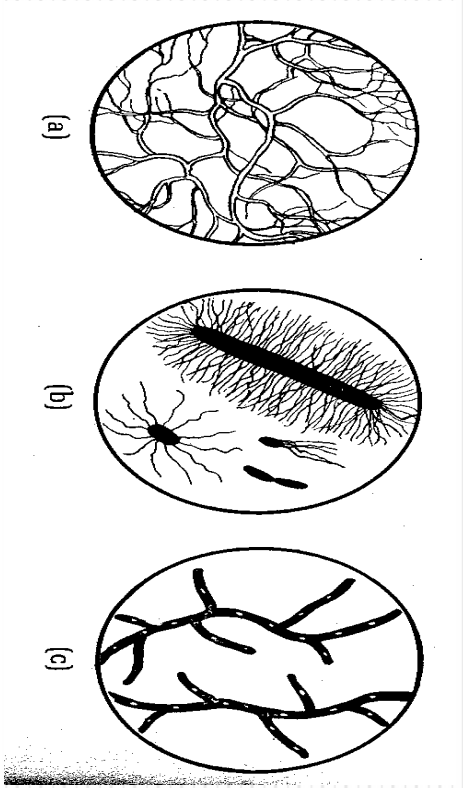
Composted Paper Mill Residuals Use in Virginia DOT Environmental Restoration Projects

Craig Coker
Director, Technical Services
Royal Oak Farm LLC

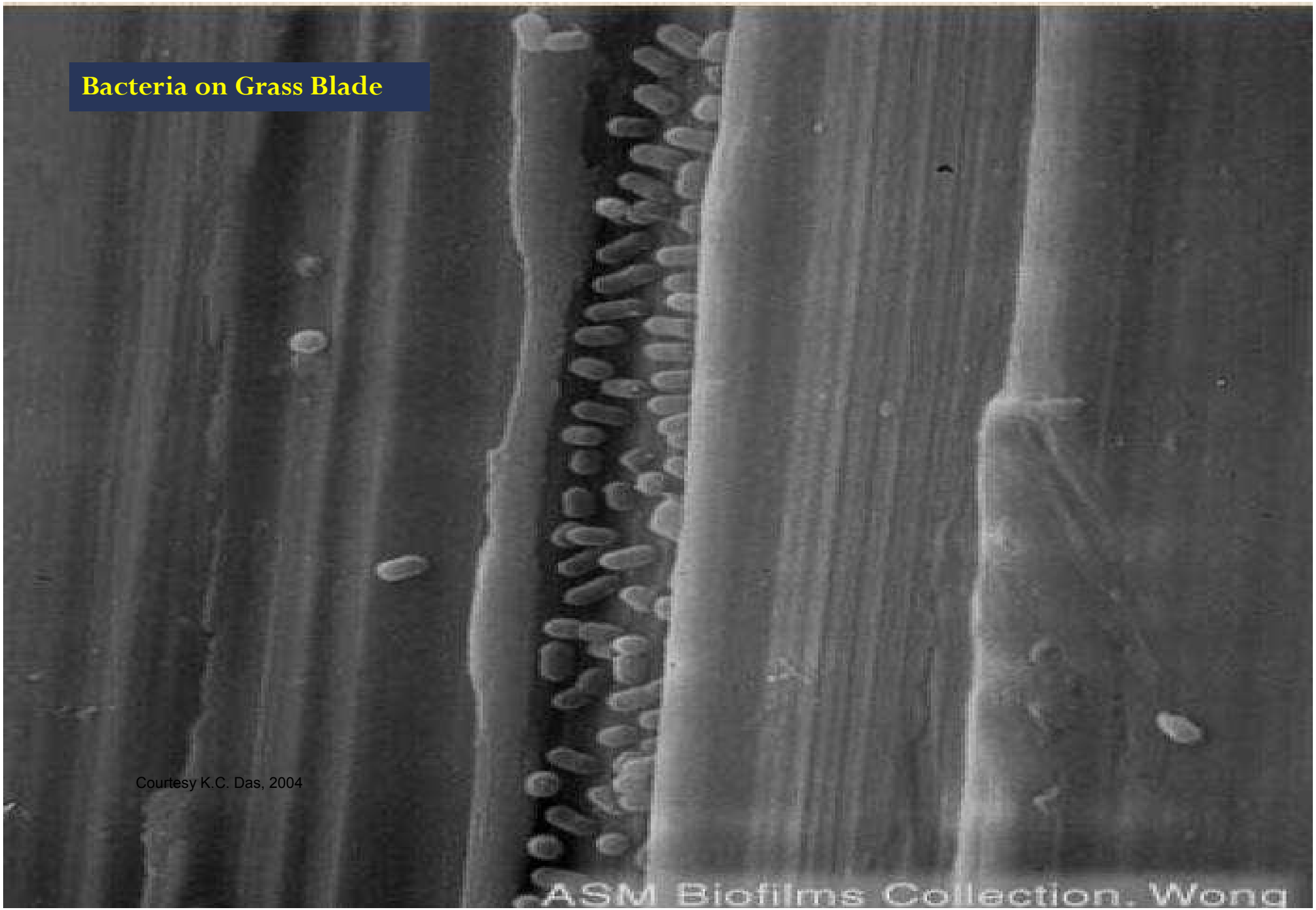
FHWA/IRC Conference
"The Use of Industrial Materials in Highway and Road Construction"
Austin, Texas November 1-2, 2011

Resource Recovery Through Composting

A controlled aerobic biological decomposition process where microorganisms convert raw organic materials into relatively stable humus-like materials suitable as a soil amendment



