The 5 Fundamentals for Successful Restoration of Construction Sites

Profile®

Solutions for your Environment™

Matthew Welch, CPESC, CESSWI
Technical and Business Development Manager
Friday, May 11, 2018

What is the most cost-effective form of erosion control?

Overview

- Overview of “The 5 Fundamentals”:
  1) **Understand Your Substrate**
  2) **Pick the Right Plant Species**
  3) **Select the Right Erosion Control Material**
  4) **Ensure Proper Installation**
  5) **Conduct Inspection and Maintenance Activities**
- Successful Case Histories
- Q & A

Fundamental # 1: Understand Your Substrate

- Evaluate soil fertility – measure of its ability to supply essential elements which may be compromised by soil chemical composition and/or presence of elevated salts/toxins
- Provide a basis for amendment recommendations
- Help ensure appropriate plant species selection
- Predict probability of desired outcome – more rapid and sustained vegetative growth
- **Profile can coordinate free soil testing for you!**

Agronomic Amendments

Fertilizers

- Quick or controlled release synthetic formulations
- Slower release organic/natural formulations

Soil Neutralizers

- Raise or lower substrate pH
- Lime, sulfur or acidifiers

Organic Matter

- Compost, manure, peat, or natural fibers such as wood or straw
- Biotic Soil Media

Growth Stimulators & Enhancers

- Achieve faster germination & establishment
- Sustain long-term plant vitality

Typical ingredients include:

- Porous ceramics
- Humic and fulvic acids
- Bacterial or microbial cultures
- Endo-Mycorrhizae
- Seaweed extracts/cytokinins

Fundamental #2 – Plant Selection

- Where is the project?
- Soil characteristics?
- Permanent or temporary vegetation?
- When will the installation occur – seasonality?

Fundamental #2 – Plant Selection

- Desired plant materials
  - Native, introduced, drought tolerant, palatable, warm or cool season, legumes, wildflowers, shrubs, trees, etc.
- What is the intended application?
    - Slope, channel, riverine, shoreline, levee, cover system, etc.
- Site characteristics – such as elevation, topography, aspect, climatic conditions
- Maintenance activities – irrigation, mowing, supplemental amendments or grazing?

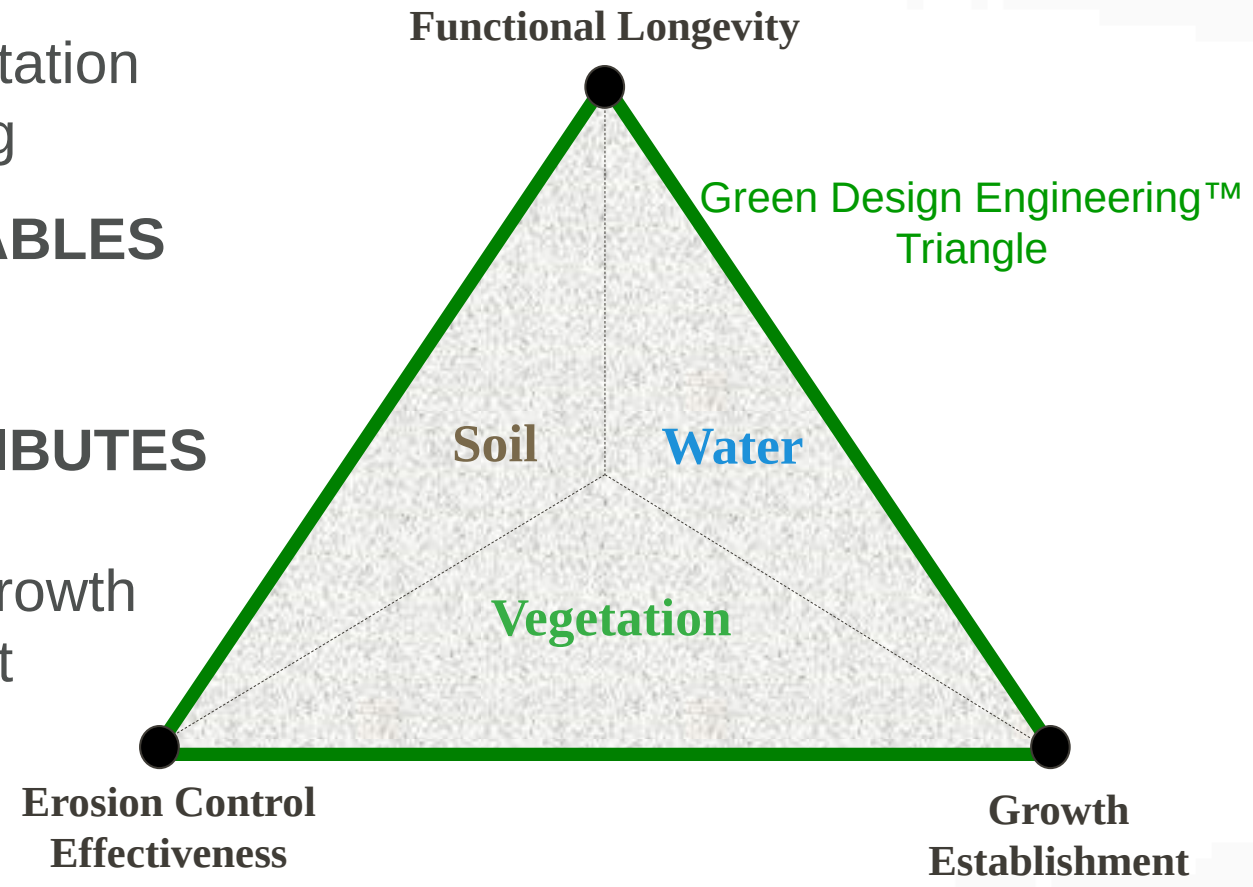
Fundamental #3 – Erosion Control Material

