Biosolids

5 Year Management Plan

Presented by Ryan Broadhead
Project Manager Nutri-Ject System Inc.

You Have Sludge, So Now What?

- Biosolids Management Plan
- Removal/Clean out
- Land Application
- Reporting
- Design

Biosolids Management Plan

5 Year Biosolids Land Application Plan

- What needs to be in the plan:
  - Sewage sludge sampling schedule and procedures
  - The amount of land required
  - Identification of the land and application methods
  - The names of the owners/operators of all land to be used
  - An overall schedule for the land application of sewage sludge.
  - The types and capacities of the equipment required
  - The volumes and types of storage and handling facilities required
  - A plan to construct or obtain any additional sludge storage, handling or application facilities or equipment which is required

Biosolids Management Plan
Sludge Sampling Schedule

67.4(1) An outline of the sewage sludge sampling schedule and procedures that will be followed to ensure that the sewage sludge being applied to land continues to meet the requirements.

Biosolids Management Plan
Sludge Sampling Schedule

What is the amount of Sludge Produced and applied over a 365 day period

TABLE 2—FREQUENCY OF MONITORING

Amount of sewage sludge per 365-day period dry weight basis	Monitoring Frequency
Greater than 0 but less than 290 metric tons (or 320 English tons)	once per year
Equal to or greater than 290 but less than 1,500 metric tons (320 to 1,653 English tons)	once per quarter (4 times per year)
Equal to or greater than 1,500 but less than 15,000 metric tons (1,653 to 16,535 English tons)	once per 60 days (6 times per year)
Equal to or greater than 15,000 metric tons (or 16,535 English tons)	once per month (12 times per year)

Biosolids Management Plan
Sludge Sampling Ceiling Concentrations

- Sludge Pollutant Testing
- Are you under the ceiling limit
- Nutrient Loadings
- Nitrogen is usually the limiting factor.

TABLE 3—CEILING CONCENTRATIONS

Pollutant	Ceiling Concentration milligrams per kilogram*
Arsenic	75
Cadmium	85
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

*Dry weight basis

Biosolids Management Plan
Cumulative Pollutant Loadings

- In the plan you will need to manage the cumulative loadings of a site.
- Life of a site based up on loadings

TABLE 4—CUMULATIVE POLLUTANT LOADING RATES

Pollutant	Cumulative Pollutant kilograms per hectare	Loading Rate pounds per acre
Arsenic	41	36
Cadmium	39	34
Copper	1500	1335
Lead	300	267
Mercury	17	15
Nickel	420	373
Selenium	100	89
Zinc	2800	2490

Biosolids Management Plan
Determine How Much Land is Needed

67.4(2) A determination of the amount of land required to allow land application to be conducted in accordance with the requirements.

Biosolids Management Plan

Acres needed in the 5 year plan.

67.4 (2) DETERMINATION OF LAND REQUIREMENTS

Population: **20,000 X 40**

---------- **= 400 acres minimum number of acres if applied annually.**

(1 dry ton) **2,000**

EPA typical projection for a population of 20,000 persons = .02875 x population

575 (Dry tons annually)

---------- **= 575 acres**

1 (Dry tons per acre)

- How many acres are needed
- Based upon population
- And Nutrient Level

BIOSOLID APPLICATON DATA NUTRI-JECT SYSTEMS

Searsboro, IA

Step 2-- Determine available nitrogen in this year's sludge

% Organic N =	1.05 % Kjeldahl N*	---	0.075 % Ammonia N*	=	0.975 % Organic N	3	

(* use recent analysis)

	0.975 % Organic N (3)	x	4 Factor I	=	3.9	4	
	0.075 % Ammonia N	x	20 Factor II	=	1.5	5	
	0.01 % Nitrate N	x	20	=	0.2	6	
Available N in Sludge = (lbs N / dry ton)	3.9 4	+	1.5 5	+	0.2 6	=	5.6 Available N

Factor I = 4 for anaerovically digested sludges
6 for aerobically digested sludges
8 for chemically or physically stabilized or unstabilized sludges

