Biosolids Utilization in Agriculture – Decades of Successful Practices in the USA

The 19th IWA Conference on Sludge Management

Kyoto, Japan

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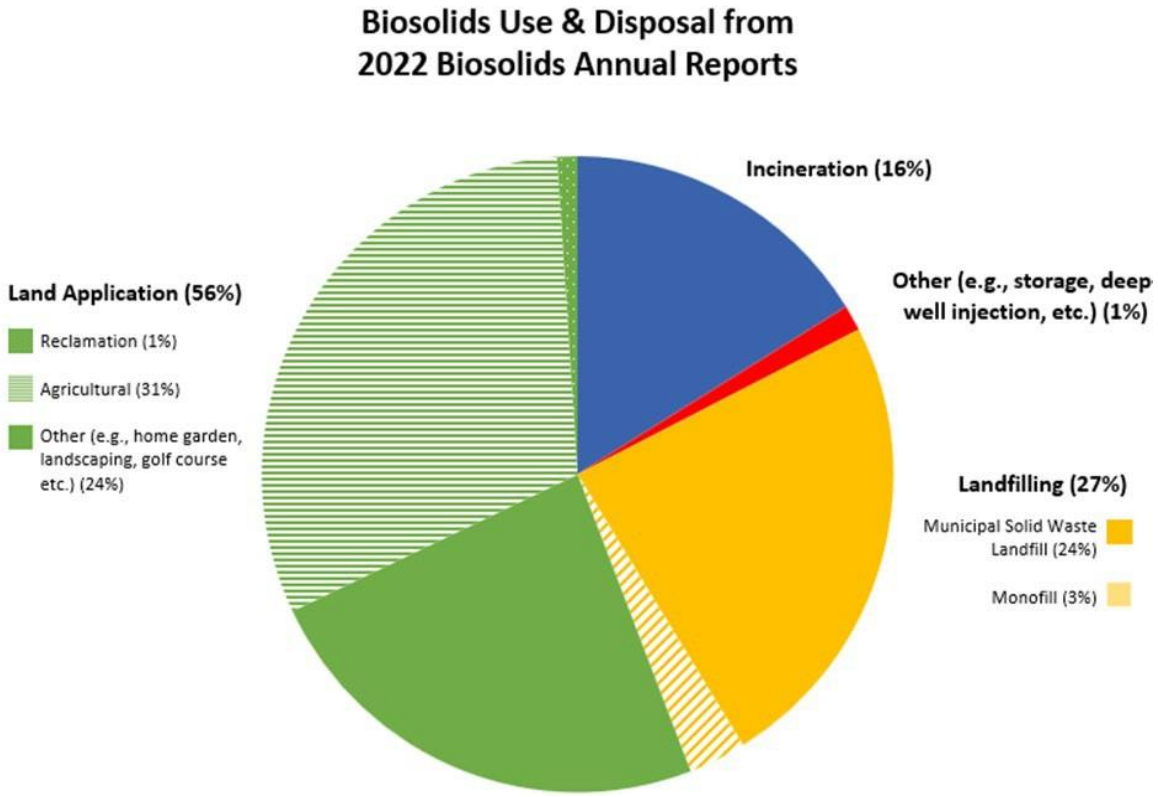
Agenda

1. History
2. Rules and Regulations are Necessary and Essential
3. Sound Agronomic Planning and Practice
4. Trained and Competent Operators
5. Management and Oversight
6. Recent Challenges
7. Example Systems

U.S. Biosolids Management Practices

- Since 40 CFR Part 503, EPA has been advocating beneficial uses of biosolids
- Beneficial use of biosolids through land application has been practiced for decades
- Latest data showed 56% of biosolids generated in the U.S. were land applied
- Incineration and landfilling accounts for 43%



