Revegetating with Biotic Soil Amendments

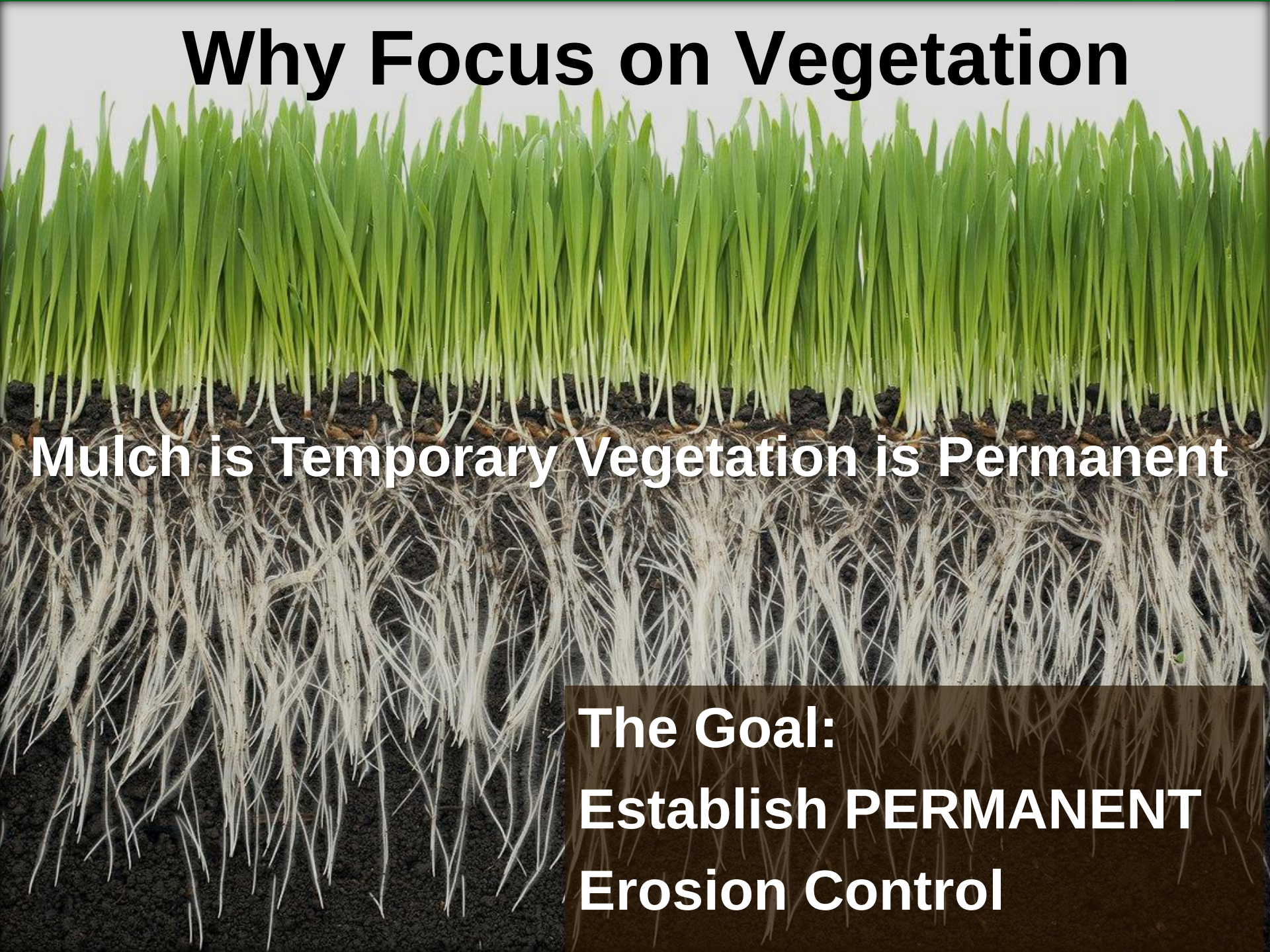
Wyoming Solid Waste & Recycling Association

The Goal:

Not just Germination

Sustainable Revegetation

Why Focus on Vegetation



Mulch is Temporary Vegetation is Permanent

The Goal:

Establish PERMANENT Erosion Control

Living in the soil are plant roots, bacteria, fungi, protozoa, algae, mites, nematodes, worms, ants, maggots, insects and grubs, and larger animals.

science of soil

soil is

made of about **45%** minerals
25% water
5% organic matter **25%** air

what's underneath

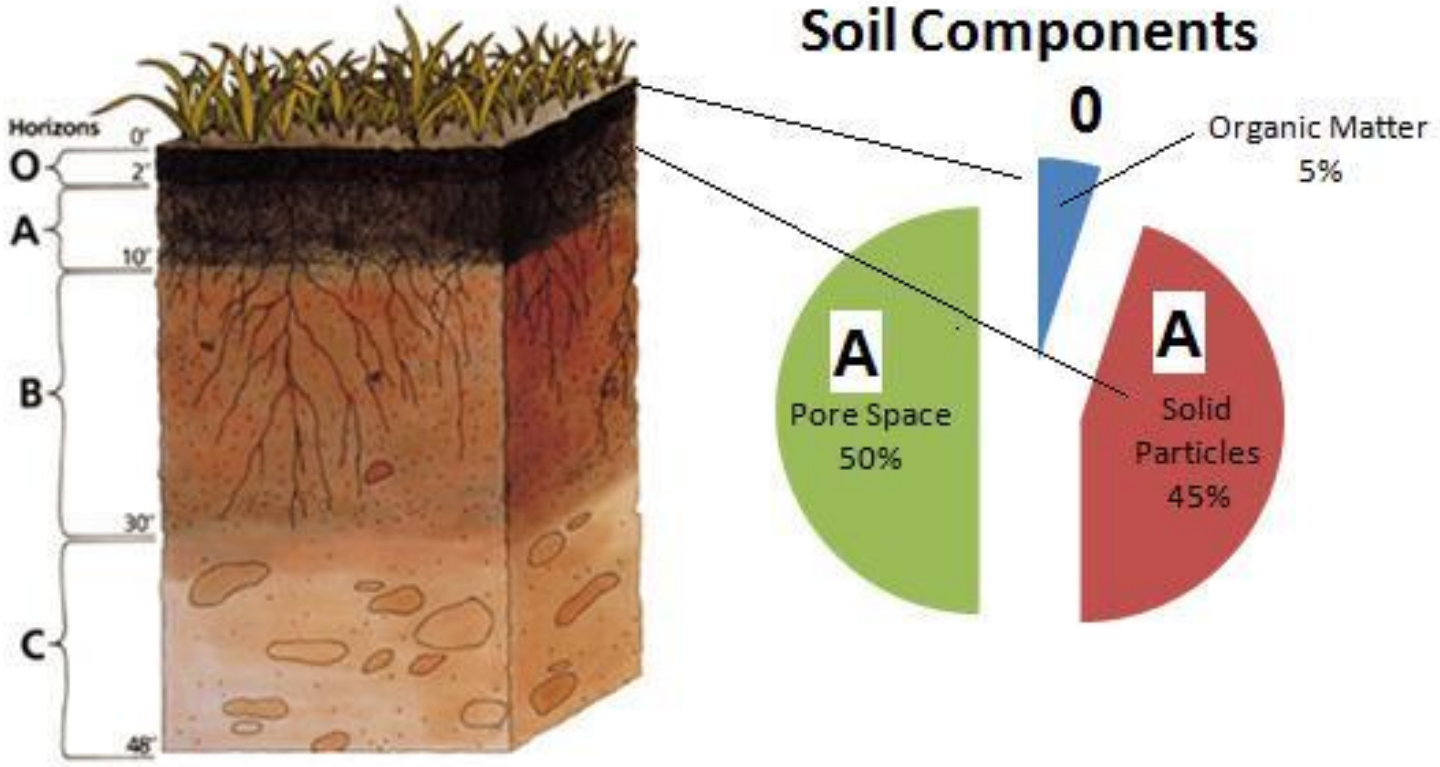
Healthy soil has amazing water-retention capacity.
Every **1%** increase in organic matter results in as much as **25,000** gal of available soil water per acre.

One teaspoon of healthy soil contains
100 million-1 billion individual bacteria

All of the soil microbes in **1ac/ft** of soil weigh more than **2 cows**

Earthworm populations consume
2 tons of dry matter per acre per year, partly digesting and mixing it with soil

If we're adding topsoil to add organic matter, but organic matter is less than 5% of topsoil?



O) Organic matter: Litter layer of plant residues in relatively undecomposed form.
A) Surface soil: Layer of mineral soil
B) Subsoil: This layer accumulates iron, clay, aluminum

Soil Amendments:
What have we tried?
What are we trying?

