JEFFERSON COUNTY COMMISSION
ENVIRONMENTAL SERVICES DEPARTMENT

JEFFERSON COUNTY, ALABAMA

2014 ANNUAL BIOSOLIDS REPORT

BIOSOLIDS MANAGEMENT PROGRAM

Jefferson County Land Reclamation Program

REPORT PREPARED BY:

JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT

2014 Annual Biosolids Report

<u>2014 EPA ANNUAL BIOSOLIDS REPORT</u>

JEFFERSON COUNTY ENVIRONMENTAL SERVICES DEPARTMENT
BIRMINGHAM, ALABAMA

Enclosed is the 2014 Annual Biosolids Monitoring Report for the Jefferson County Environmental Services' **Biosolids Land Reclamation Program**. This report is respectfully submitted to the Environmental Protection Agency (EPA) Region IV in accordance with the requirements of 40 CFR Part 503.

Information provided in this report includes:

1. Certification Statement for management practices, site restrictions, pathogen requirement, and vector attraction reduction requirements.
2. Executive Summary.
3. Project information for the Biosolids Management Program, including Jefferson County Wastewater Treatment Facility information and land application site data.
4. Biosolids testing methodology and analysis results, including sample collection forms.
5. Agronomic calculations, rate justification letter and sample worksheet for calculating agronomic rates.
6. Vector Attraction Reduction Statistics.
7. Land application site maps.

SECTION 1

CERTIFICATION STATEMENT

CERTIFICATION STATEMENT FOR THE *PREPARER* and *APPLIER* OF BULK SEWAGE BIOSOLIDS

I certify, under penalty of law, that the information that will be used to determine compliance with the management practices in §503.14, the site restrictions in §503.32 (b)(5), the Class B pathogen requirements in §503.32(b), and the vector attraction reduction requirements in §503.33(b)(6) or (10)(i) was prepared for each site on which bulk sewage sludge is applied under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

[signature] 2/19/15

Signature Date

David Denard – Director, Jefferson County Environmental Services Department
Printed Name and Position

SECTION 2

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Jefferson County Environmental Services Department utilizes land application as the method of disposal for the biosolids currently produced by its wastewater treatment facilities. There are currently nine (9) wastewater treatment facilities operated by the Environmental Services Department. During 2014, these facilities treated an average daily flow of 107 MGD of wastewater and produced 9,066 dry tons of biosolids that were sent for land application. An additional approximately 174 dry tons were generated but disposed at the Jefferson County Landfill No. 1. Seven (7) of the County's wastewater treatment facilities are Class I Publicly-Owned Treatment Works (POTWs), and therefore subject to the 40 CFR Part 503 reporting regulations.

Throughout 2014, the biosolids produced by Jefferson County's wastewater treatment facilities were land applied at two (2) former strip mine sites. Jefferson County is assisting the property owner, the United Land Corporation, in the reclamation of former strip mine sites through the land application of biosolids.

The Flat Top/Bessie Mines Land Reclamation Site (Flat Top) is located in northwestern Jefferson County and is approximately 4,670 acres total in size, with approximately 2,700 acres being disturbed through previous mining activities. Biosolids from eight (8) wastewater treatment facilities were applied at this site during 2014 on roughly 364 acres.

The Beltona Land Reclamation Site, located in northern Jefferson County, is approximately 1,000 acres in size, with about one-third of the site being previously disturbed through mining activities. Biosolids from two (2) wastewater treatment facilities were applied at Beltona during 2014 on roughly 143 acres.

Applicable site restrictions, general requirements, and management practices have been met at both Land Reclamation Sites. Biosolids were applied to both sites using the "Pollutant Concentration" (PC) option. Pathogen and vector attraction reduction requirements and all required site restrictions for Class "B" biosolids were also met.

SECTION 3

PROJECT INFORMATION

JEFFERSON COUNTY
WASTEWATER TREATMENT FACILITIES

System: Jefferson County Commission/Environmental Services Department
716 Richard Arrington, Jr. Boulevard North
Birmingham, AL 35203

Summary:

The Jefferson County Environmental Services Department currently operates nine wastewater treatment facilities. During 2014, these facilities treated an average daily flow of 107 MGD of wastewater and produced 8,995 dry (English) tons of biosolids that were land applied. Seven of the County's wastewater treatment facilities are Class I POTWs, and therefore subject to the 40 CFR Part 503 reporting regulations.

Class I POTWs:		**Dry Tons of Biosolids Land Applied**
1.	Cahaba River Wastewater Treatment Plant NPDES Permit No. AL0023027	1,260.9
2.	Five Mile Creek Wastewater Treatment Plant NPDES Permit No. AL0026913	1,170.9
3.	Leeds Wastewater Treatment Plant NPDES Permit No. AL0022297	233.6
4.	Trussville Wastewater Treatment Plant NPDES Permit No. AL0022934	694.5
5.	Turkey Creek Wastewater Treatment Plant NPDES Permit No. AL0022936	564.9
6.	Valley Creek Wastewater Treatment Plant NPDES Permit No. AL0023655	3,832.1
7.	Village Creek Wastewater Treatment Plant NPDES Permit No. AL0023647	1,266.1
Non-Class I POTWs (<1.0 MGD):		
1.	Prudes Creek Wastewater Treatment Plant NPDES Permit No. AL0056120	0.0
2.	Warrior Wastewater Treatment Plant NPDES Permit No. AL0050881	42.5
		TOTAL: 9,066 Dry Tons

Reporting Requirements:

Based on the quantity of biosolids land applied during 2014, the required frequency of monitoring was six times per year. However, Jefferson County typically performs biosolids monitoring on a monthly basis (twelve times per year).

Pathogen Requirements:

Class “B” pathogen requirements were met through Alternative 1: The Monitoring of Fecal Coliform [503.32(b)(2)]. The geometric mean fecal coliform density per gram of dry biosolids was less than 2 million colony-forming units for each sampling event (see Biosolids Analysis Results).

Vector Attraction Reduction Summary:

A portion of the biosolids from the Valley Creek WWTP and only the lime stabilized biosolids from Village Creek WWTP were land applied at the Beltona Land Reclamation Site in 2014 (10% of the total from these facilities). The Village Creek wastewater treatment facility utilized Option 6: Addition of Alkaline Material [503.33(b)(6)] for vector attraction reduction of their biosolids. The Valley Creek WWTP utilized Option 1: Volatile Solids Reduction by a minimum of 38 percent [503.33(b)(1)].

The remaining biosolids from the Valley Creek WWTP and Village Creek WWTP and the six other WWTPs were land applied at the Flat Top/Bessie Mines application site and were incorporated into the soil within six hours of application as described in Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]. This Option 10 method of vector attraction reduction was utilized for approximately 95% of the County’s total biosolids land applied during 2014. The biosolids from the Village Creek WWTP included lime stabilized biosolids associated with the centrifuge dewatering process and biosolids from drying beds.

FLAT TOP/BESSIE MINES
LAND RECLAMATION SITE

System: Jefferson County Commission/Environmental Services Department
716 Richard Arrington, Jr. Boulevard North
Birmingham, AL 35203

Reporting Period:
January 1, 2014 to December 31, 2014

Site Address:
5201 Flat Top Road, Graysville, AL 35073

Site Description:
The Flat Top Land Reclamation Site is a former strip mine site, 4,670 acres total in size, with approximately 2,700 acres being previously disturbed through mining activities. Jefferson County is assisting the property owner in the reclamation of this site through the land application of biosolids. Biosolids were land applied on roughly 423 acres at the site in 2014.

There is currently marginal soil mass present at this site for growing vegetation and, biosolids are being applied to build adequate soil mass.

Source of Biosolids:
During 2014, biosolids from eight wastewater treatment facilities were land applied at this site with no biosolids being hauled from the Prudes Creek wastewater treatment facility.

Quantity:
A total of 8,584 dry (English) tons of biosolids were applied at the Flat Top Land Reclamation Site during 2014. Biosolids were applied to Plot 3 of the site (see Figure 2).

Pollutant Limits:
Biosolids were applied to this site using the "Pollutant Concentration" (PC) option (see 2014 Biosolids Analysis Results). In order to be representative of in-situ conditions, monthly biosolids samples were taken from each treatment facility and then blended according to each facility's disposal ratio. Biosolids testing was then performed on this "blended" sample.

Pathogen Requirements:
Class "B" pathogen requirements were met through Alternative 1: The Monitoring of Fecal Coliform [503.32(b)(2)]. The geometric mean fecal coliform density per gram of dry biosolids was less than 2 million colony-forming units for each sampling event (see 2014 Biosolids Analysis Results).

Vector Attraction Reduction Requirements:

The Village Creek wastewater treatment facility primarily utilized lime stabilization for vector attraction reduction in the majority of their biosolids in accordance with Option 6: Addition of Alkaline Material [503.33(b)(6)]. To satisfy the requirements of Option 6, sufficient lime was added to the biosolids to raise the pH to at least 12 for 2 hours and at least 11.5 for an additional 22 hours, without the addition of more lime

For biosolids received at the Flat Top Land Reclamation Site from the remaining treatment plants and the portion of biosolids from Village wastewater treatment facility that did not receive lime stabilization, the method of vector attraction reduction used was Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]. These biosolids were land applied and incorporated into the soil within six hours of application on the land. The biosolids from the Valley Creek WWTP also met requirements for Option 1: Volatile Solids Reduction by a minimum of 38 percent [503.33(b)(1)].

Management Practices and Site Restrictions:

All applicable management practices stated in 503.14 were met at the site, including a minimum 100 ft. buffer zone around waters of the United States.

All applicable site restrictions stated in 503.32(b)(5) for Class "B" biosolids were also met. The Flat Top/Bessie Mines Land Reclamation site is in a remote area of Jefferson County and is located on private property; therefore there is no public access to the site.

BELTONA LAND RECLAMATION SITE

System: Jefferson County Commission/Environmental Services Department
716 Richard Arrington, Jr. Boulevard North
Birmingham, AL 35203

Reporting Period:
January 1, 2014 to December 31, 2014

Site Address:
401-B Beltona Road, Warrior, AL 35180

Site Description:
The Beltona Land Reclamation Site, which is approximately 1,000 acres in size, is a former strip mine site located in northern Jefferson County. About one-third of the site has been utilized for biosolids land application, with plot sizes ranging from 3.0 acres to 20 acres. Jefferson County is assisting the property owner in the reclamation of this site through the land application of biosolids. Biosolids were land applied on roughly 143 acres at the site in 2014. Presently, Tifton Bermuda and Winter Rye grasses are grown at Beltona and are harvested several times a year as hay.

Source of Biosolids:
During November and December 2014, biosolids from the Valley Creek and Village Creek wastewater treatment facilities were land applied at this site.

Quantity:
482 dry (English) tons of biosolids were land applied at the Beltona Land Reclamation Site during 2014.

Pollutant Limits:
Biosolids from two of the County's wastewater treatment facilities were applied to this site using the "Pollutant Concentration" (PC) option. Biosolids testing was performed on samples from these facilities at a frequency that meets or exceeds the minimum monitoring frequency requirement for each facility (see 2014 Biosolids Analysis Results).

Pathogen Requirements:
Class "B" pathogen requirements were met through Alternative 1: The Monitoring of Fecal Coliform [503.32(b)(2)]. The geometric mean fecal coliform density per gram of dry biosolids was less than 2 million colony-forming units for each sampling event (see 2014 Biosolids Analysis Results).

Vector Attraction Reduction Requirements:

The Village Creek wastewater treatment facility utilized lime stabilization for vector attraction reduction of their biosolids, as described in Option 6: Addition of Alkaline Material [503.33(b)(6)]. To satisfy the requirements of Option 6, sufficient lime was added to the biosolids to raise the pH to at least 12 for 2 hours and at least 11.5 for an additional 22 hours, without the addition of more lime. Lime stabilized biosolids were then surface-applied at the Beltona Land Reclamation Site.

The biosolids from the Valley Creek WWTP met requirements for Option 1: Volatile Solids Reduction by a minimum of 38 percent [503.33(b)(1)].

Management Practices and Site Restrictions:

All applicable management practices stated in 503.14 were met at the site, including a minimum 100 ft. buffer zone around waters of the United States.

All applicable site restrictions stated in 503.32(b)(5) for Class "B" biosolids were also met. The Beltona Land Reclamation Site is in a remote area of Jefferson County and is located on private property; therefore there is no public access to the site.

SECTION 4

BIOSOLIDS ANALYSIS

TEST METHODS FOR BIOSOLIDS ANALYSIS

Based on the quantity of biosolids land applied at the Flat Top/Bessie Mine Land Reclamation Site during 2014, the required frequency of monitoring was six (6) times per year; however, Jefferson County typically performs biosolids monitoring on a monthly basis (see 2014 Biosolids Analysis Results). Each month, samples were collected from each treatment facility and blended according to each facility's disposal ratio in order to be representative of in-situ conditions. Biosolids testing was then performed on this "blended" sample.