Source: EPA 2022 ECHO data

USEPA and Local Regulation

- USEPA: 40 CFR Part 503
  - Established national standards
    - Regulated metals
    - Pathogen control
      - PSPR – Site permit protects public health and EQ
      - PFRP – Product permit protects public health and EQ
    - Vector control
- State rules reflect 503 requirements and include additional requirements
  - Site, soil, crop management and reporting requirements for PSRP product
    - Site slope and proximity to waterways, wells and property boundaries
    - Soil depth and fertility
    - Nutrient management for specific crop associated with soil resource and location

Essential Components in A Successful Biosolids Beneficial Utilization Effort

- Planning
  - Product quality
  - Site, soil and crop
  - Nutrient management
- Operation
  - Responsible operators
  - Compliance monitoring
- Management and oversight
  - Record keeping
  - Reporting

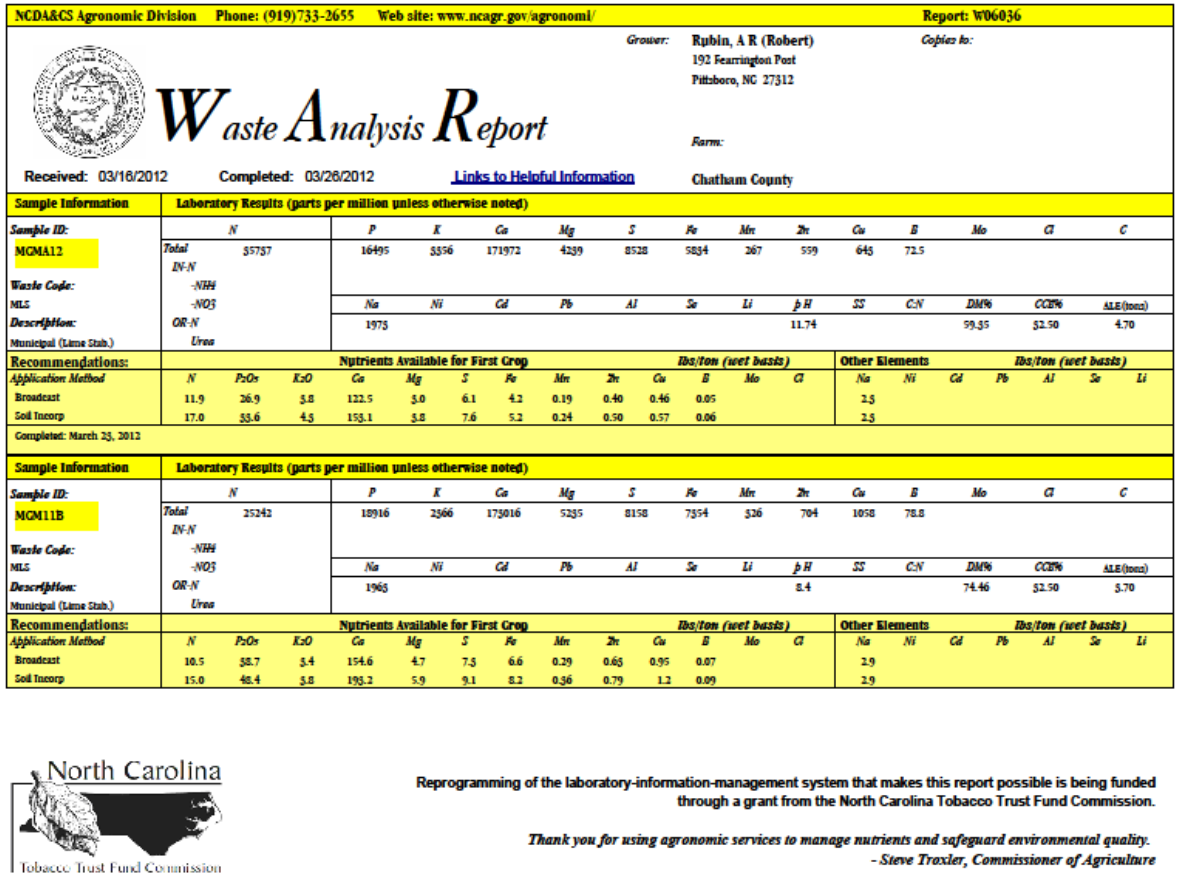
Product Quality Required for Land Application