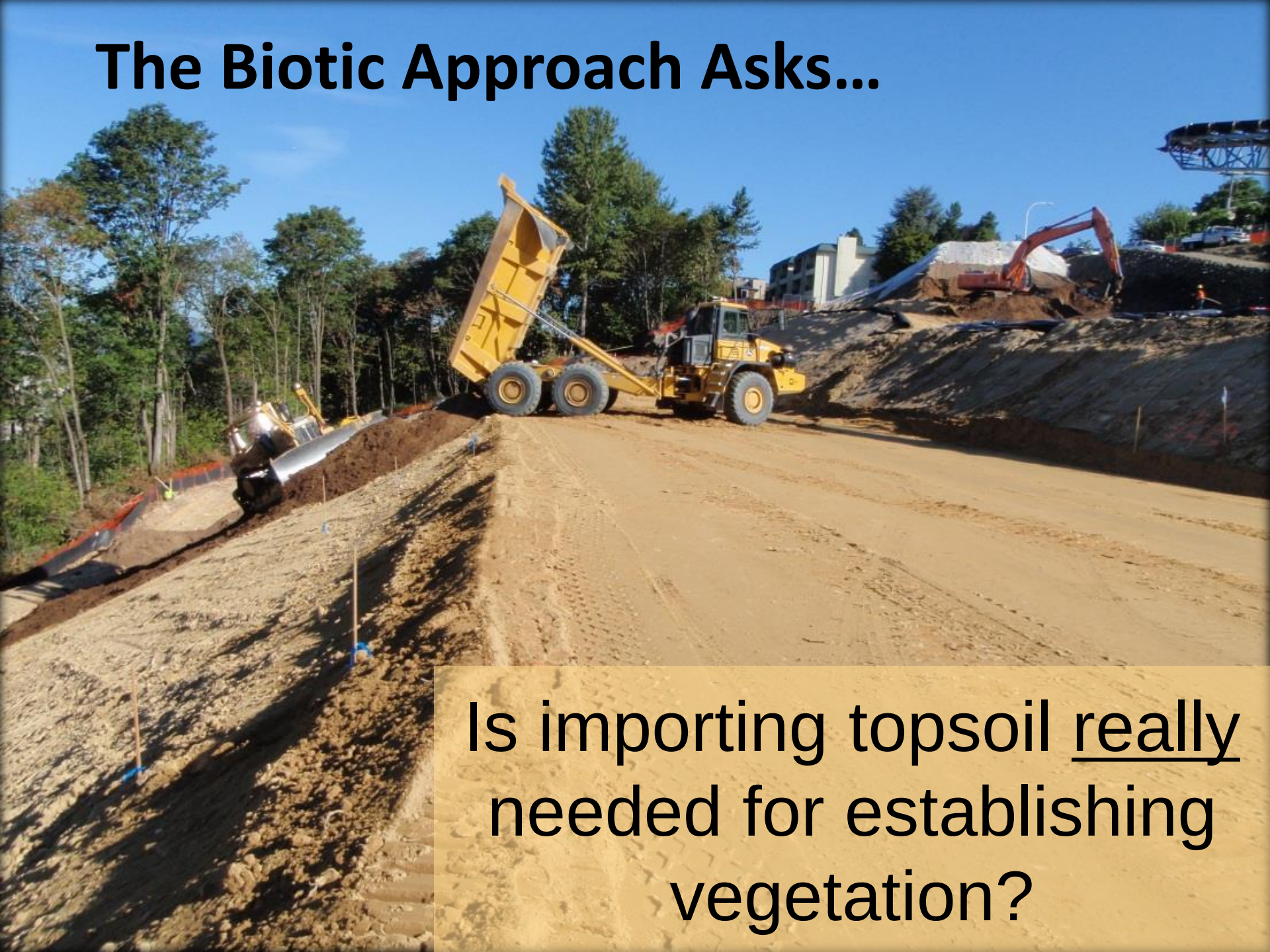
Topsoil & Compost

10 trucks per acre loaded with 26 cubic yards of soil in each.

Conventional approach to restoration.

Biotic Approach → **Add Only What's Needed!**

The Biotic Approach Asks…



Is importing topsoil <u>really</u> needed for establishing vegetation?

WEIGHTED AVERAGE ITEM PRICE REPORT BY ITEM, REGION AND QUARTER

ITEM	REGION	CALENDAR QUARTER	NUMBER OF OCCUR'S	TOTAL QUANTITY	TOTAL DOLLARS	AVERAGE AWARDED PRICE	AVERAGE OF LOW 3 BIDDERS
TOPSOIL / CUYD							
1040-0101000K	0	2015Q1	4	3,469.00	$138,045	$39.79	$40.05
		2015Q2	1	260.00	$10,400	$40.00	$51.67
		2015Q4	7	1,192.00	$74,159	$62.21	$65.45
			12	4,921.00	$222,604	$45.24	$46.81
TEMPORARY MULCHING, COMPOST / ACRE							
0280-0104030R	0	2015Q3	1	2.00	$19,600	$9,800.00	$10,666.67
			1	2.00	$19,600	$9,800.00	$10,666.67

Topsoil Prices:
Average of low bids = $46.81/CY
3 inches = $18,738/Acre
4 inches = $24,839/Acre

Oregon Department of Transportation

Alberta Transportation

PROVINCIAL, Weighted Unit Price Averages
Based on 2015, 2016 and 2017 Construction Prices
tendered between August 01, 2015 and Nov 30, 2016

Item	Description	Unit	Avg. 3 low bids for Construction Year		
			2015	2016	2017
G300	Topsoil Placement	m2	$ 0.72	$ 0.75	$ 0.78
G320	Topsoil (Supply and Place)	m2	$ 9.65	$ 12.17	$ 21.14

Topsoil Supplied & Placed Price per Hectare:

2015 = $96,500

2016 = $121,700

2017 = $211,400

*70 mm depth

Minnesota 2015

AVERAGE BID PRICES FOR AWARDED PROJECTS
ENGLISH UNITS - SPEC YEAR 16

08:15 Thursday, March 31, 2016 18

DOES NOT INCLUDE STATE AID PROJECTS
ALL ITEMS BETWEEN 01/01/15 AND 12/31/15
BY ITEM GROUP

18 CONTRACTS - AWARDED TOTAL: $48,485,379

ITEM GROUP	ITEM NUMBER	ITEM DESCRIPTION	UNITS	QUANTITY	DOLLARS (000S)	AVERAGE PRICE	CONTRACT OCCURR.
2572	2572.501/00010	TEMPORARY FENCE	L F	3,243	$6	$1.87	2
	2572.502/00010	CLEAN ROOT CUTTING	L F	3,224	$19	$6.00	1
2572					$25		
2573	2573.502/00010	SILT FENCE, TYPE HI	L F	989	$4	$3.79	3
	2573.502/00030	SILT FENCE, TYPE SD	L F	137	$1	$8.00	1
	2573.502/00040	SILT FENCE, TYPE MS	L F	20,739	$42	$2.01	7
	2573.502/00050	SILT FENCE, TYPE TB	L F	437	$3	$7.00	1
	2573.530/00010	STORM DRAIN INLET PROTECTION	EACH	388	$72	$185.82	8
	2573.533/00015	SEDIMENT CONTROL LOG TYPE COMPOST	L F	75,370	$166	$2.20	7
	2573.535/00010	STABILIZED CONSTRUCTION EXIT	LS	5	$9	$1,700.00	5
	2573.550/00010	EROSION CONTROL SUPERVISOR	LS	3	$12	$4,066.67	3
	2573.560/00010	CULVERT END CONTROLS	EACH	113	$18	$154.96	6
2573					$326		
2574	2574.508/00011	FERTILIZER TYPE 1	LB	21,549	$13	$0.59	2
	2574.508/00012	FERTILIZER TYPE 2	LB	611	$0	$0.69	1
	2574.508/00013	FERTILIZER TYPE 3	LB	18,675	$15	$0.79	4
	2574.508/00014	FERTILIZER TYPE 4	LB	4,586	$4	$0.89	4
→	2574.525/00020	ROOTING TOPSOIL BORROW	C Y	1,401	$69	→ $49.21	2
	2574.525/00040	FILTER TOPSOIL BORROW	C Y	1,940	$100	$51.69	3
	2574.575/00010	SUBSOILING	ACRE	33	$15	$462.01	3
	2574.578/00010	SOIL BED PREPARATION	ACRE	27	$3	$125.00	1
2574					$220		
2575	2575.501/00010	SEEDING	ACRE	98	$17	$176.14	6
	2575.502/22111	SEED MIXTURE 22-111	LB	3,754	$10	$2.75	2
	2575.502/25131	SEED MIXTURE 25-131	LB	90	$0	$2.34	1
	2575.502/25141	SEED MIXTURE 25-141					
	2575.502/25151	SEED MIXTURE 25-151					
	2575.502/33261	SEED MIXTURE 33-261					
	2575.502/34171	SEED MIXTURE 34-171					
	2575.502/34261	SEED MIXTURE 34-261					
	2575.502/35221	SEED MIXTURE 35-221					
	2575.502/35241	SEED MIXTURE 35-241					
	2575.502/36211	SEED MIXTURE 36-211					
	2575.502/36711	SEED MIXTURE 36-711					
	2575.505/00020	SODDING TYPE NATIVE					
	2575.511/00010	MULCH MATERIAL TYPE 1					
	2575.511/00030	MULCH MATERIAL TYPE 3					
	2575.519/00010	DISK ANCHORING					