For the Beltona Land Reclamation Site, biosolids samples from the two (2) contributing treatment facilities were collected at a frequency that meets or exceeds the minimum monitoring frequency requirement for each facility (see 2014 Biosolids Analysis Results).

METALS ANALYSIS:

Following is a list of the biosolids sample preparation and test methods used when performing metals testing:

METHODS FOR EVALUATING SOLID WASTE, SW846 METHODS:

Arsenic	3050B, 7060A
Cadmium	3050B, 7130
Chromium	3050B, 7190
Copper	3050B, 7210
Lead	3050B, 7420
Mercury	7471B
Molybdenum	3050B, 7481
Nickel	3050B, 7520
Selenium	3050B, 7740
Zinc	3050B, 7950

FECAL COLIFORM TESTING:

For each sampling event, seven (7) samples were collected and tested according to the procedure outlined in Part 9222D, *Standard Methods for the Examination of Water and Wastewater,* and Appendix F of EPA's *Environmental Regulations and Technology, Control of Pathogens and Vector Attraction in Sewage Sludge*. The geometric mean fecal coliform density per gram of dry biosolids was less than 2 million colony-forming units for each sampling event (see 2014 Biosolids Analysis Results). Serial dilutions were prepared in the range of 10^1 through 10^6, and on some occasions 10^7, thus enabling coliform colony counts of greater than 20 million.

2014 BIOSOLIDS ANALYSIS RESULTS
FLAT TOP/BESSIE MINES LAND RECLAMATION SITE
(Blended sample from all facilities)

	As	Cd	Cr	Cu	Pb	Hg	Mo	Ni	Se	Zn	% Moisture	Fecal Coliform
Date	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**CFU/g***
1/14/2014	<PQL	<PQL	110	1,500	72	2.2	17	83	<PQL	4,800	61%	385,000
2/4/2014	<PQL	<PQL	150	1,500	98	1.9	23	110	15	5,400	70%	36,000
3/4/2014	<PQL	<PQL	130	1,400	84	1.8	23	92	<PQL	2,600	73%	26,000
4/8/2014	<PQL	<PQL	110	810	56	2.1	15	76	<PQL	3,600	68%	54,000
5/6/2014	<PQL	<PQL	130	1,300	76	1.2	14	88	<PQL	6,300	63%	9,500
6/3/2014	<PQL	<PQL	120	1,200	86	1.9	16	94	<PQL	5,300	64%	66,000
7/8/2014	<PQL	<PQL	110	600	47	1.6	13	62	<PQL	3,600	59%	3,200
8/5/2014	<PQL	<PQL	110	1,200	61	1.9	17	91	<PQL	4,600	54%	91,000
9/9/2014	<PQL	<PQL	230	2,100	110	3.0	38	170	<PQL	9,700	61%	420,000
10/7/2014	<PQL	<PQL	64	900	31	2.4	11	44	<PQL	2,600	50%	50,000
11/18/2014	<PQL	<PQL	130	1,700	74	2.2	24	89	19	6,400	63%	360,000
12/2/2014	<PQL	<PQL	91	1,200	49	2.5	18	58	<PQL	3,700	52%	71,000
Average	<PQL	<PQL	**124**	**1284**	**70**	**2.1**	**19**	**88**	<PQL	**4,883**		
Maximum	<PQL	<PQL	**230**	**2,100**	**110**	**3.0**	**38**	**170**	**<PQL**	**9,700**		
PQL	11	8.0	8.0	8.0	15	0.03	5.0	6.0	15	18		
EQ/PC Limit[1]	41	39	-	1,500	300	17	-	420	100	2,800	-	-
Ceiling Limit[2]	75	85	-	4,300	840	57	75	420	100	7,500	-	-

All pollutant concentrations given on a dry-weight basis

PQL = Practical Quantitation Limit

[1] Pollutant Concentration Limits taken from Table 3, Part 503.13

[2] Ceiling Concentration Limits taken from Table 1, Part 503

* Geometric mean fecal coliform density

2014 BIOSOLIDS ANALYSIS RESULTS
BELTONA LAND RECLAMATION SITE
(Valley Creek WWTP)

	As	Cd	Cr	Cu	Pb	Hg	Mo	Ni	Se	Zn	% Moisture	Fecal Coliform
Date	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**CFU/g***
1/14/2014	<PQL	<PQL	64	580	41	1.8	16	48	<PQL	1,600	83%	150,000
2/4/2014	<PQL	<PQL	55	540	41	0.19	14	52	<PQL	1,400	83%	66,000
3/4/2014	<PQL	<PQL	39	470	37	2.8	10	41	<PQL	1,200	83%	48,000
4/8/2014	<PQL	<PQL	40	400	34	1.3	<PQL	83	<PQL	1,000	84%	41,000
5/6/2014	<PQL	<PQL	46	440	43	1.9	11	60	<PQL	1,200	84%	23,000
6/3/2014	<PQL	<PQL	39	480	41	1.8	14	51	<PQL	1,400	82%	160,000
7/8/2014	<PQL	<PQL	36	470	46	1.9	12	72	<PQL	1,400	82%	20,000
8/5/2014	<PQL	<PQL	39	550	44	1.7	20	120	<PQL	1,600	83%	790,000
9/9/2014	<PQL	<PQL	18	260	23	1.7	14	37	<PQL	730	83%	240,000
10/7/2014	<PQL	<PQL	36	560	31	1.6	23	56	<PQL	1,400	84%	1,100,00
11/18/2014	<PQL	<PQL	32	600	30	1.7	23	38	<PQL	1,500	85%	35,000
12/2/2014	<PQL	<PQL	79	620	42	1.9	25	64	<PQL	1,500	84%	280,000
Average	<PQL	<PQL	**44**	**498**	**38**	**1.7**	**15**	**60**	<PQL	**1328**		
Maximum	<PQL	<PQL	**79**	**620**	**46**	**2.8**	**25**	**120**	<PQL	**1,600**		
PQL	11	8.0	8.0	8.0	15	0.03	5.0	6.0	15	18		
EQ/PC Limit[1]	41	39	-	1,500	300	17	-	420	100	2,800	-	-
Ceiling Limit[2]	75	85	-	4,300	840	57	75	420	100	7,500	-	-

All pollutant concentrations given on a dry-weight basis

PQL = Practical Quantitation Limit

[1] Pollutant Concentration Limits taken from Table 3, Part 503.13

[2] Ceiling Concentration Limits taken from Table 1, Part 503

* Geometric mean fecal coliform density

2014 BIOSOLIDS ANALYSIS RESULTS
BELTONA LAND RECLAMATION SITE
(Village Creek WWTP)

	As	**Cd**	**Cr**	**Cu**	**Pb**	**Hg**	**Mo**	**Ni**	**Se**	**Zn**	**% Moisture**	**Fecal Coliform**
Date	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**CFU/g***
1/14/2014	<PQL	<PQL	47	450	55	2.6	10	47	<PQL	1,300	74%	65
2/4/2014	<PQL	<PQL	45	410	51	2.6	9.8	42	<PQL	1,100	72%	0
3/4/2014	<PQL	<PQL	37	390	54	2.0	8.0	36	<PQL	1,100	72%	2
4/8/2014	<PQL	<PQL	45	410	54	2.4	9.7	40	<PQL	1,200	73%	14
5/6/2014	<PQL	<PQL	40	400	56	1.6	9.5	33	<PQL	1,100	73%	0
6/3/2014	<PQL	<PQL	40	350	50	1.8	7.4	31	<PQL	1,100	68%	0
Average	<PQL	<PQL	**42**	**402**	**53**	**4.3**	**9.1**	**38**	<PQL	**1150**		
Maximum	<PQL	<PQL	**47**	**450**	**56**	**2.6**	**10**	**47**	**<PQL**	**1,300**		
PQL	11	8.0	8.0	8.0	15	0.03	5.0	6.0	15	18		
EQ/PC Limit[1]	41	39	-	1,500	300	17	-	420	100	2,800	-	-
Ceiling Limit[2]	75	85	-	4,300	840	57	75	420	100	7,500	-	-

All pollutant concentrations given on a dry-weight basis
PQL = Practical Quantitation Limit
No biosolids produced July-Dec. due to centrifuge down.

[1] Pollutant Concentration Limits taken from Table 3, Part 503.13
[2] Ceiling Concentration Limits taken from Table 1, Part 503
* Geometric mean fecal coliform density

8 Bags

1

Trussville WWTP

Jefferson County Commission Environmental Services Department–Barton Laboratory

BIOSOLIDS Sample Collection / Chain of Custody / Request for Analysis

Sample ID: Biosolids		Primary Measuring Device:	
Sample Set-up Date:	Time:	Sampler Type:	
First/Start Sample Date:	Time:	Flow Meter Type:	
Last Sample Date:	Time:	Sample Interval:	
Collection Date: 6/10/14	Time: 0730	Sample Type:	Grab ☒ Composite ☐
Sample Split? Yes ☐ No ☐			{TVVC / TCVC / TCVV}

CHAIN OF CUSTODY

Sample Collected by	Date	Time	Relinquished by	Date	Time
Ron [illegible]	6/10/14	0730	Ron [illegible]	6/10/14	0848

Received by	Date	Time	Relinquished by	Date	Time
Willie Harmon	6/10.14	0848	Willie Harmon J.	6/10.14	0938
[illegible]	6/10/14	0938			

MUST BE COMPLETED! Preservation Method: A ☐ B ☐ C ☐ D ☐ by WWTP☐ / by Barton Lab ☐ Time:

REQUEST FOR ANALYSIS

PM = PRESERVATION METHOD:
- A –Iced, 4° C.
- B –H_2SO_4 to pH < 2
- C –HNO_3 to pH < 2
- D –NaOH to pH >11

☒	Analyte	Value	Units	PM	Analyst Name
☒	TKN		mg/Kg		
	NH_3-N		mg/Kg		
	Nitrate + Nitrite		mg/Kg		
☒	Percent Moisture		%		R [illegible]
☒	Fecal Coliform	0	Col/~~100mL~~ g		R. [illegible]
	E. Coli		Col/100mL		
☒	Metals				

☒	Analyte	Value	Units	PM	Analyst Name
☒	Arsenic		mg/Kg		
☒	Cadmium		mg/Kg		
☒	Chromium		mg/Kg		
☒	Copper		mg/Kg		
☒	Lead		mg/Kg		
☒	Mercury		mg/Kg		Enersolv
☒	Molybdenum		mg/Kg		
☒	Nickel		mg/Kg		
☒	Selenium		mg/Kg		
☒	Zinc		mg/Kg		

20140610007-01

ANALYTICAL METHODS: R2=*EPA-600/4-79-020;* R3=*EPA Method 1664;* BR4=*EPA SW846;* all others ref. *Standard Methods, 21st Ed.* or later. DO, 4500-O C; Conductivity, 2510-B; pH, 4500-H^+ -B; BOD_5, 5210-B; $CBOD_5$, 5210-B; TSS, 2540-D; COD, 5220-D; TKN, *R2* 351.2; NH_3-N, 4500-NH_3-G; Total-P, 4500-P F; *ortho*-P, 4500-P F; TOC, 5310 B; Nitrate, 4500-NO3 H; Nitrite, 4500-NO_2 H; Turbidity, 2130 B; Hardness, 2340 C; Oil & Grease, *R3*, 1664; Arsenic, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7060 A); Cadmium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7130); Chromium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7190); Copper, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7210); Lead, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7420); Mercury, 3112,B (BR4 7471 B); Molybdenum, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7481); Nickel, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7520); Selenium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7740); Silver, 3030,E, 3111,B, 3113 B; Zinc, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7950); Cyanide 4500-CN^- E; Volatile Organics, 6210 D; Semi-Volatile Organics, 6410 B; Sulfate, 4500-SO_4^{2-}

8 Bags

2

Trussville WWTP

Jefferson County Commission Environmental Services Department–Barton Laboratory

BIOSOLIDS Sample Collection / Chain of Custody / Request for Analysis

Sample ID: Biosolids		Primary Measuring Device:	
Sample Set-up Date:	Time:	Sampler Type:	
First/Start Sample Date:	Time:	Flow Meter Type:	
Last Sample Date:	Time:	Sample Interval:	
Collection Date: 6/10/14	Time: 0730	Sample Type:	Grab ☒ Composite ☐
Sample Split? Yes ☐ No ☐			{TVVC / TCVC / TCVV}

CHAIN OF CUSTODY

	Date	Time		Date	Time
Sample Collected by: Ron [signature]	6/10/14	0730	Relinquished by: Ron [signature]	6/10/14	0848
Received by: [signature] Harmon	6/10.14	0848	Relinquished by: [signature] Harmon J.	6/10-14	0938
Received by: [signature]	6/10/14	0938	Relinquished by		
Received by			Relinquished by		

MUST BE COMPLETED! Preservation Method: A ☐ B ☐ C ☐ D ☐ by WWTP☐ / by Barton Lab ☐ Time:

REQUEST FOR ANALYSIS

PM = PRESERVATION METHOD:
A –Iced, 4° C.
B –H_2SO_4 to pH < 2
C –HNO_3 to pH < 2
D –NaOH to pH >11

☒	Analyte	Value	Units	PM	Analyst Name
☒	TKN		mg/Kg		
	NH_3-N		mg/Kg		
	Nitrate + Nitrite		mg/Kg		
☒	Percent Moisture		%		R [signature]
☒	Fecal Coliform	0	Col/~~100~~mL g		R. [signature]
	E. Coli		Col/100mL		
☒	Metals				

☒	Analyte	Value	Units	PM	Analyst Name
☒	Arsenic		mg/Kg		
☒	Cadmium		mg/Kg		
☒	Chromium		mg/Kg		
☒	Copper		mg/Kg		
☒	Lead		mg/Kg		
☒	Mercury		mg/Kg		Enersolv
☒	Molybdenum		mg/Kg		
☒	Nickel		mg/Kg		
☒	Selenium		mg/Kg		
☒	Zinc		mg/Kg		

20140610007-01

ANALYTICAL METHODS: R2=*EPA-600/4-79-020;* R3=*EPA Method 1664;* BR4=*EPA SW846;* all others ref. *Standard Methods, 21st Ed.* or later. DO, 4500-O C; Conductivity, 2510-B; pH, 4500-H⁺ -B; BOD_5, 5210-B; $CBOD_5$, 5210-B; TSS, 2540-D; COD, 5220-D; TKN, *R2* 351.2; NH_3-N, 4500-NH_3-G; Total-P, 4500-P F; *ortho*-P, 4500-P F; TOC, 5310 B; Nitrate, 4500-NO3 H; Nitrite, 4500-NO_2 H; Turbidity, 2130 B; Hardness, 2340 C; Oil & Grease, *R3*, 1664; Arsenic, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7060 A); Cadmium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7130); Chromium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7190); Copper, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7210); Lead, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7420); Mercury, 3112,B (BR4 7471 B); Molybdenum, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7481); Nickel, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7520); Selenium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7740); Silver, 3030,E, 3111,B, 3113 B; Zinc, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7950); Cyanide 4500-CN⁻ E; Volatile Organics, 6210 D; Semi-Volatile Organics, 6410 B; Sulfate, 4500-SO_4^{2-}

8 Bags

3

Trussville WWTP

Jefferson County Commission Environmental Services Department–Barton Laboratory

BIOSOLIDS Sample Collection / Chain of Custody / Request for Analysis

Sample ID: Biosolids		Primary Measuring Device:	
Sample Set-up Date:	Time:	Sampler Type:	
First/Start Sample Date:	Time:	Flow Meter Type:	
Last Sample Date:	Time:	Sample Interval:	
Collection Date: 6/10/14	Time: 0730	Sample Type:	Grab ☒ Composite ☐
Sample Split? Yes ☐ No ☐			{TVVC / TCVC / TCVV}

CHAIN OF CUSTODY

	Date	Time		Date	Time
Sample Collected by: Ron [signature]	6/10/14	0730	Relinquished by: Ron [signature]	6/10/14	0848
Received by: Willie J Harmon Jr	6/10-14	0848	Relinquished by: Willie J Harmon Jr.	6/10-14	0938
Received by: [signature]	6/10/14	0938	Relinquished by		
Received by			Relinquished by		

MUST BE COMPLETED! Preservation Method: A ☐ B ☐ C ☐ D ☐ by WWTP ☐ / by Barton Lab ☐ Time:

REQUEST FOR ANALYSIS

PM = PRESERVATION METHOD:
A – Iced, 4° C.
B – H_2SO_4 to pH < 2
C – HNO_3 to pH < 2
D – NaOH to pH > 11

☒	Analyte	Value	Units	PM	Analyst Name
☒	TKN		mg/Kg		
	NH_3-N		mg/Kg		
	Nitrate + Nitrite		mg/Kg		
☒	Percent Moisture		%		[initials]
☒	Fecal Coliform	0	Col/100mL		R. [initials]
	E. Coli		Col/100mL		
☒	Metals				

☒	Analyte	Value	Units	PM	Analyst Name
☒	Arsenic		mg/Kg		
☒	Cadmium		mg/Kg		
☒	Chromium		mg/Kg		
☒	Copper		mg/Kg		
☒	Lead		mg/Kg		
☒	Mercury		mg/Kg		Enersolv
☒	Molybdenum		mg/Kg		
☒	Nickel		mg/Kg		
☒	Selenium		mg/Kg		
☒	Zinc		mg/Kg		

20140607-01

ANALYTICAL METHODS: R2=*EPA-600/4-79-020;* R3=*EPA Method 1664;* BR4=*EPA SW846:* all others ref. *Standard Methods, 21st Ed.* or later. DO, 4500-O C; Conductivity, 2510-B; pH, 4500-H^+ -B; BOD_5, 5210-B; $CBOD_5$, 5210-B; TSS, 2540-D; COD, 5220-D; TKN, *R2* 351.2; NH_3-N, 4500-NH_3-G; Total-P, 4500-P F; *ortho*-P, 4500-P F; TOC, 5310 B; Nitrate, 4500-NO3 H; Nitrite, 4500-NO_2 H; Turbidity, 2130 B; Hardness, 2340 C; Oil & Grease, *R3*, 1664; Arsenic, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7060 A); Cadmium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7130); Chromium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7190); Copper, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7210); Lead, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7420); Mercury, 3112,B (BR4 7471 B); Molybdenum, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7481); Nickel, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7520); Selenium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7740); Silver, 3030,E, 3111,B, 3113 B; Zinc, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7950); Cyanide 4500-CN^- E; Volatile Organics, 6210 D; Semi-Volatile Organics, 6410 B; Sulfate, 4500-SO_4^{2-}

8 Bags

4

Trussville WWTP

Jefferson County Commission Environmental Services Department–Barton Laboratory

BIOSOLIDS Sample Collection / Chain of Custody / Request for Analysis

Sample ID: Biosolids		Primary Measuring Device:	
Sample Set-up Date:	Time:	Sampler Type:	
First/Start Sample Date:	Time:	Flow Meter Type:	
Last Sample Date:	Time:	Sample Interval:	
Collection Date: 6/10/14	Time: 0730	Sample Type:	Grab ☒ Composite ☐
Sample Split? Yes ☐ No ☐			{TVVC / TCVC / TCVV}

CHAIN OF CUSTODY

	Date	Time		Date	Time
[signature] Sample Collected by	6/10/14	0730	[signature] Relinquished by	6/10/14	0848
Willie Harmon Received by	6/10.14	0848	Willie Harmon Jr. Relinquished by	6/10-14	0938
[signature] Received by	6/10/14	0938	Relinquished by		
Received by			Relinquished by		

MUST BE COMPLETED! Preservation Method: A ☐ B ☐ C ☐ D ☐ by WWTP☐ / by Barton Lab ☐ Time:

REQUEST FOR ANALYSIS

PM = PRESERVATION METHOD:
A – Iced, 4° C.
B – H_2SO_4 to pH < 2
C – HNO_3 to pH < 2
D – NaOH to pH > 11

☒	Analyte	Value	Units	PM	Analyst Name
☒	TKN		mg/Kg		
	NH_3-N		mg/Kg		
	Nitrate + Nitrite		mg/Kg		
☒	Percent Moisture		%		[initials]
☒	Fecal Coliform	0	Col/~~100mL~~ g		R. [initials]
	E. Coli		Col/100mL		
☒	Metals				

☒	Analyte	Value	Units	PM	Analyst Name
☒	Arsenic		mg/Kg		
☒	Cadmium		mg/Kg		
☒	Chromium		mg/Kg		
☒	Copper		mg/Kg		
☒	Lead		mg/Kg		
☒	Mercury		mg/Kg		Enersolv
☒	Molybdenum		mg/Kg		
☒	Nickel		mg/Kg		
☒	Selenium		mg/Kg		
☒	Zinc		mg/Kg		

20140607-01

ANALYTICAL METHODS: R2=*EPA-600/4-79-020;* R3=*EPA Method 1664;* BR4=*EPA SW846;* all others ref. *Standard Methods, 21st Ed.* or later. DO, 4500-O C; Conductivity, 2510-B; pH, 4500-H⁺ -B; BOD_5, 5210-B; $CBOD_5$, 5210-B; TSS, 2540-D; COD, 5220-D; TKN, *R2* 351.2; NH_3-N, 4500-NH_3-G; Total-P, 4500-P F; *ortho*-P, 4500-P F; TOC, 5310 B; Nitrate, 4500-NO3 H; Nitrite, 4500-NO_2 H; Turbidity, 2130 B; Hardness, 2340 C; Oil & Grease, *R3*, 1664; Arsenic, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7060 A); Cadmium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7130); Chromium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7190); Copper, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7210); Lead, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7420); Mercury, 3112,B (BR4 7471 B); Molybdenum, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7481); Nickel, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7520); Selenium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7740); Silver, 3030,E, 3111,B, 3113 B; Zinc, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7950); Cyanide 4500-CN⁻ E; Volatile Organics, 6210 D; Semi-Volatile Organics, 6410 B; Sulfate, 4500-SO_4^{2-}

8 Bags

5

Trussville WWTP

Jefferson County Commission Environmental Services Department–Barton Laboratory

BIOSOLIDS Sample Collection / Chain of Custody / Request for Analysis

Sample ID: Biosolids		Primary Measuring Device:	
Sample Set-up Date:	Time:	Sampler Type:	
First/Start Sample Date:	Time:	Flow Meter Type:	
Last Sample Date:	Time:	Sample Interval:	
Collection Date: 6/10/14	Time: 0730	Sample Type:	Grab ☒ Composite ☐
Sample Split? Yes ☐ No ☐			{TVVC / TCVC / TCVV}

CHAIN OF CUSTODY

Received / Collected by	Date	Time	Relinquished by	Date	Time
Ron [signature] (Sample Collected by)	6/10/14	0730	Ron [signature]	6/10/14	0848
[signature] Harmon (Received by)	6/10.14	0848	[signature] Harmon J.	6/10.14	0938
[signature] (Received by)	6/10/14	0938			
Received by			Relinquished by		

MUST BE COMPLETED! Preservation Method: A ☐ B ☐ C ☐ D ☐ by WWTP☐ / by Barton Lab ☐ Time:

REQUEST FOR ANALYSIS

PM = PRESERVATION METHOD:
A –Iced, 4° C.
B –H_2SO_4 to pH < 2
C –HNO_3 to pH < 2
D –NaOH to pH >11

☒	Analyte	Value	Units	PM	Analyst Name
☒	TKN		mg/Kg		
	NH_3-N		mg/Kg		
	Nitrate + Nitrite		mg/Kg		
☒	Percent Moisture		%		R [signature]
☒	Fecal Coliform	0	Col/100mL		R. [signature]
	E. Coli		Col/100mL		
☒	Metals				

☒	Analyte	Value	Units	PM	Analyst Name
☒	Arsenic		mg/Kg		
☒	Cadmium		mg/Kg		
☒	Chromium		mg/Kg		
☒	Copper		mg/Kg		
☒	Lead		mg/Kg		
☒	Mercury		mg/Kg		Enersolv
☒	Molybdenum		mg/Kg		
☒	Nickel		mg/Kg		
☒	Selenium		mg/Kg		
☒	Zinc		mg/Kg		

20140610007-01

ANALYTICAL METHODS: R2=*EPA-600/4-79-020;* R3=*EPA Method 1664;* BR4=*EPA SW846;* all others ref. *Standard Methods, 21st Ed.* or later. DO, 4500-O C; Conductivity, 2510-B; pH, 4500-H^+ -B; BOD_5, 5210-B; $CBOD_5$, 5210-B; TSS, 2540-D; COD, 5220-D; TKN, *R2* 351.2; NH_3-N, 4500-NH_3-G; Total-P, 4500-P F; *ortho*-P, 4500-P F; TOC, 5310 B; Nitrate, 4500-NO3 H; Nitrite, 4500-NO_2 H; Turbidity, 2130 B; Hardness, 2340 C; Oil & Grease, *R3*, 1664; Arsenic, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7060 A); Cadmium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7130); Chromium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7190); Copper, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7210); Lead, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7420); Mercury, 3112,B (BR4 7471 B); Molybdenum, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7481); Nickel, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7520); Selenium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7740); Silver, 3030,E, 3111,B, 3113 B; Zinc, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7950); Cyanide 4500-CN^- E; Volatile Organics, 6210 D; Semi-Volatile Organics, 6410 B; Sulfate, 4500-SO_4^{2-}

8 Bags

6

Trussville WWTP

Jefferson County Commission Environmental Services Department–Barton Laboratory

BIOSOLIDS Sample Collection / Chain of Custody / Request for Analysis

Sample ID: Biosolids		Primary Measuring Device:	
Sample Set-up Date:	Time:	Sampler Type:	
First/Start Sample Date:	Time:	Flow Meter Type:	
Last Sample Date:	Time:	Sample Interval:	
Collection Date: 6/10/14	Time: 0730	Sample Type:	Grab ☒ Composite ☐
Sample Split? Yes ☐ No ☐			{TVVC / TCVC / TCVV}