- **PFRP (Class A)**
- Few site restrictions
- Nutrient management plan
- No crop limitations
  - Food crops

- **PSRP (Class B)**
- Site restrictions apply
  - Water table
  - Surface water
  - Drinking water wells
- Nutrient management plan
- Crop limitations

Product Quality – Nutrients and Regulated Constituents

- Nitrogen
- Phosphorus
- Potassium
- Secondary Nutrients
- Regulated constituents
  - Metals
  - Organic compounds



NCDA&CS Agronomic Division Phone: (919)733-2655 Web site: www.ncagr.gov/agronomi/ Report: W06036

Waste Analysis Report

Grower: Rubin, A R (Robert)
192 Fearrington Post
Pittsboro, NC 27312

Copies to:

Farm:
Chatham County

Received: 03/16/2012 Completed: 03/26/2012 Links to Helpful Information

Sample Information	Laboratory Results (parts per million unless otherwise noted)																		
Sample ID:	N		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C				
MGMA12	Total	35757	16495	3356	171972	4239	8528	5834	267	559	645	72.5							
Waste Code:	IN-N																		
MLS	-NH4		Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	OC2%	ALE(tons)				
Description:	-NO3		1973							11.74			59.35	32.50	4.70				
Municipal (Lime Stab.)	OR-N																		
	Urea																		

Recommendations:	Nutrients Available for First Crop												Other Elements						
	lbs/ton (wet basis)												lbs/ton (wet basis)						
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	11.9	26.9	5.8	122.5	5.0	6.1	4.2	0.19	0.40	0.46	0.05			2.5						
Soil Incorp	17.0	33.6	4.5	153.1	5.8	7.6	5.2	0.24	0.50	0.57	0.06			2.5						

Completed: March 23, 2012

Sample Information	Laboratory Results (parts per million unless otherwise noted)																		
Sample ID:	N		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	C				
MGM11B	Total	25242	18916	2566	175016	5235	8158	7554	526	704	1058	78.8							
Waste Code:	IN-N																		
MLS	-NH4		Na	Ni	Cd	Pb	Al	Se	Li	pH	SS	C:N	DM%	OC2%	ALE(tons)				
Description:	-NO3		1965							8.4			74.46	32.50	3.70				
Municipal (Lime Stab.)	OR-N																		
	Urea																		

Recommendations:	Nutrients Available for First Crop												Other Elements						
	lbs/ton (wet basis)												lbs/ton (wet basis)						
Application Method	N	P2O5	K2O	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo	Cl	Na	Ni	Cd	Pb	Al	Se	Li
Broadcast	10.5	38.7	5.4	154.6	4.7	7.5	6.6	0.29	0.65	0.95	0.07			2.9						
Soil Incorp	15.0	48.4	5.8	193.2	5.9	9.1	8.2	0.36	0.79	1.2	0.09			2.9						

North Carolina Tobacco Trust Fund Commission

Reprogramming of the laboratory-information-management system that makes this report possible is being funded through a grant from the North Carolina Tobacco Trust Fund Commission.