Bacteria on Grass Blade



Courtesy K.C. Das, 2004

The Partners

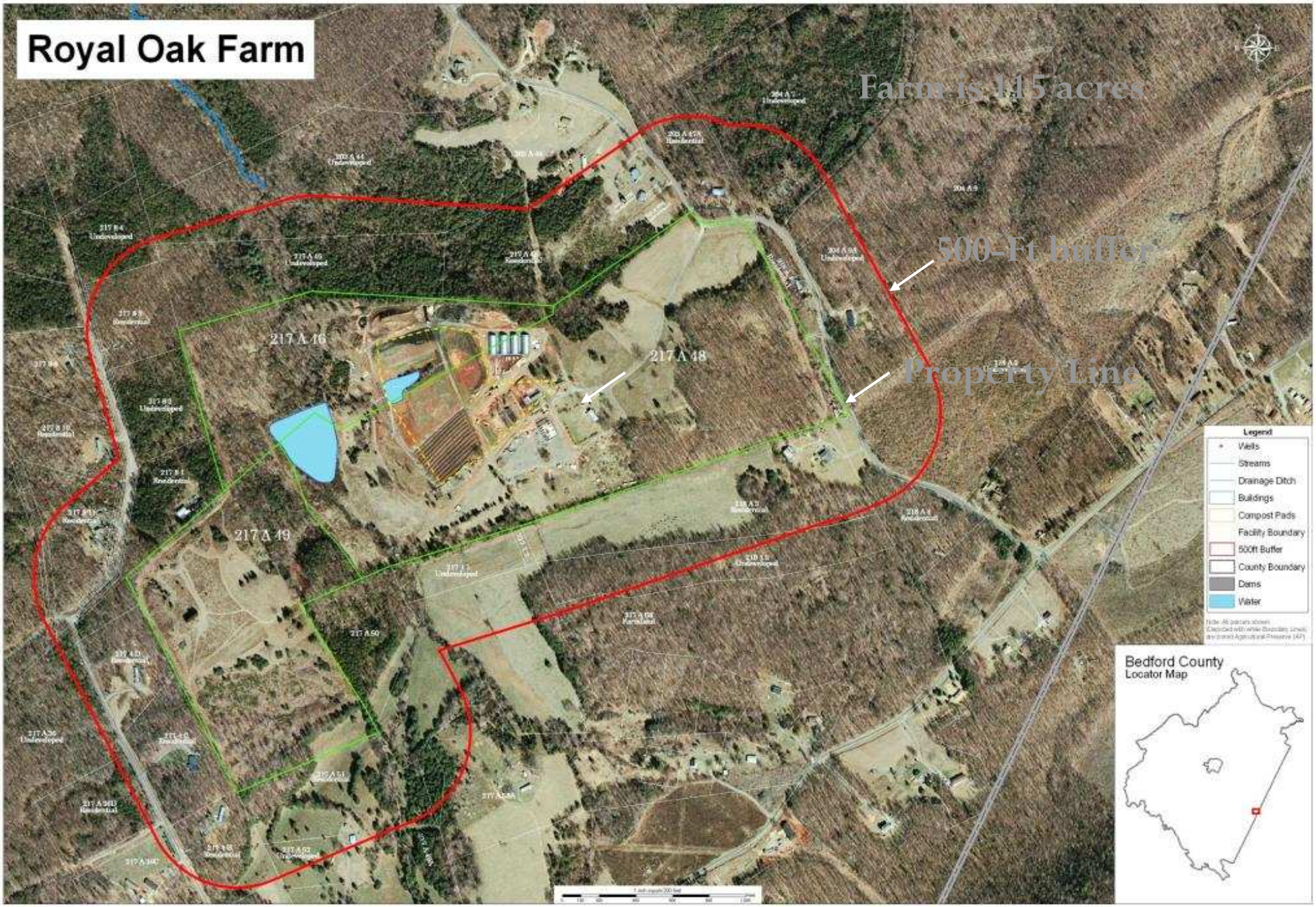
- Georgia-Pacific LLC
  - Big Island, VA Containerboard Mill
  - Makes Ultravantage® Linerboard and corrugating medium
  - Mill start-up in 1891
  - Decided to recycle short paper fiber sludge in 2005
  - Activated sludge wastewater treatment plant

- Royal Oak Farm LLC
  - Largest solid waste composting facility in VA
  - Fully permitted by Virginia Dept. of Env. Quality (# SWP-601)
  - Composting started in 1999, significantly expanded in 2008
  - Now helps nine (9) industries in VA and NC to recycle organics