CHAIN OF CUSTODY

	Date	Time		Date	Time
Ron [signature] Sample Collected by	6/10/14	0730	Ron [signature] Relinquished by	6/10/14	0848
[signature] Received by	6/10.14	0848	[signature] Relinquished by	6/10-14	0938
[signature] Received by	6/10/14	0938	Relinquished by		
Received by			Relinquished by		

MUST BE COMPLETED! Preservation Method: A ☐ B ☐ C ☐ D ☐ by WWTP☐ / by Barton Lab ☐ Time:

REQUEST FOR ANALYSIS

PM = PRESERVATION METHOD:
A –Iced, 4° C.
B –H_2SO_4 to pH < 2
C –HNO_3 to pH < 2
D –NaOH to pH >11

☒	Analyte	Value	Units	PM	Analyst Name
☒	TKN		mg/Kg		
	NH_3-N		mg/Kg		
	Nitrate + Nitrite		mg/Kg		
☒	Percent Moisture		%		R [signature]
☒	Fecal Coliform	0	Col/100mL		R. [signature]
	E. Coli		Col/100mL		
☒	Metals				

☒	Analyte	Value	Units	PM	Analyst Name
☒	Arsenic		mg/Kg		
☒	Cadmium		mg/Kg		
☒	Chromium		mg/Kg		
☒	Copper		mg/Kg		
☒	Lead		mg/Kg		
☒	Mercury		mg/Kg		Enersolv
☒	Molybdenum		mg/Kg		
☒	Nickel		mg/Kg		
☒	Selenium		mg/Kg		
☒	Zinc		mg/Kg		

20140610-07-01

ANALYTICAL METHODS: R2=*EPA-600/4-79-020;* R3=*EPA Method 1664;* BR4=*EPA SW846;* all others ref. *Standard Methods, 21st Ed.* or later. DO, 4500-O C; Conductivity, 2510-B; pH, 4500-H^+ -B; BOD_5, 5210-B; $CBOD_5$, 5210-B; TSS, 2540-D; COD, 5220-D; TKN, *R2* 351.2; NH_3-N, 4500-NH_3-G; Total-P, 4500-P F; *ortho*-P, 4500-P F; TOC, 5310 B; Nitrate, 4500-NO3 H; Nitrite, 4500-NO_2 H; Turbidity, 2130 B; Hardness, 2340 C; Oil & Grease, *R3*, 1664; Arsenic, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7060 A); Cadmium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7130); Chromium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7190); Copper, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7210); Lead, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7420); Mercury, 3112,B (BR4 7471 B); Molybdenum, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7481); Nickel, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7520); Selenium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7740); Silver, 3030,E, 3111,B, 3113 B; Zinc, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7950); Cyanide 4500-CN^- E; Volatile Organics, 6210 D; Semi-Volatile Organics, 6410 B; Sulfate, 4500-SO_4^{2-}

8 Bags

7

Trussville WWTP

Jefferson County Commission Environmental Services Department–Barton Laboratory

BIOSOLIDS Sample Collection / Chain of Custody / Request for Analysis

Sample ID: Biosolids		Primary Measuring Device:	
Sample Set-up Date:	Time:	Sampler Type:	
First/Start Sample Date:	Time:	Flow Meter Type:	
Last Sample Date:	Time:	Sample Interval:	
Collection Date: 6/10/14	Time: 0730	Sample Type:	Grab ☒ Composite ☐
Sample Split? Yes ☐ No ☐			{TVVC / TCVC / TCVV}

CHAIN OF CUSTODY

	Date	Time		Date	Time
Sample Collected by: Ron [signature]	6/10/14	0730	Relinquished by: Ron [signature]	6/10/14	0848
Received by: [signature] Harmon	6/10.14	0848	Relinquished by: [signature] Harmon J.	6/10-14	0938
Received by: [signature]	6/10/14	0938	Relinquished by		
Received by			Relinquished by		

MUST BE COMPLETED! Preservation Method: A ☐ B ☐ C ☐ D ☐ by WWTP☐ / by Barton Lab ☐ Time:

REQUEST FOR ANALYSIS

PM = PRESERVATION METHOD:
A –Iced, 4° C.
B –H_2SO_4 to pH < 2
C –HNO_3 to pH < 2
D –NaOH to pH >11

☒	Analyte	Value	Units	PM	Analyst Name
☒	TKN		mg/Kg		
	NH_3-N		mg/Kg		
	Nitrate + Nitrite		mg/Kg		
☒	Percent Moisture		%		R [signature]
☒	Fecal Coliform	0	Col/~~100mL~~ g		R. [signature]
	E. Coli		Col/100mL		
☒	Metals				

☒	Analyte	Value	Units	PM	Analyst Name
☒	Arsenic		mg/Kg		
☒	Cadmium		mg/Kg		
☒	Chromium		mg/Kg		
☒	Copper		mg/Kg		
☒	Lead		mg/Kg		
☒	Mercury		mg/Kg		Enersolv
☒	Molybdenum		mg/Kg		
☒	Nickel		mg/Kg		
☒	Selenium		mg/Kg		
☒	Zinc		mg/Kg		

20140610007-01

ANALYTICAL METHODS: R2=*EPA-600/4-79-020;* R3=*EPA Method 1664;* BR4=*EPA SW846;* all others ref. *Standard Methods, 21st Ed.* or later. DO, 4500-O C; Conductivity, 2510-B; pH, 4500-H⁺ -B; BOD_5, 5210-B; $CBOD_5$, 5210-B; TSS, 2540-D; COD, 5220-D; TKN, *R2* 351.2; NH_3-N, 4500-NH_3-G; Total-P, 4500-P F; *ortho*-P, 4500-P F; TOC, 5310 B; Nitrate, 4500-NO3 H; Nitrite, 4500-NO_2 H; Turbidity, 2130 B; Hardness, 2340 C; Oil & Grease, *R3*, 1664; Arsenic, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7060 A); Cadmium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7130); Chromium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7190); Copper, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7210); Lead, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7420); Mercury, 3112,B (BR4 7471 B); Molybdenum, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7481); Nickel, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7520); Selenium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7740); Silver, 3030,E, 3111,B, 3113 B; Zinc, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7950); Cyanide 4500-CN^- E; Volatile Organics, 6210 D; Semi-Volatile Organics, 6410 B; Sulfate, 4500-SO_4^{2-}

8 Bags

Trussville WWTP

Jefferson County Commission Environmental Services Department--Barton Laboratory

BIOSOLIDS Sample Collection / Chain of Custody / Request for Analysis

Sample ID: Biosolids		Primary Measuring Device:	
Sample Set-up Date:	Time:	Sampler Type:	
First/Start Sample Date:	Time:	Flow Meter Type:	
Last Sample Date:	Time:	Sample Interval:	
Collection Date: 6/10/14	Time: 0730	Sample Type:	Grab ☒ Composite ☐
Sample Split? Yes ☐ No ☐			{TVVC / TCVC / TCVV}

CHAIN OF CUSTODY

	Date	Time		Date	Time
Sample Collected by: Ron [signature]	6/10/14	0730	Relinquished by: Ron [signature]	6/10/14	0848
Received by: [signature] Harmon	6/10.14	0848	Relinquished by: [signature] Harmon J.	6/10-14	0938
Received by: [signature]	6/10/14	0938	Relinquished by		
Received by			Relinquished by		

MUST BE COMPLETED! Preservation Method: A ☐ B ☐ C ☐ D ☐ by WWTP☐ / by Barton Lab ☐ Time:

REQUEST FOR ANALYSIS

PM = PRESERVATION METHOD:
A --Iced, 4° C.
B --H_2SO_4 to pH < 2
C --HNO_3 to pH < 2
D --NaOH to pH >11

☒	Analyte	Value	Units	PM	Analyst Name
☒	TKN		mg/Kg		
	NH_3-N		mg/Kg		
	Nitrate + Nitrite		mg/Kg		
☒	Percent Moisture	62	%		R [signature]
☒	Fecal Coliform	0	Col/100mL		R. [signature]
	E. Coli		Col/100mL		
☒	Metals				

G.M.

☒	Analyte	Value	Units	PM	Analyst Name
☒	Arsenic		mg/Kg		
☒	Cadmium		mg/Kg		
☒	Chromium		mg/Kg		
☒	Copper		mg/Kg		
☒	Lead		mg/Kg		
☒	Mercury		mg/Kg		Enersolv
☒	Molybdenum		mg/Kg		
☒	Nickel		mg/Kg		
☒	Selenium		mg/Kg		
☒	Zinc		mg/Kg		

2014061007-01

ANALYTICAL METHODS: R2=*EPA-600/4-79-020;* R3=*EPA Method 1664;* BR4=*EPA SW846;* all others ref. *Standard Methods, 21st Ed.* or later. DO, 4500-O C; Conductivity, 2510-B; pH, 4500-H$^+$ -B; BOD_5, 5210-B; $CBOD_5$, 5210-B; TSS, 2540-D; COD, 5220-D; TKN, *R2* 351.2; NH_3-N, 4500-NH_3-G; Total-P, 4500-P F; *ortho*-P, 4500-P F; TOC, 5310 B; Nitrate, 4500-NO3 H; Nitrite, 4500-NO_2 H; Turbidity, 2130 B; Hardness, 2340 C; Oil & Grease, *R3*, 1664; Arsenic, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7060 A); Cadmium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7130); Chromium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7190); Copper, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7210); Lead, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7420); Mercury, 3112,B (BR4 7471 B); Molybdenum, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7481); Nickel, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7520); Selenium, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7740); Silver, 3030,E, 3111,B, 3113 B; Zinc, 3030,E, 3111,B, 3113 B (BR4 3050 B, 7950); Cyanide 4500-CN$^-$ E; Volatile Organics, 6210 D; Semi-Volatile Organics, 6410 B; Sulfate, 4500-SO_4^{2-}

6/10/14 Trussville Biosdids

Barton Laboratory

BIOSOLIDS BACTERIAL ANALYSIS

Analysis Date: 6/10/14

Sample ID: Trussville

Date / Time In: 6/10 / 1100

Sample Date / Time: 6/10/14 / 0730

Date / Time Read: 6/11 / 1200

Lab Analyst: RC/SM

TEST(S) PERFORMED:

Fecal Coliform [X]
Total Coliform [ ]

Fecal Strep [ ]
Other [ ]

Summary of Geometric Mean Calculations:

G. M. = <1 colony per gram of dry solids.

	Dilution Used or mL of Sample	Colonies Counted	% Dry Solids	pH	Colonies Counted X 100 / mL Sample X % Dry Solid	or Log Geometric Mean $\sqrt[N]{(X_1)(X_2)\ldots(X_N)}$
1	.01	0	26		0 / .01x26 = 0	0
2	.01	0	42		0 / .01x42 = 0	0
3	.01	0	24		0 / .01x24 = 0	0
4	.01	0	60		0 / .01x60 = 0	0
5	.01	0	49		0 / .01x49 = 0	0
6	.01	0	20		0 / .01x20 = 0	0
7	.01	0	44		0 / .01x44 = 0	0
8						$\bar{x}$ = ∅
9	Avg%	Solids:	38%			
10	Avg%	Moisture:	62%		G.M. = <1 colony per gram of dry solids.	
Blank	.01	0				

Barton Laboratory

BIOSOLIDS

Coliform Colonies Counted

Date / Time Counted: 6/11 / 1200

Sample ID: Trussville

Sample Date / Time: 6/10/14 / 0730

Lab Analyst: RC/SM

COLIFORM COLONIES COUNTED

% Solids	Sample Number	0.01 mL Filtration	0.001 mL Filtration	0.0001 mL Filtration	0.00001 mL Filtration	0.000001 mL Filtration
	1	0	0	0		
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	Blank	0				

SECTION 5

AGRONOMIC RATE INFORMATION AND CALCULATIONS

AGRONOMIC RATE
BELTONA LAND RECLAMATION SITE

Summary:
The Beltona Land Reclamation Site is a former strip mine site located in northwestern Jefferson County. The Environmental Services Department is assisting the property owner in the reclamation of this site through the land application of biosolids. In the areas that have not received any biosolids applications, no vegetation other than "scrub" vegetation is present and growing. In the areas that have received biosolids applications, Tifton Bermuda and Rye grass has been planted for nitrogen uptake.

The local Agricultural Cooperative Extension Service has recommended a fertilizer rate of 600 lb Nitrogen/Ac/year for the mine reclamation site. These calculations are based on six cuttings of hay each year (four harvests of Bermuda grass and two harvests of Rye grass each year), with 100 lb Nitrogen per acre needed for each cutting.