Average Price = $49.11/CY

3 inches = $19,610/Acre

4 inches = $26,146/Acre

CALIFORNIA DEPARTMENT OF TRANSPORTATION
CONTRACT COST DATA

2015-2016

	Item No. / Description	Unit	Dist	Qty	Unit Price	Adj Price	Total
☑	210110 - IMPORTED TOPSOIL (CY)	CY	04	270	$50.00	$46.56	$13500.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	02	250	$63.00	$58.67	$15750.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	04	510	$0.01	$0.01	$5.10
☑	210110 - IMPORTED TOPSOIL (CY)	CY	06	52	$74.00	$68.91	$3848.00
☑	028604 - ROADWAY EXCAVATION (SELECTED MATERIAL) (TOPSOIL)	CY	05	44400	$8.57	$9.94	$380508.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	11	550	$60.00	$69.62	$33000.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	02	250	$63.44	$73.61	$15860.00
☑	027919 - IMPORTED TOPSOIL (MODIFIED)	CY	03	420	$165.00	$191.45	$69300.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	04	640	$80.00	$87.33	$51200.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	02	2.4	$2600.00	$2838.15	$6240.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	12	1500	$65.00	$70.95	$97500.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	03	2790	$55.00	$55.21	$153450.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	05	1310	$75.00	$75.00	$98250.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	02	150	$75.00	$75.00	$11250.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	12	1130	$36.00	$36.00	$40680.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	01	230	$110.00	$110.00	$25300.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	05	390	$51.00	$51.00	$19890.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	04	1350	$80.00	$80.00	$108000.00
☑	210110 - IMPORTED TOPSOIL (CY)	CY	04	3.9	$200.00	$200.00	$780.00

uncheck all | check all

SUMMARY	Unmodified	Adjusted		
Average Price/Unit: $	205.84	**220.91**	Avg No. Units	2957
Std Dev. (of Unit Price): ±$	566.10	**618.76**	Rows Selected	19
Weighted Avg.: $	20.36	**22.00**	Rows Returned	19
Minimum Price/Unit: $	0.01	0.01		
Maximum Price/Unit: $	2,600.00	2,838.15		

- Adjusted prices are adjusted to today's dollars based on the Caltrans Construction Cost Index
- To remove a row from the calculations, uncheck the checkbox next to that row.
- To see additional information for a contract, click on that contract number.
- To see a trend graph of prices for an item, click on the item number.
- Red highlighted rows contain one-time use item codes. Do not reuse them!

Topsoil:
Weighted average $22/CY
3 inches = $8,877/Acre
4 inches = $11,691/Acre

Michigan Top Soil 3 & 4 inch 2016

MDOT Michigan Department of Transportation

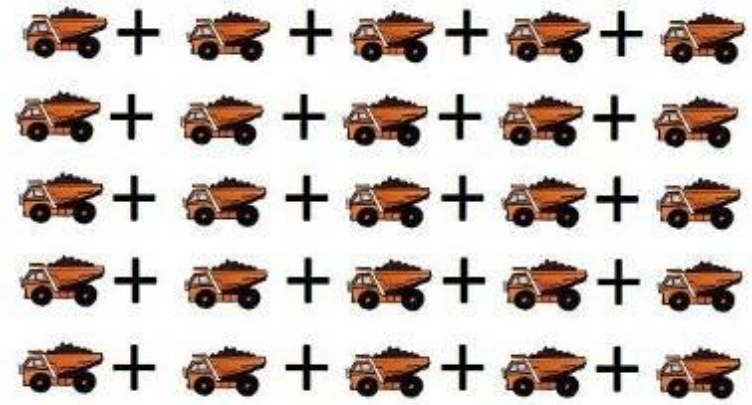
	Units	Conts	Average Qty	Total Qty	Total Dollars	Avg Award Price	Avg Low 3 Bidders
Topsoil Surface, Furn, 3 inch	Syd	2	3,670.00	7,340.00	$19,770.00	$2.69	$2.76
Topsoil Surface, Furn, 3 inch	Syd	1	50.00	50.00	$452.50	$9.05	$6.15
Topsoil Surface, Furn, 3 inch	Syd	2	18,355.00	36,710.00	$12,573.00	$0.34	$1.20
Topsoil Surface, Furn, 3 inch	Syd	4	61,689.50	246,758.00	$260,653.30	$1.06	$1.27
Topsoil Surface, Furn, 3 inch	Syd	2	9,368.00	18,736.00	$18,241.00	$0.97	$1.48
Topsoil Surface, Furn, 3 inch	Syd	1	1,451.00	1,451.00	$8,706.00	$6.00	$5.50
Topsoil Surface, Furn, 3 inch	Syd	2	14,066.50	28,133.00	$39,944.74	$1.42	$1.37
Top				3,015.00	$9,689.00	$3.21	$3.08
Top				98,520.00	$108,870.95	$1.11	$1.47
Top				13.00	$195.00	$15.00	$43.33
Top				1,001.00	$2,602.60	$2.60	$2.15
Top				423.00	$2,220.75	$5.25	$4.75
Top				7,040.00	$1,760.00	$0.25	$1.75
Top				8,470.00	$33,167.00	$3.92	$3.16
Top				5,363.00	$14,703.20	$2.74	$3.39
Topsoil Surface, Furn, 3 inch	Syd	1	2,580.00	2,580.00	$7,353.00	$2.85	$3.03
		32	8,978.57	465,603.00	$540,902.04	$1.16	$5.36

Toss the high & low
Average the rest =
$3.02/SY 3inch = $14,616/Acre
$4.72/SY 4inch = $22,844/Acre

	Units	Conts	Average Qty	Total Qty	Total Dollars	Avg Award Price	Avg Low 3 Bidders
Topsoil Surface, Furn, 4 inch	Syd	2	213.50	427.00	$4,052.00	$9.49	$15.17
Topsoil Surface, Furn, 4 inch	Syd	1	981.00	981.00	$3,924.00	$4.00	$3.18
Topsoil Surface, Furn, 4 inch	Syd	1	5,500.00	5,500.00	$7,975.00	$1.45	$1.30
Topsoil Surface, Furn, 4 inch	Syd	1	165.00	165.00	$1,815.00	$11.00	$10.50
Topsoil Surface, Furn, 4 inch	Syd	1	1,100.00	1,100.00	$4,675.00	$4.25	$6.00
Topsoil Surface, Furn, 4 inch	Syd	4	498.00	1,992.00	$6,812.00	$3.42	$5.00
Topsoil Surface, Furn, 4 inch	Syd	4	2,360.00	9,440.00	$32,837.50	$3.48	$3.79
Topsoil Surface, Furn, 4 inch	Syd	1	2,550.00	2,550.00	$2,550.00	$1.00	$3.00
Topsoil Surface, Furn, 4 inch	Syd	1	20.00	20.00	$220.00	$11.00	$10.00
Topsoil Surface, Furn, 4 inch	Syd	1	690.00	690.00	$4,229.70	$6.13	$6.37
Topsoil Surface, Furn, 4 inch	Syd	2	9,357.00	18,714.00	$64,551.00	$3.45	$3.16
Topsoil Surface, Furn, 4 inch	Syd	1	428.00	428.00	$1,891.76	$4.42	$7.81
Topsoil Surface, Furn, 4 inch	Syd	1	4,890.00	4,890.00	$14,670.00	$3.00	$3.33
Topsoil Surface, Furn, 4 inch	Syd	2	759.00	1,518.00	$6,559.00	$4.32	$4.93
Topsoil Surface, Furn, 4 inch	Syd	2	32,078.00	64,156.00	$12,756.22	$0.20	$1.58
Topsoil Surface, Furn, 4 inch	Syd	4	3,005.25	12,021.00	$44,740.28	$3.72	$4.03
Topsoil Surface, Furn, 4 inch	Syd	1	45.00	45.00	$675.00	$15.00	$15.00
Topsoil Surface, Furn, 4 inch	Syd	1	5,325.00	5,325.00	$22,631.25	$4.25	$4.42
		31	3,886.93	129,962.00	$237,564.71	$1.83	$6.03

Less Material = Less Time = Less Money

The Ontario Provincial Standard Specifies a Minimum of 5 cm (2 in) of topsoil. To achieve this requires the transport and management of 25 trucks per hectare (10/Acre) loaded with 20 m^3 (26 yd^3) of soil.



Conventional approach to site restoration

Biotic Soil Amendment Approach to Restoration
Add just what is needed

Current Practices

- Strip topsoil & stockpile
- Compact the ground
- Haul & Spread topsoil
- Apply seed, fertilizer & erosion control,
- Sometimes irrigate…

What Happens to Soil During Construction?

- Organic matter, the soil's food bank, is lost.
- Porosity, crucial for air and water exchange, is reduced.
- Microbes essential for nutrient cycling are absent.

Standard topsoil handling degrades soil


Use existing equipment,
Simpler mobilization,
$$$ Saved $$$
21C38-3
BOWIE
MULCHER
Department
of Transportation
FOR OFFICIAL USE ONLY

- ✓Standard Equipment
- ✓Lower Operating Costs
- ✓Contractor Profitability

Unique Mobilizations

Complicated Site Access

Use existing equipment for dual purpose

Hydraulic options for remote access

Cannon Application

Dillingham, AK

Pop. 2,143

- Poor Soils
- Low Organics
- Low Fertility
- Topsoil alternative


• Surface Prep
• Biotic Soil Amendments

Erosion Control: Bonded Fiber Matrix

MATERIALS	REASONS/BENEFIT	APPLICATION
Verdyol Biotic Earth Black	To build a complete soil structure / Obtain vegetative growth	3,000 pounds per acre
Custom grass seed blend	A combination of native seeds suited to environment / Obtain vegetative growth	2 pounds per thousand square feet
Fertilizer – 10-10-10-8.5	Matching a fertilizer to enhance deficient soil conditions / Obtain vegetative growth	500 pounds per acre

KNIK CONSTRUCTION

To Whom It May Concern;

My name is Troy Gray. I was the superintendent on the Dillingham Airport project. At the end of June 2014, my hydro seed crew applied Verdyol Biotic Black Earth for the first time. Application was slightly different than the mulch we normally use, but adjustments were minimal. Because of the small hydroseed applicator equipment we have, we had to make multiple loads to cover the area. That made us experts on the application. Based on the training by Alaska Garden & Pet, ease of use, lower cost of the Verdyol program compared to top soil, and results we obtained, I would suggest this product to anyone.