Factor II = 10 for surface applied sludges
20 for injected or immediately incorporated sludges

MAXIMUM ALLOWABLE NITROGEN APPLICATION

Crop	Yield per Acre	Pounds per Acre of Nitrogen based on Soil Texture		
		Coarse	Medium	Fine
Corn	75 bushel	100	120	130
	100 bushel	130	150	160
	125 bushel	150	180	190
	150 bushel	180	210	230
	175 bushel	210	250	270
Soybeans	30 bushel	120	140	150
	40 bushel	180	210	230
	50 bushel	230	270	300
	60 bushel	280	340	370
Alfalfa	4 tons	180	210	230
	6 tons	280	340	370
Barley	80 bushel	100	110	120
Bluegrass	3 tons	180	210	230
Oats	75 bushel	80	90	100
	100 bushel	130	150	160
Wheat	50 bushel	100	120	130
	75 bushel	160	180	190

Example: To grow corn on fine textured soil and achieve a yield of 150 bushel/acre, 230 pounds of nitrogen/acre must be applied.

Nutri-Ject Systems, Inc.

PO Box 398
Hudson, IA 50643

Pre-Application Bioslids Field Report

City	**Searsboro, IA**			**Lagoon System**	
Farmer	Pre-Application				
Location					
Dates Applied	**Pre-Application**				
Gallons Total	884,604		Analysis	**11/17/2016**	
Acres	35				
	Lbs / Acre		**N per DT**		
Nitrogen	38.3635		5.6	6.8506	**DT/Acre**
	Lbs / Acre		**Analysis %**		
Phosphorous	25.48		0.186	13701.3	*lbs/acre*
Potassium	37.5		0.274	13701.3	*lbs/acre*
Dry Ton per Acre	6.85			6.5%	*% solids x gal/acre*
LBS per Acre	13701			6.5%	*% solids x gal/acre*
Solids %	6.50%			6.5%	*% solids x total gal*
Total DT	239.8				

	Lbs/Acre	Analysis Mg/kg	11/17/2016	DT / Acre	EPA Ceiling mg/kg
Arsenic	0.1037	7.57	OK	6.850626	75
Cadmium	0.0385	2.81	OK	6.850626	85
Copper	0.9043	66	OK	6.850626	4300
Lead	0.2768	20.2	OK	6.850626	840
Mercury	0.00447	0.326	OK	6.850626	57
Molybdenum	0.0963	7.03	OK	6.850626	75
Nickel	0.3919	28.6	OK	6.850626	420
Selenium	0.0084	0.613	OK	6.850626	100
Zinc	2.4251	177	OK	6.850626	7500

Special comments about project or fields:
All set-backs maintained

Gal/acre	25274
Application Method	injection
MPH	
PH	7.54
Sour Test	1.98%
Coliform Fecal geo mean:	19,915

Cumulatives	None	**EPA Max. Load**
Arsenic		**36 lbs./acre**
Cadmium		**34 lbs/acre**
Copper		**1335 lbs.acre**
Lead		**267 lbs/acre**
Mercury		**15 lbs/acre**
Molybdenum		**66 lbs.acre**
Nickel		**373 lbs./acre**
Selenium		**89 lbs/acre**
Zinc		**2490 lbs/acre**

Soil Map—Poweshiek County, Iowa
(Searsboro, IA)

Warning: Soil Map may not be valid at this scale.

Nutri-Ject Systems, Inc.

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Hudson, IA 50643

Biosolids Field Report

City	Arthur, IA		
Farmer / Land Owner	Daron Siechrecht		
Location	Sec. 23 87N, 39W	NJS Field #1	
Dates Applied	11/14/16 to 12/1/16		2016
Gallons	1,398,567		
Acres	45	Corn to Beans	Analysis 3/28/2016

