Applied Polymer Systems, Inc.
519 Industrial Drive
Woodstock, GA 30189
www.siltstop.com

Soil Specific Polymer Blend Applications and Corresponding BMPs

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University of Central Florida

Stormwater Management Academy
"Managed Stormwater is Good Water"

Senior Associate

The Winner

1999 TRI – 1 Billion Pounds of Toxins released to the environment

C&EN April 2001

Aquatic Toxicity Issues of (PAM), Polyacrylamide, PAM Blends and Cationic Polymers

Toxicities Result from:

1) Acrylamide Monomer (PAM)

2) Cationic Polymers

3) Non-Specific Lithology Applications

4) Improper Site Applications

1) Acrylamide monomer in PAM is regulated for water treatment and soil polymers.

When Non-Specific Lithology Applications Occur

Results are:

1) Excess polymer material is used

2) Water viscosity increases

3) Poor soil binding occurs

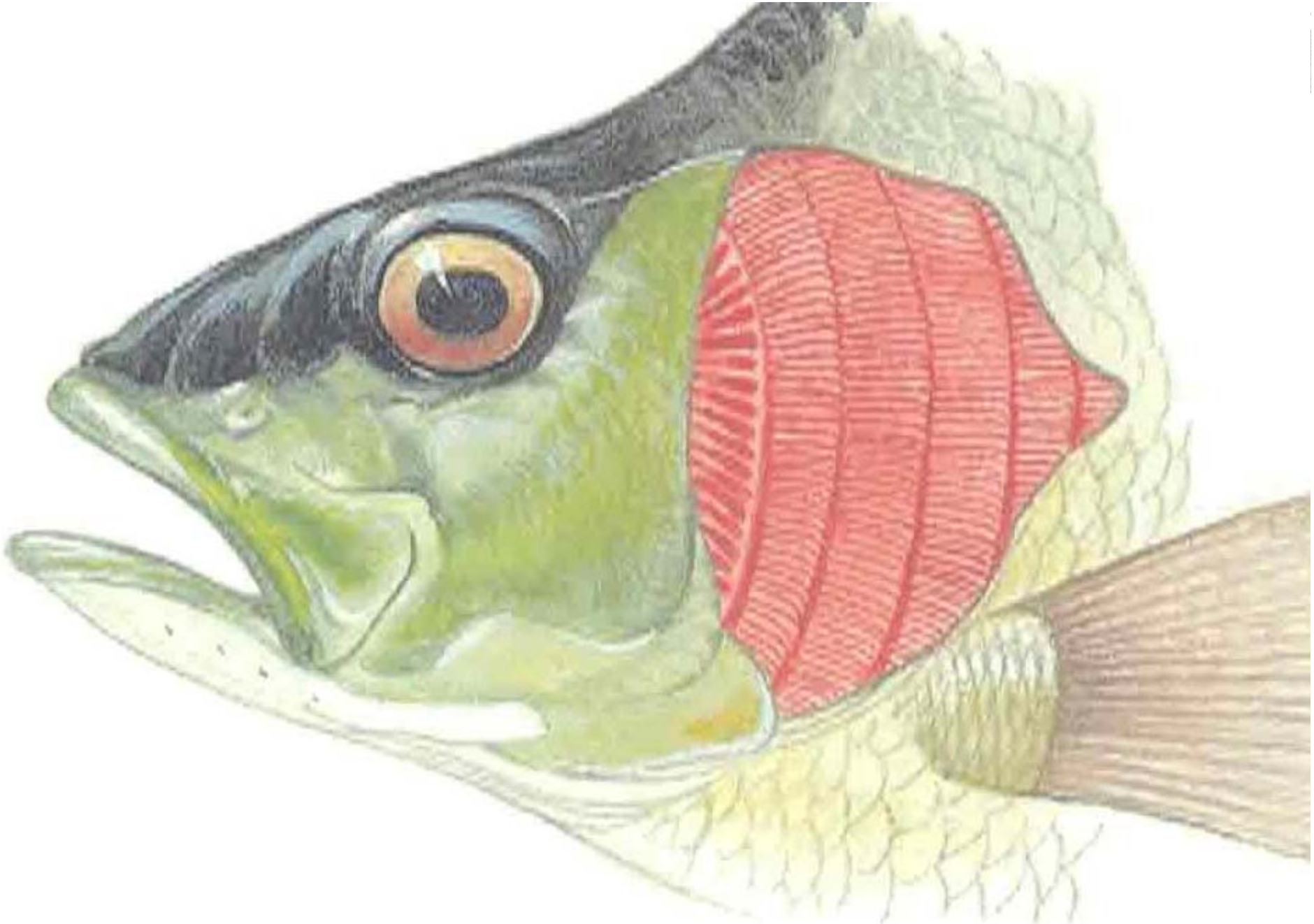
4) Poor water quality results

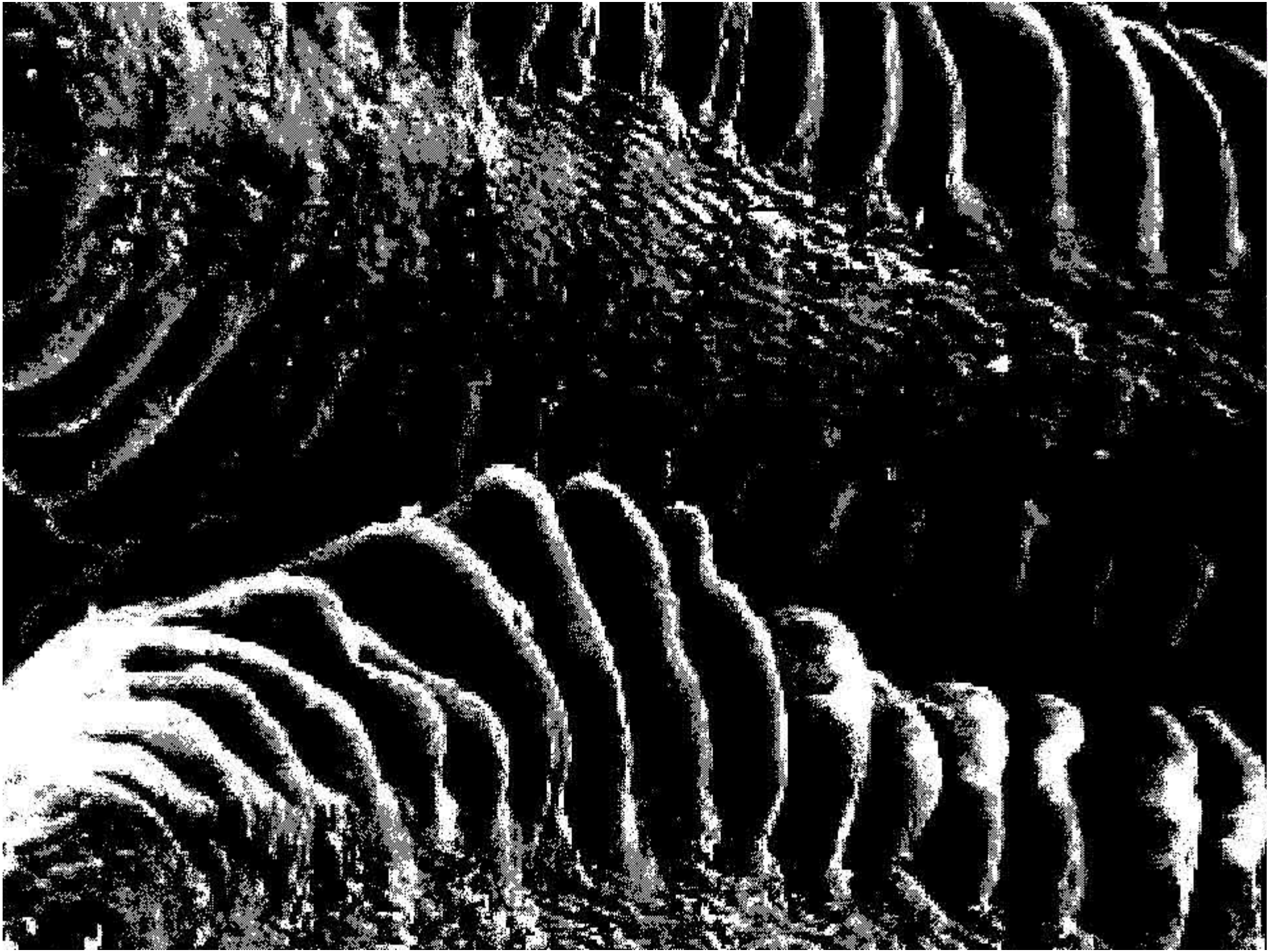
Examples of Improper Site Applications are:

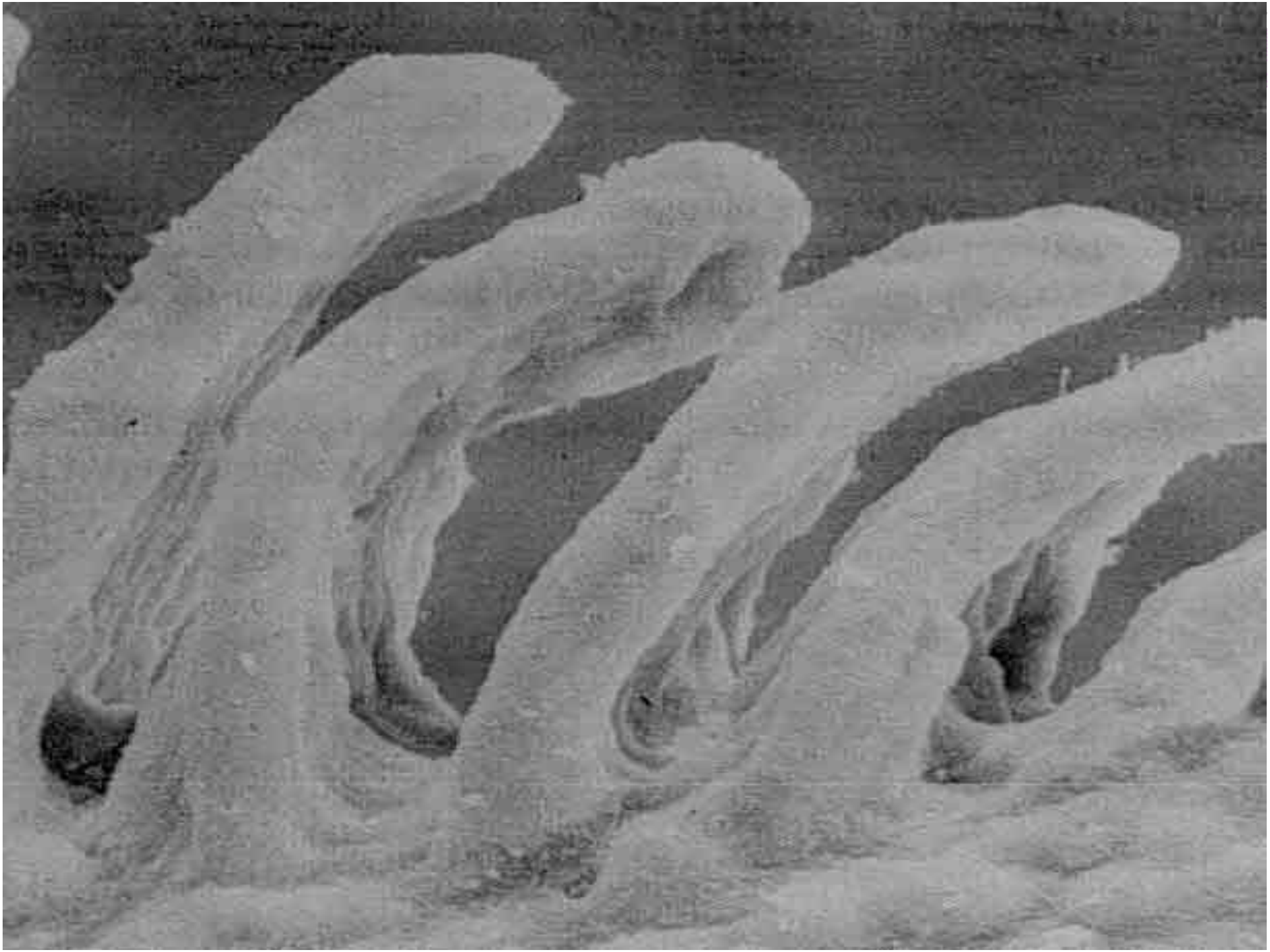
1) Excess Usage of PAM, polymers
2) Uneven coverage when applied
3) Incorrect form or type of PAM, polymer or blend is used
4) *Not used in conjunction with other BMPs