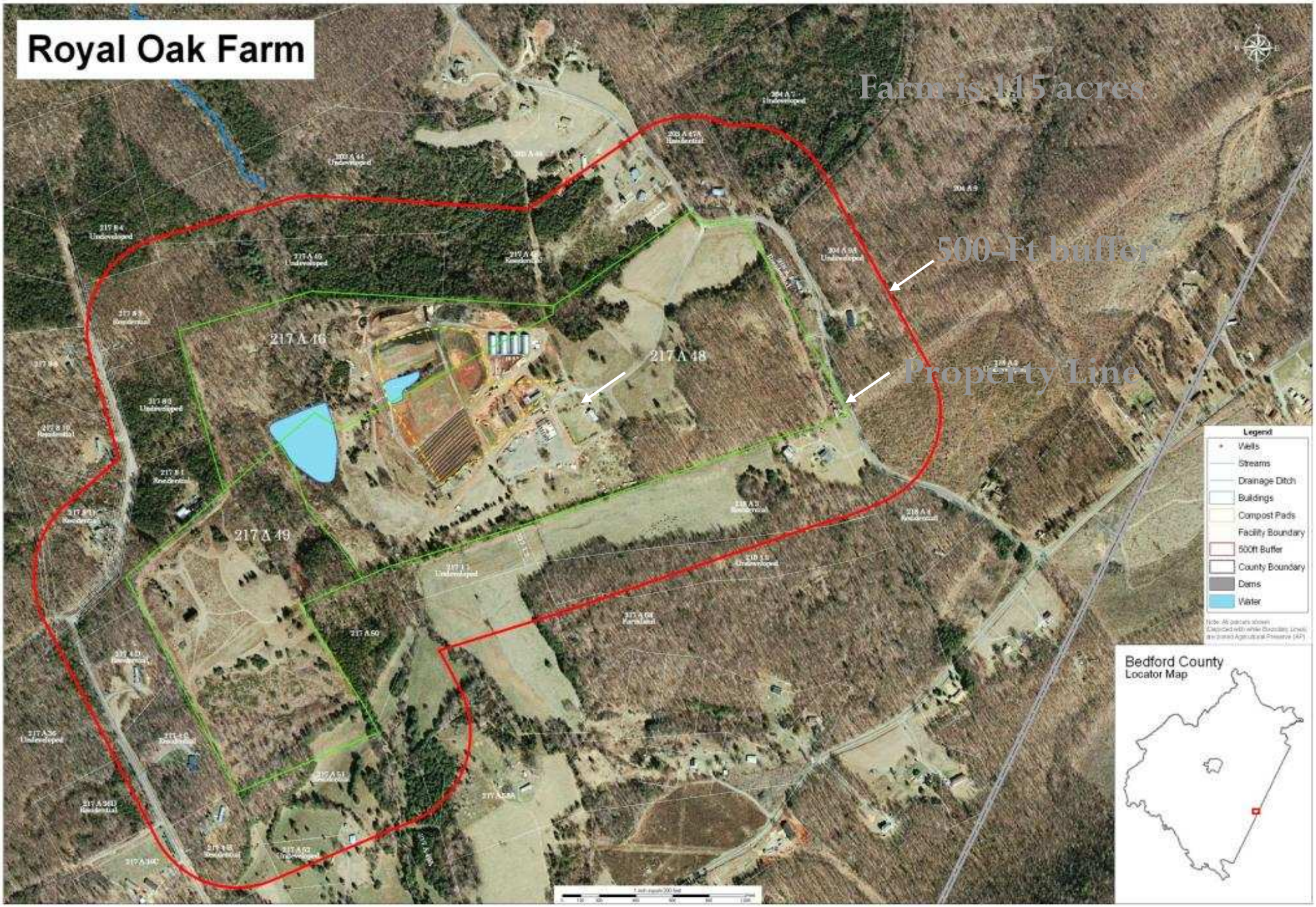
GP Wastewater Treatment Facility

- Primary clarifier
- Two one acre equalization basins
- Extended aeration activated sludge system with one secondary clarifier
- 15-acre polishing pond
- Multi-port diffuser into the James River
- Belt filter press with sludge to composting
- Nominal 7 MGD


GP Wastewater Plant


Royal Oak Farm
Farm is 115 acres
500-Ft buffer
Property Line
217 A 46
217 A 48
217 A 49
Legend
Wells
Streams
Drainage Ditch
Buildings
Compost Pads
Facility Boundary
500ft Buffer
County Boundary
Dams
Water
Bedford County
Locator Map

Royal Oak Farm – Feb. 2005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Composting Facility Upgrade

- Spring 2005 – signed 10-yr contract with GP to recycle short paper fiber sludge
- Short paper fiber sludge is a Virginia Dept. of Environmental Quality Category 4 waste
- DEQ wanted Royal Oak to obtain full Solid Waste Compost Facility permit

Upgrading The Facility

- Started: July 18, 2005
- Permit issued Dec. 21, 2006
- Construction 2007 – 2008
- Permit to Operate March, 2008
- Reopened April 14, 2008
- Permitting Cost: $140,000
- Upgrade Cost: $1.7 million

Compost Feedstocks - Now

- Short paper fiber from GP-Big Island
- Food wastes – Walmart/Sam's Club, JMU, Kroger
- Cellulose acetate production sludge
- Production wastes and out-of-date dog foods from food processing industry
- Yard trimmings – Bedford County, others
- Leaves – Cities of Lynchburg & Altavista
- Misc. construction debris – wood, drywall

SPF sludge arriving from paper mill


Wood Waste Ground by Royal Oak's Shredder


Ingredients mixed with turner
BACKHUS

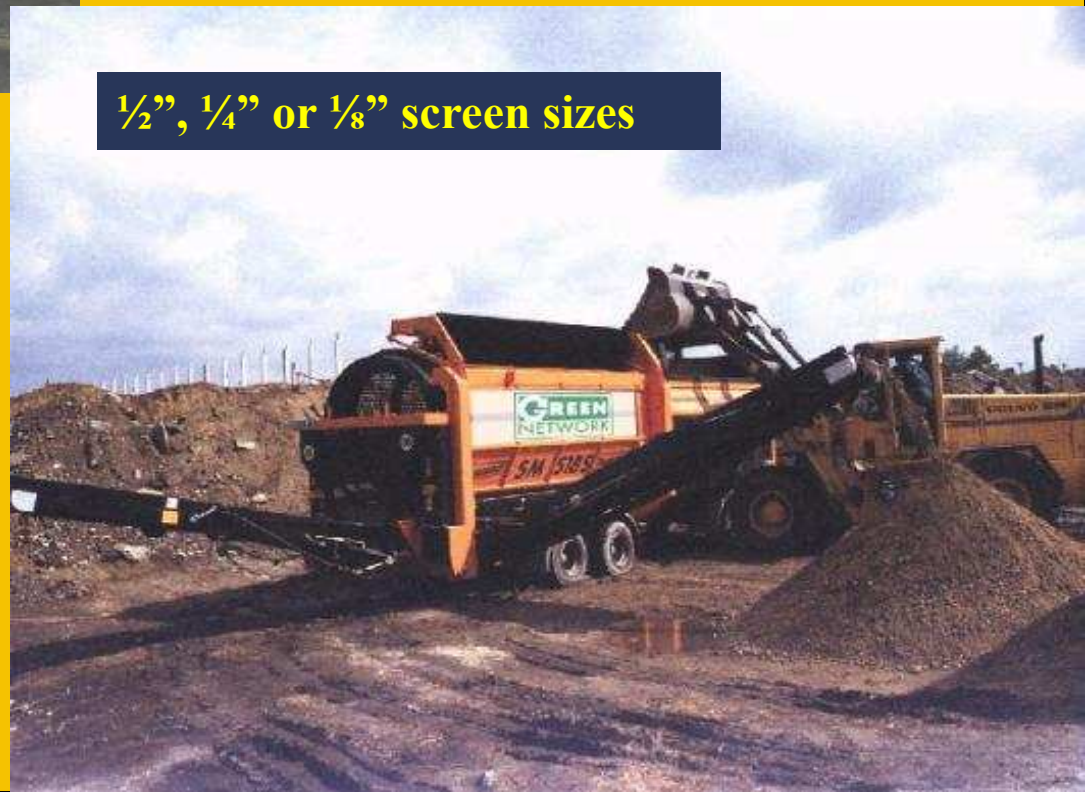
Windrows turned 5 times in 15 days while temps > 55°C

(40CFR503 – Process to Further Reduce Pathogens)


Coarse Screening at 2”+ prior to curing

Final screening with trommel

½”, ¼” or ⅛” screen sizes



Products

- Composts
  - Three screen sizes : ½", ¼", ⅛"
- Rain Garden Substrate
  - Blend of compost, silica sand, quarry rock #10's
- Topsoils
  - Customized to meet specs
  - Blend of compost and sand
- Root zone turf mix
  - 70% - 90% sand, 10% - 30% compost
- Erosion control media
  - Compost blankets
  - Compost berm/sock filter media