Establishing vegetation requires balancing

NATURAL VARIABLES

and

PRODUCT ATTRIBUTES
to create the best environment for growth and establishment



Erosion Control Selection – Slopes

Revised Universal Soil Loss Equation (RUSLE)

A = R x K x LS x C x P

Where:

A = computed soil loss/unit area/unit time

R = rainfall factor

K = soil erodibility factor

L = slope length factor

S = steepness factor

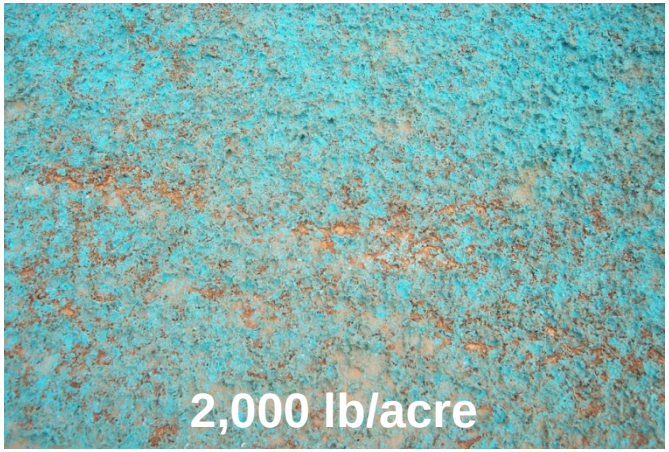
C = vegetation or cover factor

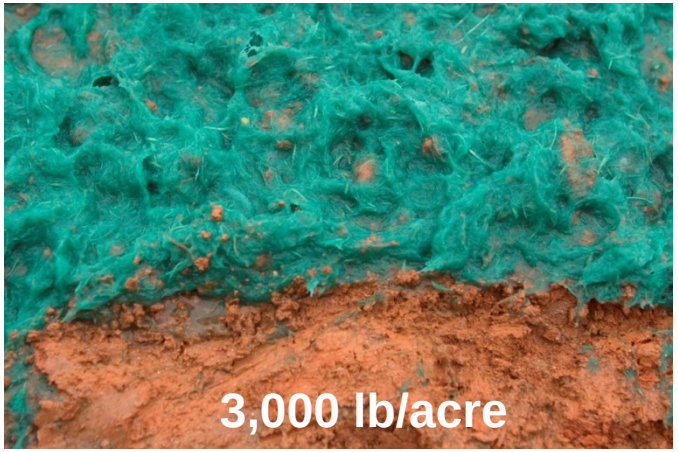
P = erosion control practice factor

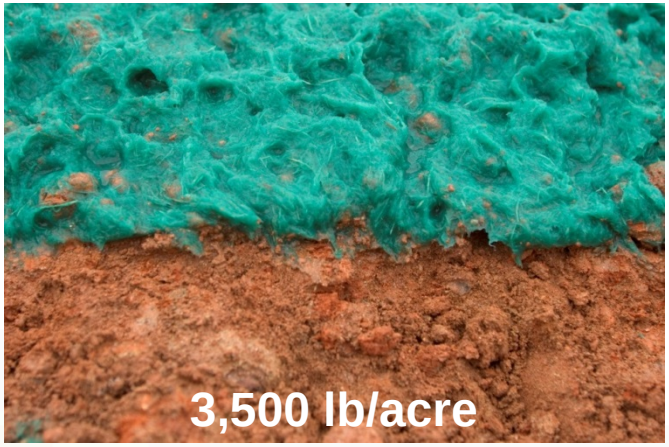
Fundamental #4 – Proper Installation

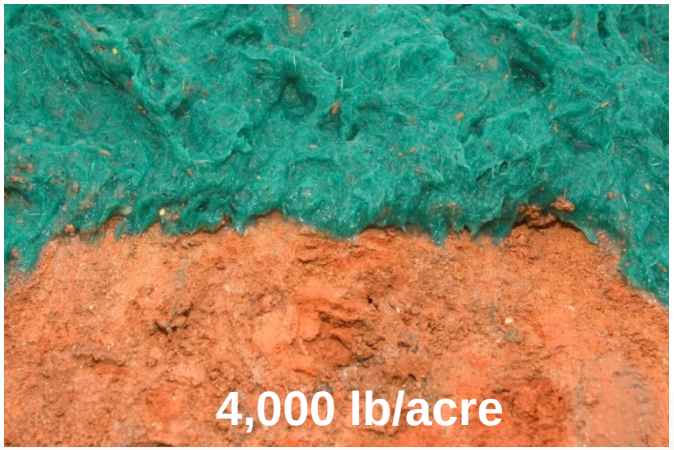
- Comprehensive and detailed construction specifications with plans/drawings
- Complete installation guidelines
- Tools or calculators to facilitate mixing ratios and/or application rates
- Experience…preferably site specific experience!