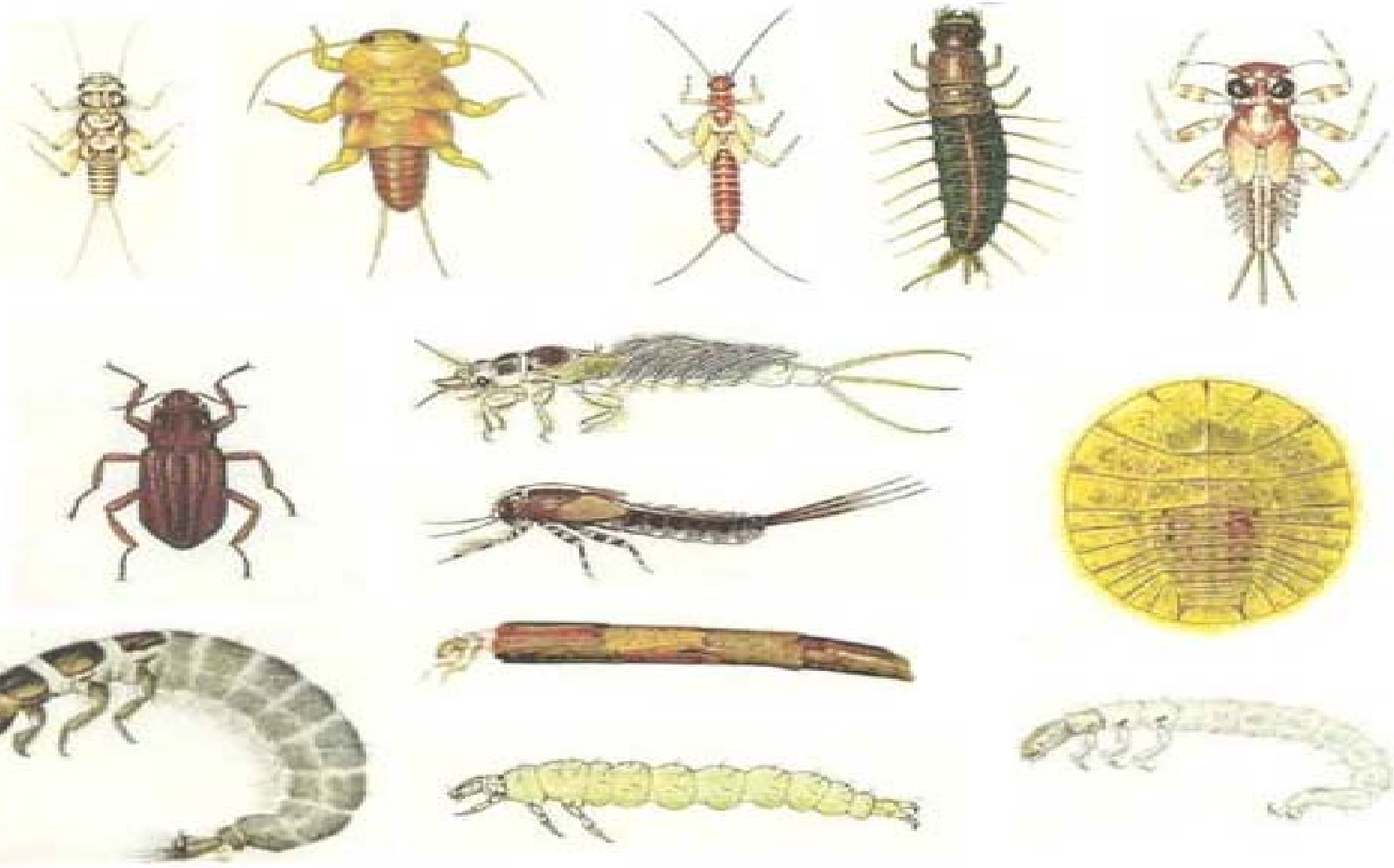
Why Cationic PAMs and polymers are

Toxic to Aquatic Respiration

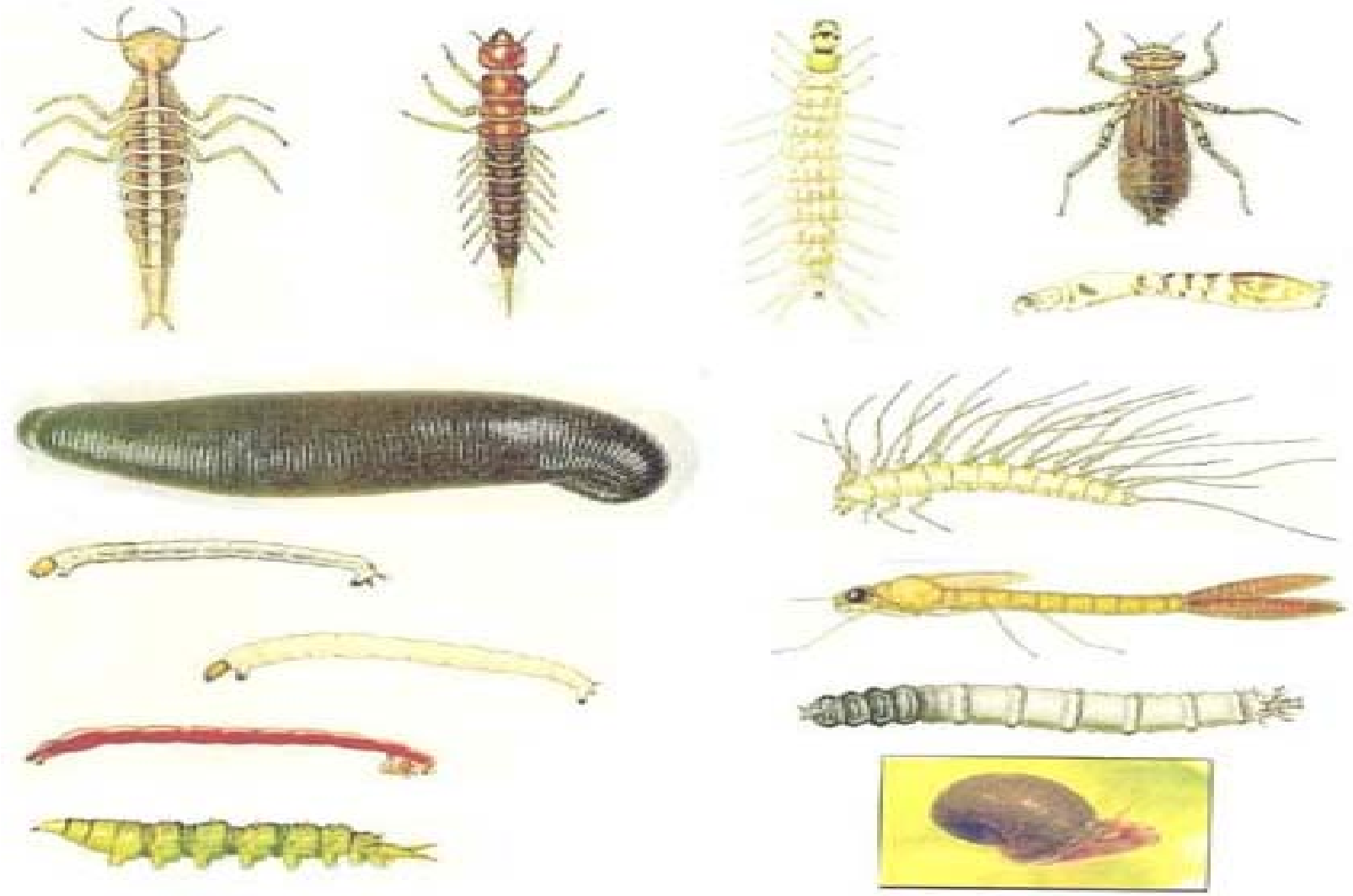








Common Stonefly Nymphs, Roachlike Stonefly Nymphs, Slender Winter Stonefly Nymphs, Brush-Legged Mayfly Nymph, Flatheaded Mayfly Nymphs, Burrowing Mayfly Nymph, Net-spinning Caddisfly Larvae, Fingernet Caddis Larva, Case-Making Caddisfly larva, Free-living Caddisfly Larvae, Dobsonfly Larva, Water Penny, Riffle Beetle.



Dragonfly Nymphs, Damselfly Nymph, Watersnipe Fly Larvae, Alderfly Larva, Cranefly Larva, Crawling Water Beetle Larvae, Predaceous Diving Beetle Larvae, Whirling Beetle Larva, Midge Larvae, Blackfly Larvae, Planorbid Snail, Leech.

Toxicity Studies for (Poly-N-acetyl--D-glucosamine) Chitosan

Data Source

PAN Pesticide Database, 2000-2004

Common Name	Scientific Name	Avg Species LC_{50} (ug/L)	LC_{50} Std Dev	Number of Studies	Avg Species Rating	Outlier Result for Organism Group?
Fish						
Channel catfish	Ictalurus punctatus	64.5	27.5	2	Very Highly Toxic	
Rainbow trout, donaldson trout	Oncorhynchus mykiss	44.0	6.00	2	Very Highly Toxic	

Reference:
Citation: S. Orme and S. Kegley,*PAN Pesticide Database,* Pesticide Action Network, North America (San Francisco, CA. 2004), http:www.pesticideinfo.org.

Information found at: http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34013#Ecotoxicity

Data Source

Protech Services, 2004 StormCon Conference

Polymer LC50 Values (mg/L)

Polymer	Daphnia Magna 48 hr	Rainbow Trout 96 hr	Fathead Minnow 96 hr
$Al_2Cl(OH)_5$	>5000	390	517
DADMAC	17.5	0.49	1.65
Mimosa Bark	258	N/A	1.3
Chitosan	13.7	1.1	6.4

Not that the $Al_2Cl(OH)_5$, a synthetic polymer, is by far the least toxic, and is in fact less toxic than many household cleaners. Chitosan is approximately equal in toxicity to DADMAC with regards to rainbowtrout, which is generally considered a sensitive species. Note also, for example that the Chitosan is considered a hazardous substance according to federal Resource Conservation and Recovery Act (RCRA) standards (due to acidity, at a pH of about 4), while many synthetic polymers such as DADMAC are not RCRA hazardous.

Reference:
Protech General Contracting Services, Inc., Technical Report July 2004 (Polymer Coagulants and Flocculants For Stormwater Applications)
Protec General Contracting Services, Inc., 61 Glenwood Drive, Napa, CA 94559
Phone: 800-433-6040 Fax:707-226-1526 www.protech-services-inc.com

Data Source

US EPA 1993, 2000

Scientific Name, Common Name	Endponit	Effect	Effect Measure	Trend / Effect %	Media Type	Duration	Conc (ug/L)	Signif / Level	Response Site / BCF	Ref#
Oncorhynchus mykiss, Rainbow trout	LC50	Mortality	Mortality	INC	FW	48 hr	A 50, 41 –62		-----	4175
Oncorhynchus mykiss, Rainbow trout	LC50	Mortality	Mortality	INC	FW	48	A 38, 33 - 43		-----	4175

Reference Number: 4175
Author(s): Waller, D.L., J.J. Rach, W.G. Cope, L.L. Marking, S.W. Fisher, and H. Dabrowska
Publication Year: 1993
Title: Toxicity of Candidate Molluscicides to Zebra Mussels (Dreissena polymorpha) and Selected Nontarget Organisms
Reference Source: J.Gt.Lakes Res. 19(4):695-702
Reference Number: 59766
Author(s); Bullock, G., V. Blazer, S. Tsukuda, and S. Summerfelt
Publication Year: 2000
Title: Toxicity of Acidified Chitosan for Cultured Rainbow Trout (Oncorhynchus mykiss)
Reference Source: Aquaculture 185(3/4):273-280
This information can be found on the US EPA Website At: http://www.epa.gov/medecotx/searches/aquatic-1-101504-1546511.htm


8 min., 16 sec.
with 0.001% Chitosan

APS 703d#3 Floc Log

	Pimephales promelas		Pimephales promelas	Ceriodaphnia dubia
	Survival	Growth		
703D#3 Floc Log	IC_{25} (ppm)[b] / NOEC	IC_{25} (ppm)[b] / NOEC	LC_{50} (ppm)[b]	LC_{50} / NOAEC (ppm)[b]
Chronic	77.8 / 52.5	50.1 / 52.5		
96 hour Acute			499	
48 hour Acute				673 / 420

APS 703d Floc Log

	Pimephales promelas		Ceriodaphnia dubia
	Survival	Growth	
703D Floc Log	IC_{25} (ppm)[b] / NOEC	IC_{25} (ppm)[b] / NOEC	LC_{50} / NOAEC (ppm)[b]
Chronic	110 / 105	130 / 105	
96 hour Acute			
48 hour Acute			383 / 105

APS 706b Floc Log

	Pimephales promelas		Pimephales promelas	Ceriodaphnia dubia
	Survival	Growth		
706b Floc Log	IC_{25} (ppm)[b] / NOEC	IC_{25} (ppm)[b] / NOEC	LC_{50} / NOAEC (ppm)	LC_{50} (ppm)
Chronic	>1,680 / 1680	>1680 / 1680		
96 hour Acute			637 / 420	
48 hour Acute				>420

APS 712 Silt Stop powder

	Pimephales promelas	Pimephales promelas	Ceriodaphnia dubia
712 Silt Stop powder	LC_{50}[b] / NOAEC[c] (ppm)	LC_{50}[b] / NOAEC[c] (ppm)	LC_{50}[b] / NOAEC[c] (ppm)
96 hour Acute	>6720 / 6720		
48 hour Acute		>6720 / 6720	
48 hour Acute			1617 / 840

\

Current Erosion Control Practices, not using soil specific PAMs or polymers result in habitat and ecosystem destruction


