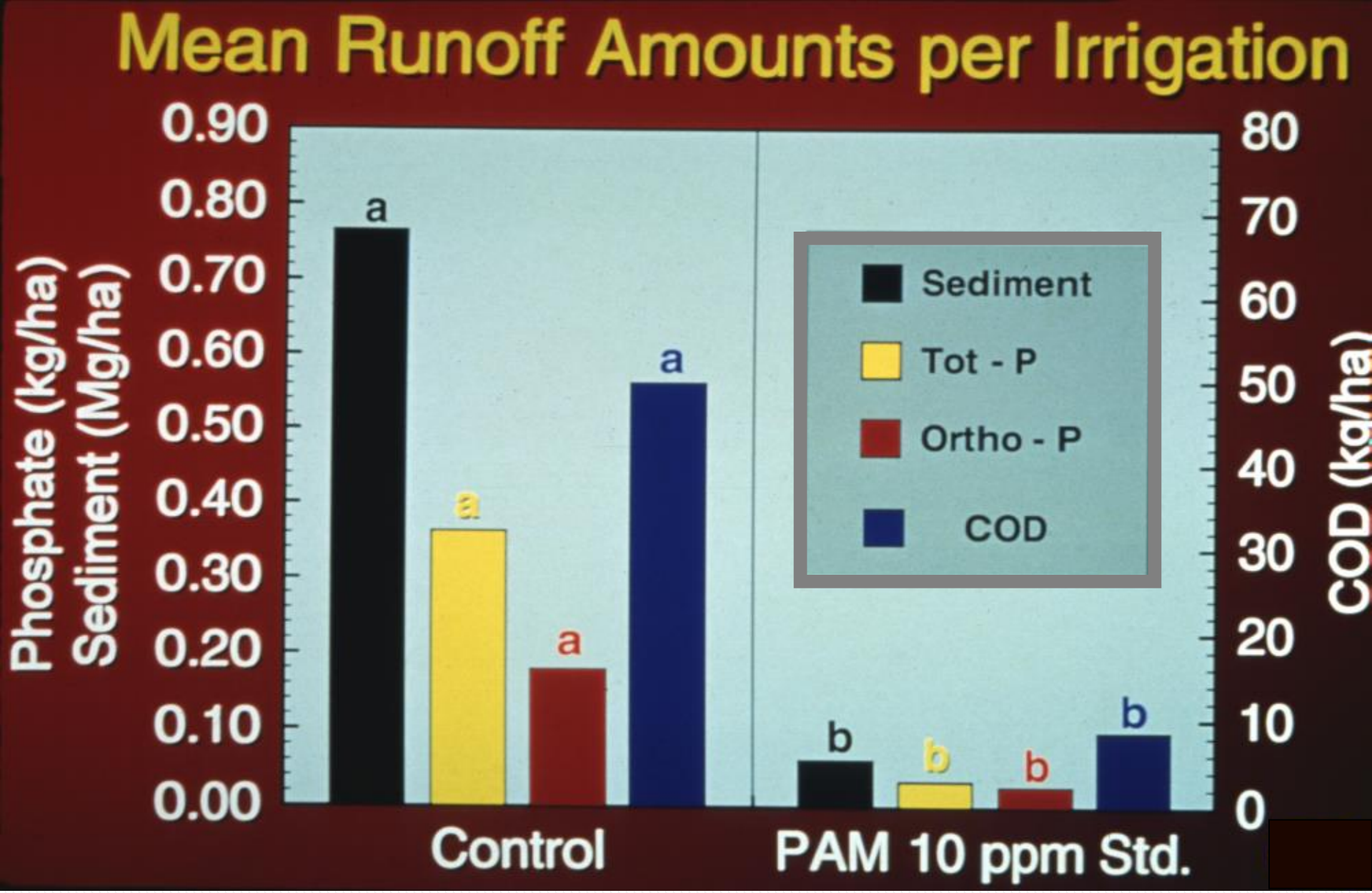
- Office of Water, 4203M
www.epa.gov/npdes/pubs/polymerfloc.pdf
Stormwater Best Management Practice: ***Polymer Flocculation October 2013***

Anionic Erosion and Water clarifications PAM based polymers are FAR less toxic than Fungicides, Insecticides, Rodenticides, Cationic Polymers, most Herbicides and even concentrated Fertilizers.

-USDA
Kimberly, ID

USDA Has Used PAM To:

- Reduce Agricultural Erosion
- Increase Soil Infiltration
- Improve Crop Yield



California & Idaho Research Also Show Reduced Pesticide in Runoff

USDA

NWISRL
Kimberly, ID

ars

Uses of Polyacrylamide

Removal of suspended solids from industrial waste water before discharging, reuse, or disposal

Clarify fruit juices and sugar liquors

COSMETICS

Flocculent in the treatment of municipal water supply

Mineral Processing

POTABLE WATER

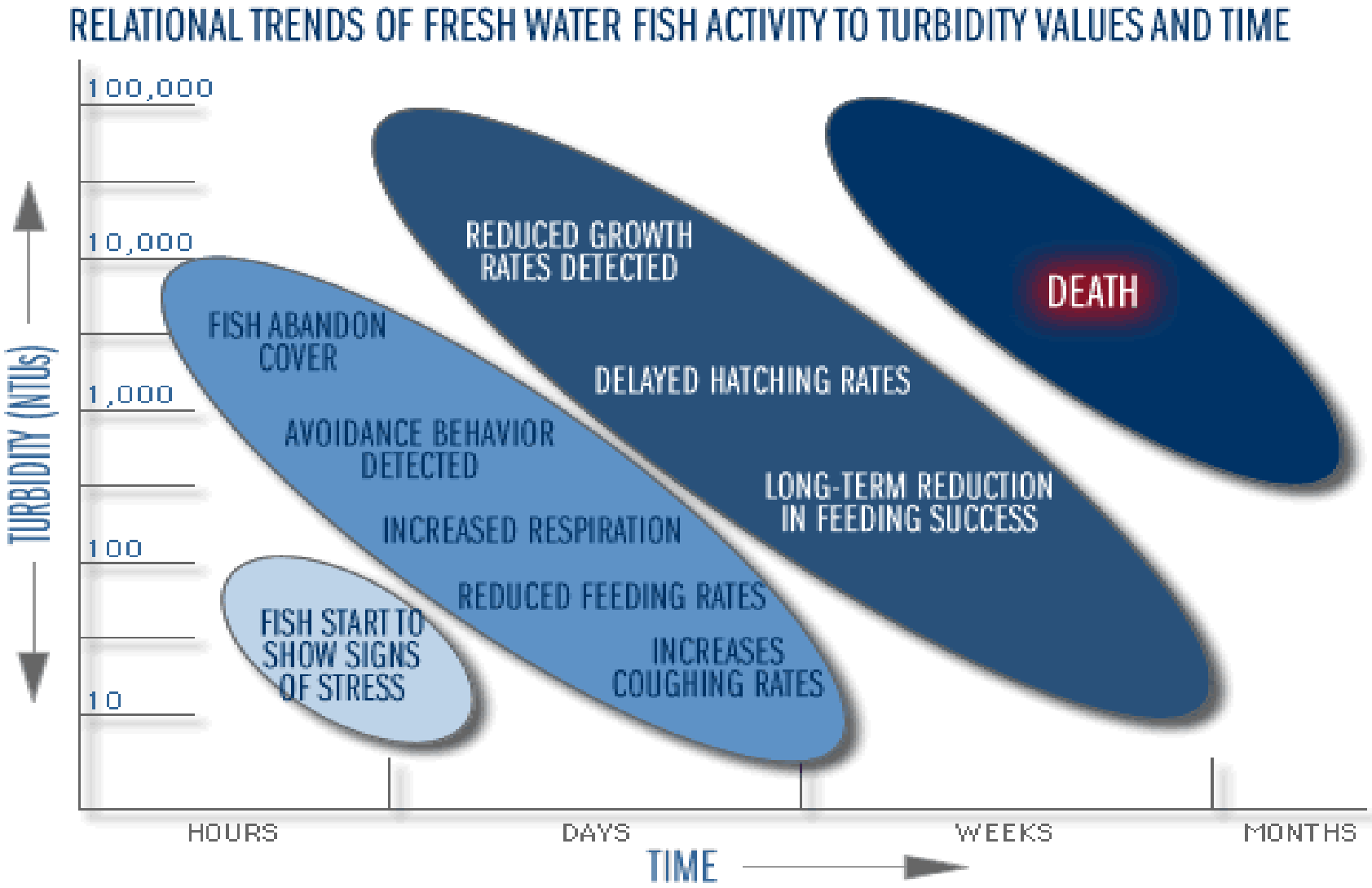
Adhesives and Paper in contact with food