Mixing and Application Guidelines

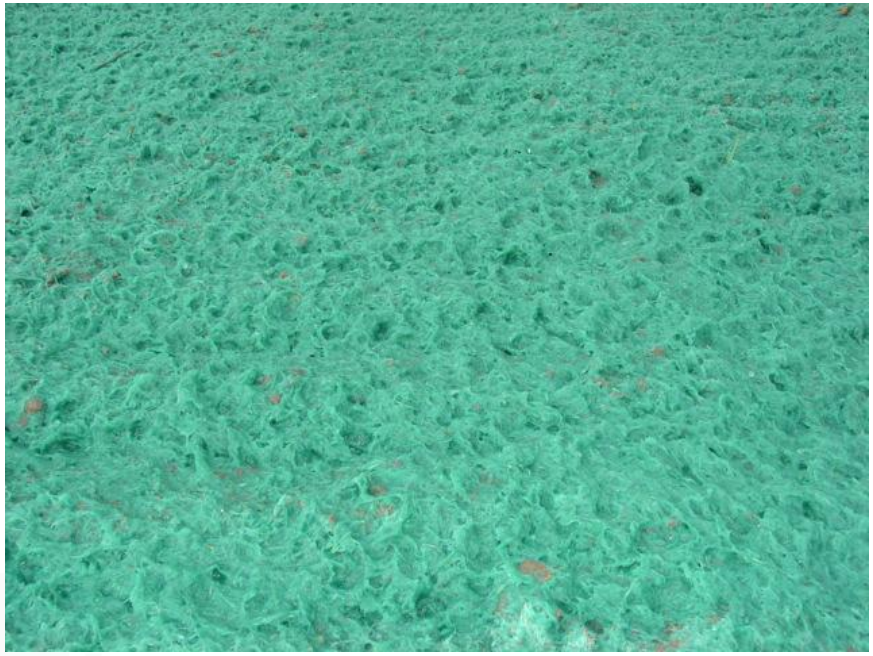








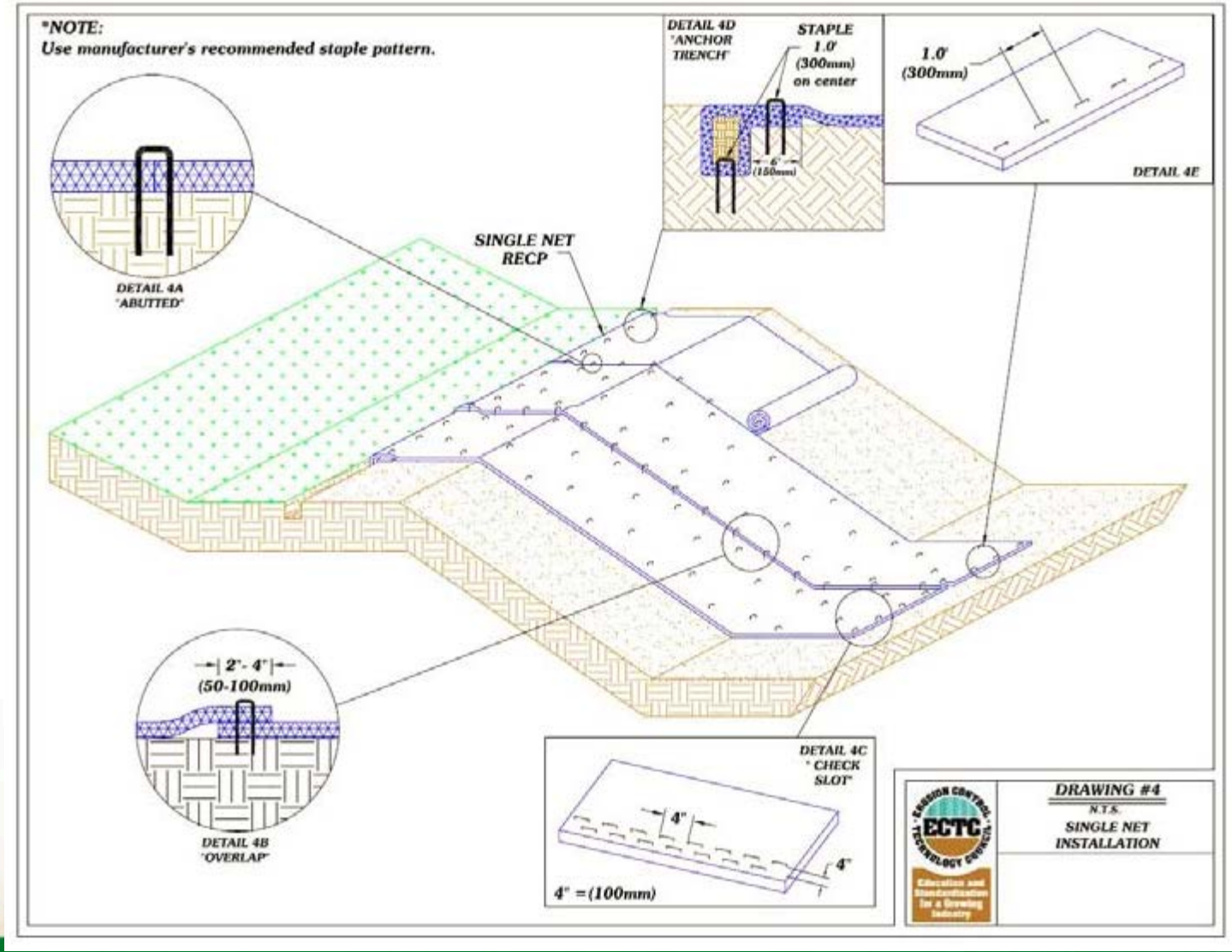
Mixing and Application Guidelines



Proper application and good coverage

Improper application and poor coverage

Rolled Erosion Control Blankets



Fundamental #5 – Inspection and Maintenance

- Inspection by qualified professionals whose expectations are consistent with installer as well as owner and regulatory entity(s)
- Initial inspections to insure installations are in accordance with plans/specs with material quantities and activities fully documented
- Subsequent inspections conducted at pre-determined time intervals and maintenance activities conducted after each significant precipitation or other potentially damaging weather event

Incorporating All 5 Fundamentals

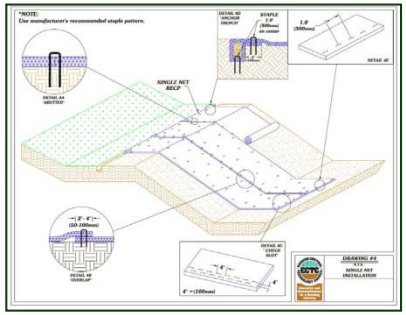
1. Understand Your Substrate

2. Pick the Right Plant Species

3. Select the Right Erosion Control Materials

$$A = R \times K \times LS \times C \times P$$

$$V = \frac{C}{n} R^{2/3} S_f^{1/2}$$



4. Ensure Proper Installation

5. Conduct Inspection and Maintenance Activities


Michigan DOT Trail Project

1. Soil Testing

- MDOT project 2 Acres of sandy slopes, through wooded forest area
- Soil samples taken in early July 2015
- Minimal organic matter content (0.2% and 0.5%)
- Elevated pH values (8 and 8.5) and nutrient de

Soil Analysis Results

Sample (#)	Texture (USDA)	Soil pH (6.3 - 7.3)	TDS[1] (ppm) (< 256)	SAR[2] (< 2)	Organic Matter (%) (3 - 5%)
1	Loam	8	224	0.17	0.5
2	Sand	8.5	115.2	0.23	0.2
(Optimum Plant Growth Cor					

Soil pH (6.3 - 7.3)

8

8.5

Organic Matter (%) (3 - 5%)

0.5

0.2

Sample (#)	NO_3 (lb/acre)[5]	(lb/acre)[5]	(lb/acre)[5]	Ca (lb/acre)[5]	Mg (lb/acre)[5]	Zn (lb/acre)[5]	Mn (lb/acre)[5]	Cu (lb/acre)[5]	Fe (lb/acre)[5]	B (lb/acre)[5]	SO_4 (lb/acre)[5]