Agronomic Rate Considerations:

1) The Agronomic Calculations presented in this report are based on an extension bulletin worksheet entitled "Calculating Biosolids Application Rates in Agriculture" (1998), developed by Craig Cogger and Dan Sullivan for the Pacific Northwest. This bulletin uses widely accepted procedures for nitrogen budgeting which are applicable across the United States.

2) During analysis, NH_4^+ -N is often converted to NH_3-N and analytical results are then reported as NH_3-N. Both forms are plant available and this combined analysis does not diminish the quality of the result.

3) There is no additional nitrogen applied to the reclamation site by Jefferson County (no fertilizer or irrigation water).

   Biosolids from the Valley and Village WWTP's are applied with a slinger spreader to each plot on an annual basis throughout the winter months. Village WWTP biosolids are anaerobically digested, mechanically dewatered, and lime stabilized. Valley WWTP biosolids are anaerobically digested and mechanically dewatered.

4) In 2014, biosolids were applied at a rate of **3.4** dry tons/acre.

AGRONOMIC RATE CALCULATIONS – BELTONA LAND RECLAMATION SITE

FORMULA:

Plant Available Nitrogen (PAN) = Available Organic Nitrogen + Inorganic Nitrogen
= [(Organic Nitrogen)(Organic Mineralization Rate)] + [(NH_4)(%NH_4 Retained) + Nitrate]

GIVEN:

- During analysis, NH_4^+ -N is converted to NH_3-N and analytical results are then reported as NH_3-N. This combined analysis does not diminish the quality of the result.
- The TKN, NH_3 and NO_3 results are averages of data available during 2014. All results are reported on a dry-weight basis.

  $TKN_{(average)}$ = 51,583 mg/Kg x 0.002 (converts mg/Kg to lb/dry ton) = 103.2 lb/dry ton
  $NH_{3(average)}$ = 1,893 mg/Kg x 0.002 = 3.8 lb/dry ton
  $NO_{3(average)}$ = 484 mg/Kg x 0.002 = 1.0 lb/dry ton

  Organic Nitrogen = TKN - NH_3 - NO_3 = 103.2 – 3.8 – 1.0 = 98.4 lb N/dry ton

- Calculations for the Beltona site are performed considering both anaerobically digested, dewatered, and anaerobically digested, dewatered, lime stabilized biosolids.

NITROGEN CREDITS FOR PREVIOUS BIOSOLIDS APPLICATIONS:

- Biosolids that were applied from 2010 through 2013 had an average Organic Nitrogen content of 33,437 mg/kg. These biosolids were applied at an average rate of 18 dry tons per acre. Using Table 1 of the Worksheet:

  Nitrogen Credit for 33,437 mg/kg:
  = 8.8 lb PAN per dry ton (years 2-5) x 18 dry tons per acre
  = 158 lb PAN per acre Nitrogen credit

- Tifton Bermuda/Rye grass nitrogen requirements = 600 lb N/Ac/Yr (based on Agricultural Cooperative Extension Service recommendation of six cuttings of hay each year with 100 lb N/Ac needed for each cutting). **With a Nitrogen Credit of 158 lb/acre, approximately 442 lb N/Ac/year is needed from the current applications of biosolids.**

AGRONOMIC RATE CALCULATIONS – BELTONA LAND RECLAMATION SITE

CALCULATIONS:

Anaerobically Digested, Dewatered, Lime Stabilized, Not Incorporated

$TKN_{(average)}$ = 51,583 mg/Kg x 0.002 (converts mg/Kg to lb/dry ton) = 103.2 lb/dry ton
$NH_{3(average)}$ = 1,893 mg/Kg x 0.002 = 3.8 lb/dry ton
$NO_{3(average)}$ = 484 mg/Kg x 0.002 = 1.0 lb/dry ton

Organic Nitrogen = TKN - NH_3 - NO_3 = 103.2 – 3.8 – 1.0 = 98.4 lb N/dry ton

Organic Nitrogen:
Mineralization Rate (Worksheet, Table 3): Anaerobic Digestion, Dewatered = 20% – 40%

Percent of Organic N available in the first year = 30% (average)

Total Organic Nitrogen available in the first year = 98.4 x 30% = 29.5 lb/dry ton

Ammonium Nitrogen:
% NH_4 Retained (Worksheet, Table 2): Incorporated (0-2 Days), Dewatered = 60%,
Incorporated (0-2 Days), Alkaline Stabilized = 10%
Percent of Ammonia retained after application = 54% (weighted average)

Ammonium Nitrogen retained after application = 3.8 lb/dry ton x 54% = 2.05 lb /dry ton

Estimated Plant Available Nitrogen (PAN):
PAN = Available Organic Nitrogen + Inorganic Nitrogen = 29.5 + 2.1 + 1.0 = 32.6 lb N/dt

Agronomic Rate:
442 lb N/Ac/year ÷ 32.6 lb N/dry ton **=** 13.6 dry tons/Acre/year

Biosolids were applied at the Beltona site throughout 2014 at a rate of 3.4 dry tons per acre. As can be seen from the above calculations, and as required by the 40 CFR Part 503 regulations, the anaerobically digested biosolids are being applied at a rate equal to or less than the agronomic rate for the crops grown.

AGRONOMIC RATE
FLAT TOP/BESSIE MINES LAND RECLAMATION SITE

Summary:
The Flat Top/Bessie Mines Land Reclamation Site is also a former strip mine site located in northwestern Jefferson County. The Environmental Services Department is assisting the property owner in the reclamation of this site through the land application of biosolids. At this site, there is currently marginal soil mass present for growing vegetation, and biosolids are being applied to build adequate soil mass. The County intends to contract with a qualified agronomist or soil scientist to evaluate the site and develop a nutrient management plan with site specific agronomic application rates.

Agronomic Rate Considerations:

1) There is no additional nitrogen applied to the reclamation site by Jefferson County (no fertilizer or irrigation water) and there is very little plant available nitrogen currently present at the site.

2) Approximately 56% of the land applied biosolids were anaerobically digested, followed by either mechanical dewatering or drying beds. The remaining biosolids were aerobically digested, followed by either mechanical dewatering or drying beds. Calculations were performed considering the three biosolids treatment and dewatering scenarios.

3) The majority of the anaerobically digested biosolids are not lime stabilized.

4) Biosolids from all plants are incorporated into the soil within six (6) hours of application.

5) In 2014, biosolids were applied on a year-round basis at a rate of **23.6** dry tons/acre.

AGRONOMIC RATE CALCULATIONS – FLAT TOP/BESSIE MINES LAND RECLAMATION SITE

FORMULA:

Plant Available Nitrogen (PAN) = Available Organic Nitrogen + Inorganic Nitrogen
= [(Organic Nitrogen)(Organic Mineralization Rate)] + [(NH_4)(%NH_4 Retained) + Nitrate]

GIVEN:

- During analysis, NH_4^+ -N is converted to NH_3-N and analytical results are then reported as NH_3-N. This combined analysis does not diminish the quality of the result.

- The TKN, NH_3 and NO_3 results are averages of data available during 2014. All results are reported on a dry-weight basis.

  $TKN_{(average)}$ = 51,583 mg/Kg x 0.002 (converts mg/Kg to lb/dry ton) = 103.2 lb/dry ton
  $NH_{3(average)}$ = 1,893 mg/Kg x 0.002 = 3.8 lb/dry ton
  $NO_{3(average)}$ = 484 mg/Kg x 0.002 = 1.0 lb/dry ton

  Organic Nitrogen = TKN - NH_3 - NO_3 = 103.2 – 3.8 – 1.0 = 98.4 lb N/dry ton

- Being a reclamation site, biosolids are applied at a sufficient rate to build soil mass. When soil mass becomes adequate to sustain crop growth, Tifton Bermuda and Rye grass will be planted for nitrogen uptake.

- Calculations will be performed considering three biosolids scenarios: (1) anaerobically digested, dewatered, and lime stabilized, (2) anaerobically or aerobically digested and mechanically dewatered and (3) anaerobically or aerobically digested, mechanically dewatered or drying beds, and incorporated into the soil within six hours of application.

AGRONOMIC RATE CALCULATIONS – FLAT TOP/BESSIE MINES LAND RECLAMATION SITE

CALCULATIONS:

$TKN_{(average)}$ = 51,583 mg/Kg x 0.002 (converts mg/Kg to lb/dry ton) = 103.2 lb/dry ton
$NH_{3(average)}$ = 1,893 mg/Kg x 0.002 = 3.8 lb/dry ton
$NO_{3(average)}$ = 484 mg/Kg x 0.002 = 1.0 lb/dry ton

Organic Nitrogen = TKN - NH_3 - NO_3 = 103.2 – 3.8 – 1.0 = 98.4 lb N/dry ton

Organic Nitrogen:
Mineralization Rate (Worksheet, Table 3): Anaerobic Digestion, Dewatered = 20%-40%
Aerobic Digestion = 30% – 45%
Drying Beds = 15%-30%

Percent of Organic N available in the first year = 29% (weighted average)

Total Organic Nitrogen available in the first year = 98.4 x 29% = 28.5 lb/dry ton

Ammonium Nitrogen:
% NH_4 Retained (Worksheet, Table 2): Incorporated (0-2 Days), Dewatered = 60%,
Incorporated (0-2 Days), Drying Bed = 100%
Incorporated (0-2 Days), Alkaline Stabilized = 10%
Percent of Ammonia retained after application = 68% (weighted average)

Ammonium Nitrogen retained after application = 3.8 lb/dry ton x 68% = 2.58 lb /dry ton

Estimated Plant Available Nitrogen (PAN):
PAN = Available Organic Nitrogen + Inorganic Nitrogen = 28.5 + 2.58 + 1.0 = 32.1 lb N/dt

Application Rate:
8583.90 dry tons/year ÷ 364 acres **= 23.6 dry tons/Acre/year**

As can be seen from the above calculations, **the current biosolids application rate is 23.6 dry tons per acre.**

APPENDIX A

AGRONOMIC RATE
SUPPORTING DOCUMENTATION

ALABAMA
COOPERATIVE
Extension
SYSTEM

Your Experts for Life

Jefferson County Extension Office
2121 Building, Suite 1700
2121 8th Avenue North
Birmingham, AL 35203-2387
Telephone: (205) 325-5342
FAX: (205) 325-5690

November 19, 2003

Mr. David Denard
A-300 Courthouse Annex
716 Richard Arrington Jr. Blvd.
Birmingham, Al 35203

David:

Enclosed is a fact sheet that we based our 600lb/N/ACRE recommendation related to the county's hay production/Bio-solid project.

The reasoning behind the high rate of nitrogen is to maximize forage tonnage which in turn will increase sludge uptake and breakdown.

The yearly fertilization schedule is based on six cuttings using 100lb/N/ac/cutting. The extra cuttings comes from over seeding the Bermudagrass with ryegrass in the fall. The ryegrass can be cut twice, while Bermudagrass is normally cut four times each year.

If you have questions or comments related to this schedule, feel free to give me a call.

Sincerely,

David Hubbard
County Extension Agent

DH/fb

PNW511

Worksheet for Calculating Biosolids Application Rates in Agriculture

By Craig Cogger, Extension Soil Scientist, WSU-Puyallup
and Dan Sullivan, Extension Soil Scientist, Oregon State University

Overview

This bulletin will walk you through the calculations that yield the biosolids agronomic rate. This rate is based on biosolids quality (determined by analytical results), site and crop nitrogen requirements, and regulatory limits for trace element application. In almost all cases, nitrogen controls the biosolids application rate. By calculating the agronomic rate, managers can match the plant-available N supplied by biosolids to crop N needs.

The calculations consist of 6 steps:

1. Collect information on the site and crop, including crop N requirement.
2. Estimate the plant-available N needed from the biosolids application.
3. Collect biosolids nutrient data.
4. Estimate plant-available N per dry ton of biosolids.
5. Calculate the agronomic biosolids application rate on a dry ton basis.
6. Convert the application rate to an “as is” basis.

This bulletin consists of:

- A worksheet with instructions for completing the application rate calculations.
- The same calculations in equation form for those who prefer using equations.
- Tables for calculating trace element loading.

To learn more about the use and management of biosolids as a fertilizer, refer to *Fertilizing with Biosolids*, PNW508, which is the companion to this bulletin.

A Pacific Northwest Extension Publication
Washington • Idaho • Oregon

Worksheet

Step 1. Collect Site Information.