Troy Grey – Knik Construction

EMC ENGINEERING LLC

- Faster Establishment
- Project Closeout
- Permit termination
- No Maintenance


WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
•Simple
•Proven
•Sustainable
•Cost Effective
VERDYOL
Biotic Earth™
AN ORGANIC APPROACH TO SOIL BUILDING


DANGER
VERDYOL
Biotic Earth™ Black
WEEDS
100%
Weed

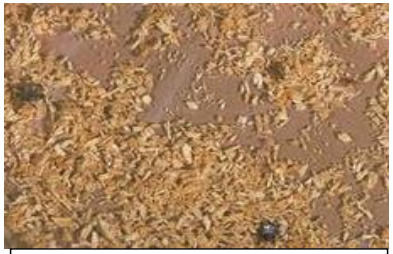
Carbon:Nitrogen ratio

UCDAVIS
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

fact sheet

About the Carbon:Nitrogen ratio

The carbon-nitrogen ratio is a useful way to compare soil amendments. This ratio is an indicator of the stability of the soil supplement. Lower ratios mean the supplement is very stable and will not draw down nutrients from the soil that plants need to grow. In general, carbon-nitrogen ratios of 30 to 1 or lower are best.



The high C:N ratio of soil amendments such as saw dust can limit the amount of soil nutrients (especially nitrogen) available for plants.

How to use the ratio

Saw dust has a very high ratio (400 to 1). As a result, saw dust makes water and nutrients unavailable (or less available) for the plants.

By contrast, compost, with a 30 to 1 rating, is nearly ideal. A drawback, however, is that compost breaks down quickly in the soil.

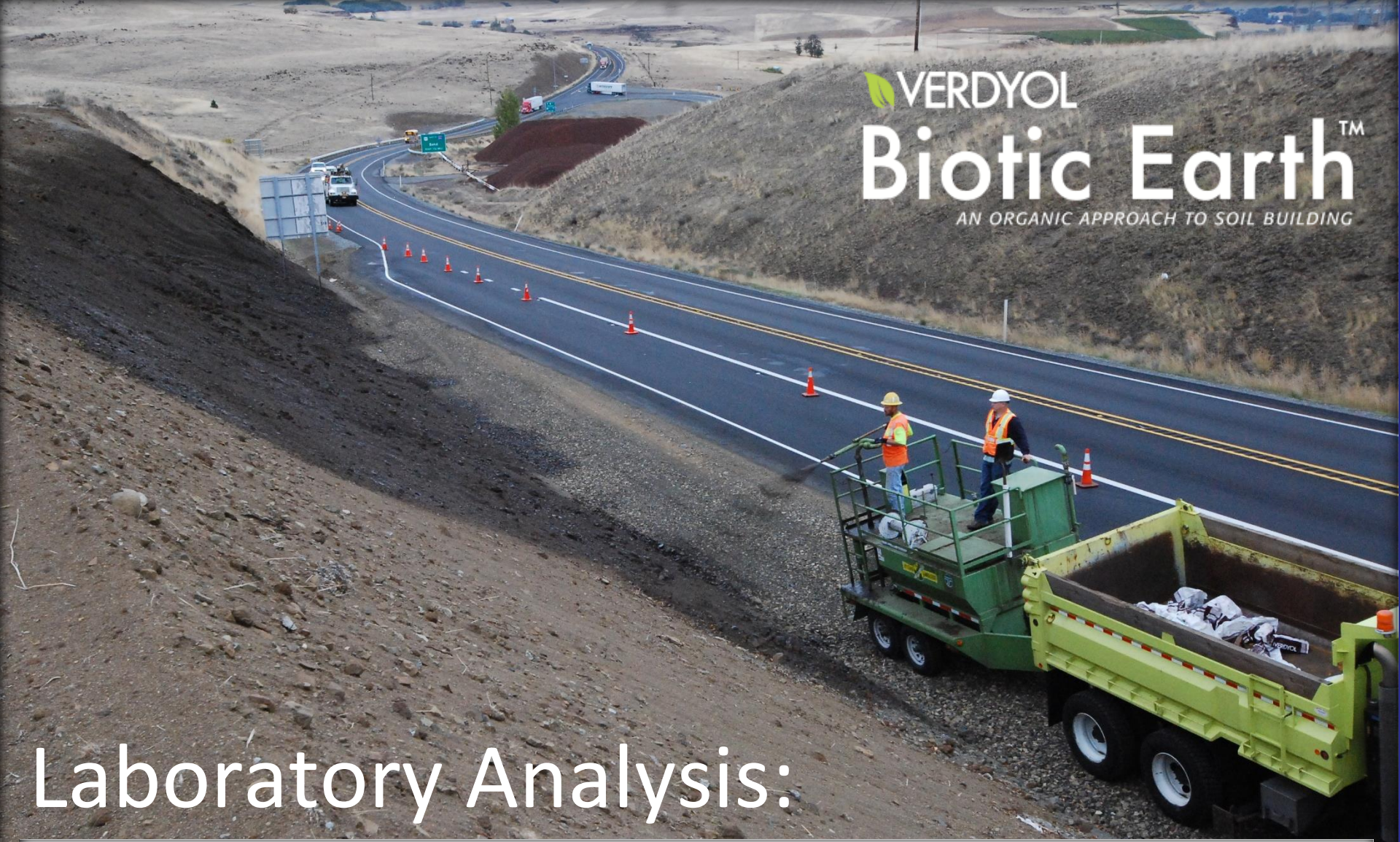
Peat moss, at 50 to 1, is near compost on the carbon-nitrogen scale. It draws down nitrogen slightly, but not enough to hurt plants. Another advantage is that peat moss lasts for years in the soil.

Common Carbon:Nitrogen Ratios

Material	C : N Ratio
Soil Humus	10 : 1
Tomato Leaves	13 : 1
Manure (Rotted)	20 : 1
Agrisol (Compost)	30 : 1
Sphagnum Peat Moss	50 : 1
Oak Leaves	65 : 1
Oat Straw	80 : 1
Pine Needles	225 : 1
Saw Dust	400 : 1

Prepared by Muhammad Marrush October 24, 2007

For more information visit: International Programs www.aes.ucdavis.edu/IntProg/Default.htm



Laboratory Analysis:

Laboratory Number	Sample ID	Total Organic Carbon **(%)	Total N** (%)	C:N Ratio **	Water pH
1	Biotic Earth	41.48	1.39	29.78	7.6
1 DUP	Biotic Earth DUP	41.25	1.49	27.67	7.7


VERDYOL
Biotic Earth™
AN ORGANIC APPROACH TO SOIL BUILDING
✓ Clean
✓ Consistent
✓ Seed & Weed Free

Seed Free Testing

No Germination = No Seed

- ✓ Peat Moss
- ✓ Straw Fiber
- ✓ Flax Fiber

Idaho State Seed Lab

P. O. Box 790
Boise, ID 83701-0790
Laboratory Report Of Analysis

C.L. "Butch" Otter
Governor

Celia R. Gould
Director

Account No.	Date Received	Date Completed	Lab Number
7533	**12/08/17**	**12/27/17**	**S18-2057**

ECB
12320 NE 37th Street
Vancouver, WA 98682

Information Provided by Sender

Variety	Biotic Earth
Kind	Mulch
Genus/Species	
Lot Number	1
Class	Service

Purity Analysis		Viability Analysis				
Component	**Purity**	**Germ Date**	**Germ**	**Dormant**	**Hard**	**Viable**
Mulch	-N-	-N-	-N-	-N-	-N-	-N-

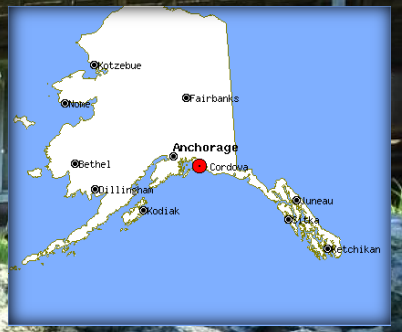
Other Determinations

No viable Noxious Weed Seed or Common Weed Seed present in sample provided: None Found, 0.00% germination in 20-30 Celsius and 15-25 Celsius alternating temperatures.

Tests Requested: Germination. No other tests requested.

WARRANTY: We warrant that the purity and germination test results reported on this form have been carried out in accordance with AOSA rules unless otherwise specified. Test results reflect the condition of the submitted sample and may not reflect the condition of the lot from which the sample was taken.
DISCLAIMER OF WARRANTIES: WE MAKE NO OTHER WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Cordova, AK



8-28-15

It appears that the site is revegetating nicely and the grass mix that we applied is competing with the knotweed very well. There are a few random knotweed plants coming up here and there which we expected. Erosion control has been a success as well; as the site has held up to several large rain events over the past few months, including one event that dumped over 5 inches of rain in a 48 hour period a week after the site was seeded. The Verdyol is doing its job as expected, helping the recommended seed mix germinate quickly, grow faster, and provide sustained nutrients for the life of the plant. If you should have any questions or concerns, please feel free to contact me at any time.