1	1.96	0.42	23.46	6172	31.35	0.6	20.8	1.2	69.2	0.4	50.92
2	4.2	3.3	50.83	1778	31.84	0.2	3.4	0.8	23	0.2	26.9

Notes: 1. Total Dissolved Salts, 2. Sodium Absorption Ratio, 3. NeutraLime is also available in a liquid form, please contact a Profile representative with questions. 4. Sodium as % Base Saturation Cation Exchange Capacity (CEC), 5. lb/acre associated with a 6-inch depth.

2. Seed Selection

- Well Draining Soil with Alkaline pH
- Varying aspects along trail and varying direct sunlight
- Seeking permanent vegetation that will be mowed
- Cool Season Grasses thrive in this region and the Installation was set to occur at the end of July, 2015

- Utilized a Michigan DOT seed mixture at 220 lb/acre
  - Consisted of a blend of Fescues, Ryegrass, and Bluegrass

3. Erosion Control Selection

- Typical slope length < 30 ft
- Typical slope gradient < 3 H:1 V
- Selected a Bonded Fiber Matrix performance product
  - 3,000 lb/acre Rate Based on Manufacturer's Recommendations

Application Rates		
Slope Condition	**English**	**SI**
≤4H to 1V	2500 lb/ac	2800 kg/ha
≥4H to 1V and ≤3H to 1V	3000 lb/ac	3360 kg/ha
≥3H to 1V and ≤2H to 1V	3500 lb/ac	3920 kg/ha
≥2H to 1V and ≤1H to 1V[1]	4000 lb/ac	4480 kg/ha
Slope Interruption Limits*		
Product Category	**Length (ft)**	**Length (m)**
EFM	50	15

4. Proper Installation

- 3 Step Application – 2 Acre Site
  1. Soil Acidifier & Trace Mulch
  2. Biotic Soil Media, Biostimulant, Fertilizer & Seed
  3. BFM Erosion Control Application


July 28, 2015

August 12, 2015

August 25, 2015

August 25, 2015


June 3, 2016


June 3, 2016


June 3, 2016

Mine Site – Attapulgus, GA

What type of mine was in Attapulgus, GA?