Soil and crop information:

Line No.		Your Information	Example
1.1	Soil series and texture (NRCS soil survey)		Puyallup sandy loam
1.2	Yield goal (grower, agronomist) (units/acre*)		5 tons/acre/yr
1.3	Crop rotation (grower; e.g., wheat/fallow/wheat)		perennial grass
1.4	Plant-available N needed to produce yield goal (fertilizer guide; agronomist) (lb N/acre/yr)		200

Plant-available N provided by other sources:

Line No.		Your Calculation	Example	Units
	Pre-application testing			
1.5	Nitrate-N applied in irrigation water		10	lb N/acre
1.6	Preplant nitrate-N in root zone (east of Cascades)**		—	lb N/acre
	Adjustments to typical soil N mineralization			
1.7	Plowdown of cover or green manure crop**		—	lb N/acre
1.8	Previous biosolids applications (Table 1)		30	lb N/acre
1.9	Previous manure applications		—	lb N/acre
	Grower information			
1.10	N applied at seeding (starter fertilizer)		—	lb N/acre

1.11	**Total plant-available N from other sources** (sum of lines 1.5 through 1.10)		40	lb N/acre

*Yield goals may be expressed as a weight (tons, lb, etc.) or as a volume (bushels).

**Do not list here if these N sources were accounted for in the nitrogen fertilizer recommendation from a university fertilizer guide.

Step 2. Estimate the Amount of Plant-Available N Needed from Biosolids.

Line No.		Your Calculation	Example	Units
2.1	Plant-available N needed to produce yield goal (from line 1.4)		200	lb N/acre
2.2	Plant-available N from other sources (from line 1.11)		40	lb N/acre
2.3	Amount of plant-available N needed from biosolids (line 2.1 – line 2.2)		160	lb N/acre

Step 3. Collect Biosolids Data.

Application Information:

Line No.		Your Information	Example
3.1	Moisture content of biosolids (liquid or solid; see Table 3, pg. 8)		liquid
3.2	Biosolids processing method (see Table 3, pg. 8)		anaerobic
3.3	Method of application (surface or injected)		surface
3.4	Number of days to incorporation of biosolids		no incorporation
3.5	Expected application season		Mar.-Sept.

Laboratory Biosolids Analysis (dry weight basis):

If your biosolids analysis is on an "as is" or wet weight basis, you will need to divide your analysis by the percent solids (line 3.10) and multiply the result by 100 to convert to a dry weight basis.

Line No.		Your Calculation	Example	Units
3.6	Total Kjeldahl N (TKN)*		50,000	mg/kg
3.7	Ammonium N*		10,000	mg/kg
3.8	Nitrate N *, **		not analyzed	mg/kg
3.9	Organic N*** (line 3.6 – line 3.7)		40,000	mg/kg
3.10	Total solids		2.5	percent

*If your analysis is in percent, multiply by 10,000 to convert to mg/kg.

**Nitrate-N analysis required for composted or aerobically-digested biosolids, but not for anaerobically-digested biosolids.

***Organic N = total Kjeldahl N - ammonium N.

Step 4. Estimate Plant-Available N Per Dry Ton of Biosolids.

Convert biosolids N analysis to lb per dry ton:

Line No.		Your Calculation	Example	Units
4.1	Total Kjeldahl N (TKN) (line 3.6 x 0.002)		100	lb N/dry ton
4.2	Ammonium N (line 3.7 x 0.002)		20	lb N/dry ton
4.3	Nitrate N (line 3.8 x 0.002)		not analyzed	lb N/dry ton
4.4	Organic N (line 4.1 – 4.2)		80	lb N/dry ton

Estimate Inorganic N Retained:

4.5	Percent of ammonium-N retained after application (Table 2, pg. 7)		60	percent
4.6	Ammonium-N retained after application (line 4.2 x line 4.5/100)		12	lb N/dry ton
4.7	Calculate biosolids inorganic N retained (line 4.3 + line 4.6)		12	lb N/dry ton

Estimate Organic N Mineralized:

4.8	Percent of organic N that is plant-available in Year 1 (Table 3, pg. 8)		30	percent
4.9	First year plant-available organic N (line 4.4 x line 4.8/100)		24	lb N/dry ton

Plant-available N:

4.10	**Estimated plant-available N** Add available inorganic N and available organic N (line 4.7 + line 4.9)		36	lb N/dry ton

Step 5. Calculate the Agronomic Biosolids Application Rate.

Line No.		Your Calculation	Example	Units
5.1	Amount of plant-available N needed from biosolids (from line 2.3)		160	lb N/acre
5.2	Estimated plant-available N in biosolids (from line 4.10)		36	lb N/dry ton
5.3	Agronomic biosolids application rate (line 5.1/line 5.2)		4.4	dry ton/acre

Step 6. Convert to "As Is" Biosolids Basis.

Desired Units		Your Calculation	Example
Gallons per acre =	(line 5.3/line 3.10) x 24,000		42,240
Acre inches per acre =	(line 5.3/line 3.10) x 0.88		1.55
Wet tons per acre =	(line 5.3/line 3.10) x 100		176

How to Use the Worksheet

Step 1. Collect Site Information.

Soil Series and Surface Soil Texture (Line 1.1)

Find the location on the county NRCS soil survey. Record the series name and surface texture of the predominant soil.

Crop Yield Goal (Line 1.2)

Field records are the best source for crop yield estimates. You can find proven yields for most grain farms from the local Farm Service Agency office. For most other cropping systems, grower records are the only source available. Be sure to note whether the yield records are on an “as is” or dry matter basis. Where field records are not available, you can make first-year estimates for a project using NRCS soil surveys, county production averages, or other local data sources.

A site used repeatedly for biosolids application should have yield data collected each year. Use this accumulated data for determining crop nitrogen requirement. If crop yield data is not kept, you may need to conduct additional monitoring (e.g., post-harvest soil nitrate testing) to be sure biosolids are applied at an agronomic rate.

Yield data is typically not available for grazed pastures because grazing animals consume the crop directly in the field. In these cases omit the yield goal, and go directly to Line 1.4. Estimate plant nitrogen needs from the appropriate pasture fertilizer guide recommendation, based on the level of pasture management.

Crop Rotation (Line 1.3)

Consult with the grower and discuss the range of possible crop rotations. Rotations that include root crops or other crops with a long post-application waiting period are not suitable for Class B biosolids applications.

Plant-Available N Needed to Produce Yield Goal (Line 1.4)

You can estimate plant-available-N needs by referring to university fertilizer guides or consulting a qualified agronomist.

University Fertilizer Guides

Land grant universities (Washington State University, Oregon State University, University of Idaho) publish fertilizer guides that estimate crop nitrogen requirements. Use the fertilizer guide most appropriate for the site and crop. For major crops, guides may cover irrigated or rainfed (dryland) cropping and different geographic areas. Don’t use guides produced for irrigated sites when evaluating dryland sites. When appropriate guides do not exist, consult the local Cooperative Extension or Natural Resources Conservation Service office, or a qualified agronomist for assistance.

Nitrogen fertilizer application rates listed in the fertilizer guides are based on field growth trials under the specified climate and cultural conditions. Growth trial results are averaged over a variety of soil types and years. Note that fertilizer guide recommendations are not the same as crop uptake. This is because the fertilizer guides account for N available from mineralization of soil organic matter and the efficiency of N removal by the crop.

The N rate recommended in fertilizer guides assumes average yields, good management practices, and removal of N from the field through crop harvest or grazing. In terms of satisfying crop N needs, plant-available N from biosolids application is considered equal to fertilizer N.

Agronomist Calculations

Because of the general nature of university fertilizer guides, it may be worthwhile to have a qualified agronomist calculate how much plant-available N is needed for a specific field. Always use the same method to calculate the N requirements. You will need to document your reasons for using agronomist calculations instead of the university fertilizer guide.

Plant-available N provided by other sources (Lines 1.5-1.11)

To make sure there isn't too much nitrogen applied to a crop, you must determine how much nitrogen comes from sources other than biosolids and soil organic matter. These sources of N are grouped into three categories in the worksheet:

- Plant-available N estimated by pre-application testing
- Adjustments to typical soil organic N mineralization (usually obtained from an agronomist)
- Information supplied by the grower

N estimated by pre-application testing (Lines 1.5-1.6)

Irrigation Water
Since the amount of nitrate-N in irrigation water varies, it should be determined by water testing. Irrigation water containing 5 mg nitrate-N per liter will contribute 1.1 pounds of nitrogen per acre inch applied; irrigation water containing 10 mg nitrate-N per liter will contribute 2.3 pounds of N per acre inch.

Preplant Nitrate-N in the Root Zone (east of Cascades)
You can estimate the preplant nitrate-N in the root zone by testing the soil in early spring. Sample in one-foot increments to a depth of at least two feet. University of Idaho Cooperative Extension Service Bulletin No. 704, *Soil Sampling*, is a good reference for soil sampling procedures.

Some fertilizer guides use preplant soil nitrate-N when calculating N fertilizer application rates. If you use these guides, don't count soil test nitrate-N in our worksheet. It has already been accounted for in the recommended fertilizer N rate prescribed in the guide.

Adjustments to typical soil N mineralization (Lines 1.7-1.9)

Nitrogen mineralization is the release of nitrogen from organic forms to plant-available inorganic forms (ammonium and nitrate). Soil organic matter supplies plant-available N through mineralization, but this is accounted for in the fertilizer guides. Sites with a history of cover crops, biosolids applications, or manure applications supply more plant-available N than do sites without a history of these inputs, and biosolids recommendations must be adjusted based on this additional supply of N.

Plowdown of Cover or Green Manure Crops

Green manures and cover crops are not removed from the field, but are recycled back into the soil by tillage. You can get an estimate of the N contributed from this plowdown by referring to the university fertilizer guides, or by estimating the yield and nitrogen concentration of the cover crop. Recovery of green manure N by the next crop ranges from 10-50% of the total N added to the soil by the cover crop. Estimates of plant-available N contributed by green manure crops should be made by a qualified agronomist.

Previous Biosolids Applications

Previous biosolids applications contribute to plant-available nitrogen in the years after the initial application. In the worksheet, they are considered as "N from other sources." We estimate that 8, 3, 1 and 1 percent of the organic N originally applied mineralizes in Years 2, 3, 4 and 5 after application. After Year 5, biosolids N is considered part of stable soil organic matter and is not included in calculations.

Table 1. Estimated nitrogen credits for previous biosolids applications at a site.

	Years After Biosolids Application			
	Year 2	Year 3	Years 4 and 5	Cumulative Years 2, 3, 4 and 5
Biosolids Organic N as applied	Percent of Organic N Applied First Year			
	8	3	1	13
mg/kg (dry wt basis)	Plant-available N released, lb N per dry ton			
10000	1.6	0.6	0.2	2.6
20000	3.2	1.2	0.4	5.2
30000	4.8	1.8	0.6	7.8
40000	6.4	2.4	0.8	10.4
50000	8.0	3.0	1.0	13.0
60000	9.6	3.6	1.2	15.6

In using Table 1, consider the following example. Suppose:

- You applied biosolids with an average organic N content of 30,000 mg/kg
- Applications were made the previous 2 years
- The application rate was 4 dry tons per acre

Table 1 gives estimates of nitrogen credits *in terms of the organic N originally applied.* Look up 30,000 mg/kg under Year 2 and Year 3 columns in the table. The table estimates 4.8 lb plant-available N per dry ton for year 2, and 1.8 lb plant-available N for year 3 (two-year credit of 6.6 lb N per dry ton). To calculate the N credit in units of lb/acre, multiply your application rate (4 dry ton/acre) by the N credit per ton (6.6 lb N/dry ton). The N credit is 26.4 lb plant-available N per acre.

Previous Manure Applications
Previous manure applications contribute to plant-available nitrogen in a similar manner to previous biosolids applications. To estimate this contribution, consult an agronomist.

Information supplied by the grower (Line 1.10)

N Applied at Seeding
For best growth, some crops depend on starter fertilizers (N applied at seeding). These fertilizers usually supply N, P and S. Examples are 16-20-0, 10-34-0. Starters are usually applied at rates that supply 10-30 lb N per acre. Enter all of the N supplied by starter fertilizer on line 1.10 in the worksheet.

Step 2. Estimate Plant-Available N Needed from Biosolids.

Next you will estimate the amount of plant-available N the biosolids must provide. This is the difference between the total plant-available N needed to produce the yield goal (line 1.4) and the plant-available N from other sources (line 1.11).

Step 3. Collect Biosolids Data.

To make the calculation, managers will need the following analyses:

- Total Kjeldahl N (TKN)
- Ammonium-N (NH_4-N)
- Nitrate-N (NO_3-N; composted or aerobically digested biosolids only)
- Percent total solids

If your laboratory results are on an "as is" or wet weight basis, you must convert them to a dry weight basis. To convert from an "as-is" to a dry weight basis, divide your analysis by the percent solids in the biosolids and multiply the result by 100.

Total Kjeldahl N includes over 95% of the total nitrogen in biosolids. In using the worksheet, we will assume that total Kjeldahl N equals total N.

Ammonium-N usually makes up over 95% of the total inorganic N in most biosolids. Ammonium-N includes both ammonia (NH_3) and ammonium (NH_4^+). Depending on your laboratory, results for ammonium-N may be expressed as either ammonia-N or ammonium-N.

Nitrate-N analyses also include small amounts of nitrite. Nitrite concentrations are negligible in biosolids. There may be significant amounts of nitrate in aerobically-digested biosolids or in composts. There is little nitrate in anaerobically-digested biosolids; therefore, nitrate analysis is not needed for these materials.

