



NUTRIENT MANAGEMENT PLAN DEVELOPMENT AND IMPLEMENTATION



What is a Nutrient Management Plan

The objective of the Nutrient Management Plan is to ensure livestock **manure**, including bedding, litter, waste feed and process wastewater, and runoff from livestock areas **is land applied to crop or grass land at a rate the nutrients will be utilized by the vegetation grown.** The manure shall be handled in a manner so as not to impact waters of the state, **exceed air quality standards** while it is stored on site, and **minimize odors to residences or public areas during land application.**

- North Dakota Livestock Program Design Manual

NMPs Need

- Type of livestock
- # of days/year on site
- Estimate of manure production
- Duration of manure storage
- Crop rotation
- Soil/manure test results
- Recommended fertilizer rates
 - North Dakota Livestock Program Design Manual
- Map of application and mark sensitive areas

NMPs Need

- Duration of manure storage
- 270 days or between empty frequency “whichever is longer.”
 - Application Frequency
 - Raw Manure/Compost
- Map of application and mark sensitive areas

Manure Production

Animal Type and Production Grouping	Total Manure ¹		Moisture ²	Total Solids	Volatile Solids	N	P	K
	lbs/day-animal	ft ³ /day-animal	% wet basis	-----lbs/day-animal-----				
Beef								
Finishing cattle	64	1	92	5	4.2	0.36	0.05	0.25
Confined cow^{3, 4}	-	-	88	15	13	0.42	0.097	0.3
Confined growing calf	50	0.81	88	6	5	0.29	0.055	0.19
Dairy								
Lactating cow	150	2.4	87	20	17	0.99	0.17	0.23
Dry cow	83	1.3	87	11	9.2	0.5	0.066	0.33
Heifer (970 lb)	48	0.78	83	8.2	7.1	0.26	-	-
Horse⁵ (1,100 lb)								
Sedentary	56	0.9	85	8.4	6.6	0.2	0.029	0.06
Intensive exercise	57	0.92	85	8.6	6.8	0.34	0.073	0.21
Poultry								
Layer	0.19	0.0031	75	0.049	0.036	0.0035	0.0011	0.0013
Swine								
Gestating sow (440 lbs)	11	0.18	90	1.1	0.99	0.071	0.02	0.048
Lactating sow⁶ (423 lbs)	25	0.41	90	2.5	2.3	0.19	0.055	0.12
Boar (440 lbs)	8.4	0.13	90	0.84	0.75	0.061	0.021	0.039

¹Total manure is calculated from total solids and manure moisture content

²As excreted manure moisture contents range from 75 to 90 percent. At these moisture levels as excreted manure has a density equal to that of water and specific gravity 1.0 was assumed in calculation of manure volume.

³Solids estimates do not include solids in urine.

⁴Beef cows values are representative of animals during non-lactating period and first six months of gestation.

⁵These values apply to horses 18 months of age or older that are not pregnant or lactating. The representative number applies to 1,100 lb horses and the range represents horses from 880 to 1320lbs. "sedentary" applies to horses not receiving any imposed exercise.

⁶Nitrogen and phosphorus values include contribution of nursing pigs.

Adapted from ASABE Standard D384.2

Typical Manure Analysis

	-----lbs/ton-----				
Solid Manure Type	Total N	P₂O₅	K₂O	NH₄	NO₃
Beef (142 Samples)	16.0	7.1	14.5	0.8	0.6
Beef Range	6.7 - 64.8	1 - 21.6	0.9 - 63.2		
Composted Beef (10 Samples)	16.6	13.0	14.3		
Composted Beef Range	8- 36	5 - 20.2	9 - 19.8		
Sheep (3 Samples)	22.0	14.2	40.8		
Turkey (92 Samples)	44.3	41.6	27.4		
Equine (5 Samples)	9.4	9.9	24.9		
	-----lbs/1000gallons-----				
Liquid Manure Type	Total N	P₂O₅	K₂O	NH₄	NO₃
Swine (17 Samples)	21.9	12.5	13.2	12.8	1.5
Swine Range	10.6 - 41.1	1.2 - 85.5	5 - 23.5		
Dairy (19 Samples)	19.5	6.7	12.5	9.6	0.1
Dairy Range	8 - 40	0.2 - 14.2	1.7 - 24.2		
Beef Containment Pond (7 Samples)	2.3	1.7	11.2	0.3	0.1
Swine Containment Pond (3 Samples)	4.7	1.1	8.0		
Dairy Containment Pond (2 Samples)	3.3	0.5	3.3		
Data collected from NDSU Soil Testing Lab.					