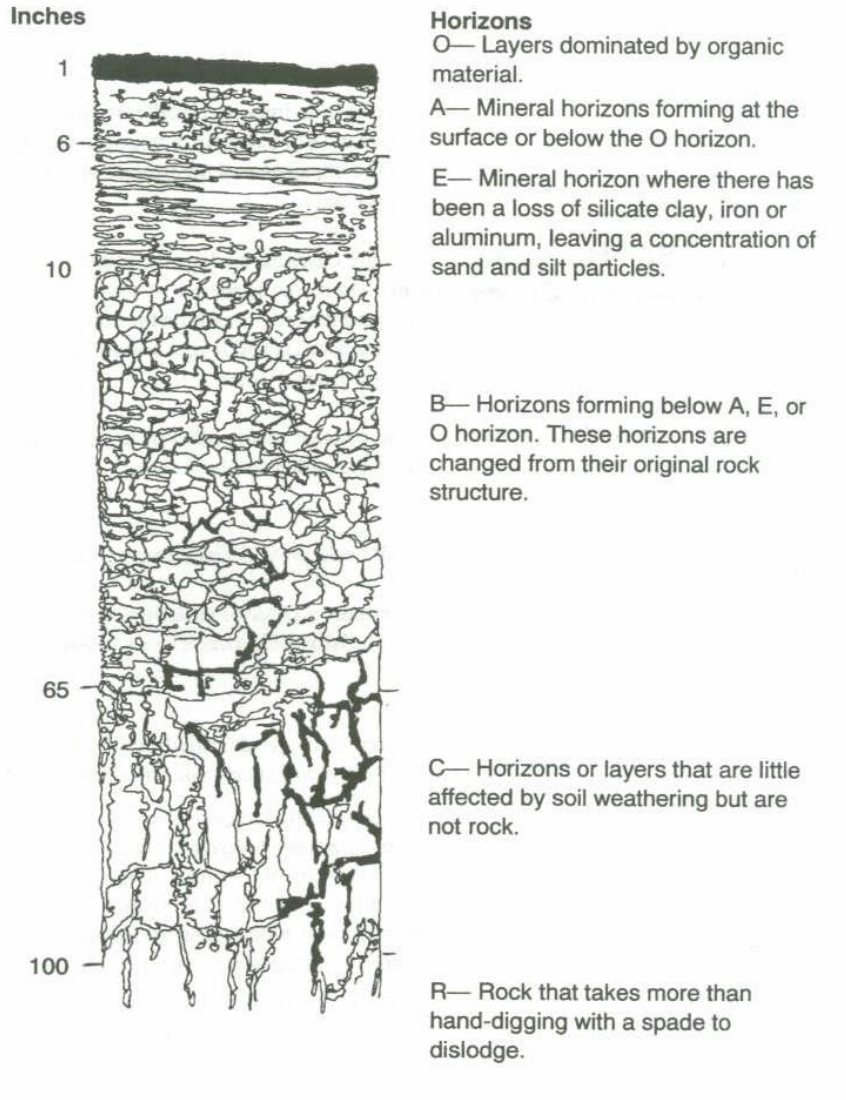
Thank you for using agronomic services to manage nutrients and safeguard environmental quality.
- Steve Troxler, Commissioner of Agriculture

Develop a Comprehensive Nutrient Management Plan

- Smart
- Sound
- Economic
- Aids Compliance
- Reduces nutrient loss
- Prevents crop/soil issues
  - Excesses
  - Deficiencies