Take care

Casey L. Dinkel
Plant Materials Center
Agronomist / Soil Erosion Control Specialist

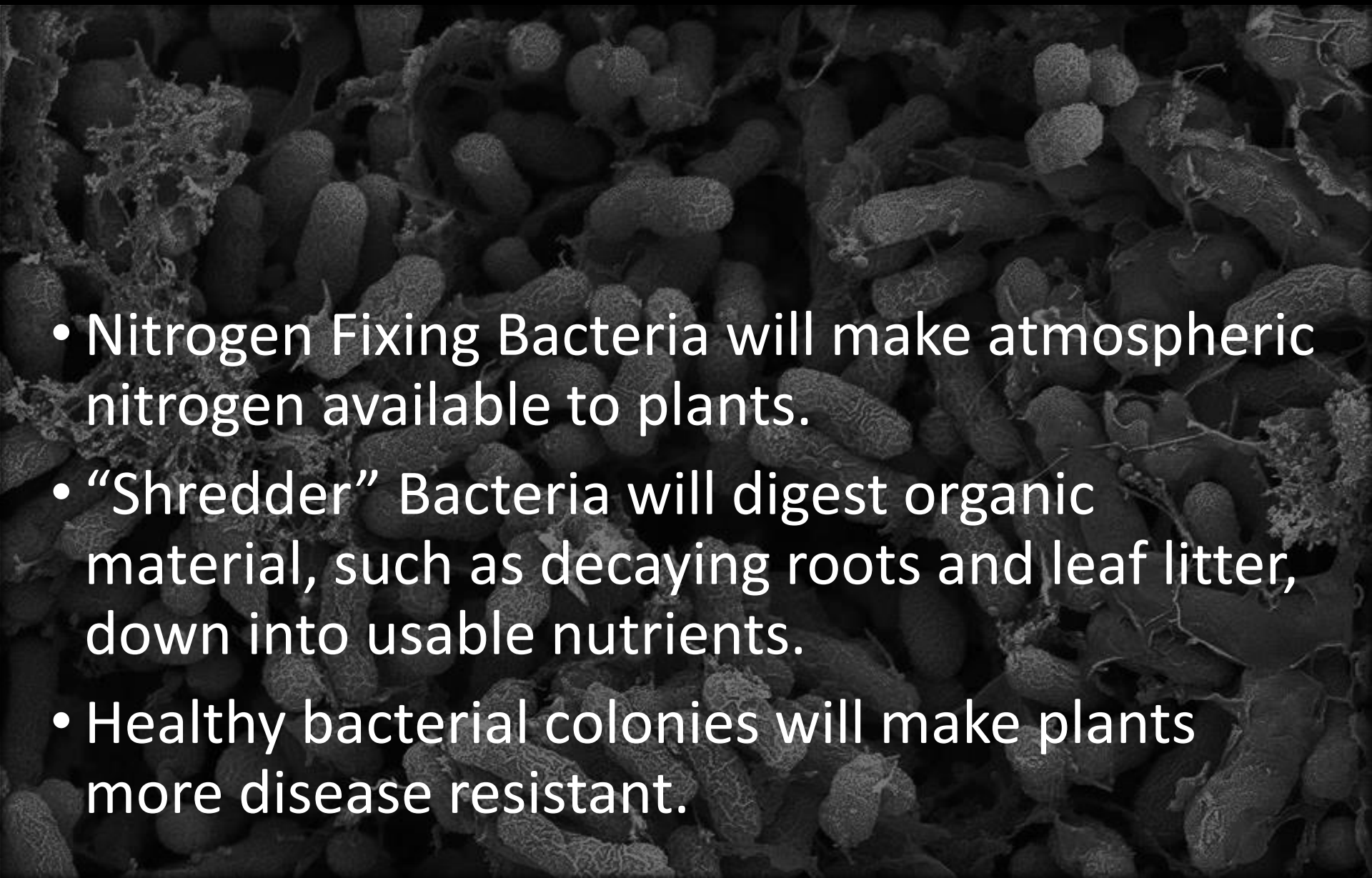
11-02


Kenai Riverbank Stabilization


Shoreline armor.


Shoreline armor.

Role of Bacteria in the Food Cycle



- Nitrogen Fixing Bacteria will make atmospheric nitrogen available to plants.
- “Shredder” Bacteria will digest organic material, such as decaying roots and leaf litter, down into usable nutrients.
- Healthy bacterial colonies will make plants more disease resistant.

Role of Mycorrhizae in the Food Cycle

- A fungus that aids in the absorption of nutrients by forming a symbiotic relationship with plant roots.
- 90% of plants form a relationship with mycorrhizae.
- They dramatically increase the area of root systems.
- Reintroduction of mycorrhizae can dramatically improve plant performance with less water and fertilizer.

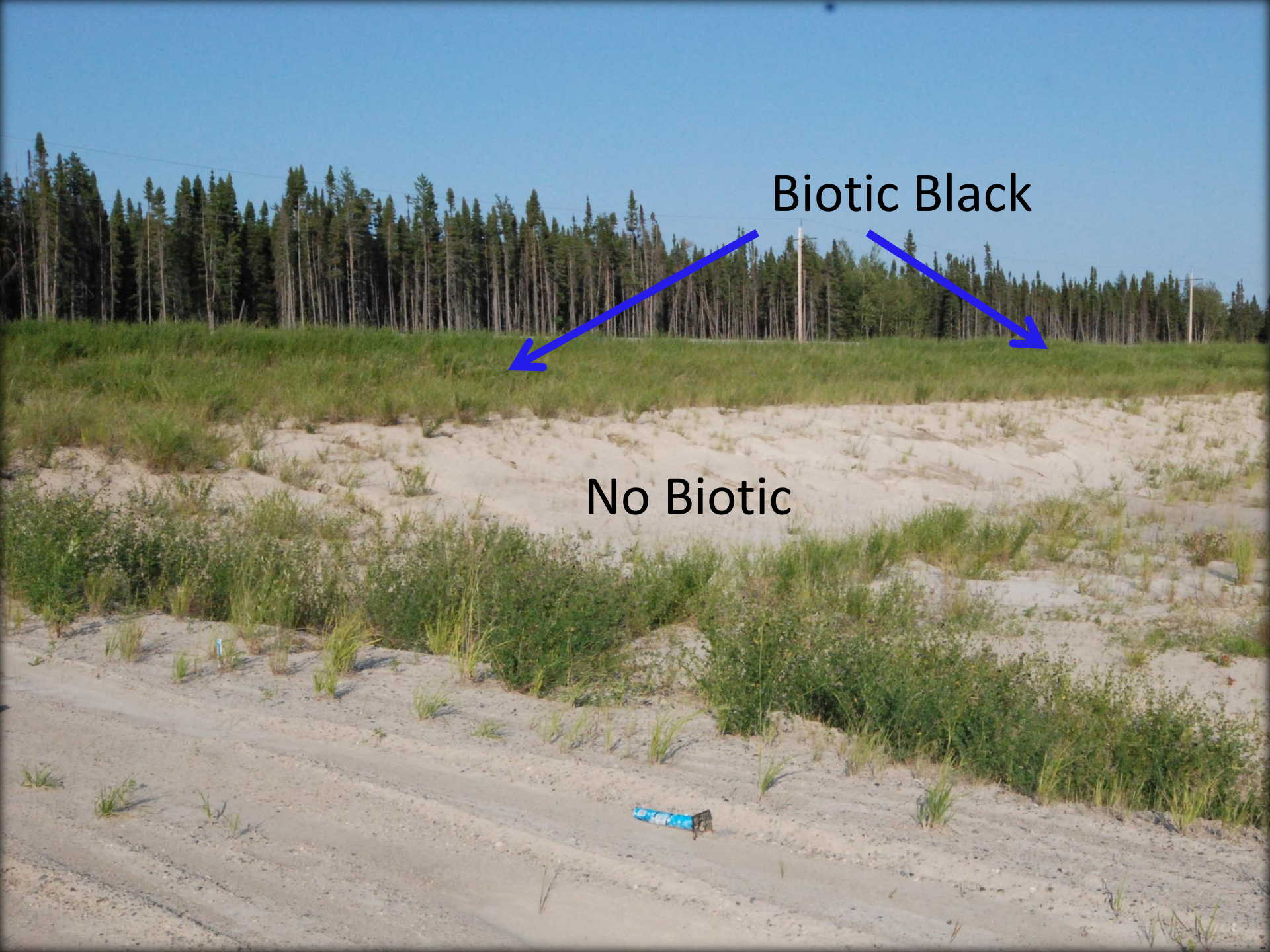
Biotic Benefits

Deeper Roots

Taller Plants

Greater Density

Treated vs Untreated


Biotic Black
No Biotic

What does success look like?

Milner Ridge Project


2 weeks later


3 weeks later


7 weeks later


13 Weeks later


14 Months later


8+ year case study

8+ year case study

Microbial Community Analysis of Milner Ridge A and B Turf Grass Samples Using TRFLP

Prepared for **Mark Myrowich (CEO) and Natalie Pienkowski**

mark@erosioncontrolblanket.com

MM - 204-797-3797, NP - 204-292-1221

December 22, 2014

Jae Min Park, Andrew Wojcik, and George Lazarovits

Table 1: Enumeration of bacteria, yeast, and mold in the turf samples.