Manure

- 50% Total N Mineralized 1st Year
- 80% Total P Mineralized 1st Year
- 90% Total K Mineralized 1st Year

Compost

- 20% Total N Mineralized 1st Year
- 30% Total P Mineralized 1st Year
- 30% Total K Mineralized 1st Year

Manure Nutrient Balancing

- **Type of livestock**
 - 700 Finishing Beef
- **# of days/year on site**
 - 365
- **Estimate of manure production**
 - Beef Feeding Operation Siting and Design Basics (NM-1155)
 - 64 lbs/day = 8,176 tons/year
 - 16 lbs N/ton = 130,816 lbs N/year
 - 7.1 lbs P/ton = 58,050 lbs P/year
 - 14.5 lbs K/ton = 118,882 lbs K/year
- **145lbs N/14 ton Corn Silage =452 acres**
 - 18 tons/acre, 128lbs P/acre

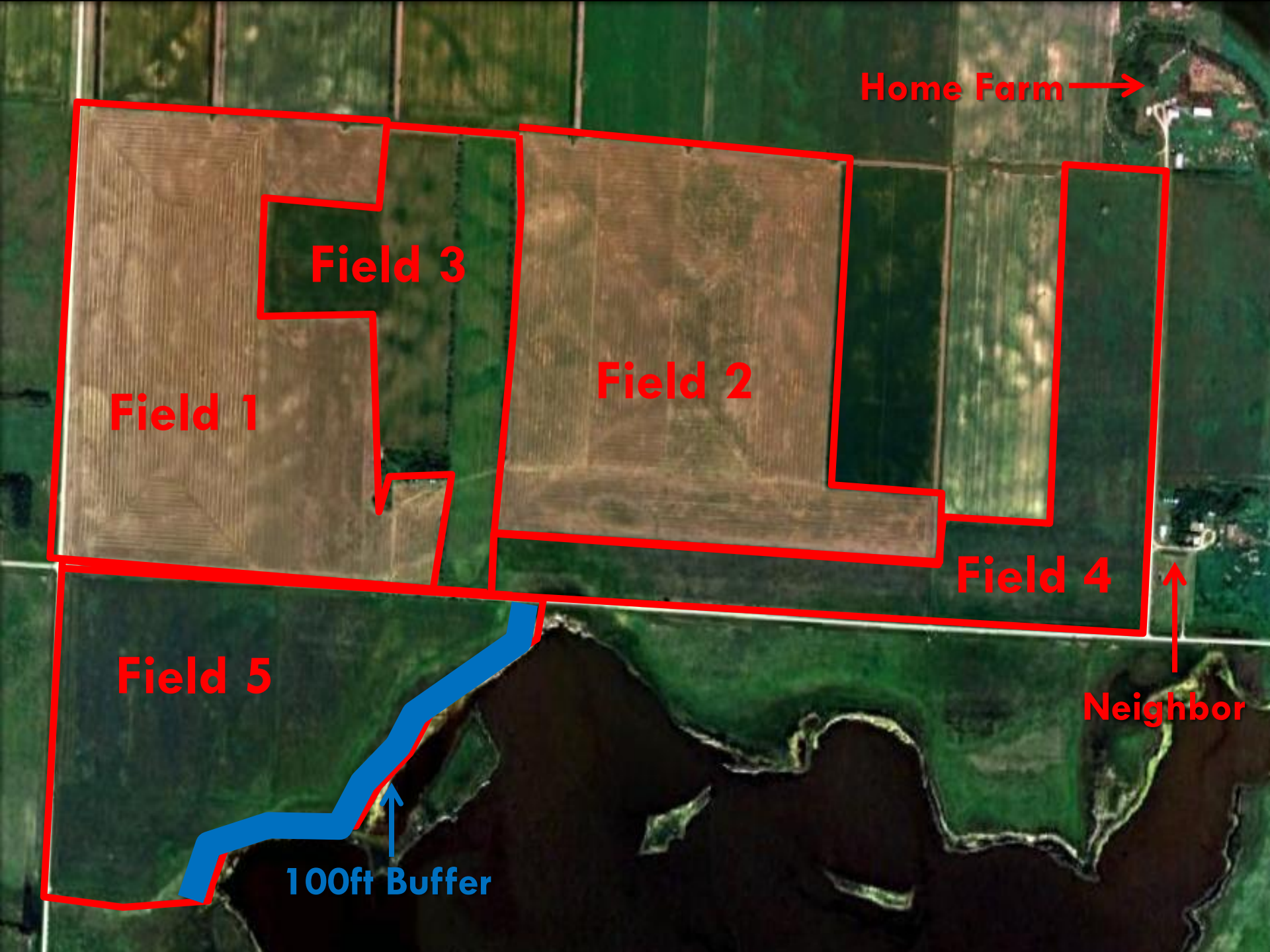
Prioritizing Fields

- Soil fertility
 - Apply N for crop needs
 - Corn does well with manure
 - Monitor PI
 - Do not apply manure on fields $125 \geq$ ppm P
- Crop sequence
- Proximity to neighbors
 - Be courteous about timing
 - Incorporate w/in 24 hours of application
- Proximity to surface waters
 - At least 100ft away from surface waters unless 35ft buffer strip or if buffer is deemed not necessary