	Lbs / Acre		Lbs N per DT		
Applied Nitrogen	78.7	*lbs/acre*	10.1218	7.78	DT/Acre

	Lbs / Acre		Analysis %	6/16/15	
Phosphorus	63.9	*lbs/acre*	0.411	15552.07	*Lbs per acre*
Potassium	23.48	*lbs/acre*	0.151	15552.07	*Lbs per acre*
Dry Ton per Acre	7.8			6.0%	*% solids x wet ton/acre*
LBS per Acre	15552.1			6.0%	*% solids x wet ton/acrex2000*
Solids %	6.00%				*% solids x wet ton/acre*
Total DT	349.92				

EPA

	Lbs/Acre	mg/kg				EPA Ceiling mg/kg
Arsenic	0.1435	9.23	*OK*	7.78	*dt/acre*	75
Cadmium	0.0322	2.07	*OK*	7.78	*dt/acre*	85
Copper	3.3592	216	*OK*	7.78	*dt/acre*	4300
Lead	0.8554	55	*OK*	7.78	*dt/acre*	840
Mercury	0.0128	0.82	*OK*	7.78	*dt/acre*	57
Molybdenum	0.0806	5.18	*OK*	7.78	*dt/acre*	75
Nickel	0.2846	18.3	*OK*	7.78	*dt/acre*	420
Selenium	0.0530	3.41	*OK*	7.78	*dt/acre*	100
Zinc	9.2535	595	*OK*	7.78	*dt/acre*	7500

Special comments about project or fields:
2.7 MPH applicator speed

Gallons Per Acre	31079	
Application Method	incorporated	
Ft. per applicator load	Cord System	
MPH	1.2	mph
Coliform Fecal geo mean:	2,187	OK
PH	7.3	OK
Sour Test	1.03	OK

Cumulative	None by NJS	**EPA Max. Load Rate**
Arsenic		**36 lbs./acre**
Cadmium		**34 lbs/acre**
Copper		**1335 lbs.acre**
Lead		**267 lbs/acre**
Mercury		**15 lbs/acre**
Molybdenum		**66 lbs.acre**
Nickel		**373 lbs./acre**
Selenium		**89 lbs/acre**
Zinc		**2490 lbs/acre**

Soil Map—Ida County, Iowa
(City of Arther, IA)

Financial Benefits of Biosolids

City **Arthur, IA**

Land Owner Daron Siechecht

Location Sec. 23, Twp 87N, 39W

Application Dates 11/13/16 to 12/1/2016

Application Method Injection

Total Gallons	1,398,567
Gal. per Acre	31079.3
Total DT	349.9
D.T. Acre	7.8
LBS Acre	15552.1
Total Acres	45

	LBS/Acre	Cost/Acre	Benefit/Ac
Nitrogen	78.71	$0.072	**$5.67**
Phosph	63.92	$1.20	**$76.70**
Potassium	23.48	$0.084	**$1.97**
Copper	3.36	$0.98	**$3.29**
Zinc	9.25	$0.75	**$6.94**
ECCE Lime	0.00	0.006	**0.00**
Calcium	0.00		**0.00**
ENM	0.00		**0.00**

Fertilizer Value	Per Acre	**$94.57**
Avg. Coop Application charge	Per Acre	$3.50
Total Value	Per Acre	**$98.07**

Total Value for **45** Acres **$4,413.35**

Biosolids Management Plan
Identify Land and Application Method

67.4(3) Identification of the land and application methods that will be used for land application of the sewage sludge. Those areas and application methods shall be selected as necessary to ensure that land application can be conducted in accordance with the requirements.

Land Application

- Analysis
- Pre-application
- Acquire land
- Notify the DNR
- Proper application
- Spill prevention plan
- Project report
- Field report

Surface or Injection

- Does it Meet Vector Attraction Standard?
  - Can it be surface applied
    - SOUR < 1.51
    - Reduction of VS >38%
    - PH Stabilized
      - PH of +12 for 2 hours
      - PH of +11.5 for 22 hours
- Injection or Incorporation is easiest way to meet Vector Attraction

Tanker Hauling and Applicator Tank Application

Umbilical Cord Application

Dry Cake Spreading

Biosolids Management Plan
Land Owners and Locations

67.4(4) The names of the landowners and the applicators for all areas to be used for land application, and identification of any legal arrangements related to the use of these areas. The programs shall also outline any restrictions or special conditions that exist regarding the use of these areas for land application of sewage sludge.