Sample	Total Bacteria Count	Total Yeast Count	Total Mold Count
Milner Ridge A	17,975,000	4,825,000	112,500
Milner Ridge B	1,655,000	190,000	15,500


Biotic Earth Over Topsoil Test Site
Side by Side
100 degrees
No extra irrigation
Texas Department of Transportation
VERDYOL
Biotic Earth™
AN ORGANIC APPROACH TO SOIL BUILDING
Standard seeding here

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16-166-054

REPORT NUMBER

CLIENT NO: 99999

SAMPLES SUBMITTED BY:

SEND TO:

LAURENALANIZ

GROWER:

US BUSINESS 83 MERCEDES

DATE: 06/15/16

SOIL ANALYSIS REPORT

SAMPLE ID	LAB NUMBER	ORGANIC MATTER % RATE ENR lbs/A	PHOSPHORUS P1 (Weak Bray) ppm-P RATE	PHOSPHORUS P2 (Strong Bray) ppm-P RATE	POTASSIUM K ** ppm-K RATE	MAGNESIUM Mg *** ppm-Mg RATE	CALCIUM Ca *** ppm-Ca RATE	SODIUM Na *** ppm-Na RATE	pH SOIL pH	pH BUFFER INDEX	COMPUTED Cation Exchange C.E.C. meq/100g	PERCENT BASE SATURATION K	Mg	Ca	H	Na
US 83	13818	0.8VL 45	9L	50H	447VH	257M	5140VH	150L	7.8		29.6	3.9	7.2	86.8	0.0	2.2

SAMPLE ID	NITRATE NO_3 *** ppm-NO3N RATE	SULFUR S *** ppm-S RATE	ZINC Zn *** ppm-Zn RATE	MANGANESE Mn *** ppm-Mn RATE	IRON Fe *** ppm-Fe RATE	COPPER Cu *** ppm-Cu RATE	BORON B *** ppm-B RATE	EX-CESS LIME RATE	SOLUBLE SALTS mmhos/cm RATE		
US 83	IS	7L	3.3M	4VL	57VH	7.2VH	0.4L	IS	IS		

CODE TO RATINGS:
VL = VERY LOW L = LOW
M = MEDIUM H = HIGH
VH = VERY HIGH NR = NOT RATED

ND = NONE DETECTED
IS = INSUFFICIENT SAMPLE
ENR = ESTIMATED NITROGEN RELEASE

This report applies only to the sample(s) tested. Samples are retained for a maximum of thirty days after testing.

A & L PLAINS AGRICULTURAL LABORATORIES, INC.

By: J. Scot Coleman, Agronomist

PHOSPHORUS - Multiply the results in ppm by 4.6 to convert to lbs per acre P2O5

** - Multiply the results in ppm by 2.4 to convert to lbs per acre K2O

*** - Multiply the results in ppm by 2 to convert to lbs per acre of the elemental form

Most soils weigh two (2) million pounds (dry weight) for an acre of soil 6-2/3 inches deep


US Business 83


US Business 83


MAY ICE IN
COLD
WEATHER


US Business 83

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17-104-119

REPORT NUMBER

CLIENT NO: 99999

SAMPLES SUBMITTED BY:

SEND TO:

LAUREN ALANIZ
540 AVENUE A
NEW BRAUNFELS, TX 78130-

DATE: 04/14/17

SOIL ANALYSIS REPORT

SAMPLE ID	LAB NUMBER	ORGANIC MATTER % RATE ENR lbs/A	PHOSPHORUS P1 (Weak Bray) ppm-P RATE	PHOSPHORUS $NaHCO_3$-P ppm-P RATE	POTASSIUM K ** ppm-K RATE	MAGNESIUM Mg *** ppm-Mg RATE	CALCIUM Ca *** ppm-Ca RATE	SODIUM Na *** ppm-Na RATE	pH SOIL pH	pH BUFFER INDEX	COMPUTED Cation Exchange C.E.C. meq/100g	PERCENT BASE SATURATION K	Mg	Ca	H	Na
F1 TWR	10619	0.5VL 40	3VL	14H	363VH	256H	3446H	443H	7.6		22.2	4.2	9.5	77.6	0.0	8.7

SAMPLE ID	NITRATE NO_3 *** ppm-NO3N RATE	SULFUR S *** ppm-S RATE	ZINC Zn *** ppm-Zn RATE	MANGANESE Mn *** ppm-Mn RATE	IRON Fe *** ppm-Fe RATE	COPPER Cu *** ppm-Cu RATE	BORON B *** ppm-B RATE	EX-CESS LIME RATE	SOLUBLE SALTS mmhos/cm RATE		
F1 TWR	35H	4L	0.8VL	6L	5M	0.3VL	0.5L	H	0.9M		

CODE TO RATINGS:
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A & L PLAINS AGRICULTURAL LABORATORIES, INC.

By: J. Scot Coleman, Agronomist

PHOSPHORUS - Multiply the results in ppm by 4.6 to convert to lbs per acre P2O5

** - Multiply the results in ppm by 2.4 to convert to lbs per acre K2O

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Most soils weigh two (2) million pounds (dry weight) for an acre of soil 6-2/3 inches deep

Baffin Wind Farm

Kenedy Ranch Texas

202Megawatts
101 Turbines


Baffin Wind Farm
Existing Soil = .05% Organic Matter
Erosion of Tower Foundation:
UNACEPTABLE!

Solution:

VERDYOL

Biotic Earth™

AN ORGANIC APPROACH TO SOIL BUILDING


South Texas
Windfarm


South Texas
Windfarm

Soil Analysis Stockpiled material

- ✓Very low organic matter

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17-349-119

REPORT NUMBER

CLIENT NO: 99999

SAMPLES SUBMITTED BY:

SEND TO:

LAUREN ALANIZ
540 AVE A
NEW BRAUNFELS, TX 78130-

GROWER:

AUSTIN LANDFILL PROJECT

DATE: 12/15/17

SOIL ANALYSIS REPORT

PAGE: 1

SAMPLE ID	LAB NUMBER	ORGANIC MATTER % RATE ENR lbs/A	PHOSPHORUS P1 (Weak Bray) ppm-P RATE	PHOSPHORUS $NaHCO_3$-P ppm-P RATE	POTASSIUM K ** ppm-K RATE	MAGNESIUM Mg *** ppm-Mg RATE	CALCIUM Ca *** ppm-Ca RATE	SODIUM Na *** ppm-Na RATE	pH SOIL pH	pH BUFFER INDEX	COMPUTED Cation Exchange C.E.C. meq/100g	PERCENT BASE SATURATION K	Mg	Ca	H	Na
TEST 1	15858	0.4VL 39	3VL	8M	298M	>800VH	9172VH		7.7		55.7	1.4	16.3	82.2	0.0	

Less than ½ percent OM

Soil Analysis Landfill Cap

- ✓ Low organic matter

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18-057-117
REPORT NUMBER

CLIENT NO: 99999
GROWER:

SAMPLES SUBMITTED BY:

SEND TO:

LAUREN ALANIZ
540 AVE. A
NEW BRAUNFELS, TX 78130-

SOIL ANALYSIS REPORT

DATE: 02/27/18

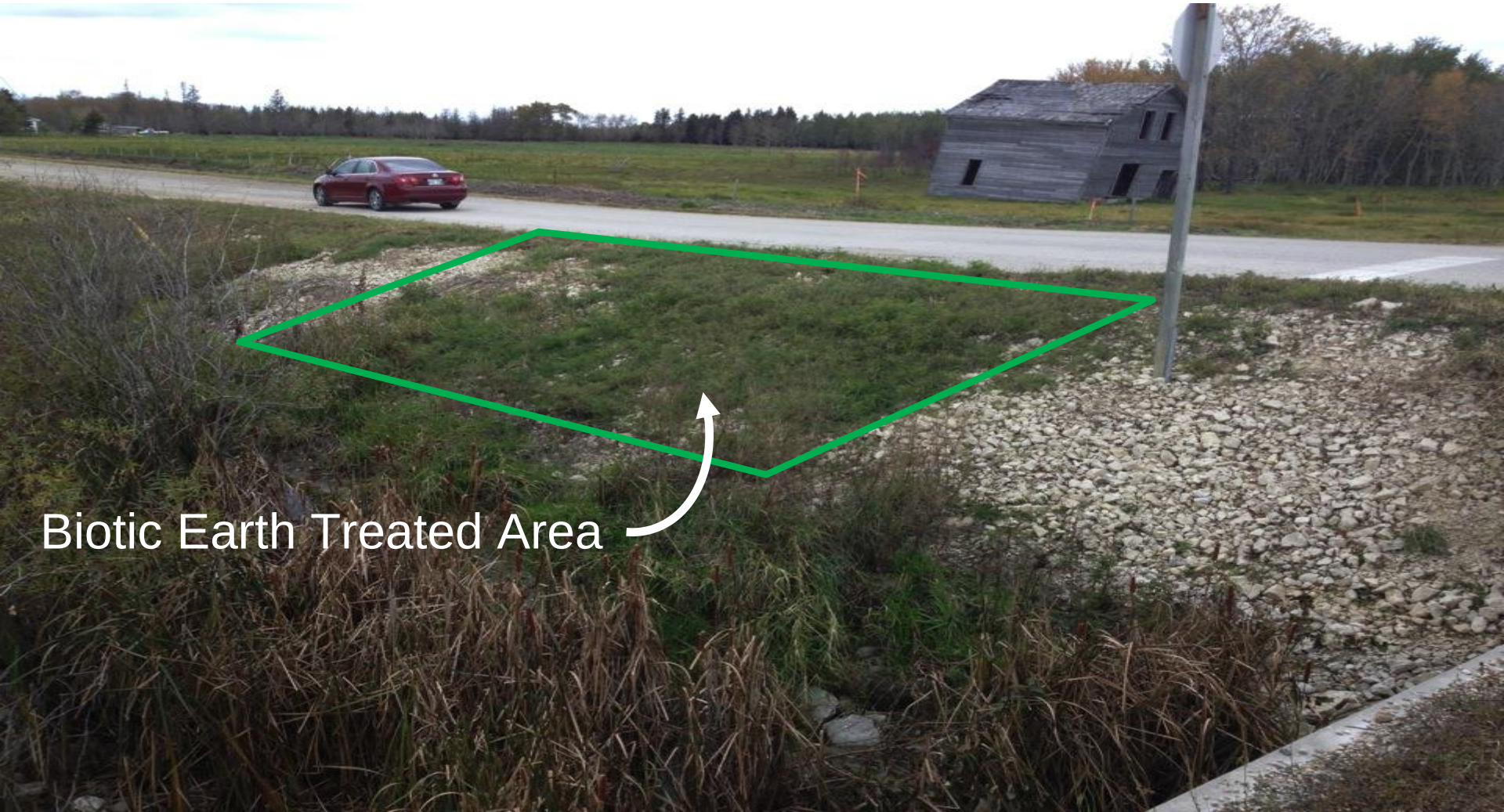
PAGE: 1

SAMPLE ID	LAB NUMBER	ORGANIC MATTER % RATE ENR lbs/A	PHOSPHORUS P1 (Weak Bray) ppm-P RATE	PHOSPHORUS P2 (Strong Bray) ppm-P RATE	POTASSIUM K ** ppm-K RATE	MAGNESIUM Mg *** ppm-Mg RATE	CALCIUM Ca *** ppm-Ca RATE	SODIUM Na *** ppm-Na RATE	pH SOIL pH	pH BUFFER INDEX	COMPUTED Cation Exchange C.E.C. meq/100g	PERCENT BASE SATURATION K	Mg	Ca	H	Na
2B	18010	1.1L 52	5VL	27M	186L	570VH	6968VH	236L	7.6		41.0	1.2	11.4	84.9	0.0	2.5
2C	18011	0.9L 48	4VL	18L	189L	435H	6318VH	249L	7.9		36.7	1.3	9.8	86.0	0.0	3.0
2D	18012	1.0L 50	4VL	13L	151L	146L	5296VH	97L	7.9		28.4	1.4	4.2	93.0	0.0	1.5
AUSTIN	18013	1.1L 52	6VL	15L	288M	278L	8891VH	79VL	7.4		47.7	1.5	4.8	93.0	0.0	0.7

Establish Vegetation in Hard Armor

Hand Application Directly Onto Riprap

Vegetation Establishment



VERDYOL

Biotic Earth™

AN ORGANIC APPROACH TO SOIL BUILDING


1 growing season

Can you tell where the Biotic is?

VERDYOL
Biotic Earth™
AN ORGANIC APPROACH TO SOIL BUILDING

Any Questions?

Alex Zimmerman CPESC, CISEC, CESSWI
AK-BC-NT-WA-CESCL
360-910-4800
alex@ecb.ca

FYI please see below draft District General Note and advise if you have any comments. Note that the red is just info for the project designers and not included in the plans.

160-2(Use Biotic Soil Amendments to the topsoil in areas that have steep or lengthy slopes that might be susceptible to erosion. This should also be used in other areas where it is known to be difficult to establish vegetation)

For certain locations as shown in the plans, use Biotic Soil Amendments to the topsoil as per the following specification.

Use a natural medium of organic soil amending materials, meeting the following requirements.

1. Free from roots, clods, hard clay, noxious weeds, tall grass, brush, sticks, stubble, or other litter and free draining and non-toxic.

2. Containing 40% by volume of thermally and mechanically processed straw, flexible flax fibers; 58% by volume of sphagnum peat moss or compost, 2% by volume of additional materials that provide plant derived valuable trace minerals, sugars, starches, proteins fiber and 16 amino acids including folic acid, vitamin A, and tricontanol growth stimulant/regulator; and mycorrhiza inoculants.

3. Total organic matter content of 93% or greater.

4. Application rate must meet manufacturer's recommendation.

Notify the engineer of the source of Biotic Soil Amendments at least 30 days prior to delivery of topsoil to the project. The engineer will confirm the Biotic Soil Amendments meet or exceed requirements before approval will be granted for its use. The cost of the Biotic Soil Amendments is subsidiary to Item 160 Topsoil.

Texas Department of Transportation


Cordillera Ranch

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16-336-100

REPORT NUMBER

CLIENT NO: 99999

SAMPLES SUBMITTED BY:

SEND TO:

ECB-VERDYAL-LAUREN ALANIZ
540 AVE A
NEW BRAUNFELS, TX 78130-

GROWER:

CORDILLERA

DATE: 12/01/16

SOIL ANALYSIS REPORT

SAMPLE ID	LAB NUMBER	ORGANIC MATTER % RATE ENR lbs/A	PHOSPHORUS P1 (Weak Bray) ppm-P RATE	PHOSPHORUS P2 (Strong Bray) ppm-P RATE	POTASSIUM K ** ppm-K RATE	MAGNESIUM Mg *** ppm-Mg RATE	CALCIUM Ca *** ppm-Ca RATE	SODIUM Na *** ppm-Na RATE	pH SOIL pH	pH BUFFER INDEX	COMPUTED Cation Exchange C.E.C. meq/100g	PERCENT BASE SATURATION K	Mg	Ca	H	Na
CORD	16610	4.7VH124	2VL	28M	494VH	286L	9509VH		6.8		52.7	2.4	4.5	90.0	3.0	

SAMPLE ID	NITRATE NO_3 *** ppm-NO3N RATE	SULFUR S *** ppm-S RATE	ZINC Zn *** ppm-Zn RATE	MANGANESE Mn *** ppm-Mn RATE	IRON Fe *** ppm-Fe RATE	COPPER Cu *** ppm-Cu RATE	BORON B *** ppm-B RATE	EX-CESS LIME RATE	SOLUBLE SALTS mmhos/cm RATE		
CORD	5L										

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By: J. Scot Coleman, Agronomist

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Most soils weigh two (2) million pounds (dry weight) for an acre of soil 6-2/3 inches deep


Cordillera Ranch


Cordillera Ranch

City Ball Park Construction

Installed September

New Technologies:
Biotic Soil Amendments


Mid October


April 21. Biotic Earth application.
amec


April 21. Completed Biotic Earth application.


April 21. Hay mulching over Biotic Earth.

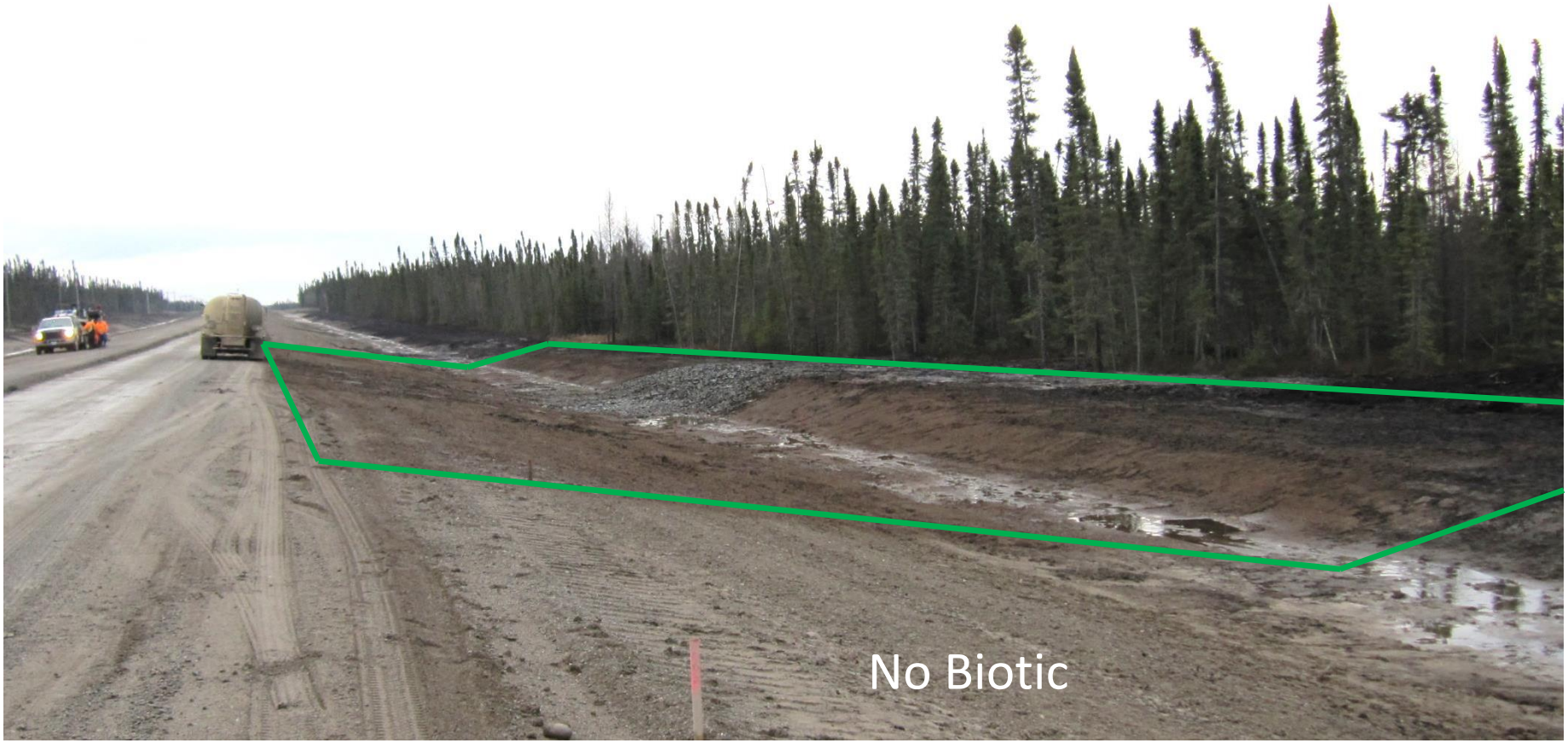

April 21. Hay mulching over Biotic Earth.