Determine biosolids organic N by subtracting ammonium-N from total Kjeldahl N (line 3.6 - line 3.7). Percent total solids analyses are used to calculate application rates. Biosolids applications are calculated as the dry weight of solids applied per acre (e.g., dry tons per acre).

Step 4. Estimate Plant-Available N Per Dry Ton of Biosolids.

The estimate of plant-available N per dry ton of biosolids includes:

- Some of the ammonium-N
- All of the nitrate-N
- Some of the organic N

Inorganic N Retained (Lines 4.5-4.7)

Ammonium-N (Lines 4.5-4.6)

Under some conditions, ammonium is readily transformed to ammonia and lost as a gas. This gaseous ammonia loss reduces the amount of plant-available N supplied by biosolids. The following section explains the factors used to estimate ammonia-N retained in plant-available form after application.

Biosolids processing
Some types of biosolids processing cause most of the ammonia-N to be lost as ammonia gas or converted to organic forms before application:

- Drying beds
- Alkaline stabilization at pH 12
- Composting

Application method
Ammonia loss occurs only with surface application. Injecting liquid biosolids eliminates ammonia loss, since the injected liquid is not exposed to the air. Surface applications of liquid biosolids lose less ammonia than do dewatered biosolids. For liquid biosolids, the ammonia is less concentrated and is held as NH_4^+ on negatively-charged soil surfaces after the liquid contacts the soil.

Ammonia loss is fastest just after application to the field. As ammonia is lost, the remaining biosolids are acidified—that is, each molecule of NH_3 loss generates one molecule of H^+ (acidity). Acidification gradually slows ammonia loss. Biosolids that remain on the soil surface will eventually reach a pH near 7, and further ammonia losses will be small. Losses of ammonia after six days on the soil surface are very close to zero.

Days to soil incorporation
Tillage to cover biosolids can reduce ammonia loss by adsorption of ammonium-N onto soil particles.

Table 2 estimates the amount of ammonium-N retained after field application. To use this table, you will need information on biosolids stabilization processes, method of application (surface or injected), and the number of days to soil incorporation.

Table 2. Estimates of ammonium-N retained after biosolids application.

	Surface-applied				Injected
Days to incorporation by tillage	Liquid Biosolids	Dewatered Biosolids	Alkaline-stabilized Biosolids*	Composted or Drying Bed Biosolids	All Biosolids
	Ammonium-N retained, percent of applied				
0 to 2	80	60	10	100	100
3 to 6	70	50	10	100	100
over 6†	60	40	10	100	100

*For alkaline-stabilized biosolids analyzed for ammonium-N before lime addition.
†If biosolids will not be incorporated by tillage, use over 6 days to incorporation.

Nitrate-N (Line 4.3)

We assume 100% availability of biosolids nitrate-N.

Organic N Mineralized (Lines 4.8-4.9)

Biosolids organic N, which includes proteins, amino acids and other organic N compounds, is not available to plants at the time of application. Plant-available N is released from organic N through microbial activity in soil—called mineralization. Mineralization is more rapid in soils that are warm and moist, and is slower in soils that are cold or dry. Biosolids organic N mineralization rates in soil also depend on the treatment plant processes that produced the biosolids.

Use Table 3 to estimate biosolids mineralization rates based on processing. Use the middle of the range presented, unless you have information specific to the site or biosolids that justifies using higher or lower values within the range.

Table 3. First-year mineralization estimates for organic N in biosolids.

Processing	Moisture Content	First-year organic-N mineralization rate
		percent of organic N
Anaerobic digestion	liquid	20–40
Aerobic digestion	liquid	30–45
Aerobic or anaerobic digestion and storage in lagoon > 6 months	liquid	15–30
Anaerobic digestion and dewatering	semi-solid	20–40
Drying bed	solid	15–30
Heat-drying	solid	20–40
Composting	solid	0–20

Step 5. Calculate the Agronomic Biosolids Application Rate.

Perform this calculation using the results of the previous sections, as shown in lines 5.1 through 5.3.

Step 6. Convert Agronomic Biosolids Application Rate to "As Is" Basis.

Use the appropriate conversion factors (given in Table 6) to convert to gallons, acre-inches, or wet tons per acre.

Other considerations for calculations

- **Small acreage sites without a reliable yield history.** Some communities apply biosolids to small acreages managed by "hobby farmers." In many of these cases, there is no reliable yield history for the site, and the goal of management is not to make the highest economic returns. You can be sure of maintaining agronomic use of biosolids nitrogen on these sites by applying at a rate substantially below that estimated for maximum yield.

- **Equipment limitations at low application rates.** At some low-rainfall dryland cropping locations east of the Cascades, the agronomic rate calculated with the worksheet will be lower than can be spread with manure spreaders (usually about 3 dry tons per acre). At these locations, you may be able to apply the dewatered biosolids at the equipment limit, but check with your permitting agency for local requirements.

- **Unavailable soil nitrate (dryland cropping, east of Cascades).** Not all of the nitrate-N determined by testing dryland soils (line 1.6) is available to the crop because chemical extraction of nitrate is more efficient than plant root extraction. This difference becomes significant when soil nitrate concentrations are low (less than 10 mg nitrate N/kg soil) and sampling is done to greater than two feet.

  Recent research has shown that the amount of "unavailable nitrate-N" increases with soil clay content. Use the following formula if you estimate "unavailable nitrate-N" based on soil clay content.

  Unavailable nitrate-N (mg/kg) = percent clay x 0.1

- **Denitrification and immobilization.** Denitrification (the loss of nitrate as gaseous N_2 or N_2O) and immobilization (the loss of nitrate or ammonium by incorporation into organic compounds) can occur following biosolids application. At agricultural sites these losses usually are not included in biosolids loading rate calculations because university fertilizer guides account for average losses due to these processes. Check with your local permitting agency before including denitrification or immobilization losses in the loading rate calculations.

- **Site Specific Inputs.** Biosolids application rates can also be calculated using a more detailed N budget method found in Washington State Department of Ecology publication, *"Managing Nitrogen from Biosolids."* The N budget method allows for more site-specific inputs into the calculation. It will be most valuable when budget components are based on actual site monitoring data. If you do not have detailed site nitrogen data, use the worksheet presented above.

Cumulative Loading of Trace Elements

Under EPA regulations (40 CFR Part 503.13), managers must maintain records on cumulative loading of trace elements *only* when bulk biosolids do not meet EPA Exceptional Quality Standards for trace elements (Table 4).

When required, the steps in tracking trace metals are:

- Obtain biosolids trace element analyses from the wastewater treatment plant database.
- Compute pounds of element per dry ton of biosolids. Multiply mg/kg (dry weight basis) by 0.002.
- Keep records of the amount of biosolids applied to the site each year (in dry tons per acre).
- Compute pounds of element applied per acre. Multiply pounds of element per dry ton by dry tons applied.
- Compare cumulative pounds of element applied with the cumulative loading rate limit (Table 5).

Table 4. Biosolids concentration limits for land application. Source: EPA 40 CFR Part 503.

Element	Symbol	Concentration Limit: Exceptional Quality Standard (EPA Table 3)* *mg/kg*	Concentration Limit: Ceiling Limit (EPA Table 1) *mg/kg*
Arsenic	As	41	75
Cadmium	Cd	39	85
Copper	Cu	1500	4300
Lead	Pb	300	840
Mercury	Hg	17	57
Molybdenum	Mo	**	75
Nickel	Ni	420	420
Selenium	Se	100	100
Zinc	Zn	2800	7500

*EPA Table 3 and Table 1 refer to tables in EPA biosolids rule (40 CFR Part 503).
**Molybdenum Table 3 level is under review by the EPA.

Table 5. Cumulative loading rate limits for bulk biosolids that do not meet EPA-Table 3 criteria and are applied to agricultural land. Source: EPA 40 CFR Part 503.13.

Element	Cumulative Limit (lb/acre)
Arsenic	37
Cadmium	35
Copper	1340
Lead	268
Mercury	15
Molybdenum	*
Nickel	375
Selenium	89
Zinc	2500

*Molybdenum limit is under review by the EPA.

Table 6. Conversion Factors

1%	=	10,000 mg/kg or ppm
	=	20 lb/ton
1 mg/kg	=	1 ppm
		.0001%
		.002 lb/ton
1 wet ton	=	1 dry ton / (percent solids x 0.01)
1 dry ton	=	1 wet ton x (percent solids x 0.01)
1 acre-inch	=	27,000 gallons

The following equations summarize the calculations in the worksheet. You can use them in place of the worksheet. These equations do the same calculation as the worksheet, so you do not have to use both. These equations will give results in dry tons of biosolids per acre. You will still need an additional calculation (Step 6 in the worksheet) to convert to an "as is" basis.

Equations for Calculating Application Rates

$$B_{app} = (N_{need} - N_{other})/B_{pan} \qquad [1]$$

$$B_{pan} = [(TN - AN) * M/100 + AN * R/100 + NN] * C \qquad [2]$$

$$N_{other} = (0.225N_w * W) + \Sigma(N_{ppi} * 2.8 * D_i) + N_{gm} + N_{bs} + N_{man} + N_{start} \qquad [3]$$

Where:

B_{app} is the biosolids application rate in dry tons/acre

N_{need} is the plant-available N needed to produce the crop yield goal in lb/acre

N_{other} is the plant-available N provided by other sources in lb/acre

B_{pan} is plant-available N in the biosolids in lb/dry ton

TN is biosolids total N in mg/kg or percent

AN is biosolids ammonium N in mg/kg or percent

NN is biosolids nitrate N in mg/kg or percent

M is the biosolids organic N mineralization rate in percent (Table 3)

R is the proportion of ammonium N retained in available form in percent (Table 2)

C is the conversion to lb/dry ton for biosolids N. For analyses in mg/kg, C = 0.002; for analyses in percent, C = 20.

N_w is the nitrogen content of irrigation water in mg/kg

W is the irrigation water applied in inches

N_{ppi} is preplant nitrogen in layer i in mg/kg. (Layers must be sampled in 12-inch increments)

D_i is soil bulk density in layer i in g/cm3

N_{gm} is nitrogen from the plowdown of a green manure or cover crop in lb/acre

N_{bs} is nitrogen released from previous biosolids applications in lb/acre (Table 1)

N_{man} is nitrogen released from previous manure applications in lb/acre

N_{start} is nitrogen supplied by starter fertilizer in lb/acre

Pacific Northwest Cooperative Extension Publications are jointly produced by the three Pacific Northwest states—Washington, Oregon, and Idaho. Similar crops, climate, and topography create a natural geographic unit that crosses state lines. Since 1949, the PNW program has published more than 450 titles. Joint writing, editing, and production have prevented duplication of effort, broadened the availability of faculty specialists, and substantially reduced costs for the participating states.

Issued by Washington State University Cooperative Extension, Oregon State University Extension Service, University of Idaho Cooperative Extension System, and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. Cooperative Extension programs and policies comply with federal and state laws and regulations on nondiscrimination regarding race, color, gender, national origin, religion, age, disability, and sexual orientation. Trade names have been used to simplify information; no endorsement is intended. Published April 1999. $1.00

APPENDIX B

VECTOR ATTRACTION REDUCTION STATISTICS

VECTOR ATTRACTION REDUCTION STATISTICS

A summary of the total amount of biosolids land applied from each wastewater treatment plant (WWTP) and the typical vector attraction reduction method used for those biosolids is provided in Tables 1 and 2 below.