Biosolids Management Plan
Land Owners and Locations

67.4 (4) NAMES AND ADDRESSES OF OWNERS OF LAND TO BE USED FOR LAND APPLICATION; IDENTIFICATION OF ANY LEGAL ARRANGEMENTS RELATIVE TO LAND USE; RESTRICTIONS OR SPECIAL CONDITIONS WHICH EXIST REGARDING USE OF AREAS FOR LAND APPLICATION.

A.) Site Location: Johnson County, Penn Township, Section 23

Owner: Clint Rarick
2736 360th. St. SW
Oxford, IA 52322-9368
319-545-2431
Legal Description: SW, NW 1/4 sec. 23, 22 T80N, R7W
Acres: 250 **Crops Planted:** Corn, Soybean rotation

B.) Site Location: Johnson County, Penn Township, Section 16

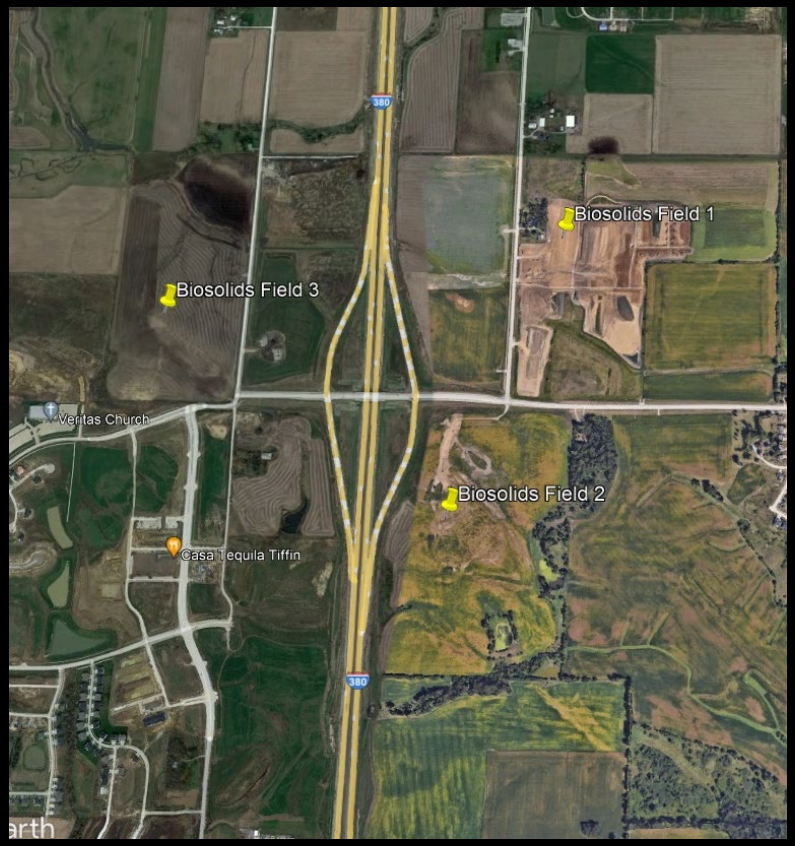
Owner: Clint Rarick
2736 360th. St. SW
Oxford, IA 52322-9368
319-545-2431
Legal Description: SW, NW 1/4 sec. 16. T80N, R7W
Acres: 200 **Crops Planted:** Corn, Soybean rotation

C.) Site Location: Johnson County, Penn Township, Section 8

Owner: Clint Rarick
2736 360th. St. SW
Oxford, IA 52322-9368
319-545-2431
Legal Description: SW, NW 1/4 sec. 8. T80N, R7W
Acres: 55 **Crops Planted:** Corn, Soybean rotation

D.) Site Location: Johnson County, Penn Township, Section 22
Owner: Clint Rarick
2736 360th. St. SW
Oxford, IA 52322-9368
319-545-2431
Legal Description: E 1/2, SE 1/4 of Section 22 T80N and R7W
Acres: 160 **Crops Planted:** Corn, Soybean rotation

E.) Site Location: Johnson County, Washington Township, Section 4



Biosolids Management Plan

Relationship with local farmers:

- What is their crop rotation
- Do they grow crops like wheat or silage that have a different growing season?
- Are they no till?
- Ultimately it's their land, they will have to live with it when you are done.