Compost Quality

- Nitrogen = 1.51%
- Phosphorus = 0.71% (P_2O_5)
- Potassium = 1.09% (K_2O)
- pH = 7.3
- Soluble Salts = 2.53 dS/m
- Fecal Coliform = 200 MPN/g
- Germination:
  - Emergence = 100%
  - Vigor = 100%

EPA 503 Heavy Metals	Compliance Limit (mg/kg, dwb)	Blueblood™ Garden Compost 3/2011 test
Arsenic	41	5.453
Cadmium	21	0.735
Copper	1500	67.93
Lead	300	24.43
Mercury	17	<0.59
Molybdenum	54	1.55
Nickel	420	16.22
Selenium	28	1.28
Zinc	2800	194.2

Benefits of Compost Use

Physical:

- Improves soil structure
- Moisture management

Chemical:

- Modifies and stabilizes pH
- Increases cation exchange capacity
- Supplies nutrients

Biological:

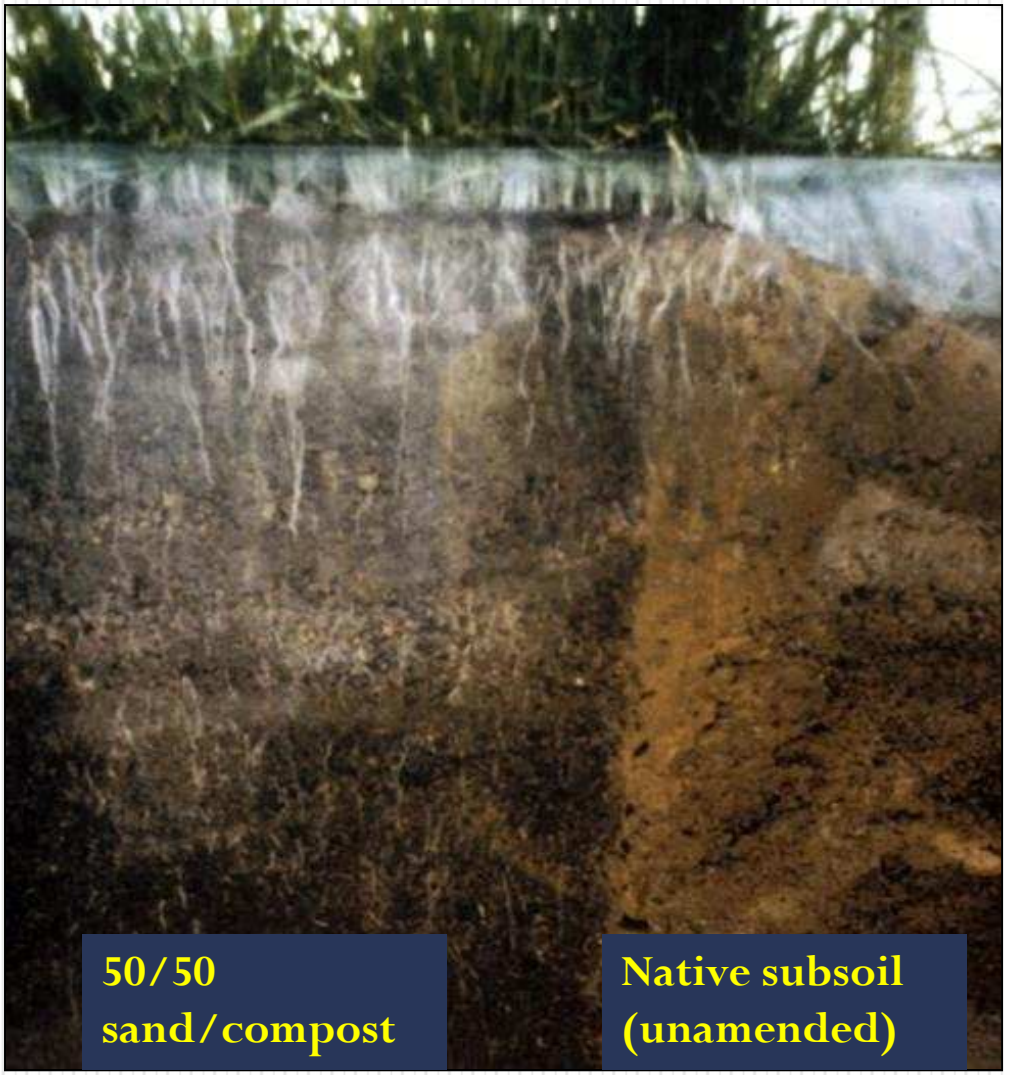
- Supplies soil biota
- Suppresses plant diseases

Other:

- Binds/degrades contaminants
- Binds nutrients

Compost can
Improve Soils…

Healthy Soils
mean
Healthy Plants



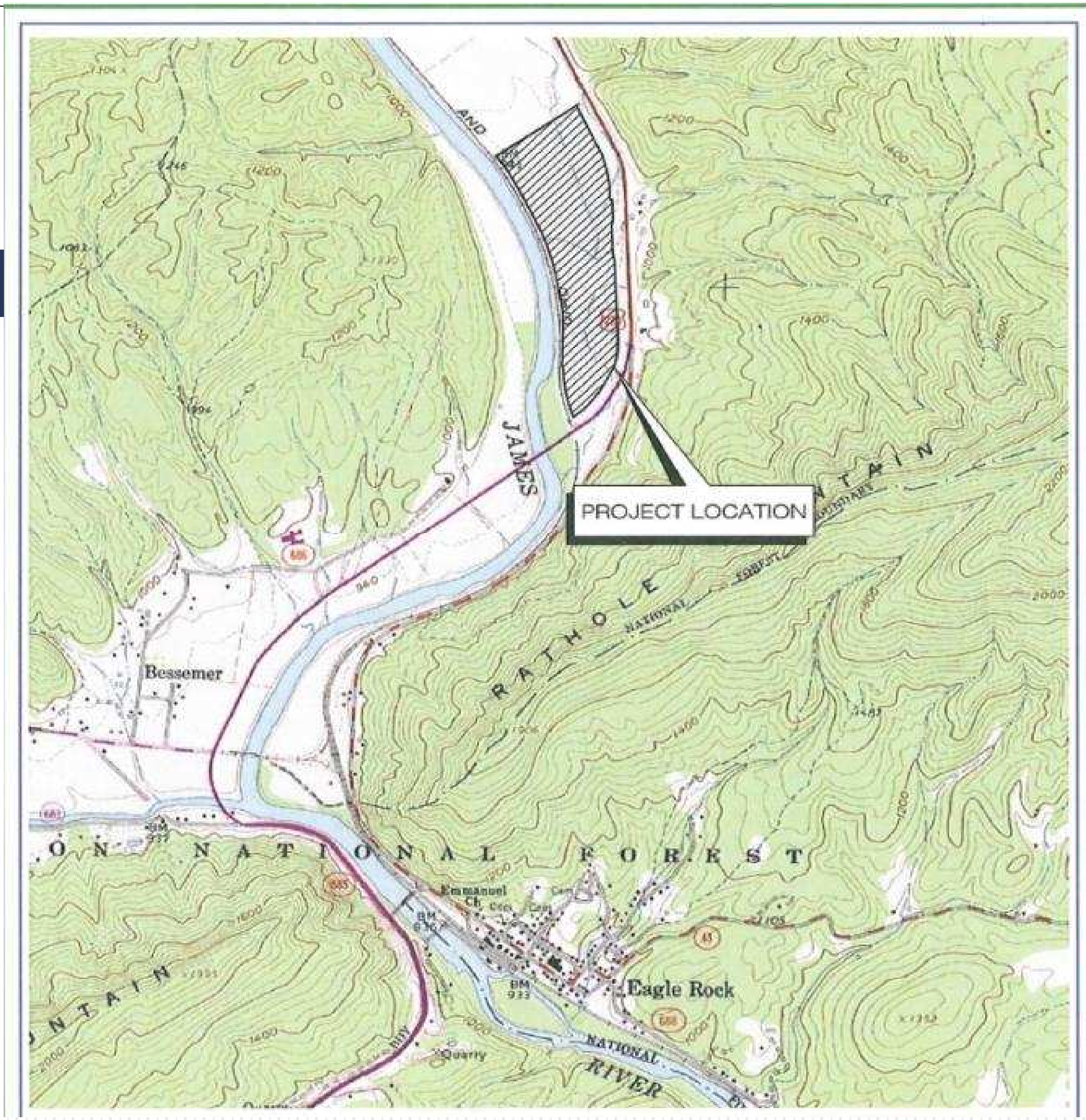
VDOT Wetlands Projects

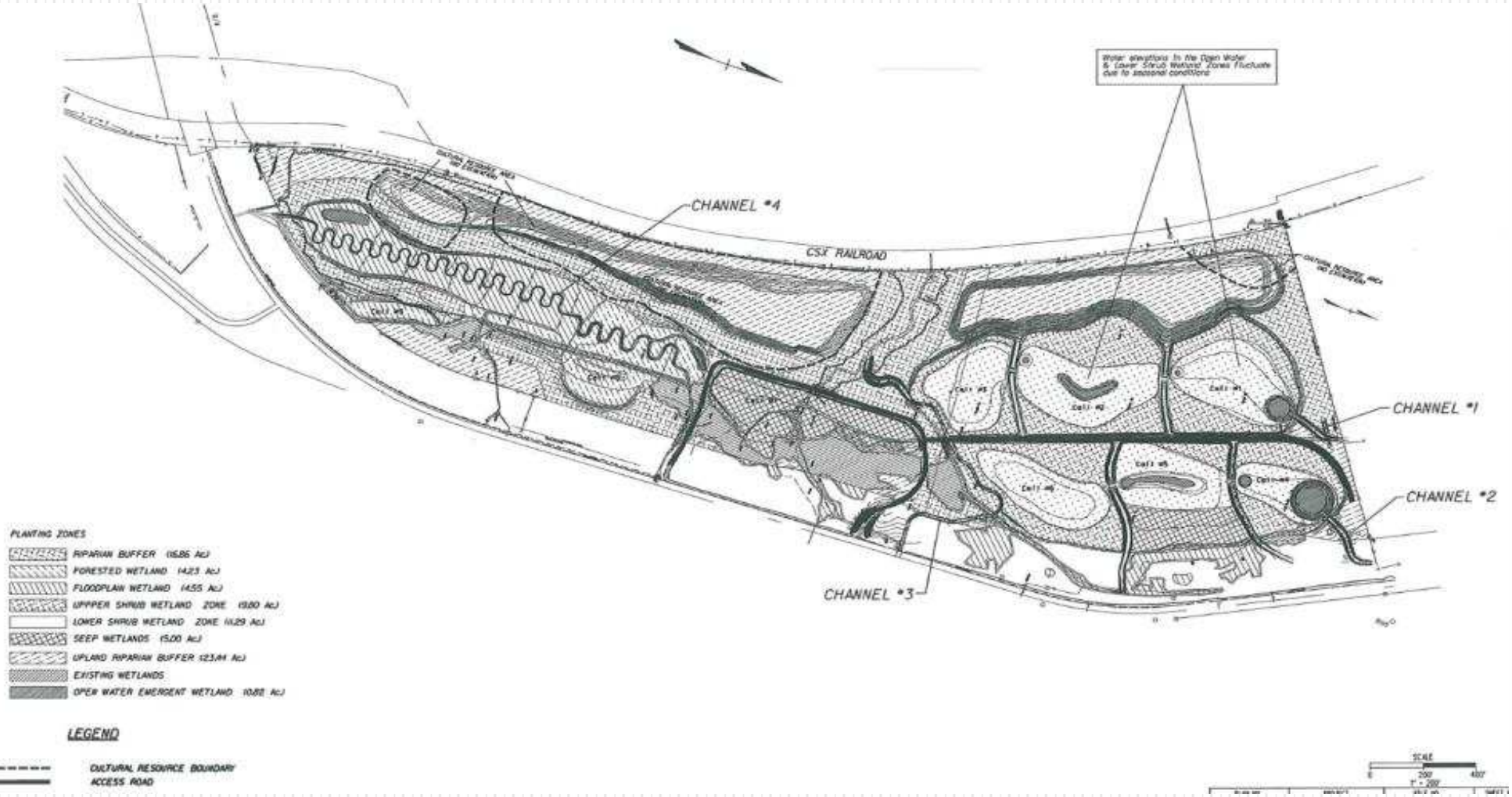
- 2007- Eagle Rock Mitigation Bank (ERMB)
  - Intended to serve as internal wetlands bank
  - Located in Botetourt County VA on James River in Northern Shales Valleys ecoregion of Upper James
  - 86- acre floodplain terrace farm acquired in 2006; 5 headwater streams cross site to enter James River
- 2010 - Webb Wetlands Compensation Site
  - Intended to offset wetlands impacts of US Hwy. 58 Bypass
    - Bypass is 5.2 mile long public-private partnership
  - Located in Carroll County VA on Little Reed Island Creek
  - 18.1 acre site, 16.8 acres amended with compost