NO DUMPING!
DRAINS TO BAY


STOP

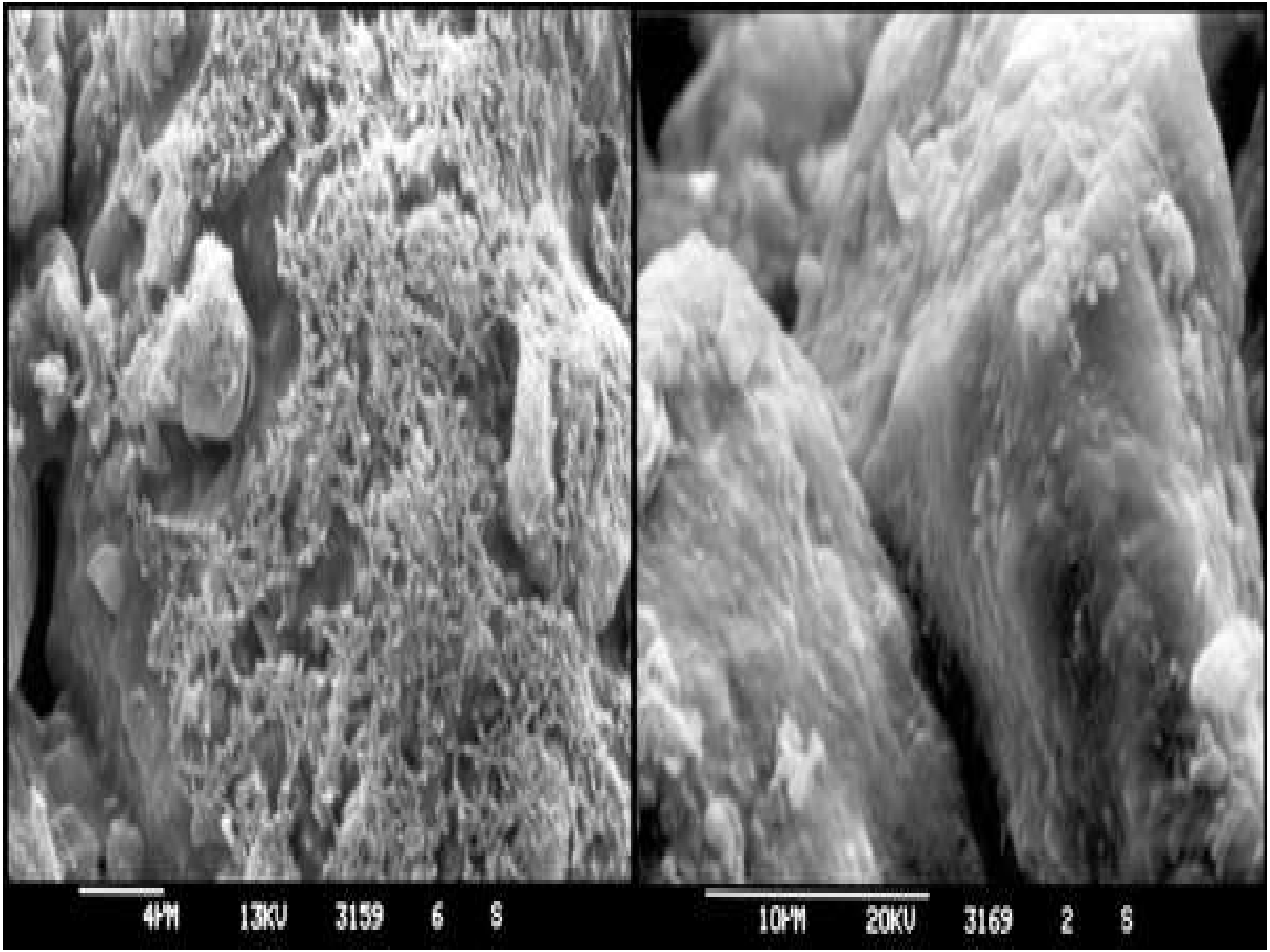

EROSION
EROSION
EROSION
EROSION
EROSION


STOP WORK
ORDER
NO FURTHER
Filling, Excavating, Grading,
Construction, Demolition Or
Alterations Without Permission
Of The
CITY OF CLEVELAND
BUILDING OFFICIAL
423-479-1913

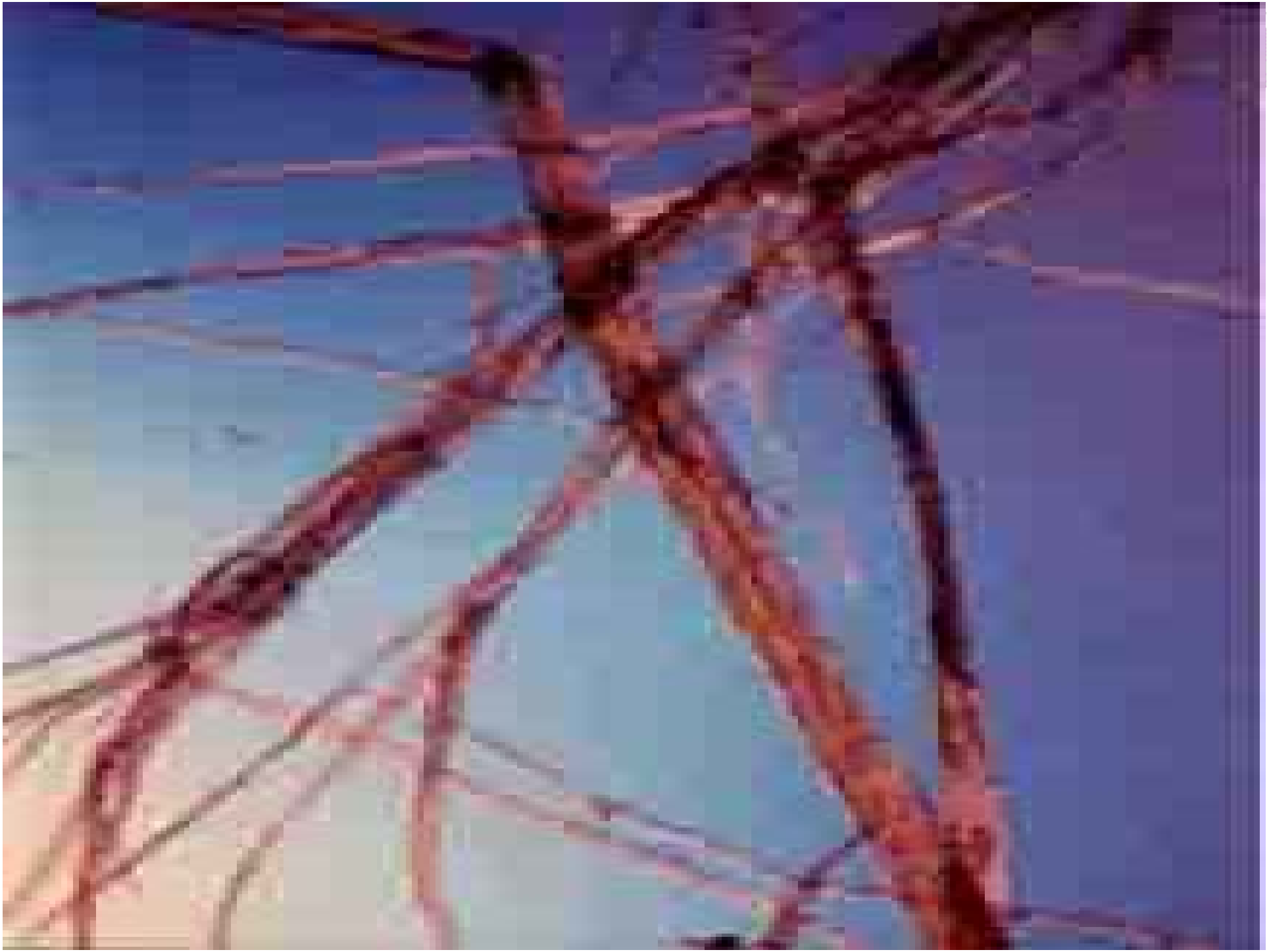
Water Quality, Sediment and Erosion Control BMPs require Balance!

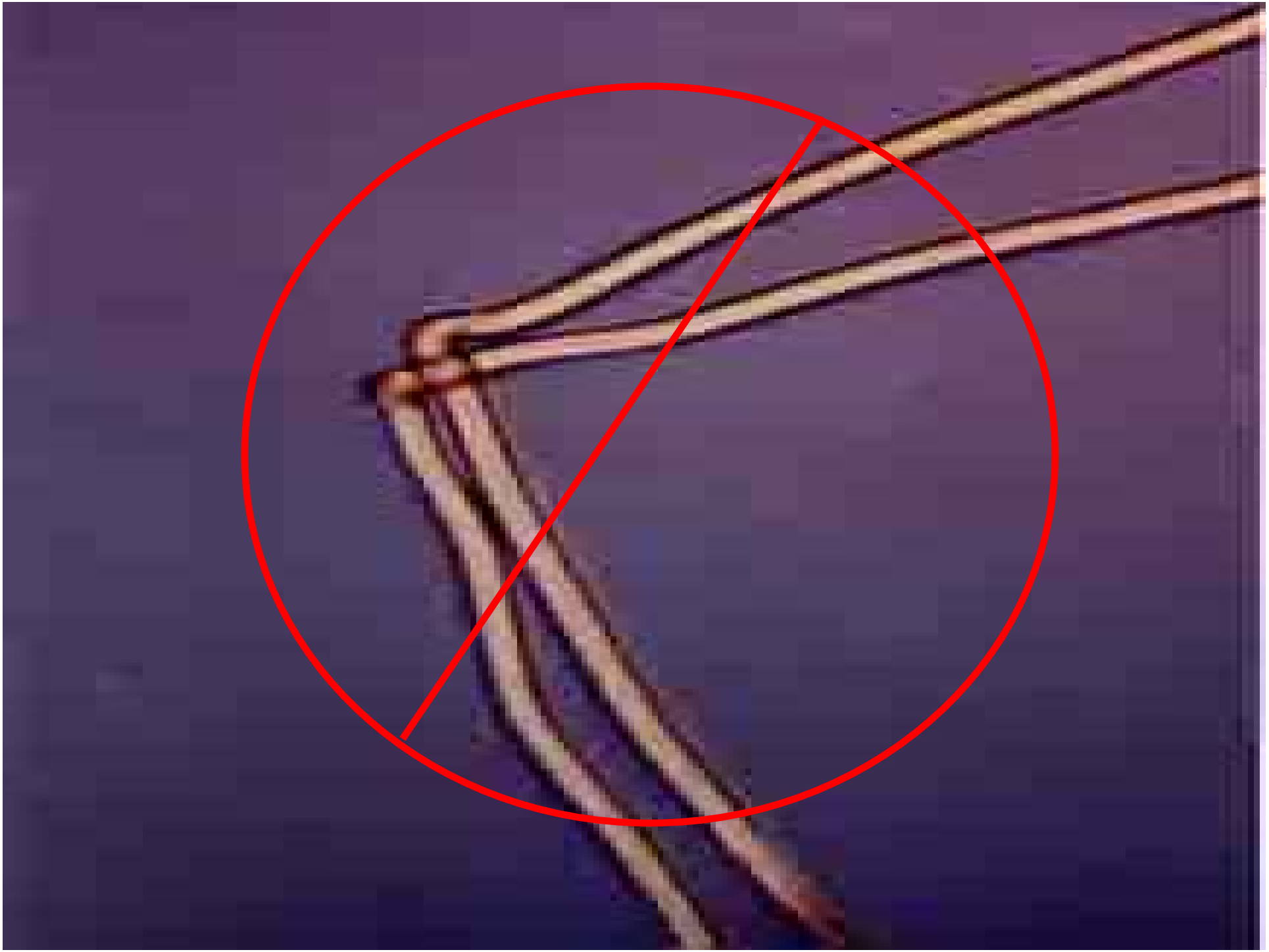
Polyacrylamide Blends (PAMs) for Land and Water applications