Biosolids Management Plan

Possible Restrictions

Is land in a flood zone?

- What type of flood zone?
  - 100 year
  - 500 year
  - 25 year
- Can your sludge be applied in a flood zone?

Biosolids Management Plan
Schedule of Application

67.4(5) An overall schedule for the land application of sewage sludge. This schedule shall indicate the areas being used, the time of year that land application will occur on each area, and the estimated application rate for each area.

Biosolids Management Plan
Schedule of Application

When and Where

67.4 (5) SCHEDULE FOR LAND APPLICATION OF BIOSOLIDS; AREAS TO BE USED, TIME OF YEAR OF APPLICATION ON EACH AREA, PROPOSED APPLICATION RATE FOR EACH AREA.

The City of and their biosolids contractor shall determine, based upon logistics and cropping needs as to which farms will be applied on a biannual basis.

Biosolids Management Plan
Types and Capacity of Equipment

67.4(6) A determination of the types and capacities of the equipment required for land application of sewage sludge in accordance with the developed application schedule. The program shall also outline how the application equipment will be made available and who will be responsible for conducting land application operations.


Nute Ject
Systems Inc
HUDSON, IA.
"THE PROBLEM SOLVERS"
CASE


Waste Ject
Systems, Inc.
HUDSON, IA.


BALZER
CAT


62403E
DSC
239684
CAUTION
H2S


JOHN DEERE
Farmstar


NUTRI-JECT
SYSTEMS, INC
CASE INTERNATIONAL
KUHN
KNIGHT
SLINGER
8132


NUTRI-JECT
SYSTEMS, INC.
CASE INTERNATIONAL
7140
KUHN
SLINGER
8132

Biosolids Management Plan

Types and Capacity of Equipment

Biosolids Transportation?

Dump Truck

Tanker

Umbilical Cord

Drying Beds


621B
CASE

Biosolids Management Plan
Storage Needs

67.4(7) A determination of the types and capacities of sludge storage structures used to ensure that the land application of sewage sludge is conducted in accordance with the land application schedule. The program shall also outline whether any additional sludge storage or handling facilities are needed.

Biosolids Management Plan

Storage Needs?

Lagoon

Cake Storage Building

Wet Storage

Drying Beds

Biosolids Management Plan
Maintenance or Construction

67.4(8) A plan to construct or obtain any additional sludge storage, handling or application facilities or equipment that are required by the land application program.

Biosolids Management Plan

Increased Capacity Need a Cleanout?

Periodic sludge judge to determine levels

Biosolids Management Plan

Other Things to Think about

Lagoon Survey to assist in Asset Management

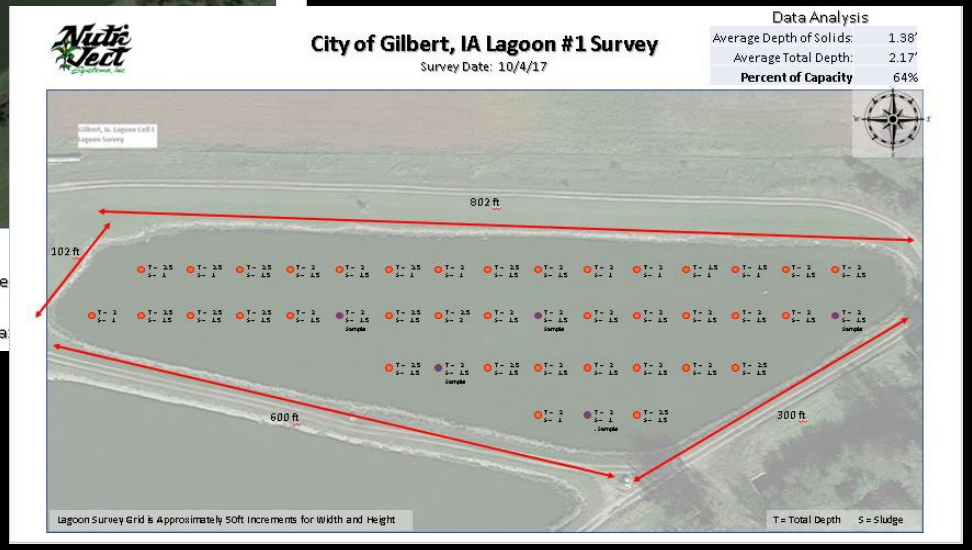
Nutri-Ject Systems Lagoon Survey
City of Gilbert Lagoon System