Compost Use in Wetlands

- ERMB
  - 23,038 CY (~ 11,519 T) spread on 36 acres and along constructed streambanks prior to planting
    - 2" layer overlain on 6" of loosened soil to reach final grade
  - Used to raise soil organic matter to hydric levels
- Webb Wetlands Compensation Site
  - 11,289 CY (~ 5,644 T) ripped and chisel-plowed into 16.8 acres
  - Installed in 150 mm lifts to bring to final grade
  - Used as soil amendment to help plant growth

ERMB


PROJECT LOCATION
JAMES
RATHOLE
Bessemer
Emmanuel Ch
Eagle Rock
Quarry
NATIONAL
RIVER
NATIONAL FOREST



ERMB Site Layout

Eagle Rock Mitigation Bank

- ERMB consists of:
  - 21.09 acres of palustrine scrub-shrub wetlands
  - 4.23 acres of palustrine forested wetlands
  - 5.00 acres of palustrine seep wetlands
  - 4.55 acres of floodplain emergent/scrub-shrub wetlands
  - 0.82 acres of open water with emergent wetland fringe
  - preservation of 5.01 acres of undisturbed/restored wetlands
  - relocation and enhancement of 1468 linear feet of degraded stream channel
  - establishment/restoration of 4013 linear feet of stream channel
  - relocation and preservation of 610 linear feet of existing stream channel
  - enhancement and preservation of 23.45 acres of upland riparian buffer
  - establishment of 16.86 acres of vegetated riparian buffer.


Webb Wetlands Compensation Site

VDOT Compost Specs

Parameter	Units	Value
Moisture	%	35 – 55
pH	Stnd. Units	5.5-8.0
Organic Matter	% dry wt.	> 35%
Bulk Density	gm/cc	< 0.60
Soluble Salts	mmhos/cm	< 3.0
Particle Size Analysis	-	95% thru 1" screen
Total N	% dry wt.	0.5 – 2.5
Phosphate (P_2O_5)	% dry wt.	0.2 – 2.0
Potash (K_2O)	% dry wt.	0.3 – 1.5
Heavy Metals	ppm	< EPA 503
C:N Ratio	-	> 16.1

- Specification is for composted yard waste
  - Other types can be approved
  - Must be at least one year old
  - Must pass maturity tests
  - Must be weed seed-free
  - Cannot have inorganic contaminants

Specifying Composts

- Composts can be made from a wide variety of industrial and commercial residuals
- Should be made at a State-permitted facility that is in compliance with all requirements
- Should be produced by a compost facility enrolled in the U.S. Composting Council's Seal of Testing Assurance (STA) program
- Compost uses in highway work –
  - Soil amendment to encourage healthy vegetation
  - Erosion control blankets
  - Sediment filter socks

US Composting Council

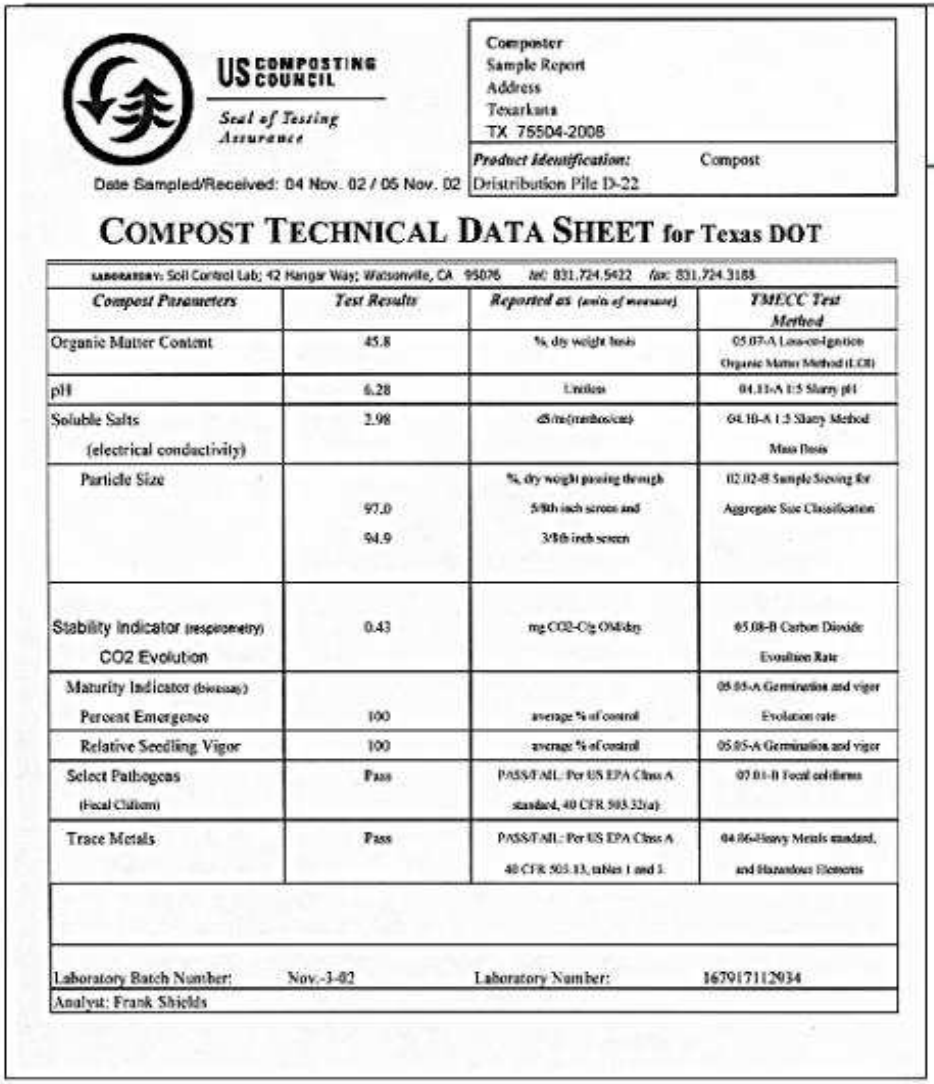
Seal of Testing Assurance Program

WHAT IS IT?