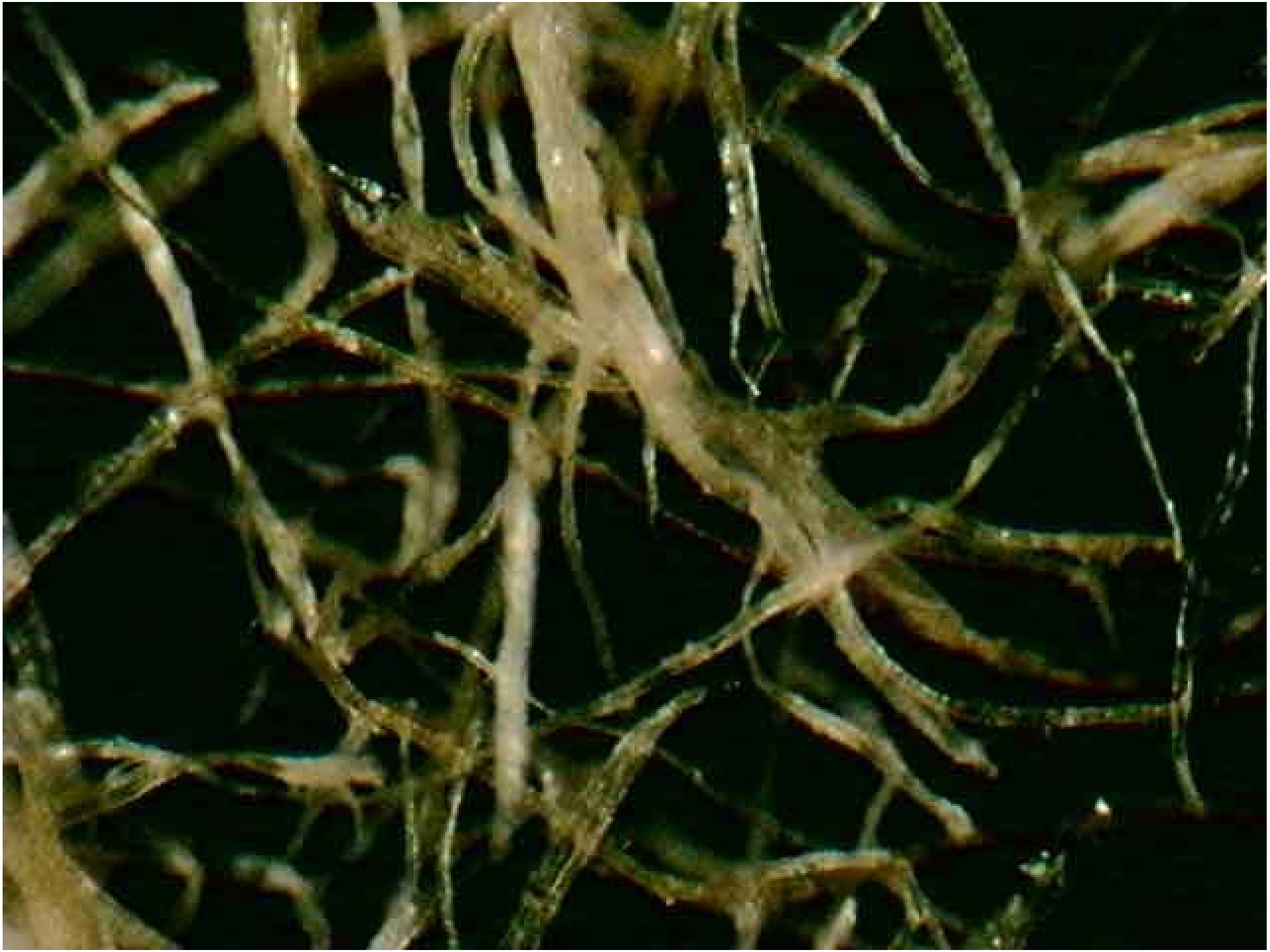
Hydroseeding over soft armor using “Soil Specific”high chelating Anionic PAM blends