- Completed on: 10/4/17
- 298 unique depth tests on 4 Lagoons
- By Ryan Broadhead

Nutri Ject SYSTEMS, INC.

Local leader in the biosolids Industry and national recognized for our commitme

515 5th St, Hudson, IA 50643 Office: 319-988-4205 Fa



Removal and Cleanout

What Does this Look Like

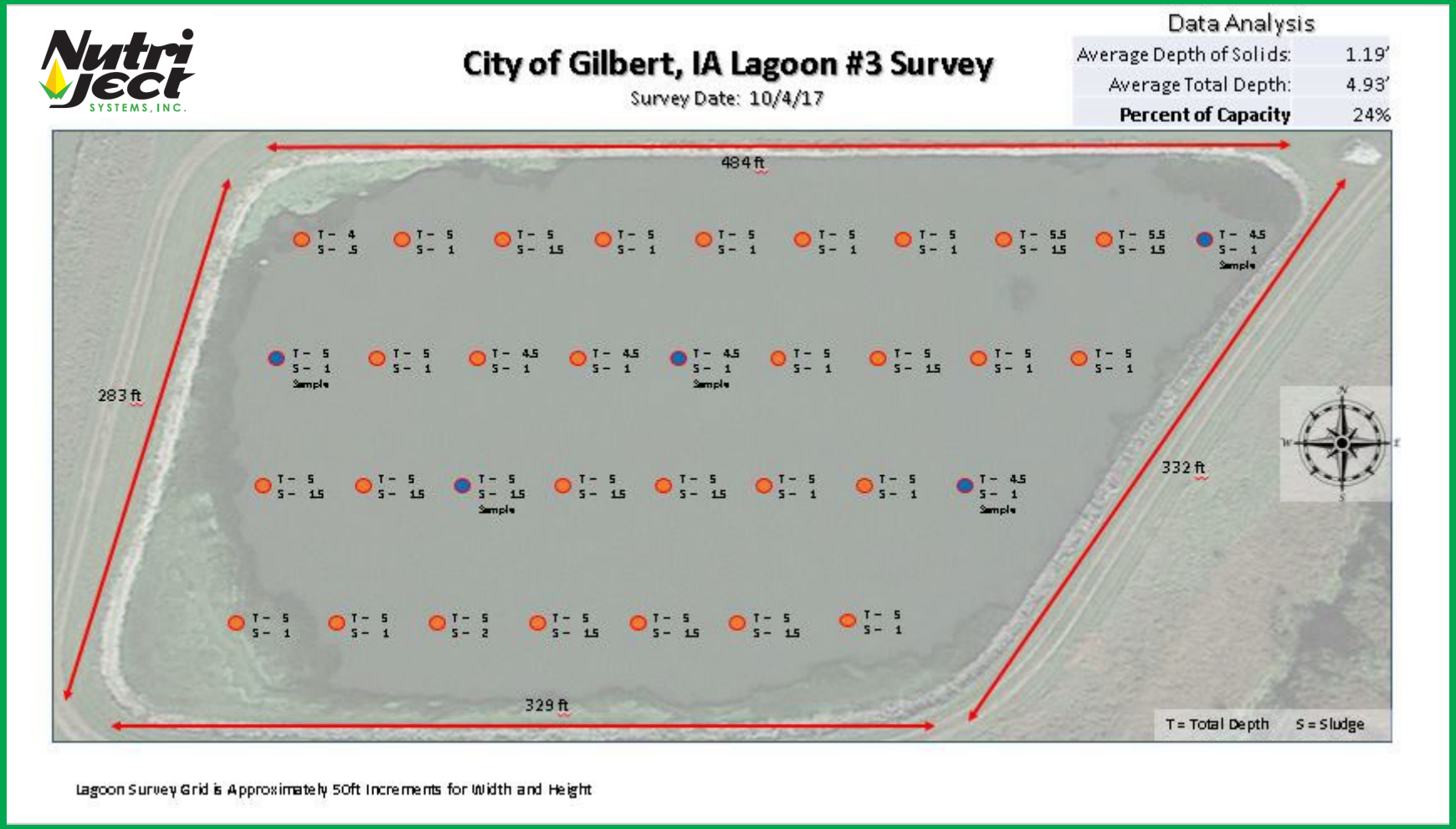
- When to clean Lagoon, Digester or Storage
  - Islands at the inlet
  - Test results, TSS, BOD
  - Detention Times IE: Lack of
  - Construction Project
  - Storage is full
  - Exceeding your permit
  - Broken Lagoon System