Assess Site and Soil Resources

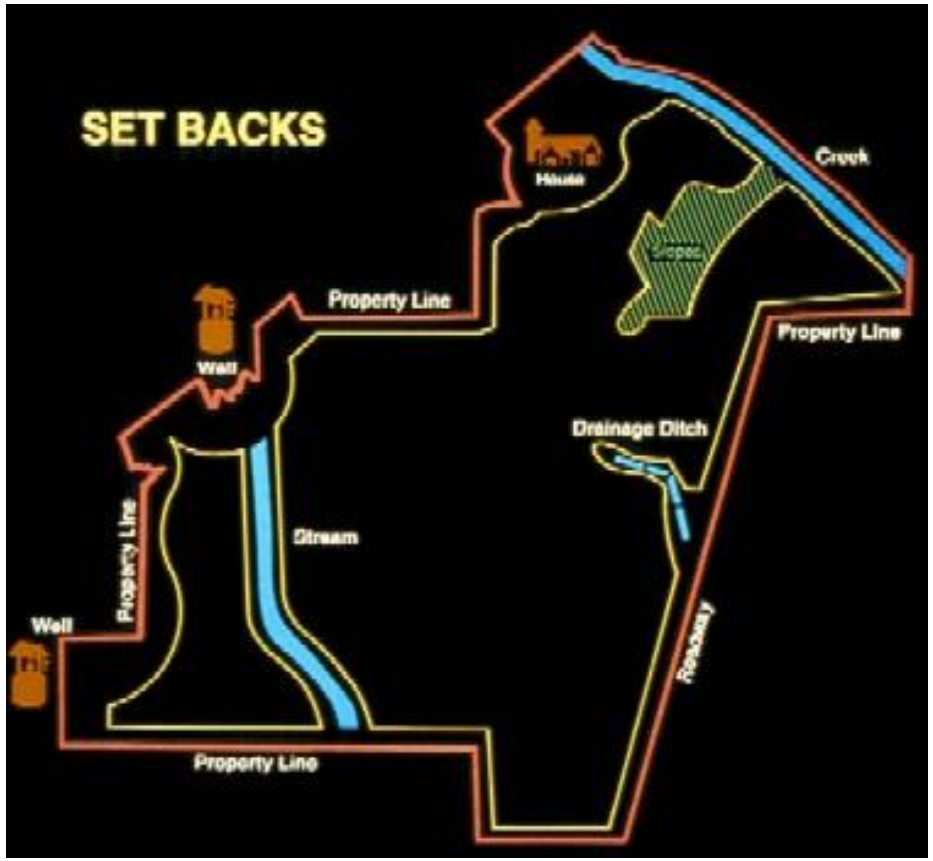
- Are the proposed crops adapted to the soils and climate?
- What is a reasonable expected yield?
- Are site and soil resources appropriate
  - Is slope acceptable
  - Soil depth critical factor
  - Depth to rock and seasonal water table must be assessed
- What do soil fertility test results show?
- What are specific site control measures?
  - Leaching potential
  - Erosion Control



Soil Profile characteristics

Develop Site Specific Recommendations

- Crop and soil
  - Determine application rates
- Buffers
  - Adjoining properties
  - Waterways and wells
- Steep slope and erosion control
  - May limit use of portions of site



Operating with Crop Nutrient Management

- The most limiting nutrient will dictate the crop production (yield) and overall plant health
- Soil, waste, and plant tissue sampling are key tools for nutrient management

Monitoring Soil and Crop Resource

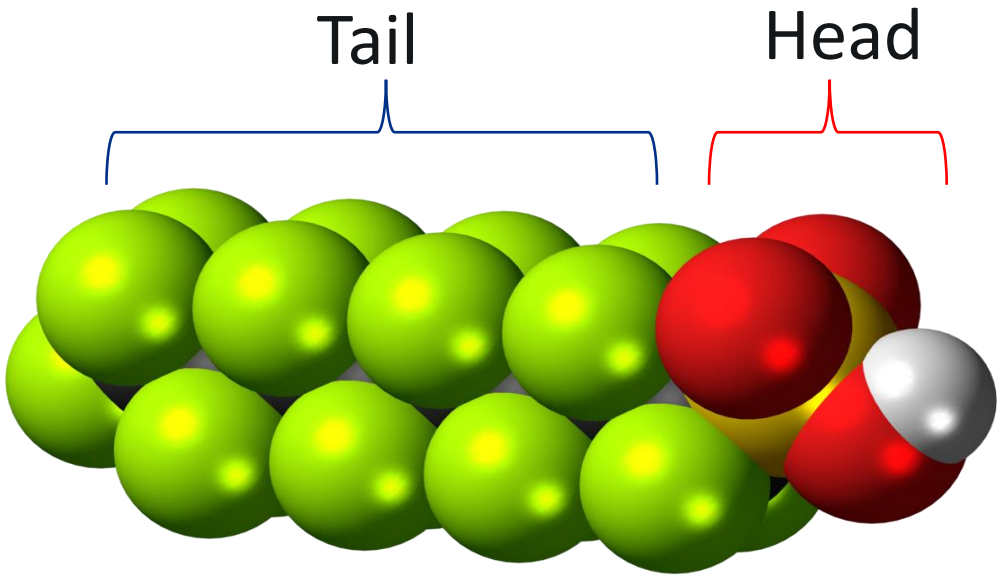
- Are the proposed crops responding positively to Biosolids
  - Yield
  - Quality/plant tissue testing
- What do soil test results show?
  - Nutrient or metal level concerns
  - Improved organic matter
- Are specific site control measures effective?
  - Leaching potential
  - Erosion Control