- Compost testing and information disclosure program (employing standardized practices)

PURPOSE…

- To assist compost end users purchase the product they require for their particular project
- To assure that compost end users know the characteristics of the compost products they purchase
- To improve overall customer confidence in compost selection and utilization



US COMPOSTING COUNCIL
Seal of Testing Assurance

Composter
Sample Report
Address
Texarkana
TX 75504-2008

Product Identification: Compost
Distribution Pile D-22

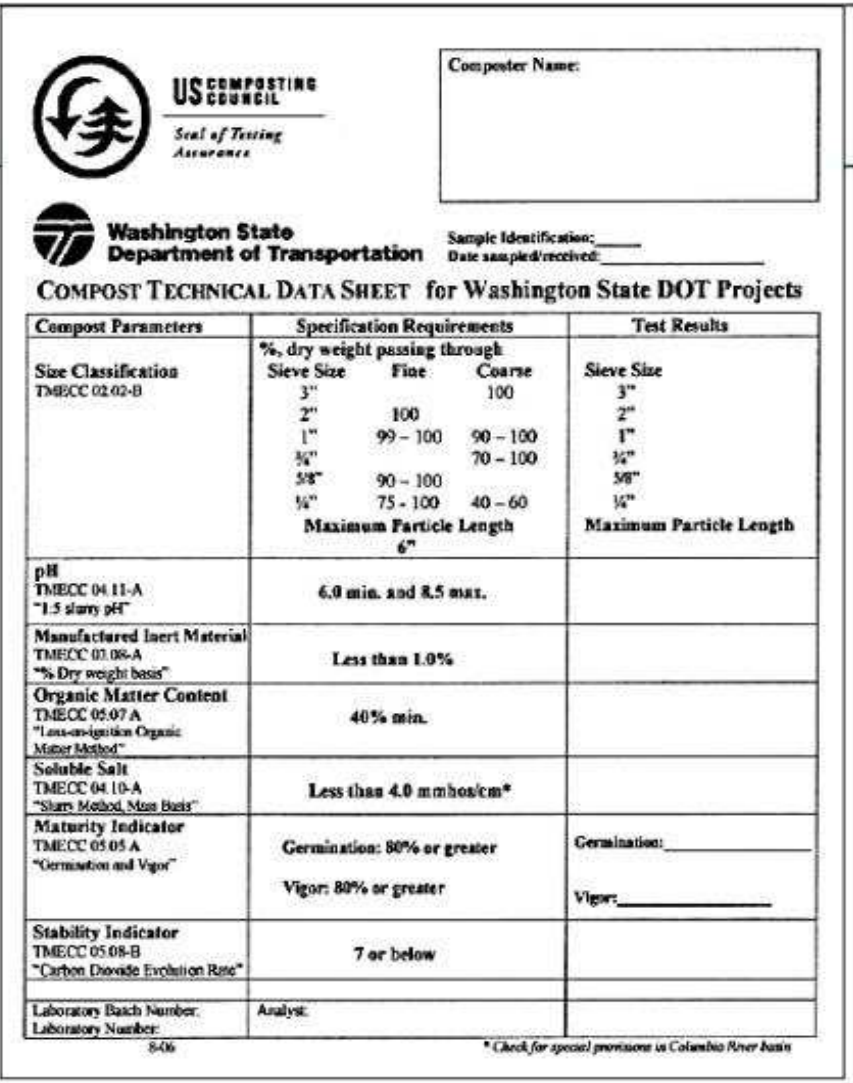
Date Sampled/Received: 04 Nov. 02 / 05 Nov. 02

COMPOST TECHNICAL DATA SHEET for Texas DOT

LABORATORY: Soil Control Lab; 42 Hangar Way; Watsonville, CA 95076 tel: 831.724.5422 fax: 831.724.3188

Compost Parameters	Test Results	Reported as (units of measure)	TMECC Test Method
Organic Matter Content	45.8	% dry weight basis	05.07-A Loss-on-Ignition Organic Matter Method (LOI)
pH	6.28	Unitless	04.11-A 1:5 Slurry pH
Soluble Salts (electrical conductivity)	2.98	dS/m (mmhos/cm)	04.10-A 1:5 Slurry Method Mass Basis
Particle Size	97.0 94.9	% dry weight passing through 5/8th inch screen and 3/8th inch screen	02.02-B Sample Sieving for Aggregate Size Classification
Stability Indicator (respirometry) CO2 Evolution	0.43	mg CO2-C/g OM/day	05.08-B Carbon Dioxide Evolution Rate
Maturity Indicator (bioassay) Percent Emergence	100	average % of control	05.05-A Germination and vigor Evolution rate
Relative Seedling Vigor	100	average % of control	05.05-A Germination and vigor
Select Pathogens (Fecal Coliform)	Pass	PASS/FAIL: Per US EPA Class A standard, 40 CFR 503.32(a)	07.01-B Fecal coliforms
Trace Metals	Pass	PASS/FAIL: Per US EPA Class A 40 CFR 503.13, tables 1 and 3	04.06-Heavy Metals standard, and Hazardous Elements

Laboratory Batch Number: Nov.-3-02 Laboratory Number: 167917112034
Analyst: Frank Shields



US COMPOSTING COUNCIL
Seal of Testing Assurance

Composter Name:

Washington State Department of Transportation

Sample Identification:_____
Date sampled/received:_____

COMPOST TECHNICAL DATA SHEET for Washington State DOT Projects

Compost Parameters	Specification Requirements	Test Results
Size Classification TMECC 02.02-B	%, dry weight passing through Sieve Size — Fine — Coarse 3" — — 100 2" — 100 — 1" — 99 – 100 — 90 – 100 ½" — — 70 – 100 5/8" — 90 – 100 — ¼" — 75 - 100 — 40 – 60 **Maximum Particle Length** **6"**	Sieve Size 3" 2" 1" ½" 5/8" ¼" **Maximum Particle Length**
pH TMECC 04.11-A "1:5 slurry pH"	**6.0 min. and 8.5 max.**	
Manufactured Inert Material TMECC 03.08-A "% Dry weight basis"	**Less than 1.0%**	
Organic Matter Content TMECC 05.07 A "Loss-on-ignition Organic Matter Method"	**40% min.**	
Soluble Salt TMECC 04.10-A "Slurry Method, Mass Basis"	**Less than 4.0 mmhos/cm***	
Maturity Indicator TMECC 05.05 A "Germination and Vigor"	**Germination: 80% or greater** **Vigor: 80% or greater**	Germination:_____ Vigor:_____
Stability Indicator TMECC 05.08-B "Carbon Dioxide Evolution Rate"	**7 or below**	
Laboratory Batch Number: Laboratory Number:	Analyst:	

8-06

*Check for special provisions in Columbia River basin

Customized for DOT inspectors, project managers ….