May 20. Four weeks growth (Biotic Earth)

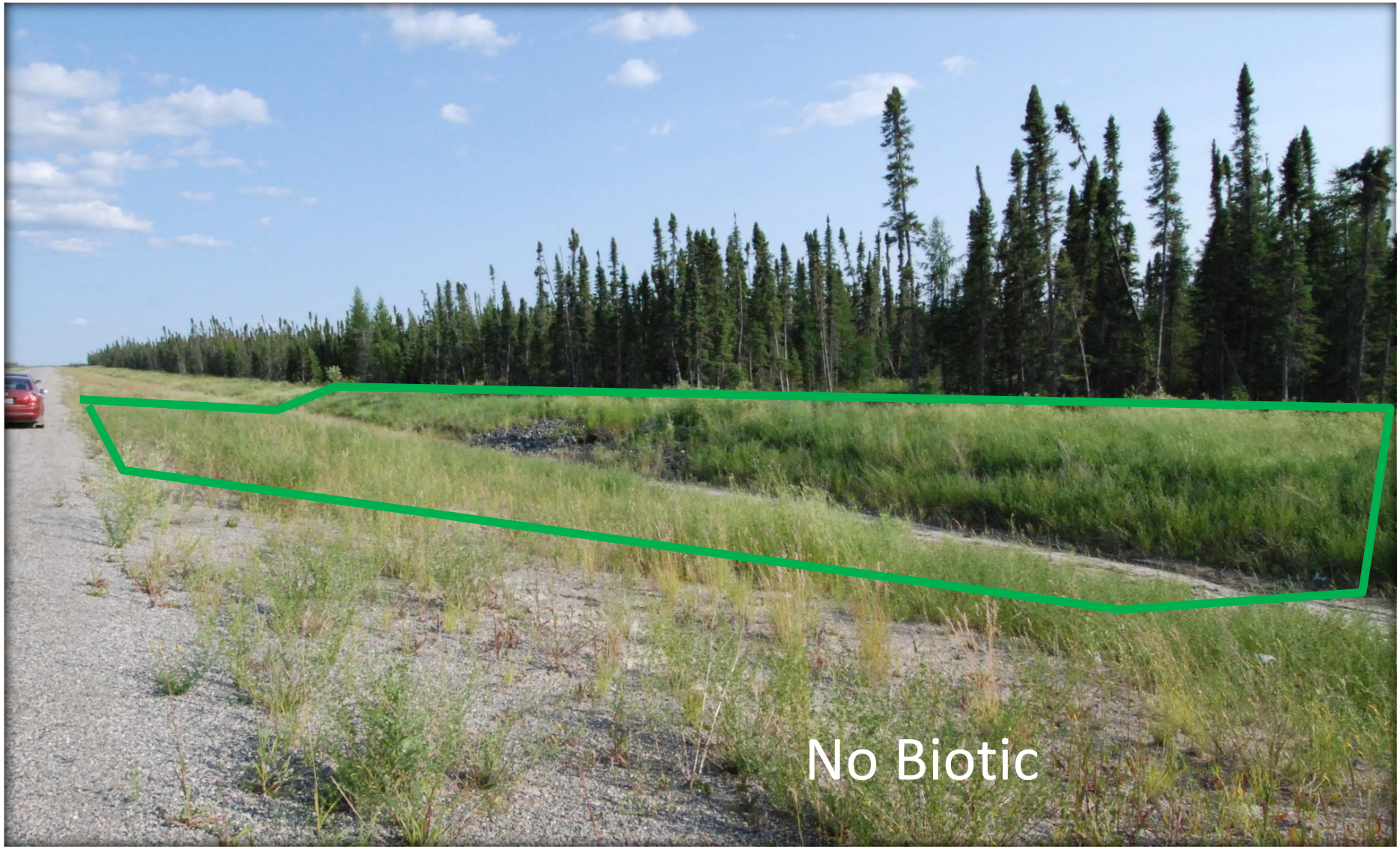

June 7. Six weeks results (Biotic Earth)


June 25. Eight weeks results (Biotic Earth)

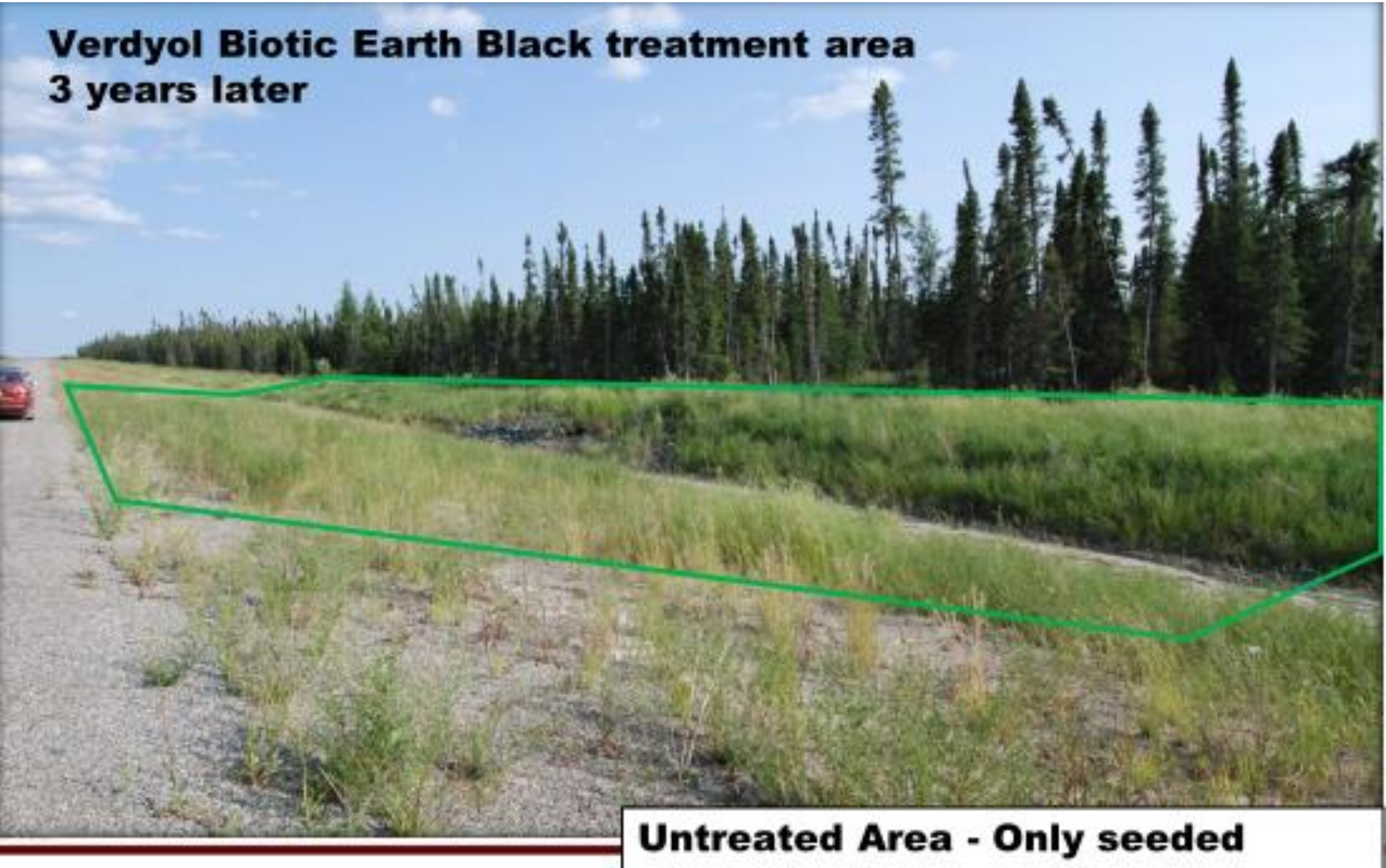
Test Plot Northern Manitoba



3.5 years later



Test Plot Northern Manitoba




3 years after application
Biotic Ends Here

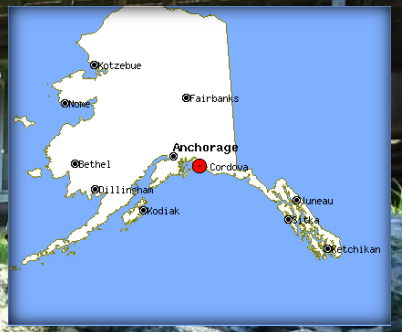

After one year of drought

Wind erosion?

Ensure Effective Erosion Control


Straw Mulch Blown Away

Cordova, AK



8-28-15

It appears that the site is revegetating nicely and the grass mix that we applied is competing with the knotweed very well. There are a few random knotweed plants coming up here and there which we expected. Erosion control has been a success as well; as the site has held up to several large rain events over the past few months, including one event that dumped over 5 inches of rain in a 48 hour period a week after the site was seeded. The Verdyol is doing its job as expected, helping the recommended seed mix germinate quickly, grow faster, and provide sustained nutrients for the life of the plant. If you should have any questions or concerns, please feel free to contact me at any time.

Take care

Casey L. Dinkel
Plant Materials Center
Agronomist / Soil Erosion Control Specialist

11-02

Complicated Crews

Biotic Soil Amendments

For site restoration