ATTAPULGITE: PROPERTIES AND USES

by

W. L. HADEN, JR.
Minerals and Chemicals Philipp Corporation, Menlo Park, New Jersey

ABSTRACT

The clay mineral attapulgite derives its non-swelling needle-like morphology from its three-dimensional crystal structure. The shape and size of the needles result in unique colloidal properties, especially resistance to high concentrations of electrolytes, and give high surface area, high porosity particles when thermally activated. Examples of industrial applications of attapulgite are reviewed with emphasis on how these characteristic properties function in the various end-uses.

INTRODUCTION

Attapulgite had been used by industry for more than 40 years before it was recognized as a distinct clay mineral. Chemical composition and some of its properties were sufficiently similar to montmorillonite to cause this confusion. In the 1940's, the structure was worked out by Bradley, and the needle-like particle shape was later demonstrated by electron microscopy (Grim, 1953, pp. 77–79).

With the realization that attapulgite was indeed a unique mineral, considerable efforts have been expended over the years by industry to take advantage of its characteristic properties in industrial applications. This paper shows how the fundamental properties of attapulgite which result from the crystal structure lead to a number of current industrial applications.

Haden Jr, W. L. "Attapulgite: properties and uses." *Clays Clay Miner* 10 (1963): 284-290.

- 44 acres mining completed in early 2000
- Initial reclamation began in 2003 (property acquired in 2008)
- Land and Lakes Reclamation Process
- Approximately 39 acres acceptable for permit release except 5-acre problem area

Major Erosion Issues

Major Erosion Issues

Soil Test Results

Please contact Matt Welch (tech@profileproducts.com) regarding these test results

Sample (#)	Aqua-pHix™ (gal/acre)	NeutraLime™[3] (lb/acre)	JumpStart™ (gal/acre)	BioPrime™ (lb/acre)	Soluble Gypsum (lb/acre)	ProGanics™ BSM (lb/acre)
1	0	160	5	160	---	5000
2	10	0	3.75	120	---	4500