-Mining and Drilling applications-

Paper and Pulp Production

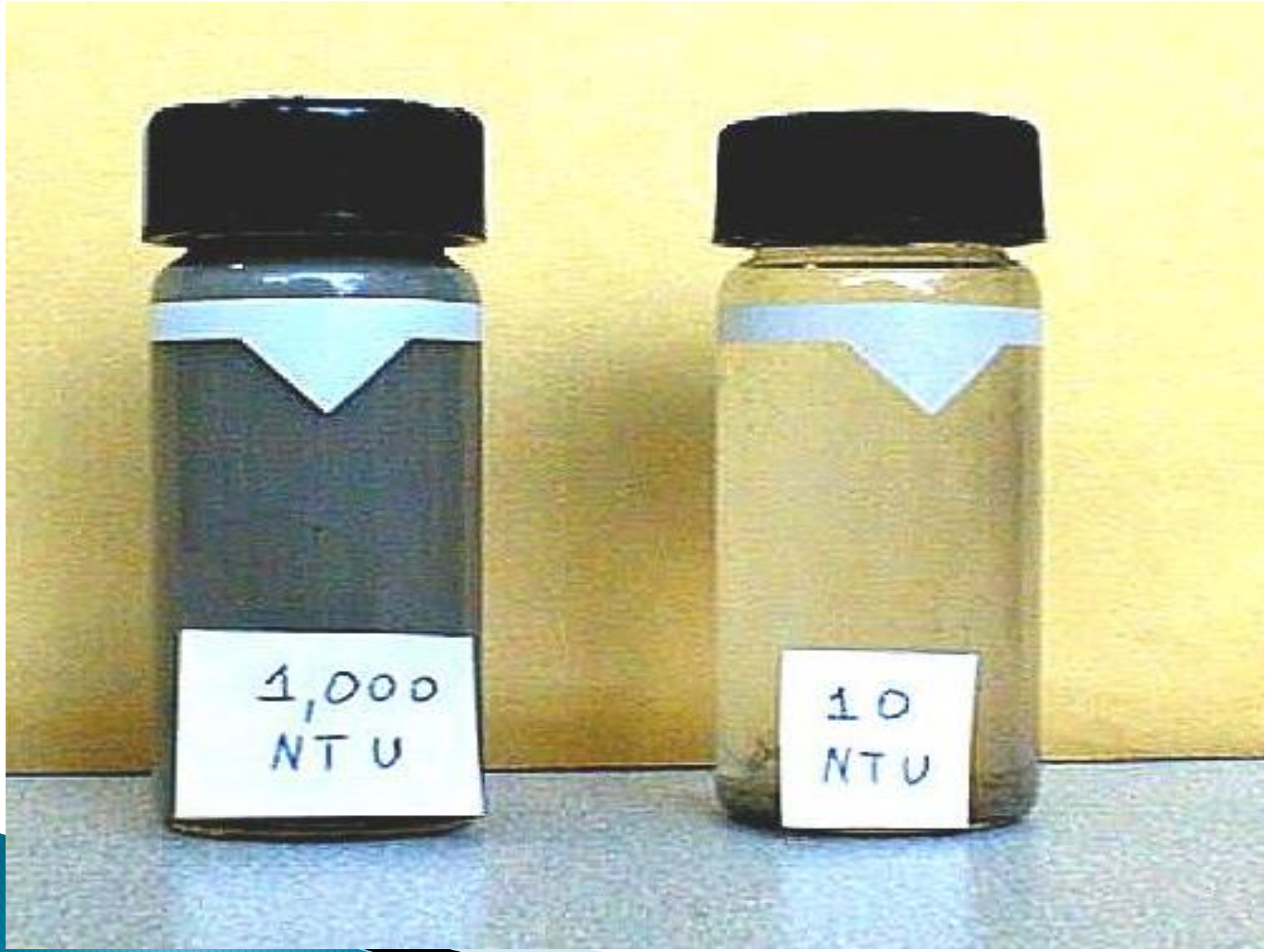
Animal Feed Thickener

Soil conditioning agent



http://duluthstreams.org/understanding/param_turbidity.html

Schematic adapted from "Turbidty: A Water Quality Measure", Water Action Volunteers, Monitoring Factsheet Series, UW-Extension, Environmental Resources Center. It is a generic, un-calibrated impact assessment model based on Newcombe, C. P., and J. O. T. Jensen. 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management. 16: 693-7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Types of Materials

- Emulsions
- Powders
- Floc/Pond Log

PRODUCT SELECTION:

Safe based on expected release rates, toxicity reports and product Material Safety Data Sheets (MSDS). An MSDS should be available for the specific anionic PAM product to be used, and should indicate that the product is safe at the anticipated concentration (calculated from product release rate) and based on the intended use. As a minimum, acute and chronic toxicity test data should also be available from the manufacturer or a third party organization….

-Anionic Polyacryamide Application Guide for Urban Construction in Ontario

http://sustainabletechnologies.ca/wp/wp-content/uploads/2013/02/Polymer-Guide-Final_NewFormat.pdf