Prioritizing Fields

	Field 1	Field 3	Field 2	Field 4
N (lbs/ac)	28	42	0	21
P ₂ O ₅ (ppm)	8 (Med)	13 (Med-High)	22 (High)	55 (High)
K ₂ O (ppm)	181	90	121	354
Crop/Yield Goal	Corn Silage (18ton/ac)	Corn Silage (18 ton/ac)	Alfalfa (5ton/ac)	Pasture (2ton/ac)
Required N (lbs/ac)	157	143	0	29
Required P (lba/ac)	67	41	0	0
Required K (lbs/ac)	0	0	0	0

- Recommended fertilizer rates
 - North Dakota Fertilizer Recommendation Tables and Equations SF-882



Home Farm →

Field 3

Field 1

Field 2

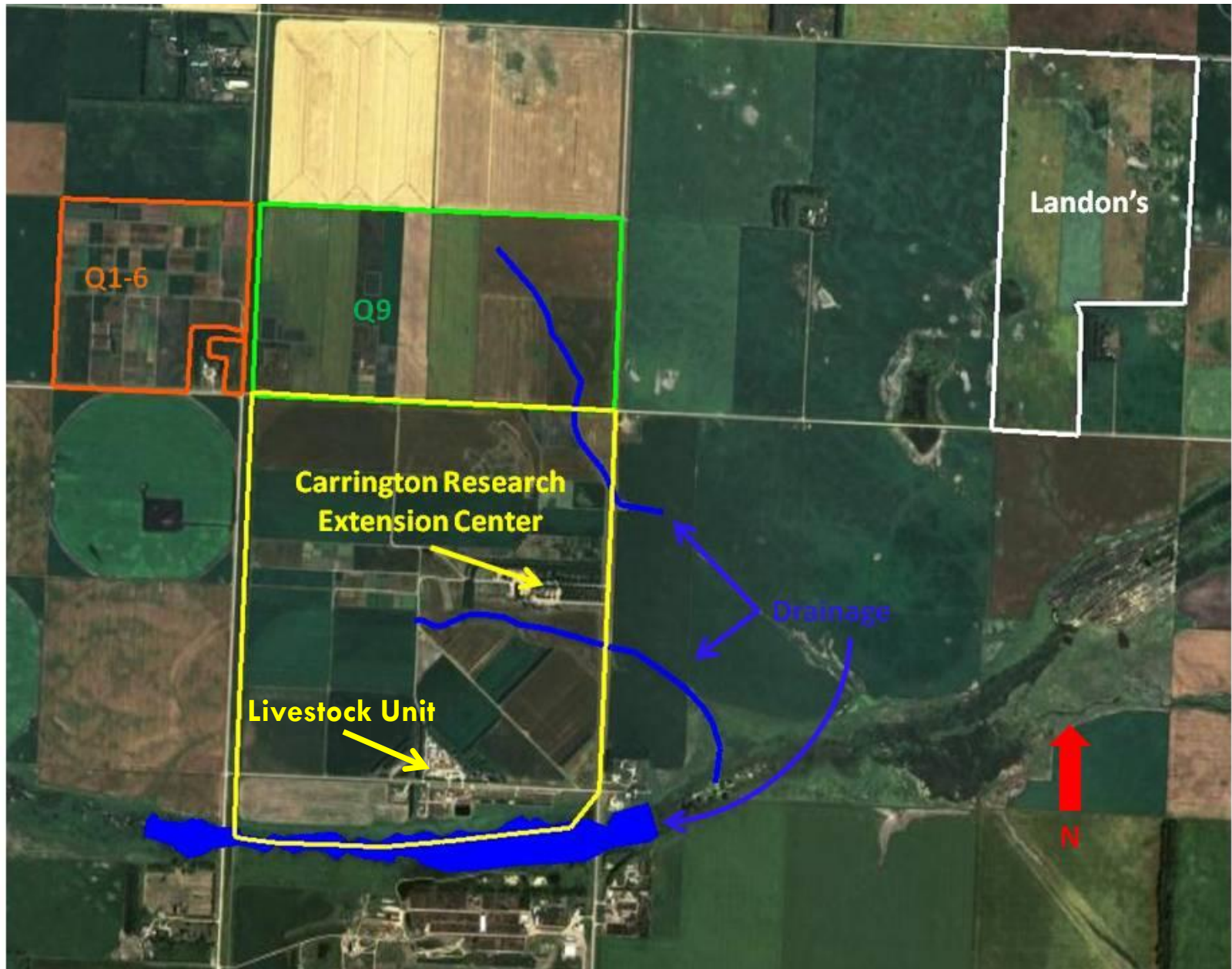
Field 4

Field 5

Neighbor ↑

100ft Buffer ↑

Map of Application and Sensitive Areas



Map of Application





Field 1

CREC



Field 14a

Field 14b

**Field 17
& 16**

Livestock Unit

© 2009 Europa Technologies

Image USDA Farm Service Agency

© 2009 Google

Jun 15, 2005 47°30'32.23" N 99°07'36.63" W elev. 1562 ft

Sampling Manure

- Collect 10-15 subsamples
- Mix
- Package
 - Leave 1 inch of air space
- Account for differences
 - Animals, Storage Facilities, Age
- Keep samples cool/freeze
- Send samples on Monday

Manure/Soil Testers

- NDSU Soil Science Department
 - <http://www.soilsci.ndsu.nodak.edu/services/Testing/soiltesting/soiltesting.html>
 - 701-231-9589
- Agvise
 - <http://www.agviselabs.com/>
 - 701-587-6010
- DHIA
 - <http://www.stearnsdhialab.com/>
 - 800.369.2697
- Manure Test Cost \$25-50
- Soil Test Cost \$10-40

Spreader Calibration

- Reduces Pollution Potential
- Ensures Proper Application
- Meet Yield Goals
- Sheet Method
- Axle Weight Method
- Manure Spreader Calibration for Nutrient Management Planning (NM-1418)
ndsu.edu/nm



SHEET METHOD

$$\text{Tons/acre} = \frac{\text{lbs of Manure on Sheet} \times 21.8}{\text{Plastic Sheet ft}^2}$$

- 8' x 2' 8.75"
- 7' x 3' 1.25"
- 6' x 3' 7.5"
- 5' x 4' 4.25"