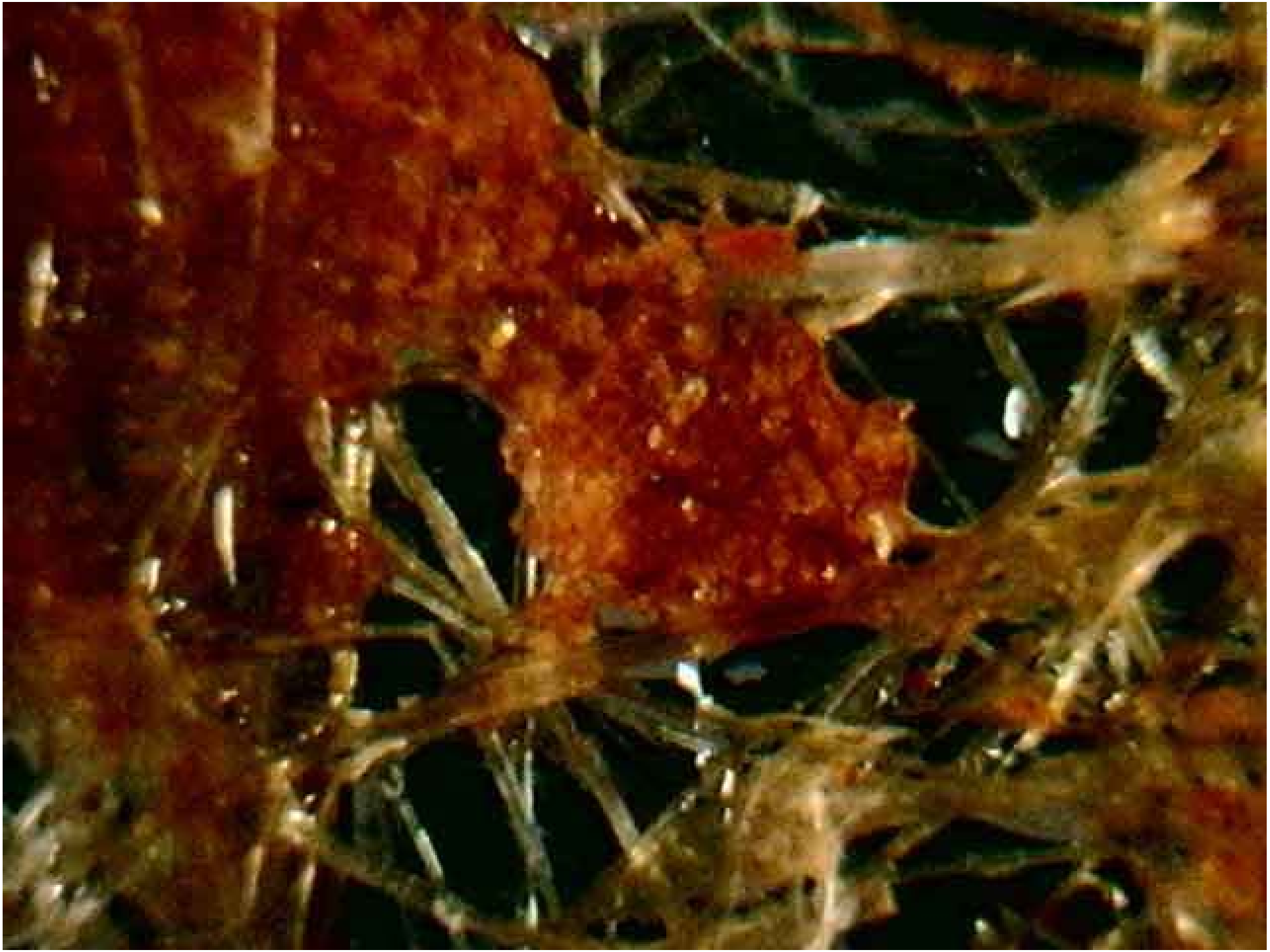

4µM 13KV 3159 6 S
10µM 20KV 3169 2 S

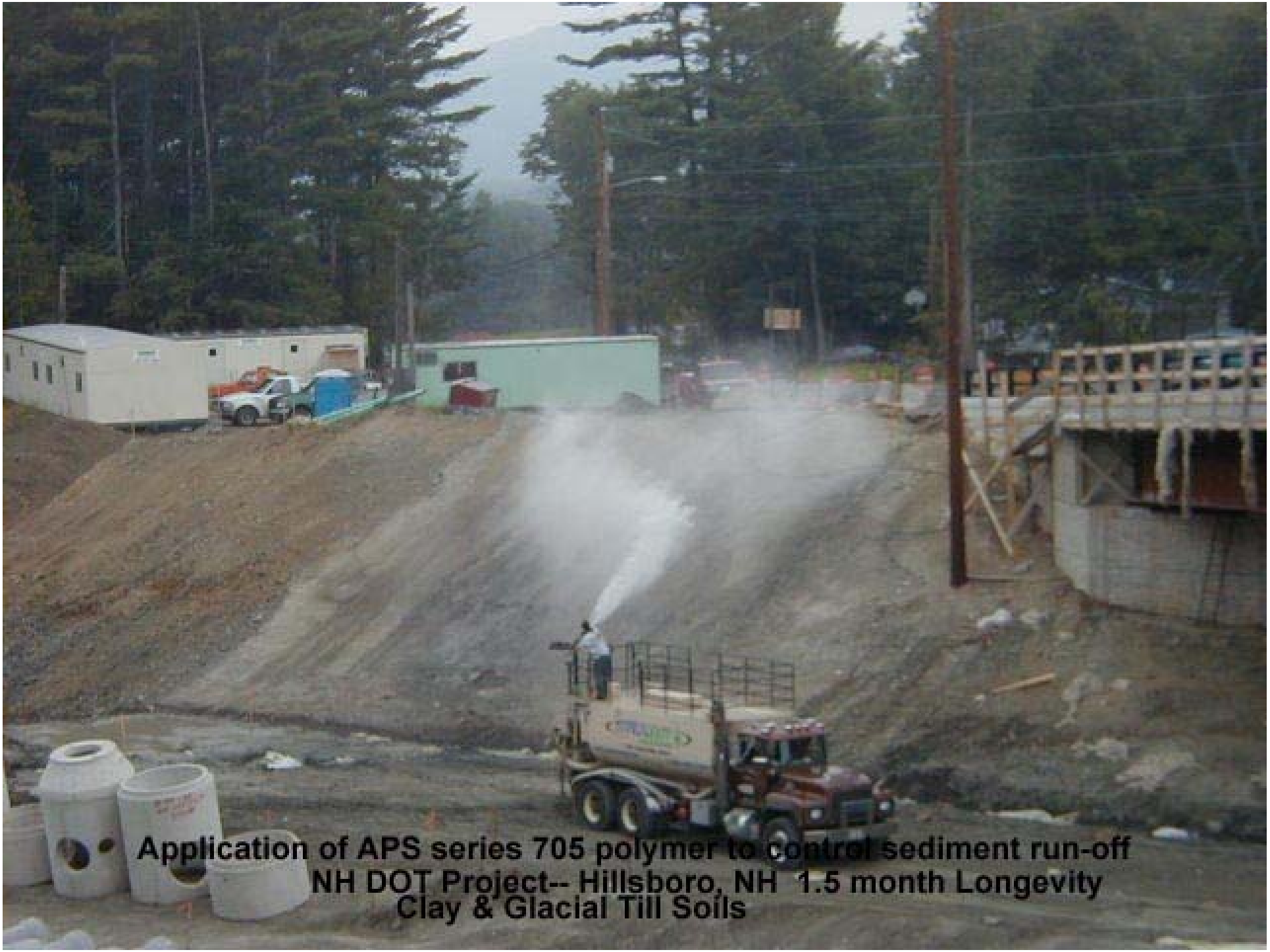

Hampton











Application of APS series 705 polymer to control sediment run-off
NH DOT Project-- Hillsboro, NH 1.5 month Longevity
Clay & Glacial Till Soils

Storm Water Clarification using Floc Log enhanced Baffle Grids


FLOC LOG
FLOC LOG
FLOC LOG
FLOC LOG


Samples are taken from entire site to match SiltStop polymer to the soil type


High organic top soils and clayey sob soils often require two different
Silt Stop polymers.


Excavation for Baffle Grid


Baffle Grid Panel placement


Silt Stop treated soil is covered with overlaping Baffle Grid Panels


Jute woven mat has best effective adheasive properties

Baffle Grid frames showing overlap installation


Baffle Grid size is based on 25 year storm event

Charging the Grid with APS Silt Stop polymer


Completed Baffle Grid


NOTICE
VEHICLES TRACKING MUD ONTO THE STREET ARE IN VIOLATION OF THE CODE OF ORDINANCES FOR THE CITY OF ROSWELL, GEORGIA. VIOLATORS WILL BE PROSECUTED WITH A FINE UP TO $1,000.00 AND 180 DAYS OF LABOR IN PUBLIC WORKS DEPT. OR ANY COMBINATION THEREOF, WITH EACH OCCURANCE. USE WATERHOSE PROVIDED TO WASH MUD FROM YOUR TIRES PRIOR TO LEAVING THE CONSTRUCTION SITE EXIT.
THANK YOU