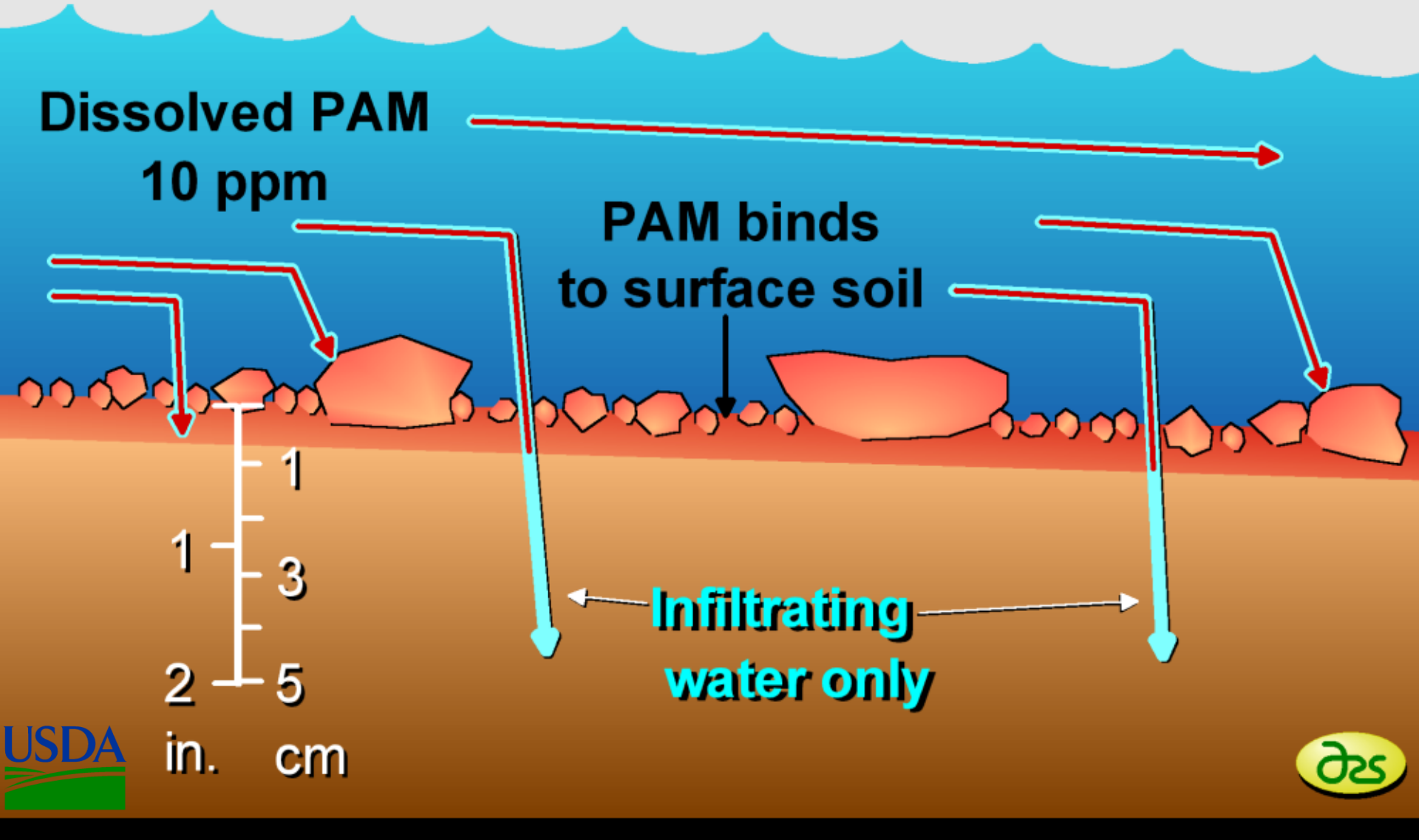
PERFORMANCE

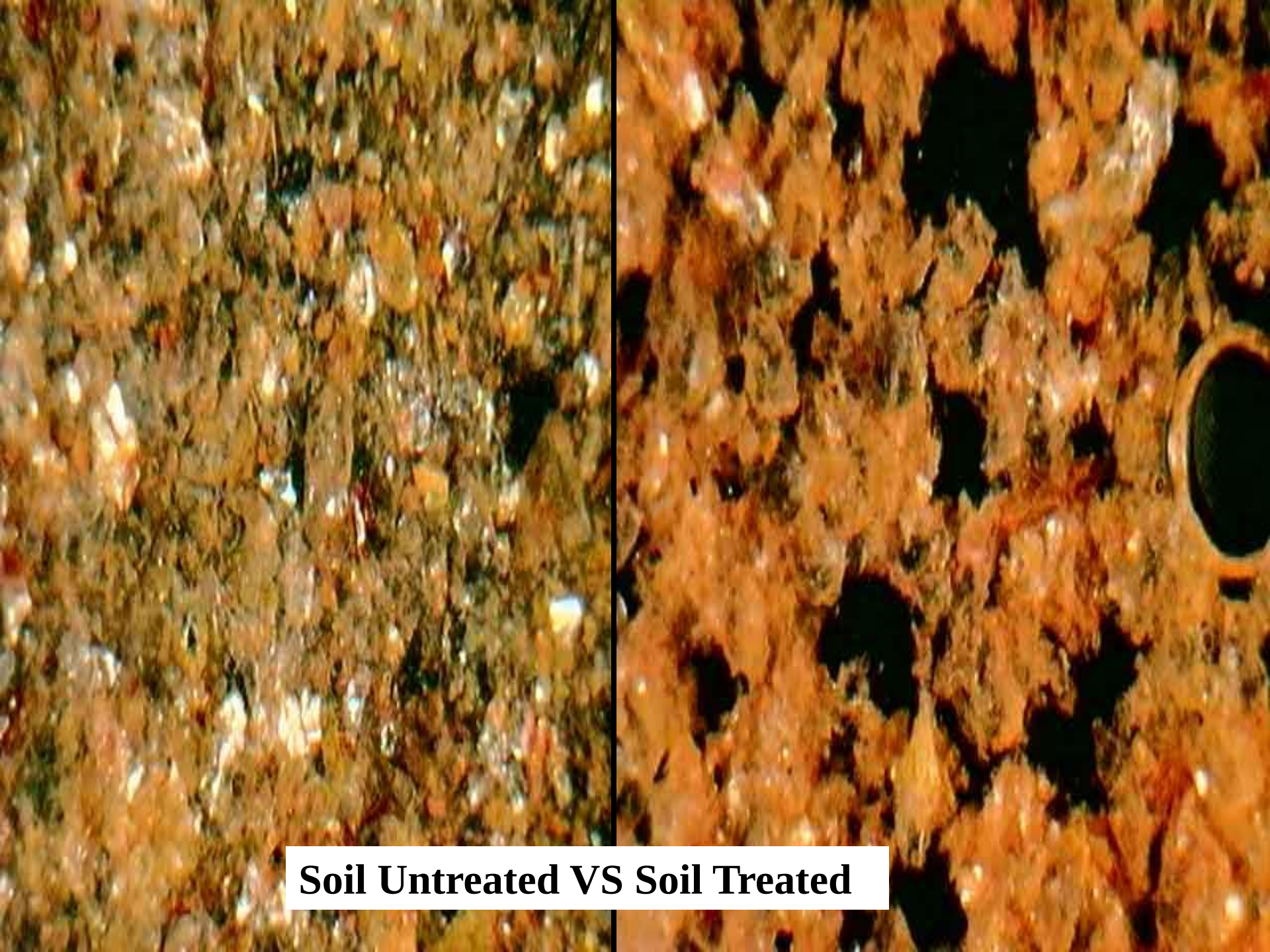
- One PAM does not work on all soil and water chemistries
- Performance testing before applying is necessary to ensure results
- Can be done doing a simple “cup test”
- Using an incorrect PAM:
  - You may not see results
  - It may not bind to your soil at all