IDNR/EPA BIOSOLIDS RECORDKEEPING

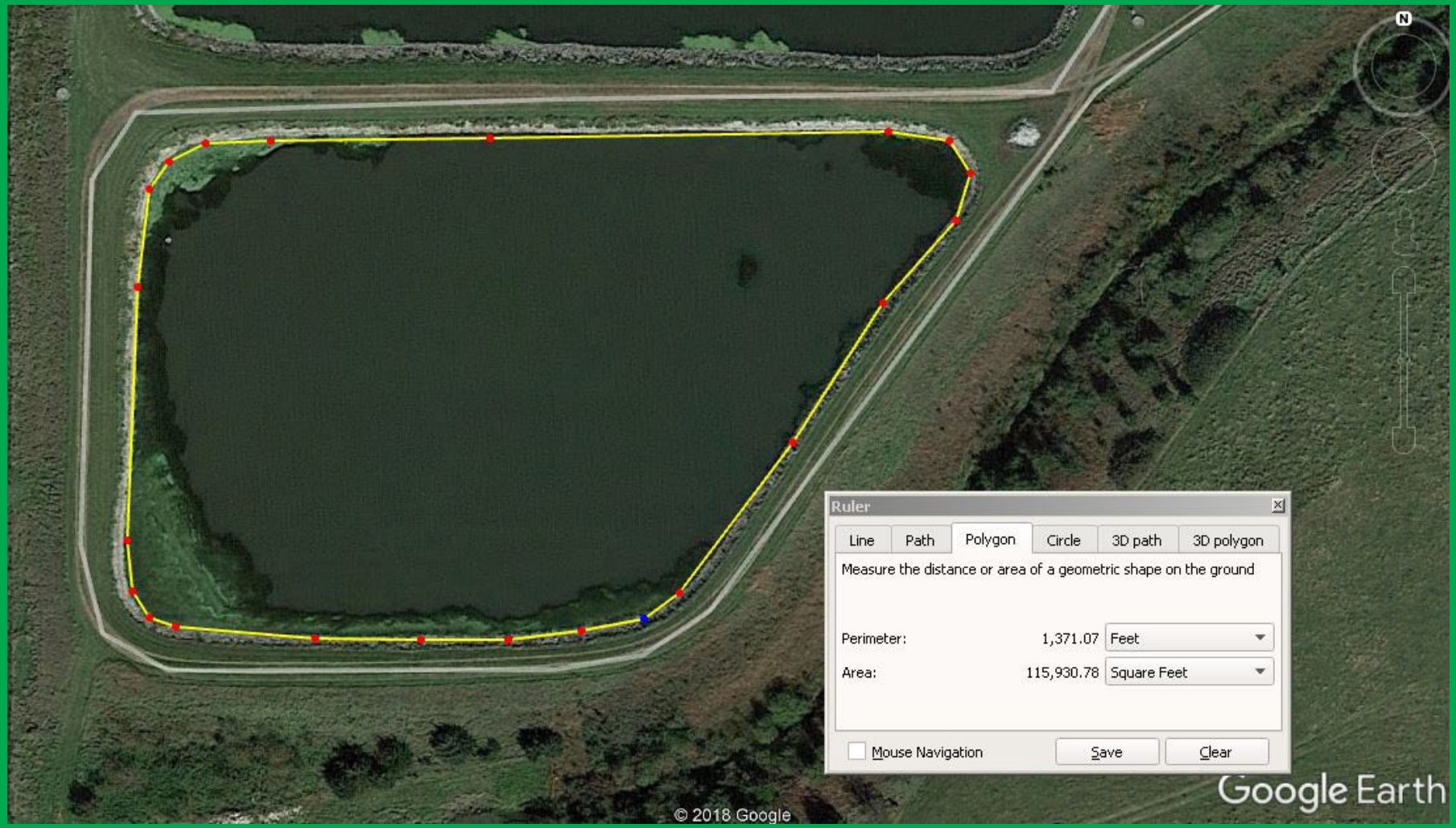
Analyze For	Chapter 67/503 Limits
• N,P,K	
• Arsenic	75 mg/kg
• Cadmium	85 mg/kg
• Chromium	3000 mg/kg
• Copper	4300 mg/kg
• Lead	840 mg/kg
• Mercury	57 mg/kg
• Molybdenum	75 mg/kg
• Nickel	420 mg/kg
• Selenium	100 mg/kg
• Zinc	7500 mg/kg