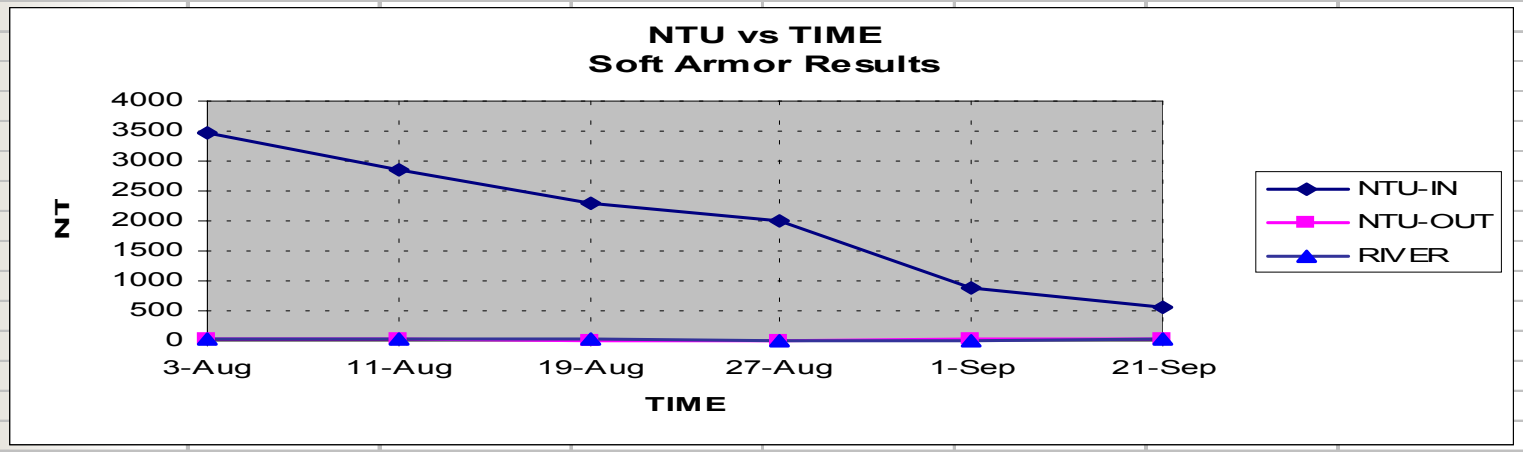

Floc Logs must be kept
moist for best results


Baffle Grid influent water treated with APS Floc Logs

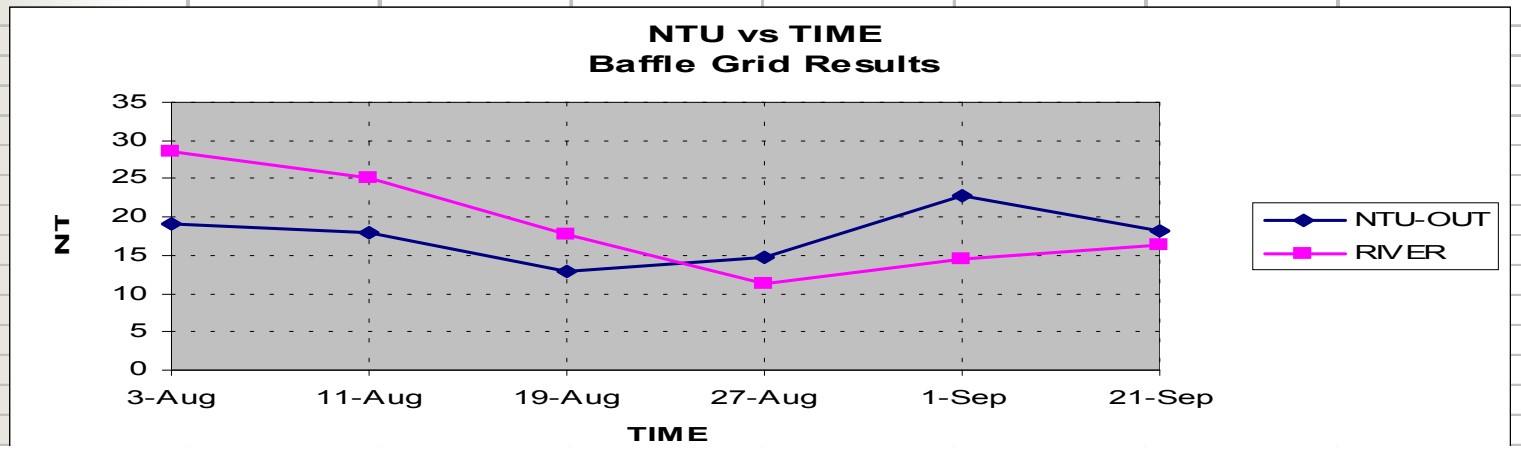

Correct Floc Log creates particle adheasion to the Baffle Grid panels

Effluent water discharged for the Baffle Grid

DATE	NTU-IN	NTU-OUT	RIVER
3-Aug	3468	19.2	28.6
11-Aug	2856	17.9	25.2
19-Aug	2288	12.9	17.7
27-Aug	1992	14.7	11.2
1-Sep	868	22.8	14.6
21-Sep	566	18.2	16.3



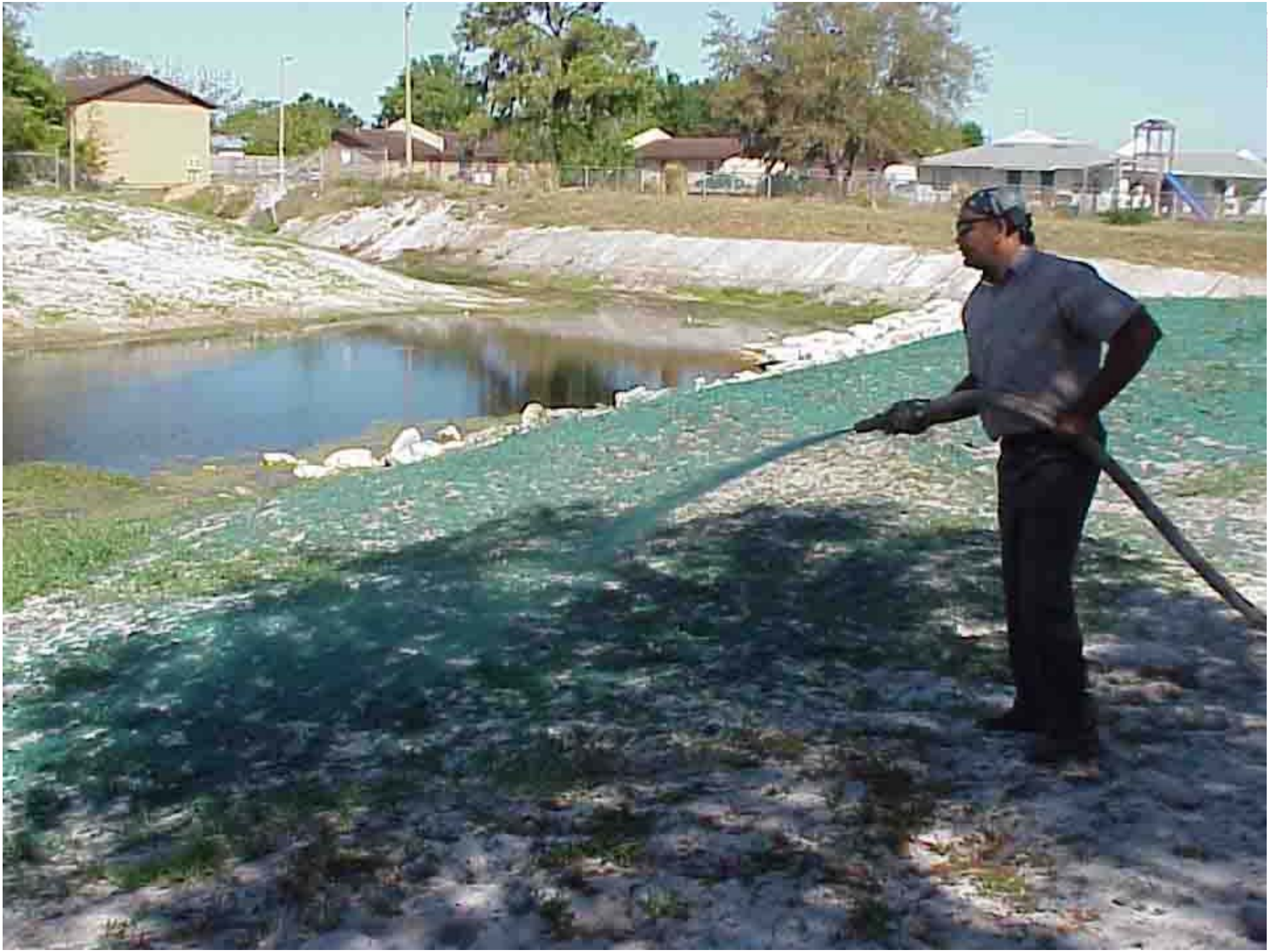
DATE	NTU-OUT	RIVER
3-Aug	19.2	28.6
11-Aug	17.9	25.2
19-Aug	12.9	17.7
27-Aug	14.7	11.2
1-Sep	22.8	14.6
21-Sep	18.2	16.3



Active (pumping) Baffle Grid applications


LES, Inc.
LES, Inc.

Florida soft armor applications for high velocity flow, erosion control and increased water quality




KOMATSU


04/22/2004

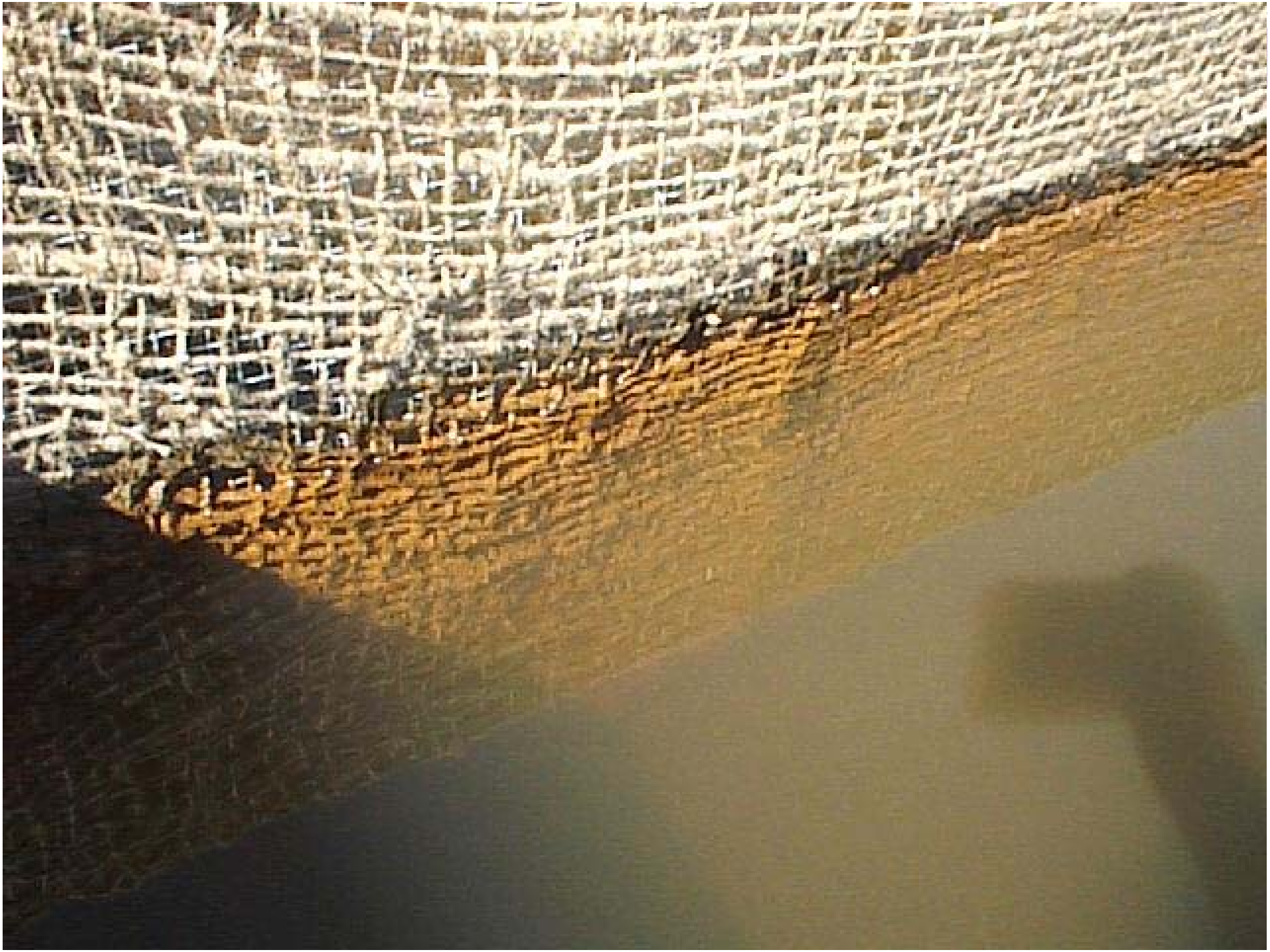

04/22/2004

Standard hydroseeding using “soil specific” PAM, polymer blends as a tackifier / growth additive