Conclusions

- Beneficial use of Biosolids well documented in U.S and E.U
- Planning, Operation and Monitoring/Management activities are essential
- Farmers and foresters value the benefits achieved with biosolids and biosolid derived products

PFAS & CECs

- PFAS concerns have dominated the environmental community in the past few years
- EPA Risk Assessment Draft published 1/15/2025
- Assessment result does not imply a regulation, limit or risk to the public
- While no federal regulations on PFAS in biosolids, states have chosen to adopt limits/standards



Biosolids Land Application Limits (ng/g)

Chemical Name	TX (proposed)	VT (interim)	MI (interim)	WI (interim)	NYS (interim)	MN (interim)	CT (ban)	ME (ban)	1633A MDL
PFBA	28.80								0.15
PFBS	40.30								0.05
PFPeA	14.40								0.07
PFHxS	0.30	0.38							0.08
PFHxA	9.40								0.06
PFHpA	0.40	0.84							0.05
PFOS	5.10	3.40	20.0	20.0	20.0	19.0			0.07
PFOA	0.90	1.60			20.0	19.0			0.07
PFOSA	2.70								-
PFNA	1.50	0.44							0.14
PFDA	0.80								0.06
PFDS	0.80								0.08
PFUnA	0.80								0.12
PFDoA	0.80								0.06
PFTrDA	0.80								0.07
HFPO-DA (GenX)	0.80								0.25