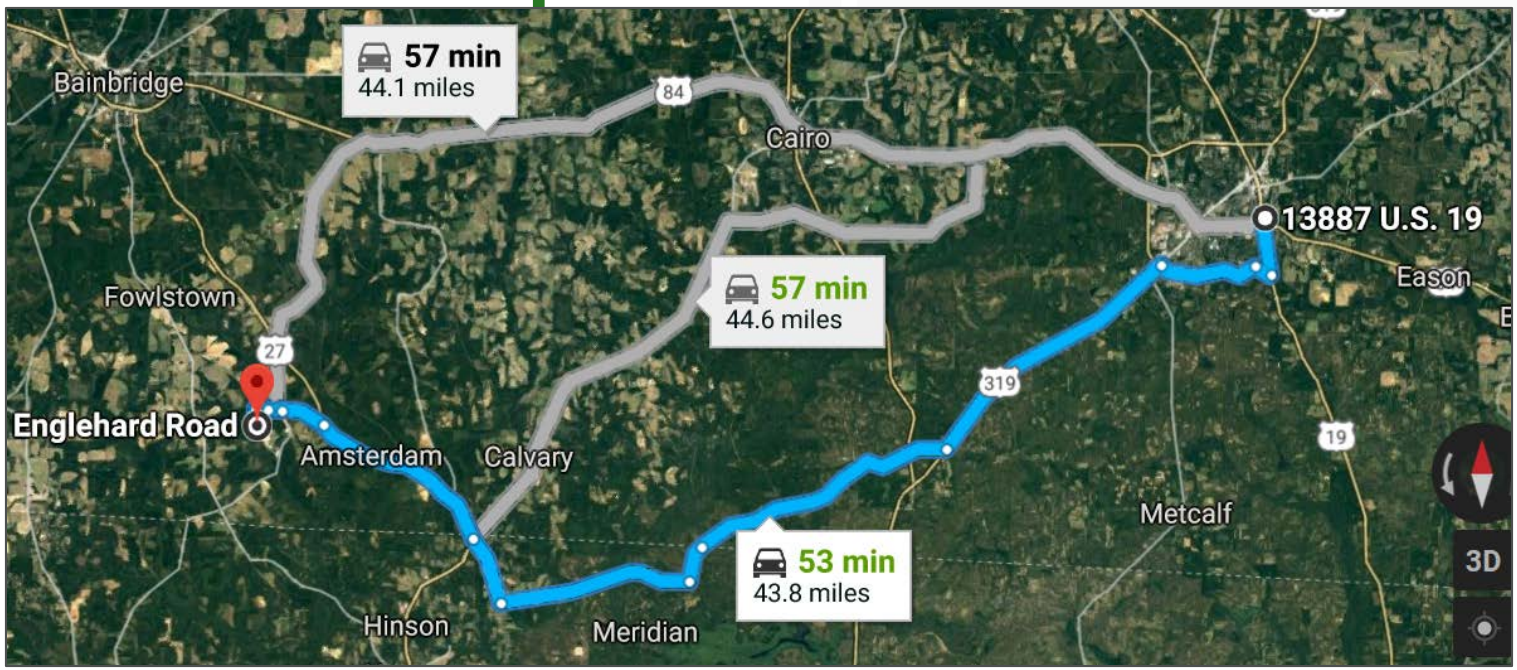
SOIL ANALYSIS RESULTS

Sample (#)	Texture (USDA)	Sand (%)	Silt (%)	Clay (%)	Soil pH (6.3 - 7.3)	TDS[1] (ppm) (< 256)	SAR[2] (< 2)	Organic Matter (%) (3 - 5%)	CEC % Sodium[4] (%) (< 2%)
1	Loamy Sand	84.8	2.4	12.8	5.2	115.2	0.22	0.4	0.4
2	Sandy Clay Loam	52.8	24.4	22.8	8.3	211.2	0.13	0.8	0.1
(Optimum Plant Growth Conditions)									

Sample (#)	NO_3 (lb/acre)[5]	PO_4 (lb/acre)[5]	K (lb/acre)[5]	Ca (lb/acre)[5]	Mg (lb/acre)[5]	Zn (lb/acre)[5]	Mn (lb/acre)[5]	Cu (lb/acre)[5]	Fe (lb/acre)[5]	B (lb/acre)[5]	SO_4 (lb/acre)[5]
1	14.2	5.36	24.24	70	5.10	0.6	1.4	0.4	5.6	0.2	34.58
2	4.04	0.82	17.99	7282	17.26	2.8	2.4	0.6	18	0.2	15.36

Notes: 1. Total Dissolved Salts, 2. Sodium Absorption Ratio, 3. NeutraLime is also available in a liquid form, please contact a Profile representative with questions. 4. Sodium as % Base Saturation Cation Exchange Capacity (CEC), 5. lb/acre associated with a 6-inch depth.

Nearest Topsoil that Meets Specifications



- Topsoil Material Cost - $19.25/cubic yard
- Material Delivery - $75.00/hour (Min - 2 Hours/Load)
  - 14 cubic yard dump truck
- Estimated $11.00/cubic yard to Install

Topsoil Cost Estimate

ProGanics™
BIOTIC SOIL MEDIA

Input Units:	U.S.	Editable Data
Acres	5	
Square Feet	217,800	

Volume Based Topsoil and/or Compost

MATERIAL COST

Material	Depth in Inches	Cubic Yards Needed	Cost Per Cubic Yard	Total Cost
Topsoil	4	2,689	$19.25	$51,761.11
Total Material	**4**	**2689**		**$51,761.11**

TRANSPORTATION & INSTALLATION COST

	Cubic Yards			Total Truckloads
Truck Size	14			192.1
Material Hauling	**Number Of Truckloads**	**Cost per Truckload**		**Total Cost**
Topsoil	192.1		$150.00	$28,809.52
Installation	**Cubic Yards Material**	**Cost Per Cubic Yard**		
Topsoil	2,689	$11.00		$29,577.78
Total Transportation & Installation Cost				**$58,387.30**
Total Cost				**$110,148.41**

ProGanics BSM Cost Estimate

Topsoil Material and Installation Estimate - **$110,148.41**

ProGanics™
BIOTIC SOIL MEDIA

Material	Application Rate (lb/ac)	# Bags Needed	Cost Per Bag	Total Cost
ProGanics™	5,000	500	$40.00	$20,000.00
Transportation		**Number Of Pallets[2]**	**Cost Per Pallet[3]**	
ProGanics™		12.5	$25.00	$312.50
Installation[4]	**Acres**	**Cost per Acre**		
ProGanics™	5	$3,000.00		$15,000.00
Total ProGanics™ Cost				$35,312.50
		ProGanics™ Cost Savings:	**67.9%**	**$74,835.91**

How much Time would it take to install?