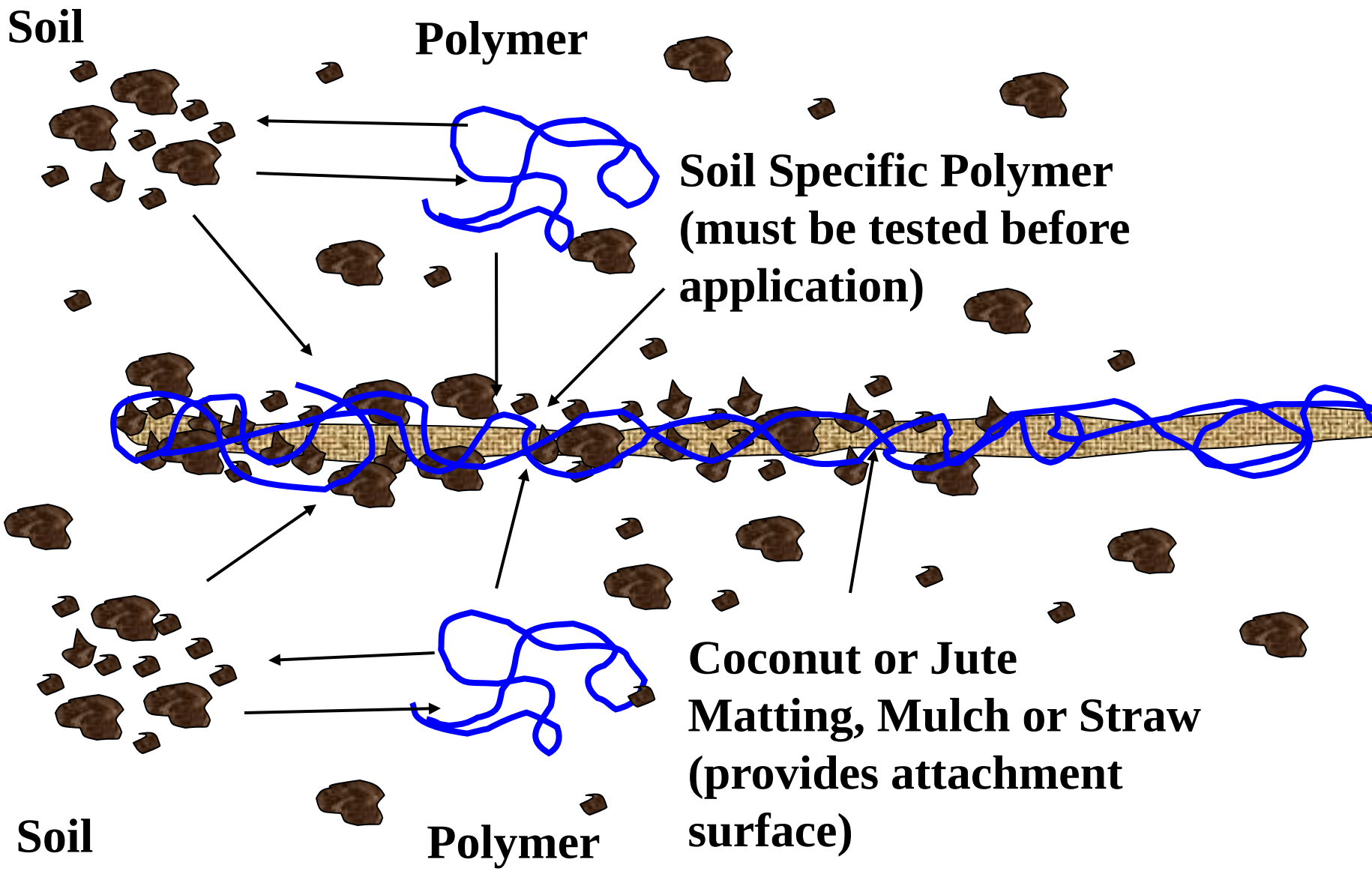
Polymer Enhanced Soil Stabilization

(Including Polymer Enhanced Soft Armoring technique)

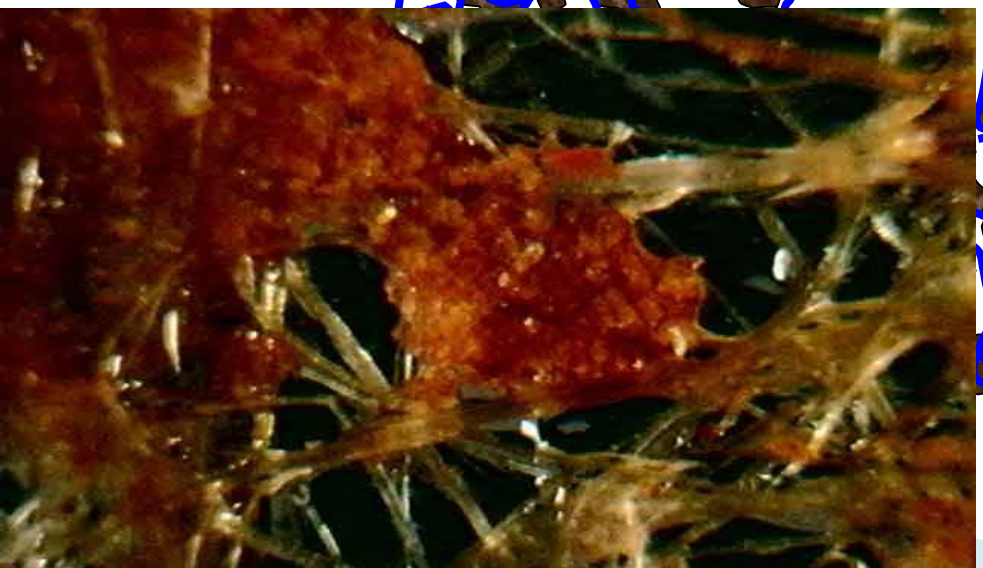
PAM-Treated Furrow Irrigation




Soil Untreated VS Soil Treated

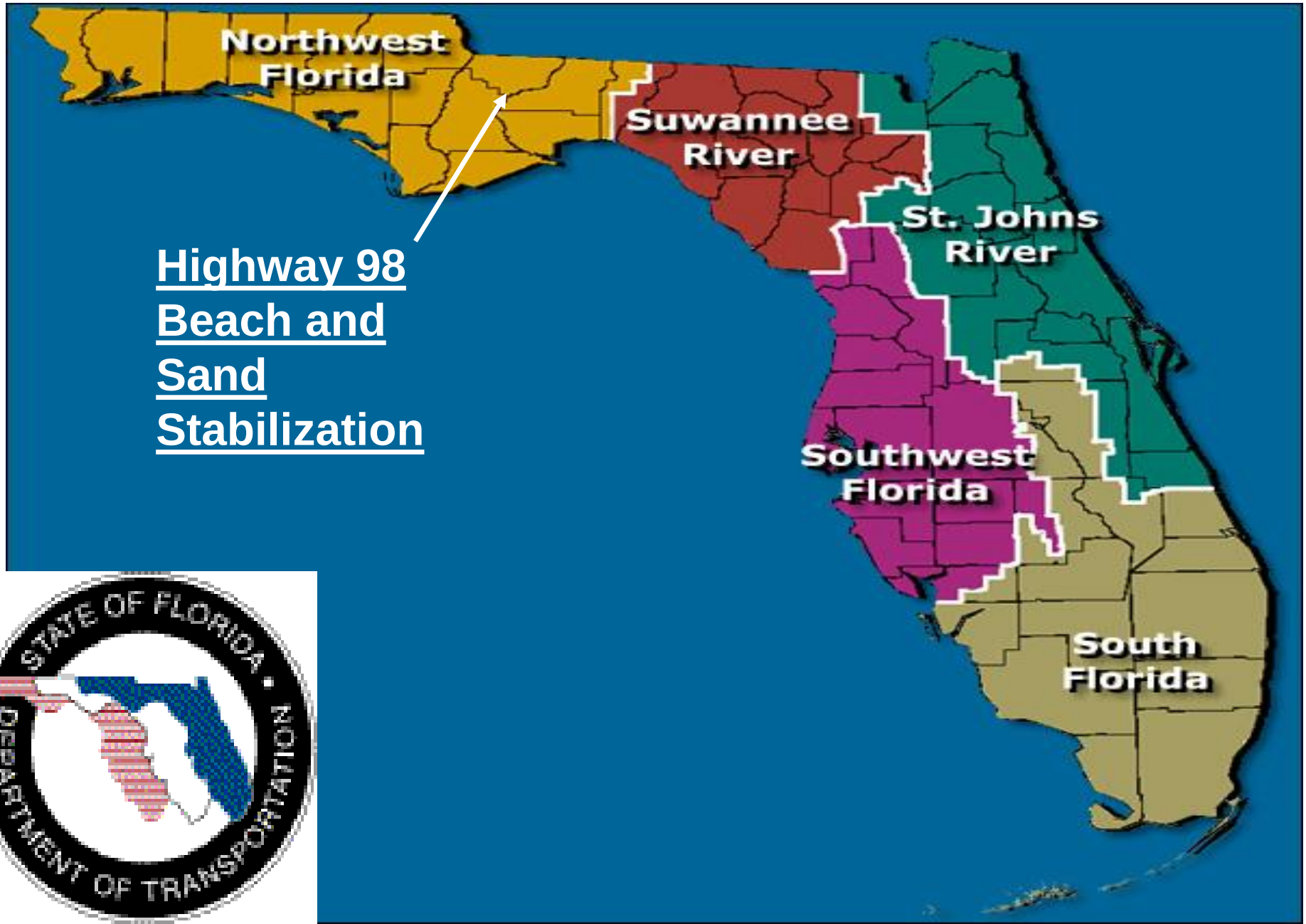

Soil
Polymer
Soil Specific Polymer (must be tested before application)
Coconut or Jute Matting, Mulch or Straw (provides attachment surface)
Soil
Polymer

Polymer-Soil Matrix



Polymer + Soil agglomerations attach to each other

HWY 98 DOT Project



Highway 98 Damage by Hurricane Dennis

July 2005 (Carabelle to Eastpoint)