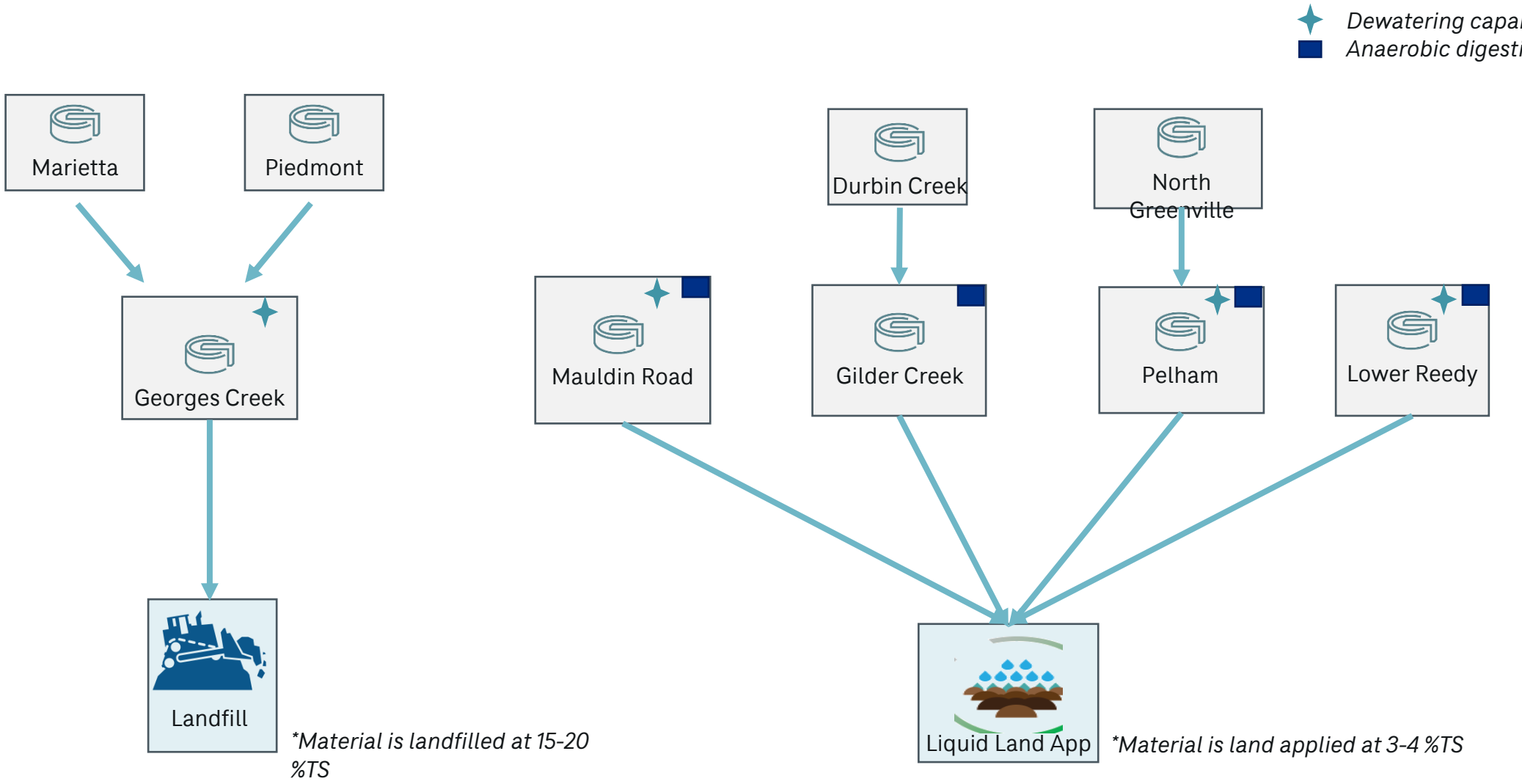
ReWa Overview

- Renewable Water Resources (ReWa) is a special purpose district in upstate South Carolina
- ReWa owns and operates 9 wastewater recovery facilities (WRRFs) and 88 pump stations
- WRRF size ranges from .07 mgd (264 m3/day) to 16 mgd (60,566 m3/day).
- Permitted for 33,0731 m3/day across all facilities
- Treat on average 148,766 m3/day

WRRF Facility	Treatment Capacity (MGD)	Average Flow (MGD)	Percent Capacity
Durbin Creek	5.2	1.8	35%
George's Creek ●	3.0	1.2	37%
Gilder Creek ■	11.3	4.3	38%
Lower Reedy ■ ●	11.5	6.3	55%
Marietta	0.67	0.23	34%
Mauldin Road ■ ●	29.0	13.9	48%
North Greenville University	0.2	0.07	35%
Pelham ■	22.5	10.1	45%
Piedmont Regional ●	4.0	1.4	35%
Total	**87.37**	**39.30**	**45%**

● *Phosphorus removal required*
■ *Anaerobic digestion*

ReWa WRRF Solids Overview



ReWa Solids Handling Data

- 2024 Biosolids Handling:
  - Class B Liquid Land Applied: 6,322.1 metric dry tons
    - 384,049 lbs (174,201 kg) of plant available nitrogen applied
    - 1,091,548 lbs (495,117 kg) of phosphate applied
  - Landfilled: 938 metric dry tons
  - Total: 7,261 metric dry tons with 87% beneficially reused
- Work with third party contractor Denali to manage land application
- Land application sites are permitted through local regulatory body DES
- 12,000 acres (4,856 hectares) of available land app sites with farmers owning the majority