- Topsoil
  - 4 Dump Trucks Available
    - 2-Hr Round Trip 10 Hour Working Days
  - Maximum 20 Loads/Day
  - 193 Trucks Needed
  - **Minimum** Estimated Time of **10 Days** to Deliver and Install Topsoil
  - Coordinate E&SC measures as the soil is installed

- ProGanics BSM
  - 12.5 Pallets of BSM delivered on the same truck as Flexterra HP-FGM prior to Hydroseeding Contractor arriving on site
  - ProGanics BSM, Seed, fertilizer and amendments **Installed** in **1 Day**
  - Flexterra HP-FGM installed the following day

Site Preparation - Proper Tracking

Site Preparation - Installed Down Drains –HDPE Pipes

- Two Berm System
  - Upper Berm - One down drain
  - Lower Berm - Two down drains
- All three discharge to the lake

Mid-Berm 18” Down Drain

BSM Application

April 25th, 2016

Erosion Control Application

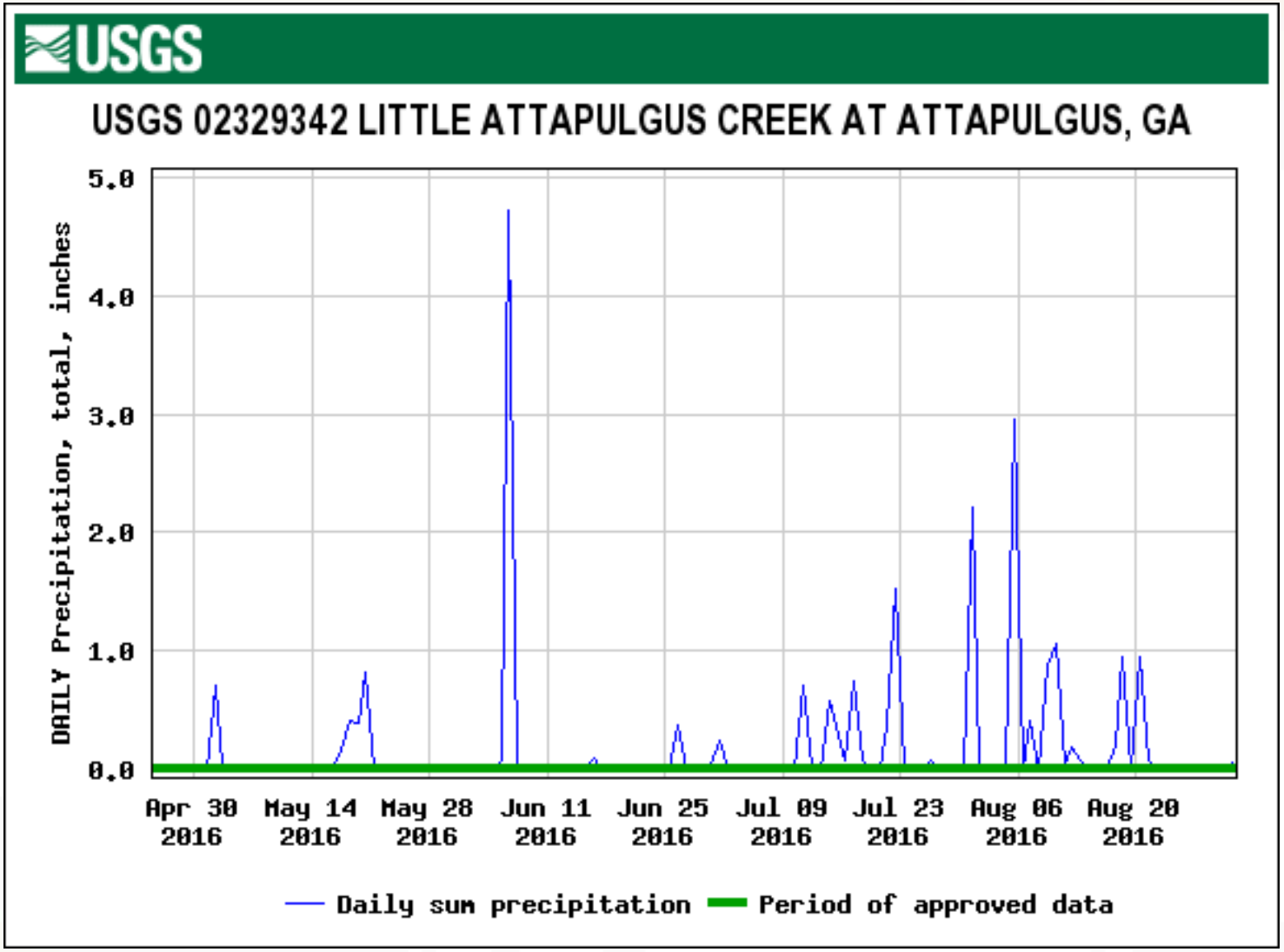
HP-FGM

BSM and HP-FGM Matrices Bonding to Soil

Vegetation Establishing – 8 Days

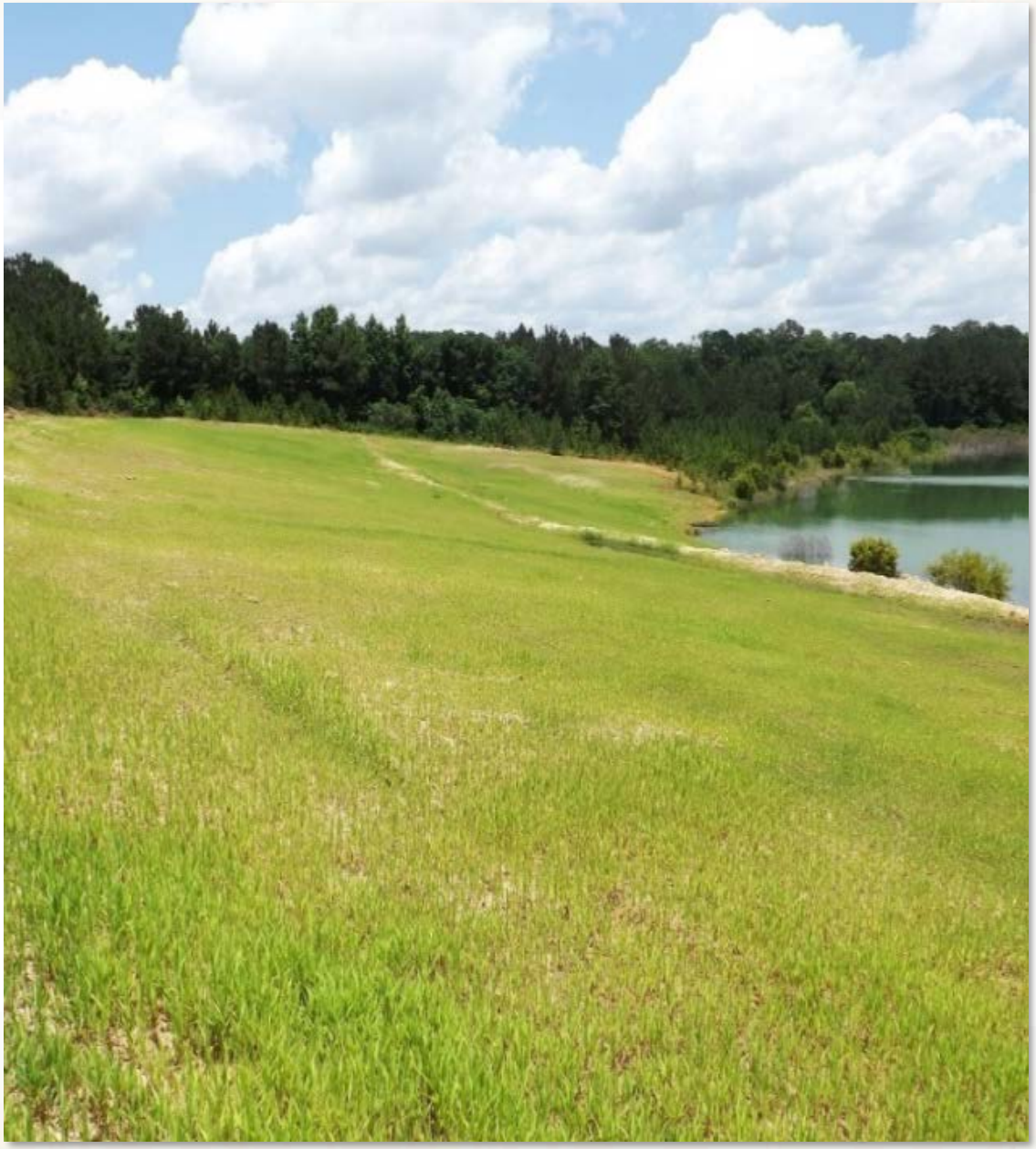
Tropical Storm Colin June 5-6, 2016

Approximately 5” of rain at site in 24 hours


USGS
USGS 02329342 LITTLE ATTAPULGUS CREEK AT ATTAPULGUS, GA
DAILY Precipitation, total, inches
5.0
4.0
3.0
2.0
1.0
0.0
Apr 30 2016
May 14 2016
May 28 2016
Jun 11 2016
Jun 25 2016
Jul 09 2016
Jul 23 2016
Aug 06 2016
Aug 20 2016
Daily sum precipitation
Period of approved data

Attapulgus, GA mine the day after Tropical Storm Colin

June 2017



October 5, 2016