SHEET METHOD



Materials

- Bucket, Scale, Sheet

- Weigh empty bucket and sheet
- Lay out the sheet



•Anchor sheet





•Measure square feet of sheet

118
119
120
121
122
123
124
125

- Record tractor gear, engine RPM, and spreader settings
- Apply the manure





**•Weigh the manure covered sheet
in the bucket**



AXLE WEIGHT METHOD

Materials

- 100ft tape measure or measuring wheel & truck scale



- Weigh manure loaded spreader



- **Record tractor gear, engine**
- **Apply manure**



- Measure the area of application
- Weigh empty spreader



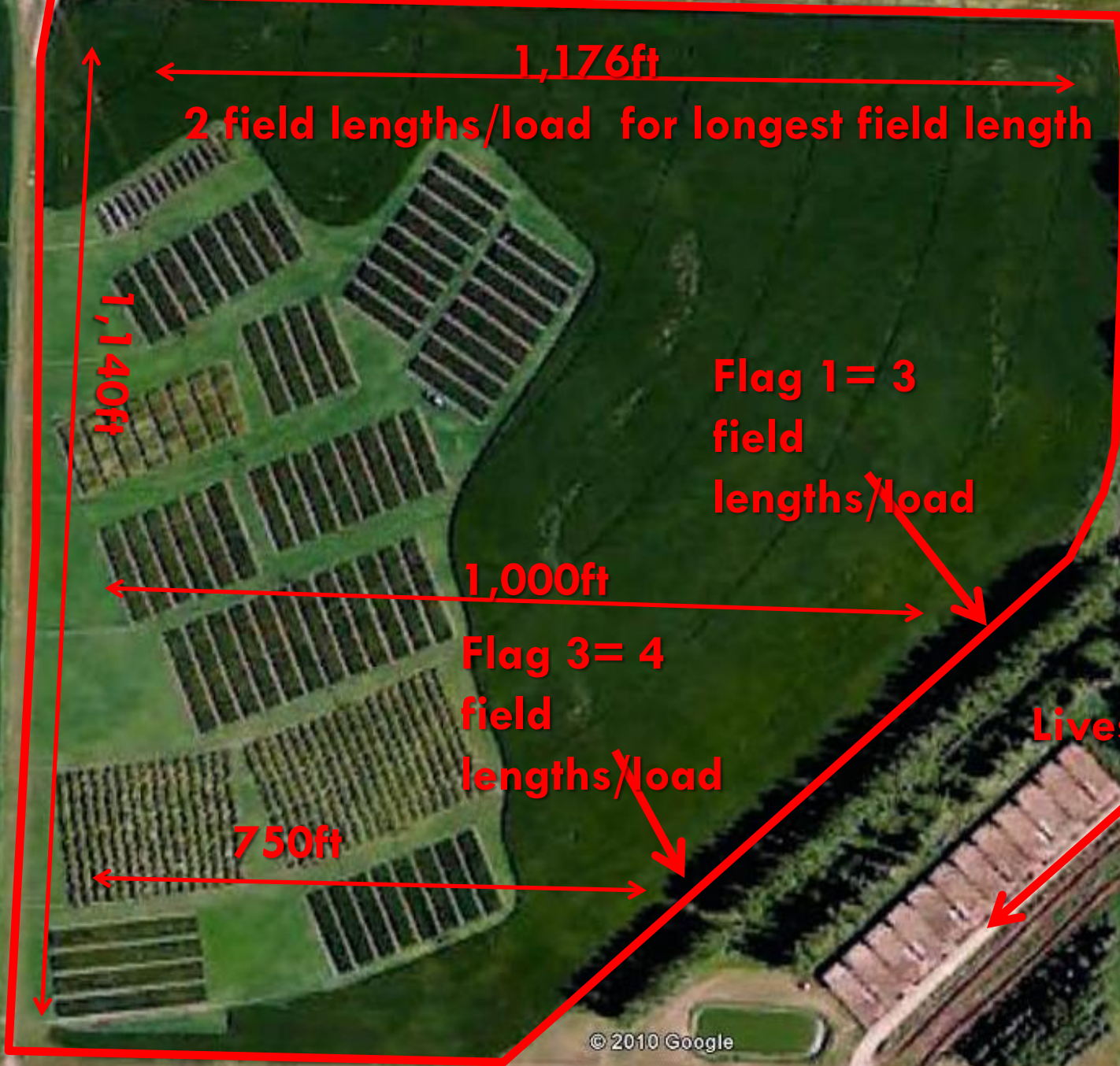
AXLE WEIGHT METHOD

$$\text{Tons/acre} = \frac{(\text{Ibs before} - \text{Ibs after}) / 2000\text{lbs}}{\text{Area Applied ft}^2 / 43560}$$

AXLE WEIGHT METHOD

	Area Applied (Square Feet)	÷	Square Feet per Acre (43,560)	=	Acres Applied (Use Later)	-	Manure Loaded Spreader Weight (lbs)	-	Spreader Weight After Application (lbs)	÷	2000 lbs	÷	Acres Applied (From Earlier)	=	Tons of Manure per Acre
Example	16,438	÷	43,560	=	0.377	-	37,188	-	19,321	÷	2000	÷	0.377	=	23.7
1		÷	43,560	=	=	-		-		÷	2000	÷	=	=	
2		÷	43,560	=	=	-		-		÷	2000	÷	=	=	
3		÷	43,560	=	=	-		-		÷	2000	÷	=	=	