Air Drop Hydroseeding after forest fires on hydrophobic soils using site specific PAM blends


S64F
745
N163AC

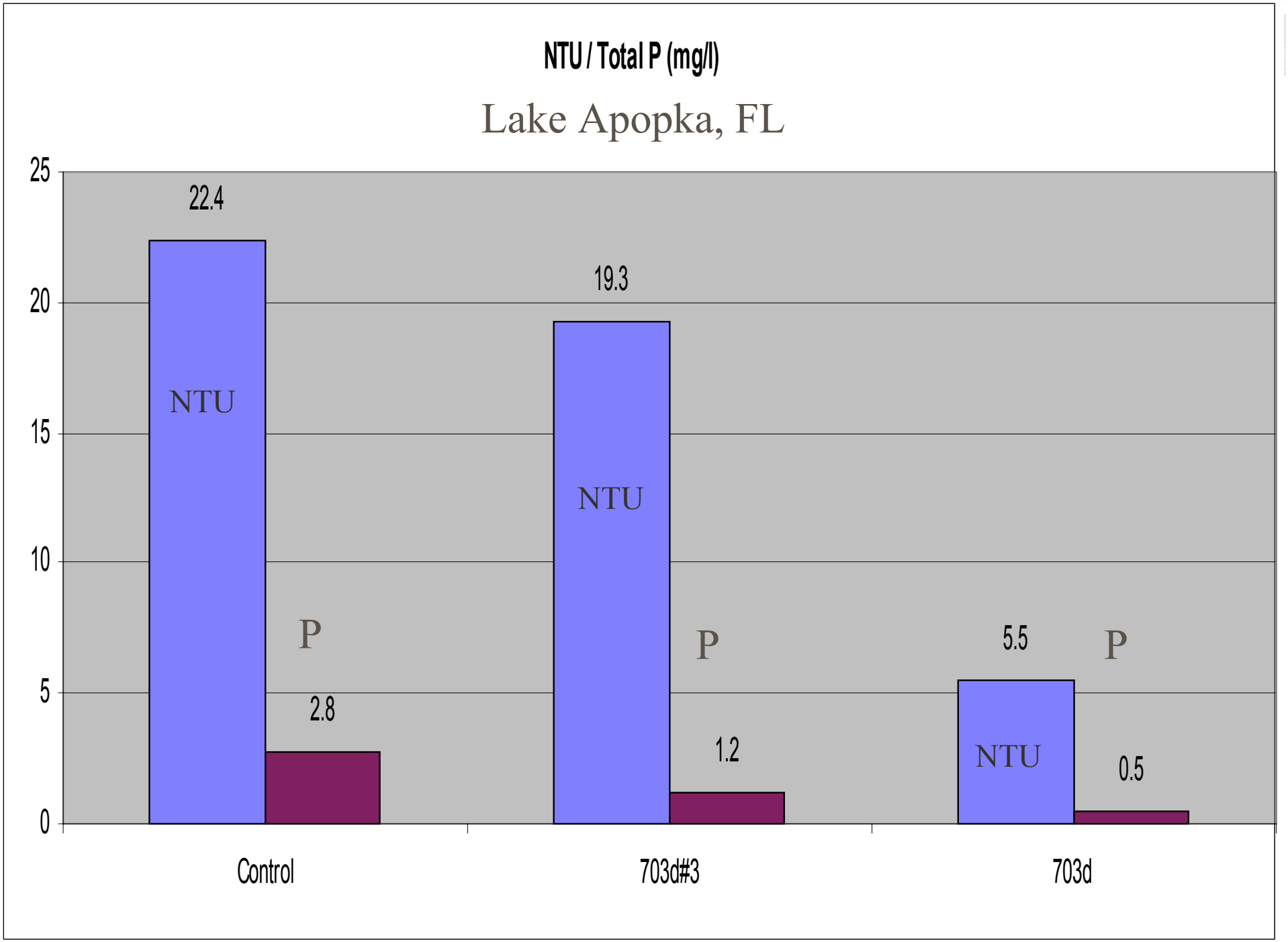
Fine sediment capture using the Floc Log and Particle Curtains



Detention or Sediment pond water clarification and dewatering


VEG. OIL
HOLLAND

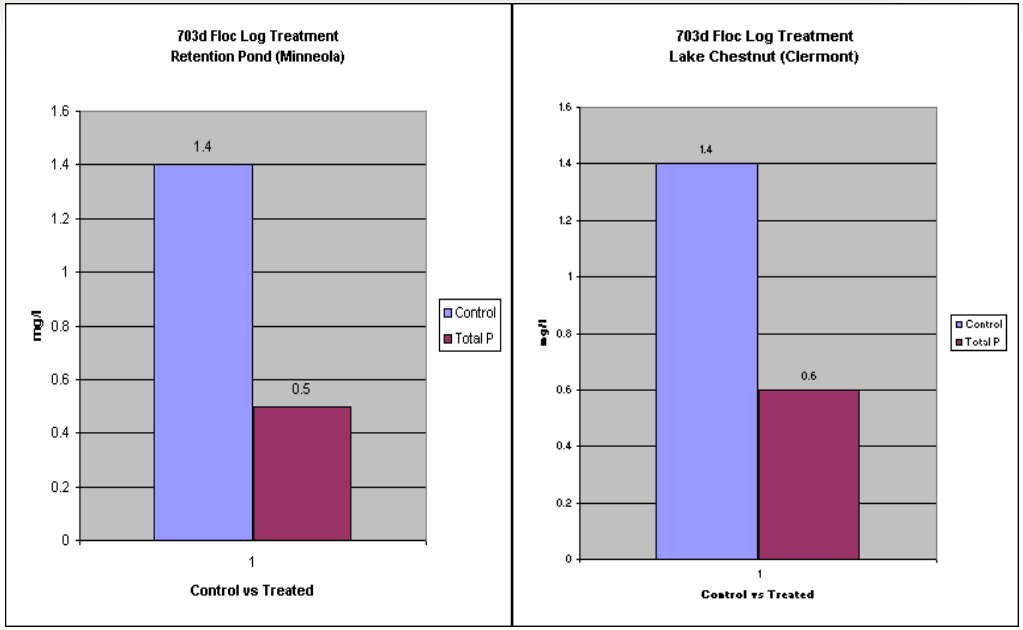

LaMotte
7.47
2020 TURBIDIMETER
CAL
READ


NTU / Total P (mg/l)
Lake Apopka, FL
25
20
15
10
5
0
22.4
NTU
P
2.8
19.3
NTU
P
1.2
5.5
NTU
P
0.5
Control
703d#3
703d

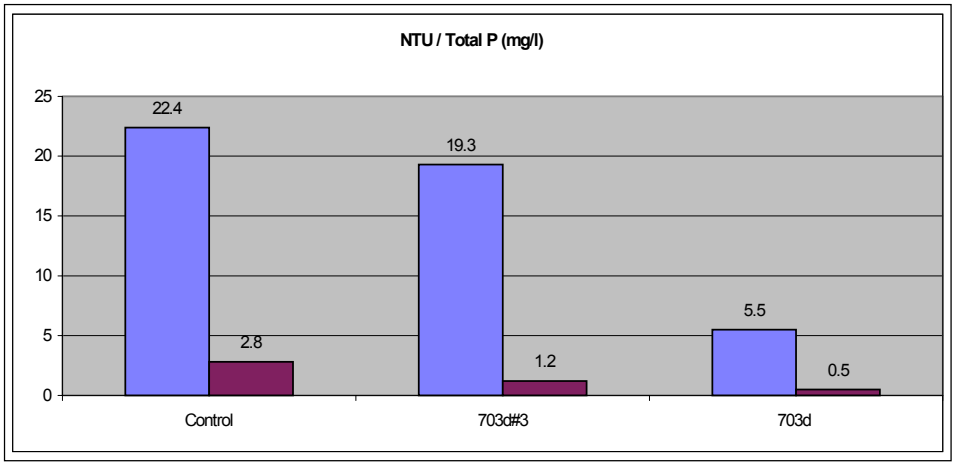
Total Phosphorus P

vs

Total Phosphorus P after Floc Log Treatment



Total Reaction Time < 45 Seconds



PAM blend Application @ 30#/Acre + >2000# of Mulch cover.

Published with US Forest Service, KGCMC Juneau, AK 1995.

PAM WEB SITES

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

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

www.siltstop.com

www.cabmphandbooks.com (California)

(EC-13 Polyacrylamide)

(SE-11 Chemical Treatment)