Table 1

Flat Top/Bessie Mines Land Reclamation Site
Summary of 2014 Vector Attraction Reduction (VAR) Methods

Jefferson County WWTP	**Amount of Biosolids Land Applied (dry tons)**	Vector Attraction Reduction Method
Cahaba River	1,261.9	Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Five Mile Creek	1,171.9	Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Leeds	233.6	Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Trussville	694.5	Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Turkey Creek	564.5	Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Valley Creek	3,409.1	Option 1: Volatile Solids Reduction by a minimum of 38 percent [503.33(b)(1)] Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Village Creek	1,207.5	Option 6: Addition of Alkaline Material [503.33(b)(6)] Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Prudes Creek	0.0	Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Warrior	42.5	Option 10: Incorporation of Biosolids into the Soil [503.33(b)(10)(i)]
Total Amount of Biosolids Applied at Flat Top:	8,584 dry tons	

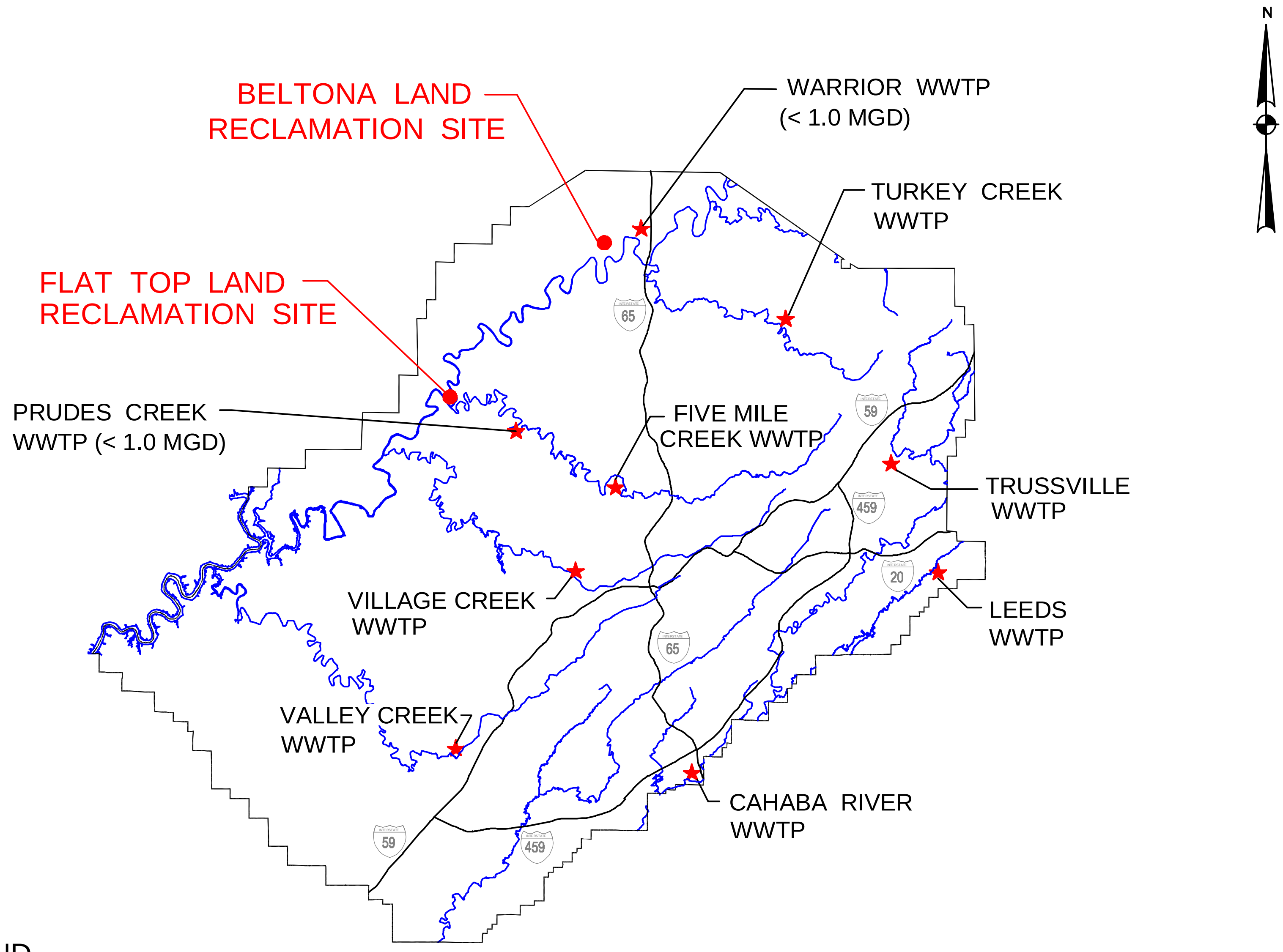
Table 2

Beltona Land Reclamation Site
Summary of 2014 Vector Attraction Reduction (VAR) Methods

Jefferson County WWTP	**Amount of Biosolids Land Applied (dry tons)**	Vector Attraction Reduction Method
Valley Creek	423.0	Option 1: Volatile Solids Reduction by a minimum of 38 percent [503.33(b)(1)]
Village Creek	58.6	Option 6: Addition of Alkaline Material [503.33(b)(6)]
Total Amount of Biosolids Applied at Beltona:	482 dry tons	*12% = Option 6, Lime Addition *88% = Option 1, Volatile Reduction

APPENDIX C

SITE MAPS



LEGEND

★ JEFFERSON COUNTY WWTP

● LAND APPLICATION SITE

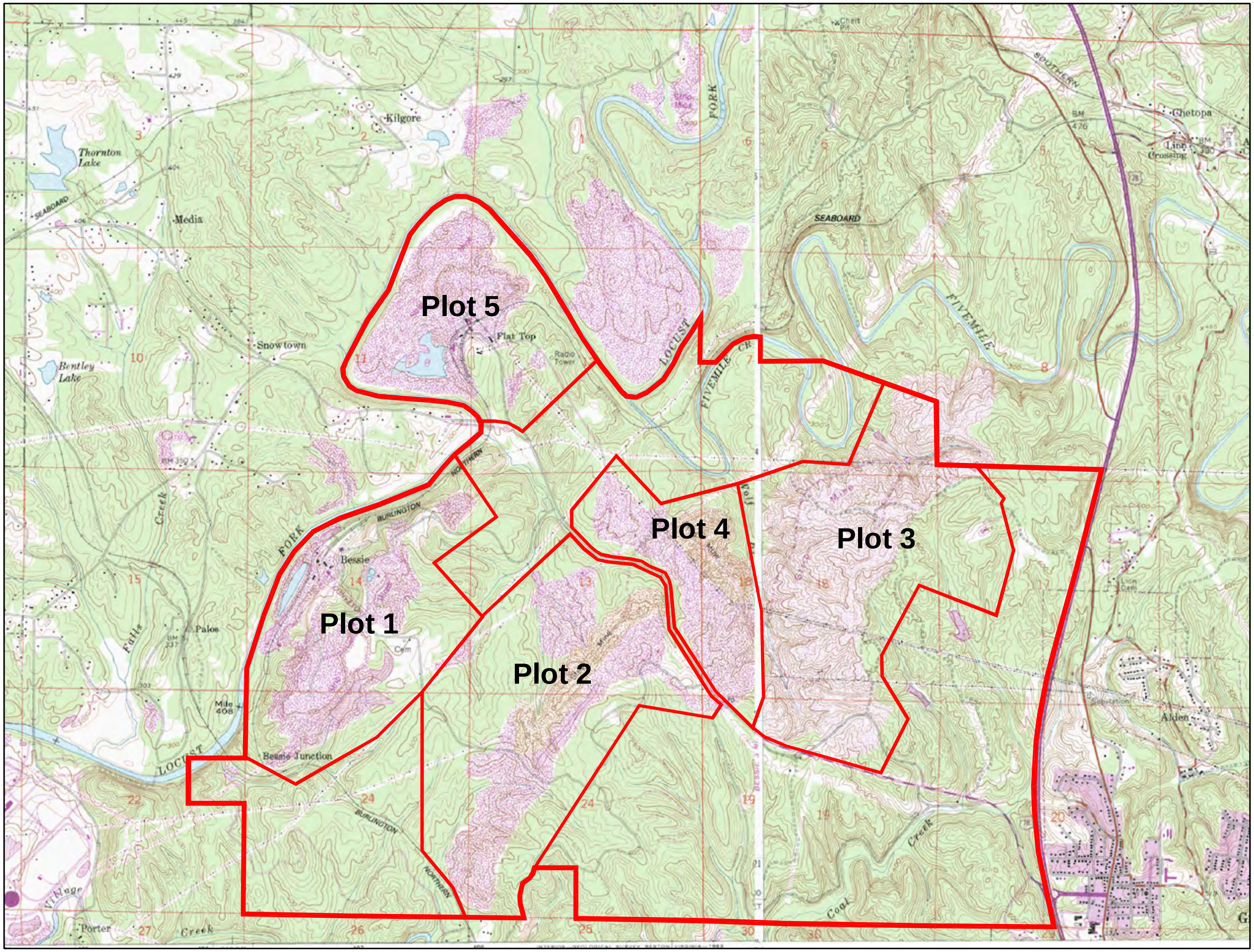
ENGINEERING SERVICE ASSOCIATES, INC.

esa INC.

ENVIRONMENTAL SERVICES DEPARTMENT
JEFFERSON COUNTY, ALABAMA

BIOSOLIDS LAND RECLAMATION PROGRAM

FIGURE 1



Located in: T1 6S, R4W, Sec. 7, 17, 18, 19 and 20
T16S, R5W, Sec. 11, 12, 13, 14, 22 and 23

LEGEND

Project Area

Plot Areas

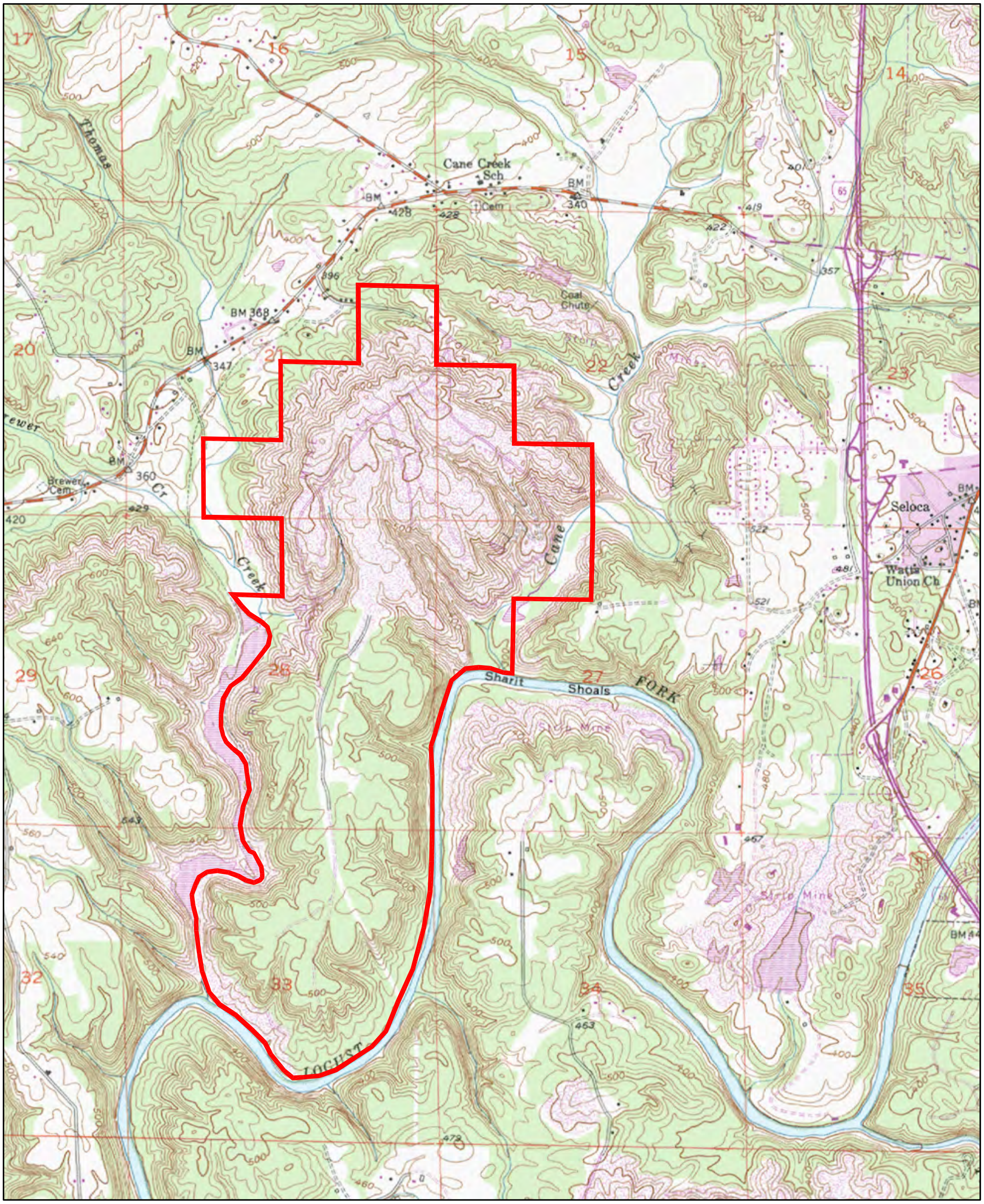
Plot 1 = 568 Acres
Plot 2 = 777 Acres
Plot 3 = 753 Acres
Plot 4 = 289 Acres
Plot 5 = 444 Acres

ENGINEERING SERVICE ASSOCIATES, INC.

FLAT TOP BIOSOLIDS LAND RECLAMATION FACILITY

JEFFERSON COUNTY, ALABAMA

FIGURE 2



Located in: T14S, R3W
Sections 21, 22, 27, 28 and 33

LEGEND

Project Area

ENGINEERING SERVICE ASSOCIATES, INC.

BELTONA BIOSOLIDS LAND RECLAMATION FACILITY

JEFFERSON COUNTY, ALABAMA

FIGURE 3

Jefferson County Environmental Services Department
716 Richard Arrington, Jr. Blvd. N., Suite A300
Birmingham, Alabama 35203
Phone (205) 325-5801
www.jeffcoes.org