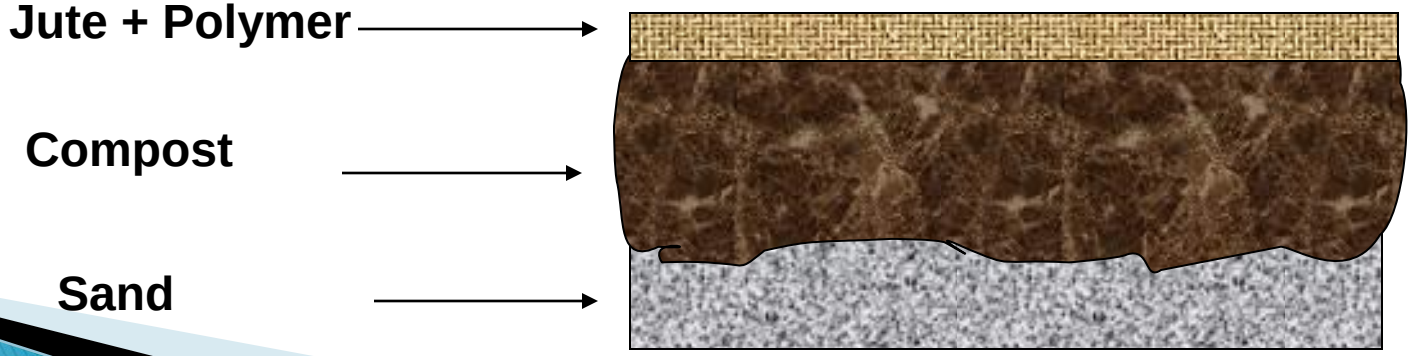
Highway 98 Repair - Carabelle to Eastpoint

Erosion after initial repair required an industrial BMP that would work on beach sands

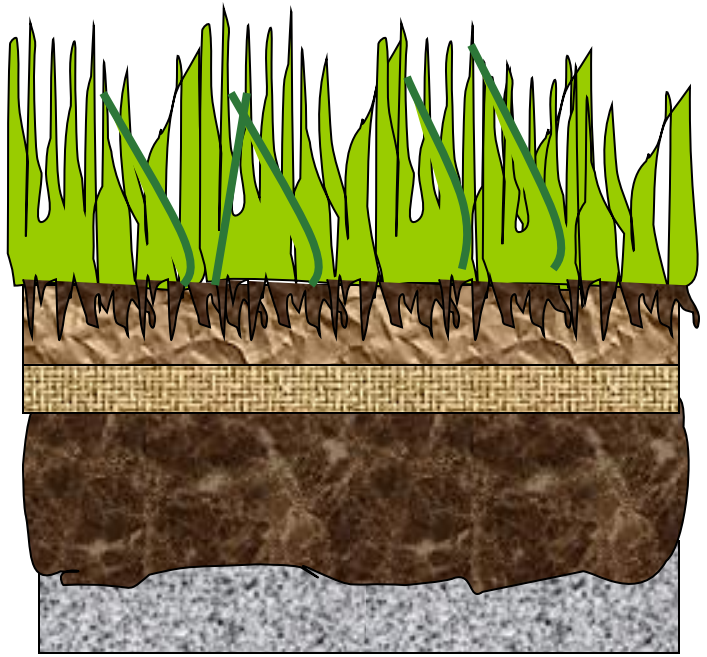
Polymer Enhanced Soft Armor Systems was chosen. After grading, compost was placed as an organic layer

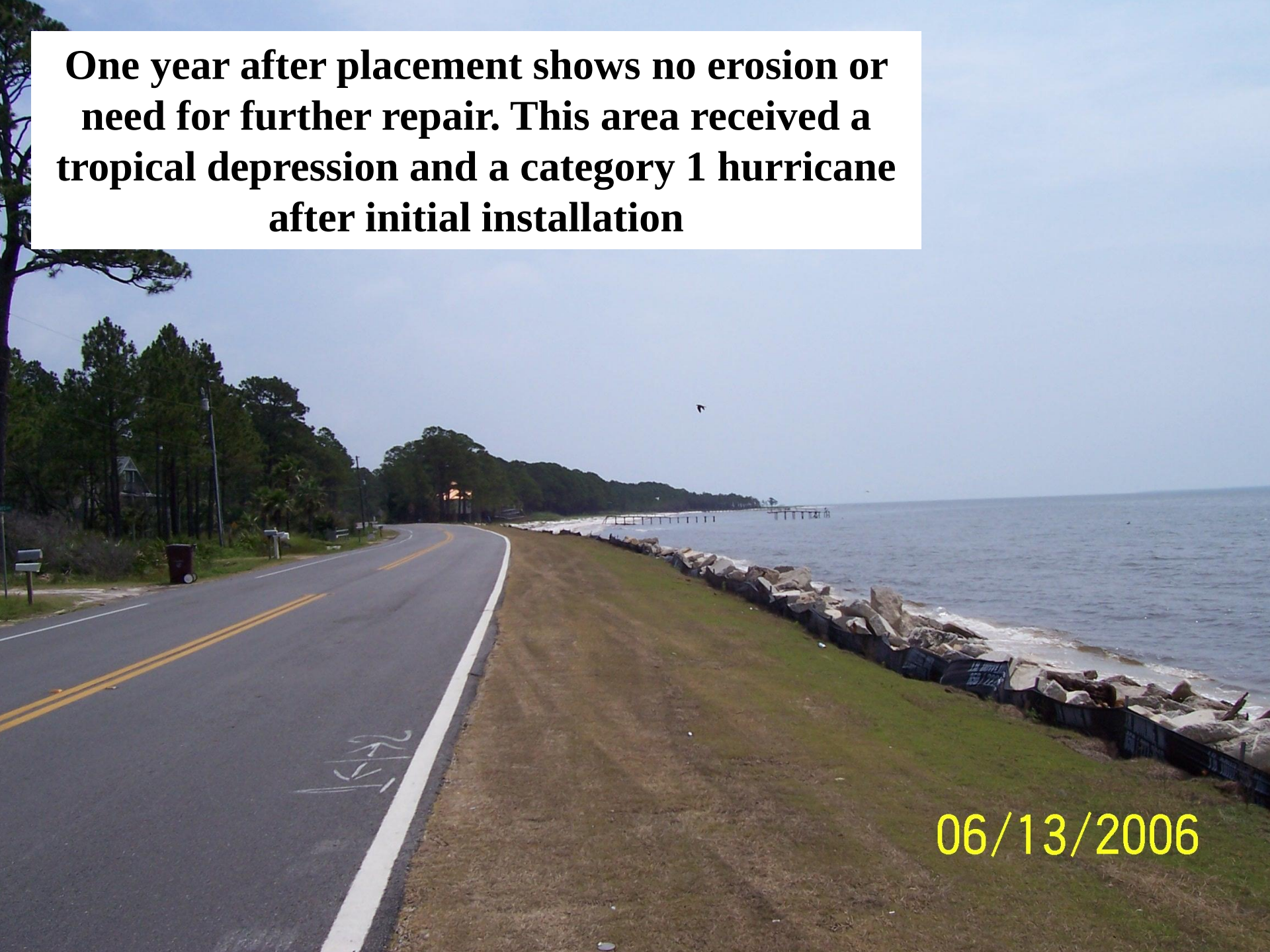
Jute matting was placed over the organic layer as a binding media for attachment of the polymer, sand and soil

Jute matting was placed over the 14 miles of repair area as a binding agent. 50 pounds / acre polymer application rate was used

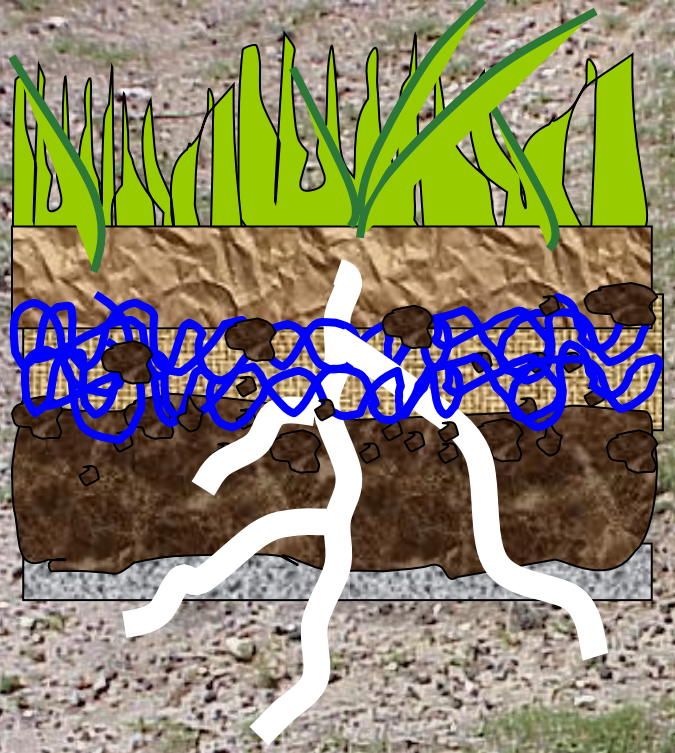


Sod was placed over the polymer enhanced BMP





One year after placement shows no erosion or need for further repair. This area received a tropical depression and a category 1 hurricane after initial installation