*Pathogens 7 samples check for geometric mean of the samples has to be less than 2,000,000

Figuring volumes



Figuring volumes



Once the land is located

- Figure acreage minus any setbacks
- Check soil survey for structure of the soil
- Crop to be planted and tillage practice
- Figure over carryover Nitrogen from all sources including from manure, soybeans, etc.
- Check soil ph must be a minimum of 6.0
- One soil sample per (10) acres
- IDNR notification and plan of operations

Methods of Removal

- Mudcat dredge - when and why
- Push cat and lagoon pump
- Pit Pump out

Dredge Removal


DEMAG

Pushcat Removal


CAT
CATERPILLAR


Wendler
JOHN DEERE
8300


VERSATILE

Reporting/Record Keeping

Who Needs Them and Why

- Reports needed
  - 503 Land app Sample Testing Results
  - Pre-application Report
  - Soil Sample Results
  - Field Reports detailing where and how much was applied
  - Farmer Field Reports
  - Fertilizer Benefit Report (optional)
  - Certification Statement
  - Field Maps

Final reporting

- Farmer
- City
- IDNR
- Other interested parties

Reporting/Record Keeping

- “Keep your records for a minimum of 5 years!”
- Annual report is due by Feb. 19th for those plants with a design flow of 1,000,000 MGD serving 10,000 population

Fun With Pictures

The

Don'ts

Don’t Forget to Plan for Unexpected Surprises

- Broken aeration
- Unseen infrastructure
- Baffle Curtains that need attention
- Lagoon Bottoms that may need attention
- Struvite Removal
- Pipe repairs

Don’t Apply incorrectly

- Stay in side your set backs
- Stay away from
  - Waterways
  - Open Water
  - Tile inlets
  - Well Heads
  - Property lines
  - Structures
- Do not abuse the land you will lose your greatest partner (the Landowner)


7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
MADE IN CHINA


SP MO16


MADE IN CHINA


05/13/2009 06:52 PM


05/13/2009 06:59 PM

The Just Flat out Don'ts


GLAD
STRENGTH


CASE IH


CASE IH
MX2


Champion Crane


MELLER
EXCAVATING & ASPHALT
CATERPILLAR


CAT


CAMEL


340


RAIZER

What We are Working to Save

Questions?

WATCH IT GROW!

IMPROVING SOIL NATURALLY

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