4		÷	43,560	=	=	-		-		÷	2000	÷	=	=	







4 tons/acre



16 tons/acre

A close-up, top-down view of a field after corn harvest. The ground is covered with a dense layer of dry, yellowish-brown corn stalks and leaves, some standing upright and others lying flat. The soil is dark brown and visible between the stalks. In the lower-left quadrant, the text "42 tons/acre" is overlaid in a bold, red, sans-serif font.

42 tons/acre

MORE INFORMATION

Nutrient Management News

<http://www.ndsu.edu/nm>

<http://www.extension.org>

<http://www.manure.umn.edu>

[http://www.health.state.nd.us/WQ/AnimalFeeding
Operations/AFOPProgram.htm](http://www.health.state.nd.us/WQ/AnimalFeedingOperations/AFOPProgram.htm)



WORKS CITED

- Franzen, D.W. 2007. North Dakota fertilizer recommendation tables and equations based on soil test levels and yield goals. http://www.ndsu.edu/uploads/media/sf882_03.pdf. NDSU Extension Service. Fargo, ND.
- American Society of Agricultural and Biological Engineers (ASABE). 2205. ASABE D384.2 manure production and characteristics. <http://www.extension.org/mediawiki/files/f/f7/Table1and2excretion.pdf>.



QUESTIONS?