Polymer Enhanced Hydroseeding

Soft armoring with matting

Soft Armoring with Matting

Polymer Enhanced Inlet Protection

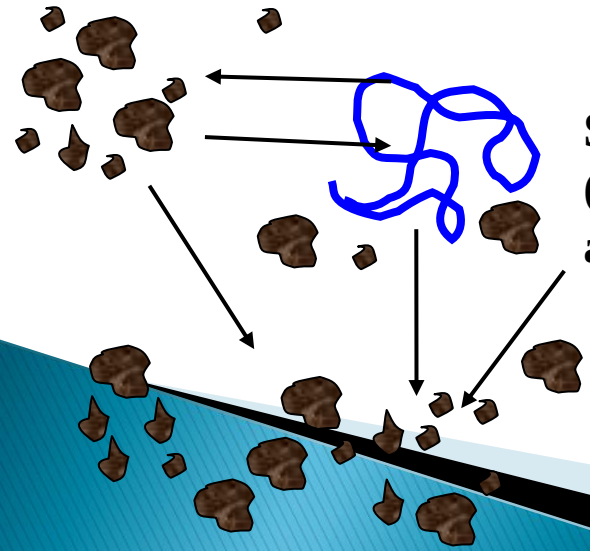
Sediment Retention Barriers (SRBs)

Sediment Retention Barriers (SRBs) in a treatment train

Water Clarification:

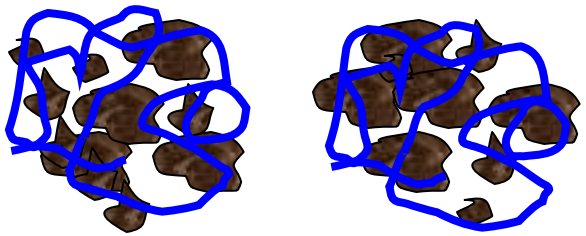
Mixing and Dewatering Systems

Soil **Polymer**



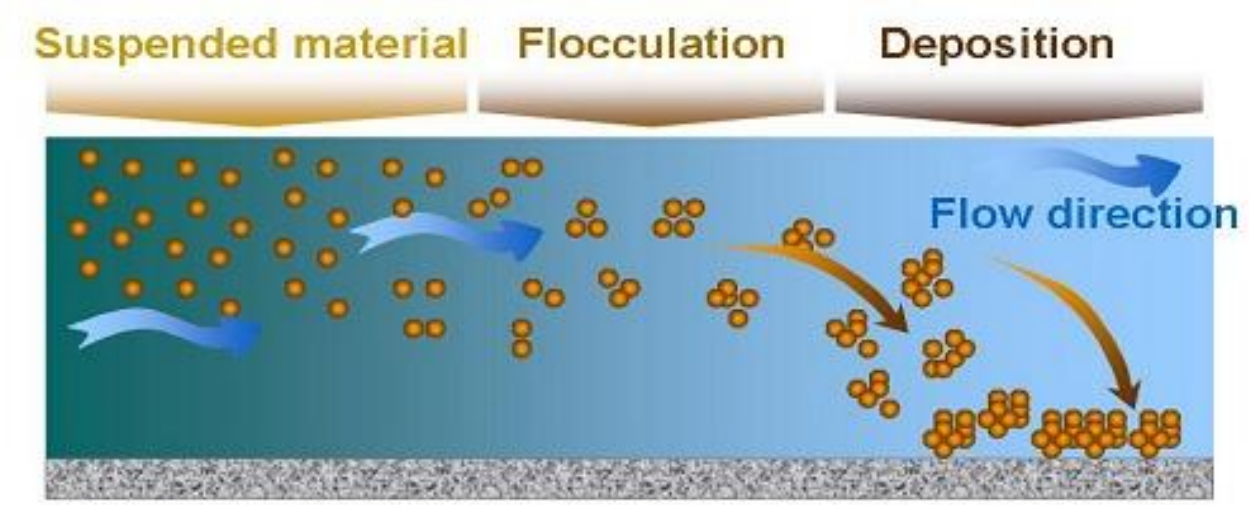
Soil Specific Polymer (must be tested before application)

Polymer + Soil matrix forms an agglomeration



Flocculation is the process where a chemical agent (flocculant) is used to reduce the turbidity of a liquid by binding suspended particles in the liquid together to form larger particles (flocs) that are heavy enough to settle to the bottom of the liquid…..Polymer flocculation provides the basis for a number of best management practices (BMPs) for reducing turbidity and its toxicity.

-www.epa.gov/npdes/stormwater/menuofbmps



Dewatering/treatment ditches using polymer logs

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Dewatering/treatment ditches using polymer logs

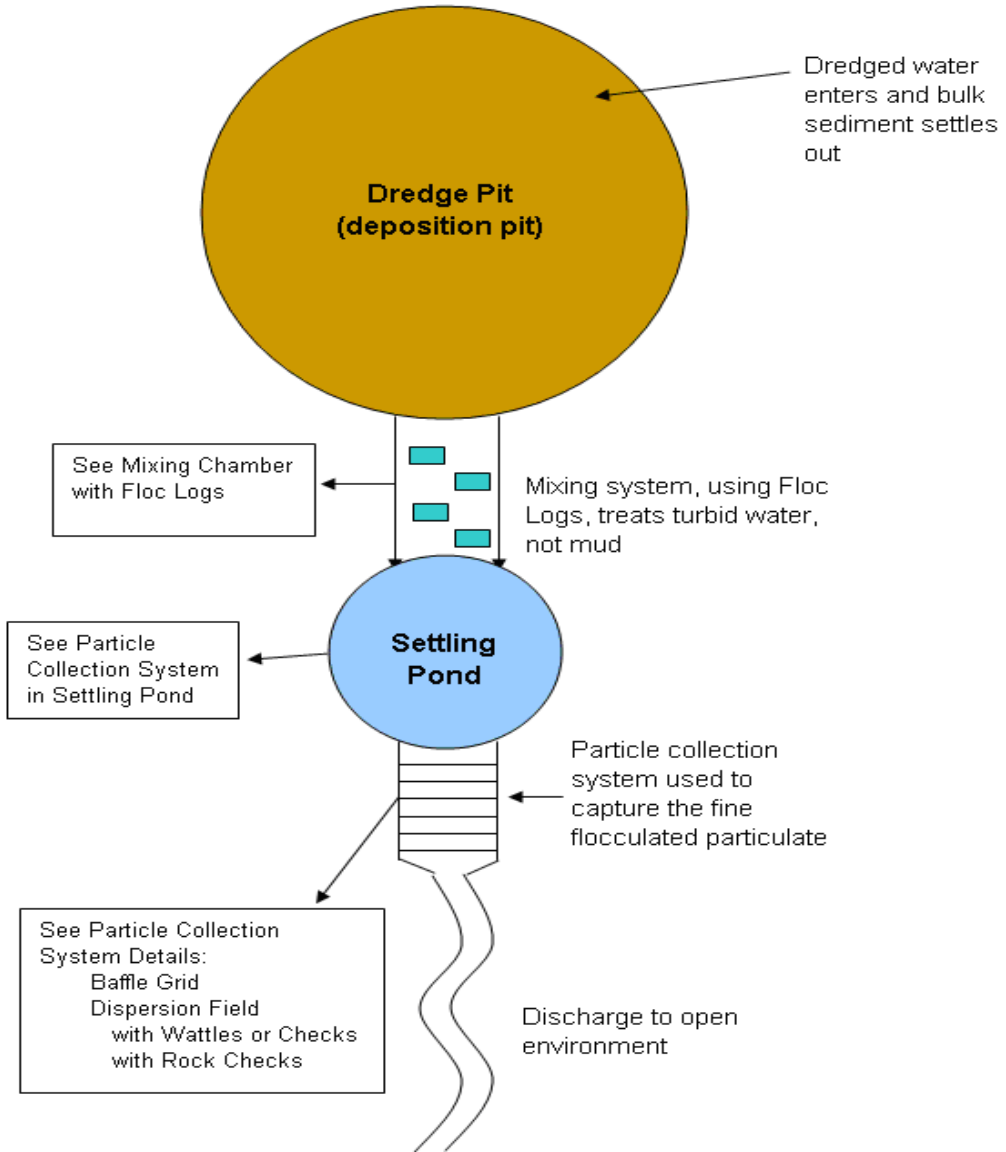
Particle Curtains

Dewatering/treatment ditches using polymer logs

Kentucky Lake Project
Tennessee Valley Authority (TVA)