US Composting Council

Other Benefits

- Acts as a framework to allow the implementation of established numerical product specifications
  - State DOTs, other
- Assists in the implementation of an inspection or quality verification program
- Can serve a quality control function (and promotional benefits) for composters
- Standardizes a set of test parameters (and methods) for use in evaluating compost product quality

DOTs Specifying STA Compost

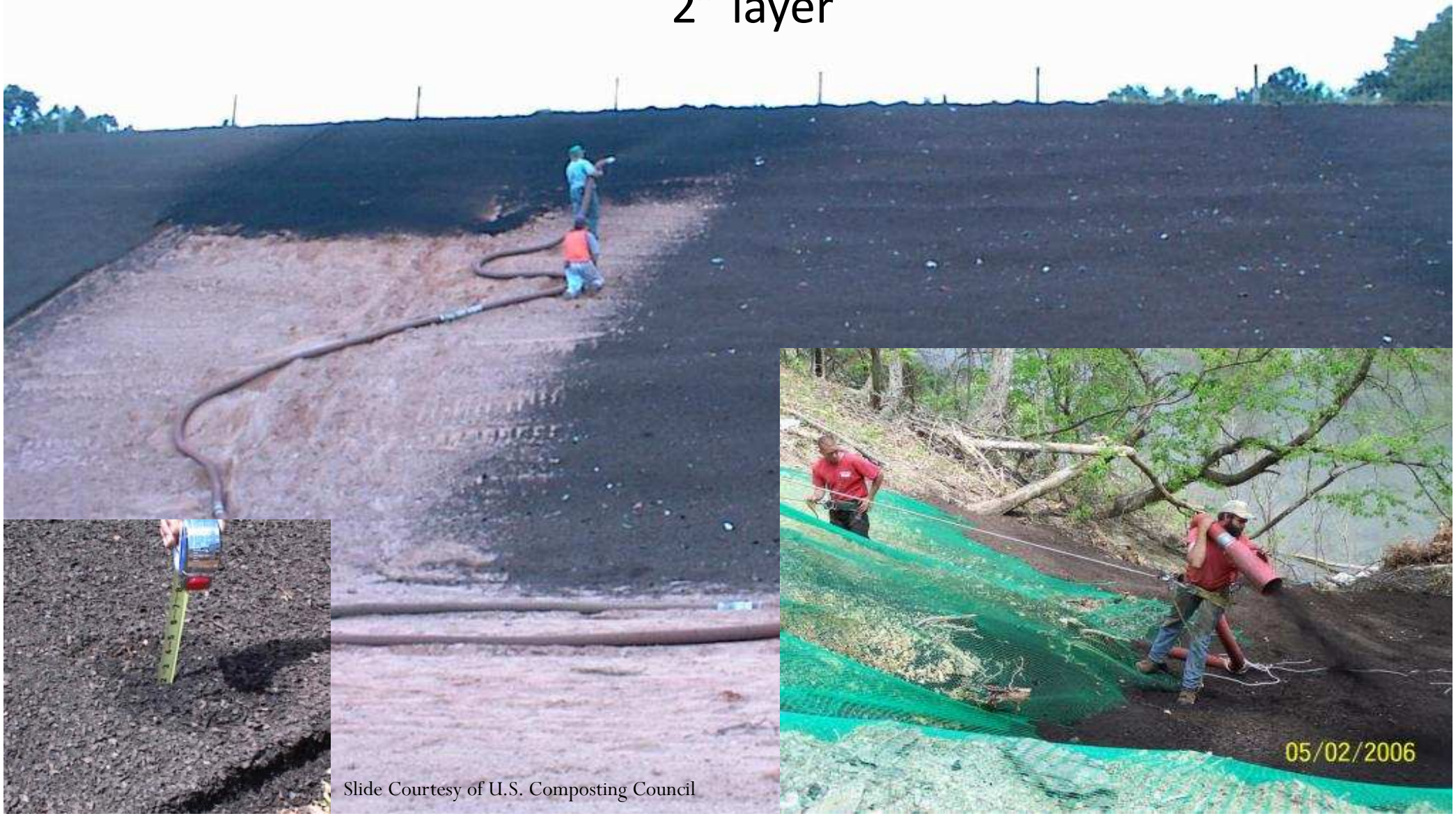
- California
- Georgia – Erosion Control only
- Oregon
- Texas
- Pennsylvania – Erosion Control only
- Washington State
- North Carolina
- South Carolina
- Iowa – Erosion Control only

AASHTO Erosion Control Specs

- MP-10 – Compost for Erosion Control Blankets
  - Can be used in up to 1:1 slope applications
  - Compost can be derived from industrial residuals
  - Compost quality standards specified
  - Application rates from ½" to 2" layer (vegetated) and 1" to 4" (unvegetated), depending on rainfall and soil erosivity index
  - Seeding mixes can be incorporated into compost as it is applied or added later
  - Compost must be tested using USCC's Test Methods for the Examination of Compost and Composting (TMECC)

Compost Blankets

2” layer



Slide Courtesy of U.S. Composting Council

Slide Courtesy of U.S. Composting Council


Hold-down netting needed on steep slopes
Slide Courtesy of U.S. Composting Council

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AASHTO Erosion Control Specs

- MP-9 – Compost for Erosion Control – Filter Berms
  - Appropriate for flat areas and slopes up to 2:1 that have sheet flow runoff
  - Can be made from industrial residuals
  - Compost quality standards specified
  - Need at least 30% fines in compost for good filtration
  - Berm dimensions 1' x 2' to 2' x 4' depending on rainfall and soil erosivity index
  - Berms can be placed 15' – 25' apart on slopes, in conjunction with compost blankets and on the downhill side of silt fence
  - Product should be tested with TMECC methods

Slide Courtesy of U.S. Composting Council

Compost Socks As Alternate to Berms

Slide Courtesy of U.S. Composting Council

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Craig Coker
Royal Oak Farm LLC
(540) 890-1086
cscoker@verizon.net
www.royaloakfarmllc.com