December 5, 2016

September 2017

MINE RECLAMATION SAGA

- Reclamation had been attempted three times before
- Subsequent significant erosion each time
- Previous contractor's monitoring and management was ineffective

"Failure a 4th time was not an option"

MINE RELEASE

- GDNR conducted initial inspection in Nov. 2015 -” Will Not Release Under Current Condition”
- Initiated/Completed design in January/February 2016
- Completed grading & re-contouring and application of Profile Products by end of April 2016
- Provided GDNR with interim reports (significant events-storms, etc.)
- GDNR Site Inspection Mid-August 2016
- Complete reclamation release by GDNR on September 1, 2016
- Approximately Six Months From Time Of Construction Initiation To Full Release By GDNR

In Conclusion

The 5 Fundamentals

1. **Understand Your Substrate –** test the soil or substrate
2. **Plant Species Selection –** pick plant materials compatible with project goals
3. **Erosion Control Materials –** select the most effective control measures for your site
4. **Proper Installation –** ensure guidelines and specifications are followed
5. **Inspection and Maintenance –** coordinate plan to ensure success

Fundamentals must be integrated into a process that entails proper planning and execution

The 5 Fundamentals for Successful Restoration of Construction Sites

Profile®

Solutions for your Environment™

QUESTIONS?

Matt Welch, CPESC, CESSWI