In Henry County, TN
Spring 2007

Dredging


Dredged water enters and bulk sediment settles out
Dredge Pit (deposition pit)
See Mixing Chamber with Floc Logs
Mixing system, using Floc Logs, treats turbid water, not mud
See Particle Collection System in Settling Pond
Settling Pond
Particle collection system used to capture the fine flocculated particulate
See Particle Collection System Details:
Baffle Grid
Dispersion Field
with Wattles or Checks
with Rock Checks
Discharge to open environment

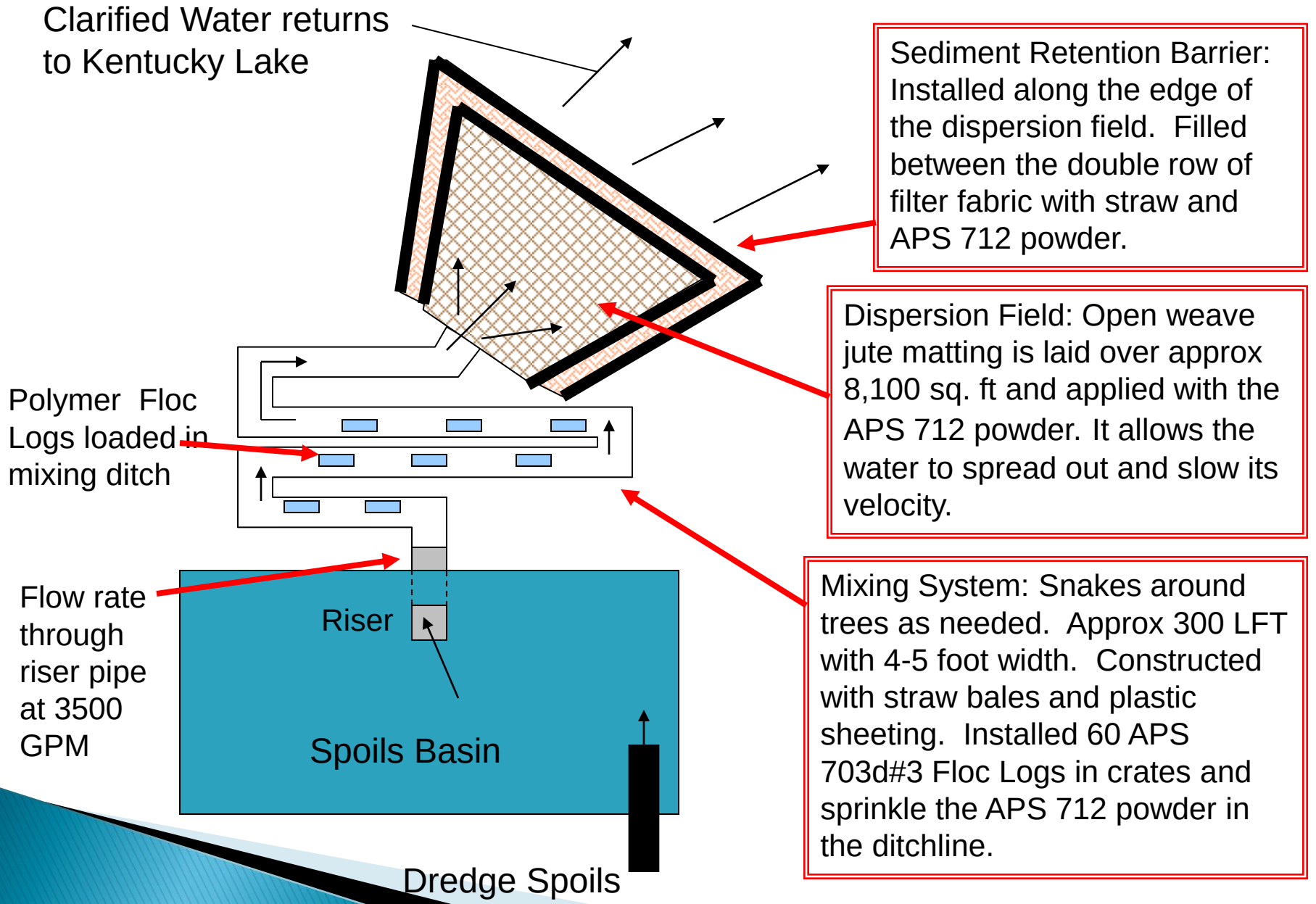
Dewatering/treatment ditches using polymer logs

Dredge spoils from Kentucky lake were discharged to a stilling basin.

Dewatering/treatment ditches using polymer logs

The water discharged from the riser into a wooded wetland area (TVA owned) and eventually back to Kentucky Lake. Complaints of deposits of clay fines in the wetlands and concerns about erosion caused the project to be shut down by TDEC.

Kentucky Lake Project, Dewatering Treatment System Diagram



Dewatering/treatment ditches using polymer logs

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Dewatering/treatment ditches using polymer logs

Dewatering/treatment ditches using polymer logs

Mud/Sediment Removal

Mud/Sediment Removal

Mud/Sediment Removal

Mud/Sediment Removal

Mud/Sediment Removal

Mud/Sediment Removal

Pond and Lake Management:

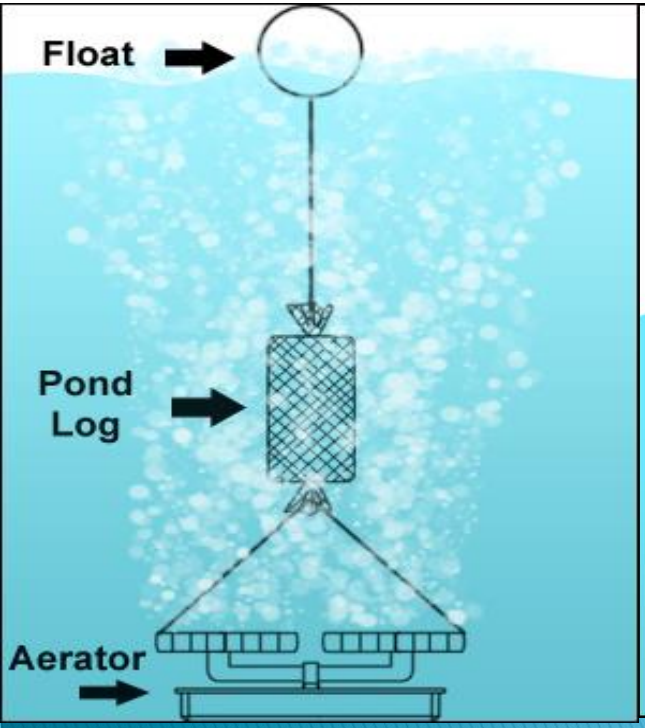
Inanimate Nutrient Control

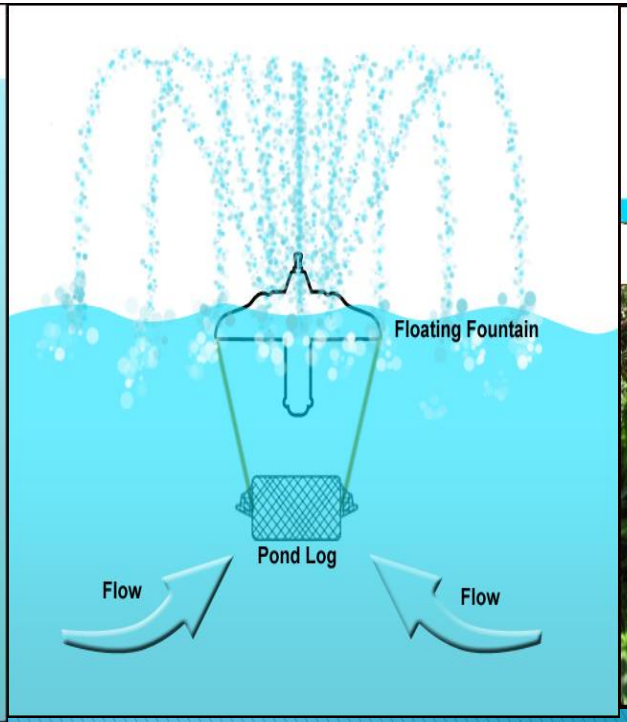
INANIMATE NUTRIENT REDUCTION USING POLYMER ENHANCED TECHNOLOGIES

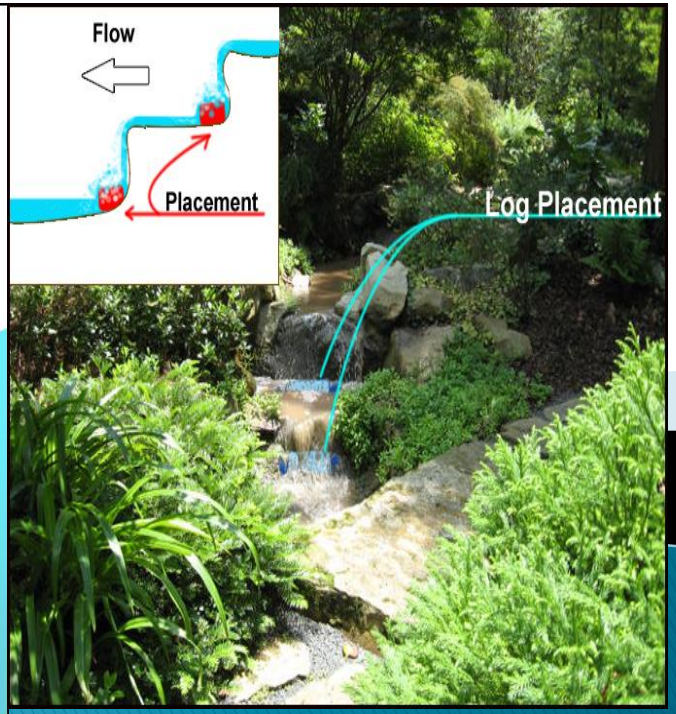
- **Studies have shown that by flocculating/ removing phosphorous using anionic water soluble polymer based technologies, inanimate nutrients can be removed and aquatic toxicity can be decreased.**

- **Various data from studies and research has shown up to a 75-90 percent reduction in phosphorus and up to a 95 percent reduction in overall turbidity.**

- **Pond Logs need to used in conjunction with circulation/aerations systems to get mixing, and in turn, reaction.**
- **As water flows over and around the Pond Log they slowly dissolve and their dissolved components are then circulated throughout the pond/lake.**
- **Phosphorus is then able to be bound together and removed from the water.**







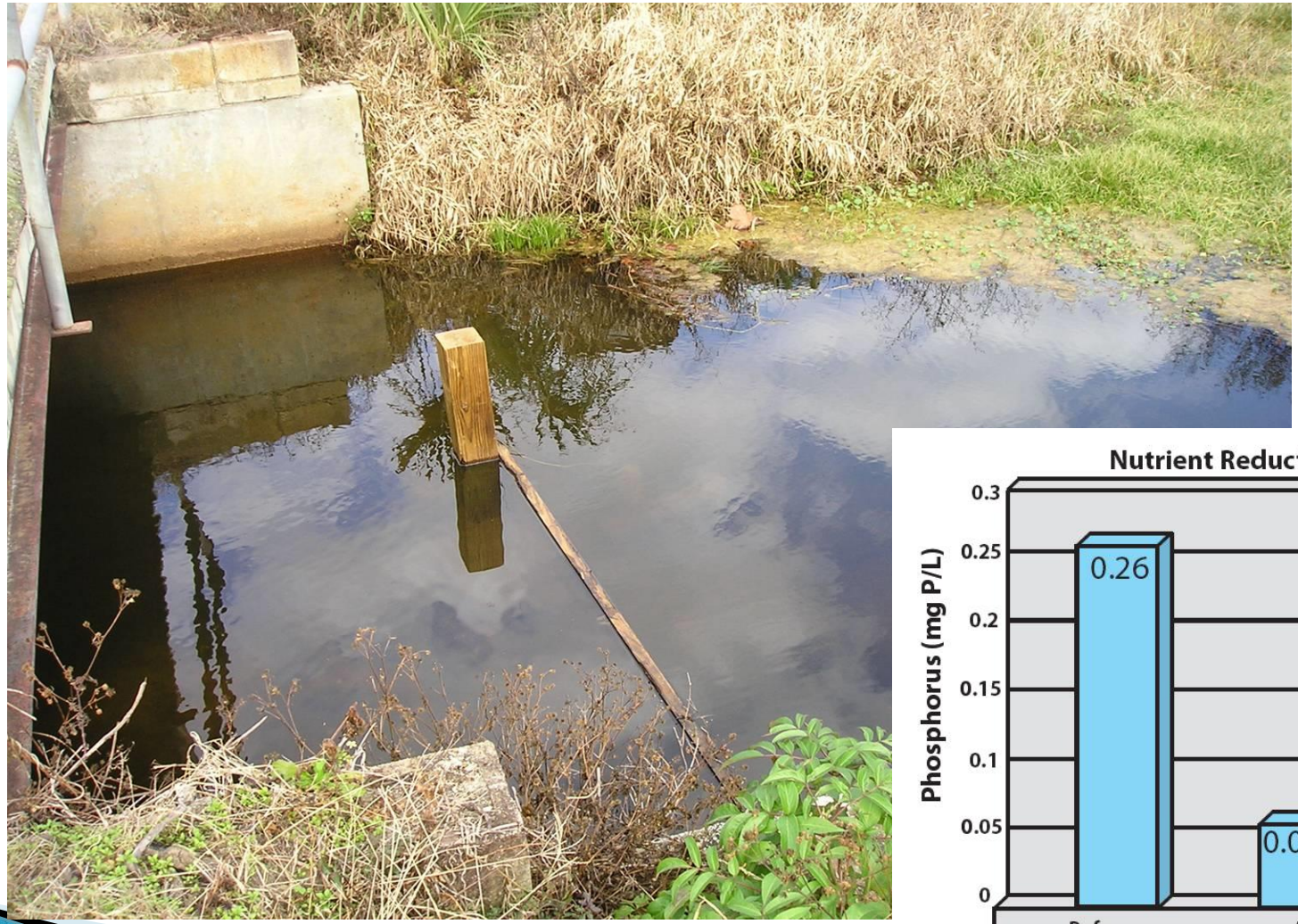
Hiliman Lake DEP Solar Bee Study

- Reedy Creek Water Management District did a 1,000 day study on Lake Hiliman starting in 2005
- A solar powered aerator/ circulator (SolarBee) was used in conjunction with the PAM blend technology
- The lake is a 2.4 acre storm water pond circulating 3 million gallons at 347 gpm
- Study was monitored and reported by Florida Department of Environmental Protection Agency

- Logs tied to a solar powered aerator/ circulator
- Placed in the flow of water to facilitate dissolving, mixing, and reaction
- Polymer is in a log form and can be added to many types of fountains, aerators, diffusers, or circulators

Before treatment

After treatment



Polymer References

http://kimberly.ars.usda.gov/pampage.shtml

www.stormwater.ucf.edu

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www.epa.gov/npdes/pubs/polymerfloc.pdf

www.epa.gov/npdes/stormwater/menuofbmps

www.siltstop.com

Go to: Polymer Enhanced BMP Application Guide