Keys to Success

- Nutrient management plan approved by local regulating body DES
  - Determines field loading rates based on crops and growin field
- Strong relationship with third party contractor Denali
  - Complex management is required during wet season due to field conditions limiting application
- Consistent communication and strong relationship with Farmers
  - Weekly land application audits
  - Yearly farmers dinner

Crop	Advised PAN values	Crop	Advised PAN values
Alfalfa	150 lbs./ac/yr.	Forest	75 lbs/ac/yr
Bermuda Grass	200 lbs/ac/yr	Milo	100 lbs/ac/yr
Blue Grass	120 lbs/ac/yr	Small Grain crops	100 lbs/ac/yr
Corn Grain	160 lbs/ac/yr	Sorghum(Silage)	180 lbs/ac/yr
Corn Silage	180 lbs./ac/yr.	Soybeans	150 lbs/ac/yr
Cotton	70 lbs/ac/yr	Timothy,Orchard Grass	160 lbs/ac/yr
Fescue	160 lbs/as/yr	Rye Grass	160 lbs/ac/yr
Bermuda Hay over seeded w/ Rye Grass/Small grains		240 lbs/ac/yr	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Corn												
Wheat, Oats, & Barley												
Grain Sorghum												
Soybeans												
Bermuda												
Fescue												
Rye												
Rye/Bermuda												
Fescue/Bermuda												
Pastures- All Varieties												

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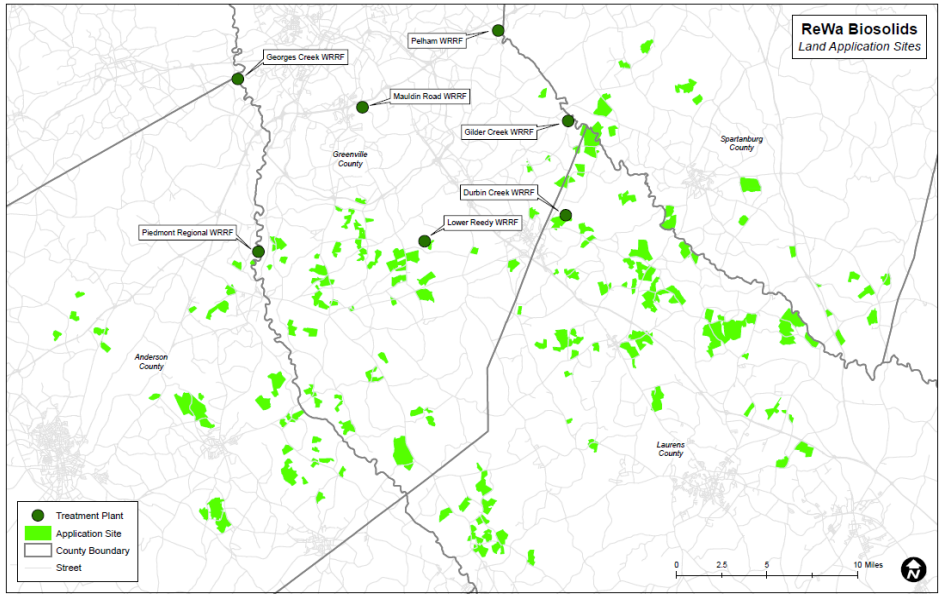
Challenges

- Program management
  - Land application is weather dependent
  - Sufficient solids storage for wet weather season
- Growing local economy
  - Longer transport to land application sites
  - Farmers selling land
  - Transport costs
- Regulations
  - Regulatory paperwork
  - Emerging contaminants
- Plan to increase resiliency
  - Transition to land application of dewatered material (20% TS)
  - Reduces liability through lower transport costs and disposal flexibility



Questions

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